DOOSAN

950106-00365ANA-1
January 2015

Excavator

Operation & Maintenance Manual

DX225LC-3

Serial Number 1001 and Up

Serial Number 50001 and Up (Europe Only)

⚠ WARNING

CALIFORNIA PROPOSITION 65 WARNING

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

⚠ WARNING

CALIFORNIA PROPOSITION 65 WARNING

Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. WASH HANDS AFTER HANDLING.

05-2010

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DX225LC-3 Excavator

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Foreword

This Operation and Maintenance Manual was written to give owner or operator instructions on safe operation and maintenance of DOOSAN equipment. READ AND UNDERSTAND THIS OPERATION AND MAINTENANCE MANUAL BEFORE OPERATING YOUR DOOSAN EQUIPMENT. Keep this manual in the cabin so it is always available. If it is lost, order another one from your DOOSAN distributor.

If there are any questions, contact your DOOSAN distributor. This manual may illustrate options and accessories not installed on your equipment.

Any modification made without written authorization or approval from DOOSAN can create a safety hazard.

Always replace parts with genuine DOOSAN parts or DOOSAN authorized replacement parts.

Intended Use

The machine is intended to be used under normal conditions for applications described in this manual. If it is used for other purposes, or in potentially hazardous environments, special precautions must be followed and the machine must be equipped for such use. Examples include, but are not limited to, are: falling object guards, work lights, etc. Do not engage in prohibited uses as described in this manual. Contact your DOOSAN distributor for further information.

Engine and Emission Control System Maintenance

Proper inspection, maintenance and repair is essential to keeping engine and machine systems properly operating. This includes proper inspection and maintenance of the machine's emission control system. This could include machine and engine components, such as an EGR (Exhaust Gas Recirculation) system, fuel system, turbocharger, electrical system, air intake system and/or cooling system.

As a heavy-duty off-road diesel engine owner, you are responsible for performing required maintenance. The required maintenance procedures are outlined in this Operation and Maintenance Manual, or Shop Manual. Do not remove, alter, or render inoperative, any emission control system.

Machine Capacity

Do not exceed machine capacity by modifying machine or using unapproved attachments.

Exceeding machine capacity can adversely affect machine performance characteristics such as: stability, system certifications such as brakes and steering, the Rollover Protective Structure (ROPS) and can result in death or serious injury. Contact your DOOSAN distributor for further information.

Product Identification Number (PIN)

A PIN number is stamped on upper frame under boom foot (Figure 1). It is also stamped on a product identification plate (Figure 2) on outside of cabin on right-hand side.

NOTE: *Record these numbers and their locations. These will be required whenever warranty or service work is requested. Keep these numbers on file in case machine is stolen.*

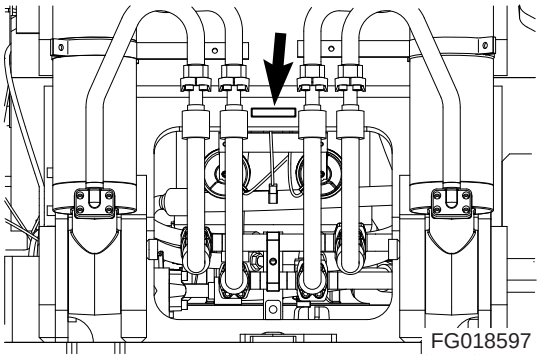


Figure 1

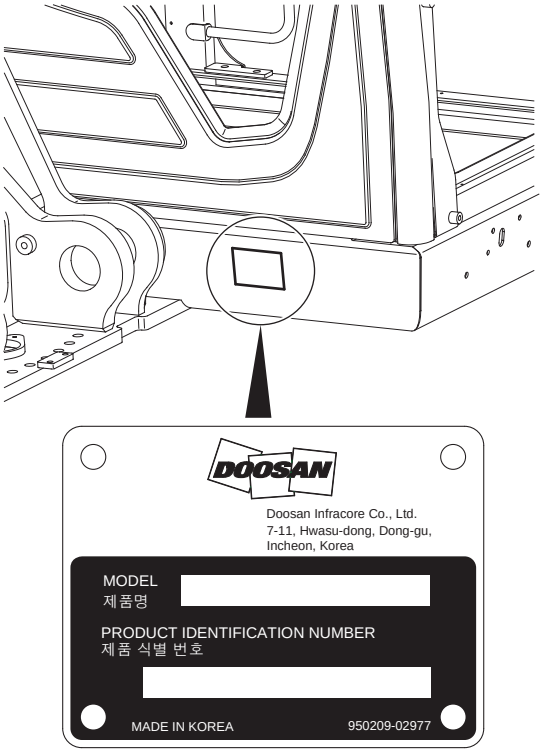


Figure 2

Component Model and Serial Numbers

There are model and serial numbers on each traceable component of machine. For example, the engine serial number is stamped on rear left side of the engine block, above the starter. Additional engine information is described on a label (Figure 3) on head cover.

Record these numbers and their locations. These will be required whenever warranty or service work is requested.

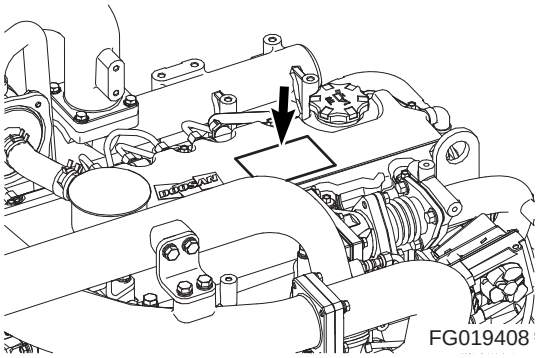


Figure 3

Safety Messages

Safety messages and safety decals included in this manual and on the machine provide instructions how to operate, service and maintain the machine. Safety messages and safety decals indicate potential hazards and describe safety precautions required to avoid hazards. Operator and maintenance personnel should read and understand these safety messages and decals before beginning operation or maintenance.

SAFETY ALERT SYMBOL

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

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

Signal Words

The signal words "DANGER", "WARNING", "CAUTION" are used throughout safety messages and safety decals in this manual or on the machine. They indicate an existence of, and the relative seriousness of, a hazard. All three indicate that a safety risk is involved. Observe the precautions indicated whenever a Safety Alert Symbol is present, no matter which signal word appears next to it.

DANGER

DANGER - This signal word is used on safety messages and safety labels and indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

WARNING - This signal word is used on safety messages and safety labels and indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

CAUTION - This signal word is used on safety messages and safety labels and indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

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.*

AEM SAFETY MANUAL (NORTH AMERICA ONLY)

The AEM Safety Manual delivered with the machine gives general safety information.

The AEM Safety Manual must be read and understood before beginning operation or maintenance and is not intended to replace the Operation and Maintenance Manual delivered with the machine.

