

DX35Z

Operation and Maintenance Manual

K1025196E

Serial Number 5001 and Up

September 2006

DOOSAN reserves the right to improve its products continuously, delivering the best possible product to the marketplace. These improvements can be implemented at any time with no obligation to change materials previously sold. It is recommended that consumers periodically contact their distributors for most recent documentation on purchased equipment.

This documentation may include attachments and optional equipment not available in your machine's package. Please call your distributor for additional items that you may require.

Illustrations used throughout this manual are used only as a representation of the actual piece of equipment, and may vary from the actual item.

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Safety

TO THE OPERATOR OF A DOOSAN DAEWOO EXCAVATOR



DANGER!

Unsafe use of the excavator could lead to serious injury or death. Operating procedures, maintenance and equipment practices or traveling or shipping methods that do not follow the safety guidelines on the following pages could cause serious, potentially fatal injuries or extensive damage to the machine or nearby property.

Please respect the importance of taking responsibility for your own safety, and that of other people who may be affected by your actions.

The safety information on the following pages is organized into the following sections:

1. "Location of Safety Labels" on page 1-5
2. "Summary of Safety Precautions for Lifting in Digging Mode" on page 1-13
3. "Unauthorized Modifications" on page 1-14
4. "General Hazard Information" on page 1-14
5. "Before Starting Engine" on page 1-24
6. "Machine Operation" on page 1-28
7. "Maintenance" on page 1-36
8. "Battery" on page 1-44
9. "Towing" on page 1-46
10. "Shipping and Transportation" on page 1-47
11. "Excavator Rated Lift Capacity Tables" on page 1-48



WARNING!

Improper operation and maintenance of this machine can be hazardous and could result in serious injury or death.

Operator and maintenance personnel should read this manual thoroughly before beginning operation or maintenance.

Keep this manual in the storage compartment to the rear of the operator's seat, and have all personnel involved in working on the machine read the manual periodically.

Some actions involved in operation and maintenance of the machine can cause a serious accident, if they are not done in a manner described in this manual.

The procedures and precautions given in this manual apply only to intended uses of the machine.

If you use your machine for any unintended uses that are not specifically prohibited, you must be sure that it is safe for any others. In no event should you or others engage in prohibited uses or actions as described in this manual.

DOOSAN delivers machines that comply with all applicable regulations and standards of the country to which it has been sent. If this machine has been purchased in another country or purchased from someone in another country, it may lack certain safety devices and specifications that are necessary for use in your country. If there is any question about whether your product complies with the applicable standards and regulations of your country, consult *DOOSAN* or your *DOOSAN* distributor before operating the machine.



SAFETY ALERT SYMBOL



Be Prepared - Get to Know All Operating and Safety Instructions.

This is the Safety Alert Symbol. Wherever it appears in this manual or on safety signs on the machine you should be alert to the potential for personal injury or accidents. Always observe safety precautions and follow recommended procedures.

Learn the Signal Words Used with the Safety Alert Symbol

The words "CAUTION," "Warning," and "DANGER" used throughout this manual and on decals on the machine indicate degree of risk of hazards or unsafe practices. All three degrees of risk indicate that safety is involved. Observe precautions indicated whenever you see the Safety Alert "Triangle," no matter which signal word appears next to the "Exclamation Point" symbol.



CAUTION!

This word is used on safety messages and safety labels and indicates potential threat of a hazardous situation that, if not avoided, could result in minor or moderate injury. It may also be used to alert against a generally unsafe practice.



WARNING!

This word is used on safety messages and safety labels and indicates potential threat of a hazardous situation that, if not avoided, could result in serious injury or death. It may also be used to alert against highly unsafe practice.



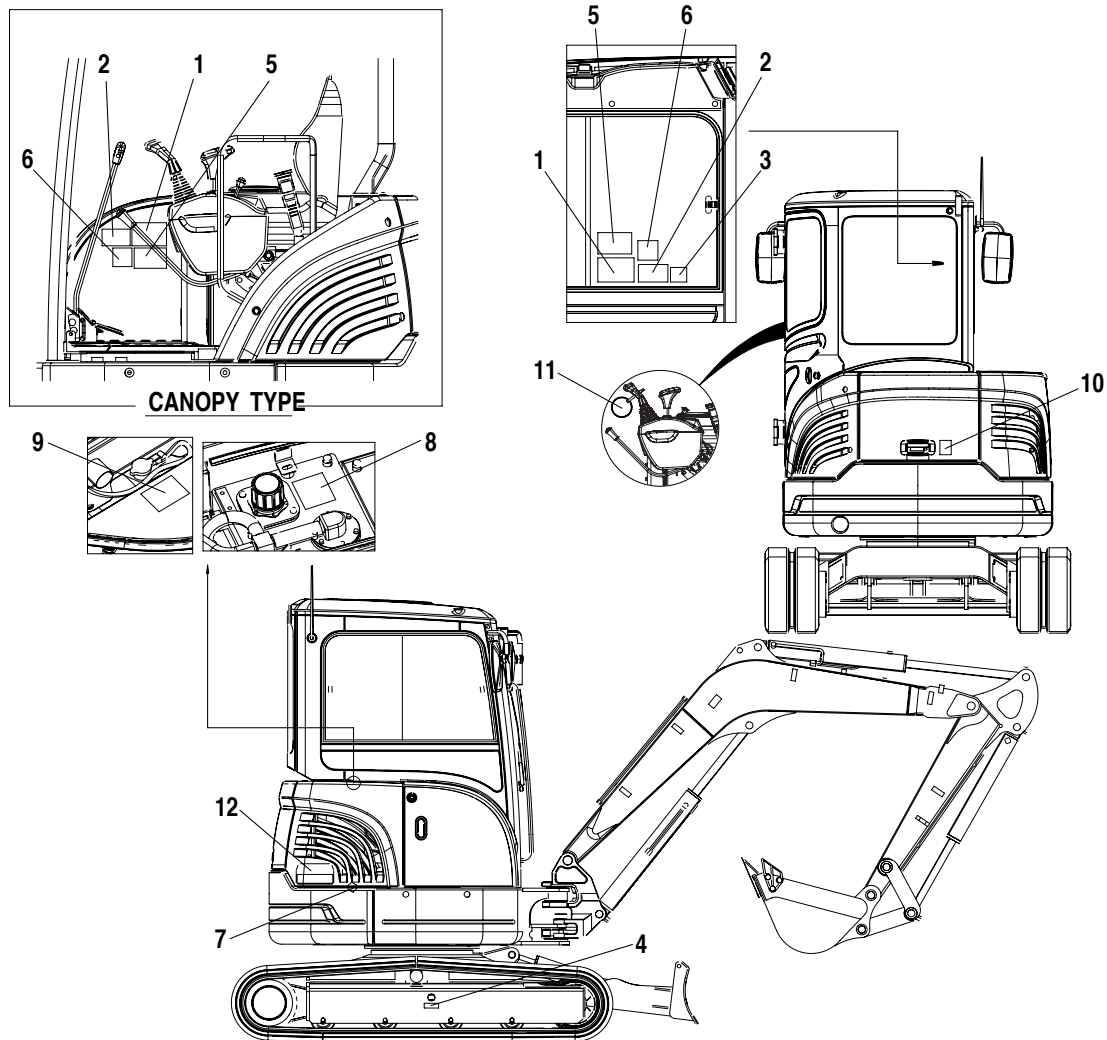
DANGER!

This word is used on safety messages and safety labels and indicates an imminent hazard of a situation that, if not avoided, is very likely to cause death or extremely serious injury. It may also be used to alert against equipment that may detonate or explode if handled or treated carelessly.

Safety precautions are described in SAFETY from page 1-5 on.

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

LOCATION OF SAFETY LABELS



FG007474

Figure 1

There are several specific warning signs on this machine. The exact location of hazards and the description of the hazards are reviewed in this section.

Please become familiarized with all warning signs.

Make sure that all the warning signs are legible. Clean the warning signs or replace the warning signs if you cannot read the words. Replace the illustrations if the illustrations are not visible. When you clean the warning signs, use a cloth, water and soap. Do not use solvent, gasoline, or other harsh chemicals to clean the safety signs. Solvents, gasoline, or other harsh chemicals could loosen the adhesive that secures the warning sign. Loose adhesive will allow the warning sign to fall off.

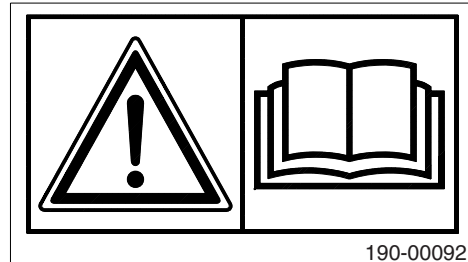
Replace any safety sign that is damaged, or missing. If a safety sign is attached to a part that is replaced, install a safety sign on the replacement part.

1. Warnings for Operation, Inspection and Maintenance (190-00688, 190-00092)

⚠ WARNING

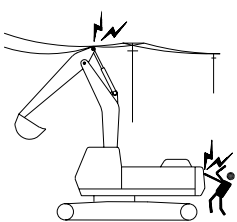
- AVOID DEATH OR SERIOUS INJURY. - READ AND UNDERSTAND OPERATION MANUAL AND SAFETY LABELS prior to operating this machine.
- Never get in under the machine while it is being jacked up with boom and arm.
- Sound the horn to alert the people nearby before operating, and make sure that all persons are clear of area.
- Controls may be changed for attachments or operator preference. Try control pattern before operating.

190-00688



ARO1080L

2. Warnings for High Voltage (190-00689, 190-00096)

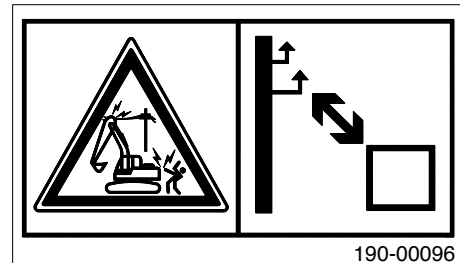


⚠ DANGER

SERIOUS INJURY OR DEATH BY ELECTROUTION can occur if machine or attachments are not a safe distance from electrical power lines.

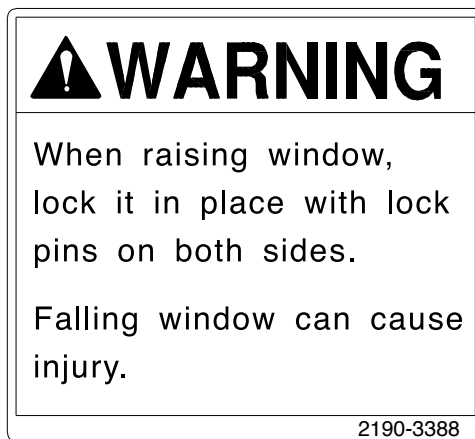
Line voltage	Safe Distance
6.6 kv	At least 3m(10ft)
66.6 kv	At least 5m(16ft)
275.0 kv	At least 10m(33ft)

190-00689



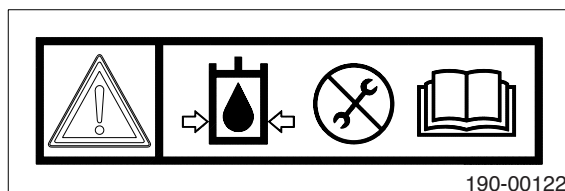
ARO1090L

3. Warnings When Opening a Front Window (2190-3388, 190-00093)



FG000665

4. Warnings for a High-pressure Cylinder (190-00122)



ARO1110L

5. Warnings When Adjusting Track Tension (2190-3386A, 190-00521)

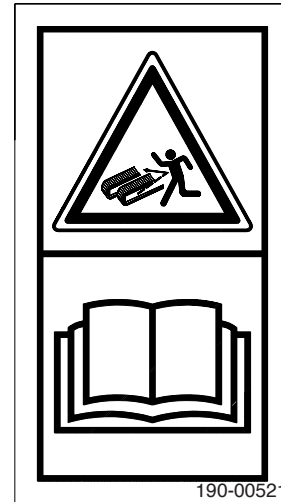


WARNING

The track adjuster adjustment and handling

- The spring in the track adjuster is loaded with great force and the pressure in the cylinder is very high. For this reason there is a possibility of an accident which may involve injury to personnel. It is very dangerous to make mistakes when performing such an adjustment or disassembly.
- Be sure to read the procedures described in the Operation and Maintenance Manual carefully before adjusting the track tension.

2190-3386A



ARO1120L

6. Warnings for Leaving Operator's Seat (190-00693, 190-00094)



WARNING

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

Always make sure when leaving operator's seat to :

- Lower equipment to the ground.
- Move safety lever to LOCK position.
- Turn key switch OFF. Remove key from switch.

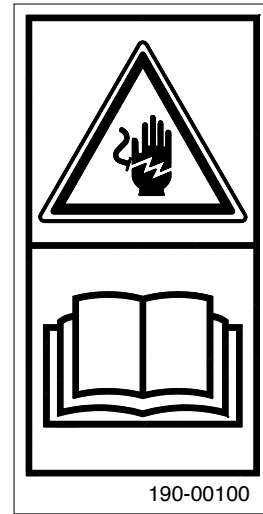
190-00693



ARO1140L

7. Warnings for Batteries Maintenance (2190-2533A, 190-00100)

⚠ DANGER • Battery fumes can explode. Keep sparks and flames away from batteries. • Always avoid storing metals like tools or flammable materials around or on the batteries. Explosion or fire can be caused by shortcircuiting batteries. • Sulfuric acid in battery is poisonous. It is strong enough burn skin, eat holes in clothing, and cause blindness if splashed eyes. If you spill acid on yourself; 1. Flush your skin with water. 2. Apply baking soda or lime to help neutralize the acid. 3. Flush your eyes with water for 10-15 minutes. Get medical attention immediately.
2190-2533A



ARO1150L

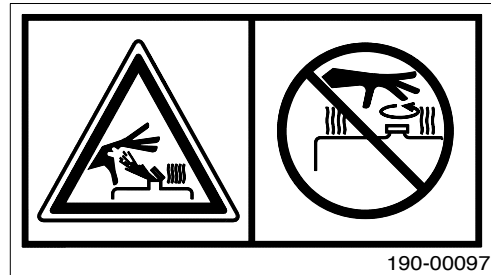
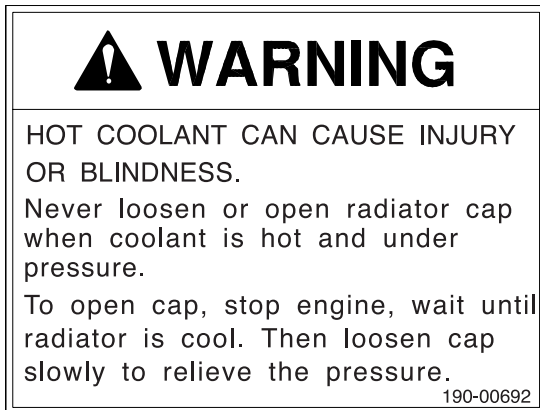
8. Warnings for High Temperature Hydraulic Oil (190-00691, 190-00097)

⚠ WARNING HYDRAULIC OIL HOT OIL CAN CAUSE INJURY OR BLINDNESS. To prevent hot oil from spurting out: • Turn engine off • Allow oil to cool • Slowly loosen cap to relieve pressure
190-00691



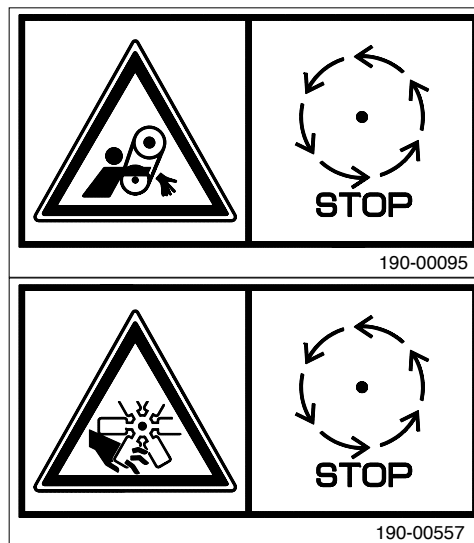
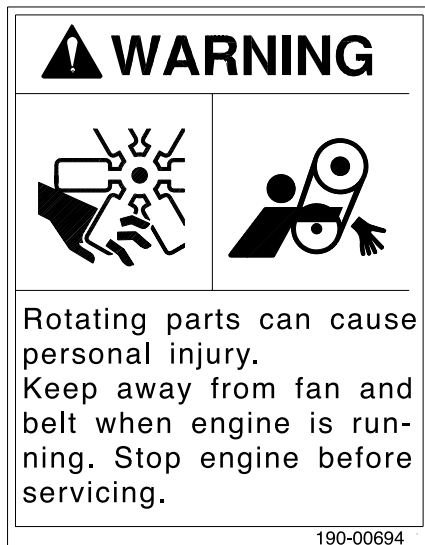
ARO1160L

9. Warnings for Hot Coolant (190-00692, 190-00097)



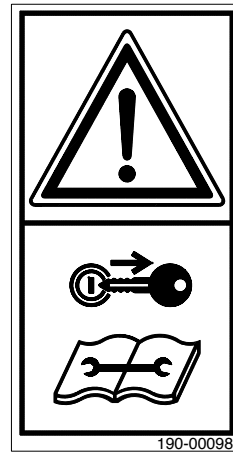
ARO1170L

10. Warnings for Rotating Parts (190-00694, 190-00095, 190-00557)



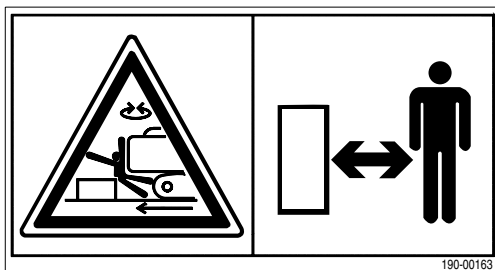
ARO1190L

11. Warning Tag - Used When Inspection and Maintenance (190-00695, 190-00098)



ARO1200L

12. Keep Out of the Swing Area (2190-3380A, 190-00163)



FG008064

SUMMARY OF SAFETY PRECAUTIONS FOR LIFTING IN DIGGING MODE



DANGER!

Unsafe use of the excavator while making rated lifts could cause serious, potentially fatal injuries or extensive damage to the machine or nearby property. Do not let anyone operate the machine unless they've been properly trained and understand the information in the Operation and Maintenance Manual.

To lift safely while in Digging Mode, the following items must be evaluated by the operator and the work site crew.

- Condition of ground support.
- Excavator configuration and attachments.
- Weight, lifting height and lifting radius.
- Safe rigging of the load.
- Proper handling of the suspended load.

Tag lines on opposite sides of the load can be very helpful in keeping a suspended load secure, if they are anchored safely to control points on the ground.



WARNING!

NEVER wrap a tag line around your hands or body.

NEVER rely on tag lines or make rated lifts when wind gusts are more than 48.3 km/h (30 MPH). Be prepared for any type of wind gust when working with loads that have a large surface area.

Always engage the "Digging Mode" control on the Instrument Panel before using the excavator for lifting work.



WARNING!

If you need more information or have any questions or concerns about safe operating procedures or working the excavator correctly in a particular application or in the specific conditions of your individual operating environment, please consult your local **DOOSAN** representative.

UNAUTHORIZED MODIFICATIONS

Any modification made without authorization or written approval from *DOOSAN* can create a safety hazard, for which the machine owner will be held responsible.

For safety's sake, replace all OEM parts with the correct authorized or genuine *DOOSAN* part. For example, not taking the time to replace fasteners, bolts or nuts with the correct replacement parts could lead to a condition where the safety of critical assemblies are dangerously compromised.

GENERAL HAZARD INFORMATION

Safety Rules

Only trained and authorized personnel can operate and maintain the machine.

Follow all safety rules, precautions and instructions when operating or performing maintenance on the machine.

Do not operate the machine if you are not feeling well, if you are taking medication that makes you feel sleepy, if you have been drinking, or if you are suffering from emotional problems. These problems will interfere with your sense of judgment in emergencies and may cause accidents.

When working with another operator or with a person on work site traffic duty, be sure that all personnel know the nature of the work and understand all hand signals that are to be used.

Always observe strictly any other rules related to safety.

Safety Features

Be sure that all guards and covers are installed in their proper position. Have guards and covers repaired immediately if damaged.

Be sure that you understand the method of use of safety features such as safety lock lever and the seat belt, and use them properly.

Never remove any safety features. Always keep them in good operating condition.

Failure to use safety features according to the instructions in the Operation and Maintenance Manual could result in serious bodily injury.

Inside Operator's Cabin

When entering the operator's cabin, always remove all mud and oil from the soles of your shoes. If you operate the travel pedal with mud or oil stuck to your shoes, your foot may slip and this may cause a serious accident.

After using the ashtray, make sure that any matches or cigarettes are properly extinguished, and be sure to close the ashtray. If the ashtray is left open, there is danger of fire.

Do not stick suction pads to the window glass. Suction pads act as a lens and may cause fire.

Do not leave lighters laying around the operator's cabin. If the temperature inside the operator's cabin becomes high, there is danger that the lighter may explode.

Do not use cellular telephones inside the operator's cabin when driving or operating the machine. There is danger that this may lead to an unexpected accident.

Never bring any dangerous objects such as flammable or explosive items into the operator's cabin.

To ensure safety, do not use the radio or music headphones when operating the machine. There is danger that this may lead to a serious accident.

When operating the machine, do not put your hands or head out of the window.

When standing up from the operator's seat, always place safety lock lever securely in the "LOCK" position. If you accidentally touch the work equipment levers when they are not locked, the machine may suddenly move and cause serious injury or damage.

When leaving the machine, lower the work equipment completely to the ground, set safety lock lever to the "LOCK" position and shut down engine. Use the key to lock all the equipment. Always remove the key and take it with you.

Clothing and Personal Protective Items

Secure long hair, and avoid loose clothing and jewelry. These items have the tendency to catch on controls or protrude into parts and cause serious injury or death.

Do not wear oily clothes. They are highly flammable.

Full eye protection, a hard hat, safety shoes and gloves may be required at the work site.

While working on the machine, never use inadequate tools. They could break or slip, causing injury, or they may not adequately perform intended functions.

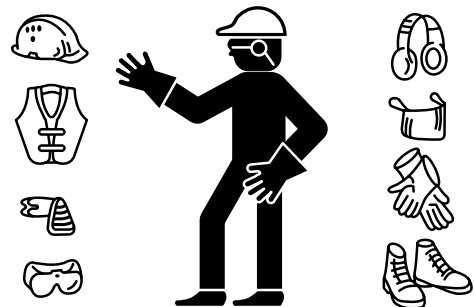


Figure 2

HAOA020L

Breathing Masks, Ear Protection May Be Required

Do not forget that some risks to your health may not be immediately apparent. Exhaust gases and noise pollution may not be visible, but these hazards can cause disabling or permanent injuries.

NOTE: *The equivalent continuous A-weighted sound pressure level at the workstation for this machine is 76 dB(A).*

Measurement is obtained on a dynamic machine following the procedures and cabin conditions as described in ISO 6396.

NOTE: *The guaranteed sound power level emitted by the machinery for this machine is 94 dB(A).*

Measurement is obtained on a dynamic machine with the procedures as described in 2000/14/EC.

Vibration Level Information

Hands/Arms: The weighted root mean square acceleration to which the hands/arms are subjected, is less than 2.5 m/s^2 .

Whole body: The weighted root mean square acceleration to which the whole body is subjected, is less than 0.5 m/s^2 .

Measurements are obtained on a representative machine, using measuring procedures as described in the following standard: ISO 2631/1, ISO 5349, and SAE J1166.

Recommendations for Limiting Vibrations

1. Select the right machine, equipment and attachments for a particular application.
2. Replace any damaged seat by a *DOOSAN* genuine part. Keep the seat maintained and adjusted.
 - Adjust the seat and suspension for the weight and size of the operator.
 - Inspect and maintain the suspension and adjustment mechanisms of the seat regularly.
3. Check that the machine is properly maintained.
 - Tire pressure, brakes, steering, linkages, etc.
4. Steer, brake, accelerate, shift gears, move the attachments and load the attachments smoothly.
5. Adjust the machine speed and travel path to reduce the vibration level.
 - Slow down if it is necessary when traveling through rough terrain.
 - When driving machine, avoid obstacles and excessive rough terrain.
6. Keep the machine on terrain where working and traveling conditions are good.
 - Remove any large rocks or obstacles.
 - Fill any ditches and holes.
 - Provide machines for and schedule time to maintain good terrain conditions.
7. Travel over longer distance (e.g. on public roads) at adjusted (medium) speed.
 - Always adjust the speed to prevent bouncing.

Mounting and Dismounting

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

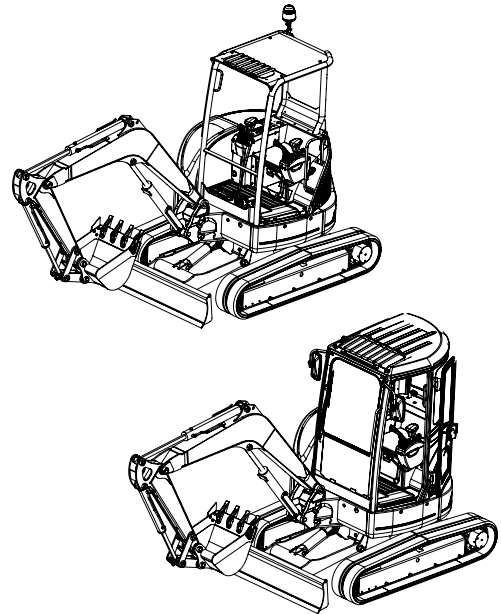
Never jump on or off the machine. In particular, never get on or off a moving machine. These actions may lead to serious injury.

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

Never hold any control levers when getting on or off the machine.

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

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



FG006339

Figure 3

Fuel, Oil and Hydraulic Fluid Fire Hazards

Fuel, oil and antifreeze will catch fire if it is brought close to a flame. Fuel is particularly flammable and can be hazardous.

Always strictly observe the following.

Add fuel, oil, antifreeze and hydraulic fluid to the machine only in a well ventilated area. The machine must be parked with controls, lights and switches turned "OFF." The engine must be "OFF" and any flames, glowing embers, auxiliary heating units or spark causing equipment must be extinguished, turned "OFF" and/or kept well clear of the machine.

Static electricity can produce dangerous sparks at the fuel filling nozzle. In very cold, dry weather or other conditions that could produce a static discharge, keep the tip of the fuel nozzle in constant contact with the neck of the fuel filling nozzle, to provide a ground.

Keep fuel and other fluid reservoir caps tight and do not start the engine until caps have been secured.



ARO1050S

Figure 4

Precautions When Handling Fluids at High Temperature

Immediately after operations are stopped, the coolant, engine oil, and hydraulic oil are at highest temperatures and the radiator and hydraulic tank 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.



HAOA050L

Figure 5

To prevent hot coolant from spurting out, shut down engine, wait for the coolant to cool, then loosen the cap slowly to relieve the pressure.

To prevent hot oil from spurting out, shut down engine, wait for the oil to cool, then loosen the cap slowly to relieve the pressure.



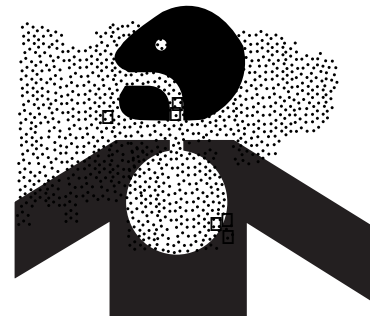
HAOA060L

Figure 6

Asbestos Dust Hazard Prevention

Asbestos dust can be HAZARDOUS to your health if it is inhaled. Materials containing asbestos fiber can be present on work site. Breathing air that contains asbestos fiber can ultimately cause serious or fatal lung damage. To prevent lung damage from asbestos fiber, observe following precautions:

- Use a respirator that is approved for use in an asbestos-laden atmosphere.
- Never use compressed air for cleaning.
- Use water for cleaning to keep down the dust.
- Work on the machine or component with the wind at your back whenever possible.
- Always observe any regulations related to the work site and working environment.



ARO1770L

Figure 7

Injury from Work Equipment

Do not enter or put your hand, 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 control levers are operated, the clearance between the machine and the work equipment will change and this may lead to serious damage or personal injury.

If going between movable parts is necessary, always position and secure the work equipment so it cannot move.



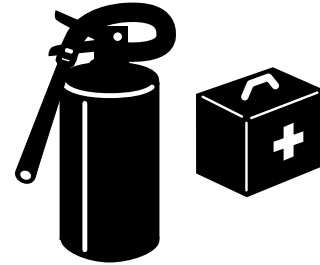
HDO1010L

Figure 8

Fire Extinguisher and First Aid Kit

As a precaution if any injury or fire should occur, always do the following.

- Be sure that fire extinguishers have been provided and read the labels to ensure that you know how to use them. It is recommended that an appropriately sized (2.27 kg [5 lb] or larger) multipurpose "A/B/C" fire extinguisher be mounted in the cabin. Check and service the fire extinguisher at regular intervals and make sure that all work site crew members are adequately trained in its use.
- Provide a first aid kit in the storage compartment and keep another at the work site. Check the kit periodically and make any additions if necessary.
- Know what to do in case of injury from fire.
- Keep emergency numbers for doctor, ambulance service, hospital and fire department near your telephone.



HDO1009L

Figure 9

If the machine catches fire, it may lead to serious personal injury or death. If a fire occurs during operation, escape from the machine as follows:

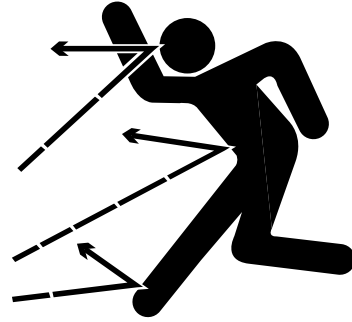
- Turn the starter switch to the "O" (OFF) position and shut down engine.
- If there is time, use the fire extinguisher to extinguish as much of the fire as possible.
- Use the handrails and steps to escape from the machine.

The above is the basic method for escaping from the machine, but changing the method may be necessary according to the conditions, so carry out practice drills at the work site.

Protection from Falling or Flying Objects

On work sites where there is danger that falling objects or flying objects may hit the operator's cabin select a guard to match the operating conditions to protect the operator.

Working in mines, tunnels, deep pits or on loose or wet surfaces could produce danger of falling rock or hazardous flying objects. Additional protection for the operator's cabin could be required in the form of a FOPS (Falling Object Protective Structure) or window guards.



HAOA110L

Figure 10

Never attempt to alter or modify any type of protective structure reinforcement system, by drilling holes, welding, remounting or relocating fasteners. Any serious impact or damage to the system requires a complete integrity reevaluation. Reinstallation, recertification and/or replacement of the system may be necessary.

Contact your *DOOSAN* distributor for available safety guards and/or recommendations to prevent danger of getting hit by objects that could strike the operator's cabin. Make sure that all other work site crew members are kept well away from the excavator and safe from possible hazards.

For breaker operation, install a front guard and apply a laminated coating sheet to the front glass. Contact your *DOOSAN* distributor for recommendations.

When carrying out demolition or cutting operation, install a front guard and top guard, and apply a laminated coating sheet to the front glass.

When working in mines or quarries where there is danger of falling rock, install FOPS (Falling Objects Protective Structure) and apply a laminated coating sheet to the front glass.

If any glass on the machine is broken, replace it with new glass immediately.



HAOA100L

Figure 11

Attachment Precautions

Option kits are available through your dealer. Contact *DOOSAN* for information on available one-way (single-acting) and two-way (double-acting) piping / valving / auxiliary control kits. Because *DOOSAN* cannot anticipate, identify or test all the attachments that owners may wish to install on their machines, please contact *DOOSAN* for authorization and approval of attachments, and their compatibility with optional kits.

Accumulator

The pilot control system is equipped with an accumulator. For a brief period of time after the engine has been shut down, the accumulator will store a pressure charge that may enable hydraulic controls to be activated. Activation of any controls may enable the selected function to operate under force of gravity.

When performing maintenance on the pilot control system, the hydraulic pressure in the system must be released as described in "Handling of Accumulator" on page 4-54.

The accumulator is charged with high-pressure nitrogen gas, so it is extremely dangerous if it is handled in the wrong way. Always observe the following precautions:

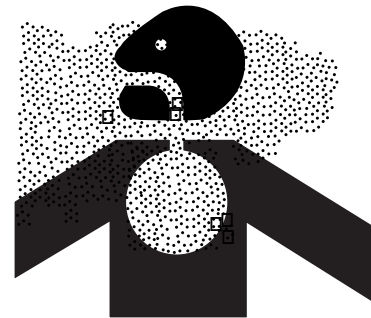
- Do not drill or make any holes in the accumulator or expose it to any flames, fire or heat source.
- Do not weld on the accumulator, or try attaching anything to it.
- When carrying out disassembly or maintenance of the accumulator, or when disposing of the accumulator, the charged gas must be properly released. Contact your *DOOSAN* distributor.
- Wear safety goggles and protective gloves when working on an accumulator. Hydraulic oil under pressure can penetrate the skin and cause serious injuries.

Indoor Ventilation

Engine exhaust gases can cause fatal accidents, and unconsciousness, loss of alertness, judgment and motor control and serious injury.

Make sure there is adequate ventilation before starting the engine in any enclosed area.

You should also be aware of open windows, doors or ductwork where exhaust may be carried, or blown by the wind, exposing others to danger.



ARO1770L

Figure 12

Emergency Exit

This machine is equipped with a glass breaking tool. It is behind the operator seat in the upper left corner of the cabin. This tool can be used in case of an emergency situation that requires the breaking of glass to exit from the operator's cabin. Grip the handle firmly and use the sharp point to break the glass.



WARNING!

Protect your eyes when breaking the glass.

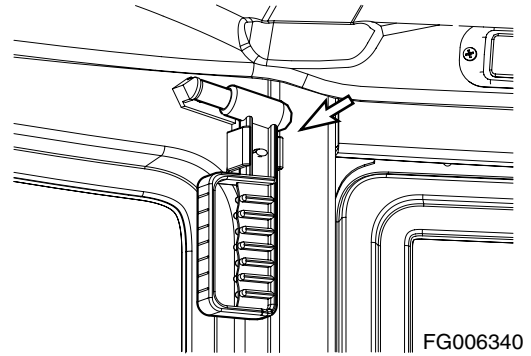


Figure 13

BEFORE STARTING ENGINE

Work Site Precautions

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

Check the terrain and condition of the ground at the work site, and determine the best and safest method of operation.

Make sure the ground surface is as hard and horizontal as possible before carrying out operations. If there is a lot of dust and sand on the work site, spray water before starting operations.

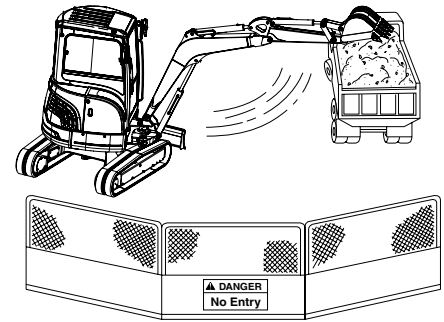
If you need to operate on a street, protect pedestrians and cars by designating a person for work site traffic duty or by erecting fences and posting "No Entry" signs around the work site.

Erect fences, post "No Entry" signs, and take other steps to prevent people from coming close to or entering the work site. If people come close to a moving machine, they may be hit or caught by the machine, and this may lead to serious personal injury or death.

Waterlines, gas lines, phone lines and high-voltage electrical lines may be buried under the work site. Contact each utility and identify their locations. Be careful not to damage or cut any of these lines.

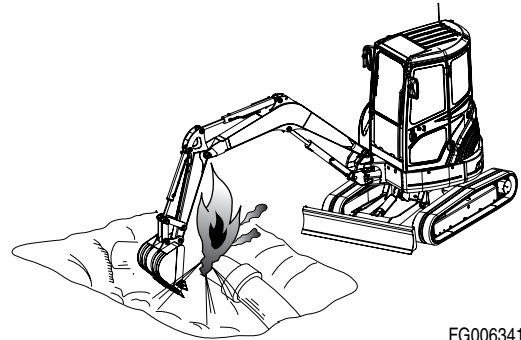
Check the condition of the riverbed, and the depth and flow of the water before operating in water or crossing a river. NEVER work in water that is more than the permissible water depth.

Any object in vicinity of boom could represent a potential hazard, or cause the operator to react suddenly and cause an accident. Use a spotter or signal person when working near bridges, phone lines, work site scaffolds, or other obstructions.



FG007481

Figure 14



FG006341

Figure 15

Minimum levels of insurance coverage, work permits or certification, physical barriers around the work site or restricted hours of operation may be mandated by governing authorities. There may also be regulations, guidelines, standards or restrictions on equipment that may have to be followed for local requirements. There may also be regulations related to performing certain kinds of work. If there is any question about whether your machine and work site complies with the applicable standards and regulations contact your local authorities and agencies.

Avoid entering soft ground. It will be difficult for the machine to escape.

Avoid operating your machine too close to the edge of cliffs, overhangs, and deep ditches. The ground may be weak in such areas. If the ground collapses, the machine could fall or tip over resulting in serious injury or death.

Remember that soil after heavy rain, blasting or after earthquakes, is weakened.

Newly laid earth and the soil near ditches is typically loose. It can collapse under the weight of vibration of your machine and cause your machine to tip over.

Install the head guard (FOPS) if working in areas where there is danger of falling rocks.

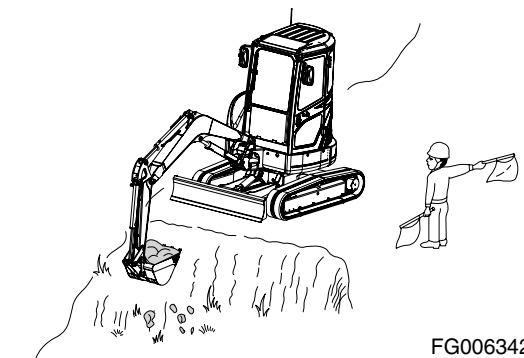


Figure 16

FG006342

Checks Before Starting Engine

Every day before starting the engine for the first time, carry out the following checks. If these checks are not carried out properly, there is danger of serious injury.

Remove all wood chips, leaves, grass, paper and other flammable materials accumulated in the engine compartment and around the battery. They could cause a fire. Remove any dirt from the window glass, mirrors, handrails, and steps.

Do not leave tools or spare parts laying around in the operator's cabin. The vibration of the machine when traveling or during operations may cause them to fall and damage or break the control levers or switches. They may also get caught in the gap of the control levers and cause the work equipment to malfunction or move dangerously. This may lead to unexpected accidents.

Check the coolant level, fuel level, and hydraulic tank oil level, and check for clogged air cleaner and damage to the electrical wiring.

Adjust the operator's seat to a position where it is easy to operate the machine, and check the seat belt and mounts for damage and wear.

Check the operation of the gauges and the angle of the mirrors, and check that the safety lever is in "LOCKED" position.

If any abnormalities are found in the above checks, carry out repairs immediately.

Engine Starting

Walk around your machine before getting in the operator's cabin. Look for evidence of leaking fluid, loose fasteners, misaligned assemblies or any other indications of possible equipment hazard.

All equipment covers and machinery safety guards must be in place, to protect against injury while the machine is being operated.

Look around the work site area for potential hazards, people or property that could be at risk while operation is in progress.

NEVER start the engine if there is any indication that maintenance or service work is in progress, or if a warning tag is attached to controls in the cabin.

A machine that has not been used recently, or is being operated in extremely cold temperatures, could require a warm-up or maintenance service before start-up.

Check gauges and monitor displays for normal operation before starting the engine. Listen for unusual noises and remain alert for other potentially hazardous conditions at the start of the work cycle.

Do not short-circuit the starting motor to start the engine. This is not only dangerous, but may also damage the machine.

When starting the engine, sound the horn as an alert.

Start and operate the machine only while seated.

Before Operating Machine

If checks are not carried out properly after starting the engine, it may result in a delay in discovering abnormalities in the machine, and this may lead to personal injury or damage to the machine.

Carry out the checks in an open area where there are no obstructions. Do not let anyone near the machine when carrying out the checks.

- Check the operating condition of the equipment, and the movement of the bucket, arm, boom, travel, and swing systems.
- Check the machine for any abnormal noise, vibration, heat, smell, or abnormality with the gauges. Check also for leakage of air, oil, and fuel.
- If any abnormality is found, repair the problem immediately. If the machine is used without repairing the problems, it may lead to unexpected injury or failure.
- Clear all personnel from directly around machine and from the area.
- Clear all obstacles from the machine's path. Beware of hazards.
- Be sure that all windows are clean. Secure the doors and the windows in the open position or in the shut position.
- Adjust the rearview mirrors for best visibility close to the machine. Make sure that the horn, the travel alarm (if equipped), and all other warning devices are working properly.
- Fasten the seat belt securely.
- Warm up the engine and hydraulic oil before operating machine.
- Before moving the machine, check undercarriage position. The normal travel position is with idler wheels to the front under the cabin and the drive sprockets to the rear. When the undercarriage is in the reversed position, the travel controls must be operated in opposite directions.

MACHINE OPERATION

When Swinging or Changing Direction of Travel

Before operating the machine or the work equipment, always observe the following precautions to prevent serious injury or death.

- Start and operate the machine only while seated.
- When changing the direction of travel from forward to reverse or from reverse to forward, reduce speed early and stop the machine before changing the direction of travel.
- Sound the horn to warn people in the area.
- Check that there is no one in the area around the machine. There are blind spots behind the machine, so if necessary, swing the upper structure to check that there is no one behind the machine before traveling in reverse.
- When operating in areas that may be hazardous or have poor visibility, designate a person to direct work site traffic.
- Ensure that no unauthorized person can come within the turning radius or direction of travel.

Be sure to observe the above precautions even if a travel alarm or mirrors are installed.

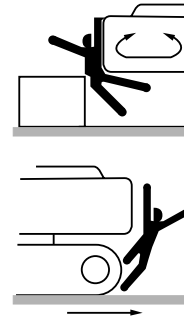


Figure 17

HAOA190L

Travel Precautions

Never turn the starting switch to the "O" (OFF) position when traveling. It is dangerous if the engine stops while the machine is traveling. It will be impossible to operate the steering.

Attachment control levers should not be operated while traveling.

Do not change selected travel mode (FAST/SLOW) while traveling.

Fold in work equipment so the outer end of the boom is as close to the machine as possible, and is 40 - 50 cm (16 - 20 in) above ground.

Never travel over obstacles or slopes that will cause the machine to tilt severely. Travel around any slope or obstacle that causes the machine to tilt 10 degrees or more to the right or left, or 30 degrees or more from front to rear.

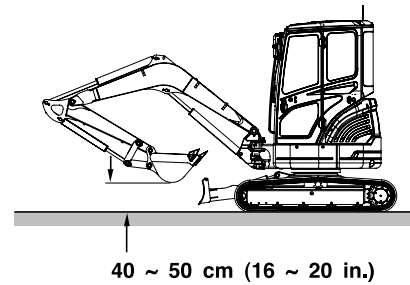
Do not operate the steering suddenly. The work equipment may hit the ground and cause the machine to lose its balance, and this may damage the machine or structures in the area.

When traveling on rough ground, travel at low speed, and avoid sudden changes in direction.

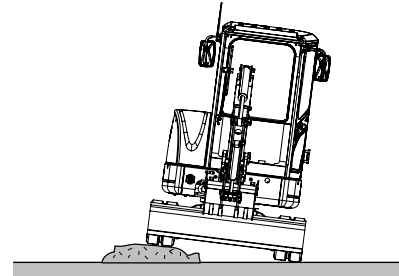
Always keep to the permissible water depth. Permissible water depth is to the center line of the upper track rollers.

When traveling over bridges or structures on private land, check first that the bridge or structure can withstand the weight of the machine. When traveling on public roads, check with the local authorities and follow their instructions.

TRAVEL POSTURE



INCORRECT



FG007524

Figure 18

Traveling on Slopes

Never jump onto a machine that is running away to stop it. There is danger of serious injury.

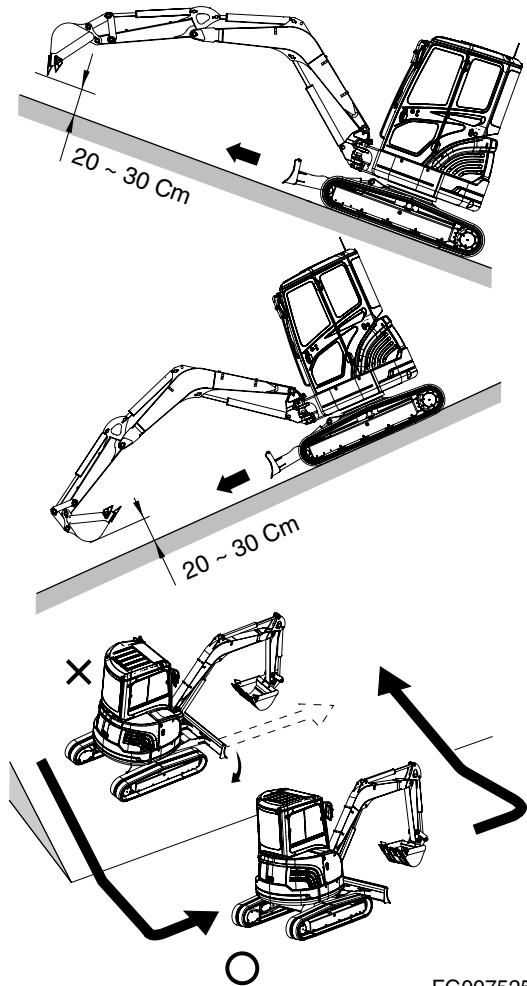
Traveling on slopes could result in the machine tipping over or slipping.

On hills, banks or slopes, carry the bucket approximately 20 - 30 cm (8 - 12 in) above the ground. In case of an emergency, quickly lower the bucket to the ground to help stop the machine.

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

Avoid changing the direction of travel on a slope. This could result in tipping or side slipping of the machine.

When possible, operate the machine up slopes and down slopes. Avoid operating the machine across the slope, when possible.

