Operation & Maintenance Manual

D87E-2
D87P-2

CRAWLER DOZER

SERIAL NUMBERS

D87E-2	P090001
D87P-2	P092001

and UP

March 2002

EMISSION CONTROL WARRANTY

EMISSION CONTROL WARRANTY STATEMENT (APPLIES TO CANADA ONLY)

1. Products Warranted

Komatsu America International Company, Komatsu Mining Systems Inc. and Komatsu Utility Corporation (collectively "Komatsu") produce and/or market products under brand names of Komatsu, Dresser, Dressta, Haulpak and Galion. This emissions warranty applies to new engines bearing the Komatsu name installed in these products and used in Canada in machines designed for industrial off-highway use. This warranty applies only to these engines produced on or after January 1, 2000. This warranty will be administered by Komatsu distribution in Canada.

2. Coverage

Komatsu warrants to the ultimate purchaser and each subsequent purchaser that the engine is designed, built and equipped so as to conform, at the time of sale by Komatsu, with all U.S. Federal emission regulations applicable at the time of manufacture and that it is free from defects in workmanship or material which would cause it not to meet these regulations within five years or 3,000 hours of operation, whichever occurs first, as measured from the date of delivery of the engine to the ultimate purchaser.

3. Limitations

Failures, other than those resulting from defects in materials or workmanship, are not covered by this warranty. Komatsu is not responsible for failures or damage resulting from what Komatsu determines to be abuse or neglect, including, but not limited to: operation without adequate coolant or lubricants; over fueling; over speeding; lack of maintenance of lubricating, cooling or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications of the engine. Komatsu is also not responsible for failures caused by incorrect fuel or by water, dirt or other contaminants in the fuel. Komatsu is not responsible for non-engine repairs, "downtime" expense, related damage, fines, all business costs or other losses resulting from a warrantable failure.

KOMATSU IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

This warranty, together with the express commercial warranties, are the sole warranties of Komatsu. **THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

GARANTIE SUR LE CONTRÔLE DES ÉMISSIONS

ÉNONCÉ DE GARANTIE SUR LE CONTRÔLE DES ÉMISSIONS (APPLICABLE AU CANADA SEULEMENT):

1. Produits garantis:

Komatsu America International Company, Komatsu Mining Systems Inc. et Komatsu Utility Corporation (collectivement Komatsu) produisent et/ou font la mise en marché de produits portant les noms de marque Komatsu, Dresser, Dressta, Haulpak et Galion. Cette garantie sur les émissions s'applique à tous les nouveaux moteurs portant le nom Komatsu, installés dans ces produits et utilisés au Canada dans des machines conçues pour utilisation industrielle non-routière. Cette garantie s'applique seulement sur les moteurs produits à partir du 1er Janvier 2000. Cette garantie sera administrée par la distribution de Komatsu au Canada.

2. Couverture:

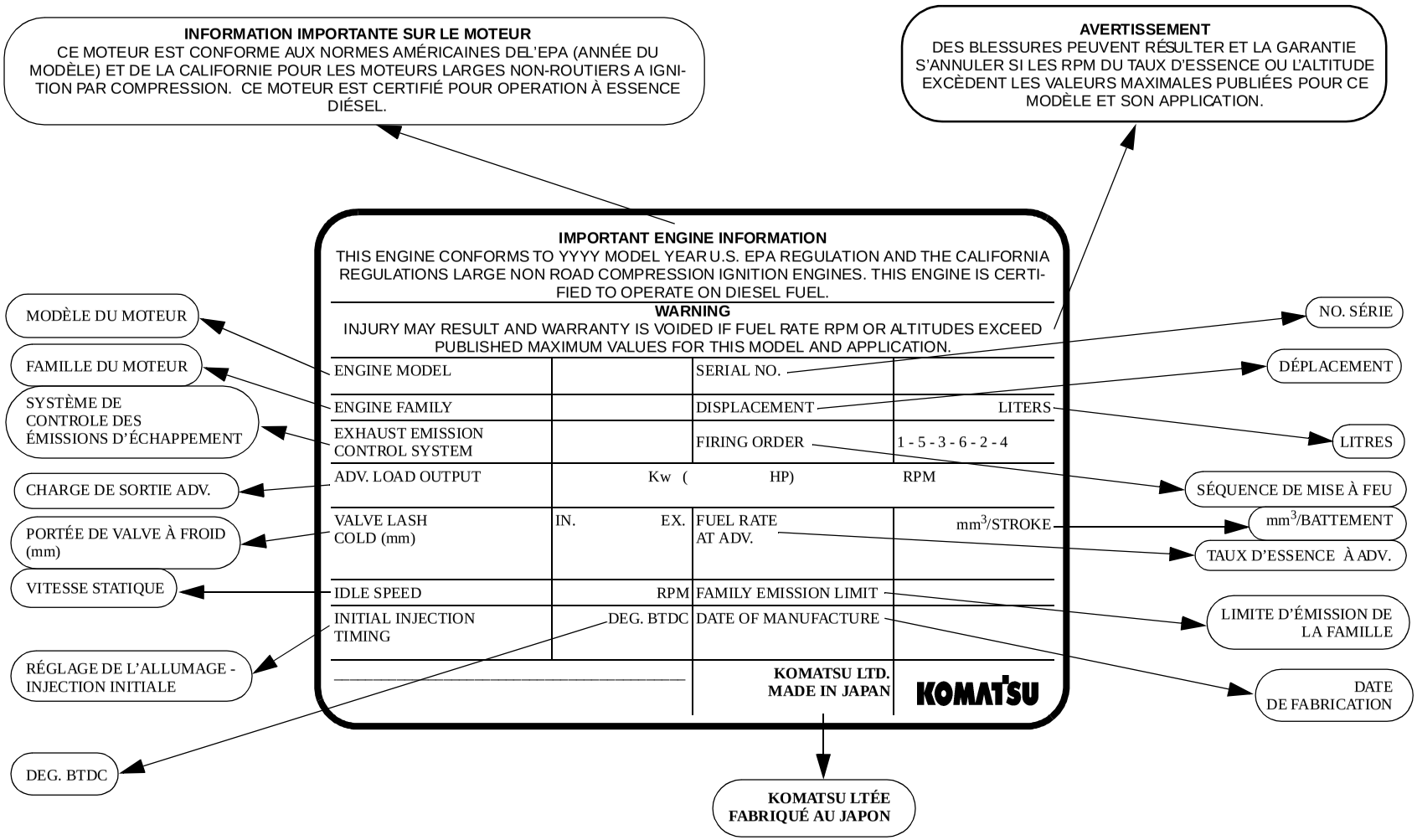
Komatsu garantit à l'acheteur ultime et chaque acheteur subséquent que le moteur est conçu, construit et équipé en toute conformité, au moment de la vente par Komatsu, avec toutes les Réglementations fédérales américaines sur les émissions applicables au moment de la fabrication et qu'il est exempt de défauts de construction ou de matériaux qui auraient pour effet de contrevenir à ces réglementations en dedans de 5 ans ou 3000 heures d'opération, mesuré à partir de la date de livraison du moteur au client ultime.

3. Limitations:

Les bris, autres que ceux résultant de défauts de matériaux ou de construction, ne sont pas couverts par cette Garantie. Komatsu n'est pas responsable pour bris ou dommages résultant de ce que Komatsu détermine comme étant de l'abus ou négligence, incluant mais ne se limitant pas à: l'opération sans lubrifiants ou agent refroidissants adéquats; la suralimentation d'essence; la survitesse; le manque d'entretien des systèmes de lubrification, de refroidissement ou d'entrée; de pratiques non-propices d'entreposage, de mise en marche, de réchauffement, de conditionnement ou d'arrêt; les modifications non-autorisées du moteur. De plus, Komatsu n'est pas responsable de bris causés par de l'essence inadéquate ou de l'eau, des saletés ou autres contaminants dans l'essence. Komatsu n'est pas responsable des réparations non-reliées au moteur, des dépenses encourues suite aux temps d'arrêts, des dommages relatifs, amendes, et de tout autre coût d'affaires ou autres pertes résultant d'un bris couvert par la garantie.

KOMATSU N'EST PAS RESPONSABLE DES INCIDENTS OU DOMMAGES CONSÉQUENTS.

Cette garantie, ainsi que les garanties expresses commerciales, sont les seules garanties de Komatsu. **IL N'Y A AUCUNE AUTRE GARANTIE, EXPRESSE OU SOUS-ENTENDUE, MARCHANDABLE OU PROPICE A UNE UTILISATION PARTICULIÈRE.**



ENGINE DATAPLATE - ENGLISH / FRENCH

PRODUCT PUBLICATIONS INFORMATION

Various product Parts and Service Publications are available to all **KOMATSU** construction equipment owners, including operation and maintenance manuals, parts books and shop manuals.

Special publications, such as service tool, air conditioning and turbocharger shop manuals are also available as well as selected Operation & Service Manuals in foreign languages.

The Publications listed below are available for this particular machine(s).

DESCRIPTION	FORM NUMBER
PARTS BOOK - PAPER:	
Chassis and Engine D87P-2	BEPB008700
Chassis and Engine D87E-2	BEPB008300
OPERATION AND MAINTENANCE MANUAL:	
Chassis and Engine	CEAM007302
SHOP MANUAL:	
Chassis	CEBM004801
Engine	SEBM006409
SAFETY MANUAL:	
Crawler	CLT80-1

Parts and Service Publications can only be acquired by authorized KOMATSU distributors using the Komatsu America International Company Parts Inventory Processing System (PIPS).

If the PIPS system is not available at the distributor location, then the following Requisition for Technical Service Publications and Service Forms can be used. Form KDC91E is shown on the reverse side of this page.

REQUISITION FOR TECHNICAL SERVICE PUBLICATIONS AND SERVICE FORMS

COMPLETE FORM AND RETURN TO ——ö

DataKom Publishing Corporation
440 North Fairway Drive
Vernon Hills, IL 60061-8112 U.S.A.
Attn: Service Publications
Fax No. (847) 970-4186
Tel No. (847) 970-5887

SHIP TO ——ö

TYPE or PRINT ONLY ——ö

COMPANY NAME
ATTN.
STREET ADDRESS
CITY, STATE, ZIP CODE
COUNTRY

PURCHASE ORDER NO.

ORDER DATE

PHONE NO.	FAX NO.	SHIPPING METHOD	DISTR/BRANCH CODE

IMPORTANT - TO ASSURE SHIPMENT OF THE CORRECT PUBLICATION(S), THE MODEL NUMBER AND MACHINE SERIAL NUMBER MUST BE SHOWN.

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

KDC91E 072199

CURRENT PRICES WILL BE CHARGED

INTRODUCTION

FORWARD

This manual describes procedures for operation, handling, lubrication, maintenance, checking, and adjustment. It will help the operator and maintenance personnel realize peak performance through effective, economical and safe machine operation and maintenance. Keep this manual handy and have all personnel read it periodically. If this manual is lost or becomes dirty and can not be read, request a replacement manual from Komatsu or your local distributor. If you sell the machine, be sure to give this manual to the new owner. Continuing improvements in the design of this machine can lead to changes in detail, which may not be reflected in this manual. Consult Komatsu or your local distributor for the latest available information on your machine or for questions regarding information in this manual.

⚠ WARNING

- **Improper operation and maintenance of this machine can be hazardous and could result in serious injury or death.**
- **Operator's and maintenance personnel must read this manual thoroughly before operating or maintaining this machine.**
- **This manual should be kept near the machine for reference and periodically reviewed by all personnel who come across it.**
- **Some actions involved in operation and maintenance can cause a serious accident, if they are not performed in the manner described in this manual.**
- **The procedures and precautions given in this manual apply only to intended uses of the machine. If you use your machine for any unintended uses that are not specifically prohibited, you must be sure that it is safe for you and others. In no event should you or others engage in prohibited uses or actions as described in this manual.**
- **Komatsu delivers machines that comply with all applicable regulations and standards of the country to which it has been shipped. If this machine has been purchased in another country or purchased from someone in another country, it may lack certain safety features and specifications that are necessary for use in your country. If there is any question about whether your product complies with the applicable standards and regulations of your country, consult Komatsu or your local distributor before operating the machine.**
- **The description of safety is given in SAFETY INFORMATION on this page and in see "SAFETY RULES" on page 1-9**

SAFETY INFORMATION

Most accidents are caused by the failure to follow fundamental safety rules for the operation and maintenance of machines. To avoid accidents, read, understand and follow all precautions and warnings in this manual and on the machine before performing maintenance and machine operations. To identify safety messages in this manual and on machine product graphics, the following signal words are used.

DANGER!	This word is used on safety messages and product graphics where there is a high probability of serious injury or death if the hazard is not avoided. These safety messages and product graphics usually describe precautions that must be taken to avoid the hazard. Failure to avoid this hazard may also result in serious damage to the machine.
WARNING!	This word is used on safety messages and product graphics where there is a potentially dangerous situation, which could result in serious injury or death if the hazard is not avoided. These safety messages and product graphics usually describe precautions that must be taken to avoid the hazard. Failure to avoid this hazard may also result in serious damage to the machine.
CAUTION!	This word is used on safety messages and product graphics for hazards, which could result in minor or moderate injury if the hazard is not avoided. These safety messages and product graphics might also use this word for hazards where the only result could be damage to the machine.
NOTE	This word is used for precautions that must be taken to avoid actions, which could shorten the life of the machine.

Safety precautions are described in SAFETY beginning on page 1-6.

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

INTRODUCTION

INTENDED USE

This dozer is designed to be used mainly for the following work:
- Dozing
- Smoothing
- Cutting into hard or frozen ground or ditching.

see “WORK POSSIBLE USING MOUNTED EQUIPMENT” on page 2-70

FEATURES

- Simple, easy operation
  Two levers with hydraulic assist is used for the steering and one lever for directional and speed control.
  One lever used for the blade control (hydraulic angle/tilt dozer).
- Simple, easy maintenance
- Fuel gauge and air cleaner restriction warning lamp installed on instrument panel.

BREAKING IN THE MACHINE

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

During breaking in:

- 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.

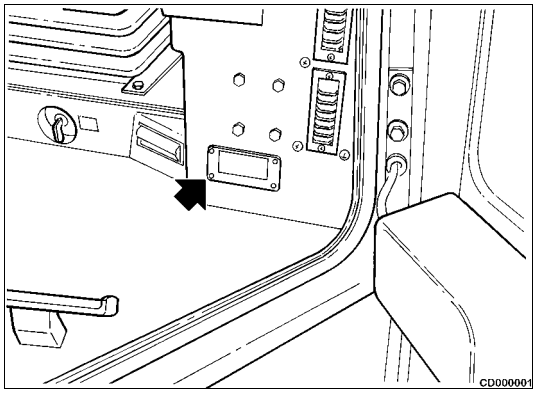
The precautions given in this manual for operating, maintenance, and safety procedures are only those that apply when this product is used for the specified purpose. If the machine is used for a purpose that is not listed in this manual, Komatsu cannot bear any responsibility for safety. All consideration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

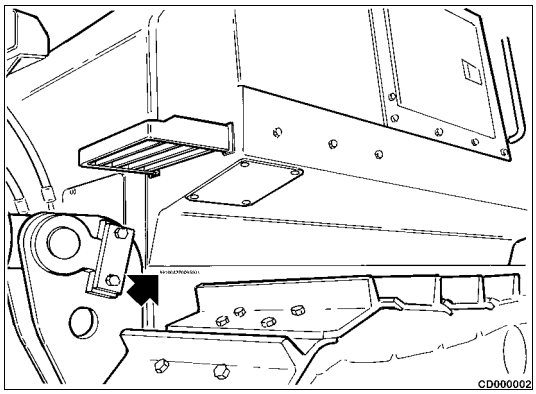
Operations that are prohibited in this manual must never be carried out under any circumstances.

LOCATION OF PLATES, TABLE TO ENTER P.I.N. AND DISTRIBUTOR

P.I.N. PLATE LOCATION

The product identification number (PIN) is stamped on a plate attached to the front of the left console below the transmission controls. It is also stamped into the right rear top of the rear main frame.





ENGINE SERIAL NO. PLATE LOCATION

The engine serial number is stamped in a plate on the left side of the engine block.

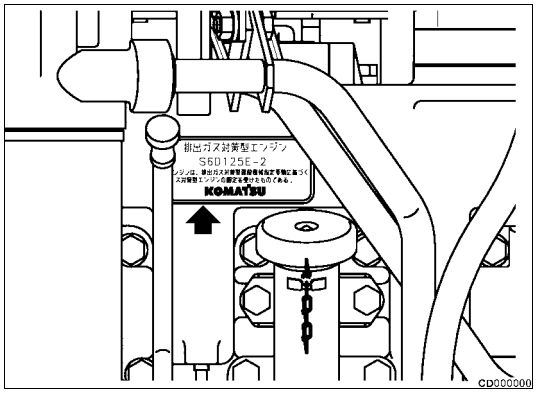


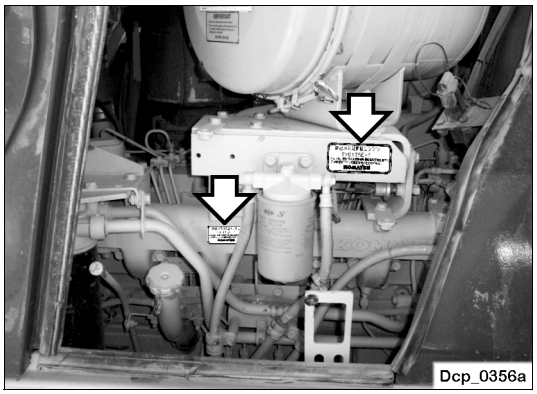
TABLE TO ENTER NUMBERS AND DISTRIBUTOR

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

NOTE: **This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.**

ENGINE SERIAL NO. PLATE LOCATION

The engine serial number is stamped in a plate and mounted on the left side of the air cleaner mounting bracket



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OPERATION

MAINTENANCE

SPECIFICATIONS

OPTIONS, ATTACHMENTS

SAFETY

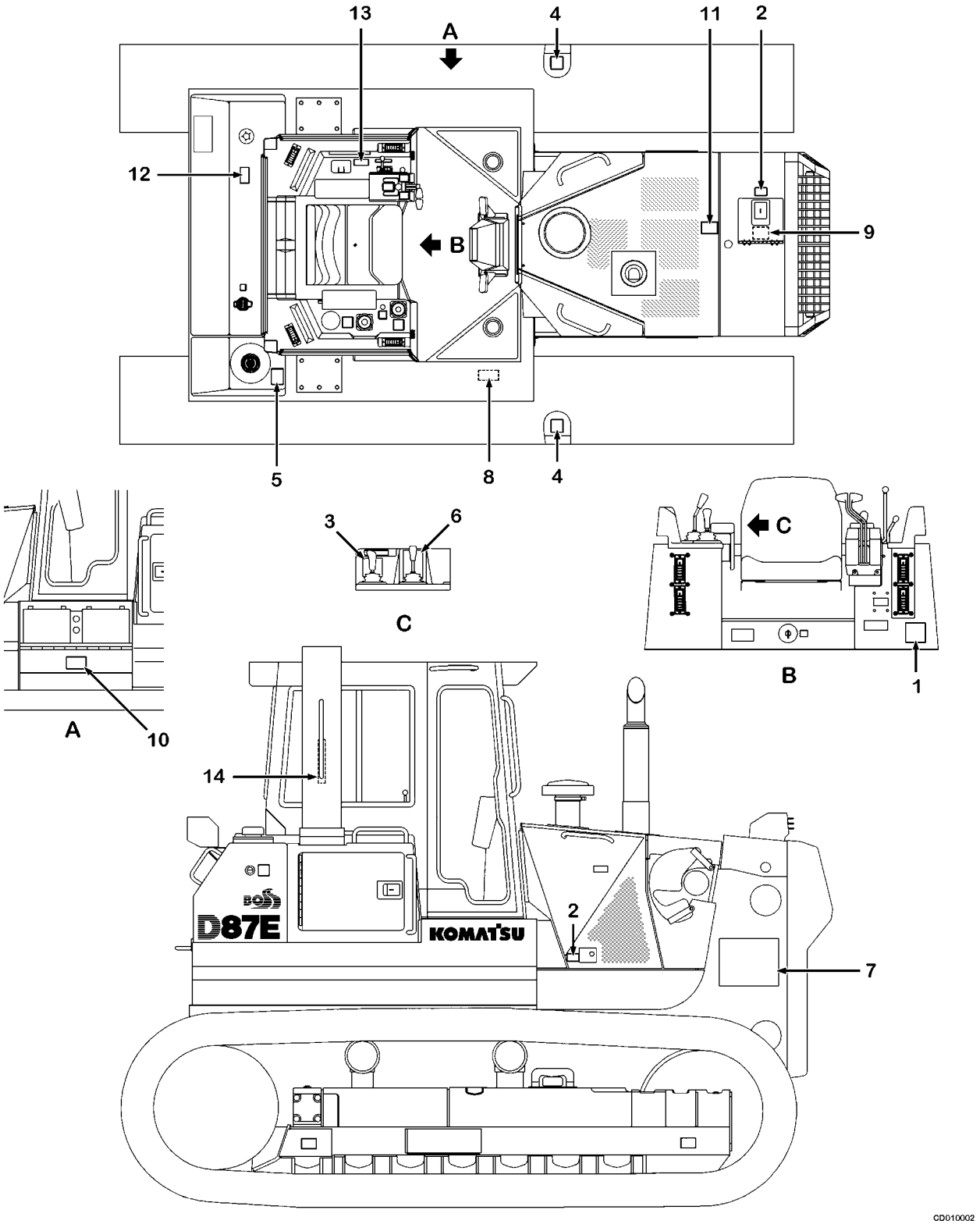
WARNING

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

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

WARNING LABELS

Always keep these labels clean. If they are lost or damaged, 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 distributor.



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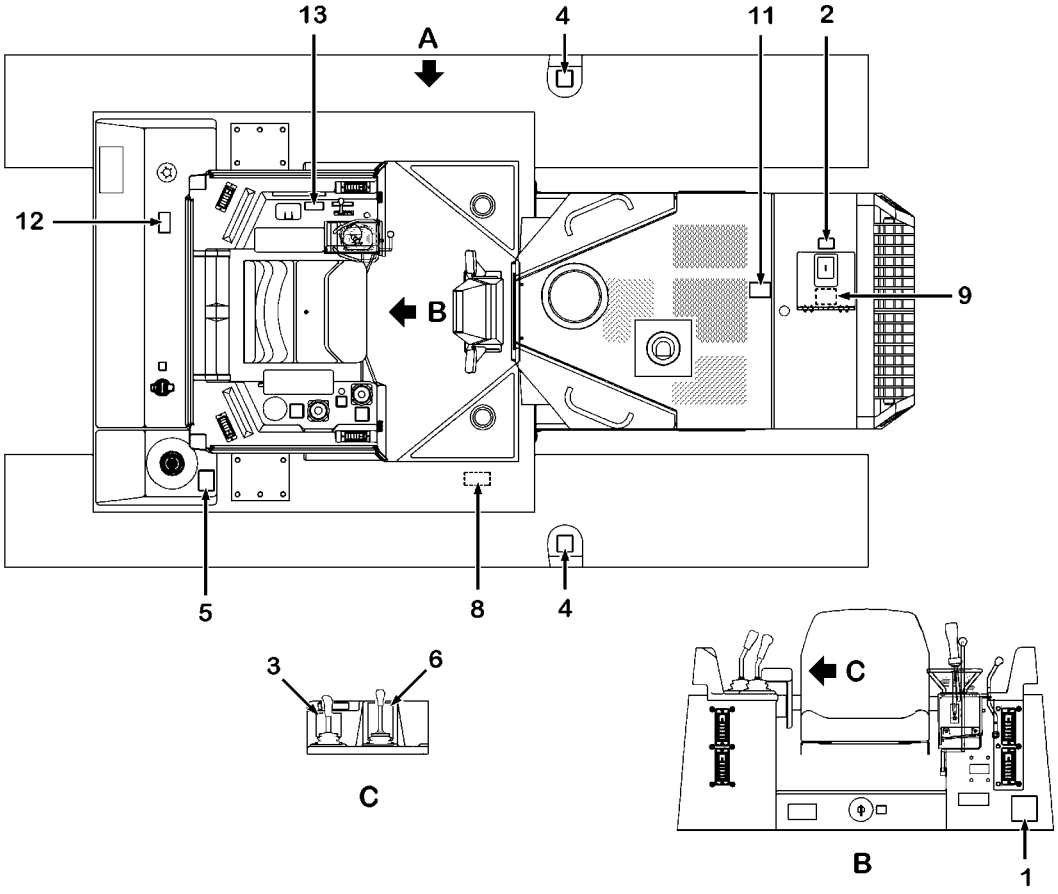

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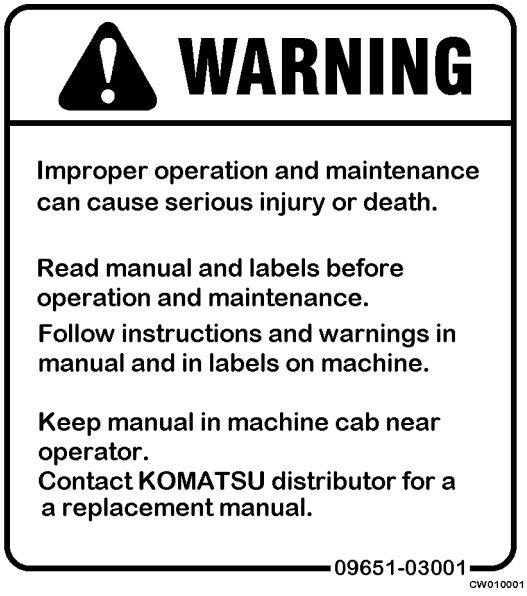
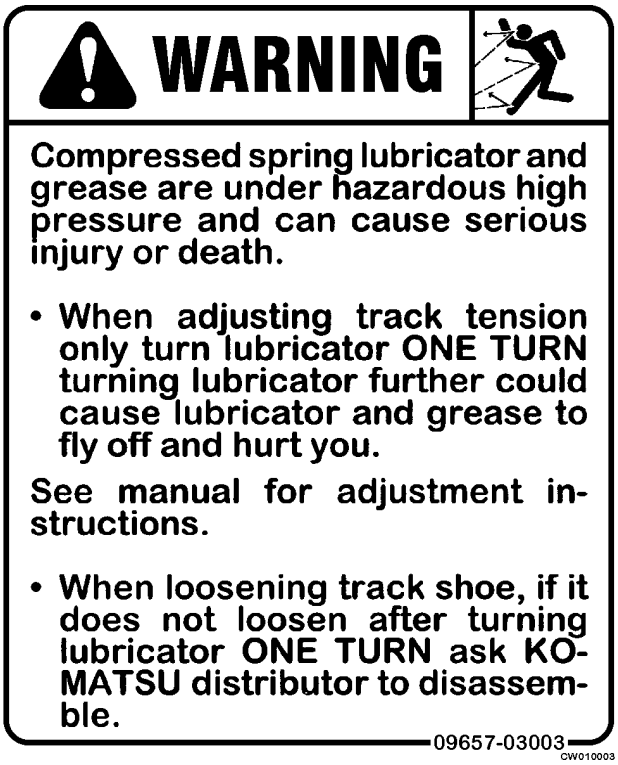
1. Operating machine 09651-03001



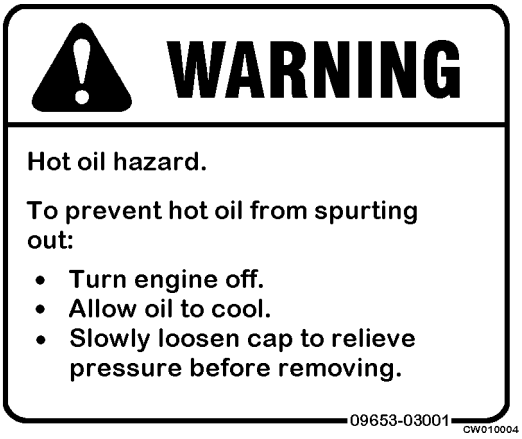
2. Door caution 09967-03001

3. Leaving operator's seat 09654-13001

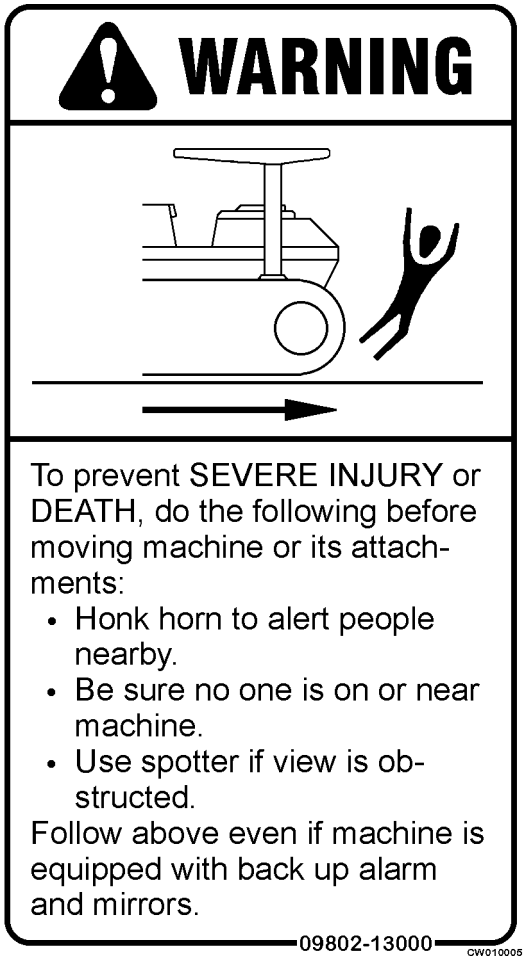
4. Adjusting track tension 09657-03003



5. Hot oil hazard 09653-03001



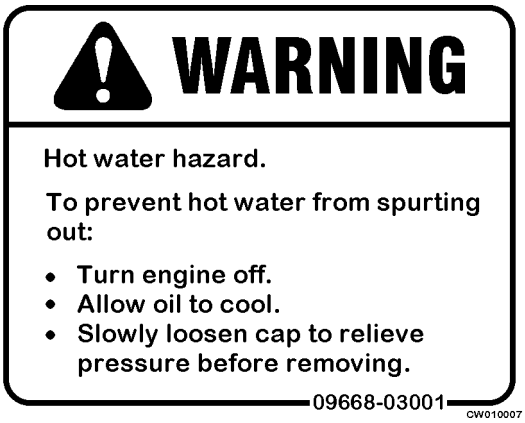
6. Moving in reverse 09802-13000



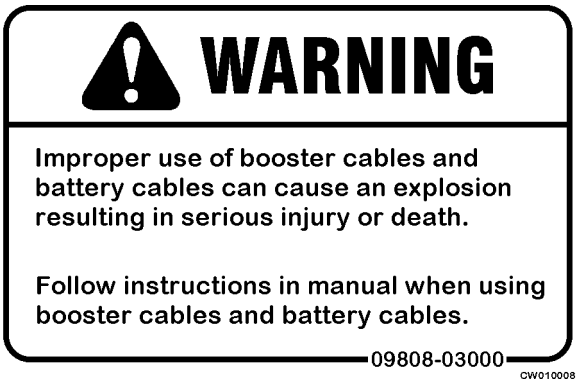
7. Machine moving 09812-13000

8. Operation during maintenance 09963-03000

9. Hot water hazard 09668-03001



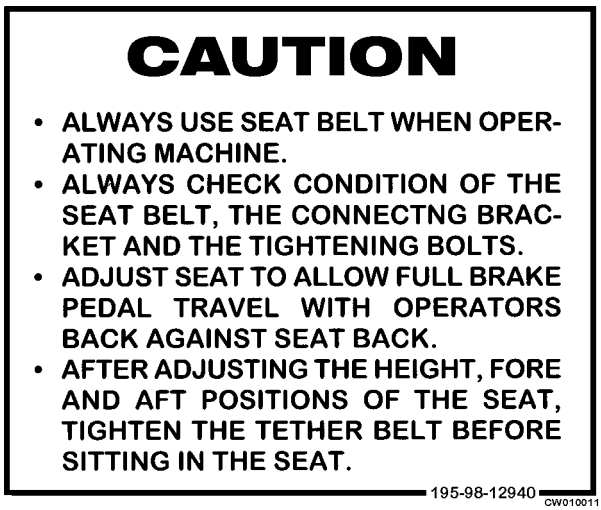
10. Battery cable 09808-03000



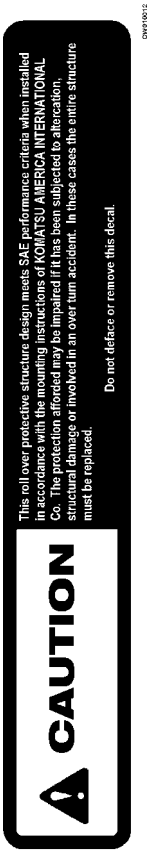
11. Hood 09805-13000

12. Fuel tank 17A-98-32920

13. Seat belt use 195-98-12940



14. ROPS caution 737 993 C3



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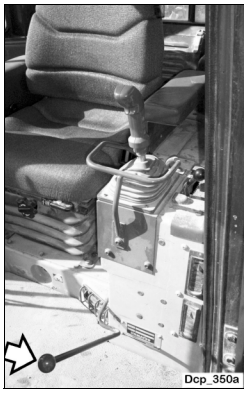
NOTE: **This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.**

ALWAYS APPLY LOCK WHEN LEAVING OPERATOR'S SEAT

LOCK



UNLOCK

GENERAL PRECAUTIONS

SAFETY RULES

- Only trained and authorized personnel should be allowed to operate and service this machine. Follow all safety rules, precautions and instructions when operating or performing maintenance on the machine.
- The owner and/or operator must replace any and all safety and warning product graphics if they are defaced or removed from the machine.
- Think before you act. Careful operators and service personnel are the best insurance against accidents. Do not rush. Hurrying can lead to accidents. Haste, carelessness and lack of training are the primary causes of equipment related injuries.
- The operator must be alert, physically fit and free from the influences of alcohol, drugs and medications that might affect his eyesight, hearing or reactions. Safety must always be the operator's most important concern. He must refuse to operate when he knows it is unsafe and consult his supervisor when safety is in doubt. When working with another operator or a person on work site traffic duty, be sure all personnel understand all hand signals that are to be used.

SAFETY FEATURES

- Be sure all guards and covers are in their proper position. Be sure to replace them after servicing the machine. Have guards and covers repaired immediately if damaged.
- Use safety features such as safety lock lever and seat belt properly. A seat belt is required by OSHA in almost all applications. Do not operate this machine without a seat belt. Never remove any safety features. Always keep them in good operating condition.

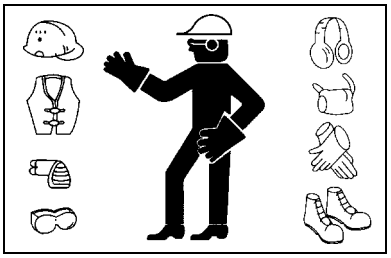
Safety lock lever, ➜ see "SAFETY LOCK LEVER" on page 2-23.
Seat belts, ➜ see "SEAT, SEAT BELT AND ARM RESTS" on page 2-20.

- Improper use of safety features could result in serious bodily injury or death. Be sure the machine has the correct equipment required by local rules and regulations.

UNAUTHORIZED MODIFICATION

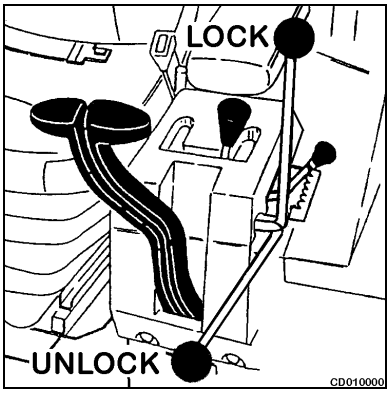
- Any modification made without authorization from Komatsu can create hazards. Before making a modification, consult your local distributor. Komatsu will not be responsible for any injury or damage caused by any unauthorized modification.

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. Do not wear oily clothes because they are flammable.
- Wear a hard hat, safety glasses, safety shoes, mask, and gloves when operating or maintaining the machine. Always wear safety goggles, hard hat and heavy gloves if your job involves hazards like metal chips or minute particles - this is particularly important when driving pins with a hammer and when cleaning the air cleaner element with compressed air.

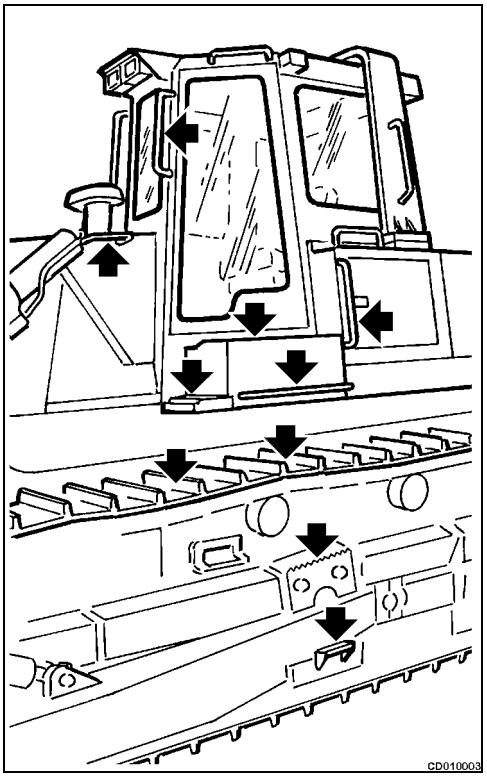
ALWAYS APPLY LOCK WHEN LEAVING OPERATOR'S SEAT



- Before getting up from the operator's seat, place the safety lock lever securely in the **LOCK** position. If you accidentally touch the directional and steering lever when it is not locked, the machine may move and cause serious injury or damage.
- Before leaving the machine, lower the work equipment completely to the ground and set the safety lock lever to the **LOCK** position. Then stop the engine and use the key to lock all the equipment locks. Always take the key with you.

Machine posture, ➜ see "PARKING THE MACHINE" on page 2-63.

MOUNTING AND DISMOUNTING

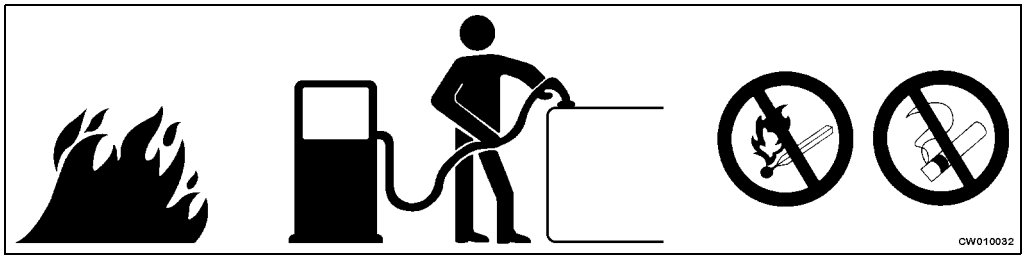


- Never jump on or off the machine. Never get on or off a moving machine. When mounting or dismounting, always face the machine and use the handrail, track shoes and track frame step.
- Do not use the machines controls or hoses as hand holds when climbing on or off the machine. Controls and hoses can move and do not provide solid support. Movement of the controls may cause unexpected machine movement and injury.
- Ensure safety by always maintaining at least three point contact of hands and feet with the handrails, steps and track shoes.
- Always remove any oil or mud from the handrails, steps and track shoes. If they are damaged, repair them and tighten any loose hardware.
- Repair any damaged hand hold, and tighten any loose bolts. Hand holds, track frames and shoes must free of oil, grease and/or excessive dirt.

FIRE PREVENTION FOR FUEL AND OIL

Fuel, oil, and antifreeze can be ignited by a flame. Fuel is particularly flammable and hazardous.

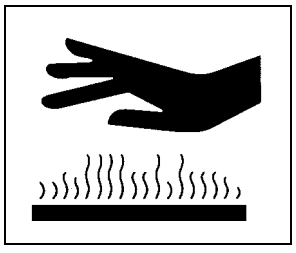
- Keep any flame away from flammable fluids.
- Stop the engine and do not smoke when refueling.
- Tighten all fuel and oil caps securely.
- Refueling and oiling should be done in well ventilated areas.
- Keep oil and fuel in the determined place and do not allow unauthorized persons to enter.



CRUSHING OR CUTTING PREVENTION

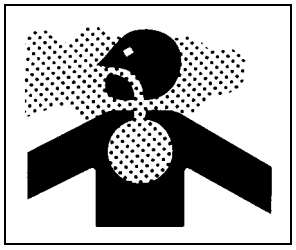
- Do not enter, or put your hand or arm or any other part of your body between movable parts such as between the work equipment and cylinders, or between the machine and work equipment. If the work equipment is operated, the clearance will change and this may lead to serious damage or personal injury.

PRECAUTIONS WHEN HANDLING AT HIGH TEMPERATURES



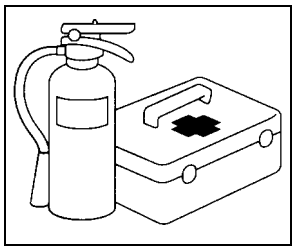
- Immediately after operations are stopped, the engine coolant, engine oil, and hydraulic oil are at high temperatures, and are still under pressure. Attempting to remove the cap, drain the oil or coolant, or replace the filters may lead to serious burns. Always wait for the temperature to go down, and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

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:
  1) Never use compressed air for cleaning.
  2) Use water for cleaning to keep down the dust.
  3) Operate the machine with the wind to your back, whenever possible.
  4) Use an approved respirator if necessary.

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 local 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.

PRECAUTIONS FOR ROPS

- Do not operate machine with the ROPS removed.
- The ROPS is installed to protect the operator if the machine should overturn. It is designed not only to take the load when the machine overturns, but also to absorb the impact energy.
- The ROPS fulfills all worldwide regulations and standards, but if any unauthorized modification is carried out on it, or if it is damaged when the machine overturns, its strength will be reduced and it will not be able to provide its original capacity. It will be able to provide this capacity only if modifications and repairs are carried out in the specified way.
- When carrying out modification or repairs, always consult your local distributor first.
- Even when the ROPS is installed, if you do not fasten your seat belt securely, it cannot protect you properly. Always fasten your seat belt when operating the machine.

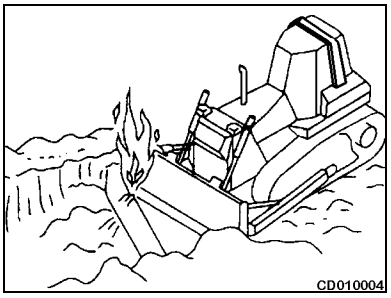
Seat belt, ➜ see "SEAT, SEAT BELT AND ARM RESTS" on page 2-20.

PRECAUTIONS DURING OPERATION

BEFORE STARTING ENGINE

SAFETY AT WORK SITE

- Before entering the operator's compartment, walk completely around the machine and clear the area of personnel and obstructions.
- Before starting the engine, thoroughly check the area for any unusual conditions that could be dangerous.
- Before starting the engine, examine the terrain and soil conditions of the work site. Determine the best and safest method of operation.
- Make rough terrain areas as level as possible before operation.
- If you need to operate on a street, protect pedestrians and cars by designating a person for work site traffic duty or by installing barriers around the work site.
- If water lines, gas lines, telephone lines, and high voltage electrical lines may be buried under the work site, 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.



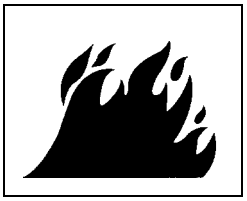
Water depth, ➜ see "PERMISSIBLE WATER DEPTH" on page 2-60.

FIRE PREVENTION

- Thoroughly remove wood chips, leaves, paper and other flammable debris that has accumulated in or around 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 "CHECKS BEFORE STARTING ENGINE" on page 2-30.

- Be sure a fire extinguisher is present and working.



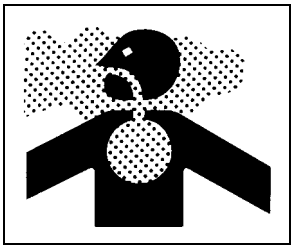
IN OPERATOR'S COMPARTMENT

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

Seat belt, ➜ see "SEAT, SEAT BELT AND ARM RESTS" on page 2-20.

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 MIRROR AND LIGHTS

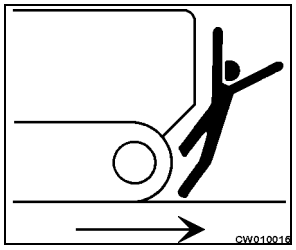
- Remove all dirt from the surface of the mirror and lights to ensure that you can see well.
- Adjust the rear view mirror so that you can see clearly from the operator's seat, and always keep the surface of the mirror clean. If any glass is broken, replace it with a new part.
- Check that the head lamps and working lamps are installed to match the operating conditions. Check also that they light up properly.

OPERATING MACHINE

WHEN STARTING ENGINE

- Perform a visual check of the machine before starting the engine. Look for such things as missing protective devices, leaks, improper fluid levels, trash buildup and loose, damaged or missing parts. Do not start the engine until any unsafe conditions are corrected.
- Walk around the 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.
- Understand all control functions before starting the engine.
- 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 operator's compartment or on the machine body.
- For machines equipped with a back up alarm, check that the warning device operates correctly.
- Keep hands and footwear free of grease, water and mud to insure positive control movement.
- Before driving the machine, adjust the seat and fasten the seat belt. Adjust the seat for maximum comfort and control of the machine. Adjust the seat belt to fit snugly and low around the hips to lessen the chance and severity of injury in the event of an accident. Never wear the seat belt across the abdomen.
- Before moving the machine, check the brakes, steering, equipment controls and safety devices such as the back up alarm for proper operation. Do not operate the machine until any unsafe conditions have been corrected.

PRECAUTIONS WHEN MOVING FORWARD OR BACKWARD

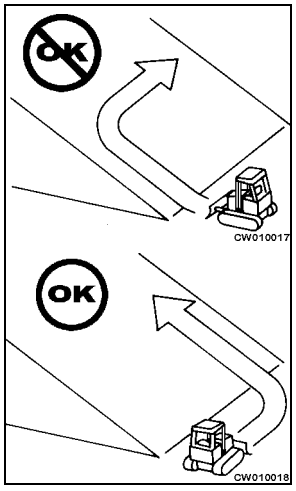


- When operating in areas that may be hazardous or have poor visibility, designate a person to direct work site traffic.
- Be sure no one is around machine, particularly behind machine.
- Before starting machine motion, sound horn to alert people.
- There is a blind spot behind the machine. Make sure that nobody is present behind it before driving the machine backward.

VISIBILITY

- Turn on the head lamps and working lamp, when working at night or at dark sites. Provide additional lighting for the work site if necessary.
- If visibility is diminished by fog, snow or rain, stop operation. Wait until there is adequate visibility for safe operation.

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 mounted equipment closer to the ground. Approximately 20 to 30 cm (8 to 12 in) above the ground. In case of emergency, quickly lower the mounted equipment to the ground to help the machine stop and prevent it from tipping over.
- Do not change directions on slopes. Avoid sideways travel whenever possible: rather travel up and down the slopes.
- 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.
- When traveling downhill, drive slowly and use the engine as a brake.
- When traveling downhill with the machine being pushed by its own weight, the machine may steer in the opposite direction, so be careful.

Downhill travel, ➜ see "WHEN TRAVELING UP OR DOWN HILLS" on page 2-60.

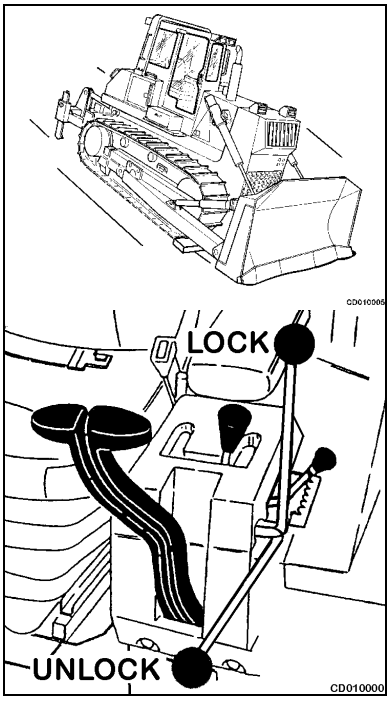
OPERATE CAREFULLY ON SNOW

- 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.

PARKING THE MACHINE



- Park on level ground whenever possible. If not possible, block the tracks, lower the mounted equipment to the ground and thrust the blade into 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 "PARKING THE MACHINE" on page 2-63.

- 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 "PARKING THE MACHINE" on page 2-63.
Places to lock, ➜ see "LOCKING" on page 2-69.

NOTE: These added illustrations show the differences for machines equipped with Single Lever Transmission/Steering Control.

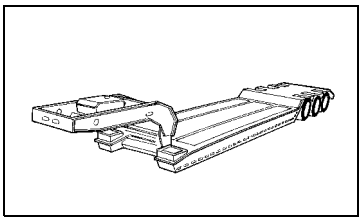
LOCK

UNLOCK

TRANSPORTATION

LOADING AND UNLOADING

- Loading and unloading the machine always involves potential hazards. Extreme caution should be used. When loading or unloading the machine, run the engine at low idle and travel at low speed.
- Perform loading and unloading on firm, level ground only. Maintain a safe distance from the edge of a road.
- Always block the wheels of the hauling vehicle and place blocks under both ramps before loading and unloading.
- Always use ramps of adequate strength. Be sure the ramps are wide and long enough to provide a safe loading slope.
- Be sure that the ramps are securely positioned and fastened, and that the two sides are at the same level as one another.
- Be sure the ramp surface is clean and free of grease, oil, 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, tie downs, etc., ➜ see "TRANSPORTATION" on page 2-82.

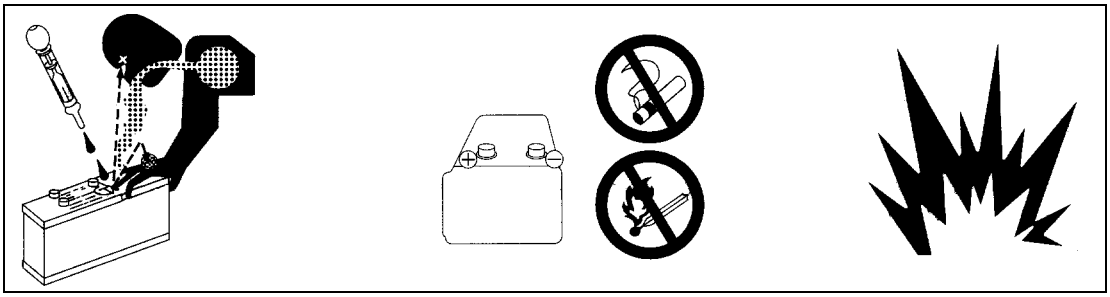
SHIPPING

- 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.

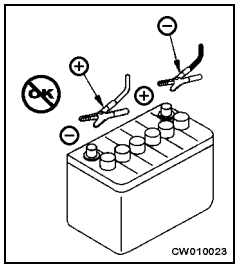
BATTERY

BATTERY HAZARD PREVENTION

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



STARTING WITH BOOSTER CABLES



- 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 "BATTERIES AND TERMINALS" on page 3-53.

TOWING

When Towing the Machine

- 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.
- Before the machine is towed, hydraulically release the secondary brake.
- 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.
- Place pieces of wood between the wire ropes and body to protect them from wear or damage.
  see “see “METHODS OF TOWING MACHINE” on page 2-96

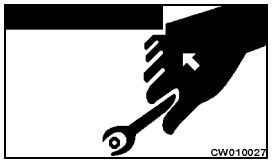
PRECAUTIONS FOR MAINTENANCE

BEFORE CARRYING OUT MAINTENANCE

WARNING TAG

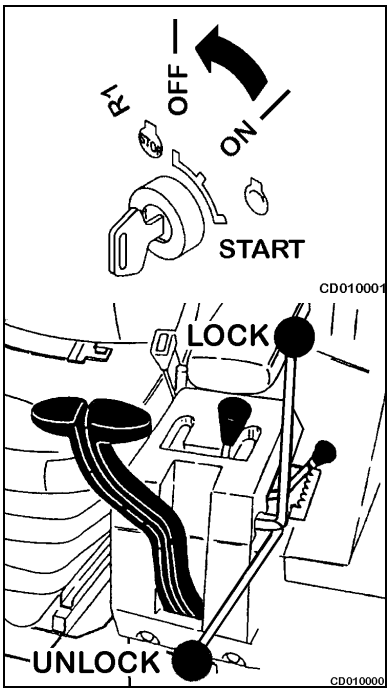
- If others start the engine or operate the controls while you are performing service and/or lubrication, you could suffer serious injury or death.
- Always attach the warning tag to the control lever in the operator's cab to alert others that you are working on the machine. Attach additional tags around the machine, if necessary. These tags are available from your 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.

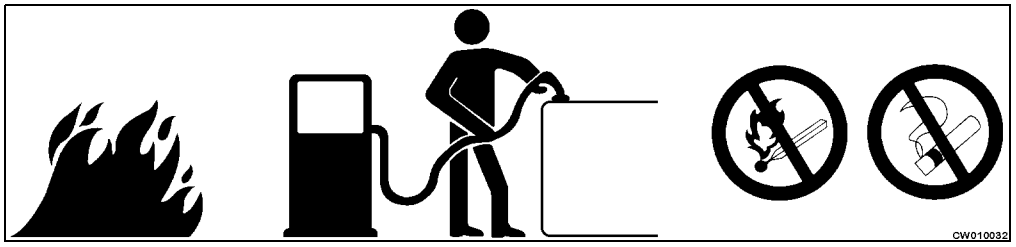
STOP ENGINE BEFORE CARRYING OUT INSPECTION AND MAINTENANCE



- Always stop the machine on firm flat ground and stop the engine before carrying out inspection and maintenance.
- If it is necessary to run the engine when carrying out maintenance, such as when cleaning the inside of the radiator, place the safety lock lever in the **LOCK** position and carry out the operation with two workers.
- One worker should occupy 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 maintenance should be extremely careful not to touch or get caught in any moving parts.

RULES TO FOLLOW WHEN ADDING FUEL OR OIL

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



NOTE: This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.

STOP ENGINE BEFORE CARRYING OUT INSPECTION AND MAINTENANCE

LOCK

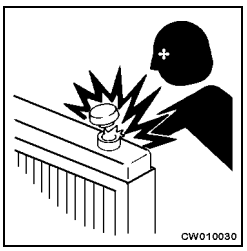
UNLOCK

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.

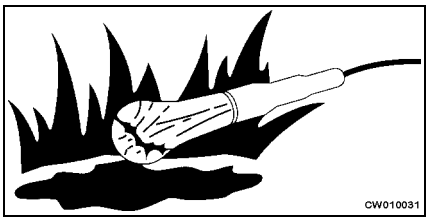
Replacement of safety critical parts, ➜ see "PERIODIC REPLACEMENT OF CRITICAL PARTS" on page 3-18.

RADIATOR COOLANT LEVEL



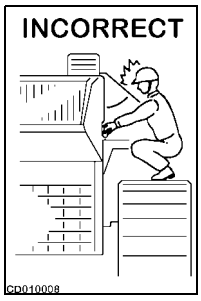
- If it is necessary to add coolant to the radiator, stop the engine and allow the engine and radiator to cool down before adding the coolant.
- Slowly loosen the cap to relieve pressure before removing the cap.

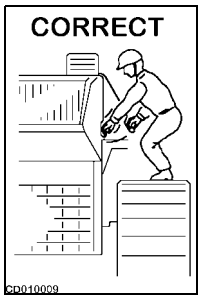
USE OF LIGHTING



- 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.

OPENING AND CLOSING ENGINE SIDE DOORS





- If you open the engine side door when on the track, always do so in a standing position.
- When the engine side door is open, do not open or close the cab door. Before opening or closing the cab door, always close the engine side door first.

DURING MAINTENANCE

PERSONNEL

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

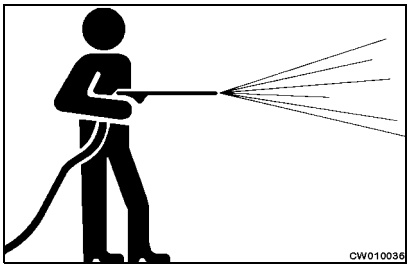
ATTACHMENTS

- 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 track shoes of the machine securely.
- Never work under the machine if the machine is poorly supported.

KEEP THE MACHINE CLEAN

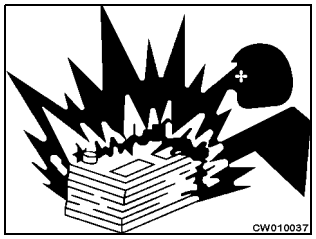


- Spilled oil or grease, or scattered tools or broken pieces are dangerous because they may cause you to slip or trip. Always keep your machine clean and tidy.
- If water gets into the electrical system, there is danger that the machine may not move or may move unexpectedly. Do not use water or steam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

HANDLING HIGH PRESSURE HOSES

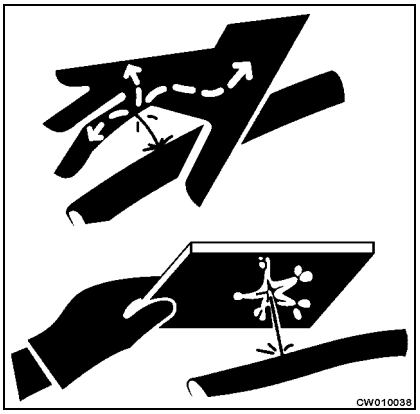
- Do not bend high pressure hoses or hit them with hard objects. Do not use any bent or cracked piping, tubes or hoses. They may burst during use.
- Always repair any loose or broken fuel hoses or oil hoses. If fuel or oil leaks, it may cause a fire.
- Avoid torching, soldering or welding on pipes, tubes or equipment that contain fuel or oils. If heated they can generate flammable fumes or mist and could cause a fire or explosion.

PRECAUTION WITH BATTERY



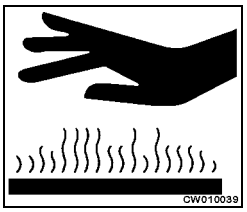
- When repairing the electrical system or when carrying out electrical welding, remove the negative ⊖ terminal of the battery to stop the flow of current.

PRECAUTION WITH HIGH PRESSURE OIL



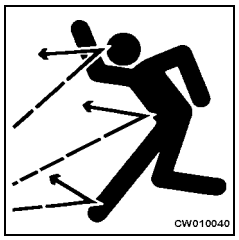
- Do not forget that the work equipment circuits are always under pressure.
- Do not add oil, drain oil, or carry out maintenance or inspection before completely releasing the internal pressure.
- If you are hit by a jet of high pressure oil, consult a doctor immediately for medical attention.
- If oil 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.

PRECAUTION WHEN CARRYING OUT MAINTENANCE AT HIGH TEMPERATURE OR PRESSURE



- Immediately after stopping machine operations, the engine coolant and oil are at high temperatures and under high pressure. In this condition, if the radiator cap is removed, or the oil or coolant 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.

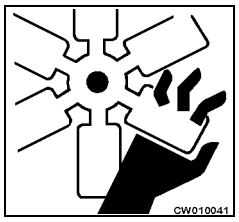
PRECAUTION WHEN USING HIGH PRESSURE GREASE TO ADJUST TRACK TENSION



- 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.

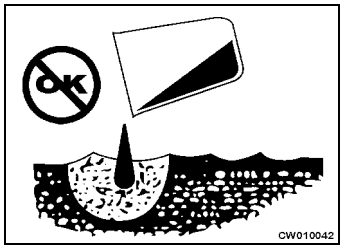
Adjusting track tension, ➜ see "CHECK AND ADJUST TRACK TENSION" on page 3-30.

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.

WASTE MATERIALS

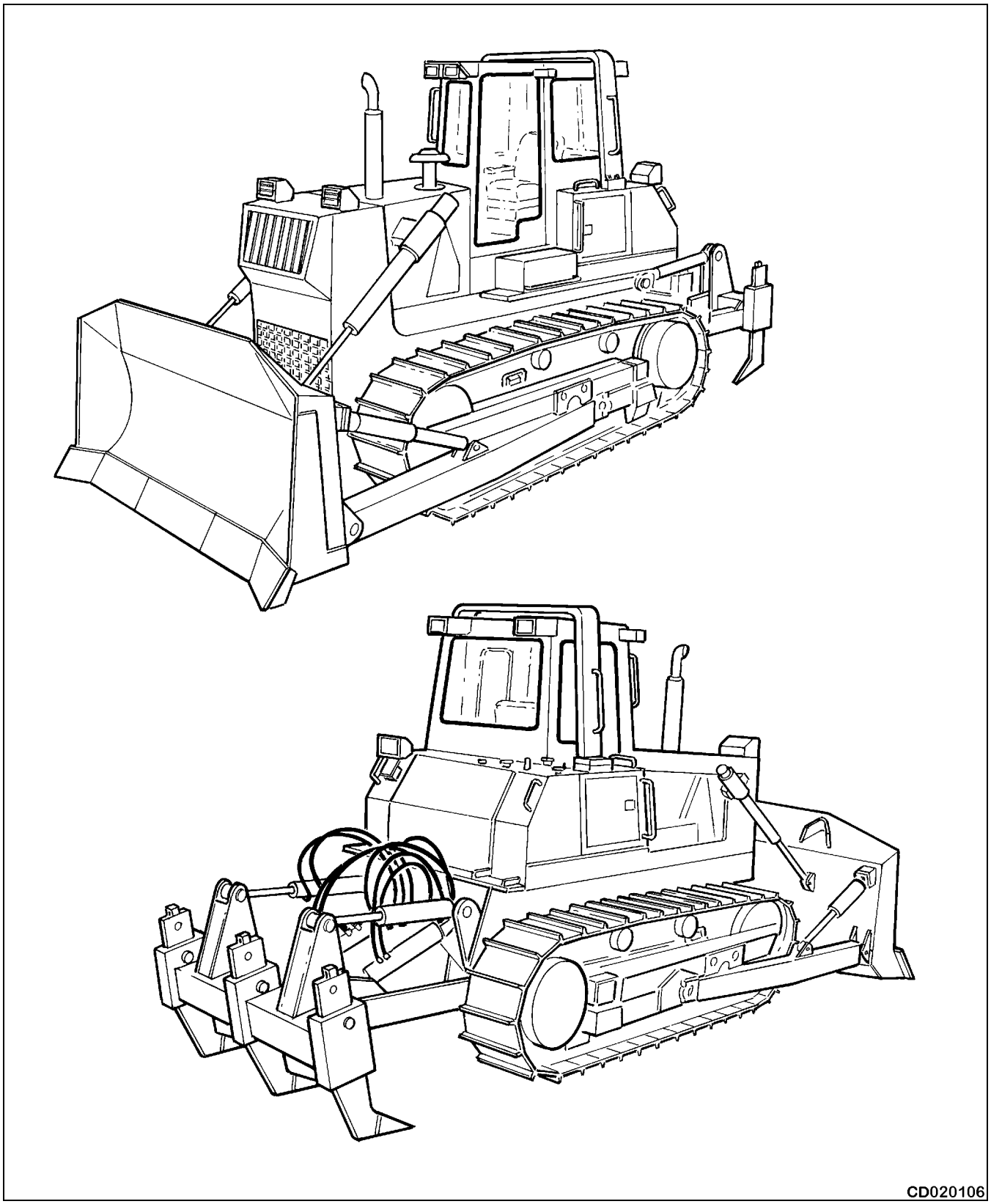


- Never dump waste oil in a sewer system, rivers, etc.
- Always put oil drained from your machine in containers. Never drain oil directly on the ground.
- Obey appropriate laws and regulations when disposing of harmful objects such as oil, fuel, coolant, solvent, filters, batteries, and others.