FG018766

Figure 4

FEDERAL EMISSION CONTROL SYSTEMS

Limited Warranty for Non-road Engines (CI)

Owner’s Warranty Rights and Obligations

The U.S. Environmental Protection Agency (EPA) and DOOSAN INFRACORE are pleased to explain the Federal Emission Control System Warranty on your 2011 and later non-road engine. DOOSAN INFRACORE warrants the engine was designed, built and equipped so as to conform at the time of sale with all applicable regulations of the EPA and of the California ARB. In California, new heavy-duty off-road engines must be designed, built and equipped to meet the state’s stringent anti-smog standards.

DOOSAN INFRACORE must warrant to the initial owner, and each subsequent owner, the emission control system on your engine for the periods of time listed below provided there has been no abuse, neglect, improper maintenance or unapproved modifications of your engine. Your emission control system may include those parts listed below:

Fuel Metering System

Fuel Injection System

Air Induction System

Intake Manifold

Turbo Charger

Charge Air Cooling Systems

Catalyst or Thermal Reactor System

Exhaust Manifold

Exhaust Gas Recirculation (EGR) System

EGR Valve

EGR Cooler

Aftertreatment System

Diesel Oxidation Catalyst (DOC)

Diesel Particulate Filter (DPF)

Miscellaneous Items Used In The Emission Control Systems

Vacuum, Temperature and Time Sensitive Valve and Switches

Electronic Control Units, Sensors, Solenoids and Wiring Harnesses

Hoses, Clamps, Fittings and Tubing

Pulleys, Belts and Idlers

Emission Control Information Labels

Where a warrantable condition exists, DOOSAN INFRACORE CONSTRUCTION EQUIPMENT AMERICA (hereafter "DICEA") will repair your heavy-duty off-road engine at no cost to you including diagnosis, parts, and labor.

Manufacturer's Warranty Coverage

The 2011 and later heavy-duty off-road engines are warranted for **five years or 3,000 hours** of operation, whichever occurs first. If any emission-related part on your engine is defective, the part will be repaired or replaced by DICEA.

The warranty period shall begin on the date the machine is delivered to the first retail customer.

Owner's Warranty Responsibilities

As the heavy-duty off-road engine owner, you are responsible for the performance of the **required maintenance listed in the Operation and Maintenance Manual**. DOOSAN INFRACORE recommends that you retain all receipts covering maintenance on your heavy-duty off-road engine, but DOOSAN INFRACORE cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

As the heavy-duty off-road engine owner, you should however be aware that DOOSAN INFRACORE may deny you warranty coverage if your heavy-duty off-road engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

Your engine is designed to operate on **Ultra Low Sulfur Diesel Fuel Only**. Use of any other fuel may result in your engine no longer operating in compliance with the EPA's emissions requirements.

You are responsible for initiating the warranty process. The EPA suggests that you present your heavy duty off-road engine to a DOOSAN INFRACORE dealer as soon as a problem exists. The warranty repairs should be completed by the dealer as expeditiously as possible.

If you have any questions regarding your warranty rights and responsibilities, you should contact your nearest authorized DOOSAN INFRACORE dealer or call DICEA at 800-743-4340.

Safety

SAFETY DECALS

Safety decals are attached to the machine to alert the operator or maintenance person about potential hazards, the consequences of potential injury, and instructions and/or actions required to avoid the hazard. The location of the safety decals and the description of the decals are reviewed in the following section. Please become familiarized with all safety decals and their messages.

Make sure that all the safety decals are in their correct location and legible. Clean or replace the safety decals if they are damaged, missing, or the texts and pictorials are not legible. When you clean the safety decals, use a soft cloth, water, and soap. Do not use solvent, gasoline, or other harsh chemicals to clean the safety decals because this could loosen the adhesive that secures the decals to the machine. Remember, if a safety decal is attached to a part that is replaced, install a new safety decal on the replacement part.

This machine uses safety decals with and without text. The type and number of safety decals can vary depending upon geographical regions and machine models.

Safety Decals With Text

Safety decals with text consist of a signal word, pictorial and a text message panel. In some cases, a pictorial panel may not be part of the safety decal.

Safety Decals Without Text (No-Text)

Safety decals without text consist of a safety sign and safety information panel. The safety sign panel is located at the top or left side and the safety information panel is located at the bottom or right side of the decal depending on its configuration. The safety sign panel uses a black triangular band and a pictorial to identify the hazard and the potential consequences of the failure to follow instructions. The safety information panel uses pictorials and/or prohibition signs to identify the actions necessary to avoid the hazard.

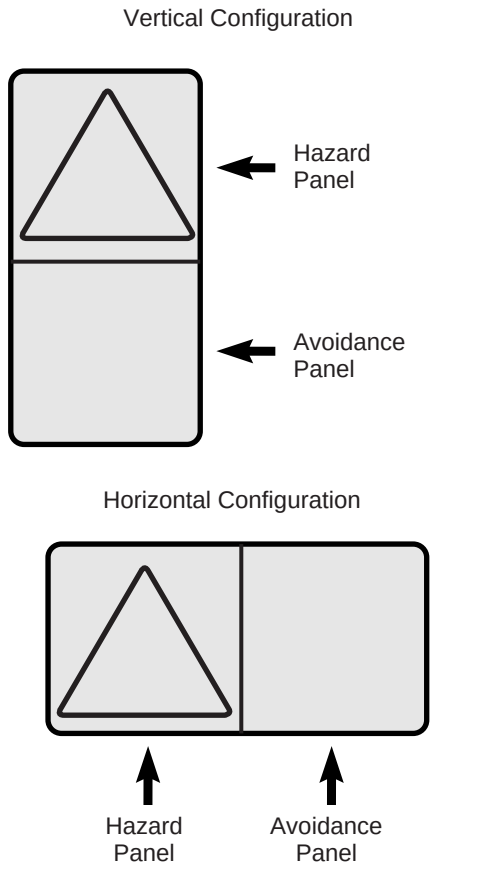
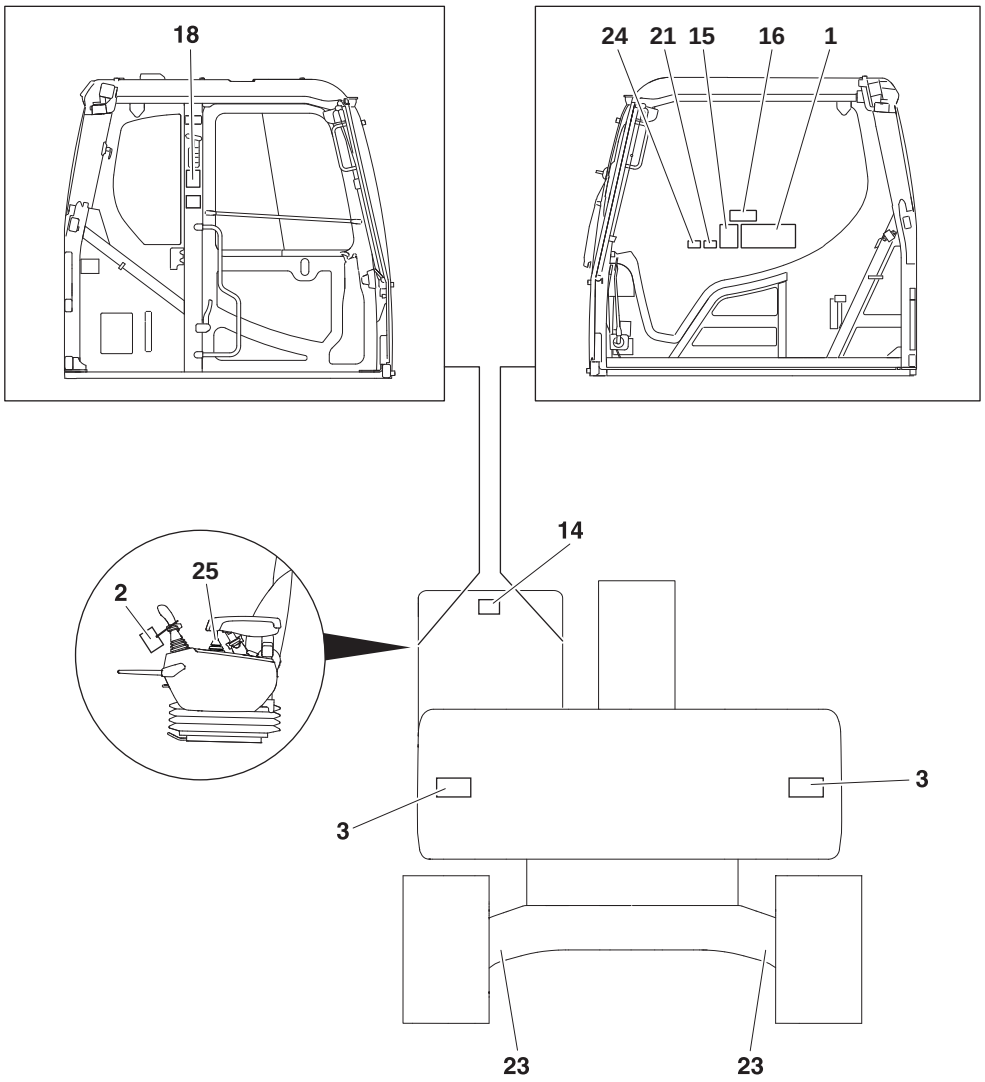