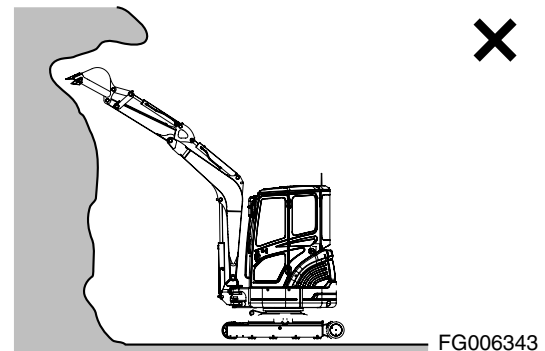


FG007525

Figure 19

Prohibited Operations

Do not dig the work face under an overhang. This may cause the overhang to collapse and fall on top of the machine.



FG006343

Figure 20

Do not carry out deep digging under the front of the machine. The ground under the machine may collapse and cause the machine to fall.

Working heavy loads over loose, soft ground or uneven, broken terrain can cause dangerous side load conditions and possible tipover and injury. Travel without a load or a balanced load may also be hazardous.

Never rely on lift jacks or other inadequate supports when work is being done. Block tracks fore and aft to prevent any movement.

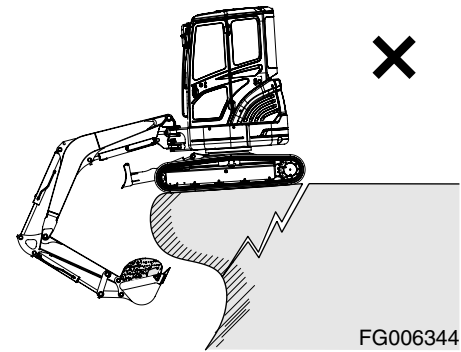


Figure 21

When using the machine, to prevent accidents caused by damage to the work equipment and overturning because of an excessive load, do not use the machine in excess of its ability (in terms of the maximum load and stability determined by the structure of the machine).

When working at the edge of an excavation or on a road shoulder, the machine could tip over, possibly resulting in serious injury or death. Investigate the configuration and ground conditions of the work site beforehand to prevent the machine from falling and to prevent the ground, stockpiles, or banks from collapsing.

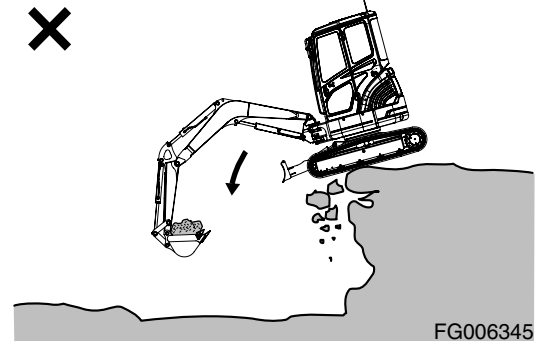


Figure 22

Precautions for Operation

Be careful not to mistakenly travel too close to the edge of a cliff.

Use the machine only for its main purpose. Using it for other purposes will cause failures.

To ensure a good view, always do the following:

- When working in dark areas, attach working lights and front lights to the machine. If necessary, set up lighting at the work site.
- Stop operations when the visibility is poor, such as in fog, mist, snow, and rain. Wait for the visibility to improve to a level which causes no problems for the operation.

To avoid hitting the work equipment, always do the following:

- When working in tunnels, on bridges, under electrical wires, or when parking the machine or carrying out other operations in places with limited height, be extremely careful not to hit the bucket or other parts.
- To prevent collisions, operate the machine at a safe speed when working in confined spaces, indoors, or in crowded areas.
- Do not pass the bucket over the heads of workers or over the operator's cabin of dump truck.

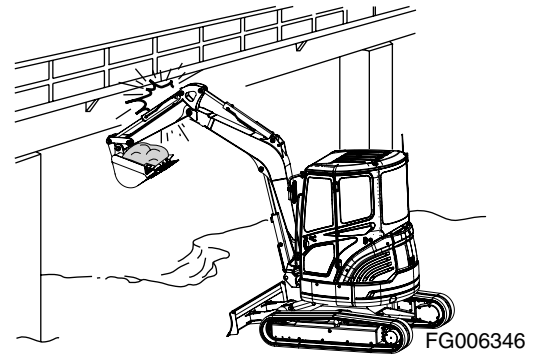


Figure 23

Avoid High-voltage Cables

Serious injury or death can result from contact or proximity to high-voltage electrical lines. The bucket does not have to make physical contact with power lines for current to be transmitted.

Use a spotter and hand signals to stay away from power lines not clearly visible to the operator.

Voltage	Minimum Safe Distance
6.6 kV	3 m (9' 10")
33.0 kV	4 m (13' 1")
66.0 kV	5 m (16' 5")
154.0 kV	8 m (26' 3")
275.0 kV	10 m (32' 10")

Use these minimum distances as a guideline only. Depending upon the voltage in the line and atmospheric conditions, strong current shocks can occur with the boom or bucket as far away as 4 - 6 m (13 - 20 ft.) from the power line. Very high voltage and rainy weather could further decrease that safety margin.

NOTE: *Before starting any type of operation near power lines (either above ground or buried cable type), you should always contact the power utility company directly and work out a safety plan with them.*

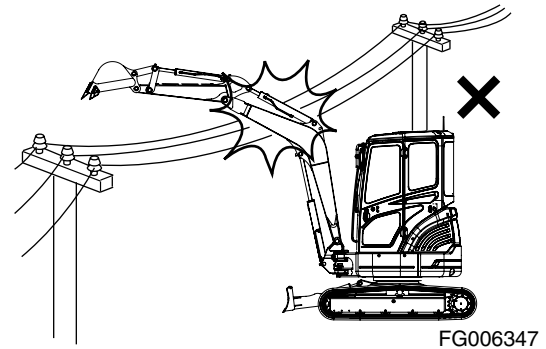


Figure 24

Operate Carefully on Snow, Ice and in Very Cold Temperatures

In icy cold weather avoid sudden travel movements and stay away from even slight slopes. The machine could skid off to one side very easily.

Snow accumulation could hide or obscure potential hazards. Use care while operating or while using the machine to clear snow.

Warming up the engine for a short period may be necessary, to avoid operating with sluggish or reduced working capacity. The jolting shocks and impact loads caused by bumping or bottoming the boom or attachment are more likely to cause severe stress in very cold temperatures. Reducing work cycle rate and work load may be necessary.

When the temperature rises, frozen road surfaces become soft, and machine travel becomes unstable.

In cold weather, do not touch metal surfaces with your bare hands. If you touch a metal surface in extremely cold weather, your skin may freeze to the metal surface.

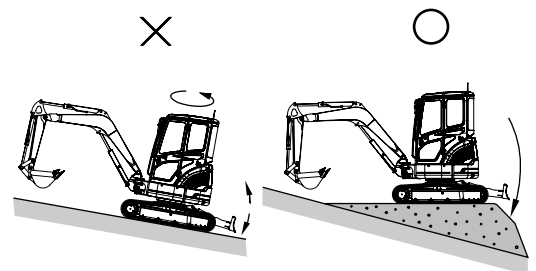
Operations on Slopes

When working on slopes, there is danger that the machine may lose its balance and turn over, when swinging, or when work equipment is operated. Always carry out these operations carefully.

Do not swing the work equipment from the uphill side to the downhill side when the bucket is loaded. This operation is dangerous.

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

In addition, lower the bucket as far as possible, keep it pulled into the front, and keep the swing speed as low as possible.



FG008060

Figure 25

Parking Machine

Avoid making sudden stops, or parking the machine wherever it happens to be at the end of the workday. Plan so the excavator will be on firm, level ground away from traffic and away from high walls, cliff edges and any area of potential water accumulation or runoff. If parking on inclines is unavoidable, block the crawler tracks to prevent movement. Lower the bucket or other working attachment to the ground, or to an overnight support saddle. There should be no possibility of unintended or accidental movement.

Park machine so there is enough clearance between it and other machines.

When parking on public roads, provide fences, signs, flags, or lights, and put up any other necessary signs to ensure that passing traffic can see the machine clearly. Park the machine so the machine, flags, and fences do not obstruct traffic.

After all attachments, such as the bucket and blade, have been lowered to an overnight storage position and all switches and operating controls are in the "OFF" position, the safety lock lever must be set to the "LOCKED" position. This will disable all pilot circuit control functions.

Always close the door of the operator's cabin.

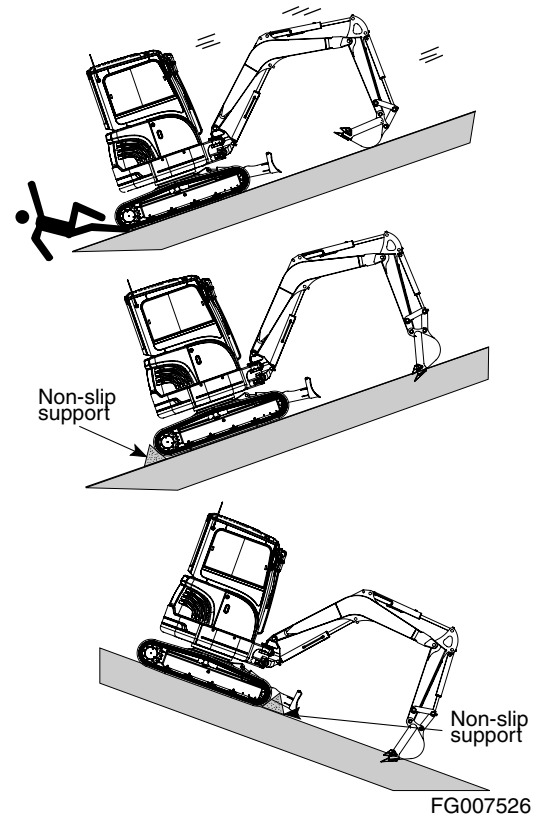


Figure 26

Precautions for Traveling in Reverse

Backing up is potentially dangerous because of restricted visibility.

Use a signalman when backing up.

- Watch for people nearby.
- Use horn or other signal to warn people nearby.
- Keep windows, mirrors and headlights clean and good repair at all times.
- Slow down when visibility is poor due to dust, heavy rain, fog, or other conditions.

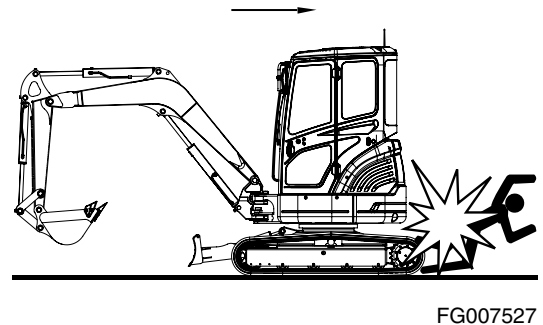


Figure 27

Never Let Anyone Ride on Attachment

Never let anyone ride on any work attachment, such as the bucket, crusher, grapple, or clamshell (grab bucket). There is a danger of the person falling and suffering serious injury.

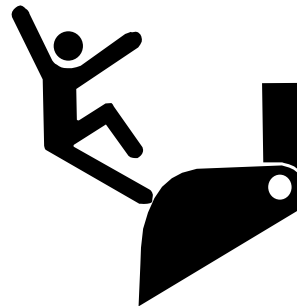


Figure 28

ARO1310L

MAINTENANCE

Warning Tag

Alert others that service or maintenance is being performed and tag operator's cabin controls – and other machine areas if required – with a warning notice. OSHA mandated control lever lockout can be made with any OSHA certified lockout device and a length of chain or cable to keep the safety lever in the fully lowered, nonactive position.

Warning tags, for controls are available from *DOOSAN* distributors.



ARO1320L

Figure 29

Clean Before Inspection or Maintenance

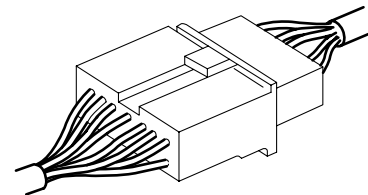
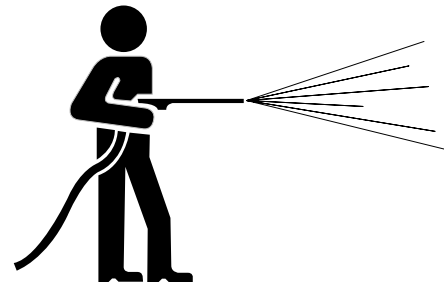
Clean the machine before carrying out inspection and maintenance. This prevents dirt from getting into the machine and also ensures safety during maintenance.

If inspection and maintenance are carried out when the machine is dirty, it will become more difficult to locate the problems, and also there is danger that you may get dirt or mud in your eyes or that you may slip and injure yourself.

When washing the machine, do the following:

- Wear shoes with nonslip soles to prevent yourself from slipping and falling on wet places.
- Wear safety glasses and protective clothing when washing the machine with high-pressure steam.
- Take action to prevent touching high-pressure water and cutting your skin or having mud fly into your eyes.
- Do not spray water directly on electrical components (sensors, connector). If water gets into the electrical system, there is danger that it will cause defective operation and malfunction.

Pick up any tools or hammers that are laying in the work place, wipe up any grease or oil or any other slippery substances, and clean the area to make it possible to carry out the operation in safety. If the work place is left untidy, you may trip or slip and suffer injury.

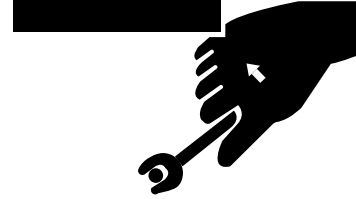


ARO1330L

Figure 30

Proper Tools

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



HDO1037L

Figure 31

Use of Lighting

When checking fuel, oil, battery electrolyte, or window washing fluid, always use lighting with antiexplosion specifications. Danger of an explosion is elevated when proper lighting equipment is not used.

If work is carried out in dark places without using lighting, it may lead to injury, so always use proper lighting.

Even if the place is dark, never use a lighter or flame instead of lighting. There is danger of fire. There is also danger that the battery gas may catch fire and cause an explosion.



HDO1040L

Figure 32

Fire Prevention and Explosion Prevention

All fuels, most lubricants and some coolant mixtures are flammable. Leaking fuel or fuel that is spilled onto hot surfaces or onto electrical components can cause a fire.

Store all fuels and all lubricants in properly marked containers and away from all unauthorized persons.

Store oily rags and other flammable material in a protective container.

Do not smoke while you refuel the machine or while you are in a refueling area.

Do not smoke in battery charging areas or in areas the contain flammable material.

Clean all electrical connections and tighten all electrical connections. Check the electrical wires daily for wires that are loose or frayed. Tighten all loose electrical wires before you operate the machine. Repair all frayed electrical wires before you operate the machine.

Remove all flammable materials before they accumulate on the machine.

Do not weld on pipes or on tubes that contain flammable fluids. Do not flame cut on pipes or on tubes that contain flammable fluids. Before you weld on pipes or on tubes or before you flame cut on pipes or on tubes, clean the pipes or tubes thoroughly with a nonflammable solvent.



HDO1015I

Figure 33

Burn Prevention

When checking the radiator coolant level, shut down engine, let the engine and radiator cool down, then check the coolant recovery tank. If the coolant level in the coolant recovery tank is near the upper limit, there is enough coolant in the radiator.

Loosen the radiator cap gradually to release the internal pressure before removing the radiator cap.

If the coolant level in the coolant recovery tank is below the lower limit, add coolant.

Cooling system conditioner contains alkali. Alkali can cause personal injury. Do not allow alkali to contact the skin, the eyes, or the mouth.

Allow cooling system components to cool before you drain the cooling system.

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

Remove the hydraulic tank filter plug only after the engine has been stopped. Make sure that the hydraulic tank filter plug is cool before you remove it with your bare hand. Remove the hydraulic tank filter plug slowly to relieve pressure.

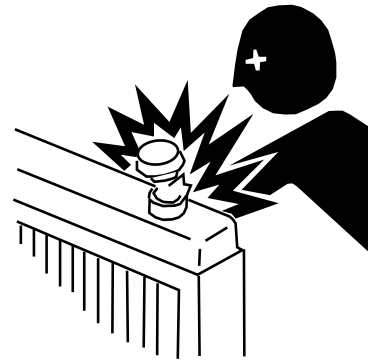
Relieve all pressure in the hydraulic oil system, in the fuel system, or in the cooling system before you disconnect any lines, fittings, or related items.

Batteries give off flammable fumes that can explode.

Do not smoke while you are checking the battery's electrolyte levels.

Electrolyte is an acid. Electrolyte can cause personal injury. Do not allow electrolyte to contact the skin or the eyes.

Always wear protective glasses when you work on batteries.



HAAE1980

Figure 34

Welding Repairs

When carrying out welding repairs, carry out the welding in a properly equipped place. The welding should be performed by a qualified worker. During welding operations, there is the danger of, generation of gas, fire, or electric shock, so never let an unqualified worker do welding.

The qualified welder must do the following:

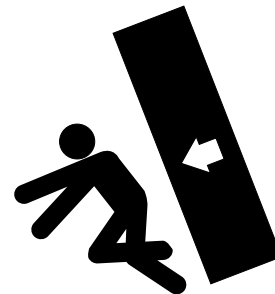
- To prevent explosion of the battery, disconnect the battery terminals and remove batteries.
- To prevent generation of gas, remove the paint from the location of the weld.
- If hydraulic equipment, piping or places close to them are heated, a flammable gas or mist will be generated and there is danger of it catching fire. To avoid this, never subject these places to heat.
- Do not weld on pipes or on tubes that contain flammable fluids. Do not flame cut on pipes or on tubes that contain flammable fluids. Before you weld on pipes or on tubes or before you flame cut on pipes or on tubes, clean the pipes or tubes thoroughly with a nonflammable solvent.
- If heat is applied directly to rubber hoses or piping under pressure, they may suddenly break, so cover them with a fireproof covering.
- Wear protective clothing.
- Make sure there is good ventilation.
- Remove all flammable objects and provide a fire extinguisher.

Precautions for Removal, Installation, and Storage of Attachments

Before starting removal and installation of attachments, decide on the team leader.

Do not allow anyone except the authorized workers close to the machine or attachment.

Place attachments that have been removed from the machine in a safe place so they do not fall. Put up a fence around the attachments and take other measures to prevent unauthorized persons from entering.



HDO1041L

Figure 35

Precautions When Working on Machine

When carrying out maintenance operations on the machine, keep area around your feet clean and tidy to prevent falls. Always do the following:

- Do not spill oil or grease.
- Do not leave tools laying about.
- Watch your step when walking.

Never jump down from the machine. When getting on or off the machine, use the steps and handrails, and maintain a three-point contact (both feet and one hand or both hands and one foot) to support yourself securely.

If the job requires it, wear protective clothing.

To prevent injury from slipping or falling, when working on the hood or covers, never use any area except the area equipped with nonslip pads.



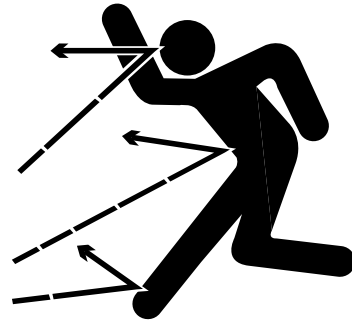
ARO1380L

Figure 36

Track Tension Adjustments Require Caution

Never turn out the track tension grease fitting nut. To release pressure from the crawler frame track tension assembly, you should NEVER attempt to disassemble the track adjuster or attempt to remove the grease fitting or valve assembly.

Keep your face and body away from the valve. Refer to the track adjustment procedure in the Operator and Maintenance Manual or Shop Manual.



HAOA110L

Figure 37

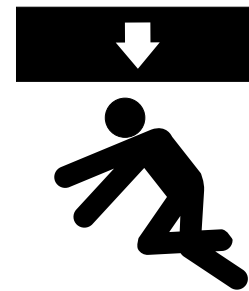
Supports and Blocking for Work Equipment

Do not allow weight or equipment loads to remain suspended.

Lower everything to the ground before leaving the operator's seat.

Do not use hollow, cracked or unsteady wobbling supports.

Do not work under any equipment supported only by a lifting jack.



HDO1042L

Figure 38

Action When Abnormality Is Found During Inspection

If any abnormality is found during inspection, always carry out repairs. In particular, if the machine is used when there are still problems with the brake or work equipment systems, it may lead to serious injury.

If necessary depending on the type of failure, please contact your *DOOSAN* distributor for repairs.

Precautions with High-pressure Lines, Tubes and Hoses

When inspecting or replacing high-pressure piping or hoses, check to verify that the pressure has been released from the circuit. Failure to release the pressure may lead to serious injury. Always do the following:

- Wear protective glasses and leather gloves.
- Fluid leaks from hydraulic hoses or pressurized components can be difficult to see but pressurized oil has enough force to pierce the skin and cause serious injury. Always use a piece of wood or cardboard to check for suspected hydraulic leaks. Never use your hands or expose your fingers.
- Do not bend high-pressure lines. Do not strike high-pressure lines. Do not install lines, tubes or hoses that are bent or damaged.
- Make sure that all clamps, guards and heat shields are installed correctly to prevent vibration, rubbing against other parts, and excessive heat during operation.
 - If any of the following conditions are found, replace the part.
 - Damage or leakage from hose end.
 - Wear, damage, cutting of covering, or exposure of strengthening wire layer.
 - Cover portion is swollen in places.
 - There is twisting or crushing at movable parts of hose.
 - Foreign material is embedded in the covering.
 - Hose end is deformed.

NOTE: Refer to “Hose In-service Lifetime Limit (European Standard ISO 8331 and EN982 CEN)” on page 4-38, for additional European regulations.

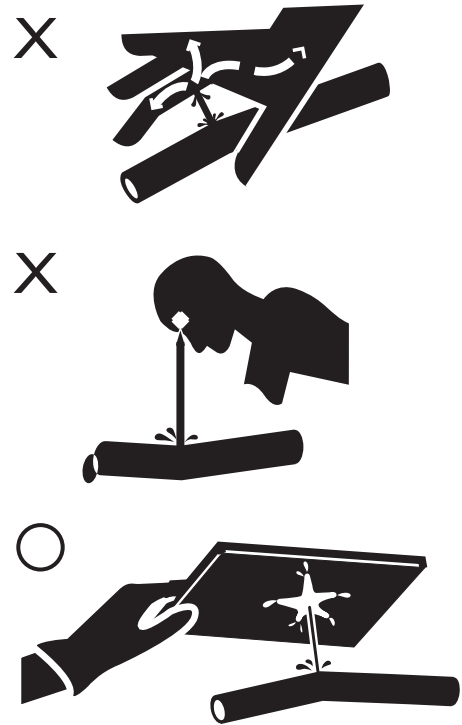


Figure 39

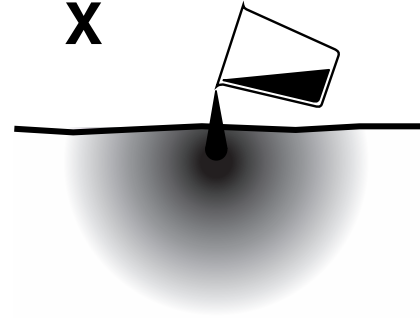
HDO1045I

Waste Materials

Physical contact with used motor oil may pose a health risk. Wipe oil from your hands promptly and wash off any remaining residue.

Used motor oil is an environmental contaminant and may only be disposed of at approved collection facilities. To prevent pollution of the environment, always do the following:

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



HAOA470L

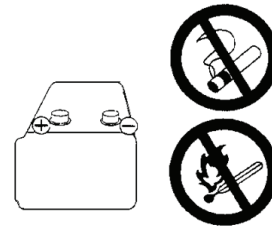
Figure 40

BATTERY

Battery Hazard Prevention

Battery electrolyte contains diluted sulfuric acid and batteries generate hydrogen gas. Hydrogen gas is highly explosive, and mistakes in handling them can cause serious injury or fire. To prevent problems, always do the following:

- Do not smoke or bring any flame near the battery.
- When working with batteries, ALWAYS wear safety glasses and rubber gloves.
- If you spill battery electrolyte on yourself or your clothes, immediately flush the area with water.
- If battery electrolyte gets into your eyes, flush them immediately with large quantities of water and see a doctor at once.
- If you accidentally drink battery electrolyte, drink a large quantity of water or milk, raw egg or vegetable oil. Call a doctor or poison prevention center immediately.
- When cleaning the top surface of the battery, wipe it with a clean, damp cloth. Never use gasoline, thinner, or any other organic solvent or detergent.
- Tighten the battery caps securely.
- If the battery electrolyte is frozen, do not charge the battery or start the engine with power from another source. There is danger that the battery may catch fire.
- When charging the battery or starting with power from another source, let the battery electrolyte melt and check that there is no leakage of battery electrolyte before starting the operation.
- Always remove the battery from the machine before charging.



HAAE2100

Figure 41

Boost Starting or Charging Engine Batteries

If any mistake is made in the method of connecting the booster cables, it may cause an explosion or fire. Always do the following:

- Turn off all electrical equipment before connecting leads to the battery. This includes electrical switches on the battery charger or boost starting equipment.
- When boost starting from another machine or vehicle do not allow the two machines to touch. Wear safety glasses or goggles while required battery connections are made.
- Connect positive cable first when installing cables and disconnect the negative cable first when removing them. The final cable connection, at the metal frame of the machine being charged or boost started, should be as far away from the batteries as possible.

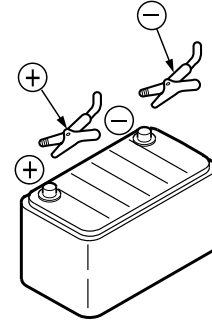


Figure 42

HAOA310L

TOWING

Precautions When Towing

If any mistake is made in the method of selecting or inspecting the towing wire or in the method of towing, it may lead to serious personal injury. Always do the following:

- Always use the method of towing given in this Operation and Maintenance Manual. Do not use any other method.
- Use leather gloves when handling the wire rope.
- When carrying out the preparation work for towing with two or more workers, determine the signals to use and follow these signals correctly.
- Always fit the towing rope to the left and right hooks and secure in position.
- If the engine on the problem machine will not start or there is a failure in the brake system, always contact your *DOOSAN* distributor.
- Never go between the towing machine and the towed machine during the towing operation.
- It is dangerous to carry out towing on slopes, so select a place where the slope is gradual. If there is no place where the slope is gradual, carry out operations to reduce the angle of the slope before starting the towing operation.
- When towing a problem machine, always use a wire rope with a sufficient towing capacity.
- Do not use a frayed, kinked rope or a rope with any loss of diameter.
- Do not use the lightweight towing hook for towing another machine.

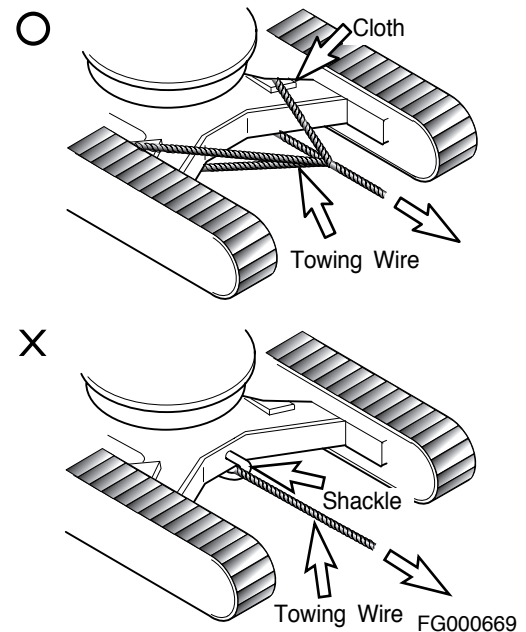


Figure 43

SHIPPING AND TRANSPORTATION

Obey State and Local Over-the-Road Regulations

Check state and local restrictions regarding weight, width and length of a load before making any other preparation for transport.

The hauling vehicle, trailer and load must all be in compliance with local regulations governing the intended shipping route.

Partial disassembly or teardown of the excavator may be necessary to meet travel restrictions or particular conditions at the work site. See the Shop Manual for information on partial disassembly.

Refer to the Transportation and Shipping section of this Operation and Maintenance Manual for information on loading, unloading and towing.

EXCAVATOR RATED LIFT CAPACITY TABLES



WARNING!

Let everybody be away from the boom cylinder. While lifting operation, boom, arm, bucket hoses might burst and then high-pressure oil will be ejected at high-speed.

If that failure mode takes place, handling weight or front structure might fall by its gravity to the ground to cause fatal injury to the person.

When changing the hoses record the part numbers of the hoses to factory log book.

Do the service job under the company's serviceman.

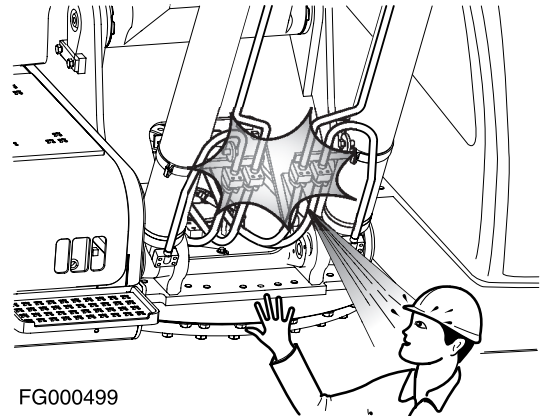


Figure 44



WARNING!

All rated lift capacities are based on the machine and the load both remaining level at all times. **DO NOT EXCEED THE RATED LIFT CAPACITY.** Lifting loads greater than those shown in the rated capacity tables can cause catastrophic equipment failure and/or structural collapse of the machine.

To operate safely the excavator should be on a firm, level and uniformly supporting surface. The operator is expected to make due allowance for all specific work site and lift related conditions, and respond to changes in those conditions that could pose a hazard. The following could all cause hazardous conditions and accidents or injuries:

- Soft or uneven ground.
- Unlevel terrain.
- Side loads.
- Modifications or poor maintenance of the excavator.
- Failure to lift squarely over the end or over the side of the machine.

When a load is in the air, the operator must remain alert.

- Avoid side loads that may be caused by uneven slings, traveling with the load or swinging too quickly.
- The load can become unbalanced if the hook line is twisted and starts to rotate. If the surface area of the load is large enough, wind gusts can create side loads.

- Keep the bucket hook point directly over the load. Tag lines on opposite sides of the load can help maintain greater stability against side loads and wind gusts.

Avoid traveling with a suspended load. Before swinging (or if required, traveling), bring the load into an arm position (radius and height) that has a safer weight capacity rating and adequate movement clearance. The operator and all work site personnel should be thoroughly familiar with safety instructions and procedures within this Operation and Maintenance Manual.

The following weight loads are in compliance with SAE (J1097) and ISO applicable, recommended standards for hydraulic excavators performing lifting operation on a firm supporting surface. An asterisk (*) next to the lift rating indicates rated load does not exceed 87% of hydraulic capacity. All other ratings have been determined not to exceed 75% of tipping capacity.

Do not attempt to lift or hold any load that exceeds rated load capacity at the specified distances (from the machine's rotation center line and height - see "lift radius" and "lift height" in the reference drawing, Figure 45).

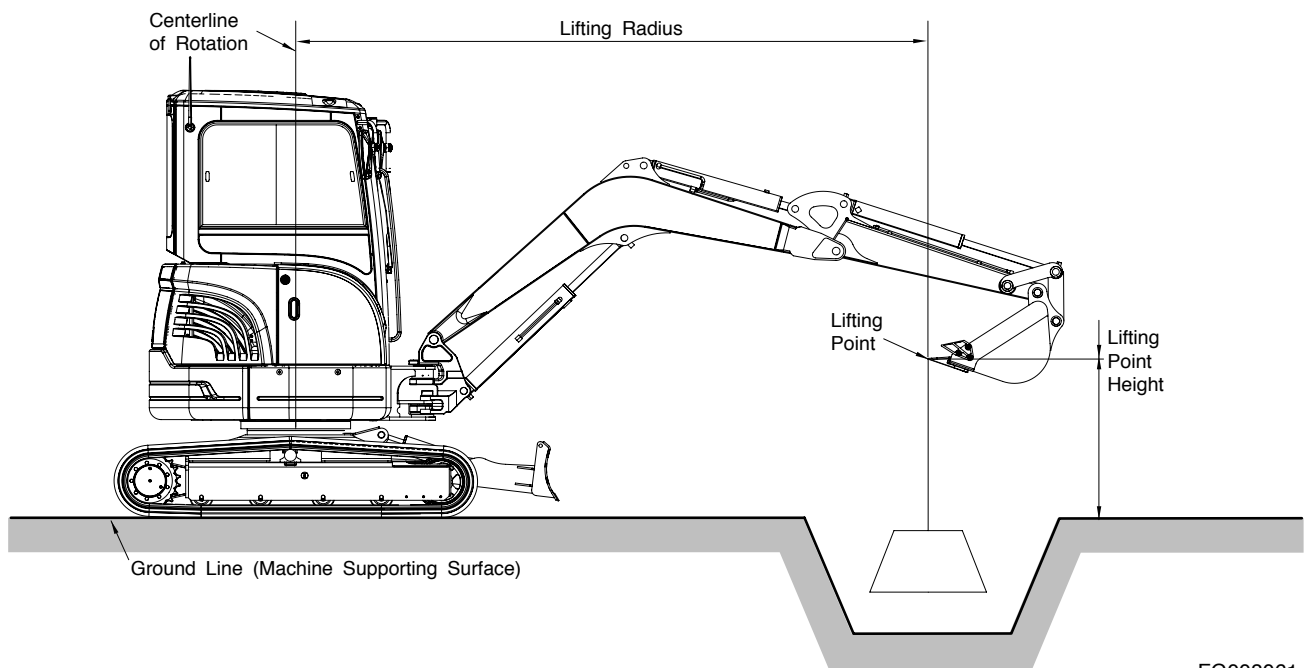
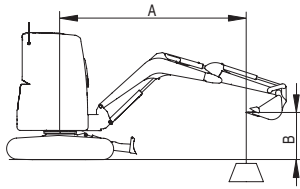


Figure 45

The weight of slings and any auxiliary lifting device (and/or the weight difference of any attachment heavier than standard configuration) must be deducted from the rated lift capacity to determine allowable net lifting load. The lift point should be on the back of the bucket, as shown in Figure 45.



WITHOUT DOZER

METRIC

TRACK WIDTH : 1.7 m (5' 7") TRACK
 BOOM : 2.405 m (7' 11")
 ARM : 1.2 m (3' 11")
 BUCKET : SAE 0.11 m³ (CECE 0.094 m³)
 SHOE : 300 mm (11.8")
 : RATING OVER FRONT
 : RATING OVER SIDE OR 360 degree
 UNIT : 1,000 kg (1,000 lb)

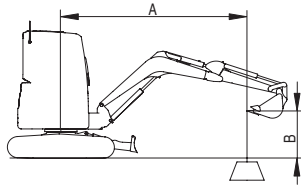
A(m) B(m)	2		3		4		MAX. REACH		A(m)
									
4							* 0.77	* 0.77	2.76
3			* 0.67	* 0.67			0.48	0.47	3.76
2			0.70	0.69	0.43	0.42	0.39	0.38	4.21
1			0.67	0.65	0.42	0.41	0.36	0.36	4.34
0 (GROUND)	1.23	1.18	0.64	0.63	0.41	0.40	0.38	0.38	4.18
-1	1.25	1.20	0.64	0.63			0.47	0.46	3.68
-2	1.30	1.25					* 0.84	0.83	2.59

FEET

A (ft) B (ft)	6'		8'		10'		12'		14'		MAX. REACH		A (ft)
													
12'					1.54	1.51					1.41	1.38	10' 6"
10'					* 1.48	* 1.48	1.12	1.10			1.08	1.06	12' 3"
8'					1.54	1.51	1.12	1.10			0.92	0.91	13' 4"
6'			2.16	2.10	1.50	1.47	1.11	1.09			0.84	0.83	13' 12"
4'			2.04	1.99	1.45	1.42	1.08	1.06	0.83	0.82	0.81	0.79	14' 3"
2'			1.97	1.92	1.41	1.37	1.06	1.04	0.82	0.81	0.81	0.79	14' 2"
0 (GROUND)			1.95	1.90	1.38	1.35	1.04	1.02			0.84	0.83	13' 9"
-2'	3.20	3.07	1.95	1.90	1.38	1.35	1.04	1.02			0.94	0.92	12' 11"
-4'	3.25	3.12	1.98	1.92	1.39	1.36					1.13	1.10	11' 6"
-6'	3.32	3.19	2.03	1.97							1.59	1.56	9' 4"

1. LOAD POINT IS THE HOOK ON THE BACK OF THE BUCKET.
2. * RATED LOADS ARE BASED ON HYDRAULIC CAPACITY.
3. RATED LOADS DO NOT EXCEED 87 % OF HYD. CAPACITY OR 75 % OF TIPPING CAPACITY.

FG007530



TRACK WIDTH : 1.7 m (5' 7") TRACK
 BOOM : 2.405 m (7' 11")
 ARM : 1.2 m (3' 11")
 BUCKET : SAE 0.11 m³ (CECE 0.094 m³)
 SHOE : 300 mm (11.8")
 : RATING OVER FRONT
 : RATING OVER SIDE OR 360 degree
 UNIT : 1,000 kg (1,000 lb)

WITH DOZER

METRIC

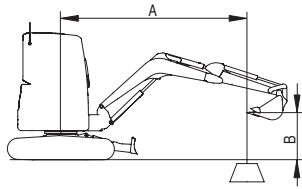
A(m) B(m)	2		3		4		MAX. REACH		
									A(m)
4							* 0.77	* 0.77	2.76
3			* 0.67	* 0.67			* 0.73	0.47	3.76
2			* 0.88	0.69	* 0.75	0.41	* 0.74	0.38	4.21
1			* 1.18	0.65	* 0.84	0.40	* 0.78	0.36	4.34
0 (GROUND)	* 1.29	1.18	* 1.34	0.63	* 0.89	0.39	* 0.82	0.38	4.18
-1	* 2.17	1.20	* 1.26	0.63			* 0.87	0.46	3.68
-2	* 1.31	1.25					* 0.84	0.83	2.59

FEET

A (ft) B (ft)	6'		8'		10'		12'		14'		MAX. REACH		
													A (ft)
12'					* 1.56	1.51					* 1.64	1.38	10' 6"
10'					* 1.48	* 1.48	* 1.58	1.10			* 1.61	1.06	12' 3"
8'					* 1.67	1.51	* 1.59	1.10			* 1.62	0.91	13' 4"
6'			* 2.61	2.10	* 2.02	1.47	* 1.75	1.09			* 1.65	0.83	13' 12"
4'			* 3.46	1.99	* 2.42	1.42	* 1.95	1.06	* 1.71	0.82	* 1.70	0.79	14' 3"
2'			* 3.97	1.92	* 2.74	1.37	* 2.13	1.04	* 1.78	0.81	* 1.75	0.79	14' 2"
0 (GROUND)			* 4.08	1.90	* 2.89	1.35	* 2.22	1.02			* 1.81	0.83	13' 9"
-2'	* 4.42	3.07	* 3.93	1.90	* 2.85	1.35	* 2.16	1.02			* 1.88	0.92	12' 11"
-4'	* 5.07	3.12	* 3.51	1.92	* 2.56	1.36					* 1.93	1.10	11' 6"
-6'	* 3.77	3.19	* 2.62	1.97							* 1.91	1.56	9' 4"

1. LOAD POINT IS THE HOOK ON THE BACK OF THE BUCKET.
2. * RATED LOADS ARE BASED ON HYDRAULIC CAPACITY.
3. RATED LOADS DO NOT EXCEED 87 % OF HYD. CAPACITY OR 75 % OF TIPPING CAPACITY.

FG007553



WITHOUT DOZER

METRIC

TRACK WIDTH : 1.7 m (5' 7") TRACK
 BOOM : 2.405 m (7' 11")
 ARM : 1.33 m (4' 4")
 BUCKET : SAE 0.11 m³ (CECE 0.094 m³)
 SHOE : 300 mm (11.8")
 : RATING OVER FRONT
 : RATING OVER SIDE OR 360 degree
 UNIT : 1,000 kg (1,000 lb)

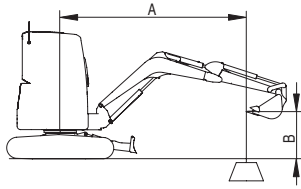
A(m) B(m)	2		3		4		MAX. REACH		
									A(m)
4							* 0.71	* 0.71	2.95
3							0.46	0.45	3.89
2			0.71	0.69	0.43	0.42	0.37	0.36	4.33
1			0.67	0.65	0.42	0.40	0.35	0.34	4.45
0 (GROUND)	1.22	1.18	0.64	0.62	0.41	0.40	0.36	0.36	4.30
-1	1.24	1.19	0.64	0.62			0.44	0.43	3.82
-2	1.28	1.24					0.74	0.73	2.80

FEET

A (ft) B (ft)	6'		8'		10'		12'		14'		MAX. REACH		A (ft)
													
12'					* 1.39	* 1.39					1.30	1.28	11' 0"
10'					* 1.35	* 1.35	1.13	1.11			1.02	1.00	12' 8"
8'					1.55	1.52	1.13	1.11			0.88	0.86	13' 8"
6'			2.17	2.11	1.50	1.47	1.11	1.09	0.84	0.83	0.80	0.79	14' 4"
4'			2.06	2.00	1.45	1.42	1.08	1.06	0.83	0.81	0.77	0.76	14' 7"
2'			1.97	1.92	1.40	1.37	1.05	1.03	0.82	0.80	0.77	0.75	14' 6"
0 (GROUND)	* 2.55	* 2.55	1.94	1.89	1.37	1.34	1.04	1.02	0.81	0.80	0.80	0.79	14' 1"
-2'	3.17	3.05	1.94	1.89	1.37	1.34	1.03	1.01			0.88	0.87	13' 3"
-4'	3.22	3.09	1.96	1.90	1.38	1.35					1.05	1.03	11' 12"
-6'	3.29	3.16	2.00	1.95							1.43	1.40	9' 12"

1. LOAD POINT IS THE HOOK ON THE BACK OF THE BUCKET.
2. * RATED LOADS ARE BASED ON HYDRAULIC CAPACITY.
3. RATED LOADS DO NOT EXCEED 87 % OF HYD. CAPACITY OR 75 % OF TIPPING CAPACITY.

FG007556



WITH DOZER

TRACK WIDTH : 1.7 m (5' 7") STD TRACK
 BOOM : 2,405 m (7' 11")
 ARM : 1.33 m (4' 4")
 BUCKET : SAE 0.11 m³ (CECE 0.094 m³)
 SHOE : 300 mm (11.8")
 : RATING OVER FRONT
 : RATING OVER SIDE OR 360 degree
 UNIT : 1,000 kg (1,000 lb)

METRIC

A(m) B(m)	2		3		4		MAX. REACH		
									A(m)
4							* 0.71	* 0.71	2.95
3							* 0.69	0.45	3.89
2			* 0.82	0.69	* 0.71	0.42	* 0.71	0.36	4.33
1			* 1.14	0.65	* 0.81	0.40	* 0.74	0.34	4.45
0 (GROUND)	* 1.46	1.18	* 1.33	0.62	* 0.88	0.40	* 0.79	0.36	4.30
-1	* 2.26	1.19	* 1.28	0.62			* 0.85	0.43	3.82
-2	* 1.49	1.24					* 0.86	0.73	2.80

FEET

A (ft) B (ft)	6'		8'		10'		12'		14'		MAX. REACH		
													A (ft)
12'					* 1.39	* 1.39					* 1.52	1.28	11' 0"
10'					* 1.35	* 1.35	* 1.45	1.11			* 1.51	1.00	12' 8"
8'					* 1.55	1.52	* 1.50	1.11			* 1.53	0.86	13' 8"
6'			* 2.40	2.11	* 1.91	1.47	* 1.67	1.09	* 1.57	0.83	* 1.57	0.79	14' 4"
4'			* 3.28	2.00	* 2.32	1.42	* 1.89	1.06	* 1.66	0.81	* 1.62	0.76	14' 7"
2'			* 3.87	1.92	* 2.67	1.37	* 2.08	1.03	* 1.75	0.80	* 1.68	0.75	14' 6"
0 (GROUND)	* 2.55	* 2.55	* 4.07	1.89	* 2.86	1.34	* 2.20	1.02	1.76	0.80	* 1.74	0.79	14' 1"
-2'	* 4.37	3.05	* 3.98	1.89	* 2.87	1.34	* 2.18	1.01			* 1.82	0.87	13' 3"
-4'	* 5.34	3.09	* 3.63	1.90	* 2.64	1.35					* 1.89	1.03	11' 12"
-6'	* 4.16	3.16	* 2.87	1.95							* 1.92	1.40	9' 12"

1. LOAD POINT IS THE HOOK ON THE BACK OF THE BUCKET.
2. * RATED LOADS ARE BASED ON HYDRAULIC CAPACITY.
3. RATED LOADS DO NOT EXCEED 87 % OF HYD. CAPACITY OR 75 % OF TIPPING CAPACITY.