OPERATION

GENERAL

VIEW OF MACHINE



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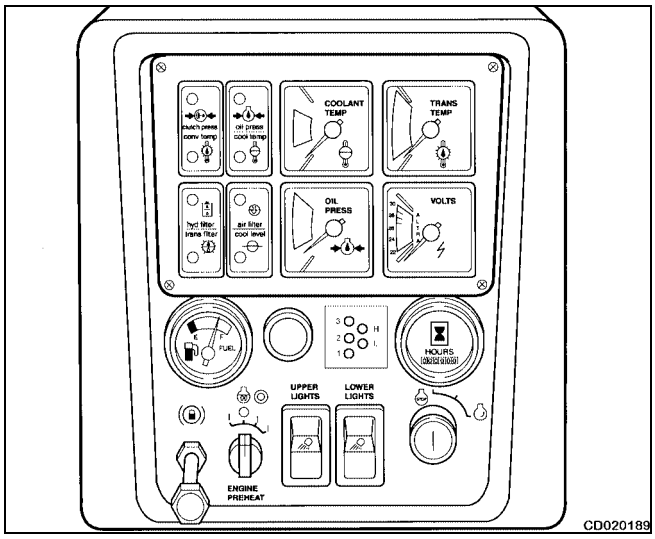
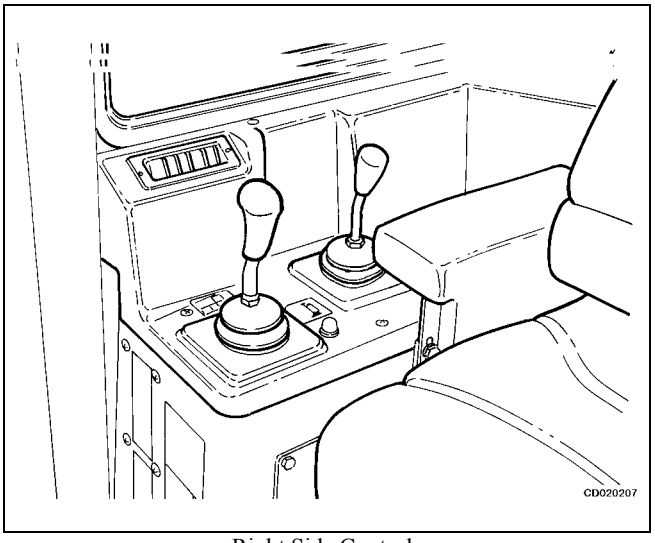
VIEWS OF CONTROLS AND GAUGES

NOTE: **This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.**



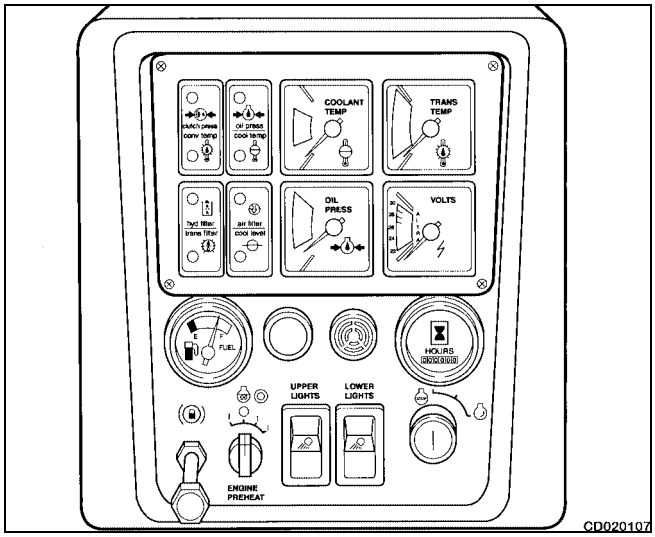
Instrument Panel

Left Side Controls

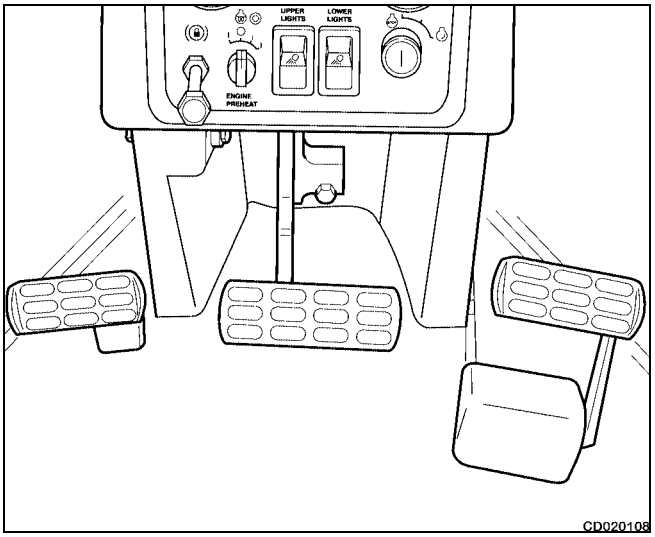


Right Side Controls

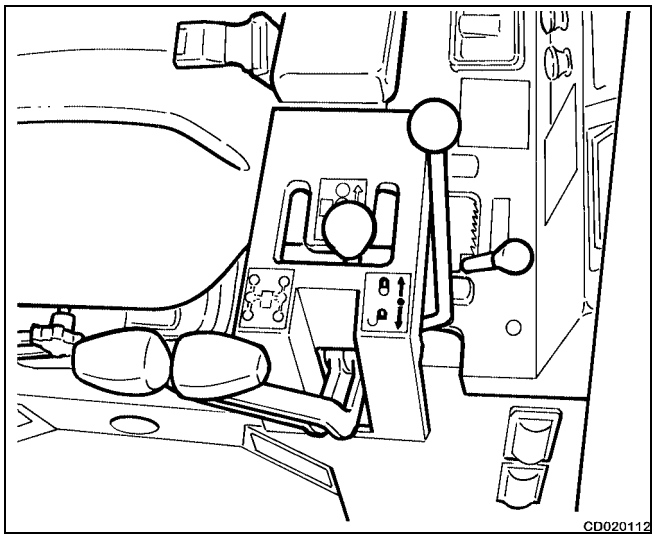
VIEWS OF CONTROLS AND GAUGES



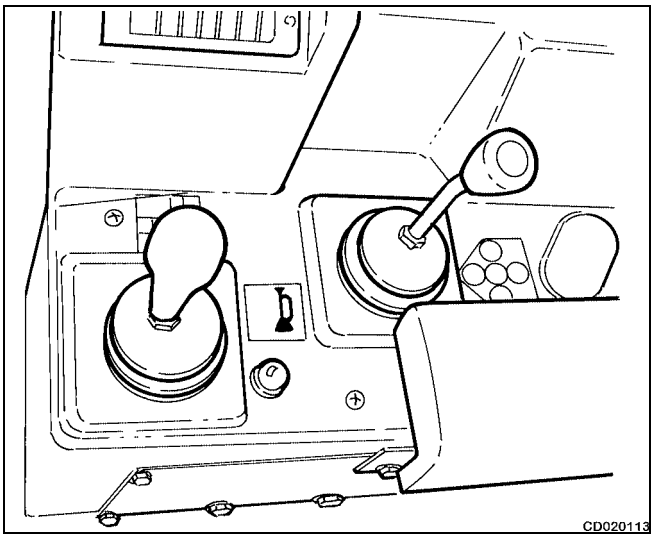
Instrument Panel



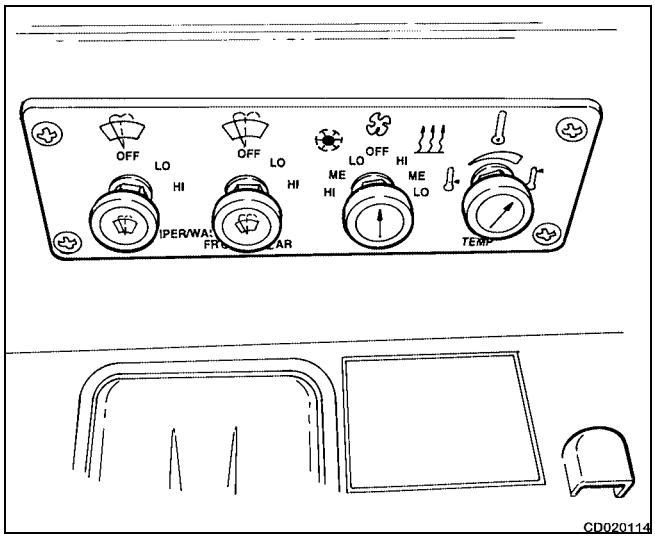
Foot Pedals



Left Side Controls



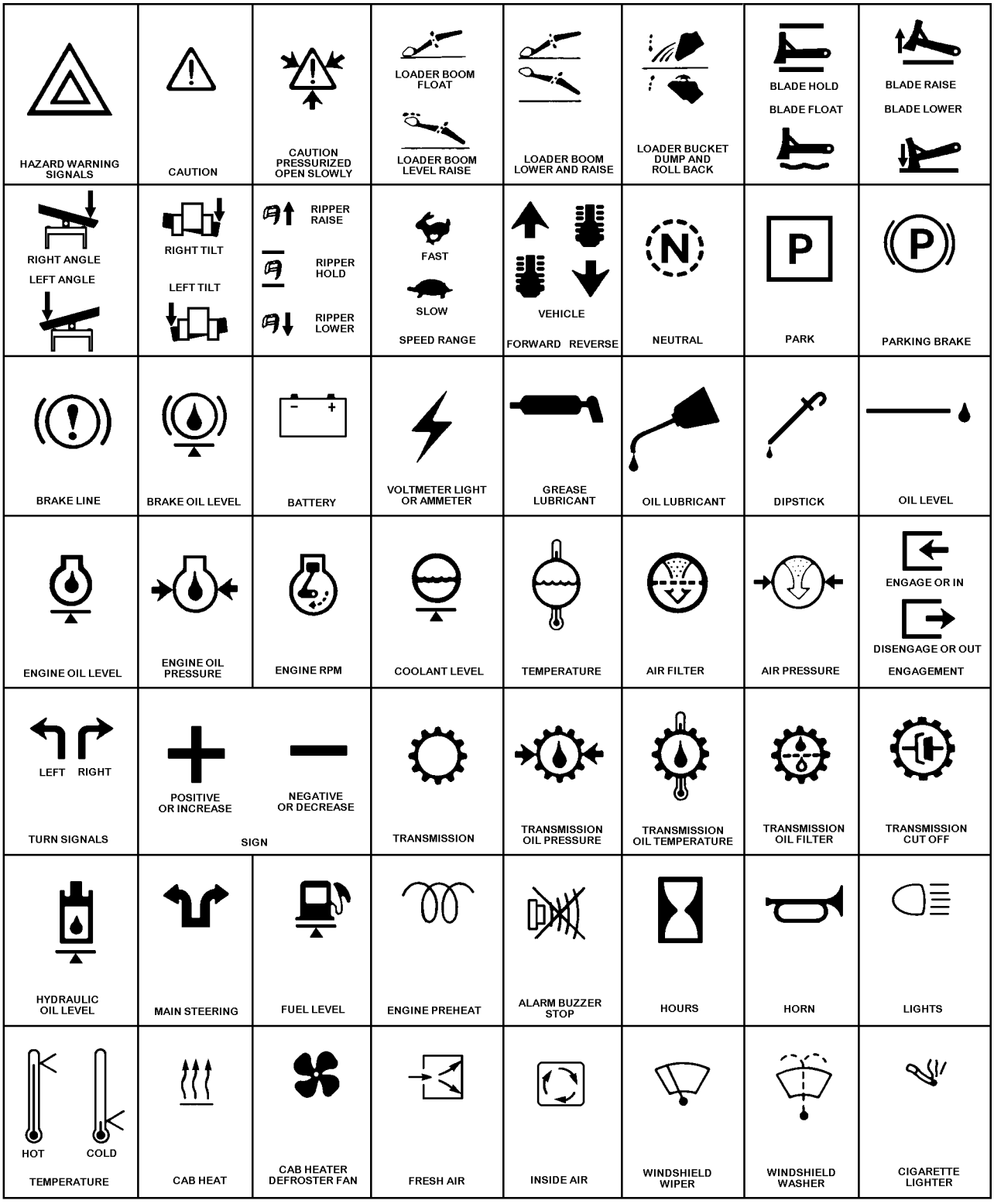
Right Side Controls



Cab Controls

UNIVERSAL SYMBOLS

Universal symbols are used to pictorially identify various instruments and controls. These symbols are an effort to overcome language differences for all operators in a positive way, thus enhancing their safety through quicker recognition of the instruments and controls while operating the equipment. Study the following symbols so you will know their meaning immediately and at a glance.



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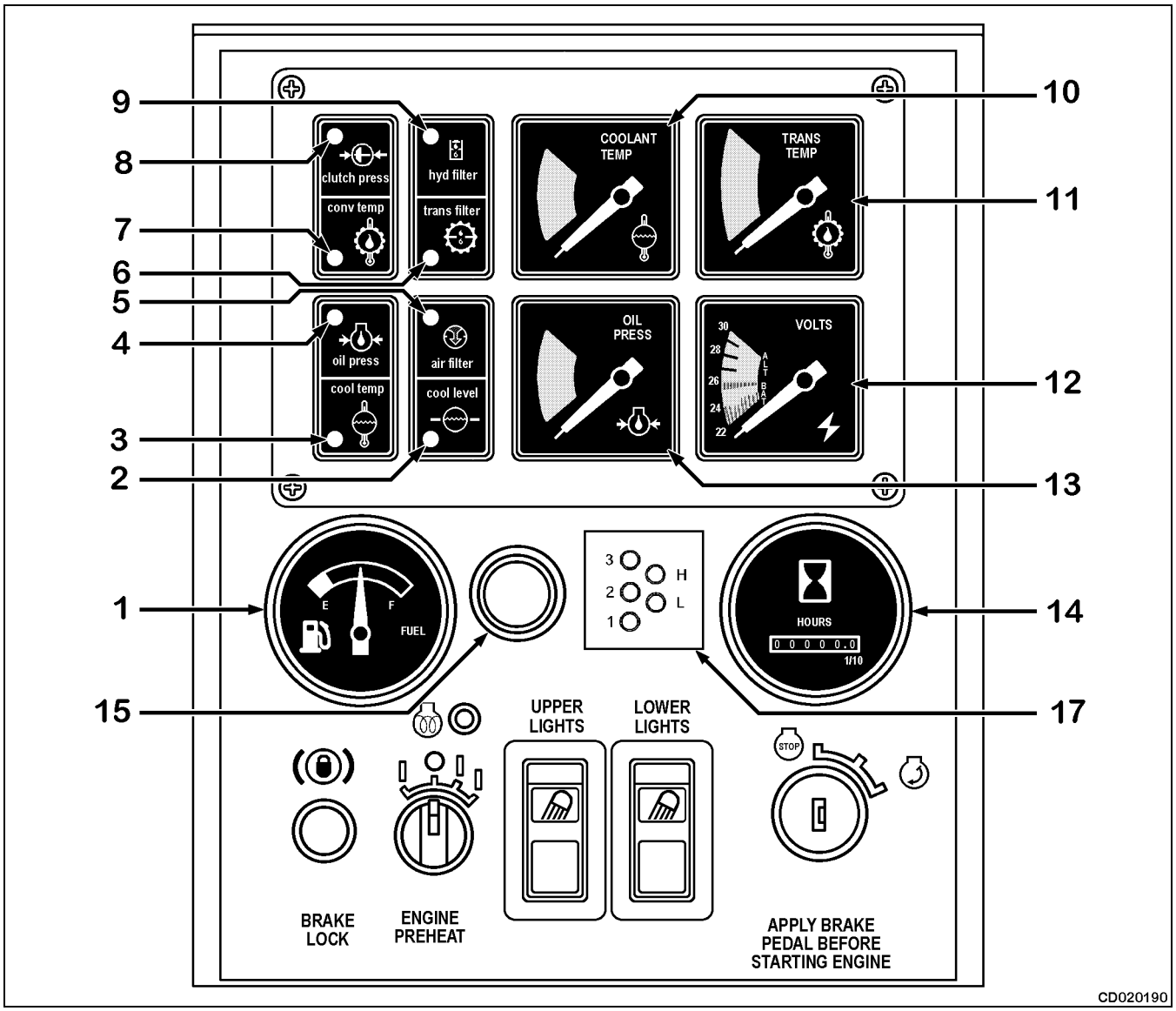
NOTE: This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.

GAUGES AND WARNING LIGHTS



1. Fuel Gauge
2. Engine Coolant Warning Light
3. Engine Coolant Temp Warning Light
4. Engine Oil Pressure Warning Light
5. Air Cleaner Service Light
6. Transmission Oil Filter Warning Light
7. Converter Temperature Warning Light
8. Drive Train Oil Pressure Warning Light
9. Equipment Filter Warning Light
10. Engine Coolant Temperature Gauge
11. Drive Train Oil Temperature Gauge
12. Voltmeter
13. Engine Oil Pressure Gauge
14. Hourmeter
15. Visual Warning Alarm
16. Audio Warning Alarm (Behind Gauge Cluster)
17. Gear Indicator

EXPLANATIONS OF COMPONENTS

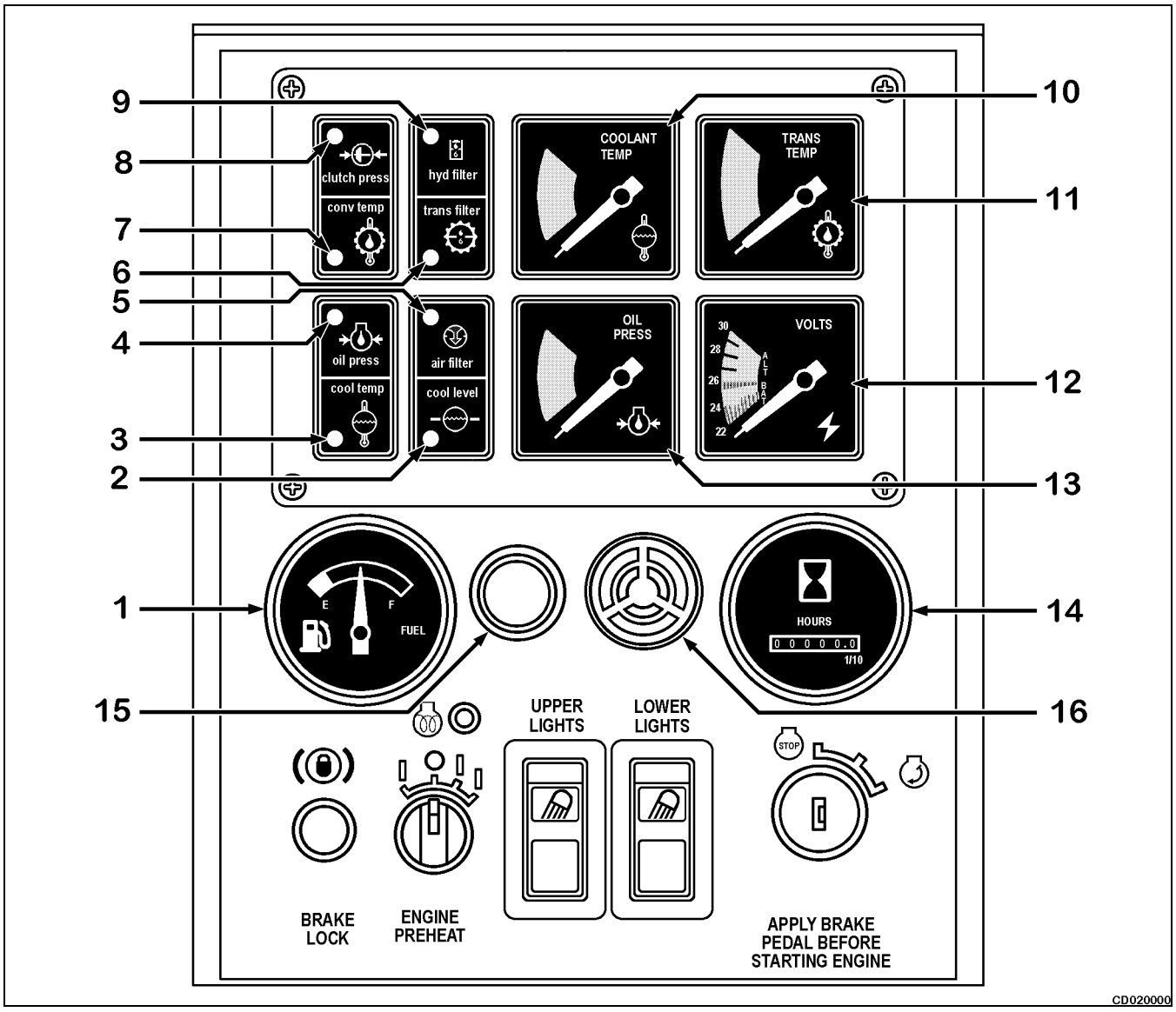
GENERAL

This area of the section covers the location and function of the various instruments and controls of this machine. In the case of controls, more detailed information regarding operation can be found in the following text within this section. Regardless of previous experience as an operator, you must be thoroughly familiar with the location and use of all instruments and controls before operating this machine.

Remark

Understand all control functions before starting the machine. After starting and while operating, observe instruments and warning lights frequently. Investigate any unusual indication or noises in the machine.

GAUGES AND WARNING LIGHTS



1. Fuel Gauge
2. Engine Coolant Warning Light
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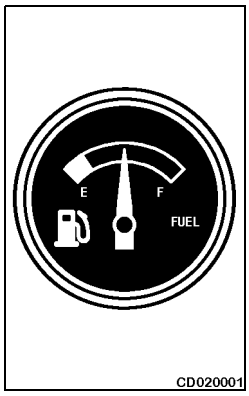
4. Engine Oil Pressure Warning Light
5. Air Cleaner Service Light
6. Transmission Oil Filter Warning Light
7. Converter Temperature Warning Light
8. Drive Train Oil Pressure Warning Light
9. Equipment Filter Warning Light
10. Engine Coolant Temperature Gauge
11. Drive Train Oil Temperature Gauge
12. Voltmeter
13. Engine Oil Pressure Gauge
14. Hourmeter
15. Visual Warning Alarm
16. Audio Warning Alarm

FUEL GAUGE

The fuel gauge (1) indicates the amount of fuel in the fuel tank. After each days operation, be sure to fill the fuel tank.

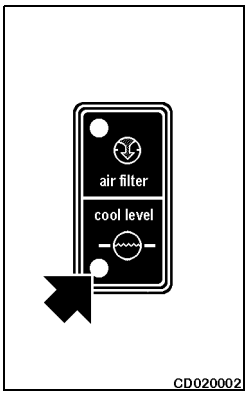
F. Indicates that the tank is full.

E. Indicates there is less than 17 L (4.5 gal) of fuel remaining in the tank, so add fuel.



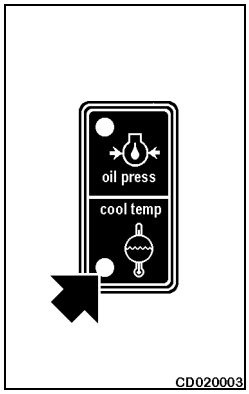
ENGINE COOLANT WARNING LIGHT

The engine coolant warning light (2) will glow red if the coolant level drops below operating level. This warning light is in addition to the main warning light (15) and audible alarm (16). If the lamp is on, check the coolant level and add coolant as required.



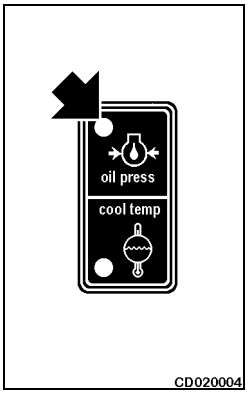
ENGINE COOLANT TEMPERATURE WARNING LIGHT

The engine coolant warning light (3) will glow red if the coolant temperature is too high. When illuminated, stop the machine and run the engine at low idle until the light goes out. This warning light is in addition to the main warning light (15) and the audible alarm.



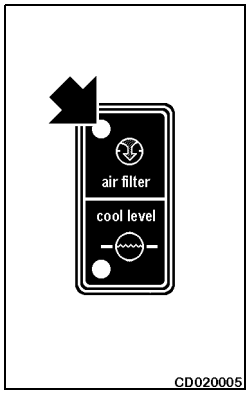
ENGINE OIL PRESSURE WARNING LIGHT

The engine oil pressure warning light (4) will glow red when the engine oil pressure is low. When this light illuminates, stop the engine immediately and look for the cause. This warning light is in addition to the main warning light (15) and the audible alarm.



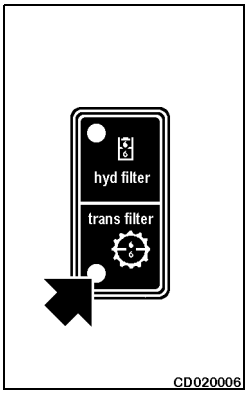
AIR CLEANER SERVICE LIGHT

The air cleaner filter service light (5) will glow amber when the filter element reaches the maximum allowable restriction. When this happens, primary filter element service is required.



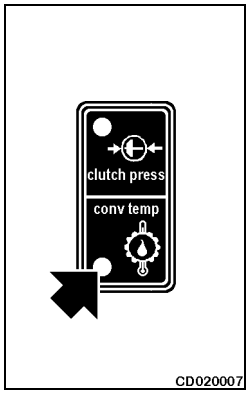
TRANSMISSION OIL FILTER WARNING LIGHT

The transmission oil filter warning light (6) will glow amber when the oil filter element reaches the maximum allowable restriction. When this happens, filter element service is required.



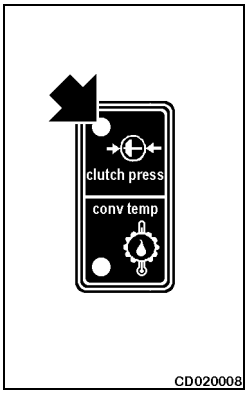
TORQUE CONVERTER TEMPERATURE WARNING LIGHT

The torque converter temperature pressure warning light (7) will glow red if the fluid temperature at the transmission output port has risen. If the light illuminates, stop the machine, run the engine under no load at mid range speed and await for the transmission temperature gauge (11) to return to the green range. This warning light is in addition to the main warning light (15) and the audible alarm.

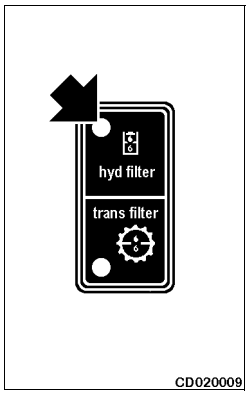


DRIVE TRAIN OIL PRESSURE WARNING LIGHT

The drive train oil pressure warning light (8) will glow red when there is insufficient oil pressure in the neutral position or insufficient oil pressure available for the transmission clutches when in gear. When the light illuminates, stop the engine and clean the transmission system suction filter and check the oil level in the rear frame. If the light continues to illuminate, stop the engine and consult your distributor before operating the machine. This warning light is in addition to the main warning light (15) and the audible alarm.

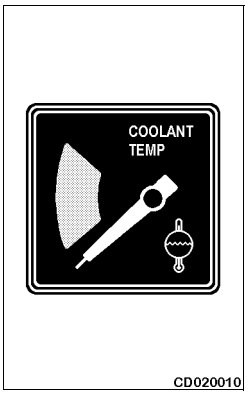


EQUIPMENT FILTER WARNING LIGHT



The equipment filter warning light (9) will glow amber when the oil filter element reaches the maximum allowable restriction. When this happens, filter element service is required.

ENGINE COOLANT TEMPERATURE GAUGE



This gauge (10) registers the temperature of the coolant circulating thru the engine. After the engine has operated a sufficient length of time, the pointer must be in the GREEN area of the gauge.

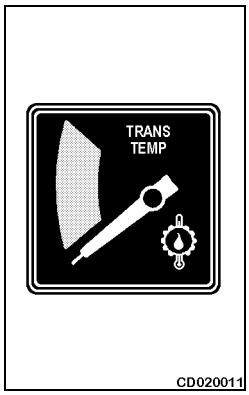
During normal operating, the gauge readings may vary between the minimum and maximum indicated by the GREEN area of the gauge. Continuous engine operating below the minimum temperature is harmful to the engine. Low coolant temperatures will also cause exhaust smoke and increase the rate of fuel consumption.

Remark

In cold weather, it may be necessary to cover part of the radiator to maintain the minimum coolant temperature indicated at the lower end of the GREEN area.

The engine temperature, under full load conditions, should remain in the GREEN area of the gauge. Continuous overheating indicates the need for mechanical correction. A clogged cooling system or a low coolant level will also cause high operating temperatures.

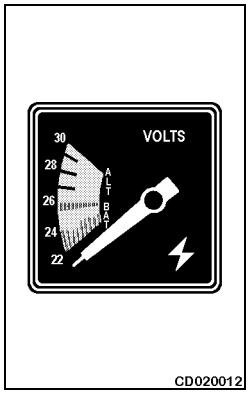
DRIVE TRAIN OIL TEMPERATURE GAUGE



The gauge (11) registers the temperature of the fluid in the drive train. After the engine has operated sufficiently to reach a stabilized drive train temperature, check the gauge. The pointer must be in the green range. If the pointer is out of this area shut down the engine and check the following:

- **A.** Restricted radiator or oil cooler core.
- **B.** Low drive train oil level.
- **C.** Torque converter charge pressure.
- **D.** Rear main frame breather.

VOLTMETER



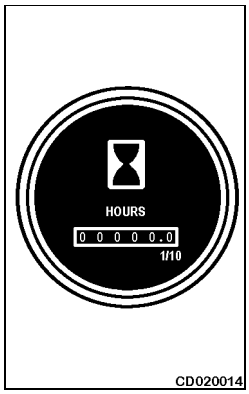
The voltmeter (12) indicates the charge condition of the battery. At low idle speed, the gauge pointer should be in the green area between the striped areas, which indicates a good battery charge. If the voltage drops below this area, the battery should be checked.

With the engine operating above low idle speed, the pointer should be in the upper green area, which is the normal operating range. If the pointer drops below or exceeds this area, the battery and/or alternator may be at fault. Stop the engine and check the belt tension. If any abnormality is found see the maintenance section for belts.

ENGINE OIL PRESSURE GAUGE

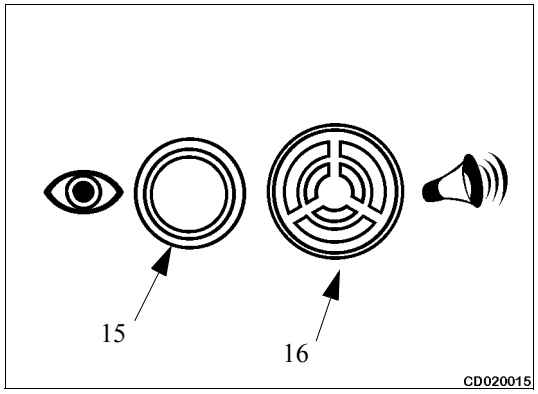
The gauge (13) registers the pressure at which the lube oil is circulated through the engine. The pointer must register in green area immediately upon engine starting and when the engine is operated at full load speeds.

HOURMETER



The hourmeter (14) electrically records the actual hours of engine operation. The purpose of the hourmeter is to indicate when to perform the recommended maintenance and lubrication operations. The hourmeter will register only when the engine is running. While the engine is running, the display at the end of the meter will advance in 1/10 hour increments and 1 for each hour of operation regardless of the engine speed.

VISUAL WARNING ALARM



This light (15) will illuminate when one and/or all of the following situations arise;

Engine coolant level ..... LOW

Engine oil pressure ..... LOW

Engine coolant temperature ..... HIGH

Torque converter oil temperature ..... HIGH

Transmission clutch pressure ..... LOW

Stop the machine and find out which warning light is aglow and check gauge indication.

AUDIO WARNING ALARM

This alarm (16) will sound when one and/or the other following situations arise;

Engine coolant level ..... LOW

Engine oil pressure ..... LOW

Stop the machine and find out which warning light is aglow. Check the gauge indication.

Engine coolant temperature ..... HIGH

Torque converter oil temperature ..... HIGH

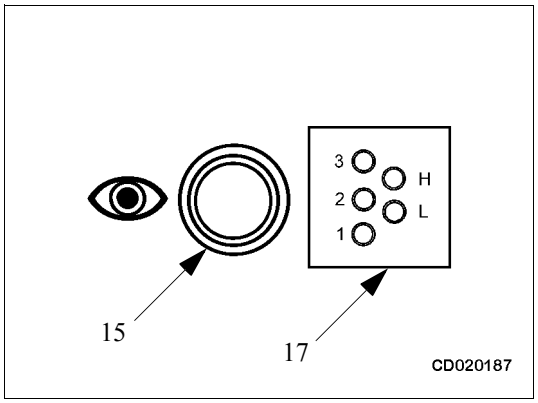
Transmission clutch pressure ..... LOW

NOTE: **This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.**

GEAR INDICATOR

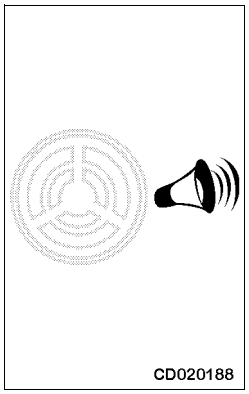
The gear indicator (17) indicates the transmission range in the left hand vertical row of three (3) green lights. One (1) of the three (3) lights will always be on.

Final drive clutch selection is indicated by the right hand vertical row of two (2) green lights. One (1) of the two (2) lights will always be on

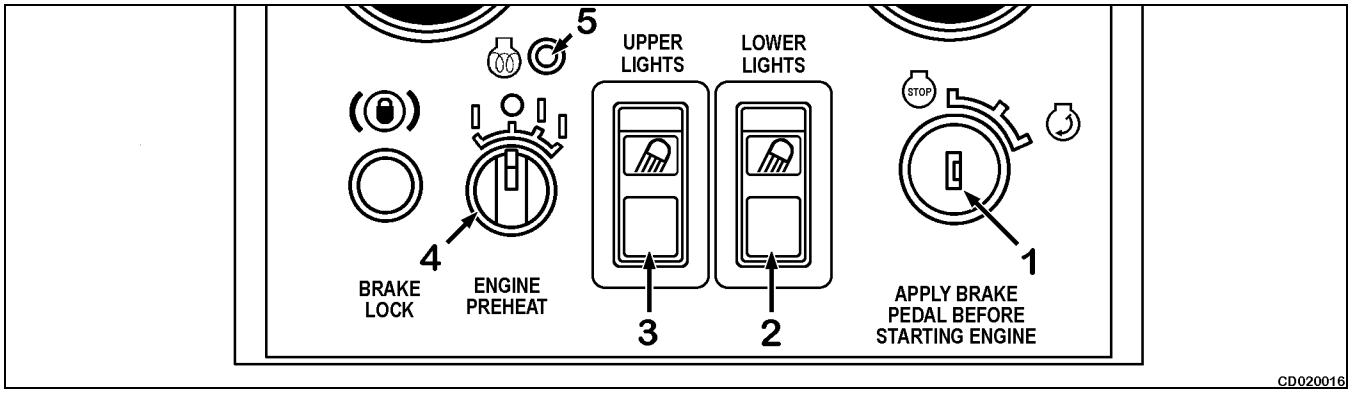


AUDIO WARNING ALARM

This alarm (hidden behind gauge cluster) will sound when one and/or the other following situations arise;



SWITCHES



KEY START SWITCH

This switch (1) is used to start or stop the engine. It has four key positions.

R1 position

This position is used to check bulbs, warning lights and the audible alarm.

OFF position

The key can be inserted or removed. The switches for the electric system, except the lighting circuits, are all turned off and the engine is stopped.

ON/ACC position

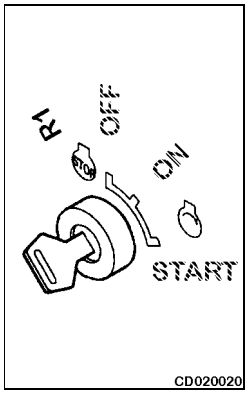
Electric current flows in the charging and lamp circuits. Keep the starting switch key in the **ON** position while the engine is running. This position is also used if the engine is not running when accessories are needed.

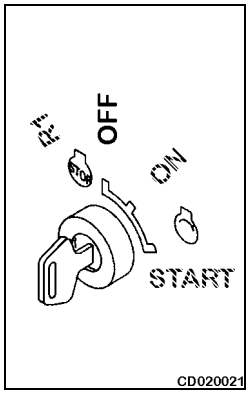
START position

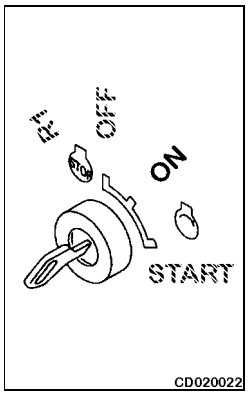
This is the engine start position. Keep key at this position during cranking. Immediately after starting engine, release the key which will automatically return to the **ON** position.

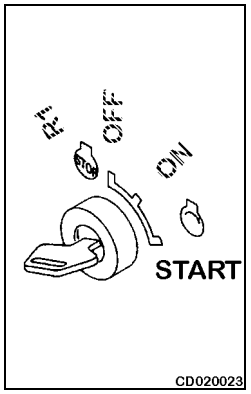
Remark

To prevent damage to the starter motor and avoid low battery output, do not continuously crank the engine for more than 30 second intervals. Allow 1 to 2 minute recovery period between cranking.









WORK LIGHT SWITCH

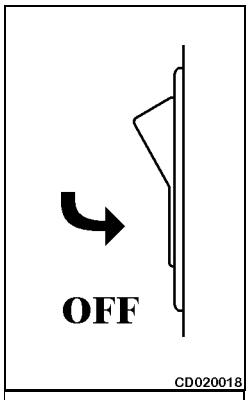
The work light switch is a rocker type switch. Activation of the switch turn on the work lights.

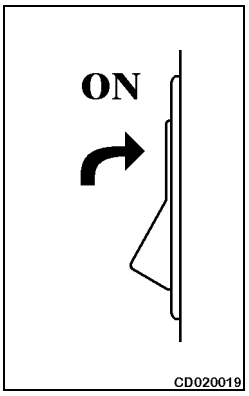
Left switch (3) Cab front and rear lights

Right switch (2) Hood level and rear fuel tank light

Remark

The lighting circuits can be operated with the starting key switch in OFF position and master disconnect switch in the ON position.





GRID HEATER TIMER SWITCH

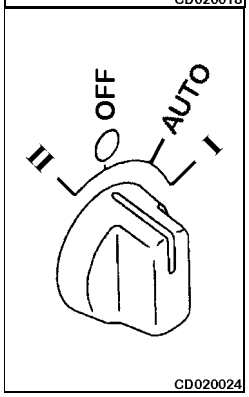
This switch (4) actuates the electrical heater to warm up the engine intake air.

OFF: Preheating is not actuated.

AUTO: Auto preheating is actuated. The length of the preheating time varies according to the ambient temperature when it is below ≈ -5° C.

I: This position is used when **AUTO** preheating is not enough to start the engine in cold weather simply with the switch at the **AUTO** position. When the switch is released, it will return to the **AUTO** position.

II: This position is used when carrying out preheating manually without using **AUTO** preheating. When the switch is released, it will return to the **OFF** position.



- For details, see "COLD WEATHER STARTING" on page 2-44.

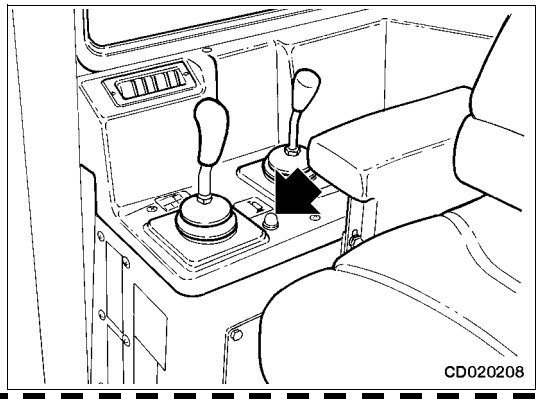
GRID HEATER INDICATOR

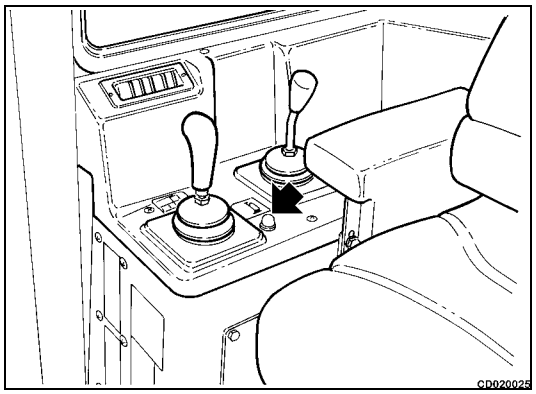
This light (5) indicates that the intake air heater is in the process of being preheated. While preheating is being carried out with the grid heater timer switch, the lamp lights up. In the case of automatic preheating, the lamp goes out when the preheating is completed. In the case of manual preheating, the lamp goes out when the glow switch is released.

HORN SWITCH

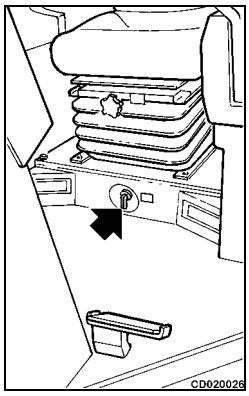
Depress the switch to sound the horn.

NOTE: This added illustration shows the difference for machines equipped with Single Lever Transmission/Steering Control.





ELECTRICAL SYSTEM MASTER SWITCH



Turn the key clockwise to connect the battery ground circuit. Turn the key counterclockwise to disconnect the battery ground circuit.

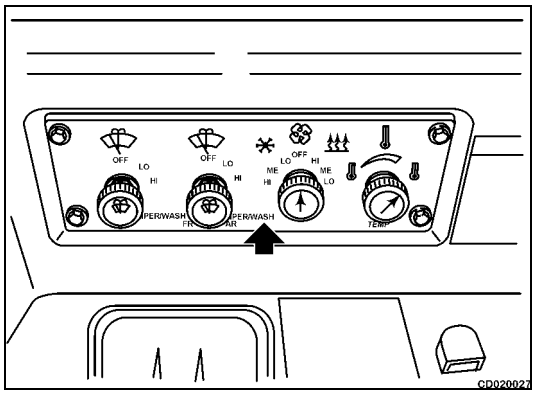
Remark

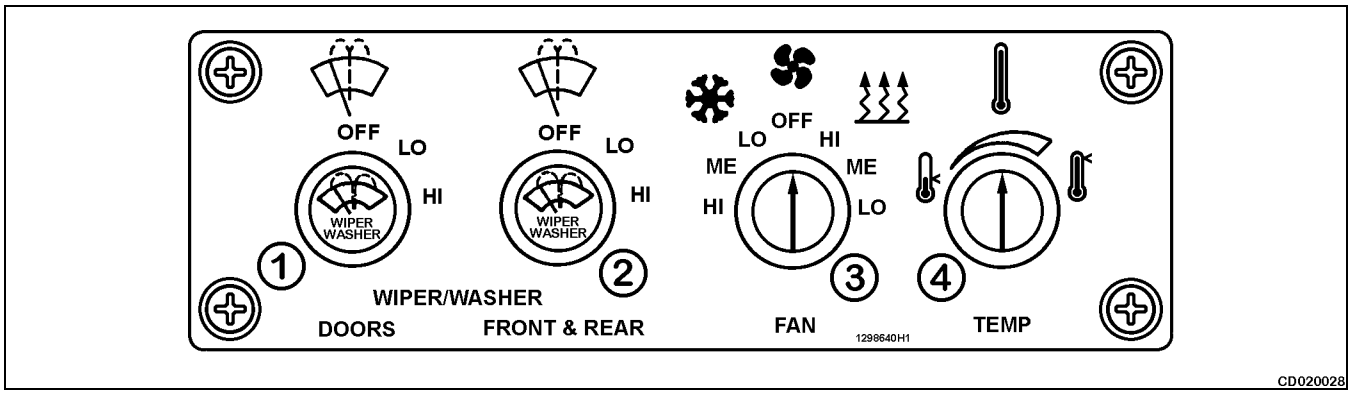
Keep the switch on while the engine is running.

CAB SWITCHES

Control Panel

The control panel is located below the left window rearward of the left entry door.





1. Door Wiper and Washer Switch

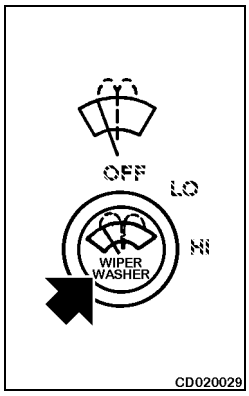
This three position push in switch is used to activate the door wiper and washer systems.

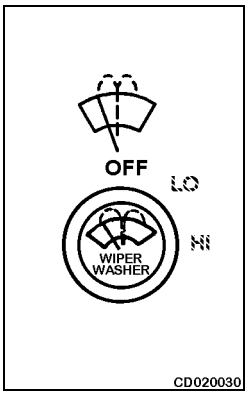
Push the switch knob in to employ the washer system.

OFF When in this position the switch deactivates the door wiper systems.

LO When in this position the switch activates the door wiper systems in a slow sweeping motion.

HI When in this position the switch activates the door wiper systems in a fast sweeping motion.





2. Front & Rear Wiper and Washer Switch

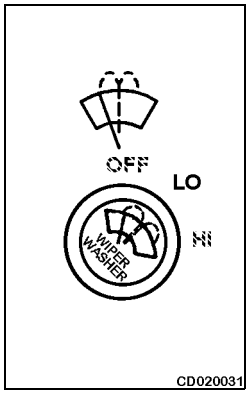
This three position push in switch is used to activate the front and rear wiper and washer systems.

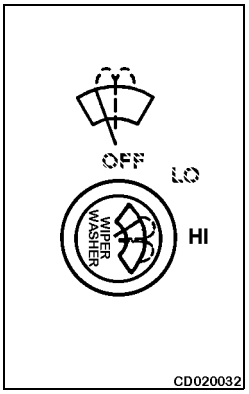
Push the switch knob in to employ the washer system.

OFF When in this position the switch deactivates the front and rear wiper systems.

LO When in this position the switch activates the front and rear wiper systems in a slow sweeping motion.

HI When in this position the switch activates the front and rear wiper systems in a fast sweeping motion.





3. Operator Environment Switch

This seven position switch is used to control the amount of heated or cooled air delivered in the cab.

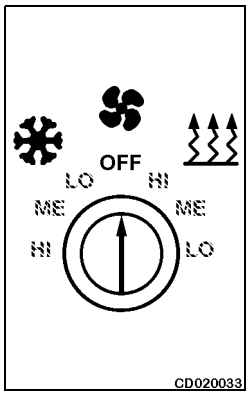
OFF -When in this position the blower fans are off.

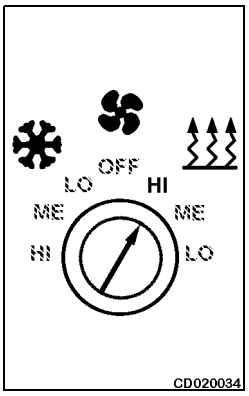
Heater Positions

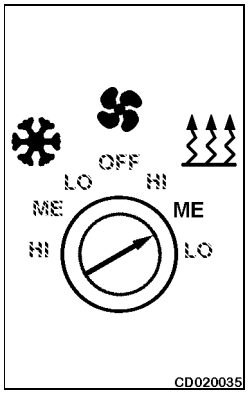
HI When in this position, a maximum amount of heated air is circulated through the cab.

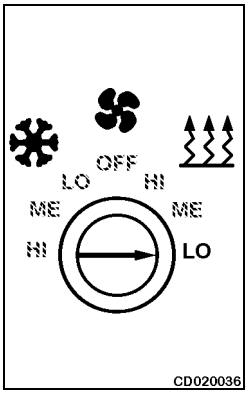
ME When in this position, a medium amount of heated air is circulated through the cab.

LO When in this position, a minimum amount of heated air is circulated through the cab.







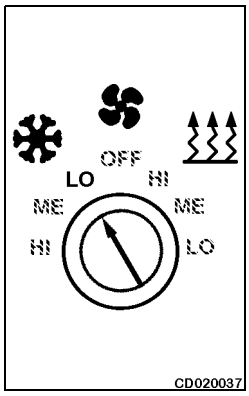


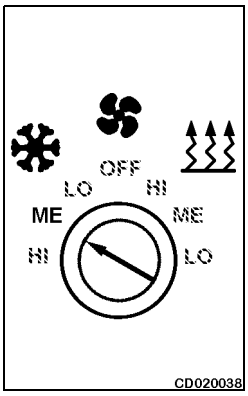
Air Conditioner Positions

LO When in this position, a minimum amount of cooled air is circulated through the cab.

ME When in this position, a medium amount of cooled air is circulated through the cab.

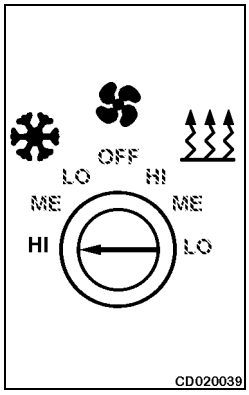
HI When in this position, a maximum amount of cooled air is circulated through the cab.

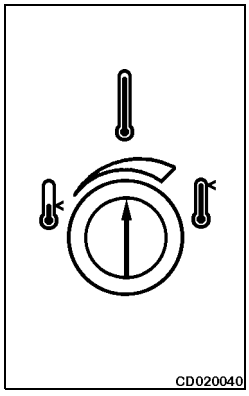




4. Heated Air Temperature Switch

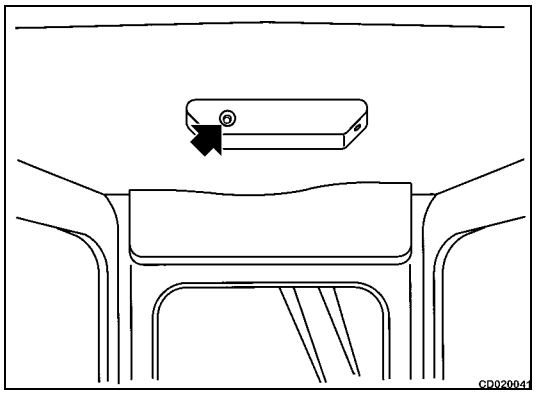
This variable position switch regulates the temperature of the air circulated throughout the cab. The left area designates the cooler air with the right area being the warmest.





5. Cab Interior Light Switch

The interior light incorporates a push type switch for on/off operation. To turn the light on push in the switch, to turn the light off push in the switch.



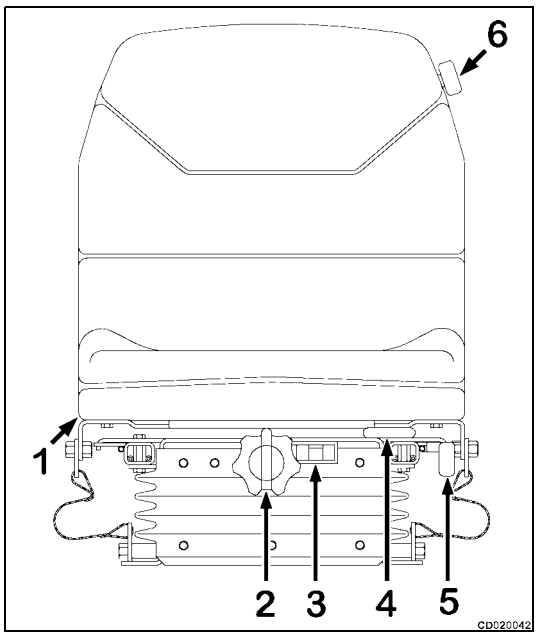
SEAT, SEAT BELT AND ARM RESTS

SEAT

This seat can be adjusted using the following seven functions.

WARNING

- **Adjust the seat position at the beginning of each shift or when operators change and fasten the seat belt.**
- **Adjust the seat so that the brake pedal can be depressed all the way with the operator's back against the seat back rest.**



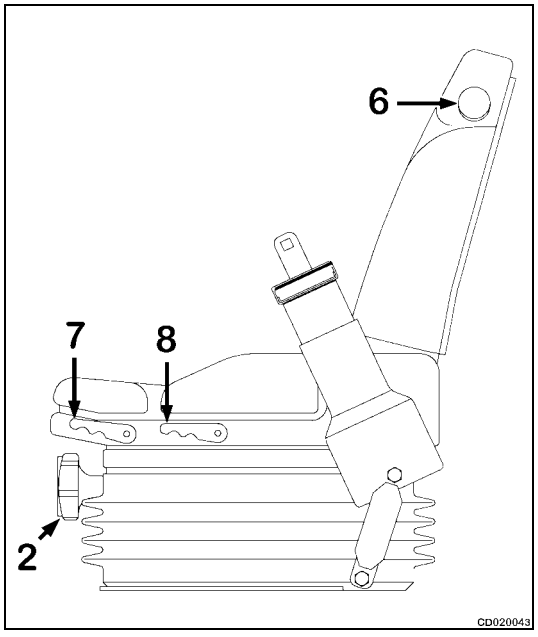
Height Adjustment (1)

This seat is equipped with a spring held three stop mechanical height positioner. To actuate the height mechanism, lift up the seat to next stop position. Lifting past the top position will return the seat to the bottom position.

Bottom to top adjustment 76 mm (3 in) in 2 stages

Weight Adjustment Knob (2)

Turn the knob clockwise or counterclockwise to adjust the seat to the desired strength. Check the indicator (3) as necessary.



Fore Aft Adjustment Lever (4)

Move the lever and slide the seat back and forth to it where it is comfortable and easy to operate, then release the lever.

Fore and aft adjustment: 52 mm (6 in) in 13 stages

Swivel Adjustment Knob (5)

Move the lever to rotate the seat left or right when operating any rear mounted equipment.

Center to left or right swivel 14°

Lumbar Support Knob (6)

The tension of the lower rear seat back can be adjusted with the knob. Turn the knob until the desired amount of lumbar support is achieved.

Lower Seat Tilt Control Lever (7)

Move the lever to tilt the lower seat to the desired position.

Up and down tilt: 10° total

Seat Back Tilt Control Lever (8)

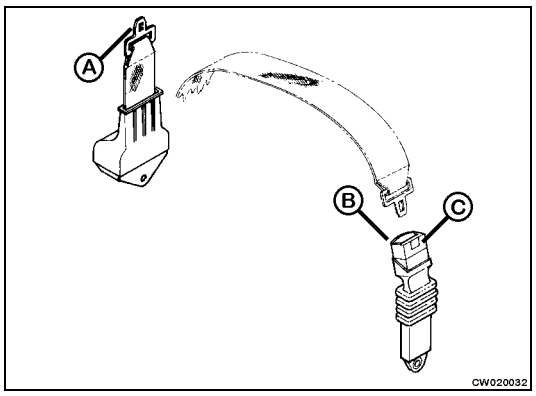
Move the lever to tilt the seat back to the desired position.

Front to back swivel: 115° in stages of 2.5°

SEAT BELT

WARNING

- **Before driving the machine, adjust the seat and fasten the seat belt. Adjust the seat belt to fit snugly and low around the hips to lessen the chance and severity of injury in the event of an accident. Never wear the seat belt across the abdomen.**
- **Do not use bleach, color dye or solvents on the seat belt webbing which may cause a severe loss of tensile strength. This could cause the webbing to break resulting in personal injury. It is recommended that the belt be cleaned only with warm water and a mild detergent.**



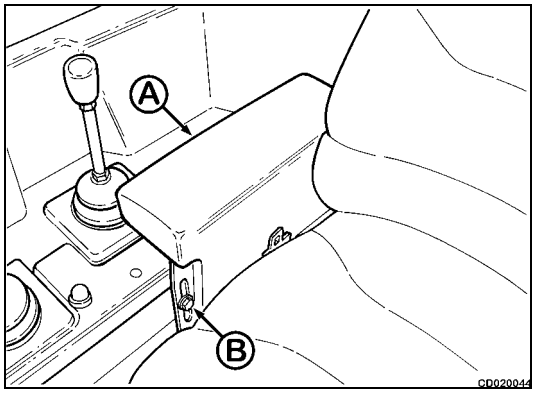
To buckle, insert the tongue portion (**A**) of the buckle into the locking portion (**B**). To release, press the release button (**C**) on the locking portion of the buckle and pull the tongue portion out.

Keep belts flat to avoid twisting and roping when not being used. Do not place heavy or sharp object on the belts.

ARM REST

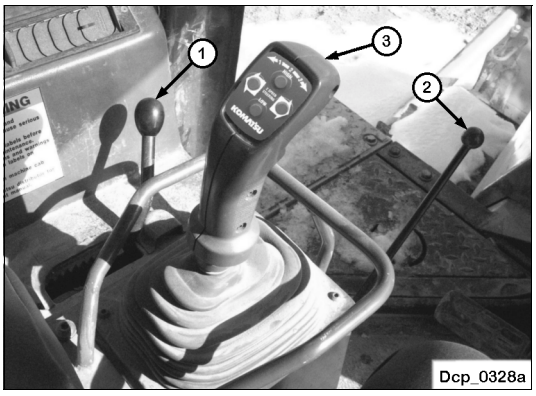
The arm rests may be adjusted up or down for the convenience of the operator.

To raise or lower arm rests (**A**), loosen the front and rear mounting bolts (**B**) and position to the desired height. Tighten the bolts after desired height has been obtained.

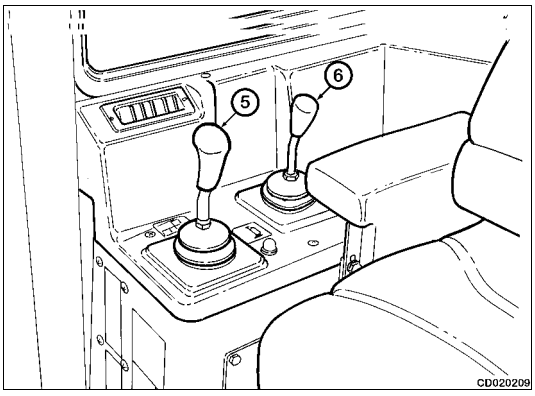


CONTROL LEVERS

NOTE: **This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.**



Left Side Controls

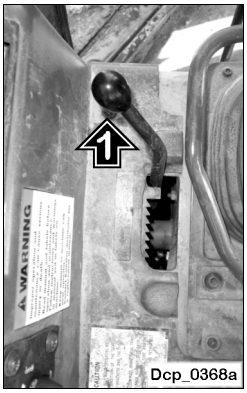


Right Side Controls

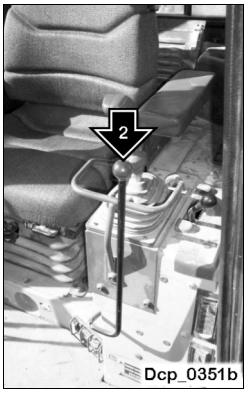
1. Fuel Control Lever
2. Safety Lock Lever
3. Transmission/Steering Lever
4. Not used
5. Blade Control Lever
6. Ripper Control Lever

FUEL CONTROL LEVER

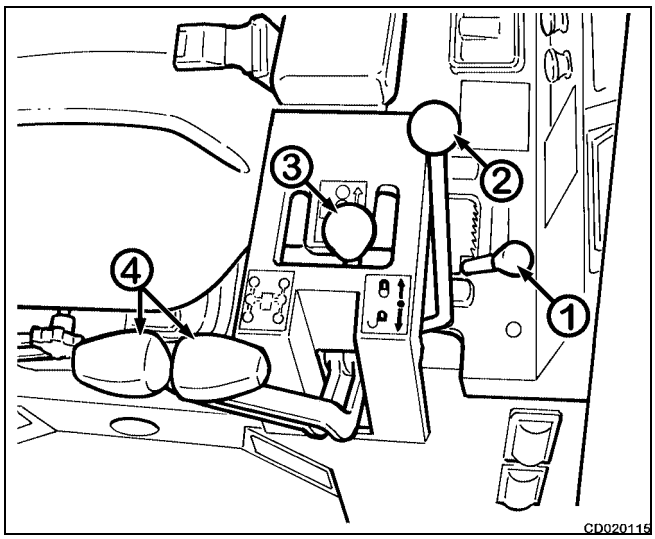
This lever (1) is used to control the engine speed and output.



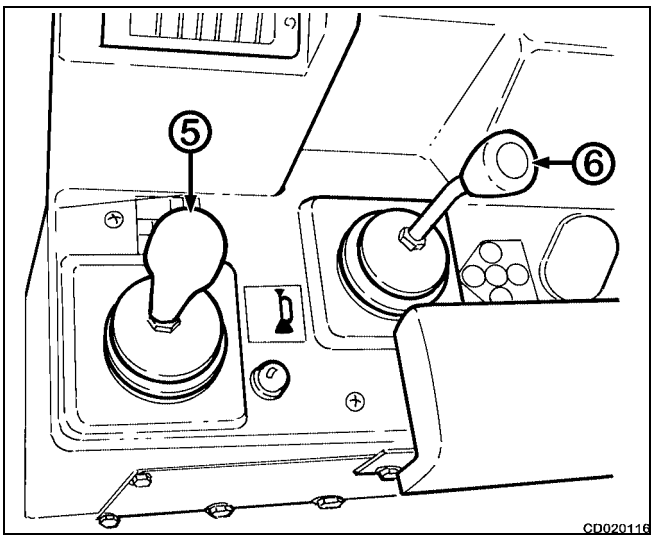
This lever (2) locks the transmission lever. Push forward and down to release (unlock) the lever. Pull rearward and up to apply (lock) the lever.



CONTROL LEVERS



Left Side Controls

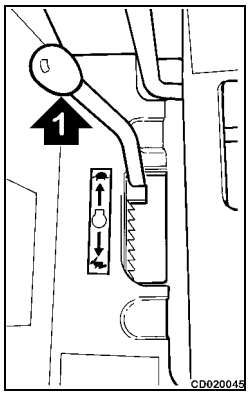


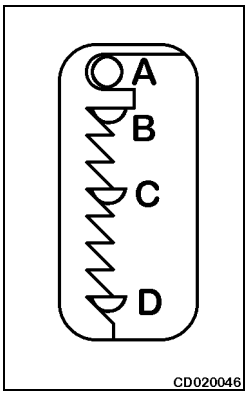
Right Side Controls

1. Fuel Control Lever
2. Safety Lock Lever
3. Transmission Lever
4. Steering Levers
5. Blade Control Lever
6. Ripper Control Lever

FUEL CONTROL LEVER

This lever (1) is used to control the engine speed and output.



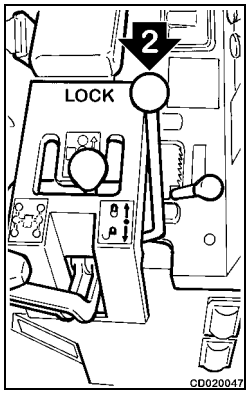


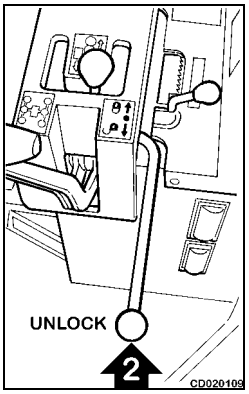
- **A** Engine Shut Off (First notch forward)
- **B** Low Idle (Second notch forward)
- **C** Mid Range Idle (4th or 5th notch)
- **D** High Idle (Last notch rearward)

SAFETY LOCK LEVER

⚠ WARNING

When leaving the operator's compartment, position the safety lock lever securely to the LOCK position. If this lever is not locked and the transmission lever is touched by mistake, this may lead to a serious accident. If the lever is not placed securely in LOCK position, the transmission lever may not be properly locked.



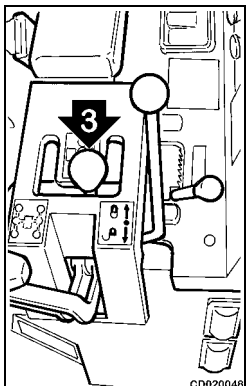


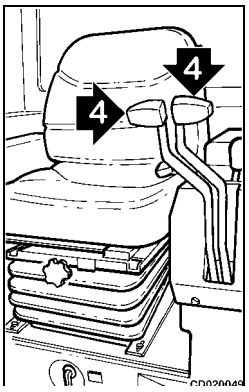
This lever (2) locks the transmission lever. Push forward to release (unlock) the lever. Pull rearward to apply (lock) the lever.

Remark

The lever must be in the LOCK (up) position to start engine.

TRANSMISSION LEVER





The lever (3) is used to select the transmission direction and various gear ranges.

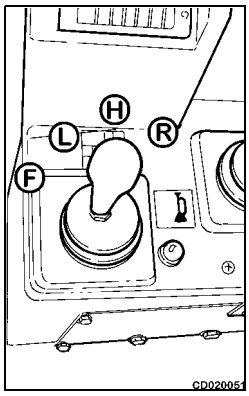
Remark

When the shift lever is put in any one of the reverse positions, the back up alarm will automatically sound

STEERING LEVERS

These levers (4) steer the machine by supplying an additional speed range to either track for gradual turns with power to both tracks. They also apply the brake to either track for pivot turns.

BLADE CONTROL LEVER



This lever (5) controls all operation of the blade; blade raise, lower and float and right or left tilt.

Remark

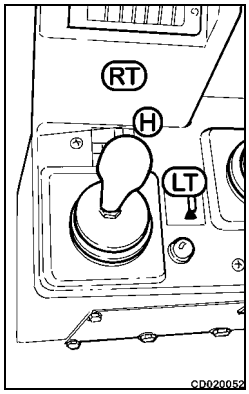
Holding the lever in any position except HOLD or FLOAT for an extended period of time after the hydraulic cylinder rod has reached the limit of its travel will produce excessive heat in the hydraulic system which may affect equipment performance.

Raise: Pull the lever back **R** to raise the blade. When released the lever will return to the hold position.

Hold: The lever automatically returns to this position **H** from any position except the float position when the lever is released. The blade will remain the same position as it was when the lever was released.

Lower: Push the lever forward **L** to lower the blade. When released the lever will return to the hold position.

Float: With the lever in the float position **F**, the blade is free to follow the contour of the ground. To place the control lever in the float position, push it all the way forward to its detented position. The lever will remain in this position until manually returned to the hold position.

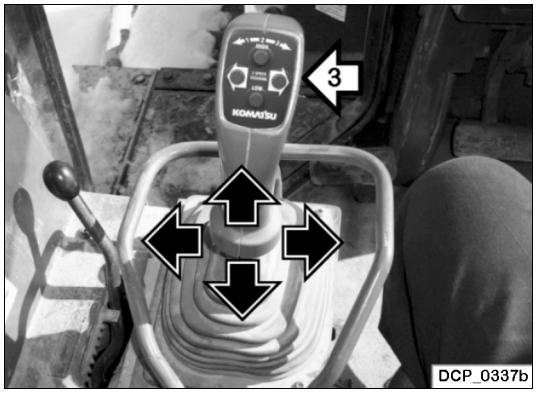


R Tilt: Push the lever to the right **RT** to lower the right hand corner of the blade. When released the lever will return to the hold position.

L Tilt: Pull the lever to the left **LT** to lower the left hand corner of the blade. The lever will return to the hold position when released.

NOTE: **This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.**

TRANSMISSION/STEERING LEVER



The transmission/steering lever (3) is used to select direction, range gear, and high or low steering clutches.

Center position of the transmission/steering lever (3) is neutral.

Move the safety lock lever to the UNLOCK position. This action supplies oil to the transmission/steering lever control valve making it operational.