Figure 1



EX1402409

Figure 2

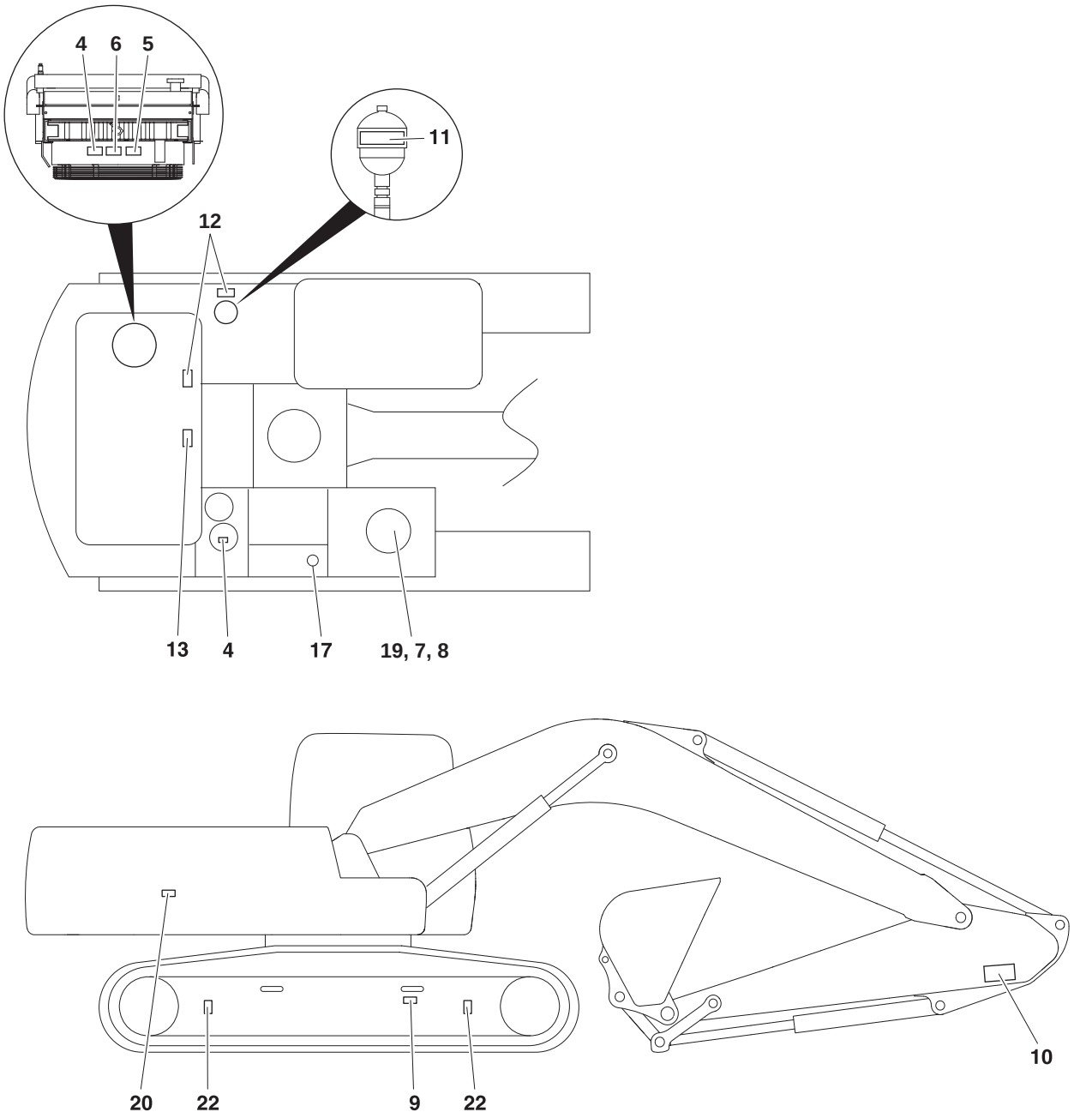
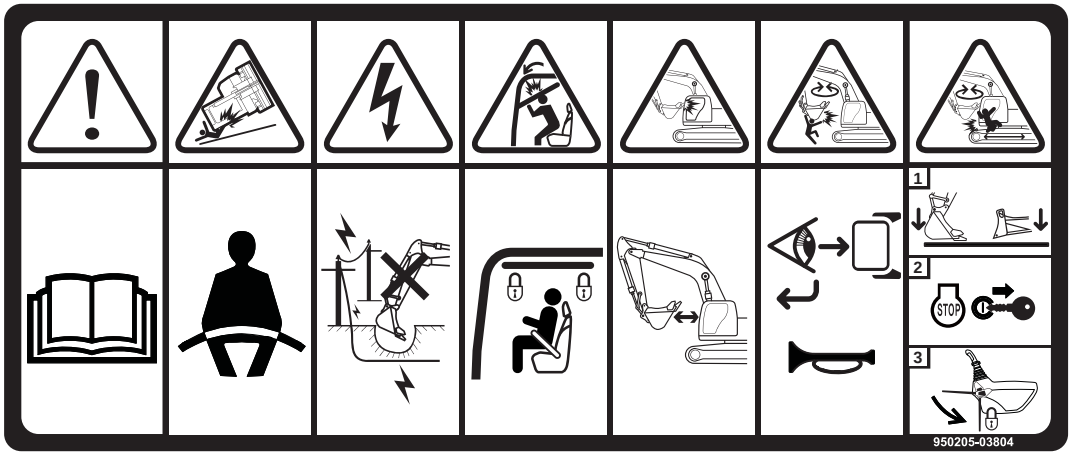