FG007555

Operating Controls

The "Operating Controls" section presented here consists of the following groups:

1. "Component Locations" on page 2-2
2. "Operator's Area" on page 2-4
3. "Operational Controls and Panels" on page 2-6
4. "instrument Panel" on page 2-13
5. "Stereo (Optional)" on page 2-18
6. "Fuse boxes" on page 2-19
7. "Miscellaneous Electrical Devices" on page 2-20
8. "Heating and Air Conditioning System (Optional)" on page 2-21
9. "Seat Adjustment" on page 2-24
10. "Seat Belt" on page 2-24
11. "Front Windows" on page 2-26
12. "Door Side Latch" on page 2-28
13. "Cabin Storage Compartments" on page 2-28
14. "Hanger" on page 2-29
15. "Cup Holder" on page 2-29
16. "Emergency Glass Breaking Tool" on page 2-29

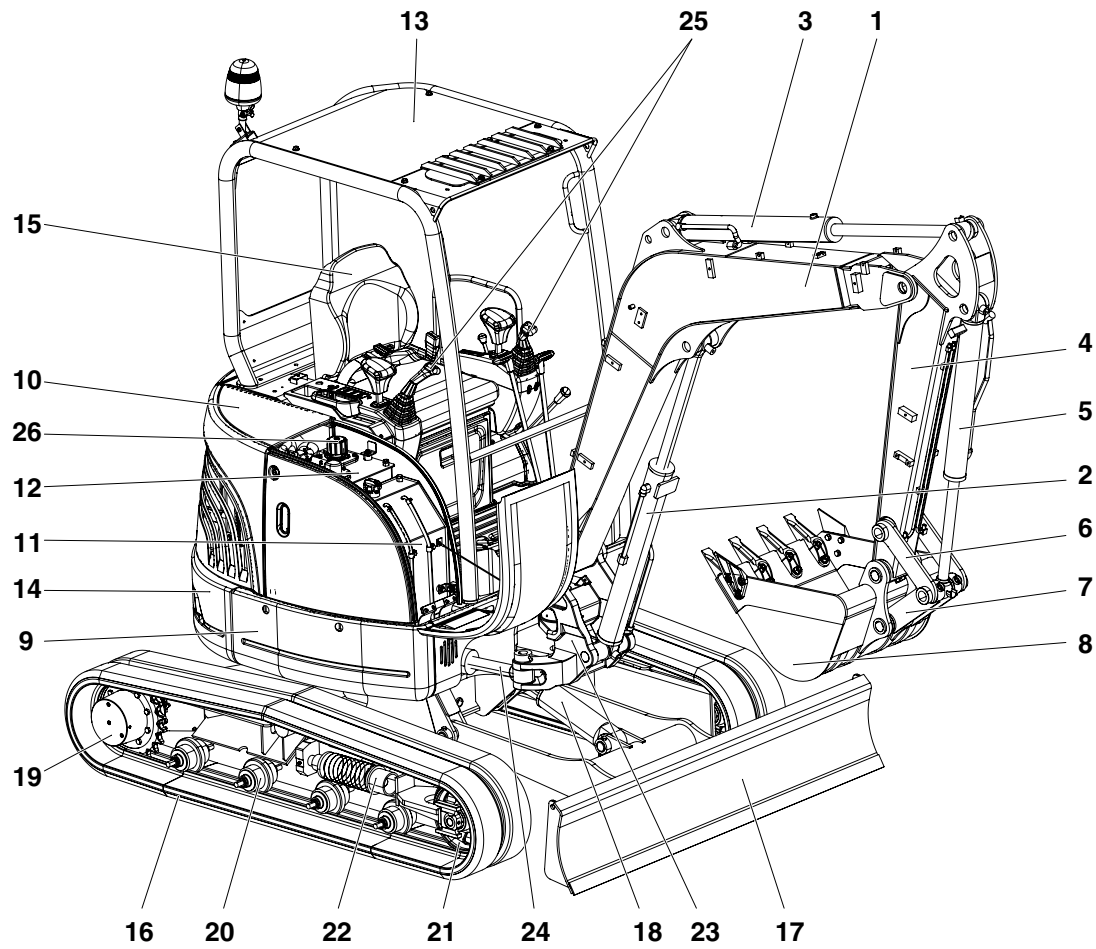
Each group is explained with a point location drawing or photo and a brief description of each control, switch, gauge or valve.

Indicator lights work besides the gauges on the instrument panel. The operator should monitor machine pressure on the instrument panel along with indicator lights. These lights will only show that there is a problem.

WARNING!

Warning lights. When any one or more of the warning lights on the control console, comes "ON," immediately stop operation and shut down unit. Investigate and correct the problem before proceeding with operation.

COMPONENT LOCATIONS



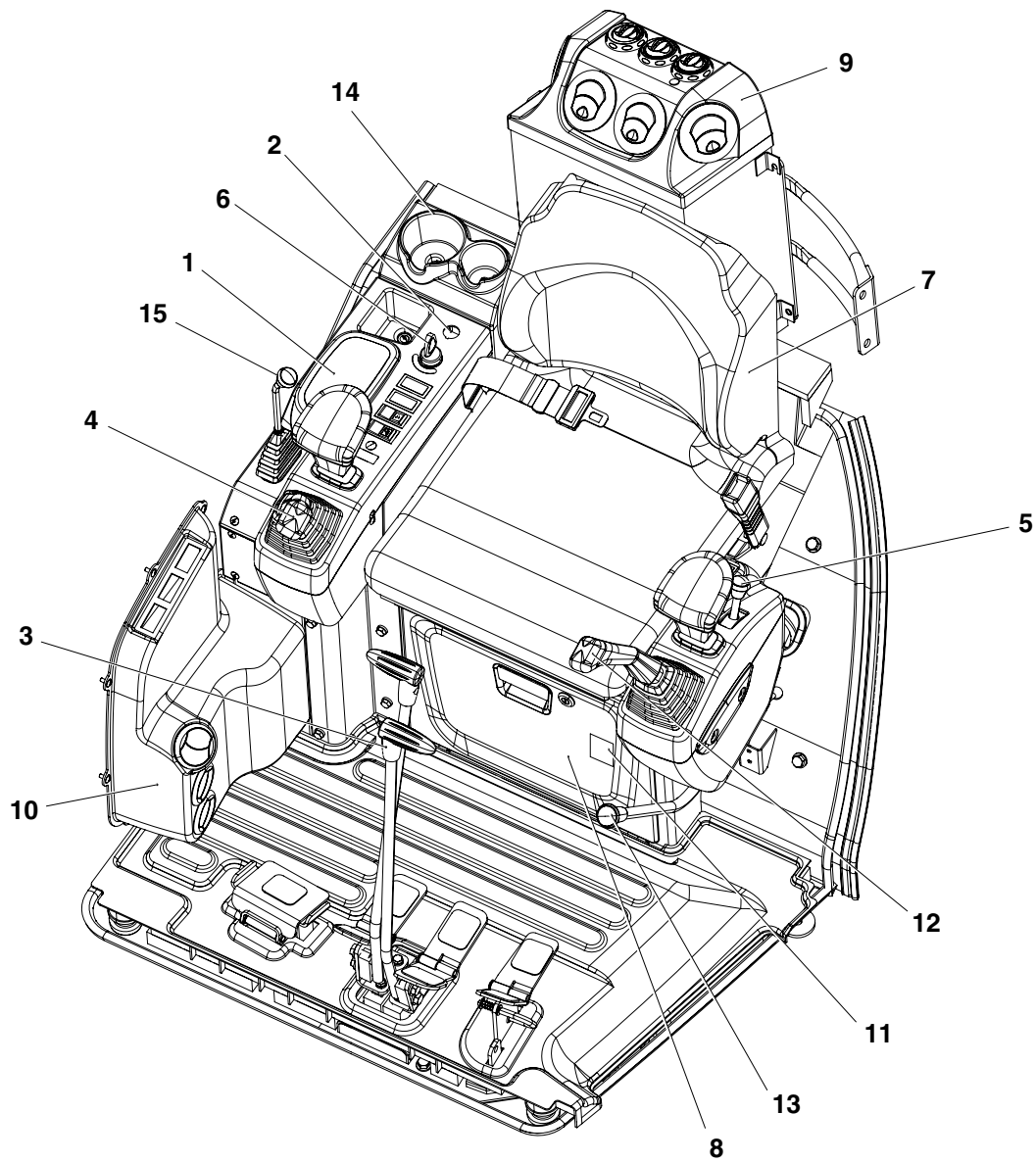
FG007483

Figure 1

Reference Number	Description
1	Boom
2	Boom Cylinder
3	Arm Cylinder
4	Arm
5	Bucket Cylinder
6	Bucket Linkage
7	(Dump) Linkage
8	Bucket
9	Swing frame
10	Cover
11	Fuel Tank
12	Hydraulic Oil Tank
13	Canopy

Reference Number	Description
14	Counterweight
15	Seat
16	Rubber Crawler (Track)
17	Blade
18	Blade Cylinder
19	Travel Motor
20	Lower Roller
21	Idler
22	Track Spring
23	Swing Bracket
24	Swing Cylinder
25	Attachment Control Levers
26	Air breather

OPERATOR'S AREA



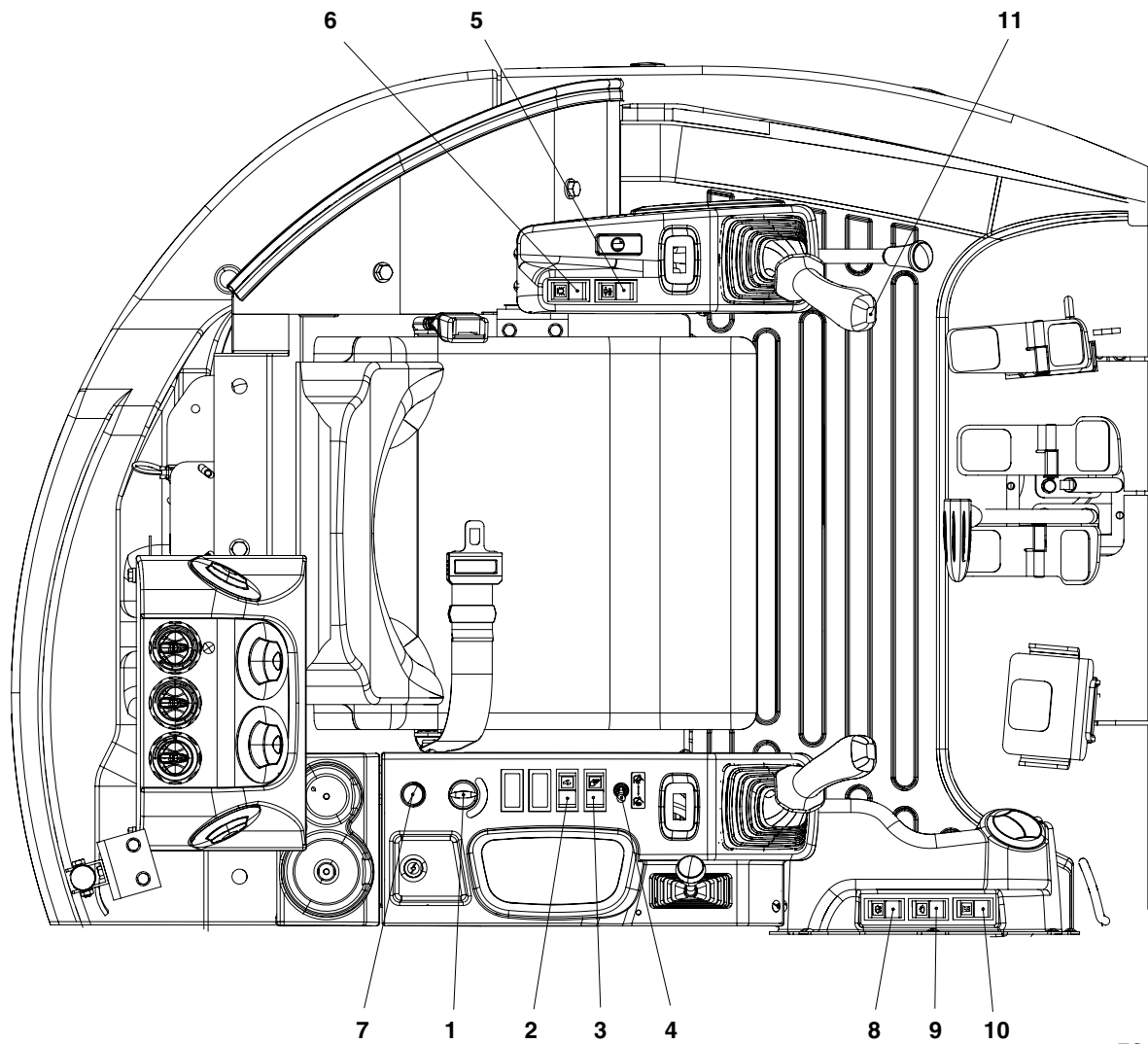
FG007488

Figure 2

Reference Number	Description
1	Instrument Panel (See page 2-12)
2	Cigar Lighter (Optional) (See page 2-10)
3	Travel Levers (See page 3-15)
4	Right-hand Work Lever (Joystick) (See page 3-22)
5	Engine Speed Control Lever (See page 2-8)
6	Starter Switch (See page 2-8)
7	Seat (See page 2-24)

Reference Number	Description
8	Storage Compartment (See page 2-28)
9	Air Conditioner Unit (Optional)
10	Heater (Optional)
11	Fuse Box (See page 2-19)
12	Left-hand Work Lever (Joystick) (See page 3-22)
13	Safety Lever (See page 3-13)
14	Cup Holder (See page 2-29)
15	Blade Lever

OPERATIONAL CONTROLS AND PANELS



FG007489

Figure 3

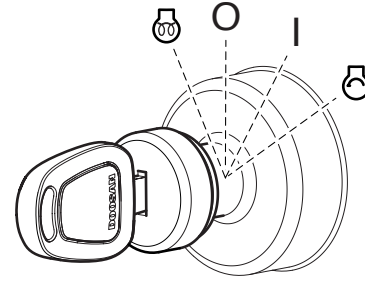
Reference Number	Description
1	Starter Switch
2	Travel Speed Selector Switch
3	Work Light Switch
4	Quick Clamp Switch (Optional)
5	Travel Alarm Switch (Optional)
6	Warning Light Switch (Optional)

Reference Number	Description
7	Cigar Lighter (Optional)
8	Windshield Washer Switch (Optional)
9	Wiper Switch (Optional)
10	Heater Switch (Optional)
11	Horn Switch

1. Starter Switch

A four-position starter switch is used to start or shut down engine for equipment operation.

- O. Turning the switch to this position turns the engine "OFF" along with its electrical system. In this position the engine is "OFF" but the interior cabin light is functional.
- I. Turning the switch to this position turns the engine electrical system "ON." The battery warning light and the oil pressure indicator light should be "ON".
-  Moving switch to this position will crank engine. When engine starts, release key and allow it to return to "I" (ON) position. Do not operate the starter switch for more than fifteen seconds at a time. This will help prevent damage to starter.



FG001364

Figure 4



WARNING!

DO NOT USE STARTING FLUIDS. The preheat system could cause the starting fluid to explode.

-  Preheat position. Used to aid engine starting in cold weather. When key is in this position, engine preheater is operating. When preheat indicator light turns "ON" engine preheat cycle is complete. Immediately turn key to crank position and start engine. This light turns "ON" after fifteen seconds when the starter switch is turned to the preheating position.

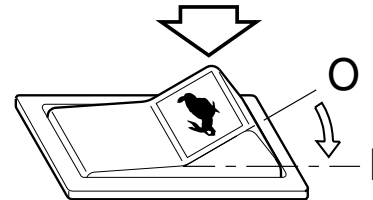
2. Travel Speed Selector Switch



WARNING!

Do not operate the travel speed selector switch when unit is in motion. Temporary loss of control could result.

- O. In this position, "LOW" travel speed is selected.
- I. In this position, "HIGH" travel speed is selected.



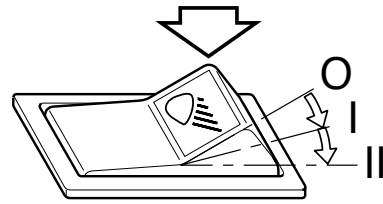
HDO2022I

Figure 5

3. Work Light Switch

This switch is used to control the work lights and the cabin work lights, if unit is equipped with them.

- O. In this position, all lights are turned "OFF."
- I. In this position, the work lights and all instrument panel lights and control switch lights are turned "ON"
- II. In this position, the work lights and all instrument panel lights and control switch lights and the front cabin work lights on the front top are turned "ON."



HA3O2014

Figure 6

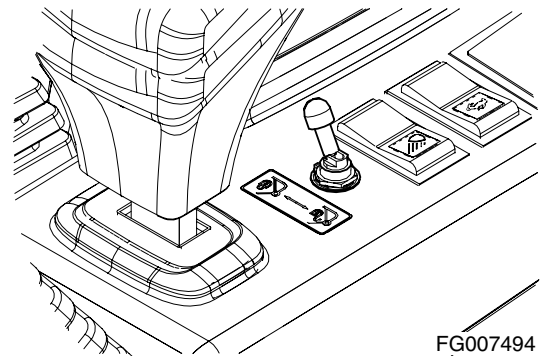
4. Quick Clamp Switch (Optional)

Clamp releasing for interchangeable attachments is controlled.

-  . In this position, the quick clamp is "LOCKED." The attachment is secured to the arm.
-  . In this position, the quick clamp is "UNLOCKED." The attachment is released from the arm.

The warning buzzer will sounds and the quick clamp indicator light will turn "ON" while the switch is in "  ," (UNLOCKED) position.

NOTE: To move the switch, pull up on the toggle and then move it into the "UNLOCKED" position.



FG007494

Figure 7

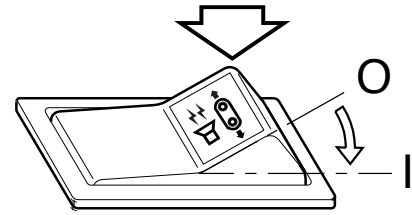
CAUTION!

When the attachment is still connected to the machine, while the switch is in the "  " (UNLOCKED) position, do not operate the machine or the attachment might fall to the ground. It would cause personnel injuries.

5. Travel Alarm Switch (Optional)

If unit is equipped with a travel alarm buzzer, push this switch to active it, whenever traveling.

- O. In this position, the travel alarm system is turned "OFF."
- I. In this position, the travel alarm will sound while traveling.



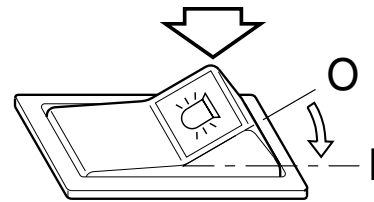
AXO1150L

Figure 8

6. Warning Light Switch (Optional)

If unit is equipped with a warning light, push this switch to activate it.

- O. In this position, the warning light is turned "OFF."
- I. In this position, the warning light turns "ON" and will start flashing.



HDO2028I

Figure 9

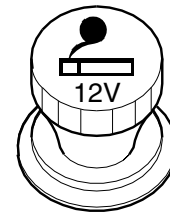
7. Cigar Lighter (Optional)

Push the lighter all the way into the socket and release your hand. After pushing it in, it will be ejected when it is heated. If it does not eject after a short time, pull it out and have it serviced.



CAUTION!

Be careful when you handle the cigar lighter because of its radiant heat and high temperature.



HA002037

Figure 10

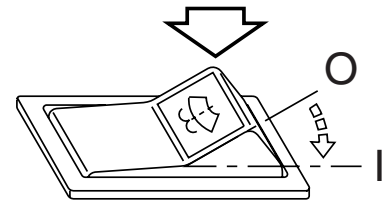
8. Windshield Washer Switch (Optional)

While the windshield wiper is running, depress the washer switch to spray windshield washer fluid onto the windshield. Use only the proper windshield washer fluid in the system.

- O. In this position, the washer is "OFF."
- I. In this position, the windshield washer sprays fluid. When released the switch returns to the "O" (OFF) position.

NOTE: Do not operate the windshield washer without any fluid. If you operate it in spite of running out of fluid, the washer motor may be damaged. Check level in washer tank, and add fluid as required.

NOTE: If you use soapy water or synthetic detergent instead of window cleaning fluid, the wiper blade or painted surfaces may be damaged. Use standard window cleaning fluid: SSK703



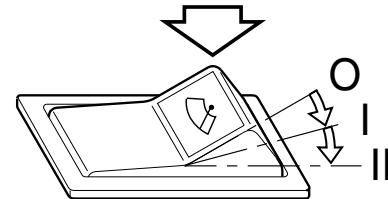
HAOA740L

Figure 11

9. Wiper Switch (Optional)

- O. In this position, windshield wiper is turned "OFF."
- I. In this position, wiper runs at "LOW" speed.
- II. In this position, wiper runs at "HIGH" speed.

NOTE: Operating wiper without washer fluid or when there is sand or dirt present will damage the window and/or wiper.



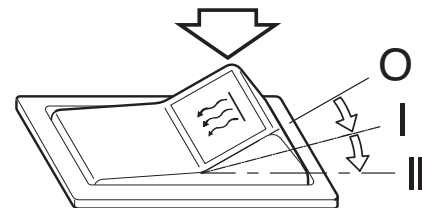
HDO2026I

Figure 12

10. Heater Switch (Optional)

This switch is used to control the speed of the blower fan used for heater.

- O. In this position, fan is "OFF."
- I. In this position, fan runs at "LOW" speed.
- II. In this position, fan runs at "HIGH" speed.



BPO0310L

Figure 13

11. Horn Switch

Press button on top of left-hand work lever (joystick) to sound horn.

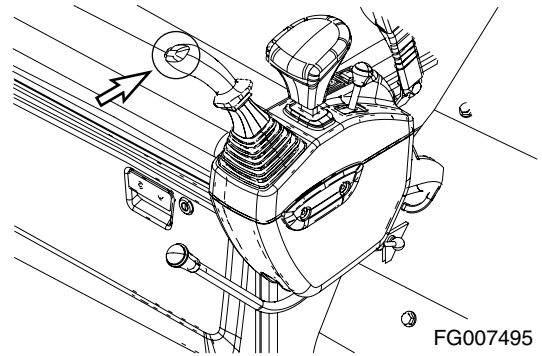
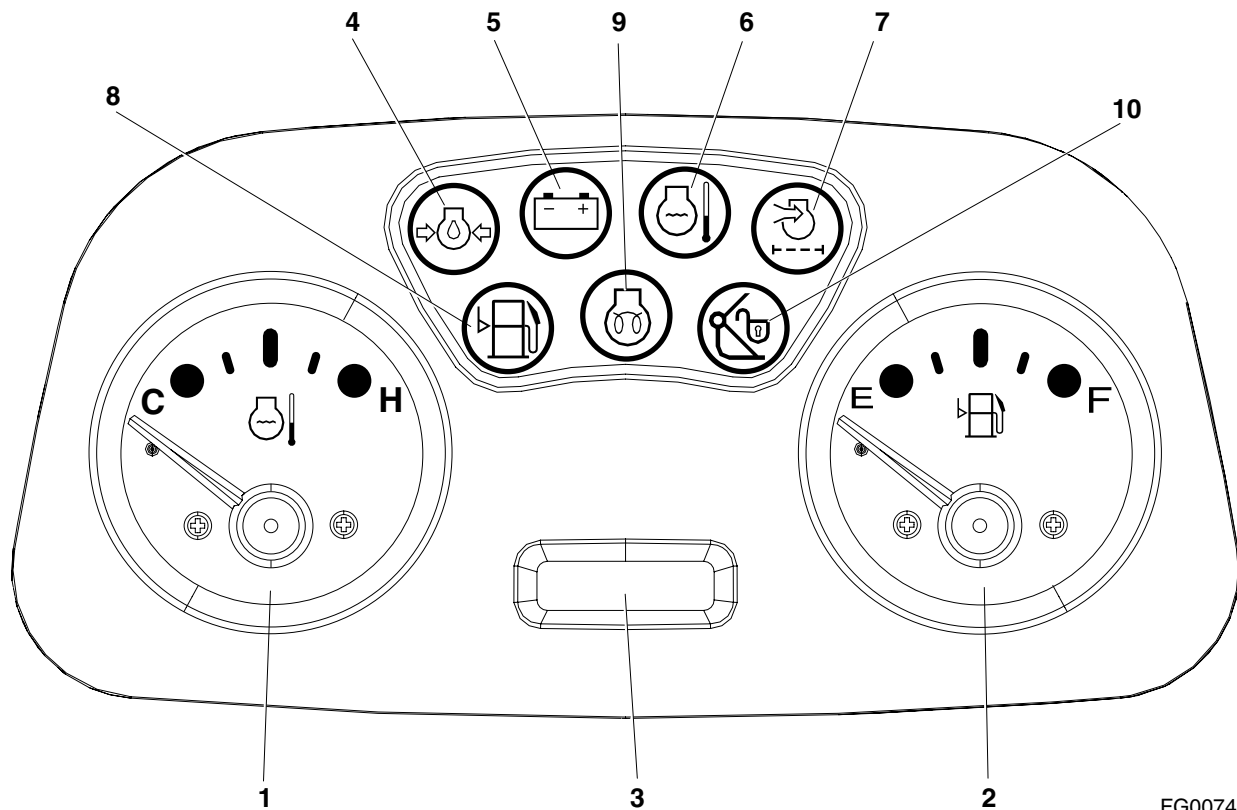


Figure 14

INSTRUMENT PANEL



FG007496

Figure 15

Reference Number	Description
1	Engine Coolant Temperature Gauge
2	Fuel Gauge
3	Hour Meter
4	Engine Oil Pressure Warning Light
5	Charge Warning Light

Reference Number	Description
6	Engine Coolant Temperature Warning Light
7	Air Cleaner Clogged Warning Light
8	Fuel Level Warning Light
9	Preheat Indicator Light
10	Quick Clamp Indicator Light

1. Engine Coolant Temperature Gauge

The colored bands indicate the temperature of the engine coolant.

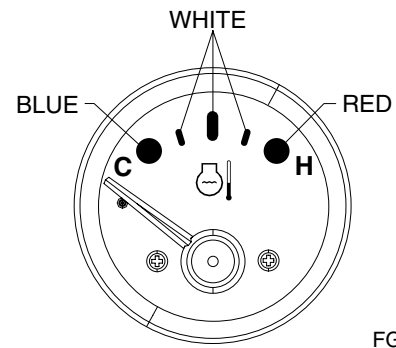
BLUE ZONE (■) - Indicates temperature is lower than the normal operating temperature.

WHITE ZONE (□) - Indicates temperature is within the normal operating range.

RED ZONE (■) - Indicates temperature is too high.

During operation, the pointer must be in the white zone.

If the gauge pointer moves into the red zone, the engine coolant temperature warning light will turn "ON". Allow the engine to run at low idle speed until the temperature gauge registers in the white zone again. When the white zone is reached, allow the engine to idle for an additional three - five minutes before shutting down the engine. If not allowed to idle, heat surge may develop which will damage the engine. Allowing the engine to idle will dissipate heat. Check the coolant level, look for a loose fan belt, inspect for debris around radiator, and so on.



FG007497

Figure 16

2. Fuel Gauge

Shows remaining fuel quantity in tank.

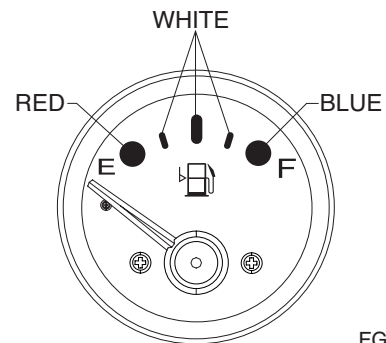
BLUE ZONE (■) - Indicates that the fuel level is full.

WHITE ZONE (□) - Indicates a normal fuel quantity.

RED ZONE (■) - Indicates that the fuel level is low.

If the gauge pointer moves into the red zone, the fuel warning light will turn "ON" in the instrument panel. Stop operation and immediately add fuel.

Check the fuel level on firm, level ground.



FG007498

Figure 17

3. Hour Meter

The hour meter is used to indicate the total number of running hours on the engine. The meter will flash every four seconds when the engine is running to indicate that it is functioning properly.

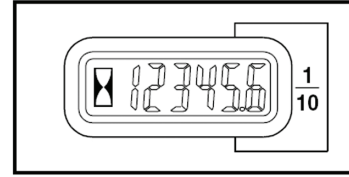


Figure 18

HA0O2012

4. Engine Oil Pressure Warning Light

This indicator light will turn "ON" when the engine starter switch is turned "ON," and should go "OFF" after the engine starts.

For example, if the engine oil pressure becomes too low, the light will turn "ON". If this happens, shut the engine down immediately and determine the cause of the problem. If you continue to work when this light is "ON," it will result in serious engine damage.

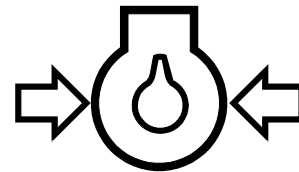


Figure 19

HA0A620L



If you continue to work when this light is "ON," it will result in serious engine damage.

5. Charge Warning Light

This indicator light will turn "ON" when the engine starter switch is turned "ON," and should go "OFF" after the engine starts. If it does not turn "OFF," shut the engine down immediately and determine the cause of the problem.

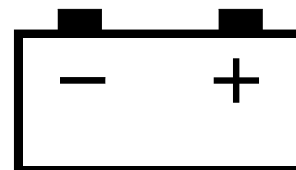


Figure 20

HA0A610L

6. Engine Coolant Temperature Warning Light

This indicator light will turn "ON" when coolant temperature rises excessively.



CAUTION!

When this light turns "ON," immediately stop work. Allow the engine to run at low idle speed until the temperature gauge registers in the "WHITE" zone again. When the white zone is reached, allow the engine to idle for an additional three - five minutes before shutting down the engine. If not allowed to idle, heat surge may develop which will damage the engine. Allowing the engine to idle will dissipate heat. Check the coolant level, look for a loose fan belt, inspect for debris around radiator, and so on.

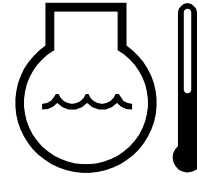


Figure 21

HAOD350L

7. Air Cleaner Clogged Warning Light

This indicator light will turn "ON" when the air cleaner filter is clogged

When it comes "ON," clean or replace the element as necessary. After the air cleaner filter has been serviced, if you place the starter switch in the "O" position and then "I" position, this indicator light turns "OFF."

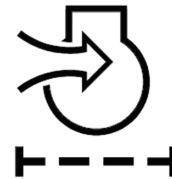


Figure 22

HAOA660L

8. Fuel Level Warning Light

This indicator light turns "ON" when the remaining fuel is about 10 liters (2.64 U.S. gal) or less.

When this indicator light turns "ON," fill the tank immediately.

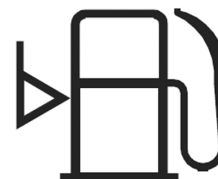


Figure 23

AXO0300L

9. Preheat Indicator Light

This indicator light will turn "ON" when preheating is completed.

This light turns "ON" after fifteen seconds when the starter switch is turned to the preheating position.



Figure 24

HAOA639L

10. Quick Clamp Indicator Light

This indicator light will turn "ON" when the quick clamp switch is in the "  " (UNLOCKED) position.



Figure 25

FG007493

STEREO (OPTIONAL)

Before operating the stereo, read operation manual enclosed with stereo.

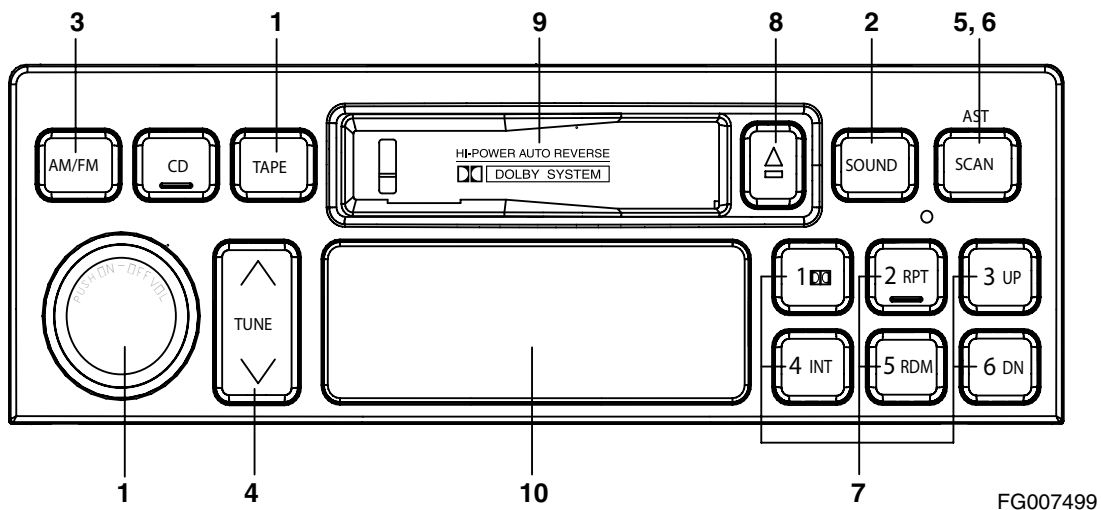


Figure 26

FG007499

Reference Number	Description
1	Power/ Volume Control
2	Sound Mode Selection
3	Band Selection
4	Tuning Up / Down
5,6	Scan Function / Auto Store

Reference Number	Description
7	Preset Station
8	Tape Ejection
9	Tape Loading Slot
10	LCD

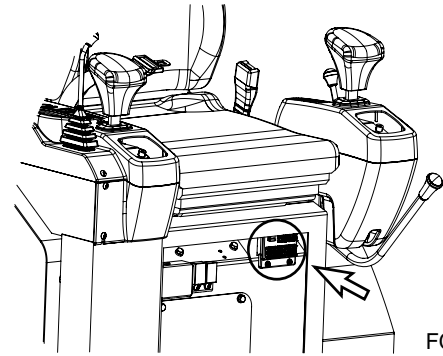
FUSE BOXES

Fuses prevent electrical devices from overloading or shorting. There is a fuse box in the electric box which is under the seat.

A decal attached to the fuse box's cover indicates the function and amperage of each fuse.

Spare fuses are mounted on the inside of fuse box's cover. (One each of a 10A, 15A, 20A and 30A.)

Change a fuse if the element separates. If the element of a new fuse separates, check the circuit and repair the circuit.



FG007500

Figure 27

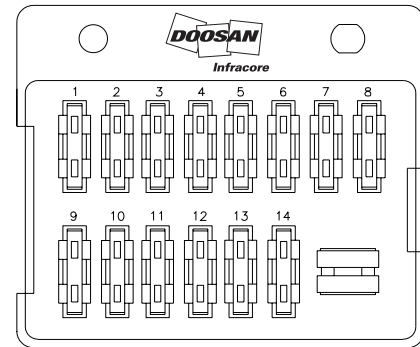


CAUTION!

Always replace fuses with the same type and capacity fuse that was removed. Otherwise, electrical damage could result.

Fuse Identification

No.	Fuse Box	
	Name	Capacity
1	Rotating Beacon	10A
2	Spare	10A
3	Horn, Travel Alarm, Fuel Pump	10A
4	Quick Clamp, High-speed	10A
5	Cigar Lighter	15A
6	Wiper, Washer, Stereo	15A
7	Pilot Cut Off	15A
8	Spare	30A
9	Air Conditioner, Compressor	20A
10	Heater	15A
11	Condenser	15A
12	Working Light, Head Light	30A
13	Gauge Panel	10A
14	Cabin Light, Hour Meter	10A



FG007491

Figure 28

MISCELLANEOUS ELECTRICAL DEVICES

Cabin Light

A light is installed on the left side on the top of the operator's cabin.

The light will work despite starter switch position.

NOTE: *If light is left "ON" for a long time while the engine is not running, the battery will be discharged.*

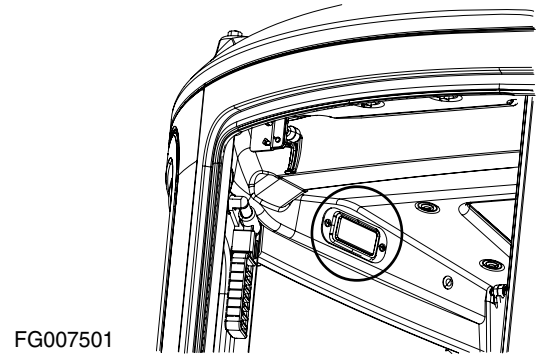


Figure 29

Pilot Cutoff Switch

When the safety lever is put into the "LOCK" position, the switch deactivates the work and travel levers. With the work and travel levers deactivated, no digging/operational work can be done.

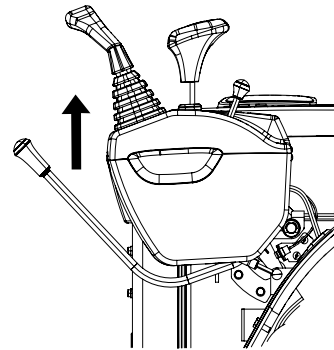


Figure 30

Fusible Link

A fusible link is in the engine compartment.

If the engine does not crank, first check that the starter switch is turned "ON" and that no power is available (No indicator lights will light.). Check that the "A" portion (Figure 31) of the fusible link is not broken or burned through. Replace the fusible link if damage and investigate cause.

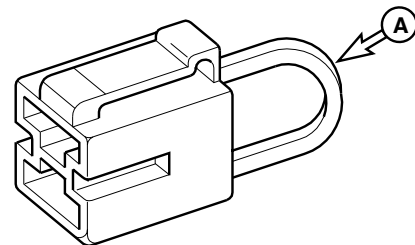


Figure 31



WARNING!

When changing the fusible link, replace the fusible link with the same capacity part. Otherwise, a fire could break out in the wiring harness and/or other components of the circuit. Always use original **DOOSAN** parts.

HEATING AND AIR CONDITIONING SYSTEM (OPTIONAL)

Location of Vents

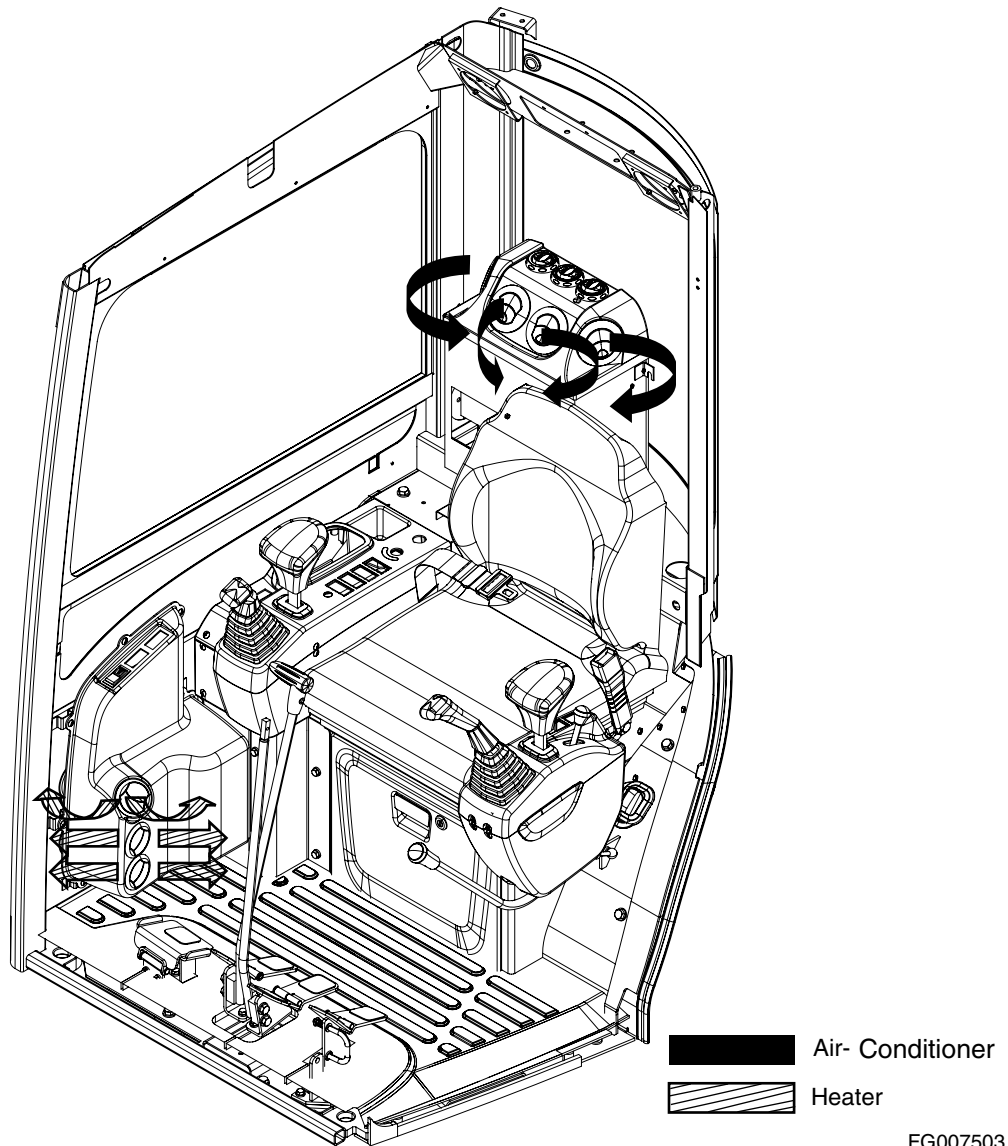


Figure 32

The heater is installed on the right side of the operator's cabin.

The air conditioner is installed on the back side of the operator's seat.

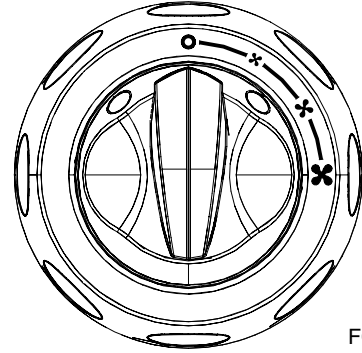
If necessary, the operator can control inner temperature using the temperature control switches installed on the right side of the operator's cabin and on the back side of the operator's seat.

Control Switches

1. Fan Speed Selector Switch of Air Conditioner

This Switch is used to control the speed of the blower fan used for air conditioner.

- ✕ In this position, fan runs at "LOW" speed
- ✕ In this position, fan runs at "INTERMEDIATE" speed.
- ✕ In this position, fan runs at "HIGH" speed.



FG007504

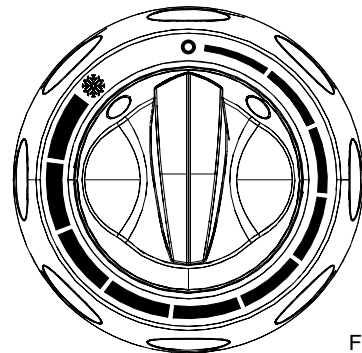
Figure 33

2. Temperature Control Switch

When the air conditioner is in operating, operator can control the coming out air temperature from the air outlets.

Clockwise, Lowers the temperature.

Counter Clockwise, Raises the temperature.



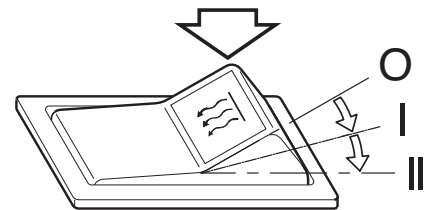
FG007505

Figure 34

3. Heater Switch

This switch is used to control the speed of the blower fan used for heater.

- O. In this position, fan is "OFF."
- I. In this position, fan runs at "LOW" speed.
- II. In this position, fan runs at "HIGH" speed.



BPO0310L

Figure 35

Additional Operating Instructions

Operate the air conditioner from 20 - 30 minutes a week to circulate the refrigerant in the system.

NOTE: *The blower switch should be on "I" position.*

If operating the air conditioner or heater for a long time, and when smoking, vent the air to the outside to prevent irritation to eyes.

The air-conditioning system not only cools indoor air but it also removes dust and moisture from the cabin.

If the system is operated when the windshield is frosted or fogged over, the unit will remove the moisture so normal visibility is possible.



WARNING!

Do not remove the refrigerant even in cold weather.

SEAT ADJUSTMENT

1. Front/rear adjustment

Pulling up the adjustment lever (1, Figure 38) allows the seat to be moved forward and backward over a range of 210 mm (8.27 in).

2. Backrest Adjustment

Lifting up the adjustment lever (2, Figure 38) under the front of the seat adjusts the seat back to obtain the desired backrest angle.

3. Suspension Adjustment

The seat is adjusted for the driver's weight with the seat empty. The adjustment is made by pulling out the actuator lever (3, Figure 38). To read off the current seating pull the actuator leave out until there is a slight resistance, pulling the actuator lever out of the end stop will return the setting to 50 kg.

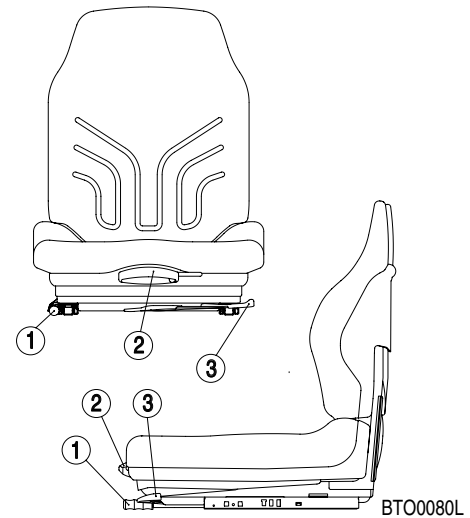


Figure 36

SEAT BELT



WARNING!

Seat belt is for operator's safety and should always be worn. Before driving machine, adjust seat to desired position for maximum comfort and machine control, then fasten seat belt. Seat belts must be worn across pelvic region and adjusted snugly to lessen chance and severity of injury in event of an accident. Never fasten a seat belt across abdomen.

Under no circumstance should operator be standing in cabin when operating wheel loader.

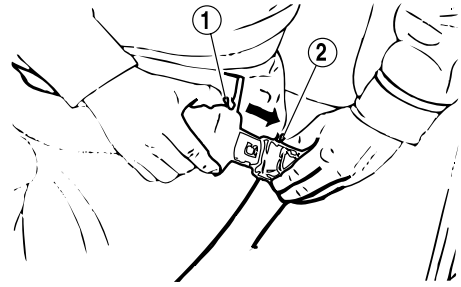
Do not adjust seat position while vehicle is moving because a loss of control may result. Stop machine, apply parking brake, and then adjust seat.

Always, check condition of seat belt and belt bracket before fastening it. Do not use it with twists in it. Replace belt or bracket if damaged or worn.

Seat Belt Locking and Unlocking

Insert belt end (1, Figure 37) into the buckle (2). Pull the belt to check that belt end is locked into buckle.

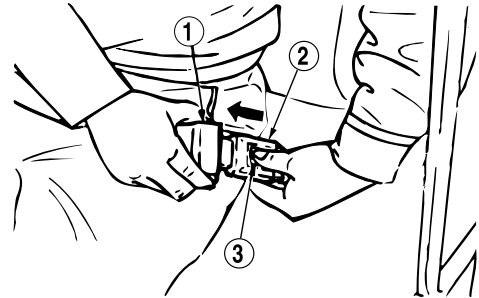
Adjust belt length so it is comfortably tight against the operator's pelvic region (hipbone).