Forward and Reverse Motion

Push the transmission/steering lever forward to engage the forward clutch for forward motion.
Pull the transmission/steering lever backward to engage the reverse clutch for reverse motion.

Remark

There is a hydraulically actuated detent for both forward and reverse, which is functional only when the engine is running and the safety lock lever is in the UNLOCK position.

Remark

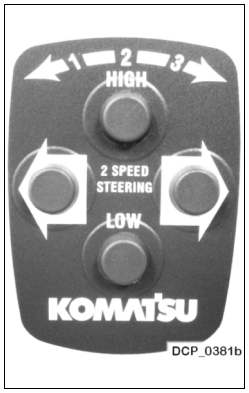
When the transmission/steering lever is operated in reverse position, the backup alarm will automatically sound.

Range Gear Selection

Rotate the transmission/steering lever to engage the desired transmission range clutch. Three (3) rotary positions of the transmission/steering lever select the range clutch as follows: Counterclockwise position is 1st gear; center position is 2nd gear; and clockwise position is 3rd gear.

Remark

There is a mechanical detent for each of three (3) rotary position of the transmission/steering lever. The three (3) transmission ranges and the two (2) steering drive ranges (described below) give a total of six (6) operating ranges in which the machine can operate.



Pivot Turns and Modulated Turns

Move the transmission/steering lever to the left to make a left turn and to the right to make a right turn.
When the transmission/steering lever is moved all the way to the left or the right, the steering clutch on that side is released and the brake on that side is applied. This results in a pivot turn.
Moving the transmission/steering lever partially to one side gives partial pressure to the clutch and brake. This results in a modulated turn.

Remark

The transmission/steering lever is spring loaded to the center for straight motion.

NOTE: **This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.**

High or Low Steering Range and Power Turns

The four (4) buttons on the transmission/steering lever control the two-speed steering clutches in the steering drive.
Move the transmission/steering lever from neutral (center) to a drive position for steering range and power turn functions.

- Press and release the upper button to select the HIGH range. Direct drive is engaged to both tracks.

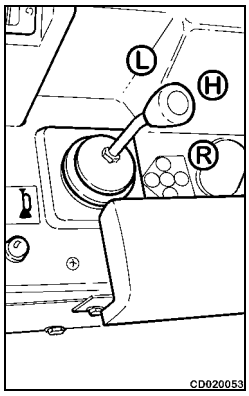
- Press and release the lower button to select the LOW range. Gear reduction is engaged to both tracks.

- Depress and hold the left button for a power turn to the left. Gear reduction is engaged to the left track and direct drive to the right track.

- Depress and hold the right button for a power turn to the right. Gear reduction is engaged to the right track and direct drive to the left track.

Releasing the left or right button returns the steering system to the range (HIGH or LOW) that had been last selected.

RIPPER CONTROL LEVER



This lever (6) controls all operation of the ripper; raise, hold, lower, pitch forward and pitch aft.

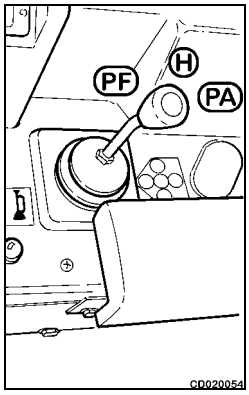
Remark

Holding the lever in any position except HOLD for an extended period of time after the cylinder rod has reached its limit of travel will produce excessive heat in the hydraulic system which may affect equipment performance.

Lower: Push the control lever to the right **L** to lower the ripper. When released the lever will return to the hold position.

Hold: The control lever will return automatically to the hold position **H** from either the lower or raise position when released. The ripper will remain in the same position it was when the control lever was released.

Raise: Pull the control lever to the left **R** to raise the ripper. When released the lever will return to the hold position.



Fore: (pitch) Move the lever forward **PF** to change the forward angle of the ripper tooth penetration. When released the lever will return to the hold position.

Aft: (pitch) Move the lever rearward **PA** to change the aft angle of the ripper tooth penetration. When released the lever will return to the hold position.

Operating Techniques

⚠ WARNING

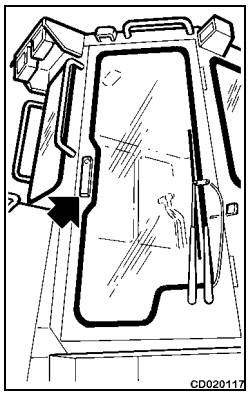
Lower the ripper to the ground before making any adjustments or whenever the machine is to be idle for any length of time.

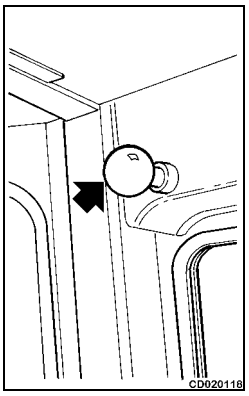
When starting to rip, lower the ripper slowly until the desired penetration is achieved. If the machine will not pull three shanks through the material to be ripped, the center shank must be removed, using only the two end shanks. In very hard material, it is normal practice to remove the two end shanks and use only the center shank for ripping. Rock and shale will often rip easier in one direction than it will in another, so, where it is possible, try ripping at various angles until the best results are obtained. Ripping should be done at depths giving the greatest production without overloading the machine engine. Try to keep the area being ripped as level as possible. Care must be exercised not to jack the rear of the machine off the ground when ripping, as this results in loss of tractive effort and increases wear on the track system of the machine. It is advisable to raise the shanks out of the ground when making turns of 15° or more. Turns of more than 15° with the shanks in the ground put undue strain on the ripper and machine and repeated practice could cause serious damage.

CAB CONTROLS

Outer Door Handle

Insert key and unlock the door. Depress the handle button and rotate the door rearward to secure with the door hold open latch.



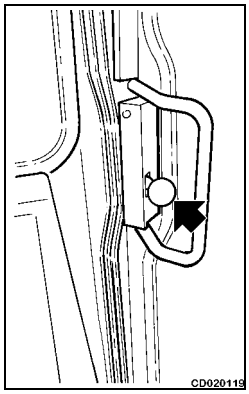


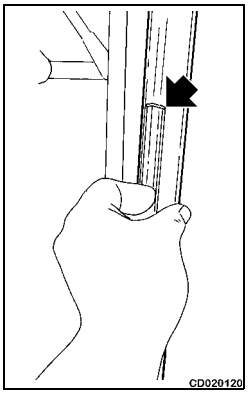
Door Hold Open Latch

This latch will catch and hold the door open when the door is rotated rearward and contact is made. Push in on the latch ball to release the door.

Inner Door Handle

Lift up on the door handle to release the door. When closed, the door will latch closed.

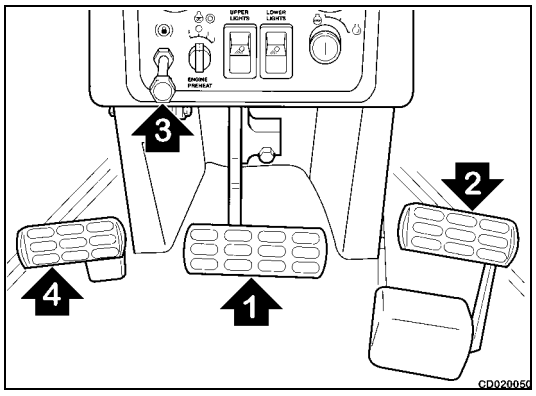




Rear and Side Window Latch

Pull the latch and slide the window to the desired opening. To close, slide the window to the lock, set the latch and secure.

PEDALS



BRAKE PEDAL

This pedal (1) stops the machine and also serves as a parking brake when the brake pedal lock (3) is applied.

DECELERATOR PEDAL

This pedal (2) overrides the engine speed control lever setting. Depress the pedal to decrease engine speed for smoother changes in machine direction and to ease the machine up to a load. Release the pedal for gradual acceleration to the engine speed control lever setting.

BRAKE PEDAL LOCK

This lock (3) secures the brake pedal in the applied position for parking the machine. To lock the brake pedal, fully depress the pedal and pull out the lock. Remove your foot from the brake pedal. To release the brake, depress the pedal and push in the lock.

Remark

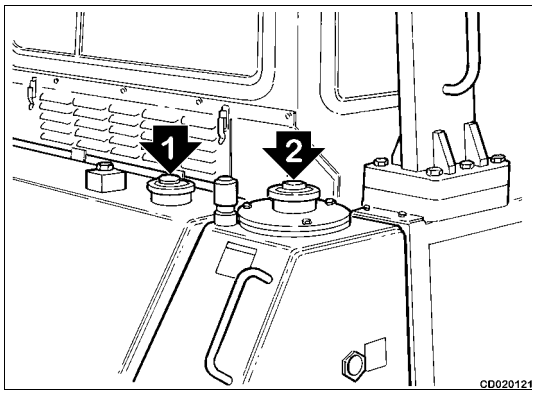
Release the brake pedal lock before moving the machine. The brakes could burn or be damaged if the machine is driven with partially applied brakes.

LEFT FOOT REST

Self explanatory (4).

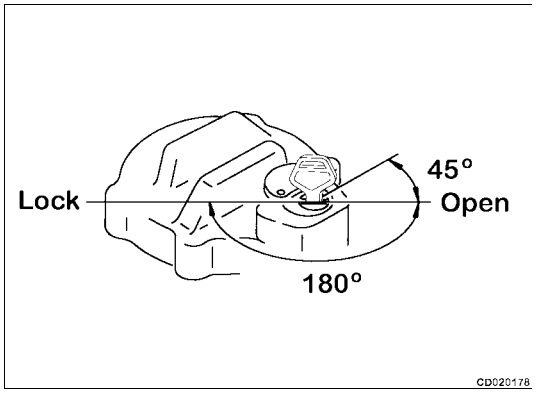
LOCKING CAP

The fuel (1) and hydraulic (2) tank filler ports are each equipped with a locking cap. Use the start switch key to lock and unlock the cap.



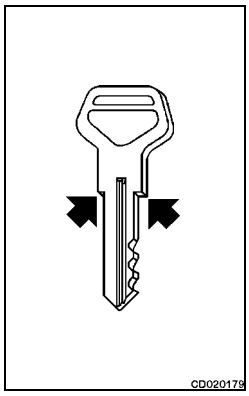
OPENING

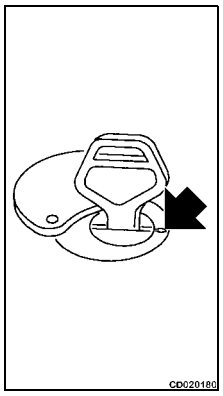
1. Move lock cover back and insert key into the cap. Ensure that the key is fully inserted up to its shoulder before turning. If the key is turned when only partially inserted, it could break.
2. Turn the key counterclockwise to align the match mark on the cap with the rotor groove, then turn the cap slowly. When a click is heard, the lock is released, enabling the cap to be removed.



LOCKING

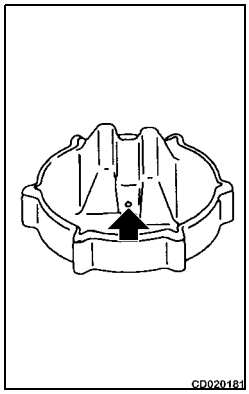
1. Install cap and turn into place. Turn the key clockwise to the lock mark and take the key out. Move lock cover in place over key entry.





Remark

If the breather hole on the cap is clogged, pressure in the tank will drop and fuel will not flow. Clean the hole from time to time.



OPERATION

CHECKS BEFORE STARTING ENGINE

GROUND LEVEL INSPECTION

WARNING

Dirt, oil or fuel around parts of the engine which reach high temperatures may cause fire and damage to machine. Check carefully, and if any abnormality is found, always repair it or contact your 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.

1. Check for Damage, Wear, and/or 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/are found, repair it/them.

2. Remove Dirt from Around Engine, Radiator.

Check that there is no dirt accumulated around the engine or radiator. If any dirt is found, remove it.

3. Check for Leakage of Coolant or Oil Around Engine.

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

4. Check for Oil Leakage from Torque Converter, Transmission, Rear Main Frame Housing, Final Drives, Hydraulic Tank, Hoses, Joints.

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

5. Check the Undercarriage (Track, Sprocket, Idler, Guard) for Damage, Wear, Loose Bolts, or Leakage of Oil from Rollers.

6. Check for Damage to Handrail.

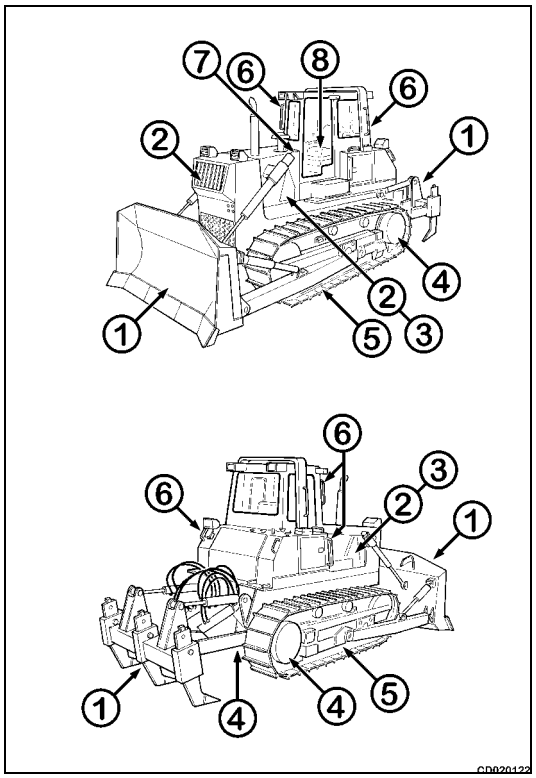
Repair any damage and tighten any loose connections.

7. Check for Damage to Gauges, Lamps on Instrument Panel.

Check for damage to the panel, gauges and lamps. If any abnormality is found, replace the parts. Clean off any dirt on the surface.

8. Check for Damage to Seat Belt and Mounting Areas.

Check that there is no abnormality in the seat belt or mounting areas. If there is any damage, replace with new parts.



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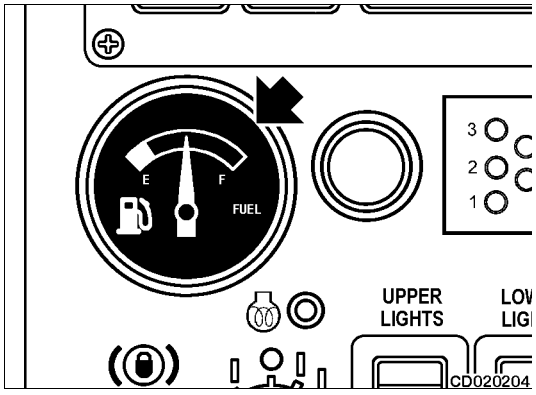
NOTE: This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.

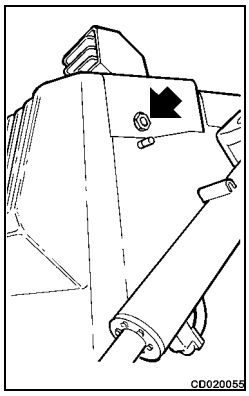


CHECK BEFORE STARTING

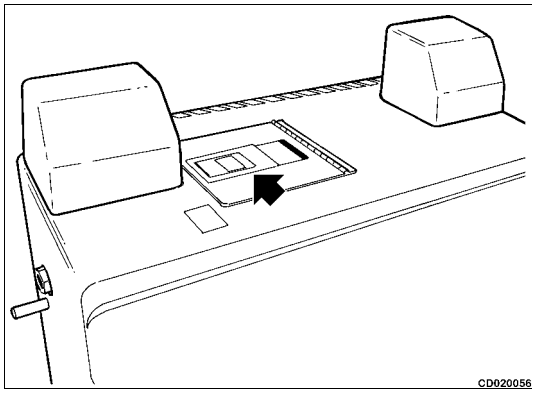
Check and Refill Coolant

WARNING

Do not remove cap while coolant is hot. Hot coolant may spurt out. When removing cap, wait until the coolant temperature goes down and release radiator pressure little by little by loosening slowly, then remove the cap.



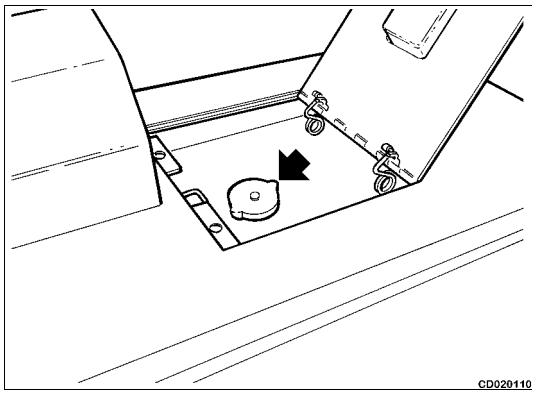
1. Check the coolant level in radiator sight glass to make sure coolant is present.
2. Open the hood access door at the top front of the machine.



3. Remove radiator cap and check that the coolant level is visible. If level is low, add coolant until it is visible in sight gauge.

- For details of the coolant to use, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7.

4. After adding coolant, tighten the cap securely and close the access door.

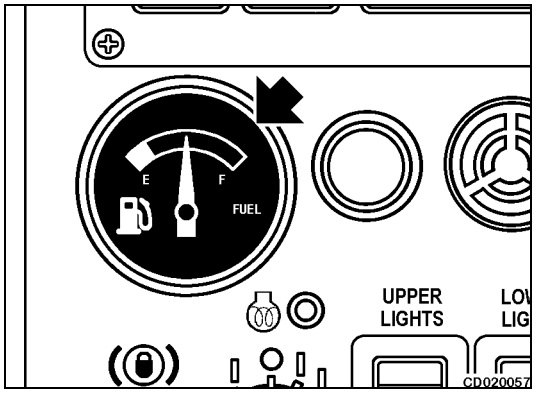


Check Fuel Level

WARNING

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

1. Check the fuel level using the fuel gauge.



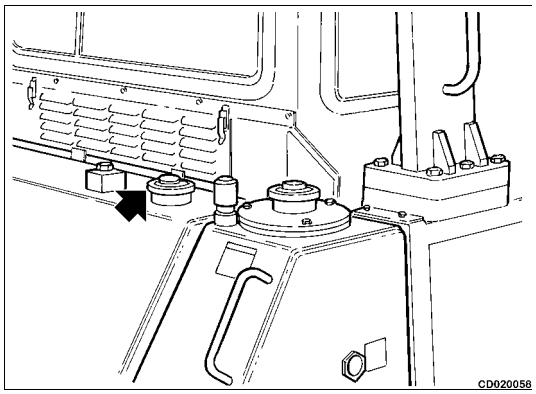
2. After completing work, fill the fuel tank through the filler port.

- For details of locking cap, see “LOCKING CAP” on page 2-29.
- For details of the fuel to use, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7.

3. After adding fuel, tighten the cap securely.

Remark

Fuel capacity: . . . . . 490 L (129 gal)

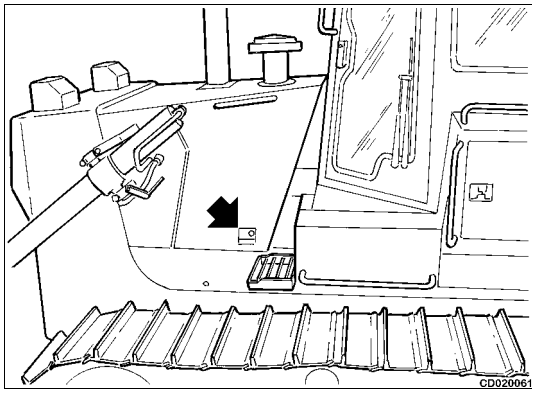


Check Engine Oil Level

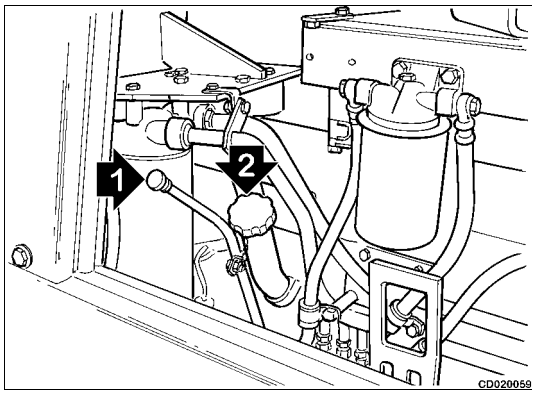
WARNING

Park the machine on level ground, stop the engine, lower all mounted equipment to the ground, apply the safety lock, apply the brake pedal lock, turn off the electrical system master switch.

1. With the engine stopped, open the left engine side door.



2. Check the oil level. For an accurate reading wait for the oil to drain into the crankcase pan.
3. Open hood access door. Remove the oil level gauge (1) and wipe it clean. Reinsert the gauge completely.

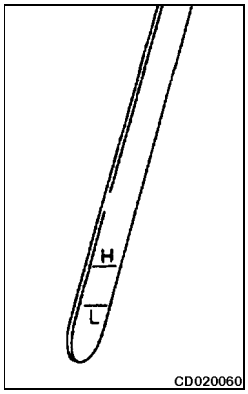


4. Remove the gauge and check the oil level. If the level is at or below the **L** mark, add oil through the filler opening (2) to bring the level up to the **H** mark on the gauge.

- For details of the oil to use, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7.

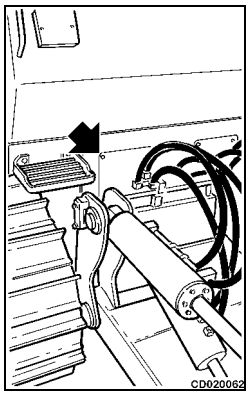
Remark

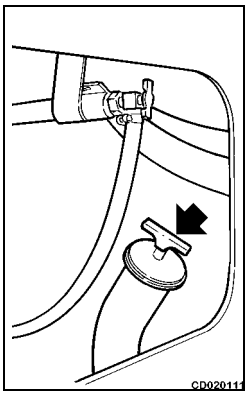
Never run the engine if the level of the oil is at or below the **L** *mark on the oil level gauge.*



Check Oil Level in Drive Train, Add Oil

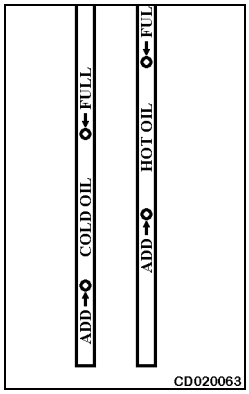
1. Open the rear access door. Unscrew the T handle of the oil level gauge, remove the gauge and wipe it clean.





2. Insert the gauge fully into the filler sleeve. Do not tighten. Remove gauge and check the lubricant level. If necessary, add oil through the filler to bring the level up the FULL mark on the gauge. Reinstall and secure the gauge.

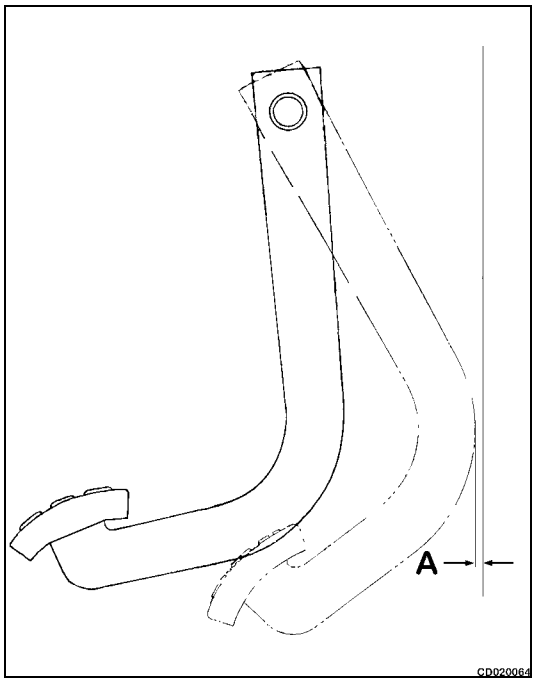
- For details of oil to use, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7.



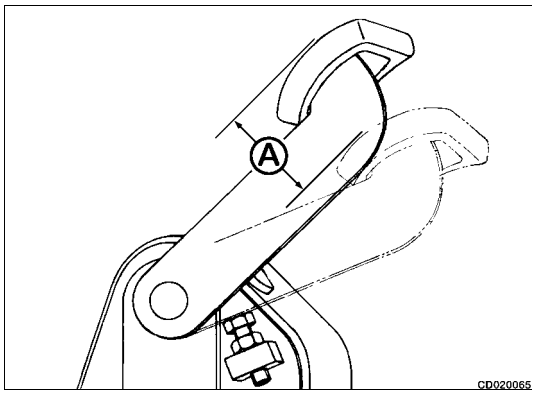
Check Brake Pedal Travel

1. Fully depress the brake pedal with 13.7 kgf (30 lbf), the back of the pedal arm should be 6 ± 0.5 mm (0.24 ± 0.02 in) (**A**) from the front face of the firewall.

2. When the dimension differs from the required as above or the engagement of the brake lock becomes difficult, contact your distributor.

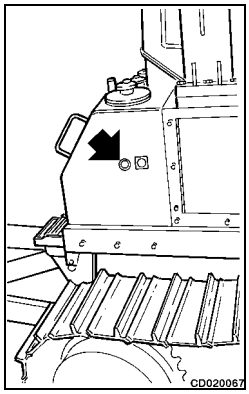


Check Decelerator Pedal Travel



1. Measure the distance (**A**) from pedal full height to stop bolt position, at center of pedal, 53 mm (2.1 in) at 850 ± 50 rpm at stop bolt.
2. If not within these criteria consult your distributor.

Check Oil Level in Hydraulic Tank, Add Oil



⚠ WARNING

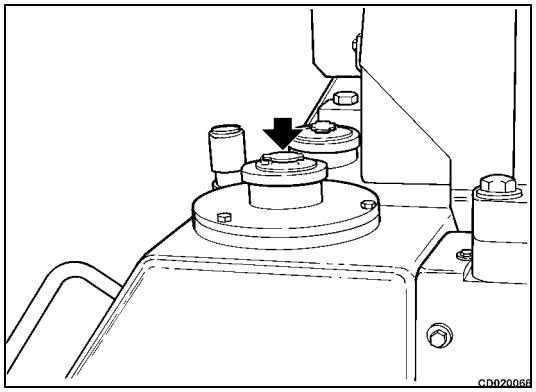
Pressurized Reservoir. When removing the oil filler cap, oil may spurt out, so stop the engine and wait for the oil temperature to go down then turn the cap slowly to release the internal pressure before removing the cap.

1. Check the hydraulic oil level in the tank at the sight gauge. The proper level is:

When cold: At bottom of sight gauge

When hot:. . . . . At center of sight gauge

2. Remove the filler cap and add oil to the proper level. Install filler cap.



- For details of locking cap, see “LOCKING CAP” on page 2-29.
- For details of the oil to use, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7.

Check Electrical Wiring

⚠ WARNING

If a circuit breaker opens frequently, or there are traces of short circuiting in the electric wiring, always locate and repair the cause.

Check for damage of the circuit breakers 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.

- Batteries
- Starting Motor
- Alternator

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

⚠ WARNING

Accumulation of flammable material (dead leaves, twigs, grass, etc.) around the battery may cause fire, so always check and remove such material.

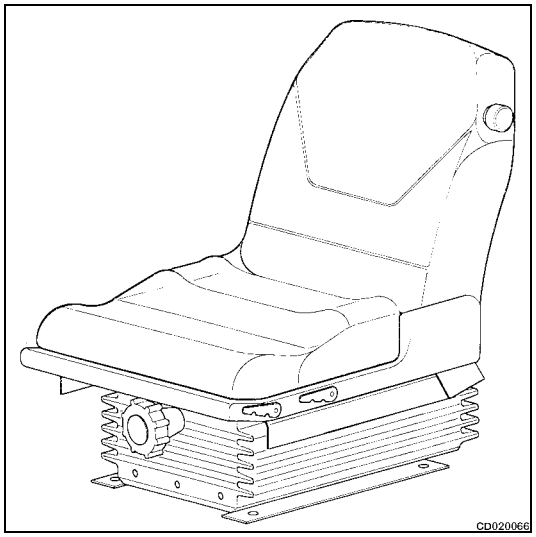
When performing walk around checks or checks before starting, always check if there is any accumulation of flammable material around the battery, and remove such flammable material.

Adjust Operator's Seat

⚠ WARNING

- **Adjust the seat position at the beginning of each shift or when the operators change.**
- **Adjust the seat so that the brake pedal can be depressed all the way with the operator's back against the backrest.**

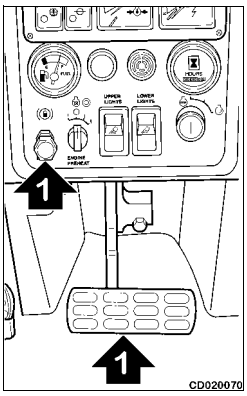
Adjust the seat to its most comfortable position. Buckle up the seat belt and adjust the arm rests as required, see "SEAT, SEAT BELT AND ARM RESTS" on page 2-20.

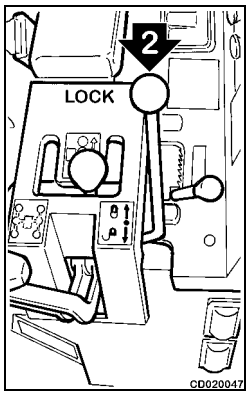


OPERATIONS AND CHECKS BEFORE STARTING ENGINE

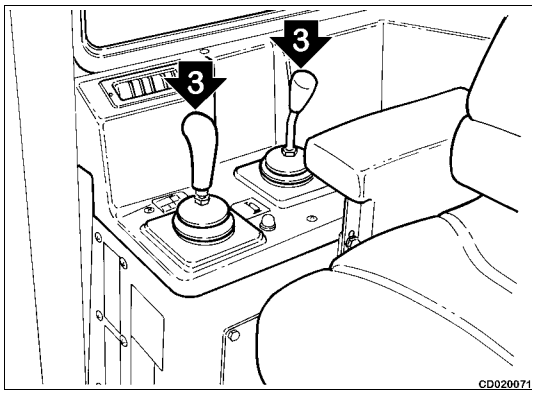
WARNING

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

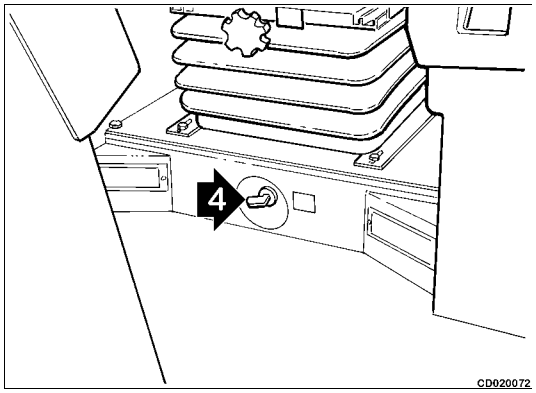




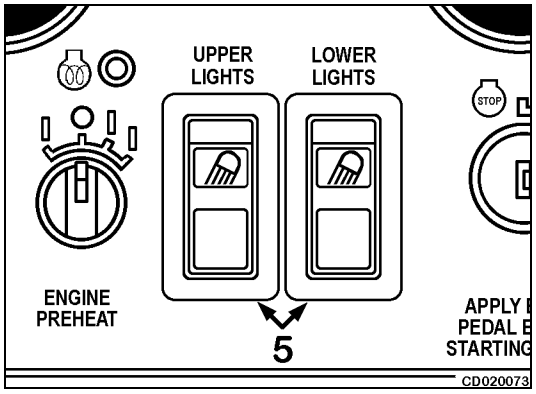
1. Check that the brake pedal is applied with the lock.
2. Check that the safety lock lever is engaged (up position).
3. Check that the mounted equipment is lowered on the ground or properly blocked and the blade control lever is in the hold position.



4. Turn the master disconnect switch to the on position (clockwise).

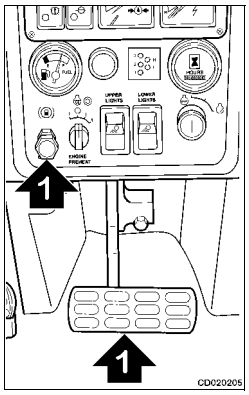


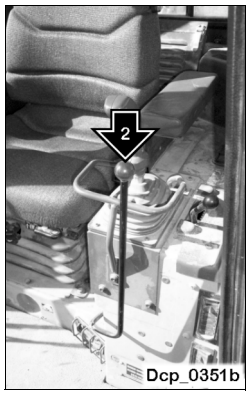
5. Push the rocker switches and check that the roof mounted front and rear work lights (x4) and the front hood and fuel tank lights (x3) are on and the instrument panel gauges are illuminated.

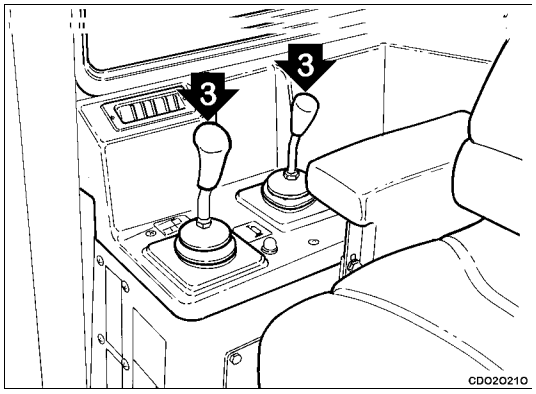


OPERATIONS AND CHECKS BEFORE STARTING ENGINE

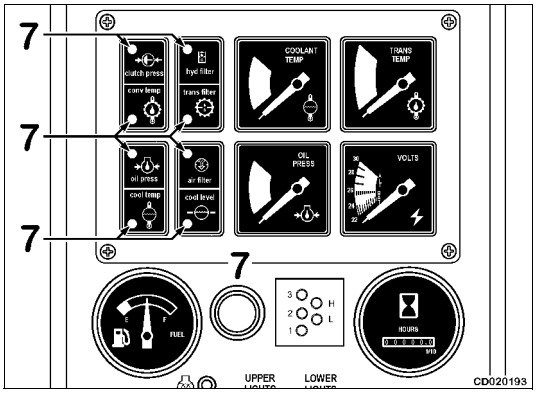
NOTE: This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.

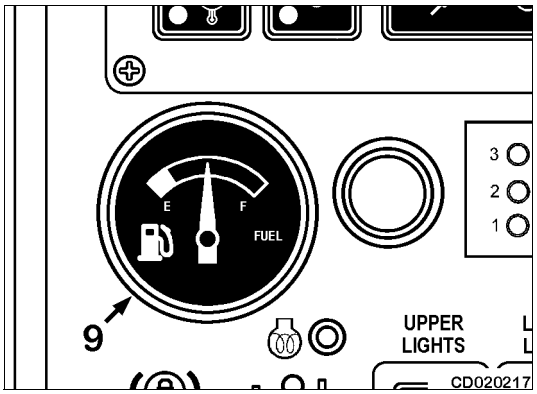




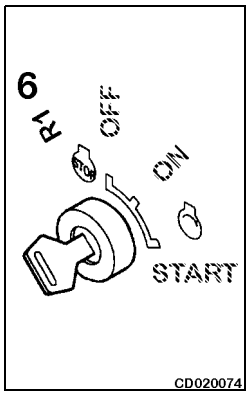


NOTE: This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.

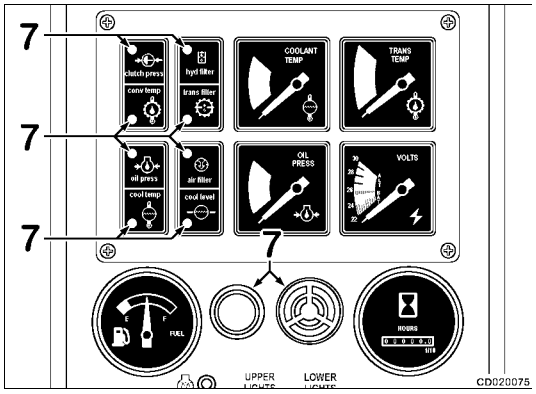




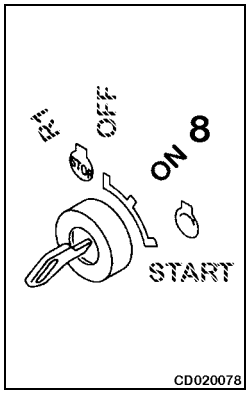
6. Insert the key in the starting switch and turn to the **R1** position.



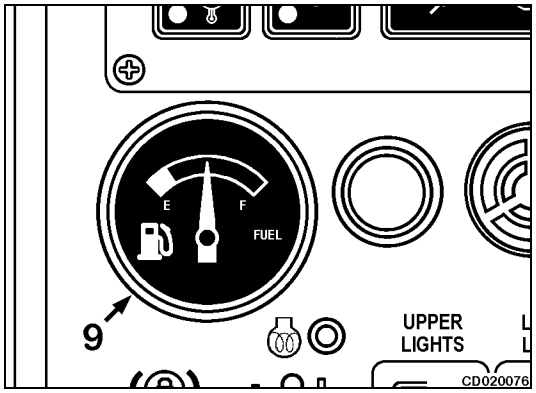
7. Check all warning lights for illumination and audible alarm for sound when the key in the start switch is in the R1 position. If warning light does not illuminate or alarm does not sound, check for abnormality.



8. Turn the start switch key to the **ON** position.

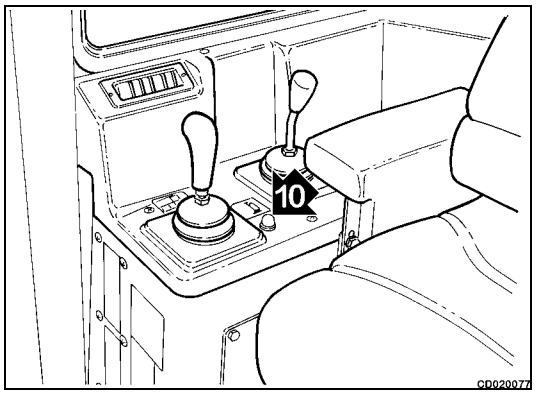


9. Check the fuel level on the fuel gauge.

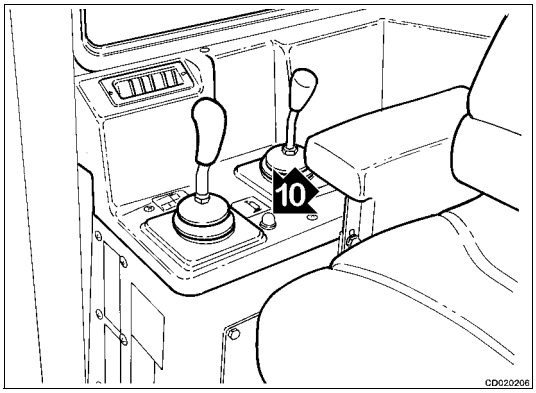


10. Press the horn switch and check that the horn sounds.

11. Clutch pressure light, oil pressure light, and visual warning light remain illuminated and audible alarm will sound in this key-on and engine-off condition.

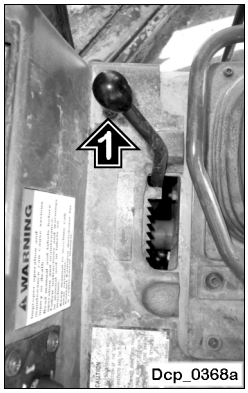


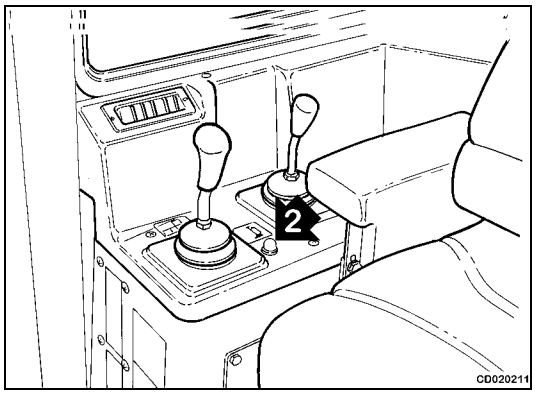
NOTE: This added illustration shows the differences for machines equipped with Single Lever Transmission/Steering Control.



NORMAL STARTING

NOTE: These added illustrations show the differences for machines equipped with Single Lever Transmission/Steering Control.





STARTING ENGINE

Remark

This engine cannot be started by towing, pushing or coasting the machine.

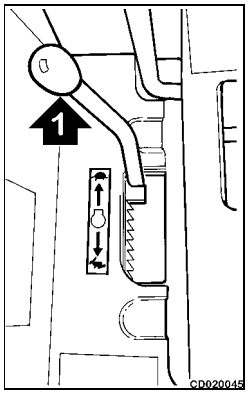
⚠ WARNING

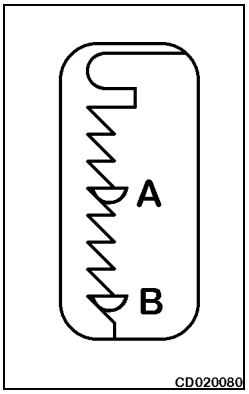
Before entering the operator's area walk completely around the machine and clear the area of personnel and obstructions.

- **Understand all control functions before starting the engine. Sound the horn. Make sure the operator's seat is adjusted properly and fasten the safety seat belt.**
- **Never start the engine indoors unless proper exhaust ventilation is provided to remove deadly exhaust gases. Once the engine is running, move the machine outdoors as soon as possible. Exhaust gases are hazardous and can cause unconsciousness and death.**
- **Read all warning product graphics before starting, operating, maintaining, or repairing the machine.**
- **Do not jump on or off the machine. Keep two hands and one foot, or two feet and one hand, in contact with the steps and hand holds at all times. Place objects on machine from ground level before climbing on. Always face the machine when climbing on or off to reduce the chances of slipping and injury.**

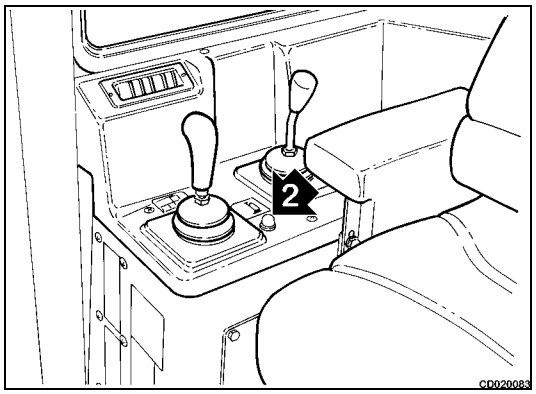
NORMAL STARTING

1. Move the fuel control lever to the 1/2 speed position (**A**) (mid range) for temperatures above 10°C (50°F). Move the engine speed control lever to the full speed position (**B**) for temperatures below 10°C (50°F).



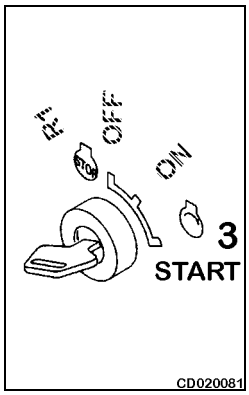


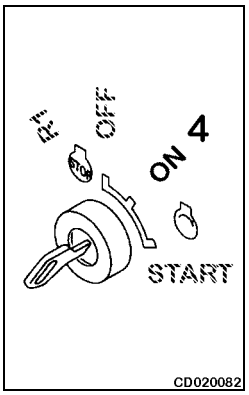
2. Sound the horn to clear all personal from the immediate area.



3. Turn the start switch key to the **START** position and release the key the instant the engine starts.

4. The key will automatically return to the **ON** position.



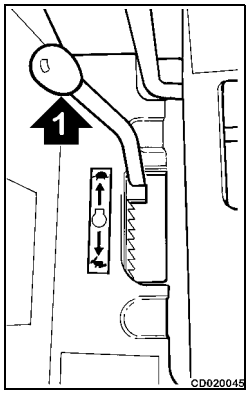


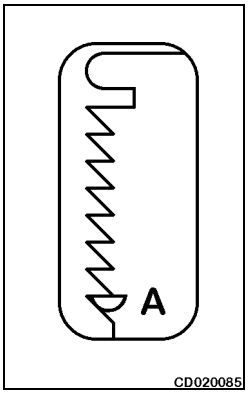
COLD WEATHER STARTING

WARNING

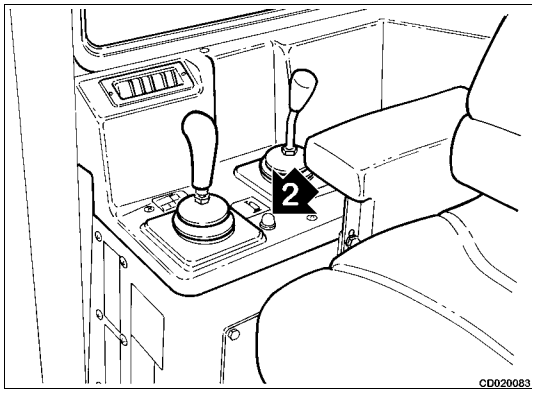
Never use starting aid fluids as they may cause explosions.

1. Move the fuel control lever to the full speed position (**A**).

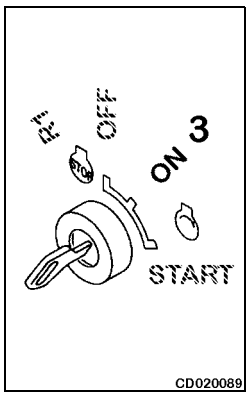




2. Sound the horn to clear all personal from the immediate area.

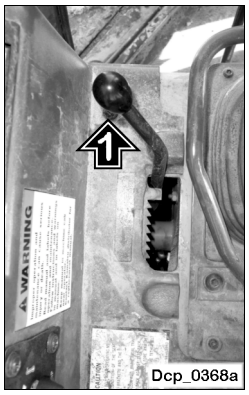


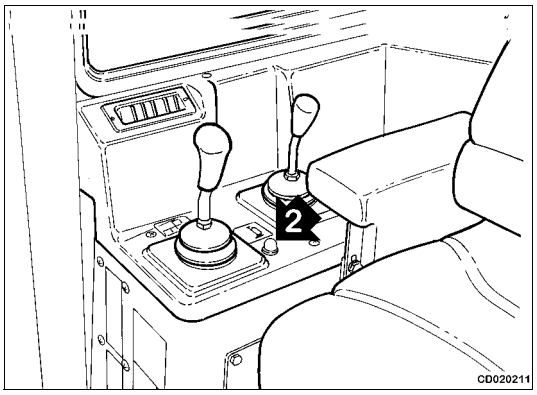
3. Turn the start switch key to the **ON** position.



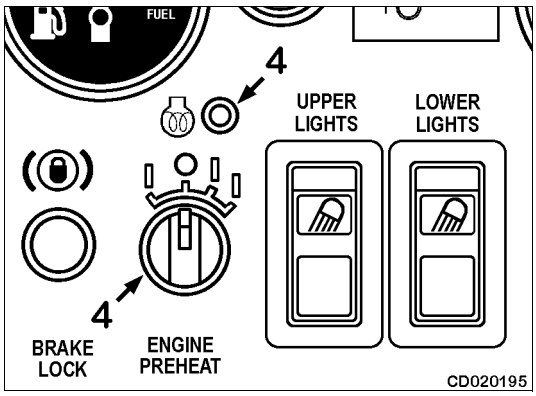
NOTE: This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.

COLD WEATHER STARTING





4. Carry out preheating.

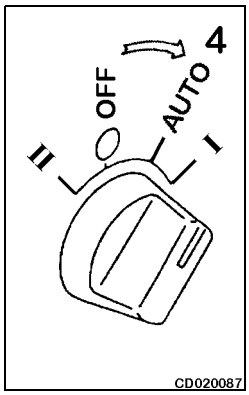


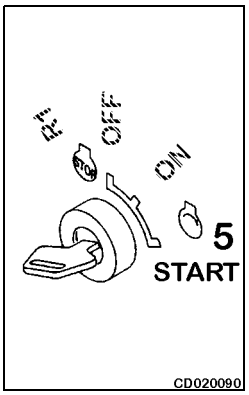
There are the following two ways of carrying out preheating. First use the convenient automatic preheating system.

Automatic Preheating

Turn grid heater timer switch (4) to the **AUTO** position. When the switch is turned to the **AUTO** position, preheating is automatically carried out according to the ambient temperature. The light above the switch illuminates during the preheating operation. When preheating is completed, the lamp above the switch will go out.

5. When the preheating is completed, turn the start switch key to the **START** position to start the engine and release the key the instant the engine starts. The key will automatically return to the **ON** position.





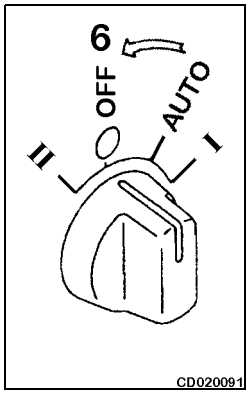
Remark

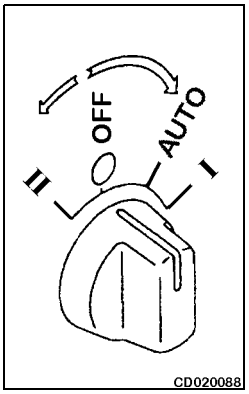
To prevent damage to the starter motor and avoid low battery output, do not continuously crank the engine for more than 30 second intervals. Allow at least a two minute recovery period between cranking.

6. After starting the engine, return grid heater timer switch to the **OFF** position.

Remark

If the engine can not start after automatic preheating, start it using manual preheating.





Manual Preheating

Turn grid heater timer switch to position **I** or **II**. The light above the switch illuminates during the preheating operation. When preheating is completed, the switch will then return automatically to the following position.

From position **I** it will return to **AUTO**

From position **II**it will return to **OFF**

The preheating times are as shown below.

Ambient temperature	Preheat time
0 to -5°C (32 to 23°F)	---
-5 to -10°C (23 to 14°F)	15 seconds
-10 to -20°C (14 to -4°F)	30 seconds
-20 to -30°C (-4 to -22°F)	45 seconds

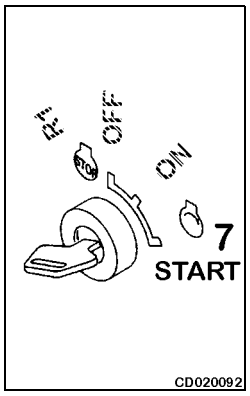
If the preheating time is too long or too short, the engine will not start easily. Observe the correct preheating time.

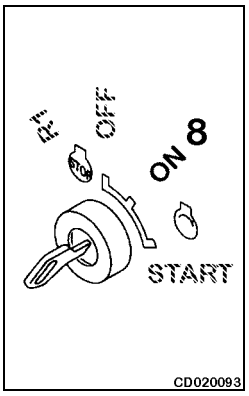
7. When the preheating is completed, turn the start switch key to the **START** position to start the engine.

8. When the engine starts, release the start switch key. The key will return automatically to the **ON** position.

Remark

To prevent damage to the starter motor and avoid low battery output, do not continuously crank the engine for more than 30 second intervals. Allow at least a two minute recovery period between cranking.





OPERATIONS AND CHECKS AFTER ENGINE STARTS

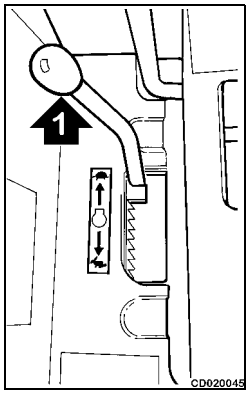
After starting the engine, do not immediately start any operations. First, carry out the following operations and checks.

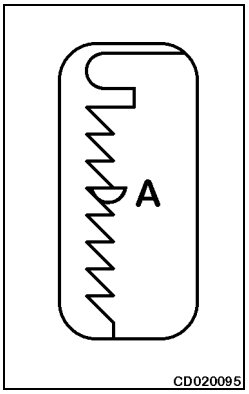
Remark

Avoid abrupt acceleration until warm up run is completed. Do not run the engine at low idle or high idle for more than 20 minutes. If it is necessary to run the engine at idle, apply a load or run at a medium speed from time to time.

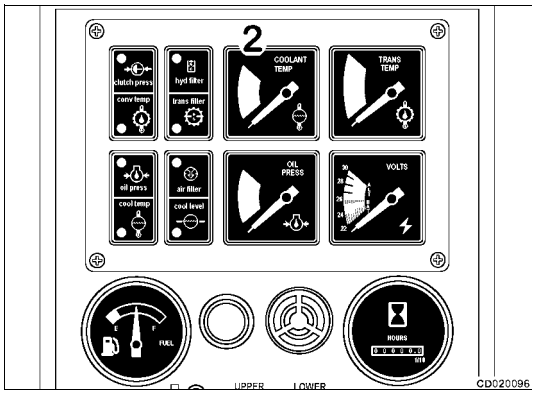
NORMAL OPERATION

1. Pull throttle lever to the center position (**A**) between low and high idle and run the engine at medium speed for about 5 minutes with no load.

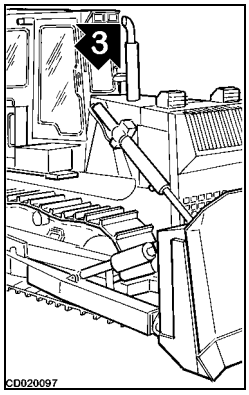




2. After warm up run is completed, check gauges and warning lights for proper operation. If any abnormality is found, repair it. Continue to run the engine at light load until the engine coolant temperature gauge indicator falls within the green range.

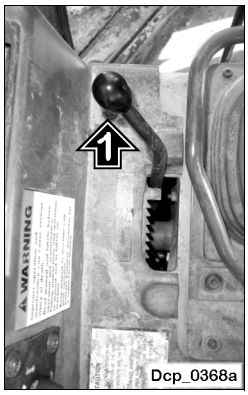


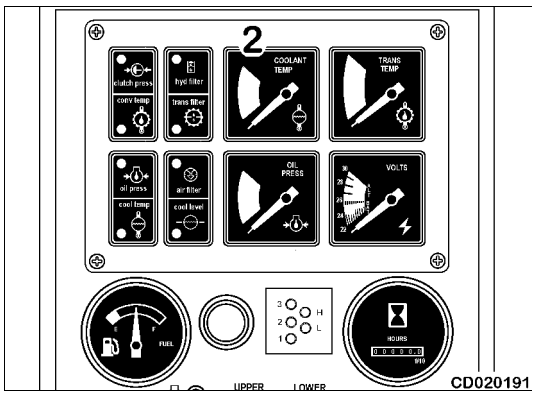
3. Check that there is no abnormal exhaust gas color, noise, or vibration. If any abnormality is found, repair it.



NOTE: This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.

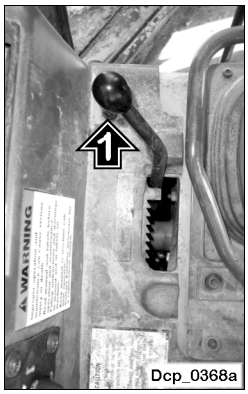
NORMAL OPERATION

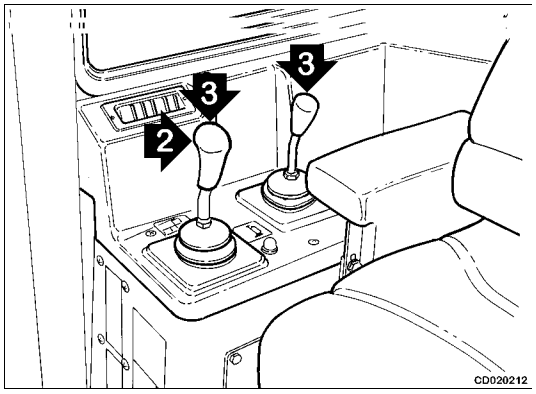


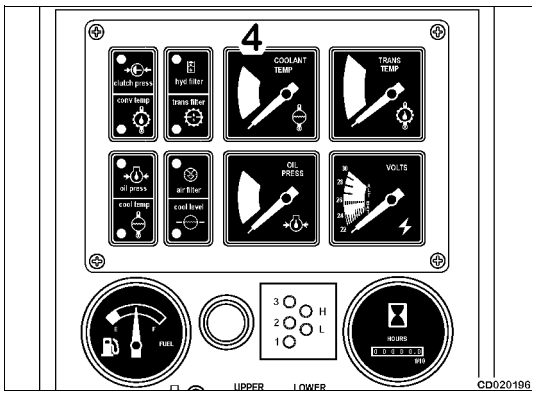


COLD OPERATION

NOTE: This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.

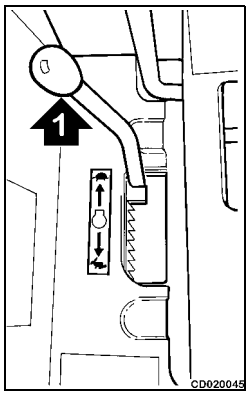


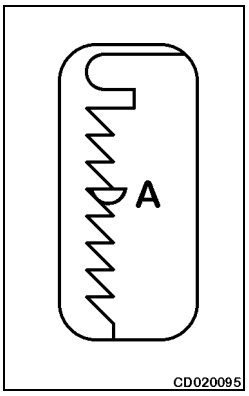




COLD OPERATION

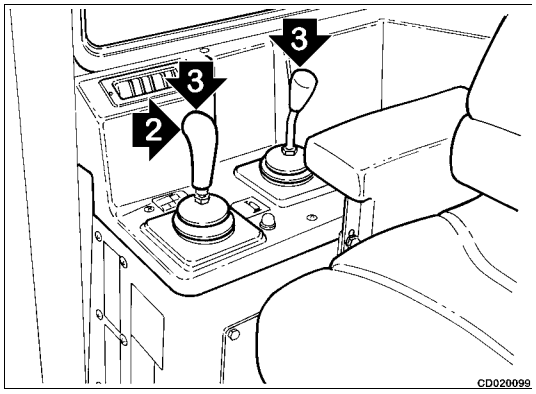
1. Pull throttle lever to the center position between low and high idle and run the engine at medium speed for about 10 minutes with no load.





2. Operate blade control lever to the full raise position, then keep the blade raised to the maximum height and continue to relieve the circuit for 10 minutes.

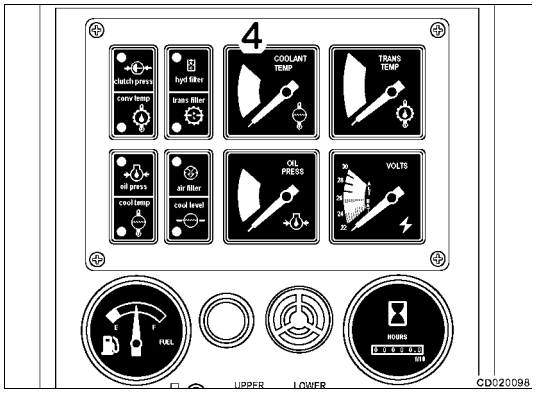
3. Finally, operate blade control lever and ripper control lever together to operate all the cylinders several times. If the oil temperature in the work equipment is not properly raised, there will be a time lag in the response of the work equipment and steering.



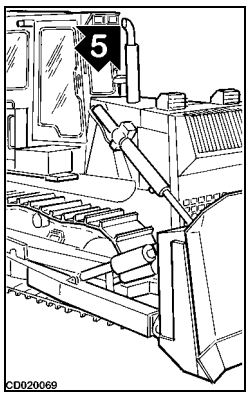
Remark

If the oil temperature in the power train is not raised properly, it will take longer to accelerate to the maximum speed.

4. After warm up run is completed, check gauges and warning lights for proper operation. If any abnormality is found, repair it. Continue to run the engine at light load until the engine coolant temperature gauge indicator falls within the green range.



5. Check that there is no abnormal exhaust gas color, noise, or vibration. If any abnormality is found, repair it.

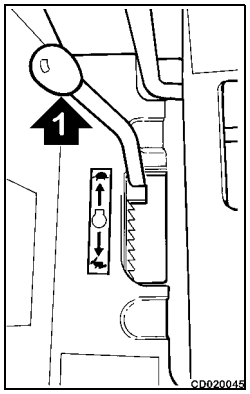


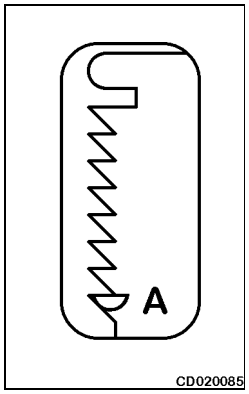
MOVING THE MACHINE

⚠ WARNING

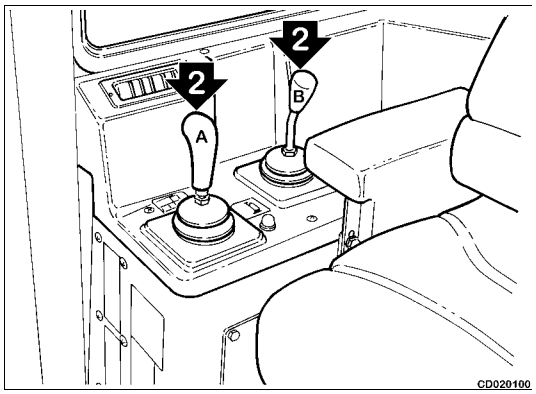
- **When moving the machine, check that the area around the machine is safe, and sound the horn before moving. Clear all personnel from the machine and the area. Clear all obstacles from the path of the machine. Use extreme care when reversing the machine. Note there is a blind spot behind the machine. When starting on slopes, always keep the brake pedal depressed even after releasing brake lock lever.**
- **When starting on a steep uphill grade, run the engine at full throttle and move gear shift lever into 1st F (forward) or R (reverse) position with brake pedal depressed. When the machine has started slowly (or track shoes slip), propel the machine by slowly releasing brake pedal.**

1. Pull the fuel control lever to the high idle position (**A**).

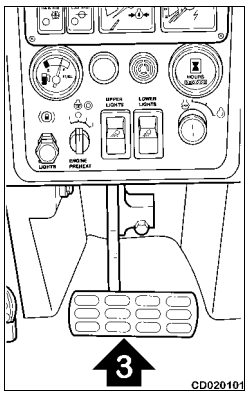


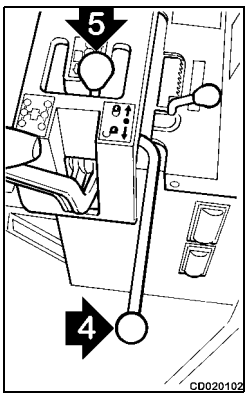


2. Pull the blade control lever (**A**) rearward to raise the blade 360 to 508 mm (15 to 20 in) off the ground. If equipped, pull the ripper control lever (**B**) rearward to raise the ripper 360 to 508 mm (15 to 20 in) off the ground.



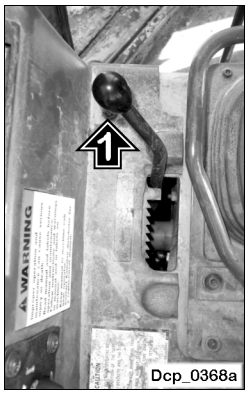
3. Depress the brake pedal to release the brake lock.
4. Move the safety lock lever down to the unlocked position.
5. Release the brake pedal and the machine will start to move. Move the transmission lever to the desired position; 1st, 2nd, or 3rd in either the Forward or Reverse position. The lever has a detent at whatever position is selected.

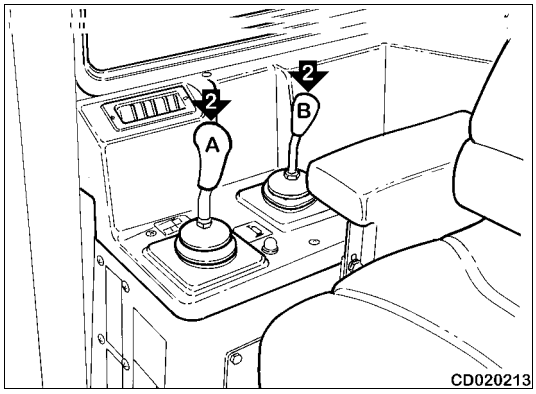




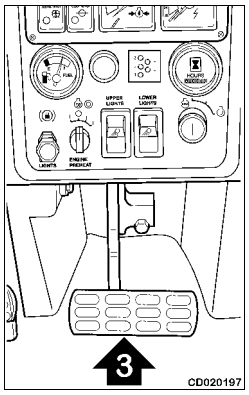
MOVING THE MACHINE

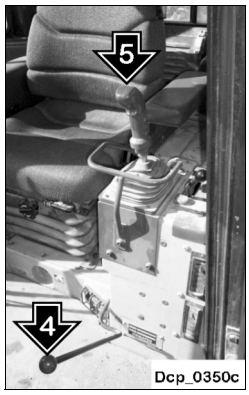
NOTE: This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.





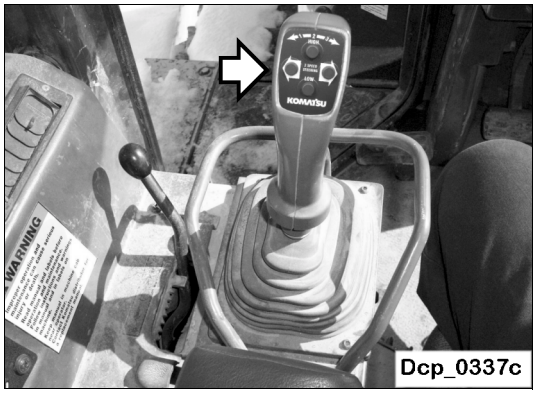
5. Rotate (twist) the transmission/steering control lever to one of three rotary detent (mechanical) positions for transmission range gear selection.
   - Counter-clockwise rotation to the 1st gear detent;
   - Center position for the 2nd gear detent; and
   - Clockwise rotation to the 3rd gear detent.
   - ★ Gear selection applies to all transmission/steering lever drive positions.
6. On the face of the transmission/steering lever, press the HIGH button to engage direct drive for both tracks or the LOW button to select gear reduction for both tracks.
7. Movement begins when the transmission/steering control lever is moved toward the desired travel direction.
   Their is a hydraulically actuated detent for forward and reverse, which is functional only when the engine is running and the safety lock lever is in the UNLOCK position.
8. Press and hold the LEFT or RIGHT button (on the face of the transmission/steering control lever) for a left or right power turn.