Figure 3

1. General Hazard (950205-03804)



EX1301176

WARNING

AVOID DEATH OR SERIOUS INJURY

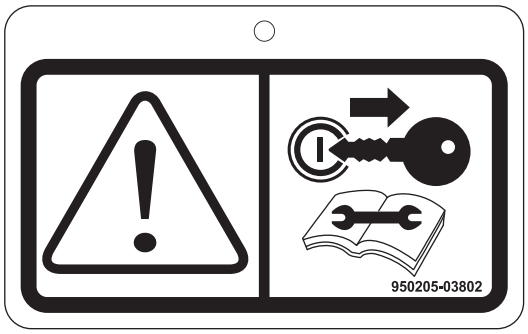
- **Never use excavator without instructions.**
- **Read Operation & Maintenance Manual before operation.**
- **Sound the horn to alert bystanders before operating.**
- **Always fasten your seat belt.**
- **Explosion or electrocution can occur if machine contacts utility lines or pipes. Check for overhead or underground lines before operating.**
- **Secure and lock front window when it is in raised position.**
- **Attachment interference can cause death, serious injury or machine damage. Check attachment to machine clearance through full working cycle before operation.**
- **Keep bystanders out of swing area and travel path and always look in the travel direction.**
- **Ensure mirrors and rear view camera are clean and working properly.**
- **Never operate machine from outside the operator's position.**
- **TO LEAVE THE EXCAVATOR:**
  1) **Lower the attachment and dozer blade (if equipped) to the ground and make sure all controls are in neutral.**
  2) **Stop engine and remove key.**
  3) **Lower safety lever to LOCK position.**

2. Warning Tag - "Do Not Operate" (950205-03802)

WARNING

AVOID DEATH OR SERIOUS INJURY

- **Stop engine and remove key.**
- **Attach "DO NOT OPERATE" warning tag to the controls before servicing the machine.**
- **Do not operate when performing inspection or maintenance.**



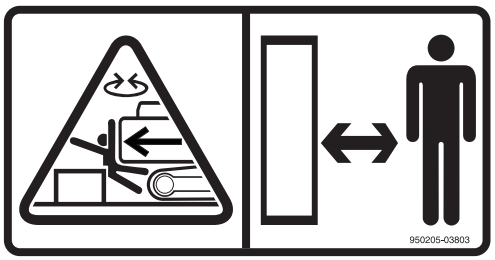
EX1301177

3. Keep Bystanders Away (950205-03803)

WARNING

AVOID DEATH OR SERIOUS INJURY

- **Keep out of swing area and travel path.**
- **Always look in the travel direction.**
- **Make sure swing area is clear of bystanders and objects.**



EX1301178

4. Hot Pressurized Fluid (950205-03781)

WARNING

HOT PRESSURIZED FLUID CAN CAUSE SERIOUS BURNS

- **Do not loosen or open cap when hot.**
- **Before opening:**
  1) **Turn engine off.**
  2) **Allow machine to cool.**
  3) **Tip cap and open slowly to relieve pressure.**

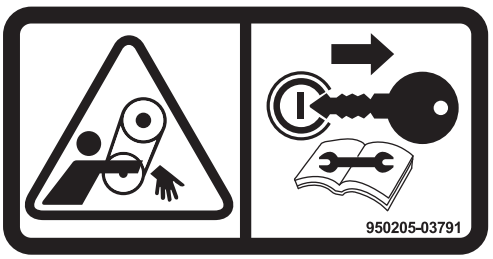
EX1301180

5. Entanglement in Rotating Parts (950205-03791)

WARNING

ROTATING PARTS CAN CAUSE DEATH OR SERIOUS INJURY

Keep away from belt and rotating parts. Stop engine before servicing.



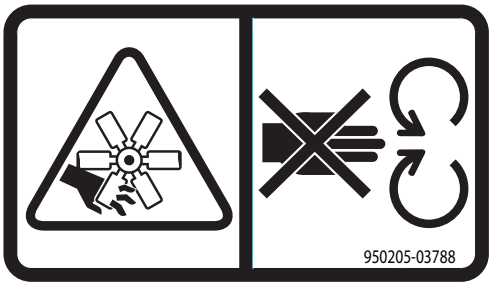
EX1301181

6. Rotating Fan (950205-03788)

WARNING

CONTACT WITH ROTATING FAN CAN CAUSE DEATH OR SERIOUS INJURY

Keep away from fan and rotating parts. Stop engine before servicing.



EX1301182

7. Battery Explosion (950205-03785)

WARNING

AVOID DEATH OR SERIOUS INJURY

- **Read and follow instructions in Operation & Maintenance Manual for battery maintenance.**
- **Keep arcs, sparks, flames, and lighted tobacco away.**
- **Do not store metal tools or flammable materials on or around batteries.**
- **Wear safety goggles and rubber gloves when working with batteries.**
- **If battery acid contact occurs:**
  1) **Flush your skin with water immediately and apply baking soda or lime to neutralize the acid.**
  2) **Flush your eyes with water for 10 - 15 minutes.**
  3) **Get medical attention <u>immediately</u>.**

EX1301183

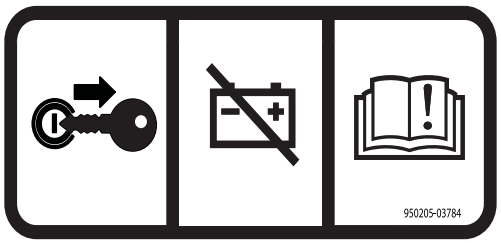
8. Battery Disconnection (950205-03784)

IMPORTANT

AVOID ELECTRICAL COMPONENT DAMAGE

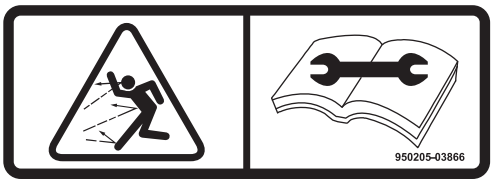
Disconnecting the battery while the engine is running can cause damage to electrical components.

Disconnect battery only when the engine is turned OFF.