HAOB140L

Figure 37

Press the button (3, Figure 38) in the center of buckle (2) and pull out belt (1) to unlock.



HAOB150L

Figure 38

FRONT WINDOWS



WARNING!

When leaving operator's seat, set the safety lever to "LOCK" position (Figure 39), if not a serious accident could occur by accidentally moving the work levers.

Front Upper Window

The front upper window can be housed in the cabin's ceiling.

Opening the Window



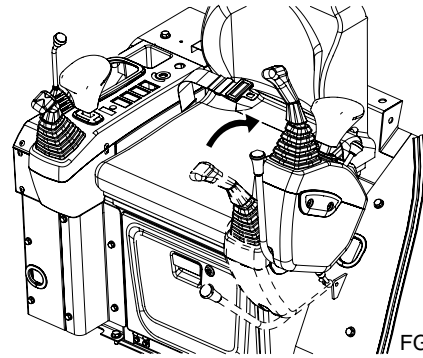
WARNING!

When stowing front window in the cabin roof, make sure both release levers (1, Figure 40) are latched.

1. Lower bucket to ground.
2. Set safety lever (Figure 39) on "LOCK."
3. Shut down engine by turning key to "O" (OFF) position.
4. Turn the lock levers (1, Figure 40) towards middle of window to release the lock.
5. Holding the lock levers pull window up and then push it back. Turn the levers to outside to lock window.
6. Check that lock levers are securely latched in the lock position.

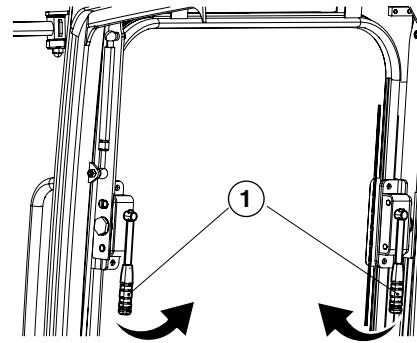
NOTE: When the front upper window is open, never extend your head or body through the window frame.

NOTE: If the window happens to fall with a strong impact against the machine, while some part of your body is extended out of the cabin, it may result in bodily injury.



FG007539

Figure 39



FG007540

Figure 40

Closing the Window



WARNING!

Be careful that your hands are not caught in window frame.

1. Lower bucket to ground.
2. Set safety lever (Figure 39) on "LOCK," and shut down engine.
3. Holding lock levers (1, Figure 41) of front window with left and right-hand, turn the lock levers towards outside edge of window to release the lock.
4. Push window forward, and lower it slowly.
5. When the bottom of the window reaches the top of the front bottom window, push the front window forward. Turn the lock levers towards frame to engage the lock.
6. Check that lock levers are securely latched in the lock position.

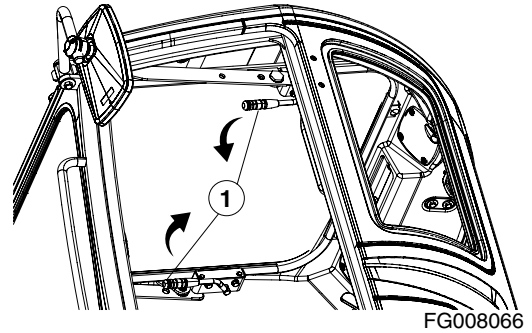


Figure 41

Front Bottom Window

The front bottom window can be removed and stored in the rear of the cabin.

1. After stowing the front upper window in the cabin ceiling, remove bottom window (1, Figure 42) from cabin in direction of the arrow.
2. Set bottom window in rubber holders (2, Figure 43) behind operator's seat. Secure window with left and right knobs (3) with push button (4).

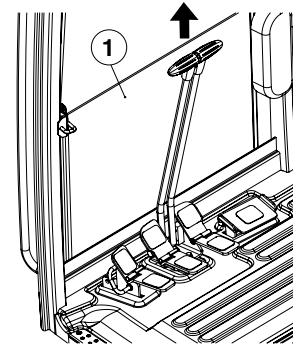


Figure 42



WARNING!

Never have wet hands when handling a window.
Never drop window or let it come into contact with other parts of the machine.

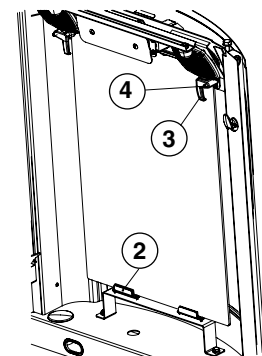


Figure 43

DOOR SIDE LATCH

1. The door side latch (1, Figure 44) is used to secure the door to the side of the cabin when it is opened.

NOTE: *Keep the door closed and locked when machine is not in use.*

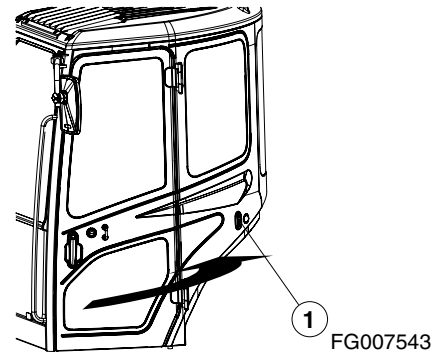


Figure 44

2. To release door from side of cabin, push the latch lever (2, Figure 45) down. The latch lever is to the left of the operator's seat.

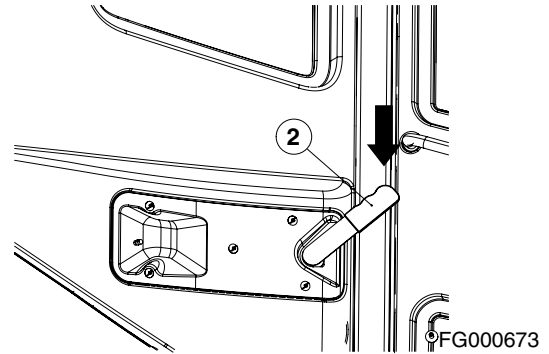


Figure 45

CABIN STORAGE COMPARTMENTS

The large compartment (1, Figure 46) is for storing nonperishable items.

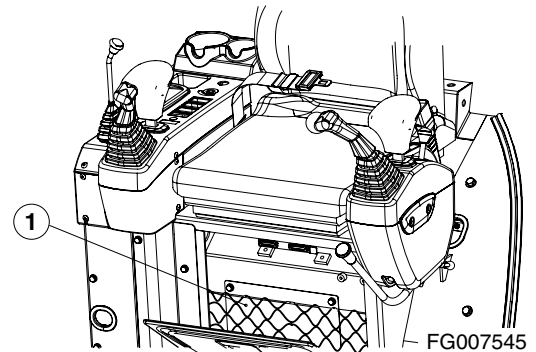


Figure 46

There is a separate small tray (2, Figure 47) on the right side of operator's seat.

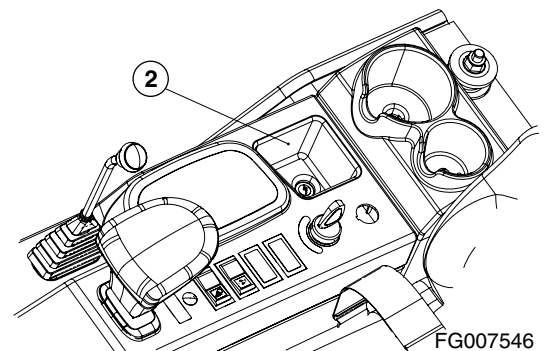


Figure 47

HANGER

A hanger (1, Figure 48) is located on the upper left side of the operator's cabin.



WARNING!

Do not hang anything that will easily fall down, or will impair your view out of the cabin.

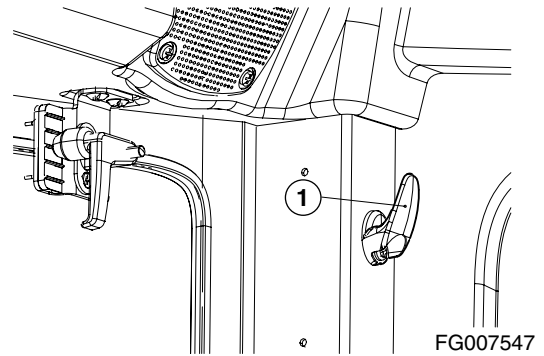


Figure 48

CUP HOLDER

There is a cup holder on the right side of the operator's seat (Figure 49).

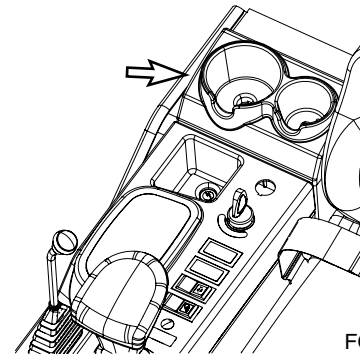


Figure 49

EMERGENCY GLASS BREAKING TOOL

The excavator is equipped with a glass breaking tool. It is to the upper left center of the cabin. This tool can be used in case of an emergency situation which requires the breaking of glass to exit from the cabin. Grip the handle firmly and use the sharp point to break the glass.



WARNING!

Protect your eyes when breaking the glass.

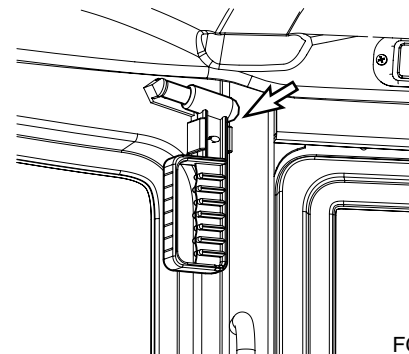


Figure 50

Operation

TO HANDLE A NEW EXCAVATOR

All DOOSAN Daewoo excavators are inspected and adjusted before leaving the factory. However, it is required that the operator follow these steps during the initial break-in period. Failure to follow these steps may result in damage to the equipment or reduced performance.

Hour	Load
For first 50 hours of operation.	Maintain about 80% load of full capacity (Engine rpm: 80% of rated rpm)
After first 50 hours of operation.	Full load

If machine is used at full load before it is broken in, it may affect the life cycle and safe running operations. This could lead to problems later.

- NOTE:**
1. Check daily for leakage of coolant, fuel, engine oil and hydraulic oil.
 2. Inspect all lubricants daily, add appropriate lubricants as required.
 3. During operation, monitor all instruments and gauges from time to time.
 4. Avoid an extreme engine load.
 5. Operate unit at 80% load until engine and all other components are at operating temperature.
 6. Check that work equipment is operating normally during operation.
 7. Check machine for loose parts or for damage that may have occurred during shipping.
 8. Check for loose wiring or terminals, check gauge operation and battery electrolyte level.

Lubrication and Filters

1. Change engine oil and replace oil filter after first 50 hours of operation.
2. Change swing reduction device oil after first 250 hours of operation.
3. Change hydraulic oil return filter after first 250 hours of operation.
4. Replace travel and reduction gear oil after first 250 hours of operation.

NOTE: *For the replenishment of oil or grease, refer to "Inspection, Maintenance and Adjustment" on page 4-1 of this manual.*

STARTING AND STOPPING THE ENGINE

Inspection Before Starting Engine



WARNING!

If a flammable materials such as leaves, paper, etc. are allowed to accumulate on high temperature components, such as the engine muffler and turbo, a fire may occur. Fuel, lubricant and hydraulic oil leaks, may cause a fire. If there is anything wrong, perform the appropriate corrective action.

Before starting engine, inspect the following items:

1. Electric system - Check for damaged electrical cables, and loose or missing connectors.
2. Fuel system - Drain water and sediment from fuel tank and water separator.
3. Hydraulic system - Check for hydraulic oil leaks, damaged tubing and hoses, and interference points of components.
4. Lubrication - Perform all daily and periodic maintenance services. Perform services according to reading shown on hour meter.
5. Safety - Perform a machine walk-around. Make sure that no one is under the machine or performing any maintenance on it, before starting engine.
6. After starting machine - Check that all operational controls and components, are in proper operating condition, and are functioning correctly. Stop operation and correct any malfunction before continuing work.

Operational Checks Before Starting Engine



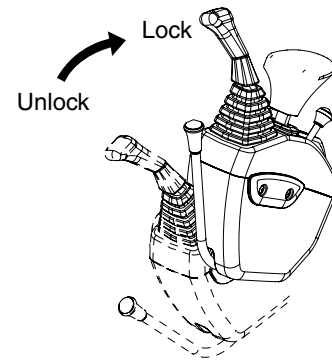
WARNING!

When leaving operator's seat, set the safety lever to "LOCK" (Figure 1) position, if not a serious accident could occur by accidentally moving the travel or work levers.

1. Set safety lever on "LOCK" (Figure 1).
2. Fasten seat belt. Check for proper operation and condition.
3. Set all operation levers in "NEUTRAL."

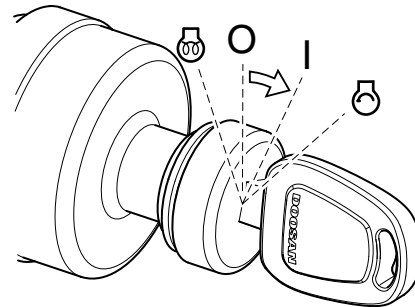
NOTE: *Be careful not to touch any switches when starting engine.*

4. Rotate the starter switch to the "I" (ON) position (Figure 2).
 - Charging warning light
 - Engine oil pressure warning light
 - Engine coolant temperature gauge
 - Fuel gauge



FG007538

Figure 1



FG001372

Figure 2

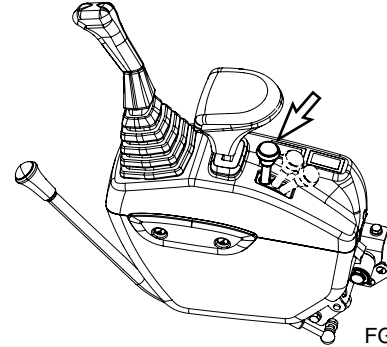
Engine Start



WARNING!

Start the engine after sounding horn and making sure that there are no people or obstacles in the area.

1. Perform all steps in "Operational Checks Before Starting Engine" on page 3-3.
2. Set engine speed control lever slightly above "LOW IDLE" (Figure 3).
3. Sound horn.



FG007557

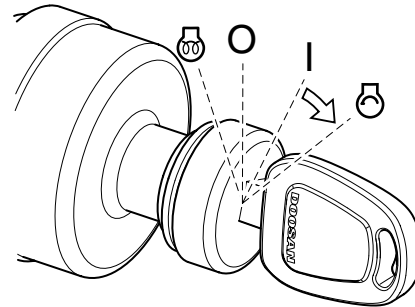
Figure 3

4. Turn starter switch to "I" (START) position (Figure 4). Engine should start in approximately five seconds.



WARNING!

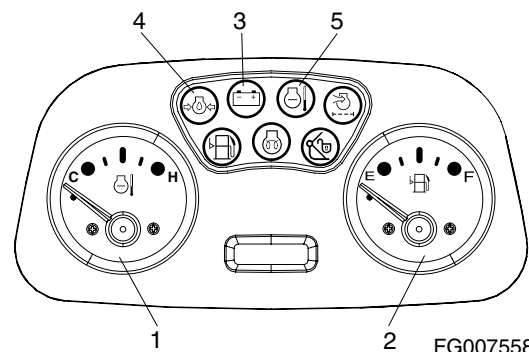
If the engine does not start after approximately fifteen seconds of cranking, release the starter switch. Wait about five minutes and repeat above step.



FG001372-1

Figure 4

5. After engine has started, release key. Key will return to the "I" (ON) position (Figure 4).
6. Follow procedures in "Hydraulic System Warm-up" on page 3-9.
7. After warming unit, check all operating indicators to make sure that all engine systems (oil pressure, coolant, etc.) are in the normal operating range. Normal indicators are:



FG007558

Figure 5

No.	INSTRUMENT PANEL LIGHT OR GAUGE	INDICATOR READING
1	Engine Coolant Temperature Gauge	White
2	Fuel Gauge	White
3	Charging Warning Light	OFF
4	Engine Oil Pressure Warning Light	OFF
5	Engine Coolant Temperature Warning Light	OFF

8. Check color of exhaust smoke.
- No color or light blue - Engine is running in good condition.
 - Black - Incomplete combustion. Check cause.
 - White or dark blue - Engine is burning engine oil. Check cause.
9. Check for usual engine vibration and noises. If any are heard or felt, investigate cause.

NOTE: *If engine coolant temperature gauge pointer moves into the red zone, the engine coolant temperature warning light will turn "ON". Allow the engine to run at low idle speed until the temperature gauge registers in the white zone again. When the white zone is reached, allow the engine to idle for an additional three - five minutes before shutting down the engine. If not allowed to idle, heat surge may develop which will damage the engine. Allowing the engine to idle will dissipate heat. Check the coolant level, look for a loose fan belt, inspect for debris around radiator, and so on.*

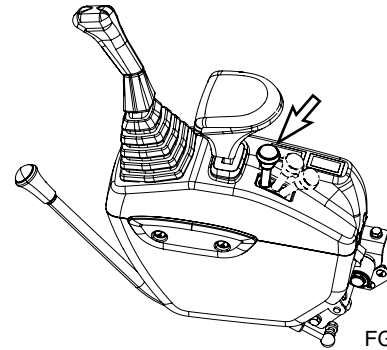
Cold Weather Starting



WARNING!

DO NOT USE STARTING FLUIDS. The preheat system could cause the starting fluid to explode. Starting fluids should never be used.

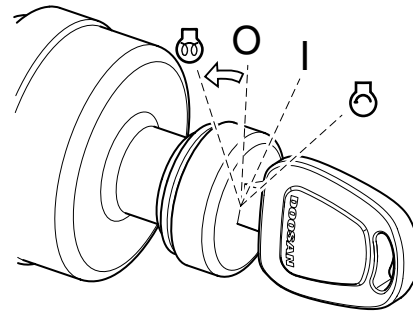
1. Perform all steps in "Operational Checks Before Starting Engine."
2. Set engine speed control lever slightly above "LOW IDLE" (Figure 6).
3. Sound horn.



FG007557

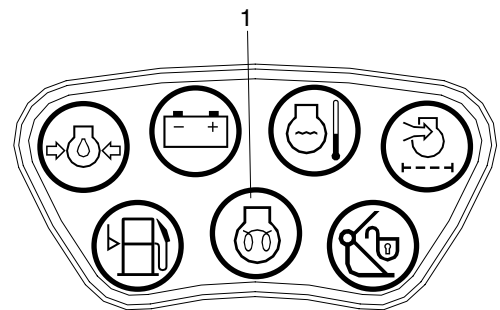
Figure 6

4. Turn starter switch to the "ON" position (Figure 7). When preheat cycle is completed, the preheat indicator light (1, Figure 8) will turn "ON."



FG008069

Figure 7



FG007559

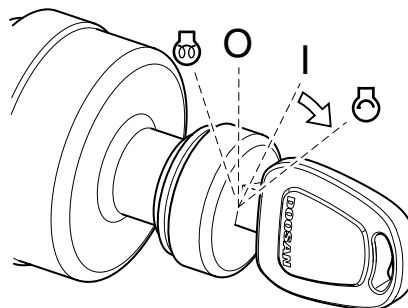
Figure 8

5. After the preheat completion, immediately turn starter switch to "O" (START) position (Figure 9). Engine should start in approximately five seconds.



WARNING!

If the engine does not start after approximately fifteen seconds of cranking, release the starter switch. Wait about five minutes and repeat above step.



FG001372-1

Figure 9

6. After engine has started, release key. Key will return to the "I" (ON) position (Figure 9).
7. After the engine starts, check all operating indicators to make sure that all engine systems (oil pressure, coolant, etc.) are in the normal operating range. If any problems are noticed, shut down engine.
8. Follow "Hydraulic System Warm-up" procedures in this section. (See page 3-9)

Starting Engine With a Booster Cable



WARNING!

1. An explosive gas is produced while batteries are in use or being charged. Keep flames or sparks away from the battery area.
2. Charge batteries in a well ventilated area.
3. Always wear eye protection when starting a machine with jumper cables.
4. Improper jump starting procedures can cause an explosion resulting in personal injury.
5. Jump start vehicles on dry ground or concrete. Do not jump start the machine on a steel floor, because the floor is always grounded.
6. When starting from another machine, make sure the machines do not touch.
7. Always connect the auxiliary battery positive (+) terminal too depleted battery positive (+) terminal first. Then connect auxiliary battery negative (-) terminal to the frame of the depleted battery machine second.
8. Connect positive cable first when installing cables and disconnect the negative cable first when removing.



HAOA440L

Figure 10

IMPORTANT

The machine has a 12V (-) negative ground electrical system. Use the same capacity 12V booster batteries when jump starting engine.

If the batteries are drained during starting procedures, jump start engine using auxiliary or booster batteries according to the following procedure:

Connecting the Booster Battery

1. Shut down engine of the machine on which booster battery is mounted (c, Figure 11).
2. Connect one end of red cable (a, Figure 11) to the positive (+) terminal of the machine battery, and the other end to the positive (+) terminal of the booster battery (d, Figure 11).
3. Connect one end of black cable (b, Figure 11) to the negative (-) terminal of the booster battery, and then make ground connection to the upper frame of the machine (e, Figure 11) to be started with the other end of black (-) cable (b, Figure 11). When making the last connection to upper frame, be sure to connect the cable end as far away from the machine battery as possible. **DO NOT CONNECT DIRECTLY TO THE NEGATIVE BATTERY TERMINAL.**
4. Start the engine.

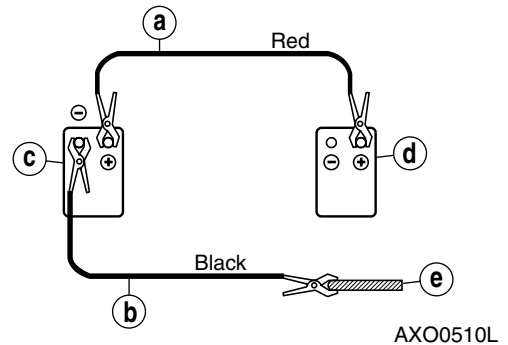


Figure 11

Disconnecting the Booster Battery

1. Disconnect black negative (-) cable (b, Figure 11) from the machine frame first.
2. Disconnect the other end of black negative (-) cable (b, Figure 11) from the booster battery.
3. Disconnect red positive (+) cable (a, Figure 11) from the booster battery.
4. Disconnect red positive (+) cable (a, Figure 11) from the machine battery.

Hydraulic System Warm-up



WARNING!

If a problem or abnormal operation occurs, immediately shut down engine. Allow excavator to reach normal operating temperature before starting work, especially in cold weather.

The correct operating temperature of the hydraulic oil is 50° - 80°C (120° - 175°F). Make sure to follow the procedures listed here for hydraulic fluid warm-up.

1. Run engine for approximately five minutes set at the middle of the speed range, without a load.

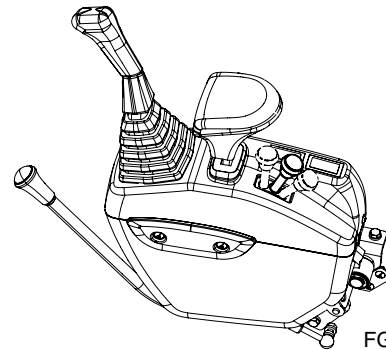


Figure 12

2. Set safety lever (1, Figure 13) on "UNLOCK" position.

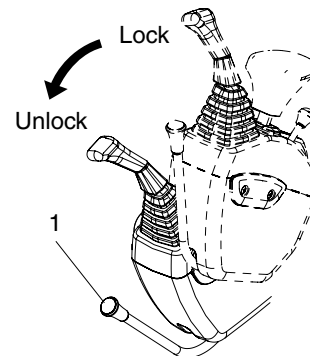


Figure 13

3. Slowly cycle boom, arm and bucket cylinders about five times without a load to circulate the oil through the system. Do this for five minutes.
4. Check for clearance and fully raise the front attachment. Swing clockwise 3 revolutions. Swing counterclockwise 3 revolutions.
5. Travel forward and reverse at low speed for two revolutions of the drive sprocket.

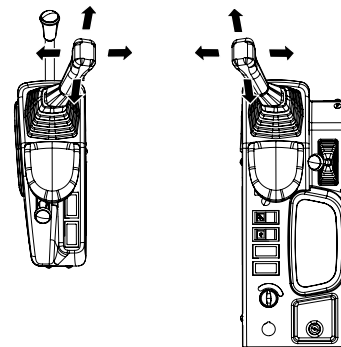


Figure 14

Hydraulic System Warm-up – Cold Weather

1. Run engine at "LOW IDLE" (no load) for five minutes (Figure 15).

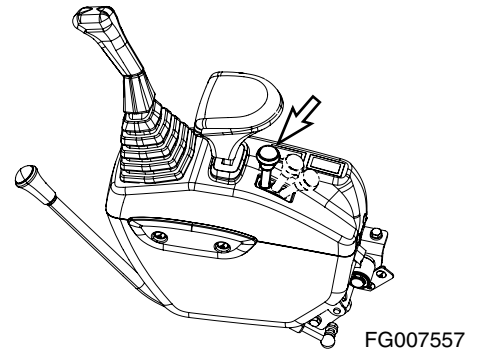


Figure 15

2. Run engine for approximately five minutes set at the middle of the speed range, without a load (Figure 16).

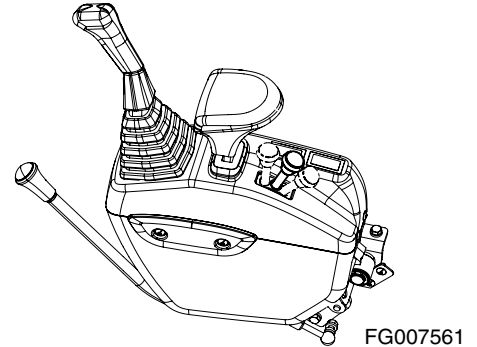


Figure 16

3. Set safety lever (1, Figure 17) on "UNLOCK" position.

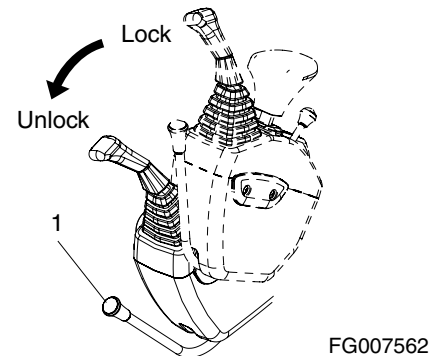


Figure 17

4. Slowly cycle boom, arm and bucket cylinders about five times without a load to circulate the oil through the system. Do this for five minutes.

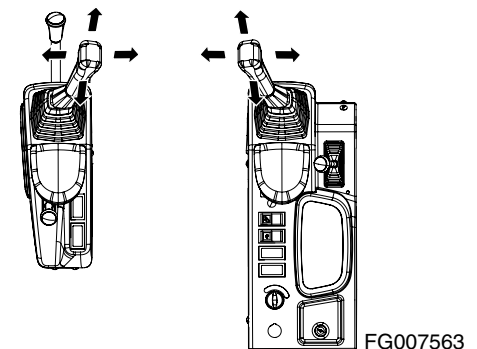


Figure 18

5. Set engine speed control dial to "HIGH IDLE" (Figure 19).
6. Repeat Step 4 for five minutes. If working speeds continue to be slow, continue to operate, but use extreme caution because the machine function may be erratic.
7. Check for clearance and fully raise the front attachment. Slowly swing clockwise 3 revolutions. Slowly swing counterclockwise 3 revolutions.
8. Travel forward and reverse at low speed for two revolutions of the drive sprocket.

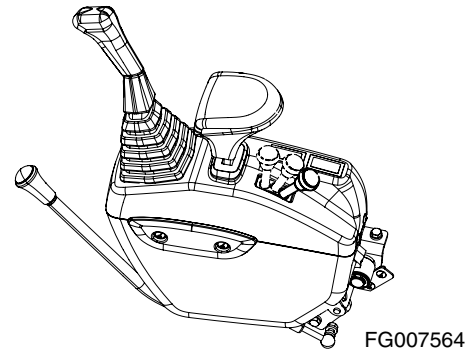


Figure 19

Engine Shut Down

NOTE: Allow engine to idle for three - five minutes before shutting down the engine. If not allowed to idle, heat surge may develop which will damage the engine. Allowing the engine to idle will dissipate heat.

1. Park machine on firm, level ground.
2. Lower front end attachment to ground and make sure all operating controls are in "NEUTRAL."
3. Set safety lever on "LOCK" position (Figure 21).

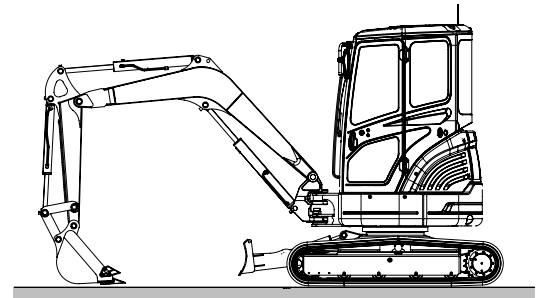


Figure 20

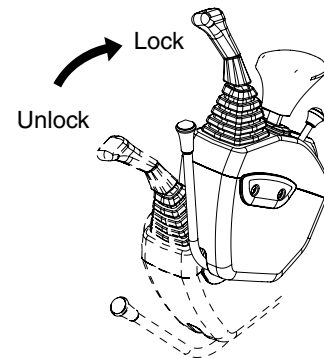


Figure 21

4. Set engine speed control lever to "LOW IDLE" (Figure 22). Allow engine to idle for three - five minutes.

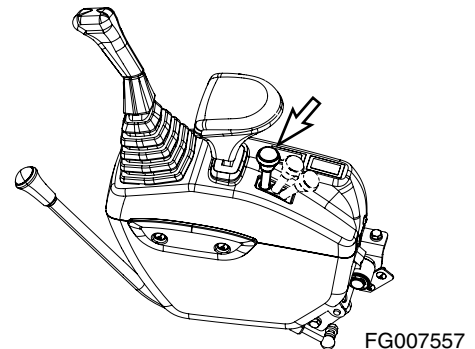
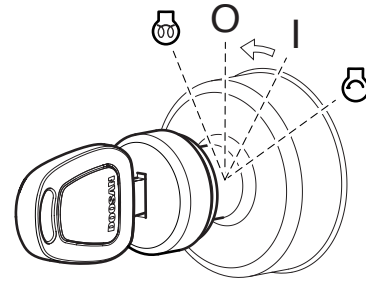


Figure 22

5. Shut down engine by turning key to "O" (OFF) position (Figure 23).
6. Remove key from starter switch.



FG001364

Figure 23

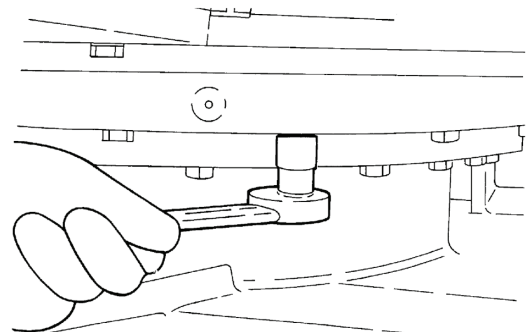
Check and Confirmation After Stopping Engine

1. Repair excavator, if there are any coolant or oil leaks.
2. Inspect front attachment and under carriage for abnormal appearances. Correct any problems.
3. Fill fuel tank.
4. Get rid of any accumulated flammable materials such as leaves and paper etc. in engine compartment.
5. Clean all mud, etc. from undercarriage and tracks. Make sure that all steps and hand holds are clean, and that the operator's cabin is clean.
6. Check machine for loose parts

IMPORTANT

Place machine on level surface, lower bucket and blade to ground, shut down engine and lock control lever.

Walk around machine and check for loose parts. Retighten, as necessary. For example, swivel bearing bolt should be tightened to 112.8 Nm / 11.5 kg·m (83 ft lb).



FG007721

Figure 24

SAFETY LEVER



WARNING!

When stopping engine or leaving the operator's seat, "LOCK" the safety lever, otherwise, a serious accident may occur by accidental movement of travel and work levers.

Whenever leaving the operator's seat, make sure the engine is shut down and the safety lever is "LOCKED."

Especially, when adjusting the seat, control stands, or raising the front window, lower window, or ceiling cover, never forget to lock the safety lever in its "LOCKED" position.

Be careful not to move the operation lever when raising up or pushing down the safety lever.

The safety lever is designed to lock the working control levers so even if the working control levers are moved unintentionally, they will not work. However, the safety lever does not control the travel levers and boom swing pedal.

1. Pull safety lever up to allow left-hand control console to raise into the "LOCKED" position. Make sure that the safety lever is "LOCKED" into the raised (up) position. When safety lever is in the "LOCKED" position, front attachment movement will be disabled even though a lever is moved.

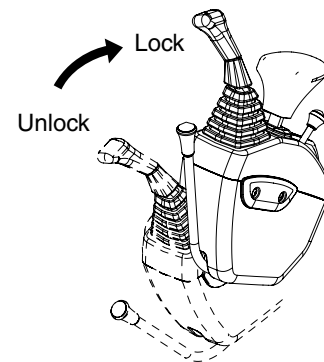
NOTE: Lower bucket (front attachment) and blade to ground. Place all control levers in "NEUTRAL" and shut down engine.

2. Set safety lever on "RELEASE/UNLOCK" position, by pushing it down before starting work.

NOTE: When the engine is not running, but the safety lever is "RELEASED" and the starter key is tuned "ON," moving the joysticks may result in movement. The charged accumulator in the system will provide pilot pressure for control valve spool movement.

NOTE: If the front attachment moves when the safety lever is moved to the "RELEASE/UNLOCK" position and all levers and pedals are in "NEUTRAL," return the safety lever to "LOCK" position, shut down engine and contact your nearest DOOSAN dealer. There is a malfunction with the system.

NOTE: If the pilot cutoff switch mounted on switch panel is not pressed to "I" position when the safety lever is in "RELEASE/UNLOCK" position, the operator cannot operate the work levers (Joysticks). (See page 2-20)



FG007566

Figure 25

TRAVEL



WARNING!

1. Before operating the travel levers, make sure that you know in which direction the machine is pointing. Look at the end of the track assemblies. If the drive motors are visible while sitting in the operator's seat, you are looking at the back end of the track assembly (therefore, you are looking backwards). In this case, the response of the travel levers will be the reverse of normal operation.
 2. Before moving, make sure that there are no personnel in the way or on the machine. Sound the horn to alert workers that you are about to move the machine.
 3. Be sure the path is clear during travel.
 4. Use extreme caution when reversing travel. Be sure there is a clear path behind the machine.
 5. Make sure to operate the travel control levers smoothly to avoid sudden starts or stops.
 6. Before leaving the operator's seat, make sure to lock out all control systems and shut down the engine to avoid accidental activation.
-

Travel Speed Control



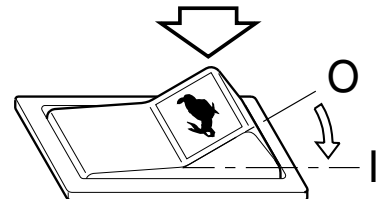
WARNING!

Do not change the travel mode while traveling. Always use speed mode "O" when traveling down a slope. It is very dangerous to change to speed modes indicated "I" or "II" while going down a slope. Only change travel mode after coming to a complete stop.

Two travel speed ranges can be selected by using the travel speed selector switch on the control panel (Figure 26).

"O" (LOW) - In this position low travel speed and a higher torque are selected.

"I" (HIGH) - In this position high travel speed and a lower torque are selected.



HDO2022I

Figure 26

Travel Control Lever Operation

1. To travel straight (Figure 27), push both travel control levers/pedals fully forward or backwards. The farther the levers/pedals are pressed, the faster the travel speed.

NOTE: "X" is the sprocket end of the track.

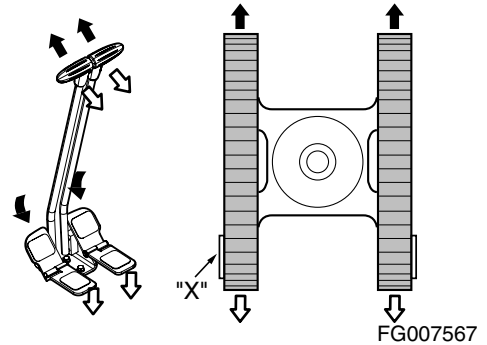


Figure 27

2. Pivot turns (Figure 28) are made by rotating only one track forward or backward. The machine will pivot on the nonmoving track.

NOTE: "X" is the sprocket end of the track.

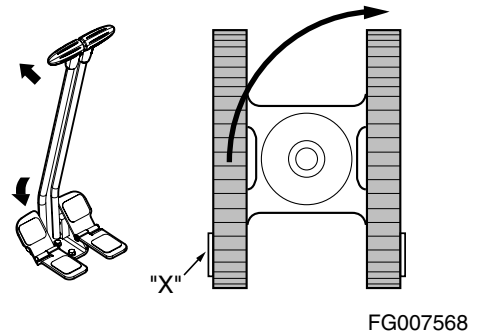


Figure 28

3. Spin turns (Figure 29) are made by rotating one track forward and one track backward. The machine will spin around its center point, thus counterrotating.

NOTE: "X" is the sprocket end of the track.

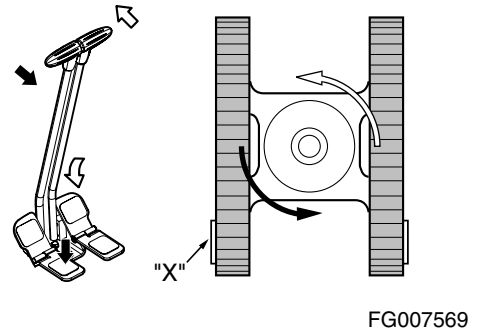


Figure 29

4. Stopping travel (Figure 30) - Returning travel levers to "NEUTRAL" position will automatically apply brakes and stop excavator.

NOTE: "X" is the sprocket end of the track.

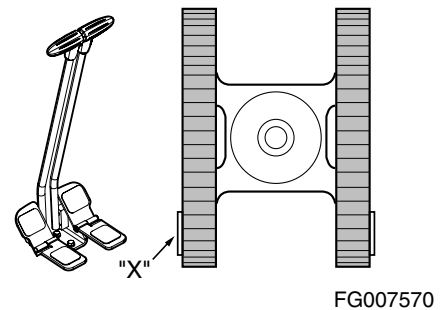
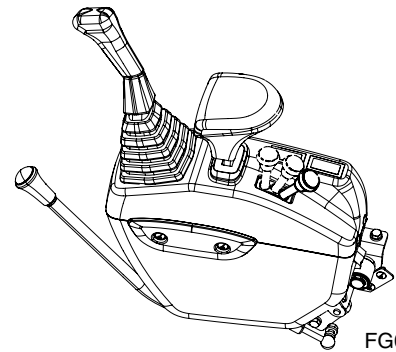


Figure 30

General Travel Instructions

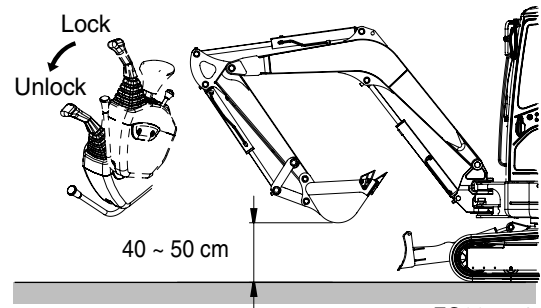
1. Set engine speed control lever (Figure 31) on desired speed.



FG007564

Figure 31

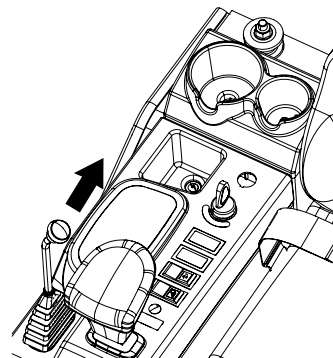
2. Set safety lever on "UNLOCK" position, and folding the front, raise it 40 - 50 cm (16 - 20 in) above ground. See Figure 32.



FG007571

Figure 32

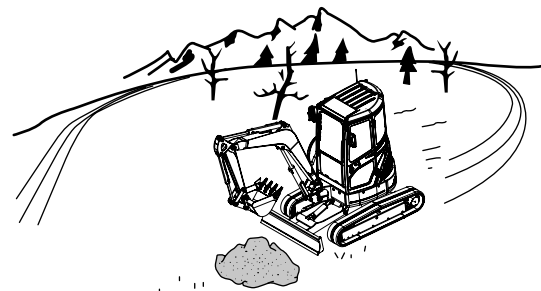
3. Raise dozer blade all the way up.



FG007658

Figure 33

4. When possible, travel on firm, level ground. Avoid sudden movements and sharp turns.
5. When traveling on rough ground, travel at a slow speed [1.0 - 1.5 km/h (0.62 - 0.93 MPH)]. Reduced engine speed, to avoid shock loading the equipment. Be careful that an excessive force is not added to equipment by touching or climbing on rocks.
6. On rough, frozen or uneven terrain, travel slowly.



FG008062

Figure 34



WARNING!

When traveling, keep bucket from 20 - 30 cm (8 - 12 in) above ground.

Do not travel backward on a slope.

Never turn or travel crosswise on a slope.

Choose a safe alternate route before climbing a slope.

If excavator starts to slip or becomes unstable, lower the bucket immediately into the ground, using it as a brake.

Avoid working on slopes, because there is a danger of overturning by becoming unbalance while swinging and performing front attachment operations.

It is very dangerous to swing towards bottom of slope with a loaded bucket.

In unavoidable cases level the slope with fill soil, to make the vehicle as horizontal as possible. See Figure 35.

Do not travel on slopes more than 30° due to turnover danger.

7. Travel straight up or down slopes, never diagonally across the slope. See Figure 36 and Figure 37. Extend the arm and lower the boom to keep the bucket about 20 - 30 cm (8 - 12 in) off the ground. If the machine starts to slide or becomes unstable, lower the bucket to regain control. If the engine stalls, lower the bucket, make sure that all controls are in the neutral position and restart the engine.

NOTE: Even though engine stops on a slope, do not operate swing control. The hydraulic accumulators may cause the unit to swing.

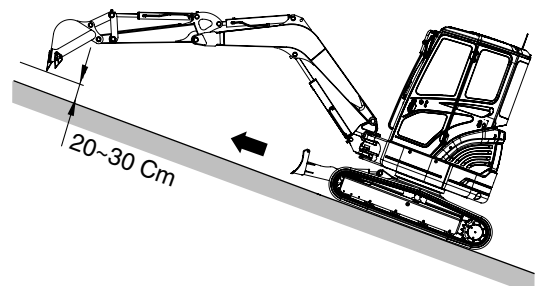
NOTE: Do not open or close operator's door on a slope. Make sure door is latched.

8. If dirt or mud builds up in the track frame, raise each track and rotate and clean that track.



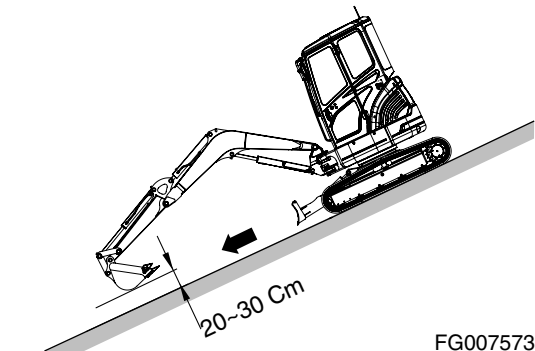
CAUTION!

When using the boom and arm to lift any portion of the machine, roll the bucket until the round base is against the ground. The angle of the arm to the boom should be at 90°.



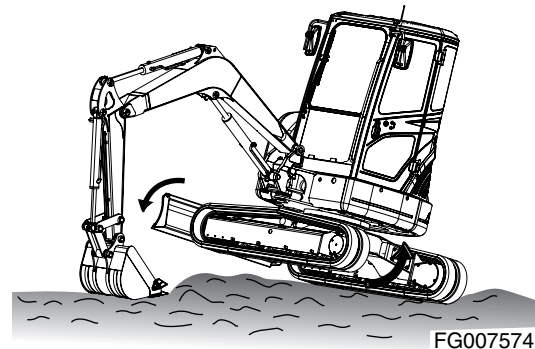
FG007572

Figure 35



FG007573

Figure 37



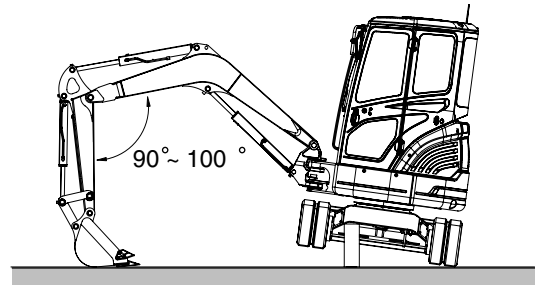
FG007574

Figure 38

Make sure that the material buildup has been cleared.
See Figure 38 and Figure 39.

9. The excavator can travel in water that comes up to center of upper carriage rollers. Make sure that footing is solid so the machine will not sink.

NOTE: *If the machine is submerged to the point that water or mud gets into the swing bearing or center joint, stop machine operation. Remove the machine from the submerged location to firm, dry ground. Do not operate until proper inspection and maintenance have been completed. Refer to the Shop Manual or contact your distributor.*



FG007575

Figure 39

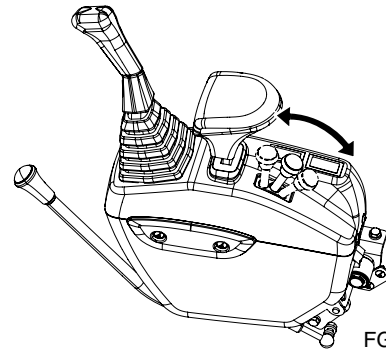
OPERATING INSTRUCTIONS

Engine Speed Control

Engine speed can be manually adjusted using the engine speed control lever. Increase engine speed by pulling the lever back. Decrease engine speed by pushing the lever forward.

IMPORTANT

The engine speed control system has been set at the factory and should not require adjustment as part of routine maintenance.