NOTE: This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.

SHIFTING THE TRANSMISSION



Center position of the transmission/steering lever is neutral.
Move the safety lock lever to the UNLOCK position. This action supplies oil to the transmission/steering lever control valve making it operational.

Forward and Reverse Motion
Push the transmission/steering lever forward to engage the forward clutch and obtain forward motion. Pull the transmission/steering lever backward to engage the reverse clutch and obtain reverse motion. There is a hydraulically actuated detent for both forward and reverse, which is functional only when the engine is running and the safety lock lever is in the UNLOCK position.

Range Gear Selection
Rotate (twist) the transmission/steering control lever to one of three rotary detent (mechanical) positions for transmission range gear selection.

- Counter-clockwise rotation to the 1st gear detent;
- Center position for the 2nd gear detent; and
- Clockwise rotation to the 3rd gear detent.

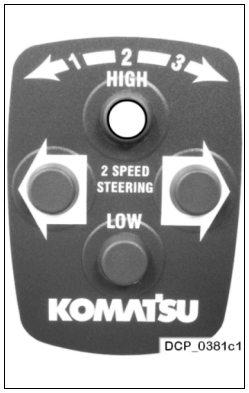
Gear selection applies to all transmission/steering lever drive positions.

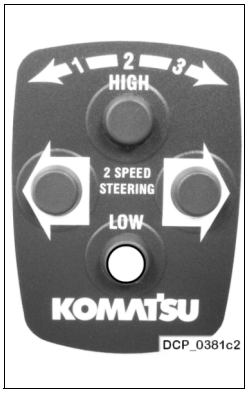
The three transmission ranges and the two steering drive ranges (described below) give a total of six operating ranges in which the machine can operate.

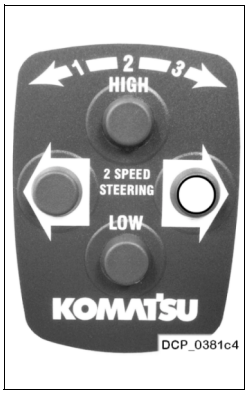
STEERING THE MACHINE

WARNING

Avoid turning the machine on a slope. The machine will tend to slip sideways. Particular care should be taken on soft dirt or clay. Never make a pivot turn at high speed.







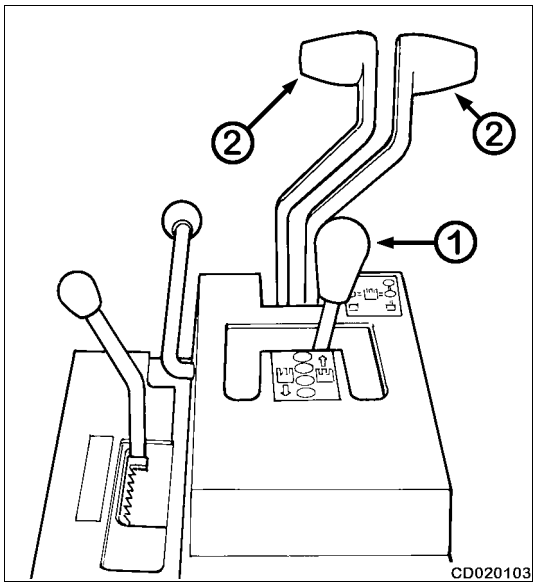
Move the transmission/steering lever to the left to make a left turn or to the right to make a right turn.
When the transmission/steering lever is moved all the way to the left or right, the steering clutch on that side is released and the steering brake on that side is applied, giving a pivot turn.
Moving the transmission/steering lever partially to one side gives partial pressure to the clutch and brake, giving a modulated turn.
The transmission/steering lever is spring loaded to the center for straight motion.

High or Low Steering Range and Power Turns
The four (4) buttons on the transmission/steering lever control the two-speed steering clutches in the steering drive.

- Move the transmission/steering lever from neutral (center) to a drive position for steering range and power turn functions.
- Press and release the upper button to select the HIGH range. Direct drive is engaged to both tracks.
- Press and release the lower button to select the LOW range. Gear reduction is engaged to both tracks.
- Depress and hold the left button for a power turn to the left. Gear reduction is engaged to the left track and direct drive to the right track.
- Depress and hold the right button for a power turn to the right. Gear reduction is engaged to the right track and direct drive to the left track.

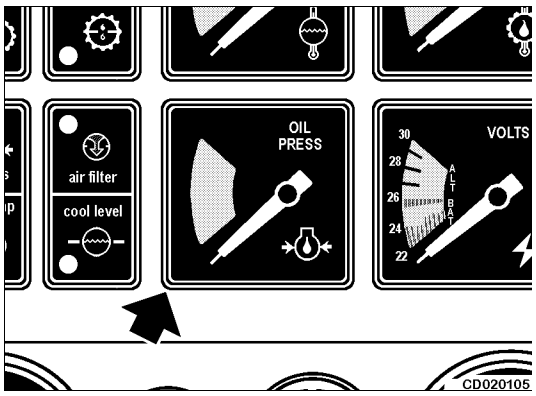
Releasing the left or right button returns the steering system to the range (HIGH or LOW) that had been last selected.

SHIFTING THE TRANSMISSION



The three speeds of the transmission, controlled by lever (1) and the high and low speed ranges of the steering drive, controlled by levers (2), provide six speeds for both forward and reverse travel. With the steering levers in low range and the transmission shift lever in the (1-2) speed position, the machine can be put into second speed by moving the steering levers into high range. The other four speeds can be obtained in the same manner. It is not necessary to stop the machine when shifting from forward to reverse (or reverse to forward). Shifting can be performed with the machine in motion. However, it is recommended when shifting in this manner that the engine be decelerated for operator's comfort.

CONVERTER OVERHEATING

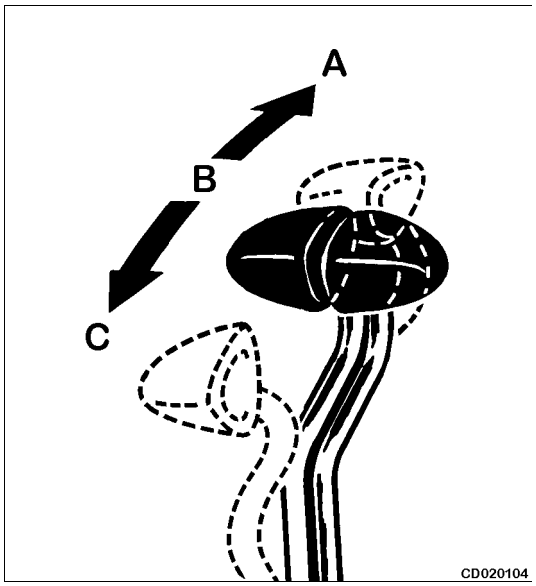


If the pointer of the torque converter oil temperature gauge moves out of the RUN area of the dial during operation, the transmission may be in a gear range which is too high for the load. Shift down into the next lower gear range. The temperature should reduce; if not, down shift again. If the dial pointer remains out of the RUN range in first gear, stop the machine, shift into neutral and run the engine at 1000 rpm until the gauge pointer moves into the RUN area. If the converter still remains overheated, stop the engine and consult your distributor before operating the machine.

STEERING THE MACHINE

⚠ WARNING

Avoid as much as possible turning the machine on a slope. The machine will tend to slip sideways. Particular care should be taken on soft or clay land. Never make a pivot turn at high speed.



Steering is accomplished with the two levers. Each of the levers function in three positions. **A** (forward) controls the high range, **B** (middle) controls the low range, and **C** (rearward) controls the pivot. To make a gradual left turn with the levers in high and pull the left lever into low. To make a gradual left turn with the levers in low, push the right lever into high. To make gradual right turns, reverse this procedure. To make a pivot turn, first slow down the machine. With the levers in either the high or low, move the lever to **C** on the side toward which the turn is to be made. When the lever is pulled back slightly from low, a feathering action starts, enabling the operator to make a gradual or full pivot turn; this feathering action continues until the **C** or pivot is reached. When both levers are pulled simultaneously all the way back, the braking action stops both tracks.

DOWNGRADE OPERATION

WARNING

When operating down hill, always put the transmission in the low range position. Use the brake pedal to slow the machine. Never go down hill with the transmission controls in neutral. Failure to do so could result in losing control of the machine and a rollover could result.

Before going down a grade, select a gear range which will provide full machine control without over speeding the engine. Steering is handled in the same manner as when traveling on level ground with or without a load.

Remark

In steep downhill operation, use the decelerator pedal and brake pedal to control machine speed.

OPERATING OVER AN OBSTRUCTION

When crossing a log or ditch bank, use the decelerator pedal to slow the machine; and when possible, cross at an angle. Then gradually increase the power to the tracks as the machine moves forward, over, and down. If the load is light, it may also be necessary to use the brake pedal.

ATTACHING TOWED EQUIPMENT

When attaching towed equipment to the drawbar refer to the following steps:

A. Use the lowest possible transmission speed. Use the lowest possible engine speed.

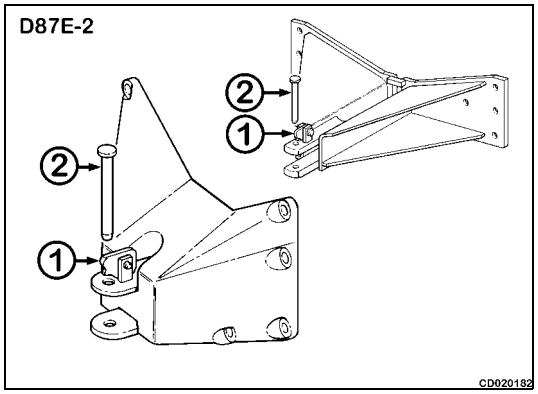
B. Pull both steering levers rearward to disconnect drive power to the tracks. Use the foot brake to prevent the machine from rolling free.

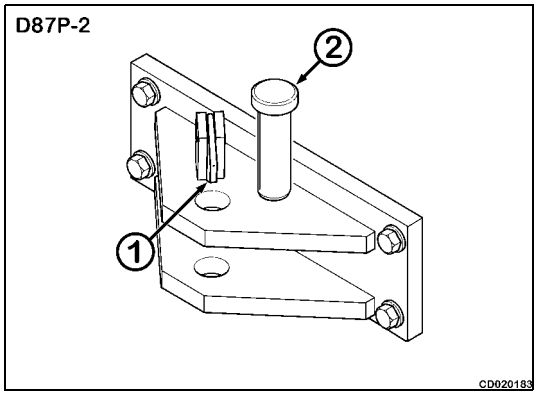
C. Move both steering levers slowly forward and permit slippage of the steering clutches to inch the machine in the required direction. It is permissible to slip the steering clutches for the purpose of inching or easing the machine movement.

WARNING

Remain clear of the rear area of the machine unless the operator agrees to your presence. You must remain in sight of the operator. When engaging the drawbar remain alert and clear of the equipment tongue. Do not insert your fingers into the drawbar pin hole. Failure to exercise extreme caution can result in personal injury or death.

D. When in position to attach the towed equipment, lift up on the lock cam (1) and secure with the tow pin (2).





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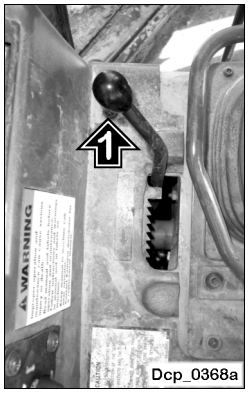
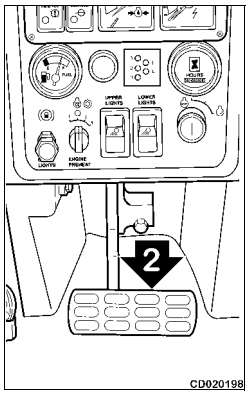
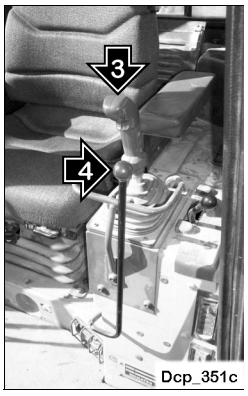
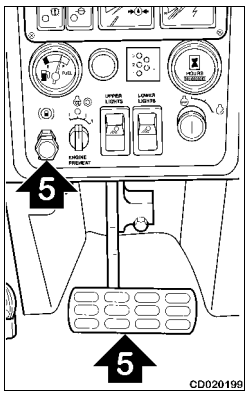
STOPPING THE MACHINE

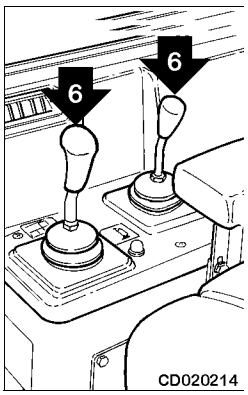
NOTE: This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.









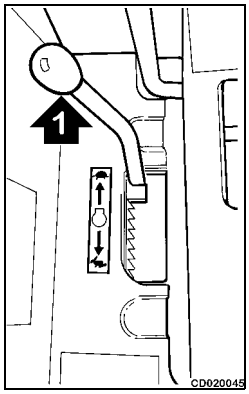


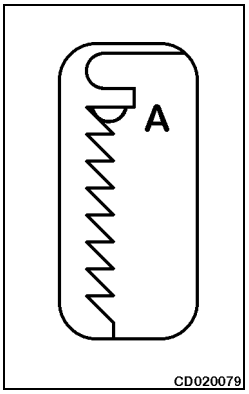
STOPPING THE MACHINE

WARNING

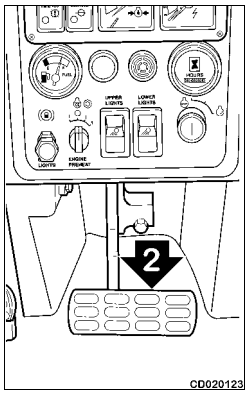
- **Avoid stopping suddenly. Give yourself ample room when stopping.**
- **When stopping the machine, select flat hard ground and avoid dangerous places. If it is unavoidably necessary to park the machine on a slope, insert blocks underneath the track shoes. As an additional safety measure, thrust the blade into the ground.**
- **If a 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.**

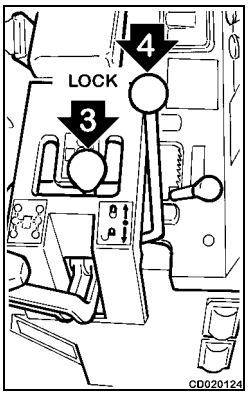
1. Move the engine speed control lever forward to the low idle position (**A**).



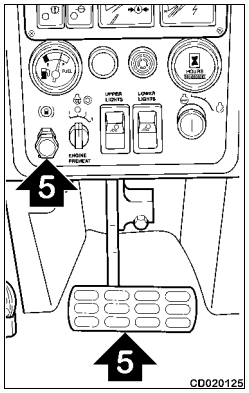


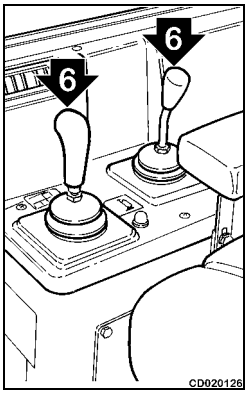
2. Depress the brake pedal until the machine is stopped.
3. Place the transmission lever in NEUTRAL.
4. Place the safety lock lever in the locked, (up) position.



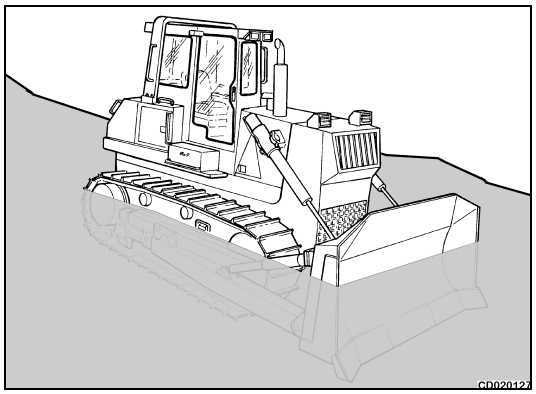


5. Lock the brake pedal.
6. Lower all mounted equipment to the ground.





PRECAUTIONS FOR OPERATION



PERMISSIBLE WATER DEPTH

When operating in water, always keep the bottom of the carrier roller above the surface of the water. Also, be careful that the engine cooling fan will not come in contact with water. The fan can be damaged.

WHEN TRAVELING UP OR DOWN HILLS

Use Engine as a Brake

When going downhill, shift the transmission lever into 1st speed to run the engine at a slower speed and travel down the slope using the engine as a brake. Never coast down the slope with the transmission lever in the **N** (neutral) position.

Braking When Traveling Downhill

While descending a slope using the engine as a brake, also apply the brakes. Failure to brake may result in over running, causing engine trouble.

ON SLOPES

Be Careful of Fuel Level

If the fuel level in the fuel tank becomes low when working on slopes, the engine may intake air because of the angle or the swaying of the machine. If this makes the engine stop, be careful not to let the level in the fuel tank become too low.

Precautions When Engine Stops on Slopes

If the engine stops while working or traveling on a hill, immediately depress the brake pedal, lower the blade to the ground to stop the machine, then lock the brake pedal with the brake lock lever. Thereafter, move the transmission lever to the **N** (neutral) position, lock the lever, then restart the engine.

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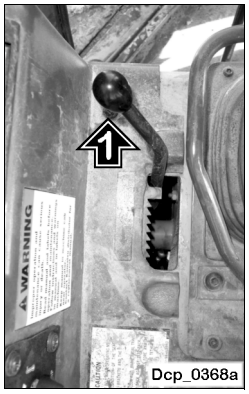
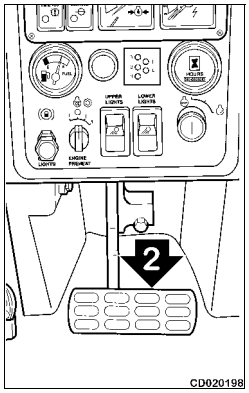
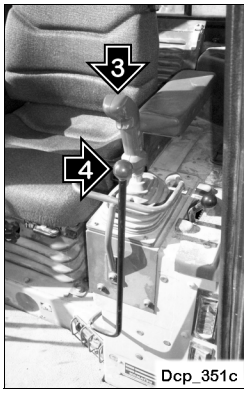
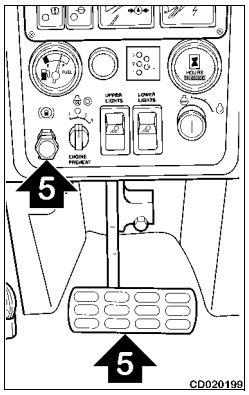
PARKING THE MACHINE

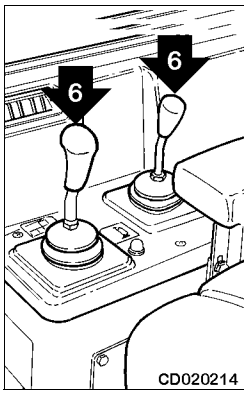
NOTE: **This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.**









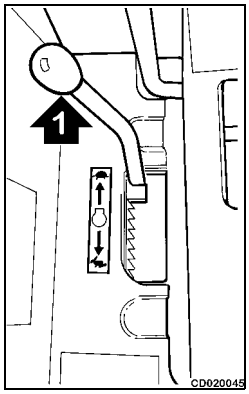


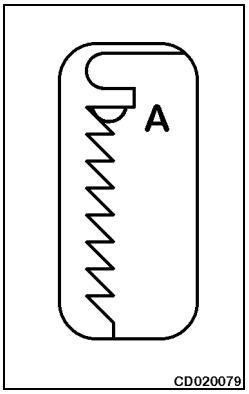
PARKING THE MACHINE

⚠ WARNING

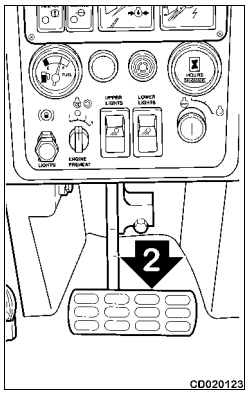
- **Avoid stopping suddenly. Give yourself ample room when stopping.**
- **When stopping the machine, select flat hard ground and avoid dangerous places. If it is unavoidably necessary to park the machine on a slope, insert blocks underneath the track shoes. As an additional safety measure, thrust the blade into the ground.**
- **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.**

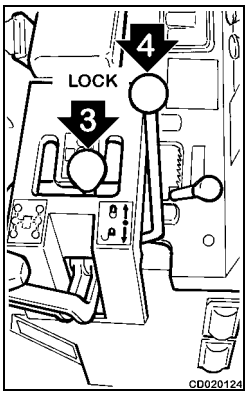
1. Move the engine speed control lever forward to the low idle position (**A**).



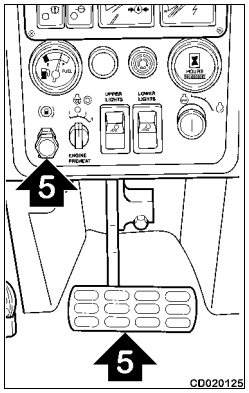


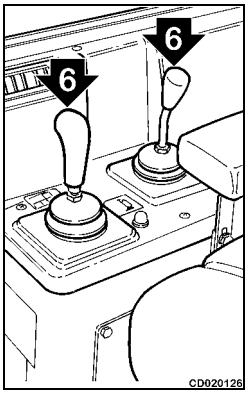
2. Depress the brake pedal until the machine is stopped.
3. Place the transmission lever in NEUTRAL.
4. Place the safety lock lever in the locked, (up) position.





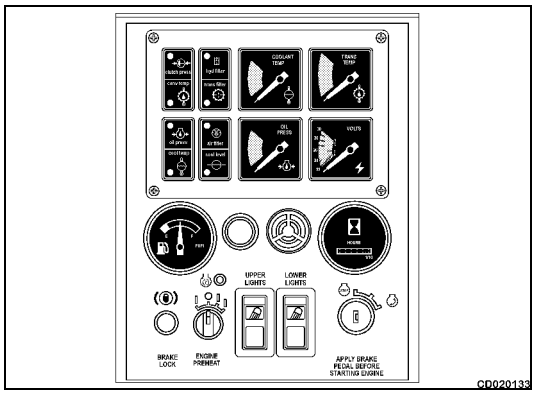
5. Lock the brake pedal.
6. Lower all mounted equipment to the ground.





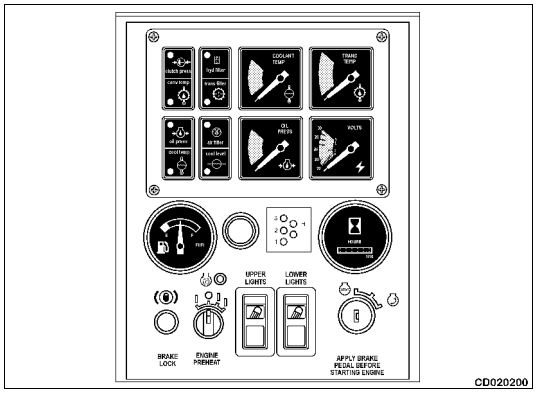
CHECK AFTER FINISHING WORK

1. Check all the gauges for proper operation.
2. Check all the warning lights so that none are illuminated



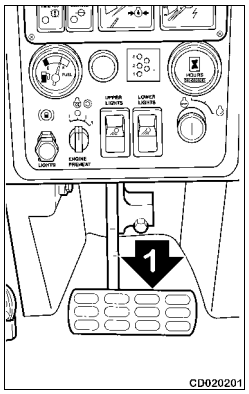
CHECK AFTER FINISHING WORK

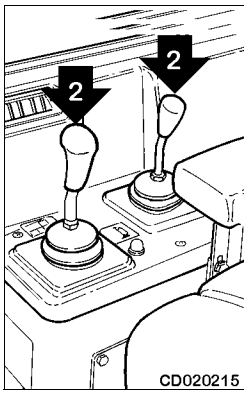
NOTE: **This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.**

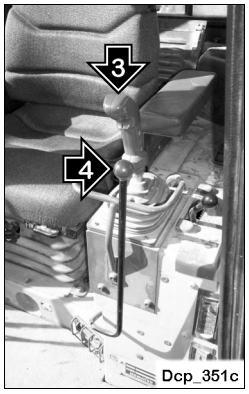


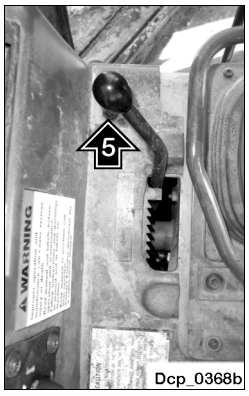
STOPPING THE ENGINE

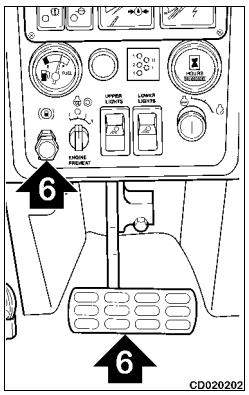
NOTE: This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.







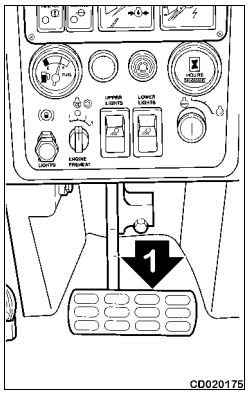


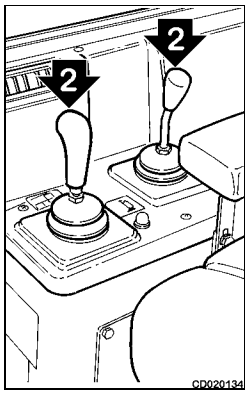


STOPPING THE ENGINE

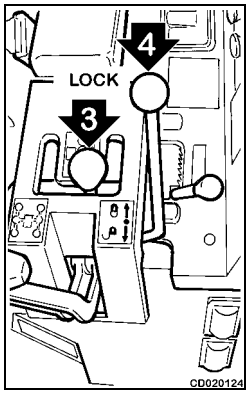
Remark

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 a emergency. In particular, if the engine has overheated, do not abruptly stop it but run it at medium speed (1/2 throttle) to allow it to cool gradually, then stop it.





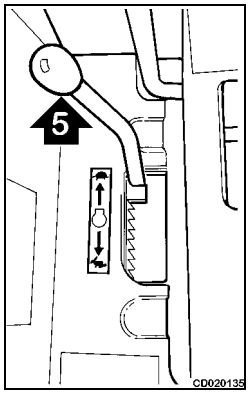
1. Depress the brake pedal until the machine is stopped.
2. Lower all mounted equipment to the ground.
3. Place the transmission lever in NEUTRAL.
4. Place the safety lock lever in the locked, (up) position.

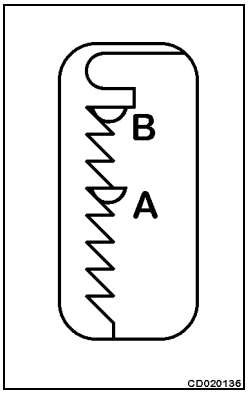


5. Operate the engine at one half speed (no load) (**A**) for three to five minutes, then move the engine speed control lever to the low idle position (**B**).

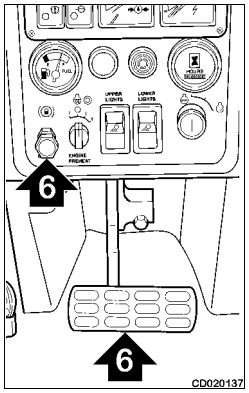
Remark

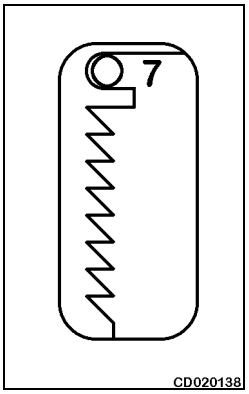
Serious damage can result to the engine and turbocharger if this cool down step is neglected.



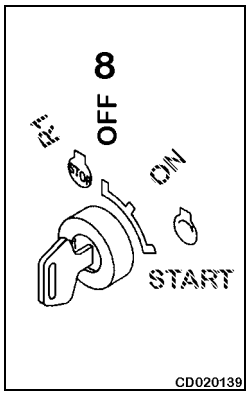


6. Depress and lock the brake pedal.
7. Move the engine speed lever fully forward.

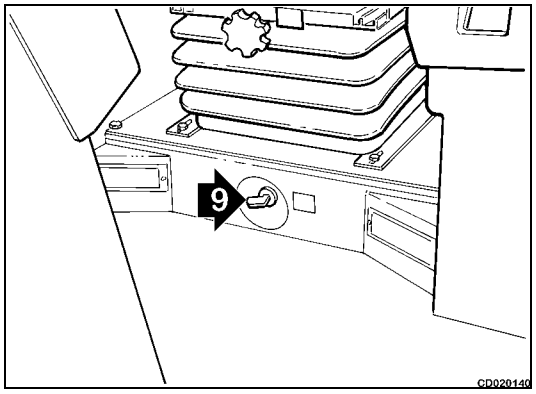




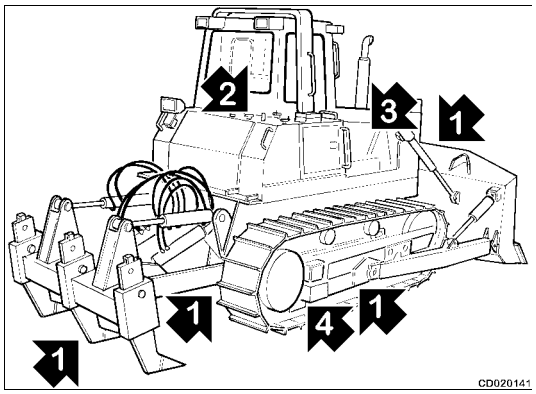
8. Turn the key switch to the off position and remove.



9. Remove the key from the master switch.



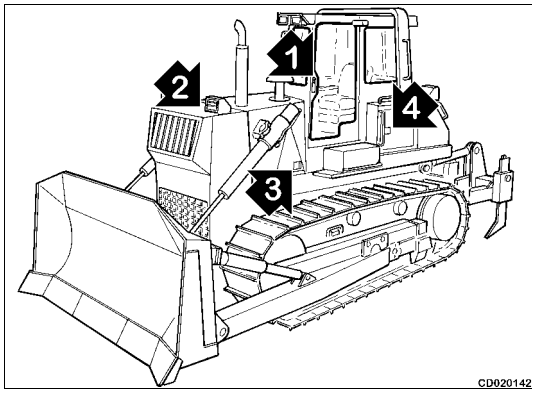
CHECKS AFTER STOPPING ENGINE



1. Walk around the machine and check the work equipment 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.

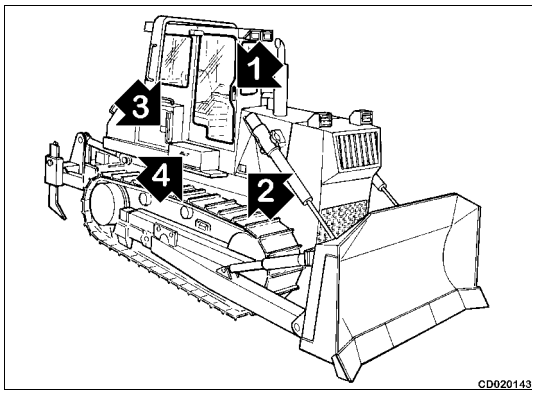
LOCKING

Always lock the following places.



LEFT SIDE

1. Cab door.
2. Access cover on engine hood.
3. Left side engine door.
4. Drive train filter door.

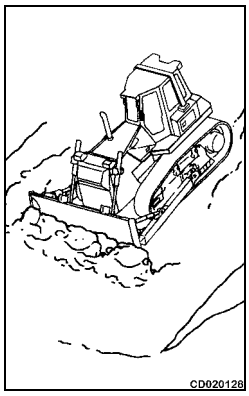


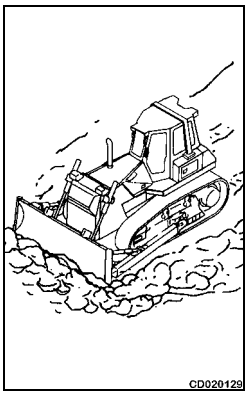
RIGHT SIDE

1. Cab door.
2. Right side engine door.
3. Equipment filter door.
4. Tool box door.

WORK POSSIBLE USING MOUNTED EQUIPMENT

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





DOZING

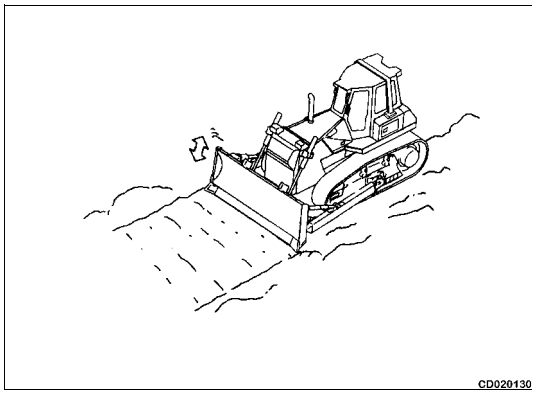
A dozer digs and transports dirt in a forward direction. Slope excavation can always be most effectively carried out by proceeding from the top downward. When dozing toward one side only, operate with angled blade.

SMOOTHING

Remark

Avoid smoothing on rocky or stony ground. It can damage the blade.

Uneven ground surfaces remaining after digging can be leveled off by fine operation of blade. The basic method is to operate the machine at low speeds with the blade fully loaded with soil and sand. A flat finished surface is also possible by slowly backing the machine with the blade floating so it is dragged across the surface. However, avoid this on rocky or stony ground, as it may damage the blade.

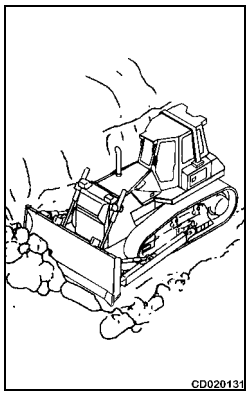


CUTTING INTO HARD/FROZEN GROUND OR DITCHING

Remark

Do not perform severe operations such as uprooting by angling or tilting the blade.

For digging and ditch excavation of hard or frozen ground, tilt the blade. Even hard ground can be dug effectively by a tilted or angled blade.

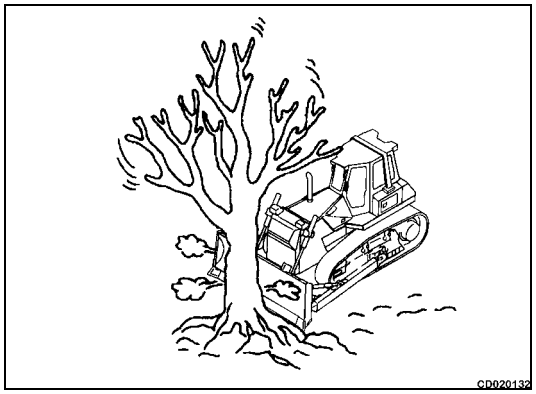


FELLING TREES, REMOVING STUMPS

Remark

Do not up root trees or stumps or fell trees by angling or tilting the blade.

For trees with a diameter of 100 to 300 mm (3.9 to 11.8 in), raise the blade high and push two or three times to fell the tree. Next, travel in reverse, and dig the corner of the blade into the ground to cut and dig up the roots. When doing this, never hit the tree at high speed or apply shock to fell the tree.



MOUNTED EQUIPMENT

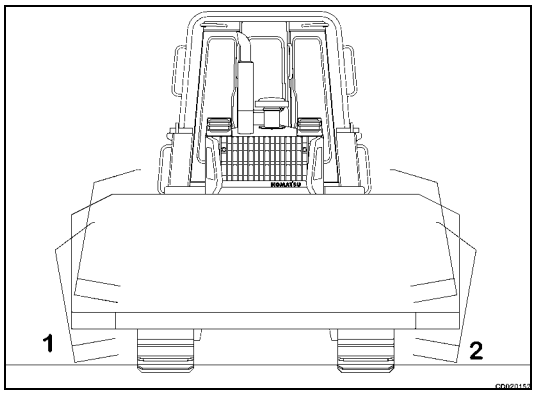
SEMI U DOZER - D87E-2

GENERAL

In addition to raising or lowering, the blade can be hydraulically tilted or manually pitched.

BLADE TILT

Equal Tilt

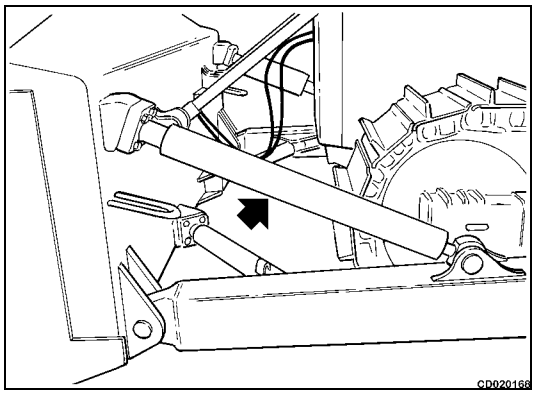


1. Right Tilt 2. Left Tilt

Remark

Equal tilt is accomplished in the normal blade position, when the back of the blade is perpendicular (90°) to the ground and the blade cutting edge is 52° to the ground with the left upper strut at its mean dimension.

1. Move blade control lever to the side in which the blade is to be tilted until the desired movement is obtained.
2. Place the lowest corner of the blade on a flat surface.
3. Hold the control lever in position on the side to which the blade is to be lowered until the blade is even along the flat surface.



Over Equal Tilt

Remark

When this tilt adjustment is selected, there will no longer be equal tilt at each side of the blade.

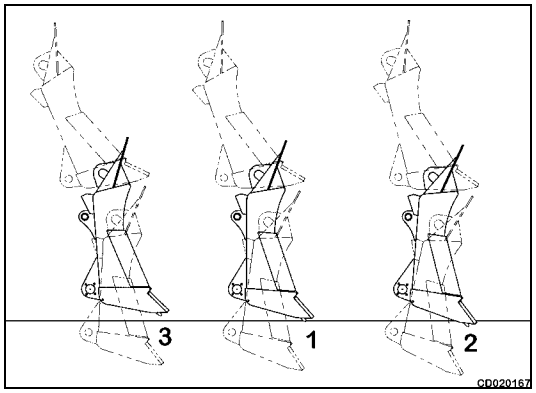
Position blade in maximum equal tilt to side selected. Using left upper strut to change tilt as follows;

Left Tilt Tilt cylinder extended so decrease strut length

Right Tilt Tilt cylinder retracted so increase strut length

PITCHING THE BLADE

Normal Blade Position (1)



Normal blade position is obtained when the left upper strut is at its mean dimension and the back of the blade is perpendicular (90°) to the ground. In this position the blade cutting edge is now 52° to the ground.

Forward Pitch, Increased Penetration Angle (2)

Raise the blade about 450 mm (17.7 in) off of the ground. Then extend the upper strut on the left side of the blade to the desired increased pitch.

Rearward Pitch, Decreased Penetration Angle (3)

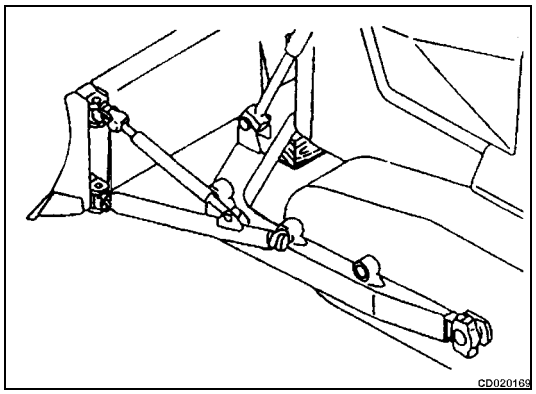
Raise the blade about 450 mm (17.7 in) off of the ground. Then retract the upper strut on the left side of the blade to the desired decreased pitch.

STRAIGHT ANGLE DOZER - D87E-2

ANGLING BLADE

WARNING

- **When adjusting the angle, it is dangerous if the work equipment is moved by mistake. Set the work equipment in a safe condition, then stop the engine.**
- **Be careful when removing the upper/lower strut. After the 2nd upper/lower strut is removed the blade can move freely on its center hinge.**



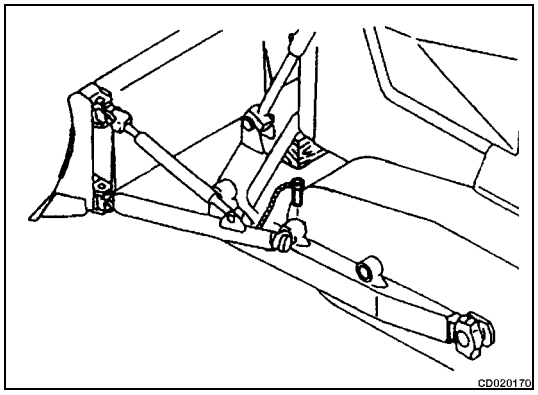
Straight to Angle

Following is straight to left angle with right angle being the opposite.

1. Raise blade 400 to 500 mm (15.8 to 19.7 in) above ground, then put blocking under the C frame.

WARNING

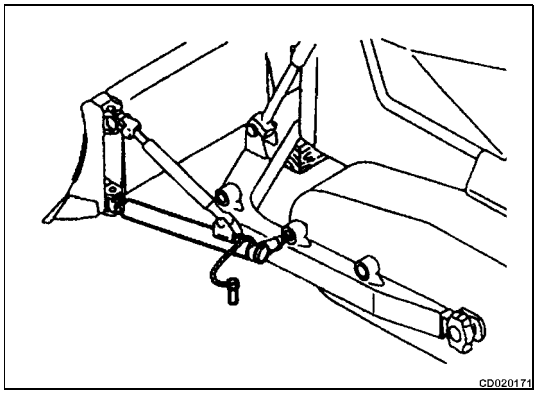
Make sure that all of the load is off of the upper struts before the lower strut is removed from the C frame bracket.



2. Remove the pin securing left upper/lower strut to C frame and remove strut from mounting bracket. Keep it close to the C frame.

WARNING

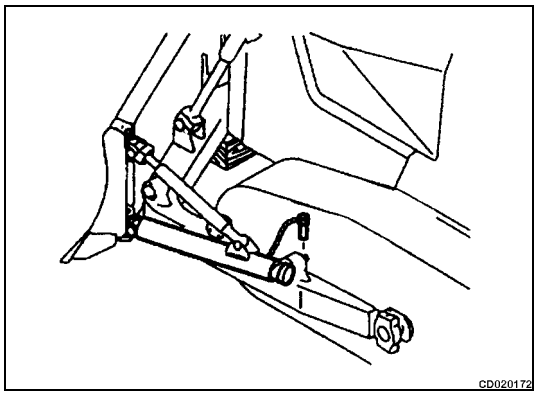
Stay clear of blade when performing above steps. Swinging the blade will cause lost of balance and drop of blade on the side of swung strut.



3. Remove the pin securing right upper/lower strut to C frame and remove strut from mounting bracket. Carefully swing the right strut out as far as it will go to regain blade balance.

4. From the other side of machine, swing out the strut, level the blade and maintain this level position while repositioning the blade, changing the angle.

5. Connect the rear most upper/lower strut to C frame first and secure with the pin. Connect and secure the remaining upper/lower strut. If necessary, adjust the upper strut to align the lower strut with the C frame bracket.



6. After angling the blade, it should be leveled so that when the blade is resting on the ground, one corner does not dig in more than the other. This may be accomplished by adjusting the upper struts. If only a small amount of adjustment is required, it will not be necessary to remove the strut trunnion from its bracket on the C frame. To raise one end of the blade, lengthen the upper strut on that side. To lower one end of the blade, shorten the upper strut. After leveling the blade, lengthen the upper struts so that there is a compression bind on them to eliminate free play. This will allow the blade to maintain an even grade.

Angle to Straight

1. Raise blade 400 to 500 mm (15.8 to 19.7 in) above ground, then put blocking under the C frame.

⚠ WARNING

Make sure that all of the load is off of the upper struts before the lower strut is removed from the C frame bracket.

2. Remove the pin securing the forward upper/lower strut to C frame and remove strut from mounting bracket swing out all the way.

⚠ WARNING

Stay clear of blade when performing above steps. Swinging the blade will cause lost of balance and drop of blade on the side of swung strut.

3. Remove the pin securing rear upper/lower strut to C frame and remove strut from mounting bracket.

4. Level the blade and maintain this level position while repositioning the blade, changing the angle to straight.

5. Move either upper/lower strut until it contacts C frame and mount. Use caution, since the blade will drop on the opposite side because of the lack of balance.

6. Assemble the strut on the opposite side into its bracket on the C frame and secure. If necessary, adjust the upper strut to align the strut with the bracket.

7. After straightening the blade, it should be leveled so that when resting on the ground, one corner does not dig in more than the other. This may be accomplished by adjusting the upper struts. If only a small amount of adjustment is required, it will not be necessary to remove the strut trunnion from its bracket on the C frame. To raise one end of the blade, lengthen the upper strut on that side. To lower one end of the blade, shorten the upper strut. After leveling the blade, lengthen the upper struts so that there is a compression bind on them to eliminate free play. This will allow the blade to maintain an even grade.

TILTING THE BLADE

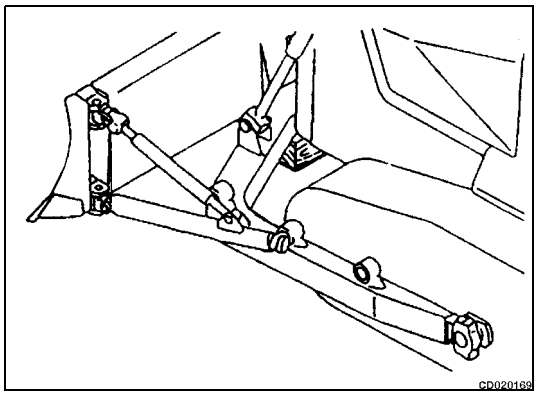
⚠ WARNING

- **When adjusting the amount of tilt, it is dangerous if the work equipment is moved by mistake. Set the work equipment in a safe condition, then stop the engine.**

Hydraulic Tilt

On machines equipped, blade tilt to either side is determined by the rod movement of each of the dual cylinders.

Mechanical Tilt



1. Raise blade 400 to 500 mm (15.8 to 19.7 in) above ground, then put blocking under the C frame.

⚠ WARNING

Make sure that all of the load is off of the upper struts before the lower strut is removed from the C frame bracket.

2. Remove the strut trunnion from its bracket on the side to be raised, and position strut close to the C frame.

3. Adjust the opposite side to get the desired tilt by shortening the upper strut. Adjust this strut to tilt the blade about half of the desired tilt.

⚠ WARNING

Always lower the side being adjusted first so lack of balance will not cause the loose strut assembly to swing out and cause unexpected injury or damage.

4. Return to the side of the machine on which the strut assembly was disengaged, and lengthen the upper strut until the strut trunnion can be inserted in its bracket on the C frame.

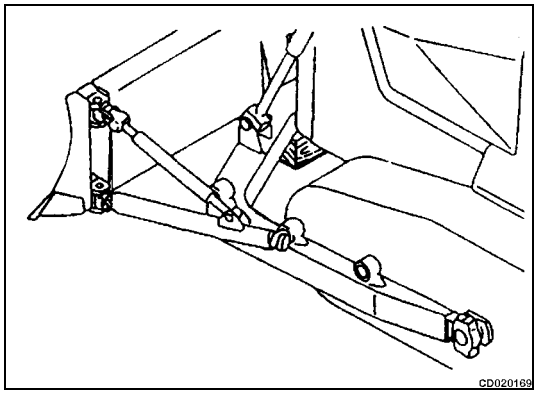
5. After tilting the blade, raise the blade and lengthen the upper struts so there is a compression bind on them to eliminate free play.

Whenever the blade is tilted, adjustments to one upper strut must always be equal and opposite to the adjustment made on the other strut. For example: if a strut on one side is shortened 1/2 turn, lengthen the opposite strut 1/2 turn.

LEVELLING BLADE

Hydraulic Tilt

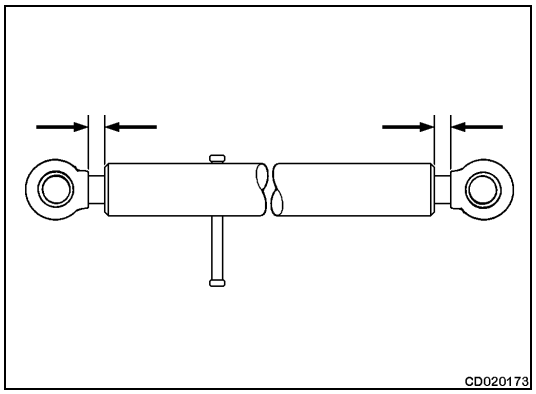
Position blade with tilted corner on ground, using cylinders level the blade.



Mechanical Tilt

1. Raise blade 400 to 500 mm (15.8 to 19.7 in) above ground, then put blocking under the C frame.

2. Remove the locking pins and adjust both upper struts so that the gap between the shoulder of the eyebolt and strut body is 39 mm (1.53 in) on each end. This will position the blade in its neutral tilt position. If the blade is not level, a half turn of the upper strut in either direction will level the blade.



3. After leveling the blade, raise it above the ground 300 mm and shut off the engine. Adjust the upper struts to a neutral position (no compression or tension) so the blade connecting pins are free to revolve in their brackets.

4. Having determined the neutral position, shorten each upper strut by one full turn.

Remark

Adjustment made in step 4 must be made only if all strut adjustments have been made with blade raised off the ground.

5. Reinstall the upper strut locking pins.

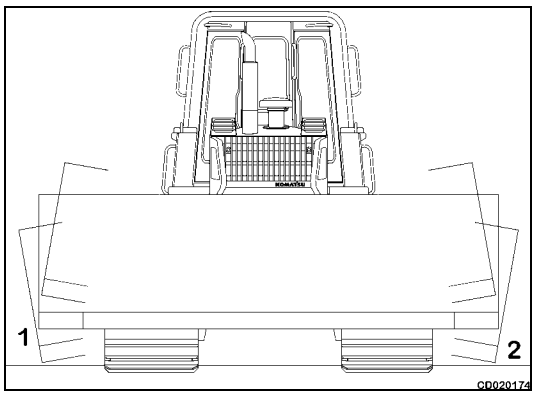
STRAIGHT DOZER - D87P-2

GENERAL

In addition to raising or lowering, the blade can be hydraulically tilted or manually pitched.

BLADE TILT

Equal Tilt



1. Right Tilt 2. Left Tilt

Remark

Equal tilt is accomplished in the normal blade position, when the back of the blade is perpendicular (90°) to the ground and the blade cutting edge is 52° to the ground with the left upper strut at its mean dimension.

1. Move blade control lever to the side in which the blade is to be tilted until the desired movement is obtained.
2. Place the lowest corner of the blade on a flat surface.
3. Hold the control lever in position on the side to which the blade is to be lowered until the blade is even along the flat surface.

Over Equal Tilt

Remark

When this tilt adjustment is selected, there will no longer be equal tilt at each side of the blade.

Position blade in maximum equal tilt to side selected. Use the left upper strut to change the tilt as follows;

Left Tilt Tilt cylinder extended so decrease strut length

Right Tilt Tilt cylinder retracted so increase strut length

PITCHING THE BLADE

Normal Blade Position

Normal blade position is obtained when the left upper strut is at its mean dimension and the back of the blade is perpendicular (90°) to the ground. In this position the blade cutting edge is now 52° to the ground.

Forward Pitch, Increased Penetration Angle

Raise the blade about 450 mm (17.7 in) off of the ground. Then extend the upper strut on the left side of the blade to the desired increased pitch.

Rearward Pitch, Decreased Penetration Angle

Raise the blade about 450 mm (17.7 in) off of the ground. Then retract the upper strut on the left side of the blade to the desired decreased pitch

RIPPER

- The optimum digging angle for the shank is when the shank is perpendicular to the ground.
- In comparatively soft rock, it is also possible to carry out ripping with the shank tilted to the rear.
- On comparatively hard rock, if ripping is carried out with the shank tilted to the rear, there will be excessive wear of the point of tip, and the self-sharpening ability will be lost.
- During ripping operations, if the shoes slip because of boulders or resistance from the bedrock, use the tilt cylinder. When picking up a stone, advance the machine at a fixed gear speed.

Remark

When raising boulders or digging up rock bed, do not put the transmission in neutral. If the transmission is in neutral, the reaction of the tilt cylinder will push the machine back. Always operate the machine with the transmission in FORWARD.

- During ripper operations, if stubborn boulders or rock bed cause the travel speed to become slower, operate the tilt cylinder to dig up the boulder/rock bed.

TIPS FOR LONGER UNDERCARRIAGE LIFE

Undercarriage life varies greatly depending on operation method, inspection and maintenance. Track components have a certain dimension when new.

As wear occurs dimensions will decrease (or increase in case of track pitch and front idler flange height) until a decision must be made whether to rebuild or recondition components, replace them or run them to destruction.

For each component or condition, five different dimensions are measured. 100% is dimension of component when new. 075%, 050% and 025% indicate percentage of wear remaining before a maintenance action should be taken. 000% is point at which either maintenance must take place or components run to destruction.

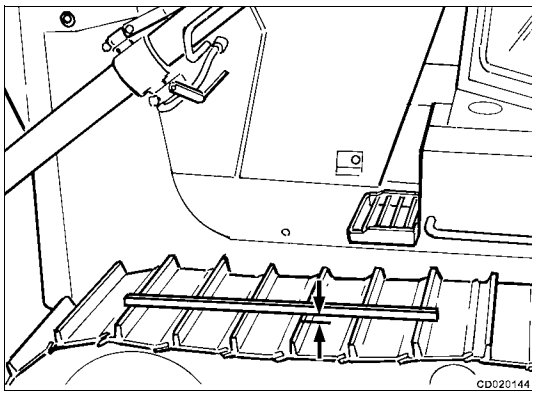
For most efficient operation, keep the following points in mind.

OPERATION METHOD

- Select the track shoe that best suits the type of soil to be encountered in service. Please consult your distributor when selecting track shoes.
- Do not allow shoe slipping to occur during operation. If shoe slipping occurs, reduce load to the blade until slipping stops.
- Avoid sudden starts, acceleration or stops, unnecessarily high speeds and sharp turns.
- Always operate machine in a straight line whenever possible. When making turns, be careful not to allow the machine to stay to one side, so operation in both turning directions can be done properly. Make turns with the largest possible radius.
- Prior to operation, clear boulders and obstacles to prevent machine from riding over them while operating.
- On a slope, operate the machine parallel to the inclination of the slope. Do not operate across the slope. Also when stopping the machine on a slope, the machine should face toward the top of the slope.
- When ground inclines to left or right during digging operation, do not continue to dig with machine inclined. Move machine back to level ground and start to dig again.
- When idlers or sprockets are lifted due to obstacles during dozing, do not attempt to force the machine to perform. Work at this time exceeds machine working capability.

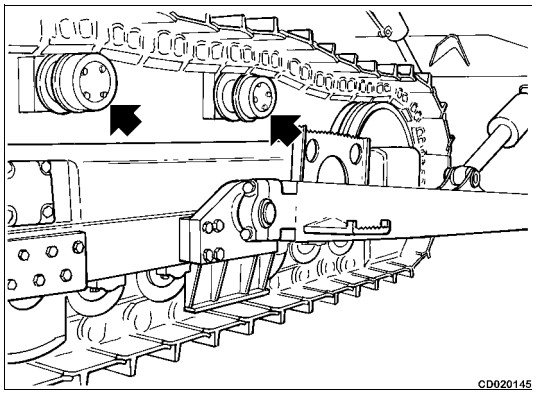
INSPECTION AND ADJUSTMENT

Properly adjust track tension. Tension should be measured at clearance shown in the diagram - usually 50 to 63 mm (2 to 2.5 in) at this point. For rocky terrain, tighten tracks slightly. In clay or sandy areas, slightly loosen them. For inspection and adjustment procedures, see “CHECK AND ADJUST TRACK TENSION” on page 3-30.



Check idler rollers for oil leakage and loose bolts. If any trouble is detected, repair immediately.

Check the clearance between the idler guide plate and the track frame. If clearance increases, the idler may develop side motion and the tracks may come off.

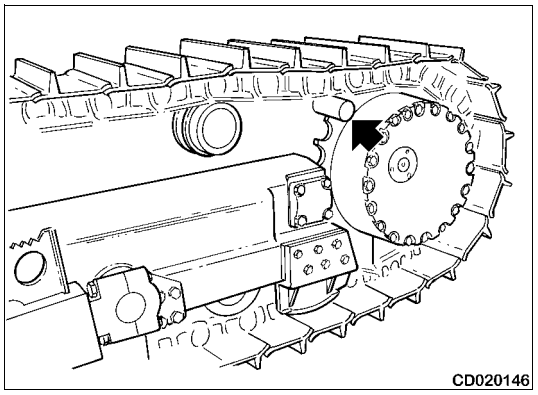


INSPECTION AND REPAIR

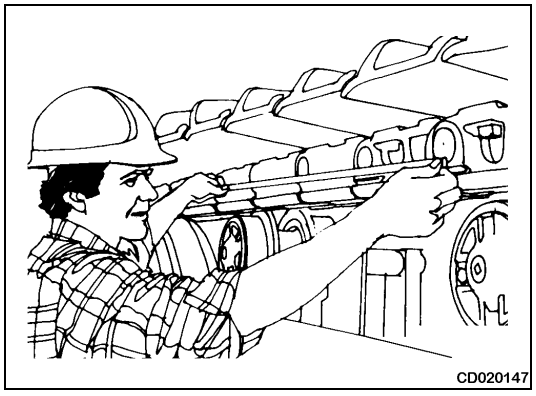
Frequent inspection and prompt repair will reduce repair costs. The following items for inspection will serve as a guide to maintenance service of each undercarriage part. Perform periodical inspection and contact the distributor in your area when machine has approached repairable limits and reversing limits.

Measuring Link Pitch

1. Insert a wooden block between track shoe and sprocket to take up the slack in track shoes.

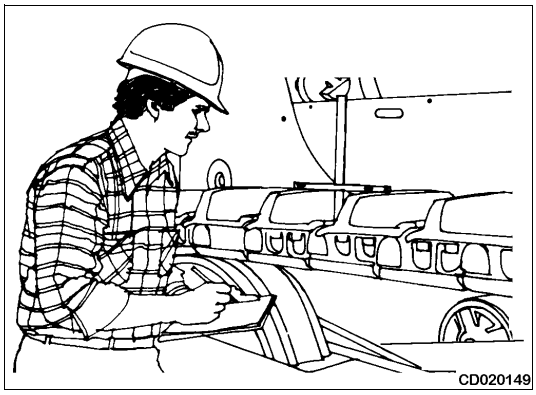


2. Measure pitch length of four links in stretched portion. The link pitch is ¼ of the length measured.



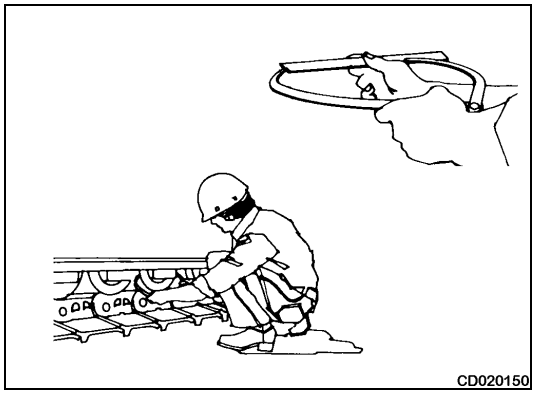
Measuring Height of Grouser

Clean off all materials on the shoe plate and grouser tops. Lay a squeeze bar across grousers approximately 1/4 of way in from the end of the shoe. Insert a 305 mm (12 in) scale in the squeeze bar so that the scale is against the top of the track plate and take a reading.



Measuring Outside Diameter of Track Roller

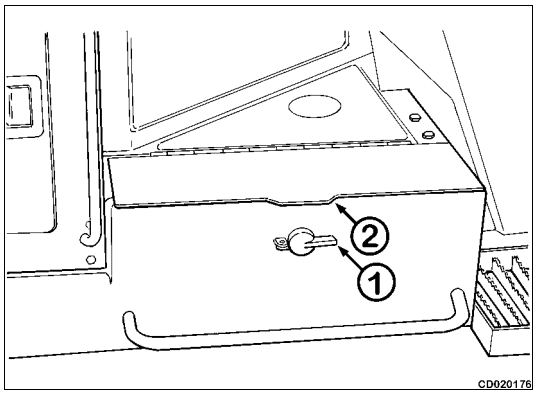
Place the tips of a 305 mm (12 in) caliper against tread area of roller. Adjust caliper so a slight drag is present when caliper is removed. Using a 305 mm (12 in) scale, measure distance between caliper tips.



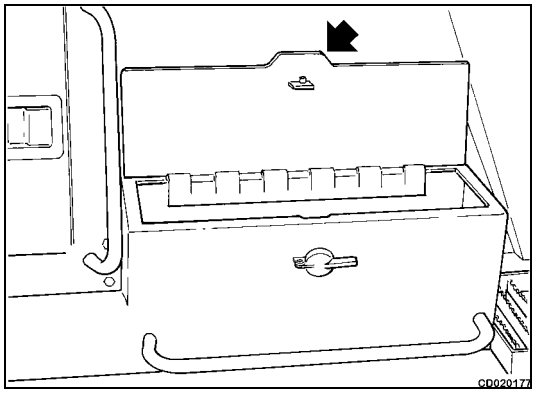
UTILITY BOX

An utility box is located at the right side of the machine utilized as an operator's compartment step. It can be used to hold a variety of useful things and can be pad locked when not in use.

1. To open, remove pad lock, pull down on the handle (1) and lift up on the deck plate (2).



2. To close, pull down on the deck plate and secure with the handle and a pad lock.



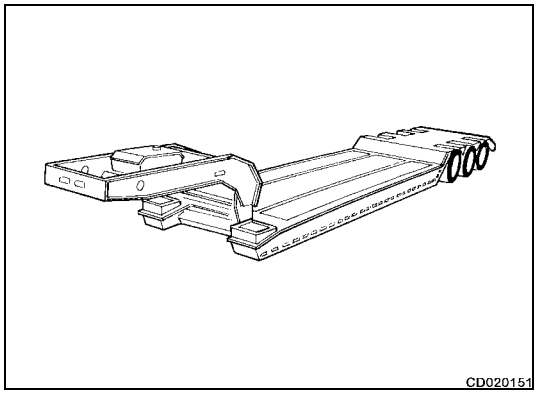
TRANSPORTATION

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

LOADING, UNLOADING THE MACHINE

WARNING

- **Make sure the ramp has sufficient width, length and thickness to enable the machine to be safely loaded and unloaded. If the ramp sags appreciably, reinforce it properly.**
- **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 loading. If it is necessary to change direction, drive off and correct the direction, then drive on.**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When loading or unloading, always follow trailer instructions and carry out the operations as follows.

1. Properly apply the brakes on the trailer and insert block beneath the tires to ensure that it does not move.
2. Determine direction, then slowly load or unload the machine.
3. Load the machine correctly in the specified position on the trailer.

LIFTING THE MACHINE

When raising the machine, if the rope is not fixed properly, the machine may slip and cause a serious accident or injury.

The weight table given below shows the weights of the machine manufactured by Komatsu when it is shipped from the factory.

	D87E-2 Semi U Dozer	D87E-2 Angle Dozer	D87P-2
Standard machine weight with cab, ROPS, air conditioner, blade and ripper.	27280 kg (60142 lbs)	27608 kg (60872 lbs)	29280 kg (64552 lbs)

1. Always apply the parking brake before fitting a sling or wire rope.
2. Always use a sling or rope of suitable strength when raising the machine.
3. Use protectors at sharp corners or places where the wire or cable will bite in. Position the crane so that the machine is raised horizontally. Make the width of the sledder and bar wide enough so that it does not contact the machine.

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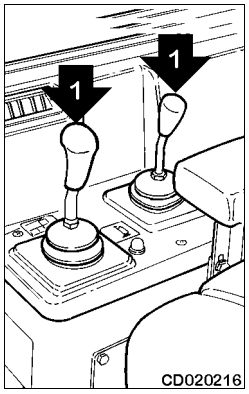
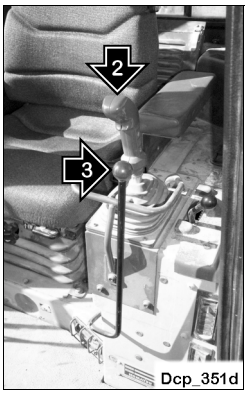
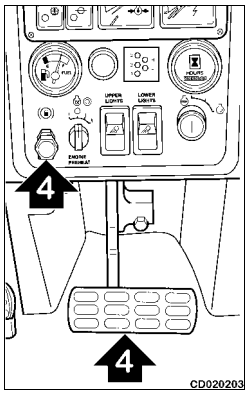
NOTE: This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.