EX1301184

9. Flying Debris or Objects (950205-03866)



EX1301185

WARNING

HIGH-PRESSURE GREASE CAN CAUSE DEATH OR SERIOUS INJURY

- **Track adjusting systems use grease under high-pressure which can penetrate body if improperly serviced.**
- **NEVER LOOSEN track tension grease valve more than one complete turn from the fully tightened position.**
- **Bleed off pressure slowly and keep body away from grease valve.**
- **Wear eye protection.**
- **Read and follow instructions in Operation & Maintenance Manual for more information on track adjustment.**

10. Crush Hazard (950205-03805)

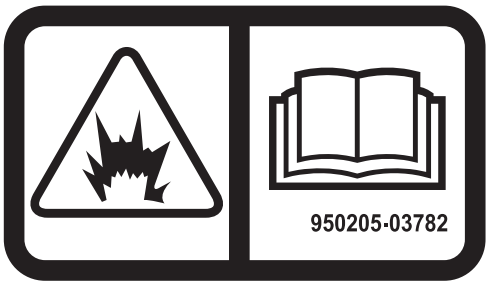
EX1301186

WARNING

AVOID DEATH OR SERIOUS INJURY

Stay clear of the boom, arm, and attachment.

11. Pressurized Gas and Fluid (950205-03782)



EX1301187

WARNING

AVOID DEATH OR SERIOUS INJURY

- **Heat or impact can cause the accumulator to explode.**
- **Keep away from flame.**
- **Do not weld on or drill into accumulator.**

12. Fall Hazard (950205-03783)

WARNING

AVOID DEATH OR SERIOUS INJURY

Do not step in this area.

EX1301188

13. Hot Surface (950205-03777)

WARNING

HOT SURFACE CAN CAUSE SERIOUS BURNS

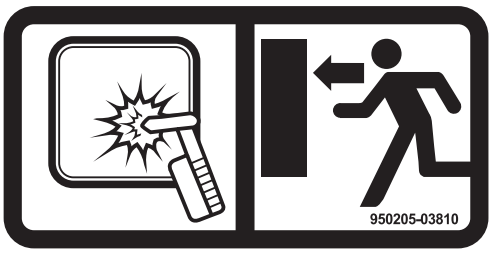
- **Do not touch hot surface.**
- **Allow to cool before servicing.**

EX1301189

14. Emergency Exit (950205-03810)

IMPORTANT

If primary exit is blocked, use glass breaking tool to break glass for secondary exit.



EX1301190

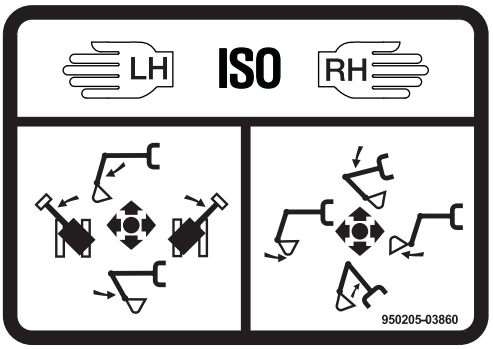
15. ISO Control Pattern (950205-03860)

WARNING

AVOID INJURY OR DEATH

Read and understand the Operation & Maintenance Manual for more information.

Refer to "Operating Instructions" section of this manual for details regarding the work levers (joysticks) control functions.



EX1301191

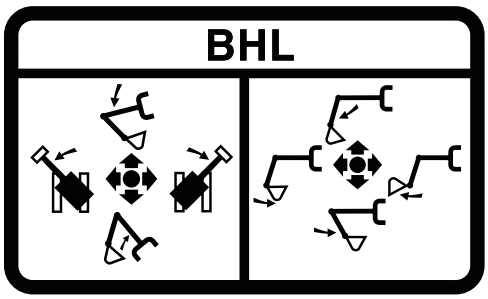
BHL Control Pattern (US Only) (950205-03868)

WARNING

AVOID INJURY OR DEATH

Read and understand the Operation & Maintenance Manual for more information.

Refer to "Operating Instructions" section of this manual for details regarding the work levers (joysticks) control functions.



EX1301192

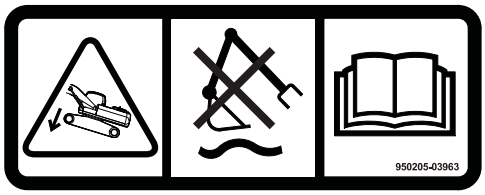
16. Impact Hazard (Optional) (950205-03963)

WARNING

AVOID DEATH OR SERIOUS INJURY

- **Activating the Intelligent Floating Boom Control with the tracks raised up can cause the machine to drop suddenly.**
- **Do not activate Intelligent Floating Boom Control when tracks are raised.**
- **Do not raise tracks when control is activated.**

Refer to "Intelligent Floating Boom Control (Optional)" section of this manual for more information.

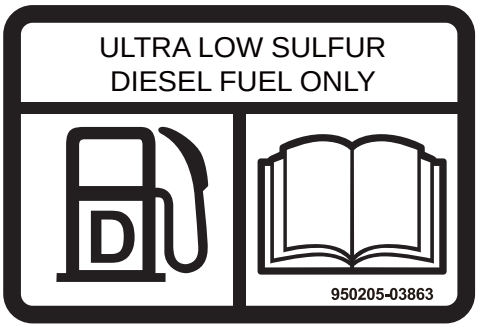


EX1301193

17. Ultra Low Sulfur Diesel Fuel (Optional) (950205-03863, 950205-03864)

IMPORTANT

Only use Ultra Low Sulfur Diesel (ULSD) fuel with this machine.



EX1301196

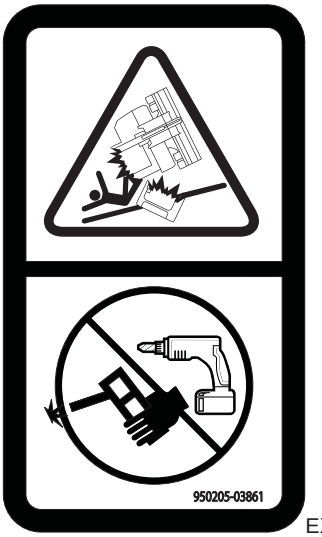
EX1301194

18. ROPS Warning (Optional) (950205-03861)

WARNING

AVOID DEATH OR SERIOUS INJURY

- **Do not weld on or drill holes in the protective structure.**
- **Replace ROPS, if damaged or modified.**



EX1301197

19. Falling Object (Optional) (950205-03786)

EX1301198

WARNING

UNSUPPORTED DOOR CAN FALL CAUSING DEATH OR SERIOUS INJURY

- **To open door:**
  1) **Hold door firmly.**
  2) **Lift door slowly until locking device engages.**
- **To close door:**
  1) **Hold door firmly.**
  2) **Press locking device to disengage.**
  3) **Lower door slowly.**

