DX220A
DX225LCA

Operation and Maintenance Manual

K1049155AE

Serial Number 11707 and Up

August 2012

DOOSAN reserves the right to improve our products in a continuing process to provide the best possible product to the market place. These improvements can be implemented at any time with no obligation to change materials on previously sold products. It is recommended that consumers periodically contact their distributors for recent documentation on purchased equipment.

This documentation may include attachments and optional equipment that is 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.

Table of Contents

Safety

TO THE OPERATOR OF A DOOSAN 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:

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 Signal Words Used with 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 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 a 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 explode or detonate if handled or treated carelessly.

Other Signal Words

In addition to safety signal words, the following signal words are used to indicate proper and effective use of machine.

IMPORTANT

This signal word identifies procedures which must be followed to avoid damage to machine.

NOTE: *The word "NOTE" identifies information for effective use.*

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 some procedures, contact a DOOSAN distributor.

LOCATION OF SAFETY LABELS

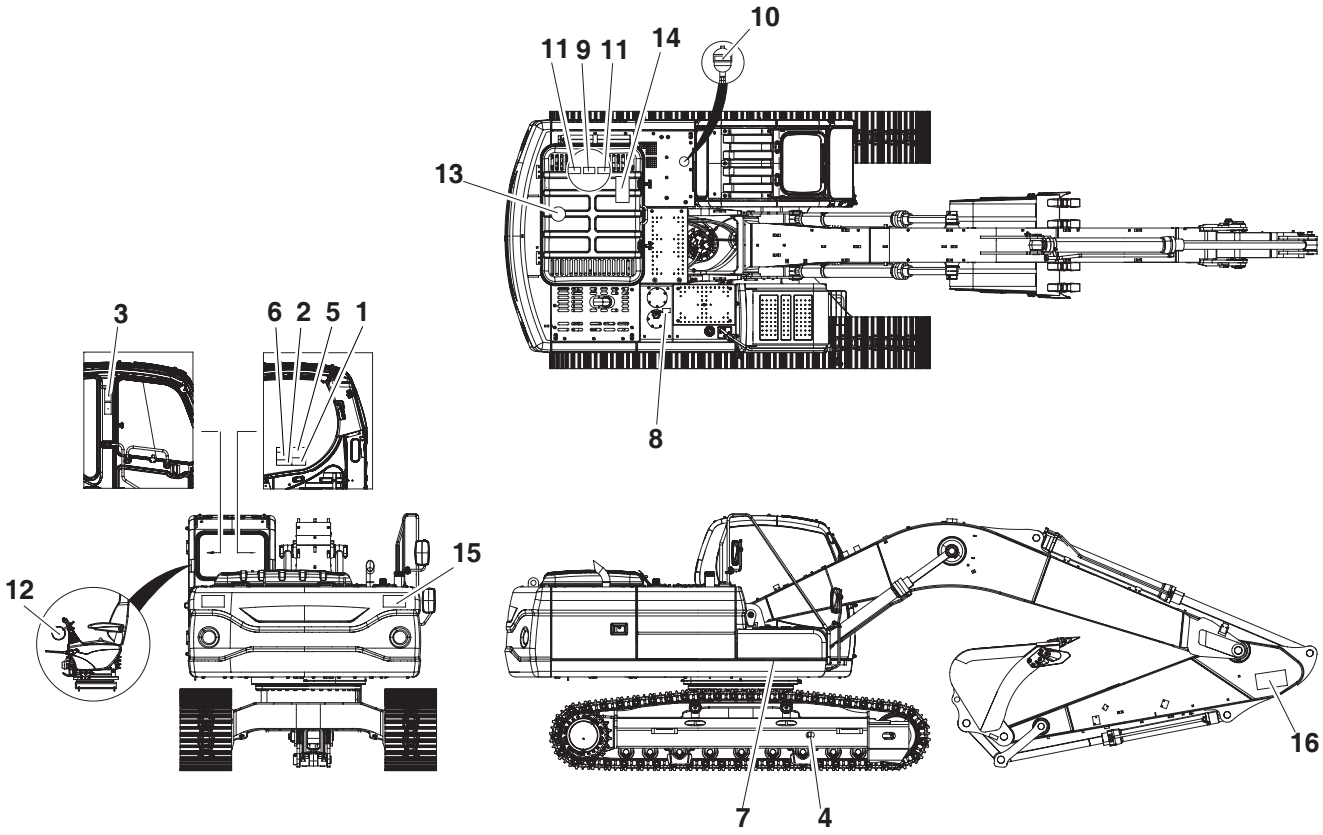

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Figure 1

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.

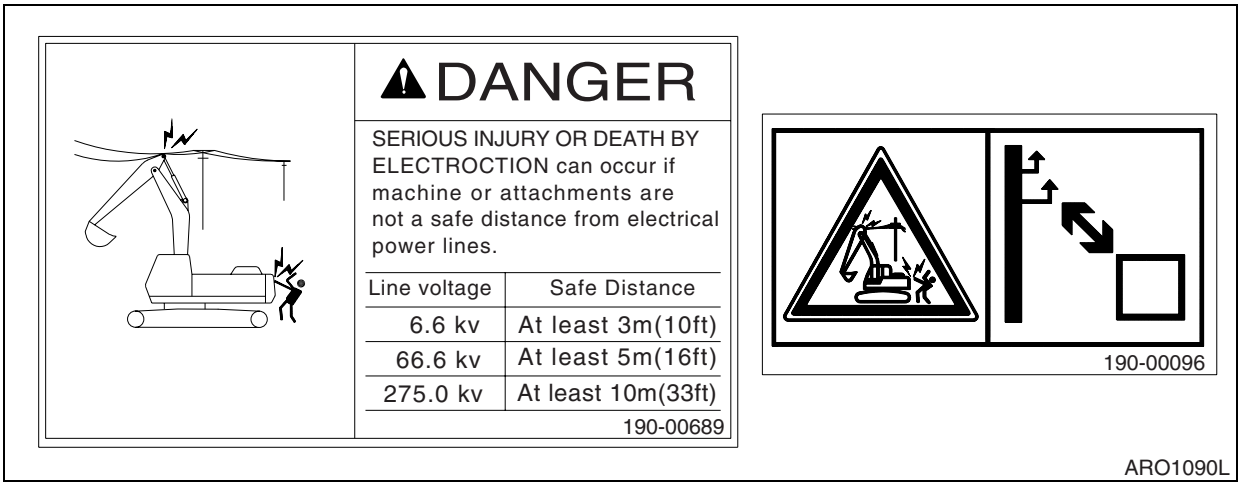
Please become familiarized with all warning signs.

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.

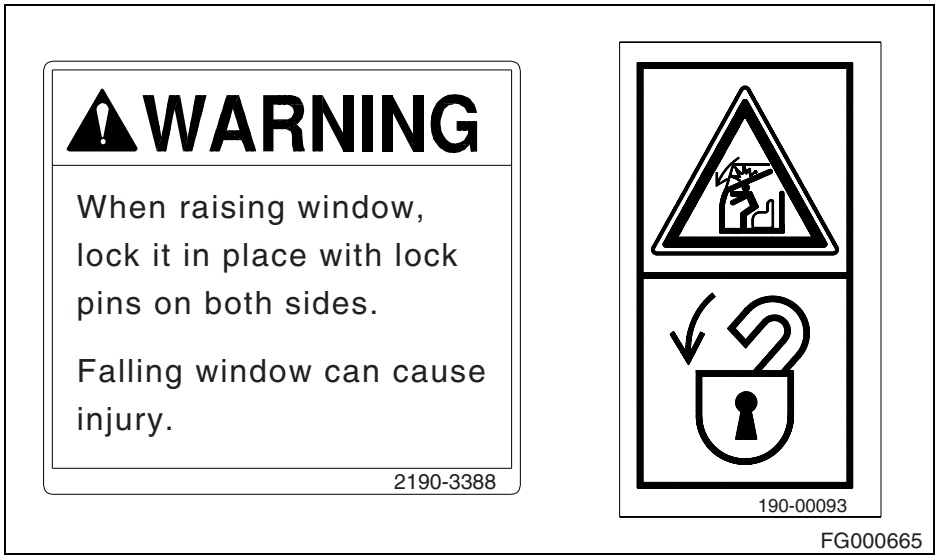
Replace any safety sign that is damaged, or missing. If a safety sign is attached to a part that is replaced, install a safety sign on the replacement part.

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

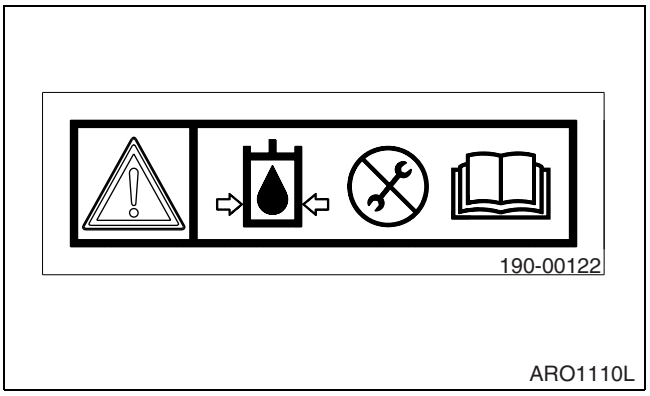
2. Warnings for High Voltage (190-00689, 190-00096)



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



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



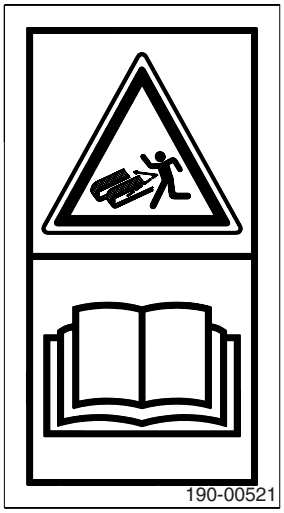
5. Warnings When Adjusting Track Tension (2190-3386A, 190-00521)

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



190-00521

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

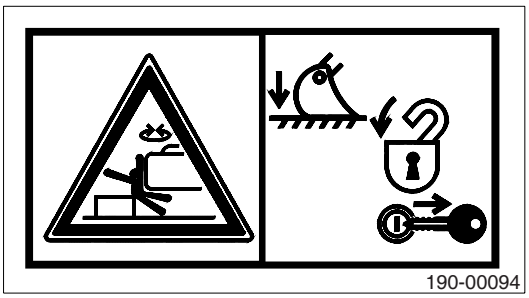
WARNING

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



190-00094

FG014281

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

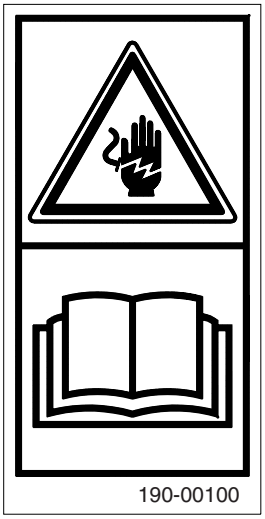
⚠ DANGER

- 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.
- Surfuric 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



190-00100

ARO1150L

8. Warnings for High Temperature Hydraulic Oil (190-00691A, 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
- Lift cap to relieve pressure

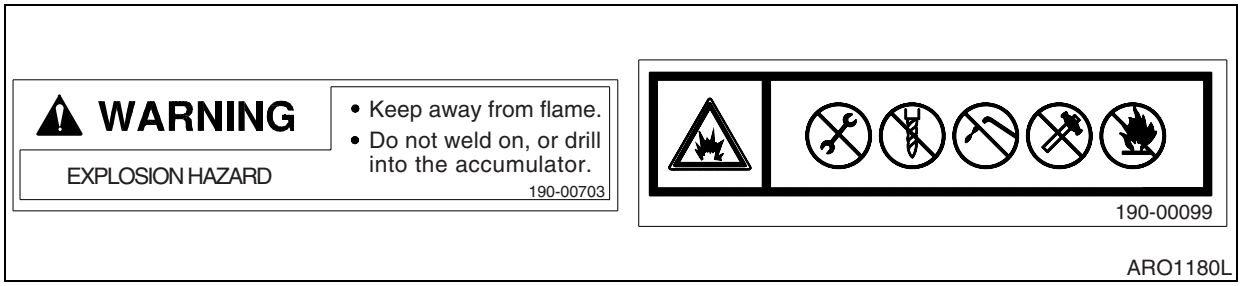
190-00691A

190-00097

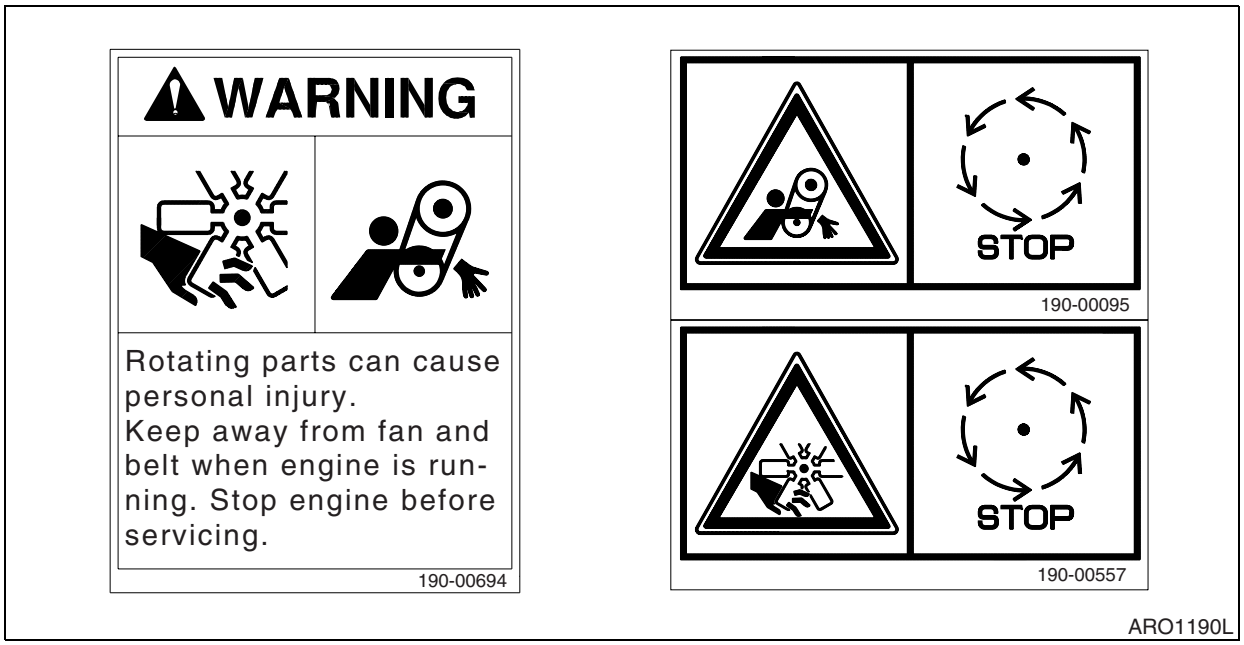
FG012873

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

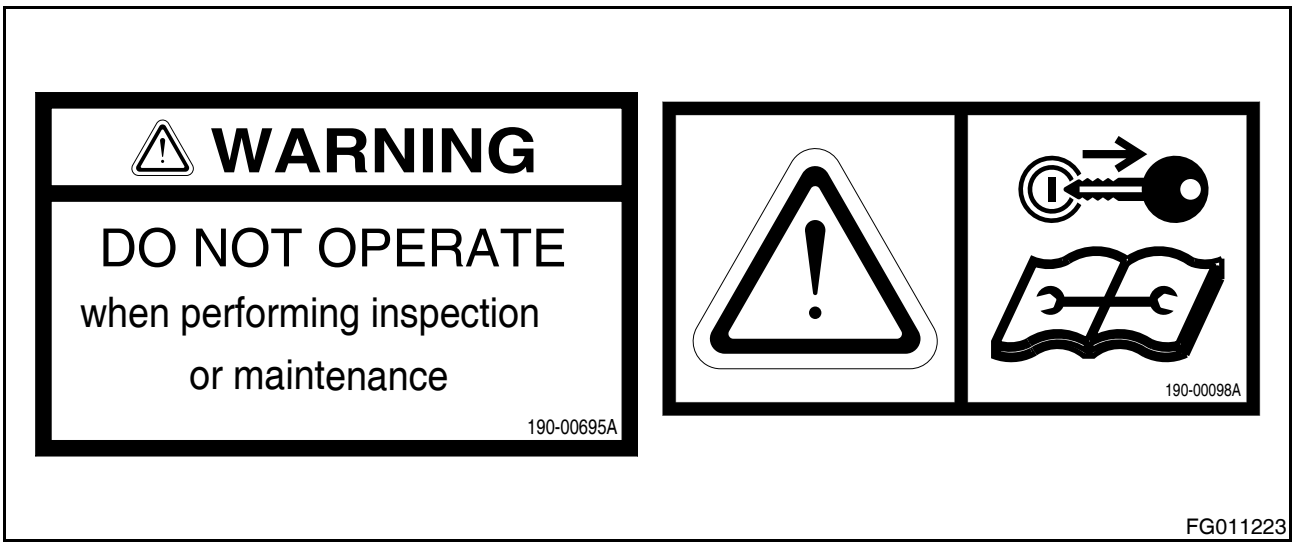
10. Warnings for Handling an Accumulator (190-00703, 190-00099)



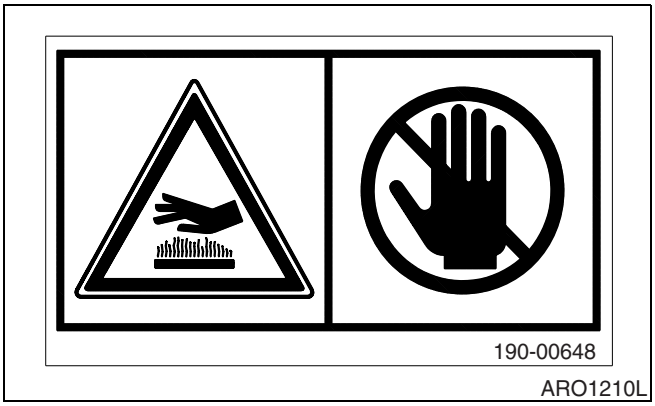
11. Warnings for Rotating Parts (190-00694, 190-00095, 190-00557)



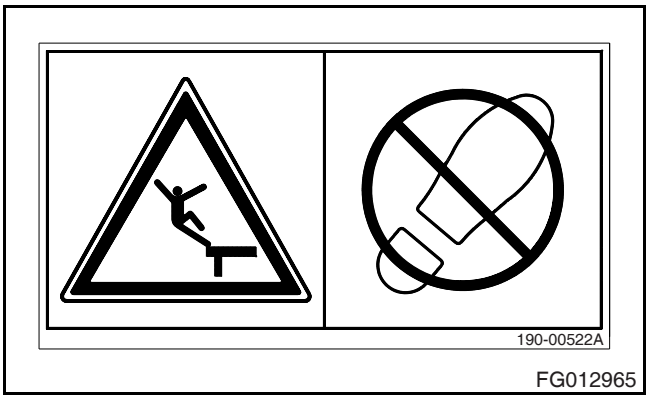
12. Warning Tag - Used When Inspection and Maintenance (190-00695A, 190-00098A)



13. Warning for a Hot Surface (190-00648A)



14. Caution for Hood (190-00522A)



15. Keep Out of the Swing Area (2190-3379A, K1008571)

16. Warnings for Front Attachments (190-00652)

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 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 must 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 in which the safety of critical assemblies is 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 a 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 a danger that lighter may explode.

Do not use cellular telephones inside the operator's cabin when driving or operating the machine. There is a 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 a 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, completely lower the work equipment 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 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 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.

HAOA020L

Figure 2

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 73 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 103 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 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 distances (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.

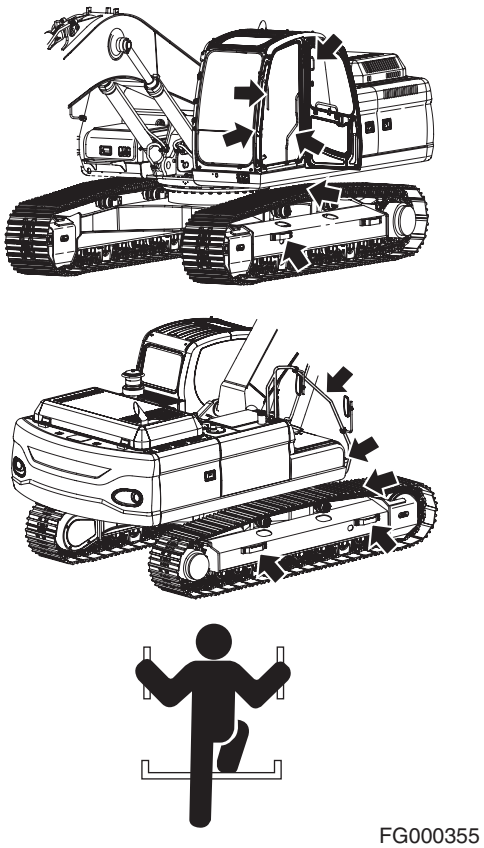
Never jump on or off the machine. In particular, never get on or off a moving machine. These actions may lead to serious injury.

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.



FG000355

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 doused, 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 cap, drain the oil or coolant, or replacing 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.

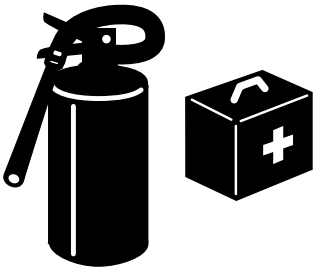
HDO1010L

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:

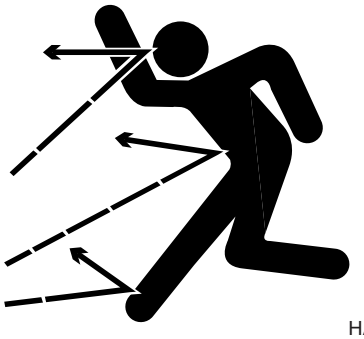
- Turn the starter switch to the "O" (OFF) position and shut down engine.
- If there is time, use the fire extinguisher to put out as much of the fire as possible.
- Use the handrails and steps to escape from the machine.

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 a danger that falling 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 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.

HAOA100L

Figure 11

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 a 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.

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 options 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 4-76.

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

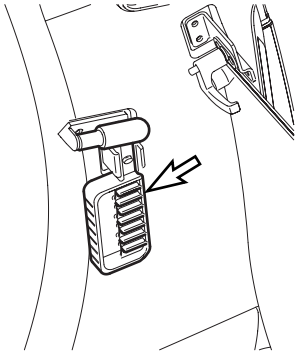
Figure 12

Emergency Exit

The excavator is equipped with a glass breaking tool. It is behind the operator seat in the upper right corner of the cabin. This tool can be used in case of an emergency that requires breaking 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.



FG000178

Figure 13

BEFORE STARTING ENGINE

Work Site Precautions

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

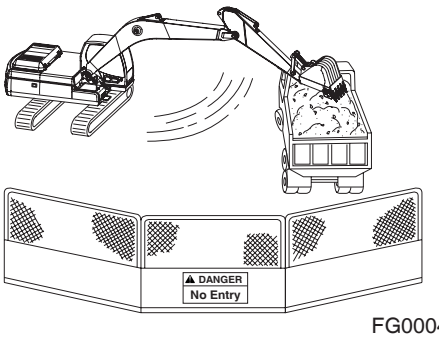
Check the terrain and condition of the ground at the work site, and determine the best and safest method of operation.

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.

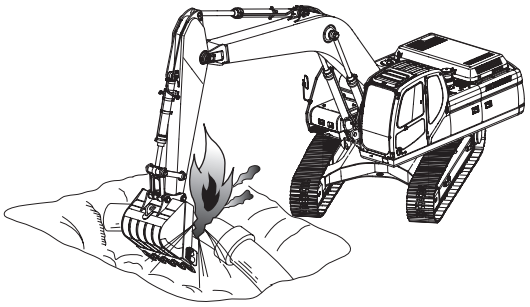


FG000400

Figure 14

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.

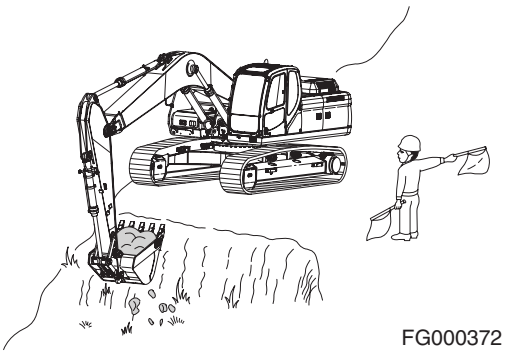
Any object in vicinity of boom could represent a potential hazard, or cause the operator to react suddenly and cause an accident. Use a spotter or signal person when working near bridges, phone lines, work site scaffolds, or other obstructions.



FG000363

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.



FG000372

Figure 16

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

Avoid operating your machine to 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 a danger of falling rocks.

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 a 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, fuel, and hydraulic tank oil levels, 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 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.

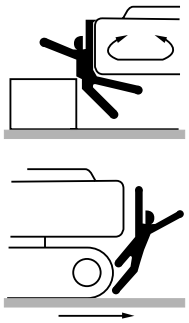
- Check the operating condition of the equipment, and the movement of the bucket, arm, boom, travel, and swing systems.
- Check the machine for any abnormal noise, vibration, heat, smell, or abnormality with the gauges. Check also for leakage of air, oil, and fuel.
- If any abnormality is found, repair 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 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.

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 travel direction from forward to reverse or from reverse to forward, reduce speed early and stop the machine before changing travel direction.
- 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.



HAOA190L

Figure 17

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) aboveground.

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 centerline of the upper track rollers.

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

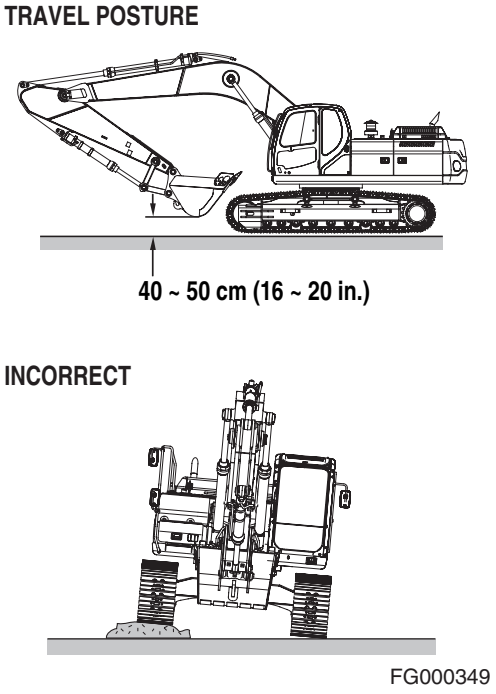


Figure 18

Traveling on Slopes

Never jump onto a machine that is running away to stop it. There is a 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 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 machine is always traveling directly up or down the slope.

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

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

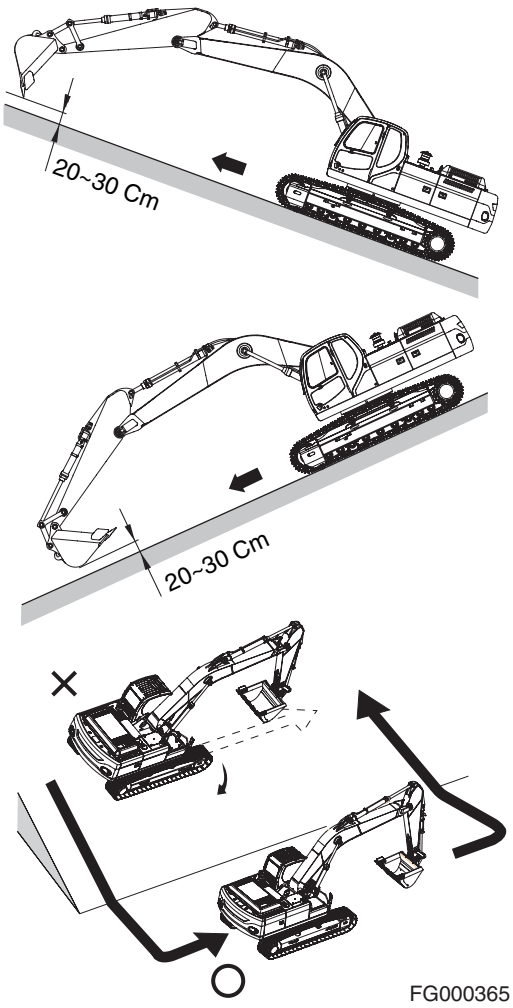


Figure 19

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.

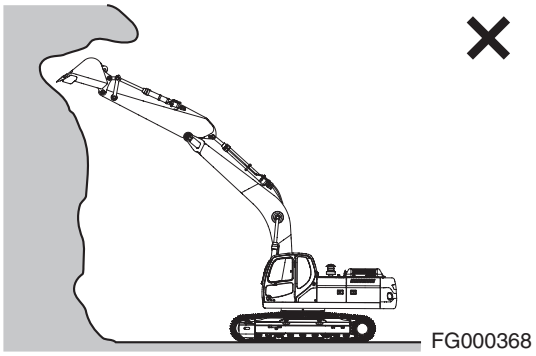


Figure 20

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 relay on lift jacks or other inadequate supports when work is being done. Block tracks fore and aft to prevent any movement.

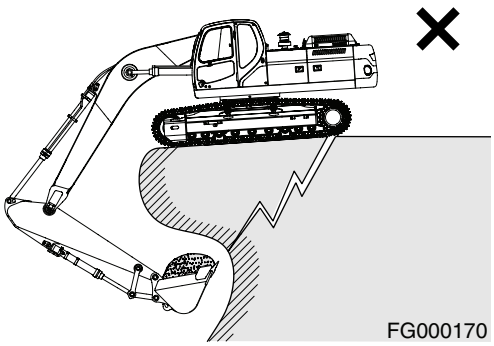


Figure 21

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.

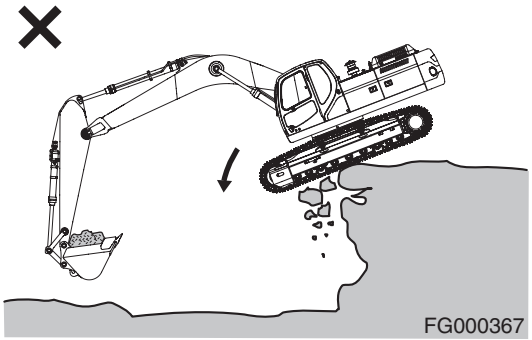


Figure 22

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 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 faraway 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 operation near power lines (either aboveground or buried cable type), you should always contact the power utility company directly and work out a safety plan with them.*

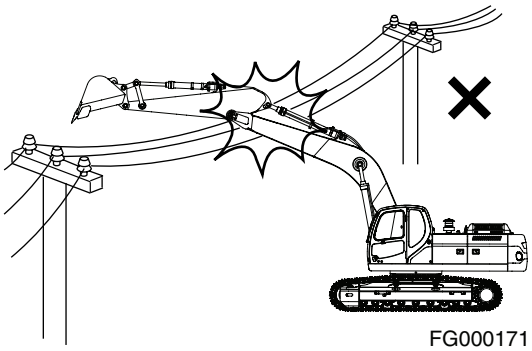


Figure 24

Protecting Cabin from Falling Object (Optional)

In a work site where falling objects or flying objects are expected, be sure to install adequate protective devices for covering the cabin.

When using a breaker, be sure to install the front window protection guard (1, Figure 25).

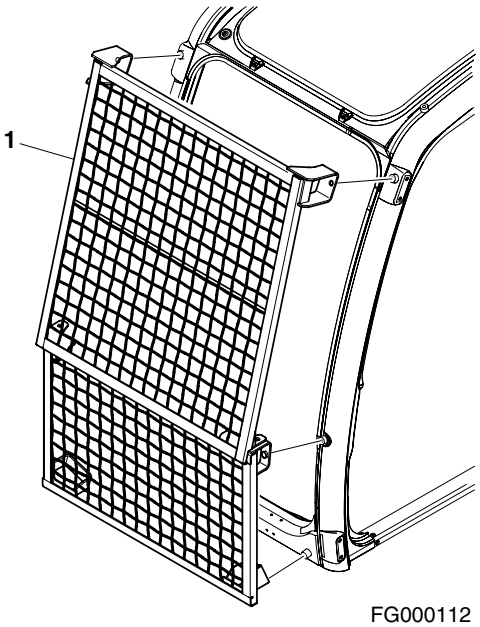


Figure 25

In a work site where falling rocks can cause damage and possibly crush personnel, or in a mining operation, be sure to install the falling object protective structure (2, Figure 26).

Be sure to install any other additional protective structures required for work site conditions.

When the falling object protective structure is installed, and the front window needs to be cleaned, loosen the bolts marked with an arrow. Be sure to tighten bolts when done.

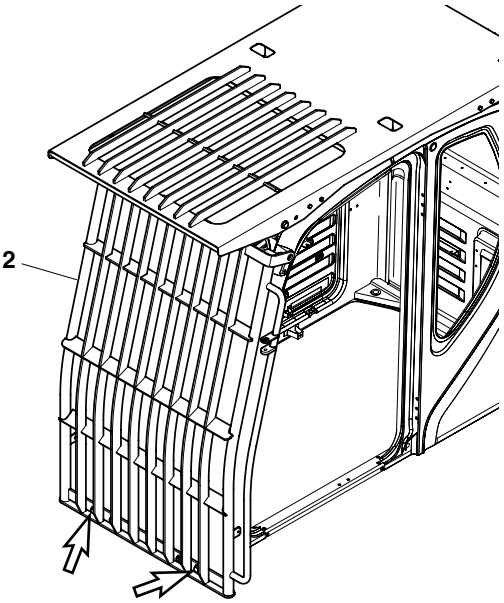


Figure 26

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, so the 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.

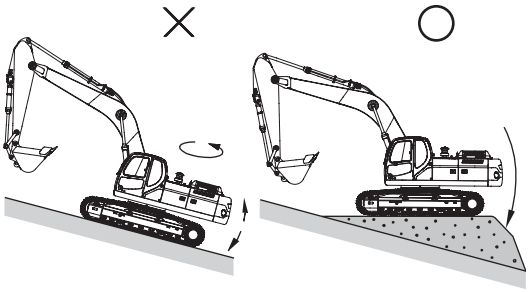
Operations on Slopes

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.



FG000212

Figure 27

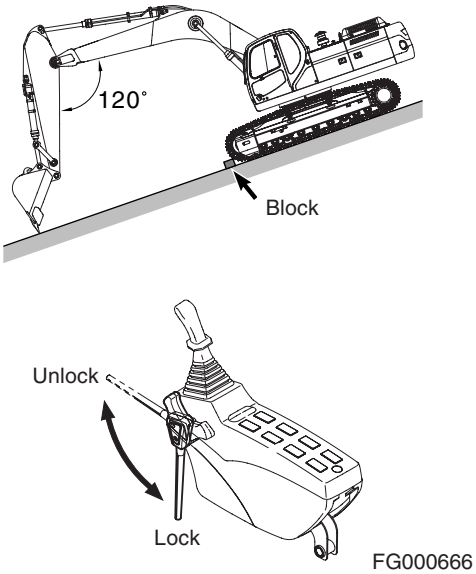
Parking Machine

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 completely to the ground, or to an overnight support saddle. There should be no possibility of unintended or accidental movement.

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 the front attachment has 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.

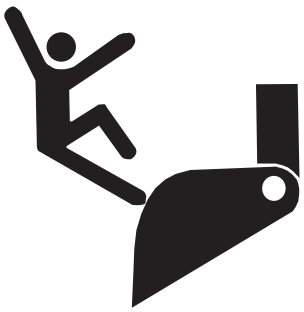


FG000666

Figure 28

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 potential danger of the person falling and suffering serious injury.



ARO1310L

Figure 29

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.

FG012195

Figure 30

Clean Before Inspection or Maintenance

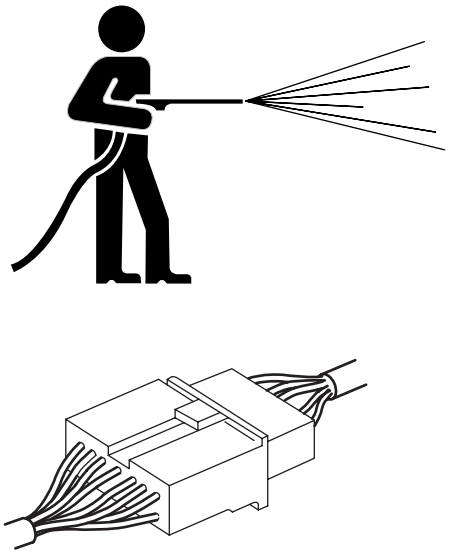
Clean the machine before carrying out inspection and maintenance. This prevents dirt from getting into the machine and ensures safety during maintenance.

If inspection and maintenance are carried out when the machine is dirty, it will become more difficult to locate the problems, and there is a 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 a danger that it will cause defective operation and malfunction.

Pick up any tools or hammers that are laying in the workplace. 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 workplace is left untidy, you may trip or slip and suffer injury.

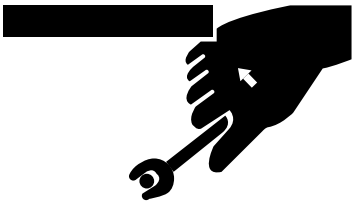


ARO1330L

Figure 31

Proper Tools

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



HDO1037L

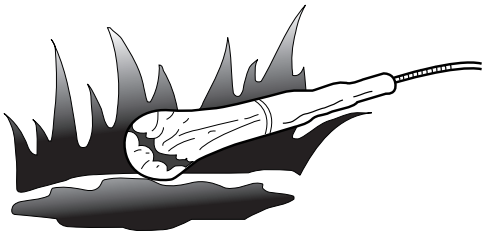
Figure 32

Use of Lighting

When checking fuel, oil, battery electrolyte, or window washing fluid, always use lighting with antiexplosion specifications. If such lighting equipment is not used, there is a danger of an explosion.

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 a danger of fire. There is also danger that battery gas may catch fire and cause an explosion.



HDO1040L

Figure 33

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 that 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 lose 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 34

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

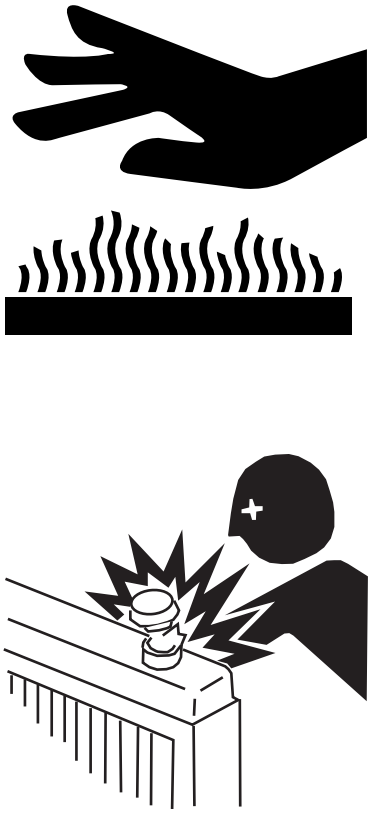
Relieve all pressure in the hydraulic oil system, in the fuel system, or in the cooling system before you disconnect any lines, fittings, or related items.

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 35

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 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 a 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.

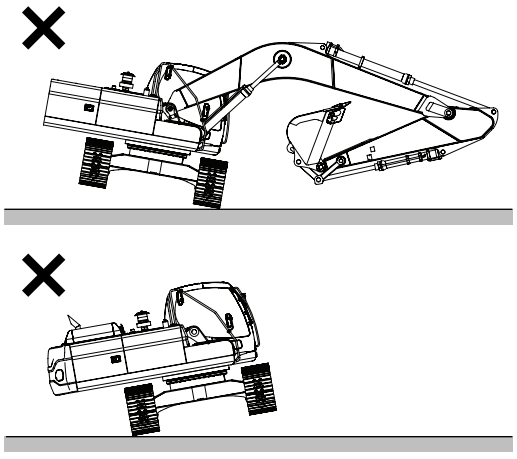
Warning for Counterweight and Front Attachment Removal

DANGER

DOOSAN warns any user, that removal of the counterweight from the machine, front attachment or any other part, may affect the stability of the machine. This could cause unexpected movement, resulting in death or serious injuries. DOOSAN is not liable for any misuse.

Never remove counterweight or front attachment unless the upper structure is in-line with the lower structure.

Never rotate the upper structure once the counterweight or front attachment has been removed.



FG000371

Figure 36

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 37

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 38

Lock Inspection Covers

When carrying out maintenance with the inspection cover open, lock the cover securely in position with the lock bar.

If maintenance work is carried out with the inspection cover open but not locked, there is a danger that it may suddenly close and cause injury if there is a gust of wind.

Prevention of Crushing and Cutting

You should always have at least two people working together if the engine must be run during service. One person needs to remain in the operator's seat, ready to work the controls or stop the machine and shut off the engine.

Unless you are instructed otherwise, never attempt adjustments while the machine is moving or while the engine is running.

Stay clear of all rotating parts and moving parts.

Keep objects away from moving fan blades. The fan blades will throw objects and the fan blades can cut objects.

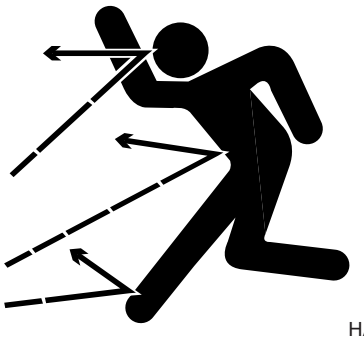
Do not use a wire rope cable that is kinked or fraved. Wear gloves when you handle a wire rope cable.

When you strike a retainer pin, the retainer pin might fly out. The loose retainer pin can injure personnel. Make sure that area is clear of people when you strike a retainer pin. To avoid injury to your eyes, wear protective glasses when you strike a retainer pin.

Track Tension Adjustments Require Caution

Never turn out the track tension grease valve. To release pressure from the crawler frame track tension assembly, you should NEVER attempt to disassemble the track adjuster or attempt to remove 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 39

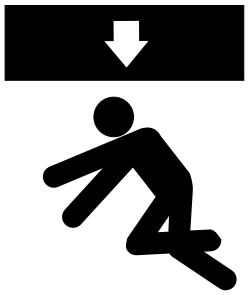
Supports and Blocking for Work Equipment

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 40

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 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 4-54, for additional European regulations.*

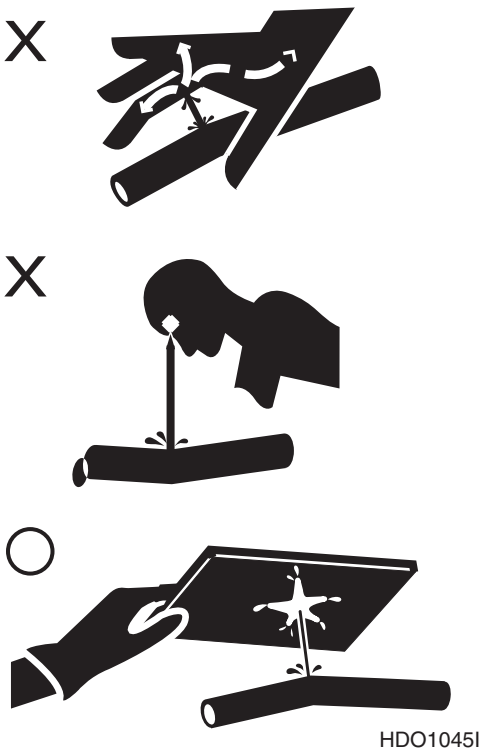


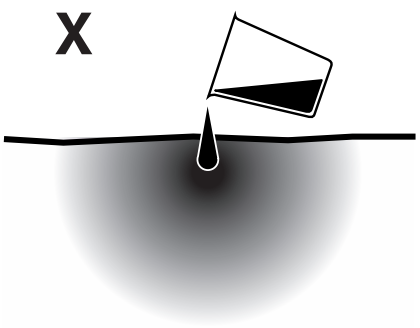
Figure 41

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

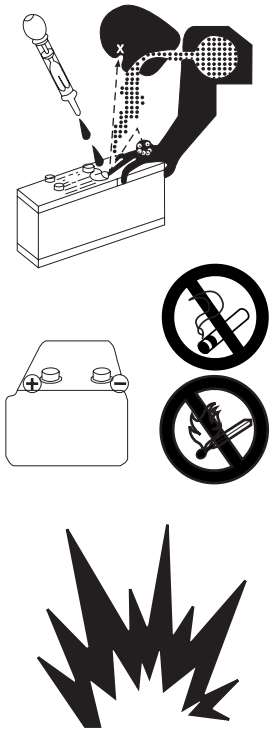
Figure 42

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 a danger that 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 battery from the machine before charging.



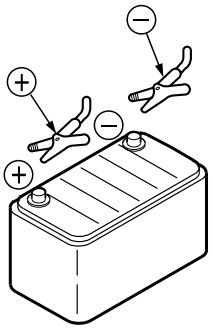
HAAE2100

Figure 43

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.
- 24 volt battery units consisting of two series connected twelve volt batteries have a cable connecting one positive terminal on one of the 12 volt batteries to a negative terminal on the other battery. Booster or charger cable connections must be made between the nonseries connected positive terminals and between the negative terminal of the booster battery and the metal frame of the machine being boosted or charged. Refer to the procedure and illustration in “Starting Engine With a Booster Cable” on page 3-7 of this manual.
- 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.



HAOA310L

Figure 44

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.

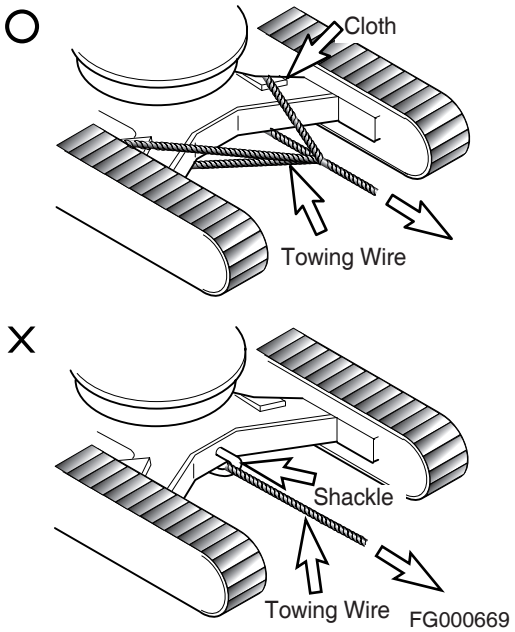


Figure 45

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

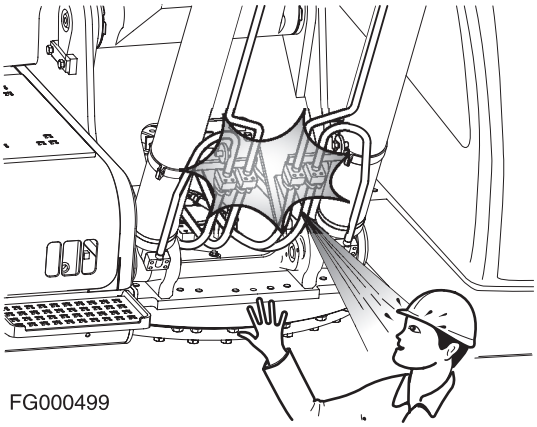
WARNING

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.



FG000499

Figure 46

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 47).

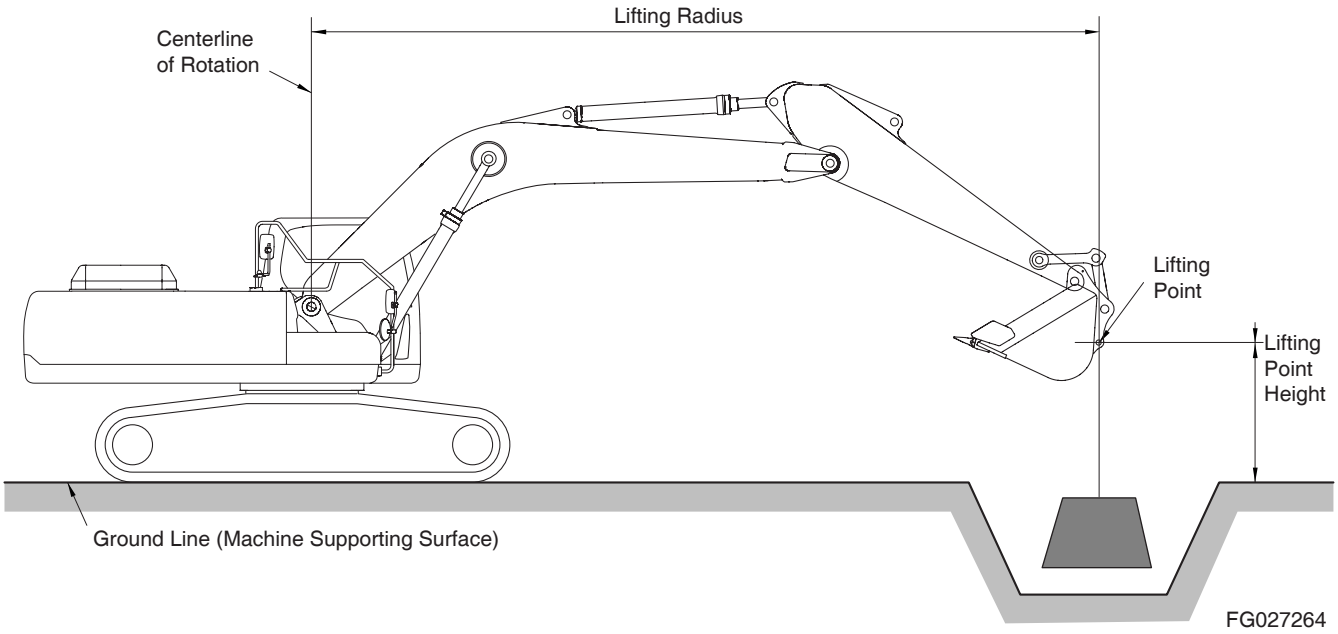


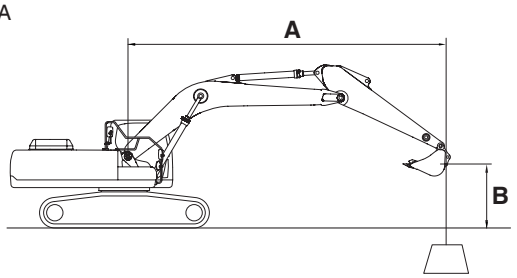
Figure 47

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 47.

IMPORTANT

Select the Digging Mode switch on the Instrument Panel before using the excavator for lifting work. Engine and hydraulic oil should both be fully warmed up to operating temperature before starting a lift.

DX220A



Track Width : 2.8 m (9' 2") STD Track
Boom : 5.7 m (18' 8")
Arm : 2.4 m (7' 10")
Bucket : SAE 1.05 m^3 (CECE 0.92 m^3)
Counterweight : 3,800 kg (8,378 lb)
Shoe : 600 mm (24")
: Rating Over Front
: Rating Over Side or 360 degree
Unit : 1,000 kg (1,000 lb)

FG027262

Figure 48

1,000 kg

A (m) / B (m)	2		3		4		5		6		7		8		Max. Reach		
																	A (m)
8															* 4.35	* 4.35	5.33
7									* 4.91	4.13					* 4.06	3.73	6.31
6									* 4.96	4.10	* 4.04	3.04			* 3.94	3.01	7.03
5							* 5.67	5.48	* 5.24	3.99	4.59	3.00			* 3.94	2.58	7.54
4			*10.17	*10.17	* 7.70	7.52	* 6.44	5.21	* 5.69	3.83	4.50	2.92			3.62	2.31	7.89
3					* 9.29	6.94	* 7.33	4.90	5.67	3.66	4.38	2.81	3.47	2.19	3.40	2.14	8.10
2					10.68	6.44	7.36	4.62	5.48	3.48	4.26	2.70	3.41	2.13	3.28	2.04	8.18
1					10.30	6.12	7.10	4.39	5.32	3.33	4.16	2.61	3.35	2.08	3.26	2.02	8.14
0			* 7.79	* 7.79	10.12	5.97	6.95	4.25	5.20	3.23	4.09	2.54			3.34	2.06	7.97
-1	* 7.54	* 7.54	*10.78	9.71	10.07	5.93	6.87	4.19	5.14	3.17	4.05	2.50			3.53	2.18	7.67
-2	*10.79	*10.79	*14.05	9.81	10.11	5.97	6.87	4.19	5.13	3.17	4.06	2.51			3.89	2.41	7.21
-3	*14.33	*14.33	*12.64	9.98	*10.09	6.06	6.94	4.25	5.19	3.22					4.54	2.83	6.57
-4	*13.36	*13.36	*10.61	10.24	* 8.58	6.23	* 6.90	4.38							* 5.78	3.63	5.68
-5					* 6.05	* 6.05									* 5.40	* 5.40	4.39

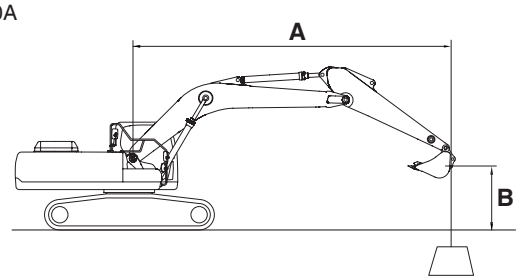
FEET

1,000 lb

A (ft) / B (ft)	5		10		15		20		25		MAX. REACH		
													A (ft)
25											* 9.28	* 9.28	18.84
20							* 10.88	8.78			* 8.71	6.77	22.85
15					* 13.90	* 13.77	* 11.85	8.42	8.59	5.53	8.41	5.41	25.28
10					* 17.56	12.48	12.20	7.87	8.36	5.32	7.51	4.73	26.55
5					18.43	11.34	11.60	7.32	8.08	5.06	7.19	4.46	26.82
0			* 17.76	* 17.76	17.74	10.73	11.18	6.94	7.89	4.88	7.35	4.53	26.14
-5	* 18.95	* 18.95	* 28.20	20.89	17.57	10.59	11.03	6.81			8.14	5.03	24.43
-10	* 29.52	* 29.52	* 27.39	21.39	17.80	10.79	11.18	6.94			10.09	6.29	21.43
-15			* 19.70	* 19.70	* 14.11	11.39					* 12.45	9.95	16.42

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 HYDRAULIC CAPACITY OR 75% OF TIPPING CAPACITY.