FG007576

Figure 40

Work Levers (Joysticks) (ISO Style)



WARNING!

Check surrounding area before swinging. When operating a lever while in auto idle, do it carefully, because the engine speed will increase rapidly.

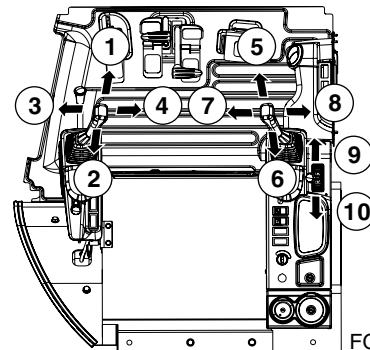
NOTE: When starting work, move work levers (joysticks) slowly and check movement of swing and front attachment.

This equipment is manufactured using the lever configuration described in ISO standards. Do not change valving, hoses, etc., that would change this standard. The boom, arm and bucket movements and swing direction of work levers (joysticks) are as follows:

Left-hand Work Lever (Joystick) (Figure 41 and Figure 42)

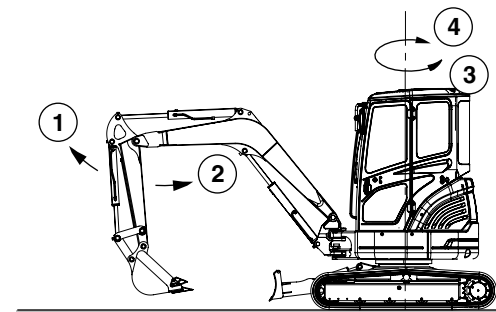
1. Arm dump
2. Arm crowd
3. Left swing
4. Right swing

NOTE: The swing brake is spring applied and hydraulically released. It is always engaged when the work lever (joystick) is in "NEUTRAL" or the engine is shut down.



FG007577

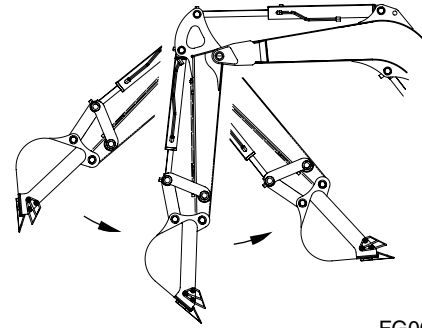
Figure 41



FG007578

Figure 42

NOTE: *The following is not a mechanical malfunction but a proper phenomenon of the excavator. When operating the arm, it may stop momentarily. When the arm is operated, the weight of the arm may cause it to move faster than the amount of oil being supplied.*



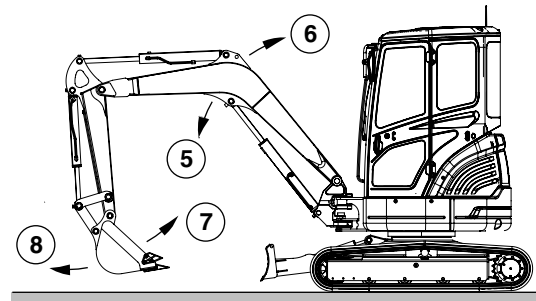
FG007579

Figure 43

Right-hand Work Lever (Joystick) (Figure 41 and Figure 44)

- 5. Boom down
- 6. Boom up
- 7. Bucket crowd
- 8. Bucket dump

NOTE: *Even after stopping the engine, the front and the dozer can be lowered to the ground by operating work lever (joystick), by setting safety lever on "UNLOCK" position and turning starter switch "ON."*

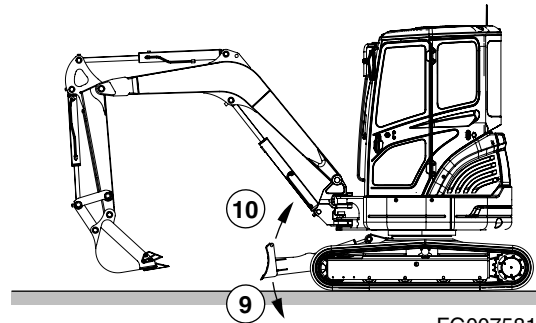


FG007580

Figure 44

Right-hand Dozer Lever

- 9. Dozer down
- 10. Dozer up



FG007581

Figure 45

Change Machine Control Pattern by Select Valve (If Equipped)



WARNING!

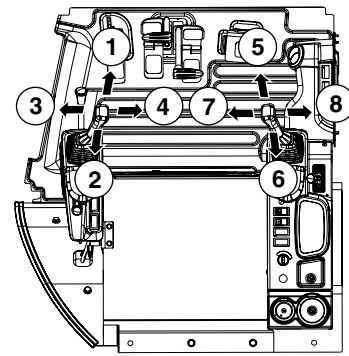
Check surrounding area before swinging. When operating a lever while in auto idle, do it carefully, because the engine speed will increase rapidly.

NOTE: When starting work, move work levers (joysticks) slowly and check movement of swing and front attachment.

The machine control pattern can easily be changed to the ISO standard or to the standard backhoe loader hydraulic system (BHL) by changing the position of the select valve (if equipped). Use the following procedure to change the position of the select valve.

The select valve is located in the rear of the cabin.

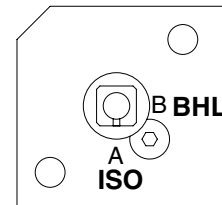
1. Rotating spool to the ISO position or to the BHL position. (Figure 47)



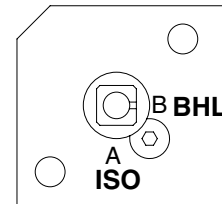
FG007624

Figure 46

<ISO PATTERN>



<BHL PATTERN>



FG007582

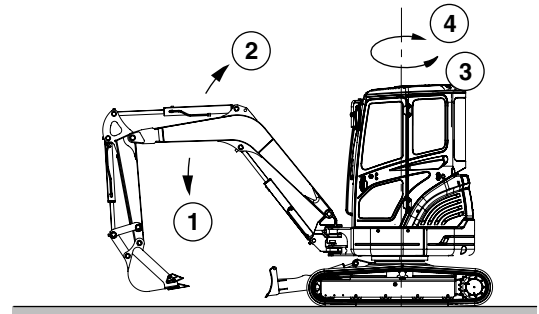
Figure 47

Work Levers (Joysticks) (BHL Style)

Left-hand Work Lever (Joystick) (Figure 46 and Figure 48)

1. Boom down
2. Boom up
3. Left swing
4. Right swing

NOTE: The swing brake is spring applied and hydraulically released. It is always engaged when the work lever (joystick) is in "NEUTRAL" or the engine is shut down.



FG007583

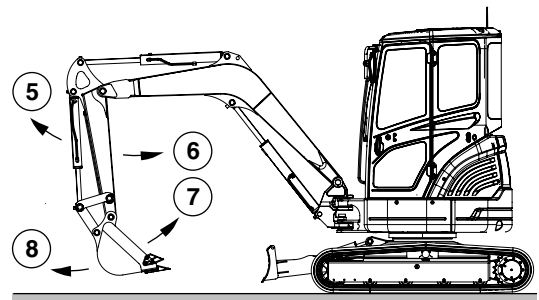
Figure 48

Right-hand Work Lever (Joystick) (Figure 46 and Figure 49)

5. Arm dump
6. Arm crowd
7. Bucket crowd
8. Bucket dump

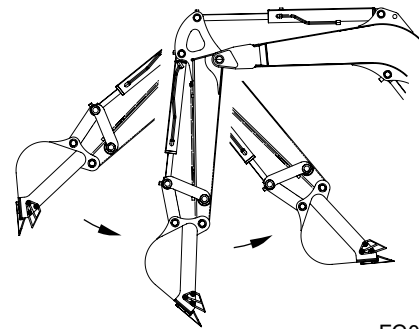
NOTE: The following is not a mechanical malfunction but a proper phenomenon of the excavator. When operating the arm, it may stop momentarily. When the arm is operated, the weight of the arm may cause it to move faster than the amount of oil being supplied.

NOTE: Even after stopping the engine, the front can be lowered to the ground by operating work lever (joystick), by setting safety lever on "UNLOCK" position and turning starter switch "ON."



FG007584

Figure 49



FG007579

Figure 50

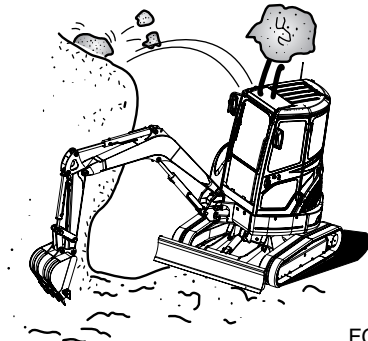
OPERATING PRECAUTIONS



WARNING!

Do not rest your feet on the travel pedals during normal machine operation. Unexpected machine travel may occur in this situation.

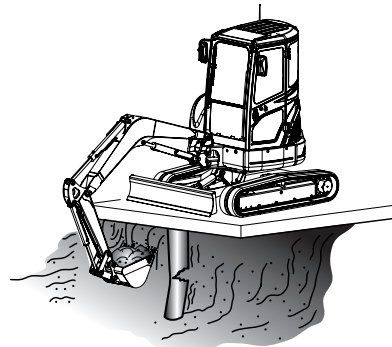
1. Before starting work, investigate terrain and soil condition. Level ground and drain area if necessary.
2. Install window guards when working where there is a possibility of falling rocks or other objects.



FG007586

Figure 51

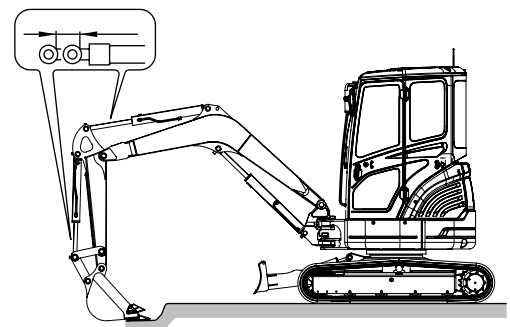
3. Check strength of supported structures in advance before working on them. If insufficient, reinforce it. If any doubt exists about structural strength, refuse to operate unit.
4. It is possible that the boom, arm or bucket may come into contact with the upper or lower structure of the machine. There are digging conditions which could allow this to happen.



FG007588

Figure 52

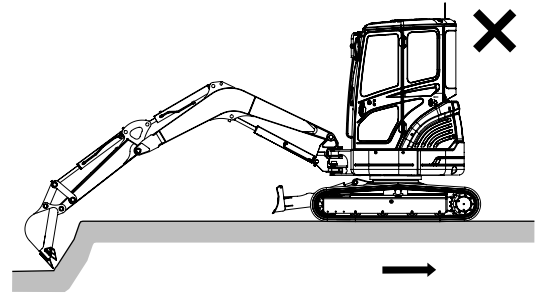
5. Do not continually "bottom out" the hydraulic cylinders. Machine damage may occur if the cylinders are fully extended or retracted, example: arm cylinder fully retracted and the bucket cylinder is extended to rotate the bucket into the ground.



FG007589

Figure 53

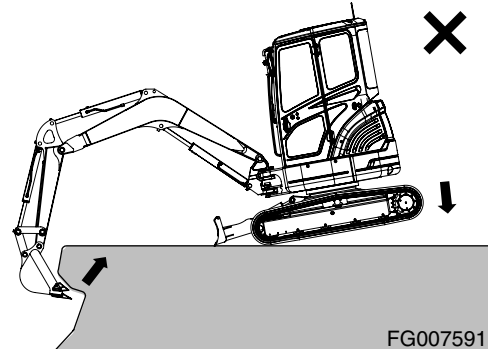
6. Do not use machine travel or swing when the bucket is in the ground to provide additional breakout force. See Figure 54.



FG007590

Figure 54

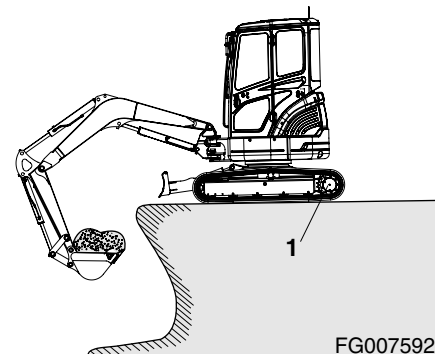
7. Do not use machine weight to provide additional breakout force. See Figure 55.
8. When working on soft or muddy ground, make sure that the machine is not sinking.



FG007591

Figure 55

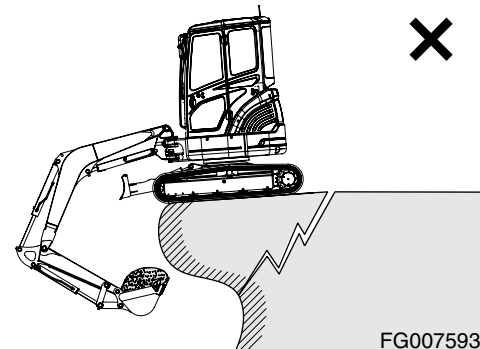
9. When working close to the excavated edge, make sure that the ground the machine is sitting on is solid. Keep the travel motors (1, Figure 56) to the rear. See Figure 56.



FG007592

Figure 56

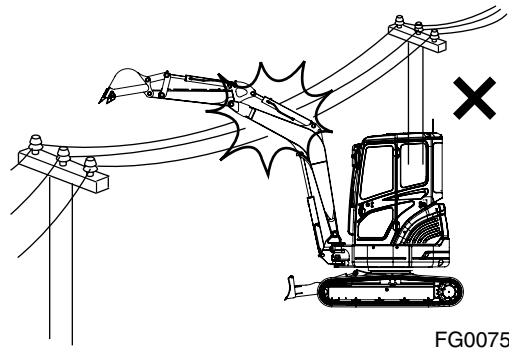
10. Do not excavate underneath the machine. See Figure 57.



FG007593

Figure 57

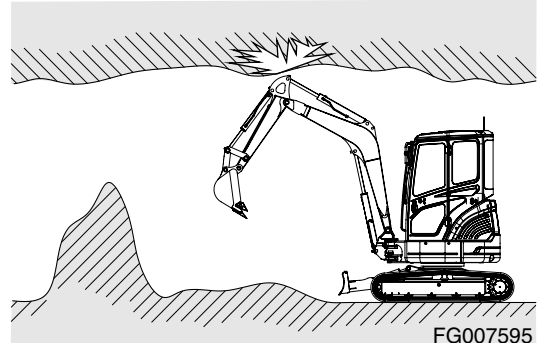
11. Make sure that there is adequate clearance from overhead electrical supply lines. See Figure 58.



FG007594

Figure 58

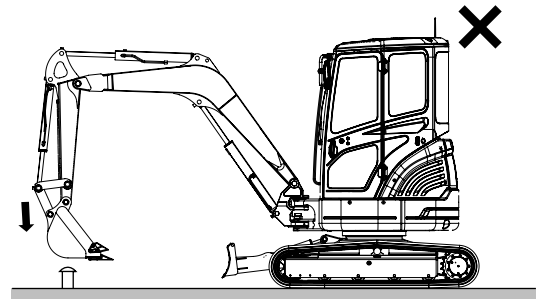
12. If the excavation is in an underground location or in a building, make sure that there is adequate overhead clearance and that there is adequate ventilation. See Figure 59.



FG007595

Figure 59

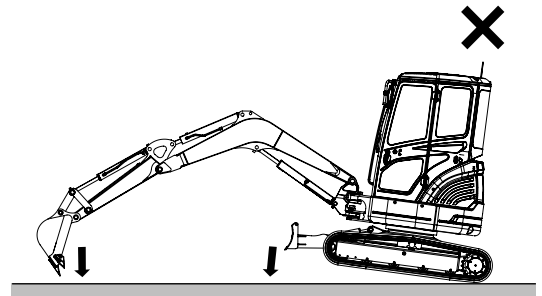
13. Do not use the bucket as a hammer or ramming device. This is dangerous and causes damage to the front attachment. See Figure 60.



FG007596

Figure 60

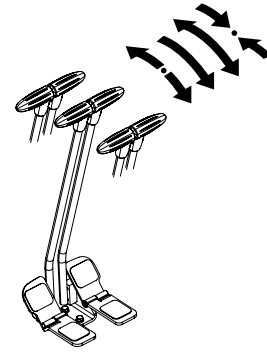
14. Do not dig with the excavator tracks raised. This can result in structural and mechanical failures.



FG007627

Figure 61

15. Do not operate travel lever quickly when traveling in high range.
 - Avoid sudden starts.
 - When traveling in one direction come to a complete stop before reversing directions. Do not rock excavator back and forth with levers.
 - Avoid sudden stops. Return levers to neutral by hand. Do not let them snap back to neutral on their own.
16. If the optional long fronts or attachments or heavy duty front end attachments are used, the machine balance will be altered. Follow these additional operating precautions.



FG007597

Figure 62



WARNING!

Do not travel downhill with the front end attachments raised.

Do not travel across slopes; travel straight up or down slope.

Use extreme caution when swinging the upper frame when positioned on a slope.

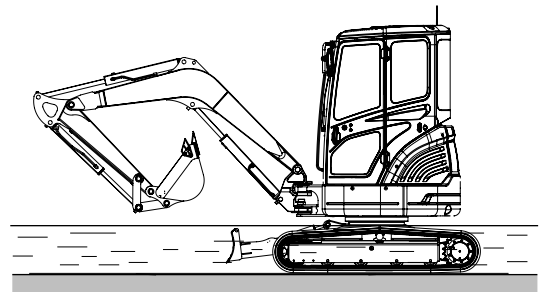
Allow extra swing stopping room. The additional momentum generated by the longer or heavier front end equipment will increase the amount of time needed to stop the swing motion.

Make sure that all optional equipment has been authorized and installed properly.

17. Do not move dirt or objects by swinging the excavator into them. This can result in structural and mechanical failures.

Operation under Water or on Weak Ground

1. If a riverbed is uneven or the current is swift, be especially careful. Do not travel in water deeper than the upper part of the shoes on the idler end of tracks. Be careful not to submerge the center joint, swivel bearing or pinion gear in water, mud or sand.
2. On weak, unstable surfaces, the machine may sink: keep watching the tracks and checking the riverbed surface.



FG007628

Figure 63

IMPORTANT

If the center joint, Swivel bearing or pinion gear are submerged in water, mud or sand, they need to be serviced, either lubricated or in some cases rebuilt. In addition, any other component that is submerged, such as a bucket pin, should be lubricated.

PARKING EXCAVATOR



WARNING!

Park machine on firm, level ground. Avoid parking on slopes. If excavator must be parked on a slope, block tracks and place bucket teeth in ground. See Figure 64.

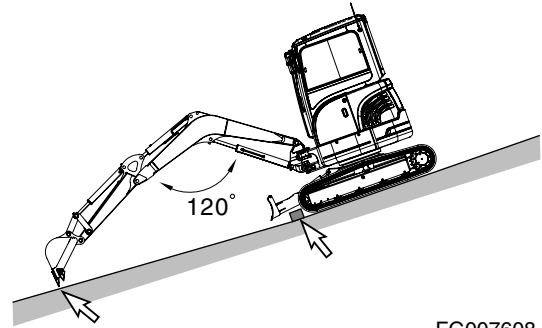


Figure 64

FG007608

1. Park machine on firm, level ground. Lower bucket to ground as shown in Figure 65.

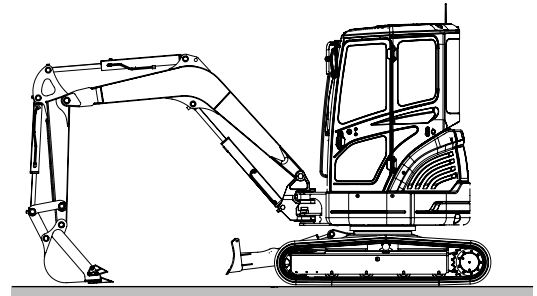


Figure 65

FG007609

2. Set engine speed control dial on "LOW IDLE."

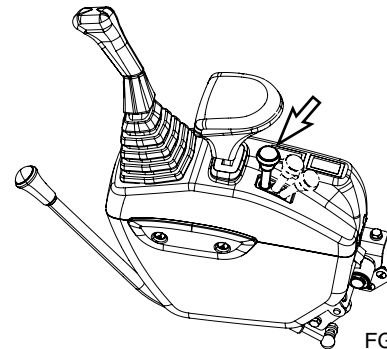


Figure 66

FG007557

3. If you touch the operation lever unintentionally, it may create a serious accident. Before leaving operator's seat, set safety lever on "LOCK" position.

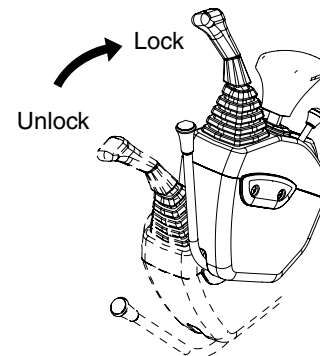


Figure 67

FG007566

TOWING PROCEDURE



WARNING!

Never use a damaged wire rope or chain. They could brake and cause a serious accident.

Always wear gloves when handling a chain or wire rope.

When towing excavator use a wire rope or chain capable of handling the load.

Attach chain or wire rope to track frame as shown in Figure 68

Insert protective material such as thick cloths between track frame and wire rope to prevent the wire rope from being damage.

IMPORTANT

Use shackle hook on track frame to only haul objects that weigh less than 5 metric tons (5.51 U.S. Tons). Never use it to haul objects over 5 metric tons (5.51 U.S. Tons).

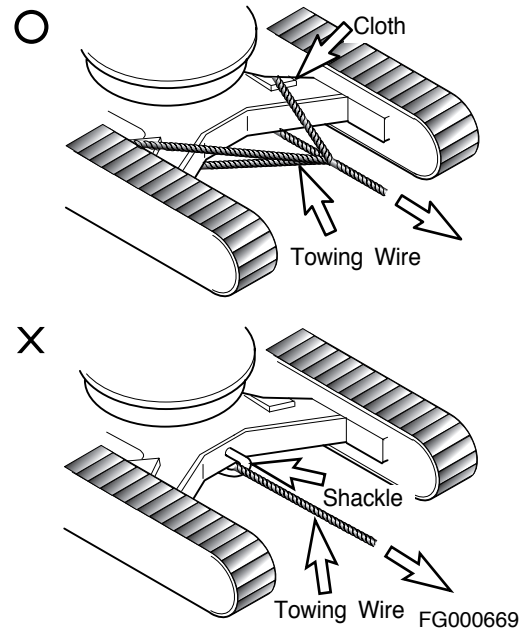


Figure 68

HYDRAULIC BREAKER

IMPORTANT

If a hydraulic breaker and piping is installed without **DOOSAN's** authorization, it may create a serious malfunction which will not be covered under the excavator warranty.

Selection of Hydraulic Breaker

If a hydraulic breaker is installed, consider equipment's stability and suitability for such modification. Also, consider hydraulic oil pressure and quantity. When selecting a hydraulic breaker consult with a **DOOSAN** distributor or sales agency.

Hydraulic Hoses and Tubing for Breaker

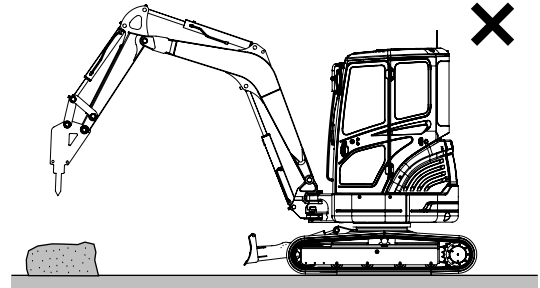
1. When installing hydraulic breaker, assemble according to drawings provided with kit.
2. If breaker is taken off excavator, be sure to plug and cap all hoses and tubing to prevent contamination from entering hydraulic system.
3. Plug and cap all connectors and fittings on breaker to prevent contamination.
4. Check all hydraulic connections for signs of leaks or loose components before starting operation.

Hydraulic Breaker Operation

NOTE: Hydraulic pressure and flow settings may need to be changed. Refer to the Maintenance Section of this manual for further information.

1. Make sure to read and understand the breaker user's manual.
2. Inspect all mechanical and hydraulic connections.
3. Do not use the breaker as a hammer. See Figure 69.
Do not drop breaker from extreme heights.

The breaker is relatively heavy and drops fast. Do not drop breaker from extreme heights or damage to upper structure may result.

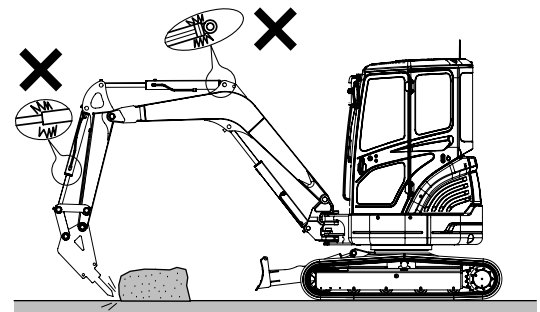


FG007610

Figure 69

4. Do not operate the breaker with the boom or arm cylinders fully extended (bottomed out). See Figure 70.

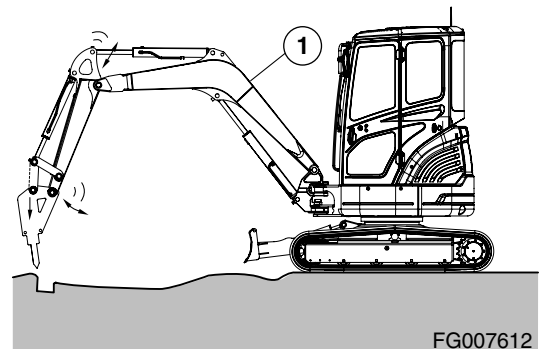
Leave over 100 mm (4 in) of clearance between rod end of cylinder and cylinder head. This will help prevent damage to cylinders during breaker operation.



FG007611

Figure 70

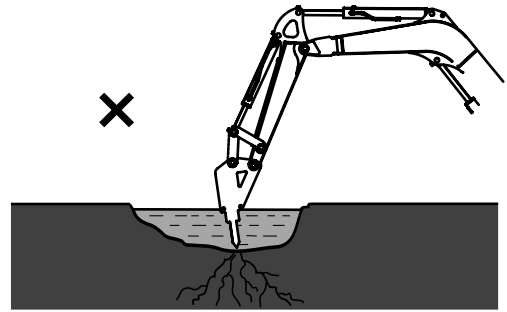
5. Do not use the breaker if the hydraulic hoses vibrate excessively. See Figure 71. Check the breaker's hydraulic accumulator (1) for damage and repair as required. If excavator is operated under this condition, structural and hydraulic components can be damaged.



FG007612

Figure 71

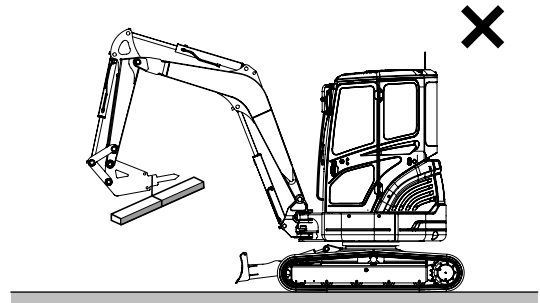
6. Do not allow the breaker body to go into water if not equipped for underwater operation. The breaker seal can be damaged and allow rust, foreign material or water to enter the hydraulic system and cause damage. Only insert the breaker tool into water. See Figure 72.



FG007613

Figure 72

7. Do not any lifting or towing with a breaker. See Figure 73.



FG007614

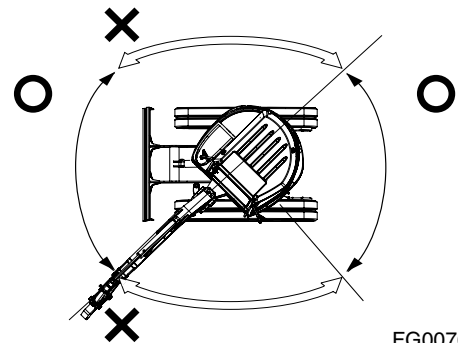
Figure 73

8. Operate the breaker only to the front and rear of the excavator. Do not use the breaker to either side of the excavator. Do not swing the breaker from side to side when operating it. See Figure 74.



WARNING!

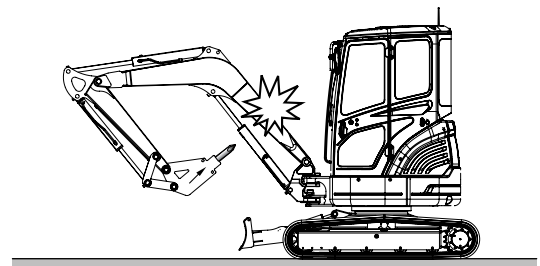
Operating a breaker with the upper body turned 90° to the tracks can result in tipping over the machine or reduction in service life.



FG007615

Figure 74

9. Do not curl the breaker tool tip into the arm or boom when traveling or parking the excavator. See Figure 75.



FG007616

Figure 75

Hydraulic Oil and Filter Service Intervals

When using a hydraulic breaker, the viscosity breakdown and contamination of hydraulic oil is faster because the work condition is more severe than during normal digging work. To prevent the hydraulic components (especially pump) from having a shortened life cycle, replace the hydraulic oil and main hydraulic oil return filter using the following schedule.

Attachment	Operation Rate	Hydraulic Oil	Filter
Bucket Work	100%	2,000 Hours	250 Hours (First Replacement) 1,000 Hours (After First Replacement)
Hydraulic Breaker Work	100%	500 Hours	100 Hours
* These service intervals only apply, when a genuine <i>DOOSAN</i> oil and filter are used. If any other brands are used, the guaranteed changed interval should be reduced in half.			

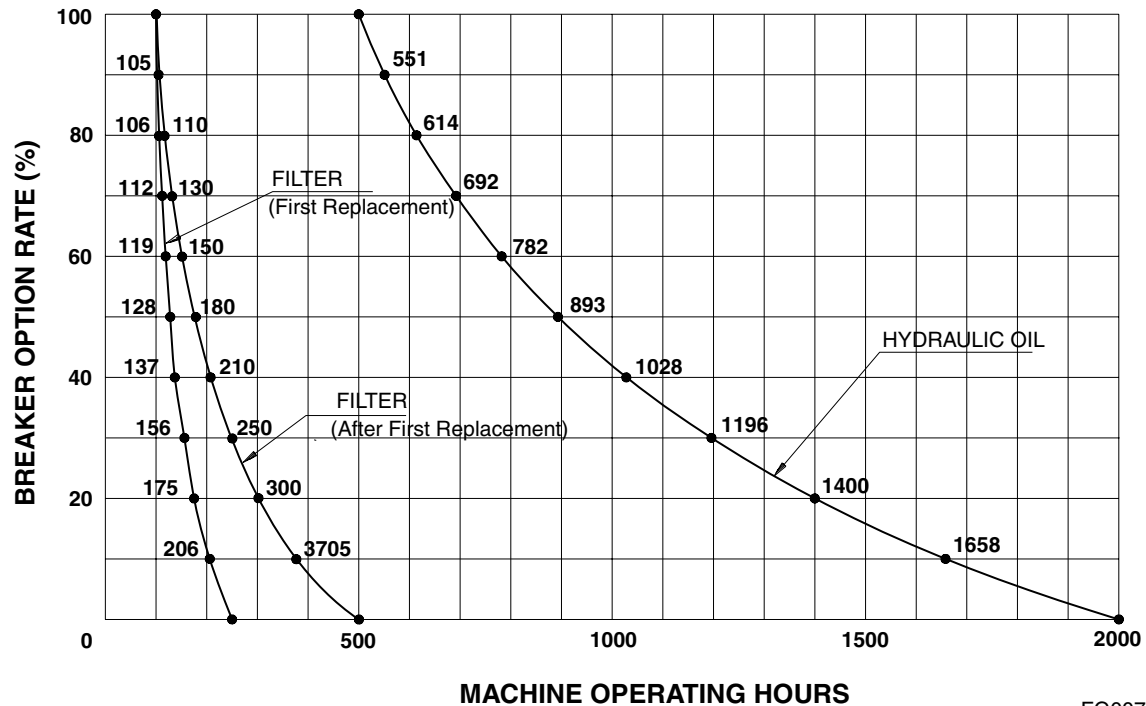


Figure 76

FG007618

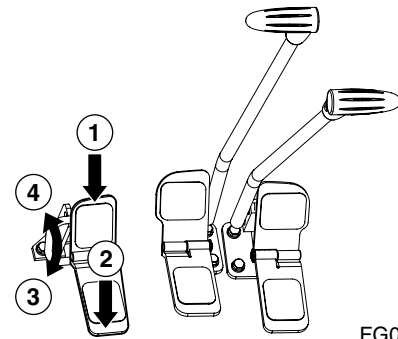
NOTE: The replacement intervals of hydraulic oil and filter depend upon the amount of time the hydraulic breaker is being used. These intervals should be followed as opposed to regularly scheduled maintenance.

PTO Pedal Valve (Optional)

Rotating Attachment Using the Pedal Valve

1. Pressing end (1, Figure 77) of pedal, is used to turn clockwise.
2. Pressing end (2, Figure 77) of pedal, is used to turn counterclockwise.

NOTE: Before activating the pedal, be sure to check the function of the attachment.



FG007599

Figure 77

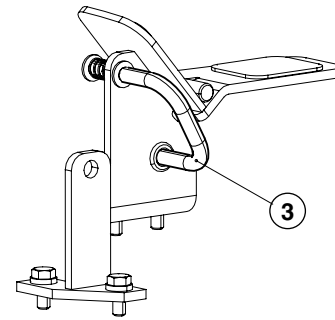
Breaker Operation Using the Pedal Valve

1. Pushing down on the top end of the PTO pedal, operates the breaker.
2. Releasing the pedal stops the breaker.

Locking the Pedal

When rotating is not needed, the pedal can be locked by using the prop rod (3) locking device.

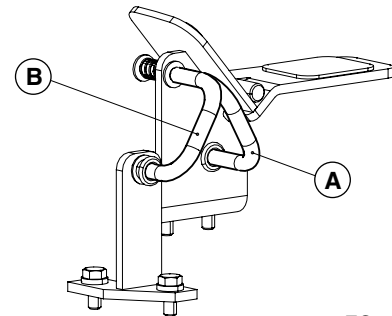
Locking is completed when the top end of the prop (3) is positioned into pedal hole.



FG007600

Figure 78

- A. Position for "UNLOCKING."
- B. Position for "LOCKING."



FG007601

Figure 79

Boom Swing Pedal

This pedal, located near the operator's right foot swings the boom. The pedal is used to dig along a gully wall or a retaining wall.

How to operate boom

Pressing the left of the pedal (1, Figure 80) swings the boom to the left, while pressing the right of the pedal (2, Figure 80) swings the boom to the right.

When boom swing pedal is not in use, lock pedal lock by moving it from position (3, Figure 80) to (4, Figure 80). When unlocking it, move it from position (4, Figure 80) to (3, Figure 80).

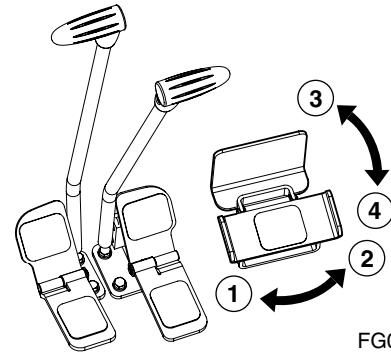


Figure 80

FG007602

1. Left swing: 70°
2. Right swing: 50°

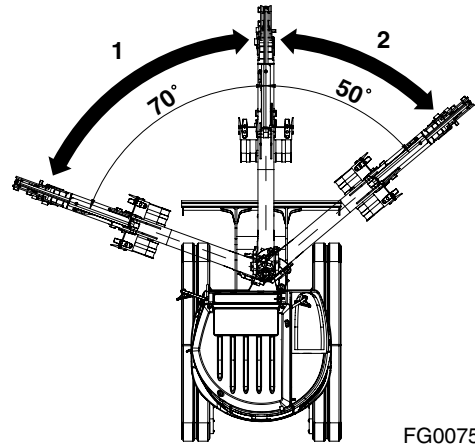


Figure 81

FG007585

Blade Control Lever

The blade control lever, located on the right-hand side of the driver's seat, controls the operation of the blade. When the lever is released, it goes to the NEUTRAL position and the blade stops immediately.

1. Pulling lever back "RAISES" dozer blade.
2. Pushing lever forward "LOWERS" dozer blade.

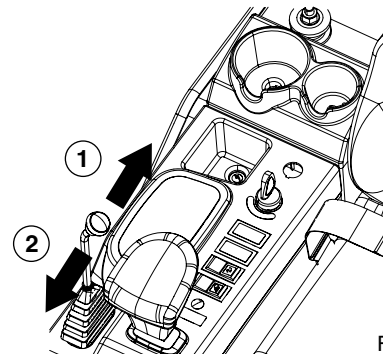
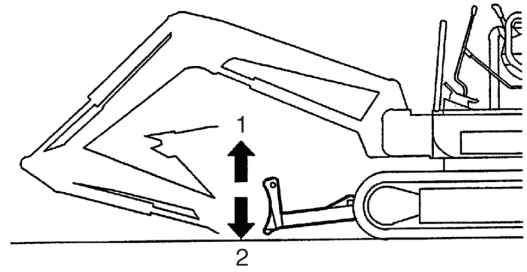


Figure 82

FG007603



FG007604

Figure 83

Precautions for Blade Use

The blade control lever, located on the right-hand side of the driver's seat, controls the operation of the blade. When the lever is released, it goes to the NEUTRAL position and the blade stops immediately.

1. Use the blade only for earth moving. Do not use the blade to dig: this can damage the blade or the track system.
2. Do not apply a large or unbalanced, off-center load to the blade: this can damage the blade or the track system.
3. Do not strike anything with the blade while traveling. This can damage the blade or track system.
4. When using the blade to jack up the machine, make sure the ground is even and will give good support and that the blade contacts the ground evenly.
5. When the blade is positioned in front of the machine, while excavating or bringing the front attachment in, be careful not to strike and damage the blade.

OPERATING TECHNIQUES

Lifting

IMPORTANT

There may be local or government regulations, about the use of excavators for the lifting of heavy loads. Always contact your local and government agencies in regards to these regulations.

Lifting Unknown Weight

When loads are not accurately known are to be lifted, the person responsible for the job shall ascertain that the weight of the load does not exceed the machine LOAD RATING CHART at the radius at which it is to be lifted.

It is recommended that you feel your way into any lift as a precaution against tip-over. One method is to position the boom at 90° over the side of the machine. Slowly lift the load until it clears the ground. A lift over the side is the most unstable, and as the load is swung into the front zone of the excavator it will become more stable. DO NOT INCREASE SWING RADIUS AFTER THE LOAD IS LIFTED.



DANGER!

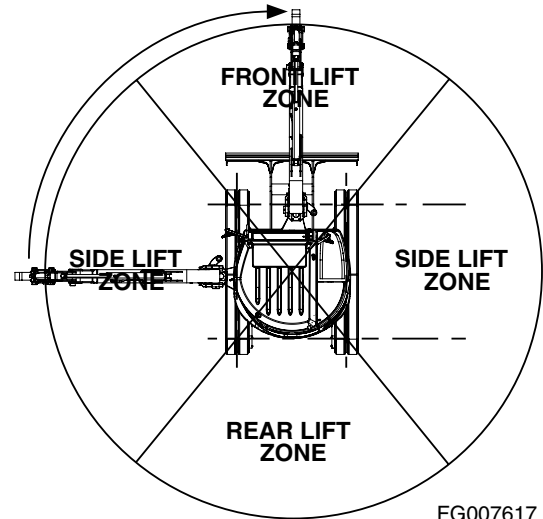
If a load is picked up from the front zone and swung into the side zone, a tip-over could result causing a deadly or fatal injury.

Lifting Known Weight

The load chart is the governing factor when lifting known weights. It is recommended that you feel your way into any lift as a precaution against tip-over. Whenever possible, lift and swing payloads between the front idler area.

Pick and Carry

The machine can pick and carry payloads without added labor. We recommend when traveling with a suspended payload, you evaluate the prevailing conditions and determine the safety precautions required in each case. The following factors must be considered before attempting to pick and carry a load.



FG007617

Figure 84

Align the boom with the forward direction of machine travel. Maintain this boom position when turning the machine. Turn only when necessary, at the slowest speed, and at a wide turning radius.

1. Use the shortest lifting radius distance possible.
2. Keep the load as close to the ground as conditions will permit.
3. Provide tag lines to prevent load from pendulating. Pendulating can cause a change in radius. A change in radius could exceed the load chart rating or cause a tip-over condition.
4. Govern travel speed to suit conditions.
5. Avoid sudden starts and stops.

OPERATION UNDER UNUSUAL CONDITIONS

NOTE: See "Long Term Storage" on page 4-55 for other recommendations.

Operation In Extreme Cold

If machine is to be operated in extreme cold weather temperatures, certain precautions must be taken to assure continued normal operation. The following paragraphs detail checks to be made to be certain the machine is capable of operating at these temperatures.

1. Check the cooling system for correct antifreeze solution for lowest temperature expected. Carefully inspect cooling system and correct or report any leaks.
2. Keep batteries fully charged to prevent freezing. If water is added to batteries, run engine at least one hour to mix electrolyte solution.
3. Keep engine in best possible mechanical condition to assure easy starting and good performance during adverse weather.
4. Use engine oil of the proper specifications for the expected temperatures. Refer to the "Lubrication Specifications" of the engine manual for details.
5. Keep fuel tank full at all times. Drain condensation from tank before and after operation. Drain and service fuel filter. To eliminate clogging of fuel filters due to wax crystal formation in the fuel, be sure that the fuel used has a cloud point specification below the lowest expected temperature.
6. Lubricate entire machine according to "Periodic Service Table and Chart" Section 4, in this manual or lubrication chart on machine.
7. Start engine and allow it to reach normal operating temperature before applying load.
 - A. If mud and ice collects and freezes on any of the moving parts while machine is idle, apply heat to thaw the frozen material before attempting to operate machine.
 - B. Operate hydraulic units with care until they have reached a temperature to enable them to operate normally.
 - C. Check all machine controls and/or functions to be sure they are operating correctly.
8. An extra outer air filter should be kept in the operator's cabin to replace element that could become iced and cause restricted airflow to engine.

9. If cold weather starting aid must be used, see "Engine Starting" COLD WEATHER START portion of this manual.
10. Clean off all mud, snow and ice to prevent freezing. Cover machine with tarpaulin if possible, keep ends of tarpaulin from freezing to ground.

Operation in Extreme Heat

Continuous operation of the machine in high temperatures may cause the machine to overheat. Monitor engine and transmission temperatures and stop machine for a cooling-off period whenever necessary.

1. Make frequent inspections and services of the fan and radiator. Check coolant level in radiator. Check grills and radiator fins for accumulation of dust, sand and insects which could block the cooling passages.
 - A. Formation of scale and rust in cooling system occurs more rapidly in extremely high temperatures. Change antifreeze each year to keep corrosion inhibitor at full strength.
 - B. If necessary, flush cooling system periodically to keep passage clear. Avoid use of water with a high alkali content which increases scale and rust formation.
2. Check level of battery electrolyte daily. Keep electrolyte above plates preventing damage to batteries. Use a slightly weaker electrolyte solution in hot climates. Dilute 1.28 specific gravity electrolyte as issued to 1.20 - 1.24 specific gravity readings at full charge. Recharge batteries whenever they reach a 1.16 specific gravity reading. Batteries self-discharge at a higher rate if left standing for long periods at high temperatures. If machine is to stand for several days, remove batteries and store in a cool place.



WARNING!

Do not store acid type storage batteries near stacks of tires; the acid fumes have a harmful affect on rubber.

3. Service fuel system as directed in "Engine Fuel System" Section 5, of this manual. Check for water content before filling fuel tank. High temperatures and cooling off cause condensation in storage drums.
4. Lubricate as specified in "Periodic Service Chart and Table" Section 4, in this manual or Lubrication Decal on the machine.
5. Do not park machine in sun for long periods of time. When practical park machine under cover to protect it from sun, dirt and dust.

- A. Cover inactive machine with tarpaulin if no suitable shelter is available. Protect engine compartment, transmission and hydraulics from entrance of dust.
- B. In hot, damp, climates corrosive action will occur on all parts of the machine and will be accelerated during the rainy season. Rust and paint blisters will appear on metal surfaces and fungus growth on other surfaces.
- C. Protect all unfinished, exposed surfaces with a film of preservative lubricating oil. Protect cables and terminals with ignition insulation compound. Apply paint or suitable rust preventive to damaged surfaces to protect them from rust and corrosion.

Operation in Dusty or Sandy Areas

Operation of the machine can cause dust in almost any area. However, when in predominantly dusty or sandy areas, additional precautions must be taken.

1. Keep cooling system fins and cooling areas clean. Blow out with compressed air, if possible, as often as necessary.



WARNING!

Wear goggles when using compressed air.

2. Use care when servicing fuel system to prevent dust and sand from entering the tank.
3. Service the air cleaner at frequent intervals, check air restriction indicator daily and keep dust cup and dust valve clean. Prevent dust and sand from entering engine parts and compartments as much as possible.
4. Lubricate and perform services outlined on current lubrication chart on machine and "Lubrication Chart and Table" Section 4. Clean all lubrication fittings before applying lubricant. Sand mixed with lubricant becomes very abrasive and speeds wear on parts.
5. Protect machine from dust and sand as much as possible. Park machine under cover or protect with tarpaulin to keep dust and sand from damaging unit.

Operation in Rainy or Humid Conditions

Operation under rainy conditions is similar to that as in extreme heat procedures listed previously.

1. Keep all exposed surfaces coated with preservative lubricating oil. Pay particular attention to damaged or unpainted surfaces. Cover all paint cracks and chip marks as soon as possible to prevent corrosive effects.

Operation in Salt Water Areas

The corrosive effect of salt water and salt water spray is very extensive. When operating in salt water areas, observe the following precautions.

1. When exposed to salt water, dry machine thoroughly and rinse with fresh water as soon as possible.
2. Keep all exposed surfaces coated with preservative lubricating oil. Pay particular attention to damaged paint surfaces.
3. Keep all painted surfaces in good repair.
4. Lubricate machine as prescribed on lubrication chart on machine or "Periodic Service Table and Chart" Section 4, in this manual. Shorten lubricating intervals for parts subject to exposure to salt water, if found necessary.