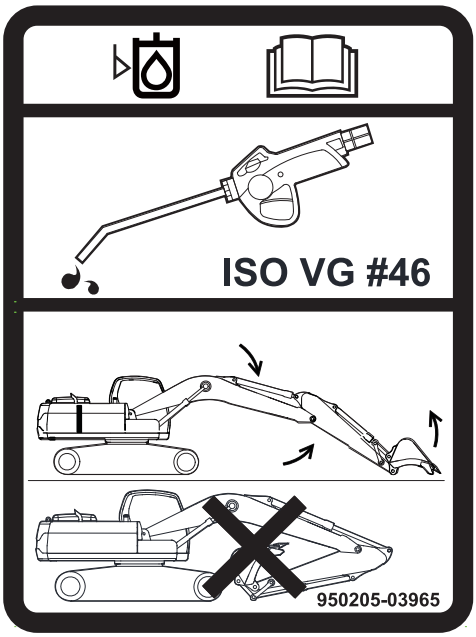
20. Hydraulic Oil Check (Optional) (950205-03965)

IMPORTANT

INCORRECT OIL LEVEL OR INCORRECT FLUID CAN CAUSE HYDRAULIC SYSTEM DAMAGE

Place the excavator with the boom and arm fully extended with the attachment on the ground before checking hydraulic fluid level.

Use only ISO VG#46 hydraulic fluid.



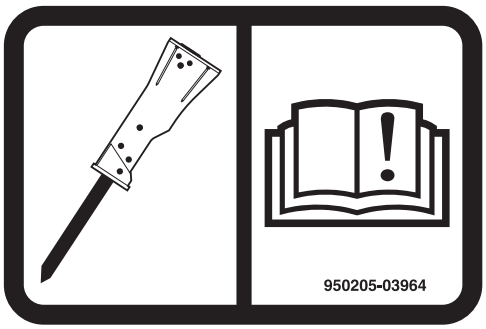
EX1301199

21. Hydraulic Breaker (Optional) (950205-03964)

IMPORTANT

AVOID HYDRAULIC SYSTEM DAMAGE

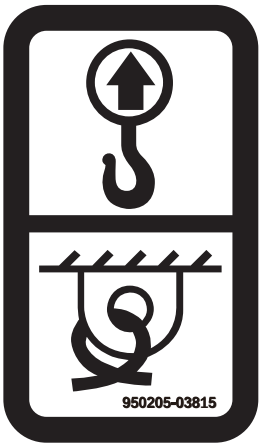
To adjust breaker impact, see Operation & Maintenance Manual for additional instructions.



EX1301200

22. Lift/Tie down (Optional) (950205-03815)

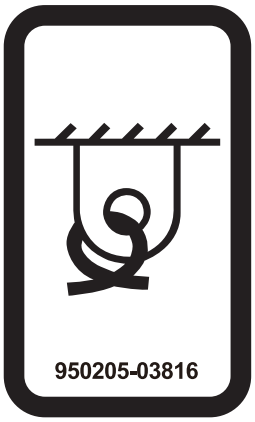
Identifies lift point and tie down point location.



EX1301201

23. Tie down (Optional) (950205-03816)

Identifies tie down point location.

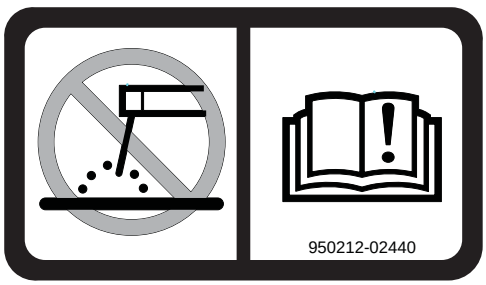


EX1301203

24. Electric Welding Attention (950212-02440)

IMPORTANT

Electrical welding on the frame can damage the engine's electronic control unit (ECU).



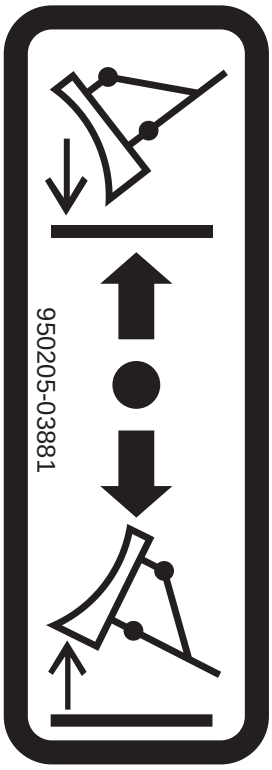
EX1402396

25. Dozer (950205-03881)

WARNING

AVOID DEATH OR SERIOUS INJURY

- **Check the dozer blade location before traveling. When the blade is to the rear, operate the steering levers/foot pedal in the opposite direction to when the blade is in the front.**
- **Before moving, make sure there are no persons or property in the way. Never allow riders. Sound the horn to alert workers and bystanders that you are about to move the machine.**
- **Always make sure the path is clear during travel.**
- **Use extreme caution when reversing travel. Be sure there is a clear path behind the machine.**
- **Operate the travel control levers smoothly to avoid sudden starts or stops.**
- **Before leaving the operator's seat, make sure to lock out all control systems and stop engine to avoid accidental activation of the controls.**



EX1402247

Safe Operation is Operator's Responsibility

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

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

- Do not operate machine if you are under the influence of drugs or alcohol. An operator who is taking prescription drugs must get medical advice to determine if he or she can safely operate a machine.
- When working with other personnel on a work site, be sure that all personnel know nature of work and understand all hand signals that are to be used.
- Be sure that all guards and shields are installed in their proper location. Have guards and shields repaired or replaced immediately if damaged.
- Be sure that you understand the use and maintenance of all safety features such as safety lock lever and seat belt. Use them properly.
- Never remove, modify or disable any safety features. Always keep them in good operating condition.
- Always check for and know the location of underground and overhead utility lines before excavating.
- Failure to use and maintain safety features according to instructions in this manual, Safety Manual and Shop Manual can result in death or serious injury.

Know Your Machine

Know how to operate your machine. Know the purpose of all controls, gauges, signals, indicators and monitor displays. Know the rated load capacity, speed range, braking and steering characteristics, turning radius and operating clearances. Keep in mind that rain, snow, ice, loose gravel, soft ground, slopes etc., can change operating capabilities of your machine.

Proper Work Tools and Attachments

Only use work tools and attachments that are recommended by DOOSAN for use on DOOSAN machines. When installing and using optional attachments, read instruction manual for attachment, and general information related to attachments in this manual. Because DOOSAN cannot anticipate, identify or test all attachments that owners may want to install on their machines, contact DOOSAN for written authorization and approval of attachments, and their compatibility with optional kits.

Attachments and attachment control systems that are compatible with the machine are required for safe and reliable machine operation. Do not exceed maximum operating weight (machine weight plus attachment) that is listed on ROPS certification plate.

Make sure that all guards and shields are in place on machine and on work tool. Depending on type or combination of work equipment, there is a potential that work equipment could interfere with the cabin or other parts of machine. Before using unfamiliar work equipment, check if there is any potential of interference, and operate with caution.