DX220A



Track Width : 2.8 m (9' 2") STD Track
Boom : 5.7 m (18' 8")
Arm : 2.9 m (9' 6")
Bucket : SAE 0.92 m^3 (CECE 0.81 m^3)
Counterweight : 3,800 kg (8,378 lb)
Shoe : 600 mm (24")
: Rating Over Front
: Rating Over Side or 360 degree
Unit : 1,000 kg (1,000 lb)

FG027263

Figure 49

METRIC

1,000 kg

A (m) / B (m)	1		2		3		4		5		6		7		8		MAX. REACH		
																			A (m)
8																	* 3.19	* 3.19	5.95
7																	* 3.01	* 3.01	6.86
6											* 4.51	4.22	* 4.09	3.16			* 2.93	2.73	7.51
5											* 4.83	4.11	* 4.63	3.10			* 2.93	2.37	7.99
4									* 5.90	5.37	* 5.30	3.94	4.59	3.00	3.61	2.32	* 2.99	2.13	8.32
3					*11.82	11.53	* 8.47	*7.22	* 6.83	5.05	5.78	3.75	4.46	2.88	3.54	2.25	* 3.11	1.98	8.52
2					* 9.12	* 9.12	*10.01	6.66	7.50	4.74	5.57	3.56	4.33	2.76	3.46	2.18	3.05	1.89	8.60
1					* 7.74	* 7.74	*10.46	6.26	7.20	4.48	5.38	3.39	4.21	2.65	3.38	2.11	3.02	1.86	8.56
0			* 5.21	* 5.21	* 8.82	* 8.82	*10.19	6.03	7.00	4.30	5.24	3.26	4.11	2.56	3.33	2.05	3.08	1.89	8.40
-1			* 7.63	* 7.63	*10.76	9.61	10.07	5.93	6.89	4.20	5.15	3.18	4.05	2.50	3.30	2.03	3.23	1.98	8.11
-2	* 8.80	*8.80	*10.01	*10.01	*13.31	9.67	*10.06	5.92	6.85	4.17	5.12	3.15	4.03	2.49			3.51	2.16	7.68
-3	*10.98	*10.98	*12.68	*12.68	*13.72	9.81	*10.13	5.98	6.88	4.19	5.14	3.17	4.07	2.52			4.00	2.48	7.09
-4			*15.89	*15.89	*11.98	10.03	* 9.47	6.11	6.99	4.29	5.24	3.26					4.90	3.06	6.27
-5					* 9.41	* 9.41	* 7.52	6.33	* 5.87	4.48							5.62	4.30	5.14

FEET

1,000 lb

A (ft) / B (ft)	5		10		15		20		25		MAX. REACH		
													A (ft)
25							* 7.95	* 7.95			* 6.85	* 6.85	20.78
20							* 9.90	9.06			* 6.47	6.11	24.46
15							* 10.98	8.67	8.79	5.72	* 6.50	4.98	26.74
10			* 25.20	24.90	* 16.21	12.90	12.43	8.08	8.50	5.45	* 6.84	4.38	27.94
5			* 18.43	* 18.43	18.77	11.63	11.76	7.47	8.18	5.15	6.67	4.13	28.20
0			* 20.01	* 20.01	17.87	10.85	11.27	7.02	7.92	4.91	6.78	4.17	27.56
-5	* 17.98	* 17.98	* 27.01	20.64	17.54	10.56	11.02	6.80	7.82	4.81	7.40	4.55	25.94
-10	* 26.02	* 26.02	* 29.71	21.03	17.64	10.65	11.06	6.83			8.88	5.51	23.14
-15			* 23.19	21.85	* 16.45	11.09					* 12.51	8.02	18.60

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 HYDRAULIC CAPACITY OR 75% OF TIPPING CAPACITY.

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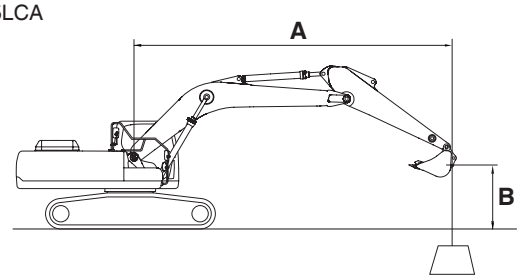

Track Width : 2.99 m (9' 10") LC Track
Boom : 5.7 m (18' 8")
Arm : 2.4 m (7' 10")
Bucket : SAE 1.05 m^3 (CECE 0.92 m^3)
Counterweight : 4,100 kg (9,039 lb)
Shoe : 600 mm (24")
: Rating Over Front
: Rating Over Side or 360 degree
Unit : 1,000 kg (1,000 lb)

FG027265

Figure 50

1,000 kg

A (m) / B (m)	2		3		4		5		6		7		8		Max. Reach		
																	A (m)
7									* 5.03	* 4.98					* 4.47	* 4.47	6.29
6									* 5.06	* 4.96	* 4.46	3.80			* 4.44	3.79	7.00
5							* 5.77	* 5.77	* 5.37	* 4.88	* 5.13	3.77			* 4.51	3.32	7.52
4			*10.28	*10.28	* 7.83	* 7.83	* 6.58	6.36	* 5.84	4.76	* 5.37	3.70			* 4.66	3.03	7.87
3					* 9.51	8.64	* 7.52	6.12	* 6.40	4.62	* 5.70	3.62	4.67	2.91	4.59	2.86	8.08
2					*10.98	8.24	* 8.41	5.89	* 6.95	4.48	5.71	3.54	4.62	2.86	4.47	2.77	8.17
1					*11.86	7.99	* 9.07	5.72	7.17	4.37	5.63	3.46	4.58	2.82	4.47	2.75	8.12
0			* 5.72	* 5.72	*12.14	7.87	* 9.43	5.61	7.08	4.29	5.57	3.41			4.59	2.82	7.96
-1	* 5.52	* 5.52	* 8.70	* 8.70	*11.96	7.84	9.45	5.56	7.03	4.24	5.54	3.39			4.85	2.98	7.65
-2	* 8.80	* 8.80	*12.21	*12.21	*11.41	7.87	* 9.16	5.56	7.03	4.24	5.56	3.40			5.33	3.27	7.20
-3	*12.33	*12.33	*13.09	*13.09	*10.45	7.95	* 8.47	5.61	* 6.88	4.29					* 6.05	3.78	6.56
-4	*13.90	*13.90	*11.03	*11.03	* 8.93	8.10	* 7.19	5.72							* 6.08	4.77	5.67
-5					* 6.36	* 6.36									* 5.73	* 5.73	4.38

FEET

1,000 lb

A (ft) / B (ft)	10		15		20		25		MAX. REACH		
											A (ft)
25									* 10.05	* 10.05	18.84
20					* 11.11	10.66			* 9.78	8.49	22.79
15			* 14.13	* 14.13	* 12.15	10.38	* 10.73	7.13	* 10.06	7.02	25.22
10	* 21.27	* 21.27	* 17.99	15.51	* 13.87	9.95	11.16	6.96	10.15	6.31	26.49
5			* 21.44	14.60	15.55	9.52	10.95	6.76	9.83	6.06	26.78
0	* 13.18	* 13.18	* 23.02	14.13	15.22	9.23	10.80	6.62	10.11	6.21	26.10
-5	* 23.57	* 23.57	* 22.63	14.03	15.11	9.13			11.18	6.85	24.39
-10	* 28.35	28.06	* 20.29	14.20	* 14.76	9.24			* 13.35	8.41	21.39
-15	* 20.56	* 20.56	* 14.76	14.69					* 13.15	12.87	16.39

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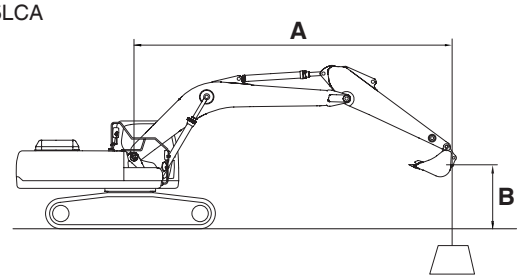
DX225LCA



Track Width : 2.99 m (9' 10") LC Track
Boom : 5.7 m (18' 8")
Arm : 2.9 m (9' 6")
Bucket : SAE 0.92 m^3 (CECE 0.81 m^3)
Counterweight : 4,100 kg (9,039 lb)
Shoe : 600 mm (24")
: Rating Over Front
: Rating Over Side or 360 degree
Unit : 1,000 kg (1,000 lb)

FG027266

Figure 51

1,000 kg

A (m) / B (m)	2		3		4		5		6		7		8		Max. Reach		
																	A (m)
8															* 3.42	* 3.42	5.94
7															* 3.31	* 3.31	6.85
6									* 4.53	* 4.53	* 4.39	3.84			* 3.30	* 3.30	7.51
5									* 4.87	* 4.87	* 4.69	3.79			* 3.36	2.99	7.99
4							* 5.95	* 5.95	* 5.37	4.79	* 4.99	3.72	* 4.50	2.95	* 3.48	2.75	8.32
3			*11.94	*11.94	* 8.57	* 8.57	* 6.92	6.19	5.97	4.64	* 5.36	3.62	4.67	2.90	* 3.65	2.59	8.52
2			* 7.08	* 7.08	*10.19	8.36	* 7.89	5.93	* 6.58	4.49	4.26	2.70	4.61	2.84	* 3.89	2.51	8.60
1			* 5.62	* 5.62	*11.36	8.03	* 8.69	5.73	* 7.11	4.36	4.16	2.61	4.55	2.79	4.09	2.50	8.56
0	* 3.08	* 3.08	* 6.66	* 6.66	*11.94	7.85	* 9.21	5.59	7.05	4.26	4.09	2.54	4.51	2.75	4.18	2.54	8.40
-1	* 5.53	* 5.53	* 8.59	* 8.59	*12.03	7.77	9.40	5.51	6.98	4.19	4.05	2.50	4.48	2.73	4.39	2.67	8.11
-2	* 7.92	* 7.92	*11.11	*11.11	*11.71	7.77	* 9.28	5.48	6.96	4.17	4.06	2.51			4.76	2.90	7.69
-3	*10.58	*10.58	*14.12	*12.89	*10.99	7.82	* 8.81	5.51	6.98	4.19					4.41	2.829	7.09
-4	*13.78	*13.78	*12.36	*12.36	* 9.77	7.94	* 7.86	5.59	* 6.29	4.26					* 5.86	4.00	6.28
-5			* 9.77	* 9.77	* 7.80	* 7.80	* 6.10	5.75							* 5.85	* 5.50	5.15

FEET

1,000 lb

A (ft) / B (ft)	10		15		20		25		MAX. REACH		
											A (ft)
25					* 8.41	* 8.41			* 7.41	* 7.41	20.73
20					* 9.94	* 9.94			* 7.28	* 7.28	24.45
15					* 11.10	10.46	* 10.37	7.16	* 7.50	6.34	26.73
10	* 25.44	* 25.44	* 16.42	15.73	* 12.94	10.00	11.16	6.95	* 8.03	5.73	27.93
5	* 13.83	* 13.83	* 20.28	14.71	* 14.86	9.52	10.91	6.72	* 8.91	5.51	28.20
0	* 15.25	* 15.25	* 22.52	14.09	15.16	9.16	10.71	6.53	9.21	5.61	27.56
-5	* 22.18	* 22.18	* 22.80	13.87	14.97	9.00	10.63	6.46	10.05	6.12	25.95
-10	* 30.58	27.61	* 21.20	13.95	* 15.02	9.03			12.02	7.31	23.15
-15	* 23.99	* 23.99	* 17.02	14.32					* 12.97	10.35	18.64
-20					* 8.41	* 8.41			* 7.41	* 7.41	20.73

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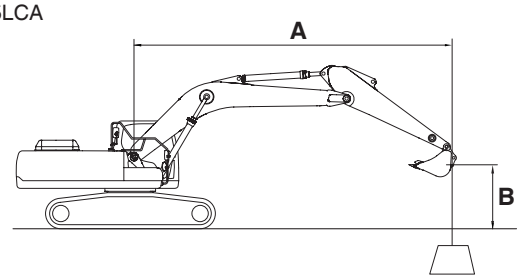
DX225LCA



Track Width : 2.99 m (9' 10") LC Track
Boom : 5.7 m (18' 8")
Arm : 3.5 m (11' 6")
Bucket : SAE 0.81 m^3 (CECE 0.72 m^3)
Counterweight : 4,100 kg (9,039 lb)
Shoe : 600 mm (24")
: Rating Over Front
: Rating Over Side or 360 degree
Unit : 1,000 kg (1,000 lb)

FG027267

Figure 52

1,000 kg

A (m) / B (m)	2		3		4		5		6		7		8		9		Max. Reach		
																			A (m)
8																	* 2.97	* 2.97	6.61
7											* 3.54	* 3.54					* 2.89	* 2.89	7.43
6											* 4.04	3.92	* 2.98	* 2.98			* 2.89	* 2.89	8.04
5											* 4.24	3.86	* 3.87	3.05			* 2.94	2.72	8.49
4									* 4.83	* 4.83	* 4.57	3.77	* 4.39	2.99			* 3.03	2.51	8.81
3			* 9.80	* 9.80	* 7.45	* 7.45	* 6.21	* 6.21	* 5.46	4.71	* 4.97	3.67	* 4.64	2.93			* 3.18	2.38	9.00
2			*13.13	*13.13	* 9.20	8.53	* 7.26	6.02	* 6.13	4.54	* 5.41	3.56	4.63	2.86	* 3.62	2.33	* 3.38	2.30	9.07
1			* 8.04	* 8.04	*10.63	8.12	* 8.19	5.77	* 6.74	4.38	5.63	3.45	4.55	2.79	3.77	2.29	* 3.65	2.28	9.03
0	* 3.76	* 3.76	* 7.64	* 7.64	*11.54	7.85	* 8.87	5.59	7.05	4.25	5.53	3.36	4.49	2.73			3.82	2.31	8.88
-1	* 5.45	* 5.45	* 8.73	* 8.73	*11.93	7.71	* 9.25	5.47	6.95	4.16	5.46	3.30	4.48	2.69			3.98	2.41	8.61
-2	* 7.33	* 7.33	*10.55	*10.55	*11.87	7.66	9.30	5.41	6.90	4.12	5.43	3.27	4.44	2.68			4.27	2.58	8.21
-3	* 9.47	* 9.47	*13.01	*12.64	*11.41	7.68	* 9.06	5.41	6.90	4.11	5.43	3.28					4.75	2.88	7.66
-4	*12.02	*12.02	*13.59	12.79	*10.51	7.76	* 8.40	5.46	* 6.83	4.15							5.59	3.39	6.91
-5	*15.24	*15.24	*11.49	*11.49	* 9.01	7.91	* 7.19	5.57									* 5.77	4.36	5.91
-6			* 8.30	* 8.30	* 6.51	* 6.51											* 5.75	* 5.75	4.46

FEET

1,000 lb

A (ft) / B (ft)	10		15		20		25		MAX. REACH		
											A (ft)
25									* 6.45	* 6.45	22.80
20							* 7.80	7.43	* 6.36	* 6.36	26.22
15					* 9.93	* 9.93	* 9.48	7.28	* 6.55	5.78	28.35
10			* 14.55	* 14.55	* 11.86	10.14	* 10.43	7.02	* 6.99	5.25	29.49
5	* 23.19	* 23.19	* 18.77	14.90	* 13.97	9.59	10.94	6.74	* 7.71	5.03	29.75
0	* 17.48	* 17.48	* 21.70	14.10	15.16	9.15	10.68	6.50	8.42	5.09	29.14
-5	* 21.68	* 21.68	* 22.73	13.73	14.88	8.90	10.54	6.37	9.07	5.48	27.62
-10	* 29.55	27.07	* 21.90	13.70	14.83	8.86	10.56	6.39	10.55	6.38	25.02
-15	* 27.18	* 27.18	* 18.87	13.96	* 13.48	9.06			* 12.58	8.49	20.92
-20									* 12.60	* 12.60	14.05

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Operating Controls

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

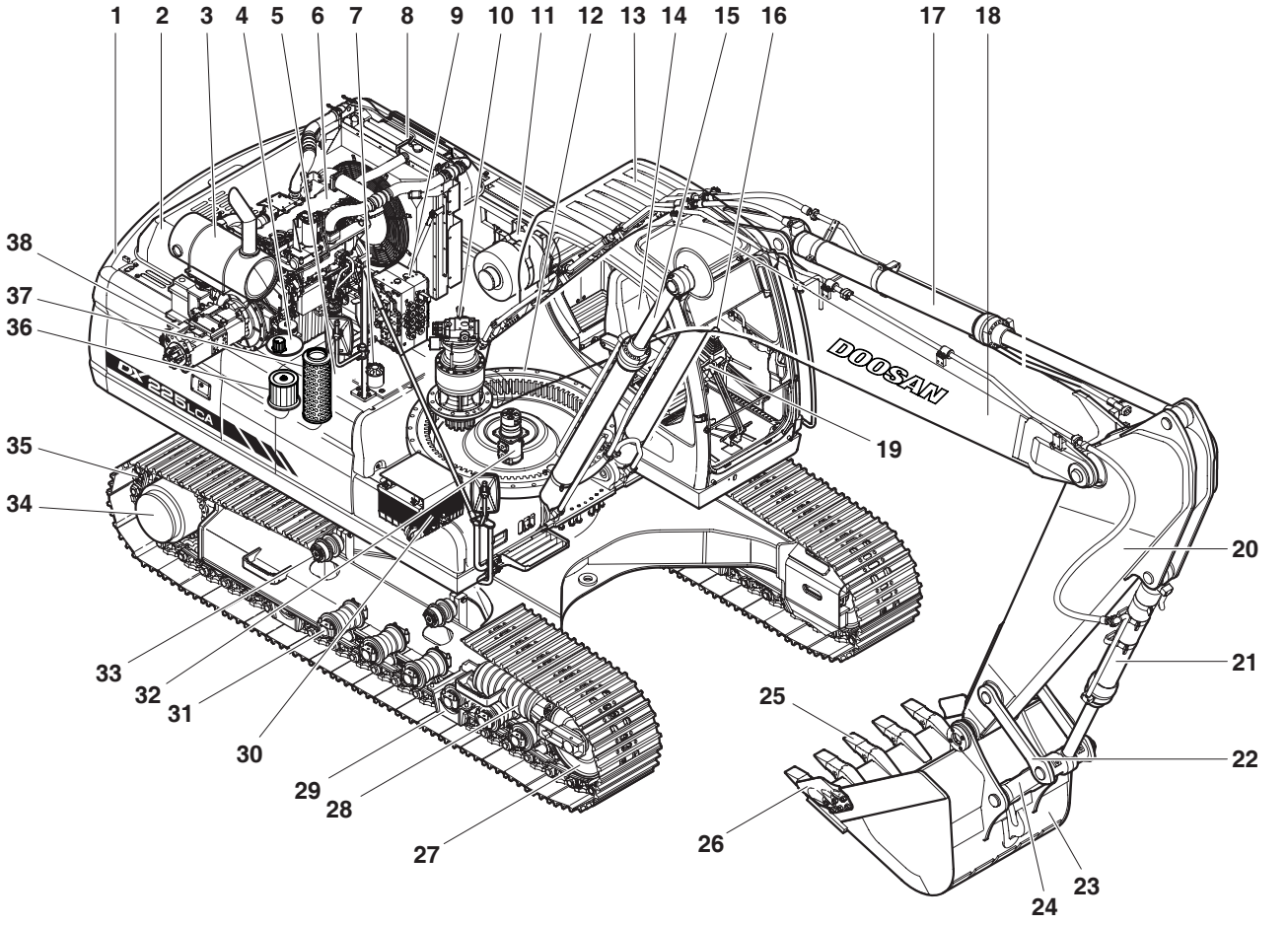
Each group is explained with a point location drawing or photo and a brief description of each control, switch, gauge or valve.

Indicator lights work besides the gauges on the instrument panel. The operator should monitor machine pressure on the instrument panel with indicator lights. These lights will only show 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



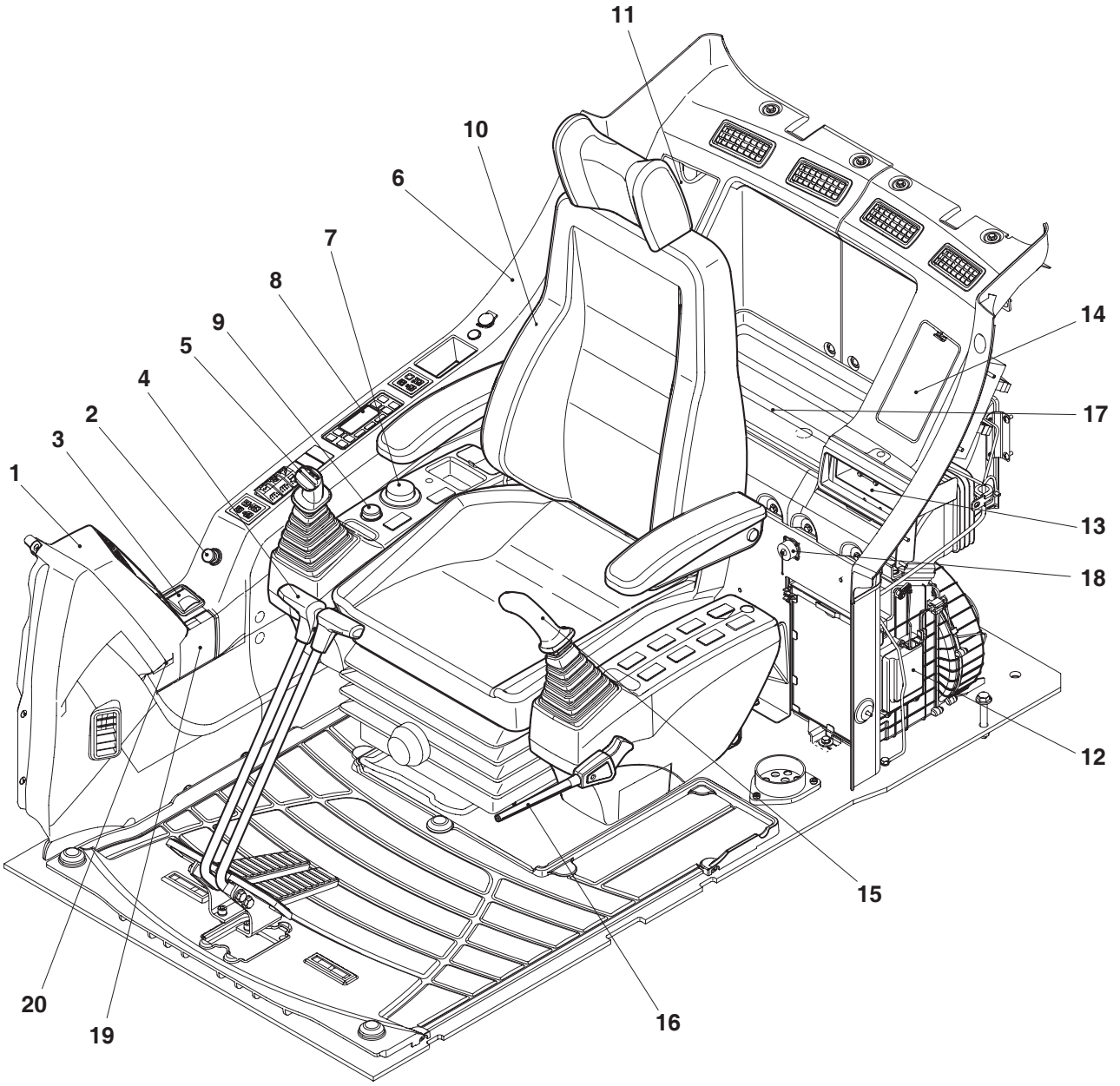
FG014178

Figure 1

Reference Number	Description
1	Counterweight
2	Hood
3	Muffler
4	Hydraulic Oil Tank
5	Fuel Tank
6	Engine
7	Fuel Tank Fill Cap
8	Radiator and Oil Cooler
9	Control Valves
10	Swing Motor
11	Air Cleaner
12	Swing Bearing
13	Cabin
14	Seat
15	Boom Cylinder
16	Work Lever (Joystick) Controls
17	Arm Cylinder
18	Boom
19	Travel Lever

Reference Number	Description
20	Arm
21	Bucket Cylinder
22	Guide Link
23	Bucket
24	Push Link
25	Tooth Point
26	Side Cutter
27	Idler
28	Track Adjuster
29	Track Guide
30	Battery
31	Lower Roller
32	Center Joint
33	Upper Roller
34	Travel Motor
35	Track Link and Shoe
36	Suction Filter
37	Return Filter
38	Pumps

OPERATOR'S AREA



FG001346

Figure 2

Reference Number	Description
1	Instrument Panel (See page 2-19)
2	Cigarette Lighter (See page 2-15)
3	Ashtray (See page 2-62)
4	Travel Levers (See page 3-15)
5	Right-hand Work Lever (Joystick) (See page 3-24)
6	Storage Tray (See page 2-62)
7	Engine Speed Control Dial (See page 2-9)
8	Heater and Air Conditioner Control Panel (See page 2-45)
9	Starter Switch (See page 2-8)
10	Seat (See page 2-54)

Reference Number	Description
11	Storage Compartment (See page 2-62)
12	Heater and Air Conditioner Unit
13	Stereo (See page 2-51)
14	Fuse Box (See page 2-53)
15	Left-hand Work Lever (Joystick) (See page 3-24)
16	Safety Lever (See page 3-13)
17	Storage Compartment (See page 2-62)
18	DMS Laptop Computer Connector
19	Cup Holder (See page 2-64)
20	Hour Meter (See page 2-22)

OPERATIONAL CONTROLS AND PANELS

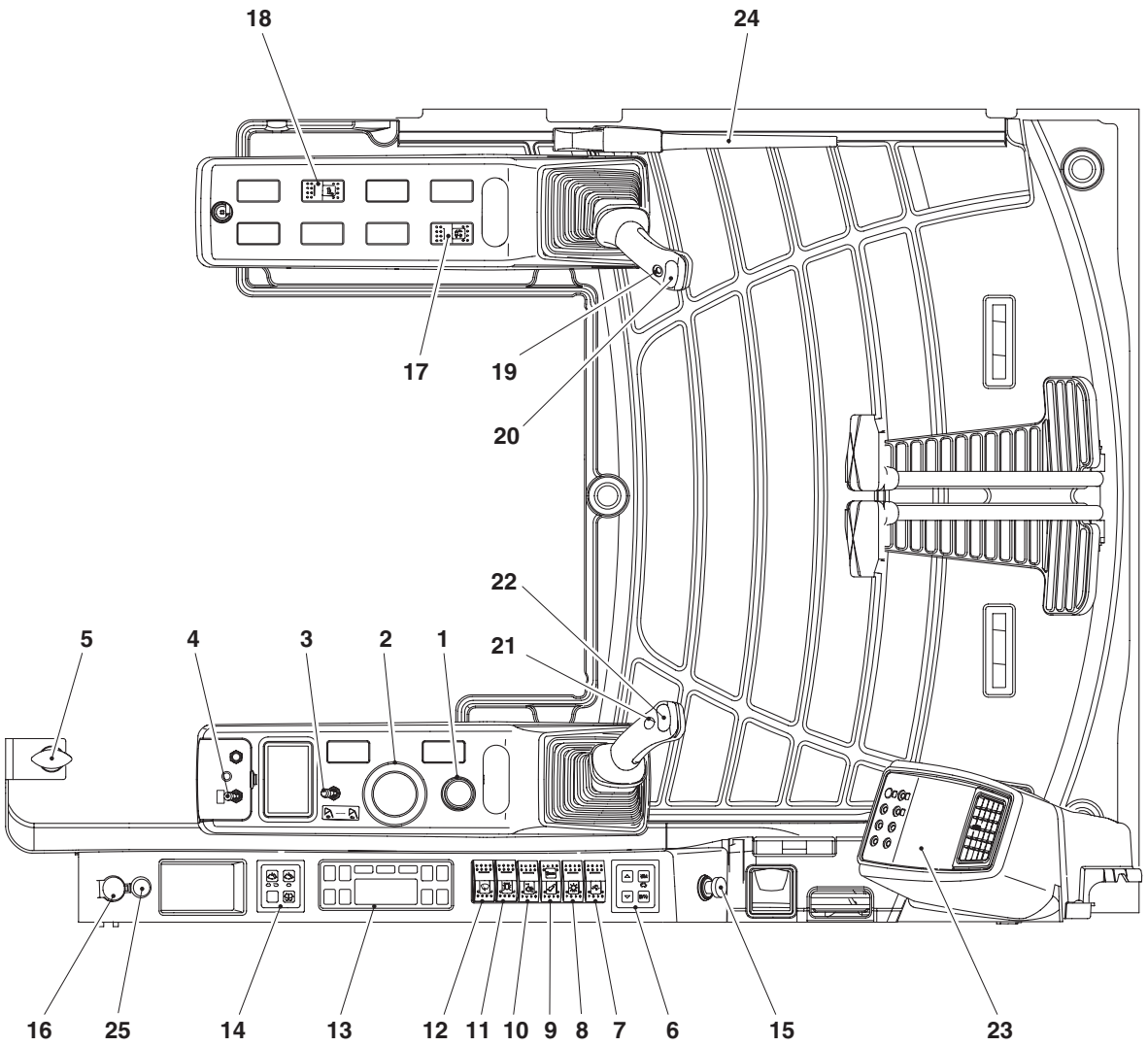


Figure 3

Reference Number	Description
1	Starter Switch
2	Engine Speed Control Dial
3	Quick Clamp Switch (Optional)
4	Auxiliary Mode Switch
5	Engine Emergency Stop Cable
6	Audio Control Panel
7	Travel Speed Selector Switch
8	Light Switch
9	Breaker / Booster / Shear Selector Switch
10	Cabin Work Light Switch (Optional)
11	Warning Light Switch (Optional)
12	Lower Wiper Switch (Optional)
13	Heater and Air Conditional Control Panel

Reference Number	Description
14	Wiper Control Panel
15	Cigarette Lighter
16	Power Socket For 12v
17	Travel / Swing Alarm Switch (Optional)
18	Seat Warmer Switch (Optional)
19	Horn Button
20	Rotating Buttons
21	Booster Button
22	Shear Buttons
23	Instrument Panel
24	Safety Lever
25	Photo Sensor

1. Starter Switch

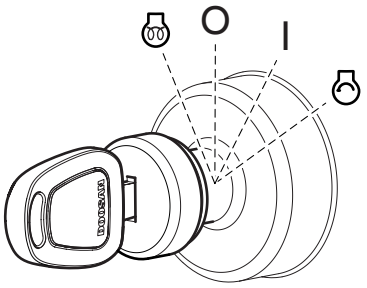
A three-position starter switch is used to start or shut down engine for equipment operation.

O. Turning switch to this position turns engine "OFF" with its electrical system. In this position engine is "OFF" but interior cabin light and fuel tank transfer pump (if equipped) are functional.

I. Turning switch to this position turns engine electrical system "ON." When switch is first turned "ON" six indicator/warning lights across top of instrument panel, will light for approximately two seconds. The battery warning light and engine oil pressure warning light should remain "ON" after the other four have turned "OFF."

NOTE: *Preheat Indicator Light - The operation of the preheat cycle depends on coolant temperature. When the engine coolant is cold enough, the preheat indicator light will remain "ON" until the engine preheat cycle is completed. The preheat cycle takes about twenty seconds to complete, and the indicator light will turn "OFF." When the light turns "OFF," engage the starter.*

. Moving switch to this position will crank engine. When engine starts, release key and allow it to return to the "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. Starting fluids should never be used.

. Preheat position. Used to aid engine starting in cold weather. When key is in this position, engine preheater is operating. When preheat cycle indicator light turns "ON" engine preheat cycle is complete. Immediately turn key to crank position and start engine. This light turns "ON" after 15 seconds when the starter switch is turned to the preheating position.

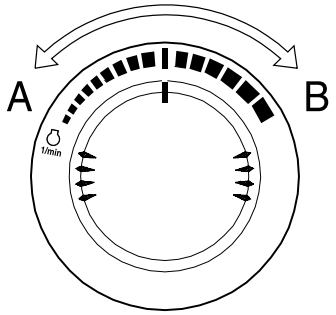
2. Engine Speed Control Dial

The engine speed is controlled by the dial. Rotating it clockwise increases engine speed (rpm) and counterclockwise decreases engine speed.

A Low idle (Lowest engine speed)

B High idle (Highest engine speed)

NOTE: *The auto idle system will automatically reduce engine speed to idle speed approximately four seconds after all of the control levers are in the neutral position. This system is designed to reduce fuel consumption and noise. See "2. Auto Idle Selector Button" on page 2-30.*



HAOA690L

Figure 5

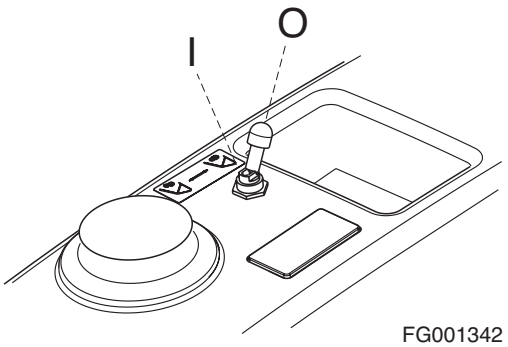
3. Quick Clamp Switch (Optional)

Clamp releasing for dispensable attachment is controlled.

O. In this position, the quick clamp is "LOCKED." The attachment is secured to the arm.

I. In this position, the quick clamp is "UNLOCKED." The attachment is released from the arm.

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



FG001342

Figure 6

WARNING

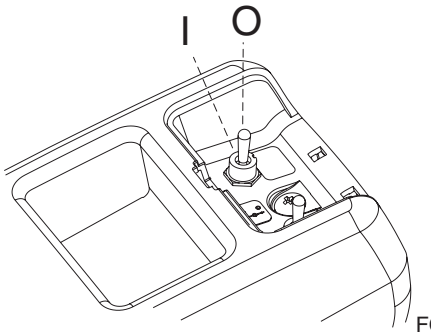
When the attachment is still connected to the machine, while the switch is "I" ( ) position, do not operate the machine or the attachment might fall to the ground. It would cause personnel injuries.

4. Auxiliary Mode Switch

When the control system is out of order, the pump system can be controlled manually.

O. In this position, the manual pump control is "OFF."

I. In this position, the manual pump control is "ON."



FG001343

Figure 7

CAUTION

Be sure to turn pump control to the "O" (OFF) position, after the control system is operating properly.

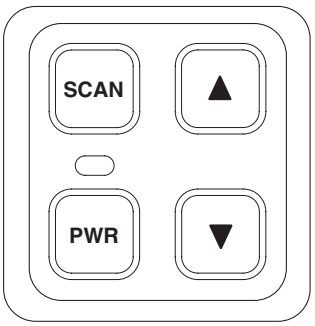
5. Engine Emergency Stop Cable

If the engine does not shut down when using the starter switch, it can be stopped by moving the engine emergency stop cable.

See “Engine Speed Control” on page 3-20.

6. Audio Control Panel

The audio system can be remotely controlled using this panel.



FG000018

Figure 8

Each time this power button is pressed, the audio system is turned either "ON" or "OFF."

If the audio system turns "ON," an indicator light above the button turns "ON."

FG000019

Figure 9

Press the up button, to "INCREASE" volume.

FG000020

Figure 10

Press the down button, to "DECREASE" volume.

FG000021

Figure 11

Manual Scan: When pressing scan button once, for less than half-a-second, the frequency will be moved up in sequence to the next available signal.

Auto Scan: When pressing scan button for more than a half-a-second, the frequencies are automatically scanned to the next higher one and will continue until button is again pressed to stop the scan.

FG000022

Figure 12

7. Travel Speed Selector Switch

WARNING

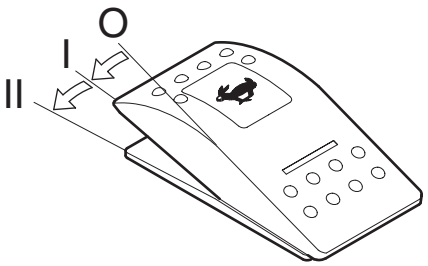
Do not operate the travel speed selector switch when unit is in motion. Temporary loss of control could result.

This switch activates the automatic speed range for travel.

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

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

II. In this position, "AUTOMATIC" travel speed is selected. The travel speed automatically changes between "LOW" or "HIGH" range, depending on engine speed and travel motor loads.



FG000023

Figure 13

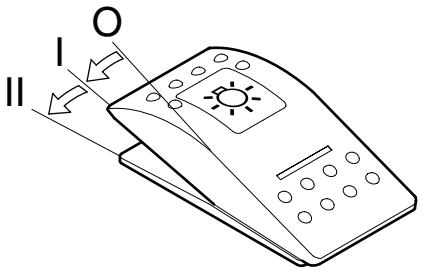
8. Light Switch

This switch is used to turn "ON" the lights.

O. In this position, all lights are "OFF."

I. In this position, all illumination lights of the instrument panel and the control switches are turned "ON."

II. In this position, all illumination lights and work lights are turned "ON."



FG000024

Figure 14

CAUTION

Do not leave instrument panel or work lights "ON" when the engine is not running. Leaving lights "ON" with the engine shut down will discharge batteries.

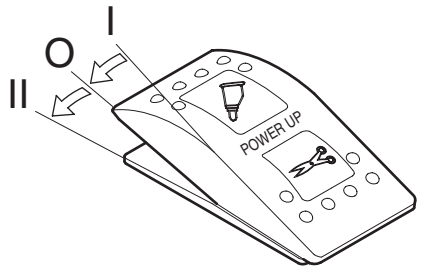
9. Breaker / Boost / Shear Selector Switch

This switch is used to either select the breaker, power boost, or shear.

O. In this position, a hydraulic pressure rise will be activated when pressing the button on the right-hand work lever (joystick).

I. In this position, shear is activated.

II. In this position, breaker is activated.



FG000025

Figure 15

WARNING

Before using any attachment in a work application, be sure to check its functional control. Make sure that desired movement or action is being activated by the control. e.g. opening/closing, CW/CCW, crowd/dump, etc.

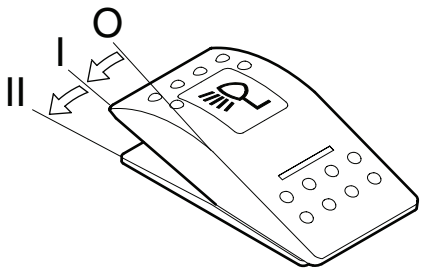
10. Cabin Work Light Switch (Optional)

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

O. In this position, all cabin work lights are turned "OFF."

I. In this position, the front cabin work lights on the front top of cabin will turn "ON."

II. In this position, the front cabin work lights on the front top of cabin and rear cabin work lights on rear top of cabin will turn "ON."



FG000026

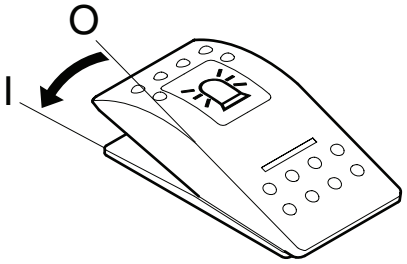
Figure 16

11. 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.



FG000027

Figure 17

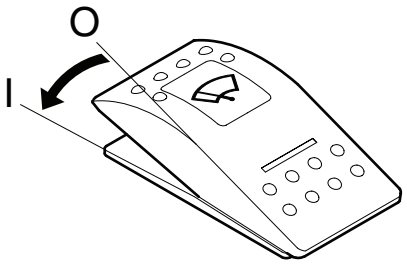
12. Lower Wiper Switch (Optional)

This switch is used to control the lower front window wiper.

O. In this position, lower windshield wiper is "OFF."

I. In this position, lower windshield wiper runs at a constant speed.

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

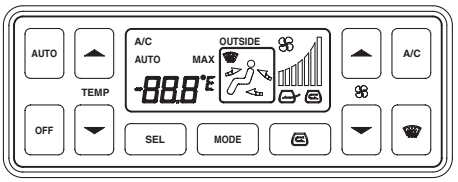


FG000028

Figure 18

13. Heater and Air Conditioner Control Panel

This panel is used to control air conditioner and heater in operator's cabin. Refer to “Heater and Air Conditioner Control Panel” on page 2-45 for more details.



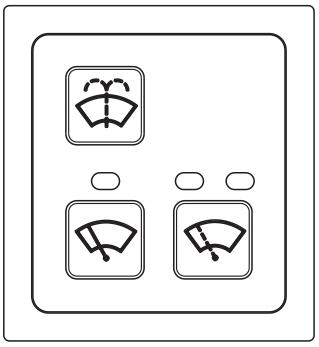
FG000029

Figure 19

14. Wiper Control Panel

This panel is only for operation of the upper windshield wiper. When the wiper stops running, it moves to right side of the cabin, resting in its support.

NOTE: *When the front window is lifted, the wiper motor will not operate.*



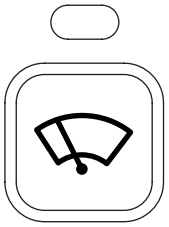
FG000308

Figure 20

Constant Speed Button

Pressing the button turns "ON" the windshield wiper. An indicator light above the button will turn "ON" indicating that wiper is "ON." The wiper will run at a constant speed.

Pressing the button again, turns "OFF" the windshield wiper.



FG000241

Figure 21

Intermittent Speed Button

Pressing button once (first time):

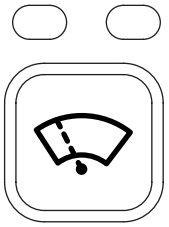
Windshield wiper runs approximately on a three second intermittent cycle. The left side indicator light will turn "ON."

Pressing button again (second time):

Windshield wiper runs approximately on a six second intermittent cycle. The right side indicator light will turn "ON."

Pressing button again (third time):

Turns "OFF" the windshield wiper. Both indicator lights will be turned "OFF."



FG000242

Figure 22

Windshield Washer Button

Pressing the washer button will spray windshield washer fluid onto the windshield. Use only the proper windshield washer fluid in the system.

NOTE: *Do not operate the windshield washer without any fluid. If operate without any fluid, the washer motor may be damaged. Check level in washer tank, and add fluid as required.*

NOTE: *Using soapy water or synthetic detergent instead of window cleaning fluid, may damage the wiper blade or painted surfaces. Use standard window cleaning fluid: SSK703*

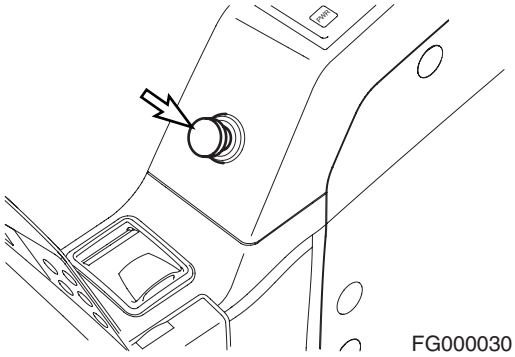
FG000243

Figure 23

15. Cigarette Lighter

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.

NOTE: *This cigarette lighter is for 24V only. Never connect a 12V electrical device to the lighter.*



FG000030

Figure 24

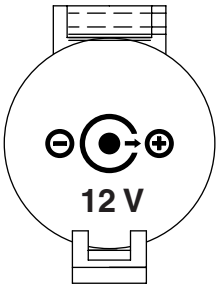
16. Power Socket for 12 Volt

This is a power socket for only 12V DC devices.

This socket can be used for charging a cellular phone or powering a small 12V DC electrical device.

Open the cap when using it.

NOTE: *This socket is designed for small electrical capacity devices. Do not use this socket for large electrical capacity devices. Thus, damage can be avoided.*



HAAE1990

Figure 25

17. Travel/Swing Alarm Switch (Optional)

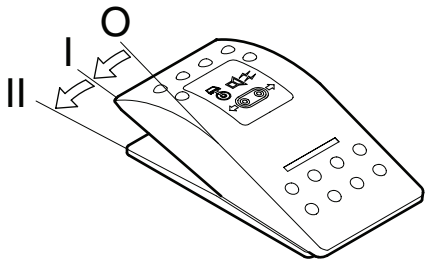
If unit is equipped with a travel/swing alarm buzzer, push this switch to active it, whenever swinging or traveling.

O. In this position, the travel/swing alarm system is turned "OFF."

I. In this position, the travel alarm will only sound, when the machine is moving.

II. In this position, the travel/swing alarm will sound while swinging and traveling, if equipped with a swing alarm device.

NOTE: *If machine is only equipped with a travel alarm device, the alarm will not sound when swinging although the switch is in the "II" position.*



FG000031

Figure 26

18. Seat Warmer Switch (Optional)

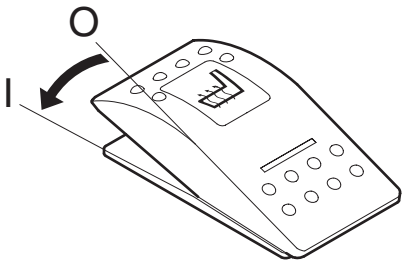
If the seat is equipped with the optional seat warmer, push this switch to activate it.

When the seat is warmed, the warmer is automatically turned "OFF."

O. In this position, the seat warmer is turned "OFF."

I. In this position, the seat warmer is turned "ON."

NOTE: *The starter switch must be "ON" with the engine running, for the heater to operate.*



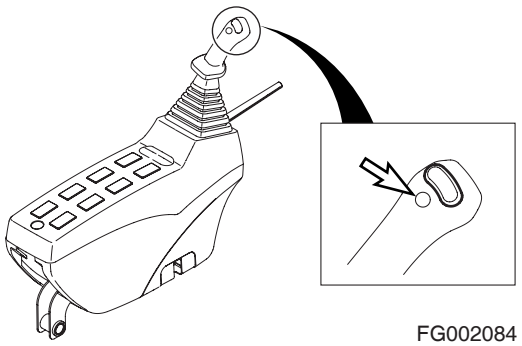
FG000034

Figure 27

19. Horn Button (Left-hand Work Lever)

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

NOTE: *The starter switch must be "ON."*

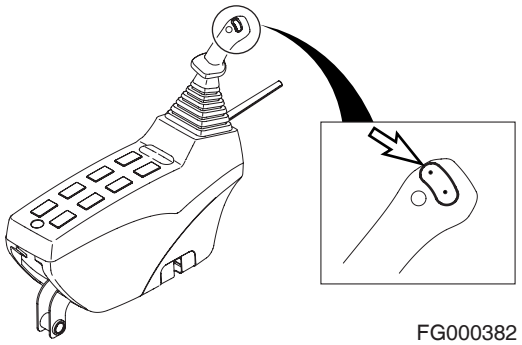


FG002084

Figure 28

20. Rotating Buttons

For a machine equipped with an attachment that rotates, press the upper two buttons on the top of the left-hand work lever (joystick) to rotate the attachment clockwise or counterclockwise. Left button is for counterclockwise and the right one is for clockwise.



FG000382

Figure 29

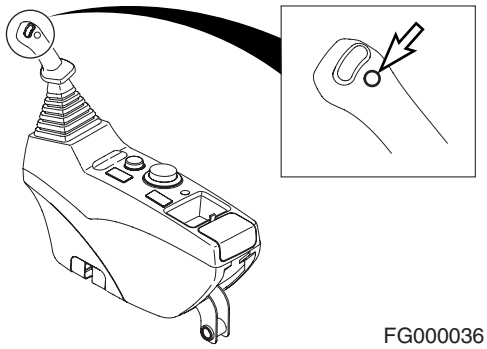
WARNING

Before using any attachment in a work application, be sure to check its functional control. Make sure that the desired movement or action is being activated by the control. e.g. opening/closing, CW/CCW, crowd/dump, etc.

21. Booster Button (Right-hand Work Lever)

Press the lower button on the top of the right-hand work lever (joystick) to boost the hydraulic pressure. Refer to the "Boost Mode" on page 3-23.

NOTE: *This button works with the breaker/boost/shear selector switch. See "9. Breaker / Boost / Shear Selector Switch" on page 2-12.*



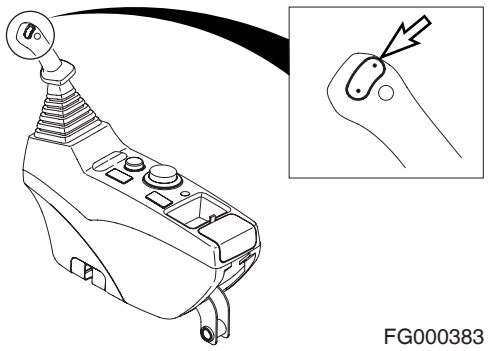
FG000036

Figure 30

22. Shear Buttons

For a machine equipped with shear, press the two upper buttons on the top of the right-hand work lever (joystick) to open or close the shear. Left button is for closing (crowd), right button is for opening (Dump).

NOTE: *These buttons work with the breaker/boost/shear selector switch. See "9. Breaker / Boost / Shear Selector Switch" on page 2-12.*



FG000383

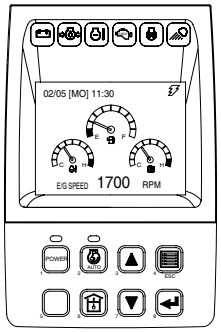
Figure 31

WARNING

Before using any attachment in a work application, be sure to check its functional control. Make sure that the desired movement or action is being activated by the control. e.g. opening/closing, CW/CCW, crowd/dump, etc.

23. Instrument Panel

See “Instrument Panel” on page 2-19.

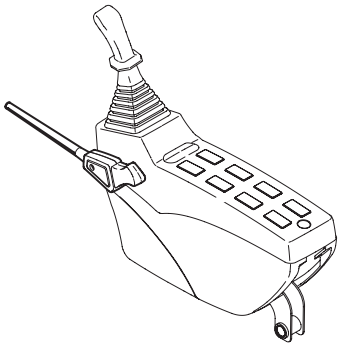


FG014201

Figure 32

24. Safety Lever

See “Safety Lever” on page 3-13.



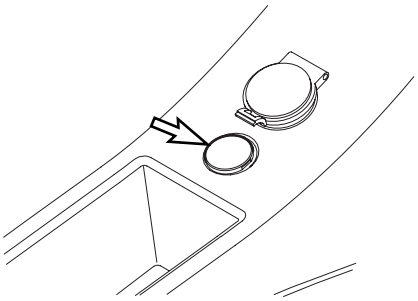
FG000038

Figure 33

25. Photo Sensor

The photo sensor detects the radiant energy of the sun.

In auto mode the air conditioner will automatically adjust the air temperature based on to the detected radiant energy.



FG000399

Figure 34

INSTRUMENT PANEL

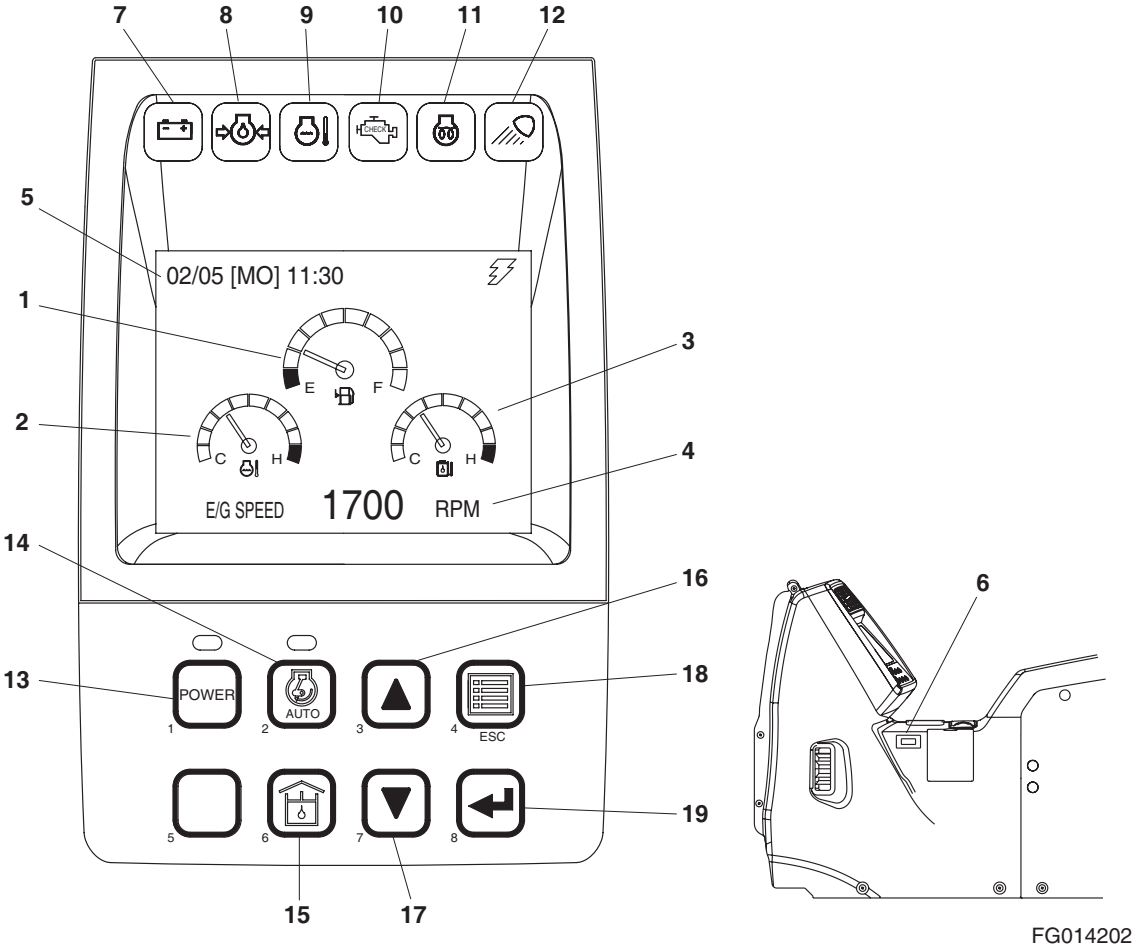


Figure 35

Reference Number	Description
1	Fuel Gauge
2	Engine Coolant Temperature Gauge
3	Hydraulic Oil Temperature Gauge
4	Multifunction Gauge and Graphic Information Area (See page 2-25)
5	Digital Clock
6	Hour Meter
7	Charge Warning Light
8	Engine Oil Pressure Warning Light
9	Engine Coolant Temperature Warning Light
10	Engine Check Warning Light
11	Preheat Indicator Light

Reference Number	Description
12	Work Light Indicator Light
13	Power Mode Selector Button (See page 2-30)
14	Auto Idle Selector Button (See page 2-30)
15	Flow Control Button (See page 2-31)
16	Up Arrow Button (See page 2-32)
17	Down Arrow Button (See page 2-33)
18	Display Selector Button (See page 2-33)
19	Selection Button (See page 2-33)

Functional check

When the engine starter switch is turned to the "I" (ON) position, all gauge bands, switch/button indicator lights and warning lights will turn "ON" and the alarm buzzer will sound about two seconds.