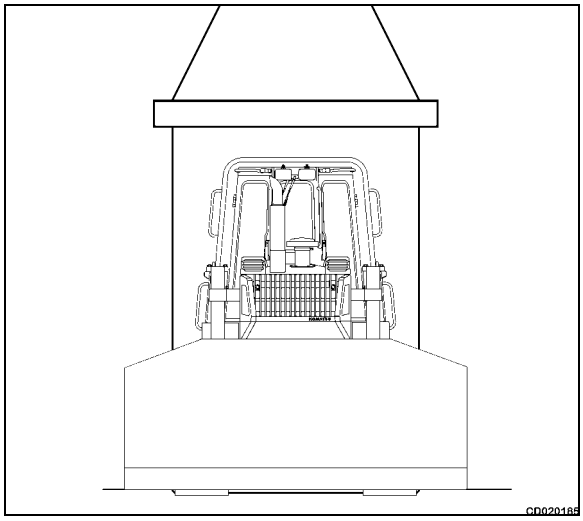
SECURING THE MACHINE

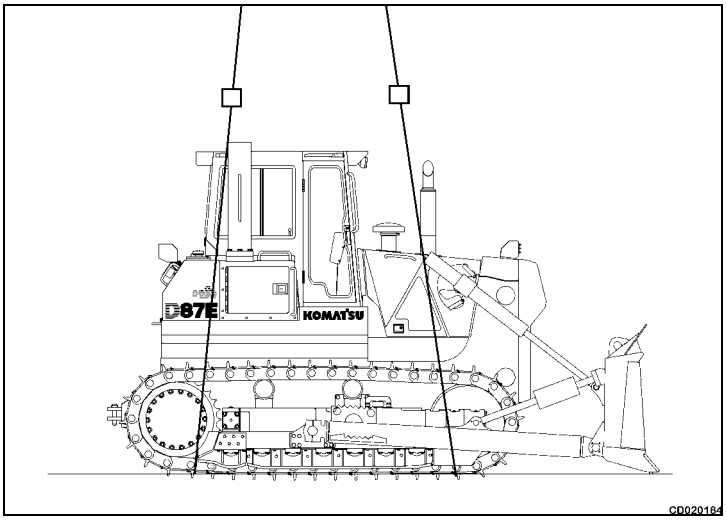






4. Method of fitting rope.





5. After fitting the rope, raise the machine 100 to 200 mm (4 to 8 in) and check that there is no slack in the wire cable and that the machine is being raised horizontally.

6. If any points are unclear, please contact your local distributor for advice.

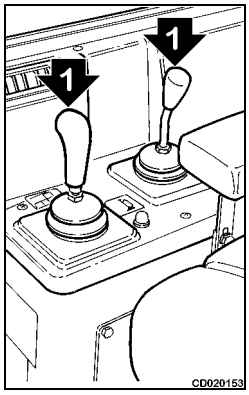
SECURING THE MACHINE

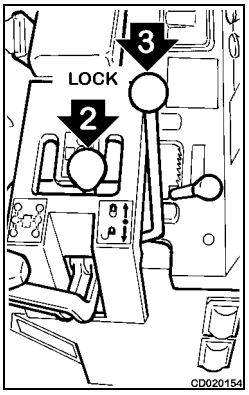
After loading on the trailer, secure the machine as follows.

1. Lower the work equipment slowly.

2. Place the transmission lever in neutral.

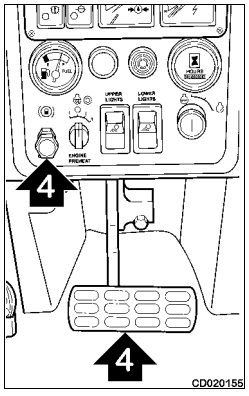
3. Place the safety lock lever in the locked, (up) position.

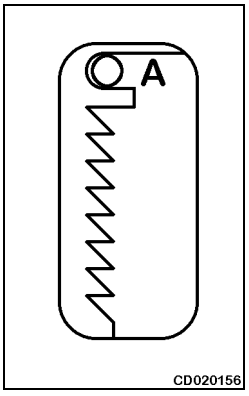




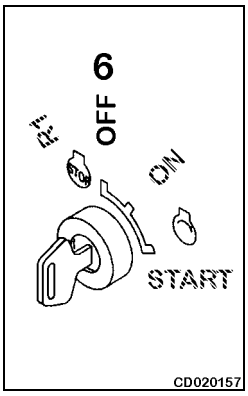
4. Depress the brake pedal and pull the lock lever to apply the brakes.

5. Move the fuel control lever to the notched position (**A**).

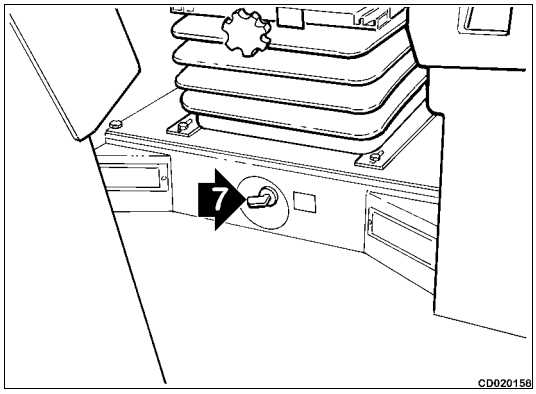




6. Turn the starting switch key to the **OFF** position to stop the engine. Remove the key.



7. Turn the master disconnect switch to OFF and remove key.



8. To avoid machine slippage, secure it tightly as follows.

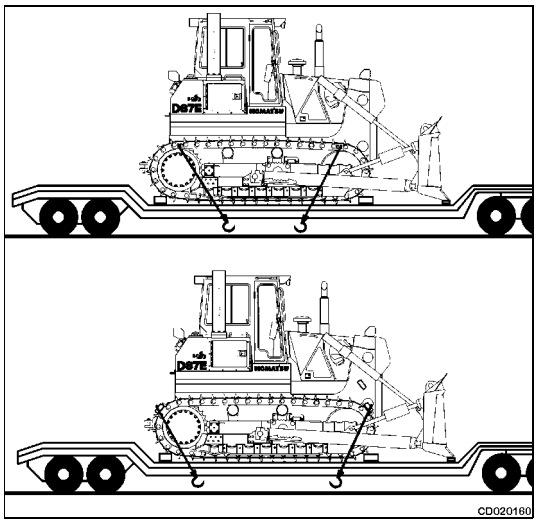
   A. Put blocks in front and behind the track shoes of both sides.

   B. Secure with chain or wire as follows

      1. Set up chain or wire through the holes of track links.

      2. Set up chain or wire around the track shoes.

      3. Protect the wire or chain with padding from contacting directly with angular parts of the machine.



9. Confirm that the height of the load clears various limitations on the way (width and height of tunnels, size of guards, branches of trees) and meets all laws and regulations governing transportation.

PRECAUTIONS

⚠ 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.

COLD WEATHER OPERATIONS

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:

FUEL AND LUBRICANTS

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

- For details of the specified viscosity, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7.

COOLANT

⚠ WARNING

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

Remark

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, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7. Use a permanent antifreeze (ethylene glycol mixed with corrosion inhibitor, anti-foam agent, etc.) meeting standard requirements 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

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.

Fluid temp / Charge rate	20°C (68°F)	0°C (32°F)	-10°C (14°F)	-20°C (-4°F)
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

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 impossible, park the machine on wooden boards. The boards help protect the tracks from freezing into the 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. To prevent fluid in the battery from freezing in the night, do not add the water after the day's work.

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 “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7.
- If for any reason permanent antifreeze cannot be used, and an ethylene 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 system thoroughly, and fill with fresh coolant.

LONG TERM STORAGE

BEFORE STORAGE

WARNING

If possible, prepare the machine for long term storage outdoors. If this must be done indoors, open doors and windows for ventilation to prevent carbon monoxide poisoning.

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 necessary to leave it outdoors, park the machine on the flat ground and cover it with canvas etc.
- Completely fill the fuel tank, lubricate and change the oil before storage. Apply a thin coat of grease to metal surface of the hydraulic piston rods.
- Disconnect the negative terminals of the batteries and cover them, or remove it from the machine and store separately.
- If the ambient temperature is expected to drop below 0°C (32°F), always add antifreeze to the coolant.
- Place the safety lock lever in the locked (up) position and place the fuel control lever in the stop position. Do not lock the brake pedal; use blocks to stop the machine from moving.

DURING STORAGE

- Operate the engine and move the machine for a short distance once a month so that a new film of oil will be coated over movable parts and component surfaces. At the same time, also charge the batteries.
- Before operating the work equipment, wipe off the grease on the hydraulic piston rod.

AFTER STORAGE

Remark

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

TROUBLESHOOTING

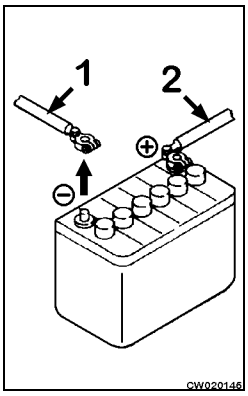
AFTER RUNNING OUT OF FUEL

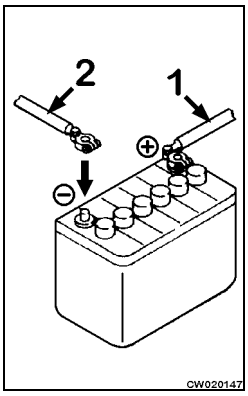
When starting after running out of fuel, fill with fuel, then fill the fuel filter cartridge with clean fuel and bleed the air from the fuel system before starting. For details of bleeding the air, see “REPLACE FUEL FILTER CARTRIDGE” on page 3-48.

IF BATTERY IS DISCHARGED

⚠ WARNING

- **When checking or handling the batteries, stop the engine and turn the starting key to the OFF position before starting.**
- **The batteries generates hydrogen gas, so there is danger of explosion. Do not bring lighted cigarettes near the batteries, or do anything that will cause sparks.**
- **Battery electrolyte is dilute sulfuric 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 batteries, always wear protective goggles.**
- **When removing the batteries, first disconnect the cable from the ground (normally, from the negative ⊖ terminal). When installing, install the positive ⊕ terminal first. If a tool touches the cable connecting the positive terminal and the chassis, there is danger that it will cause sparks.**
- **If the terminals are loose, there is danger that the defective contact may generate sparks that will cause an explosion. When installing the terminals, install them tightly.**



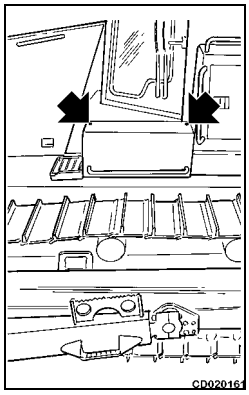


STARTING ENGINE WITH BOOSTER CABLE

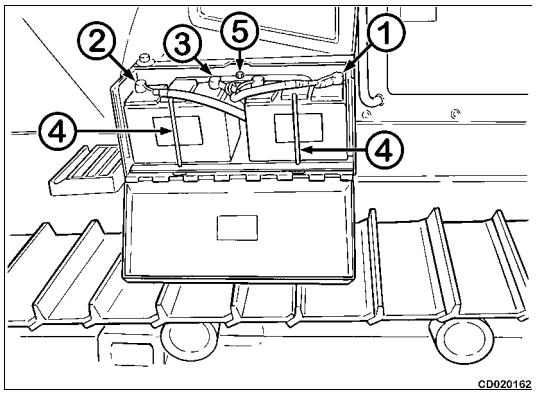
When starting the engine with a booster cable, do as follows:

Removal, Installation Of Batteries

1. Remove two top bolts and rotate the battery case cover down.



2. Disconnect the negative ⊖ cable (1) from rear battery. Disconnect the positive ⊕ cable (2) from the front battery. Disconnect and remove cross over ⊖ to ⊕ cable (3) from each battery. Remove front long bolts (4) then single rear bolt and retainer plate (5). Remove batteries from compartment.



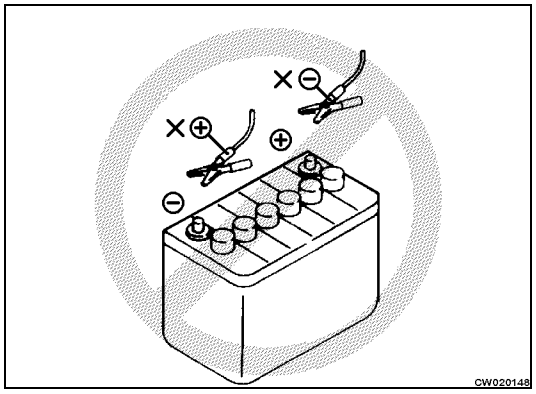
To install batteries, reverse the removal procedure installing batteries with positive ⊕ terminals facing forward.

N•m Battery terminal nut ..... 30 N•m (22 lbf ft)
Long bolts (4)..... 9 N•m (7 lbf ft)

When Connecting and Disconnecting Booster Cable

WARNING

- **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 batteries. 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 engine block of the problem machine, but sparks will be generated when this is done, so connect to a place as far as possible from the batteries.**
- **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.**



Remark

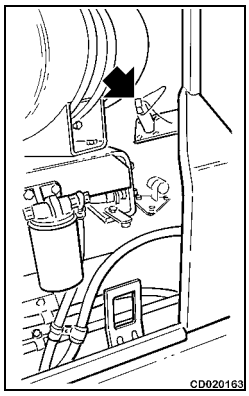
The size of the booster cable and clip should be suitable for the battery size. The battery of the normal machine must be the same capacity as that of the engine to be started. Check the cables and clips for damage or corrosion. Make sure that the cables and clips are firmly connected.

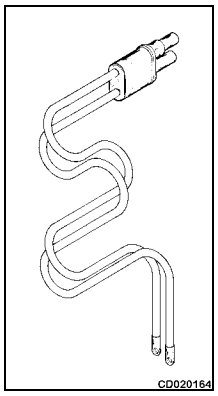
Connecting With Starting/Charging Receptacle

(Optional attachment)

1. Open left engine access door. Remove plug from receptacle.

2. With charging receptacle attach to a host machine, insert at problem machine. Start host machine and allow a few minutes precharge time.

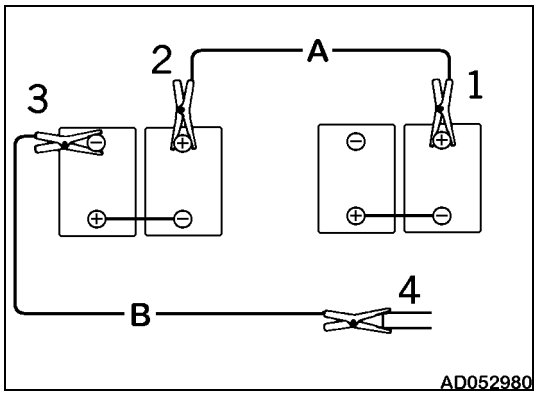




Connecting With Booster Cables

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 ⊕ (1) of the problem machine (2).
3. Connect the other clip of booster cable (**A**) to the positive ⊕ terminal (3) of the normal machine (4).
4. Connect one clip of booster cable (**B**) to the negative ⊖ terminal (5) of the normal machine (4).
5. Connect the other clip of booster cable (**B**) to the engine block (6) of the problem machine (2).



Starting the Engine

1. Make sure the clips are firmly connected to the battery terminals.
2. Start the engine of the normal machine and let it to run at high idle.
3. Turn the starting switch of the problem machine and start the engine, see “STARTING ENGINE” on page 2-43

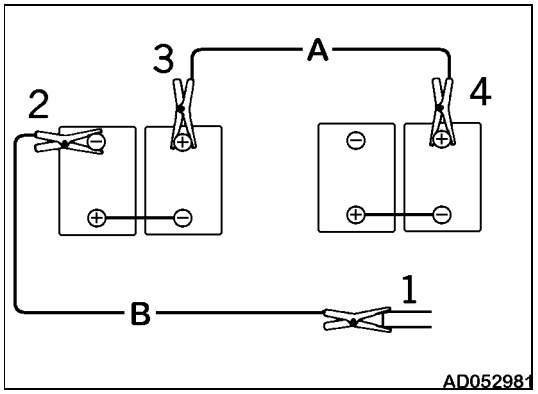
Disconnecting Starting/Charging Receptacle

1. Pull cables from plug in and install protective cap. Close access door
2. Remove from host machine.

Disconnecting 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 (6) of the problem machine (2).
2. Remove the other clip of booster cable (**B**) from the negative ⊖ terminal (5) of the normal machine (4).
3. Remove one clip of booster cable (**A**) from the positive ⊕ terminal (3) of the normal machine (4).
4. Remove the other clip of booster cable (**A**) from the positive ⊕ terminal (1) of the problem machine (2).



OTHER TROUBLE

{ } : Always contact your distributor when handling these items.

- In cases of abnormalities or causes which are not listed below, please contact your distributor for repairs.

ELECTRICAL SYSTEM

PROBLEM	MAIN CAUSE	REMEDY
Voltmeter does not register charge when engine runs at high idle or flickers while engine is running	• Defective wiring • Defective adjustment of belt tension	{Check, repair loose terminals, disconnections} Adjust, see "ENGINE FAN AND ALTERNATOR BELT" on page 3-44
Voltmeter registers extreme high charge	• Defective alternator • Defective wiring	{Replace} {Check, repair}
Abnormal noise is generated from alternator	• Defective alternator	{Replace}
Starting motor does not turn when key switch is turned on	• Defective wiring • Insufficient battery charge	{Check, repair} Charge
Pinion of starting motor keeps going in and out	• Insufficient battery charge	Charge
Starting motor turns engine sluggishly	• Insufficient battery charge • Defective starting motor	Charge {Replace}
Starting motor disengages before engine starts	• Defective wiring • Insufficient battery charge	{Check, repair} Charge
Automatic preheating is not actuated	• Defective wiring • Defective glow heater • Defective timer	{Check, repair} {Replace} {Replace}
Glow signal lamp does not go out	• Defective wiring • Defective heater relay	{Check, repair} {Replace}
Glow signal lamp does not glow red	• Defective wiring • Defective heater relay • Defective glow signal	{Check, repair} {Replace} {Replace}
Warning lamps do not illuminate when engine is stopped, start switch at on position, possible 8 places	• Defective warning lamp • Defective lamp switch • Defective wiring	{Replace} {Replace} {Check, repair}
Outside of electrical intake air heater is not warm when touched by hand	• Defective wiring • Disconnection in electrical intake air heater • Defective operation of heater relay switch	{Check, repair} {Replace} {Check repair switch}
Air conditioner does not work	• Blown fuse • Insufficient battery charge • Defective air conditioner switch • Defective blower switch • Defective compressor	{Check repair switch} Charge {Replace switch} {Replace switch} {Replace}

CHASSIS

PROBLEM	MAIN CAUSE	REMEDY
When transmission lever is moved to the desired position, machine does not start or traveling speed is low	• Oil pressure of drive train is not raised 1. Insufficient oil in system	Add oil to specified level, see “CHECK OIL LEVEL IN DRIVE TRAIN” on page 3-30
When transmission steering lever is moved to turn machine, machine does not turn and goes straight	• Steering clutch of moved side is not disengaged. . . . . . • Brake of moved side is not actuated. . .	Adjust brake Adjust brake
When brake pedal is depressed, machine does not stop	• Brake out of adjustment	Adjust brake
Track comes off	• Track too loose	Adjust tension, see “CHECK AND ADJUST TRACK TENSION” on page 3-30
Abnormal wear of sprocket	• Track too loose or too tight	
Blade rises slowly, does not rise	• Lack of hydraulic oil	Add oil to specified level, see “CHECK OIL LEVEL IN HYDRAULIC TANK” on page 3-24
Does not steer when steering levers are operated	• Defective hydraulic pressure at steering clutch	{Check, repair}
Noise generated from idlers or rollers	• Lack of oil in idler or rollers	Add oil to specified level. see “TIPS FOR LONGER UNDERCARRIAGE LIFE” on page 2-78
Blade control lever is not held at float	• Insufficient warm up	Carry out warm up
Transmission pressure does not rise	• Wear, scuffing of gear pump . . . . . • Lack of oil in power train case . . . . . • Element of oil strainer clogged	{Check, replace} Add oil to specified level. see “CHECK OIL LEVEL IN DRIVE TRAIN” on page 3-30 Clean. see “DRIVE TRAIN SUCTION STRAINER” on page 3-34
Lacks drawbar pull, cannot travel at full speed	• Lack of drive power from engine	See ENGINE on next page
Machine does not move off when transmission lever is placed in gear	• Lack of oil in power train case . . . . . • Transmission pressure does not rise . . . • Steering clutch is slipping . . . . . 1. Wear, scuffing of gear pump	Add oil to specified level, see “CHECK OIL LEVEL IN DRIVE TRAIN” on page 3-30 See Transmission pressure does not rise above {Check, replace}
Torque converter overheats	• Lack of oil in power train case . . . . . • Transmission pressure does not rise . . . • Steering clutch is slipping . . . . . 1. Wear, scuffing of gear pump • Excessive load when operating	Add oil to specified level. see “CHECK OIL LEVEL IN DRIVE TRAIN” on page 3-30 See Transmission pressure does not rise above {Check, replace} Shift down one speed, or reduce load and increase the speed when operating

ENGINE

PROBLEM	MAIN CAUSE	REMEDY
Engine oil pressure warning light remains lit when engine speed is raised after completion of warm up	• Engine oil pan level is low • Clogged oil filter element • Defective tightening of tube, oil leakage from damaged part • Defective warning light	Add oil to specified level, see "CHECK ENGINE CRANKCASE OIL LEVEL" on page 3-23 Replace element, see "DRIVE TRAIN PRESSURE FILTER" on page 3-54 {Check repair} {Replace light}
Steam is emitted from top part of radiator	• Coolant level low, leakage • Loose fan belt • Dirt or scale accumulated in cooling system	Add coolant, see "CHECK RADIATOR COOLANT LEVEL" on page 3-23 Adjust fan belt tension, see "ENGINE FAN AND ALTERNATOR BELT" on page 3-44 Change coolant, clean inside of system, see "DRAIN, FLUSH AND REFILL COOLING SYSTEM" on page 3-85
Coolant temperature gauge indicator is out of run range	• Clogged/damaged radiator fins • Defective thermostat • Loose radiator filler cap, high altitude operation • Defective coolant temp gauge	{Check repair} {Replace thermostat} Tighten cap or replace {Replace coolant temperature gauge}
Coolant temperature gauge indicator does not go in run range	• Defective thermostat • Defective coolant temp gauge	{Replace thermostat} {Replace coolant temperature gauge}
Engine does not start when starting motor is engaged	• Lack of fuel • Air in fuel system • Defective fuel injection pump or nozzle • Starting motor cranks engine sluggishly • Defective compression caused by defective valve clearance	Add fuel, see "FILL FUEL TANK" on page 3-27 Repair place where air is sucked in {Replace pump or nozzle} Check, see "RELATING TO ELECTRICAL SYSTEM" on page 3-5 {Adjust valve clearance}
Exhaust smoke is white or blue	• Too much oil in oil pan • Improper fuel	Drain to specified level, see "CHECK ENGINE CRANKCASE OIL LEVEL" on page 3-23 Change to specified fuel, see "USE OF FUEL, COOLANT AND LUBRICANTS" on page 3-7
Exhaust smoke occasionally turns black	• Clogged air cleaner element • Defective nozzle • Defective compression	Clean or replace, see "CLEAN AIR CLEANER ELEMENTS" on page 3-65 {Replace nozzle} {Adjust valve clearance}
Combustion noise occasionally makes rasping sounds	• Defective nozzle	{Adjust valve clearance}
Abnormal noise generated, combustion or mechanical	• Low grade fuel being used • Overheating • Damage inside muffler • Excessive valve clearance	Replace, see "USE OF FUEL, COOLANT AND LUBRICANTS" on page 3-7 See item, Coolant temperature gauge indicator is out of run range {Replace muffler} {Adjust valve clearance}

METHODS OF TOWING MACHINE

WARNING

- **When using a chain or cable, be sure it is strong enough for the expected load and it is properly secured to the drawbar pins, ripper toolbeam or tow hook.**
- **When pulling with a chain or cable, take up the slack slowly to avoid jerking. A chain or cable which fails under load can whip and cause serious injury. Stand clear. Do not pull or tow unless the operator's compartment is guarded against or out of reach of a whipping chain or cable. Attach only to the machine tow hook, ripper toolbeam or drawbar. Failure to follow these instructions could cause serious injury.**

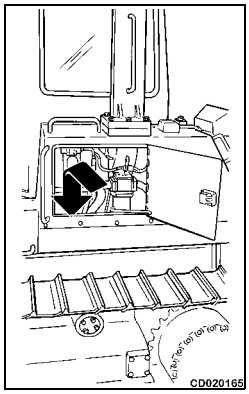
Remark

If the steering drive, final drive or tracks are damaged, do not tow the machine. The machine must be transported on a carrier to avoid further damage.

To avoid the possibility of power train damage, limit the towing to a distance of 0.8 km (0.5 mile) at speeds less than 1.6 km/h (1 mph). The brakes on this machine are automatically spring applied when the engine is stopped. The brakes can only be released hydraulically. A towing port for applying external pressure to release each side brake is located in the left side box below the drive train filter. If the machine can be towed and the engine and steering hydraulic system can be operated, proceed as follows:

1. Position the safety lock lever in the up position. Start the engine. Use a towing cable of sufficient strength. Keep the engine running at half throttle and the safety lock locked in the up position during the tow.

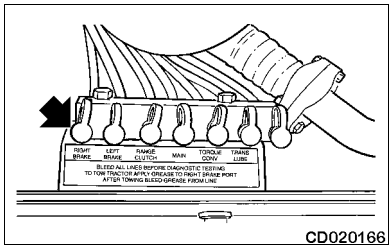
If the machine can be towed but the engine and/or steering hydraulic system is/are inoperable, proceed as follows:



2. Open the left side door. Modify a grease gun by installing a female quick disconnect fitting and hose of sufficient length to the right brake port as marked. This will allow operation of the grease gun from the operator's seat for releasing the spring applied brakes.

3. Pump sufficient grease into the fitting to release the brakes. The amount of grease required depends on the amount of pressure dissipation in the system.

4. Use a towing cable of sufficient strength. During the tow, it may be necessary to pump more grease into the brake release fittings to replace the loss of pressure.



WARNING

Stop towing the machine before reapplying grease to the fittings.

5. Depressing the brake pedal will relieve pressure and apply the brakes. When towing is completed, remove the grease gun and close the left side door.

MAINTENANCE

GUIDES TO MAINTENANCE

Obey all safety precautions in this manual and Product Graphics on the machine when performing 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 hourmeter:

- Check the service hourmeter 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 Book list as replacement parts.

Komatsu genuine oils:

- Use Komatsu genuine oils and grease. Choose oils and grease with proper viscosities specified for ambient temperature.
- For details of the fluid to use, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7

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 is easier to find the parts causing problems. Keep clean in particular, grease fittings, breathers and oil level gauges clean and avoid foreign matters from getting in them.

Be careful of hot coolant and oil:

- Draining hot oils and coolant 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, approximately 20 to 40°C (68 to 104°F), before draining it.

Checking for foreign materials in drained oil:

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

Fuel strainer:

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

Oil change:

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

Warning tag:

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

Welding instructions:

- Turn off the engine starting switch and master switch.
- Do not apply more than 200 V continuously.
- Connect the ground cable within 1 m (3.28 ft) from the area to be welded.
- Avoid seals or bearings from being between the area to be welded and the position of grounding point.

Fire prevention:

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

Clamp faces:

- When o-rings or gaskets are removed, clean the clamp faces and replace the o-rings and gaskets with new ones. Be sure to 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.

Cleaning machine:

- Do not direct a high pressure jet directly at the radiator.
- Do not splash water over the electrical equipment.

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.

When working at dusty work sites, do as follows:

- Check the air cleaner for clogging more frequently. 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.

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	EO1
Drive train; transmission, torque converter and rear main frame	HDTF
Final drive	MPL
Undercarriage Components	EO1
Hydraulic tank	HDTF or EO2
Fuel tank	D975 No. 2
Radiator	50-50 Antifreeze/water

For details of the fluid to use, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7.

OUTLINE OF OIL, FUEL, COOLANT

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 this Operation & 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 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 distributor.

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 this Operation & 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.

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 antifreeze, always observe the precautions given in this Operation & Maintenance Manual.
- These machines are supplied with antifreeze in the coolant when the machine is shipped. This antifreeze is effective in preventing corrosion of the cooling system. Therefore, it can be used as it is even in hot areas.
- Antifreeze is volatile, so be extremely careful not to expose it to flame or fire. The proportion of antifreeze to water differs according to the ambient temperature. For details of the mixing proportions, see “COOLING SYSTEM” on page 3-10
- 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.

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.

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.

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 procedures in this Operation & 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 distributor. Do not open packs of spare filters until just before they are to be used. Always use Komatsu genuine filters.

RELATING TO ELECTRICAL 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. When working on the seashore, carefully clean the electric system to prevent corrosion. Never connect any optional power source to the fuse, starting switch, battery relay, etc.

WEAR PARTS LIST

Wear parts such as the filter element, cutting edge, 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. When ordering parts, please check the part number in the parts book. Use the current parts book to write in the numbers.

Item	Part No.	Part Name	Qty.	Replacement Frequency
Engine oil filter	600-211-1230	Cartridge	1	Every 250 Hours Service
Fuel filter	600-311-8292	Cartridge	1	Every 500 Hours Service
Drive train suction strainer *	637463C91	60 Mesh element	1	Every 500 Hours Service
Drive train scavenge strainer *		14 Mesh element	1	Every 500 Hours Service
Corrosion resistor	600-411-1150	Cartridge	1	Every 1000 Hours Service
Hydraulic oil return filter	1214275H4	Cartridge	1	Every 1000 Hours Service
Drive train pressure filter	1266751H2	Cartridge	1	Every 1000 Hours Service
Drive train breather	662250C1 or 666156C1	Breather element	1	Every 1000 Hours Service
Hydraulic oil pilot filter		Cartridge	1	Every 2000 Hours Service
Engine fan belt	04121-22271	Fan belt - V	2	Periodic or when required
Air cleaner	600-181-4300	Primary element	1	Periodic or when required
	6125-81-7032	Secondary element	1	Periodic or when required
Blade - D87E-2 Semi U dozer	734528C1 734529C1 734532C1 734531C1 326301R1 25530R1	Center cutting edge Outer cutting edge Left end bit Right end bit Plow bolt Hex nut	1 2 1 1 31 31	---
Blade - D87E-2 Straight angle dozer	326301R1 25530R1	Center cutting edge Left end bit Right end bit Plow bolt Hex nut	2 1 1 20 20	---
Blade - D87P-1 Straight dozer	623985C1 734824C1 734825C1 326301R1 25530R1	Cutting edge Left end bit Right end bit Plow bolt Hex nut	2 1 1 34 34	---

* Clean or replace strainer as required.

USE OF FUEL, COOLANT AND LUBRICANTS

PROPER SELECTION OF FUEL, COOLANT AND LUBRICANTS

It is not our policy to approve lubricants or to guarantee oil performance in service. The responsibility of quality of the lubricant must remain with the supplier of the lubricant. When in doubt consult your distributor. The lubricants specified for this machine are shown below.

POINT	TYPE	AMBIENT TEMPERATURES				CAPACITY
		40 to -7°C (120 to 20°F)	21 to -23°C (70 to -10°F)	-12 to -34°C (10 to -30°F)	-12 to -54°C (10 to -65°F)	
Crankcase with filter change	EO	SAE 15W-40	SAE 10W-30	SAE 5W-20 or SAE 5W-30	Multi-purpose ARTIC oil	27 L (7.1 gal)
Front idler rebuilt	HDTF	SAE 30			Multi-purpose ARTIC oil	0.3 L (10.1 oz)
Track roller rebuilt	HDTF	SAE 30			Multi-purpose ARTIC oil	0.4 L (13.5 oz)
Top idler rebuilt	HDTF	SAE 30			Multi-purpose ARTIC oil	0.4 L (13.5 oz)
Final drive	MPL	SAE 85W-140		SAE 80W-90	ARTIC grade 75	38 L (10 gal)
Pivot shaft housing	MPL	SAE 85W-140		SAE 80W-90	ARTIC grade 75	2.4 L (2.5 qt)
Drive train%	HDTF	SAE 10W		SAE 5W-30 or SAE 5W-20	Multi-purpose ARTIC oil	173 L (45.7 gal)
Equipment system	HDTF	SAE 10W			Multi-purpose ARTIC oil	126 L (33.3 gal)
Equipment system with ripper	HDTF	SAE 10W			Multi-purpose ARTIC oil	134 L (35.4 gal)
Fuel tank	DF	D975 No.2D		D975 No.1D	VV-F-800DF-A	490 L (130 gal)
Cooling system	For details, see "COOLING SYSTEM" on page 3-10					58.7 L (15.5 gal)

% Drive train consists of the rear main frame, steering drive, transmission, torque converter, oil cooler and all appropriate lines.

ABBREVIATIONS

HDTF — Komatsu heavy duty transmission fluid or equivalent, see "DRIVE TRAIN OIL SPECIFICATIONS" on page 3-9.

EO1 — Komatsu engine oil or multigrade diesel engine oil, see "ENGINE OIL SPECIFICATIONS" on page 3-8

EO2 — (For service only) Komatsu hydraulic fluid or engine oil API CD/CC, CD or MIL-L-2104 and passing TO-2 and C-3 test with 0.10% minimum zinc.

MPL — Komatsu gear lube or multi purpose gear lube, see "FINAL DRIVE OIL OR PIVOT SHAFT HOUSING SPECIFICATIONS" on page 3-9.

MPG — Komatsu super grease or multi purpose grease 251 HEPM or NLGI grade #2 multi purpose lithium grease with 3 to 5% MoS_2 (molybdenum disulfide).

HTF — (For service only) Komatsu hydraulic transmission fluid.

DF — Diesel fuel Grade 1 or 2 depending on ambient temperature, see "FUEL SYSTEM" on page 3-12.

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

ENGINE OIL SPECIFICATIONS

NORMAL OPERATION

Oil performance recommendations are as follows:

- The use of a quality engine lubricating oil combined with appropriate oil and filter change intervals are critical factors in maintaining engine performance and durability.
- Komatsu Engine Oil or multi viscosity engine oil meeting API performance classification CF-4, CG-4, CF-4/SG or CG-4/SH or MIL-L-2104D or E is recommended.

NOTE
Classification CD, CE, CD/SF or CE/SF oils may be used in areas where CF-4, CG-4, CF-4/SG or CG-4/SH oil is not yet available. If API classification CC or CC/CD is used, reduce the engine oil change interval by half.

- A sulfated ash limit of 1.0 to 1.5 mass percent is suggested for optimum valve and piston deposit and oil consumption control. The sulfated ash must not exceed 1.85 mass percent. The sulfated ash limit of 1.85 mass percent has been placed on all engine lubricating oils recommended for use in the engine. Higher ash oils can cause valve and/or piston damage and lead to excessive oil consumption.
- The API service symbol displays the following information. The upper half of the symbol displays the appropriate oil categories; the lower half may contain words to describe oil energy conserving features. The center section identifies the SAE oil viscosity grade.

Oil viscosity recommendations are as follows:

- The use of a multi-grade lubricating oil has been found to improve oil consumption control and improve engine cranking in cold temperatures while maintaining lubrication at high operating temperatures. While SAE 15W-40 multi-viscosity oil is recommended for most operating climates, refer to the previous table for oil viscosity recommendations for extreme climates.

NOTE
Limited use of low viscosity oils, such as SAE 10W-30 may be used for easier starting and providing sufficient oil flow at ambient temperatures below -5°C (+23°F). However, continuous use of low viscosity oils can decrease engine life due to wear.

- Special break in lubricating oils are not recommended for a new or rebuilt engine. Use the same type of oil during the break in as specified for normal operation.

Additional information regarding lubricating oil availability throughout the world is available in the EMA. Lubricating Oils Data Book for Automotive and Industrial Engines. The data book may be ordered from the Engine Manufacturers Association, 401 North Michigan Ave., Chicago, Il U.S.A. 60611. The telephone number is (312) 644-6610.

ARCTIC OPERATION

If an engine is operated in ambient temperatures consistently below -23°C (-10°F) and there are no provisions to keep the engine warm when it is not in operation, use a synthetic engine oil API performance classification CF-4, CG-4, CF-4/SG or CG-4/SH with adequate low temperature properties such as SAE 5W-20 or 5W-30.

The oil supplier must be responsible for meeting the performance service specifications.

NOTE
The use of a synthetic base oil does not justify extended oil change intervals. Extended oil change intervals can decrease engine life due to factors such as; corrosion, deposits and wear.

DRIVE TRAIN OIL SPECIFICATIONS

NOTE
The drive train consist of the following items; rear main frame, steering drive, transmission, torque converter and oil cooler.

Komatsu Heavy Duty Transmission Fluid or an equivalent fluid meeting C-4 and TO-4 and not containing a viscosity index improver is recommended.

For service only of the drive train, optionally use Komatsu Hydraulic Fluid or engine oil with an API classification of CD/CC, CD or MIL-L-2104D or E and meeting C-3 and TO-2 and containing 0.10% zinc minimum.

TRACK FRONT IDLER, TRACK ROLLER, TOP IDLER OIL SPECIFICATIONS

Komatsu Heavy Duty Transmission Fluid or an equivalent fluid meeting C-4 and TO-4 and NOT containing a viscosity index improver is recommended.

For service only of the track front idlers, track rollers and top idlers, optionally use Komatsu Hydraulic Fluid or engine oil with an API classification of CD/CC, CD or MIL-L-2104D or E and meeting C-3 and TO-2 and containing 0.10% zinc minimum.

EQUIPMENT SYSTEM OIL SPECIFICATIONS

Komatsu Heavy Duty Transmission Fluid or an equivalent fluid meeting C-4 and TO-4 and NOT containing a viscosity index improver is recommended.

For service only of the equipment hydraulic system, optionally use Komatsu Hydraulic Fluid or engine oil with an API classification of CD/CC, CD or MIL-L-2104D or E and meeting C-3 and TO-2 and containing 0.10% zinc minimum.

FINAL DRIVE OIL OR PIVOT SHAFT HOUSING SPECIFICATIONS

Komatsu Gear Lubricant or an equivalent multi purpose gear lubricant meeting API GL-5 or MIL-L-2105C is recommended.

COOLING SYSTEM

GENERAL

The cooling system operates under pressure which is controlled by the pressure relief valve in the radiator cap. The belt driven water pump circulates the coolant through the engine block, cylinder heads, radiator, and engine oil cooler. Circulation is controlled by the thermostat which by passes coolant flow around the radiator until the engine reaches operating temperature.

Proper cooling is possible only when the system is sealed, the radiator cap gasket is in good condition, the pressure relief valve and thermostat are operating properly. The system is free of coolant and air flow restrictions and filled to the proper level.

Selection and maintenance of the engine coolant is important to long engine life. The following information provides recommendations for selecting the engine coolant, maintaining the coolant inhibitors and servicing the cooling system. The system operates successfully with a water/antifreeze mixture or inhibited/conditioned water as the coolant. Water alone allows rust, scale deposits, and corrosion to occur within this system. After 2000 hours or one year of operation, whichever comes first, the cooling system should be drained, flushed and refilled.

WATER

Use water which has a low mineral content. Water used in conjunction with antifreeze, coolant filters and inhibited water must meet the following standards:

Total Hardness

Not to exceed 170 parts per million (10 grains/gallon maximum) to prevent scale deposits. Water containing dissolved magnesium and calcium (the usual reason for water hardness) above the specified amount will cause scale deposits to develop in the engine.

Chlorides

Not to exceed 40 parts per million (2.5 grains/gallon maximum) to prevent corrosion.

Sulfites

Not to exceed 100 parts per million (5.8 grains/gallon maximum) to prevent corrosion.

Dissolved Solids

Not to exceed 340 parts per million (20 grains/gallon maximum) to minimize sludge deposits, scale deposits, corrosion or a combination of these. If any of the requirements cannot be met, use distilled, de-ionized, or de-mineralized water. To determine if local water supplies meet these standards, water samples can be tested by water treatment laboratories. Softened water that is prepared using common salt (sodium chloride) contains excessive amounts of chlorides and should not be used.

Remark

Never use water alone in the cooling system because corrosion will occur.

ANTIFREEZE

Low silicate ethylene glycol antifreeze is recommended. The antifreeze should contain no more than 0.1% anhydrous alkali metasilicate. Low silicate antifreeze is recommended to avoid the formation of silica-gel (hydro-gel). This gel formation can occur when the cooling system contains an over concentration of high silicate antifreeze and or supplemental coolant additive. Do not use methanol or alcohol as an antifreeze because of its low boiling point. Antifreeze may retain its freeze protection for more than one season but coolant conditioners must be added to maintain corrosion protection. Antifreeze formulated with methoxy propanol, or propylene glycol, is not recommended for this system.

Remark

Do not mix types of antifreeze solutions. Mixed solutions make it impossible to determine the protection against freezing. Antifreeze containing sealer or antileak additives should not be used in this system. Sealer or antileak additives will cause plugging problems in the cooling system.

WARNING

Use extreme caution when adding coolant to a hot radiator to avoid being burned. Wear gloves and goggles and keep face away from the filler neck.

Check the solution periodically and at normal operating temperature, to be sure the cooling system has sufficient protection against freezing. An antifreeze concentration greater than 68% will adversely affect freeze protection and heat transfer rates. Antifreeze concentrations between 68% and 100% actually have a higher freezing point than a 68% antifreeze concentration and should not be used due to reduced heat transfer rates.

Remark

Do not use a 100% antifreeze solution for freezing protection, this will cause severe corrosion in the cooling system and if not detected will cause radiator and oil cooler core damage. Use a water/antifreeze solution as described in the following table.

The following table shows the approximate percentage of antifreeze solution required for various temperatures.

Approximate Freezing Point	Percentage of Antifreeze Concentration by Volume	Specific Gravity at 16°C (60°F)
0°C (32°F)	0%	1.000
-7°C (20°F)	15%	1.025
-12°C (10°F)	25%	1.040
-18°C (0°F)	33%	1.053
-23°C (-10°F)	40%	1.062
-29°C (-20°F)	45%	1.070
-34°C (-30°F)	48%	1.074
-40°C (-40°F)	53%	1.080
-46°C (-50°F)	56%	1.083
-51°C (-60°F)	59%	1.088
-57°C (-70°F)	62%	1.092
-62°C (-80°F)	65%	1.095
-68°C (-90°F)	67%	1.097
-69°C (-92°F)	68%	1.098

INHIBITORS/CONDITIONERS

1. All cooling system inhibitors, including those in antifreeze solutions, become depleted through normal operation. If the inhibitors in antifreeze are allowed to become depleted, the antifreeze becomes corrosive and attacks and coats the metallic surfaces of the cooling system which reduces heat transfer. Cooling system conditioners which contain these inhibitors must be added to maintain corrosion protection.

2. Soluble oil is not recommended for use in this engine as its use will reduce heat transfer.

3. There are no miracle additives that will increase heat transfer or prevent overheating. Conditioned water is still the best coolant.

FUEL SYSTEM

GENERAL

Cleanliness of diesel fuel determines the service life of the fuel injection components. Water and contaminants, allowed to reach precision injection components, cause rapid wear and poor performance. Clean fuel and regular servicing of the fuel tank and fuel filtering components are necessary for long service life. Always clean the area around the fuel tank filler cap before refueling.

Remark

Below -12°C (10°F) the paraffin in Grade 2 diesel fuel will change to wax particles and clog the fuel filters. For best results use Grade 1 in cold weather.

Check the solution periodically and at normal operating temperature, to be sure the cooling system has sufficient protection against freezing.

⚠ WARNING

- **Fire hazard - never mix gasoline, gasohol and/or alcohol with diesel fuel. This practice creates an extreme fire hazard and under certain conditions an explosion which could result in personal injury or death.**
- **Never remove the fuel tank filler cap or refill the fuel tank while the engine is running or hot or when the machine is indoors. Fumes are dangerous, a spark or flame could result in a fire or explosion.**

DIESEL FUEL SPECIFICATIONS

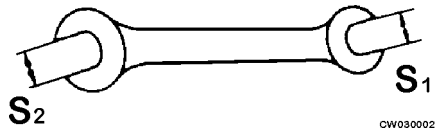
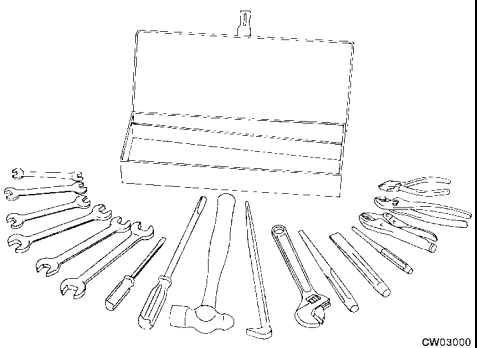
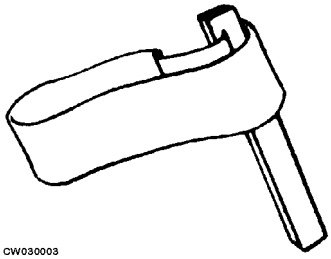
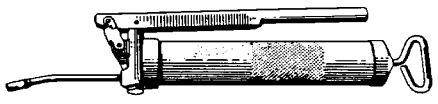
ASTM refers to American Society for Testing and Materials. The D-396 fuels must also meet the cetane number and sulfur requirements of the D-975 specifications.

DIESEL FUEL SPECIFICATIONS	
Type of Operation	**Preferred Specifications**
Normal Service Above -12°C (10°F)	ASTM D-975 Grade 2/D ASTM D-396 Grade 2
Below -12°C (10°F) or Extended Idling	ASTM D-975 Grade 1-D ASTM D-396 Grade 1
Optionally, the equivalent grades of recognized Federal Government specifications may be used; latest revisions of VV-F-800a.	

STANDARD TIGHTENING TORQUES

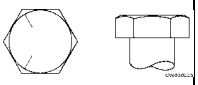
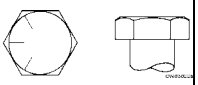
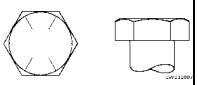
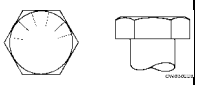
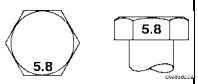
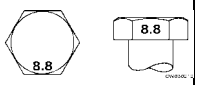
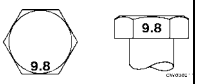
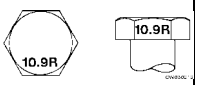
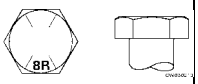
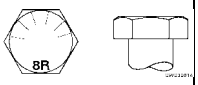
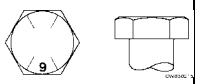
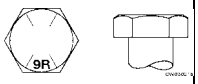
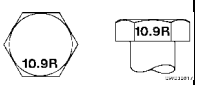
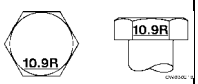
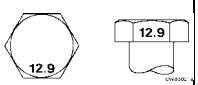
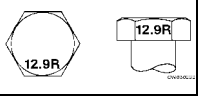
INTRODUCTION OF NECESSARY TOOLS

The following tools are needed when carrying out maintenance.

No.	Name of tool	Part No.	Description	
1.	Wrench Set	09000-30006	Width across flats - S_1xS_2 Open end wrench - 8x10 mm Open end wrench - 12x14 mm Open end wrench - 13x17 mm Open end wrench - 19x22 mm Open end wrench - 24x27 mm Open end wrench - 30x33 mm	
2.	Tool Kit	276 820 R91	Open end wrench - 7/16x1/2 Open end wrench - 9/16x5/8 Open end wrench - 5/8x11/16 Open end wrench - 3/4x13/16 Open end wrench - 15/16x1 Screwdriver - 1/4 shank Screwdriver - 3/8 shank Ball peen hammer Pry bar - 9/16x16 Adjustable wrench Center punch - 5/16x10 Chisel - 7/8x10 Pin punch - 3/16x10 Vise grip wrench Slip joint plier Diagonal (side) cutter Tool box	
3.	Filter Wrench	DR02-535	Removal of filter cartridge	
4.	Grease Pump	999 677 R91	For lubrication of machine	
5.	Grease Cartridge		For type, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7	

If any of the above tools are broken, please order them from your distributor. When not using the tools, always put them in the appropriate tool box.

BOLT IDENTIFICATION CHART

TYPE/CLASS	DESCRIPTION	HEAD MARK
Type 5 Inch Thread	Three radial lines on top and none on side of head. Medium carbon steel quenched and tempered.	
Type 5.2 Inch Thread	Three radial lines on top and none on side of head. Low carbon boron steel quenched and tempered.	
Type 8 Inch Thread	Six radial lines on top and none on side of head. Medium carbon or carbon alloy steel quenched and tempered.	
Type 8.2 Inch Thread	Six radial lines on top and none on side of head. Low carbon boron steel quenched and tempered.	
Class 5.8 Metric Thread	Marked on top or side of head. Low or medium carbon steel.	
Class 8.8 Metric Thread	Marked on top or side of head. Medium carbon or carbon alloy or low carbon boron steel quenched and tempered.	
Class 9.8 Metric Thread	Marked on top or side of head. Medium carbon or carbon alloy or low carbon boron steel quenched and tempered.	
Class 10.9 Metric Thread	Marked on top or side of head. Medium carbon or carbon alloy or low carbon boron steel quenched and tempered.	
Type 8R Inch Thread	Six radial lines on head with type designation, none on sides. Medium carbon or medium carbon alloy steel quenched and tempered.	
Type 8R Inch Thread	Six radial lines on head with type designation, none on sides. Low carbon boron steel quenched and tempered.	
Type 9 Inch Thread	Six radial lines on head with type designation, none on sides. Medium carbon alloy steel quenched and tempered.	
Type 9R Inch Thread	Six radial lines on head with type designation, none on sides. Medium carbon alloy steel quenched and tempered.	
Class 10.9R Metric Thread	Marked on top or side of head. Medium carbon or carbon alloy steel quenched and tempered.	
Class <u>10.9R</u> Metric Thread	Marked on top or side of head and underlined. Low carbon boron steel quenched and tempered.	
Class 12.9 Metric Thread	Marked on top or side of head. Medium carbon alloy steel quenched and tempered.	
Class 12.9R Metric Thread	Marked on top or side of head. Medium carbon alloy steel quenched and tempered.	

GRADE 5 AND 8 NON-PHOSPHATE COATED HARDWARE

Recommended torque for all standard application nuts and bolts, provided; all thread surfaces are clean and lubricated with SAE-30 engine oil or joints are rigid, that is, no gaskets or compressible materials are used. When reusing nuts or bolts, use minimum torque values.

THREAD	GRADE 5	
	N•m	lbf ft
1/4NC	8	6
1/4NF	9	7
5/16NC	18	13
5/16NF	20	15
3/8NC	33	24
3/8NF	37	27
7/16NC	52	38
7/16NF	57	42
1/2NC	79	58
1/2NF	88	65
9/16NC	114	84
9/16NF	126	93
5/8NC	156	115
5/8NF	175	130
3/4NC	278	205
3/4NF	312	240
7/8NC	414	305
7/8NF	454	334
1NC	617	455
1NF	691	510
1-1/8NC	827	610
1-1/8NF	929	685
1-1/4NC	1166	860
1-1/4NF	1295	955
1-3/8NC	1532	1130
1-3/8NF	1749	1290
1-1/2NC	2034	1400
1-1/2NF	2291	1690
1-3/4NC	3213	2370
2NC	4813	3550

THREAD	GRADE 8	
	N•m	lbf ft
1/4NC	12	9
1/4NF	15	11
5/16NC	24	18
5/16NF	28	21
3/8NC	46	34
3/8NF	52	38
7/16NC	73	54
7/16NF	81	60
1/2NC	111	82
1/2NF	122	90
9/16NC	163	120
9/16NF	179	132
5/8NC	224	165
5/8NF	251	185
3/4NC	393	290
3/4NF	434	320
7/8NC	617	455
7/8NF	698	515
1NC	942	695
1NF	1064	785
1-1/8NC	1342	990
1-1/8NF	1505	1110
1-1/4NC	1898	1400
1-1/4NF	2102	1550
1-3/8NC	2481	1830
1-3/8NF	2827	2085
1-1/2NC	3295	2430
1-1/2NF	3701	2730
1-3/4NC	5166	3810
2NC	7810	5760

Multiply the standard torque by 0.65 when finished jam nuts are used, 0.7 when molykote, white lead or similar mixture are used as lubricants, 0.75 when parkerized bolts or nuts are used, 0.85 when cadmium plated bolts or nuts and zinc bolts with waxed zinc nuts are used or 0.9 when hardened surfaces are used under the nut or bolt head. The general torque must be used in all cases where special torques are not given. Values listed in this manual are lubricated (wet) threads; values should be increased 1/3 for non lubricated (dry) threads.

GRADE 8 PHOSPHATE COATED HARDWARE

NOMINAL THREAD	STANDARD TORQUE ± 10%	
	N•m	lbf ft
1/4	10	8
5/16	21	16
3/8	38	28
7/16	60	45
1/2	92	70
9/16	130	100
5/8	180	140
3/4	325	240
7/8	520	590
1	780	580
1-1/8	1110	820
1-1/4	1565	1160
1-3/8	2050	1520
1-1/2	2720	2020
1-3/4	3380	2510
2	5080	3780

This chart provides tightening torque for general purpose applications using original equipment standard hardware as listed in the Parts Books for the machine involved.

DO NOT SUBSTITUTE.

Original equipment standard hardware is defined as Grade 8, coarse thread bolts and nuts and thru hardened flat washers (Rockwell C 38-45), all phosphate coated and assembled without supplemental lubrication (as received) condition.

The torques shown also apply to the following:

Phosphate coated bolts used in tapped holes in steel or gray iron. Phosphate coated bolts used with phosphate coated prevailing torque nuts (nuts with distorted threads or plastic inserts). Phosphate coated bolts used with copper plated weld nuts.

Markings on bolt heads or nuts indicate material grade only and are not to be used to determine required torque.

STANDARD METRIC FASTENERS

NOMINAL THREAD	STANDARD TORQUE ± 10%	
	N•m	lbf ft
6	10	7
7	16	12
8	23	17
10	46	34
12	80	60
14	125	90
16	200	150
18	275	200
20	385	290
22	530	390
24	670	500
27	980	730
30	1330	990
33	1790	1330
36	2325	1730
39	3010	2240

This chart provides tightening torque for general purpose applications using original standard hardware as listed in the Parts Book for the machine involved.

DO NOT SUBSTITUTE.

Original standard hardware is defined as metric class 10.9 bolts and class 10.0 nuts and thru flat washers (Rockwell C 38-45), all phosphate coated and assembled without supplemental lubrication.

The torques shown also apply to the following:

Phosphate bolts used in tapped holes in steel or gray iron, with phosphate coated prevailing torque nuts or with copper plated weld nuts.

Markings on bolt heads or nuts indicate material class only and are not to be used to determine required torque.

HYDRAULIC TUBES AND FITTINGS

The torque figures are recommended for plain, cadmium or zinc plated fittings, dry or wet installations. Swivel nuts either swaged or brazed. Figures are for tube nuts used with 37° flared fittings and JIC - 37° seat o-ring boss plugs and swivel nuts.

Tube Nuts			O-ring Boss Plugs And Swivel Nuts					
For 37° Flared Fitting			JIC 37° Seat					
Size	Tubing OD	Thread	N•m			lbf ft		
4	1/4	7/16-20	12	to	16	9	to	12
5	5/16	1/2-20	16	to	20	12	to	15
6	3/8	9/16-18	33	to	21	21	to	24
8	1/2	3/4-16	47	to	54	35	to	40
10	5/8	7/8-14	72	to	79	53	to	58
12	3/4	1-1/16-12	104	to	111	77	to	82
14	7/8	1-3/16-12	122	to	136	90	to	100
16	1	1-5/16-12	149	to	163	110	to	120
20	1-1/4	1-5/8-12	190	to	204	140	to	150
24	1-1/2	2-1/2-12	217	to	237	162	to	175
32	2	2-1/2-12	305	to	325	225	to	240

HOSE CLAMPS

This chart provides the tightening torques for hose clamps used in all rubber applications (radiator, air cleaner, operating lever boots, hydraulic system, fuel systems etc.).

Clamp Type and Size	Torque ± 0.6 N•m (5 lbf in)			
	Hydraulic System		All Others	
	N•m	lbf in	N•m	lbf in
T Bolt	---	---	6.2 to 7.3	55 to 65
Worm drive under 1-3/4 in open diameter	4.5 to 5.6	40 to 50	2.2 to 3.3	20 to 30
Worm drive over 1-3/4 in open diameter	---	---	4.5 to 5.6	40 to 50
Worm drive all Ultra-Tite	4.5 to 5.6	40 to 50	10.7 to 11.8	95 to 105

SPLIT FLANGE CONNECTIONS

The following chart provides the tightening torques for split flange connections used in hydraulic systems. Flanges and fitting shoulders should fit squarely. Install all bolts, finger tight, then torque evenly. Over torquing bolts will damage the flanges and/or bolts, which may cause leakage.

Flange Size	Bolt Size	Bolt Torque	
		N•m	lbf ft
1/2	5/16	20 to 24	15 to 18
3/4	3/8	30 to 37	22 to 27
1	3/8	37 to 47	27 to 35
1-1/4	7/16	47 to 61	35 to 45
1-1/2	1/2	62 to 79	46 to 58
2	1/2	75 to 88	55 to 65
2-1/2	1/2	107 to 123	79 to 91
3	5/8	187 to 203	138 to 150
3-1/2	5/8	159 to 180	117 to 133

PERIODIC REPLACEMENT OF 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 on the next page. 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 time as the hoses. When replacing the hoses, always replace the o-rings, gaskets, and other such parts at the same time. Ask your distributor to replace the critical parts.

No.	Safety Critical Parts for Periodic Replacement	Qty.	Replacement Interval
1	Fuel supply hose	1	Every 2 years or 4000 hours, whichever comes first
2	Fuel return hose	1	
3	Fuel spill hose	1	
4	Drive train hose - rear main frame to suction strainer	1	
5	Drive train hose - suction strainer to pump	1	
6	Drive train hose - pump to pressure filter	1	
7	Drive train hose - pressure filter to pressure regulator valve **M** port	1	
8	Drive train hose - pressure regulator valve **M** port to steering valve	1	
9	Drive train hose - pressure regulator valve **C** port to torque converter	1	
10	Drive train hose - torque converter to oil cooler	1	
11	Drive train hose - oil cooler to pressure regulator valve **L** port	1	
12	Drive train hose - torque converter to transmission breather	1	
13	Drive train hose - flywheel housing to scavenge pump	1	
14	Drive train hose - scavenge pump to rear main frame	1	
15	Drive train hose - transmission to scavenge pump	1	
16	Drive train hose - scavenge pump to rear main frame	1	
17	Drive train hose - pressure test ports to transmission valves	5	
18	Drive train hose - pressure test ports to steering valve	2	
19	Drive train hose - pilot valve manifold to transmission valves	7	
20	One speed steering hose - manifold to drive clutch	2	
21	One speed steering hose - manifold to brake clutch	2	
22	Two speed steering hose - manifold to **HI** clutch	2	
23	Two speed steering hose - manifold to brake clutch	2	
24	Two speed steering hose - manifold to **LO** clutch	2	
25	Seat belt	1	Every 3 years

MAINTENANCE SCHEDULE CHART

SERVICE PROCEDURE

INITIAL 10 HOURS SERVICE

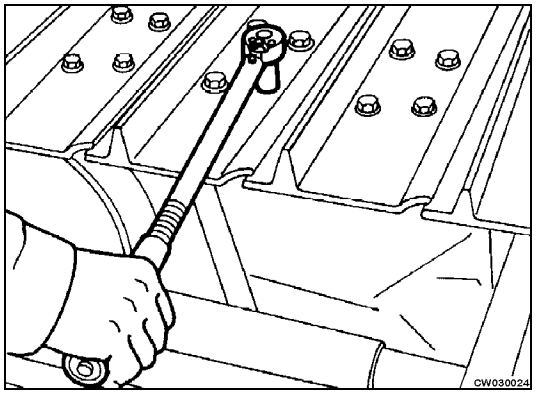
BLADE CUTTING EDGE HARDWARE

Check the torque of the blade cutting edge and end bit hardware.

N•m Plow bolt nuts 725 N•m (535 lbf ft)

TRACK SHOE BOLT TORQUE

The bolts used for attaching the track shoes to the tracks are heat treated alloy bolts and will stand a considerable tightening strain. Ordinary bolts must not be used. Nuts must be assembled so that washer face is not against track link. Radius side of nuts must be against track link. Torque bolts to listed value below.



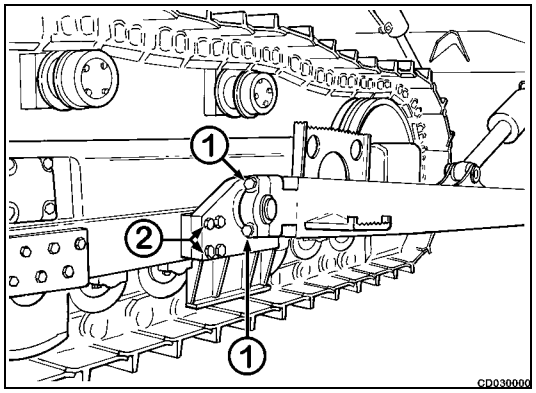
Threads and under bolt head Engine oil

N•m Track shoe bolt 400 ± 70 N•m (295 ± 52 lbf ft) + 120°

- 120° designates two flats of bolt head.

TRUNNION HARDWARE

Check the torque of the trunnion cap bolts (1), qty. 4, and trunnion plate mounting bolts (2), qty.16.



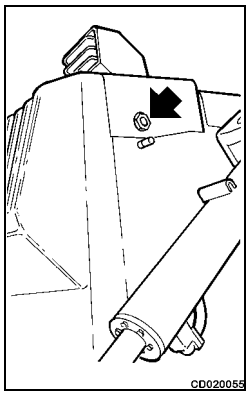
N•m Trunnion hardware 1050 N•m (775 lbf ft)

EVERY 10 HOURS SERVICE

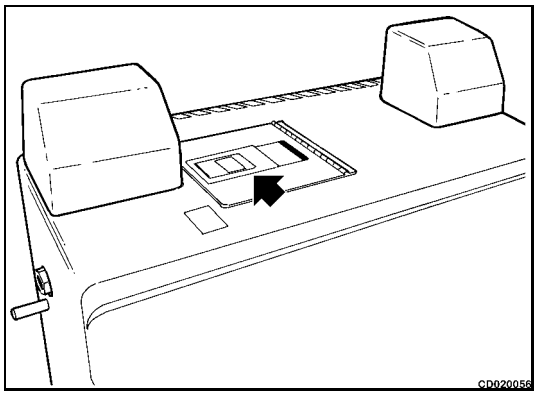
CHECK RADIATOR COOLANT LEVEL

WARNING

- **Hot, scalding coolant can spray out if the radiator cap is removed suddenly. Relieve system pressure by slowly turning the cap to the first notch or lifting the safety lever (if equipped). Remove the cap only after the pressure is relieved.**
- **Use extreme caution when adding coolant to a hot radiator to avoid being burned. Wear gloves and goggles and keep face away from the filler neck.**



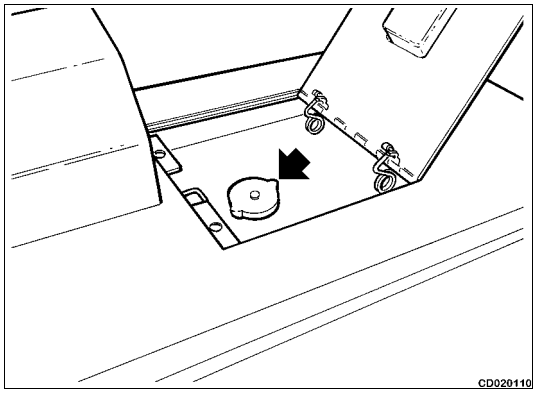
1. Check the coolant level in radiator sight glass to make sure coolant is present.
2. Open the hood access door at the top front of the machine.



3. Remove radiator cap and check that the coolant level is visible. If level is low, add coolant until it is visible in sight gauge.

- For details of the coolant to use, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7.

4. After adding coolant, tighten the cap securely and close the access door.

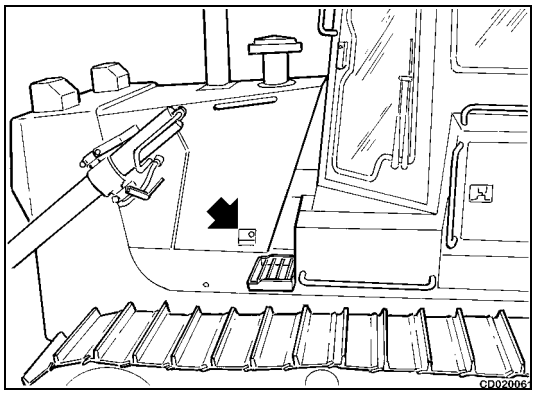


CHECK ENGINE CRANKCASE OIL LEVEL

WARNING

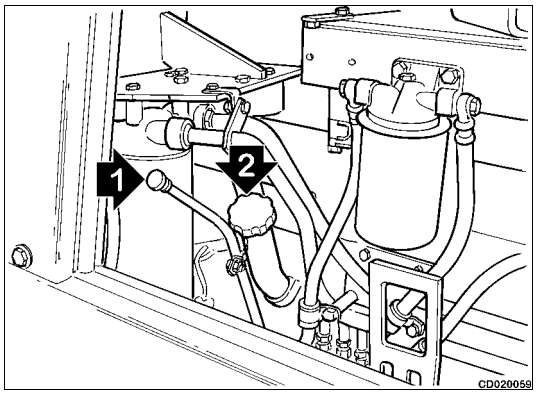
Park the machine on level ground, stop the engine, lower all mounted equipment to the ground, apply the safety lock, apply the brake pedal lock, turn off the electrical system master switch.