While you are performing any maintenance, testing, or adjustments to attachments, stay clear of the following areas: cutting edges, pinch points, and crushing surfaces.

Never use attachment as a work platform or manlift.

Contact your DOOSAN distributor about auxiliary hydraulic kits for attachments installation. If you are in doubt about compatibility of a particular attachment with a machine, consult your DOOSAN distributor.

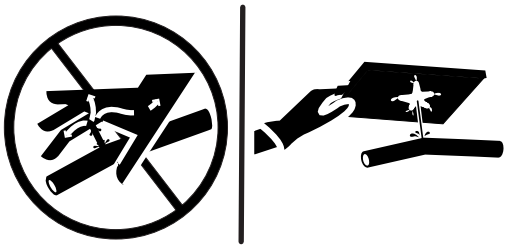
Pressurized Fluids

Pressurized air or fluids can cause debris and/or fluids to be blown out. This could result in death or serious injury.

Immediately after operations are stopped, coolant, engine oil, and hydraulic oil are at their highest temperatures and the radiator and hydraulic tank are still under pressure. Always wait for temperature to cool down. Follow specified procedures when attempting to remove caps, drain oil or coolant, or replacing filters. Always wait for temperature to cool down, and follow specified procedures when performing these operations. Failure to do so can result in death or serious injury.

When pressurized air and/or pressurized water is used for cleaning, wear protective clothing, protective shoes, and eye protection. Eye protection includes goggles or a protective face shield.

Pressure can be trapped in a hydraulic system and must be relieved before maintenance is started.



FG018457

Figure 4

Releasing trapped pressure can cause sudden machine movement or attachment movement. Use caution if you disconnect hydraulic lines or fittings.

High-pressure oil that is released can cause a hose to whip or oil to spray. Fluid penetration can result in death or serious injury. If fluid enters skin or eyes, get immediate medical attention from a physician familiar with this injury.

Obey all local laws and regulations for disposal of liquids.

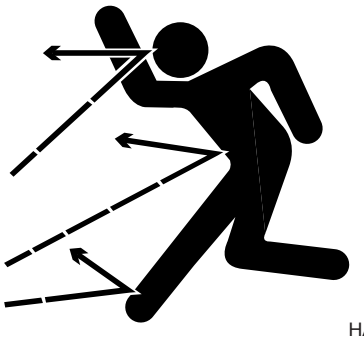
To prevent hot coolant from spraying out, stop engine and wait for coolant to cool. Using gloves, slowly loosen cap to relieve pressure.

Flying or Falling Objects

On work sites where there is a potential hazard that flying or falling objects can hit operator's cabin, select and use a guard to match operating conditions for additional operator protection.

Working in mines, tunnels, deep pits, and loose or wet surfaces, could produce hazard of falling rocks or flying objects. Additional protection for operator's cabin could be required such as an Operator Protection Guard (OPG) or window guards. Contact your DOOSAN distributor for information on available protective guards.

To prevent personnel from being struck by flying objects, keep personnel out of work area.



HAOA110L

Figure 5

HAOA100L

Figure 6

Personal Protective Equipment (PPE)

Do not wear loose clothing and accessories. Secure long hair. These items can snag on controls or on other parts of equipment.

Do not wear oily clothes. They are highly flammable.

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. Breathing masks and/or ear protection may be required.

Wear a hard hat, safety shoes, safety goggles, mask, leather gloves, earplugs and other protective equipment, as required.

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

HAOA020L

Figure 7

Correction of Machine Problems

If any machine problems are found during operation and maintenance (noise, vibration, smell, incorrect gauges, smoke, oil leakage, etc.), or if any abnormal warning alerts are displayed on display monitor, stop the machine and take the necessary corrective actions. Do not operate machine until problem has been corrected.

Crushing and Cutting

Keep objects away from moving fan blades. Fan blades can throw and cut objects.

Do not use a wire rope that is kinked or frayed, or a wire rope with any loss of diameter. Wear leather gloves when handling a wire rope.

When striking a loose retainer pin, it can fly out and can cause a serious injury. Make sure that area is clear of personnel when striking a retainer pin. To avoid injury to your eyes, wear safety goggles when striking a retainer pin.

Do not put your hand, arm or any other part of your body between movable parts. If going between movable parts is necessary, always position and secure work equipment so it cannot move. Properly support equipment before performing any work or maintenance under raised equipment.

If control levers are operated, clearance between machine and work equipment will change and this may lead to serious damage or can result in death or serious injury. Stay clear of areas that may have a sudden change in clearance with machine movement or equipment movement. Stay clear of all rotating and moving parts. Unless instructed, never attempt adjustments while machine is moving or while engine is running.

Do not depend on hydraulic cylinders to support raised equipment. Equipment can fall if a control is moved, or if a hydraulic line breaks, is loosened or disconnected.

If it is necessary to remove guards to perform maintenance, always install guards after maintenance is completed.

HDO1010L

Figure 8

Hot Coolant and Oils - Burn Prevention

Do not touch any part of an operating engine. Immediately after operations are stopped, coolant, engine oil, and hydraulic oil are at their highest temperatures. The radiator and hydraulic tank are still under pressure. Always wait for temperature to cool down. Attempting to remove caps, drain oil or coolant, or replacing filters may lead to serious burns, if done when hot. Relieve all pressure in air system, hydraulic oil system, lubrication system, fuel system, and cooling system, before any lines, fittings or related items are disconnected.

FG019095

Figure 9

To prevent hot oil or coolant from spraying out, stop engine, wait for oil and coolant to cool. Using gloves, slowly loosen cap to relieve pressure.

FG019096

Figure 10

Fire and Explosion Prevention

All fuels, most lubricants and some coolant mixtures are flammable and can cause a fire resulting in death or serious injury, and property damage. Flammable fluids that are leaking or spilled onto hot surfaces or onto electrical components can cause fire.

Inspect for and remove all flammable materials such as spilled fuel and oil, and debris from machine. Do not allow any flammable materials to accumulate on machine.

Always observe the following:

HDO1015I

Figure 11

- Add fuel, oil, antifreeze and hydraulic fluid to machine only in a well ventilated area. Machine must be parked with controls, lights and switches turned "OFF". Engine must be "OFF" and any flames, glowing embers, auxiliary heating units or spark causing equipment must be extinguished, or turned "OFF" and kept well clear of machine.
- Dust that is generated from repairing or grinding nonmetallic hoods or nonmetallic fenders can be toxic, flammable and explosive. Repair these components in a well ventilated area away from flames or sparks and wear dust mask when grinding painted parts.

FG018458

Figure 12

Maintenance

The machine and some attachments have components that are at high temperatures under normal operating conditions. The primary source of high temperatures are the engine and exhaust system. If damaged or incorrectly maintained, the electrical system can be a source of arcs or sparks.

Flammable debris (leaves, straw, etc.) must be removed regularly. If flammable debris is allowed to accumulate, it can cause a fire hazard. Clean machine often to avoid this accumulation. Flammable debris in an engine compartment is a potential fire hazard.