During this functional check, a LOGO will appear on the multifunction gauge in the graphic information area (3 and 4, Figure 35).

Password Activated

If a password has already been set and the system has been "LOCKED," the password display will appear on the screen once the functional check has been completed. Enter the password into the text area and then engage the starter.

NOTE: *Refer to "Set Password (Lock and Unlock)" on page 2-39, for further details.*

CAUTION

If the password does not match the stored password, the engine will not start.

1. Fuel Gauge

Shows remaining fuel quantity in tank.

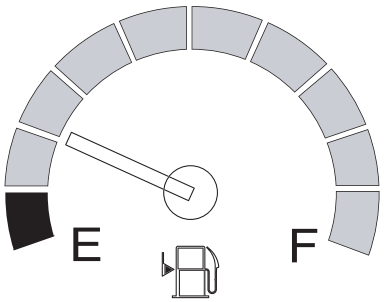
BLUE ZONE ( ) - Indicates a normal fuel quantity.

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

If the gauge pointer moves into the red zone, the fuel level symbol will turn "ON," and be display in the screen. Stop operation and immediately and add fuel.

NOTE: *See "Abnormal State Warning Symbols" on page 2-27, for location of this warning symbol and others.*

Check the fuel level on firm, level ground.



FG000040

Figure 36

2. Engine Coolant Temperature Gauge

The colored bands indicate the temperature of the engine coolant.

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

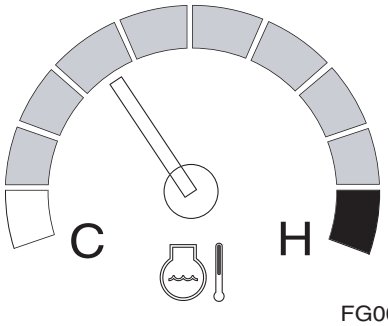
BLUE ZONE ( ) - Indicates temperature is within the normal operating range.

RED ZONE ( ) - Indicates temperature is too high.

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

If the gauge pointer moves into the red zone, the engine coolant temperature warning light will turn "ON," a warning buzzer will sound, and the engine speed will be automatically reduced. Allow the engine to run at low idle speed until the temperature gauge registers in the blue zone again. When the blue 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.

When the temperature reaches the normal range, the engine speed will automatically recover.



FG000041

Figure 37

3. Hydraulic Oil Temperature Gauge

The colored bands indicate the temperature of the hydraulic oil

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

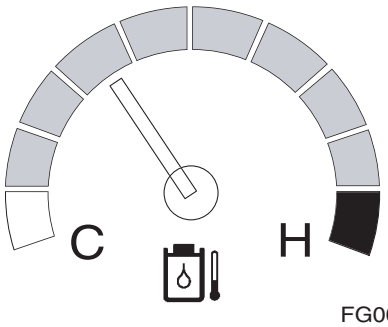
BLUE ZONE ( ) - Indicates temperature is within the normal operating range.

RED ZONE ( ) - Indicates temperature is too high.

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

If the gauge pointer moves into the red zone, the hydraulic oil temperature symbol will turn "ON," and be display in the screen. Allow the engine to run at low idle speed until temperature gauge registers in the blue zone again.

NOTE: *See "Abnormal State Warning Symbols" on page 2-27, for location of this warning symbol and others.*

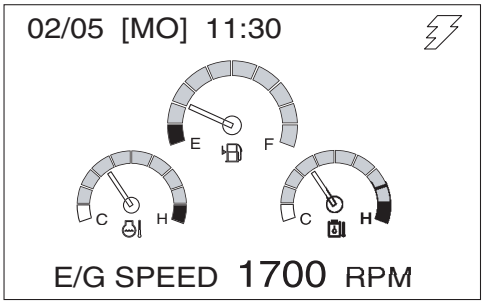


FG000042

Figure 38

4. Multifunction Gauge and Graphic Information Area

See “Multifunction Gauge and Graphic Information” on page 2-25. This section will have a more in-depth explanation of the display area.



FG000043

Figure 39

5. Digital Clock

A digital clock, shows the current time. The displayed contents are as follows.

Display	Description
MM	Month
DD	Date
W	Day
HH	Hour
mm	Minute
A (P)	AM (PM)

Refer to the “Setting Main Menu” on page 2-32 for time setting.

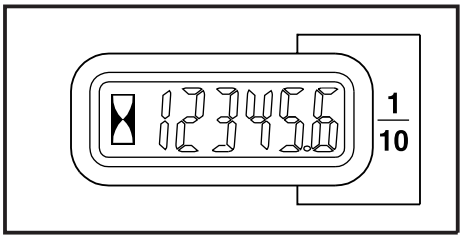
MM/DD [W] HH:mm

FG000044

Figure 40

6. 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.

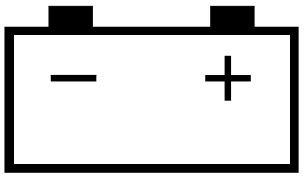


HAOA601L

Figure 41

7. 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.



HAOA610L

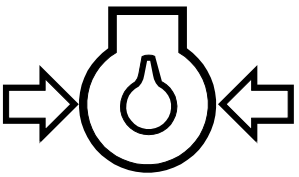
Figure 42

8. 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" and a warning buzzer will sound. 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.

CAUTION

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



HAOA620L

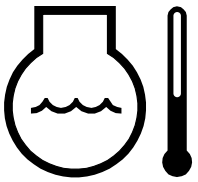
Figure 43

9. Engine Coolant Temperature Warning Light

If engine coolant overheats, this light will turn "ON," an alarm will sound, and the engine speed will be automatically reduced, until coolant temperature drops. Do not turn engine "OFF" because this will cause coolant temperature to rise and may cause engine to siege because of heat surge.

NOTE: *Check the engine coolant temperature gauge. If the gauge pointer moves into the red zone, the engine coolant temperature warning light will turn "ON," a warning buzzer will sound, and the engine speed will be automatically reduced. Allow the engine to run at low idle speed until temperature gauge registers in the blue zone again. When the blue 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.*

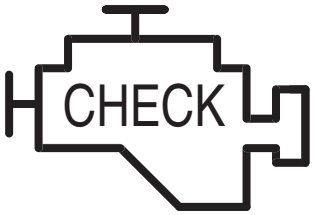
When the temperature reaches the normal range, the engine speed will automatically recover.



HAOD350L

Figure 44

10. Engine Check Warning Light (Not Used)



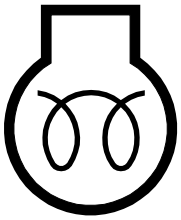
FG000045

Figure 45

11. Preheating Indicator Light

In cold weather this light indicates that the engine preheat function is operating.

When this indicator light turns "OFF," it means that engine preheat cycle has been completed.

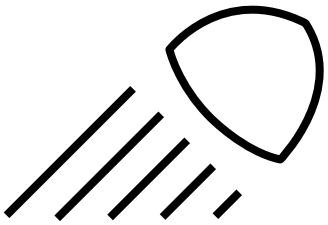


HAAE2000

Figure 46

12. Work Light Indicator Light

The indicator light indicates that the work lights are turned "ON."



HB4O2003

Figure 47

MULTIFUNCTION GAUGE AND GRAPHIC INFORMATION

When the engine starter switch is turned to the "I" (ON) position, a LOGO will appear on the display screen for about two seconds.

When the LOGO disappears, the multifunction gauge and graphic information screen will appear.

The engine rpm is normally displayed at the bottom of the screen when the starter switch is first turned "ON." Each time the display selector button (19, Figure 35) is pressed, the digital readout changes in the following sequence; Engine speed (RPM) -> Battery voltage (VOLT) -> Front pump pressure (BAR) -> Rear pump pressure (BAR).

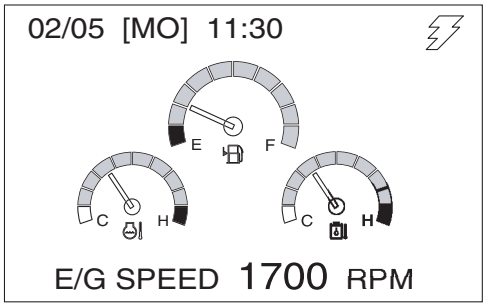
NOTE: *See Figure 51 thru Figure 54.*

A digital clock is located at the top of the display.

By using a combination of the mode selector buttons, information for filters and oils can also be displayed.

The display can also be set for the desired language.

Refer to the “Setting Main Menu” on page 2-32 for the language selection and information display sequences.



FG000043

Figure 48

Communication Indicator

Indicates the condition of communication between main controller and instrument panel.

1. Normal Condition:

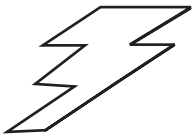
   The symbol will sequentially move like lightening.

   NOTE: *See Figure 51 thru Figure 54.*

2. Abnormal Condition:

   If the symbol is not displayed, it means there is a communication error.

   NOTE: *See Figure 50.*



FG000047

Figure 49

Communication Error Warning

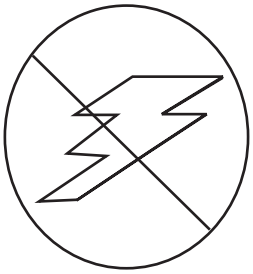
If a communication error is generated between e-EPOS controller and instrument panel, this symbol will be displayed.

When this symbol is displayed, contact a DOOSAN distributor or sales agency.

NOTE: *If a communication error occurs during operation, the last mode setting is stored. e.g. power mode, work mode and auto idle are stored during failure.*

NOTE: *When starter switch is turned to the "I" (ON) position during a state of communication error failure, the e-EPOS controller will default to the following modes.*

Power mode: Standard mode
Working mode: Digging mode
Auto idle: "ON" (Selection state)



FG000048

Figure 50

Engine Speed

The engine speed is numerically displayed.

FG000049

Figure 51

Battery Voltage

The battery voltage is numerically displayed. With the engine running, the reading should be between 26V - 30V.

When the starter is engaged or the preheat system is being used, the voltage can temporarily drop below 24V, but this is a normal condition.

FG000050

Figure 52

Front Hydraulic Pump Pressure

The front pump pressure is numerically displayed.

NOTE: *This pump is closest to engine flywheel housing or is the upper one of hydraulic pump.*

It displays the reading in BARs.

FG000051

Figure 53

Rear Hydraulic Pump Pressure

The rear pump pressure is numerically displayed.

NOTE: *This pump is the farthest from engine flywheel housing or is the lower one of hydraulic pump.*

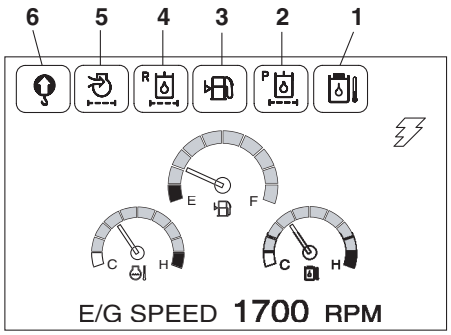
It displays the reading in BARs.

FG000052

Figure 54

Abnormal State Warning Symbols

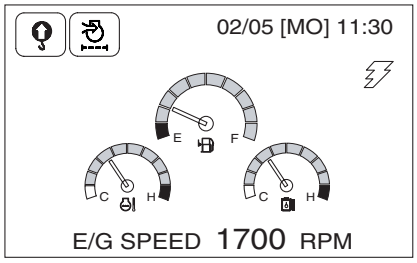
1. Hydraulic Oil Overheating Warning
2. Pilot Filter Clogged Warning
3. Fuel Shortage Warning
4. Return Filter Clogged Warning
5. Air Cleaner Clogged Warning
6. Overload Warning (Optional)



FG001088

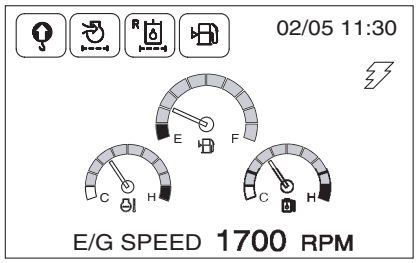
Figure 55

Examples of Warning Display



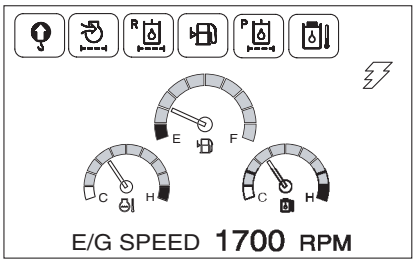
FG000059

<2 kinds of warning display>



FG000060

<4 kinds of warning display>



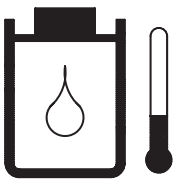
FG000061

<6 kinds of warning display>

Figure 56

1. Hydraulic Oil Overheat Warning

If the hydraulic oil temperature is too high, this symbol appears on the screen.



FG000056

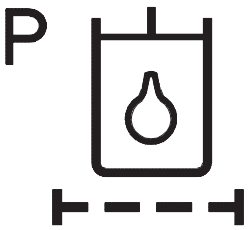
Figure 57

2. Pilot Filter Clogged Warning

This symbol indicates when the pilot filter clogged.

If this symbol is displayed, immediately stop operation and replace the pilot filter.

After the pilot filter has been serviced, restart machine operation to remove the warning symbol.



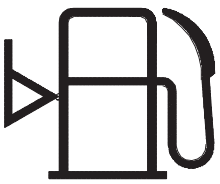
FG000055

Figure 58

3. Fuel Shortage Warning

If the fuel quantity is too low, this symbol appears on the screen.

If this light turns "ON," add fuel as soon as possible.



FG000057

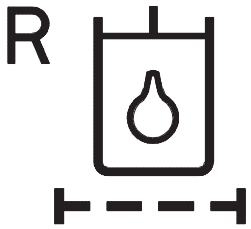
Figure 59

4. Return Filter Clogged Warning

This symbol indicates when the hydraulic return filter is clogged.

If this symbol is displayed, immediately stop operation and replace the return filter.

After the return filter has been serviced, restart machine operation to remove the warning symbol.



FG000054

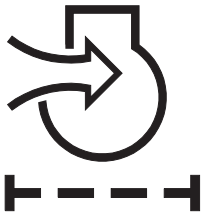
Figure 60

5. Air Cleaner Clogged Warning

This symbol indicates when the air cleaner is clogged.

If this symbol is displayed, immediately stop operation and replace or clean the air filter.

After the air filter has been serviced, restart machine operation to remove the warning symbol.



FG000053

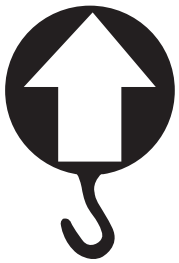
Figure 61

6. Overload Warning (Optional)

If the overload warning switch is turned "ON," and this symbol appears on the screen and the warning buzzer sounds, that indicates that overloaded condition is occurring. Immediately reduce the load.

WARNING

If this warning appears on the screen and a warning buzzer sound, reduce the load immediately.
If you continue to work, the machine can be turned over or damage to hydraulic components and structural parts could occur.



FG000253

Figure 62

MODE SELECTOR BUTTONS

1. Power Mode Selector Button
2. Auto Idle Selector Button
3. Flow Control Button

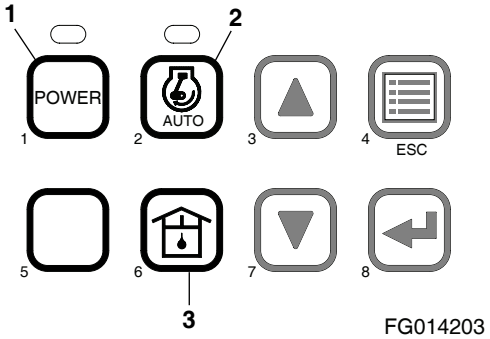


Figure 63

1. Power Mode Selector Button

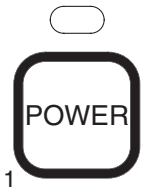
This power mode is suitable for heavy-duty work that requires a high operating speed. Push this button to turn power mode "ON" or "OFF."

When the power mode button is pushed to the "ON" position, an indicator light above it turns "ON."

When the power mode button is pushed again, it is turned "OFF" and the power mode is deactivated and returns to the standard operating mode.

When turning the engine starter switch to the "I" (ON) position, the power mode is automatically defaulted to "Standard Mode."

NOTE: *For further details, see “Mode Selection” on page 3-22.*



FG000063

Figure 64

2. Auto Idle Selector Button

When the auto idle system is activated, the engine will automatically reduce speed to "IDLE" approximately four seconds after all of the control levers are in the neutral position. This system is designed to reduce fuel consumption and noise.

When the auto idle selector button is pushed to the "ON" position, an indicator light above it turns "ON."

When the auto idle selector button is pushed again, it is turned "OFF" and the engine speed will return to the setting of the engine speed dial and will remain at this speed despite control lever position, until engine speed dial is moved.

FG000065

Figure 65

3. Flow Control Button

When the button is pushed, you can control the hydraulic oil flow rate.

The flow control button is used to set the flow rate of pump to match the installed tool/attachment for optimal performance, without damaging it.

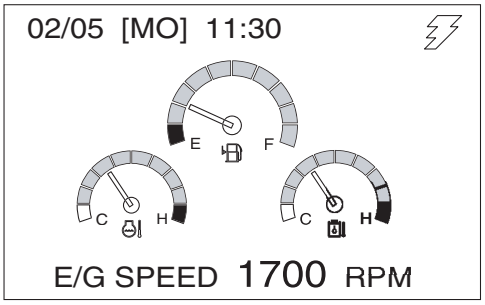
NOTE: *For further details, see “Flow Control” on page 2-41.*

FG000066

Figure 66

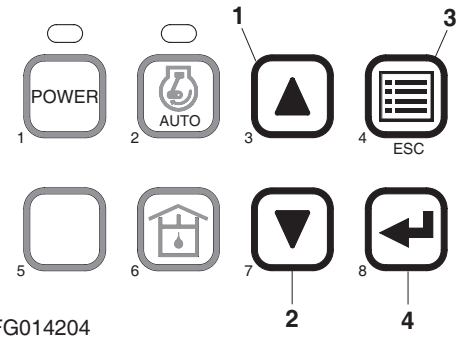
SETTING MAIN MENU

By using a combination of the selector buttons (Figure 68), you can review and set the contents of the display screen. Items such as language, time and filter/oil information can be checked, and if necessary, set with new information.



FG000043

Figure 67



FG014204

Figure 68

1. Up Arrow Button

Up arrow button (▲), is used to move a menu item "Up" or to the "Left."

FG000068

Figure 69

2. Down Arrow Button

Down arrow button (▼), is used to move a menu item "Down" or to the "Right."

FG000069

Figure 70

3. Display Selector Button (ESC - Escape)

Display selector button ( ), is used to change the displayed information on the screen. Each time the display selector button is pressed, the digital readout changes.

NOTE: *When setting the main menu, this button is used as the menu / exit button (ESC). To access the menus the button must be pressed and held for three* seconds*.*

NOTE: *When this button is used for menu / exit button, it is used to access to main menu or return to a previous screen from each submenu.*

FG000070

Figure 71

4. Selection Button

Selection button ( ), is used to set a menu or clear the operating hour of filter/oil.

FG000071

Figure 72

Display Selection and Escaping

Display Selection

When the display button (Figure 73) is pressed for more than three seconds, the main menu screen (Figure 75) is displayed.

In the normal display screen, the engine speed (rpm), battery voltage (volt), front pump pressure (bar), and rear pump pressure (bar) can be displayed.

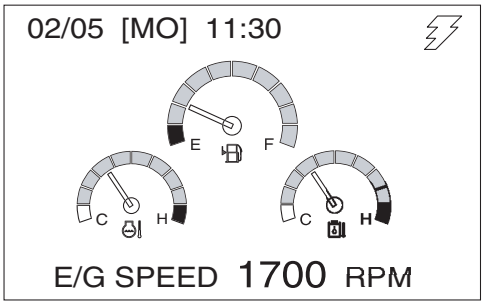
FG000070

Figure 73

ESC Button

The screen will return from the main menu to the normal display screen, by again pressing the "ESC" ( ) button.

NOTE: *If more than twenty seconds are spent in any menu, without changing the screen, it will return to the normal display screen.*



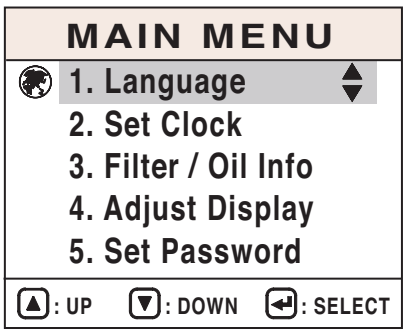
FG000043

Figure 74

Main Menu

The menu selection can be changed by pressing the "UP" (▲) or "DOWN" (▼) buttons. The selected menu item will be highlighted, and a cursor will appear by the menu item.

When the selected menu item is highlighted, press the "SELECT" (↵) button to enter the next submenu.



FG000072

Figure 75

1. “Language” on page 2-35.
2. “Set Clock” on page 2-35.
3. “Filter / Oil Info” on page 2-36.
4. “Adjust Display” on page 2-38
5. “Set Password (Lock and Unlock)” on page 2-39

Language

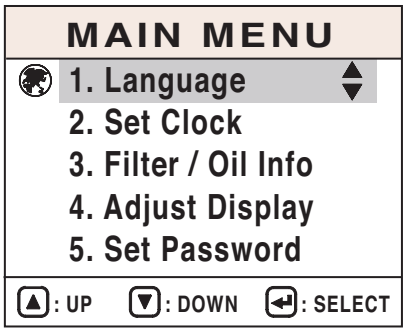
When the cursor is on "Language," press the "SELECT" (↵) button. The language submenu will appear.

The desired language can be selected by using the "UP" (▲) or "DOWN"(▼) buttons.

The display can be set for the desired language.

Press the "SELECT" (↵) button to set the selected language.

NOTE: *If more than twenty seconds are spent in the menu, without changing the screen, it will return to the normal display screen.*



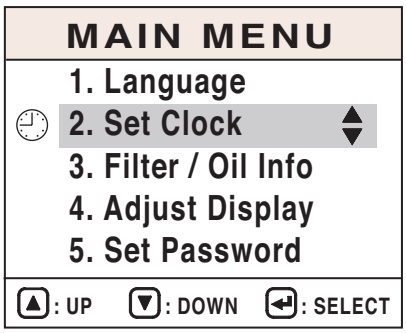
FG000072

Figure 76

Set Clock

When the cursor is on "Set Clock," press the "SELECT" (↵) button. The set clock submenu will appear.

NOTE: *If more than twenty seconds are spent in the menu, without changing the screen, it will return to the normal display screen.*

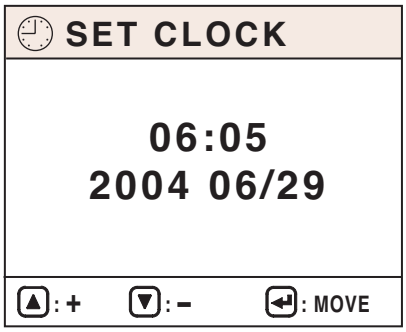


FG000075

Figure 77

Setting Method

1. Move the cursor to desired number by using the "SELECT" (↵) button. When selected the number will flash.
2. Set the time by using the "UP" (▲) or "DOWN"(▼) buttons.
   - "+" (▲), "-" (▼): Increase or decrease number.
   - "MOVE" (↵): Confirm and move the cursor to next number.
   - "ESC" ( ): Exit to the main menu.

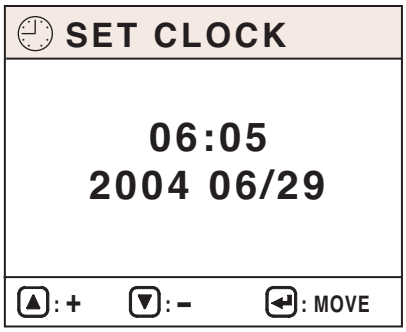


FG000076

Figure 78

'00' Minute Setting

1. Simultaneously press the "SELECT" (↵) button and "UP" (▲) button.
2. If the displayed time is 30 minutes or less, the clock will display the preceding hour.
3. If the displayed time is more than 30 minutes, the clock will display the succeeding hour.
4. When the preceding hour is more than 23, the day will be increased.

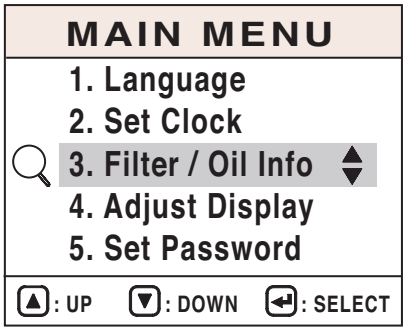


FG000076

Figure 79

Filter / Oil Info

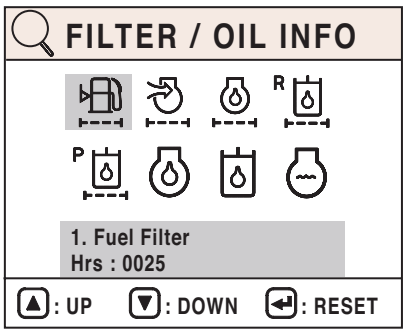
When the cursor is on "Filter/Oil Info," press the "SELECT" (↵) button. The filter/oil information submenu will appear.



FG000077

Figure 80

Each symbol can be selected by pressing the "UP" (▲) or "DOWN" (▼) buttons. At the bottom of the screen the operating hour (Hrs) of each filter and/or oil is displayed.



FG000078

Figure 81

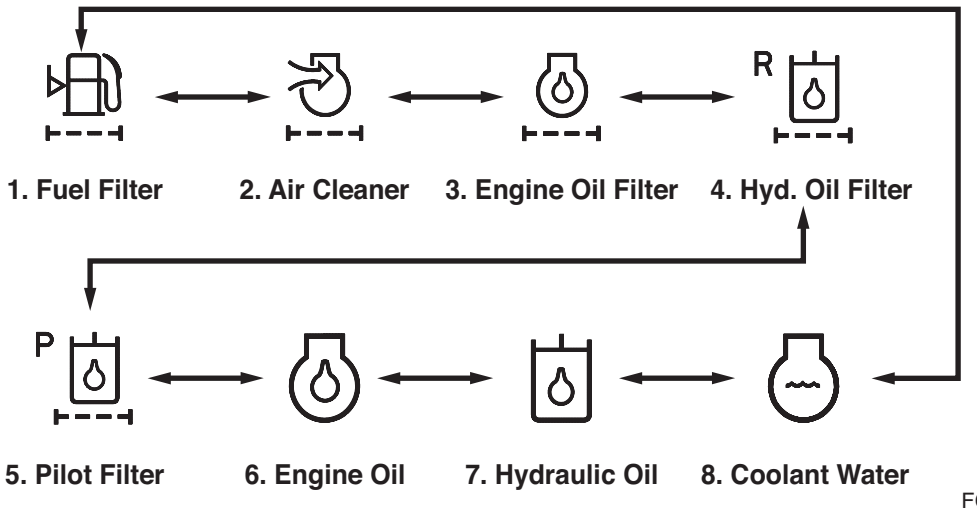


Figure 82

Filter / Oils Operating Hour Reset

After changing a filter or oil, reset the operating hour to zero (Hrs: 0000). The next replacement period can than be easily checked. The operating hours are only accumulated while the engine is running.

On the filter / oil information screen, press the "SELECT" (↵) button and then the reset screen will be displayed.

On the reset screen, the operating hour can be changed to zero hour (Hrs: 0000) by pressing the "SELECT" (↵).

If the "SELECT" (↵) button is pressed, the reset will be completed. and the screen will be returned to the previous menu.

If the "ESC" ( ) button is pressed, the screen will be returned to the previous menu without being reset.

NOTE: *If more than twenty seconds are spent in the menu, without changing the screen, it will return to the normal display screen.*

The screen is returned to the main menu by pressing the "ESC" ( ) button.

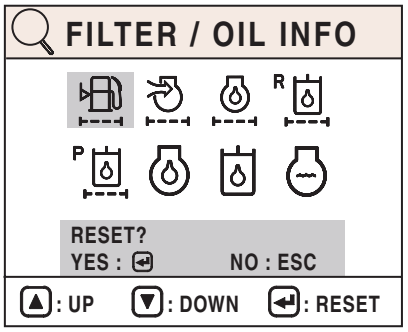
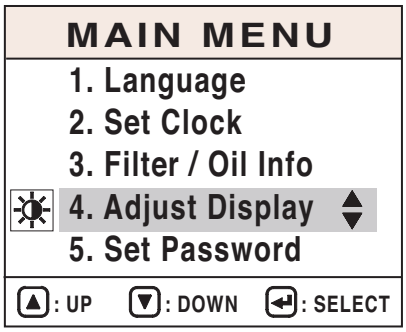


Figure 83

Adjust Display

When the cursor is on "Adjust Display," press the "SELECT" (↵) button. The adjust display submenu will appear.



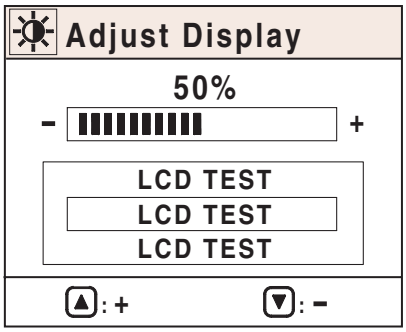
FG000080

Figure 84

The desired brightness adjustment can be selected by using "UP" (▲) or "DOWN" (▼) buttons.

NOTE: *When the equipment shipped, the default brightness is set to 50%.*

The screen is returned to the main menu by pressing the "ESC" ( ) button. The display is then saved.



FG000081

Figure 85

Set Password (Lock and Unlock)

Use extreme care when setting the password for starting the engine. If a mistake is made when entering the number, and the number is excepted by the system, as being correct, that number will be the only one that will allow the security system to be activated or deactivated.

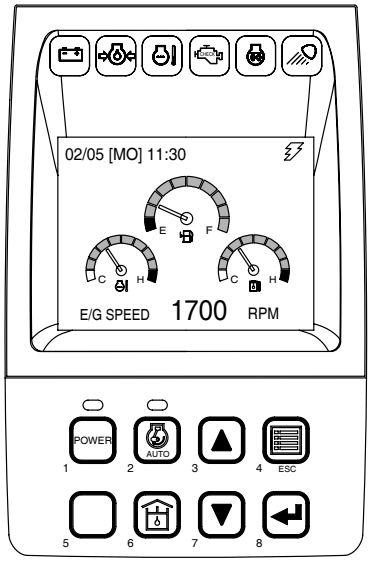
Write your password down and keep it in a safe location.

Password numbers can only use numbers between 1 and 8. The small number to the lower left of each button on the instrument panel, indicates the number that will be entered when that button is pressed. Numbers "0" and "9" are invalid choices.

Example:

2785 is acceptable.

9024 is not acceptable.

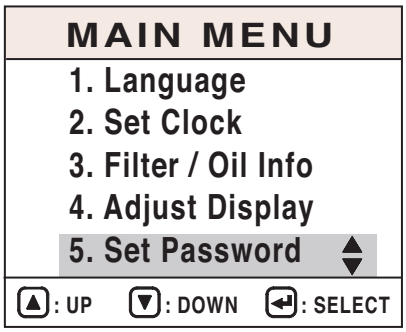


FG014205

Figure 86

When the cursor is on "Set Password" press the "SELECT" (↵) button. The set password submenu will appear.

NOTE: *The screen can be returned to the main menu by pressing the "ESC"( ) button (3, Figure 68).*



FG000227

Figure 87

Password inquiry menu will be displayed.

NOTE: *The initial password is "1111."*

The password can be changed within ten minutes while the starter switch is in "I" (ON) position.

After changing password, be sure to use the changed password.

FG000228

Figure 88

CAUTION

Failure to enter correct password three times, will return normal display screen, and another attempt will not be possible for ten minutes.

A three item menu will be displayed. The items are "LOCK," "UNLOCK," and "CHANGE PASSWORD." An item can be selected by using the "UP" (▲) or "DOWN" (▼) buttons, and then selected by pressing the "SELECT" (↵) button.

Press "ESC" ( ) button (3, Figure 68) for 1 more second, it returns to main menu.

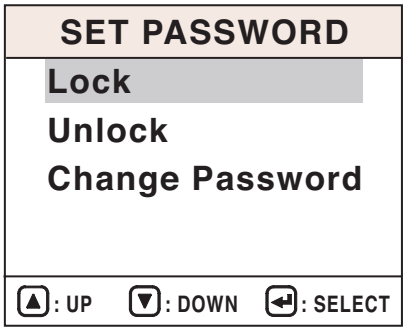
According to the selection of adoption (lock) or nonadoption (unlock), the password function will be in working or nonworking.

When you want to change a password, follow below procedure.

1. Move the cursor to "Change Password."
2. Input desired 4 digits password using selector buttons (at the first column). Input the same password one more time (at the second column)
3. Select adoption (lock) or nonadoption (unlock) at set password menu.

   NOTE: *Keep in mind never to forget password.*

   NOTE: *Please contact a DOOSAN distributor, if you forget your password.*

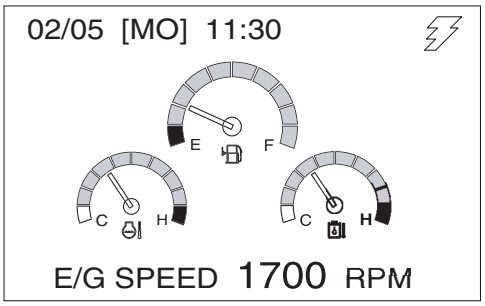


FG000229

Figure 89

FLOW CONTROL

The flow control is used to set the proper flow rate for an optional attachment (If equipped). The flow control screen is accessed directly from the normal display screen without going through the main menu or any submenus.



FG000043

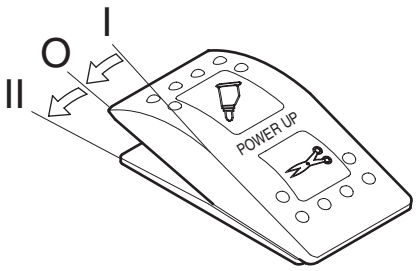
Figure 90

When the flow control button (Figure 66 and Figure 91) is pressed at the normal display screen (Figure 90), the flow control screen (Figure 93) will be displayed.

FG000066

Figure 91

Select a tool by using the breaker / boost / shear selector switch. The symbol in the upper left corner of the display screen will change according to the position that the selector switch is in. Compare the symbols shown in (Figure 93 and Figure 94).



FG000025

Figure 92

Adjusting Flow Rate

Use "UP" (▲) or "DOWN" (▼) buttons to adjust flow rate.

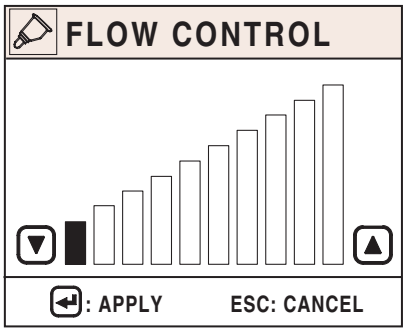
"UP" (▲) button is used to increase a flow rate.

"DOWN" (▼) button is used to decrease a flow rate.

Flow Control Step	Pump Flow Setting (l/min)
0	40
1	60
2	80
3	100
4	120
5	140
6	160
7	180
8	200
9	220
10	239

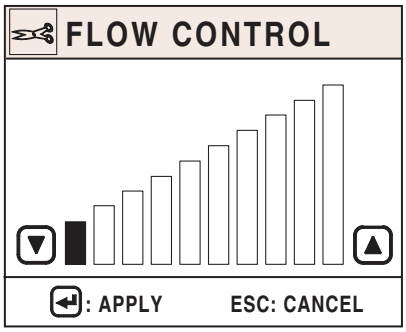
Pump flow setting is at rated engine speed, for only the output of one pump.

Pump displacement will vary according to changes in engine rpm.



FG000254

Figure 93 Breaker



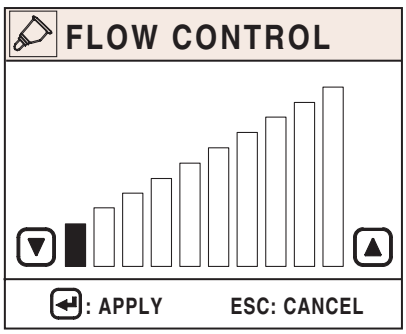
FG000255

Figure 94 Shear

Escape

A. Press flow control button (, Figure 91) to return to normal display screen and save the flow rate setting.

B. If there is no adjustment for twenty seconds, the flow control screen will return to the normal display screen.



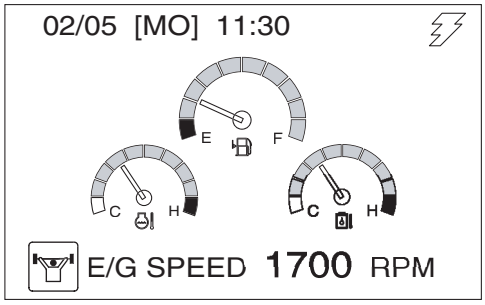
FG000254

Figure 95

OPERATION SELECTION DISPLAY

In the monitor you can see the application that is currently selected.

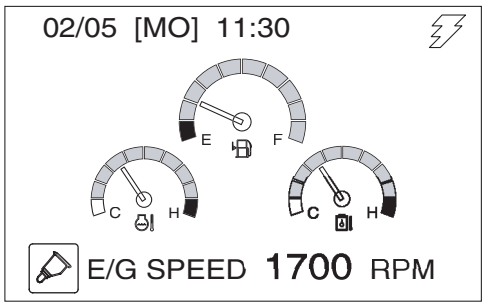
Power Boost Selection



FG000257

Figure 96

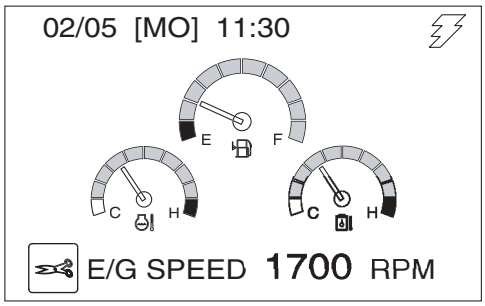
Breaker Selection



FG000258

Figure 97

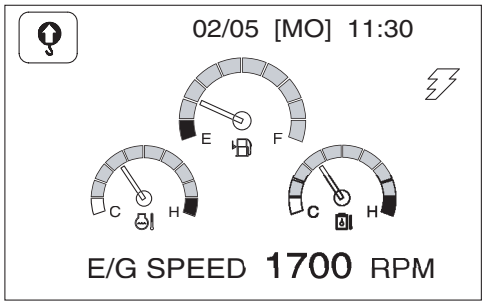
Shear Selection



FG000259

Figure 98

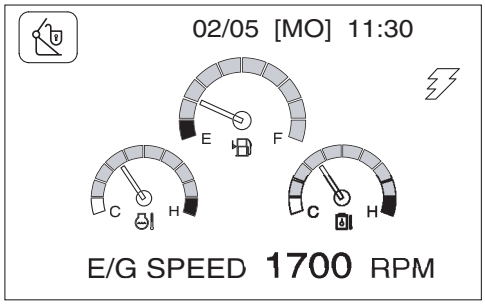
Overload Alarm Selection (Optional)



FG000260

Figure 99

Quick Clamp Operation Selection (Optional)

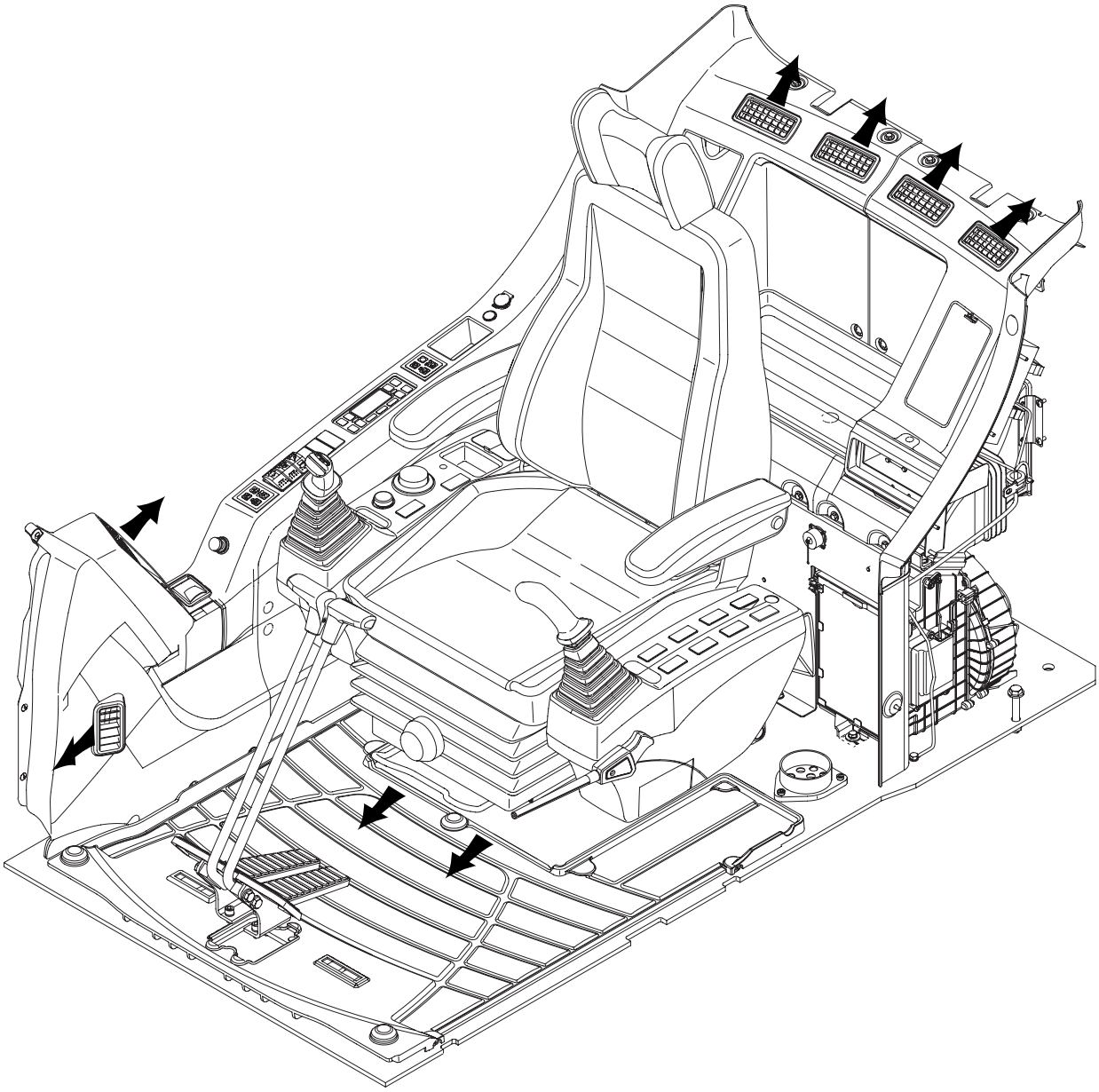


FG000388

Figure 100

HEATER AND AIR CONDITIONER CONTROL PANEL

Location of Controls and Vents

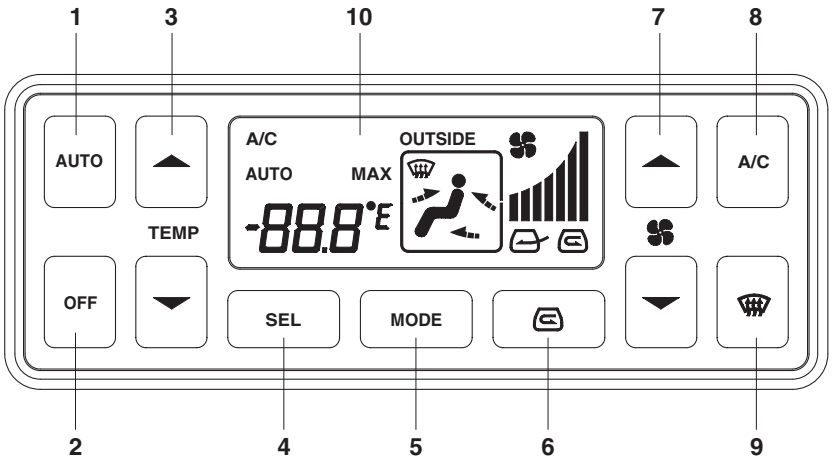


FG000288

Figure 101

The heater and air conditioner are combined into one unit in the rear cover behind the operator's seat.

The operator can control cabin temperature using the control panel installed in the switch panel.



FG000086

Figure 102

Reference Number	Description
1	Automatic Temperature Control Button
2	Off Button
3	Temperature Control Button
4	Temperature Unit Selector Button
5	Air Outlet Selector Button

Reference Number	Description
6	Air Inlet Selector Button
7	Fan Speed Selector Button
8	Air Conditioner Button
9	Defroster Button
10	LCD Display

NOTE: *When the light switch is turned to "I" or "II" position, the LED for illuminating in the control panel will turn "ON."*

1. Automatic Temperature Control Button

This button is used to control the temperature level in the cabin, according to the temperature setting of the operating panel.

When the automatic temperature control function is activated, the word "AUTO" will be displayed in the upper left of LCD display.

When the system is in "AUTO" mode, specifications can be manually changed by pushing another button.

If a function is manually changed, the word "AUTO" does not appear in the LCD display, but the unchanged functions will remain in "AUTO" mode.

FG000088

Figure 103

2. Off Button

This button is used to stop the fan and air conditioner.

FG000089

Figure 104

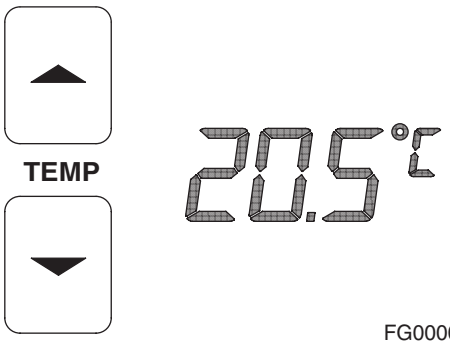
3. Temperature Control Button

These buttons are used to control the cabin temperature.

Temperature is adjustable from 17°C (62°F) to 32°C (90°F) by 0.5°C (1°F) increments.

Temperature setting is displayed on the LCD.

When the system is turned "ON," the previously set temperature is used as a starting point.



FG000090

Figure 105

4. Temperature Unit Selector Button

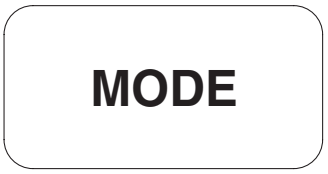
This button gives the choice to select either °C or °F.

FG000094

Figure 106

5. Mode Selector Button

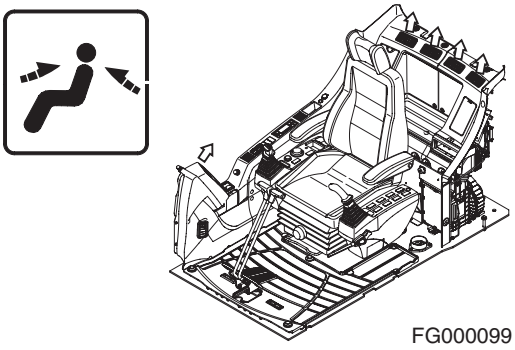
This button is used to select which combination air outlets will be used.



FG000096

Figure 107

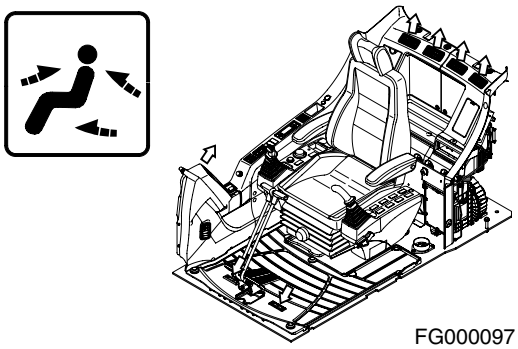
A. Used to direct air flow to upper portion of operator's cabin from both the front and rear.



FG000099

Figure 108

B. Used to direct air flow to upper portion of operator's cabin from both the front and rear. It will also deliver air to the lower portion of operator's cabin from under the operator's seat.

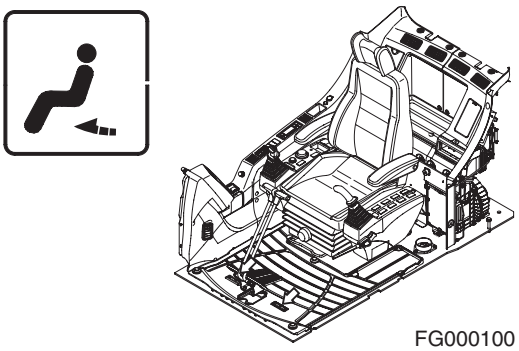


FG000097

Figure 109

C. Used to direct air flow to lower portion of operator's cabin and feet.

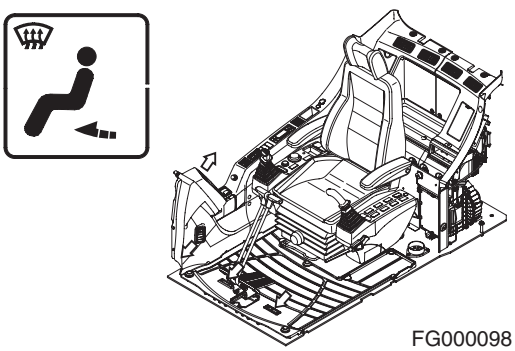
This mode is mainly used for heating.



FG000100

Figure 110

D. Used to direct air flow to the front window and to operator's feet.



FG000098

Figure 111

6. Air Inlet Selector Button

This button is used to select fresh air from outside the cabin, or recirculate air within the cabin.

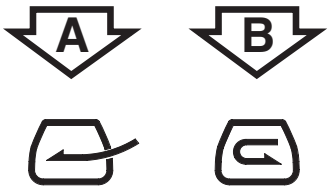
Pressing this switch enables the choice between fresh air and recirculating air within the operator's cabin. The select mode is displayed on the LCD.

FG000101

Figure 112

A. "A" Symbol - Draws fresh air into operator's cabin. Used to exchange air within the operator's cabin with fresh air. Used to remove condensation or ice on window (Winter / Rainy Season).

B. "B" Symbol - Recirculates air within the operator's cabin. Used to quickly warm or cool the operator's cabin.



FG000102

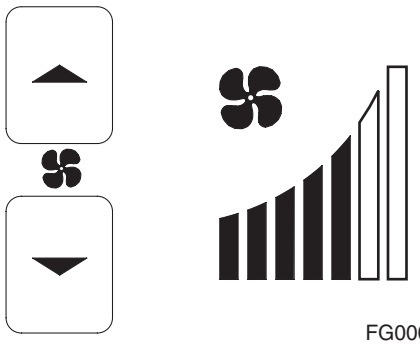
Figure 113

7. Fan Speed Selector Buttons

These buttons are used to control the speed of the blower fan.

Momentarily, pressing a button, changes the speed one stage.

Continuously pressing and holding a button, repeatedly changes the speed.



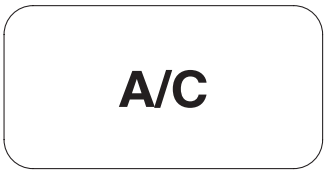
FG000103

Figure 114

8. Air Conditioner Button

This button is used to turn the air conditioner "ON" or "OFF."

When this function is activated, an "A/C" is displayed in the upper left corner of the LCD.

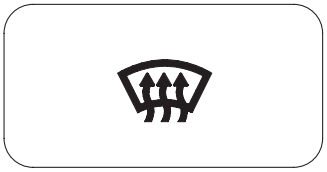


FG000105

Figure 115

9. Defroster Button

Used to direct air flow to front window.

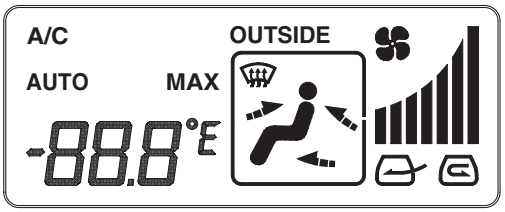


FG000106

Figure 116

10. LCD Display

This display shows the current setting.



FG000107

Figure 117

Memory Function

The air conditioner panel has a memory function. When the starter switch is turned "OFF" the settings for the panel, will be stored. When the excavator is started, the last stored setting will be used.

Additional Operating Instructions

A proper indoor temperature in summer is 5 - 6°C (10 - 12°F) less than the outdoor temperature.

Operate the air conditioner for twenty - thirty minutes a week to circulate the refrigerant in the system.

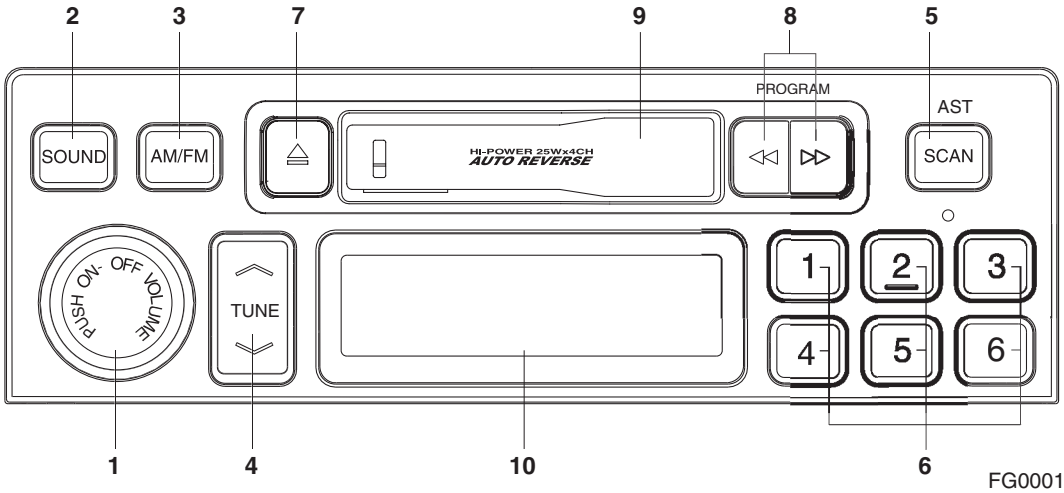
NOTE: *The blower button should be on "Three Bars."*

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

STEREO

Before operating the stereo or CD player, read operation manual enclosed with stereo.