1. With the engine stopped, open the left engine side door.



2. Check the oil level. For an accurate reading wait for the oil to drain into the crankcase pan.

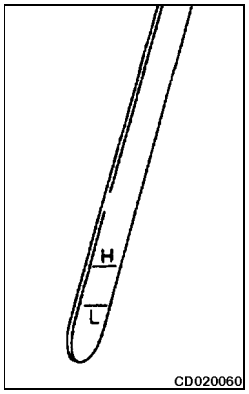
3. Open hood access door. Remove the oil level gauge (1) and wipe it clean. Reinsert the gauge completely.



4. Remove the gauge and check the oil level. If the level is at or below the **L** mark, add oil through the filler opening (2) to bring the level up to the **H** mark on the gauge.

- For details of the oil to use, see "USE OF FUEL, COOLANT AND LUBRICANTS" on page 3-7

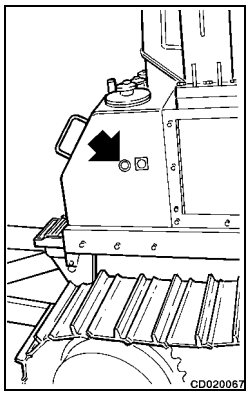
Never run the engine if the level of the oil is at or below the ADD mark on the oil level gauge.



CHECK OIL LEVEL IN HYDRAULIC TANK

WARNING

Pressurized Reservoir. When removing the locking filler cap, oil may spurt out, so stop the engine and wait for the oil temperature to go down. Turn the cap slowly to release the internal pressure before removing the cap.



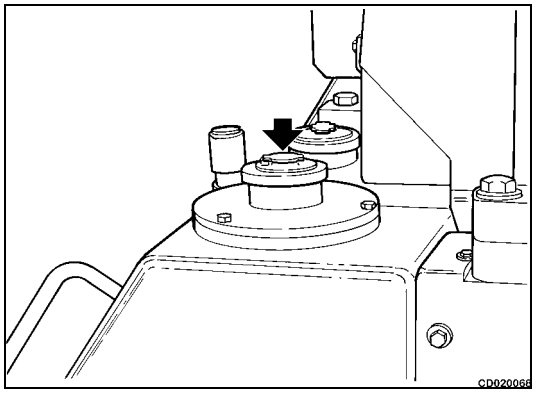
1. Check the hydraulic oil level in the tank at the sight gauge. The proper level is:

   When cold: At bottom of sight gauge

   When hot: At center of sight gauge

2. Remove the locking filler cap and add oil to the proper level, then reinstall the filler cap.

- For details of locking cap, see "LOCKING CAP" on page 2-29.
- For details of the oil to use, see "USE OF FUEL, COOLANT AND LUBRICANTS" on page 3-7



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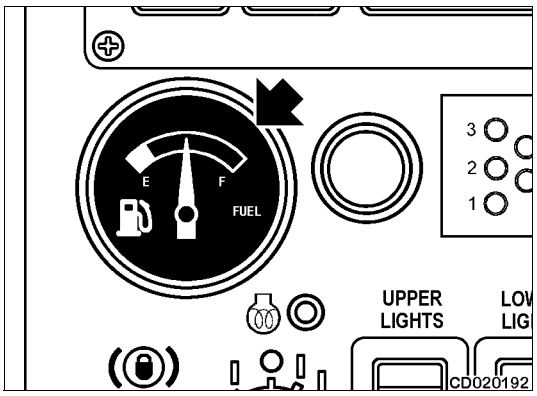
FILL FUEL TANK

NOTE: This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.

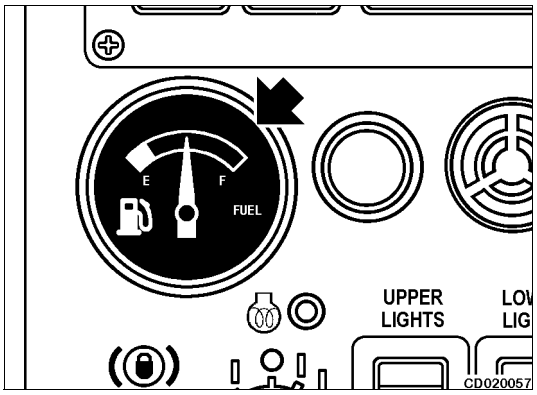


FILL FUEL TANK

WARNING

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

1. Check the fuel level using fuel gauge.



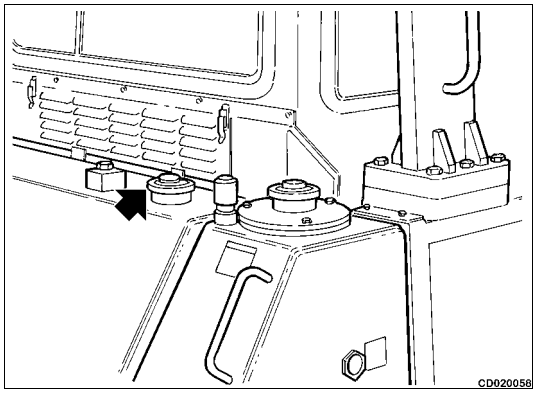
2. After completing work, fill the fuel tank through the filler port.

- For details of locking cap, see “LOCKING CAP” on page 2-29
- For details of the fuel to use, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7.

3. After adding fuel, tighten the cap securely.

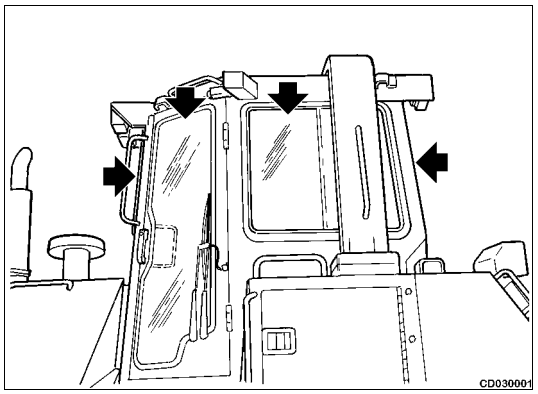
Remark

Fuel capacity: 490 L (129 gal)



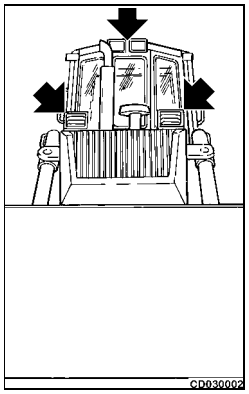
CAB GLASS

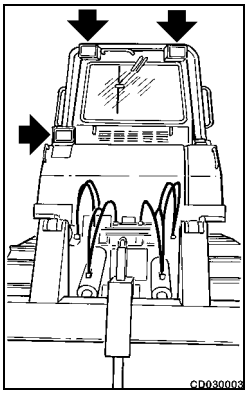
Thoroughly clean the inside and outside of all cab glass.



FRONT AND REAR WORK LIGHT

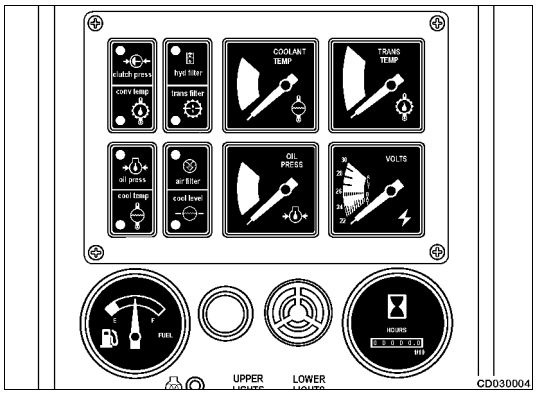
Thoroughly clean the front and rear work lights.





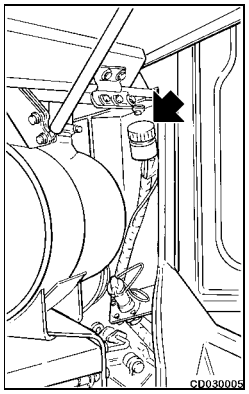
INSTRUMENT PANEL

Thoroughly clean the faces of the gauges and warning lights.



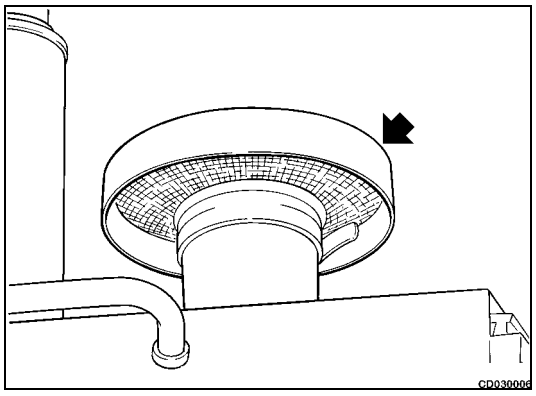
WINDOW WASHER RESERVOIR

Open the left engine access door. Remove cap and fill washer fluid. Install cap when filled.



AIR CLEANER CAP

The dome of the air cleaner cap serves as a rain shield and prevents chaff and course dirt from getting into the air cleaner. Keep this area clean from all chaff. A clogging will reduce the power of the engine by restricting the flow of air. Loosen the clamp screw on the air cleaner cap. Twist and pull upward to remove the cap. Use compressed air to clean the screen. If compressed air is not available, wash in clean hot water or water containing a small amount of nonsudsing detergent.



Remark

Never wash air cleaner cap when it is installed on the machine as water may penetrate to the engine.

DRIVE BELTS AND FAN

Visually inspect the belts and fan for damage.

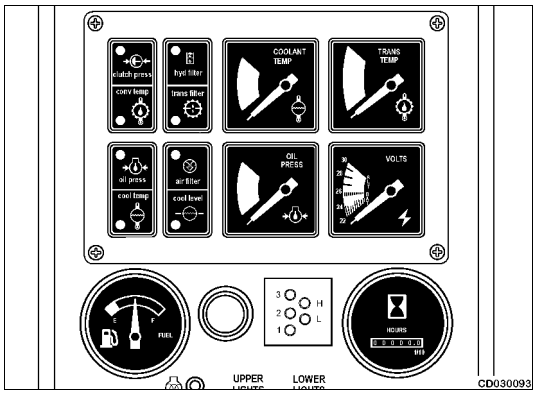
GROUND LEVEL INSPECTION

Perform ground level inspection, see “GROUND LEVEL INSPECTION” on page 2-30

INSTRUMENTS AND WARNING LIGHTS

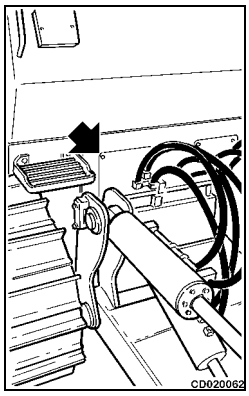
Check that the instruments and warning lights are working, see “GAUGES AND WARNING LIGHTS” on page 2-9

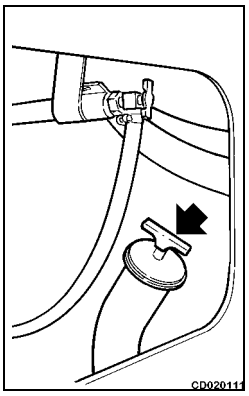
INSTRUMENT PANEL



NOTE: **This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.**

EVERY 50 HOURS SERVICE



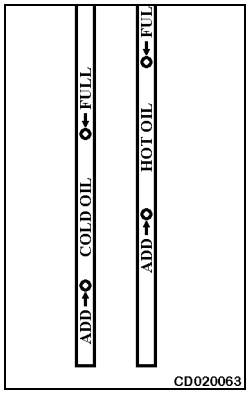


- Perform maintenance for every 10 hours of service at this time.

CHECK OIL LEVEL IN DRIVE TRAIN

1. Open the rear access door. Unscrew the T handle of the oil level gauge, remove the gauge and wipe it clean.

2. Insert the gauge fully into the filler sleeve. Do not tighten. Remove gauge and check the lubricant level. If necessary, add oil through the filler to bring the level up the FULL mark on the gauge. Reinstall and secure the gauge.



- For details of oil to use, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7

RADIATOR CORE

Remove dirt from the radiator core by blowing it through with compressed air in the direction opposite to the fan. Clean as required as by the condition of the radiator core.

CHECK AND ADJUST TRACK TENSION

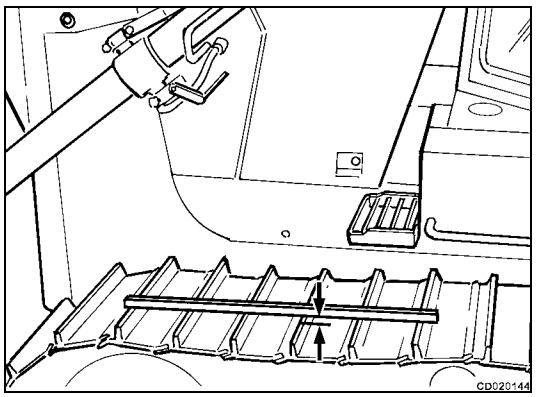
Proper Adjustment

Tracks adjusted too tightly increase operating loads on final drives and accelerate wear on undercarriage components, especially in packing conditions. In forward operation with correctly adjusted tracks will experience track loads only along the ground from the front idler to where the bushings engage the sprocket. Lubed track systems are adjustable to provide a sag in the chain between to front top idler and the front idler. Correct tension reduces stress levels throughout the undercarriage.

Checking Tension

1. Place a wooden block, 305 mm (12 in) in height, under the front most track shoe lug. Drive the machine forward until the track chain is tight along the ground and around the sprocket. Apply and lock brake pedal, lock trans shift lever in neutral and stop the engine.

2. Stand on the track between the front idler and the first track idler in order to accumulate all the chain slack at this point. Place a straightedge on the track so the ends rest over the front idler and track idler. Measure the clearance between the bottom of the straightedge and the top of the shoe grouser with a ruler at the midway point between the idlers.



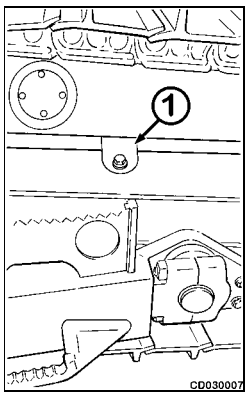
If the distance is more than 64 mm (2.5 in) or less than 38 mm (1.5 in), adjust the track tension.

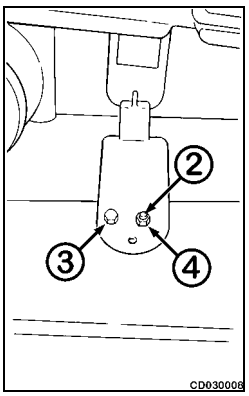
Adjusting Tension

The track chains are adjusted by hydraulic pressure. When lubricant is introduced into the front idler fork through the lubrication fitting, it acts upon the piston within the front idler fork forcing the front idler fork and front idler forward for track adjustment.

⚠ WARNING

To avoid possible injury, always stand to the side of the bleeder plug when making track adjustment. The pressure in the front idler fork is held by the bleeder plug and check valve. A loose or improper thread fit of either of these parts can allow them to be ejected by the pressure of the lubricant, causing possible injury. When increasing track tension, be sure the bleeder plug and check valve are properly torqued. When relieving track tension, never loosen the bleeder plug and check valve more than 2-1/2 turns. Before adding lubricant for track adjustment, be sure the ball check and relief valve are properly torqued.





1. Remove hardware and open track adjuster cover (1). To increase track tension, connect a lubricator nozzle to the fitting (2). Determine the amount of adjustment necessary, and add lubricant to obtain proper chain tension. It is advisable to move machine forward and backward slightly to be sure correct tension has been obtained.

2. To reduce track tension, loosen the relief valve (3) 1/2 to 1 full turn to allow the pressurized lubricant to escape through the relief passage. If the lubricant does not appear, loosen the check valve (4), (located under the lubrication fitting), 1/2 to 1 full turn to allow the pressurized lubricant to escape from a second relief passage.

3. If lubricant still does not appear, use the following emergency method. Should relief passages still be blocked, unscrew ball check and/or relief valve an additional 1-1/2 to 2 turns (2-1/2 total turns). This will allow a greater amount lubricant to free the passages.

⚠ WARNING

Use extreme care when relieving pressure with the following emergency method. If loosened excessively, the ball check or relief valve can be ejected by the cylinder pressure. Never loosen these parts more than a total of 2-1/2 turns.

4. When the proper tension has been obtained, tighten the ball check and/or relief valve to value given below. Close the cover and secure with removed hardware.

N•m Ball Check or Relief Valve 68 N•m (50 lbf ft)

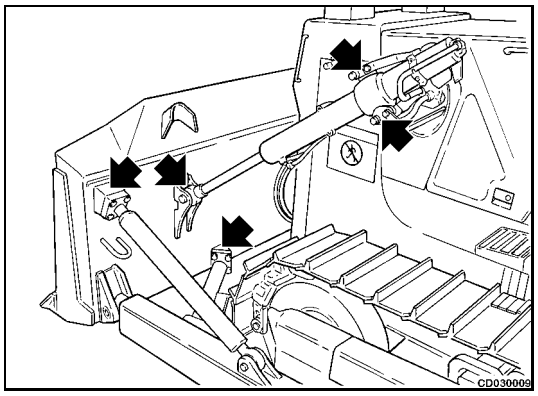
Remark

Never remove one link to bring a stretched track to within range of proper track adjustment. A track that is worn badly enough to take up the length of one link, will be so far out of pitch that the increased wear on the sprocket will far more than offset the saving obtained by the removal of one link in the chain.

LUBRICATION

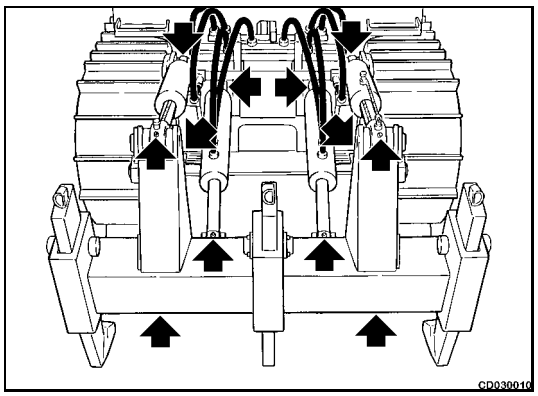
Blade Equipment — 10 FITTINGS

Apply grease until clean lubricant is visible. Always use a clean lubricator and wipe dirt from fittings before fresh grease is applied. If grease fails to go through the fitting, determine the cause and correct it. After greasing, wipe off any old grease that was purged.



Ripper Equipment — 12 FITTINGS

Apply grease until clean lubricant is visible. Always use a clean lubricator and wipe dirt from fittings before fresh grease is applied. If grease fails to go through the fitting, determine the cause and correct it. After greasing, wipe off any old grease that was purged.



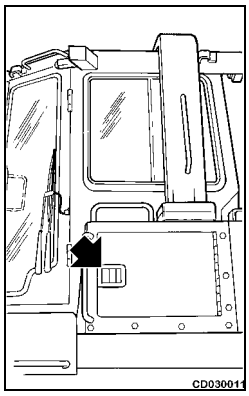
INITIAL 250 HOURS SERVICE

DRIVE TRAIN PRESSURE FILTER

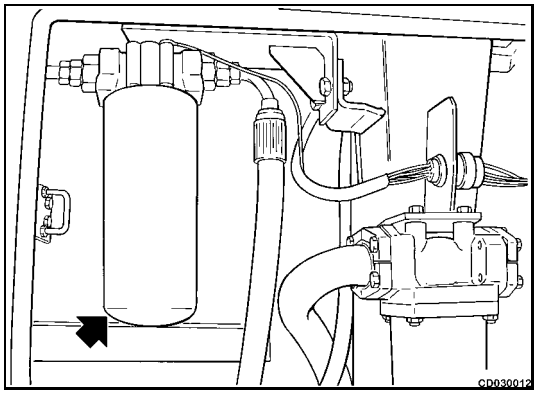
Remark

If the pressure filter indicator light on the instrument panel, remains on at operating oil temperature with the engine running, the pressure filter must be changed.

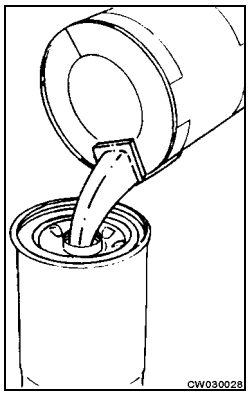
1. With the engine stopped, operate the transmission and steering levers several times to relieve any pressure. Open the left access side door. Remove all outside dirt from filter.

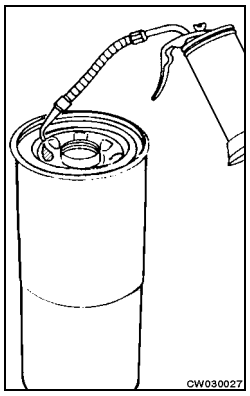


2. Using a filter wrench remove the spin on filter. Wipe the filter base, removing all of the old oil from the seal area.



3. Fill the new filter with clean oil, then coat the filter seal with clean oil.



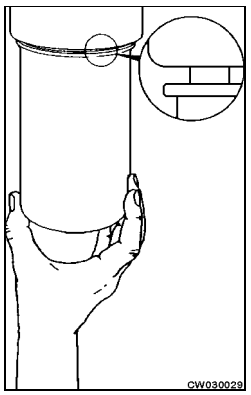


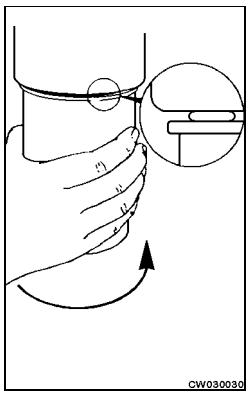
4. Install the filter by threading (do not spin) it onto the filter base (3) until the seal contacts the base, turn the filter by hand an additional 1/4 to 1/2 turn.

Remark

Do not over tighten the filter or use any tools for installation because this can damage the gasket and filter. Mechanical over tightening may distort the filter header threads or damage the element seal.

5. Check the level in the drive train system.

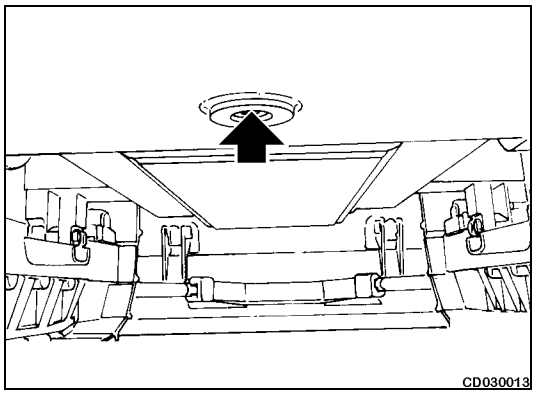




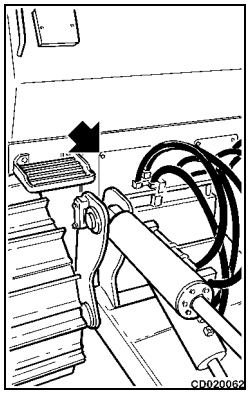
CHANGE DRIVE TRAIN SYSTEM OIL

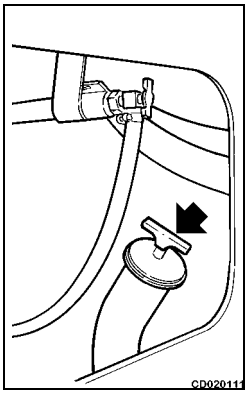
WARNING

When working under the machine, turn off the electrical system master switch and tag the controls to warn against starting the machine.



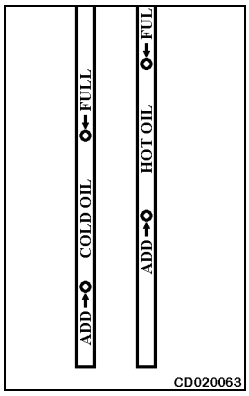
1. Remove the drain plug immediately after operation while the lubricant is still warm. Drain into a suitable container.
2. After the system has been completely drained, reinstall and tighten the drain plug.
3. Open the rear access door. Unscrew the T handle of the oil level gauge, remove the gauge and wipe it clean.





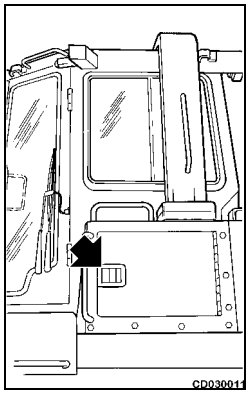
4. Pour lubricant into the rear frame through the filler tube to bring the level up to the FULL mark on the gauge. Insert level gauge.

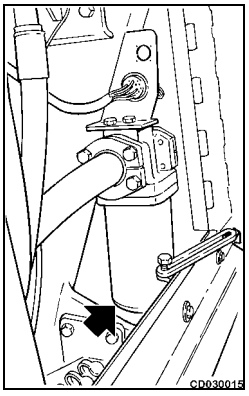
- For details of oil to use, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7.



DRIVE TRAIN SUCTION STRAINER

1. Open the left access side door. Remove all outside dirt from the suction strainer.





2. Remove the four hex nuts and separate the housing (7) from the base (1). Pull out the element (4) with o-ring (3) from the housing (7). Remove the ceramic magnets (8) and clean the magnets with a clean soft cloth, do not rap the magnets. Wash the element (4), spring (5) and housing (7) in a nonflammable commercial cleaning solvent.

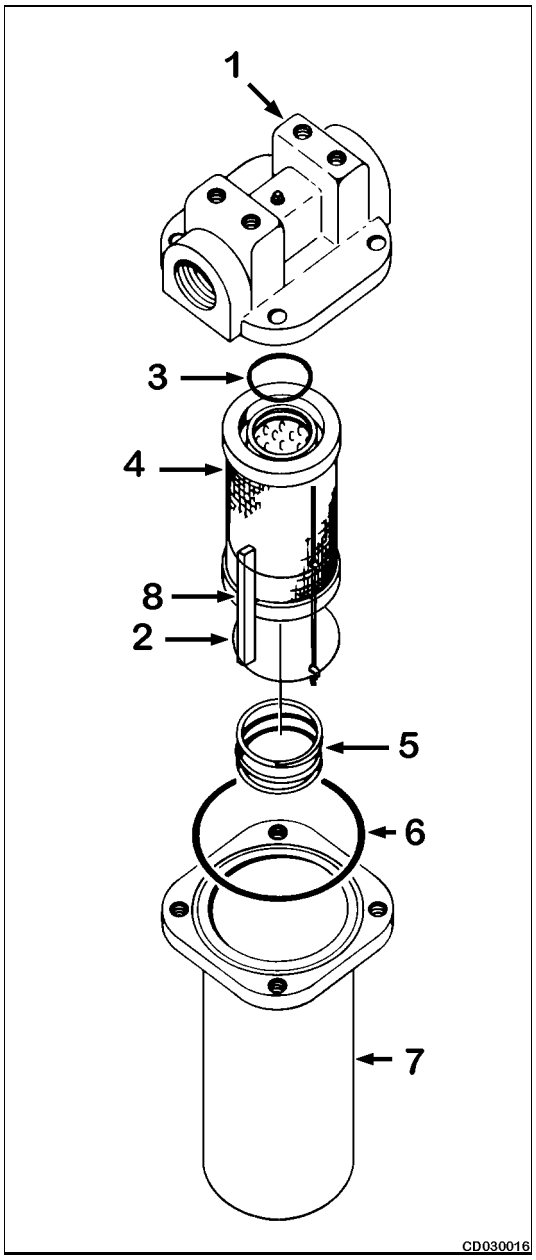
3. Reassemble the magnets (8) and retainer (2). Inspect the o-rings (3 and 6) for wear or damage and replace with new if necessary. When in doubt, always install a new o-ring. Remove all dirt from the inside of the base (1), using a cloth dampened with nonflammable commercial cleaning solvent. Install spring (5) into housing (7).

4. Check that the o-ring (3) is in place in the groove in the element (4). Slip the spring end of the element into the housing. Secure the housing to the base (1) with the hardware previously removed. Tighten the hex nuts.

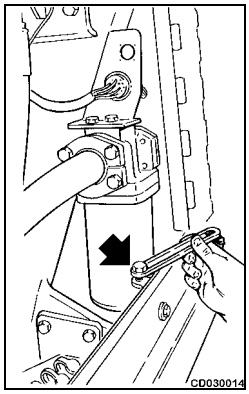
N•m Hex nuts . . . . . 17 to 21 N•m (13 to 15 lbf ft)

5. Start the engine and let it idle for approximately five minutes. During this time, check the suction strainer for leaks. Correct all leaks no matter how minor. Then check the lubricant level in the drive train system.

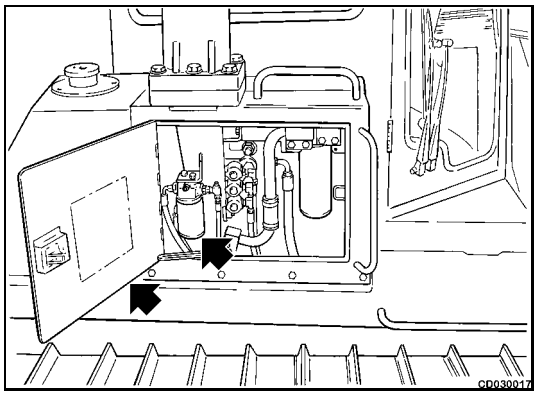
- For details of the fluid to use, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7.



6. When finished, lift up on door stay and close door.



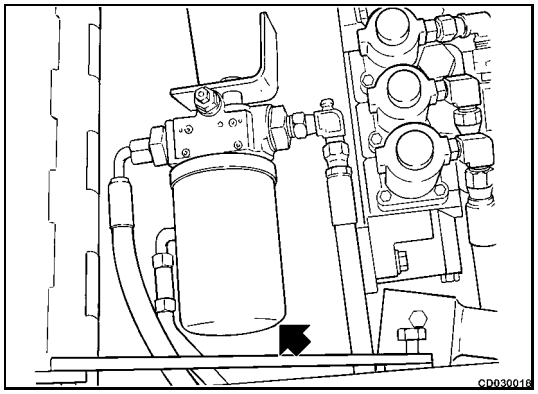
EQUIPMENT SYSTEM PILOT FILTER



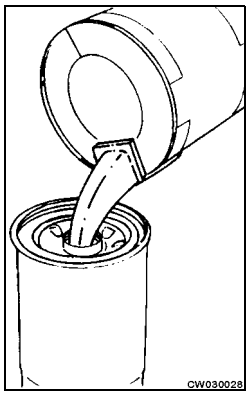
Remark

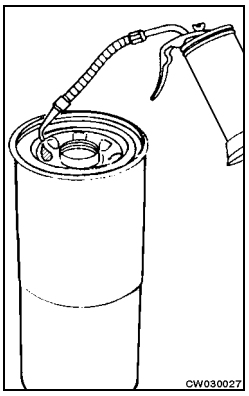
If the filter indicator light on the instrument panel, remains on at operating oil temperature with the engine running, the filter cartridge must be changed.

1. With the engine stopped, operate the equipment levers several times to relieve any pressure. Open the right access side door. Remove all outside dirt from filter.

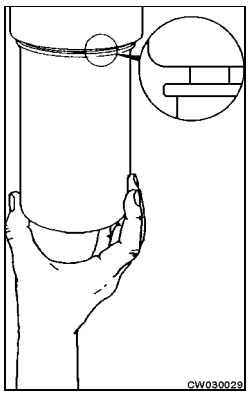


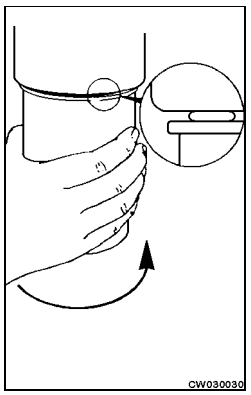
2. Using a filter wrench remove the spin on filter. Wipe the filter base, removing all of the old oil from the seal area.





3. Fill the new filter with clean oil, then coat the filter seal with clean oil.





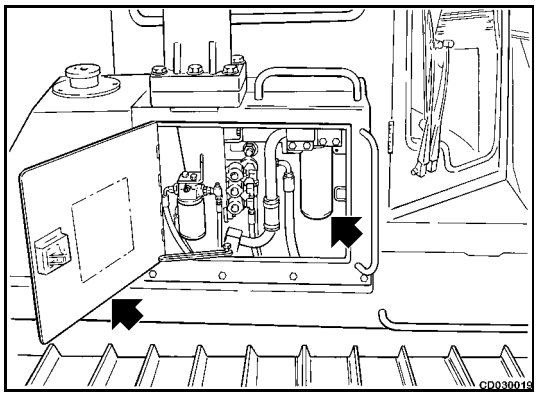
4. Install the filter by threading (do not spin) it onto the filter base (3) until the seal contacts the base, turn the filter by hand an additional 1/4 to 1/2 turn.

Remark

Do not over tighten the filter or use any tools for installation because this can damage the gasket and filter. Mechanical over tightening may distort the filter header threads or damage the element seal.

5. Check the level in the equipment hydraulic system.

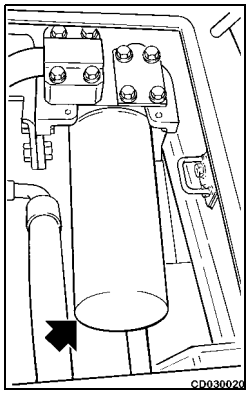
EQUIPMENT SYSTEM RETURN FILTER



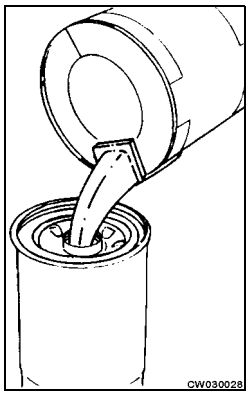
Remark

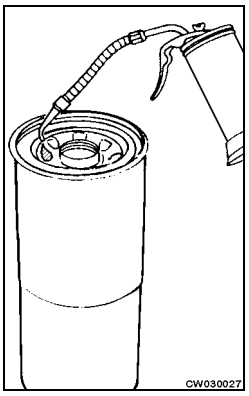
If the filter indicator light on the instrument panel, remains on at operating oil temperature with the engine running, the filter cartridge must be changed.

1. With the engine stopped, operate the equipment levers several times to relieve any pressure. Open the right access side door. Remove all outside dirt from filter.

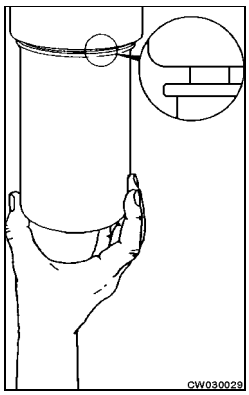


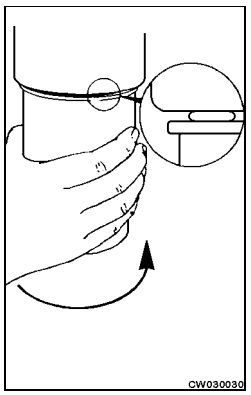
2. Using a filter wrench remove the spin on filter. Wipe the filter base, removing all of the old oil from the seal area.





3. Fill the new filter with clean oil, then coat the filter seal with clean oil.





4. install the filter by threading (do not spin) it onto the filter base (3) until the seal contacts the base, turn the filter by hand an additional 1/4 to 1/2 turn.

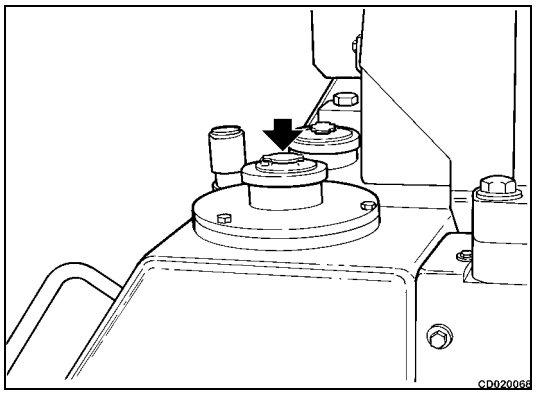
Remark

Do not over tighten the filter or use any tools for installation because this can damage the gasket and filter. Mechanical over tightening may distort the filter header threads or damage the element seal.

5. Check the level in the equipment hydraulic system.

CHANGE EQUIPMENT SYSTEM OIL

1. Start the engine and operate the blade to warm the oil for easy draining. Park the machine on level ground, lower blade and ripper equipment to the ground. Stop the engine. Shift to neutral and apply the lock lever. Apply and lock the parking brake. Turn the electrical system master switch and dash key to **OFF** and remove keys.

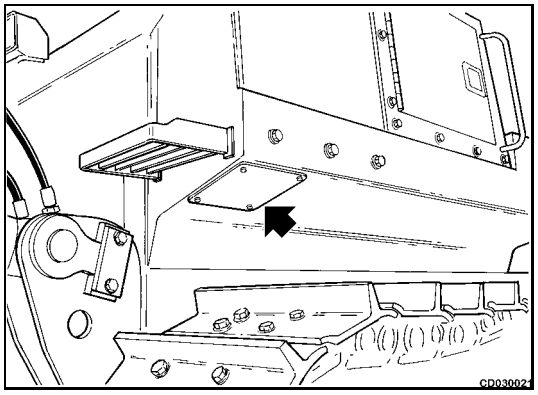


⚠ WARNING

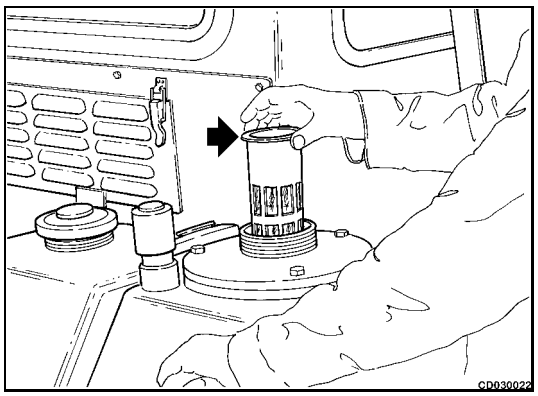
Pressurized Reservoir. Always loosen the locking cap slowly in case there is still some pressure in the system.

2. Slowly loosen and remove reservoir locking cap to relieve reservoir pressure, see “LOCKING CAP” on page 2-29.

3. Remove radiator drain access plate. Remove the magnetic drain plug and drain the reservoir into a suitable container.



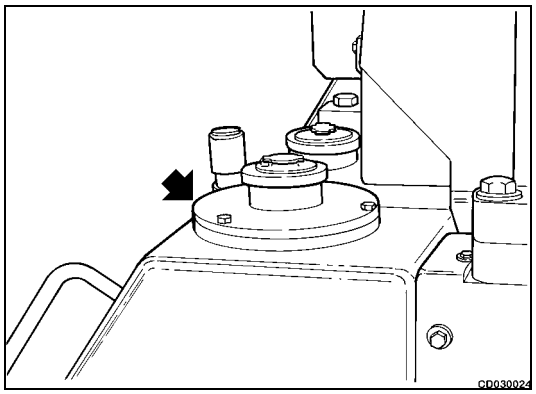
4. This screen filters the oil entering the tank and eases the job of the oil filter. Remove and clean the screen with a nonflammable commercial cleaning solvent. Install the screen in the reservoir and mount locking cap.



⚠ WARNING

Fire hazard - do not use kerosene, diesel fuel or flammable liquids to clean parts. A spark or a flame could cause a fire or an explosion. Use a nonflammable commercial solvent.

5. Remove reservoir top cover and discard o-ring. Using a M24 socket and extension, remove strainer assembly from reservoir.



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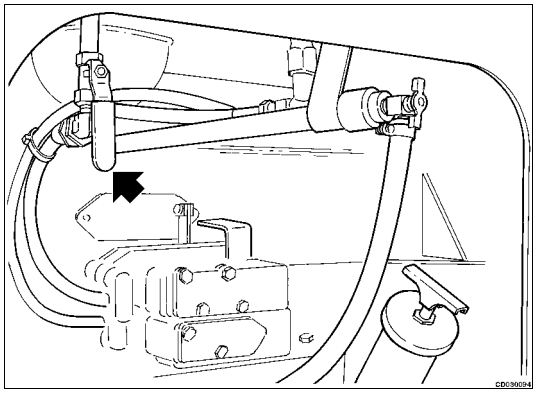
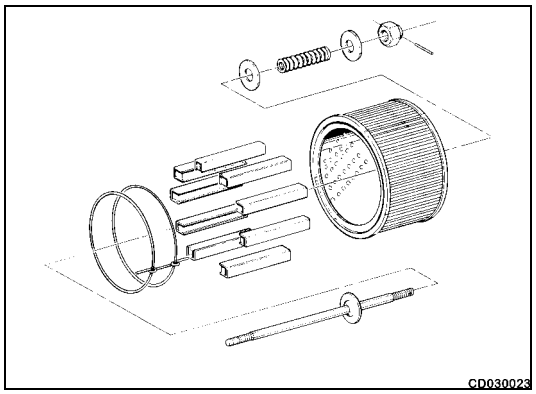
NOTE: **This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.**



6. Clean the strainer with a nonflammable commercial cleaning solvent. Install the strainer in the reservoir and mount reservoir top cover with new o-ring to reservoir.



Remark

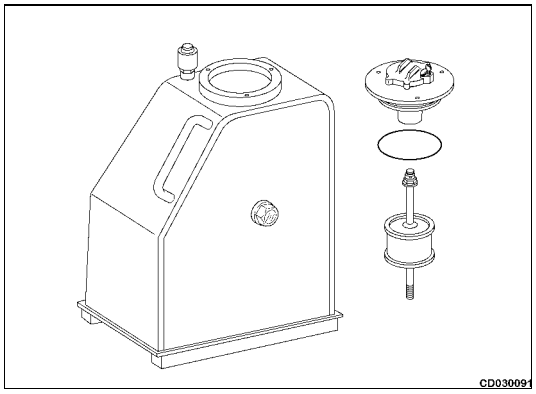
The strainer does not have to be disassembled for cleaning.

WARNING

Fire hazard - do not use kerosene, diesel fuel or flammable liquids to clean parts. A spark or a flame could cause a fire or an explosion. Use a nonflammable commercial solvent.

Remark

Use clean oil from a clean container. Maintain all packing and fittings so as to prevent leakage.



7. Reinstall the drain plug. Fill the reservoir with lubricant up to the center line of the sight gauge. Reinstall the filler cap.

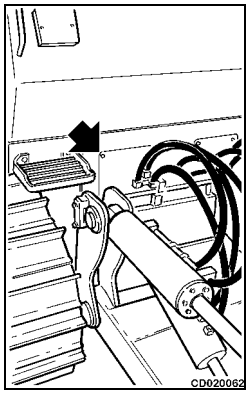
- For details of the fluid to use, see "USE OF FUEL, COOLANT AND LUBRICANTS" on page 3-7.

8. Start the engine and run it at low idle speed. Operate all the controls through all positions four or five times so the cylinders are filled with oil and air expelled. Check the oil level and repeat until the fluid level remains at the specified level in the reservoir.

REPLACE FUEL FILTER CARTRIDGE

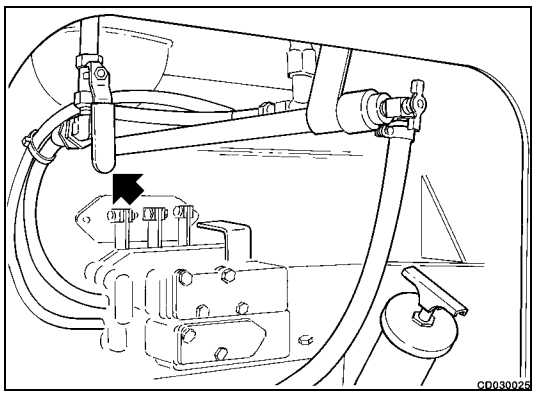
WARNING

- **Park the machine on level ground, stop the engine, lower all mounted equipment to the ground, apply the safety lock, apply the brake pedal lock, turn off the electrical system master switch.**
- **The engine is at high temperature immediately after the machine has been operated. Wait for the engine to cool down before replacing the filter cartridge.**
- **Do not bring fire or sparks near the fuel.**

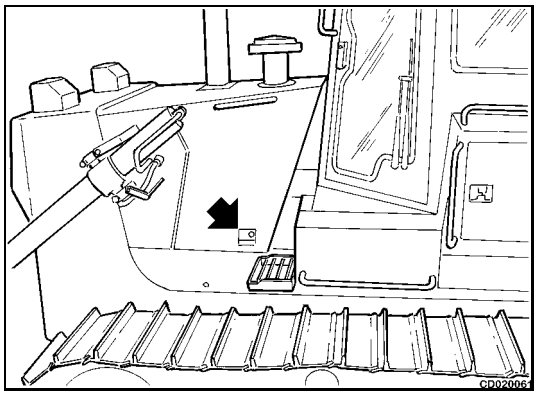


1. Open the rear access door.

2. Close the fuel shutoff valve under the fuel tank.



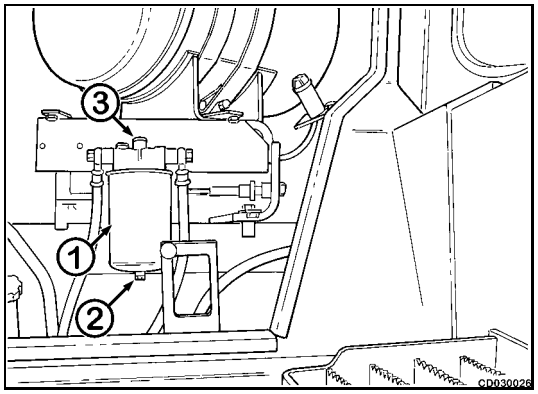
3. With the engine stopped, open the left engine side door.



4. Position a catch container under the fuel filter cartridges (1). Loosen the plug (2) at the bottom of cartridge and drain fuel.

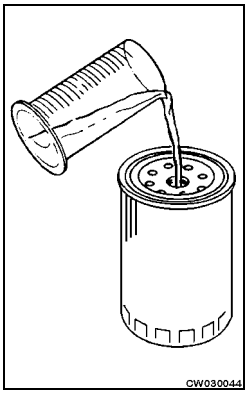
5. Before loosening the filter, clean the filter head to prevent dirt or foreign material from entering the system. Remove the fuel filter from the filter header by turning counterclockwise. A filter wrench can be used if unable to turn the filter by hand. Discard the fuel filter in a suitable container.

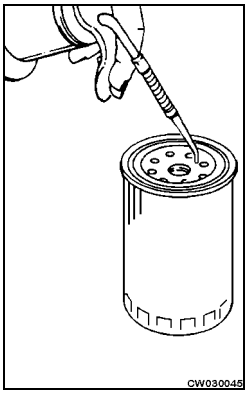
6. Thoroughly clean the fuel filter header with kerosene or diesel fuel to prevent dirt or foreign material from falling into the new filter. Keep the new filter in the original package until ready for installation.



7. Fill fuel filters with clean fuel.

8. Apply a light coating of clean engine oil or chassis grease to the seal surface on the new filter.

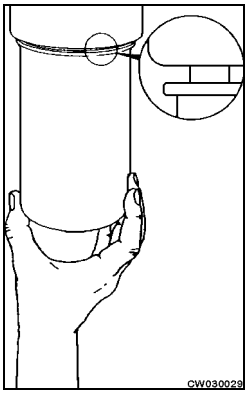


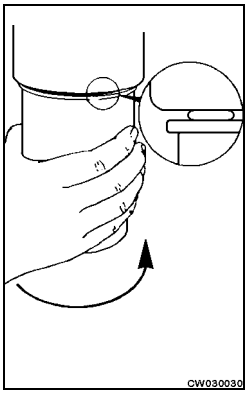


9. Install, but do not spin, the new filter, turning it until the seal just contacts the filter head. Make aligning marks on the filter and the filter header and tighten the filter an additional 1/2 to 3/4 turn. Open the fuel line shutoff valve.

Remark

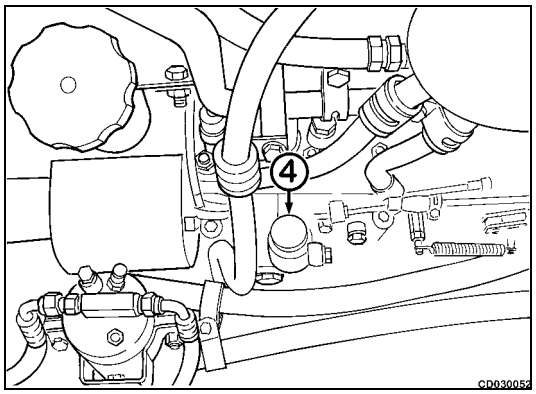
Do not over tighten the filter or use any tools for installation because this can damage the gasket and filter. Mechanical over tightening may distort the filter header threads or damage the element seal.





10. After replacing the fuel filter cartridge, loosen the air bleed plug (3).

11. Loosen the knob of fuel feed pump (4), then operate it up and down until no more bubbles come out with the fuel from air bleed plug. Tighten air bleed plug (3), then push in the knob of feed pump and tighten it. Open the fuel shut off valve at the rear of the machine.



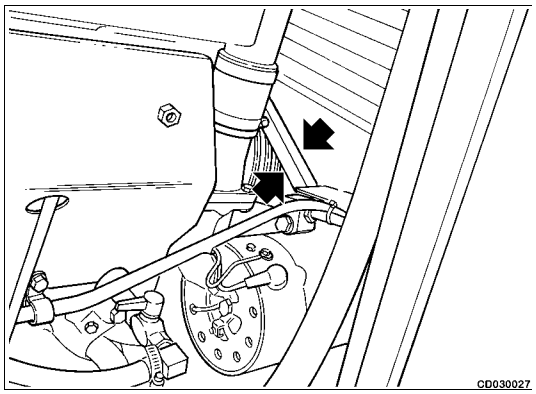
12. After replacing the filter cartridge, start the engine and check that there is no leakage of fuel from the filter seal surface. If there is any leakage of fuel, check the tightening of the filter cartridge. Whenever there is leakage of fuel, follow steps 1 through 5 to remove the filter cartridge, then check the packing surface for damage or foreign material. If any damage or foreign material is found in the packing, replace the packing with a new part, then repeat steps 6 through 12 to install the filter cartridge.

ENGINE VALVE CLEARANCE

Contact your local distributor for inspection or adjustment.

EVERY 250 HOURS SERVICE

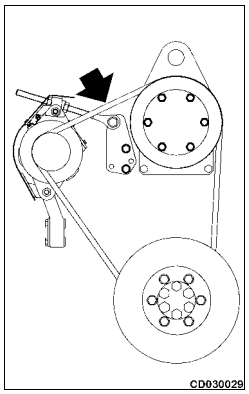
- Perform maintenance for every 10 and 50 hours of service at this time.



ENGINE FAN AND ALTERNATOR BELT

Check

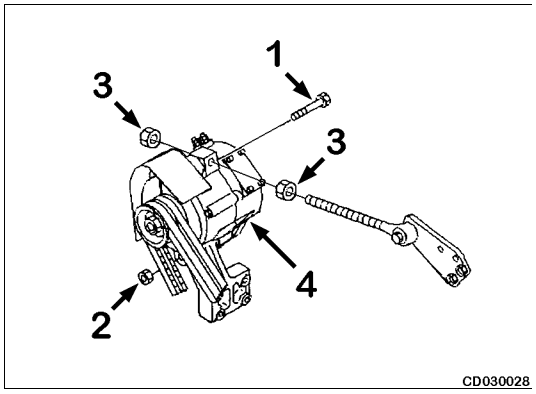
The belt should normally deflect by 6 to 10 mm (0.24 to 0.39 in) when pressed with the finger, with ≈ 6 kgf (13 lbf) at a point midway between the alternator pulley and fan pulley.



Adjusting

1. Loosen top bolt (1) and lower nut (2). Loosen both stop nuts (3). Move alternator (4) to adjust the belt tension so that the deflection is 6 to 10 mm (0.24 to 0.39 in) when pushed with a force of ≈ 6 kgf (13 lbf). When achieved, tighten stop nuts (3). Tighten the bolt (1) and nut (2) to fix alternator in position.

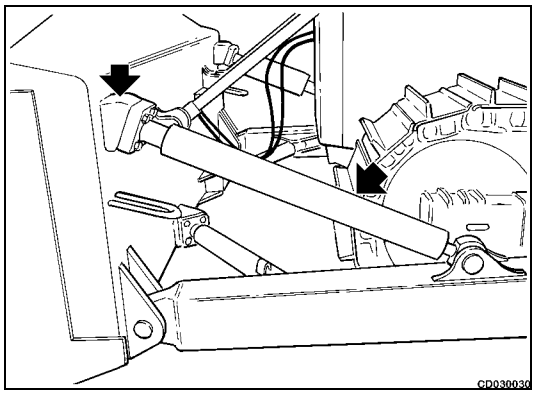
2. Check each pulley for damage, wear of the V groove, and wear of the V belt. In particular, be sure to check that the V belt is not touching the bottom of the V groove. If any belt has stretched and there is no allowance for adjustment, or if there are cuts or cracks on any belt, replace both belts at the same time. When the new belt is set, readjust it after operation for an hour.



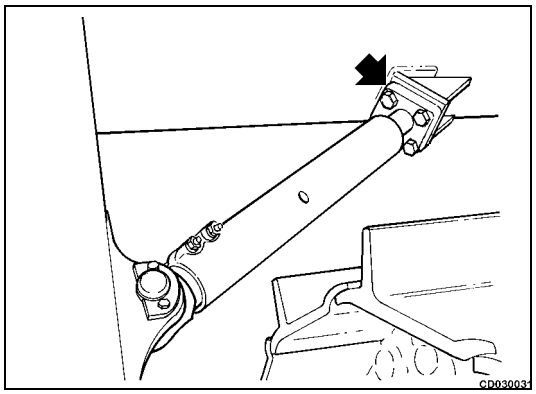
LUBRICATION

Upper Strut And Joint — 2 FITTINGS

Apply grease until clean lubricant is visible. Always use a clean lubricator and wipe dirt from fittings before fresh grease is applied. If grease fails to go through the fitting, determine the cause and correct it. After greasing, wipe off any old grease that was purged.



Diagonal Strut Joints 1 FITTING



Apply grease until clean lubricant is visible. Always use a clean lubricator and wipe dirt from fittings before fresh grease is applied. If grease fails to go through the fitting, determine the cause and correct it. After greasing, wipe off any old grease that was purged.

REVERSIBLE FAN

WARNING

Keep clear of fan and fan belts when the engine is running. Rotating fan and belt contact will result in serious injury.

The fan blades must be reversed to prevent corrosion and dirt build up that may cause binding of the shafts in the fan hub. After reversing the blades return the blades to the desired position.

CHANGE ENGINE CRANKCASE OIL AND FILTER

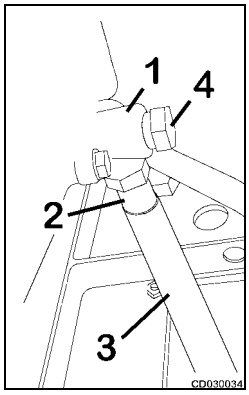
WARNING

- **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.**
- **When draining the oil, do not remove drain plug.**

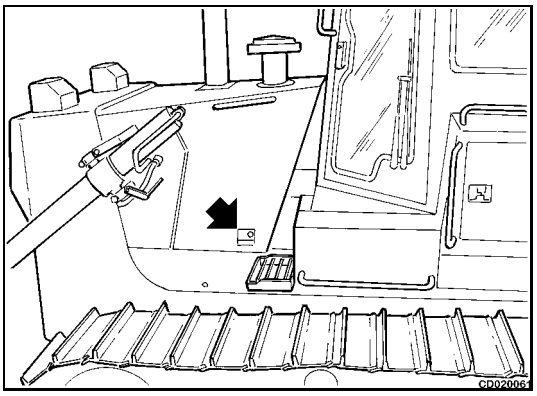
- Container to catch drained oil Min. 27 L (7.1 gal)
- Refill capacity 27 L (7.1 gal)
- Tools required Drain hose, filter wrench

1. Remove the cover at the left side of engine crankcase guard. Set container to catch the oil under the drain plug.
2. Through opening, remove plug (2) at bottom of drain plug (1). Install a drain hose (3) of sufficient length to valve. Loosen drain valve (4) slowly to avoid getting oil on yourself, and drain the oil into the catch container.

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



3. After all the oil is drained, close the drain valve (4), remove hose (3) and install drain plug (2).



N•m Drain valve . . . . . 58 to 78 N•m (43 to 57 lbf ft)

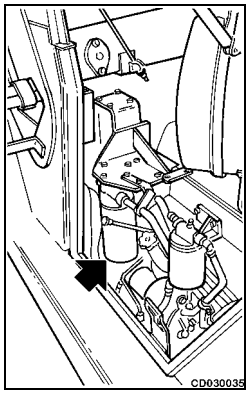
N•m Drain plug . . . . . 48 to 78 N•m (37 to 57 lbf ft)

4. Open the engine left side access panel.

- The engine oil filter is a spin on type. This filter cannot be cleaned and should not be disturbed except when it is necessary to replace it.

Remark

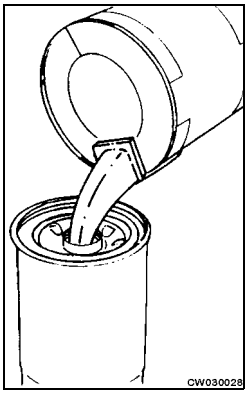
Use only a recommended genuine filter available from your distributor.

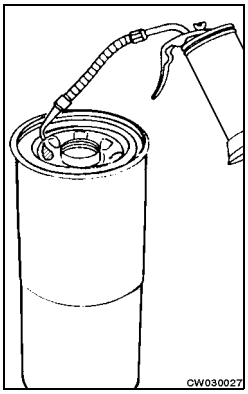


5. Clean the outside of the filter. Remove the spin on type filter by turning it counterclockwise. Discard the old filter in a suitable, covered refuse container. When doing this, to prevent getting oil on yourself, do not carry out this operation from immediately under the cartridge. Clean the filter header.

- 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 to 15 minutes before starting the operation.

6. Fill the new filter element with clean engine oil and apply a little clean engine oil to the seal.

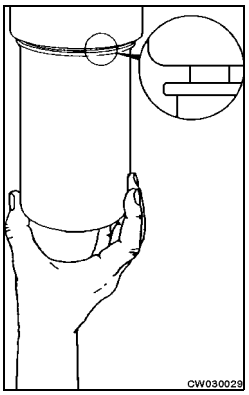


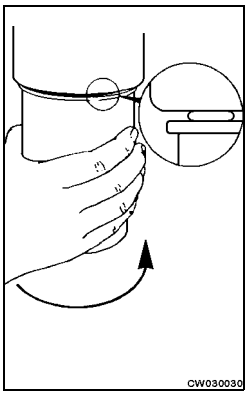


7. Thread the filter on by hand (do not spin) by turning it clockwise until the seal just makes contact the filter header. Give the element an additional 3/4 to 1 turn.

Remark

Do not over tighten the filter or use any tools for installation because this can damage the gasket and filter. Mechanical over tightening may distort the filter header threads or damage the element seal.





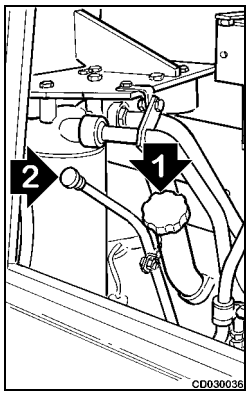
8. Add engine oil through oil filler (1) until the oil level is between the **H** and **L** marks on the dipstick (2).

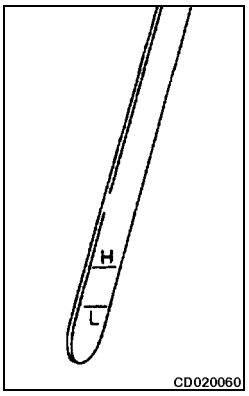
- For details of the oil to use, see "USE OF FUEL, COOLANT AND LUBRICANTS" on page 3-7.

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.

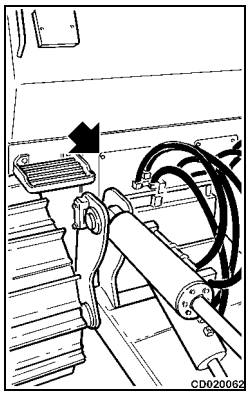
Remark

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. In 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.





EVERY 500 HOURS SERVICE



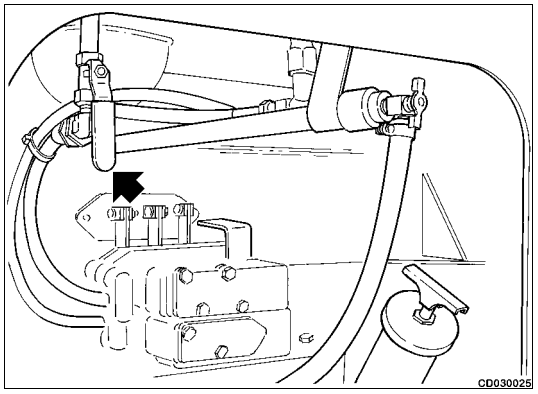
- Perform maintenance for every 10, 50 and 250 hours of service at this time.

REPLACE FUEL FILTER CARTRIDGE

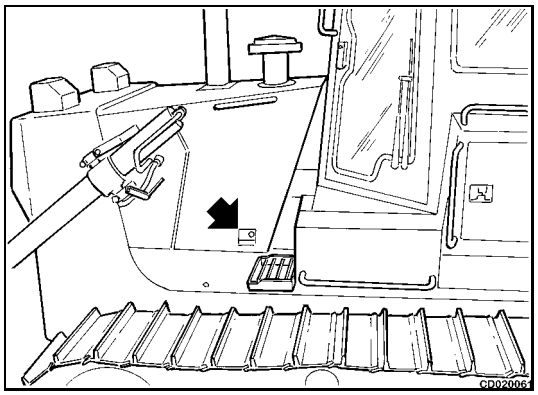
⚠ WARNING

- **Park the machine on level ground, stop the engine, lower all mounted equipment to the ground, apply the safety lock, apply the brake pedal lock, turn off the electrical system master switch.**
- **The engine is at high temperature immediately after the machine has been operated. Wait for the engine to cool down before replacing the filter cartridge.**
- **Do not bring fire or sparks near the fuel.**

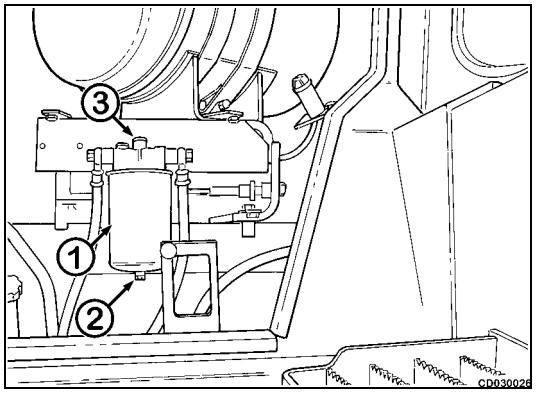
1. Open the rear access door.
2. Close the fuel shutoff valve under the fuel tank.



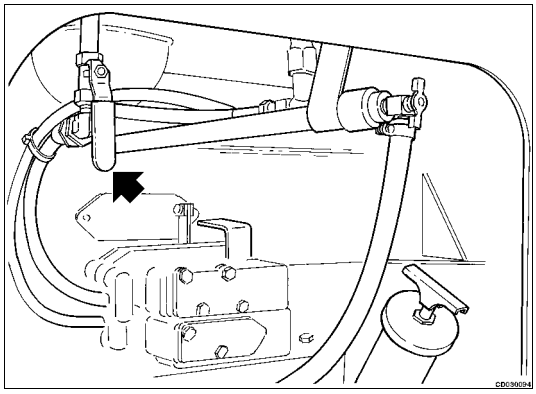
3. With the engine stopped, open the left engine side door.



4. Position a catch container under the fuel filter cartridge (1). Loosen the plug (2) at the bottom of cartridge and drain fuel.
5. Before loosening the filter, clean the filter head to prevent dirt or foreign material from entering the system. Remove the fuel filter from the filter header by turning counterclockwise. A filter wrench can be used if unable to turn the filter by hand. Discard the fuel filter in a suitable container.
6. Thoroughly clean the fuel filter header with kerosene or diesel fuel to prevent dirt or foreign material from falling into the new filter. Keep the new filter in the original package until ready for installation.

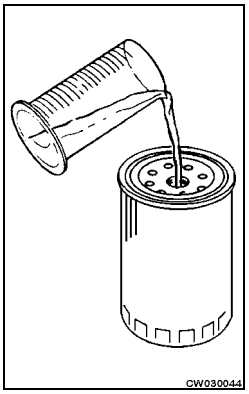


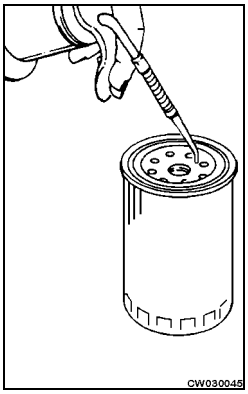
NOTE: **This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.**



7. Fill fuel filters with clean fuel.

8. Apply a light coating of clean engine oil or chassis grease to the seal surface on the new filter.

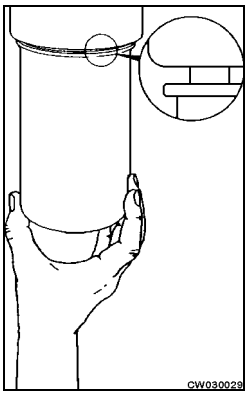


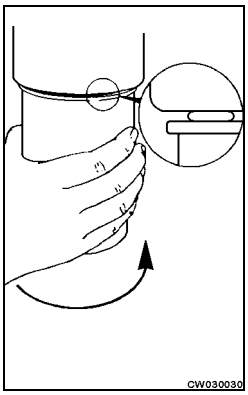


9. Install, but do not spin, the new filter, turning it until the seal just contacts the filter head. Make aligning marks on the filter and the filter header and tighten the filter an additional 1/2 to 3/4 turn. Open the fuel line shutoff valve.