Operation at High Altitudes

Normally, operation of machine at high altitudes will be as outlined in extreme cold. Before operating at high altitudes, engine fuel and air mixture may have to be adjusted according to appropriate engine manual.

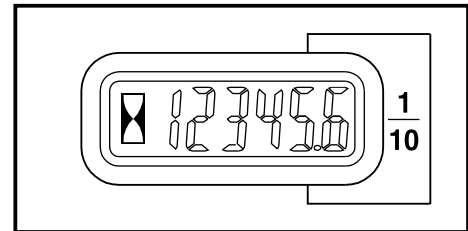
1. Check engine operating temperature for evidence of overheating. The pressure cap on radiator must make a perfect seal to maintain coolant pressure in the system.

Inspection, Maintenance and Adjustment

PREVENTIVE MAINTENANCE

Routine maintenance and inspections are required to keep your machine in the correct operating condition. The following pages list the inspection intervals, the system or component checks, and location references.

NOTE: *The following pages list the service checks and their required intervals. The service cycles may need to be shortened depending on the working conditions. Extremely hot or dusty conditions will require more frequent service. Operational hours are determined by the amount of time accumulated on the engine hour meter on the control console in the cabin.*



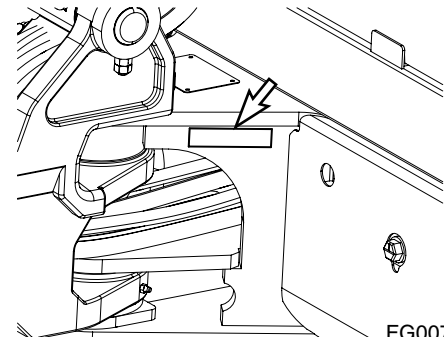
HAOA601L

Figure 1

Product Identification Number (P. I. N.) Location

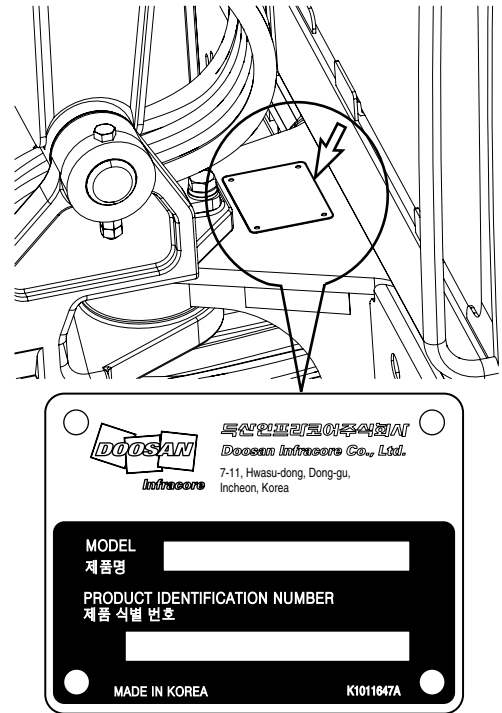
A P.I.N. number, is stamped on the main frame, under the boom foot (Figure 2). It is also stamped on the product identification plate (Figure 3) on outside of the cabin in front.

NOTE: *Please make note of these numbers and their locations. These will be required whenever warranty or service work is requested. Keep this number on file, incase the machine is stolen.*



FG007645

Figure 2



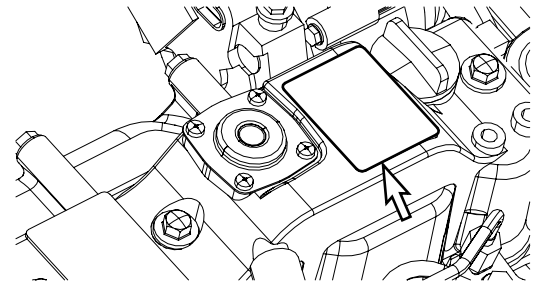
FG007656

Figure 3

Component Serial Numbers

There are many serial numbers on each traceable component of the machine. For example, the engine serial number is stamped on the rear left side of the engine block, above the starter. Additional engine information is described on a label (Figure 4) on the rocker cover.

Please make note of these numbers and their locations. These will be required whenever warranty service work is requested.



FG007659

Figure 4

Safety Precautions

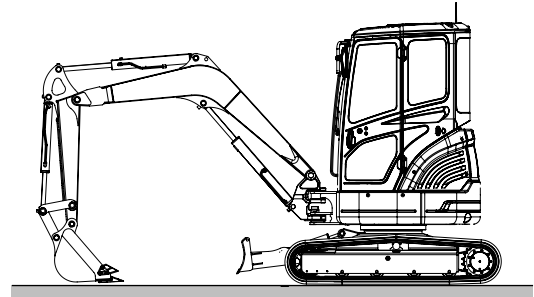
1. Make sure to lock out the hydraulic controls and post a notice (Warning Tag) that the machine is being serviced to prevent any unauthorized operation.
2. Make sure to clean up any fluid spills, especially around the engine.
3. Inspect all fuel lines to make sure that fittings, lines, filters and O-rings, etc., are tight and are not showing signs of wear or damage.
4. If the inspection or test procedure requires that the engine be running, make sure to keep all unauthorized personnel away from the machine, and that all industry standard safety precautions are followed.

PRELIMINARY WORK MACHINE SETUP FOR MAINTENANCE

When performing maintenance specified in this manual, always park the excavator as follows.

NOTE: *Certain types of maintenance may require the machine to be positioned differently. Always return machine to this position.*

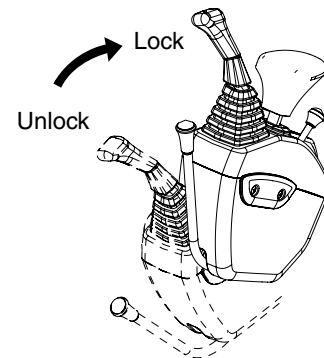
1. Park on firm, level ground.
2. Lower bucket to ground.



FG007565

Figure 5

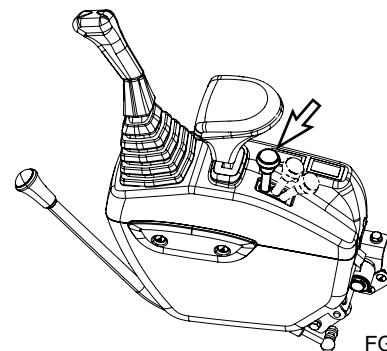
3. Set safety lever on "LOCK" position.



FG007566

Figure 6

4. Allow engine to run at low idle for a minimum of five minutes to allow engine to cool. If this is not done, heat surge may occur.



FG007557

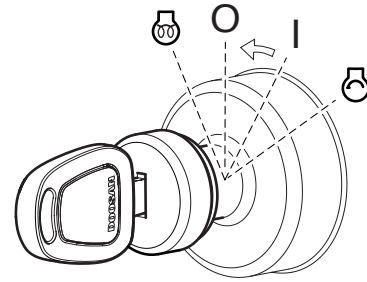
Figure 7

5. Shut down engine by turning key to "O" (OFF) position. Remove key from starter switch.



WARNING!

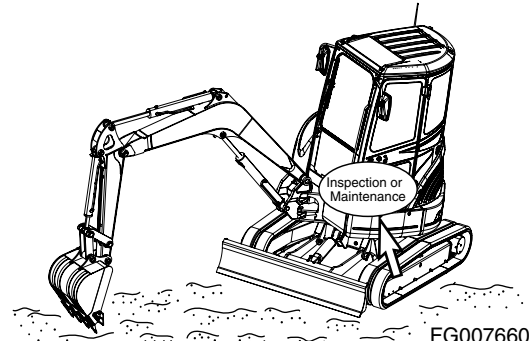
If engine must be run while performing maintenance, use extreme care. Always have one person in the cabin at all times. Never leave the cabin with the engine running.



FG001364

Figure 8

6. Before starting maintenance work, hang up a tag, "Do Not Touch When Performing Inspection or Maintenance" on cabin door or work lever.



FG007660

Figure 9

TABLE OF RECOMMENDED LUBRICANTS

NOTE: Refer to the Maintenance Intervals Table for application points.

Reservoir	Kind of Fluid	Ambient Temperature										
		-22	-4	14	32	50	68	86	104	122		
		-30	-20	-10	0	10	20	30	40	50	°C	
Engine Oil Pan	** Engine Oil			SAE 10W-30								
				* SAE 10W-40								
				SAE 15W-40								
Swing Drive Case	Gear Oil			SAE 90 and API GL5								
Final Drive Case				* SAE 80W-90 and API GL5								
				SAE 140 and API GL5								
Hydraulic Oil Tank	*** Hydraulic Oil			ISO VG 32								
				* ISO VG 46								
				ISO VG 68								
Fuel Tank	Diesel Fuel			* ASTM D975 No. 2								
				ASTM D975 No. 1								
Grease Fitting	Grease			* Multipurpose Lithium Grease NLGI No. 2								
Cooling System	Coolant	Add Antifreeze * (50% antifreeze - 50% distilled water)										
* Installed at factory.												
** Engine oil must meet ACEA-E5 or API-CI-4.												

*** Hydraulic oil change interval is 2,000 hours, only when *DOOSAN* Genuine Oil is used. If other brands of oil is used, guaranteed change interval is 1,000 hours.

API: American Petroleum Institute.

ACEA: Association des Constructeurs Europens d'Automobiles.

ASTM: American Society of Testing and Material.

ISO: International Standardization Organization.

NLGI: National Lubricating Grease Institute.

SAE: Society of Automotive Engineers.

IMPORTANT

Do not mix oils from different manufacturers. *DOOSAN* does not endorse specific brands but does suggest that owners select quality oils whose suppliers provide assurance that required standards will always be met or exceeded.

Fluctuating daily or weekly extremes of temperature, or operation in subzero freezing weather may make it impractical to use straight weight lubricants. Use good judgment in selecting lubricant types that are appropriate for climate conditions.

FLUID CAPACITIES

Component		Capacity
Engine	Oil Pan with Filter	6.3 liters (1.66 U.S. gal.)
	Cooling System	2 liters (0.5 U.S. gal.)
Fuel Tank		42 liters (11.1 U.S. gal.)
Hydraulic Oil	Tank Level	40 liters (10.6 U.S. gal.)
	System	60 liters (15.9 U.S. gal.)
Travel Reduction Device (Each)		0.5 liters (1.8 U.S. gal.)

LUBRICATION AND SERVICE CHART

Lubrication and service chart is on the inside of battery box cover. The symbols shown here are used in the lubrication and service chart on the next page.

Symbol	Description
	Lubrication
	Gear Oil (Swing Device, Travel Device)
	Engine Oil
	Engine Oil Filter
	Hydraulic Oil
	Hydraulic Oil Return Filter

Symbol	Description
	Coolant
	Air Cleaner Element
	Fuel Filter
	Air Conditioner Filter
	Drain Water

Description of Lubrication and Service Chart

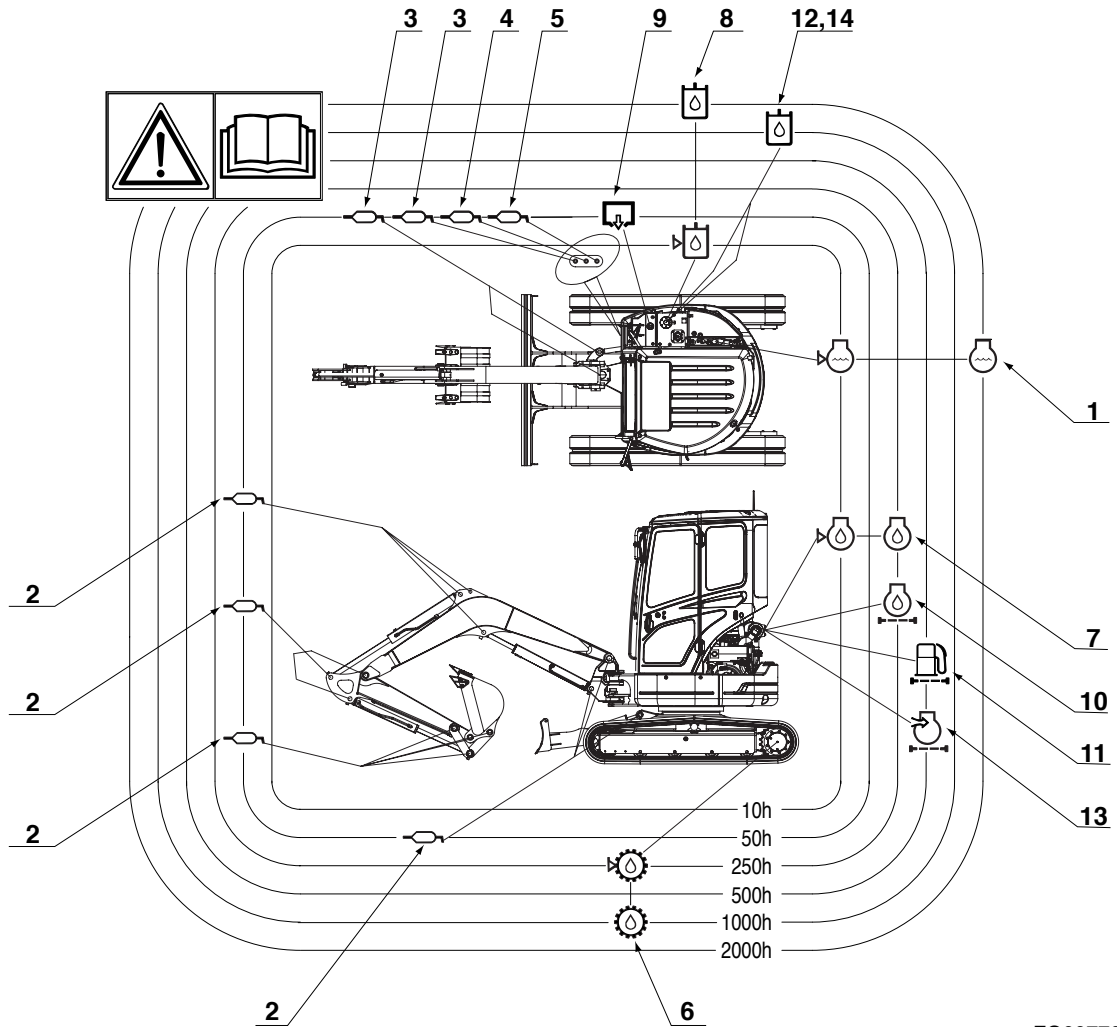


Figure 10

SERVICE DATA									
No.	Items to Check	Service	Qty.	Service Interval					
				10	50	250	500	1000	2000
1	Radiator	Coolant (Antifreeze)	2 L	V					
2	Front & Blade (Note)	Grease	17	F100	W10				
3	Boom Swing Cylinder (Note)	Grease	4	F100					
4	Swing Gear (Note)	Grease	1						
5	Swing Bearing (Note)	Grease	1		W10				
6	Travel Reduction Device	Gear Oil (80W90)	0.5 L			V, F			
7	Engine Oil	Engine Oil (10W40)	6.3 L	V	F				
8	Hydraulic Oil Tank	Hydraulic Oil	40 L	V					
9	Fuel Tank	Diesel	42 L	V					
	Water Separator	(Water-Drain)	1	V					
10	Engine Oil Filter	Cartridge	1		F				
11	Fuel Filter	Cartridge	1						
12	Hydraulic Oil Return Filter	Element	1			F			
13	Air Cleaner (Outer)	Element	1			C			
	Air Cleaner (Inner)	Element	1						
14	Hydraulic Oil Suction Strainer	Element	1			F			
V: Maintenance and Refill.									
C: Cleaning.									
F: First Time Exchange Only.									
F100: Every 10 Hours For First 100 Hours.									
W10: Every 10 Hours If Operating In Water.									
: Replacement On Every Interval.									
NOTE: Grease every 10 hours for first 100 hours. Maintenance required when operating in water or mud.									

MAINTENANCE INTERVALS

SERVICE ITEM	PAGE
10 Hour / Daily Service	
Grease Dozer, Boom Swing and Front Attachment Pins (for first 100 hours)	4-12
Check Engine Oil Level	4-12
Check Level of Hydraulic Oil Tank	4-13
Check for Leaks in Hydraulic System	4-14
Check Fuel Level	4-15
Check for Leaks in Fuel System	4-15
Check Water Separator and Drain Water as Required	4-16
Check Cooling System and Refill As Required	4-16
Check Level of Window Washer Liquid	4-17
Inspect Cooling Fan Blade	4-17
Check Air Intake System	4-18
Inspect Seat Belt for Proper Operation	4-18
Inspect the Structure for Cracks and Faulty Welds	4-18
Check the Operation of All Switches	4-18
Check the Operation of All Exterior Lights, Horn and Monitor Lights	4-19
Start Engine, Check Starting Ability, and Observe Exhaust Color at Start-up and at Normal Operating Temperature. Listen for Any Abnormal Sounds	4-19
Check Operation of All Controls	4-19
50 Hour / Weekly Service	
Perform All Daily Service Checks	4-20
Grease Front Attachment Pins	4-20
Grease Dozer Pins and Dozer Cylinder	4-21
Grease Boom Swing Cylinder and Bracket	4-21
Grease Swing Gear Pinion Teeth	4-21
Grease Swing Bearing	4-21
Drain Water and Sediment from Fuel Tank	4-22
Check Engine Fan Belt for Cracks, Wear and Correct Tension (After First 50 Hours)	4-22
Change Engine Oil and Filter (After First 50 Hours)	4-22
Inspect the Track Assemblies for Proper Tension and Loose, Worn or Damaged Parts (Links, Shoes, Rollers, Idlers)	4-22
250 Hour / Monthly Service	
Perform All Daily and 50 Hour Service Checks	4-23
Clean Outer Filter of Air Cleaner	4-23
Change Engine Oil and Filter	4-24
Check Engine Fan Belt Tension	4-25
Check Engine Fan Belt Wear	4-26
Check Oil Level in Travel Reduction Device (One on Each Side of Unit)	4-27
Change Oil in Travel Reduction Device (One on Each Side of Unit) (After First 250 Hours)	4-27
Replace Hydraulic Oil Return Filter (After First 250 Hours)	4-27
Replace Hydraulic Oil Suction Filter (After First 250 Hours)	4-28

SERVICE ITEM	PAGE
Inspect Pins and Bushings of the Front End Attachments for Signs of Wear	4-28
Check Fluid Levels in Batteries and Battery Charge Levels	4-28
Inspect for Any Loose or Missing Nuts and Bolts	4-28
Inspect Fuel System Hose Clamps	4-28
500 Hour / 3 Month Service	
Perform All Daily, 50 and 250 Hour Service Checks	4-29
Replace Outer and Inner Air Cleaner Elements	4-29
Change Fuel Filter	4-30
1,000 Hour / 6 Month service	
Perform All Daily, 50, 250 and 500 Hour Service Checks	4-31
Replace Hydraulic Oil Return Filter	4-31
Change Oil in Travel Reduction Device (One on Each Side of Unit)	4-32
Replace Hydraulic Oil Suction Filter	4-32
2,000 Hour / Yearly Service	
Perform All Daily, 50, 250, 500 and 1,000 Hour Service Checks	4-33
Change Radiator Coolant	4-33
Hydraulic Oil Exchange and Suction Filter Replacing	4-34
Check Alternator and Starter**	4-35
Check All Rubber Antivibration Shock Mounts	4-35
Perform and Record the Results of the Cycle Time Tests	4-36
Inspect Machine to Check for Cracked or Broken Welds or other Structural Damage	4-36
Check, Adjust Valve Clearance **	4-36
Check Head Bolt Torques	4-36
4,000 Hour / Biennial Service	
Major Parts - Periodic Replacement	4-37
12,000 Hour / Six Year Service	
Hose In-service Lifetime Limit (European Standard ISO 8331 and EN982 CEN)	4-38

** These checks need to be completed by an authorized *DOOSAN* dealer.

10 HOUR / DAILY SERVICE

Grease Dozer, Boom Swing and Front Attachment Pins (for first 100 hours)



WARNING!

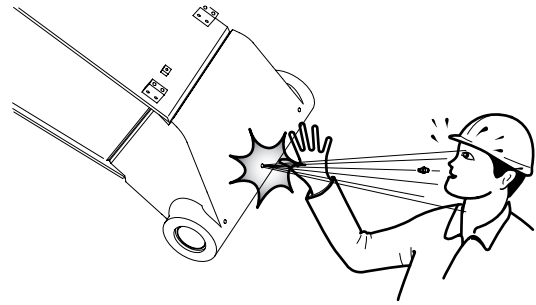
Do not remove the grease fitting until the pressure is entirely bleed off by loosening grease fitting slowly to avoid fatal wound.

Let anybody never be in the blowing direction.

Be careful to any kinds of works for nipples and hydraulic line plugs.

Grease every 10 hours for first 100 hours and every 50 hours thereafter (See page 4-21).

NOTE: *If the unit has been running or working in water the front attachment should be greased on a 10 hour / daily basis.*



FG000500

Figure 11

Check Engine Oil Level

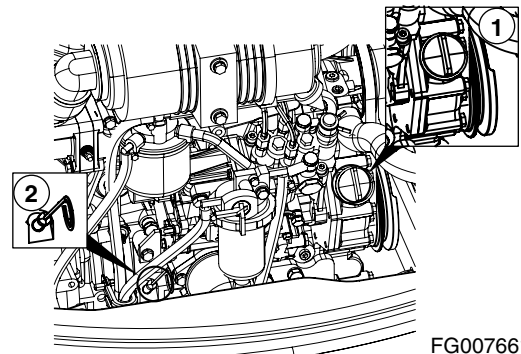


WARNING!

Allow the engine to cool before checking the oil level to avoid burns by touching hot engine parts.

NOTE: *When checking level using a dipstick always remove and wipe it clean before making final level check.*

1. Shut down engine and wait for fifteen minutes. This will allow all oil to drain back to oil pan.
2. Remove dipstick (1, Figure 12) and wipe the oil off with a clean cloth.
3. Insert dipstick fully in the oil gauge tube, then take it out again.



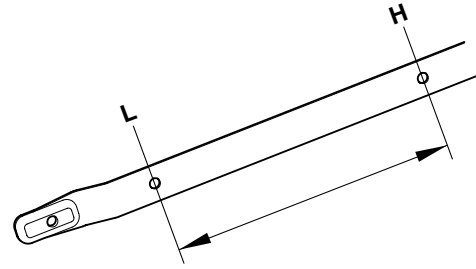
FG007661

Figure 12

4. Engine oil level must be between "HIGH" and "LOW" marks on dipstick.

NOTE: *If oil is above "HIGH" mark on dipstick, some must be drained to return oil to proper level.*

5. Add oil through engine oil fill cap (2, Figure 12), if the oil level is below the "LOW" mark.



FG000616

Figure 13

Check Level of Hydraulic Oil Tank



WARNING!

The hydraulic oil will be hot after normal machine operation. Allow the system to cool before attempting to service any of the hydraulic components.

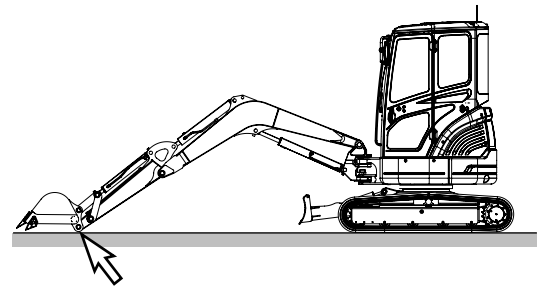
The hydraulic tank is pressurized. Turn the breather cap slowly to allow the pressurized air to vent. After the pressure has been released, it is safe to remove either the fill cap or service covers.

1. Park machine on firm, level ground. Lower boom and position bucket on ground as shown in Figure 15.
2. Set engine speed to "LOW IDLE."



ARO1760L

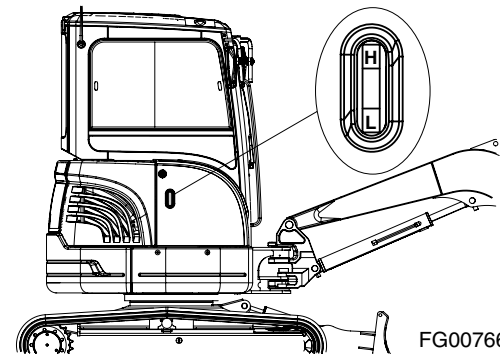
Figure 14



FG007662

Figure 15

3. Set safety lever to "LOCK" position.
4. Check level gauge by opening right access door. Oil level must be between marks on sight gauge.



FG007663

Figure 16

5. If the level is below "L" mark add oil.
 - A. Shut down engine.
 - B. The hydraulic tank is pressurized. Turn the breather cap slowly to allow the pressurized air to vent.
 - C. Remove the upper cover of the hydraulic tank and add oil.

IMPORTANT

Do not fill above "H" mark on sight gauge. Overfilling can result in damage to equipment and oil leaking from hydraulic tank due to expansion.

6. If oil level is above the "H" mark drain oil.
 - A. Swing upper structure perpendicular (90°) to tracks as shown in (Figure 18).
 - B. Shut down engine and wait for the hydraulic oil to cool down.
 - C. Remove the right bottom cover.
 - D. Drain the excess oil from drain valve at the bottom of the tank into a suitable container.

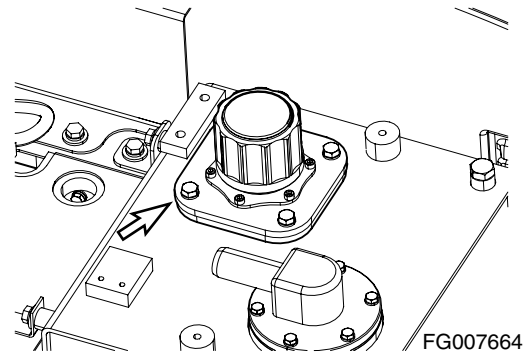


Figure 17

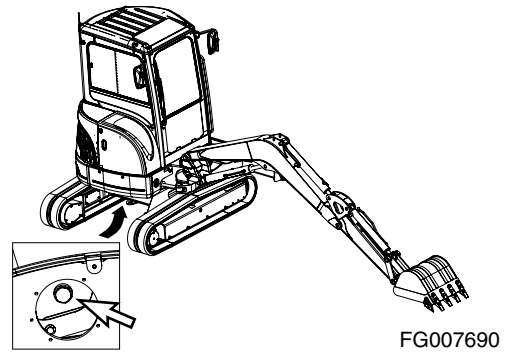


Figure 18

Check for Leaks in Hydraulic System

1. Perform a daily walk-around inspection to make sure that the hoses, piping, fittings, cylinders and hydraulic motors are not showing any signs of leakage. If any is noted, determine the source of the leak and repair.

Check Fuel Level



WARNING!

Use extreme safety precautions while refueling to prevent explosions or fire.

Immediately clean up any split fuel.

1. At end of each workday, fill fuel tank. Add fuel through fuel fill tube (1, Figure 19). When working at a temperature of 0°C (32°F) or higher, use ASTM No. 2-D or its equivalent. At temperatures below 0°C (32°F) use ASTM No. 1-D or its equivalent.
2. Make sure that the fuel fill hose is grounded to the excavator before fueling begins.
3. Check the amount of fuel in the tank by observing the fuel tank sight gauge (2, Figure 19).

NOTE: See "Fluid Capacities" on page 4-7. for capacity.

4. The excavator may be equipped with the optional battery operated fuel fill pump. The pump assembly is in the hydraulic pump compartment. Put the suction hose of the pump into the fuel resupply tank. Turn the switch in the pump compartment "ON," and the fuel will be pumped into the excavator fuel tank.

NOTE: See "Handling of Accumulator" on page 4-54, for further information.

5. Do not overfill the tank.
6. Securely tighten cap after fueling.

NOTE: If breather holes (3, Figure 20) in cap are clogged, a vacuum may form in the tank preventing proper fuel flow to engine. Keep holes in fuel cap clean.

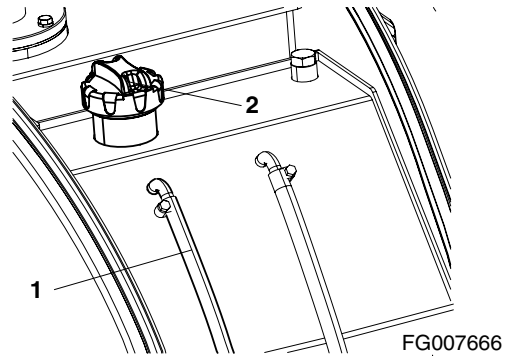


Figure 19

FG007666

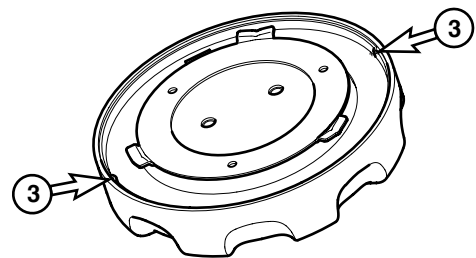


Figure 20

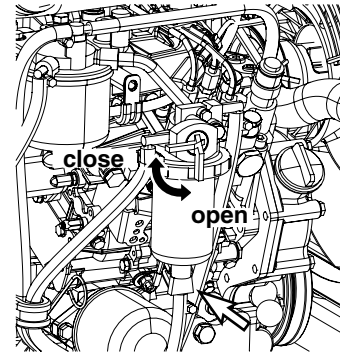
FG000317

Check for Leaks in Fuel System

1. Perform an inspection of the engine compartment to verify that the fuel system is not leaking. If any is noted, determine the source of the leak and repair.

Check Water Separator and Drain Water as Required

1. A fuel water separator is inside the hood cover.
2. Open the access hood cover the on rear of the machine.
1. Open engine cover and check water separator.
2. When there is water in the cup, a red indicator will appear in the float window.



FG007667

Figure 21

3. Turn lever to "CLOSED" position to shut off fuel supply before draining water.

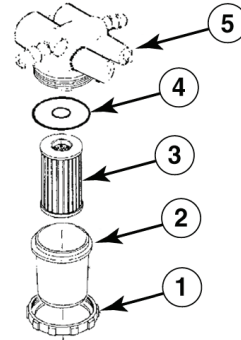
NOTE: Lever must be pointing up.

4. Remove ring nut (1, Figure 22), cup (2), separator (3) and seals (4) from head (5).
5. Drain water and sediment from cup (2, Figure 22). Wipe inside of cup out and clean separator (3).

NOTE: Dispose of drained fluids according to local regulations.

6. Install seals (4, Figure 22), separator (3), cup (2) and ring nut (1) on head (5).
7. Turn fuel lever to "OPEN" position.

NOTE: Lever must be pointing down.



HAOK190S

Figure 22

Check Cooling System and Refill As Required



WARNING!

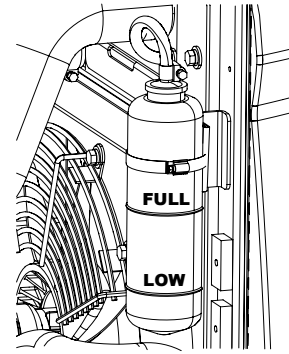
Allow the engine to cool before releasing the radiator cap. Make sure to loosen the cap slowly to release any remaining pressure.

Radiator cleaning is performed while the engine is running. Take extreme caution when working on or near a running engine. Make sure to lock out and tag the controls notifying personnel that service work is being performed.

Do not remove the radiator cap unless it is required. Observe the coolant level in the coolant recovery tank.

NOTE: Do not mix ethylene glycol and propylene glycol antifreeze together. If the two are mixed, the protection level will be reduced to the level of the ethylene glycol.

1. When the engine is cold, remove the radiator cap and check the coolant level inside the radiator. Do not rely on the level of coolant in the coolant recovery tank. Refill radiator as required. Refer to coolant concentration table. (See page 4-53)
2. Check to make sure that the coolant transfer line from the coolant recovery tank to the radiator is free and clear of obstructions, or not pinched.
3. Observe the level of coolant in the coolant recovery tank. The normal cold engine fluid level should be between "FULL" and "LOW" marks on tank.
4. If the coolant is below the "LOW" mark, add coolant to this tank.



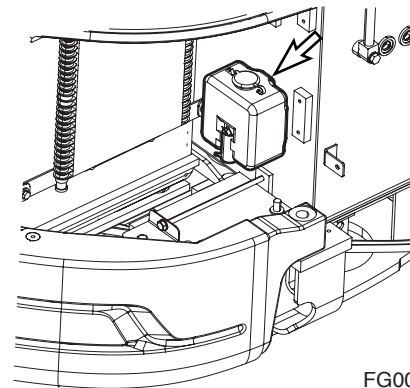
FG007668

Figure 23

Check Level of Window Washer Liquid

1. Open the back hood door and the right door.
2. Check fluid level in windshield washer tank.
3. Open fill cap and add fluid.

NOTE: Use a washer liquid that is rated for all seasons. This will prevent freezing during cold weather operation. Use standard window cleaning fluid: SSK703



FG008149

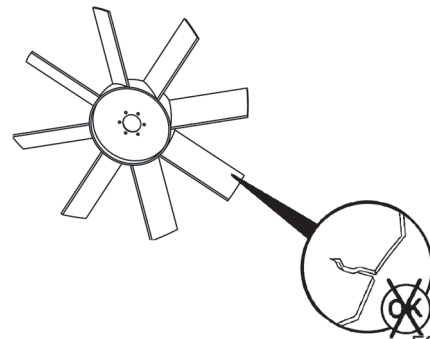
Figure 24

Inspect Cooling Fan Blade



Personal injury can result from a fan blade failure. Never pull or pry on the fan. This can damage the fan blade (s) and cause fan failure.

1. An inspection of the cooling fan is required daily. Check for cracks, loose bolts, bent or loose blades, and for contact between the blade tips and the fan shroud. Check the fan to make sure it is securely mounted. Tighten the bolts if necessary. Replace any fan that is damaged.



FG006206

Figure 25

Check Air Intake System



Hot engine components can cause burns.

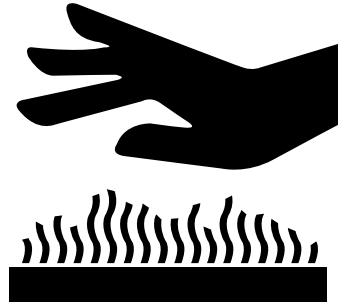
Avoid contact with hot engine components

1. Park the machine on a level surface, lower the attachment to the ground, set safety lever to "LOCK" position, and shut down engine.
2. Check the engine intake hose, and hose bands for damage and tightness.
3. If damaged, wrinkled, or loose, replace or retighten or contact your nearest *DOOSAN* dealer.

IMPORTANT

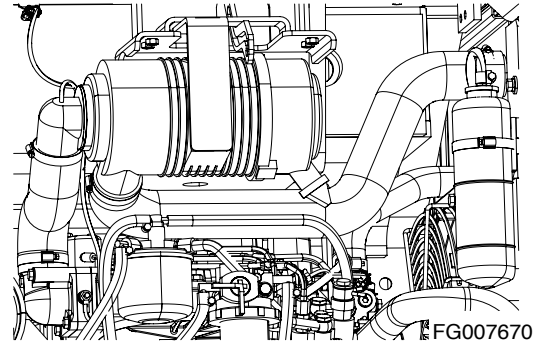
Severe engine damage will result from running with unfiltered air.

Do not operate engine if any leaks or defects are found on air intake system.



HAOA050L

Figure 26



FG007670

Figure 27

Inspect Seat Belt for Proper Operation

Inspect the Structure for Cracks and Faulty Welds

1. During the daily walk-around inspection and when greasing the machine, look for any visible damage to the machine. Repair or replace any damaged parts before operating the machine.

Check the Operation of All Switches

1. Verify the working condition of all switches before starting the engine.

Check the Operation of All Exterior Lights, Horn and Monitor Lights

1. Turn engine starter switch to the "I" (ON) position and observe all the indicator lights.
2. Restore operation of any lightbulbs that do not turn "ON" now.
3. Sound the horn. Repair or replace if required.
4. Turn "ON" and inspect all exterior work lights. Replace any monitors, burned out bulbs or cracked or broken housings or lenses.

Start Engine, Check Starting Ability, and Observe Exhaust Color at Start-up and at Normal Operating Temperature. Listen for Any Abnormal Sounds

Check Operation of All Controls

IMPORTANT

Cold weather operation requires that the operator fully warm up the hydraulic oil before beginning machine operation. Follow all warm up instructions listed in the Operating Instruction section of this manual. Make sure to cycle oil through all the components, including all cylinders, both travel motors and the swing motor. Cold hydraulic oil in the lines and components needs to be warmed before beginning full operation. If this is not done, damage to the cylinders or hydraulic motors can occur.

1. With the engine at rated speed, operate all the controls.
2. Follow cold weather hydraulic system warm-up procedures.
3. Note any slow operations or unusual movements. Determine the cause and repair the fault before operating.

50 HOUR / WEEKLY SERVICE

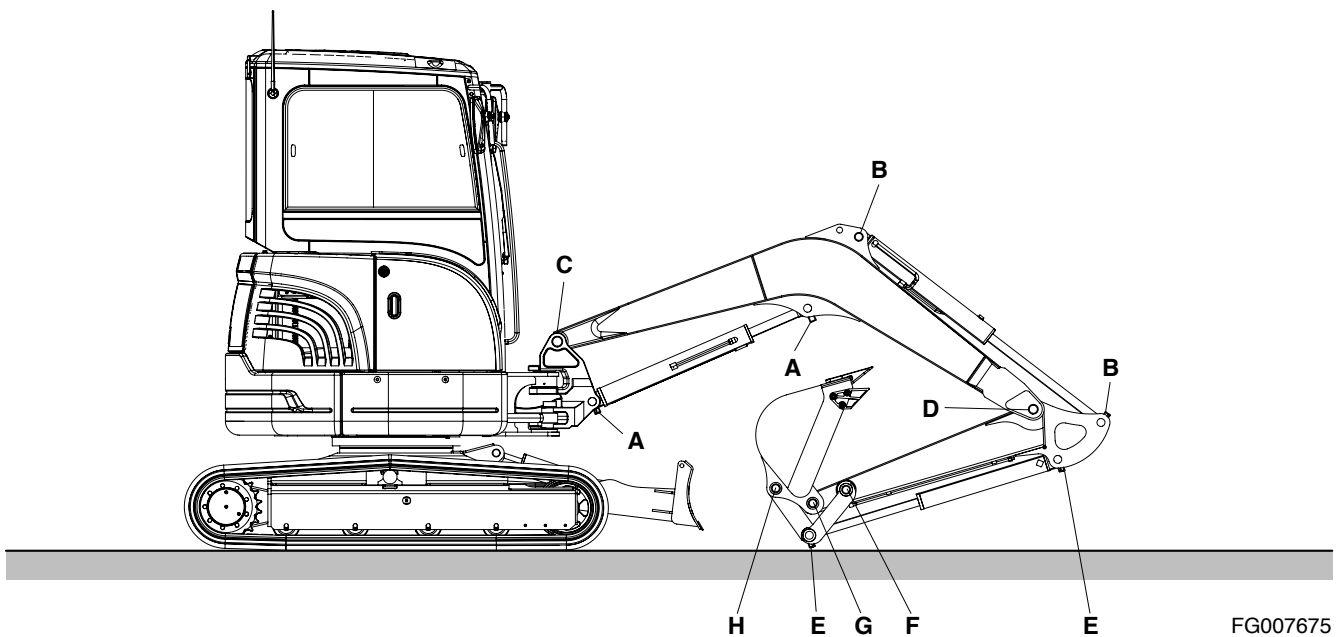
Perform All Daily Service Checks

Grease Front Attachment Pins

Grease every 10 hours for first 100 hours and every 50 hours thereafter.

NOTE: *If the unit has been running or working in water the front attachment should be greased on a 10 hour / daily basis.*

- Position machine as shown below and lower the front attachment to the ground and shut down engine
- Press the grease fitting and inject grease with the grease gun on the marked point
- After injection, clean off the old grease that has been purged.



Reference Number	Description
A	Boom Cylinder (2 Points)
B	Arm Cylinder (2 Points)
C	Boom and Boom Swing Joint (1 Points)
D	Boom and Arm Joint (1 Point)

Reference Number	Description
E	Bucket Cylinder (2 Points)
F	Arm link Joint Pin (1 Point)
G	Arm and Bucket Joint (1 Point)
H	Link Joint (3 Point)

Grease Dozer Pins and Dozer Cylinder

- A. Dozer pins (2 points).
- B. Dozer cylinder (2 points).

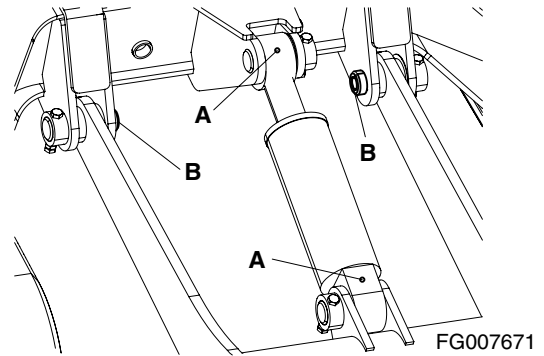


Figure 29

Grease Boom Swing Cylinder and Bracket

There are four grease fittings for the Boom Swing.

Do not over lubricate, purge oil grease with new. Remove all purged grease.

- A. Boom swing cylinder head (1 points).
- B. Swing gear (1 points).
- C. Swing bearing (1 points).
- D. Boom swing cylinder rod (1 points).
- E. Boom swing bracket (2 points).

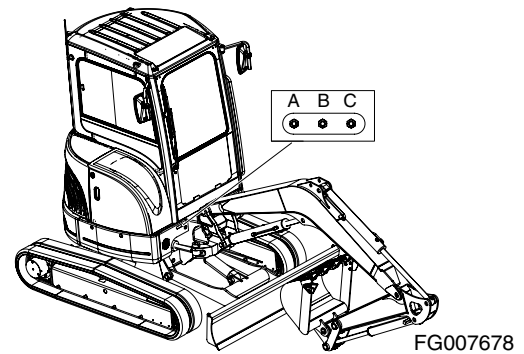


Figure 30

Grease Swing Gear Pinion Teeth

1. Inject two or three strokes of grease through the grease fitting (B, Figure 31).
2. Lift bucket about 20 cm (8 in) from ground. Turn upper body 90° at a time for two full turns, greasing the swing gear pinion teeth at each stop.

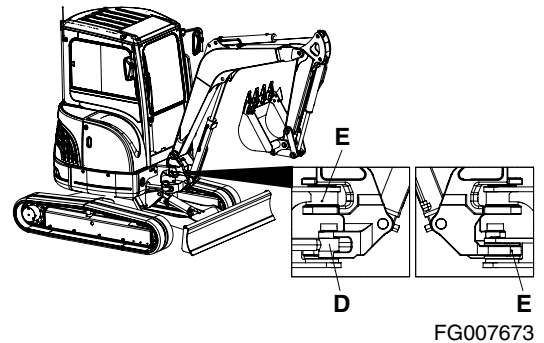


Figure 31

Grease Swing Bearing

1. Inject grease through the three grease fittings (C, Figure 31) using a grease gun.
2. Lift bucket about 20 cm (8 in) from ground. Turn upper body 90° at a time for one full turn, greasing the swing bearing at each stop.

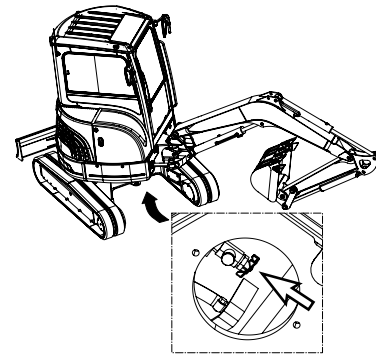
NOTE: *If the unit has been running or working in water the swing bearing should be greased on a 10 hour / daily basis.*

Drain Water and Sediment from Fuel Tank

1. Perform this procedure before operating the machine.
2. Drain water and sediment from bottom of fuel tank into a suitable container.

NOTE: *Dispose of drained fluid according to local regulations.*

NOTE: *Always completely fill fuel tank at end of each workday to prevent condensation from forming on the inside walls of the tank.*



FG007674

Figure 32

Check Engine Fan Belt for Cracks, Wear and Correct Tension (After First 50 Hours)

1. Inspect after first 50 hours of operation and every 250 hours thereafter. For details, See "Check Engine Fan Belt Tension" on page 4-25.

Change Engine Oil and Filter (After First 50 Hours)

1. Change engine oil and filter after first 50 hours of operation or rebuild, then every 500 thereafter. For details, See "Change Engine Oil and Filter" on page 4-24.

Inspect the Track Assemblies for Proper Tension and Loose, Worn or Damaged Parts (Links, Shoes, Rollers, Idlers)

1. Do a daily walk-around inspection of all components including the track assemblies. Look for missing, damaged or excessively worn parts. See "Long Term Storage" on page 4-55.
2. Jack up each track and perform the two speed travel motor test.

250 HOUR / MONTHLY SERVICE

Perform All Daily and 50 Hour Service Checks

Clean Outer Filter of Air Cleaner

NOTE: Clean outer filter every 500 hours / 3 months of service.

NOTE: When working in severely dusty conditions, the service interval should be shortened.



WARNING!

Never clean or attempt to remove the air cleaner filter if the engine is running.

If using compressed air to clean the filter, make sure that proper eye protection is worn.

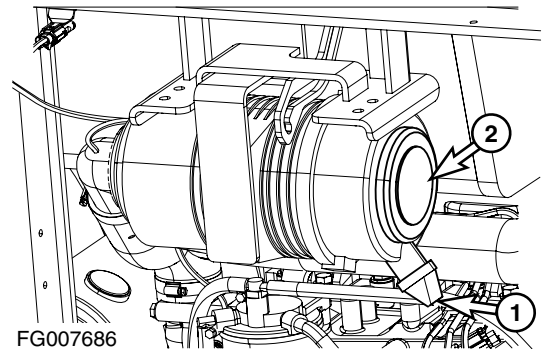
1. Locate the air cleaner assembly.

NOTE: Replace outer filter after cleaning 5 times or every 2,000 hours / 1 year of service.