Stereo



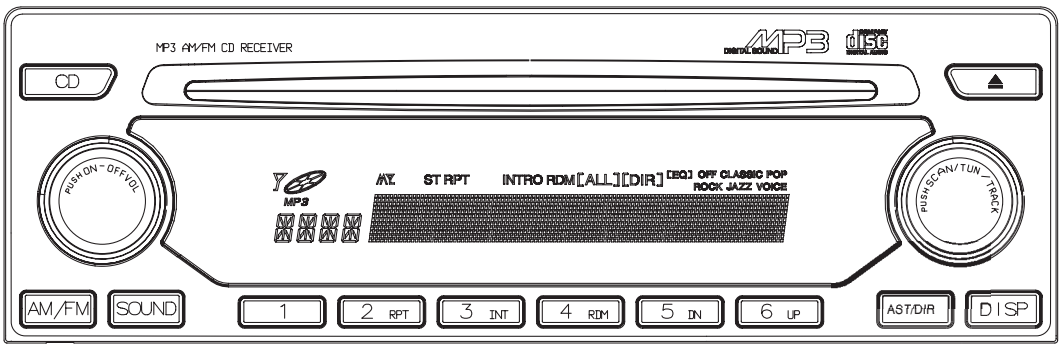
FG000108

Figure 118

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

Reference Number	Description
6	Preset Station
7	Tape Ejection
8	Fast Forward / Rewind
9	Tape Loading Slot
10	LCD

CD Player (Optional)



FG000109

Figure 119

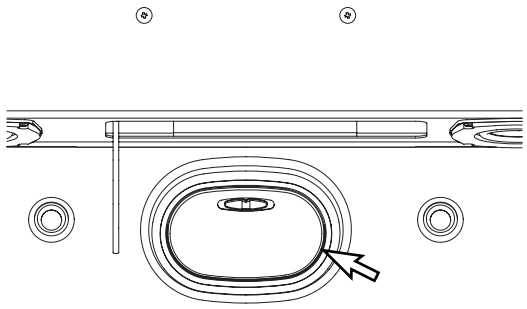
MISCELLANEOUS ELECTRICAL DEVICES

Cabin Light

A light is installed 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.*

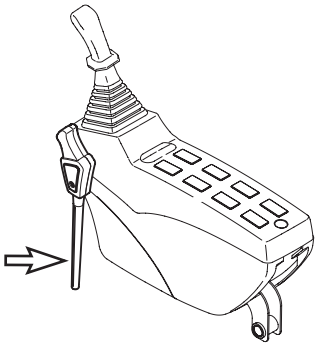


FG000417

Figure 120

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.



FG000211

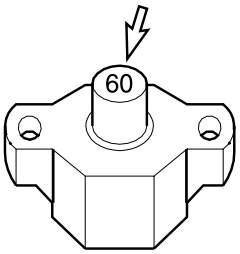
Figure 121

Circuit Breaker

A main circuit breaker is in the battery box. It will automatically cut off in case of an electrical short circuit or overload. This will prevent the electrical wiring and components from being burned or damaged.

If the circuit breaker is cut off, check all related circuits, this means something is wrong in the electrical circuit.

After maintenance, press the red button for normal operation of circuit breaker.



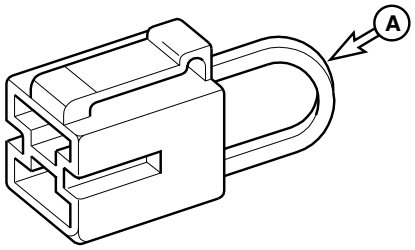
HAAE2110

Figure 122

Fusible Link

A fusible link is in the battery box.

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 123) of the fusible link is not broken or burned through. Replace the fusible link if damage and investigate cause.



HAAE2120

Figure 123

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.

Fuse Boxes

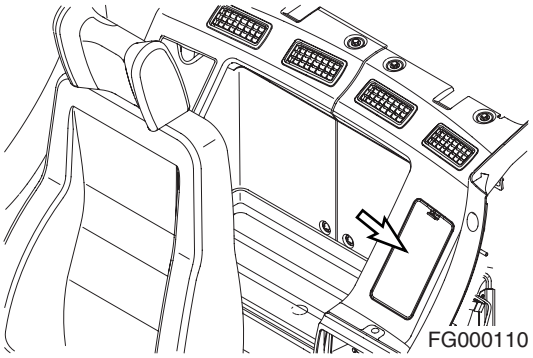
There are two fuse boxes (Figure 124) on the left side of the heater box. The fuses prevent electrical devices from overloading or shorting.

A decal attached inside the fuse box access cover indicates the function and amperage of each fuse.

NOTE: *For a further explanation see "Fuse Boxes" on page 4-69.*

Spare fuses are mounted on the inside of fuse box access cover.

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



FG000110

Figure 124

CAUTION

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

SEAT ADJUSTMENT

WARNING

Adjust the seat position before starting operations or after changing the operator.

Always fasten your seat belt while operating machine.

Adjust the seat so that the control levers and pedals can be operated freely and easily with the operator back against the backrest.

1. Forward / Backward Adjustment

Holding lever (1, Figure 125), raise it up, move the seat to the desired position. Release lever to lock the seat in the selected position. Adjustment range is 200 mm (7.9 in).

2. Seat Tilt and Height Adjustment

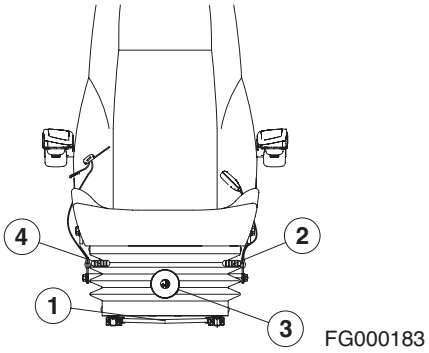


Figure 125

Forward Tilt

Push lever (2, Figure 125) down to adjust the angle of the front of the seat. There are four positions that it can be set at.

Rear Tilt

Pull lever (2, Figure 125) up to adjust the angle of the rear of the seat. There are four positions that it can be set at.

Seat Height

It is possible to move the seat up or down by combining adjustments forward and rear tilt. Adjust the seat according to operator's size and work conditions. Height adjustment is 60 mm (2.4 in).

3. Suspension Adjustment

Turning knob (3, Figure 125) to right makes the suspension harder. Turning knob to left makes the suspension softer. Adjust according to operator's weight by checking the weight indicator dial. Adjustment range is from 50 - 120 kg (110 - 265 lb).

4. Reclining Position Adjustment

Pulling up the right lever (4,Figure 125) allows the seat backrest to be moved forward or backward.

Sit with your back against the seat back when adjusting it. If your back is not touching the seat back, the seat back may suddenly move forward.

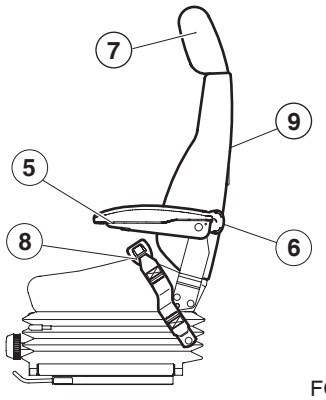
5. Armrest Angle Adjustment

The angle of each armrest can be adjusted by turning a dial (5, Figure 126) on bottom of armrest. When adjusting the angle, manually raise the armrest before turning the dial.

6. Lumbar Support Adjustment

A lumbar support is located in the seat back.

Turn the dial (6, Figure 126) counterclockwise to increase the force of the lumbar support



FG000778

Figure 126

7. Headrest

The headrest (7, Figure 126) can be adjusted forward/ backward and up/down. Move it by holding both sides.

8. Seat Belt

WARNING

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

Under no circumstances should the operator be standing in the cabin when operating the excavator.

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

Always, check the 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 127) into the buckle (2). Pull belt to check that belt end is locked into buckle.

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

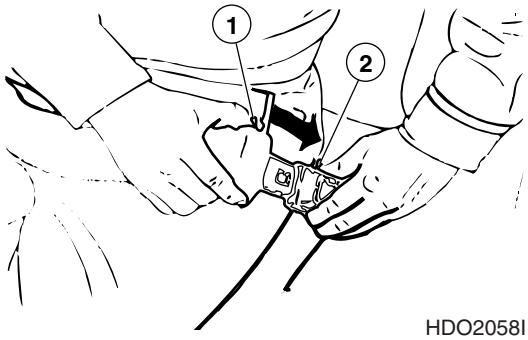


Figure 127

Press button (3, Figure 128) in center of buckle (2) and pull out belt (1) to unlock.

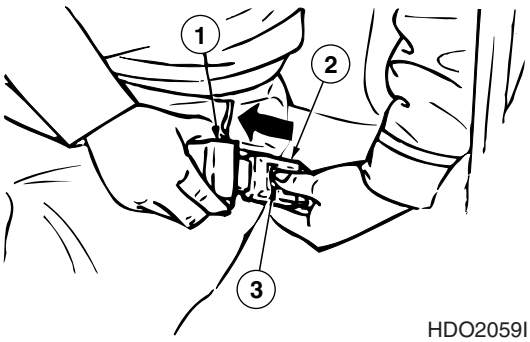


Figure 128

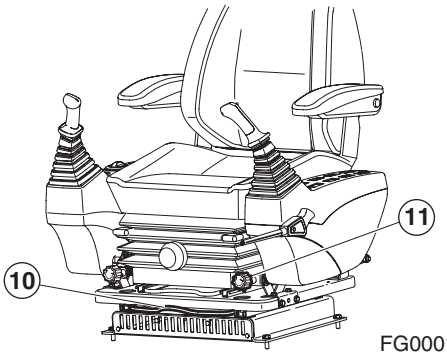
9. Seat Back-pocket

The seat has a seat back pocket. It is used for storing the Operation And Maintenance Manual.

10. Left and Right Control Stand Adjustment

For operator's convenience, the right and left control stands and seat can slide together, within a 160 mm (6.3 in) forward or backward travel distance.

Holding lever (10, Figure 129), raise it up, set the seat to desired position. Release lever to lock seat in the selected position.



FG000185

Figure 129

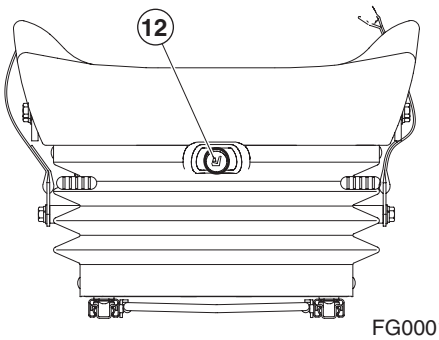
11. Left and Right Control Stand Height Adjustment

The left and right dials (11, Figure 129) at the lower part of the seat can be turned to adjust the elevation height of each control stand.

It can be used to adjust the height of the control joystick.

12. Air Suspension Seat (Optional)

The operator seat is also available with air suspension for even better comfort. The switch (12, Figure 130) in the middle of the seat can be used to adjust the air cushion. If the switch is pressed, the seat become harder, and pulling it out makes the seat softer, when the air is bleed out.

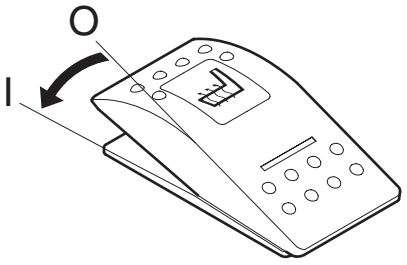


FG000187

Figure 130

13. Heating the Operator's Seat (Optional)

The air suspension seat can be heated. The switch on the left control stand is used to warm the seat. When heating is not needed or seat is warmed, turn the switch to "OFF" position.

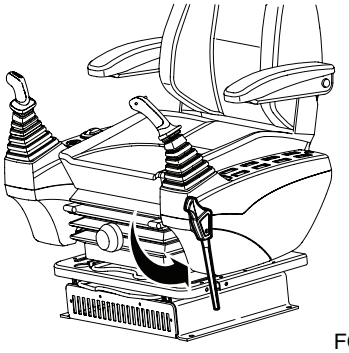


FG000034

Figure 131

CEILING COVER

NOTE: *If machine is equipped with the optional transparent ceiling cover never use any chemical cleaners on its surface. Only use warm water to wash dust and dirt from its surfaces, and after that, dry it with a soft fabric towel.*



FG000189

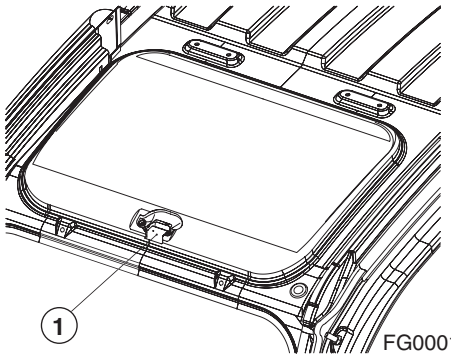
Figure 132

Opening the Ceiling Cover

1. Lower bucket to ground.
2. Set safety lever (Figure 132) on "LOCK."
3. Pull lock (1, Figure 133) in front center of ceiling cover and push it up with handle.

Closing the Ceiling Cover

1. Lower bucket to ground.
2. Set safety lever (Figure 132) on "LOCK."
3. Pull down cover with handle (Figure 133) so lock (1) can be locked into bracket in ceiling frame.



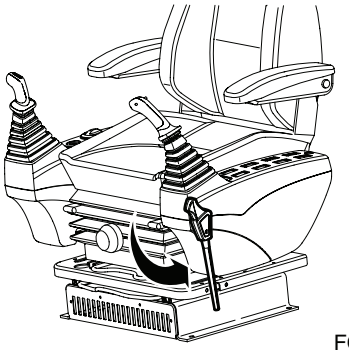
FG000190

Figure 133

FRONT WINDOWS

WARNING

When leaving operator's seat, set safety lever to "LOCK" position (Figure 134), if not a serious accident could occur by accidentally moving the work levers.



FG000189

Figure 134

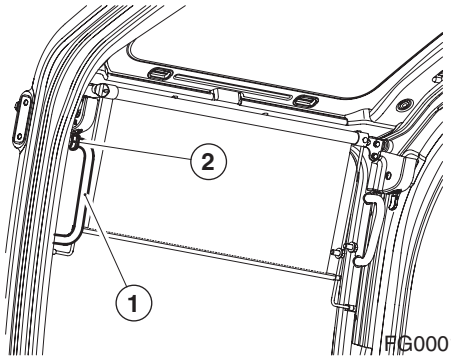
Front Upper Window

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 135) are latched.



FG000192

Figure 135

1. Lower bucket to ground.
2. Set safety lever (Figure 134) on "LOCK."
3. Set engine speed control dial to "LOW IDLE." Allow engine to idle for three - five minutes.
4. Shut down engine by turning key to "O" (OFF) position.
5. Hold window handles (1, Figure 135), then pull lock levers (2) to release lock. The top of front window will come out.
6. Pull window up, and push it against lock pin at the rear of the cabin. Make sure that it is securely latched.
7. Check that lock levers are securely latched in lock position.

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

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

WARNING

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

1. Lower bucket to ground.
2. Set safety lever (Figure 134) on "LOCK," and shut down engine.
3. Holding upper handles (1, Figure 136) of front window with left and right-hand, pull lock levers (2, Figure 136) to release the lock.
4. Push window forward, and lower it slowly.
5. When bottom of window, reaches the top of front bottom window, push front window to engage lock (2, Figure 135).
6. Check that lock levers are securely latched in lock position.

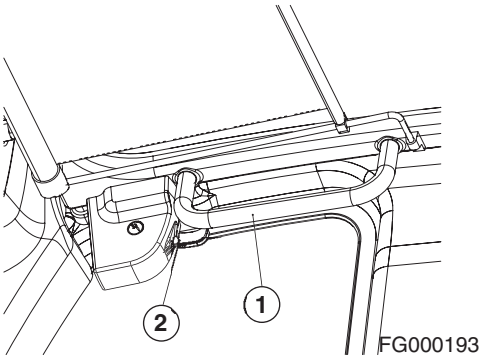


Figure 136

Front Bottom Window

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

1. After stowing the front upper window in the cabin ceiling, remove bottom window (1, Figure 137) from cabin in direction of the arrow.

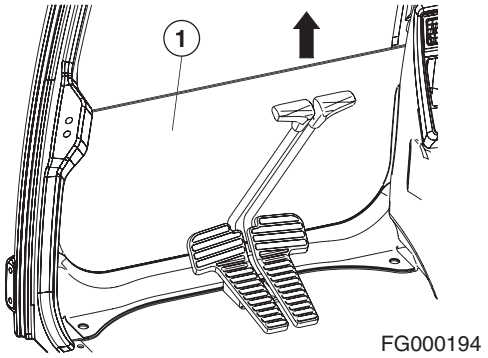


Figure 137

2. Set bottom window in rubber holders (2, Figure 138) behind operator's seat. Secure window with left and right knobs (3) with push button (4).

WARNING

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

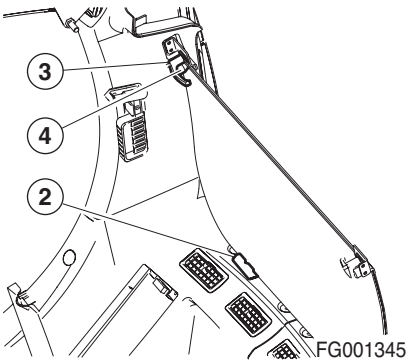


Figure 138

DOOR SIDE LATCH

1. The door side latch (1, Figure 139) is used to secured door to side of cabin when it is opened.

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

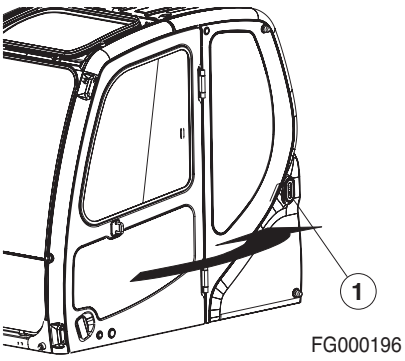


Figure 139

2. To release door from side of cabin, push latch lever (2, Figure 140) down. The latch lever is to the left of operator's seat.

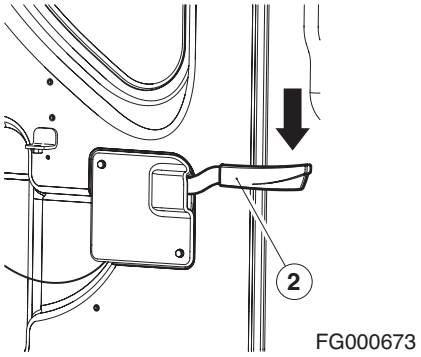


Figure 140

CABIN STORAGE COMPARTMENTS

There are two storage compartments behind the operator's seat.

The large compartment (1, Figure 141) is for storing nonperishable items.

The covered other one (2, Figure 141) is interconnected with the air conditioner. It can be supplied with either warm or cool air when air conditioner is turned "ON."

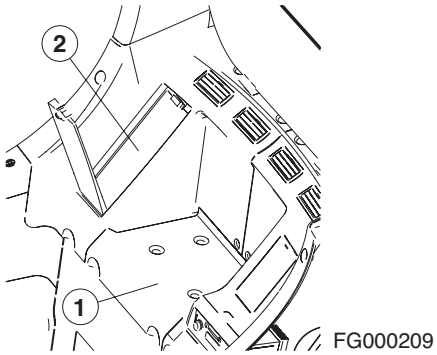


Figure 141

There is a separate small tray (3, Figure 142) on right side of operator's seat.

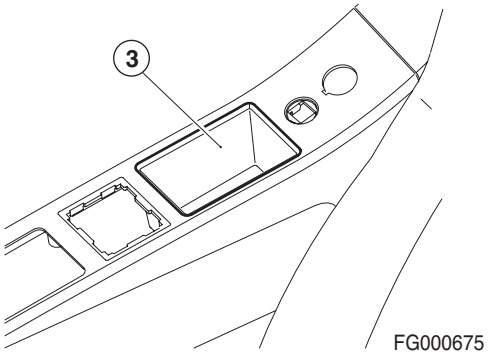


Figure 142

ASHTRAY

An ashtray (1, Figure 143) is to the right side of the operator's seat on side of cabin. Always close ashtray after putting out a cigarette.

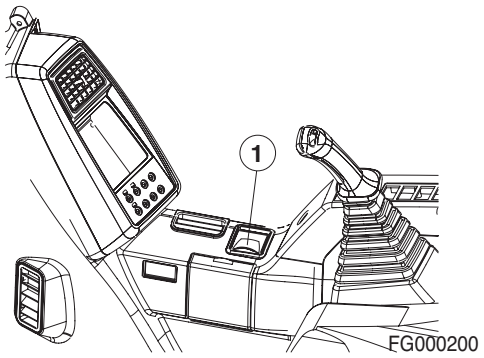


Figure 143

SUN VISOR

The sun visor can be used to reduce the amount of sunlight coming through the front window and ceiling.

When wanting to reduce the amount of sunlight coming in the front window, pull bar (1, Figure 144) down.

When not wanting protection, hold bar with left-hand and push release button (2, Figure 144) with right-hand. This will allow visor to retract.

NOTE: *Do not allow visor to roll back up without holding it. Not holding it may result in damage to the visor and retract mechanism.*

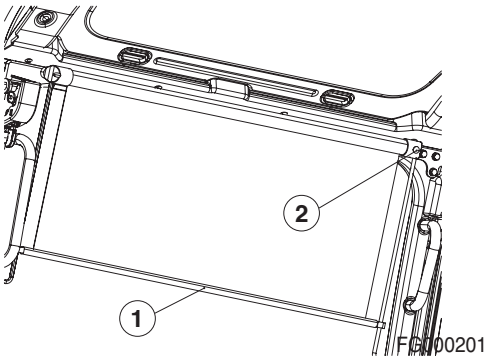


Figure 144

Ceiling sun visor (3, Figure 145) slides forward and backwards. Move it with handle (4) on each side.

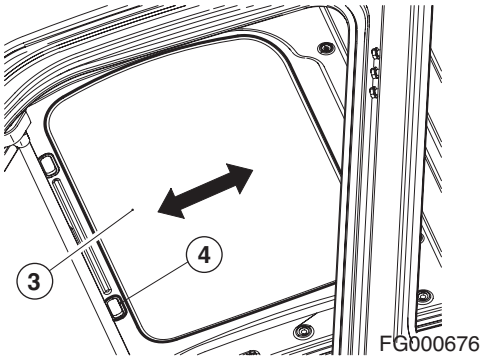


Figure 145

When opening the ceiling cover (if equipped), push the sun visor into its compartment (Figure 146).

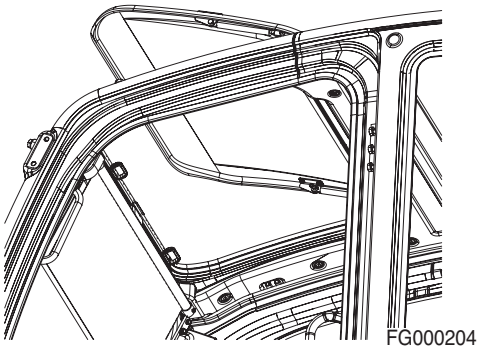


Figure 146

HANGER

A hanger (1, Figure 147) is located on 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.

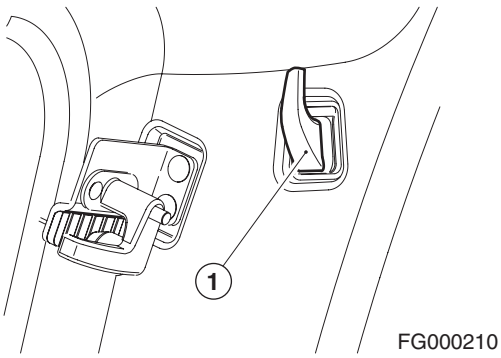


Figure 147

CUP HOLDER

There is a cup holder on the right side of the cabin (1, Figure 148). Open the access cover and lower it to a horizontal position.

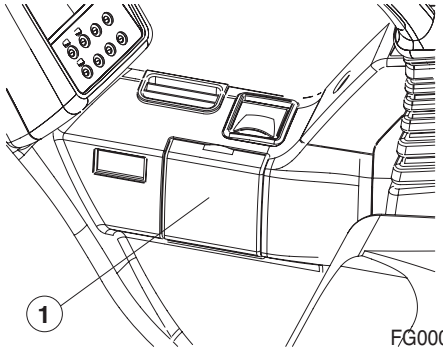


Figure 148

DOOR WINDOW HOLDER

When the machine is being operated with the cabin door window opened, window vibration can be reduced by tightening knob (1, Figure 149) against the window.

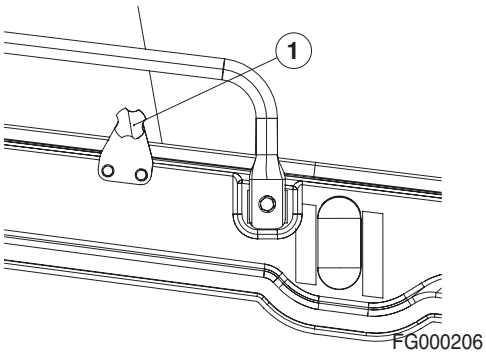


Figure 149

EMERGENCY GLASS BREAKING TOOL

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

WARNING

Protect your eyes when breaking the glass.

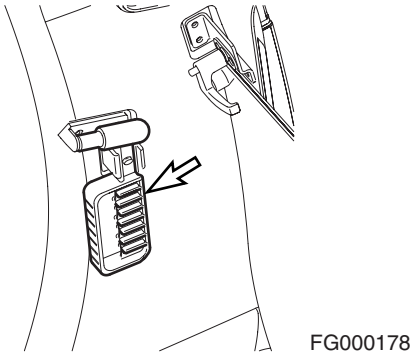


Figure 150

MISCELLANEOUS ACCESS COVERS AND DOORS

Side Door

Open the side access door and slide prop rod (1, Figure 151) in slot (2) until it locks at end of slot.

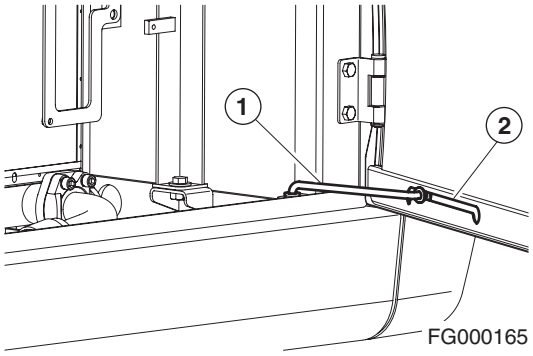


Figure 151

Battery Box Door

Opening

Open door until locking device (1, Figure 152) latches.

Closing

While holding door, press locking device to release lock and close door.

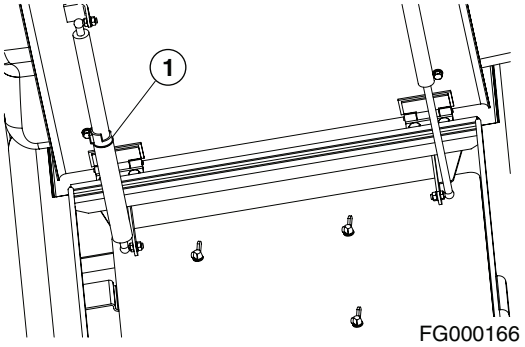


Figure 152

Engine Cover

Open cover and slide prop rod (1, Figure 153) in slot (2) until it locks in notch at the end of slot to support the cover.

To close cover, move end of prop rod out of notch so it can slide in slot.

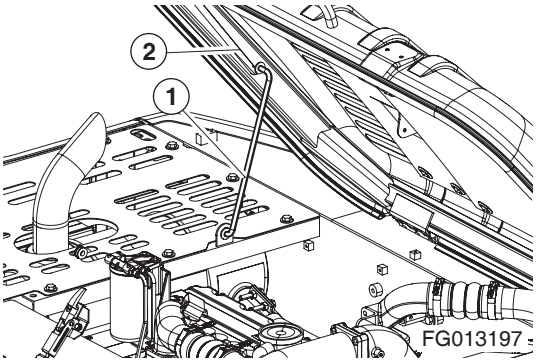


Figure 153

Operation

TO HANDLE A NEW EXCAVATOR

All DOOSAN excavators are inspected and adjusted before leaving the factory. However, it is required that 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 electric 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.

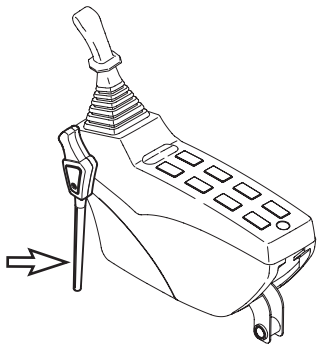
1. Set safety lever on "LOCK" (Figure 1).
2. Fasten seat belt. Check for proper operation and condition.
3. Set all operation levers in "NEUTRAL."

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

4. Rotate the starter switch to the "I" (ON) position (Figure 2). Check all indicator lights. A warning buzzer will sound for about two seconds. After two seconds, all lights except the following will turn "OFF."

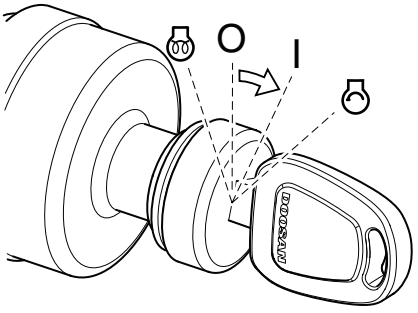
   - Charging warning light
   - Engine oil pressure warning light
   - Engine coolant temperature gauge
   - Fuel gauge
   - Hydraulic oil temperature gauge
   - Engine rpm (0 rpm) digital readout

   NOTE: *If all of the indicator lights do not come "ON" when the key is first turned, there is a problem.*



FG000211

Figure 1



FG001372

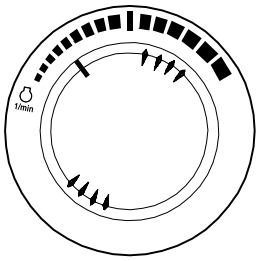
Figure 2

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 dial slightly above "LOW IDLE" (Figure 3).
3. Sound horn.

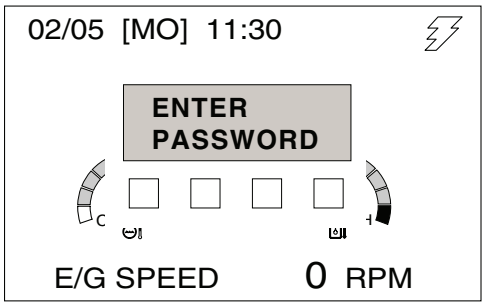


HAOB34L

Figure 3

4. Enter password.

NOTE: *If the security system is "LOCKED," a four-digit password will be required to start the engine. If the system is "UNLOCKED," no password will be required and this display screen will not appear.*



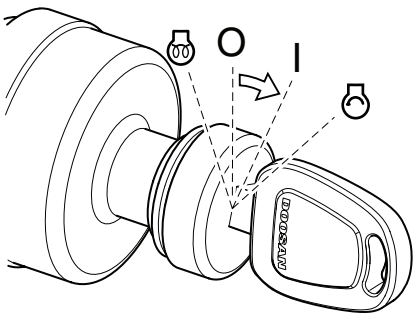
FG001445

Figure 4

5. Turn starter switch to "⏻" (START) position (Figure 5). 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

Figure 5

6. After engine has started, release key. Key will return to the "I" (ON) position (Figure 5).
7. Follow procedures in “Hydraulic System Warm-up” on page 3-9.

8. After warming unit, 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. Normal indicators are:

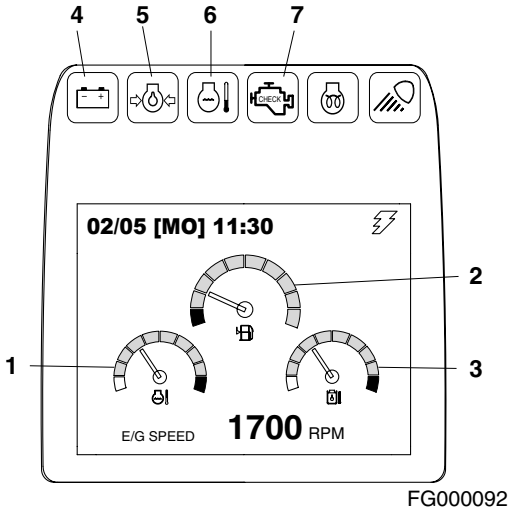


Figure 6

No.	INSTRUMENT PANEL LIGHT OR GAUGE	INDICATOR READING
1	Engine Coolant Temperature Gauge	Blue Range
2	Fuel Gauge	Blue Range
3	Hydraulic Oil Temperature Gauge	Blue Range
4	Charging Warning Light	OFF
5	Engine Oil Pressure Warning Light	OFF
6	Engine Coolant Temperature Warning Light	OFF
7	Engine Check Warning Light (Not Used)	OFF

9. 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.
10. Check for usual engine vibration and noises. If any are heard or felt, investigate cause.

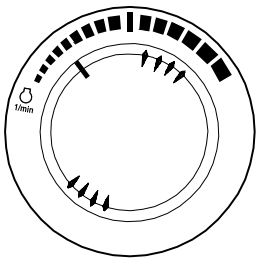
    NOTE: *If engine coolant temperature gauge pointer moves into the red zone, the engine coolant temperature warning light will turn "ON," a warning buzzer will sound, and the engine speed will be automatically reduced. Allow the engine to run at low idle speed until temperature gauge registers in the blue zone again. When the blue 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

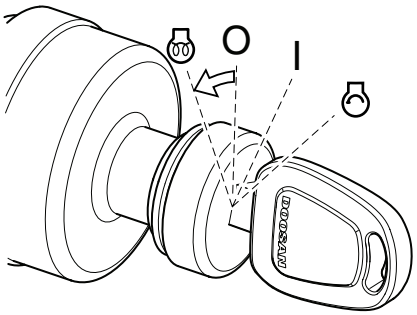
DO NOT USE STARTING FLUIDS. The preheat system could cause the starting fluid to explode. Starting fluids should never be used.

1. Perform all steps in "Operational Checks Before Starting Engine."
2. Set engine speed control dial slightly above "LOW IDLE" (Figure 7).
3. Sound horn.
4. Turn starter switch to the "⌂" (PREHEATING) position (Figure 8). When preheat cycle is completed, the preheat indicator light (1, Figure 9) will turn "ON."



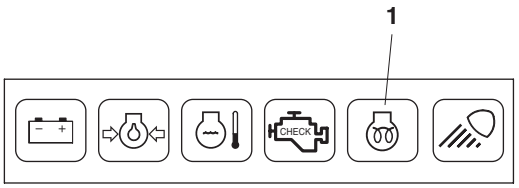
HAOB34L

Figure 7



FG001372-2

Figure 8



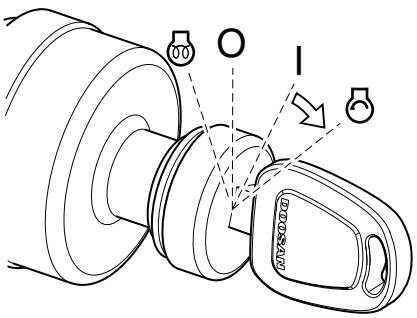
FG000217

Figure 9

5. After the preheat completion, immediately turn starter switch to "⌂" (START) position (Figure 10). 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 10

6. After engine has started, release key. Key will return to the "I" (ON) position (Figure 10).
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 11

IMPORTANT

The machine has a 24V (-) negative ground electrical system. Use the same capacity 24V 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 Batteries

1. Shut down engine of the machine on which booster batteries (3, Figure 12) are mounted.
2. Connect one end of red cable (1, Figure 12) to the positive (+) terminal of the machine batteries (4), and the other end to the positive (+) terminal of the booster batteries.
3. Connect one end of black cable (2, Figure 12) to the negative (-) terminal of the booster batteries (3), and then make ground connection to the upper frame (5) of the machine to be started with the other end of black (-) cable (2, Figure 12). When making the last connection to upper frame, be sure to connect the cable end as far away from the machine batteries as possible. DO NOT CONNECT DIRECTLY TO THE NEGATIVE BATTERY TERMINAL.
4. Start the engine.

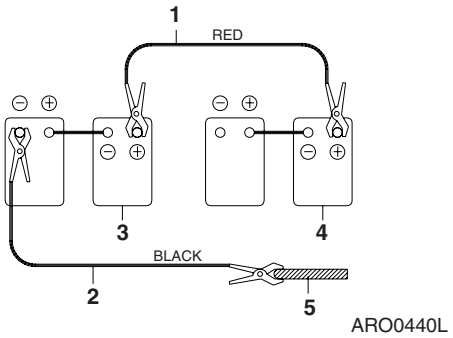


Figure 12

Disconnecting the Booster Batteries

1. Disconnect black negative (-) cable (2, Figure 12) from the machine frame (5) first.
2. Disconnect the other end of black negative (-) cable (2, Figure 12) from the booster batteries (3).
3. Disconnect red positive (+) cable (1, Figure 12) from the booster batteries (3).
4. Disconnect red positive (+) cable (1, Figure 12) from the machine batteries (4).

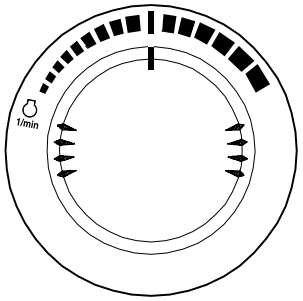
Hydraulic System Warm-up

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.

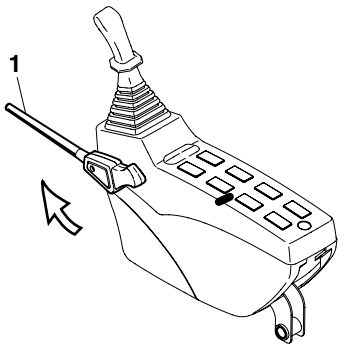
1. Run engine for approximately five minutes set at the middle of the speed range, without a load.



HAOB410L

Figure 13

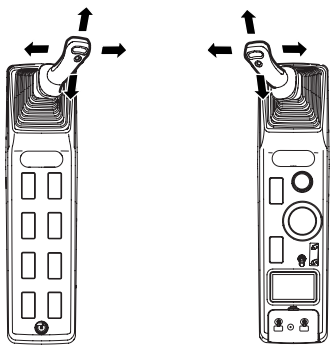
2. Set safety lever (1, Figure 14) on "UNLOCK" position.



FG000093

Figure 14

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.

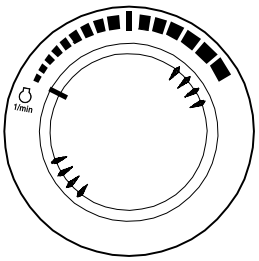


FG000380

Figure 15

Hydraulic System Warm-up – Cold Weather

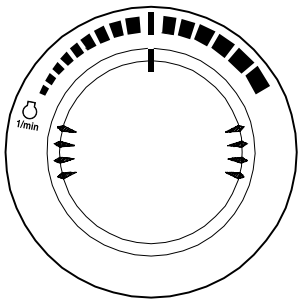
1. Run engine at "LOW IDLE" (no load) for five minutes (Figure 16).



HAOB290L

Figure 16

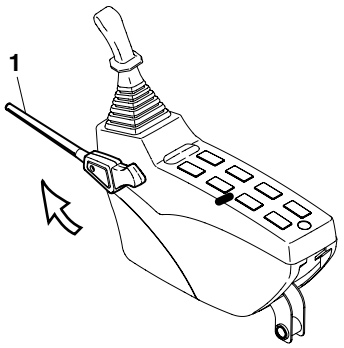
2. Run engine for approximately five minutes set at the middle of the speed range, without a load (Figure 17).



HAOB410L

Figure 17

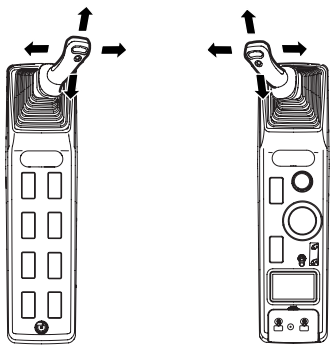
3. Set safety lever (1, Figure 18) on "UNLOCK" position.



FG000093

Figure 18

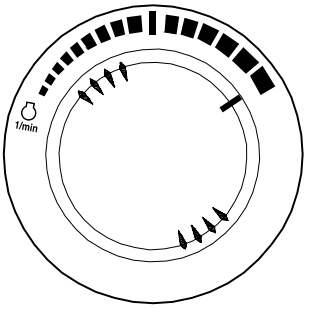
4. Slowly cycle boom, arm and bucket cylinders about five times without a load to circulate the oil through the system. Do this for five minutes.



FG000380

Figure 19

5. Set engine speed control dial to "HIGH IDLE" (Figure 20).
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.



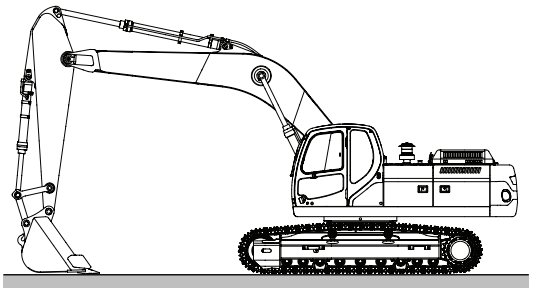
HAOB550L

Figure 20

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.*

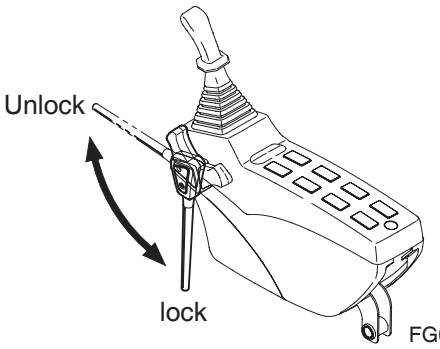
1. Park excavator on level and firm ground.
2. Lower front end attachment to ground and make sure all operating controls are in "NEUTRAL."



FG000111

Figure 21

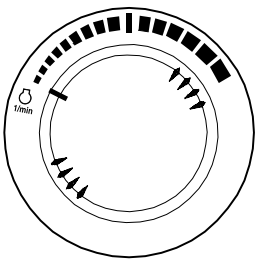
3. Set safety lever on "LOCK" position (Figure 22).



FG001091

Figure 22

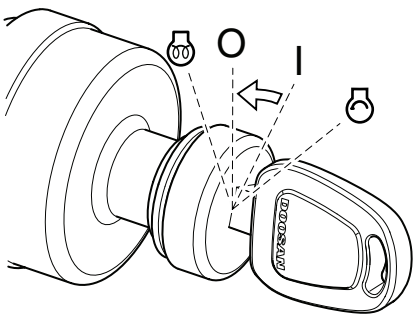
4. Set engine speed control dial to "LOW IDLE" (Figure 23). Allow engine to idle for three - five minutes.



HAOB290L

Figure 23

5. Shut down engine by turning key to "O" (OFF) position (Figure 24).
6. Remove key from starter switch.



FG001372-3

Figure 24

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.

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 work levers (joysticks) when moving safety lever.

1. Push safety lever (Figure 25) down into the "LOCKED" position. When safety lever is in the "LOCKED" position, the front attachment, swing and travel movement will be disabled even though a lever is moved.

   NOTE: *Lower bucket (front attachment) to ground. Place all control levers in "NEUTRAL" and shut down engine, before using the safety lever.*

2. Set safety lever (Figure 25) on "RELEASE/UNLOCK" position, by pulling it up 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 work levers (joysticks) may result in movement. The charged accumulators in the system will provide pilot pressure for control valve spool movement.*

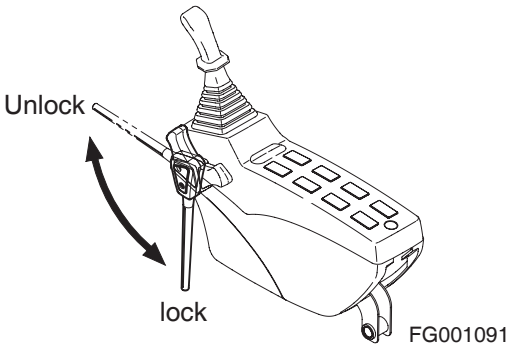


Figure 25

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.**

Automatic Travel Speed Control

WARNING

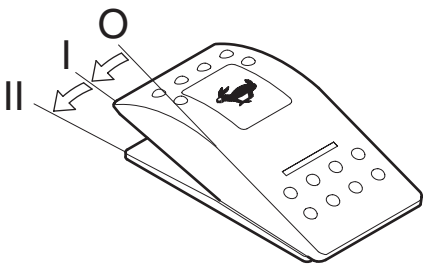
Do not change the travel mode while traveling. Always use speed mode "O" when traveling down a slope. It is very dangerous to change to speed modes indicated "I" or "II" while going down a slope. Only change travel mode after coming to a complete stop.

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.

"II" (AUTOMATIC) - Setting the control at the "II" position enables the machine to change to a different speed range automatically. This change happens automatically depending on the hydraulic oil pressure in the travel circuit. When hydraulic oil pressure rises, the travel speed is automatically set to low. An example is if the machine is traveling on a flat, solid surface, the higher speed range would be used. When a slope is encountered, the speed drops and the travel circuit hydraulic pressure rises, causing the control circuit to shift to the higher torque, lower speed range.



FG000023

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.*

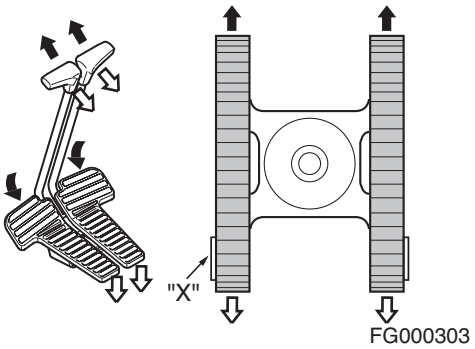


Figure 27

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.*

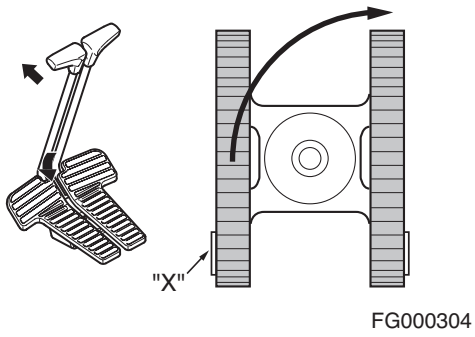


Figure 28

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.*

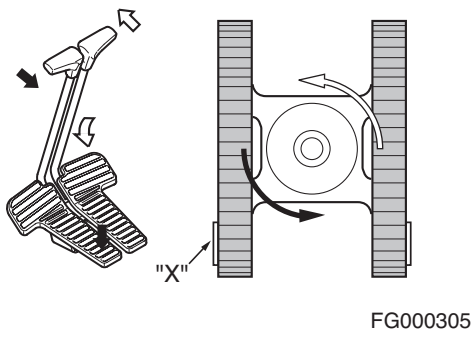


Figure 29

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.*

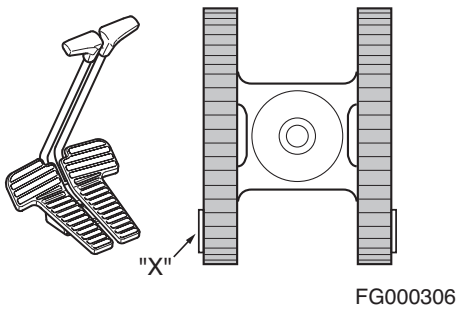
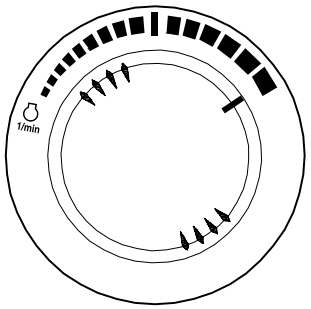


Figure 30

General Travel Instructions

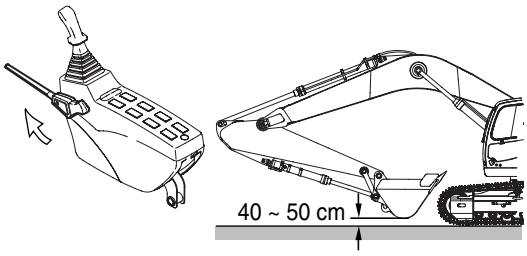
1. Set engine speed control dial (Figure 31) on desired speed.



HAOB550L

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.



FG000123

Figure 32

3. When possible, travel on firm, level ground. Avoid sudden movements and sharp turns.
4. 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.
5. On rough, frozen or uneven terrain, travel slowly.

FG000423

Figure 33

⚠ 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.

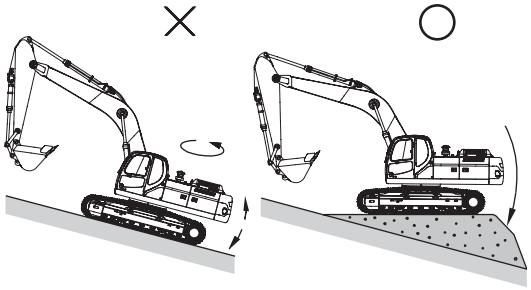
If excavator starts to slip or becomes unstable, lower the bucket immediately into the ground, using it as a brake.

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 34.

Do not travel on slopes more than 30° because of turnover danger.



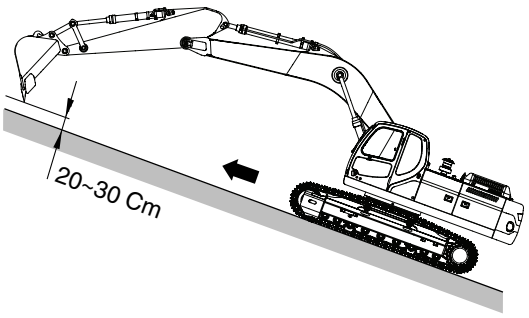
FG000212

Figure 34

6. Travel straight up or down slopes, never diagonally across the slope. See Figure 35 and Figure 36. 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.

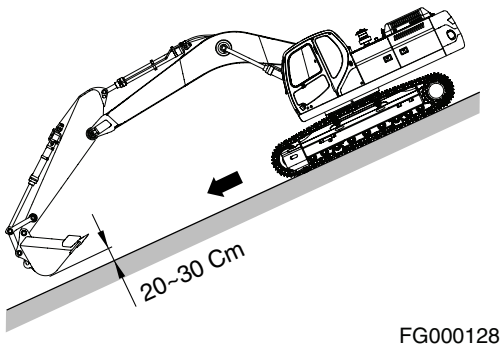
   NOTE: *Even though engine stops on a slope, do not operate swing control. The hydraulic accumulators may cause the unit to swing.*

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



FG000126

Figure 35



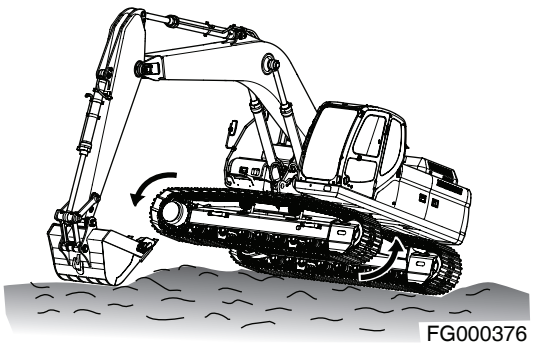
FG000128

Figure 36

7. 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 round base is against the ground. The angle of the arm to the boom should be at 90°.



FG000376

Figure 37

Make sure that the material buildup has been cleared. See Figure 37 and Figure 38.

8. The excavator can travel in water that comes up to center of upper carriage rollers. Make sure that footing is solid so that the machine will not sink. See “Working in Water” on page 3-31.

   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 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.*

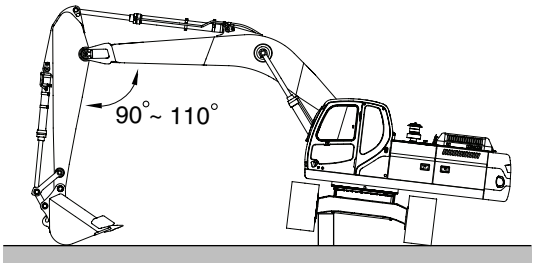


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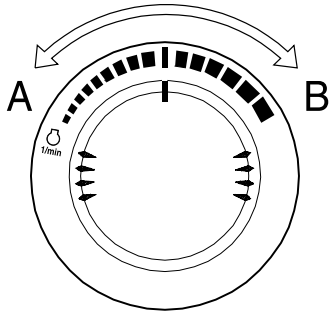
Figure 38

Engine Speed Control

Engine speed can be manually adjusted using the engine speed control dial, Increase engine speed by rotating the control knob clockwise. Decrease engine speed by rotating the control knob counterclockwise.



HAOA690L

Figure 39

IMPORTANT

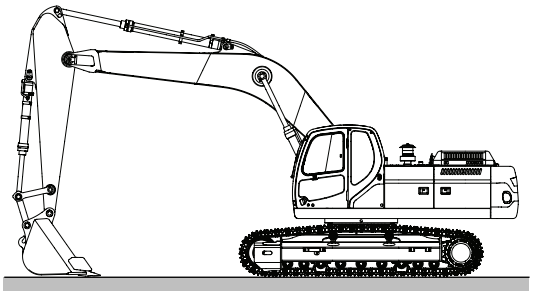
The engine speed control system has been set at the factory and should not require adjustment as part of routine maintenance.

If the engine speed control system should have an electrical malfunction, the engine throttle system can be set for manual operation. Use the following procedure;

IMPORTANT

If the engine rpm is being manually adjusted, the equipment will not function in its optimum capacity. Please contact a DOOSAN distributor or service center for repairs.