Remark

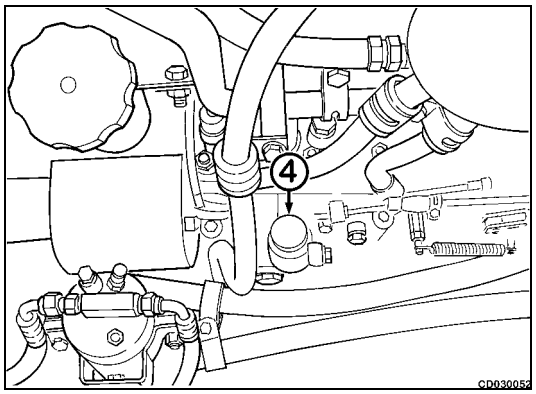
Do not over tighten the filter or use any tools for installation because this can damage the gasket and filter. Mechanical over tightening may distort the filter header threads or damage the element seal.





10. After replacing the fuel filter cartridge, loosen the air bleed plug (3). Loosen the knob of fuel feed pump (4), then operate it up and down until no more bubbles come out with the fuel from air bleed plug. Tighten air bleed plug (3), then push in the knob of feed pump and tighten it. Open the fuel shut off valve at the rear of the machine.

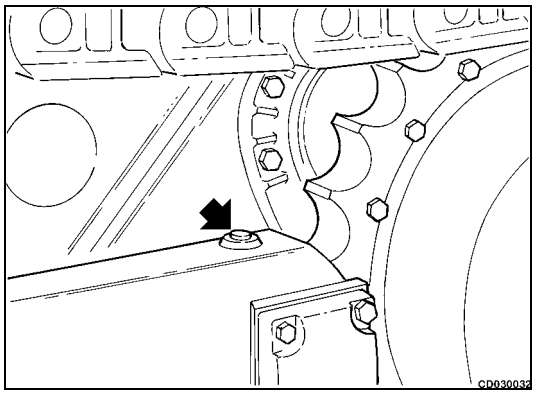
11. After replacing the filter cartridge, start the engine and check that there is no leakage of fuel from the filter seal surface. If there is any leakage of fuel, check the tightening of the filter cartridge. Whenever there is leakage of fuel, follow steps 1 through 5 to remove the filter cartridge, then check the packing surface for damage or foreign material. If any damage or foreign material is found in the packing, replace the packing with a new part, then repeat Steps 5 through 12 to install the filter cartridge.



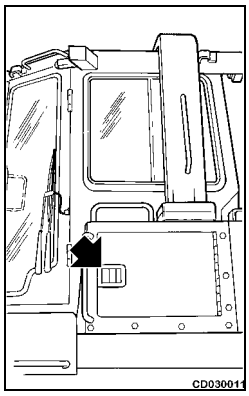
PIVOT SHAFT HOUSING OIL LEVEL

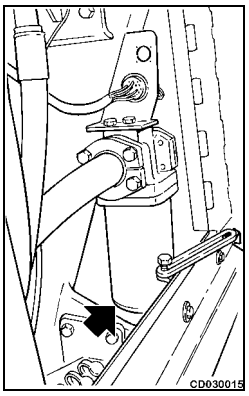
Remove the plug (one at each side), check the oil level. The proper level is at the bottom of the plug opening. If the lubricant is low, fill to the bottom of the plug opening. Reinstall and tighten the plug.

- For details of the fluid to use, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7.



DRIVE TRAIN SUCTION STRAINER





1. Open the left access side door. Remove all outside dirt from the suction strainer.

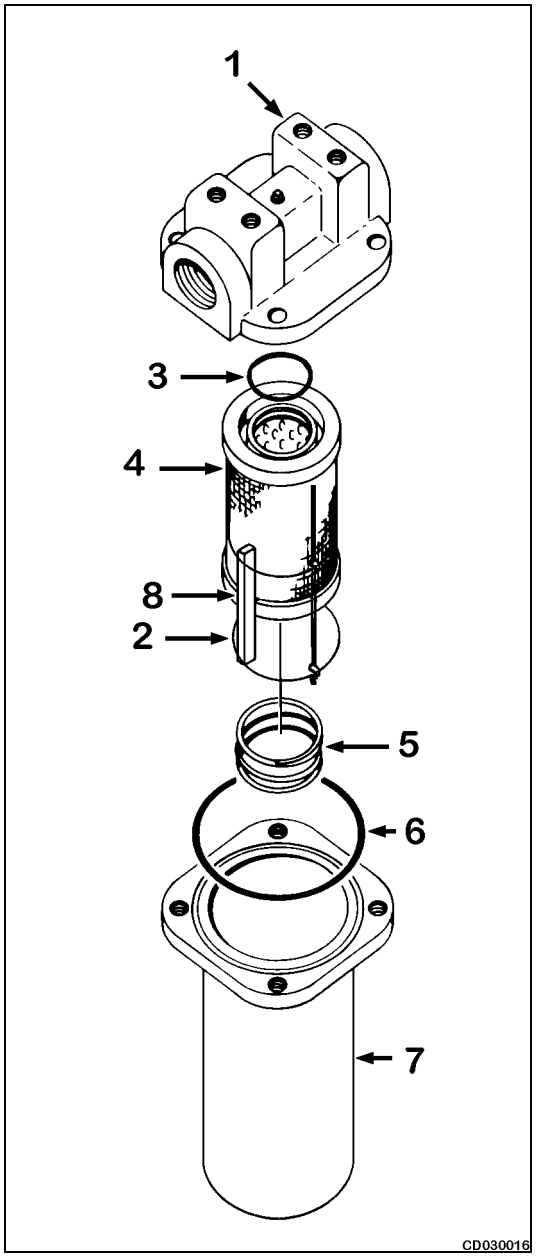
2. Remove the four hex nuts and separate the housing (7) from the base (1). Pull out the element (4) with o-ring (3) from the housing (7). Remove the ceramic magnets (8) and clean the magnets with a clean soft cloth, do not rap the magnets. Wash the element (4), spring (5) and housing (7) in a nonflammable commercial cleaning solvent.

3. Reassemble the magnets (8) and retainer (2). Inspect the o-rings (3 and 6) for wear or damage and replace with new if necessary. When in doubt, always install a new o-ring. Remove all dirt from the inside of the base (1), using a cloth dampened with nonflammable commercial cleaning solvent. Install spring (5) into housing (7).

4. Check that the o-ring (3) is in place in the groove in the element (4). Slip the spring end of the element into the housing. Secure the housing to the base (1) with the hardware previously removed. Tighten the hex nuts.

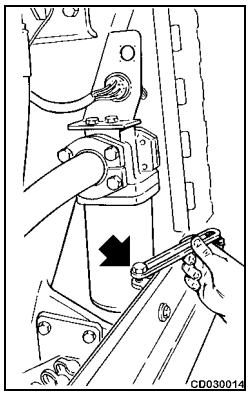
N•m Hex nuts . . . . . 17 to 21 N•m (13 to 15 lbf ft)

5. Start the engine and let it idle for approximately five minutes. During this time, check the suction strainer for leaks. Correct all leaks no matter how minor. Then check the lubricant level in the drive train system.



- For details of the fluid to use, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7

6. When finished, lift up on door stay and close door.

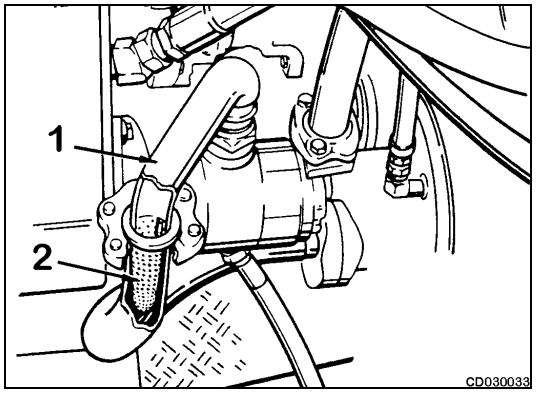


TRANSMISSION SCAVENGER SUCTION STRAINER

1. To gain access to the oil strainer first remove the center cover in floor of cab. Disconnect the transmission scavenger hose (1) from the intake pipe (2). Remove the strainer from the hose.

2. Clean the strainer with a nonflammable commercial cleaning solvent. Reinstall the strainer into hose (1). Reinstall the transmission scavenger hose to the pipe (2). Make sure that filter strainer is properly seated in the hose.

3. Reinstall the center cover.



EVERY 1000 HOURS SERVICE

- Perform maintenance for every 10, 50, 250 and 500 hours of service at this time.

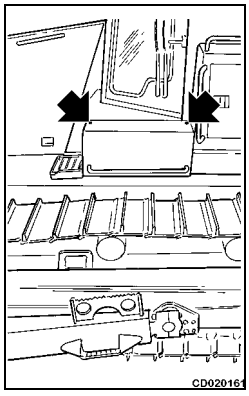
BATTERIES AND TERMINALS

General

WARNING

- **A battery gives off highly flammable gas. Never allow sparks, open flame or lighted smoking material near the battery. Avoid spilling any electrolyte on hands or clothing. Always wear safety glasses when working on a battery.**
- **When using a booster battery and jumper cables, connect the negative (ground) cable to the machine's frame, away from the battery. Always connect the ground cable last and disconnect it first to avoid sparks near the battery. A spark could cause a battery explosion and injury.**
- **Never check the battery charge by placing a metal object across the terminals. The sparks could cause a battery explosion. Use a voltmeter or hydrometer to measure charge.**
- **Be sure the electrical system master switch is off when connecting or disconnecting the battery to minimize the chance of sparks and explosion.**

The machine is equipped with two 12 volt batteries. They are located in the left fender battery box. Never allow a battery to stand on concrete, ground or a metal support unless proper insulation is provided. A wooden platform or board is sufficient insulation. Be sure the battery is fastened securely to avoid damage from vibration.



Maintenance

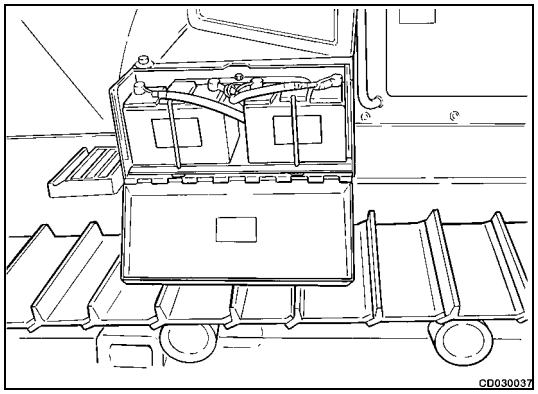
Proper battery maintenance will assure maximum service. Following are a few simple rules:

- Keep battery cable terminals clean and tight.
- Keep filler cap vent holes unplugged.
- Replace worn, cracked, broken or corroded cables.
- Keep battery fastened securely in frame.

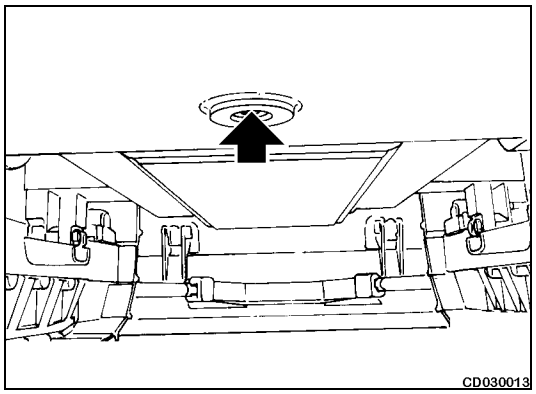
Remark

Excessive tightening can warp or crack battery case.

- Maintain the correct battery liquid level, conventional battery only.
- Always charge the battery in a ventilated area.
- Keep the battery clean.



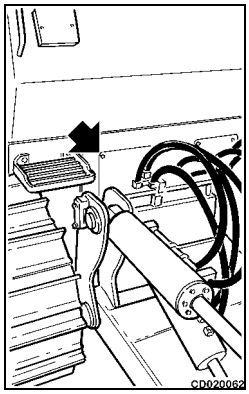
CHANGE DRIVE TRAIN SYSTEM OIL

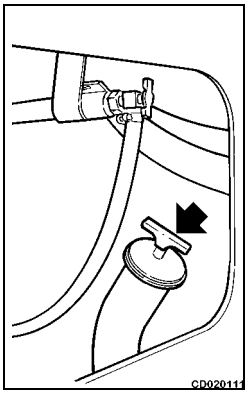


WARNING

When working under the machine, turn off the electrical system master switch and tag the controls to warn against starting the machine.

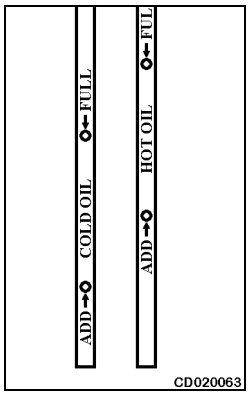
1. Remove the drain plug immediately after operation while the lubricant is still warm. Drain into a suitable container.
2. After the system has been completely drained, reinstall and tighten the drain plug.
3. Open the left rear access door. Unscrew the T handle of the oil level gauge, remove the gauge and wipe it clean.

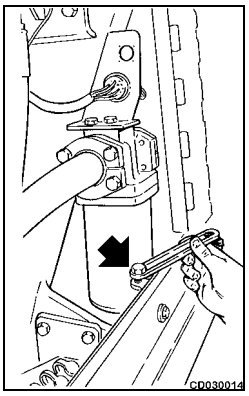




4. Pour lubricant into the rear frame through the filler tube to bring the level up to the FULL mark on the gauge. Insert level gauge.

- For details of oil to use, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7



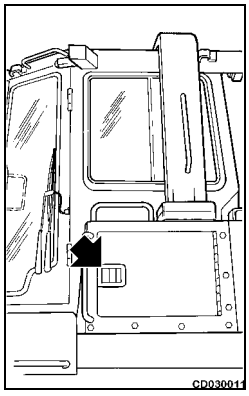


DRIVE TRAIN PRESSURE FILTER

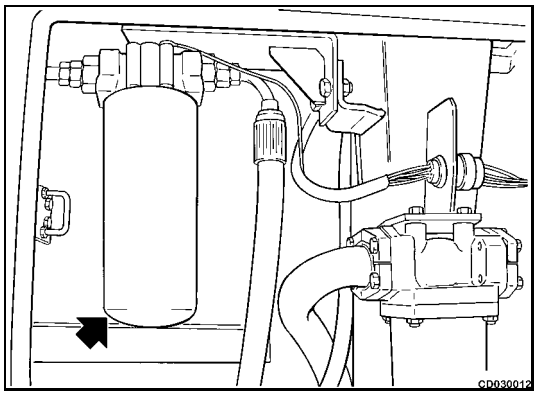
Remark

If the pressure filter indicator light on the instrument panel remains on at operating oil temperature with the engine running, the pressure filter must be changed.

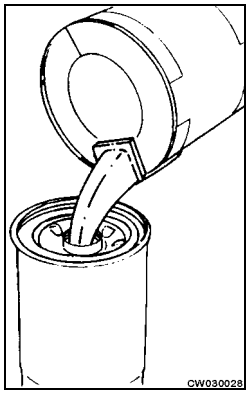
1. With the engine stopped, operate the transmission and steering levers several times to relieve any pressure. Open the left access side door. Remove all outside dirt from filter.

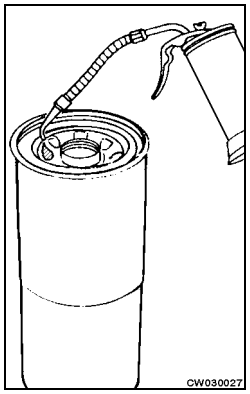


2. Using a filter wrench remove the spin on filter. Wipe the filter base, removing all of the old oil from the seal area.



3. Fill the new filter with clean oil, then coat the filter seal with clean oil.



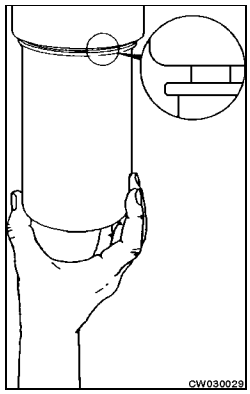


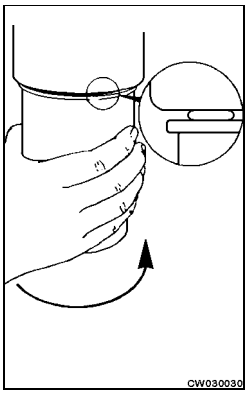
4. Install the filter by threading (do not spin) it onto the filter base (3) until the seal contacts the base, turn the filter by hand an additional 1/4 to 1/2 turn.

Remark

Do not over tighten the filter or use any tools for installation because this can damage the gasket and filter. Mechanical over tightening may distort the filter header threads or damage the element seal.

5. Check the level in the drive train system.



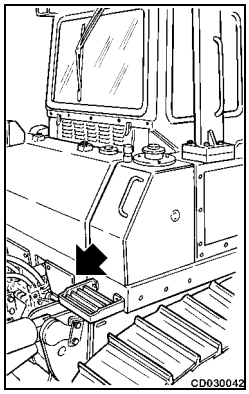


REPLACE DRIVE TRAIN SYSTEM BREATHER

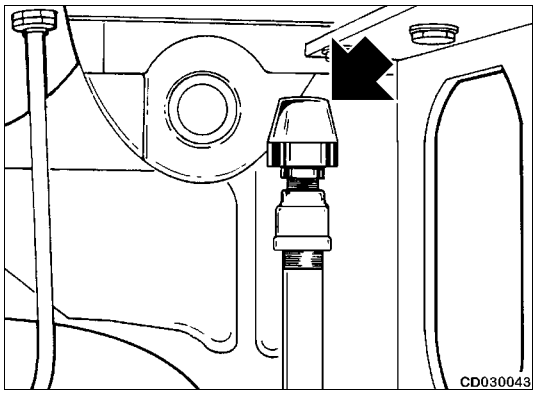
Remark

To prevent dirt from entering the critical areas of the drive train system, keep the breather clean.

1. Open the right rear access door.



2. The breather is located on a stand pipe at the right rear top of the rear main frame cover. Unscrew the breather from the reducer nipple and discard. Install the new breather on the nipple.

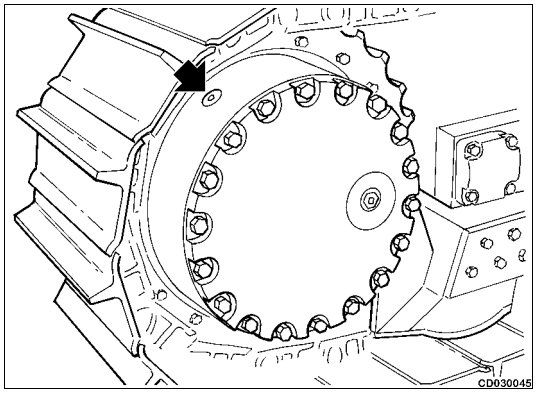


DRAIN, FLUSH AND REFILL FINAL DRIVE OIL

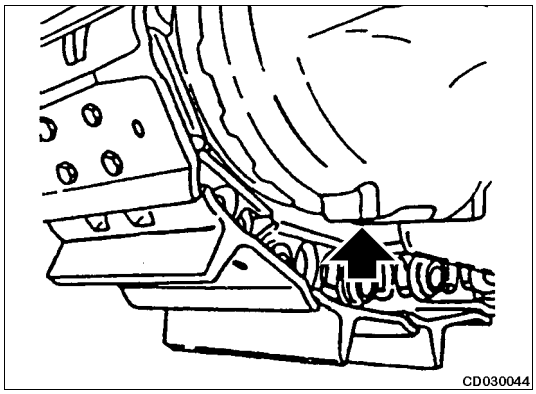
- Drain one side of the machine at a time.

1. While the lubricant is at operating or ambient temperature, park the machine on level ground with the outside drain plug at the lowest point. Remove drain plug and allow the lubricant to drain into a suitable container. Install and tighten the drain plug.

- The outside drain plug shown here is ≈152° from level ground.



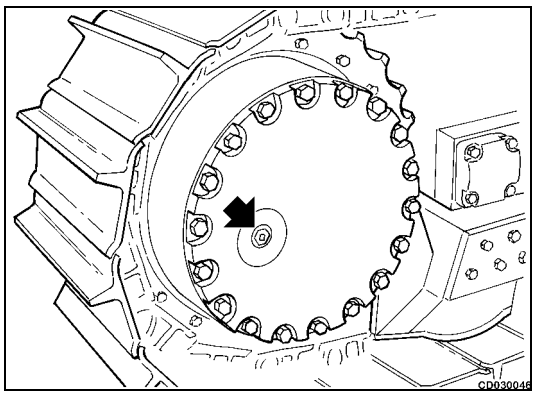
2. Remove the inside drain plug and allow the lubricant to drain into a suitable container. Install and tighten the drain plug.



3. Move the machine so that the OIL LEVEL filler/check plug is parallel to the track frame.

4. Remove the filler and level plug. Fill the housing with fuel oil up to the filler and level plug opening and install the pipe plug.

5. Operate the machine in low gear (with no load) for a few minutes. Position machine so that outside drain plug is at the bottom. Remove the drain plugs and thoroughly drain the fuel oil into a suitable container. Reinstall and tighten the drain plugs.



6. Move the machine so that the OIL LEVEL filler/check plug is parallel to the track frame. Remove the check/filler plug. Fill the housing with fresh lubricant up to the bottom of the check/ filler plug opening. Reinstall and tighten the filler and level plug.

- For details of the fluid to use, see "USE OF FUEL, COOLANT AND LUBRICANTS" on page 3-7.

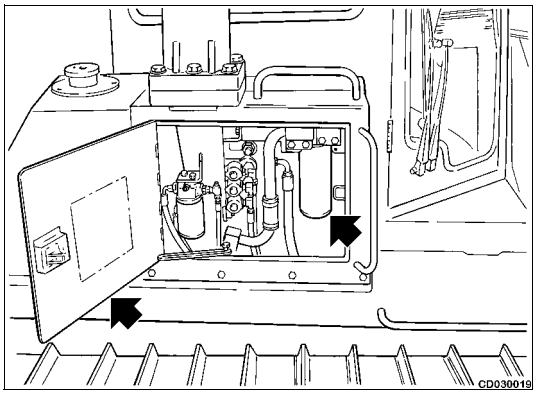
7. Repeat this procedure for remaining side final drive.

EQUIPMENT SYSTEM RETURN FILTER

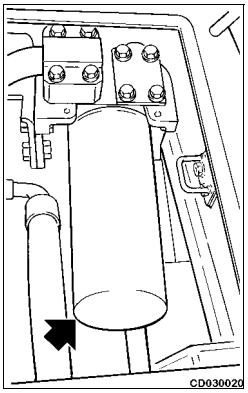
Remark

If the filter indicator light on the instrument panel remains on at operating oil temperature with the engine running, the filter cartridge must be changed.

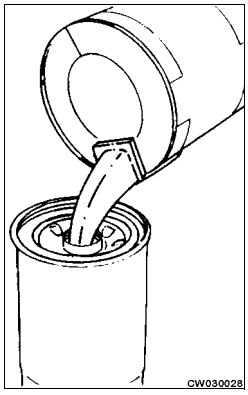
1. With the engine stopped, operate the equipment levers several times to relieve any pressure. Open the right access side door. Remove all outside dirt from filter.

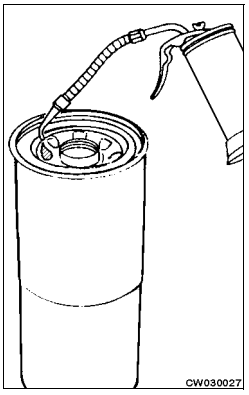


2. Using a filter wrench remove the spin on filter. Wipe the filter base, removing all of the old oil from the seal area.

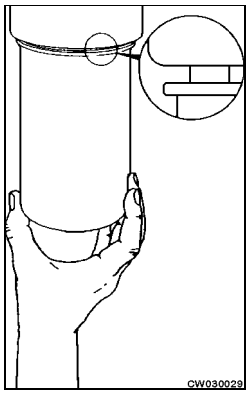


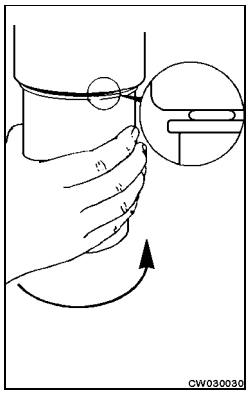
3. Fill the new filter with clean oil, then coat the filter seal with clean oil.





4. Install the filter by threading (do not spin) it onto the filter base (3) until the seal contacts the base, turn the filter by hand an additional 1/4 to 1/2 turn.





Remark

Do not over tighten the filter or use any tools for installation because this can damage the gasket and filter. Mechanical over tightening may distort the filter header threads or damage the element seal.

5. Check the level in the hydraulic system.

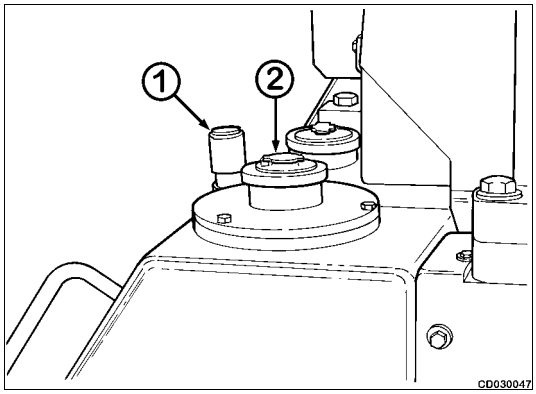
CLEAN HYDRAULIC RESERVOIR RELIEF VALVE

⚠ WARNING

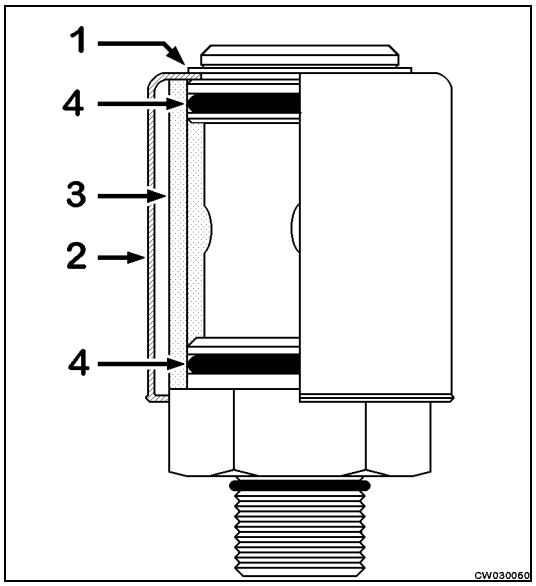
- **Pressurized Reservoir. Always loosen the locking cap slowly in case there is still some pressure in the system.**
- **Fire hazard - do not use kerosene, diesel fuel or flammable liquids to clean parts. A spark or a flame could cause a fire or an explosion. Use a nonflammable commercial solvent.**

1. Park the machine on level ground, lower the blade to the ground and stop the engine as outlined above. Turn the electrical master switch to OFF. Tag all controls to prevent inadvertent starting. With the engine stopped, operate the equipment lever several times to relieve any pressure. Remove all outside dirt from breather (1).

2. Slowly loosen the locking reservoir cap (2) in order to relieve any pressure in the reservoir, then retighten.



3. Remove the lock ring (1) and cover (2). Remove the element (3) and clean in a nonflammable commercial solvent. Dry thoroughly. Check o-ring (4) for wear or deterioration. Replace if necessary. Replace filter (3) and cover (2). Secure with lock ring (1).

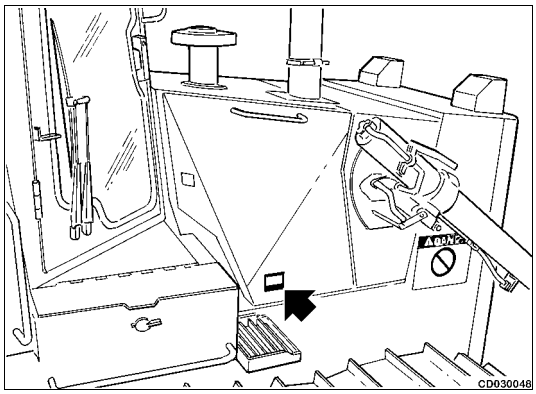


LUBRICATE GIMBAL TUBE

WARNING

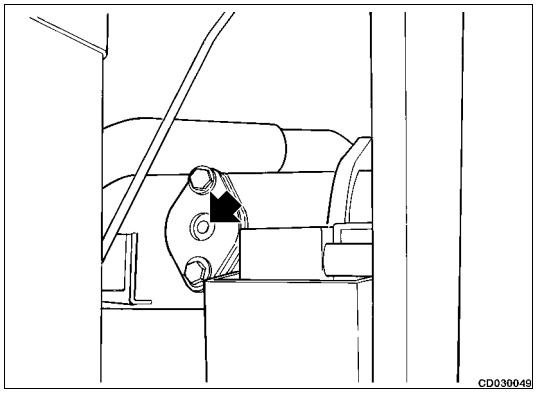
Park the machine on level ground, stop the engine, lower all mounted equipment to the ground, apply the safety lock, apply the brake pedal lock, turn off the electrical system master switch.

1. With the engine stopped, open the right engine side door.

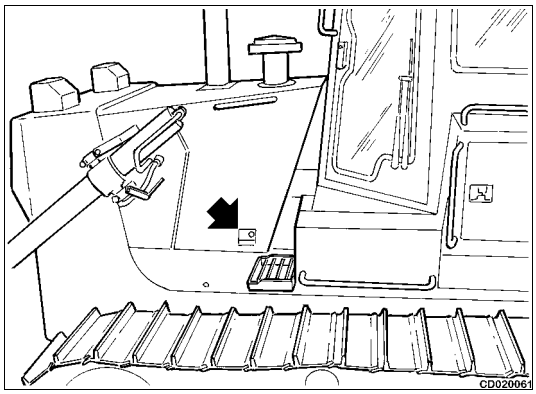


1. Remove plug and install grease fitting 109461. **1 FITTING**

2. Apply grease until clean lubricant is visible. Always use a clean lubricator and wipe dirt from fittings before fresh grease is applied. If grease fails to go through the fitting, determine the cause and correct it. After greasing, wipe off any old grease that was purged.



3. Open the left engine side door and repeat steps 1 through 3 for this side.

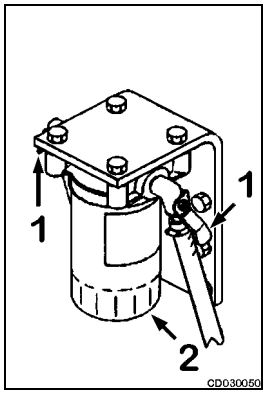


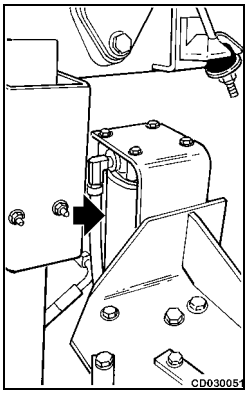
REPLACE CORROSION RESISTOR CARTRIDGE

WARNING

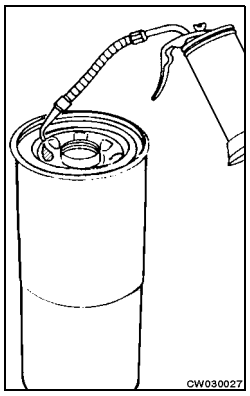
- **If the engine has been operated, all parts will be at a high temperature, so never try to replace the cartridge immediately after stopping the engine.**
- **Always wait for the engine and other parts to cool down.**

1. Open the left engine side door.
2. Close the shut off valve levers (1) (each side).
3. Set a container under the cartridge to catch the drained coolant. Using a filter wrench, remove cartridge (2).





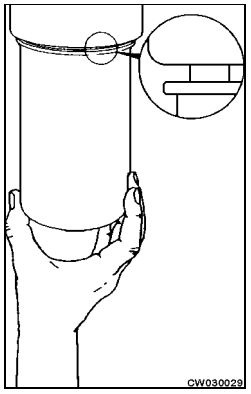
4. Clean the filter holder, coat the thread and the seal surface of the new cartridge thinly with engine oil, then install the cartridge.

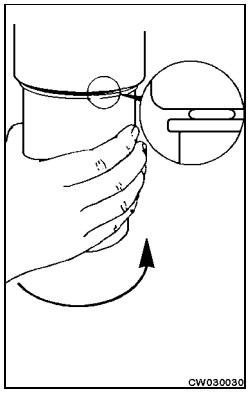


5. Install the filter by threading (do not spin) it onto the filter base until the seal contacts the base, turn the filter by hand an additional 2/3 turn. Open each shut off valve lever.

Remark

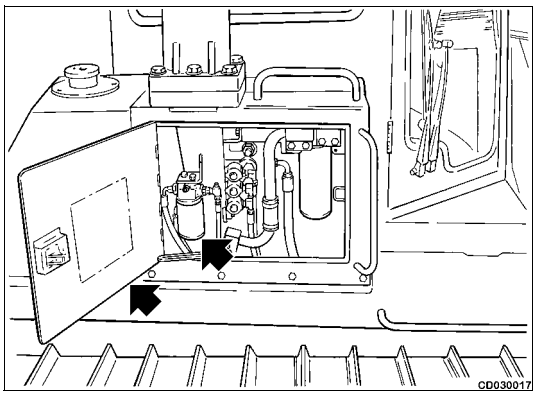
Do not over tighten the filter or use any tools for installation because this can damage the gasket and filter. Mechanical over tightening may distort the filter header threads or damage the element seal.





6. After replacing the cartridge, start the engine and check that there is no leakage of coolant from the filter seal surface. If any coolant leakage is found, check the tightening of the cartridge.

EVERY 2000 HOURS SERVICE



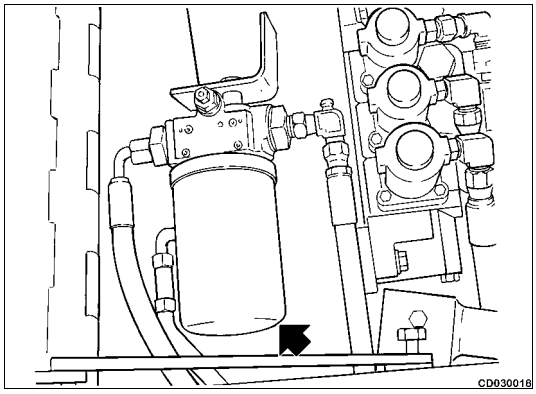
- Perform maintenance for every 10, 50, 250, 500 and 1000 hours of service at this time.

EQUIPMENT SYSTEM PILOT FILTER

Remark

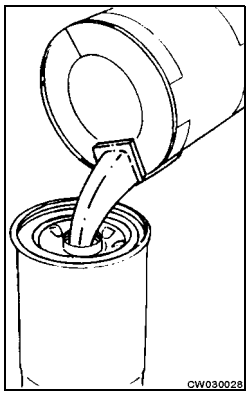
If the filter indicator light on the instrument panel, remains on at operating oil temperature with the engine running, the filter cartridge must be changed.

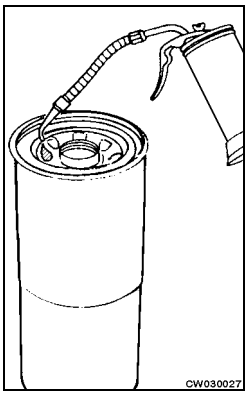
1. With the engine stopped, operate the equipment levers several times to relieve any pressure. Open the right access side door. Remove all outside dirt from filter.



2. Using a filter wrench remove the spin on filter. Wipe the filter base, removing all of the old oil from the seal area.

3. Fill the new filter with clean oil, then coat the filter seal with clean oil.

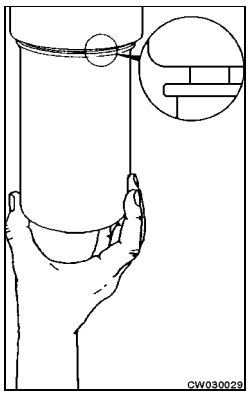


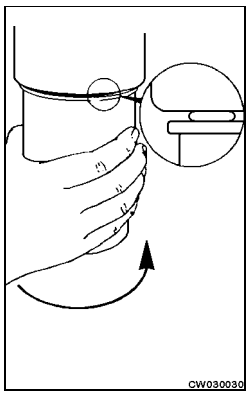


4. Install the filter by threading (do not spin) it onto the filter base (3) until the seal contacts the base, turn the filter by hand an additional 1/4 to 1/2 turn.

Remark

Do not over tighten the filter or use any tools for installation because this can damage the gasket and filter. Mechanical over tightening may distort the filter header threads or damage the element seal.

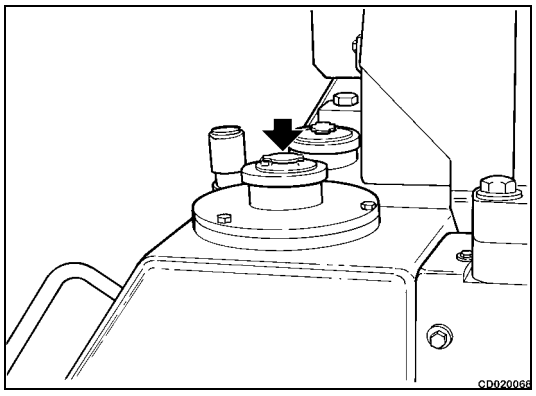




5. Check the level in the drive train system.

CHANGE EQUIPMENT SYSTEM OIL

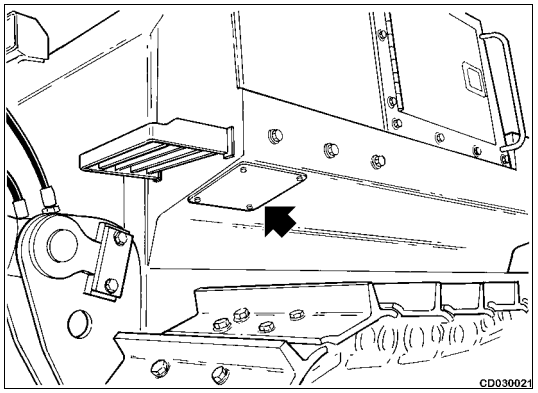
1. Start the engine and operate the blade to warm the oil for easy draining. Park the machine on level ground, lower blade and ripper equipment to the ground. Stop the engine. Shift to neutral and apply the lock lever. Apply and lock the parking brake. Turn the electrical system master switch and dash key to **OFF** and remove keys.



⚠ WARNING

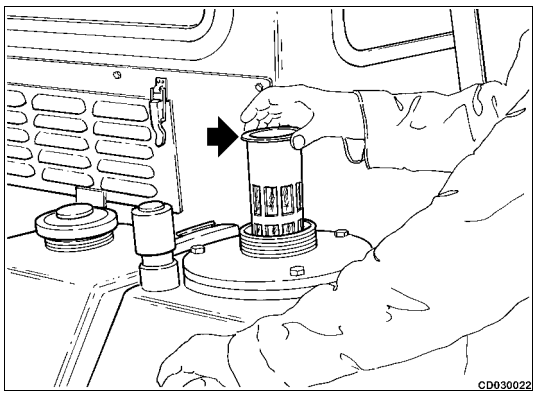
Pressurized Reservoir. Always loosen the locking cap slowly in case there is still some pressure in the system.

2. Slowly loosen and remove reservoir locking cap to relieve reservoir pressure, see “LOCKING CAP” on page 2-29



3. Remove drain access plate. Remove the magnetic drain plug and drain the reservoir into a suitable container.

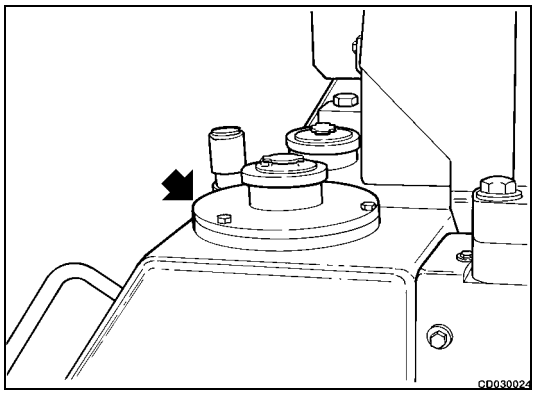
4. The filler screens the oil entering the tank and eases the job of the filter. Remove and clean the screen with a nonflammable commercial cleaning solvent. Install the screen in the reservoir and mount locking cap.



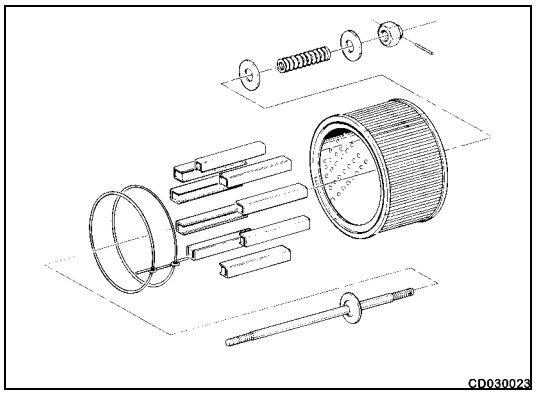
⚠ WARNING

Fire hazard - do not use kerosene, diesel fuel or flammable liquids to clean parts. A spark or a flame could cause a fire or an explosion. Use a nonflammable commercial solvent.

5. Remove reservoir top cover and discard o-ring. Using a M24 socket and extension, remove strainer assembly from reservoir.



6. Clean the strainer with a nonflammable commercial cleaning solvent. Install the strainer in the reservoir and mount reservoir top cover with new o-ring to reservoir.



Remark

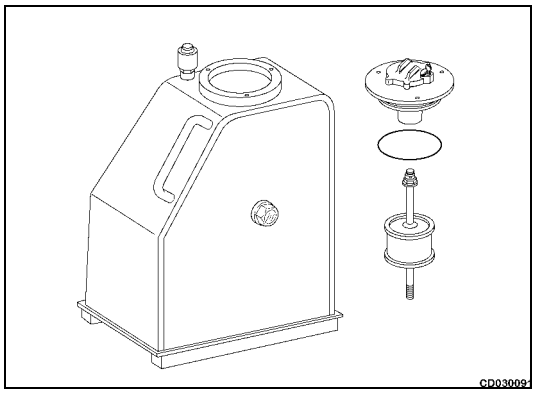
The strainer does not have to be disassembled for cleaning.

⚠ WARNING

Fire hazard - do not use kerosene, diesel fuel or flammable liquids to clean parts. A spark or a flame could cause a fire or an explosion. Use a nonflammable commercial solvent.

Remark

Use clean oil from a clean container. Maintain all packing and fittings so as to prevent leakage.

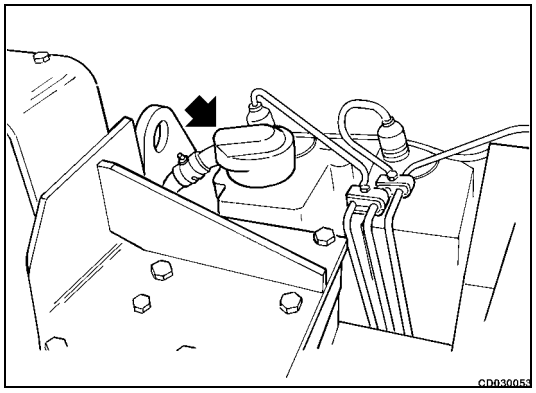


7. Reinstall the drain plug. Fill the reservoir with lubricant up to the center line of the sight gauge. Reinstall the filler cap.

- For details of the fluid to use, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7.

8. Start the engine and run it at low idle speed. Operate all the controls through all positions four or five times so the cylinders are filled with oil and air expelled. Check the oil level and repeat until the fluid level remains at the specified level in the reservoir.

CLEAN ENGINE BREATHER ELEMENT



1. Wipe off all the dirt around the breather and remove.

2. Wash the whole breather in diesel oil or flushing oil, then blow it dry with compressed air.

3. Replace the breather o-ring with a new part, coat with engine oil, and install it.

ENGINE VALVE CLEARANCE

Contact your local distributor for inspection or adjustment.

CLEAN, CHECK TURBOCHARGER

Contact your distributor for cleaning or inspection.

CHECK ALTERNATOR, STARTING MOTOR

The brush may be worn, or the bearing may have run out of grease, so contact your distributor for inspection or repair. If the engine is started frequently, carry out inspection every 1000 hours.

CHECK VIBRATION DAMPER

Check that there are no cracks or peeling in the outside surface of the rubber. If any cracks or peeling are found, contact your distributor to have the parts replaced.

EVERY 4000 HOURS SERVICE

- Perform maintenance for every 10, 50, 250, 500, 1000 and 2000 hours of service at this time.

CHECK WATER PUMP

Check that there is oil leakage, water leakage, or clogging of the drain hole. If any abnormality is found, contact your distributor for disassembly and repair or replacement.

WHEN REQUIRED

CLEAN AIR CLEANER ELEMENTS

Remark

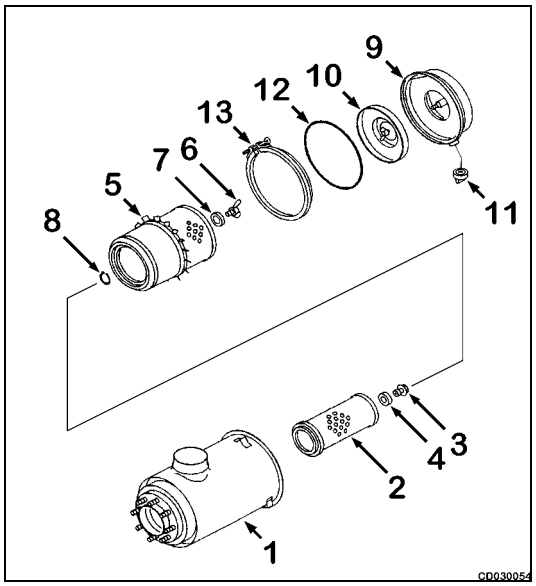
Whenever the service light comes on, check the air cleaner elements. The audio alarm will not sound.

General

This machine is equipped with a dry type air cleaner with replaceable filter elements. The air cleaner has two filter elements, a outer and a inner. The outer element can be cleaned for a limited number of times before replacement is necessary, however, the inner element must be replaced when plugged. Detailed service procedures for this air cleaner are covered in the following text.

Precautions

As a precaution against dirt entering the engine:



1. Cleaner Body
2. Inner Filter Element
3. Retainer Nut
4. Seal Washer
5. Outer Filter Element
6. Wing Nut
7. Seal Washer

- Make sure all the air cleaner connections and the turbocharger mounting gaskets are in good condition and all joints and connections are tight.
- Never operate the engine unless a filter element is in place and the filter end cover o-ring is installed.
- Never remove the element from the air cleaner while the engine is running.

Outer Filter Element

SERVICE

The air cleaner outer element must be serviced whenever indicated by the air cleaner filter service light, see “AIR CLEANER SERVICE LIGHT” on page 2-10.

After servicing the outer element, if the air cleaner filter service light continues to operate, check the air inlet screen or precleaner tubes for obstructions. If service light remains illuminated, replace the inner element. After servicing the outer element and replacing the inner element, if the service light continues to operate, replace the outer element too. The outer element can be cleaned with compressed air.

Remark

A outer filter element must be replaced after six cleanings.

Remark

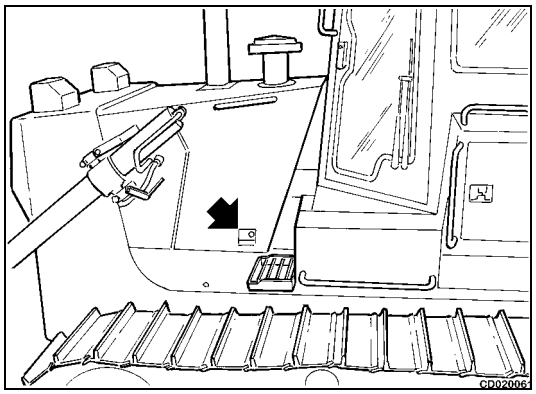
After cleaning, if an element is to be stored for later use, place it in a plastic bag and store in an element shipping container to protect against dirt and damage.

REMOVAL

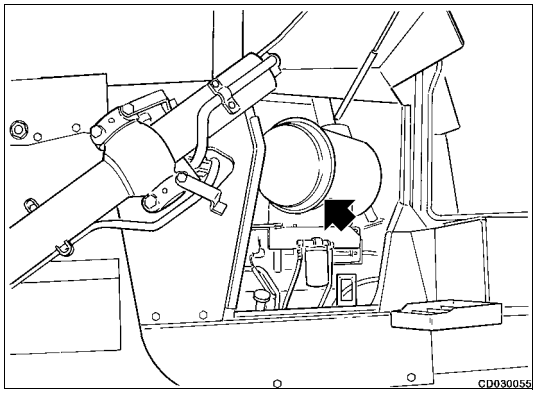
WARNING

- **Never clean or replace the air cleaner filter element with the engine running.**
- **When using compressed air to clean the filter element, wear safety glasses or goggles to protect your eyes and limit the air pressure to less than 7 kg/cm² (99 psi).**

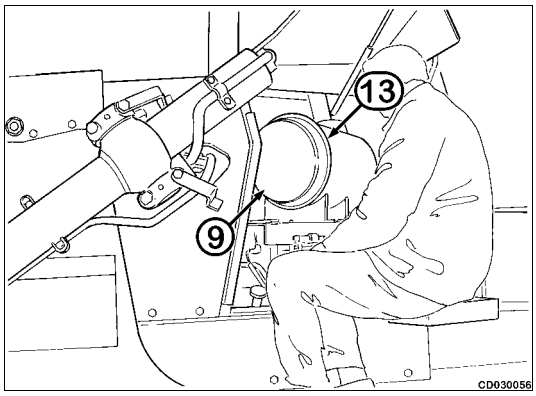
1. Stop the engine and lower all mounted equipment to the ground. Open the left engine side door.



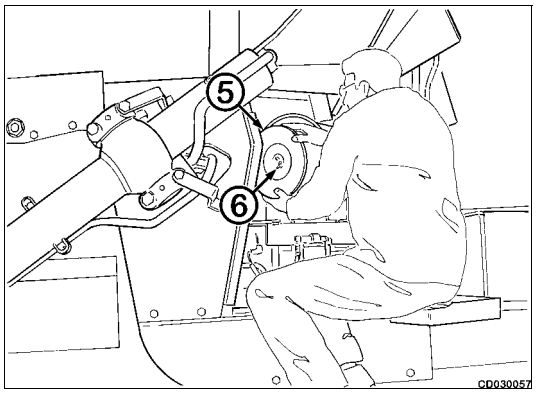
2. Remove all dirt and contamination from the clamp and end cover of the air cleaner body.



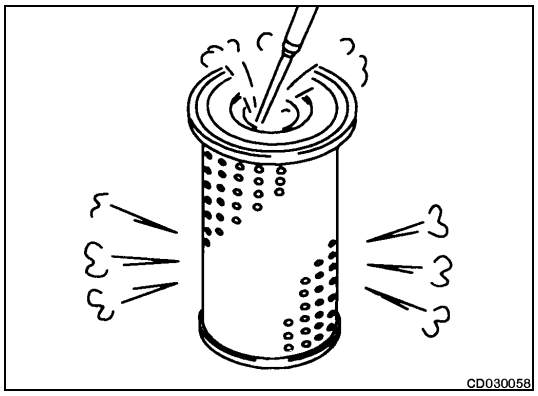
3. Loosen the T bolt of the retainer clamp (13) and remove vacuator end cover (9).



4. Loosen the wing nut (6) and slide out the outer element (5) being careful not to dislodge dust from the dirty element onto the inner element.



5. Carefully tap the side or end of the element against the palm of your hand to remove loose dust. Direct clean dry compressed air up and down the pleats on the inside of the element, then direct it from outside along its folds and again from inside.

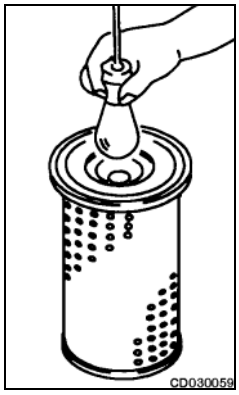


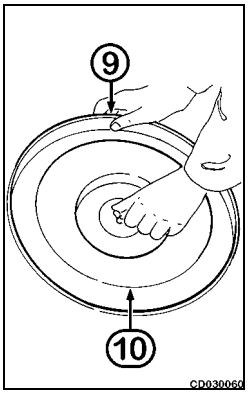
Remark

If small holes or thinner parts are found on the element when it is checked with an electric bulb after cleaning, replace the element. Do not use an element whose folds or gasket or seal are damaged. Do not tap the element against a hard surface; this will damage the element.

6. Inspect the filter element for leaks or damage by placing a bright light inside the element. Inspection of the element on the outside will disclose any holes where concentrated light shines through. The slightest rupture requires replacement of the filter element.

7. Remove baffle (10) and vacuator valve (11) from end cover (10). Clean all parts and reassemble.



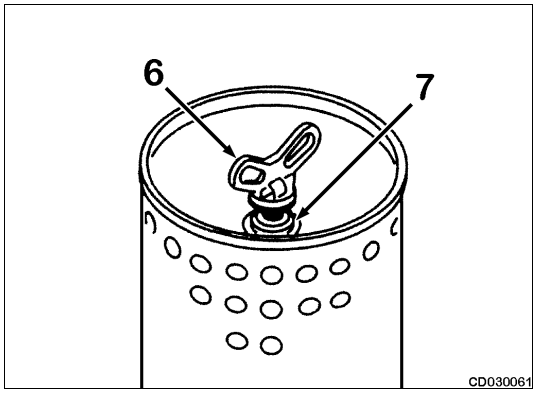


Remark

Remove one seal from the outer element. The number of times the outer element has been cleaned can be seen by the number of removed seals. Replace the outer element which has been cleaned six times repeatedly or used throughout a year and the inner element at the same time. Replace the element when service light illuminates soon after installing the cleaned element even though it has not been cleaned six times.

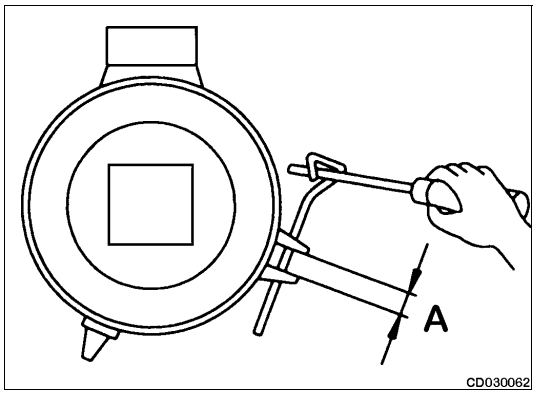
8. Replace seal washer (7) and/or wing nut (6) with new parts if they are broken.

9. Insert the open end of the outer element (5) into the air cleaner body and secure with the wing nut and seal washer.

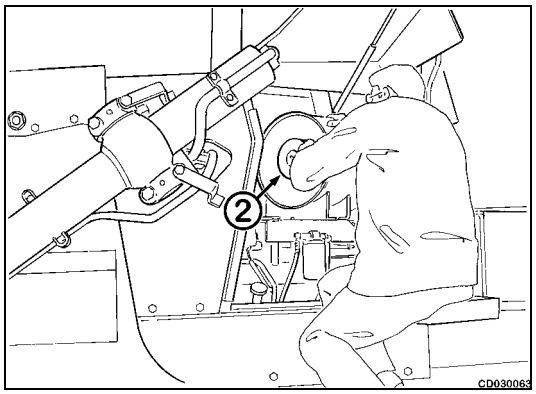


10. Position retainer clamp (13) with new o-ring (12) on cleaner body. Install the end cover (9) onto the air cleaner body. Secure with the wing nut (1) making sure the cover is not cocked. Tighten T bolt of retainer clamp so that distance **A** at the inside face of the clamp is 17 ± 2 mm (0.67 ± 0.08 in).

11. Inspect and tighten all air cleaner connections before resuming operation. Start the engine. If the air cleaner filter service light continues to show air flow restriction, replace the primary or primary and safety filter element.



Inner Filter Element

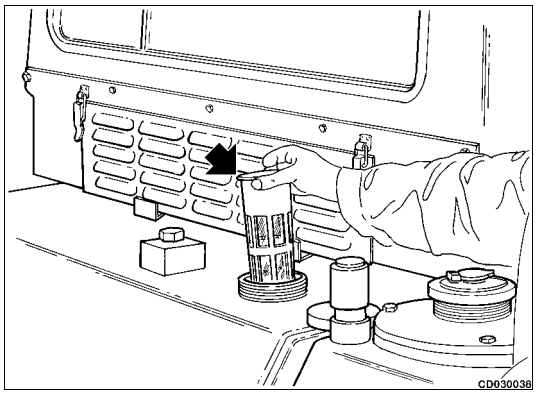


1. Remove the cover and the outer element, and then remove the inner element (2).
2. To prevent dust from getting in, use a clean cloth or tape to cover the air connector (outlet side)
3. Clean the air cleaner body interior, then remove the cloth cover. Fit a new inner element to the connector and tighten it with nuts. Do not clean and reinstall a inner element.
4. Install the outer element and the cover.

Dust Vacuator Valve

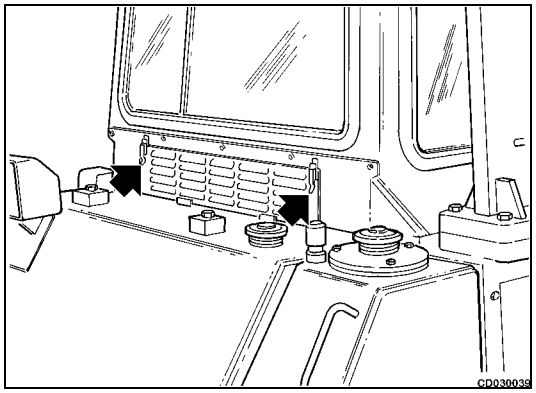
The dust vacuator valve will automatically remove dust and water from the air cleaner. To function, the vacuator valve lips must point downward and be kept free of debris. The lips should be closed except when engine is idling slowly or stopped. If the vacuator valve is lost or damaged, replace it to maintain the air cleaners efficiency and normal element service life.

FUEL TANK FILLER STRAINER



This screen filters the fuel entering the tank and eases the job of the fuel filter. Remove and clean the screen with a nonflammable cleaning solvent.

CAB FRESH AIR FILTER



1. Open rear inspection cover.

⚠ WARNING

Wear eye protection when using air under pressure to clean parts. Limit air pressure to 2.1 kg/cm² (30 psi).

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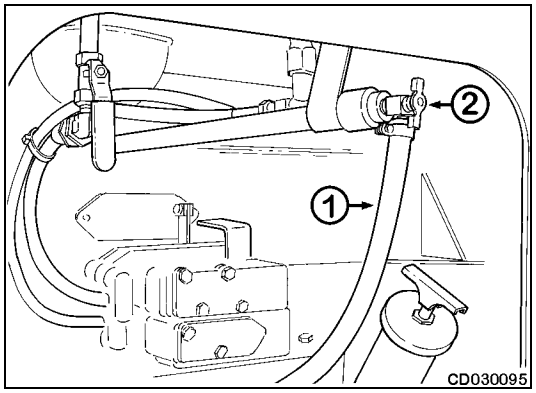
NOTE: **This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.**

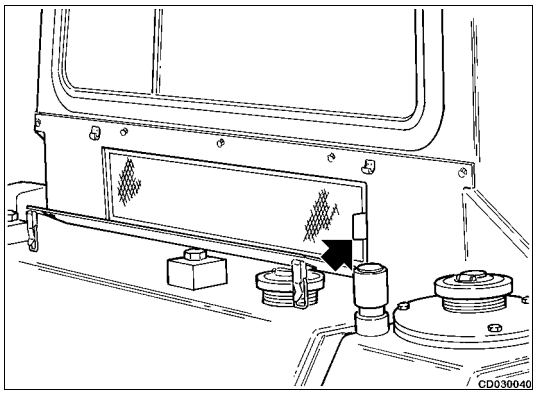


2. Remove the filter from the box. Clean inside of the filter box.

3. Clean filter with compressed air. If it is extremely dirty, wash it in a neutral agent. After washing, dry completely before installing again.

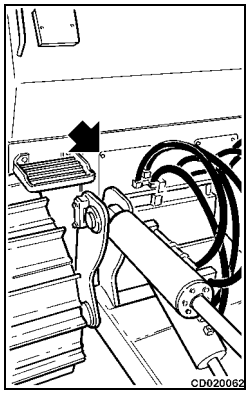
Remark

If clogging of the filter cannot be removed by washing or using compressed air, replace the filter with a new one.



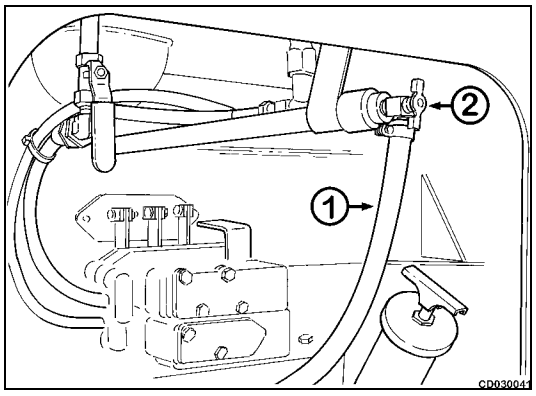
DRAIN FUEL TANK SEDIMENT BOWL

1. Open the rear access cover.



2. Position drain hose (1) outside of machine into a suitable container. Open the valve (2) and drain water and sediment from the fuel tank until clean diesel fuel appears. Close the valve.

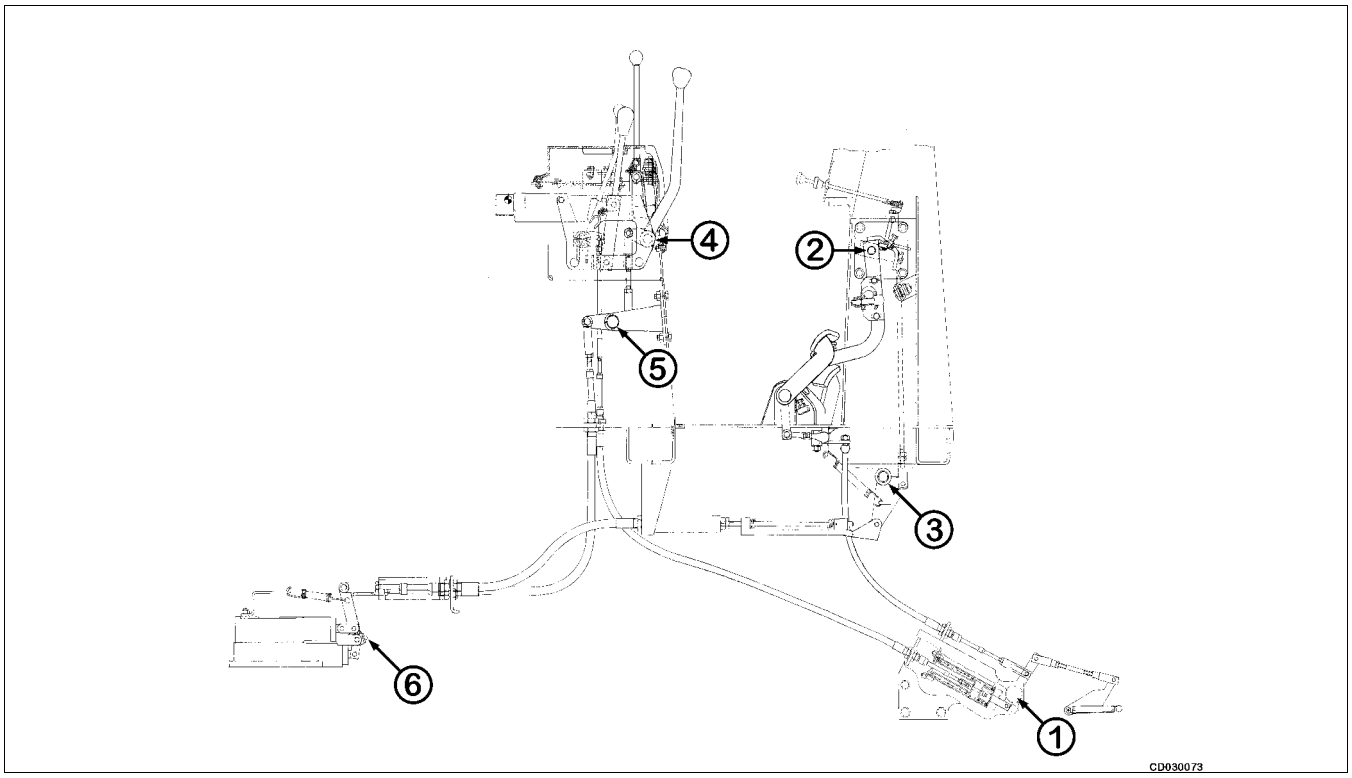
3. Insert drain hose and close rear access cover.



PILOT VALVE PLATE SURFACE LUBRICATION

Apply a generous coat of clean MPG to plunger plate surface and the contact areas of the plungers.