2. Remove and clean rubber evacuator valve (1, Figure 33) from bottom of air cleaner housing cover (2, Figure 33). Inspect seal lips for wear or damage. Replace valve if necessary.

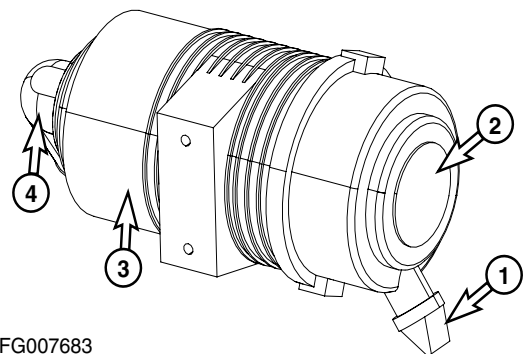
NOTE: Install evacuator valve with lips parallel to the cover.

3. Remove the access cover (2, Figure 34) by loosening the latches.
4. Remove the outer filter (3, Figure 34) from the housing. Do not remove inner filter (4).



FG007686

Figure 33



FG007683

Figure 34

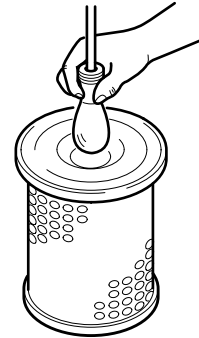
5. Clean the outer filter (3, Figure 35) by blowing compressed air from the inside of the filter towards the outside. Do not use more than 205 kPa (30 psi) air pressure.



HAOC570L

Figure 35

6. Check outer filter by shining a light through it. If small holes or thinner parts are found on the element after cleaning it, replace the filter.
7. Clean the inside of the air cleaner body and the inside of the air cleaner cover. Do not use compressed air.
8. Properly install the air filter and cover.
9. After filter service be sure to install cover with arrows pointing "UP."



FG000412

Figure 36

Change Engine Oil and Filter

NOTE: *Change engine oil and filter after first 50 hours of operation or rebuild, then every 250 thereafter.*

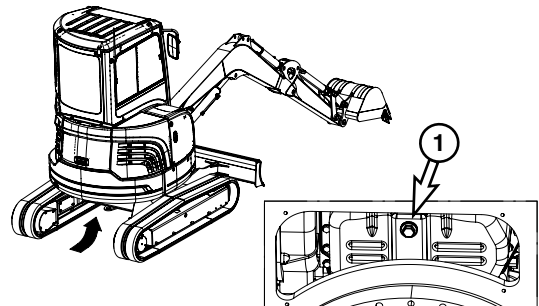


WARNING!

DO NOT change oil on a hot engine. Allow the engine to cool down before attempting to change the engine oil and filter to avoid burns by touching hot engine parts.

1. Position a larger container under the engine. Remove cap (1, Figure 37) and install hose to drain the engine oil. Remove hose and install cap (1).

NOTE: *Dispose of drained fluids according to local regulations.*



FG007679

Figure 37

2. Replace engine oil filter by using filter wrench. The engine oil filter is a spin-on type. See (1, Figure 38). Remove and discard filter.
3. Install new filter. Apply a small amount of oil around filter gasket. Screw filter on head until gasket contacts head, turn filter 1/2 turn more.
4. Refill the engine with the correct oil through the oil fill port (2, Figure 38). Refer to the Lubrication Table of this manual for the recommended oil for the operating conditions.

NOTE: See "Fluid Capacities" on page 4-7. for capacity.

5. Start engine. Run engine for five minutes at "LOW IDLE," and check engine oil pressure light.
6. Shut down engine. Look for signs of leaks at filter. Recheck oil level after fifteen minutes.

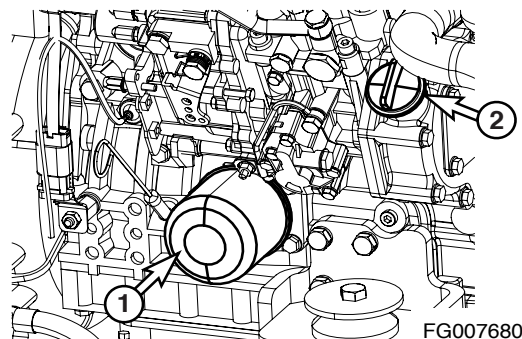


Figure 38

Check Engine Fan Belt Tension

IMPORTANT

A loose fan belt can cause engine overheating, poor charging, and/or premature belt wear. A belt that is too tight can cause damage to the water pump, alternator bearing or belt.

1. Inspect every 250 hours. (Inspect after first 50 hours of operation.)
2. With the engine shut off, check the tension of the fan belt by pressing downwards on the belt, midway between the fan pulley and alternator pulley. The belt should flex approximately 10 mm (0.4 in). See Figure 39. To adjust the belt, loosen the alternator adjustment plate bolts, adjust the belt tension and retighten the bolts.

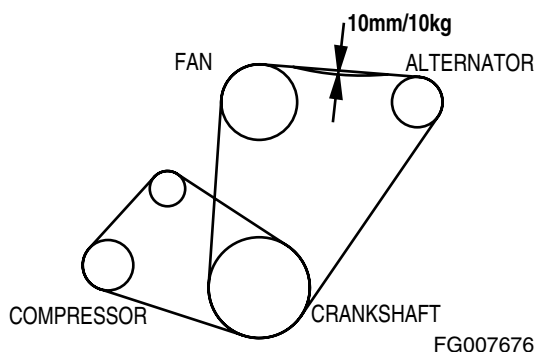


Figure 39

Check Engine Fan Belt Wear

WARNING!

Keep clear of engine fan and fan drive belts when the engine is running. Rotating fan and belt contact can cause injury.

WARNING!

When checking, adjusting or replacing drive belts, care must be taken to prevent accidental cranking of the engine. Be sure the starter switch is in the "OFF" position and the controls are tagged.

1. Replace badly worn, greasy or severely cracked belts immediately. These conditions prevent proper belt function. Visually inspect the belt. Check the belt for intersecting cracks. Transverse (across the belt width) cracks are acceptable. Longitudinal (direction of belt length) cracks that intersect with transverse cracks are not acceptable. Replace the belt if it is frayed or has pieces of material missing.
2. Before installing new belts, make sure all pulley grooves are clean and not worn. Replace pulley, if damaged, or if the grooves are worn.
3. All pulley support bearings, shafts, and brackets must be in working order.
4. When replacing belts and pulleys, pulley alignment must be checked with belts tensioned and brackets securely clamped. A misalignment that can be detected by the naked eye is detrimental to belt performance.
5. Do not force the belts into the pulley grooves by prying with a screwdriver or pry bar. This will damage the belt side cords which will cause the belts to turn and result in complete destruction of the belts in operation.
6. Belts on new machines and replacement belts lose their tension as they seat into the pulley grooves. Check the tension of new belts at 50 hour intervals until tension is stabilized and thereafter, every 250 hours. If the tension falls below the required minimum, the belt slips damaging the belts and pulley grooves.

NOTE: *When operating in abrasive conditions, check tension every 100 hours.*

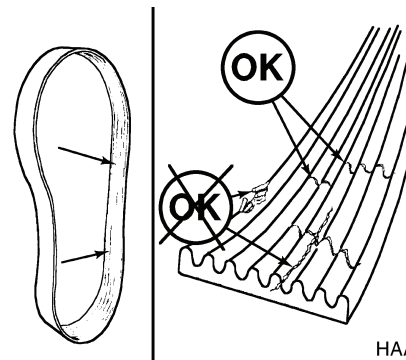


Figure 40

HAAA4030

Check Oil Level in Travel Reduction Device (One on Each Side of Unit)



WARNING!

The gear oil is very hot after the machine has been operating. Shut all systems down and allow them to cool. Before fully removing any motor case inspection port plug, etc., loosen the plug slightly to allow pressurized air to escape.

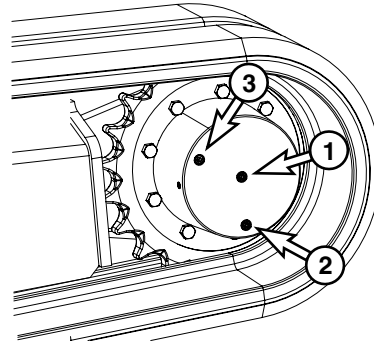


Figure 41

FG007685

1. Make sure that the machine is on firm, level ground.
2. Rotate the track until ports (1 thru 3, Figure 41) are in their proper positions as shown.
3. Loosen fill plug (3, Figure 41) slightly to allow pressurized air to escape.
4. Remove oil level plug (1, Figure 41).
5. Check oil level. The oil should be near the bottom of the level plug opening.
6. Add oil through the fill plug (3, Figure 41) opening, if necessary.
7. Clean and install oil level and fill plugs (1 and 3, Figure 41).
8. Repeat this procedure on the other travel reduction device.

Change Oil in Travel Reduction Device (One on Each Side of Unit) (After First 250 Hours)

NOTE: *Drain and refill oil after first 250 hours of operation or rebuild, and every 1,000 hours thereafter (See page 4-32).*

Replace Hydraulic Oil Return Filter (After First 250 Hours)

NOTE: *Replace hydraulic oil return filter after first 250 hours of operation or rebuild, then every 1,000 hours thereafter (See page 4-31).*

Replace Hydraulic Oil Suction Filter (After First 250 Hours)

NOTE: *Replace hydraulic suction filter after first 250 hours of operation or rebuild, then every 1,000 hours thereafter (See page 4-31).*

Inspect Pins and Bushings of the Front End Attachments for Signs of Wear

Check Fluid Levels in Batteries and Battery Charge Levels

Inspect for Any Loose or Missing Nuts and Bolts

Inspect Fuel System Hose Clamps

500 HOUR / 3 MONTH SERVICE

Perform All Daily, 50 and 250 Hour Service Checks

Replace Outer and Inner Air Cleaner Elements



WARNING!

Never clean or attempt to remove the air cleaner element if the engine is running.

NOTE: Replace outer element after cleaning 5 times or every 2,000 hours of service.

NOTE: Replace inner element whenever a new outer element is installed.

If there is clogged filter signal on the gauge panel, use the following procedure.

1. Open the access door at the hood.
2. Remove the evacuator valve (1, Figure 42) and air cleaner cover (2).

NOTE: Inspect evacuator valve seal lips for wear or damage. Replace valve if necessary. Install evacuator valve with lips parallel to the cover.

3. Remove outer filter (3, Figure 43) from the air cleaner housing.
4. Clean the air cleaner cover and the inside of the air cleaner housing.
5. Remove inner filter (4, Figure 43).
6. Clean out inside of air cleaner housing. Do not use compressed air to blow out housing.
7. Install new inner filter. Do not clean and reuse inner element.
8. Install new outer filter.
9. Install air cleaner cover and evacuator valve.

NOTE: Make sure that all gaskets and cover are properly installed and seated.

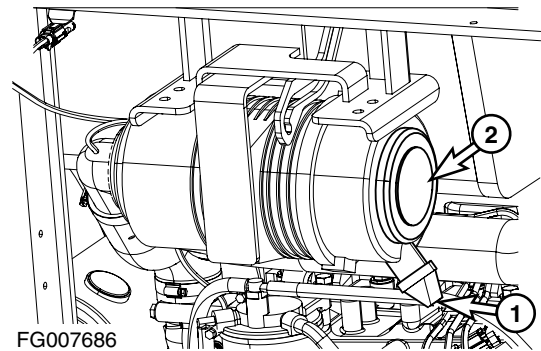


Figure 42

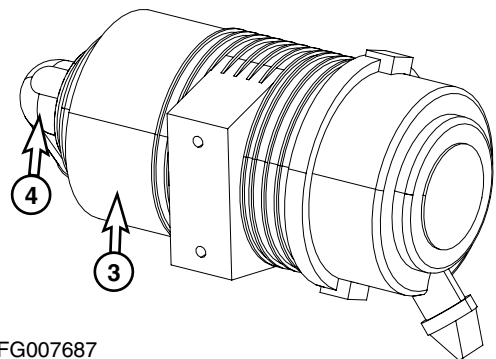


Figure 43

Change Fuel Filter



WARNING!

Exchange filter after waiting for engine to cool. Be careful of fire hazards. Do not smoke.

1. Locate fuel filter inside engine compartment.
2. Position a small container under fuel filter (1, Figure 44).
3. Unscrew fuel filter from head assembly. Discard fuel filter.

NOTE: *Dispose of drained fluids according to local regulations.*

4. After cleaning filter head, install new fuel filter. Screw filter on head until gasket contacts head, and turn filter 1/2 turn more with a filter wrench.

NOTE: *Coat fuel filter gasket with fuel.*

NOTE: *Fill fuel filter with clean fuel. This will help reduce fuel system priming.*

Fuel System Priming

If air remains in the fuel inlet line to the engine, it may cause the engine to run in an abnormal condition. Air may impact the starting capability of the engine, and may also result in surging engine speeds.

If the machine happens to have run out of fuel, or if the fuel filter has been replaced, air may need to be bled using the following procedure:

1. Shut down engine.
2. Fill fuel tank.
3. Loosen plug (2, Figure 44).
4. Turn starter switch to the "I" (ON) position to activate electric fuel pump which sends fuel under pressure to each injection nozzle and to bleed off pipes of each nozzle holder, and then returns air the fuel tank
5. After air has been bleed, tighten plug (2, Figure 44) in fuel prefilter head.
6. Start engine and check fuel system for leaks.

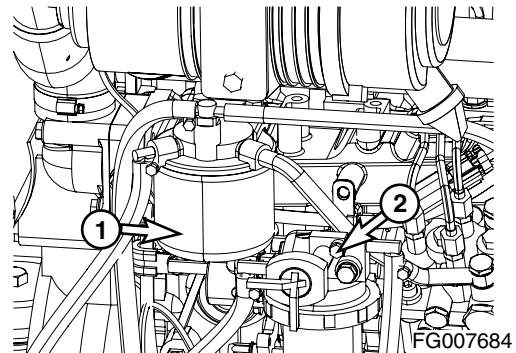


Figure 44

FG007684

1,000 HOUR / 6 MONTH SERVICE

Perform All Daily, 50, 250 and 500 Hour Service Checks

Replace Hydraulic Oil Return Filter

NOTE: *Change hydraulic oil return filter after first 250 hours of operation or rebuild, and every 1,000 hours thereafter.*



WARNING!

The hydraulic oil will be hot after normal machine operation. Allow the system to cool before attempting to service any of the hydraulic components.

The hydraulic tank is pressurized. Loosen the hydraulic breather cap slightly to allow the pressurized air to vent. After the pressure has been released, it is safe to remove either the fill cap or service covers or drain water from the tank.

IMPORTANT

Make sure to clean any dirt or water from the top of the hydraulic tank, especially around the fill port and filter ports.

1. Park machine on firm, level ground. Lower the front attachment to the ground and shut down engine.
2. Loosen the breather cap (1, Figure 45) slightly to release the internal pressure.
3. Remove bolts (2, Figure 45) and oil filter set (3).
4. Remove bolts (5) and filter locker.
5. Discard the filter (7). Install new filter.
6. Clean the oil filter set (3) and O-ring (4, Figure 45).
7. Install all parts in reverse order.
8. Run engine for ten minutes at low idle to purge air from circuit.
9. Check level in hydraulic oil tank (See page 4-13). Add oil if necessary.

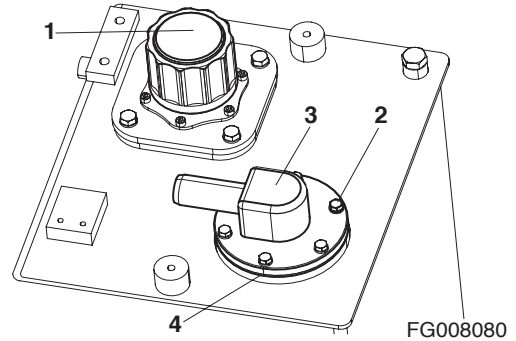


Figure 45

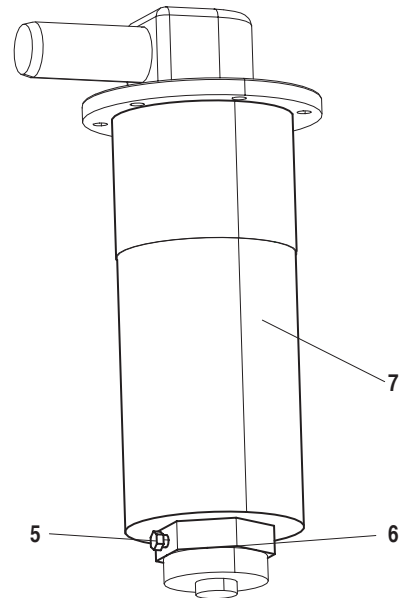


Figure 46

Change Oil in Travel Reduction Device (One on Each Side of Unit)



WARNING!

The gear oil is very hot after the machine has been operating. Shut all systems down and allow them to cool. Before fully removing any motor case, inspection port plug, etc., loosen the plug slightly to allow pressurized air to escape.

NOTE: Drain oil after first 250 hours of operation or rebuild, and every 1,000 hours thereafter.

1. Make sure that the machine is on firm, level ground.
2. Rotate the track until ports (1 thru 3, Figure 47) are in their proper positions as shown.
3. Place a container under drain plug (2, Figure 47) and remove plugs (1 thru 3) to drain the travel reduction gear oil.

NOTE: Dispose of drained fluids according to local regulations.

4. Install drain plug (2, Figure 47). Refill the travel reduction gear case with fluid through fill port (3) until the fluid level is at port (1). Install level plug (1) and fill plug (3).

NOTE: See "Fluid Capacities" on page 4-7. for capacity.

5. Repeat this procedure on the other travel reduction device.

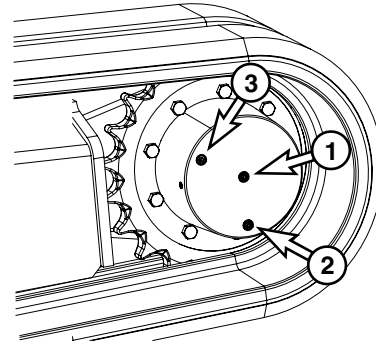


Figure 47

FG007685

Replace Hydraulic Oil Suction Filter

NOTE: Replace hydraulic suction filter after first 250 hours of operation or rebuild, then every 1,000 hours thereafter (See page 4-34).

2,000 HOUR / YEARLY SERVICE

Perform All Daily, 50, 250, 500 and 1,000 Hour Service Checks

Change Radiator Coolant



WARNING!

Allow the engine to cool before releasing the radiator cap. Make sure to loosen the cap slowly to release any remaining pressure.

Radiator cleaning is performed while the engine is running. Take extreme caution when working on or near a running engine. Make sure to lock out and tag the controls notifying personnel that service work is being performed.

Do not remove the radiator cap unless it is required. Observe the coolant level in the coolant recovery tank.

1. Slowly open the radiator cap to allow any pressure to escape.
2. Place a container under the radiator and open the drain valve (2, Figure 49).

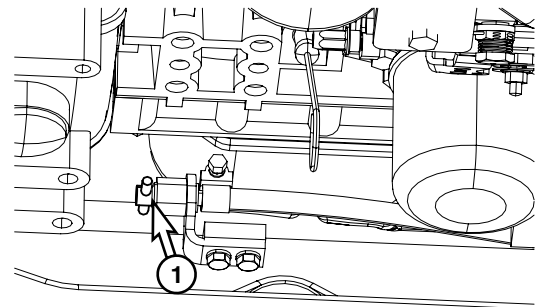
NOTE: *Dispose of drained fluids according to local regulations.*

3. Install drain plug, and close drain valve after coolant has completely drained from system.
4. Fill cooling system with a flushing solution.
5. Run engine at low idle until the coolant temperature gauge reaches the "BLUE ZONE." Run engine for another ten minutes.
6. Allow engine to cool.
7. Drain flushing fluid and fill system with water.
8. Run engine again to allow water to completely circulate.
9. After allowing engine to cool, drain water and fill system with proper antifreeze mixture for ambient temperature. Refer to coolant concentration table. See "Antifreeze Concentration Tables" on page 4-53.
10. Run engine without radiator cap installed, so all air will be purged from system. Fill radiator to fill neck.
11. Drain and fill radiator coolant recovery tank.



ARO1760L

Figure 48



FG007688

Figure 49

Hydraulic Oil Exchange and Suction Filter Replacing



WARNING!

The hydraulic oil will be hot after normal machine operation. Allow the system to cool before attempting to service any of the hydraulic components.

The hydraulic tank is pressurized. Loosen the breather cap to allow the pressurized air to vent. After the pressure has been released, it is safe to remove either the fill cap or service covers.



ARO1760L

Figure 50

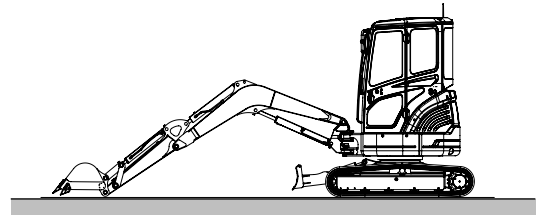
IMPORTANT

Make sure to clean any dirt or water from the top of the hydraulic tank, especially around the fill port and filter ports.

Hydraulic oil change interval is 2,000 hours, only when **DOOSAN** Genuine Oil is used. If another brand of oil is used, guaranteed change interval is 1,000 hours.

NOTE: *Based on the type of excavating being completed, the working conditions (extremely hot or dusty) and the extra front end attachments being used (hydraulic breaker, etc.), the hydraulic fluid will need to be changed more frequently.*

1. Park machine on firm, level ground. Swing upper structure perpendicular (90°) to tracks. Lower boom and position bucket on ground as shown in Figure 51.
2. Set safety lever on "LOCK" position.
3. Shut down engine.
4. Release pressurized air from hydraulic tank by rotating breather cap (1, Figure 51).



FG007689

Figure 51

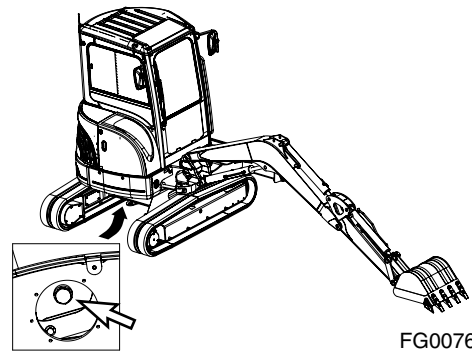
5. Drain hydraulic oil from tank into a container capable of holding 40 liters (11 U.S. gal.). After draining tank, install drain plug.

IMPORTANT

Be careful of squirting oil when removing drain plug.

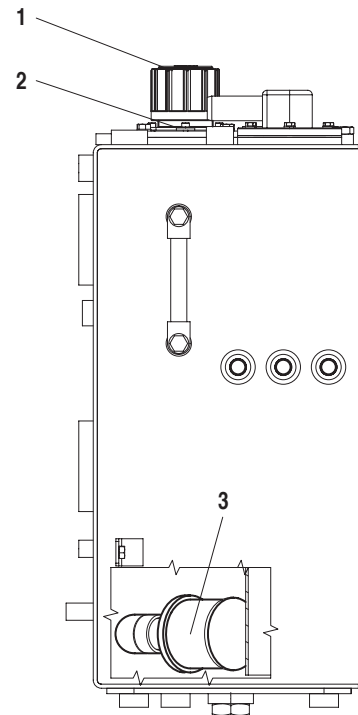
NOTE: *Used filter and used oil should always be disposed of according to local regulations.*

6. Carefully remove bolts and cover (2, Figure 53) from top of hydraulic oil tank.
7. Remove the suction filter (3).
8. Install new suction filter. Fill the hydraulic oil tank. Check level using sight gauge on side of tank.
9. Install all parts in reverse order.



FG007690

Figure 52



FG008082

Figure 53

Check Alternator and Starter**

**These checks need to be completed by an authorized DOOSAN dealer.

Check All Rubber Antivibration Shock Mounts

Perform and Record the Results of the Cycle Time Tests

**Inspect Machine to Check for Cracked
or Broken Welds or other Structural
Damage**

Check, Adjust Valve Clearance **

Check Head Bolt Torques

4,000 HOUR / BIENNIAL SERVICE

Major Parts - Periodic Replacement

To ensure safe operation and work, perform periodic inspections. Also, to increase safety, replace the following parts. These parts are the ones most often subjected to abrasion, heat and fatigue. Exchange these parts with new ones at the designated time intervals, even if the old parts look good.

Always replace all related parts such as gaskets and O-rings. Use only original equipment manufacturers parts.

Major Component		Parts Name to be Exchanged Periodically	Time to Exchange
Engine		Fuel hose (Tank to filter).	2 years or 4,000 hours
		Fuel hose (Tank to fuel injection pump).	
		Heater hose (Heater to engine).	
Hydraulic System	Body	Pump suction hose.	
		Pump discharge hose.	
		Swing hose.	
	Work Device	Boom cylinder line hose.	
		Arm cylinder line hose.	
		Bucket cylinder line hose.	
		Pilot hose.	
		Boom swing cylinder line hose.	

12,000 HOUR / SIX YEAR SERVICE

Hose In-service Lifetime Limit (European Standard ISO 8331 and EN982 CEN)

European regulations state that the in-service life of any hydraulic hose may not exceed six years. *DOOSAN* recommends the following:

- Hoses at the customer premises cannot be stored more than 2 years before being discarded or installed on a machine.
- In-service lifetime of hoses fitted on a machine can never exceed 6 years, but replace hoses described in "Major Parts - Periodic Replacement" on page 4-37, every 2 years. Always replace hoses having exceeded the allowed in-service lifetime irrespective of the external appearance/wear.
- Always store hoses in a dark place at a maximum of 65% relative humidity, between 0°C (32°F) and 35°C (95°F) but as close as possible to 15°C (59°F) and away from copper, manganese or tube generating Ozone.

AIR-CONDITIONING SYSTEM

Check Air Conditioner Hoses

Check the hose for cracking and damage.



CAUTION!

When a leak occurs, dirt will accumulate in the area where the leak is. Consult a **DOOSAN** distributor or sales agency.

Check Condenser

Inspect the condenser for dust and debris. Clean if necessary.

Check Magnetic Clutch

Check the magnetic clutch for dirt and interference.

Push the "A/C" switch to energize magnetic clutch and check the magnetic clutch.

Check Belt Tension

NOTE: See "Check Engine Fan Belt Tension" on page 4-25.

BOLT AND NUT INSPECTION

Inspect ALL fasteners after the first 50 hours of operation and every 250 hours thereafter. If any are loose or are missing tighten them or install new hardware. Always use a calibrated torque wrench.

IMPORTANT

Always clean fasteners before tightening.

If counterweight is loose, contact a *DOOSAN* distributor or sales agent.

No.	Point to be Inspected		Bolt Dia. Mm	Qty.	Bolt Head Size	TORQUE		
						Nm	kg·m	ft lb
1	Engine vibration dampening bolts		12	4	19	73.5	7.5	54
2	Engine bracket	Bolt	10	4	17	63.7	6.5	47
		Nut	10 (2)	4	17			
3	Hydraulic and fuel tank mounting bolts		10	8	17	42.2	4.3	31
4	Hydraulic hose and pipe joint		PF1/4			26.5-29.4	2.7-3.0	20-22
			PF3/8			46-51	4.7-5.2	34-38
			PF1/2			56-62	5.7-6.3	41-46
5	Pump mounting bolt		12	2	19	112.8	11.5	83
6	Control valve mounting bolt		8	4	13	21.6	2.2	16
7	Control valve base mounting bolt		10	4	17	42.2	4.3	31
8	Swivel mounting bolt		14	4	22	176.5	18	130
9	Canopy mounting bolt		12	5	19	112.8	11.5	83
10	Cabin mounting bolt		12	5	19	112.8	11.5	83
11	Cabin stopper bolt		16	4	24	269.7	27.5	199
12	Swivel bearing mounting bolt	swiveling body	12	16	19	112.8	11.5	83
		track	12	16	19	112.8	11.5	83
13	Traveling body mounting bolt		12	18	19	112.8	11.5	83
14	Sprocket mounting bolt		12	18	19	112.8	11.5	83
15	Lower roller mounting bolt		20	12	30	338	34.5	249
16	Cover mounting bolt		8	28	13	21.6	2.2	16
17	Counterweight mounting bolt		20	3	30	539	55	397

NOTE: *At installation, remove rust, sand, dirt and dust.*

At installation, lubricate to reduce abrasion.

Apply Loctite to lower roller mounting bolts.

The top 2 notes above are not keyed to anything

BUCKET

Bucket Tooth Replacement



WARNING!

Due to the possibility of flying metal objects, always wear safety helmet, protective gloves and eye protection when changing bucket teeth.

Curl the bucket upwards and place the round rear surface of the bucket firmly on the ground. Shut the engine off and lock out the hydraulic controls before working on the bucket.

NOTE: *These instructions are only for DOOSAN OEM buckets. If you are using other manufacturers buckets, refer to their specific instructions.*



HAOJ022L

Figure 54

1. On a routine basis, inspect the bucket teeth to make sure that tooth wear or breakage has not developed. Do not allow the replaceable bucket teeth to wear down to the point that the bucket is exposed. See Figure 54.

2. Place bucket, with wooden blocks under it, as shown in illustration.

Move front edge of bucket up slightly to make work easier, if desired. Do not raise it too far or the teeth may cause injury if fallen on.

3. Check tooth point and side cutter for wear or looseness.
4. Tighten tooth points and side cutters or replace if damaged:
 - A. Remove nuts (1), washers (2) and bolts (3). Remove side cutters (4). (Each side cutter has three sets of bolts and nuts.)
 - B. Remove nuts (5) and bolts (6). Remove tooth point. (A tooth point has two sets of bolts and nuts)
 - C. Reinstall parts in reverse order of disassembly.
 - D. After the first operation following point replacement, retighten nuts.

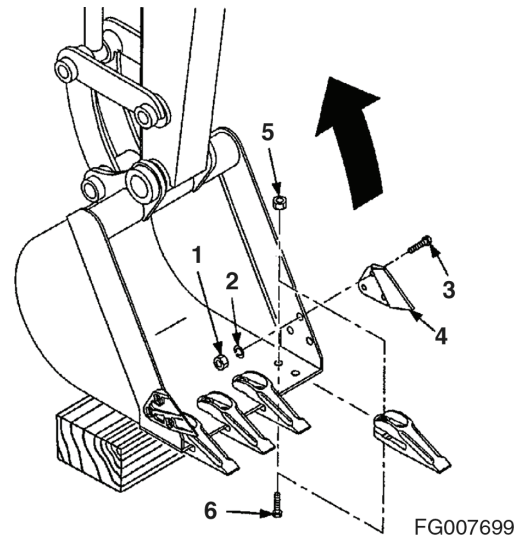


Figure 55

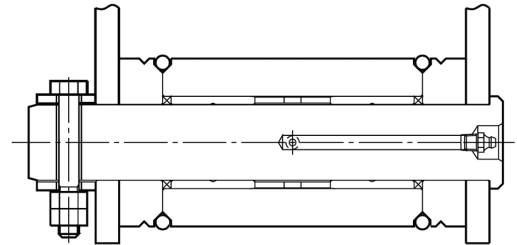
Bucket O-ring Replacement



WARNING!

Due to possibility of flying metal objects, always wear safety helmet, protective gloves and eye protection when changing pins.

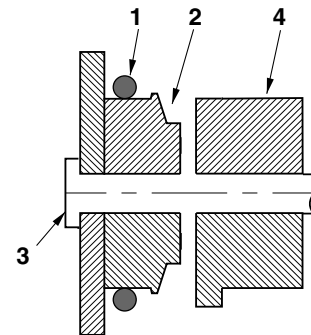
1. Inspect the bucket O-rings on a routine basis. If worn or damaged, replacement is necessary.



FG007694

Figure 56

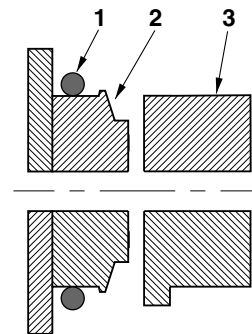
2. Roll the old O-ring (1) onto the bushing (2) around the bucket pin (3).
3. Remove the bucket pin and move the arm or bucket link (4) out of the way.



FG007695

Figure 57

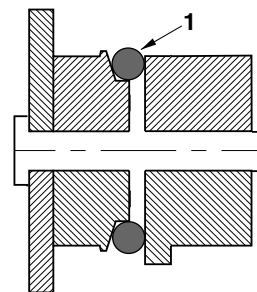
4. Remove the old O-ring and temporarily install the new O-ring (1) onto the bucket bushing (2). Make sure that the O-ring groove on both the bucket link (3) and bushing have been cleaned.
5. Realign the arm or link with the bucket pin hole and insert the bucket pin (3).



FG007696

Figure 58

6. Roll the new O-ring (1) into the O-ring groove.



FG007697

Figure 59

Bucket Shimming Procedures

New Bucket Installation

1. If a new bucket is being installed on excavator, measure inside dimension between bucket ears and outside dimension across arm mounting boss.
2. Subtract clearance on both sides from difference of two and shim accordingly, before assembly.

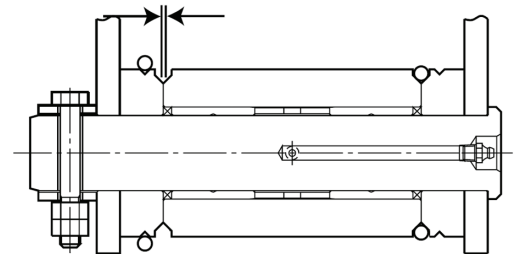


WARNING!

To check end play (side to side) clearance at bucket attachment point, the bucket must be free to move but at all other times lower it to the ground or use support blocks to immobilize this assembly. Shut off engine and tag and lock out controls to prevent movement during this procedure.

Shimming Procedures for Installed Bucket

1. With bucket attached, curl bucket and arm outward and lower boom so bucket teeth are pointing away from excavator, just a few inches off ground. This position provides easy accessibility for dimensional measurements.
2. Force bucket to one side and check for end play (side to side) clearance under O-rings at attachment point. Clearance should be between 0.2 - 0.7 mm (0.008 - 0.027 in) on each end of arm boss, between side face of boss and inside edge of ear busing. Too tight a fit can cause excessive wear while too much clearance may produce excessive noise and potentially hazardous slack control.
3. Recheck end play by forcing bucket towards opposite side and repeating clearance measurements.
4. If an adjustment is required, remove bolt and pin. Add or remove shims as required. Install pin and bolt. Torque bolts to 42 Nm / 4.3 kg·m (31 ft lb).



FG007698

Figure 60

Replace Bucket



WARNING!

When removing pin, metal pieces can fly out and cause injury. Be sure to wear safety glasses or goggles, safety hat and safety gloves to prevent injuries.

Bucket Disassembly

1. Place bucket as shown in illustration.

IMPORTANT

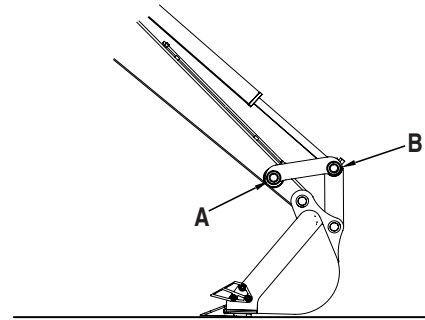
In next step, O-rings are removed with pins. Be careful not to damage them.

2. Remove bolts holding pins A and B, remove pins, and remove bucket.

NOTE: *If pins do not come out easily, the bucket may be resting on the ground too "heavily."*

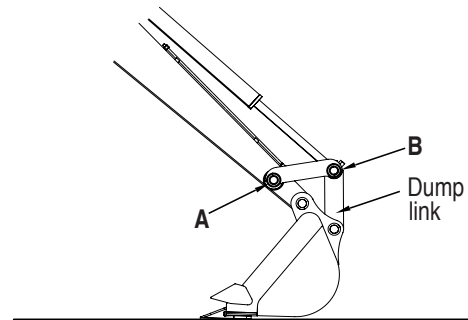
Bucket Installation

1. Clean and grease pins and pin holes.
2. Install new bucket as shown in illustration.
3. Install pins, aligning arm hole A with dump link hole B. Install O-rings.
4. Apply grease to pins.
5. Run engine at low idle and move bucket slowly through one stroke to make sure parts are installed correctly.



FG007692

Figure 61



FG007693

Figure 62

ELECTRICAL SYSTEM

NOTE: *Never disassemble electrical or electronic parts. Consult with a DOOSAN distributor or sales agency before servicing.*

Battery



WARNING!

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.

Battery generates hydrogen gas, so there is danger of an explosion. Do not bring lighted cigarettes near the battery, or do anything that will cause sparks.

Before working with batteries, shut down engine and turn the starter switch to the "O" (OFF) position.

Avoid short-circuiting the battery terminals through accidental contact with metallic objects, such as tool.

When removing or installing, check which is the positive (+) terminal and negative (-) terminal.

When removing the battery, first disconnect the negative (-) terminal. When installing the battery, first connect the positive (+) terminal.

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.

Batteries in Cold Weather

In colder weather a greater drain is placed on the batteries when they are used for the preheat cycle and when starting a cold engine. Battery performance decreases as the temperature gets lower.

In extremely cold weather, remove the batteries at night and move them to a warm location. This will help to keep them at a higher power level.

Inspection of Battery Electrolyte Level

This machine has two maintenance free batteries. They never require the addition to water.

When the charge indicator becomes transparency, it means low electrolyte state because of the leakage or charging system error. Determine the cause of problem and replace the batteries immediately.

Check Charging State

Check charging state through the charging indicator.

- GREEN: Sufficiently charged.
- BLACK: Insufficient charged.
- TRANSPARENT: Replace battery.

Check the Battery Terminals

Be certain that the battery is held securely in its compartment. Clean the battery terminals and the battery cable connectors. A solution of baking soda and water will neutralize acid on the battery surface, terminals, and cable connectors. Petroleum jelly or grease can be applied to the connectors to help prevent corrosion.

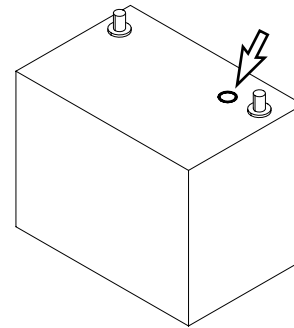
Battery Replacement

When the charging indicator indicates transparency state, replace the battery. The batteries should always be replaced in pairs.

Using an old battery with a new one will shorten the life span of the new battery.

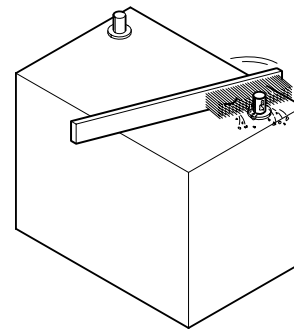
Fuses

1. The fuses in the fuse box are used to protect the various electrical circuits and their components from being damaged. See Figure 65. The fuses used are standard automotive type fuses.
2. The section on "Fuse Identification" on page 4-49, lists the circuits and the fuse amperage required for each circuit. If a fuse blows, determine the cause and repair any faults or failures.
3. Do not insert a higher amperage fuse into a lower amperage slot. Serious damage to the electrical components or fire can result.



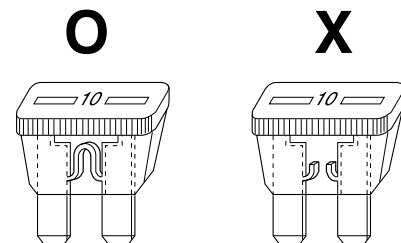
FG007701

Figure 63



FG007702

Figure 64



HAOC670L

Figure 65



CAUTION!

Before replacing a fuse, be sure to turn starter switch to "O" (OFF) position.

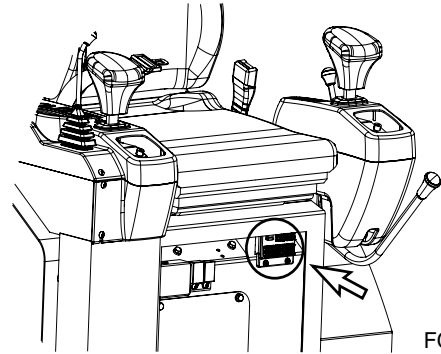
Fuse Box

There is a fuse box (Figure 66) in the electric box which is under the seat. The fuses prevent electrical devices from overloading or shorting.

A decal attached to the fuse box's cover indicates the function and amperage of each fuse.

Spare fuses are mounted on the inside of fuse box's cover. (One each of a 10A, 15A, 20A and 30A.)

Change a fuse if the element separates. If the element of a new fuse separates, check the circuit and repair the circuit.



FG007500

Figure 66

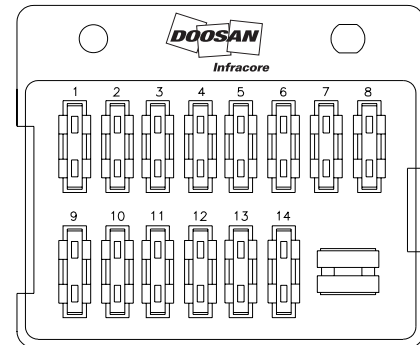


CAUTION!

Always replace fuses with the same type and capacity fuse that was removed. Otherwise, electrical damage could result.

Fuse Identification

No.	Fuse Box	
	Name	Capacity
1	Rotating Beacon	10A
2	Spare	10A
3	Horn, Travel Alarm, Fuel Pump	10A
4	Quick Clamp, High-speed	10A
5	Cigar Lighter	15A
6	Wiper, Washer, Stereo	15A
7	Pilot Cut Off	15A
8	Spare	30A
9	Air Conditioner, Compressor	20A
10	Heater	15A
11	Condenser	15A
12	Working Light, Head Light	30A
13	Gauge Panel	10A
14	Cabin Light, Hour Meter	10A



FG007491

Figure 67

ENGINE COOLING SYSTEM

General

Keeping an engine's cooling system in peak operating condition can have many benefits in keeping a machine in good operating condition. A properly functioning cooling system will; improve fuel efficiency, reduce engine wear, and extend component life.

Always use distilled water in the radiator. Contaminants in tap water neutralize the corrosion inhibitor components. If tap water must be used, it should not exceed 300 ppm hardness, or contain more than 100 ppm of either chloride or sulfate. Water that has been treated with a water softener also contains salt that will cause corrosion of components. Water from creeks and stagnant pools usually contains dirt, minerals and/or organic material that are deposited in the cooling system and impair cooling efficiency. Distilled water is the best.

Make at least a minimum mixture of 40% antifreeze with 60% distilled water for adding additional fluid to the system during normal maintenance. This level will help maintain the additive concentration of the system. Check the coolant every 500 hours.

Engine overheating is often caused by bent or clogged radiator fins. The spaces between the fins can be cleaned by use of air or water under pressure. When straightening bent fins, use care not to damage the tubes or break the bond between the fins and the tubes.



CAUTION!

Maintaining the proper anticorrosive additive levels in antifreeze will help protect the engine and other components from becoming corroded.

If anticorrosive additive levels are not properly maintained and monitored, server damage to the cooling pump and cylinder liners may result. This corrosion can also result in the radiator tubes becoming clogged and loosing their heat transfer efficiency. The engine (Model: DV11) uses a wet-type cylinder liner design, which requires, a high efficiency cooling system flow, to maintain proper engine temperatures.

The coolant and its additives can be checked by using coolant test paper (No: 60.99901-0038).



WARNING!

Pressure at air nozzle must not exceed 2.1 kg/cm² (30 psi). Always wear goggles when using compressed air.

Do not pour cold water into radiator when engine is very hot and water level is below the top of the tubes. Such action could result in damage to engine cylinder heads.

Heavy duty diesel engines require a balanced mixture of water and antifreeze. Drain and replace the mixture every year or 2,000 hours of operation, whichever comes first. This will eliminate buildup of harmful chemicals.

Antifreeze is essential in any climate. It broadens the operating temperature range by lowering the coolant's freezing point and by raising its boiling point. Do not use more than 50% antifreeze in the mixture unless additional freeze protection is required. Never use more than 68% antifreeze under any condition.

Measuring the Concentration of Coolant

The coolant and its additives can be checked by using coolant test strips (No: 60.99901-0038). Use the following procedure to conduct the test:

1. With a coolant temperature of 10° - 55°C (50° - 131°F), drain 1 liter (1 U.S. quart) of it from the radiator into a clean plastic container.

NOTE: *Do not take the sample from the coolant recovery tank. Recovery tank coolant concentration can differ from the concentration level of coolant in the radiator.*

2. Dip test strip, into coolant sample for 3 - 5 seconds. Remove strip and excessive coolant by giving the strip one shake.
3. Wait for 45 seconds, for the test strip to change color.

NOTE: *Measuring time should not be more than 75 seconds. If it is over this time limit, the color will be changed and an inaccurate reading will result.*

4. Compare the color of the test strip with the color table on the outside of test strip container bottle, and determine what numeric value corresponds to the color in the table.

- A. Check antifreeze concentration levels by comparing the color change at the end of test paper, with the green spectrum range, with the green symbol on the upper portion of the container bottle.

NOTE: *A suitable concentration indicator should be between 33% and 50%.*

- B. Check the anticorrosive additives, by comparing brown color in the middle range of the test strip and pink color on the lower part of the test strip, with the brown and pink spectrum range. Where the brown (vertical) color and pink (horizontal) color intersects represents the anticorrosive additive level.

NOTE: *A reading between 0.3 and 0.8, represents an adequate additive level.*

5. Correct the antifreeze concentration and additive levels.

- A. If anticorrosive additive level is below 0.3, add 100% pure antifreeze to the radiator.
- B. If anticorrosive additive level is greater 0.8, add a 50% distilled water and antifreeze mixture to lower the additive reading.

NOTE: *In either case keep the antifreeze concentration level between 33% and 50%.*

6. Run the engine to recirculate the coolant mixture. Be sure that engine reaches operating temperature to ensure a thorough mix. Shut down engine and retest antifreeze.

NOTE: *When making adjustment, drain 1 liter (1 U.S. quart) of coolant from the radiator. Add 30 cc (1 fl oz) at a time to the drained fluid. Keep track of how many cc's (fl oz's) were added to the 1 liter (1 U.S. quart) to obtain a proper reading. Then multiply that number times the total system capacity of liters (U.S. quarts). Add that amount to the radiator.*

Example: If 1 liter needs 90 cc to obtain proper reading. Then system capacity of 40 liters x 90 cc = 3,600 cc (3.6 liters) of correction fluid.