1. Park on firm, level ground.
2. Lower bucket to ground.
3. Set safety lever on "LOCK" position.
4. Set engine speed control dial to "LOW IDLE." Allow engine to idle for 3 - 5 minutes.
5. Shut down engine. Remove key from starter switch.
6. Attach tag, "DO NOT START" on right-hand work lever (joystick).
7. Disconnect control cable (1, Figure 41) by removing nut and spring washer (2) and loosening the nuts (3) holding cable to bracket.
8. Remove nut and spring washer (5, Figure 41) from manual engine control cable (4) and loosen the nuts (10) holding cable to bracket. Attach manual engine control cable ball joint to hole (6) by using nut and spring washer (5) and attach it to slot (11) by tightening the nuts (10).
9. Start the engine.
10. Display the engine rpm on the instrument panel by pressing the "DISPLAY" button.



FG000111

Figure 40

11. On the rear of left control stand in cabin is a vernier caliper throttle control. The throttle control is a push/pull and/or screw type assembly. The locking collar (7, Figure 44) at base of mechanism must be turned to the released position before the throttle can be adjusted.
Turn the locking collar counterclockwise to adjust engine speed by pulling the cable.
Turn the locking collar clockwise to fix engine speed after obtained the desired engine speed.

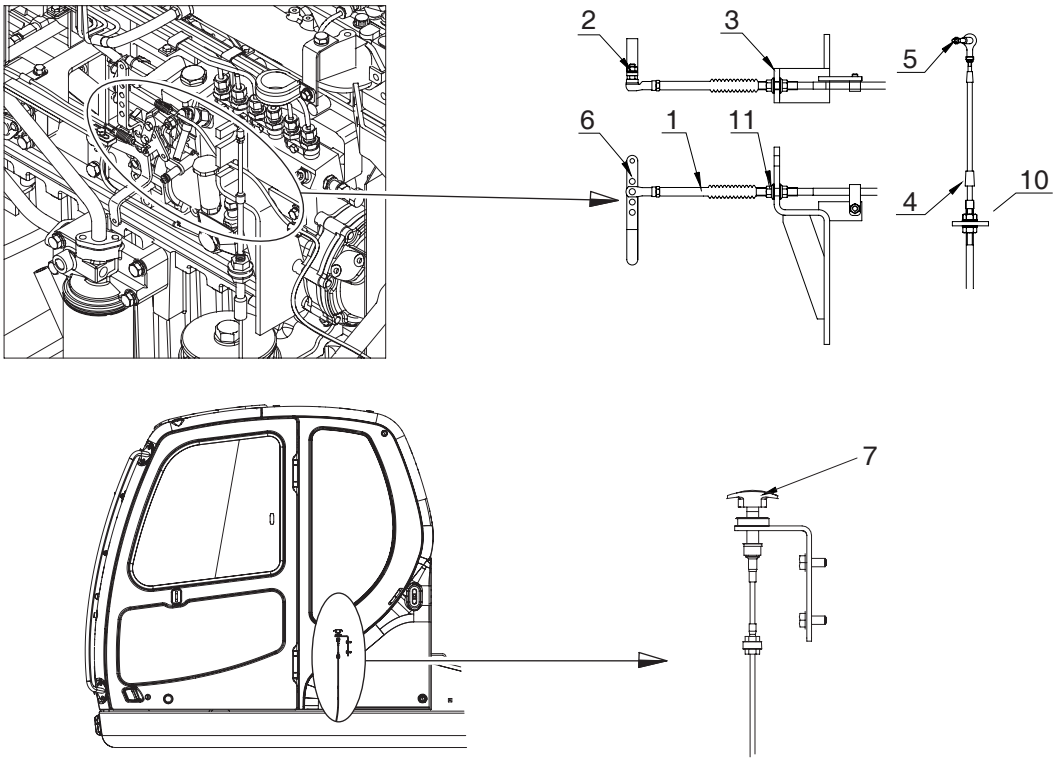


Figure 41

Mode Selection

More efficient work can be done by choosing a proper power and work mode combination, suitable to type of work and conditions. Use the mode selection according to following guide.

Power Mode

1. When the starter switch is turned "ON" the power mode is automatically defaulted to the standard setting.
2. Select a proper power mode using button (1, Figure 42) before starting work.
3. When the power mode button (1, Figure 42) is pressed, a signal sounds, changing the power mode to either "ON" or "OFF." When the power mode is turned "ON," the LED indicator (2, Figure 42) turns "ON."

   Deactivate the power mode by pressing it a second time. When the power mode is turned "OFF," the LED indicator (2, Figure 42) turns "OFF" and the power mode returns to the standard mode.

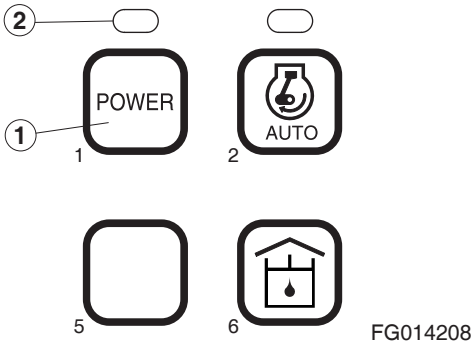


Figure 42

Mode	Selection Point
STANDARD MODE	• General work. • Minimize fuel consumption.
POWER MODE	• Required to perform heavy work in a short period of time. • Fast speed loading. • Fast speed travel.

Auto Idle Mode

1. The system will automatically reduce engine speed to idle speed approximately four seconds after all of the control levers are in the neutral position. When a pilot function is activated, engine speed is automatically returned to the preselected range.
2. When the starter switch is turned "ON," the work mode is automatically defaulted to "AUTO IDLE."
3. When the LED indicator (4, Figure 43) is turned "ON," the auto idle function is activated. Deactivate the auto idle function by again pressing the auto idle selector button (3, Figure 43). At this time the LED indicator will be turned "OFF."

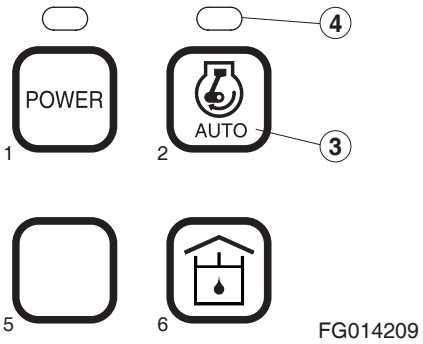


Figure 43

WARNING

Turn "OFF' auto idle function when performing work in close operating area, i.e., work in a narrow area and loading / unloading on or off a trailer.

Boost Mode

1. Power boost switch is used to gain maximum digging force.
2. The power boost is activated while the lower button is being pressed on top of the right-hand work lever (joystick). The breaker / boost / shear selector switch must be in the "O" (BOOST) position.

   NOTE: *The power boost mode does not affect forward and reverse travel.*

   Do not use this switch for more than ten seconds.

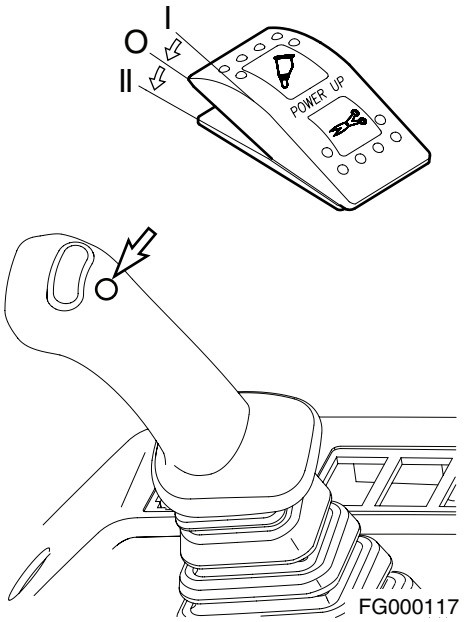


Figure 44 RIGHT-HAND WORK LEVER (JOYSTICK)

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.*

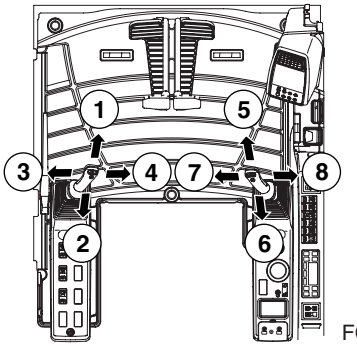
This equipment is manufactured using the lever configuration described in ISO standards. Do not change valving, hoses, etc., that would change this standard. The boom, arm and bucket movements and swing direction of work levers *(joysticks)* are as follows:

Left-hand Work Lever (Joystick) (Figure 45 and Figure 46)

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.*

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.*



FG000381

Figure 45

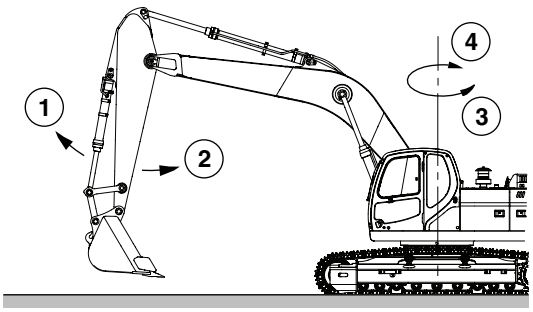


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Figure 46

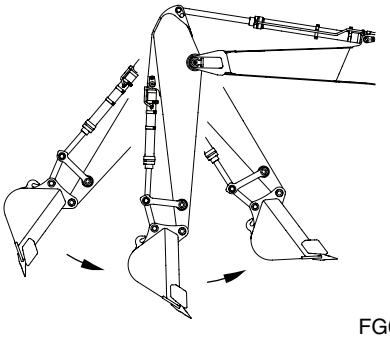
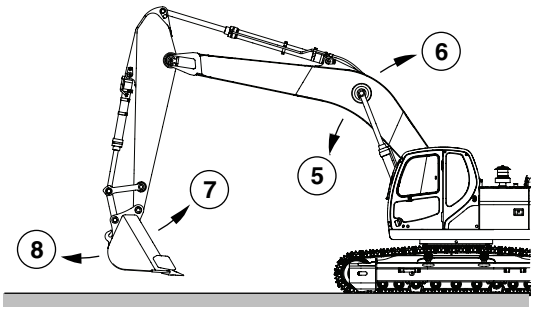

FG000120

Figure 47

Right-hand Work Lever (Joystick) (Figure 45 and Figure 48)

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

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."*



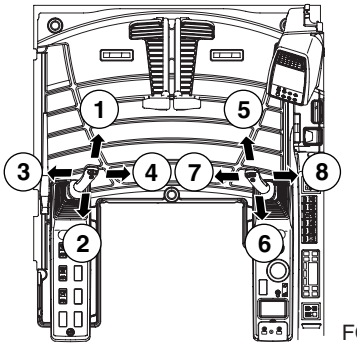
FG000121

Figure 48

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.



FG000381

Figure 49

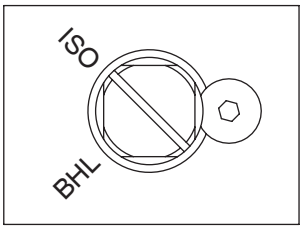
NOTE: *When starting work, move work levers (joysticks) slowly and check movement of swing and front attachment.*

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

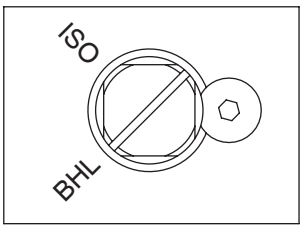
The select valve is located in the rear of the cabin.

1. Rotating spool to the ISO position or to the BHL position. (Figure 50)

<ISO PATTERN>



<BHL PATTERN>



FG004954

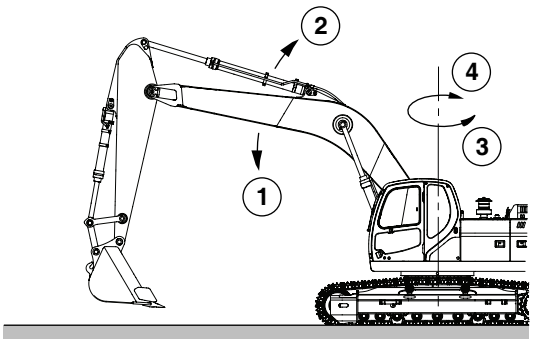
Figure 50

Work Levers (Joysticks) (BHL Style)

Left-hand Work Lever (Joystick) (Figure 49 and Figure 51)

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.*



FG004951

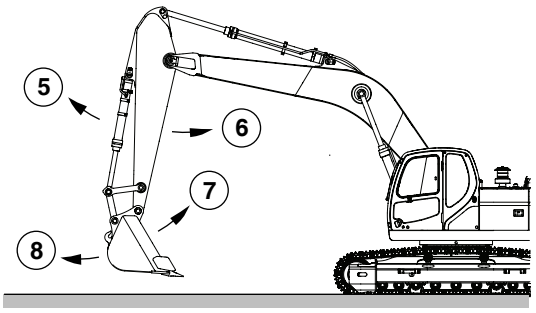
Figure 51

Right-hand Work Lever (Joystick) (Figure 49 and Figure 52)

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

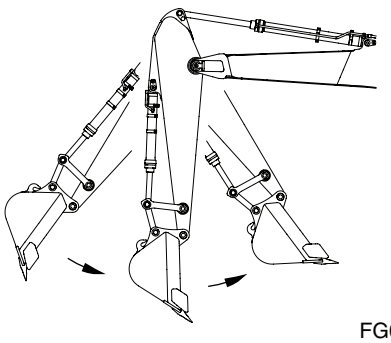
NOTE: *The following is not a mechanical malfunction but a proper phenomenon of the excavator. When operating the arm, it may stop momentarily. When the arm is operated, the weight of the arm may cause it to move faster than the amount of oil being supplied.*

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."*



FG004952

Figure 52



FG000120

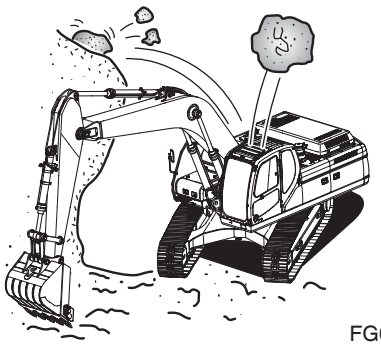
Figure 53

OPERATING PRECAUTIONS

WARNING

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

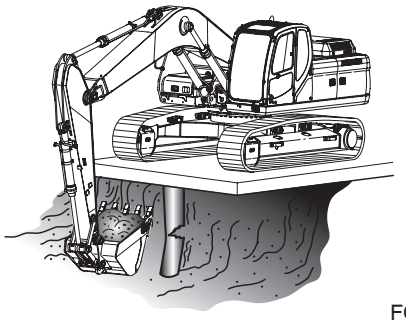
1. Before starting work, investigate terrain and soil condition. Level ground and drain area if necessary.
2. Install window guards when working where there is a possibility of falling rocks or other objects.



FG000374

Figure 54

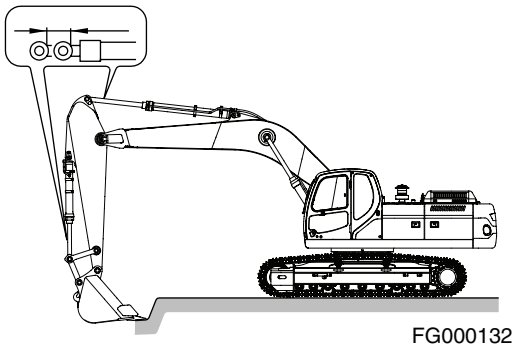
3. Check strength of supported structures in advance before working on them. If insufficient, reinforce it. If any doubt exists about structural strength, refuse to operate unit.
4. It is possible that the boom, arm or bucket may come into contact with the upper or lower structure of the machine. There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



FG000375

Figure 55

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.



FG000132

Figure 56

6. Do not use machine travel or swing when the bucket is in the ground to provide additional breakout force. See Figure 57.

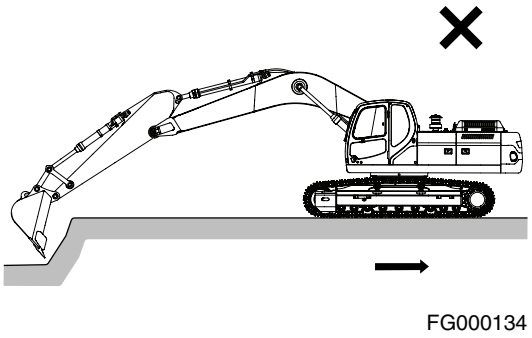


Figure 57

7. Do not use weight of machine to provide additional breakout force. See Figure 58.
8. When working on soft or muddy ground, make sure that machine is not sinking.

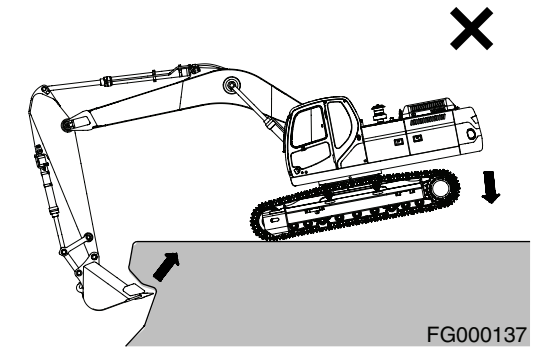


Figure 58

9. When working close to the excavated edge, make sure that ground the machine is sitting on is solid. Keep the travel motors (1, Figure 59) to the rear. See Figure 59.

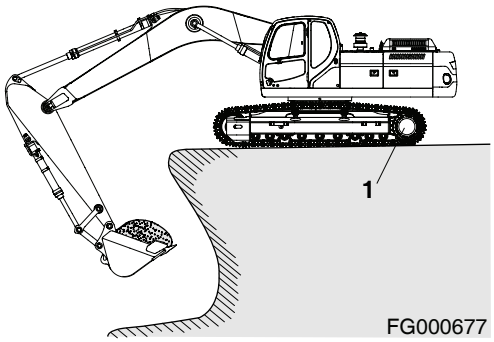


Figure 59

10. Do not excavate underneath the machine. See Figure 60.

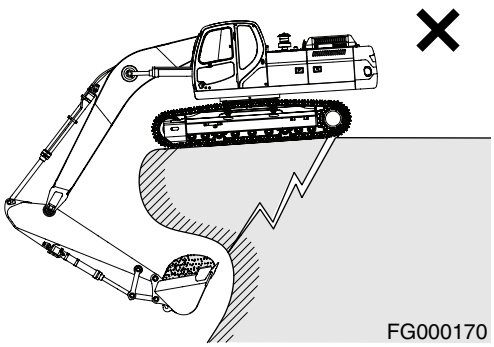


Figure 60

11. Make sure there is adequate clearance from overhead electrical supply lines. See Figure 61.

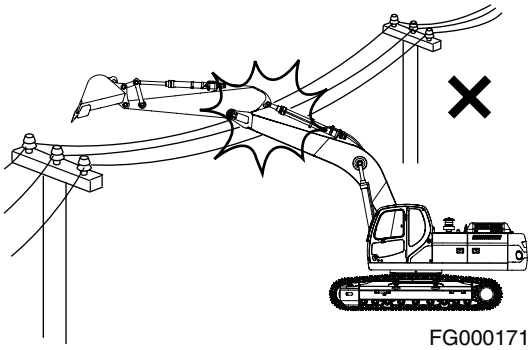


Figure 61

12. If the excavation is in an underground location or in a building, make sure there is adequate overhead clearance and there is adequate ventilation. See Figure 62.

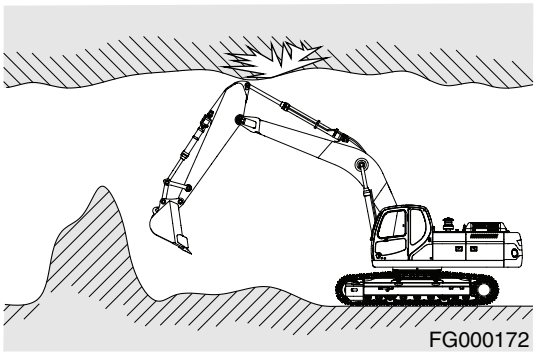


Figure 62

13. Do not use the bucket as a hammer or ramming device. This is dangerous and causes damage to the front attachment. See Figure 63.

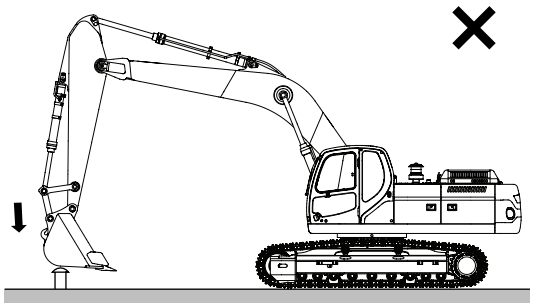


Figure 63

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

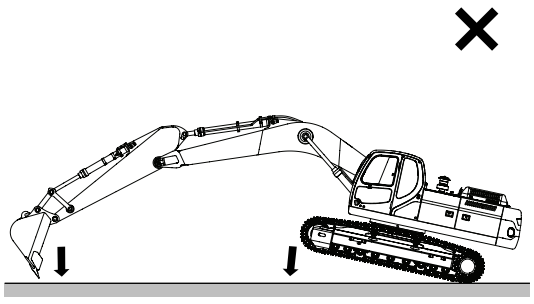
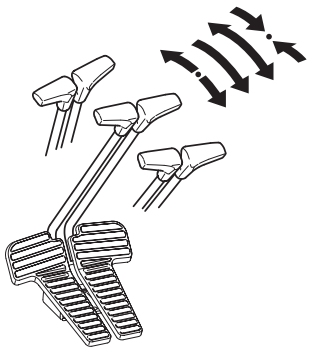


Figure 64

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.



FG000213

Figure 65

WARNING

Do not travel downhill with the front end attachments raised.

Do not travel across slopes; travel straight up or downslope.

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

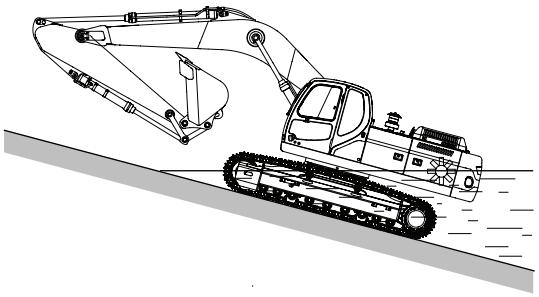
Allow extra swing stopping room. The additional momentum generated by the longer or heavier front end equipment will increase the amount of time needed to stop the swing motion.

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.

IMPORTANT

When working in water, do not exceed a slope of more than 15°. If the slope is over 15°, the rear part of the upper structure will be immersed in water, resulting in radiator fan and engine ECU damage.



FG000179

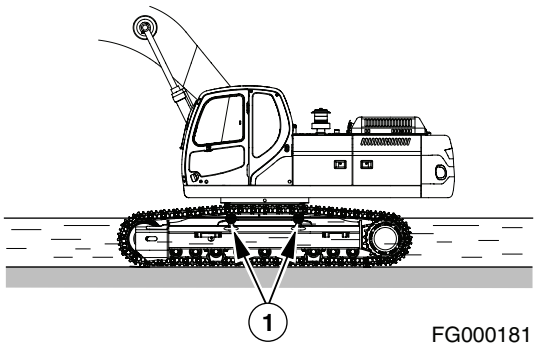
Figure 66

When working in water, do not operate in water over center of upper roller (1, Figure 67).

If swing bearing gets wet, immediately grease it until all old grease is purged from bearing.

If water gets into swing gear housing, drain water immediately by removing lower inspection cover. Apply new grease.

After working in water, purge old grease on bucket pins.



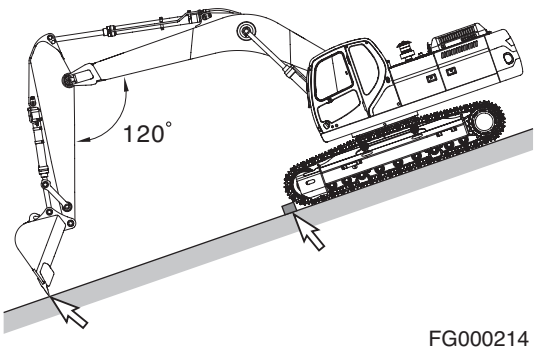
FG000181

Figure 67

PARKING EXCAVATOR

WARNING

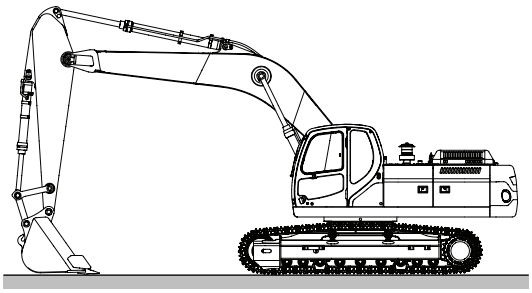
Park excavator on firm, level ground. Avoid parking on slopes. If excavator must be parked on a slope, block tracks and place bucket teeth in ground. See Figure 68.



FG000214

Figure 68

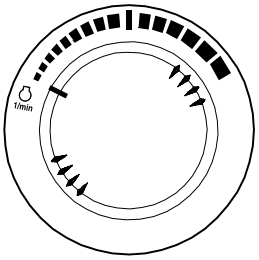
1. Park excavator on firm, level ground. Lower bucket to ground as shown in Figure 69.



FG000111

Figure 69

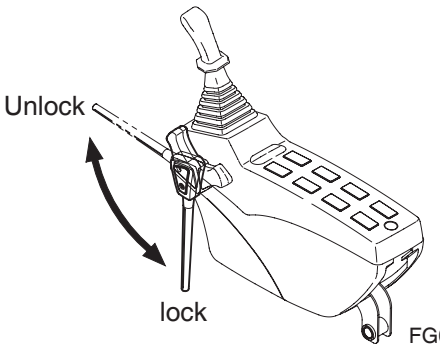
2. Set engine speed control dial on "LOW IDLE."



HAOB290L

Figure 70

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.



FG001091

Figure 71

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 72

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).

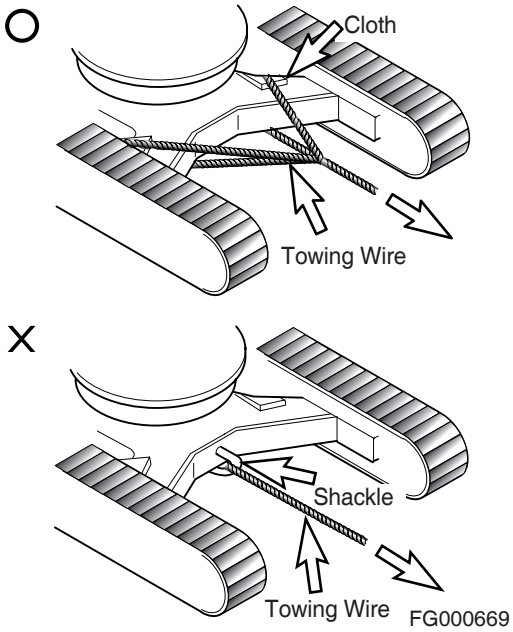


Figure 72

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.

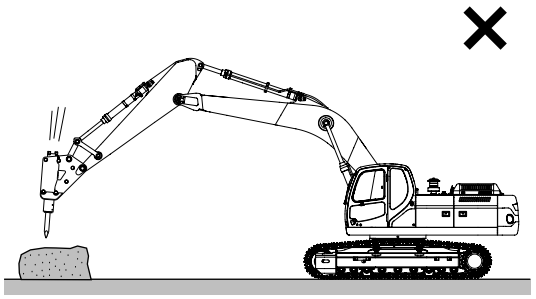
Hydraulic Breaker Operation

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 73.

   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.

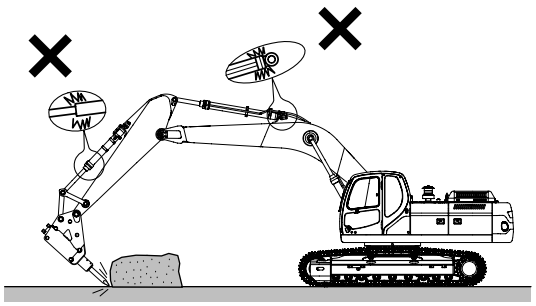


FG000188

Figure 73

4. Do not operate the breaker with the boom or arm cylinders fully extended (bottomed out). See Figure 74.

   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.



FG000191

Figure 74

5. Do not use the breaker if the hydraulic hoses vibrate excessively. See Figure 75. 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.

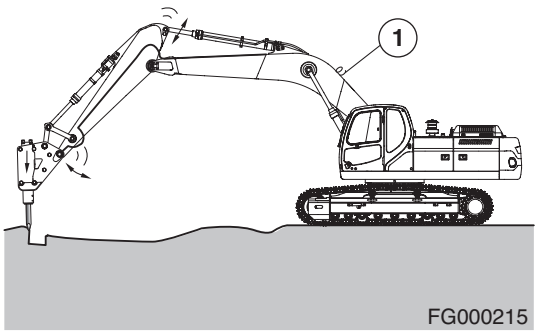
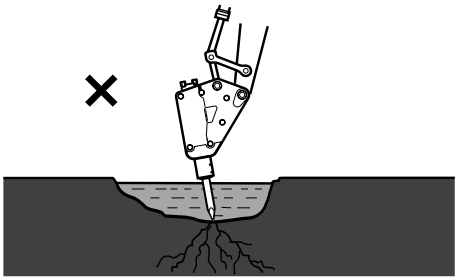


Figure 75

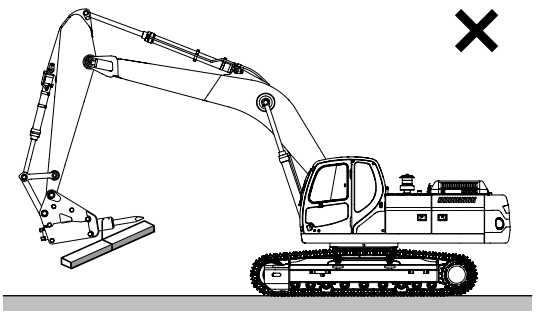
6. Do not allow the breaker body to go into water if not equipped for underwater operation. The breaker seal can be damaged and allow rust, foreign material or water to enter the hydraulic system and cause damage. Only insert the breaker tool into water. See Figure 76.



HAOB970L

Figure 76

7. Do not any lifting or towing with a breaker. See Figure 77.



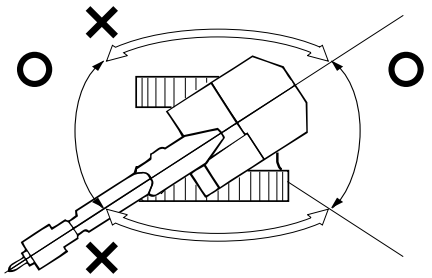
FG000207

Figure 77

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 78.

WARNING

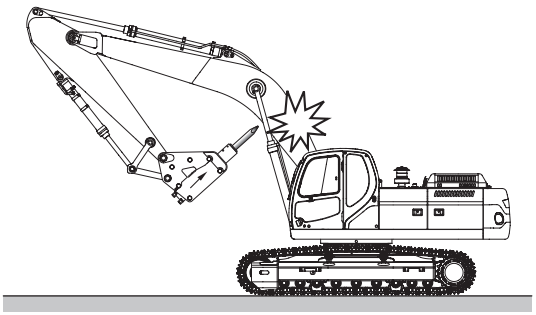
Operating a breaker with the upper body turned 90° to the tracks can result in tipping over the machine or reduction in service life.



HAOB990L

Figure 78

9. Do not curl the breaker tool tip into the arm or boom when traveling or parking the excavator. See Figure 79.



FG000216

Figure 79

To activate breaker

1. Set breaker selector switch to "II" (BREAKER) position.
2. Press lower button on top of right-hand work lever (joystick) to activate hydraulic breaker.
3. Release lower button on top of right-hand work lever (joystick) to deactivate hydraulic breaker.

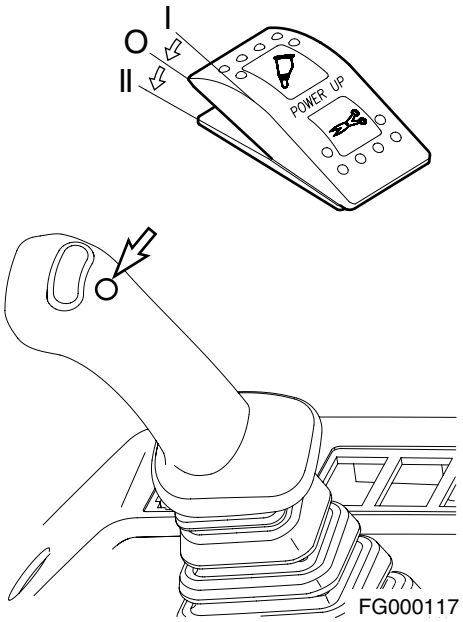


Figure 80 RIGHT-HAND WORK LEVER (JOYSTICK)

Relief Valve Adjustment

1. Cap pipe on arm end, using a cap capable of handling 350.0 kg/cm^2 (5,000 psi) under the condition of disconnecting hose to hydraulic breaker.
2. Adjust pump pressure using activating the breaker, and watching the pressure displayed on the instrument panel. Press the display selector button to show digital pressure reading. (A separate pressure gauge is not required.)
3. Adjust the relief valve pressure by turning the adjustment screw of breaker relief valve. The relief valve is installed on the left side of the upper structure behind the boom. (Do not use the overload relief valve on the lower part of control valve for the breaker relief valve.)

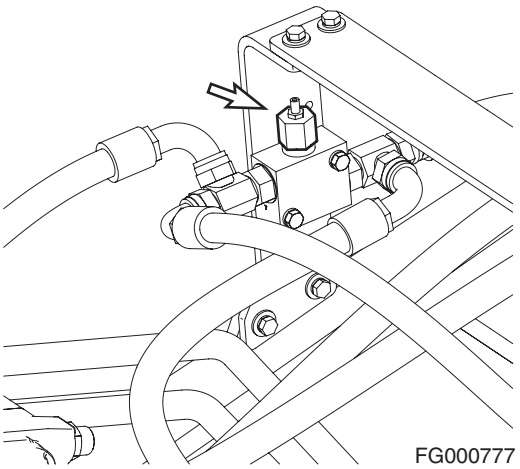


Figure 81

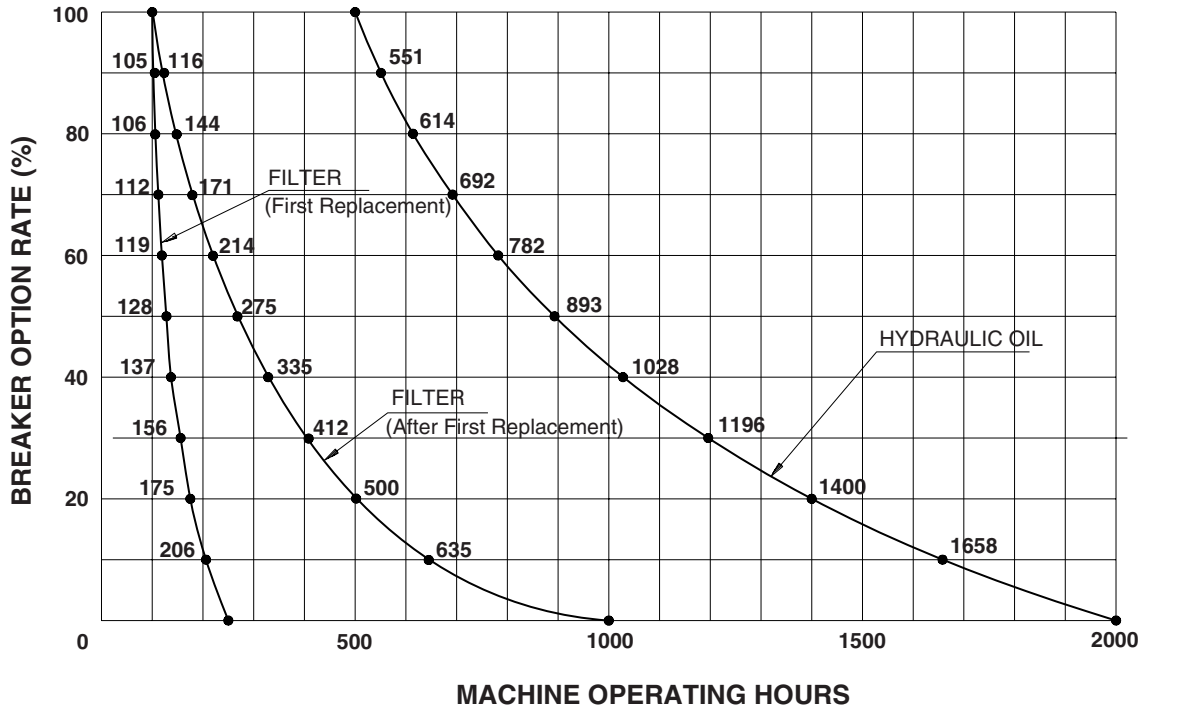
WARNING

If the relief valve pressure is adjusted while the hydraulic breaker is connected, there is possibility that a high-pressure spike or setting could break a hose or pipe. Personal injury or death could result from a hydraulic hose or pipe failure.

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 DOOSAN oil and filter are used. If any other brands are used, the guaranteed changed interval should be reduced in half.			



FG000767

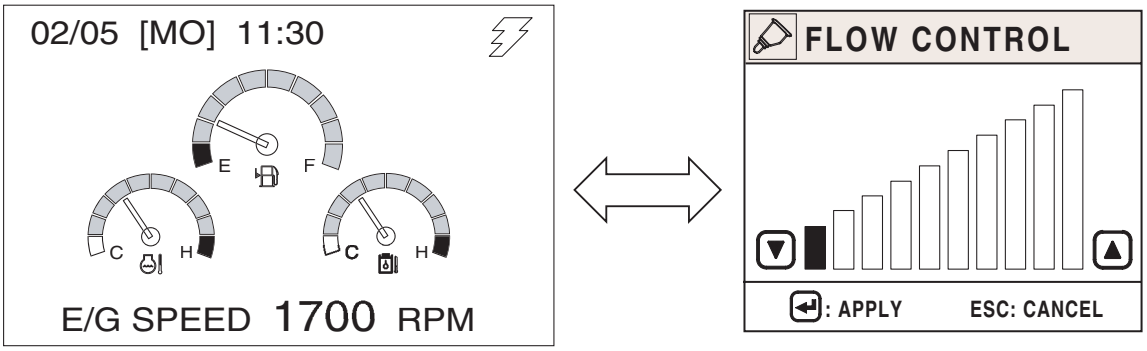
Figure 82

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.*

ADJUSTING THE PUMP FLOW

NOTE: *For further information, see "Flow Control" on page 2-41.*

1. On the instrument panel, press the flow control button , the flow control screen (Figure 83) will be displayed.
2. Use "UP" (▲) or "DOWN" (▼) buttons to adjust flow rate.
3. Press "SELECT" (↵) button, to return to normal display screen and save the flow rate setting.



<Normal Display> <Flow Control Display>

FG001090

Figure 83

Flow Control Step	Pump Flow Setting (l/min)
0	40
1	60
2	80
3	100
4	120
5	140
6	160
7	180
8	200
9	220
10	239

Shear Pedal Valve (Optional)

Activating Shear with Pedal Valve

1. Select shear with the selector switch of the right panel.
2. Two-way operation is possible by rocking pedal back and forth between positions (1 and 2, Figure 84). When pedal is in its center (at rest) position the valve is in "NEUTRAL" and hydraulic oil flow is stopped.
3. Before operating attachment, be sure to check function controlled by direction of the pedal movement.

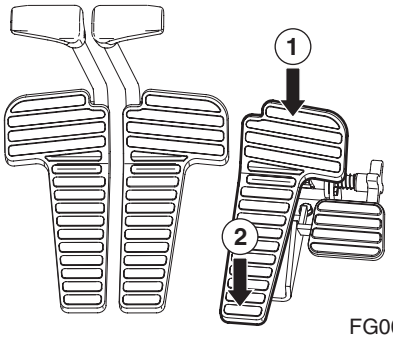


Figure 84

Activating Breaker with Pedal Valve

1. Select "BREAKER" with selector switch of the right panel.
2. Rotate knob (3, Figure 85) 120° for stopper (4, Figure 85) be fastened to (5, Figure 85).
3. In the condition that (2, Figure 85) is fastened, activate the breaker to the direction (1, Figure 85).

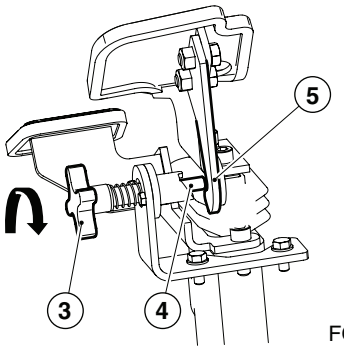


Figure 85

Adjusting the Stopper

1. Rotate knob (3, Figure 85) in the direction of the arrow. then the pedal is activated according to the display caused by (3, Figure 85) knob rotation.

⚠ CAUTION

When only operating breaker or shear using joystick button(s), and it is not being controlled by pedal, make sure stopper is in "LOCKED" position to prevent pedal from being activated.

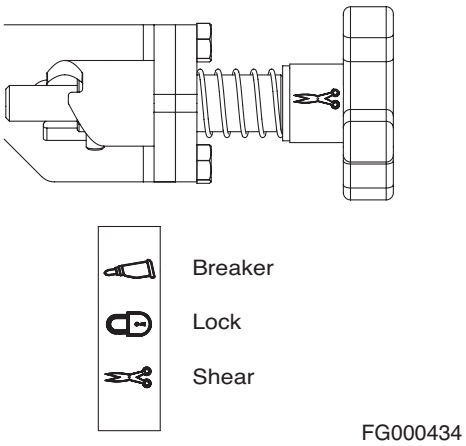


Figure 86

Rotating Pedal Valve (Optional)

Attachment Rotating by Using the Pedal Valve

1. Pressing end (1, Figure 87) is used to turn clockwise.
2. Pressing end (2, Figure 87) is used to turn counterclockwise.

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

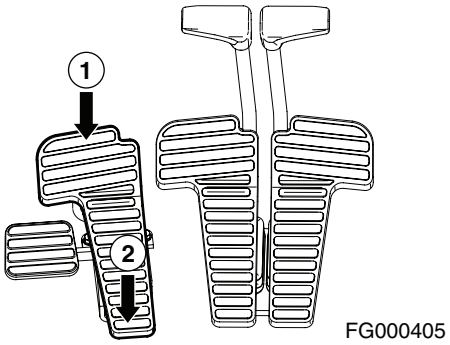


Figure 87

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.

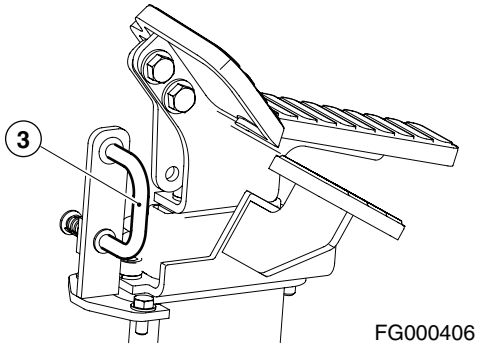


Figure 88

A. Location for "UNLOCKING."

B, Location for "LOCKING."

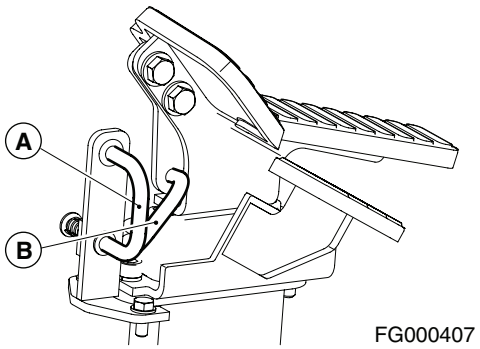


Figure 89

Attachment Rotation Using the Left-hand Work Lever (Joystick)

For a machine equipped with an attachment that rotates, rotation is activated while one of the control buttons is being pressed on top of the left-hand work lever (joystick).

There are three buttons on top of the left-hand work lever. The left and right ones are for controlling rotation.

NOTE: *The middle button is for the horn.*

Left button is for counterclockwise rotation, and the right one is for clockwise rotation.

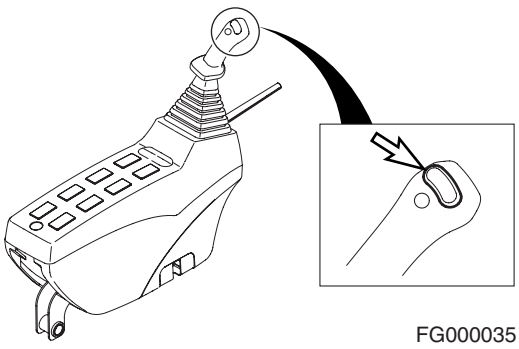


Figure 90 LEFT-HAND WORK LEVER (JOYSTICK)

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.

To prevent injury, do not exceed the rated load capacity of the machine. If the machine is not on level ground, load capacities will vary.

Short slings will prevent excessive load swing.

Use the lifting eye on the bucket that is provided to lift objects.

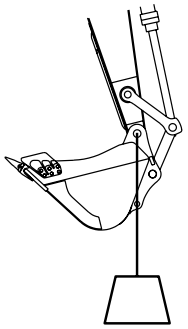
Always try to maintain the lifting eye (Figure 91) straight below the center line of the arm and bucket pin. In this manner the weight of the load is being primarily held only by the pin, and not by the bucket cylinder, link, and link pins.

When a lifting eye is used, the sling/lifting device must be fastened to the eye in a manner that will not allow it to come loose.

The most stable position is over the corner of the machine.

For best stability, carry a load as close to the ground and machine as possible.

Lift capacity decreases as the distance from the machine swing center line is increased.



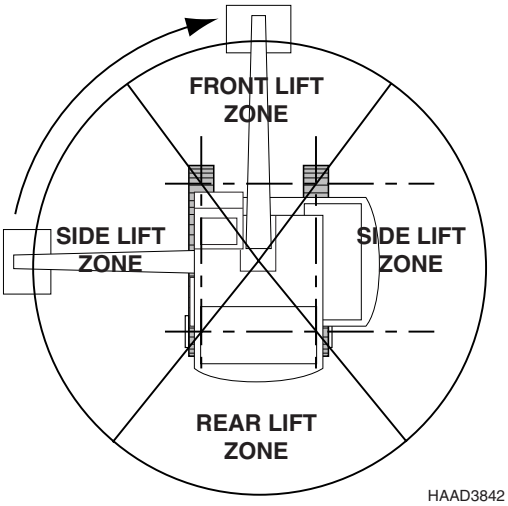
HAAD3830

Figure 91

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.



HAAD3842

Figure 92

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.

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 "Maintenance in Special Conditions" on page 4-83 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 conditions.
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 because of wax crystal formation in the fuel, be sure that 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 air flow 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.

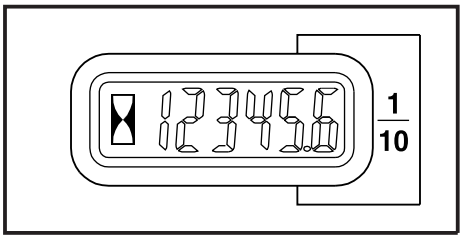
1. Check engine operating temperature for evidence of overheating. The pressure cap on radiator must make a perfect seal to maintain coolant pressure in the system.

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.

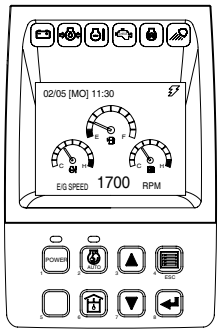
NOTE: *The following pages list the service checks and their required intervals. The service cycles may need to be shortened depending on the working conditions. Extremely hot or dusty conditions will require more frequent service. Operational hours are determined by the amount of time accumulated on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



HAOA601L

Figure 1

NOTE: *Besides the normal hour meter, the multifunction gauge can be used to keep track of the hours on individual filters. See “Filter / Oil Info” on page 2-36.*



FG014201

Figure 2

Product Identification Number (PIN) Location

A PIN number, is stamped on the upper frame, under the boom foot (Figure 3). It is also stamped on the product identification plate (Figure 4) on outside of the cabin on right.

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.*

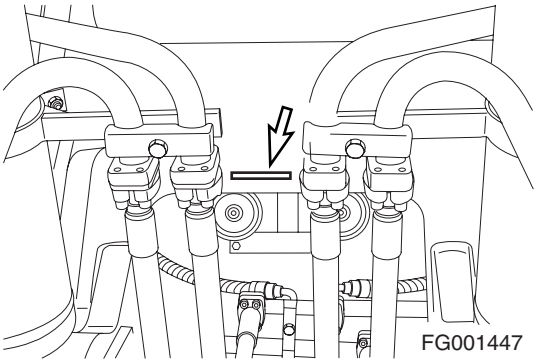


Figure 3

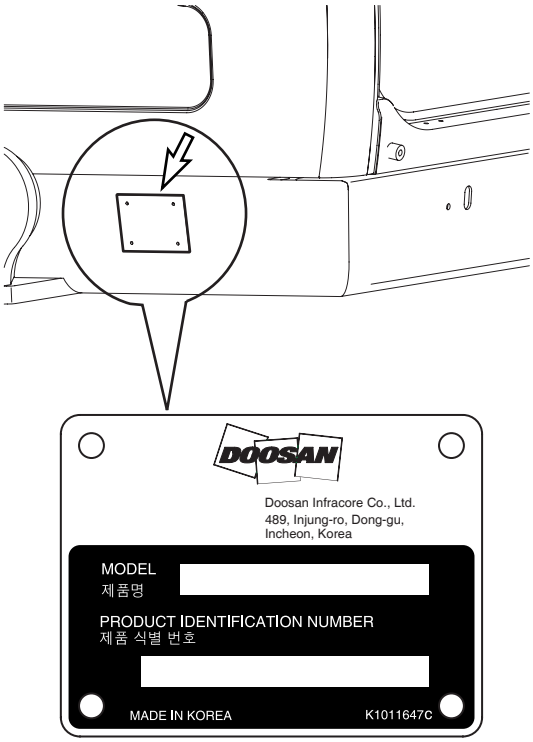


Figure 4

Component Serial Numbers

There are many serial numbers on each traceable components 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 5) on the rocker cover.

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

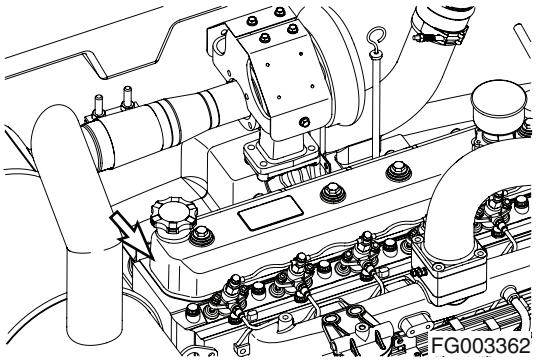


Figure 5

Safety Precautions

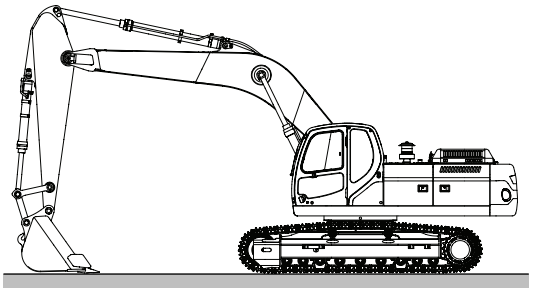
1. Make sure to lock out the hydraulic controls and post a notice (Warning Tag) that the machine is being serviced to prevent any unauthorized operation.
2. Make sure to clean up any fluid spills, especially around the engine.
3. Inspect all fuel lines to make sure that fittings, lines, filters and O-rings,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

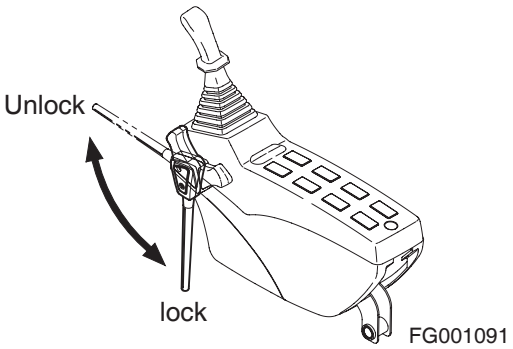
1. Park on firm, level ground.
2. Lower bucket to ground.



FG000111

Figure 6

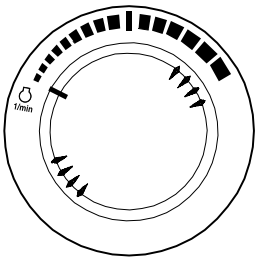
3. Set safety lever on "LOCK" position.



FG001091

Figure 7

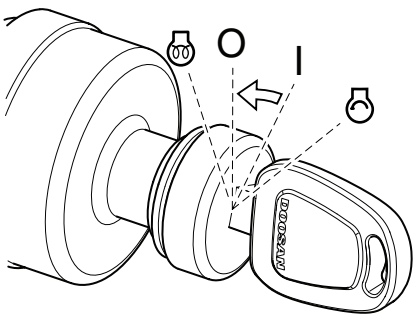
4. Allow engine to run at low idle for a minimum of five minutes to allow engine to cool. If this is not done, heat surge may occur.



HAOB290L

Figure 8

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



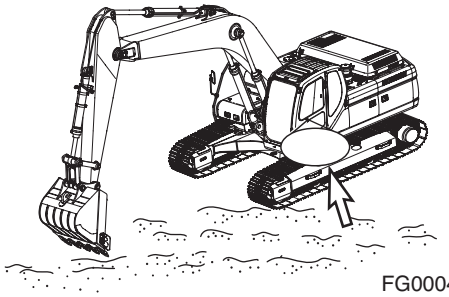
FG001372-3

Figure 9

⚠ 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.