LINKAGE LUBRICATION



Front Lower Throttle Lever (1) **1 FITTING**

Apply grease until clean lubricant is visible. Always use a clean lubricator and wipe dirt from fittings before fresh grease is applied. If grease fails to go through the fitting, determine the cause and correct it. After greasing, wipe off any old grease that was purged.

Brake Pedal Support (2) **1 FITTING**

Apply grease until clean lubricant is visible. Always use a clean lubricator and wipe dirt from fittings before fresh grease is applied. If grease fails to go through the fitting, determine the cause and correct it. After greasing, wipe off any old grease that was purged.

Brake Rod Lever (3) **1 FITTING**

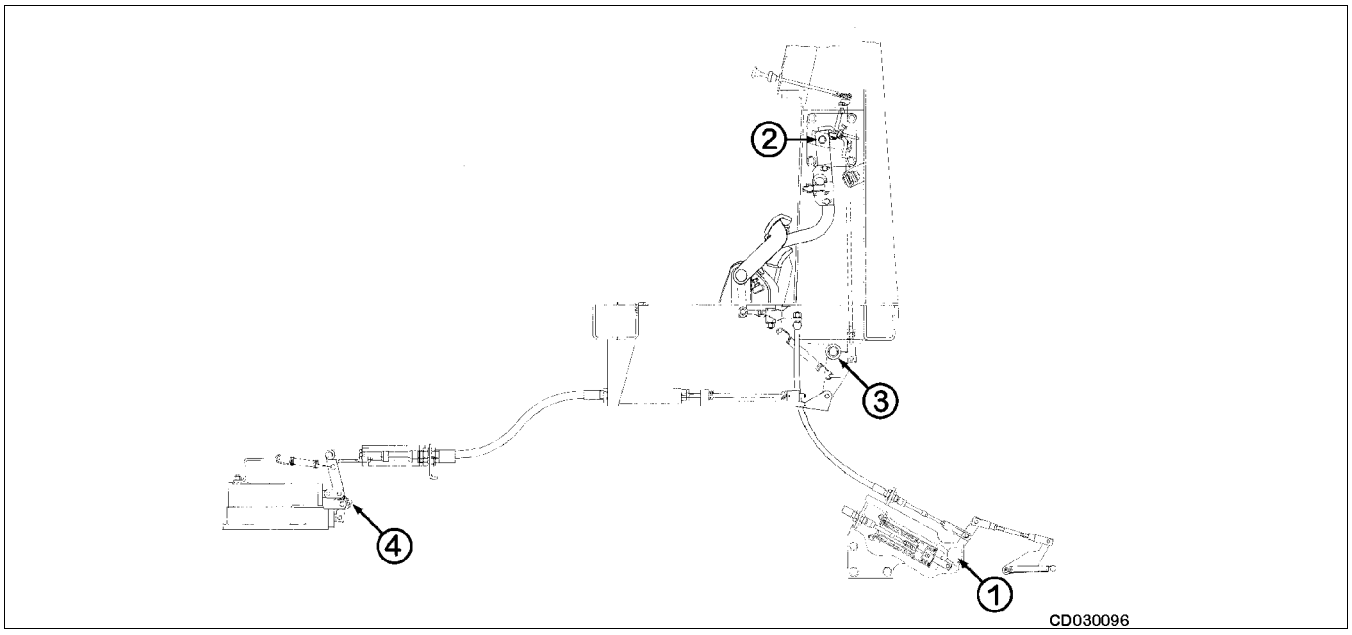
Apply grease until clean lubricant is visible. Always use a clean lubricator and wipe dirt from fittings before fresh grease is applied. If grease fails to go through the fitting, determine the cause and correct it. After greasing, wipe off any old grease that was purged.

Steering Levers (4) **2 FITTINGS**

Apply grease until clean lubricant is visible. Always use a clean lubricator and wipe dirt from fittings before fresh grease is applied. If grease fails to go through the fitting, determine the cause and correct it. After greasing, wipe off any old grease that was purged.

LINKAGE LUBRICATION

NOTE: This added page shows the differences for machines equipped with Single Lever Transmission/Steering Control.



Front Lower Throttle Lever (1) **1 FITTING**

Apply grease until clean lubricant is visible. Always use a clean lubricator and wipe dirt from fittings before fresh grease is applied. If grease fails to go through the fitting, determine the cause and correct it. After greasing, wipe off any old grease that was purged.

Brake Pedal Support (2) **1 FITTING**

Apply grease until clean lubricant is visible. Always use a clean lubricator and wipe dirt from fittings before fresh grease is applied. If grease fails to go through the fitting, determine the cause and correct it. After greasing, wipe off any old grease that was purged.

Brake Rod Lever (3) **1 FITTING**

Apply grease until clean lubricant is visible. Always use a clean lubricator and wipe dirt from fittings before fresh grease is applied. If grease fails to go through the fitting, determine the cause and correct it. After greasing, wipe off any old grease that was purged.

Brake Valve Lever (4) **1 FITTING**

Apply grease until clean lubricant is visible. Always use a clean lubricator and wipe dirt from fittings before fresh grease is applied. If grease fails to go through the fitting, determine the cause and correct it. After greasing, wipe off any old grease that was purged.

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Steering Lever Pivot (5) **2 FITTINGS**

Apply grease until clean lubricant is visible. Always use a clean lubricator and wipe dirt from fittings before fresh grease is applied. If grease fails to go through the fitting, determine the cause and correct it. After greasing, wipe off any old grease that was purged.

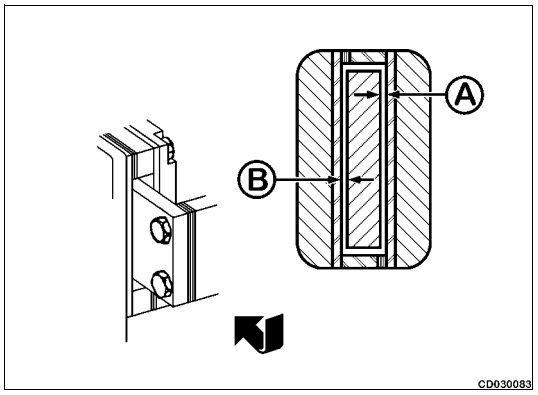
Steering Valve Lever (6) **1 FITTING**

Apply grease until clean lubricant is visible. Always use a clean lubricator and wipe dirt from fittings before fresh grease is applied. If grease fails to go through the fitting, determine the cause and correct it. After greasing, wipe off any old grease that was purged.

WEAR OF UNDERCARRIAGE COMPONENTS

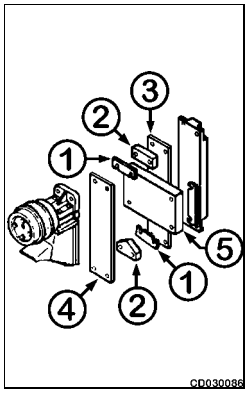
Track Frame Guide

1. To avoid excessive wear of undercarriage components and track frame suspension points, the track frame guide must be checked periodically.
2. Adjust as follows:



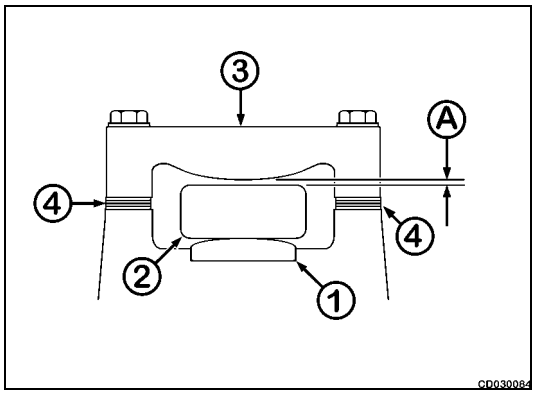
A. Measure clearances **A** and **B**. If the total is 6.5 mm (0.256 in) or more, adjust by removing shims (1) from between the spacer blocks (2) and wear plates (3 and 4). Remove enough shims to reduce the total clearance (**A** + **B**) to 0.8 mm (0.031 in). Keep the removed shims for future use.

B. If removal of all the shims will not provide a total clearance of less than 6.5 mm (0.256 in), replace the wear plates and guide plate (5), as required. Reinstall the shims and repeat the check. Lubricate track frame guides.

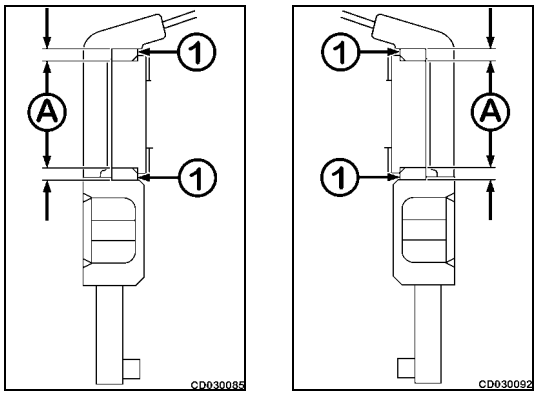


Equalizer Bar

Periodically check the condition of the wear pads (1) that support the equalizer bar (2) ends in the track frame rebound brackets (3). The distance (**A**) between the equalizer bar and rebound bracket is to be measured periodically also. Perform the measurements when both track frames are on level ground. Add or remove shims (4) to obtain a distance of 4.8 to 6.3 mm (0.189 to 0.248 in) (**A**). For replacement of pads, consult your local distributor.



Front Idler Guides

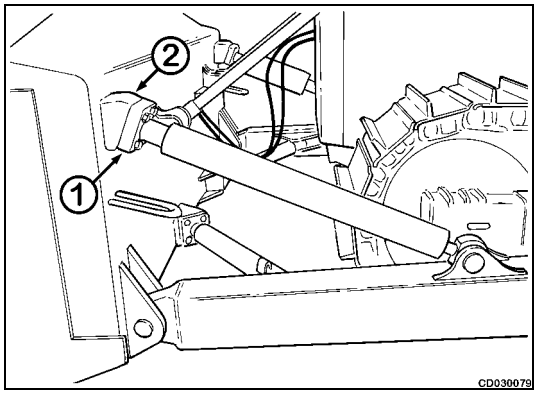


Periodically check the thickness of the front idler guides (1). Consult your local distributor.

A (minimum thickness)16 mm (0.63 in)

SOCKETS AND DIAGONAL STRUT

Upper Strut And Tilt Cylinder



1. The upper strut and tilt cylinder sockets must be checked occasionally to ensure that excessive movement does not occur between the cap (1) and the blade socket (2). When movement exceeds 1.3 mm (0.51 in), readjustment is necessary.

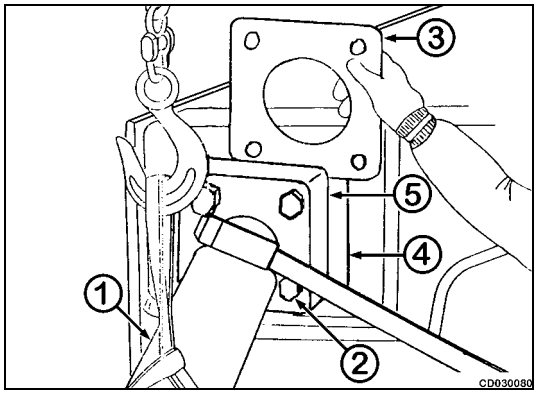
2. Adjust as follows:

   A. Attach a suitable hoist and sling to the upper stud or tilt cylinder (1). Remove bolts (2) securing cap (5) to blade socket (4).

   B. Retract upper strut or tilt cylinder while supporting the assembly with the hoist and sling. Remove shims (3). Extend strut or tilt cylinder until the ball on the strut or tilt cylinder bottoms in the blade socket.

   C. Install cap with four bolts. Pretorque evenly to 270 N•m (199 lbf ft) to ensure the cap is not cocked on the strut ball.

   D. Using the removed shims determine the maximum amount of shims which will fill the gap between the cap and socket. When the correct shim pack for the gap between the cap and socket is determined add one shim to provide clearance.

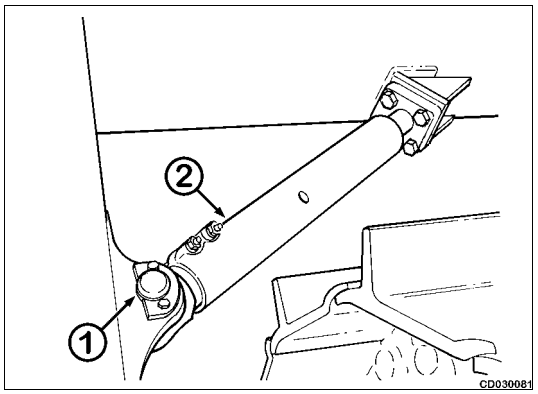


Each shim is 0.75 mm (0.03 in) thick.

   E. Prior to final assembly clean all shims, mating surfaces of strut cap and socket mating surfaces of all foreign material, dirt and paint. Insert the shims over the strut or tilt cylinder ball and extend until the ball bottoms in the blade socket. Install the bolts and tighten. Adjust the blade strut to the desired blade angle.

N•m Cap bolts 845 N•m (623 lbf ft)

Diagonal Strut



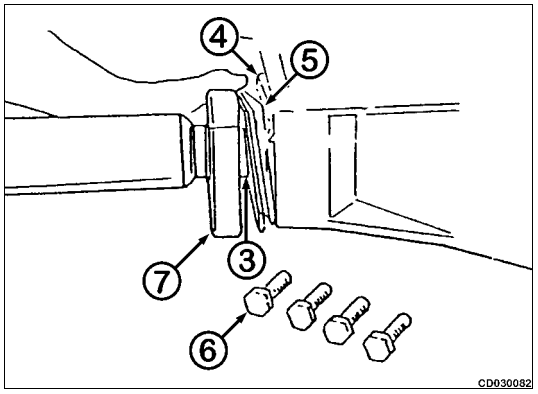
1. The diagonal strut adjustment must be checked occasionally and if it is found that the strut presses on the blade, it has to be adjusted.

2. Adjust as follows:

   A. With the blade on the ground and stopped engine, remove the pin (1) at the push arm bracket connection. Adjust the length of strut (2) so that hole of eyebolt is aligned with bracket bore on a beam. Extend the strut to maximum while keeping the ability to insert the pin. Install and secure the pin in the connection and tighten the clamping screws to prevent turning.

Remark

When making this adjustment, remember that the distances between the inner surface of the blade beam and the fixed point on the track frame should be the same on both sides.



   B. Put the ball end (3) without shims to the socket (4). Install and fix the strut cap (7) with four bolts (6) so that flange will adjoin tightly to the ball seated firmly in the socket. Determine the number of necessary shims (5) by measuring the gap between the flange and the socket. Ensure that the gap between the socket and strut cap is the same all around. To ensure adequate play add one more shim.

   C. Remove the strut and install determined number of shims. Install the struts turning them additionally by a half turn in order to get proper pressure stress. Tighten the bolts.

N•m Strut cap bolts 1050 N•m (775 lbf ft)

ELECTRICAL SYSTEM

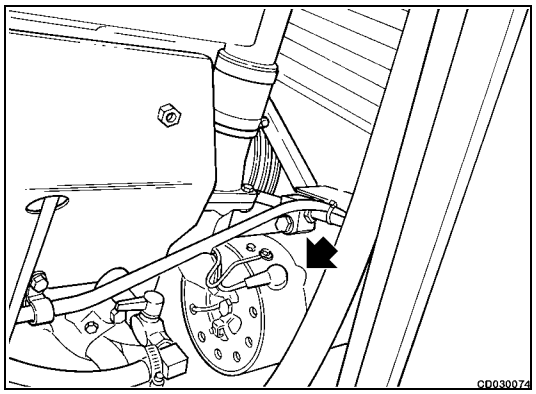
Precautions

⚠ WARNING

- **Before working on the engine or electrical system, disconnect the negative (ground) battery cable. Tag the cable and controls to warn against starting.**
- **When installing the battery be sure to connect the ground cable to the negative terminal. When connecting a booster battery or battery charger make certain to connect the negative terminal to the negative terminal and the positive terminal to the positive terminal. Do not short across or ground any terminals of the alternator or regulator. Failure to observe these precautions will result in severe damage to the harness and alternator.**

All terminals must be clean and fastened securely. Never paint electrical connections or the alternator. Repair or replace all broken wires immediately. Surface under all terminals must be clean and good electrical connections must be established after reassembly. Also all clips must grip cables tightly to prevent vibrations and rapid cable wear. All clips and straps must be closed so as not to damage the insulation.

Alternator



The alternator requires no lubrication since its bearings are factory lubricated for life and require attention only at time of major overhaul. The alternator is equipped with an integral, transistorized voltage regulator.

If the alternator fails to operate properly, consult your distributor.

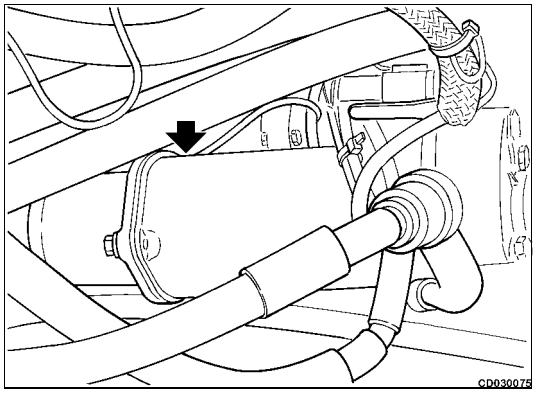
Remark

The unit electrical system is negative ground. Be certain the ground polarity is correct when installing a new battery, connecting a battery charge or using a booster. Failure to observe proper polarity will result in damage to the alternator.

- Never use a fast charger as a booster to start the engine.
- Never turn off the electrical system master switch or unhook a battery terminal while the engine is running.
- Never disconnect the alternator cable while the engine is running.

Be sure the terminals on the back of the alternator are clean and the cables are fastened securely to the proper terminals as shown.

Cranking Motor



Should it become necessary to remove the motor in the process of engine servicing, tag all disconnected cables for correct installation.

1. Disconnect all electrical cables and remove cranking motor. Clean outer surfaces.
2. Saturate all wicks and lightly lubricate the splines underneath the clutch housing with clean engine oil. Install the cranking motor and connect all electrical cables. Tighten the cranking motor mounting bolts.

If the cranking motor fails to operate properly, consult your distributor.

Circuit Breakers

The hourmeter and fuel level gauge circuits are protected by an automatic reset circuit breaker. A 10 amp circuit breaker is mounted on the underside of the instrument panel. In the event of a short circuit or ground, the circuit breaker will open and close until the trouble clears or is corrected. The circuit breaker will then return to and stay in its normal closed position. It is important to use the same capacity circuit breaker for replacement.

The upper working lights (cab or canopy mounted) and the lower working lights (hood and fuel tank mounted) are each protected by an automatic reset circuit breaker. A 15 amp circuit breaker is mounted on the underside of the instrument panel. In the event of a short circuit or ground, the circuit breaker will open and close until the trouble clears or is corrected. The circuit breaker will then return to and stay in its normal closed position. It is important to use the same capacity circuit breaker for replacement.

The key switch and horn circuits are protected by an automatic reset circuit breaker. A 15 amp circuit breaker is mounted on the underside of the instrument panel. In the event of a short circuit or ground, the circuit breaker will open and close until the trouble clears or is corrected. The circuit breaker will then return to and stay in its normal closed position. It is important to use the same capacity circuit breaker for replacement.

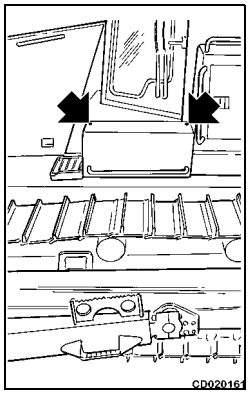
The engine coolant level circuit is protected by an automatic reset circuit breaker. A 6 amp circuit breaker is mounted on the underside of the instrument panel. In the event of a short circuit or ground, the circuit breaker will open and close until the trouble clears or is corrected. The circuit breaker will then return to and stay in its normal closed position. It is important to use the same capacity circuit breaker for replacement.

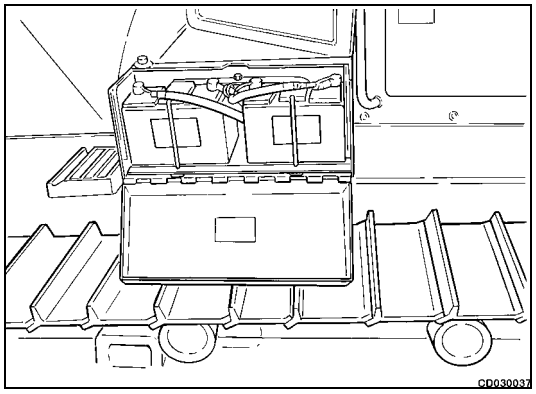
The cab wiper circuit (each 10 amp, qty. 4) and blower circuit (25 amp) are each protected by an automatic reset circuit breaker. They are mounted on the back side of the cab panel. In the event of a short circuit or ground, the circuit breaker will open and close until the trouble clears or is corrected. The circuit breaker will then return to and stay in its normal closed position. It is important to use the same capacity circuit breaker for replacement.

Batteries

The following precautions must be taken when working around batteries:

- Use a battery carrier to avoid spilling electrolyte on clothing.
- Wearing rubber aprons and gloves is advisable.
- Be careful that tools or other metallic objects do not fall across the battery terminals.
- Never break a live circuit at the terminals. This could cause sparks.
- Make sure charger cable clamps or booster leads are clean and making good contact.
- If it becomes necessary to prepare electrolyte of a desired specific gravity, always pour the acid into the water.
- Always turn the charger to the off position before connecting or removing charger leads to the battery.
- When charging a battery, it is recommended that the vent caps be left on. A damp cloth should be placed on top of the vent caps.





CLEANING THE BATTERIES

⚠ WARNING

Battery acid causes severe burns. Avoid contact with eyes, skin, or clothing. Wear goggles, rubber gloves, and apron. If eye contact occurs, flush with water for 15 minutes and get prompt medical attention. If skin contact occurs, flush with soap and water.

If the top of the batteries are dirty, they may be cleaned with a brush dipped in ammonia or soda solution. The vent plugs must be tightened and sealed to prevent any solution from getting into the battery cells. After the foaming stops, flush off the battery with clean water and unseal the vent plugs. Brighten the terminal contact surfaces with steel wool or a stiff brush.

LIQUID LEVEL - CONVENTIONAL BATTERY

The electrolyte in each cell must be at the proper level, 6 to 13 mm (1/4 to 1/2 in) above the plates, at all times to prevent battery failure. Check the level of the electrolyte. When the electrolyte is below this level, pure distilled water must be added. Never use hydrant water or any water which has been in a metal container. Acid or electrolyte must never be added except by a skilled battery man. Under no circumstances add any special battery solutions or powders.

It is especially important to keep the battery at full charge for cold weather operation. Add distilled water to the battery in freezing temperatures only when the engine is to operate for several hours, to thoroughly mix the water and the electrolyte, or damage to the battery may occur.

CHARGING FULLY DISCHARGED MAINTENANCE FREE BATTERIES

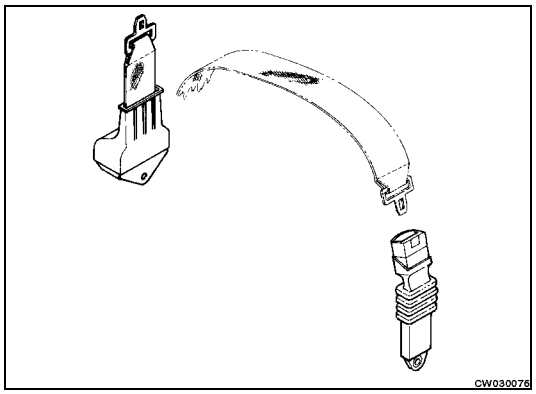
When a machine is not in use for an extended period, the maintenance free battery can become discharged. For this reason, when a machine will not be used for over 30 days, it is recommended that the negative ground terminal cable be disconnected.

Prior to starting up a machine that has been idle, always make a visual inspection of the battery and take an open circuit voltage test. A reading of 12.3 volts (65% of full charge) or less indicates a state of discharge. The open circuit voltage test should be taken after removing the surface charge. This is accomplished with a draw of 300 amps for 15 seconds. Wait for a couple of minutes, then check the open circuit voltage.

The point to remember is the lower the open circuit voltage, the longer it will take before the battery begins to accept a measurable amount of charge. Charge the battery until a minimum open circuit voltage of 12.4 volts is reached. Then test the battery.

If an open circuit voltage reading of 12.4 volts is not attained at the end of 12 hours, it can be assumed that the battery has failed. If the voltage does not drop below 9.6 volts at 21°C (70°F) for the duration of the load test, the battery is good

SEAT BELT

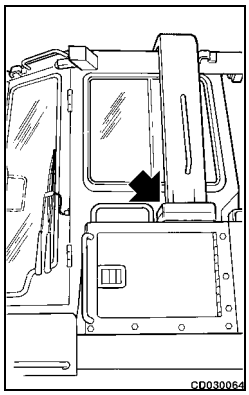


WARNING

Seat Belt - Do not clean with solvents or bleach or redye color of the webbing as this may cause a severe loss of strength. This could cause the webbing to break and result in personal injury. Wash in warm water with a mild detergent.

Keep the belt flat to avoid twisting and roping when not being used. Do not place heavy or sharp objects on the belt. The entire assembly should be inspected periodically for corrosion, wear, fraying or wear spots. The mounting bolts should also be periodically inspected for tightness.

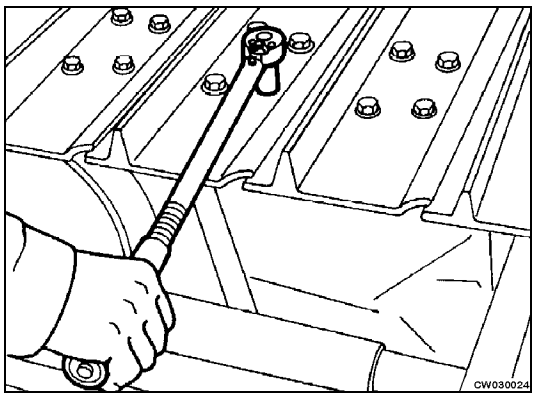
ROPS MOUNTING BOLT TORQUE



Check the torque of the ROPS mounting bolts.

N·m ROPS bolts 780 N•m (575 lbf ft)

TRACK SHOE BOLT TORQUE



The bolts used for attaching the track shoes to the chains are heat treated alloy bolts and will stand a considerable tightening strain. Ordinary bolts must not be used. Nuts must be assembled so that the washer face is not against the track link, radius side of the nuts must be against the track link. Torque the bolts to listed value below.

Threads and under bolt head Engine oil

N·m Track shoe bolt 400 ± 70 N•m (295 ± 52 lbf ft) + 120°

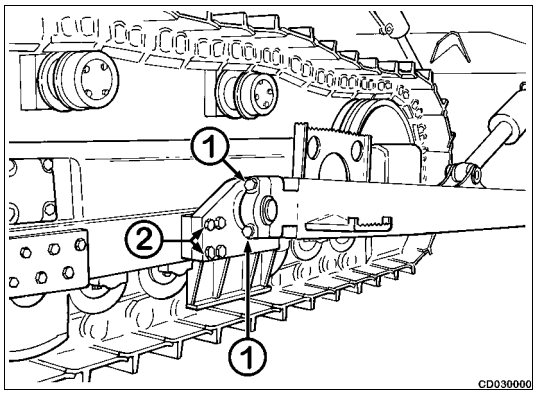
- 120° designates two flats of the bolt head.

BLADE CUTTING EDGES AND END BIT BOLT TORQUE

Check the torque of the blade cutting edge and end bit nuts.

N·m Plow bolt nuts 725 N•m (535 lbf ft)

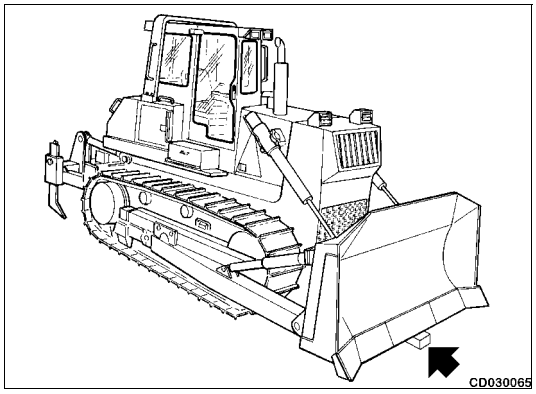
TRUNNION HARDWARE



Check the torque of the trunnion cap bolts (1), qty. 4, and trunnion plate mounting bolts (2), qty.16.

N•m Trunnion hardware 1050 N•m (775 lbf ft)

CUTTING EDGE AND END BIT WEAR



WARNING

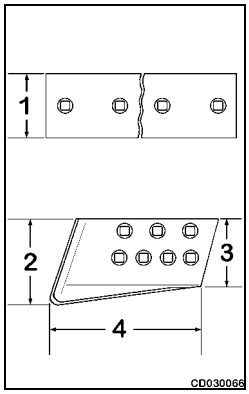
It is dangerous if the work equipment moves by mistake when the cutting edges and end bits are being reversed or replaced. Set the work equipment in a stable condition, then stop the engine.

1. Raise the blade to a proper height and apply a block to the blade frame so as to prevent the blade from falling.
2. Measure the wear of the end bit and cutting edge in accordance with the wear standards given below.

Wear Standards

Unit: mm (in)

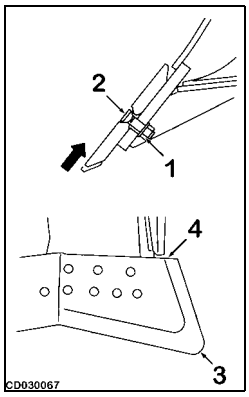
Item		Judgement standard	
No.	Measurement point	Standard dimension	Repair limit
1	Height of cutting edge	254 (10)	213 (8.4)
2	Outer height of end bit	295 (11.6)	211 (8.3)
3	Inner height of end bit	254 (10)	211 (8.3)
4	Width of end bit	450 (17.7)	375 (14.7)



3. If the cutting edge and the end bit on both sides are worn out, replace with new one.
4. If it has been worn out up to the fitting surface, repair the fitting surface and then reverse or replace.
5. Remove the cutting edge and the end bit and clean the mounting surface.
6. Reverse or replace the cutting edge and the end bit when worn out.

N•m Plow bolt nuts 725 N•m (535 lbf ft)

7. If bolt (1) and nut (2) are damaged, replace them with new ones at the same time.

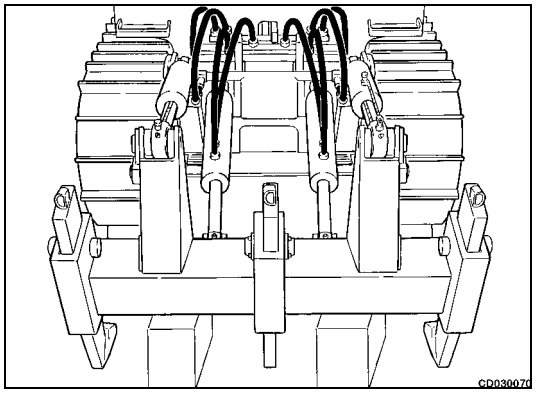


8. Loosen nut (2) and remove bolt (1), then replace or turn over cutting edge.
    - Install the cutting edge to the blade and tighten temporarily, then push the blade against the ground surface to remove any play in the bolt and tighten to the specified torque.
    - When installing the end bit (3), bring the top surface (4) of the end bit into tight contact with stopper (5), then tighten the bolts.
9. After several hours of running, retighten the nuts.

RIPPER POINTS FOR WEAR

WARNING

It is dangerous if the work equipment moves during the replacement operation. Set the work equipment in a stable condition, then stop the engine.

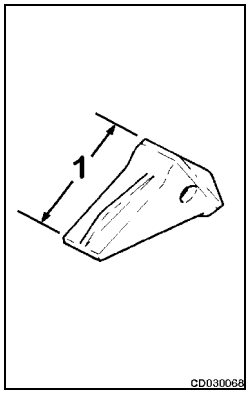


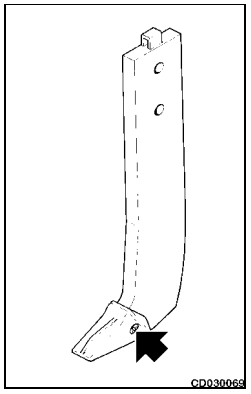
1. Raise the ripper to a proper height and apply a block to the frame so as to prevent it from coming down.
2. Measure the wear of the ripper point in accordance with the wear standards given below.

Wear Standards

Unit: mm (in)

Item		Judgement standard	
No.	Measurement point	Standard dimension	Repair limit
1	Ripper point	330 (13)	220 (8.6)



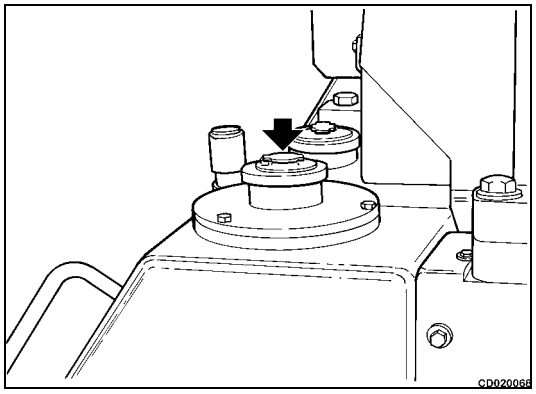


3. If the part is worn, replace it with a new one.
4. Using a hammer, remove the point pin in the direction shown by arrow, then clean the mounting surfaces. Install new point. If the point pin is damaged replace with new.

HYDRAULIC RESERVOIR STRAINERS

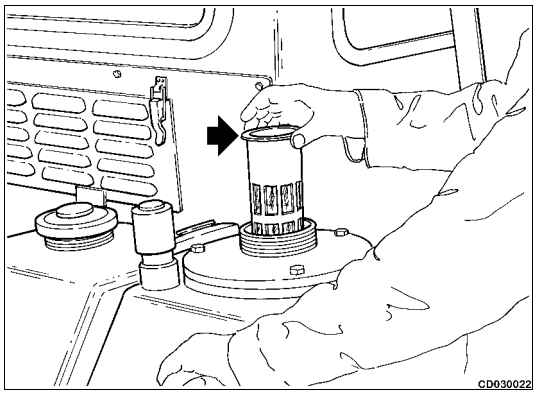
WARNING

Pressurized Reservoir. Always loosen the locking cap slowly in case there is still some pressure in the system.



1. Slowly loosen and remove reservoir locking cap to relieve reservoir pressure, see “LOCKING CAP” on page 2-29

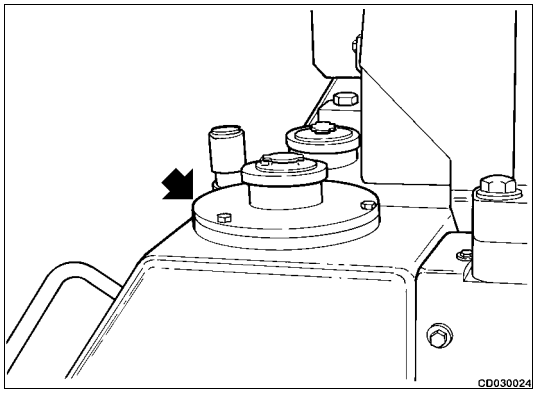
2. The filler screens the oil entering the tank and eases the job of the filter. Remove and clean the screen with a nonflammable commercial cleaning solvent. Install the screen in the reservoir and mount locking cap.



⚠ WARNING

Fire hazard - do not use kerosene, diesel fuel or flammable liquids to clean parts. A spark or a flame could cause a fire or an explosion. Use a nonflammable commercial solvent.

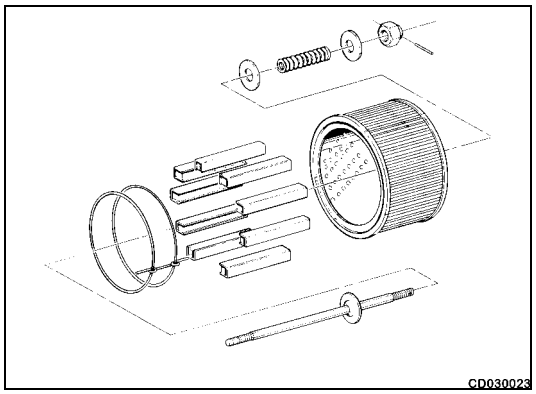
3. Remove reservoir top cover and discard o-ring. Using a M24 socket and extension, remove strainer assembly from reservoir.



4. Clean the strainer with a nonflammable commercial cleaning solvent. Install the strainer in the reservoir and mount reservoir top cover with new o-ring to reservoir.

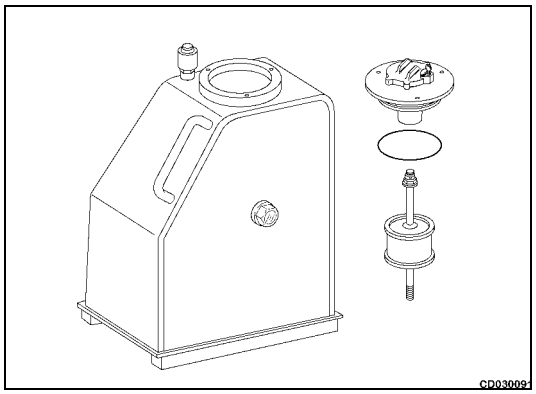
Remark

The strainer does not have to be disassembled for cleaning.



⚠ WARNING

Fire hazard - do not use kerosene, diesel fuel or flammable liquids to clean parts. A spark or a flame could cause a fire or an explosion. Use a nonflammable commercial solvent.



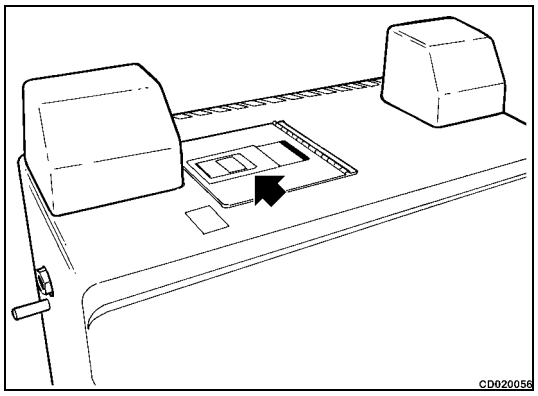
DRAIN, FLUSH AND REFILL COOLING SYSTEM

WARNING

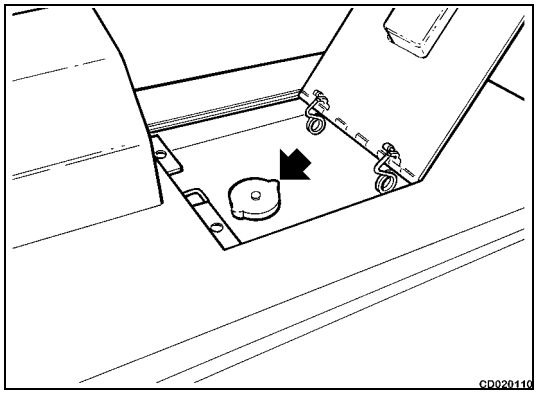
- **Soon after the engine has been stopped, the coolant is hot and can cause personal injury. Allow the engine cool before draining the coolant.**
- **Never remove the radiator cap when the engine is at operating temperature. At operating temperature, the coolant is under pressure. Steam blowing up from the radiator could cause personal injury. Allow the engine to cool until the radiator filler cap is cool enough to touch with your hands. Remove the filler cap slowly to relieve pressure.**
- **Never be under the machine with the engine running. To avoid serious injury, always stop the engine before being under the machine to open the drain valve.**
- **When removing drain plug, avoid pouring coolant on yourself.**
- **Antifreeze is flammable, so keep it away from any flame.**
- **Flushing agents, neutralizing agents, and anticorrosive 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**

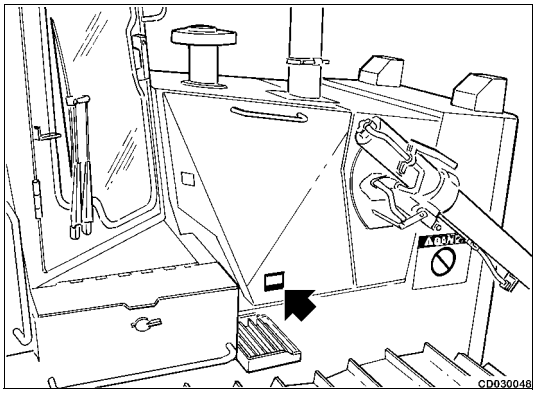
Draining the System

1. Turn the radiator cap slowly and remove it.



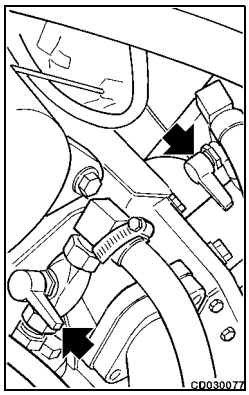
2. Open the right engine access door.

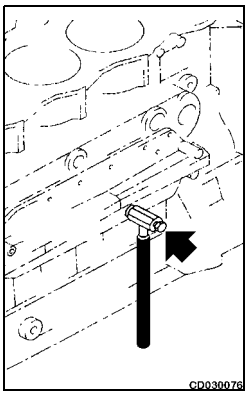




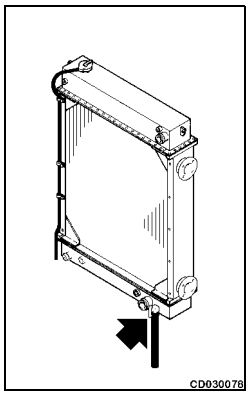
3. Open the heater valves.

4. Attach a drainage hose of suitable length to the engine oil cooler drain valve. Open the valve and allow the coolant to drain into a suitable container.





5. Open the radiator drain valve. Allow the system to completely drain into a suitable container. Do not let drain outlets plug up during draining. Close the radiator drain valve and engine oil cooler drain valve.



Flushing the System

1. Be sure the radiator drain valve and engine oil cooler drain valve are closed and tightened. Fill the system with clean water and add a flushing compound that is compatible with aluminum. Flush the system in accordance with the instructions furnished with the compound.

2. After flushing, rinsing and completely draining the system, refill with clean coolant, see the following.

Refilling the System

1. Be sure the radiator drain valve and engine oil cooler drain valve are closed and tightened. Fill the cooling system to maximum capacity. Fill with antifreeze according to the instructions printed on the container. For details of the fluid to use, see “USE OF FUEL, COOLANT AND LUBRICANTS” on page 3-7

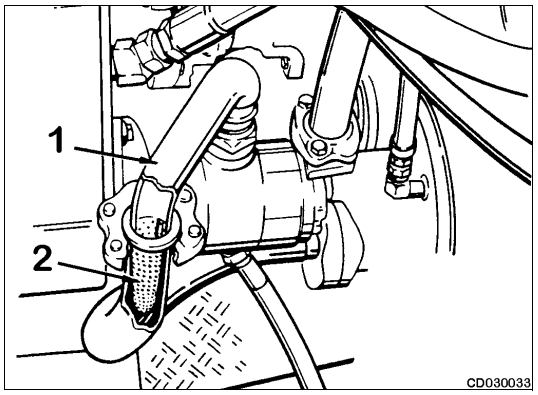
2. Start engine and run until normal operating temperature is reached. Add coolant to keep the proper level at the bottom of the filler neck tube.After all air is removed and level remains fixed, install the radiator cap.

TRANSMISSION SCAVENGER SCREEN

1. To gain access to the oil strainer first remove the center cover in floor of cab. Disconnect the transmission scavenger hose (1) from the intake pipe (2). Remove the screen from the hose.

2. Clean the screen with a nonflammable commercial cleaning solvent. Reinstall the screen into hose (1). Reinstall the transmission scavenger hose to the pipe (2). Make sure that the screen is properly seated in the hose.

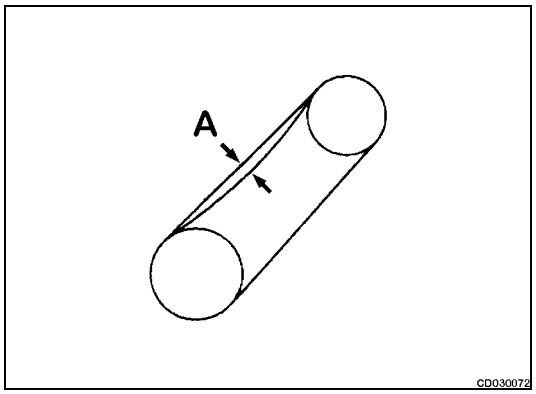
3. Reinstall the center cover.



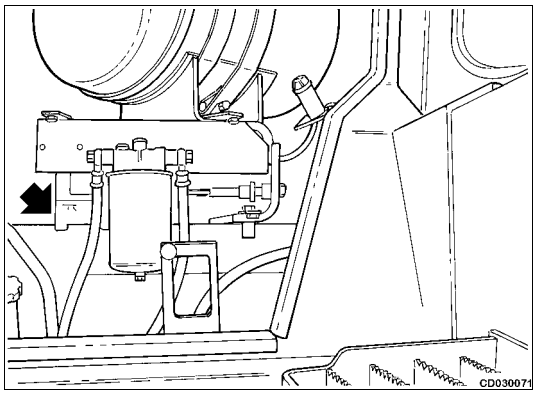
CHECKING TENSION OF COMPRESSOR BELT

If the belt is loose, it will slip and the cooling effect will be reduced. From time to time, press a point midway between the drive pulley and compressor pulley with your finger ≈ 10 kgf (22 lbf) and check that the deflection (**A**) is 15 to 18 mm (0.6 to 0.7 in).

When the belt is new, there will be initial elongation, so always adjust again after 2 or 3 days.



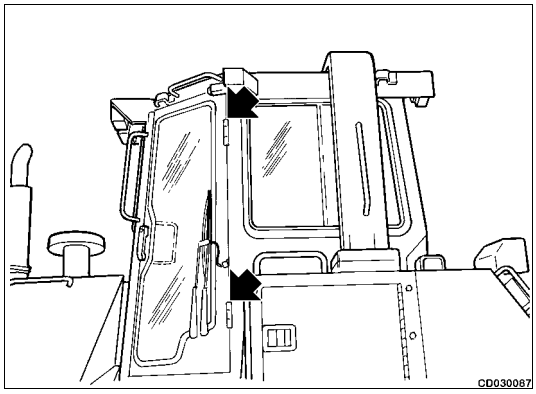
ELECTRIC INTAKE AIR HEATER



Before the start of the cold season (once a year), contact your distributor to have the electrical air intake heater checked or repaired for dirt or disconnections.

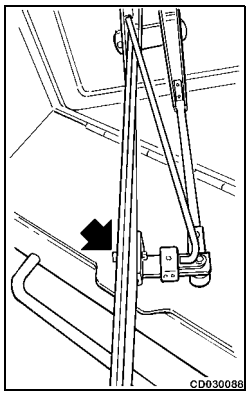
When inspecting or replacing the electrical air heater, replace the gaskets with new ones.

GREASE CAB DOOR HINGES 2 FITTINGS per door



Apply grease until clean lubricant is visible. Always use a clean lubricator and wipe dirt from fittings before fresh grease is applied. If grease fails to go through the fitting, determine the cause and correct it. After greasing, wipe off any old grease that was purged.

CHECK WIPER BLADES

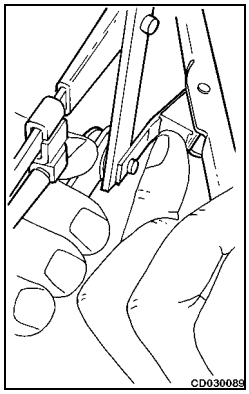


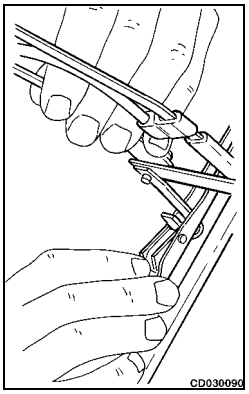
Check the condition of the wiper blades and replace as necessary.

Door Wipers

1. Fold the wiper blade down. Remove the mounting screw and nut, then the blade.
2. Position a new blade to the wiper arm and secure with the screw and nut.

Front and Rear Wipers





1. The blade is hooked to the wiper arm. Unclick the center hinge and push off of arm. Lift the blade out to clear the center hinge and remove.
2. To install, reverse step 1.

MEMORANDA

SPECIFICATIONS

SPECIFICATIONS AND DIMENSIONS

SPECIFICATIONS

					D87E-2		D87P-2
					Semi U Blade	Angle Blade	Straight Blade
WEIGHT - Includes blade equipment, ROPS, cab, standard equipment and full capacity of lubricants, coolant and fuel.							
• Operating weight w/o operator	kg (lbs)				23998 (52885)	24326 (53630)	25909 (57120)
BLADE							
• Equipment weight, with cylinders	kg (lbs)				2902 (6390)	3230 (7120)	2756 (6075)
• Blade capacity	m^3 (yd^3)				7.04 (9.2)	3.88 (5.07)	6.03 (7.89)
RIPPER							
• Ripper weight, with cylinders and 1 shank	kg (lbs)				2900 (6400)		---
• Each additional shank	kg (lbs)				190 (240)		---
PERFORMANCE							
• Travel speeds	km/h (mph)	Forward	1st	Lo	2.7 (1.7)		
				Hi	3.7 (2.3)		
			2nd	Lo			5.0 (3.1)
				Hi	6.6 (4.1)		
			3rd	Lo	8.1 (5.0)		
				Hi			10.3 (6.4)
		Reverse	1st	Lo	3.4 (2.1)		
				Hi	4.4 (2.7)		
			2nd	Lo			6.0 (3.7)
				Hi	7.7 (4.8)		
			3rd	Lo	9.5 (5.9)		
				Hi			12.1 (7.5)
• Maximum drawbar pull	kg (lbs)				60000 (132277)		
• Ground pressure @	560 mm (22 in) shoe				0.69 (9.9)	0.701 (10.07)	---
kg/cm^2 (psi)	610 mm (24 in) shoe				0.64 (9.1)	0.65 (9.3)	---
	660 mm (26 in) shoe				0.59 (8.5)	0.60 (8.6)	---
	914 mm (36 in) shoe				---	---	0.41 (5.9)

@ Includes blade equipment, ROPS, cab, standard equipment, shoes as shown, and full capacity of lubricants, coolant and fuel.

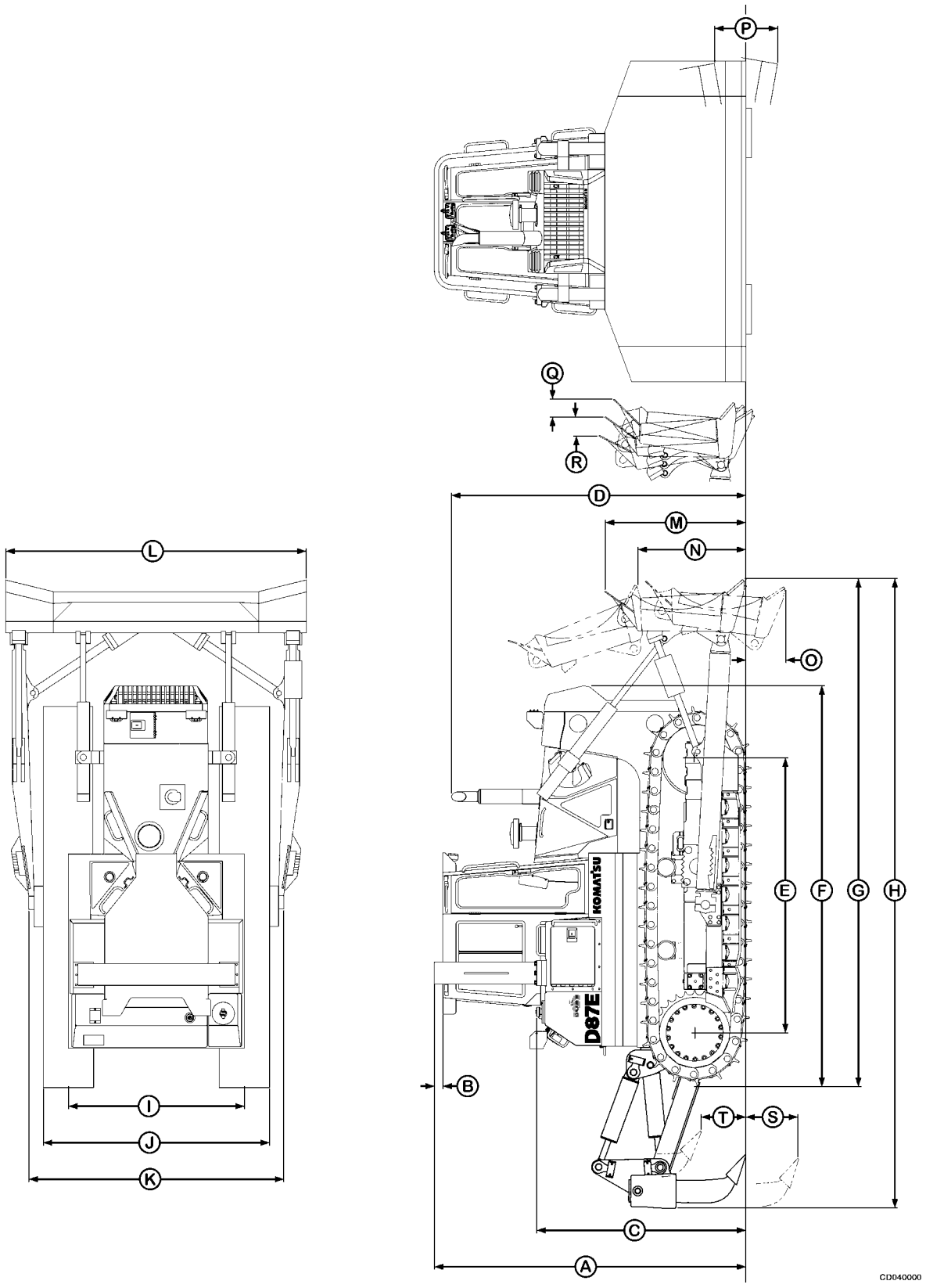
		D87E-2		D87P-2
		Semi U Blade	Angle Blade	Straight Blade
ENGINE				
• Model		Komatsu S6D125E-2 Diesel Engine		
• Flywheel horse	kW (hp)	172 (230) @ 2100 RPM		
• Maximum torque	N•m (lbf ft)	999 (737) @ 1400 RPM		
• Starting motor		24V		
• Alternator		24V @ 50A		
• Battery	Standard	12V x 2 @ 625 CCA		
	Optional	12V x 2 @ 950 CCA		

D87E-2 DIMENSIONS

SEMI U DOZER

On machine height dimensions, 66.55 mm (2.62 in) has been added. This represents the track shoe grouser height.

Ref	Description		mm	in
A	Height, ground to top of ROPS		3569	141
B	Height, top of cab to top of ROPS		98	4
C	Height, fuel tank refill		2322	92
D	Height, exhaust stack		3378	133
E	Length, center of final drive to center of front idler		3079	121
F	Length, nose of mask to rear track chain		4513	178
G	Length, blade to drawbar		5920	233
H	Length, blade to ripper		6970	275
I	Width, track gauge		1981	78
J	Width, across track shoes	560 mm (22 in) shoe	2541	100
		610 mm (24 in) shoe	2591	102
		660 mm (26 in) shoe	2641	104
K	Width, including trunnions		2896	114
L	Width, blade		3480	137
M	Height, top of blade		1600	63
N	Height, full blade raise		1187	47
O	Height, full blade lower		440	17
P	Angle, blade tilt		25°	25°
Q	Angle, forward pitch		9°	9°
R	Angle, rearward pitch		9°	9°
S	Height, ripper lower		599	24
T	Height, ripper raised		686	27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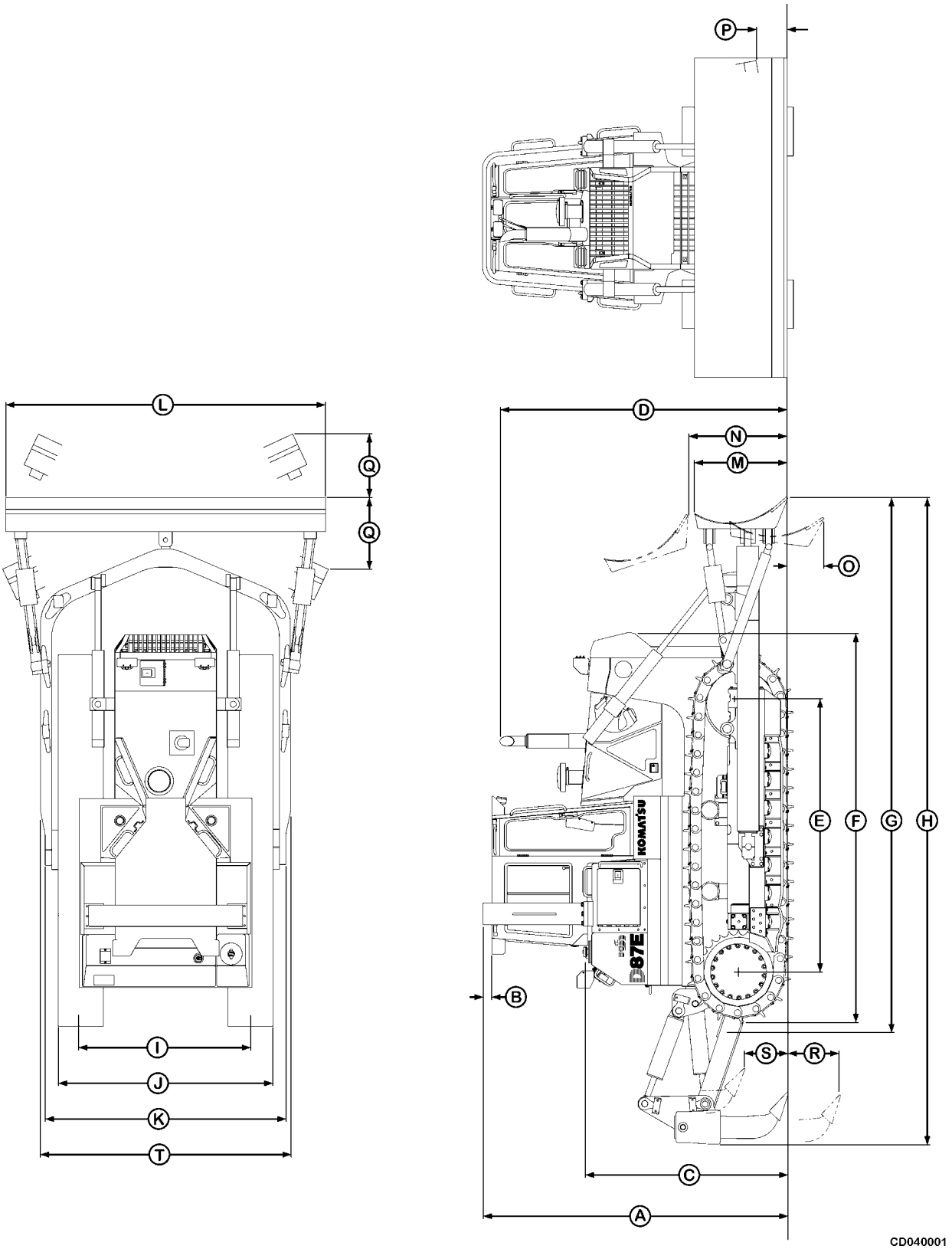
STRAIGHT ANGLE DOZER

On machine height dimensions, 66.55 mm (2.62 in) has been added. This represents the track shoe grouser height.

Ref	Description		mm	in
A	Height, ground to top of ROPS		3569	141
B	Height, top of cab to top of ROPS		98	4
C	Height, fuel tank refill		2322	92
D	Height, exhaust stack		3372	133
E	Length, center of final drive to center of front idler		3079	121
F	Length, nose of mask to rear track chain		4513	178
G	Length, blade to drawbar		6129	241
H	Length, blade to ripper		7271	286
I	Width, track gauge		1981	78
J	Width, across track shoes	560 mm (22 in) shoe	2541	100
		610 mm (24 in) shoe	2591	102
		660 mm (26 in) shoe	2641	104
K	Width, including trunnions		2896	114
L	Width, blade		4420	174
M	Height, top of blade		1092	43
N	Height, full blade raise	Blade straight	1219	48
		Blade angled	1542	60
O	Height, full blade lower		550	21.6
P	Angle, blade tilt		6.7°	6.7°
Q	Angle, left or right blade		25°	25°
R	Height, ripper lower		599	24
S	Height, ripper raised		686	27
T	Width over C frame		3175	125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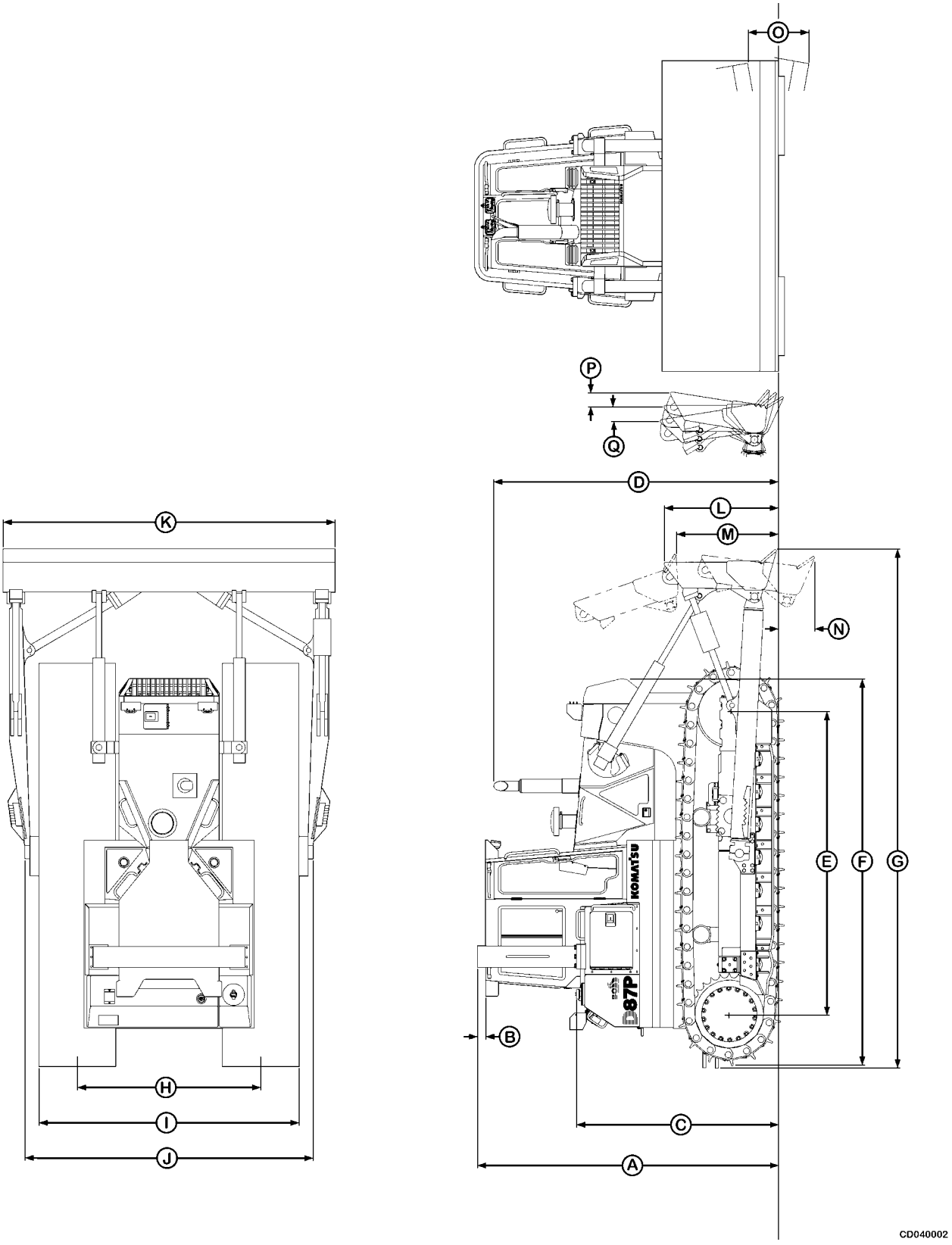
D87P-2 DIMENSIONS

STRAIGHT DOZER

On machine height dimensions, 66.55 mm (2.62 in) has been added. This represents the track shoe grouser height.

Ref	Description		mm	in
A	Height, ground to top of ROPS		3569	141
B	Height, top of cab to top of ROPS		98	4
C	Height, fuel tank refill		2322	92
D	Height, exhaust stack		3372	133
E	Length, center of final drive to center of front idler		3397	134
F	Length, nose of mask to rear track chain		4513	178
G	Length, blade to drawbar		5690	224
H	Width, track gauge		2230	88
I	Width, across track shoes	864 mm (34 in) swamp shoe	3099	122
		914 mm (36 in) shoe	3144	124
J	Width, including trunnions		3328	131
K	Width, blade		4370	172
L	Height, top of blade		1350	53
M	Height, full blade raise		1260	50
N	Height, full blade lower		662	26
O	Angle, blade tilt		25°	25°
P	Angle, forward pitch		9°	9°
Q	Angle, rearward pitch		9°	9°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MEMORANDA

OPTIONS, ATTACHMENTS

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 & Maintenance Manual, please contact your distributor first. If you do not contact them, 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.**
- **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 lbs), 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.**
- **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.**
- **Never go under a load suspended from a crane. Always stand in a position that is safe even if the load should fall.**

Remark

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 distributor

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