Types of Antifreeze

There are two main classifications of antifreeze available on the market today.

1. Ethylene Glycol - Standard Life Antifreeze
2. Propylene Glycol - Extended Life Antifreeze

Ethylene glycol (standard life antifreeze) has been on the market for many years. Its chemical properties do not provide the improved corrosion resistance that propylene glycol (extended life antifreeze) does. Ethylene glycol is also very hazardous to the environment, people and animals. *DOOSAN* recommends that ethylene glycol be replaced with propylene glycol.

The newer propylene glycol antifreeze comes in many different colors. Some of the colors are pink, red, orange and yellow. There are even some that come in a blue-green color. The blue-green color makes it very difficult to tell the difference of what type of antifreeze is in a cooling system. The colors are only a dye added to the clear antifreeze. Do not rely on color. Keep careful machine records of what brand and type of antifreeze is used in the unit. If you are unsure of what type of antifreeze is in the system, drain and flush the system.

NOTE: *Do not mix ethylene glycol and propylene glycol antifreeze together. If the two are mixed, the protection level will be reduced to the level of the ethylene glycol.*

Antifreeze Concentration Tables

Ethylene Glycol - Standard Life Antifreeze (1,000 Hour / 6 Months)		
Ambient Temperature	Cooling Water	Antifreeze
-10°C (14°F)	80%	20%
-15°C (5°F)	73%	27%
-20°C (-4°F)	67%	33%
-25°C (-13°F)	60%	40%
-30°C (-22°F)	56%	44%
-40°C (-40°F)	50%	50%

Propylene Glycol - Extended Life Antifreeze (2,000 Hour / Yearly)		
Ambient Temperature	Cooling Water	Antifreeze
-10°C (14°F)	78%	22%
-15°C (5°F)	71%	29%
-20°C (-4°F)	65%	35%
-25°C (-13°F)	59%	41%
-30°C (-22°F)	55%	45%
-40°C (-40°F)	48%	52%

HANDLING OF ACCUMULATOR



WARNING!

Even though the engine is stopped, the hydraulic accumulators for the pilot system are still charged. Do not disconnect any pilot system hoses until accumulator pressure has been released from the circuit. To release pressure, turn the starter switch to the "I" (ON) position and operate all hydraulic control levers and forward/reverse travel levers. Even though the engine is shutdown hydraulic actuated components may move while releasing pilot pressure. Keep all personnel away from excavator while performing this operation.

- Set safety lever on "LOCK" position after stopping engine.
- DO NOT mishandle accumulator (s). They are very dangerous because they contain high-pressure nitrogen gas.
- DO NOT punch a hole or apply heat or fire to an accumulator.
- DO NOT weld on accumulator, or try attaching anything to it.
- When replacing an accumulator, contact a *DOOSAN* distributor or sales agency so the gas can be properly released.
- Wear safety goggles and protective gloves when working on an accumulator. Hydraulic oil under pressure can penetrate the skin and cause serious injuries.

Release pilot accumulator pressure using the following procedure:

1. Park machine on firm, level ground. Lower the front attachment to the ground and shut down engine.
2. Set safety lever on "RELEASED" position.
3. Turn starter switch to the "I" (ON) position.
4. Fully stroke work and travel levers in all directions.
5. Set safety lever on "LOCK" position.
6. Turn key to "O" (OFF) position and remove from starter switch.
7. Remove accumulator by unscrewing it slowly.

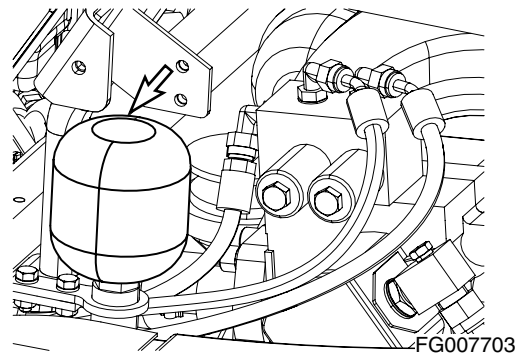


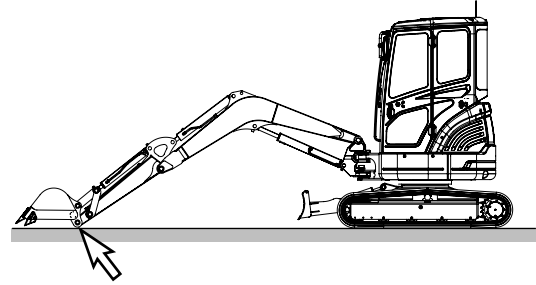
Figure 68

LONG TERM STORAGE

IMPORTANT

When storing machine, position as shown in illustration to protect the cylinder rod. Protect the cylinder against rust.

Perform the following if storing the excavator for more than one month.



FG007662

Figure 69

Conditions	Maintenance Required
Cleaning	1. Pressure wash the undercarriage and wheel drive assemblies. Inspect for damage or loose or missing parts.
Lubrication	1. Perform all daily lubrication procedures. 2. Apply a coating of light oil to the exposed plated metal surfaces, such as hydraulic cylinder rods, etc. 3. Apply a coating of light oil to all the control linkages and control cylinders (control valve spools, etc.).
Battery	1. Remove the battery from the excavator and store in a warm place. Fully charge battery before storing.
Cooling System	1. Inspect the coolant reserve tank to make sure that the antifreeze level in the system is at the correct level. 2. Every 90 days or 750 hours on the hour meter, use a hydrometer to measure the protection level of the coolant. Refer to the antifreeze/coolant protection chart to determine the amount of protection the cooling system requires. Add coolant as required.
Hydraulic System	1. Once a month, start the engine and follow the "Hydraulic Oil Warm-up" procedures listed in this manual.

After Storage

1. Check fluid levels and check for missing parts, then start engine.

IMPORTANT

Sudden operation may damage seals and gaskets.

2. When operating cylinders, run engine at idle and operate each control 3 or 4 times to lubricate hydraulic components.

MAINTENANCE IN SPECIAL CONDITIONS

NOTE: See "Operation Under Unusual Conditions" on page 3-38 for other recommendations.

Conditions	Maintenance Required
Operating in mud, water or rain.	1. Perform a walk around inspection to check for any loose fittings, obvious damage to the machine or any fluid leakage. 2. After completing operations, clean mud, rocks or debris from the machine. Inspect for damage, cracked welds or loosened parts. 3. Perform all daily lubrication and service. 4. If the operations were in salt water or other corrosive materials, make sure to flush the affected equipment with fresh water.
Operating in an extremely dusty or hot environment.	1. Clean the air intake filters on a more frequent basis. 2. Clean the radiator and oil cooler fins to remove embedded dirt and dust. 3. Clean the fuel system intake strainer and fuel filter more frequently. 4. Inspect and clean the starter and alternator as required.
Operating in rocky terrain.	1. Check the undercarriage and wheel drive assemblies for damage or excessive wear. 2. Inspect for loose or damaged fittings or bolts. 3. Inspect wheels and tires for damage. 4. On a more frequent basis, inspect the front end attachments for damage or excessive wear. 5. Install a top guard and front guard as required for protection against falling rock.
Operating in extreme cold.	1. Use the proper fuel for the temperature conditions. 2. Using a hydrometer, check the antifreeze to make sure that it is providing the proper cold weather freeze protection. 3. Verify the condition of the batteries. In extremely cold weather remove the batteries at night and store them in a warmer area. 4. Remove mud build up as soon as possible to prevent it from freezing to the undercarriage and causing damage.
Falling objects/stones	1. Install overhead guard on cabin. Contact your Daewoo dealer.
Salt water or air	1. Wash the machine thoroughly to remove salt.

TRACK TENSION



WARNING!

Safely measuring track tension requires two people. One person must be in the operator's seat, running the controls to keep one side frame in the air, while the other person makes dimensional checks. Take all necessary precautions to make sure the machine won't move or shift position during service. Warm up the engine to prevent stalls, travel the excavator to an area that provides level, uniform ground support and/or use support blocks when necessary.

The track adjusting mechanism is under very high-pressure. **NEVER** release pressure too suddenly. The grease cylinder valve should never be backed off more than 1 complete turn from the fully tightened down position. Bleed off pressure slowly and keep your body away from the valve at all times. If there is problem in the fitting thread, the valve or fitting might be ejected at high-speed, causing a fatal injury.

Track shoe link pins and bushings wear with normal usage, reducing track tension. Periodic adjustment is necessary to compensate for wear and it may also be required by working conditions.

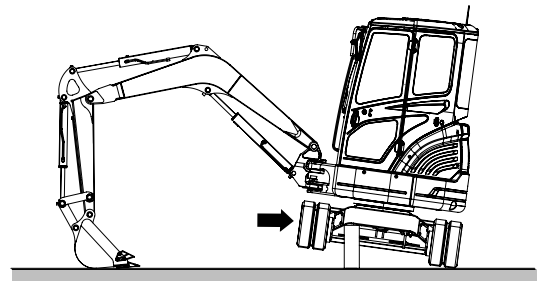
Inspection

1. Turn upper body so it is at a 90° angle to the tracks.

NOTE: *On rubber crawlers, move machine body so seam of crawler pad is on the axle center line, then turn body.*

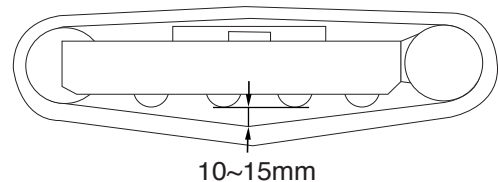
2. Track tension is checked by jacking up one side of the excavator. See Figure 70. Place blocking under frame while taking measurement.
3. Measure clearance between track roller and track contact surfaces. Clearance should be approximately 10 - 15 mm (0.39 - 0.59 in)

NOTE: *This measurement can be thrown off if there is too much mud or dirt or other material in the track assembly. Clean off the tracks before checking clearance.*



FG007704

Figure 70



FG007705

Figure 71

NOTE: For machines with steel crawlers (optional), checking and adjustment steps and the clearance are the same.

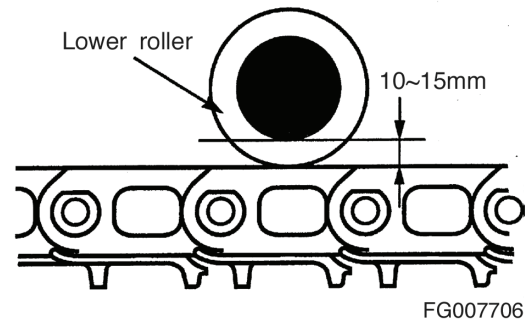


Figure 72



WARNING!

The track adjusting mechanism is under very high-pressure. **NEVER** release pressure too suddenly. The grease cylinder valve should never be backed off more than 1 complete turn from the fully tightened down position. Bleed off pressure slowly and keep your body away from the valve at all times. If there is problem in the fitting thread, the valve or fitting might be ejected at high-speed, causing a fatal injury.

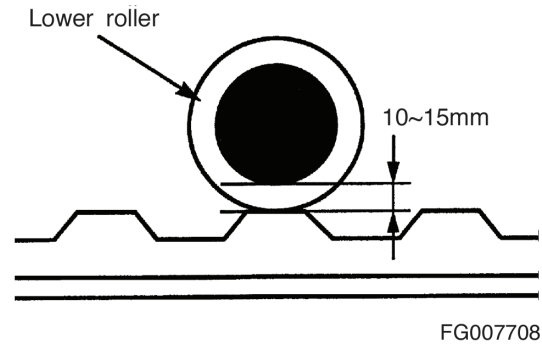


Figure 73

How to Adjust Tension

1. Apply grease through grease fitting.
2. Move track forward and backward to distribute grease and readjust tension if necessary.
3. If tension cannot be increased, replace pin and bushing, or, on rubber crawlers, replace cylinder seal or crawler.

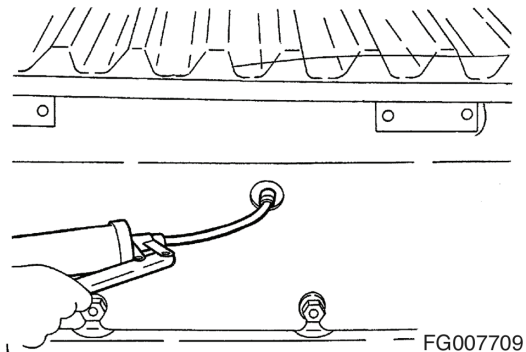


Figure 74

To Reduce Tension

1. Loosening the cartridge valve causes grease to drain out and track tension to decrease. Loosen valve slowly a maximum of 1 to turns.
2. When crawler tension is correct, tighten cartridge valve to 59 - 88 Nm / 6-9 kg·m (43 - 65 ft lb)
3. Recheck tension by moving track forward and backward.
4. Recheck tension and adjust as necessary.

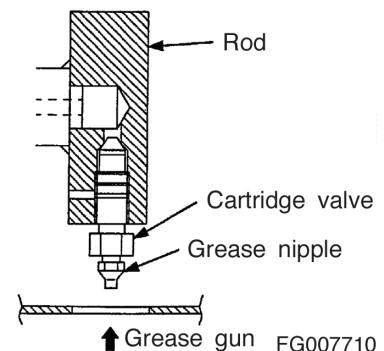


Figure 75

VENTING AND PRIMING HYDRAULIC SYSTEM

Main System Pump

NOTE: *If pump is run without sufficient oil in the main hydraulic pump, damage can occur. Always vent pump of air after draining hydraulic system.*

1. With the engine stopped, remove vent plug (Figure 76) to see if any oil is present.
2. If oil is not present, fill pump with oil through port (Figure 76).
3. Install vent plug (Figure 76) first.
4. Start engine and run it for several minutes at low idle engine speed. This will pressurize the hydraulic oil tank and system.
5. Slowly loosen vent plug (Figure 76) several turns, until hydraulic oil flows out of plug. This shows that air has been released.
6. Tighten the plug (Figure 76).

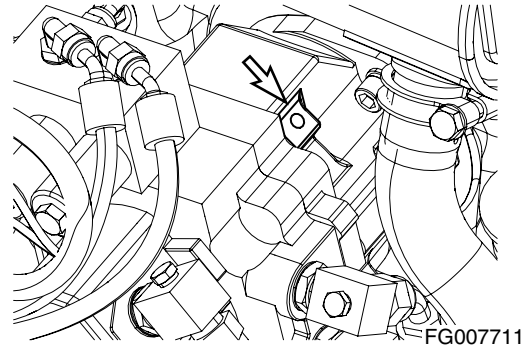


Figure 76

Hydraulic Cylinders

IMPORTANT

If cylinders are operated in high idle after the hydraulic system has been drained or the cylinder has been rebuilt, damage to piston packing and seals may occur. Always vent air from cylinders at low idle and at a slow speed.

1. Run engine at low idle. Extend and retract each cylinder to within 100 mm (4 in) of fully stroking it 4 - 5 times.
2. Operate fully extend and retract each cylinder 3- 4 times.
3. Repeat procedure until cylinders extend and retract smoothly.

Travel Motor

NOTE: *Perform this only when oil is drained from travel motor*

1. Shut down engine
2. Disconnect drain hose (Figure 77) and fill motor case with hydraulic oil.
3. Connect drain hose.
4. Start engine and set engine speed control dial to "LOW IDLE." Run the engine for one minute and slowly drive excavator forwards and backwards.

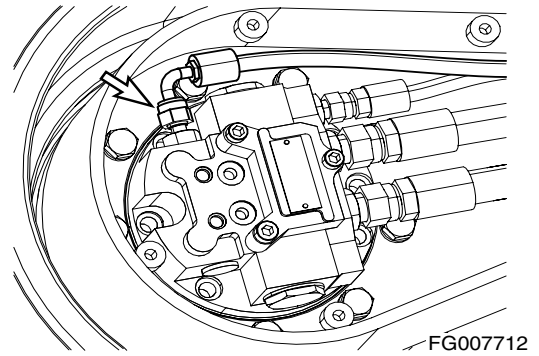


Figure 77

General Venting

1. After venting air from all components, shut the engine down and check the hydraulic oil level. Fill hydraulic oil tank to "H" mark on sight gauge.
2. Start engine and operate all controls again, run engine for five minutes to ensure all systems have been vent and purged of air. Set engine speed to "LOW IDLE," and check hydraulic oil level again. Add oil as necessary.
3. Check for oil leaks and clean all fill and venting locations.

Transportation

Obey all local, state or federal regulations for the transportation of the excavator. If unsure of regulations check with local authorities.

Check the intended route for road width, overhead clearances, weight restrictions, and traffic control regulations. Special approval or permits may be required.

LOADING AND UNLOADING



WARNING!

When transporting the machine, know the width, height, length and weight.

Loading or unloading the machine can be a dangerous operation. Make sure to run the engine at the lowest speed setting, and travel at the slowest speed possible.

Make sure that the ramp being used can handle the weight of the machine. If required, add blocking under the ramp for additional support.

Make sure that the ramp surface is free of grease or mud that could cause the machine to slip or slide.

Make sure that the trailer is parked on firm, level ground before attempting to load/unload the excavator.

If it is required to turn the machine while it is on the trailer, make sure to do this at the slowest engine and travel speeds possible.

Make sure to secure the excavator onto the trailer as required by local transportation laws.

Total Height	Total Width	Total Length	Weight	Remarks
2,515 mm (8' 3")	1,700 mm (5' 7")	4,650 mm (15.3 in)	3.65 metric tons	2.5 m Boom 1.25 m Arm 300 G Shoe

1. Make sure that the trailer is parked on firm, level ground. See Figure 1.
2. Make sure that the ramps that are being used are designed to handle the weight of the excavator. If required, add blocking under the ramp to provide additional support.
3. The ramp angle should be less than or not exceeding a 15° angle. Ramps steeper than this may cause a problem when loading or unloading.

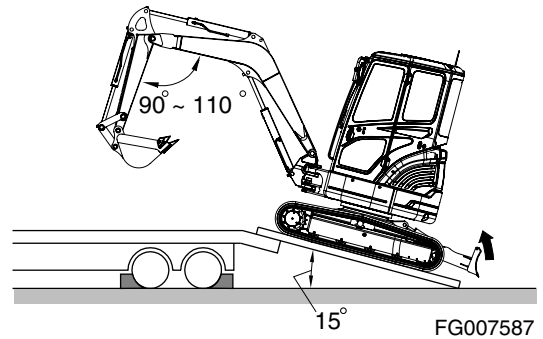


Figure 1

4. Set the travel speed selector switch to "O" (OFF) position. See Figure 2.
5. Set engine speed to "LOW IDLE."

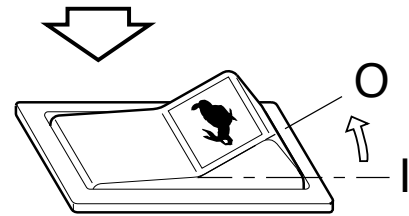


Figure 2

6. If the machine is equipped with work equipment, set the work equipment at the front, and travel forward to load it.

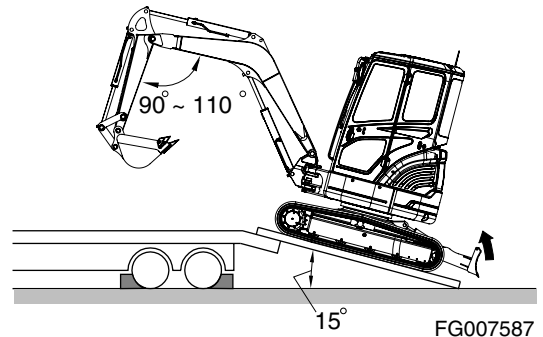


Figure 3

7. Extend bucket and arm cylinders to maximum length and then lower the boom slowly.

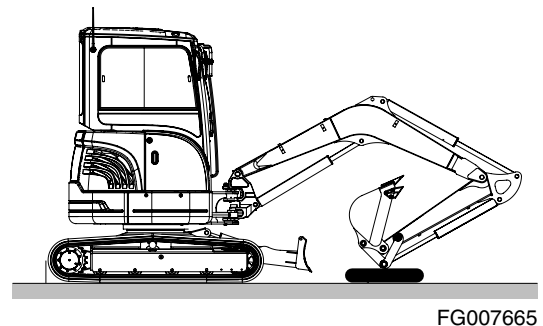
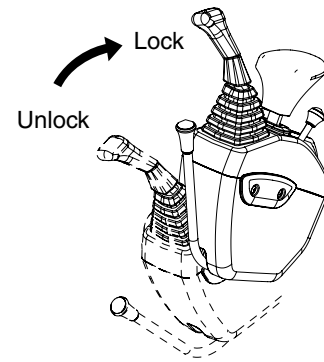


Figure 4

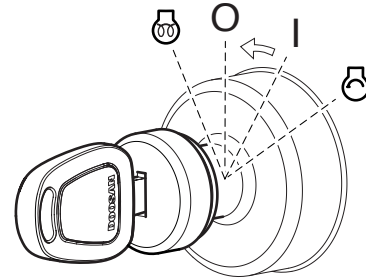
8. Set safety lever on "LOCK" position.



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Figure 5

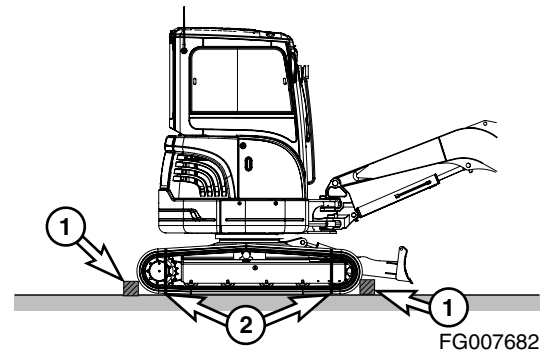
9. Shut down engine by turning key to "O" (OFF) position (Figure 6).
10. Remove key from starter switch.



FG001364

Figure 6

11. Make sure to secure the excavator onto the trailer before transporting. Place blocking (1, Figure 7) in front of and behind each track. Use chains or cable tie-downs (2) as required by local transportation laws.
12. Refer to the Dimensions for Transportation table and drawing for overall machine height and width measurements. Make sure to position the excavator as shown. If not transported in this position, the height measurements may be different.



FG007682

Figure 7

LIFTING WITH SLING

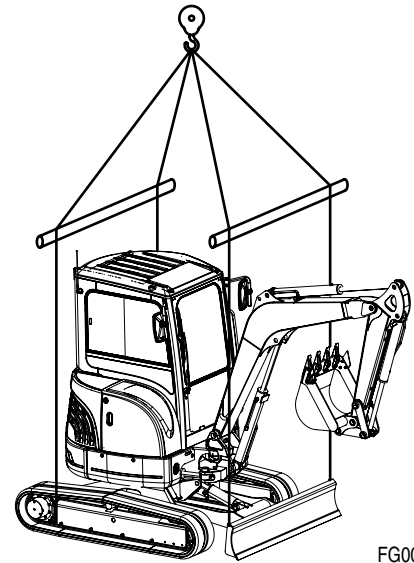


WARNING!

Improper lifting can allow load to shift and cause injury or damage.

1. Refer to "Specification" on page 7-1 of this manual for information on weight and dimensions.
2. Use properly rated cables and slings for lifting.
3. Position machine for a level lift.
4. Lifting cables should have a long enough length to prevent contact with the machine. Spreader bars may be required.

NOTE: *If spreader bars are used, be sure that cables are properly secured to them and that the angle of the cables is factored into the lift strength.*



FG008073

Figure 8

Troubleshooting

Anytime that a malfunction occurs, take immediate corrective action. Check for and investigate the cause of the malfunction. A schedule maintenance program can prevent malfunctions from occurring by doing preventative maintenance. A systematic approach should be taken to troubleshooting, since several overlapping malfunctions may give the appearance of a problem that does not exist. If cause for the malfunction cannot be determined, contact your *DOOSAN* distributor. Never perform an adjustment of or disassembly of, hydraulic components, electrical and electronic components, without first consulting a *DOOSAN* distributor.

CONTROL VALVE

Problem	Possible Cause	Remedy
Fails to bear load.	Leaky spool.	Replace valve housing assembly relief valve.
	Leaky port relief valve.	Disassemble, clean or replace port.
Load drops when control is moved from neutral to UP.	Foreign material in load check valve.	Disassemble and clean load check valve.
	Damaged poppet or seal in load check valve.	Replace poppet or lap poppet and seal.
Spool sticking.	Hydraulic oil excessively hot due to blockage.	Remove blockage.
	Hydraulic oil fouled.	Change oil and clean oil passages.
	Valve housing deformed due to overtightened fittings on hydraulic oil line.	Replace valve housing.
Spool does not move.	Foreign material in valve.	Clean valve.
	Spool cap fouled with oil.	Replace cap shaft seal.
	Leaky spool.	Replace valve housing assembly.

Problem	Possible Cause	Remedy
Leaky oil seal.	Foreign material in spool.	Clean or replace valve housing assembly.
	Pressure too high.	Check with pressure gauge and adjust.
	Lever or linkage bent.	Remove and check linkage.
	Return spring damaged.	Replace.
	Valve temperature uneven.	Warm up entire system.
	Foreign material in seal.	Clean seal.
	High back pressure in valve return line.	Increase size of return line.
	Foreign material in seal.	Clean seal.
	Damaged spool.	Replace valve housing assembly.
	Seal cracked or damaged.	Replace.

RELIEF VALVE

Problem	Possible Cause	Remedy
Pressure does not rise.	Poppet sticking open.	Disassemble and clean.
Pressure unstable.	Damaged pilot poppet seal.	Replace damaged parts.
	Main poppet of pilot piston sticking.	Disassemble, clean and remove surface pitting.
Abrupt rise and fall in pressure.	Wear, due to foreign material.	Replace worn parts.
	Locknut and adjusting spring loose.	Adjust pressure.
Oil leaks.	Seals leaking, O-ring worn.	Replace worn or damaged parts.
	Parts sticking, due to foreign material.	Disassemble, check for damage and clean.

CENTER JOINT

Problem	Possible Cause	Remedy
Lack of power	Bad center joint seal.	Replace.
	Damaged center joint rotor.	Replace.
	Bad seal.	Replace seal.

CONTROL LEVER

Problem	Possible Cause	Remedy
Lever feels "heavy" when operated.	Foreign material in control valve spool.	Clean control valve.
	Valve spool sticking.	Replace valve housing assembly.
	Lack of linkage lubrication.	Lubricate.

ATTACHMENTS

Problem	Possible Cause	Remedy
Lack of power.	Lack of engine power.	
	Poor performance due to worn hydraulic pump.	Replace hydraulic pump.
	Bad main relief valve.	Adjust pressure or replace.
	Low level of hydraulic oil.	Add oil.
	Wrong viscosity hydraulic oil.	Replace with correct viscosity.
	Suction filter restricted.	Replace filter.
Poor overall performance.	Hydraulic pump failure.	Replace hydraulic pump.
	Hydraulic oil level low.	Add oil.
Lack of power.	Main or port relief valve pressure set too low.	Adjust pressure.
	Damaged hydraulic cylinder seal.	Replace seal.
	Hydraulic cylinder piston or rod damaged.	Replace piston or rod.
Unusual sound from attachment connections.	Lack of grease.	Add grease.
	Coupling pin worn.	Replace bushing or pin.

HYDRAULIC MOTOR

Problem	Possible Cause	Remedy
Hydraulic motor does not rotate.	Hydraulic oil low.	Add oil.
	Hydraulic pump bad.	Replace pump.
	Oil leak from inside hydraulic motor.	Replace motor.
	Overload applied to output shaft.	Locate and remove cause of overload.
	Low viscosity hydraulic oil.	Change to oil with correct viscosity.
Hydraulic motor will not allow turning to one side.	Bad control valve relief valve.	Clean or replace relief valve.
	Counterbalance valve spool sticking.	Replace counterbalance valve.
RPM low.	Main or port relief valve pressure set too low.	Add oil.
	Oil leak due to excessive high temperature.	Reduce oil temperature.
	Air in system.	Bleed.
	Oil leak from inside motor.	Replace motor.
Unusual sound from hydraulic motor.	Hydraulic oil level low.	Add oil.
	Air in motor.	Retighten fittings on suction side.
	Wear and damage inside hydraulic motor.	Replace motor.
	Shaft not properly installed.	Readjust shaft.

HYDRAULIC CYLINDER

Problem	Possible Cause	Remedy
Lack of cylinder power.	Relief valve pressure set too low.	Adjust pressure.
	Oil leak from inside cylinder.	Replace cylinder seals.
	Cylinder piston or rod damaged.	Replace piston or rod.
	Oil leak from inside control valve.	Replace valve housing assembly.
Oil leak from outside cylinder.	Bad hydraulic cylinder seals.	Replace seals.
	Damaged cylinder rod.	Replace rod.
Unsmooth piston movement.	Hydraulic oil temperature high.	Lower temperature.
	Air in system.	Retighten fittings on oil fill and suction sides.

HYDRAULIC PUMP

Problem	Possible Cause	Remedy
Poor oil delivery.	Hydraulic oil level low.	Add oil.
	Suction filter restricted.	Clean or replace filter.
Pressure does not rise.	Oil leak from inside pump.	Replace pump.
	Air in pump.	Add oil or check suction side hose.
	Main relief valve pressure set too low.	Adjust pressure.
Unusual sound from hydraulic pump.	Cavitation from bent suction side hose or clogged suction filter.	Replace hose and filter.
	Cavitation from suction side fittings and air in system due to low oil level.	Tighten fittings and add oil.
	Cavitation due to high viscosity oil.	Replace oil.
	Pump and engine not aligned.	Readjust shaft.
	Air in hydraulic oil.	Bleed.
Oil leak from outside pump.	Bad hydraulic pump seal.	Replace seal or pump.

SWING SYSTEM

Problem	Possible Cause	Remedy
Swing power weak.	Hydraulic motor performs poorly.	Replace hydraulic motor.
	Swing bearing seized.	Grease or replace swivel bearing.
Braking power weak.	Brake valve pressure set low.	Adjust pressure.
	Foreign material in port relief or brake valves.	Clean valves.
Swing motion drags while stopping.	Port relief or brake valve pressure set low.	Adjust pressure.
	Foreign material in port relief or brake valves.	Clean valves.
Unusual sound.	Air in system.	Add oil.
	Swing bearing needs grease.	Grease.

TRAVEL

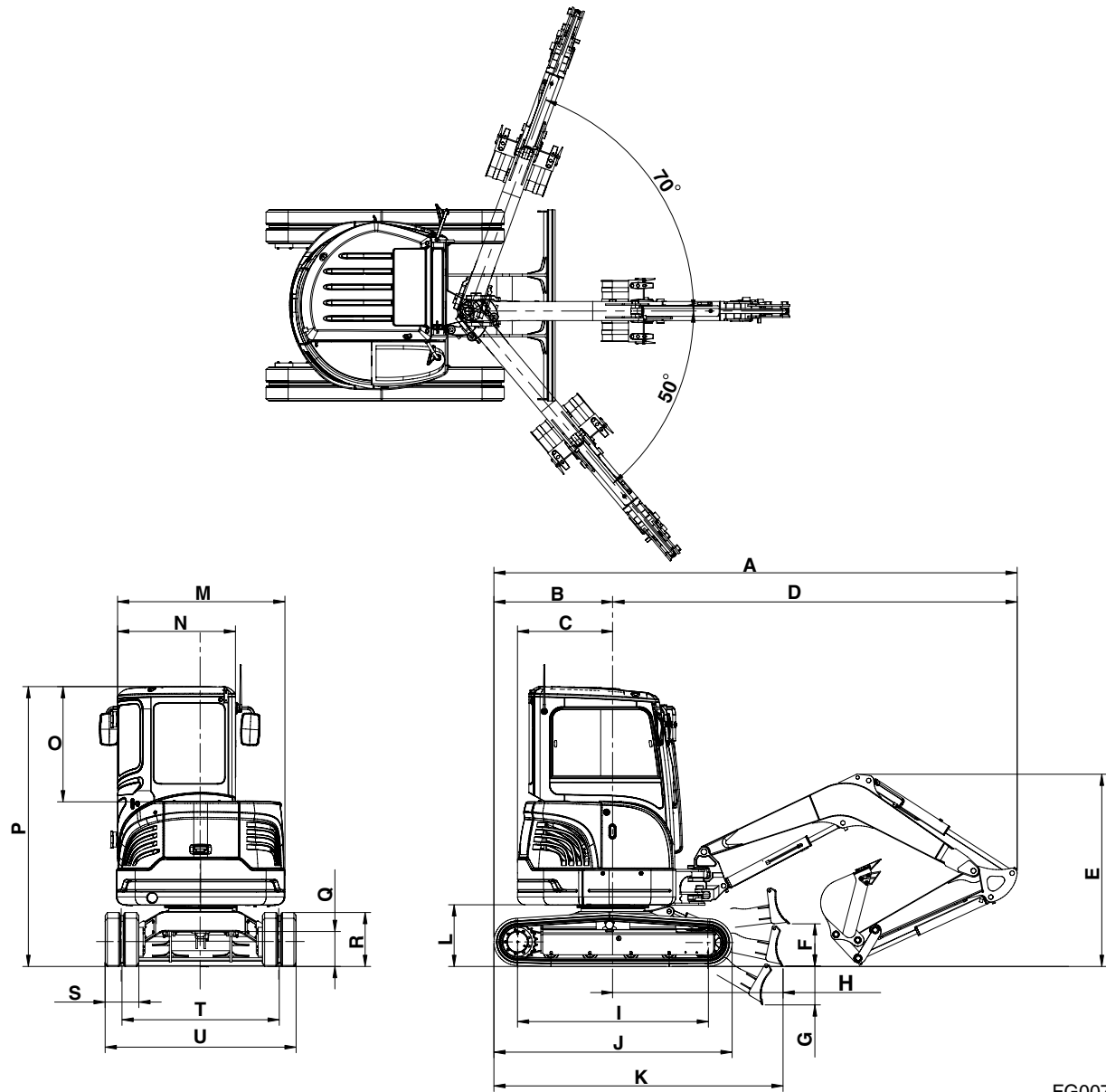
Problem	Possible Cause	Remedy
Lack of power when traveling.	Main relief valve pressure set too low.	Adjust pressure.
	Counterbalance valve bad.	Replace counterbalance valve.
	Hydraulic motor performs poorly.	Replace hydraulic motor.
	Damaged center joint seal.	Replace seal.
	Hydraulic pump bad.	Replace hydraulic pump.
	Oil leak from inside control valve.	Replace valve housing assembly.
Travel not smooth.	Tracks tension low.	Adjust tension.
	Stone(s) jammed in track.	Remove.
	Counterbalance valve bad.	Replace valve.
	Hydraulic motor performs poorly.	Replace hydraulic motor.
	Air in hydraulic motor.	Add oil.
Machine wanders, does not travel straight.	Tracks have different tension.	Adjust so tracks have equal tension.
	Hydraulic pump performs poorly.	Replace hydraulic pump.
	Hydraulic motor performs poorly.	Replace hydraulic motor.
	Oil leak from inside control valve.	Replace valve housing assembly.
	Damaged center joint seal.	Replace seal.
	Lever linkage loose.	Readjust linkage.

Specification

STANDARD SPECIFICATION

COMPONENT			SPECIFICATION			
			STANDARD (1.20m ARM)	1.20m ARM+Q/C	1.33m ARM	1.33m ARM+Q/C
Bucket capacity	SAE (CECE)		0.11 m ³ (0.094 m ³)			
Operating weight			3.7 tons			
Engine	Model		3TNV88-SDB			
	Displacement (Total dis. Volume)		1,642 cc			
	Rated power		27.7 hp @ 2,200 rpm			
			20.3 kW @2,200 rpm			
Front Attachment	Boom length		2,500 mm			
	Arm length (Standard)		1,250 mm			
	Arm length (Option)		1,330 mm			
Transport Dimension	Length		4,644 mm			
	Height		2,515 mm			
	Height (Boom)		1,720 mm			
	Width		1,700 mm			
Performance	Max.digging force	Bucket	3,010 kgf	2,380 kgf	3,010 kgf	2,380 kgf
		Arm	2,140 kgf	1,960 kgf	1,960 kgf	1,790 kgf
	Traveling speed	1-speed	2.6 km/h			
		2-speed	4.6 km/h			
	Swing speed		9.53 rpm			
	Drawbar pull		3,110 kg			
Hydraulic pump	Type		Variable displacement axial piston pump			
	Max. flow rate		28.5 x 2 liters/min + 10.7 liters/min (Gear pump: 5.1 liters/min)			
	Main relief set pressure		230 kg/cm ²			
Track	Shoe width		300 mm			
	Tumbler distance		1,700 mm			
Control	Lever control type		Hydraulic pilot			
	Lever pattern		SAE			
Tank	Fuel tank		42 liters			
	Hydraulic tank		40 liters			
Ground pressure			0.32 kg/cm ²			

OVERALL DIMENSIONS

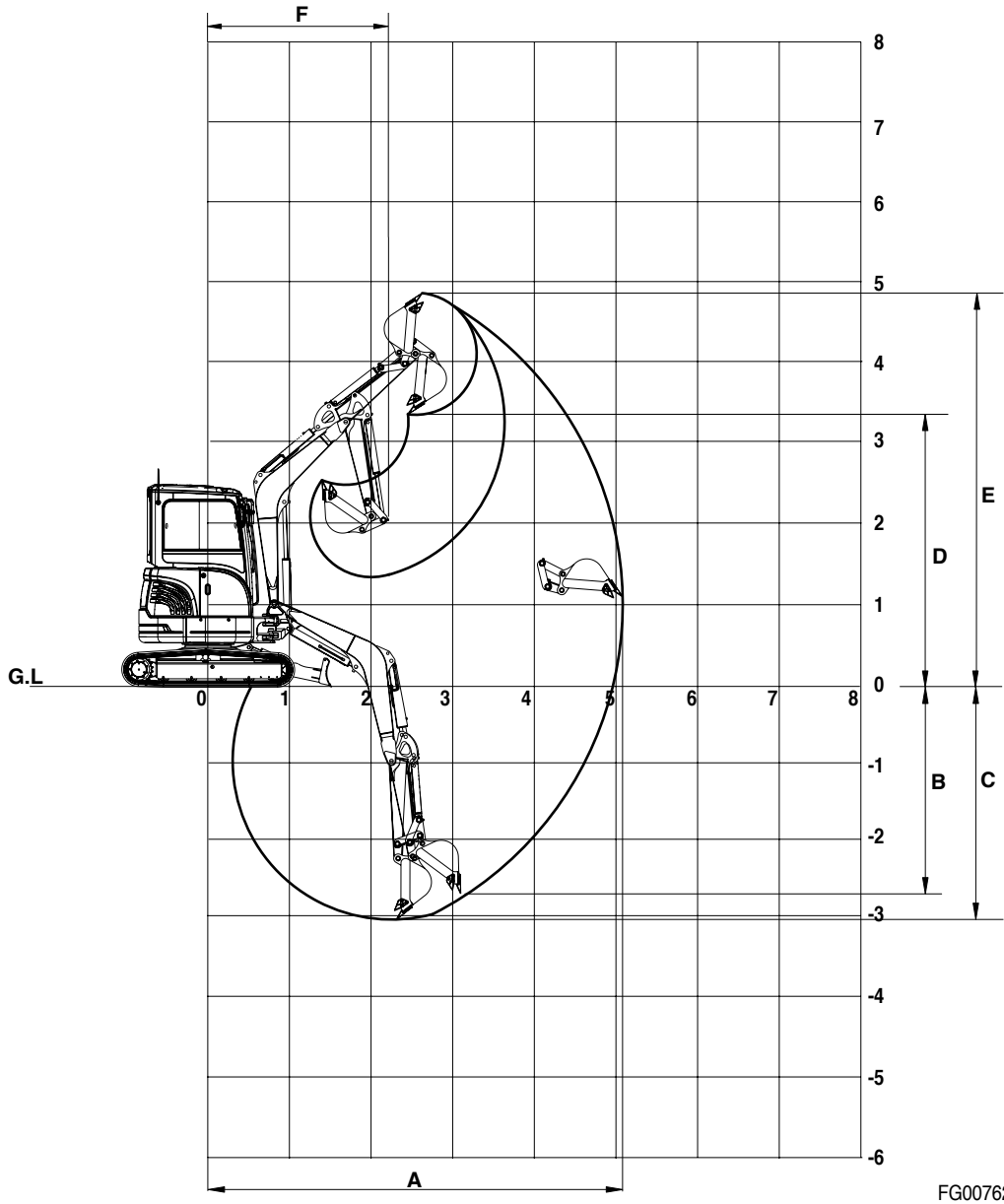


FG007625

Figure 1

DIMENSION	2.405 M (7.89 FT) BOOM
A	4,644 mm (15' 3")
B	1,060 mm (3' 6")
C	850 mm (2' 9")
D	3,584 mm (11' 9")
E	1,720 mm (5' 8")
F	365 mm (1' 2")
G	407 mm (1' 4")
H	1,520 mm (4' 12")
I	1,700 mm (5' 7")
J	2,123 mm (6' 12")
K	2,580 mm (8' 6")
L	576 mm (1' 11")
M	1,500 mm (4' 11")
N	1,030 mm (3' 5")
O	1,015 mm ((3' 4")
P	2,515 mm (8' 3")
Q	310 mm (1' 0")
R	475 mm (1' 7")
S	300 mm (11.8 in)
T	1,400 mm (4' 7")
U	1,700 mm (5' 7")

WORKING RANGE



FG007629

Figure 2

DIM.		2.405 m (7.89 ft) BOOM	
		1.2 m (3.9 ft) ARM	1.33 m (4.4 ft) ARM
A	Max. digging radius	5,092 mm (16' 7")	5,201 mm (17' 1")
B	Max. vertical digging depth	2,558 mm (8' 4")	2,627 mm (8' 6")
C	Max. digging depth	3,023 mm (9' 9")	3,153 mm (10' 3")
D	Max. dump height	3,391 mm (11' 1")	3,441 mm (11' 3")
E	Max. digging height	4,887 mm (16' 0")	4,933 mm (16' 2")
F	Min. digging radius	2,184 mm (7' 2")	2,040 mm (6' 7")

APPROXIMATE WEIGHT OF WORKLOAD MATERIALS

IMPORTANT

Weights are approximations of estimated average volume and mass. Exposure to rain, snow or ground water; settling or compaction due to overhead weight and chemical or industrial processing or changes due to thermal or chemical transformations could all increase value of weights listed in table.

MATERIAL	LOW WEIGHT OR DENSITY 1,100 KG/M ³ (1,850 LB/YD ³), OR LESS	MEDIUM WEIGHT OR DENSITY 1,600 KG/M ³ (2,700 LB/YD ³), OR LESS	HIGH WEIGHT OR DENSITY 2,000 KG/M ³ (3,370 LB/YD ³), OR LESS
Charcoal	401 kg/m ³ (695 lb/yd ³)	-----	-----
Coke, blast furnace size	433 kg/m ³ (729 lb/yd ³)	-----	-----
Coke, foundry size	449 kg/m ³ (756 lb/yd ³)	-----	-----
Coal, bituminous slack, piled	801 kg/m ³ (1,350 lb/yd ³)	-----	-----
Coal, bituminous r. of m., piled	881 kg/m ³ (1,485 lb/yd ³)	-----	-----
Coal, anthracite	897 kg/m ³ (1,512 lb/yd ³)	-----	-----
Clay, DRY, in broken lumps	1,009 kg/m ³ (1,701 lb/yd ³)	-----	-----
Clay, DAMP, natural bed	-----	1,746 kg/m ³ (2,943 lb/yd ³)	-----
Cement, Portland, DRY granular	-----	1,506 kg/m ³ (2,583 lb/yd ³)	-----
Cement, Portland, DRY clinkers	-----	1,362 kg/m ³ (2,295 lb/yd ³)	-----
Dolomite, crushed	-----	1,522 kg/m ³ (2,565 lb/yd ³)	-----
Earth, loamy, DRY, loose	-----	1,202 kg/m ³ (2,025 lb/yd ³)	-----
Earth, DRY, packed	-----	1,522 kg/m ³ (2,565 lb/yd ³)	-----
Earth, WET, muddy	-----	-----	1,762 kg/m ³ (2,970 lb/yd ³)

MATERIAL	LOW WEIGHT OR DENSITY 1,100 KG/M³ (1,850 LB/YD³), OR LESS	MEDIUM WEIGHT OR DENSITY 1,600 KG/M³ (2,700 LB/YD³), OR LESS	HIGH WEIGHT OR DENSITY 2,000 KG/M³ (3,370 LB/YD³), OR LESS
Gypsum, calcined, (heated, powder)	961 kg/m ³ (1,620 lb/yd ³)	-----	-----
Gypsum, crushed to 3 inch size	-----	1,522 kg/m ³ (2,565 lb/yd ³)	-----
Gravel, DRY, packed fragments	-----	-----	1,810 kg/m ³ (3,051 lb/yd ³)
Gravel, WET, packed fragments	-----	-----	1,922 kg/m ³ (3,240 lb/yd ³)
Limestone, graded above 2	-----	1,282 kg/m ³ (2,160 lb/yd ³)	-----
Limestone, graded 1-1/2 or 2	-----	1,362 kg/m ³ (2,295 lb/yd ³)	-----
Limestone, crushed	-----	1,522 kg/m ³ (2,565 lb/yd ³)	-----
Limestone, fine	-----	-----	1,602 kg/m ³ (2,705 lb/yd ³)
Phosphate, rock	-----	1,282 kg/m ³ (2,160 lb/yd ³)	-----
Salt	929 kg/m ³ (1,566 lb/yd ³)	-----	-----
Snow, light density	529 kg/m ³ (891 lb/yd ³)	-----	-----
Sand, DRY, loose	-----	1,522 kg/m ³ (2,565 lb/yd ³)	-----
Sand, WET, packed	-----	-----	1,922 kg/m ³ (3,240 lb/yd ³)
Shale, broken	-----	1,362 kg/m ³ (2,295 lb/yd ³)	-----
Sulfur, broken	529 kg/m ³ (1,620 lb/yd ³)	-----	-----

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