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



FG000401

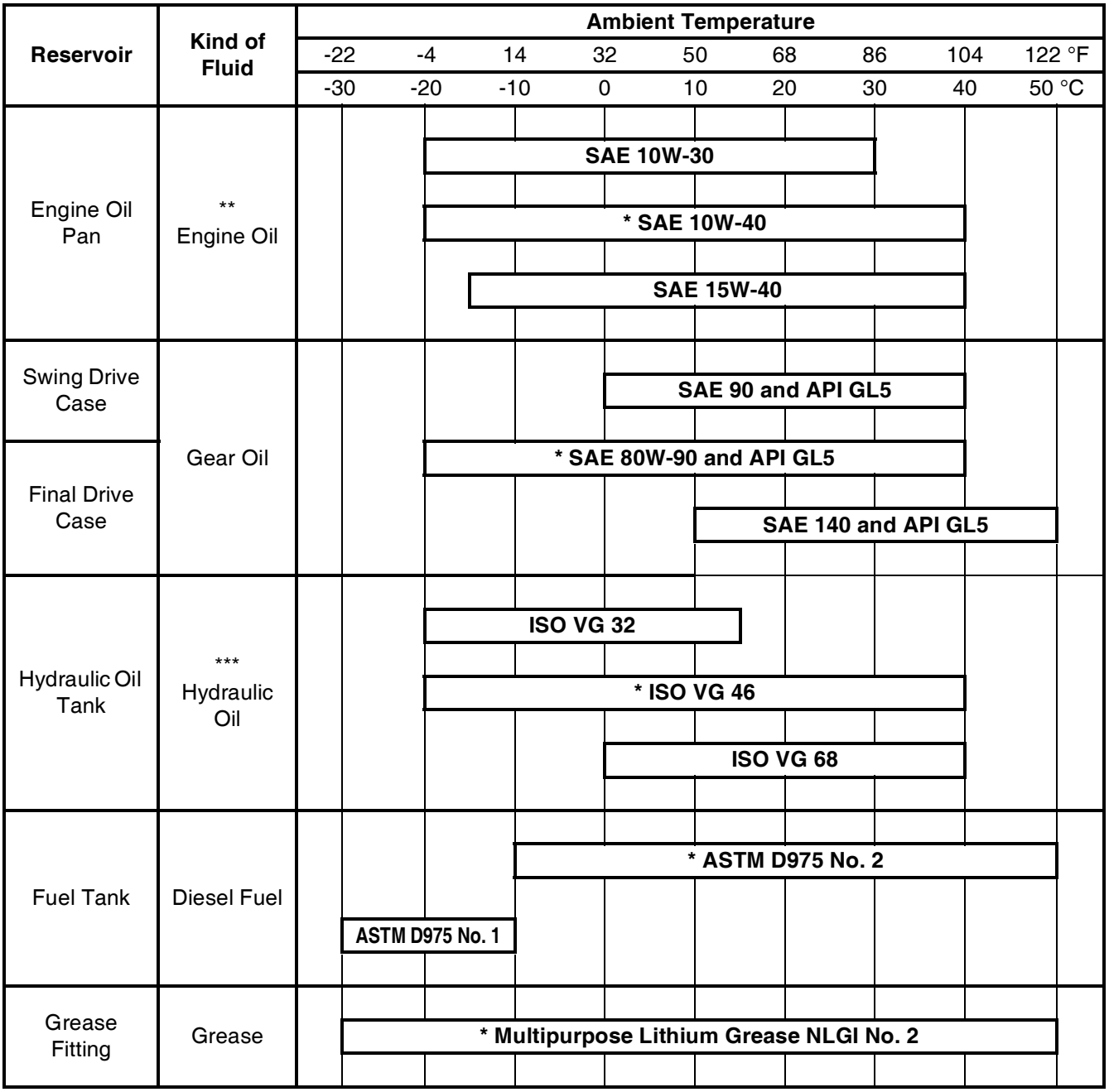
Figure 10

TABLE OF RECOMMENDED LUBRICANTS

IMPORTANT

It is highly recommend to use the DOOSAN Genuine Products, or products which meet the specification below. Using other products may damage the equipment.

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



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.		

CAUTION

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.

IMPORTANT

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

FLUID CAPACITIES

Component		Capacity
Engine	Oil Pan with Filter	25 liters (6.6 U.S. gal.)
	Cooling System	24 liters (6.3 U.S. gal.)
Fuel Tank		400 liters (105 U.S. gal.)
Hydraulic Oil	Tank Level	140 liters (37 U.S. gal.)
	System	240 liters (63 U.S. gal.)
Travel Reduction Device (Each)		3.3 liters (0.87 U.S. gal.)
Swing Device		5 liters (1.3 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
	Hydraulic Oil Tank Breather
	Coolant
	Air Cleaner Element
	Fuel Filter
	Air Conditioner Filter
	Drain Water

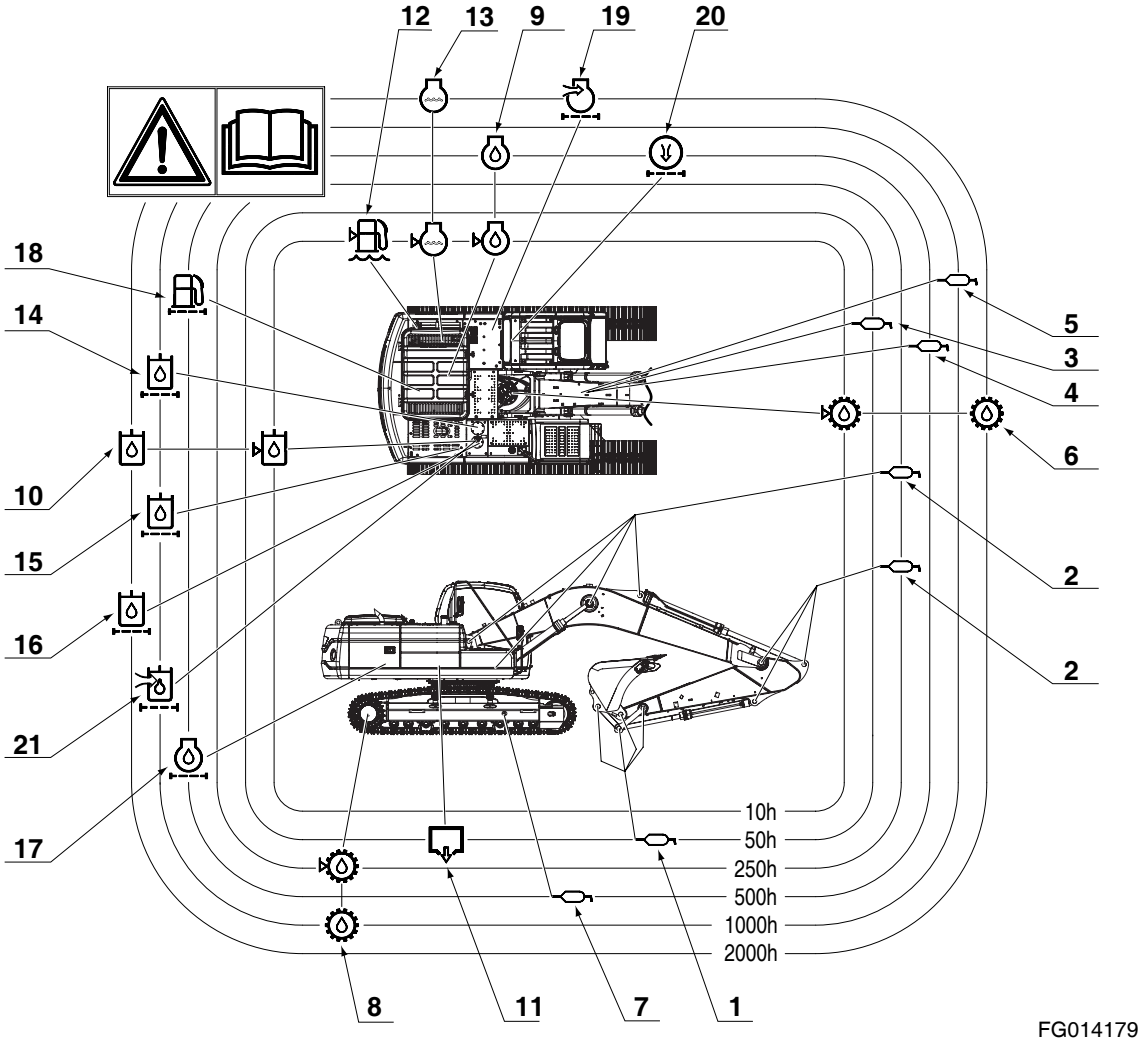

12
13
9
19
20
18
14
10
15
16
21
17
5
3
4
6
2
2
10h
50h
250h
500h
1000h
2000h
8
11
7
1
FG014179

Figure 11

SERVICE DATA									
No.	Items to Check	Service	DX225LCA						
			Qty.	Service Interval					
				10	50	250	500	1000	2000
1	Front Joint Pin (1)	Grease	6	F100	W10				
2	Front Joint Pin (2)	Grease	11	F100		W10			
3	Swing Bearing	Grease	2		W10				
4	Swing Gear	Grease	1						
5	Swing Reduction Gear	Grease	1					W10	
6	Swing Device	Gear Oil (80W90)	5 L	V		F			
7	Track Spring	Grease	2				W10		
8	Travel Reduction Device	Gear Oil (80W90)	2X3.3 L			F, V			
9	Engine Oil	Engine Oil (10W40)	25 L	V	F				
10	Hydraulic Oil Tank	Hydraulic Oil	240 L	V					
11	Fuel Tank	Diesel	400 L	V					
12	Water Separator	Drain Water	-	V					
13	Radiator	Coolant (Antifreeze)	24 L	V					PG
14	Hydraulic Oil Return Filter	Element	1			F			
15	Pilot Filter	Element	1			F			
16	Hydraulic Oil Suction Strainer	Strainer	1						C
17	Engine Oil Filter	Cartridge	1		F				
18	Fuel Filter	Cartridge	1						
19	Air Cleaner (Outer)	Element	1				C		
	Air Cleaner (Inner)	Element	1						
20	Air Conditioner Filter (Outer)	Cartridge	1				C		
	Air Conditioner Filter (Inner)	Cartridge	1				C		
21	Air Breather Filter	Cartridge	1						

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.

EG: Ethylene Glycol - Doosan Genuine Antifreeze Solution (Drain and replace using this interval.) See "Engine Cooling System" on page 4-71, for further explanation.

PG: Propylene Glycol - Doosan Genuine Antifreeze Solution (Drain and replace using this interval.) See "Engine Cooling System" on page 4-71, for further explanation.

: Replacement On Every Interval.

NOTE: *For additional service items see list of "Maintenance Intervals" on page 4-12.*

MAINTENANCE INTERVALS

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

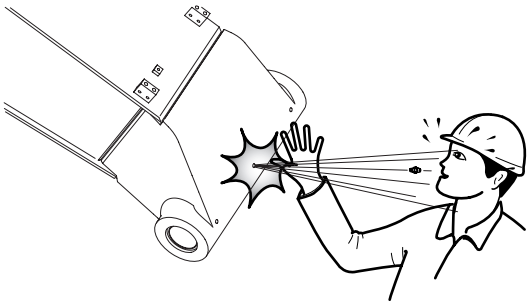
Grease Boom, Arm and Front Attachment Pins (for first 100 hours)

WARNING

Do not remove grease fitting until 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.



FG000500

Figure 12

Grease every 10 hours for first 100 hours and every 50 or 250 hours thereafter (See page 4-23).

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

Check Engine Oil Level

WARNING

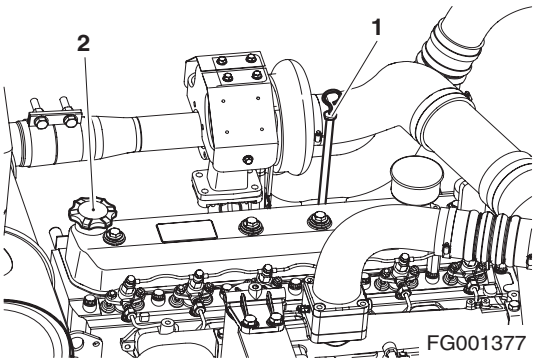
Allow the engine to cool before checking the oil level to avoid burns by touching hot engine parts.

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 13) and wipe the oil off with a clean cloth.
3. Insert dipstick fully in the oil gauge tube, then take it out again.
4. Engine oil level must be between "HIGH" and "LOW" marks on dipstick.

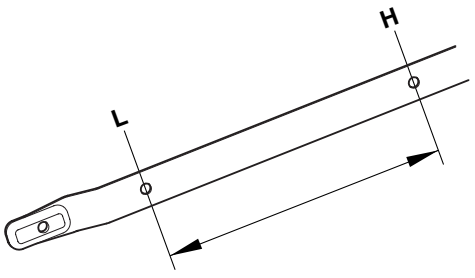
   NOTE: *If oil is above "HIGH" mark on dipstick, some must be drained to return oil to proper level.*

5. Add oil through engine oil fill cap (2, Figure 13), if the oil level is below the "LOW" mark.



FG001377

Figure 13



FG000616

Figure 14

Check Level of Hydraulic Oil Tank

WARNING

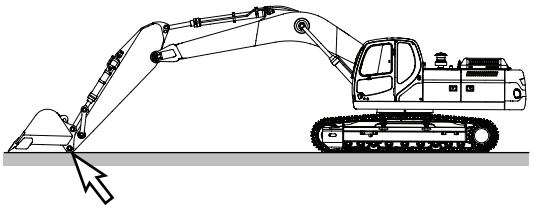
The hydraulic oil will be hot after normal machine operation. Allow the system to cool before attempting to service any of the hydraulic components.

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.

ARO1760L

Figure 15

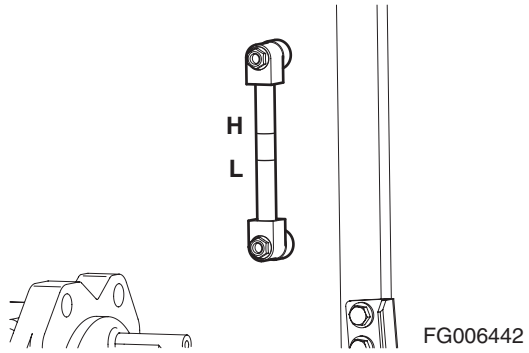
1. Park machine on firm, level ground. Lower boom and position bucket on ground as shown in Figure 16.
2. Set engine speed to "LOW IDLE."



FG000012

Figure 16

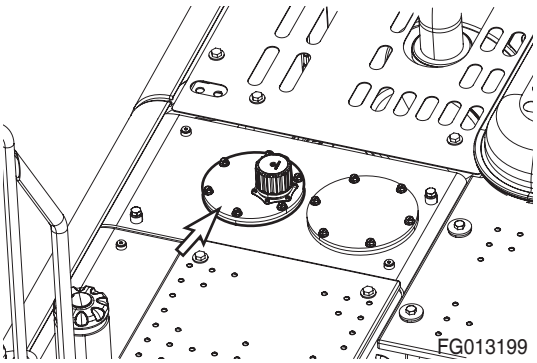
3. Set safety lever to "LOCK" position.
4. Check level gauge by opening right access door. Oil level must be between marks on sight gauge.



FG006442

Figure 17

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



FG013199

Figure 18

IMPORTANT

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

6. If oil level is above the "H" mark drain oil.

   A. Shut down engine and wait for the hydraulic oil to cool down.

   B. Drain the excess oil from drain plug (Figure 19) at the bottom of the tank into a suitable container, using a hose at the port (plug).

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

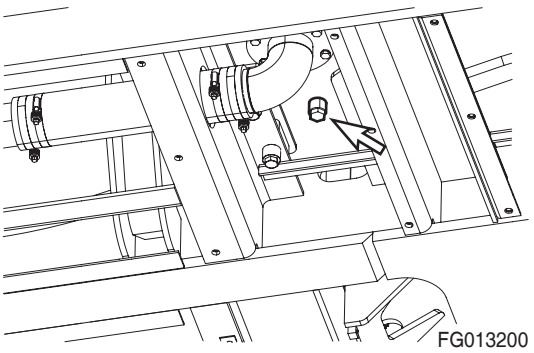


Figure 19

Check for Leaks in Hydraulic System

1. Perform a daily walk-around inspection to make sure that 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.

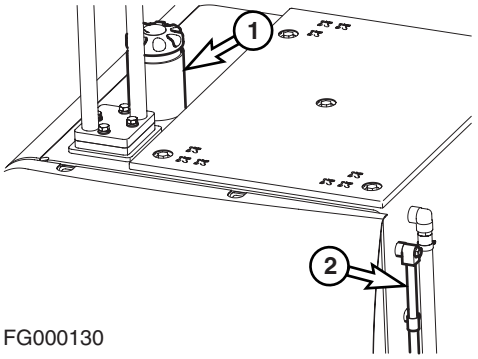


Figure 20

1. At end of each work day, fill fuel tank. Add fuel through fuel fill tube (1, Figure 20). 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 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 20).

   NOTE: *See "Fluid Capacities" on page 4-8. for capacity.*

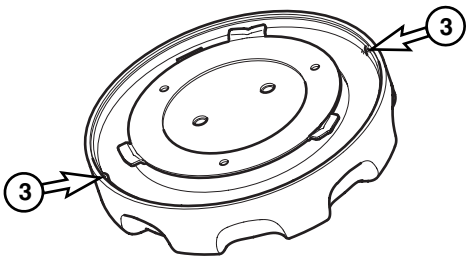
4. The excavator may be equipped with the optional battery operated fuel fill pump. The pump assembly is in the hydraulic pump compartment. Put the suction hose of the pump into the fuel resupply tank. Turn the switch in the pump compartment "ON," and the fuel will be pumped into the excavator fuel tank.

   NOTE: *See "Fuel Transfer Pump (Optional)" on page 4-74, for further information.*

5. Do not overfill the tank.

6. Securely tighten cap after fueling.

   NOTE: *If breather holes (3, Figure 21) in cap are clogged, a vacuum may form in the tank preventing proper fuel flow to engine. Keep holes in fuel cap clean.*



FG000317

Figure 21

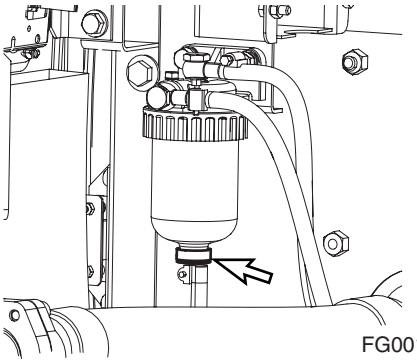
Check for Leaks in Fuel System

1. Perform an inspection of the engine compartment to verify that 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 water separator is inside the left side access door.
2. Open the access door on left side of the machine.
3. If red ring in bowl reaches level line, loosen plug (Figure 22) at bottom of body and drain water into a suitable container.

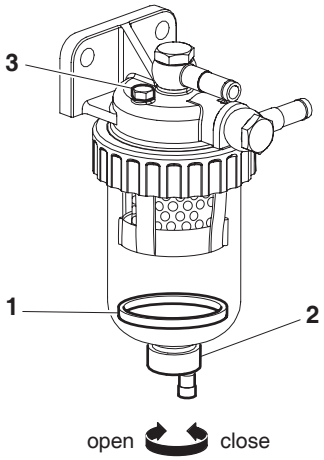
   NOTE: *Dispose of drained fluids according to local regulation.*



FG001382

Figure 22

4. Tighten plug (Figure 22) and prime fuel system. (See page 4-40)
5. Close access door.



FG014180

Figure 23

Check Oil Level of Swing Reduction Device

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

1. Remove dipstick (1, Figure 24) and wipe the oil from the dipstick with a cloth.
2. Insert dipstick (1, Figure 24) fully into dipstick tube.

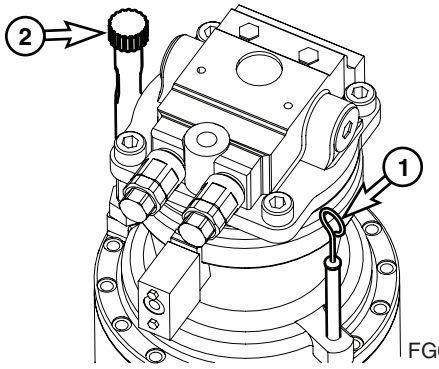


Figure 24

3. When dipstick is pulled out, 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 proper level.*

4. If the oil does not reach the "L" mark on the dipstick, add oil through fill port (2, Figure 24).

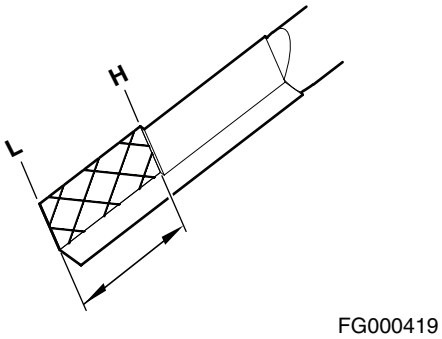


Figure 25

5. If the oil level exceeds the "H" mark on the dipstick, release the drain plug. Drain the excessive oil into a suitable container.

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

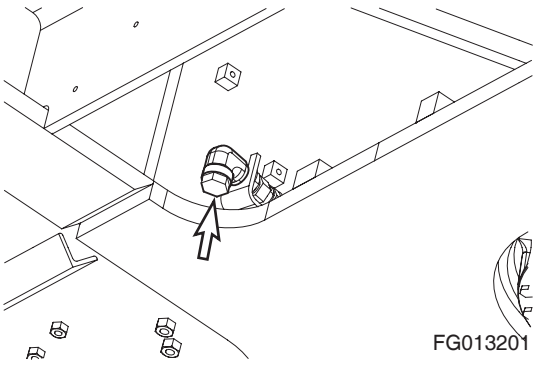


Figure 26

Clean Dust Net in Front of Oil Cooler and Intercooler

IMPORTANT

If running excavator in dusty area, check dust net everyday and clean it if dirty.

⚠ WARNING

If using compressed air or water to clean the dust net, make sure that proper eye protection is worn.

1. Loosen the wing bolt(s) and remove dust net.
2. Clean with compressed air or water.

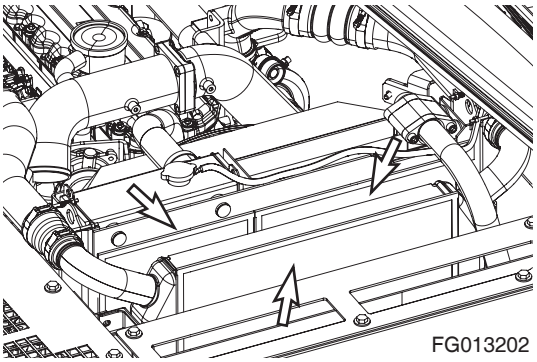

FG013202

Figure 27

Check Cooling System and Refill As Required

⚠ WARNING

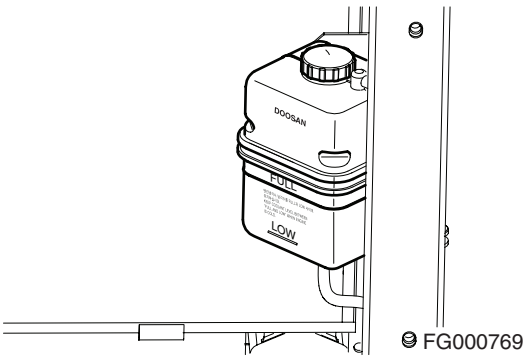
Allow the engine to cool before releasing the radiator cap. Make sure to loosen the cap slowly to release any remaining pressure.

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 4-73)
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.



FG000769

Figure 28

Check Level of Window Washer Liquid

1. Open left front access door and check fluid level in windshield washer tank.
2. 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.*

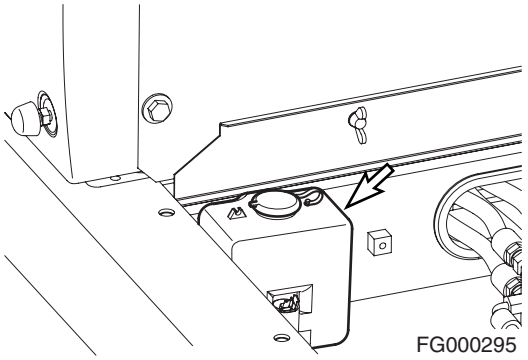


Figure 29

Inspect the Bucket Teeth and Side Cutters for Signs of Wear

1. Daily, inspect the bucket teeth to make sure that tooth wear or breakage has not developed.
2. Do not allow the replaceable bucket teeth to wear down to the point that bucket adapter is exposed. See Figure 30.

   NOTE: *These instructions are only for DOOSAN OEM buckets. If you are using other manufacturers' buckets, refer to their specific instructions.*

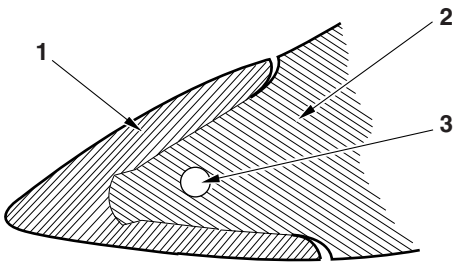


Figure 30

1. POINT, 2. ADAPTER and 3. PIN

Inspect Cooling Fan Blade

WARNING

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 damage.

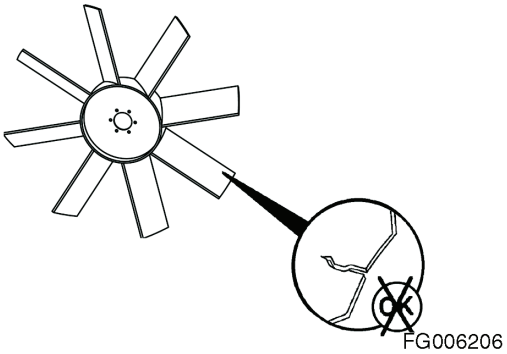


Figure 31

Check Air Intake System

CAUTION

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.

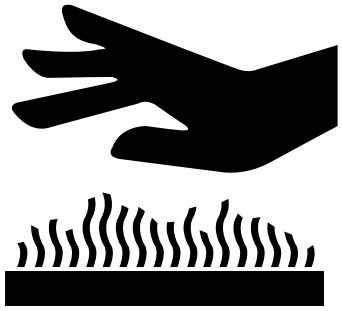


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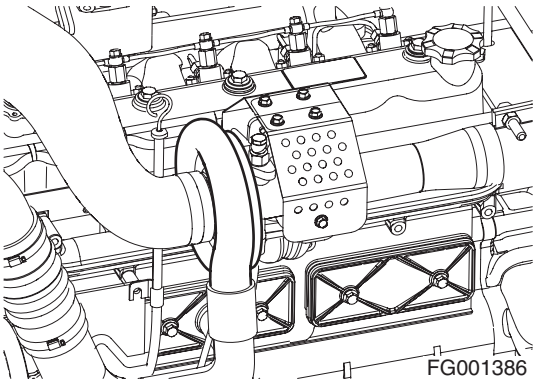
Figure 32



FG001386

Figure 33

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 Control Console Indicator and Monitor Lights

1. Turn engine starter switch to the "I" (ON) position and observe all of the indicator lights.
2. Restore operation of any light bulbs 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 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 of 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 of 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 Arm and 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.

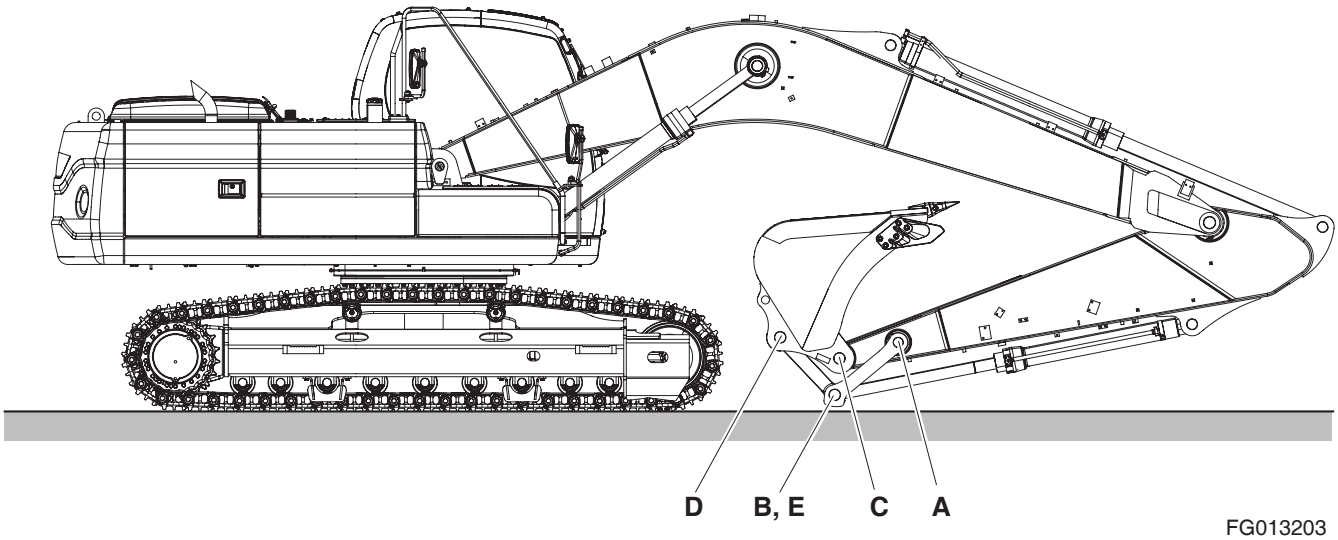


Figure 34

Reference Number	Description
A	Arm Link Joint Pin (1 Point)
B	Link Joint Pin (2 Points)
C	Arm Bucket Joint Pin (1 Point)

Reference Number	Description
D	Bucket Link Joint Pin (1 Point)
E	Bucket Cylinder Rod Pin (1 Point)

A. Arm link joint pin (1 point)

B. Link joint pin (2 points)

C. Arm bucket joint pin (1 point)

D. Bucket link joint pin (1 point)

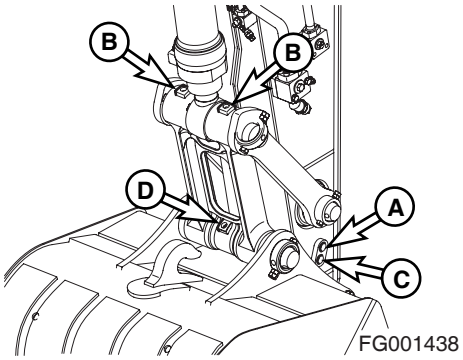


Figure 35

E. Bucket cylinder rod pin (1 point)

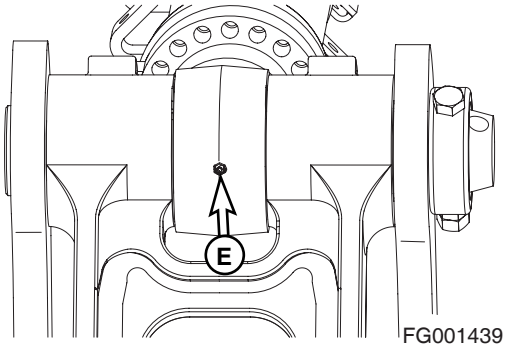


Figure 36

Grease Swing Bearing

1. Park machine on firm, level ground. Lower the front attachment to the ground and shut down engine.
2. There are three grease fittings for the swing bearing. Do not over lubricate. Purge old grease with new. Remove all purged grease.

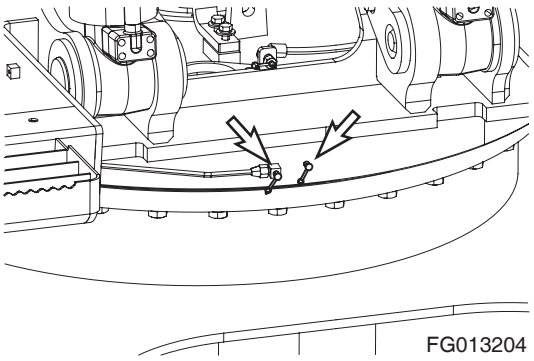


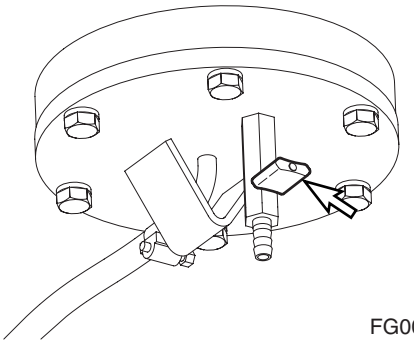
Figure 37

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.*



FG000296

Figure 38

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 4-29.

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 4-34.

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 “Track Tension” on page 4-77.
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

Change Swing Reduction Device Oil (Drain and Refill After First 250 Hours)

NOTE: *Change swing reduction device oil after first 250 hours on a new machine and every 2,000 hours thereafter (See page 4-47).*

Grease Arm and Front Attachment Pins

Grease every 10 hours for first 100 hours and every 250 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.

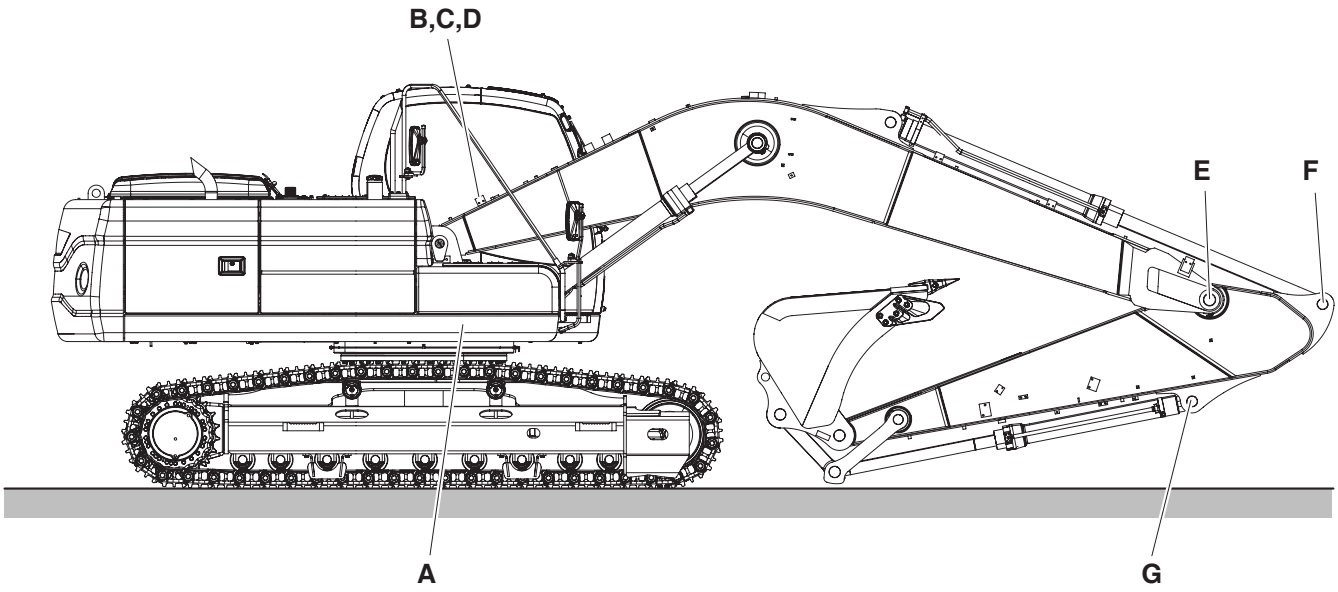


Figure 39

Reference Number	Description
A	Boom Cylinder Head Pin (2 Points)
B	Boom Foot Pin (2 Points)
C	Boom Cylinder Rod Pin (2 Points)

Reference Number	Description
D	Arm Cylinder Head Pin (1 Point)
E	Boom Arm Joint Pin (2 Points)
F	Arm Cylinder Rod Pin (1 Point)
G	Bucket Cylinder Head Pin (1 Point)

A. Boom cylinder head pin (2 points)

FG001389

Figure 40

B. Boom foot pin (2 points)

C. Boom cylinder rod pin (2 points)

D. Arm cylinder head pin (1 point)

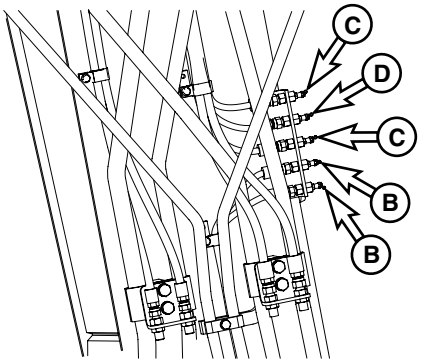


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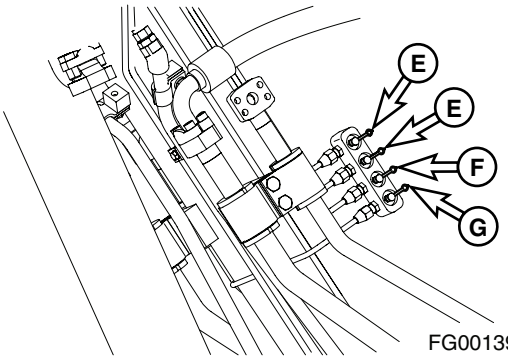
Figure 41

E. Boom arm joint pin (2 points)

F. Arm cylinder rod pin (1 point)

G. Bucket cylinder head pin (1 point)



FG001391

Figure 42

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 43. To adjust the belt, loosen the alternator adjustment plate bolts, adjust the belt tension and retighten the bolts.

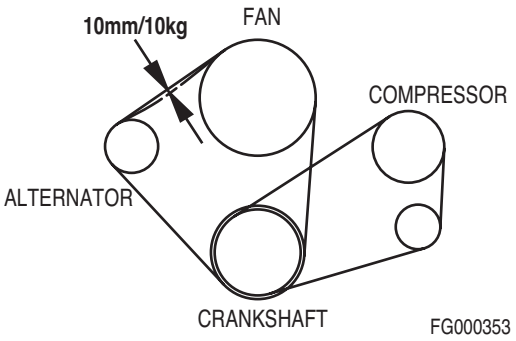


Figure 43

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.

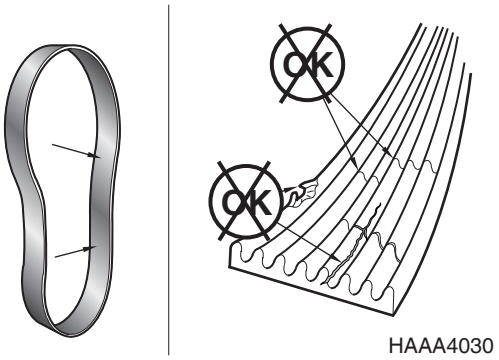


Figure 44

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 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.*

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.

1. Make sure that machine is on firm, level ground.
2. Rotate the track until ports (1 thru 3, Figure 45) are in their proper positions as shown.
3. Loosen fill plug (3, Figure 45) slightly to allow pressurized air to escape.
4. Remove oil level plug (1, Figure 45).
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 45) opening, if necessary.
7. Clean and install oil level and fill plugs (1 and 3, Figure 45).
8. Repeat this procedure on the other travel reduction device.

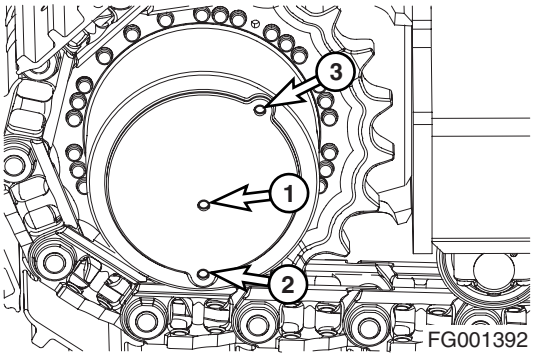


Figure 45

Change Breaker Filter Element (Optional)

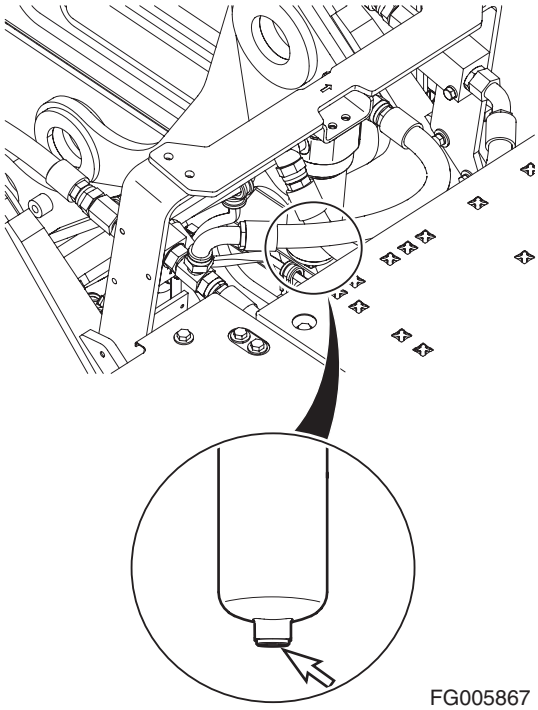
WARNING

The hydraulic oil will be hot after normal machine operation.

Allow the system to cool down before changing pilot filter.

1. Park machine on firm, level ground. Lower the front attachment to the ground and shut down engine.
2. Lift the hydraulic oil tank breather cap to release pressure.
3. Locate breaker filter assembly (Figure 46).
4. Position a container under the filter assembly. Remove the drain plug and completely drain the assembly.
5. Using a 30 mm spanner, unscrew filter housing from filter bottom.
6. Remove O-ring from filter head.
7. Replace filter.
8. Apply a small amount of oil around the entire O-ring and install the filter housing on the filter head.

   NOTE: *Tightening torque: 27 kg•m (265 Nm, 195 ft lb)*
9. Install drain plug in bottom of filter housing.
10. After changing breaker filter, vent air from pump and check level of hydraulic oil tank.



FG005867

Figure 46

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 4-44).*

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 4-42).*

Change Pilot Filter (After First 250 Hours)

NOTE: *Change pilot filter after first 250 hours and every 1,000 hours thereafter (See page 4-43).*

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

Grease Swing Gear and Pinion

WARNING

Greasing swing gear and pinion must be serviced by only one person.

1. Remove inspection cover and inspect the condition of the grease. Make sure that water or other contaminants are not noticeable.

   NOTE: *The upper structure must be rotated a little at a time so that the entire face of the swing gear can be lubricated. Use extreme caution when performing this operation.*

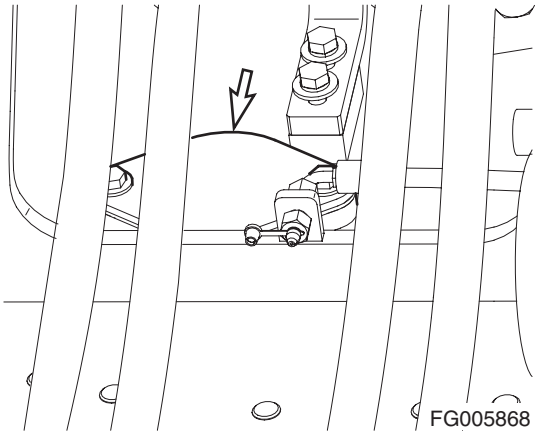


Figure 47

2. If water or other contaminations are found, remove lower access cover so the gear teeth can be thoroughly cleaned and lubricated.
3. Install access covers after lubricating gear teeth.

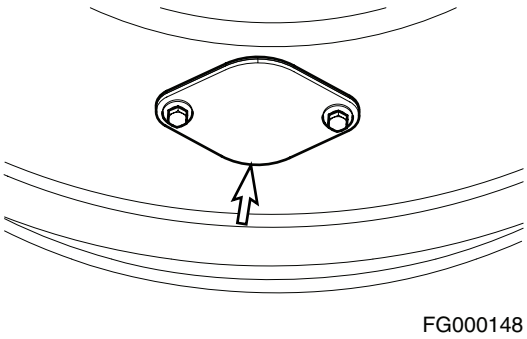


Figure 48

Change Engine Oil and Filter

NOTE: *Change engine oil and filter after first 50 hours of operation or rebuild, then every 500 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 49) and install hose (2) to drain the engine oil. Remove hose (2) and install cap (1).

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

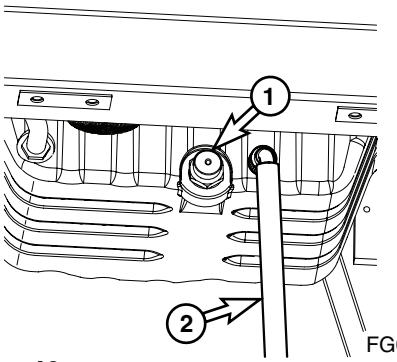


Figure 49

2. Replace engine oil filter by using filter wrench. The engine oil filter is a spin-on type. See Figure 50. 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.

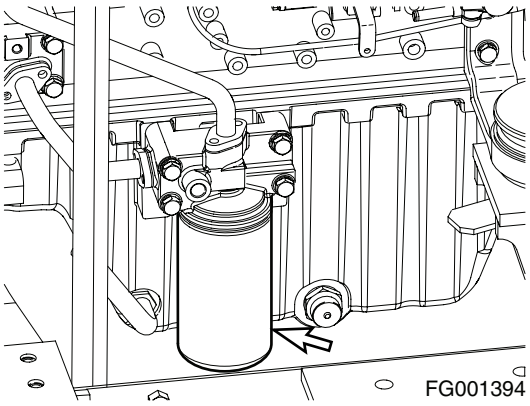


Figure 50

4. Refill the engine with the correct oil through the oil fill port (Figure 51). Refer to the Lubrication Table of this manual for the recommended oil for the operating conditions.

   NOTE: *See "Fluid Capacities" on page 4-8. 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.

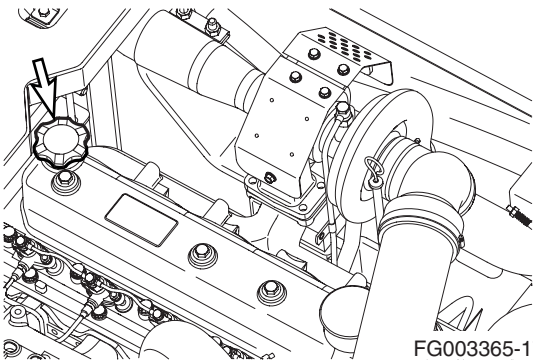


Figure 51

Clean Air-Conditioning Outer Filter

The unit is equipped with an air filtration system which filters out dirt and dust particles from air being circulated into operator's cabin. This filter should be cleaned out.

NOTE: *In the unit is being operated in a dusty environment, the cleaning and replacement should be performed more frequently. If filter is damaged, replace damaged filter with a new one.*

WARNING

All service and inspection of air-conditioning system should be performed with the starter switch in the "O" (OFF) position.

WARNING

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

NOTE: *All right and left call outs are based on the operator being seated in the operator's seat facing the front.*

1. Open the door in the left front of the machine, then remove the cover (1, Figure 52) by loosening the four wing bolts.

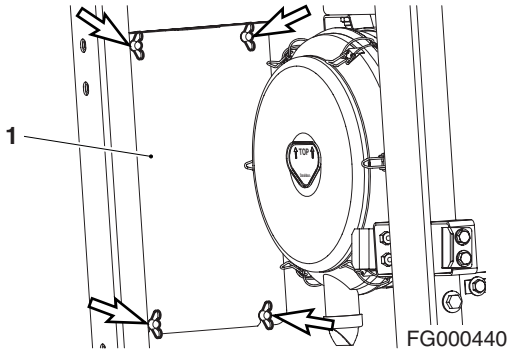


Figure 52

2. Open the cover by turning the knob (1, Figure 53) in the rear of the cabin.

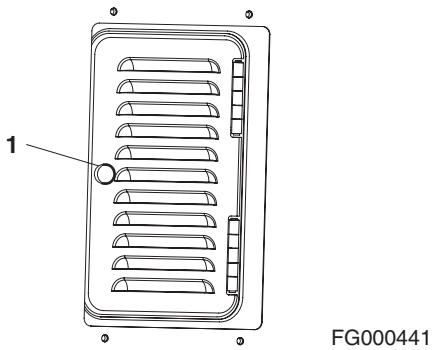


Figure 53

3. Remove filter (Figure 54) and inspect for any damage.
4. Use compressed air to clean filter. If filter is still dirty, then change to new one.
5. Reassemble in reverse order.

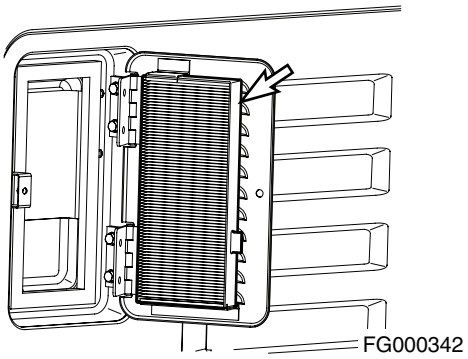


Figure 54

Check and Clean Air-Conditioning Inner Filter

WARNING

All service and inspection of air-conditioning system should be performed with the starter switch in the "O" (OFF) position.

WARNING

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

1. Remove the filter by pulling out ward the knob while pressing the upper part and lower part of the filter handle which is inside of the left rear part of the cabin.
2. Use compressed air in the clean filter. If the filter is damaged replaced by a new one.
   If the filter is very dirty use a mild soap or detergent and water to clean it.

IMPORTANT

If water was used to clean filter, be certain it is completely dry before installing.

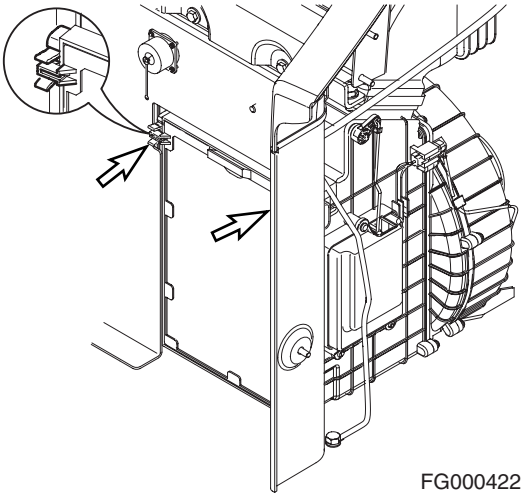


Figure 55

Clean Radiator, Oil Cooler, Intercooler, Fuel Cooler and Air Conditioner Condenser Core

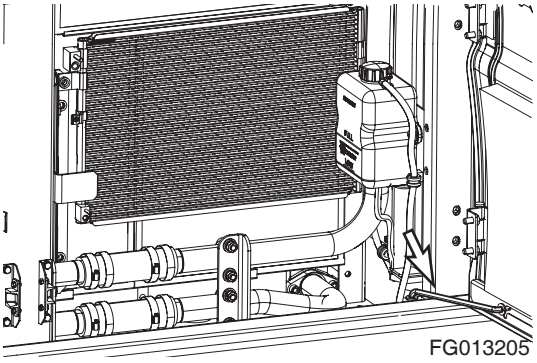

FG013205

Figure 56

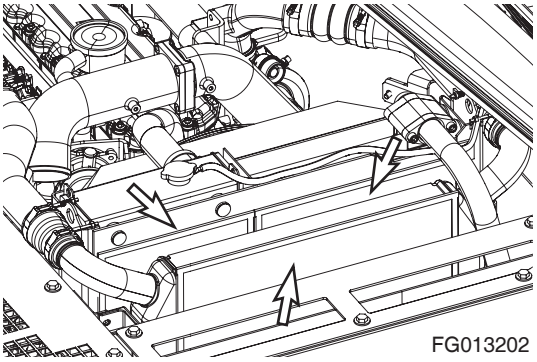

FG013202

Figure 57

⚠ WARNING

If compressed air, steam or water hit your body directly, there is danger of injury. Always wear protective glasses, mask and safety shoes during the cleaning precess. Make sure that all extra personnel are clear of the work area.

1. Open the rear left door and engine cover.
2. Loosen the wing bolt(s) and remove dust net from in front of oil cooler and intercooler.
3. Clean the outside of the radiator and oil cooler, intercooler and fuel cooler with compressed air, steam or water. Wash from the outside of the engine compartment inwards. Repeat the cleaning process from the inside of the engine compartment outwards to remove all dirt and debris.

   NOTE: *Clean dust net and install it after cleaning radiator, oil cooler, intercooler and fuel cooler.*
4. Clean air conditioner condenser core with compressed air, steam or water.

IMPORTANT

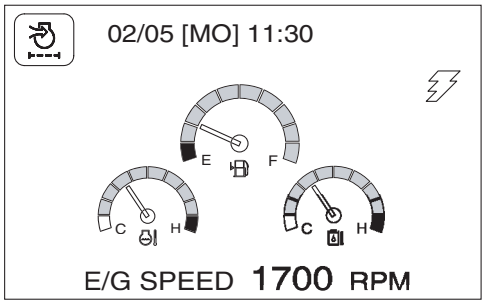
To prevent damage to the cores, apply compressed air from an appropriated distance. Damaged core may cause water leakage or overheating. In a dusty site, check the core daily, irrespective of the maintenance interval.

Clean Outer Filter of Air Cleaner

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

NOTE: *If air cleaner clogged warning light (Figure 58) on instrument panel comes "ON" the air cleaner must be serviced.*

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



FG000264

Figure 58

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: *When it reaches every 500 hours or If indicator light (Figure 58) on instrument panel comes "ON" the air cleaner must be serviced.*

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

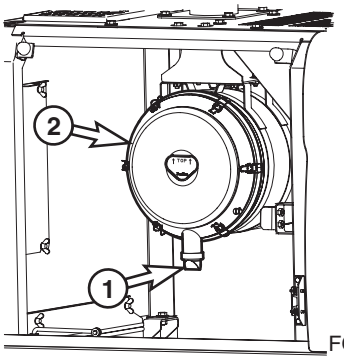
2. Remove and clean rubber evacuator valve (1, Figure 59) from bottom of air cleaner housing cover (2). Inspect seal lips for wear or damage. Replace valve if necessary.

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

3. Remove the access cover (2, Figure 60) by loosening the latches (3).

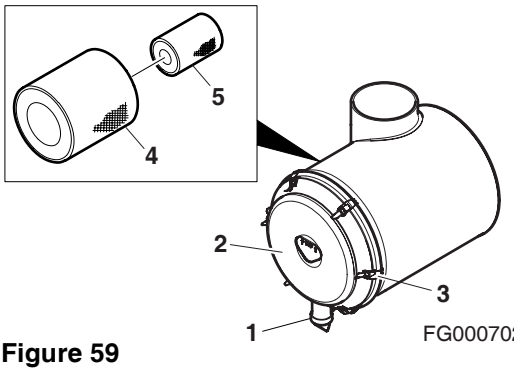
4. Remove outer filter (4, Figure 60) from the housing. Do not remove inner filter (5).

5. Clean the outer filter (4, Figure 60) by blowing compressed air from the inside of the filter towards the outside. Do not use more than 205 kPa (30 psi) air pressure.



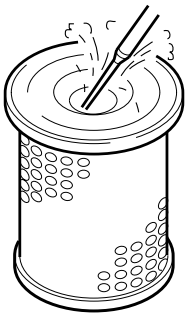
FG000297

Figure 58



FG000702

Figure 59

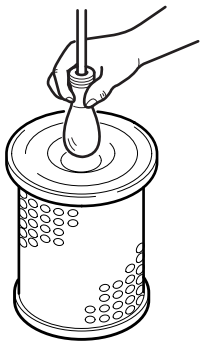


HAOC570L

Figure 60

6. Check outer filter by shinning 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."

   NOTE: *If after cleaning the outer filter, the air cleaner clogged indicator remains "ON," replace the outer and inner filters. Do not clean inner filter.*



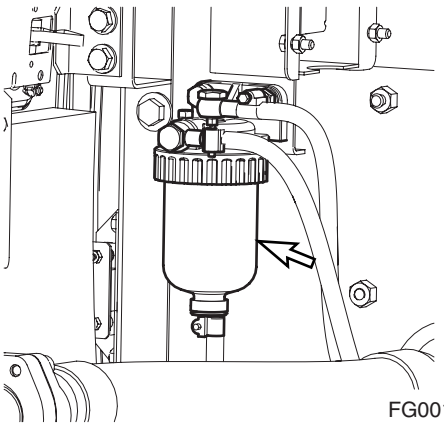
FG000412

Figure 61

Clean Water Separator

1. Open the left rear side door to access water separator.
2. Position a small container under water separator. Drain fuel by opening drain valve on bottom of filter.

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

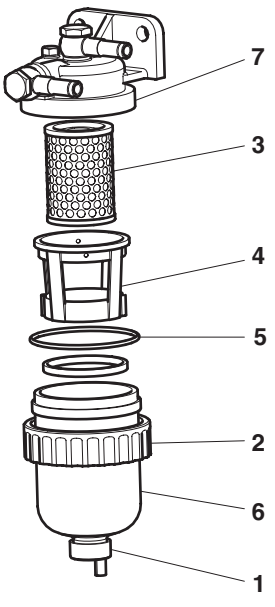


FG001399

Figure 62

3. Unscrew water separator bowl from head assembly.
4. Clean strainer (3, 4) after disassemble them.
5. After cleaning strainer, install water separator bowl. Screw bowl (2) on head until gasket contacts head by hand.

   NOTE: *Coat water separator gasket with fuel.*
6. Tighten filter 3/4 turn more for airtightness.



FG001400

Figure 63

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.

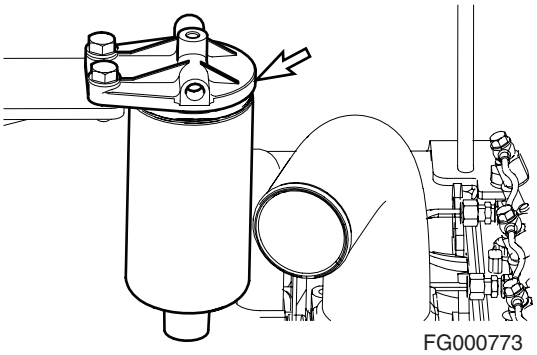

FG000773

Figure 64

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.*

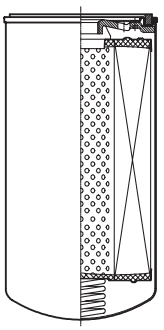

FG000478

Figure 65

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 bleed using the following procedure:

1. Loosen plug (Figure 66) on top of fuel filter head.
2. Unscrew and pump the hand operated primer pump (Figure 67) by the fuel injection pump. Pump primer until fuel is present at plug hole in fuel filter head.
3. Tighten plug in fuel filter head.
4. Continue to pump primer pump until a strong resistance is felt. Screw the primer pump knob back into housing.
5. Start engine and look for signs of leaks.
6. Repeat procedure if necessary.

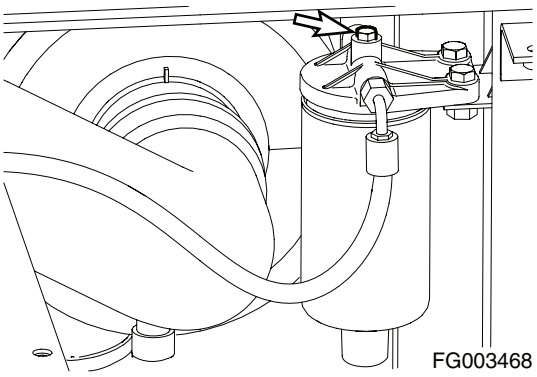

FG003468

Figure 66

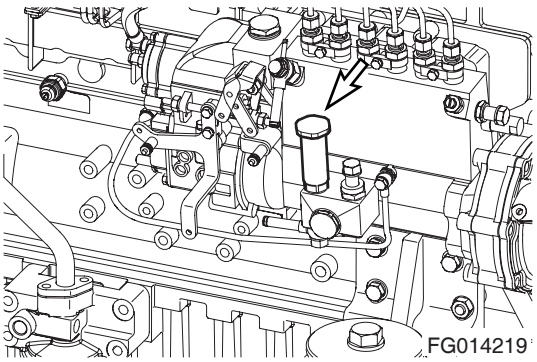

FG014219

Figure 67

1,000 HOUR / 6 MONTH SERVICE

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

Grease Swing Reduction Device

1. Park machine on firm, level ground. Lower the front attachment to the ground and shut down engine.
2. Remove air vent plug (1, Figure 68) from swing reduction device.

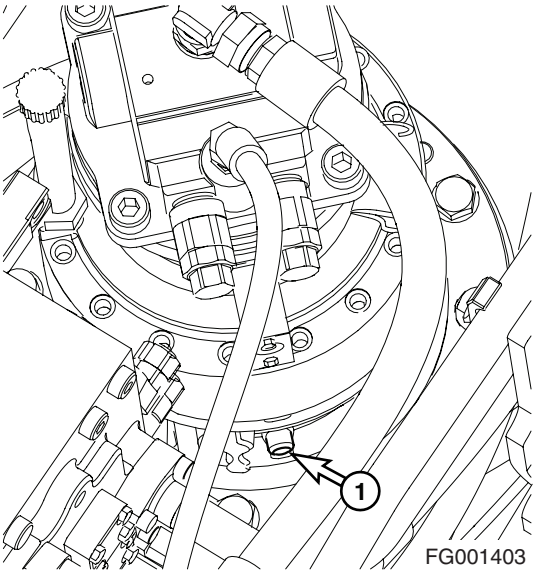


Figure 68

3. Press grease fitting and inject grease with the grease gun on the marked point (2, Figure 69).
4. Install air vent plug (1, Figure 68) in swing reduction device.

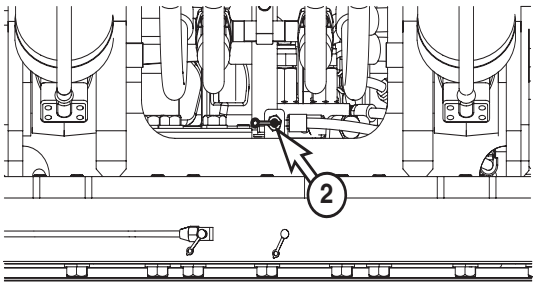
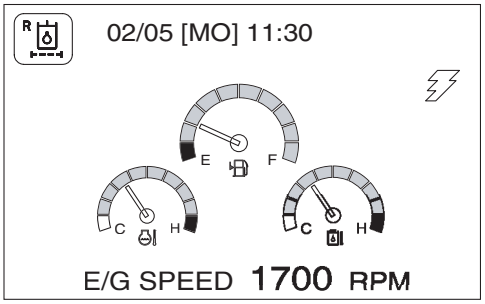


Figure 69

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.*

NOTE: *If return filter clogged warning light (Figure 70) on instrument panel comes "ON" the return filter must be serviced.*



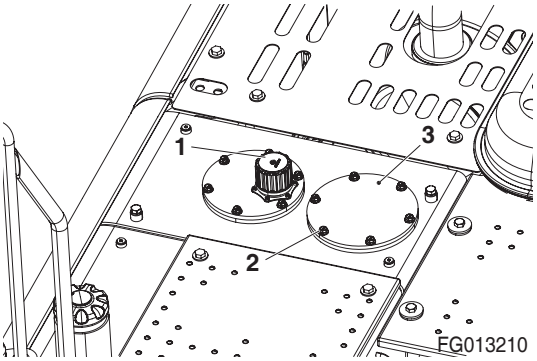
FG000760

Figure 70

⚠ 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. Lift 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.



FG013210

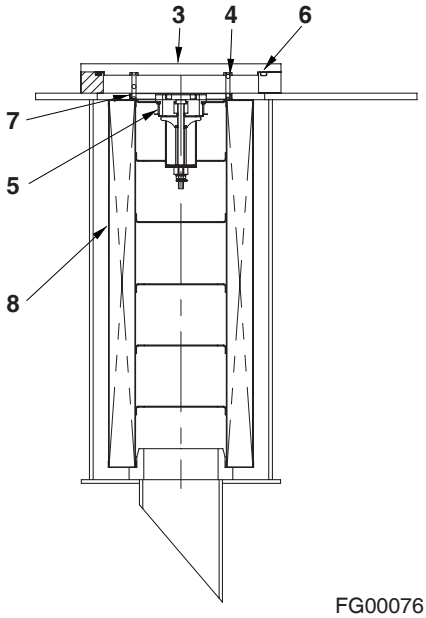
Figure 71

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. Lift the breather cap (1, Figure 71) slightly to release the internal pressure.
3. Remove bolts (2, Figure 71) and service cover (3). Remove spring (4), valve (5) O-ring (6), and bypass strainer (7), and then filter (8).
4. Remove filter and discard.

   NOTE: *Used filter should always be disposed of according to local regulations.*
5. Install new filter and a new O-ring. Install bypass strainer, valve and spring. Install service cover plate.
6. Tighten the breather cap (1, Figure 71).
7. Run engine for ten minutes at low idle to purge air from circuit.
8. Check level in hydraulic oil tank (See page 4-15). Add oil if necessary.



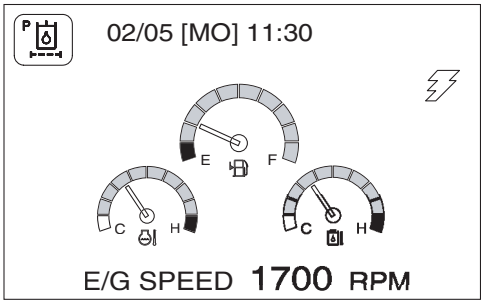
FG000761

Figure 72

Change Pilot Filter

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

NOTE: *If pilot filter clogged warning light (Figure 73) on instrument panel comes "ON" the pilot filter must be serviced.*



FG000763

Figure 73

⚠ WARNING

The hydraulic oil will be hot after normal machine operation.

Allow the system to cool down before changing pilot filter.

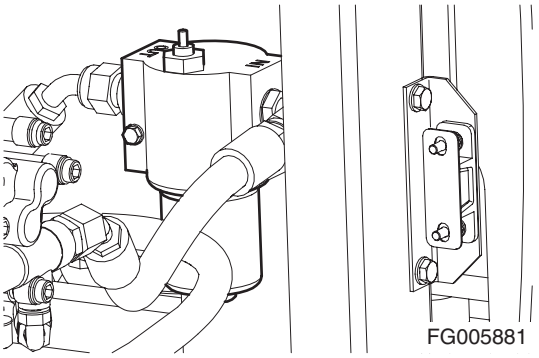
1. Park machine on firm, level ground. Lower the front attachment to the ground and shut down engine.
2. Lift the breather cap (1, Figure 71) slightly to release the internal pressure.
3. Locate pilot system filter assembly. See Figure 74.
4. Unscrew canister (5, Figure 75) and remove O-ring (3) and filter cartridge (4).

   NOTE: *The canister will be filled with oil. Use caution when removing this assembly.*

5. Insert a new filter cartridge and O-ring. Apply a small amount of oil around the entire O-ring and install the canister assembly onto the filter head (1, Figure 75).

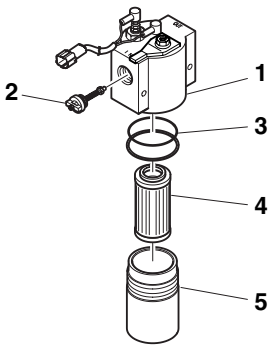
   NOTE: *Used filter should always be disposed of according to local regulations.*

6. After changing pilot filter, vent air from pump and check level of hydraulic oil tank.



FG005881

Figure 74



FG000323

Figure 75

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

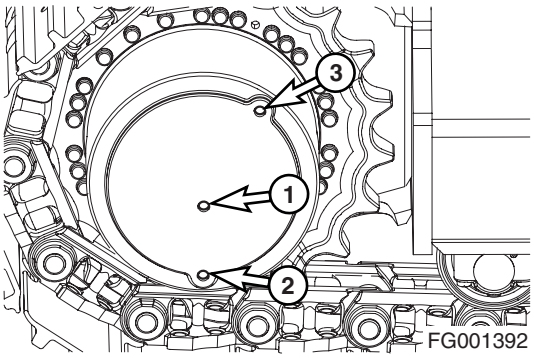


Figure 76

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 machine is on firm, level ground.
2. Rotate the track until ports (1 thru 3, Figure 76) are in their proper positions as shown.
3. Place a container under drain plug (2, Figure 76) 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 76). 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 4-8. for capacity.*
5. Repeat this procedure on the other travel reduction device.

Change Air Breather Filter

1. Park machine on firm, level ground. Lower the front attachment to the ground and shut down engine.
2. Lift the breather cap(2. Figure 77) slightly to release the internal pressure.
3. Unscrew the bolt (1, Figure 77) and take off the breather cap (2, Figure 77).
4. Change a filter cartridge (3, Figure 77) and assemble the breather cap by tighting the bolt.

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

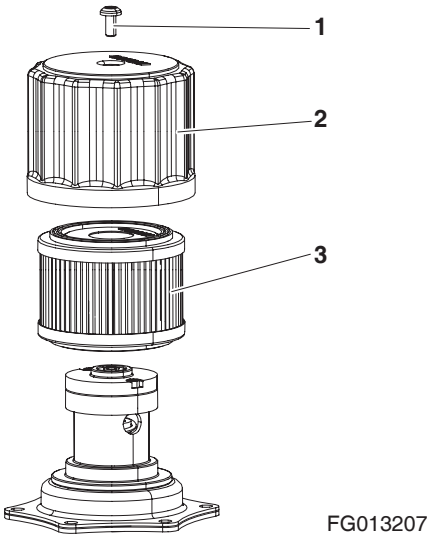


Figure 77

Change Air-Conditioning Outer Filter

The unit is equipped with an air filtration system which filters out dirt and dust particles from air being circulated into operator's cabin. This filter should be cleaned out.

NOTE: *In the event that the unit is being operated in a dusty environment, the cleaning and replacement should be performed more frequently. If filter is damaged, replace damaged filter with a new one.*

WARNING

All service and inspection of air-conditioning system should be performed with the starter switch in the "O" (OFF) position.

NOTE: *All right and left call outs are based on the operator being seated in the operator's seat facing the front.*

1. Open the door in the left front of the machine, then remove four wing bolts and washers, and access cover (1, Figure 78).

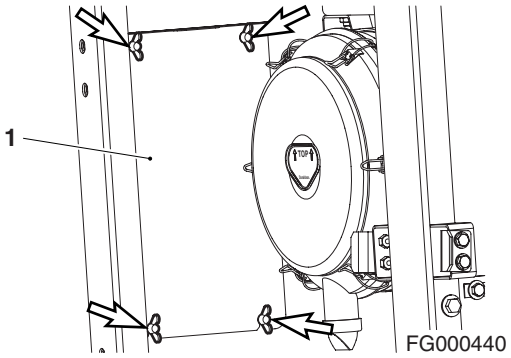


Figure 78

2. Open the cover by unscrewing the knob (1, Figure 79) in the rear of the cabin.

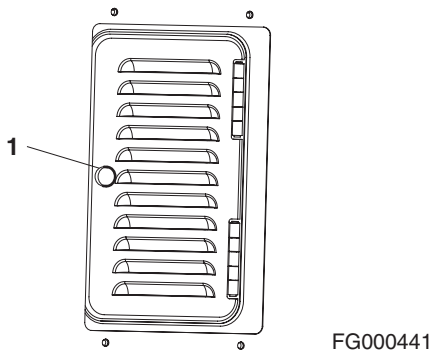


Figure 79

3. Remove filter (Figure 80) and replace with new one.
4. Reassemble in reverse order.

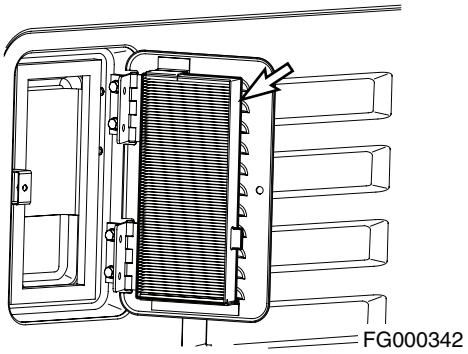
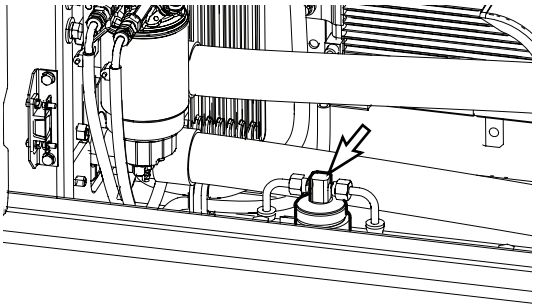


Figure 80

Check Air Conditioner Refrigerant



FG006443

Figure 81

WARNING

Mixing of tobacco smoke and freon is deadly.

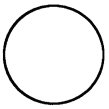
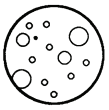
Do not smoke while servicing or recharging air-conditioning system.

1. Run engine at about 1800 rpm. Operate for a minimum of ten minutes to stabilize the system.
2. Press the "HI" fan speed switch to set maximum air flow.
3. Put the temperature control switch in maximum cooling position.
4. Press the "Internal Air Circulation" switch.
5. Compare the flow of bubbles in the sight glass of receiver dryer with the drawings in the following table.

CAUTION

Overfilling refrigerant may cause dangerous high-pressure and poor cooling action; and low refrigerant level may cause compressor damage.

Always maintain refrigerant at normal level.

Amount of Refrigerant	Appearance of the Sight Glass	Solutions
Normal	 Almost clear. Any bubbles disappear.	
High	 No bubbles are seen.	Charge or withdraw the system with the correct amount of HFC-134a refrigerant.
Low	 A flow of bubbles is visible.	

Check and Adjust Engine **

Contact your nearest DOOSAN dealer.

Engine dealer for checking and adjusting the following items:

- Engine Compression Pressure.
- Injection Pressure.
- Injection Timing.

2,000 HOUR / YEARLY SERVICE

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

Change Swing Reduction Device Oil

NOTE: *Change swing reduction device oil after first 250 hours of operation or rebuild and every 2,000 hours thereafter.*

WARNING

The gear oil is very hot after the machine has been operating. Shut all systems down and allow them to cool.

1. Set a container under excavator.
2. Release the drain plug and drain the swing reduction device oil into a container.

   NOTE: *Dispose of drained fluids according to local regulations.*
3. After draining oil, tighten the drain plug.

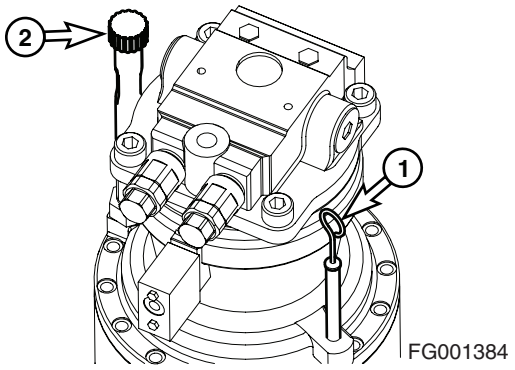


Figure 82

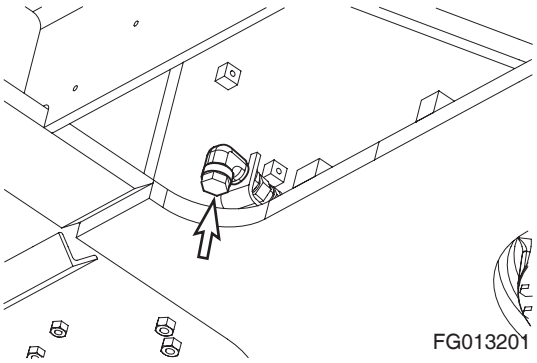


Figure 83

4. Remove breather/fill cap (2, Figure 82) and add oil to "H" mark on dipstick (1).

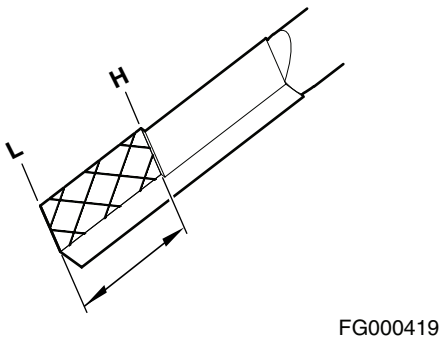


Figure 84

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.*

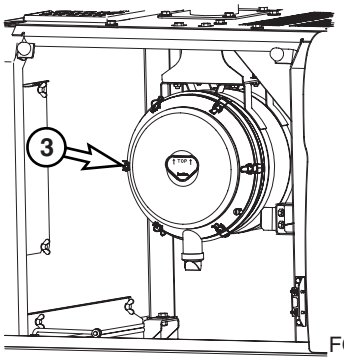
NOTE: *Replace inner element whenever a new outer element is installed.*

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

1. Open the access door at the rear of the cabin.
2. Remove the evacuator valve (1, Figure 86) and air cleaner cover (2).

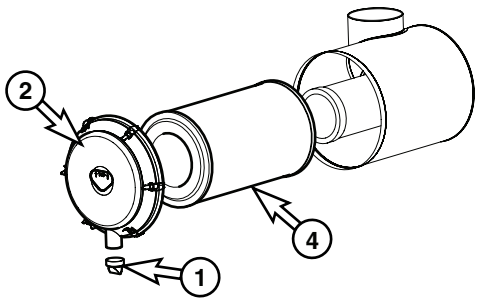
   NOTE: *Inspect evacuator valve seal lips for wear or damage. Replace valve if necessary. Install evacuator valve with lips parallel to the cover.*
3. Remove outer filter (4, Figure 86) from the air cleaner housing.
4. Clean the air cleaner cover and the inside of the air cleaner housing.
5. Remove inner filter (5, Figure 87).
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.*



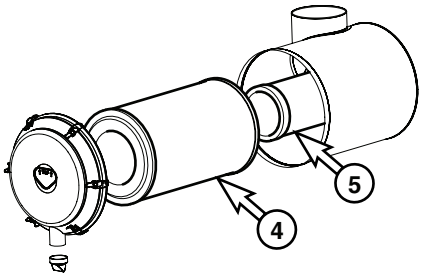
FG000414

Figure 85



FG000425

Figure 86



FG000426

Figure 87

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 radiator cap unless it is required. Observe the coolant level in the coolant recovery tank.

ARO1760L

Figure 88

CAUTION

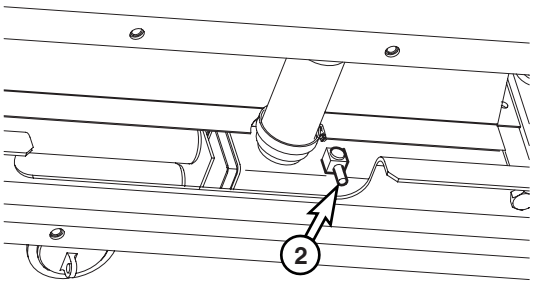
Do not mix ethylene glycol and propylene glycol when changing the antifreeze solution. Flushing should be performed to minimize volume of mixing between the two columns. Mixing the two compounds may cause generation of foreign material to damage the system.

Do not mix antifreeze solutions from different manufactures. Mixed solution may degrade the capabilities of the system. It is recommended to use the standard product from DOOSAN.

In the bitterly cold area or weather, the customer should frequently check the performance of the coolant for appropriateness for the weather, and then determine change cycle of the coolant.

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 89).

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



FG001407

Figure 89

3. Remove coolant drain plug (1, Figure 90) from engine.
4. Install drain plug, and close drain valve after coolant has completely drained from system.
5. Fill cooling system with a flushing solution.
6. Run engine at low idle until the coolant temperature gauge reaches the "BLUE ZONE." Run engine for another ten minutes.
7. Allow engine to cool.
8. Drain flushing fluid and fill system with water.
9. Run engine again to allow water to completely circulate.
10. 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 4-73.
11. Run engine without radiator cap installed, so that all air will be purged from system. Fill radiator to fill neck.
12. Drain and fill radiator coolant recovery tank.

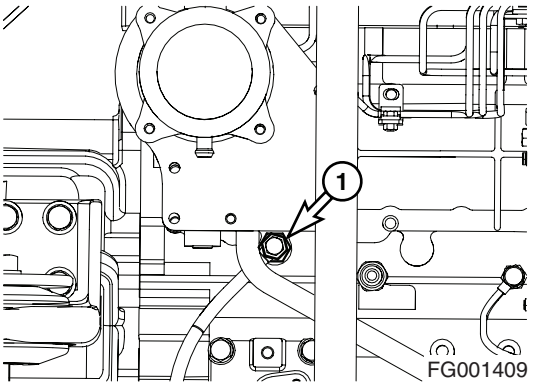


Figure 90

Hydraulic Oil Exchange and Suction Strainer Cleaning

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. Lift 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.

IMPORTANT

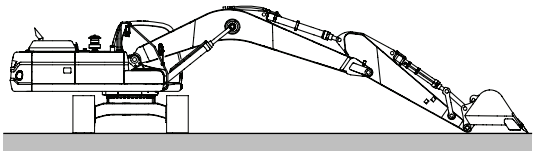
Make sure to clean any dirt or water from the top of the hydraulic tank, especially around the fill port and filter ports.

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.*

Figure 91

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 92.
2. Set safety lever on "LOCK" position.
3. Shut down engine.
4. Release pressurized air from hydraulic tank by lifting breather cap (1, Figure 95).



FG000356

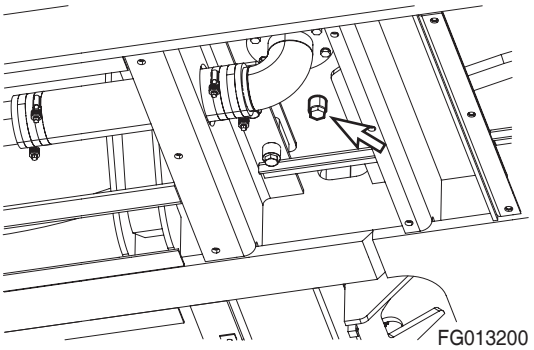
Figure 92

5. Drain hydraulic oil from tank into a container capable of holding 280 liters (74 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.*

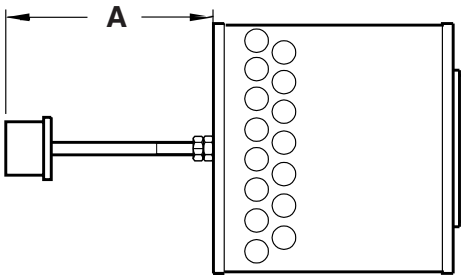


FG013200

Figure 93

6. Carefully remove bolts and cover (2, Figure 95) from top of hydraulic oil tank. There is a spring (3) under the cover that will force the cover up.
7. Remove spring (3, Figure 95) and strainer (5), by pulling on rod (4).
8. Clean inside and outside of strainer. Replace strainer if it is broken.
9. Position strainer (5, Figure 95) on boss portion of suction pipe (6).

NOTE: *Measurement "A" is 650 mm (25.59 in).*



HAOC411L

Figure 94

10. Fill the hydraulic oil tank. Check level using sight gauge on side of tank.
11. Place spring (3, Figure 95) on rod (4) and assemble cover (2).
12. After replacing and cleaning the hydraulic oil, filter and strainer, vent the system. See “Venting and Priming Hydraulic System” on page 4-79.

IMPORTANT

When the hydraulic breaker is being used, because of the higher heat generated by this unit, use replacement intervals recommended under the “Hydraulic Oil and Filter Service Intervals” on page 3-38.

13. Check level of hydraulic oil tank. (See page 4-15)

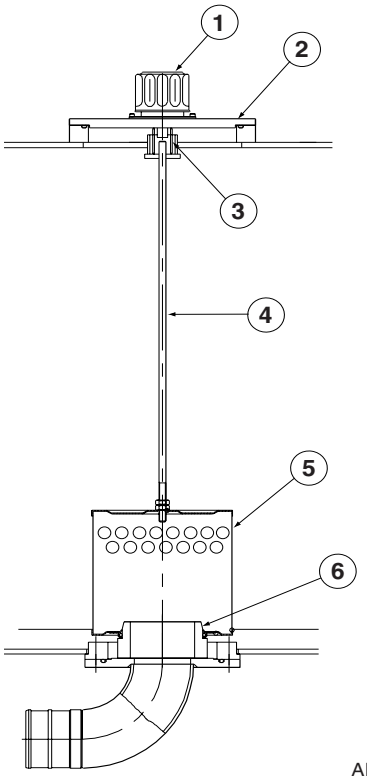


Figure 95

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 water separator)	2 years or 4,000 hours
		Fuel hose (Water separator to fuel injection pump)	
		Fuel hose (Tank to fuel injection pump)	
		Heater hose (Heater to engine)	
		Heater hose (Heater to engine)	
		Heater hose (Heater to radiator)	
		Air Conditioner hose	
Hydraulic System	Body	Pump suction hose	
		Pump discharge hoses	
		Pump side branch hoses	
		Swing motor hoses	
		Travel motor hoses	
	Work Device	Boom cylinder line hoses	
		Arm cylinder line hoses	
		Bucket cylinder line hoses	

12,000 HOUR / 6 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 4-53, 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

NOTE: *See "Clean Air-Conditioning Outer Filter" on page 4-35.*

Check Control Panel

When a function switch is pushed, the last setting has to be displayed on the LCD display.

When the light switch is turned to "I" position, the LED for illumination in the control panel has to turn "ON."

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.

NOTE: *See "Clean Radiator, Oil Cooler, Intercooler, Fuel Cooler and Air Conditioner Condenser Core" on page 4-37.*

Check Magnetic Clutch

Check the magnetic clutch for dirt and interference.

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

Check Belt Tension

NOTE: *See "Check Engine Fan Belt Tension" on page 4-29.*

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. M M	QTY.	BOLT HEAD SIZE	TORQUE		
						kg•m	N•m	ft lb
1	Joint bolt with engine mounting bracket and engine	pump side	16	8	24	27	264	195
		fan side	10	8	17	5	49	36
2	Joint bolt and nut between engine mounting bracket and frame	pump side	20	2	30	46	451	333
		fan side	20	2	30	46	451	333
3	Radiator mounting bolt		16	4	24	27	265	195
4	Tightening bolt for hydraulic oil tank		16	6	24	27	265	195
5	Tightening bolt for fuel tank		16	6	24	27	265	195
6	Tightening bolt for pump		20	4	17	49	480	354
7	Tightening bolt for control valve		16	4	24	27	265	195
8	Tightening bolt for swing reduction device		20	11	30	55	539	398
9	Tightening bolt for swing motor		12	12	10	14.4	141	105
10	Tightening bolt for battery		10	2	17	5	49	36
11	Joint bolt with cabin mounting rubber and frame		10	20	17	6.5	64	47
	Joint bolt with cabin mounting rubber and cabin		16	5	24	21	206	152
12	Joint bolt with swing bearing and upper frame		20	36	30	55	539	398
	Joint bolt with swing bearing and bottom frame		20	36	30	55	539	398
13	Tightening bolt for travel device		16	60	24	30	294	217
	Tightening bolt for sprocket		16	60	22	30	294	217
14	Tightening bolt for upper roller		20	4	30	55	539	398
15	Tightening bolt for bottom roller		16	72	24	27	265	195
16	Tightening bolt for track guard		16	16	24	27	265	195
17	Bolt for track shoes		20	392	27	78	765	564
18	Fixing bolt for front pin		16	10	24	27	265	195
19	Breaker Filter (Optional)			1	30	27	265	195
20	Grease valve for track adjuster		PF 1/2	2	27	14	137	101

1. Joint bolt with engine mounting bracket and engine

   1) Pump side

   - Tool: 24 mm ( )
   - Torque: 27 kg•m (264 N•m, 195 ft lb)

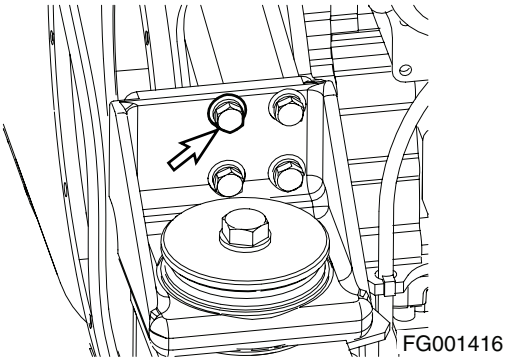

FG001416

Figure 96

   2) Fan side

   - Tool: 17 mm ( )
   - Torque: 5 kg•m (49 N•m, 36 ft lb)

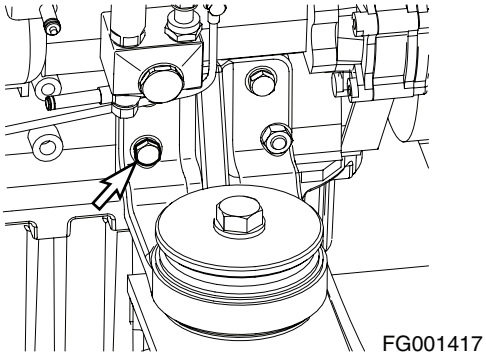

FG001417

Figure 97

2. Joint bolt and nut between engine mounting bracket and frame

   1) Pump side

   - Tool: 30 mm ( )
   - Torque: 46 kg•m (451 N•m, 333 ft lb)

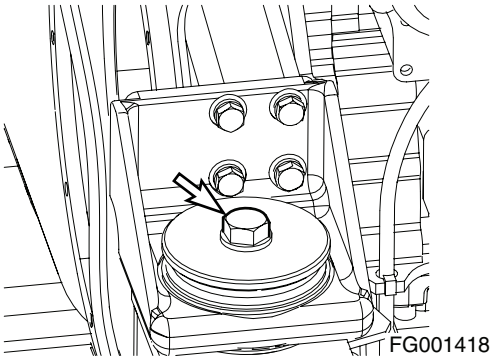

FG001418

Figure 98

   2) Fan side

   - Tool: 30 mm ( )
   - Torque: 46 kg•m (451 N•m, 333 ft lb)

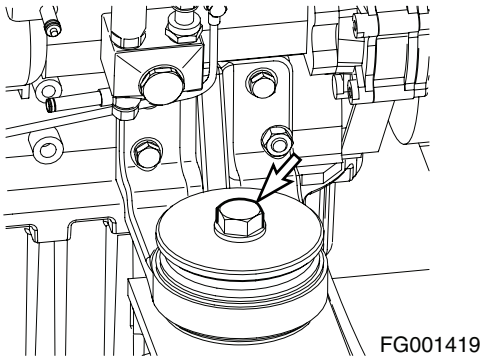
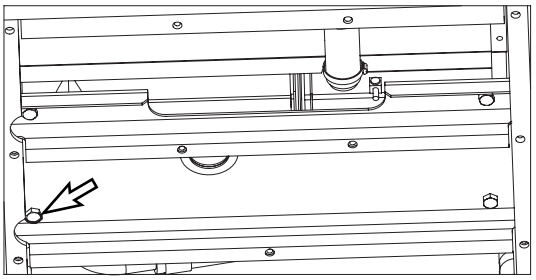

FG001419

Figure 99

3. Radiator mounting bolt

   - Tool: 24 mm ( )
   - Torque: 27 kg•m (265 N•m, 195 ft lb)

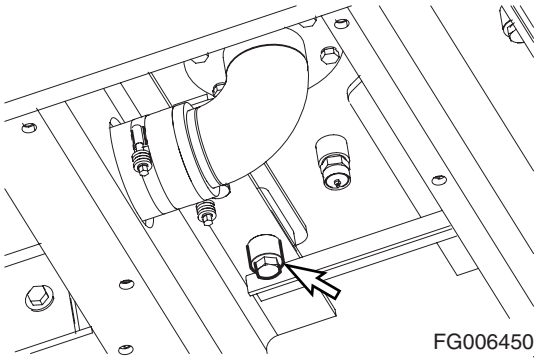


FG001420

Figure 100

4. Tightening bolt for hydraulic oil tank

   - Tool: 24 mm ( )
   - Torque: 27 kg•m (265 N•m, 195 ft lb)

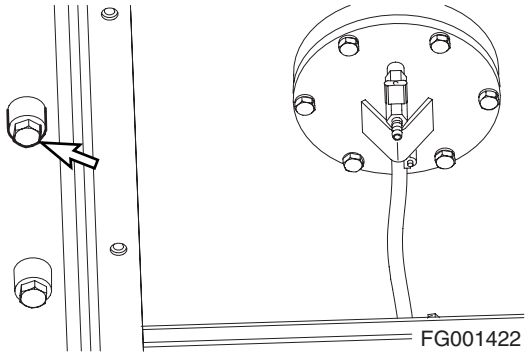


FG006450

Figure 101

5. Tightening bolt for fuel tank

   - Tool: 24 mm ( )
   - Torque: 27 kg•m (265 N•m, 195 ft lb)

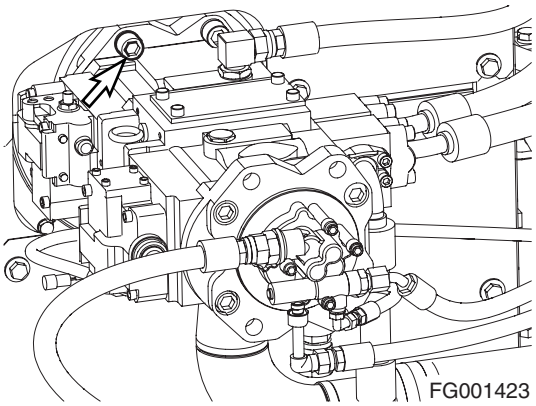


FG001422

Figure 102

6. Tightening bolt for pump

   - Tool: 17 mm ( )
   - Torque: 49 kg•m (480 N•m, 354 ft lb)



FG001423

Figure 103

7. Tightening bolt for control valve

   - Tool: 24 mm ( )
   - Torque: 27 kg•m (265 N•m, 195 ft lb)

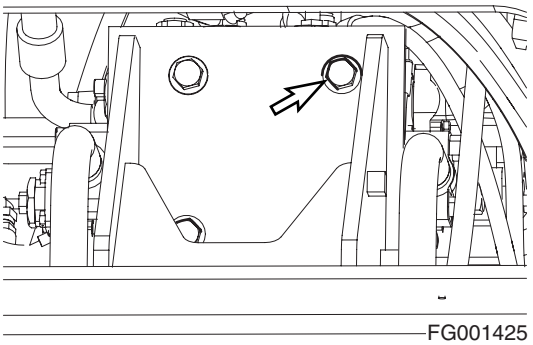


Figure 104

8. Tightening bolt for swing reduction device

   - Tool: 30 mm ( )
   - Torque: 55 kg•m (539 •Nm, 398 ft lb)

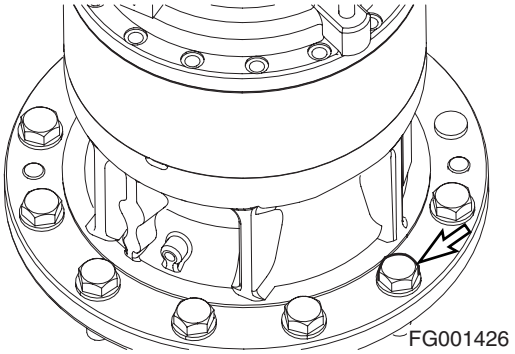


Figure 105

9. Tightening bolt for swing motor

   - Tool: 10 mm ( )
   - Torque: 14.4 kg•m (141 N•m, 105 ft lb)

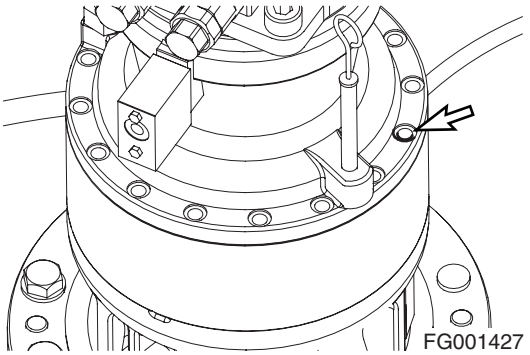


Figure 106

10. Tightening bolt for battery

    - Tool: 17 mm ( )
    - Torque: 5 kg•m (49 N•m, 36 ft lb)

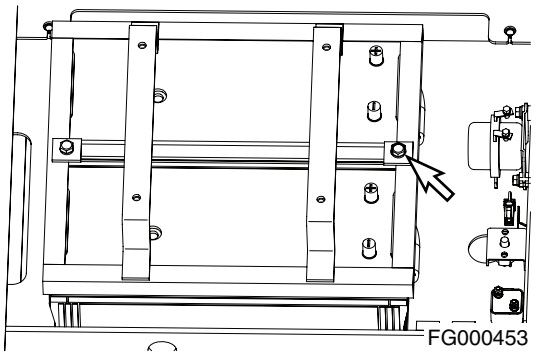


Figure 107

11. Joint bolt with cabin mounting rubber and frame

    - Tool: 17 mm ( )
    - Torque: 6.5 kg•m (64 N•m, 47 ft lb)

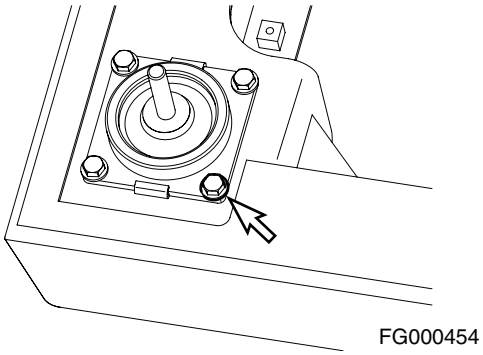


Figure 108

Joint bolt with cabin mounting rubber and cabin

- Tool: 24 mm ( )
- Torque: 21 kg•m (206 N•m, 152 ft lb)

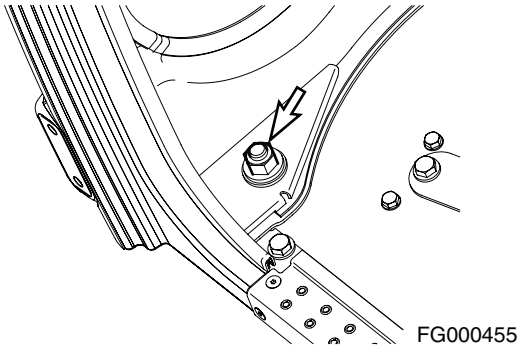


Figure 109

12. Joint bolt with swing bearing and upper frame

    - Tool: 30 mm ( )
    - Torque: 55 kg•m (539 N•m, 398 ft lb)

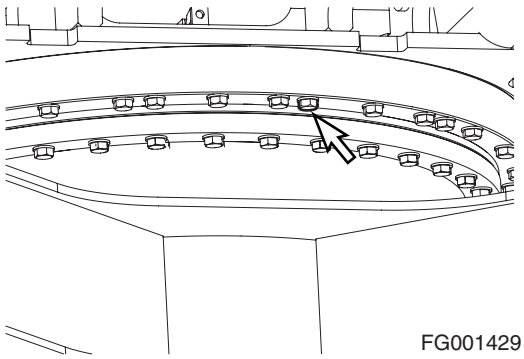


Figure 110

Joint bolt with swing bearing and bottom frame

- Tool: 30 mm ( )
- Torque: 55 kg•m (539 N•m, 398 ft lb)

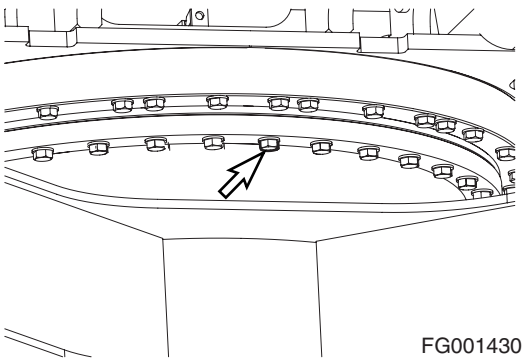


Figure 111

13. Tightening bolt for travel device

    - Tool: 24 mm ( )
    - Torque: 30 kg•m (294 N•m, 217 ft lb)

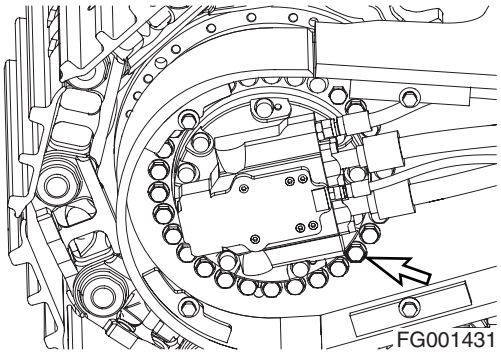


Figure 112

Tightening bolt for sprocket

- Tool: 22 mm ( )
- Torque: 30 kg•m (294 N•m, 217 ft lb)

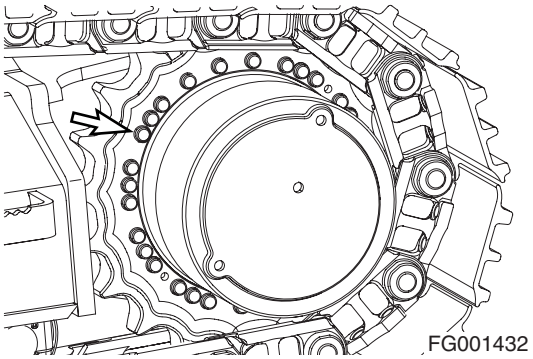


Figure 113

14. Tightening bolt for upper roller

    - Tool: 30 mm ( )
    - Torque: 55 kg•m (539 N•m, 398 ft lb)

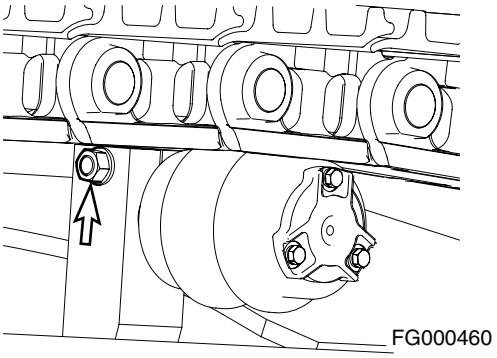


Figure 114

15. Tightening bolt for bottom roller

    - Tool: 24 mm ( )
    - Torque: 27 kg•m (265 N•m, 195 ft lb)

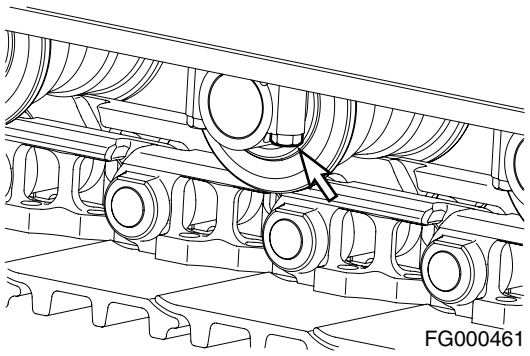


Figure 115

16. Tightening bolt for track guard

    - Tool: 24 mm ( )
    - Torque: 27 kg•m (265 N•m, 195 ft lb)

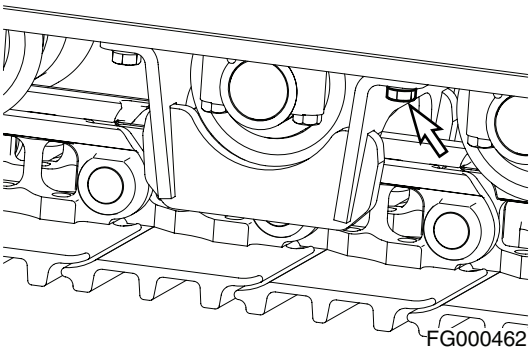


Figure 116

17. Bolt for track shoes

    - Tool: 27 mm ( )
    - Torque: 78 kg•m (765 N•m, 564 ft lb)

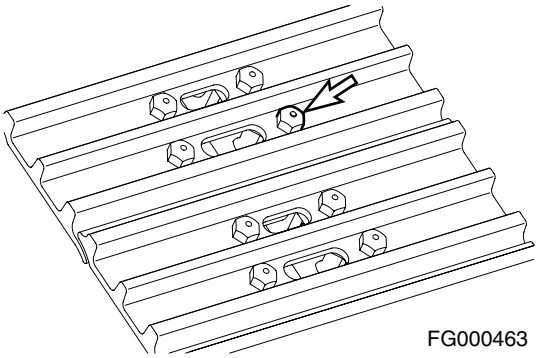


Figure 117

18. Fixing bolt for front pin

    - Tool: 24 mm ( )
    - Torque: 27 kg•m (265 N•m, 195 ft lb)

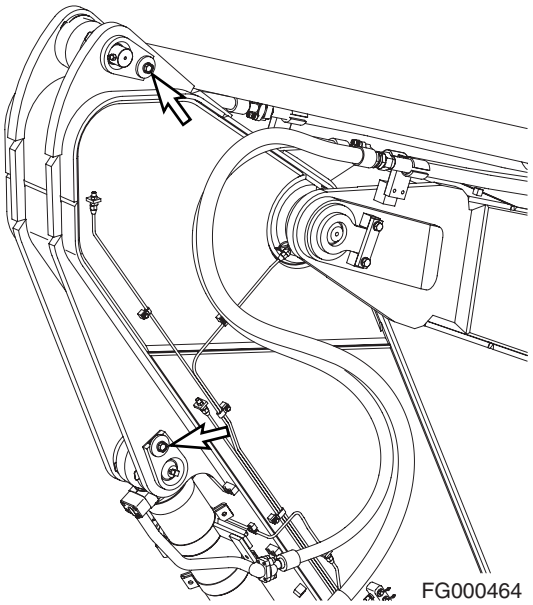


Figure 118

19. Fixing breaker filter (Optional)

- Tool: 30 mm ( )
- Torque: 27 kg•m (265 N•m, 195 ft lb)

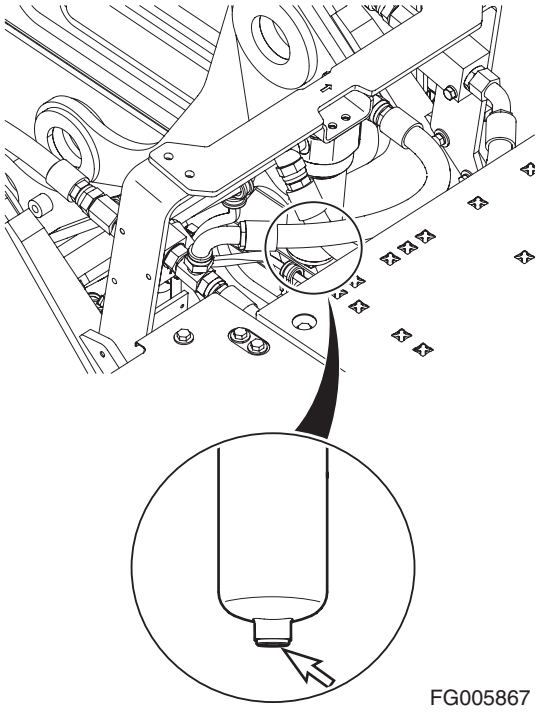


Figure 119

20. Grease valve for track adjuster

- Tool: 27 mm ( )
- Torque: 14 kg•m (137 N•m, 101 ft lb)

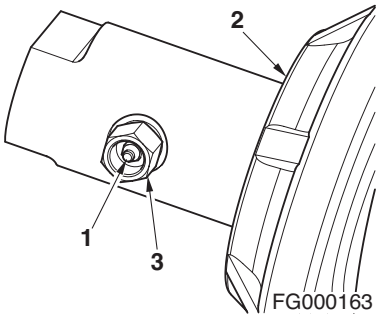


Figure 120

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.

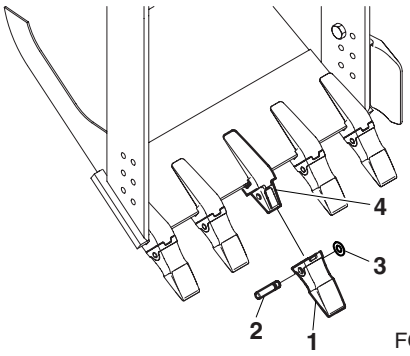
Curl the bucket upwards and place the round rear surface of the bucket firmly on the ground. Shut the engine off and lock out the hydraulic controls before working on the bucket.

NOTE: *These instructions are only for DOOSAN OEM buckets. If you are using other manufacturers buckets, refer to their specific instructions.*

HAOC680L

Figure 121

1. On a routine basis, inspect bucket teeth to make sure that tooth wear or breakage has not developed. Do not allow replaceable bucket teeth to wear down to a point that bucket adapter is exposed. See Figure 121.
2. To replace a tooth (1, Figure 122), use a hammer and punch to drive locking pin (2) and lock washer (3) out of tooth adapter (4).
3. Once worn tooth has been removed, use a putty knife to scrape adapter as clean as possible.
4. Slide new tooth into position and insert lock washer.
5. Insert locking pin into tooth and with a hammer, drive pin in until lock washer seats in locking groove.



FG000346

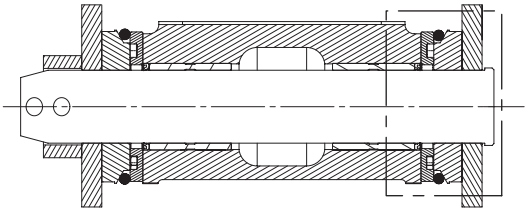
Figure 122

Bucket O-ring Replacement

WARNING

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

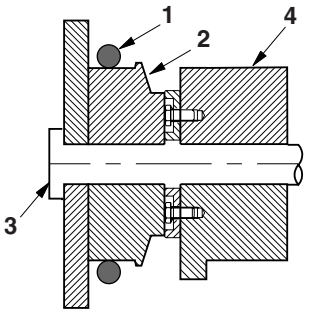
1. Inspect bucket O-rings on a routine basis. If worn or damaged, replacement is necessary.



FG005886

Figure 123

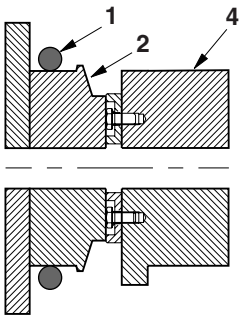
2. Roll old O-ring (1, Figure 124) onto boss (2) around bucket pin (3). Remove bucket pin and move arm or bucket link (4) out of way.



ARO1390L

Figure 124

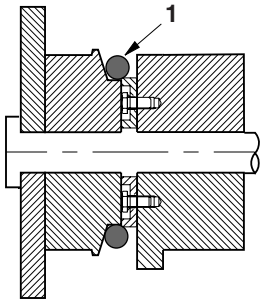
3. Remove old O-ring and temporarily install new O-ring (1, Figure 125) onto bucket boss (2). Make sure that O-ring groove on both bucket link (4) and boss have been cleaned.
4. Realign arm or link with bucket pin hole and insert bucket pin (3, Figure 124).



ARO1391L

Figure 125

5. Roll new O-ring (1, Figure 126) into O-ring groove.



ARO1392L

Figure 126

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

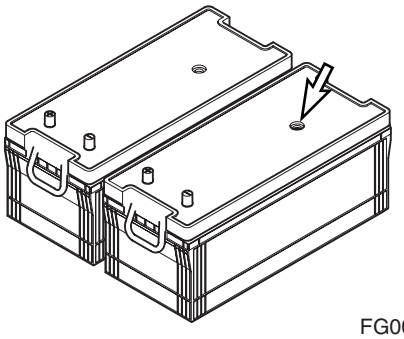
In colder weather a greater drain is placed on the batteries when they are used for the preheat cycle and when starting a cold engine. Battery performance decreases as the temperature gets lower.

In extremely cold weather, remove 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.



FG000347

Figure 127

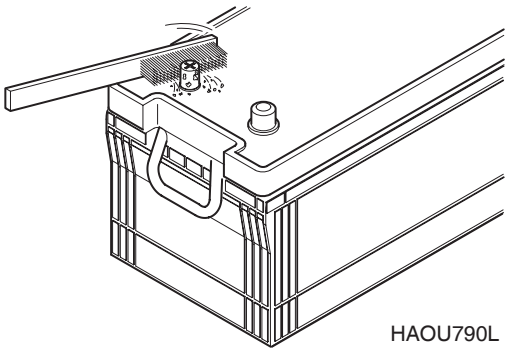
Check Charging State

Check charging state through the charging indicator.

- GREEN: Sufficiently charged.
- BLACK: Insufficient charged.
- TRANSPARENT: Replace battery.

Check the Battery Terminals

Be certain that 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.



HAOU790L

Figure 128

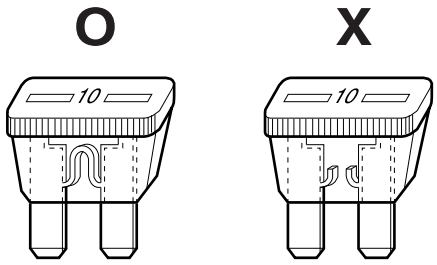
Battery Replacement

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 129. The fuses used are standard automotive type fuses.
2. The section on “Fuse Identification” on page 4-70, 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.



HAOC670L

Figure 129

CAUTION

Before replacing a fuse, be sure to turn starter switch to "O" (OFF) position.

Fuse Boxes

There are two fuse boxes (Figure 130) on the left side of the heater box. The fuses prevent electrical devices from overloading or shorting.

A decal attached inside 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.

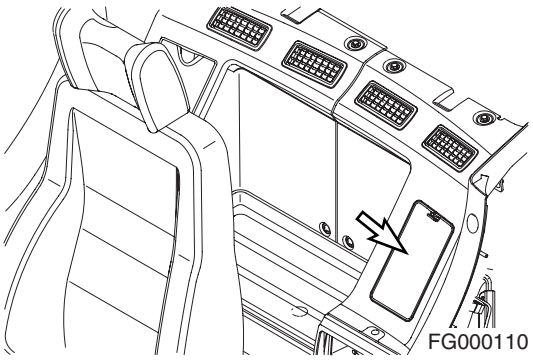
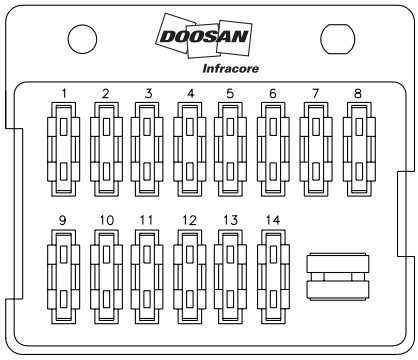


Figure 130

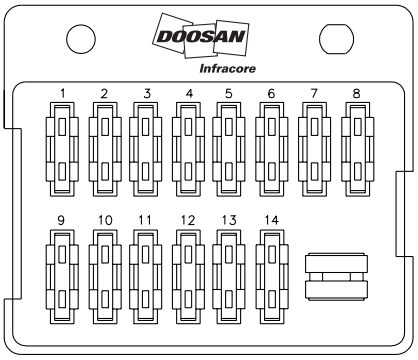
CAUTION

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

Fuse Box (1)



Fuse Box (2)



FG000542

Figure 131

No.	Fuse Box One	
	Name	Capacity
1	Warning Light (Optional)	10A
2	2-pump (Optional)	10A
3	Cigar Lighter	10A
4	12V Power	10A
5	Wiper, Washer	10A
6	Lower Wiper (Optional)	10A
7	Stereo	10A
8	Starter Switch, Hour Meter	10A
9	Spare	30A
10	Air Conditioner, Heater	20A
11	Shear, Breaker (Optional)	20A
12	Seat Heater (Optional)	15A
13	e-EPOS, Booster, Travel speed changer, Booster	15A
14	Spare	15A

No.	Fuse Box Two	
	Name	Capacity
1	Horn	10A
2	Quick Clamp (Optional)	10A
3	Travel Alarm (Optional)	10A
4	Auxiliary Mode	10A
5	Engine Throttle Control, After Heat Relay	10A
6	Pilot Cutoff	10A
7	Memory Backup	10A
8	Room Light	10A
9	Cabin Light (Optional)	30A
10	Work Light	20A
11	Fuel Heater	20A
12	Instrument Panel, Pressure Sensor	15A
13	Headlight	15A
14	Fuel Pump (Optional), Wiper	15A

ENGINE COOLING SYSTEM

General

Keeping an engine's cooling system in peak operating condition, can have many benefits to 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.

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.

WARNING

Pressure at air nozzle must not exceed 2 bar (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, which ever 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.

Types of Antifreeze

There are two main classifications of antifreeze available on the market today.

1. Ethylene Glycol - Doosan Genuine Antifreeze Solution (for all seasons)
2. Propylene Glycol - Doosan Genuine Antifreeze Solution (for all seasons)

Ethylene glycol has been on the market for many years. Its chemical properties do not provide the improved corrosion resistance that propylene glycol 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.

CAUTION

Do not mix the ethylene glycol and propylene glycol solutions. If these two chemicals are mixed, undesirable chemicals may be formed, which damages the equipment.

Do not mix up the solutions from different manufacturers. Otherwise, the performance may be deteriorated. It is recommended to use the Doosan Genuine Product.

In the regions under extreme weather, the user should determine the performance of the coolant suitable for the weather condition and decide the replacement cycle.

Antifreeze Concentration Tables

Ethylene Glycol - Doosan Genuine Antifreeze Solution (for all seasons) (2,000 Hour / Yearly)		
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 - Doosan Genuine Antifreeze Solution (for all seasons) (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%

NOTE: *Mixing ratio is for reference purpose only, and is not an absolute standard.*

NOTE: *Replacement cycle of the Doosan Genuine Product is 2,000 hours or one year.*

FUEL TRANSFER PUMP (OPTIONAL)

WARNING

Do not dry operate fuel pump for more than fifteen seconds.

- **Cooling and lubrication of pump is achieved by fuel passing through pump. If pump is dry operated, heat generated by moving parts will cause damage to pump rotors, vanes and seals. To prevent unnecessary wear and/or damage to pump do not dry operate fuel pump for more than fifteen seconds.**

Do not operate pump for more than fifteen minutes at a time.

- **Continuous usage of pump over recommended time interval will cause overheating of motor and will result in causing motor damage.**

Do not use refueling pump for other types of fuel or fluids. (Use only for diesel fuel.)

- **Do not use refueling pump for other types of fuel which have a low flash point.**
- **Do not use refueling pump for fuel contaminated with water or high humidity. Moisture in pump mechanism can cause rust and can create pump failure.**

Always operate pump using strainer installed on inlet hose. This will prevent any foreign materials from being introduced into pump. Always maintain pump and all of its components in a clean condition.

- **If dirt or other foreign materials enter pump, it can become lodged between the rotor and/or vanes and generate heat which can cause pump damage.**
- **Do not remove strainer or use a strainer with larger mesh to increase flow of fuel.**

Be careful not to overfill or spill fuel.

Make sure direction of check valve is in line with flow direction of fuel.

If any pump parts or components become lost, damaged or inoperable, immediately replace it with a new ones.

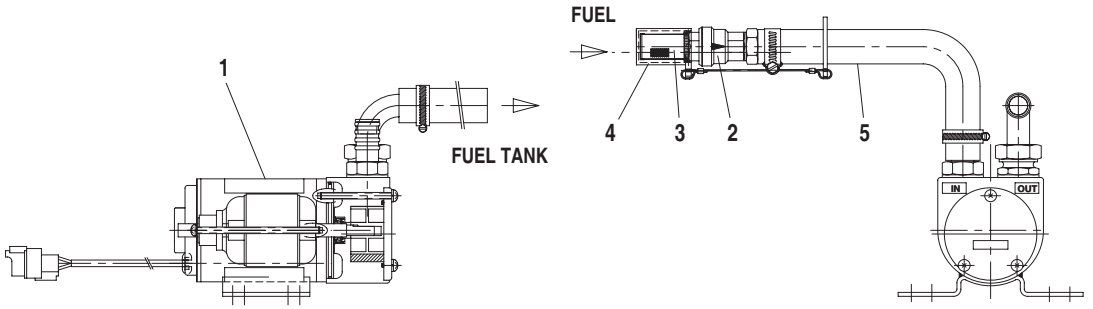
IMPORTANT

If there are any sign of leakage while operating transfer pump, inspect the following components to prevent any fires or hazardous fuel spills.

- **Check all hoses leading to and from the transfer pump.**
- **Check all hose clamps.**
- **Check transfer pump inlet port.**

The transfer pump is used to transfer fuel from a refueling source to the fuel tank. A check valve is installed in the inlet hose to prevent fuel from flowing back from fuel tank to source. A strainer is installed in inlet hose to prevent any foreign material from being introduced into transfer pump or fuel tank.

A thermal limiter, built into the motor, will automatically shut off power if motor is overheating to protect it from being damaged.



FG000161

Figure 132

Reference Number	Description
1	Body
2	Check Valve
3	Strainer

Reference Number	Description
4	Strainer Cap
5	Inlet Hose

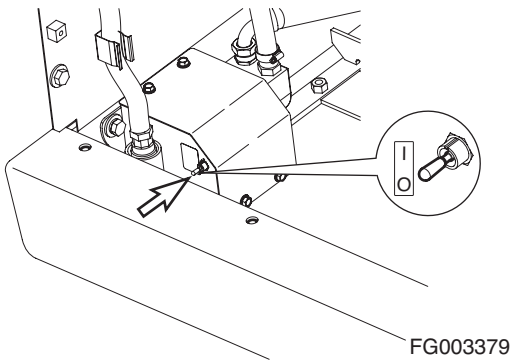
1. Remove strainer cap (4, Figure 132) from strainer (3) on end of inlet hose (5).

   NOTE: *Keep strainer cap (4*, Figure 132*) in a safe location to reseal strainer (3) after refueling is complete.*

2. Insert inlet hose (5, Figure 132) into refueling tank.
3. Turn fuel pump switch (Figure 133) inside of battery box on front side to "I" (ON) position.

   NOTE: *Transfer pump rate of flow is approximately 35 lpm (9.24 U.S. gpm). Use extra care not to overfill fuel tank so fuel does not over flow.*

4. Once fuel transfer is completed, immediately turn switch to "O" (OFF) position to stop pump.
5. Lift inlet hose (5, Figure 132) from fueling source and turn switch to "I" (ON) position for two - three seconds to drain remaining fuel from hose to fuel tank.
6. Install strainer cap (4, Figure 132) on inlet strainer (3) and return hose (5) to storage position.



FG003379

Figure 133

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.

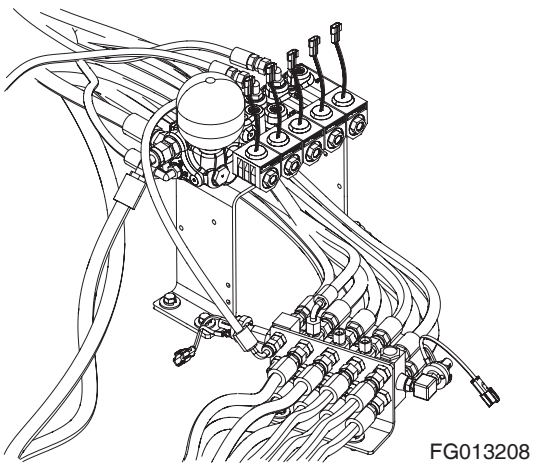


Figure 134

TRACK TENSION

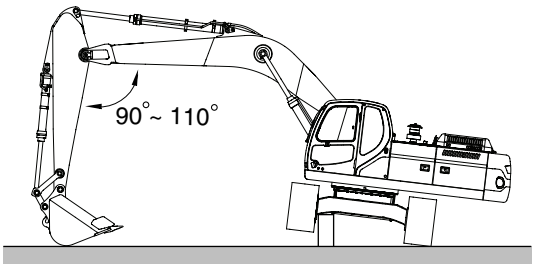
WARNING

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 track tension grease valve should never be backed off more than one complete turn from the fully snugged down position. Bleed off pressure slowly and keep your body away from the valve at all times.

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.

1. Track tension is checked by jacking up one side of the excavator. See Figure 135. Place blocking under frame while taking measurement.



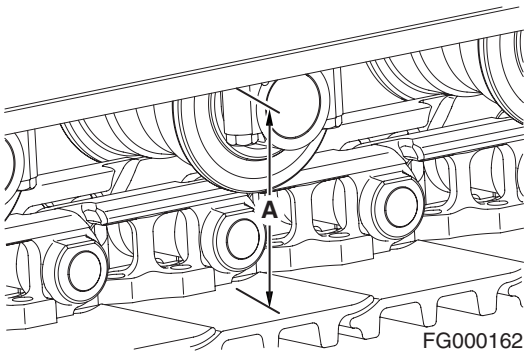
FG000345

Figure 135

2. Measuring the distance (A, Figure 136) between the bottom of the side frame and the top of the lowest crawler shoe. Recommended tension for operation over most types of terrain is 320 - 340 mm (12.60 - 13.39 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.*

3. Too little sag in the crawler track (less than 320 mm (12.60 in) clearance) can cause excessive component wear. The recommended adjustment can also be too tight causing accelerated stress and wear if ground conditions are wet, marshy or muddy.



FG000162

Figure 136

4. The increased clearance recommended for muddy, sandy or snowy ground conditions is between 340 - 370 mm (13.39 - 14.57 in).

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 snugged down position. Bleed off pressure slowly and keep your body away from the valve at all times. If there is problem with the valve thread, the valve must be ejected at high speed to cause fatal wound.

5. Track tension adjustments are made through the grease fitting (1, Figure 137) in the middle of each side frame. Adding grease increases the length of an adjustment cylinder (2). The longer the adjustment cylinder, the greater the pressure on the tension spring pushing the track idler wheel outward.

6. If there is not enough slack or clearance in the tracks and the adjustment is too tight, the idler wheel and adjusting cylinder can be retracted by bleeding off grease through hole in valve (3, Figure 137) by loosening valve slowly (3, Figure 137).

NOTE: *After track tension is adjusted by loosening valve, be sure to tighten valve (3, Figure 137) with 14 kg•m (137 Nm, 101 ft lb).*

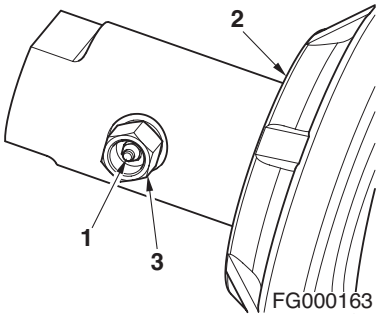


Figure 137

WARNING

Do not loosen or remove the grease fitting (1, Figure 137) until the pressure is entirely bleed off by loosening valve (3, Figure 137) slowly.

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. Shot down engine, remove vent plug (Figure 138) to see if any oil is present.
2. If oil is not present, fill pump with oil through port (Figure 138).
3. Install vent plug (Figure 138) 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 138) several turns, until hydraulic oil flows out of plug. This shows that air has been released.
6. Tighten the plug (Figure 138).

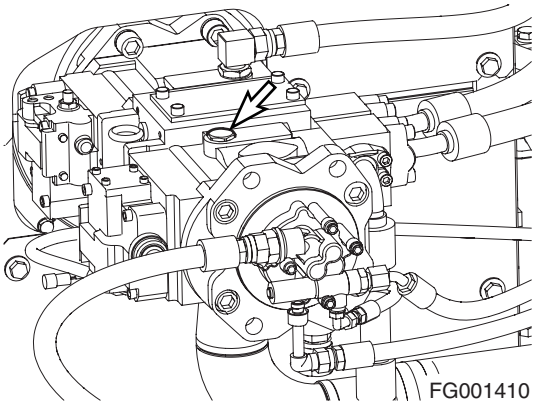


Figure 138

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.

Swing Motor

IMPORTANT

If the air is not vented from the system, it will cause damage to the swing motor and bearings.

NOTE: *Perform this only when oil has been drained from swing motor.*

1. Shut down engine.
2. Disconnect drain hose and fill swing motor case with hydraulic oil.
3. Connect the drain hose.
4. Start engine and set throttle at "LOW IDLE" and swing upper structure slowly two full revolutions to the left and right.

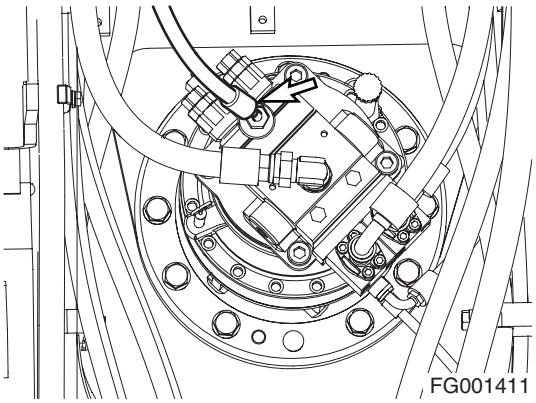


Figure 139

Travel Motor

NOTE: *Perform this only when oil is drained from travel motor*

1. Shut down engine.
2. Disconnect drain hose (Figure 140) 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.

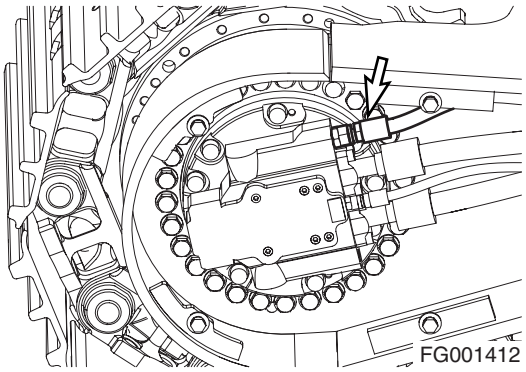


Figure 140

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.

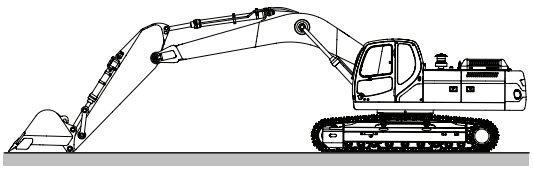
LONG TERM STORAGE

When a machine is taken out of service and stored for a time exceeding 30 days, steps must be taken to protect the machine. Leaving equipment outdoors exposed to the elements will shorten its life.

An enclosure will protect the machine from rapid temperature changes and lessen the amount of condensation that forms in hydraulic components, engine, fuel tank, etc. If it is not possible to put the machine in an enclosure, cover it with a tarpaulin.

Check that the storage site is not subject to flooding or other natural disasters.

After the machine has been positioned for storage and the engine shut down, perform the following operations:



FG014341

Figure 141

Before Storage

Keep the excavator in the position shown in Figure 92 to prevent rust of the hydraulic piston rods.

- Inspect for damaged, loose or missing parts.
- Repaint necessary area to prevent oxidation.
- Wash and clean all parts of machine.
- Store the machine indoor, stable place. If stored outside, cover with a waterproof tarpaulin.
- Perform lubrication procedures on all grease points.
- Apply a coating of light oil to the exposed plated metal surfaces (such as hydraulic cylinder rods, etc.) and to all the control linkage and control cylinders. (Control valve spools, etc.)
- Remove the battery from the excavator to be fully charged and stored.
- Inspect the coolant recovery tank and radiator to make sure the antifreeze level in the system is correct. Make sure that antifreeze concentration is enough for the lowest temperature anticipated during storage.
- Seal all external openings (i.e. engine exhaust outlet, crankcase and hydraulic breather, fuel vent line, etc.) with tape wide enough to cover the opening, regardless of size.

  NOTE: *When sealing with tape, be sure to extend tape approximately one inch (25 mm) beyond opening to insure a good seal.*

During Storage

- Once a month, start the engine and follow the "Hydraulic Oil Warm-up" procedures listed in this manual.

  NOTE: *Remove all seals from the machine (i.e. crankcase and hydraulic breathers, engine air intake, fuel tank vent lines, etc.).*

  Operate hydraulic functions for traveling, swing and digging two or three times for lubrication after "Hydraulic Oil Warm-up." Coat all the moving parts and surfaces of the components with a new oil film after operating. At the same time, charge the battery. Rotate track to prevent track seizing."

- Every 90 days, use a hydrometer to measure the protection of the coolant. Refer to the antifreeze/ coolant protection chart to determine protection of the cooling system. Add coolant as required.

After Storage

- When operating the work equipment, remove all grease from the hydraulic cylinder rods.
- Add grease and oil at all lubrication points.
- Adjust fan and alternator belt tension.
- Connect the charged battery.
- Check condition of all hoses and connections.
- Check the levels of engine oil, fuel, coolant and hydraulic circuit oil. If there is water in the oil, change all the oil.
- Change all filter elements.
- When starting the engine after long-term storage, follow the "Hydraulic Oil Warm-up" procedures listed in this manual.

MAINTENANCE IN SPECIAL CONDITIONS

NOTE: *See "Operation Under Unusual Conditions" on page 3-44 for other recommendations.*

Conditions	Maintenance Required
Operating in mud, water or rain.	Perform a walk around inspection to check for any loose fittings, obvious damage to the machine or any fluid leakage.
	After completing operations, clean mud, rocks or debris from the machine. Inspect for damage, cracked welds or loosened parts.
	Perform all daily lubrication and service.
	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.	Clean the air intake filters on a more frequent basis.
	Clean the radiator and oil cooler fins to remove embedded dirt and dust.
	Clean the fuel system intake strainer and fuel filter more frequently.
	Inspect and clean as required the starter and alternator.
Operating in rocky terrain.	Check the undercarriage and track assemblies for damage or excessive wear.
	Inspect for loose or damaged fittings or bolts.
	Relax track tension.
	On a more frequent basis, inspect the front end attachments for damage or excessive wear.
	Install a top guard and front guard as required for protection against falling rock.
Operating in extreme cold.	Use the proper fuel for the temperature conditions.
	Using a hydrometer, check the antifreeze to make sure that it is providing the proper cold weather freeze protection.
	Verify the condition of the batteries. In extremely cold weather remove the batteries at night and store them in a warmer area.
	Remove mud buildup as soon as possible to prevent it from freezing to the undercarriage and causing damage.

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

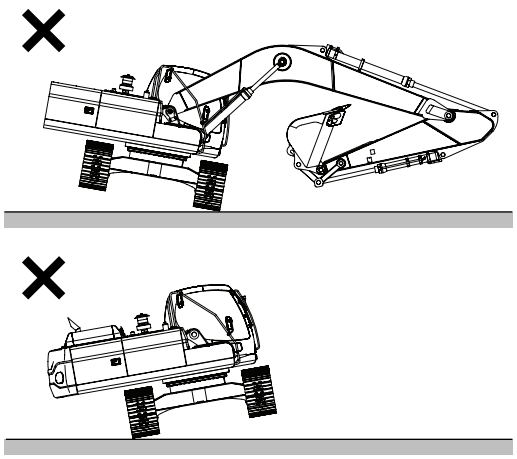
Warning for Counterweight and Front Attachment Removal

DANGER

DOOSAN warns any user, that removal of the counterweight from the machine, front attachment or any other part, may affect the stability of the machine. This could cause unexpected movement, resulting in death or serious injuries. DOOSAN is not liable for any misuse.

Never remove counterweight or front attachment unless the upper structure is in-line with the lower structure.

Never rotate the upper structure once the counterweight or front attachment has been removed.



FG000371

Figure 1

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 ramp being used can handle the weight of the machine. If required, add blocking under the ramp for additional support.

Make sure that ramp surface is free of grease or mud that could cause the machine to slip or slide.

Make sure that 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
3,005 mm (9' 10")	2,990 mm (9' 9")	9,485 mm (373.4 in)	21.5 metric tons (23.7 tons)	5.7 m Boom 2.9 m Arm LC Track 600 G Shoe 4.1ton Counterweight

1. Make sure that trailer is parked on firm, level ground. See Figure 2.
2. Make sure that 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.

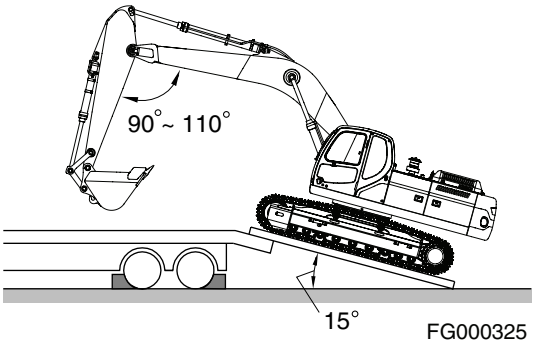
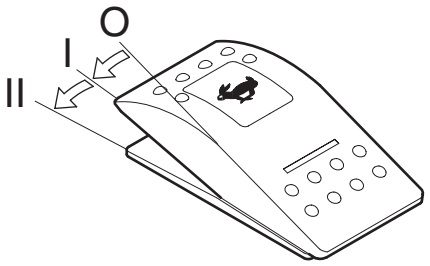


Figure 2

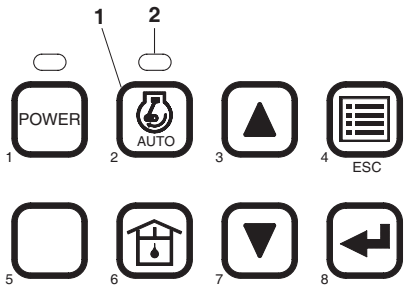
4. Set the travel speed selector switch to "O" (OFF) position. See Figure 3.



FG000023

Figure 3

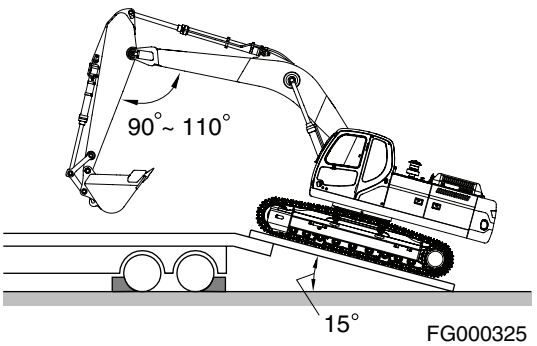
5. Turn "OFF" auto idle selector button (1, Figure 4). The indicator light (2) will not be lit.
6. Set engine speed to "LOW IDLE."



FG014212

Figure 4

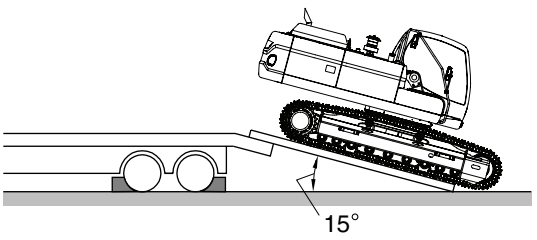
7. If the machine is equipped with work equipment, set the work equipment at the front, and travel forward to load it.



FG000325

Figure 5

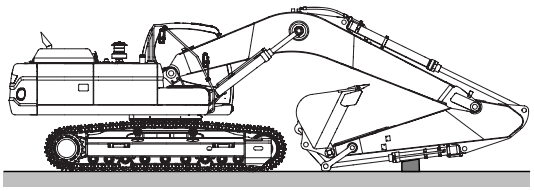
8. The unit does not require disassembly for normal over-the-road transportation. If the boom and arm need to be removed, the counterweight will place more weight on the rear of the machine. Make sure to back the excavator onto the trailer so the counterweight end of the excavator is positioned on the ramp first. See Figure 6.



FG000326

Figure 6

9. Extend bucket and arm cylinders to maximum length and then lower the boom slowly.



FG000327

Figure 7

10. Set safety lever on "LOCK" position.

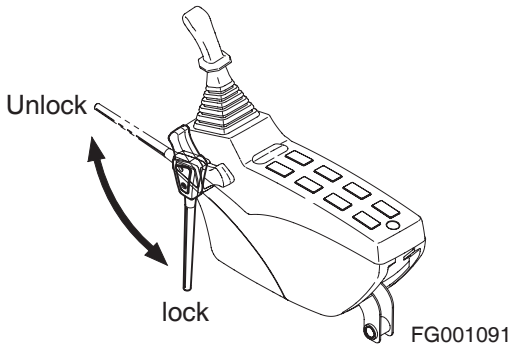


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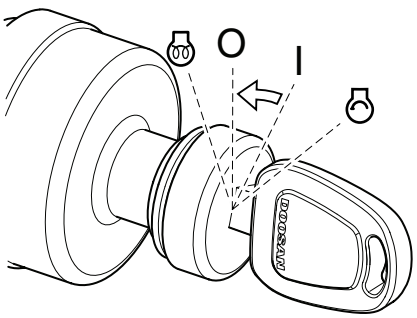
Figure 8

11. Shut down engine by turning key to "O" (OFF) position (Figure 9).
12. Remove key from starter switch.



FG001372-3

Figure 9

13. Make sure to secure the excavator onto the trailer before transporting. Place blocking (1, Figure 10) in front of and behind each track. Tie front and rear (2, Figure 10) and tie down point (3, Figure 10) on lower frame with wire cable as required by local transportation laws.
14. 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.

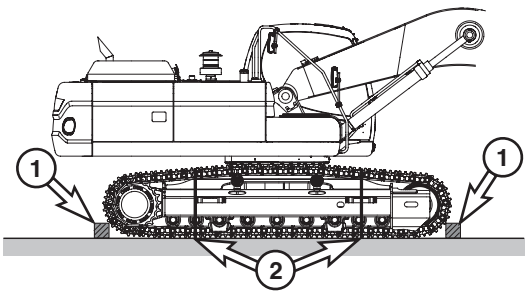


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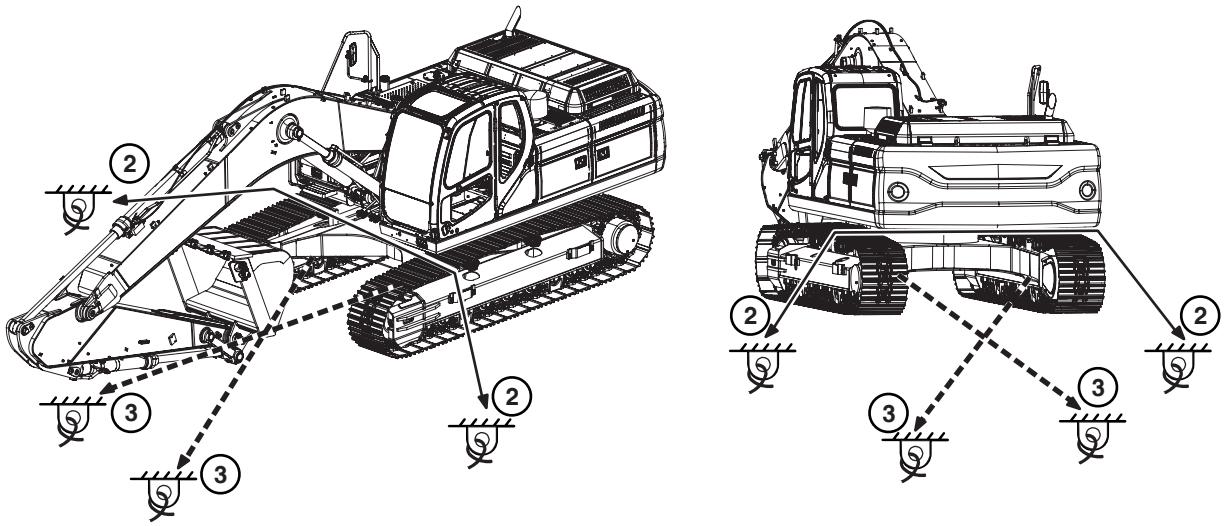
Figure 10



FG014870

Figure 11

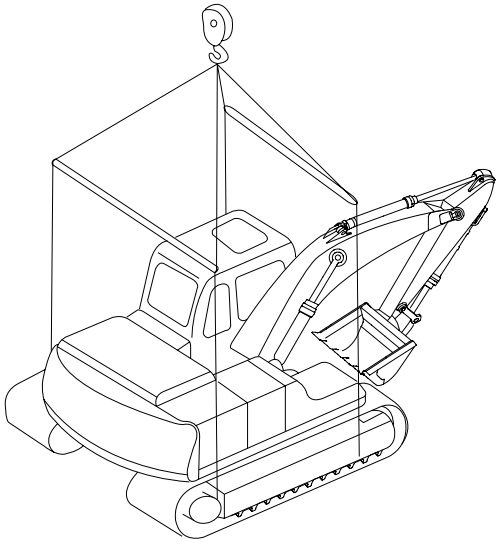
LIFTING WITH SLING

⚠ 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.*



FG016361

Figure 12

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.

ELECTRICAL SYSTEM

Problem	Cause	Remedy
Battery will not hold a charge.	Low battery power.	Clean and retighten.
	Alternator belt loose or bad.	Tighten or replace belt.
	Loose or corroded terminals.	Tighten or replace as required.
	Alternator faulty.	Repair or replace as required.
Low battery power.	Internal battery short.	Replace battery.
	Short circuit in wiring.	Repair as required.
Engine speed is not controllable.	Speed control dial failed.	Replace control dial.
	Throttle controller failed.	Replace controller.
	Speed control motor failed.	Repair or replace as required.
	Blown fuse.	Replace fuse.
	Wiring harness damaged.	Repair or replace as required.
	Connector failed.	Repair or replace as required.
Power mode selector does not work.	Blown fuse.	Replace fuse.
	Power mode selector switch failed.	Replace switch.
	Connector failed.	Replace connector.
	Wiring harness damaged.	Repair or replace as required.
	e-EPOS controller failed.	Repair or replace as required.

ENGINE

Problem	Cause	Remedy
Starter does not operate.	Low battery power.	Charge battery.
	Poor terminal contact.	Clean and tighten connections.
	Starter switch failed.	Replace switch.
	Starter relay failed.	Replace relay.
	Starter controller failed.	Replace controller.
	Wiring harness faulty.	Replace harness.
	Battery relay failed.	Replace relay.
	Blown fuse.	Replace fuse.
Starter engages, engine does not start.	Fuel gelled in cold weather.	Replace fuel.
	Fuel filters plugged.	Replace filters.
	Water or dirt in fuel system.	Clean system and add new fuel.
	Air in fuel system.	Purge air from system.
	Engine stop control failed.	Contact your DOOSAN dealer.
	Engine stop relay failed.	Replace relay.
	Blown fuse.	Replace fuse.
Engine starts, runs only at low speed or shuts down.	Engine oil viscosity incorrect.	Change oil.
	Clogged or dirty fuel injectors.	Clean injectors.
	Fuel filters plugged.	Replace filters.
Engine knocks, runs unevenly or surges.	Low engine oil.	Refill.
	Plugged air intake system.	Clean system and replace filter.
	Injection pump out of adjustment.	Contact your DOOSAN dealer.
	Plugged fuel filter.	Replace fuel filter.
	Water or dirt in fuel system.	Clean system and add new fuel.
	Clogged or dirty fuel injectors.	Clean injectors.
Engine has poor power.	Plugged air intake system.	Clean system and replace filter.
	Clogged or dirty fuel injectors.	Clean injectors.
	Fuel filters plugged.	Replace filters.
	Engine speed control cable out of adjustment.	Readjust.
	Injection pump out of adjustment.	Contact your DOOSAN dealer.
	Valve backlash faulty.	Adjust backlash.

Problem	Cause	Remedy
Engine runs hot.	Low coolant level.	Add coolant.
	Thermostat faulty.	Replace thermostat.
	Radiator cap faulty.	Replace radiator cap.
	Radiator core plugged.	Clean radiator.
	Oil cooler core plugged.	Clean oil cooler.
	Fan belt loose or damaged.	Tighten or replace as required.
	Temperature sensor faulty.	Replace sensor.

HYDRAULIC SYSTEM

Problem	Cause	Remedy
None of the controls function (loud noise from pumps).	Hydraulic pump failed.	Contact your DOOSAN dealer.
	Low hydraulic oil level.	Add hydraulic oil as required.
	Suction line plugged or damaged.	Clean or replace as required.
None of the controls function (no noise from pumps).	Pilot pump failure.	Contact your DOOSAN dealer.
	Cut off solenoid valve failed.	Replace solenoid.
	Pilot cutoff switch is ON.	Adjust pilot cutoff switch clearance.
All actuators have low power.	Low hydraulic oil level.	Add hydraulic oil as required.
	Suction filter clogged.	Clean filter.
	Hydraulic pumps faulty.	Contact your DOOSAN dealer.
	Main relief pressure too low.	Contact your DOOSAN dealer.
	Hydraulic pumps excavating.	Bleed air from hydraulic pumps.
Only one or two actions have little or no power.	Overload relief pressure too low.	Reset pressure.
	Makeup check valve leaking.	Clean or replace as required.
	Control valve spool faulty.	Replace valve spool.
	Dirt in valve spool.	Clean or replace as required.
	Actuator failed.	Repair or replace as required.
	Cylinder seal failed.	Repair or replace as required.
	Cylinder rod damaged.	Repair or replace as required.
	Remote control valve failed.	Replace control valve.
	Wrong pilot line connection.	Reconnect pilot lines.
Oil temperature too high.	Oil cooler faulty.	Contact your DOOSAN dealer.
	Fan belt loose.	Tighten fan belting as required.

SWING SYSTEM

Problem	Cause	Remedy
No swinging motion.	Swing brake valve faulty.	Replace brake valve.
	Hydraulic timer faulty.	Replace timer.
	Low brake release pressure.	Adjust pressures.
	Swing motor failed.	Replace swing motor.
	Remote control valve failed.	Replace control valve.
	Wrong pilot line connection.	Reconnect pilot lines.
Swing motion jerky.	Swing gear worn.	Replace swing gear.
	Swing bearing damaged.	Replace bearing.
	Improper lubrication.	Add grease.

TRAVEL SYSTEM

Problem	Cause	Remedy
Travel motion does not function.	Center joint leaking.	Repair or replace as required.
	Parking brake will not release.	Repair parking brake.
	Travel motor failed.	Repair or replace as required.
	Remote control valve failed.	Repair or replace as required.
	Wrong pilot line connection.	Reconnect pilot lines.
Travel speed is too low.	Track tension too high or too low.	Adjust tension.
	Damaged rollers or idlers.	Repair or replace as required.
	Track frame damaged.	Repair as required.
	Parking brake will not release.	Repair parking brake.

Specification

STANDARD SPECIFICATION

COMPONENT			SPECIFICATION	
			METRIC	ENGLISH
Bucket Capacity	CECE		0.81 m^3	1.06 yd^3
	PCSA		0.92 m^3	1.20 yd^3
Equipment Weight			21.5 metric tons	23.7 tons
Engine	Model		DB58TIS	
	Type		Water Cooled - 6 Cylinders	
	Rated Output		150 ps @1,900 rpm	148 hp @1,900 rpm
	Maximum Torque		61.5 kg•m @ 1,400 rpm	445 ft lb @ 1,400 rpm
	Fuel Tank Capacity		400 liters	106 U.S. gal.
Hydraulic Pump	Type		Axial Piston	
	Discharging Pressure		350 kg/cm^2	5,000 psi
	Maximum Discharge Quantity		2 x 207 liters/min	2 x 54.7 U.S. gpm
	Hydraulic Oil Capacity	Tank Level	140 liters	37.2 U.S. gal.
		System	240 liters	63.4 U.S. gal.
Performance	Digging Capability	Bucket	13.3 metric tons	14.6 tons
		Arm	10.5 metric tons	11.6 tons
	Swing Speed		11.0 rpm	
	Travel Speed	High Speed	5.5 km/h	3.4 MPH
		Low Speed	3.0 km/h	1.9 MPH
	Traction Force	High Speed	11.7 metric tons	12.8 tons
		Low Speed	22.2 metric tons	24.5 tons
	Gradeability		35° (70% slope)	
	Ground Pressure		0.45 kg/cm^2	6.4 psi
Ground Clearance			480 mm	18.9 in
Track Shoe Width			600 mm	23.6 in
Upper Roller Qty.			2 per side	
Bottom Roller Qty.			9 per side	

Base Option : Boom (5.7 m), Arm (2.9 m), Counterweight (4.1 ton), LC Track

OVERALL DIMENSIONS

DX220A

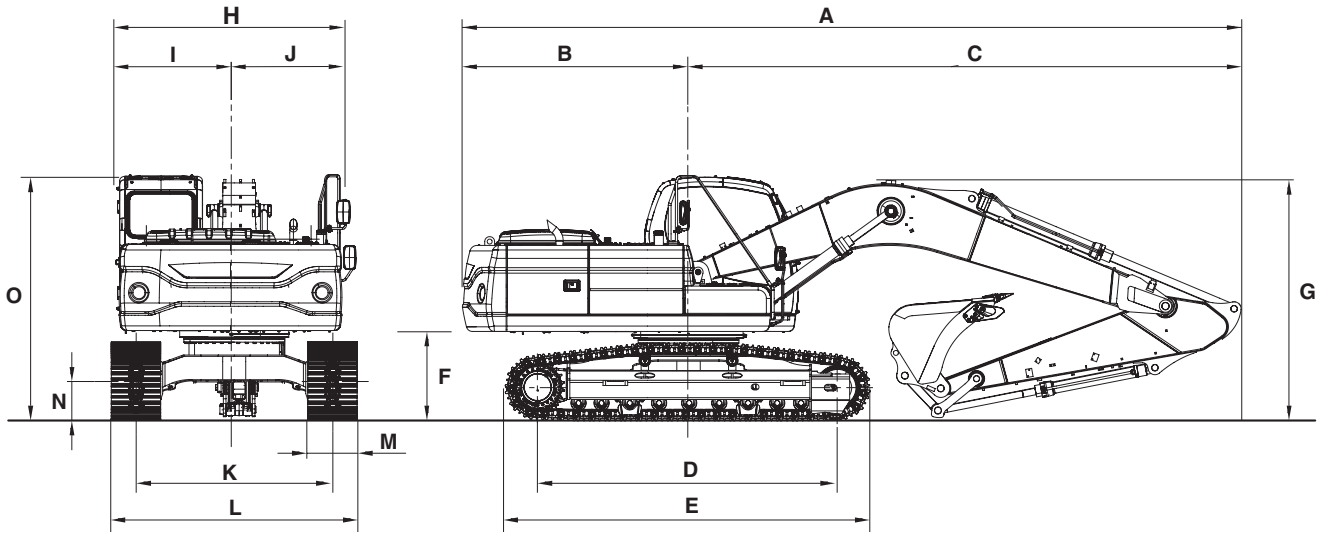


Figure 1

DIMENSION	5.2 m (17' 1") BOOM		5.7 M (18' 8") BOOM	
	2.0 m (6' 6") ARM	**2.4 m (7' 10") ARM**	**2.4 m (7' 10") ARM**	**2.9 m (9' 6") ARM**
A	9,080 mm (29' 9")	8,990 mm (29' 6")	9,500 mm (31' 2")	9,485 mm (31' 1")
B	2,750 mm (9' 0")			
C	6,330 mm (22' 9")	6,240 mm (20' 6")	6,750 mm (22' 8")	6,735 mm (22' 1")
D	3,270 mm (10' 9")			
E	4,065 mm (13' 4")			
F	1,055 mm (3' 6")			
G	3,210 mm (10' 6")	3,050 mm (10' 0")	3,110 mm (10' 2")	3,005 mm (9' 10")
H	2,710 mm (8' 10")			
I	1,400 mm (4' 7")			
J	1,310 mm (4' 4")			
K	2,200 mm (7' 3")			
L	2,800 mm (9' 2")			
M	600 mm (1' 12")			
N	480 mm (1' 7")			
O	2,975 mm (9' 9")			

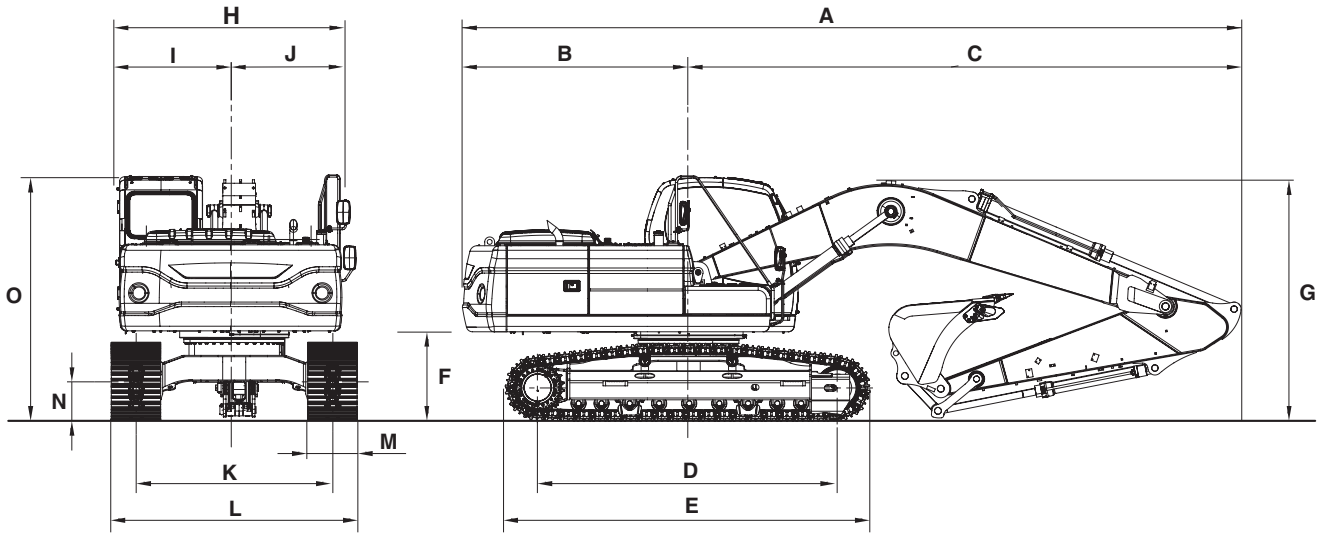


Figure 1

DIMENSION	5.2 m (17' 1") BOOM		5.7 m (18' 8") BOOM		
	2.0 m (6' 6") ARM	**2.4 m (7' 10") ARM**	**2.4 m (7' 10") ARM**	**2.9 m (9' 6") ARM**	**3.5 m (11' 6") ARM**
A	9,080 mm (29' 9")	8,990 mm (29' 6")	9,500 mm (31' 2")	9,485 mm (31' 1")	9,500 mm (31' 2")
B	2,750 mm (9' 0")				
C	6,330 mm (22' 9")	6,240 mm (20' 6")	6,750 mm (22' 8")	6,735 mm (22' 1")	6,750 mm (22' 2")
D	3,650 mm (11' 12")				
E	4,445 mm (14' 7")				
F	1,055 mm (3' 6")				
G	3,210 mm (10' 6")	3,050 mm (10' 0")	3,110 mm (10' 2")	3,005 mm (9' 10")	3,290 mm (10' 10")
H	2,710 mm (8' 10")				
I	1,400 mm (4' 7")				
J	1,310 mm (4' 4")				
K	2,390 mm (7' 10")				
L	2,990 mm (9' 10")				
M	600 mm (1' 12")				
N	480 mm (1' 7")				
O	2,975 mm (9' 9")				

WORKING RANGE

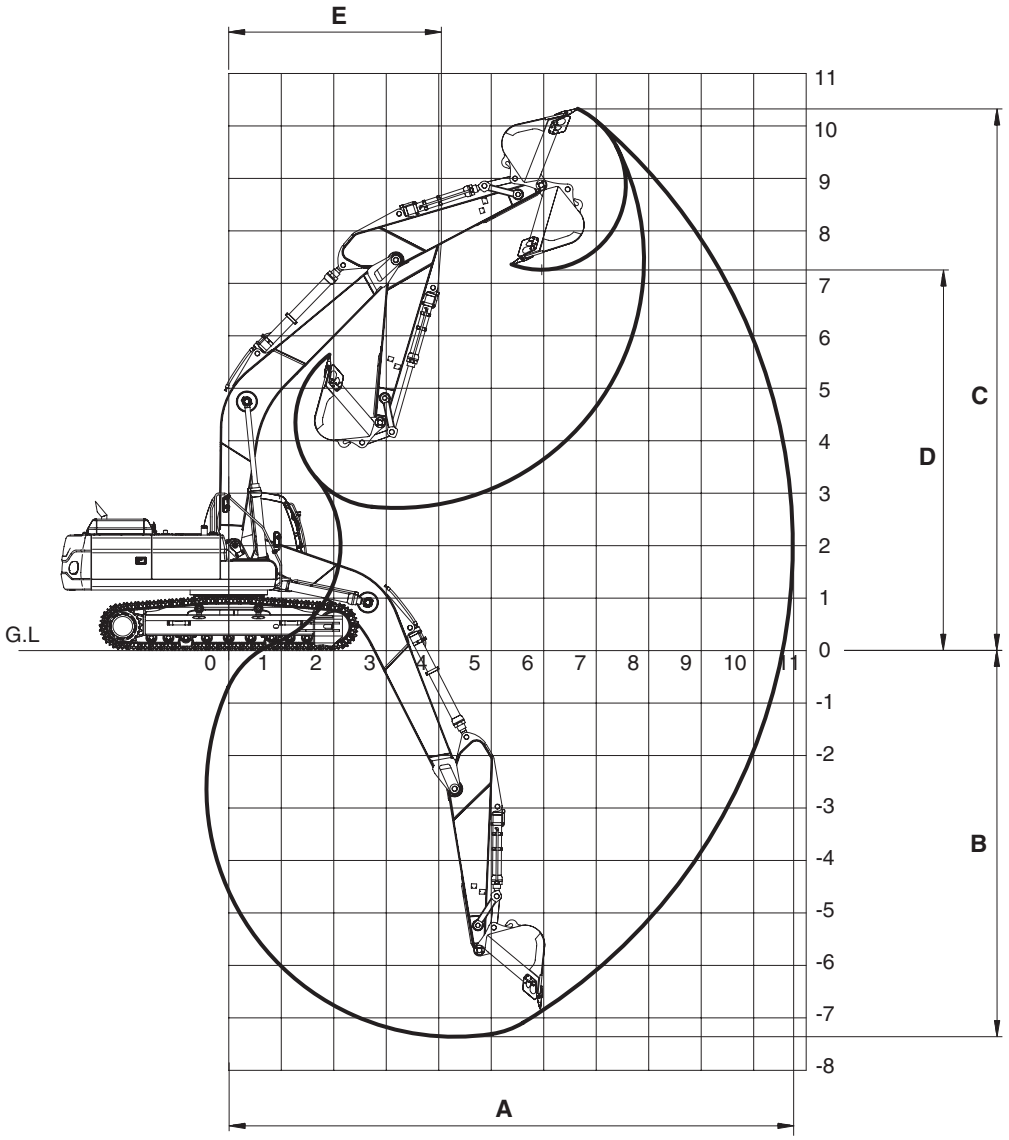


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Figure 2

DIMENSION	5.2 m (17' 1") BOOM		5.7 m (18' 8") BOOM		
	2.0 m (6' 6") ARM	2.4 m (7' 10") ARM	2.4 m (7' 10") ARM	2.9 m (9' 6") ARM	3.5 m (11' 6") ARM
A	8,580 mm (28' 2")	8,950 mm (29' 4")	9,480 mm (31' 1")	9,900 mm (32' 6")	10,340 mm (33'11")
B	5,350 mm (17' 7")	5,750 mm (18' 10")	6,110 mm (20' 1")	6,620 mm (21' 7")	7,220 mm (23' 8")
C	6,080 mm (19' 11")	9,060 mm (8' 7")	9,630 mm (31' 7")	9,750 mm (32' 0")	9,870 mm (32' 5")
D	8,840 mm (29' 0")	6,290 mm (7' 6")	6,830 mm (22' 5")	6,990 mm (22' 11")	7,150 mm (23' 5")
E	3,370 mm (11' 1")	3,190 mm (5' 6")	3,410 mm (11' 2")	3,410 mm (11' 2")	3,440 mm (11' 3")

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/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
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)	----------
Sulphur, broken	529 kg/m^3 (1,620 lb/yd^3)	----------	----------

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