The operator's area, engine compartment and engine cooling system must be inspected every day and cleaned. This is necessary to prevent fire hazards and overheating.

Operation

Do not use machine where exhaust, arcs, sparks or hot components can contact flammable material, explosive dust or gases.

Do not operate machine near any flame.

Exhaust shields (if equipped) protect hot exhaust components from oil spray or fuel spray in case of a break in a line, hose, or seal. Exhaust shields must be correctly installed.

Electrical

Check all electrical wiring and connections for damage daily.

Keep battery terminals clean and tight. Repair or replace any damaged part or wires that are loose or frayed. Clean all electrical connections and tighten all electrical connections.

Never check battery charge by placing a metal object across terminal posts. Use a voltmeter or a hydrometer.

Battery gas can explode and can result in death or serious injury. Follow procedures in this manual for connecting battery and for jump-starting. Do not jump-start or charge a frozen or damaged battery. Keep any flames or sparks away from batteries. Do not smoke in battery charging area.

Improper jumper cable connections can cause an explosion that can result in death or serious injury. Refer to “Starting Engine With a Booster Cable” on page 3-11, for proper procedure in this manual.

Do not charge a frozen battery. This can cause an explosion.

After market radios or other electric operated equipment in cabin must have a fuse in the electrical circuit.

Hydraulic System

Check hydraulic tubes, hoses and fittings for damage, wear or for leaks. Hydraulic lines and hoses must be properly routed and have adequate support and secure clamps. Leaks can cause fires. Never use a flame or bare skin to check for leaks.

Tighten or replace any parts that show leakage.

Check that all hose and tube clamps, guards, and cushions are securely attached. If they are loose, they can vibrate during operation and rub against other parts. This can cause damage to hoses and cause high-pressure oil to spray on hot surfaces, causing a fire and death or serious injury.

Always clean fluid spills. Do not use gasoline or diesel fuel for cleaning parts. Use commercial nonflammable solvents.

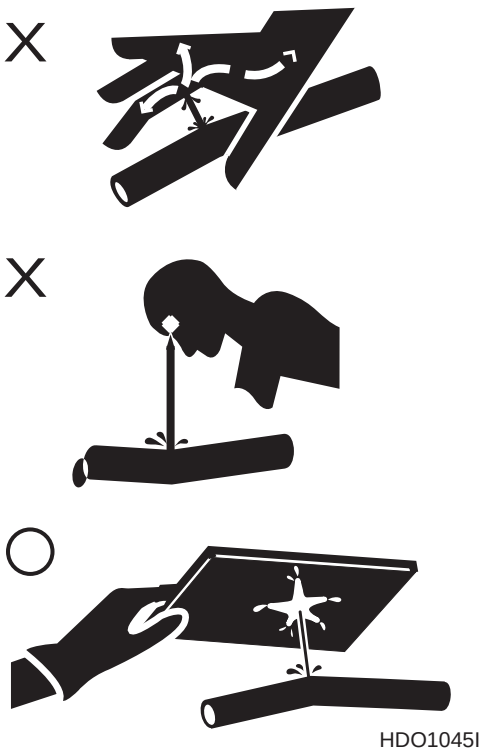


Figure 13

Fueling

Use caution when you are refueling a machine.

Fuel is flammable and can catch fire if it is brought close to a flame.

Stop engine and let it cool before adding fuel. Do not smoke while you are refueling a machine. Do not refuel a machine near flames or sparks. Fill fuel tank outdoors.

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

Store fuels and lubricants in properly marked containers away from unauthorized personnel. Store oily rags and any flammable materials in protective containers.

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

Always place plastic fuel containers on the ground before filling.

ARO1050S

Figure 14

Never Use Ether Starting Aids

Do not use ether or starting fluids on any engine that has glow plugs, or an electric grid type manifold heater. These starting aids can cause an explosion and result in death or serious injury.

Use procedures in this manual for connecting battery and for jump-starting.

FG018458

Figure 15

Welding and Grinding

Always clean machine and attachment, set battery disconnect switch to "OFF" position, and disconnect wiring from electronic controllers before welding. Cover rubber hoses, battery and all other flammable parts. Keep a fire extinguisher near machine when welding.

Toxic dust or gas can be produced when grinding or welding painted parts. Grinding or welding painted parts must be done in a well ventilated area. Wear dust mask when grinding painted parts.

Dust generated from repairing nonmetallic parts such as hoods, fenders or covers can be flammable or explosive.

Repair such components in a well ventilated area away from flames or sparks.

Do not weld on lines or on tanks that contain flammable fluids. Do not flame cut lines or tanks that contain flammable fluid. Clean any such lines or tanks thoroughly with a nonflammable solvent before welding or flame cutting.

If a Fire Occurs

If a fire occurs:

- Do not attempt to move machine or continue operations.
- Turn starter switch to "O" (OFF) position to stop engine.
- Use handrails, guardrails and steps to get off machine.
- Immediately call for help or fire station.
- When using a fire extinguisher, always aim extinguisher at base of fire.
- If an optional fire extinguishing system is in place, be familiar with its operating procedures.

  NOTE: *Depending on job conditions, other procedures could be necessary if a fire occurs.*

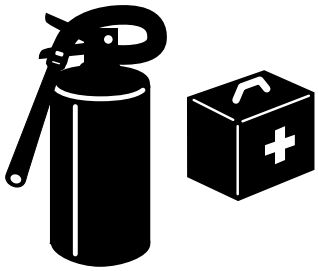
FG018459

Figure 16

Fire Extinguisher and First-Aid Kit (Emergency Medical Kit)

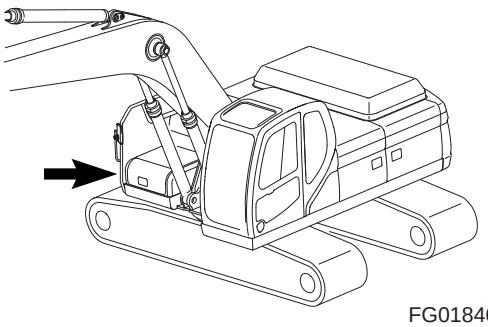
To be prepared in the event of a fire:

- Be sure that fire extinguishers have been provided and read 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 cabin. Check and service fire extinguisher at regular intervals and make sure that all work site crew members are adequately trained in its use.
- Inspect fire extinguisher and service fire extinguisher regularly.
- Follow instructions on extinguisher instruction plate.
- Keep a first aid kit in storage compartment (Figure 18) and keep another kit at work site. Check kit periodically and keep it properly supplied.
- Keep emergency numbers for doctor, ambulance service, hospital and fire department readily available.



HDO1009L

Figure 17



FG018460

Figure 18

Electrical System and Electrical Shock

Never short across starter terminals or across batteries. Shorting could damage electrical system and engine neutral start system.

When engine is running or immediately after it has stopped, high voltage is generated at injector terminal and inside engine controller, so there is a potential for an electrical shock. Never touch injector terminal or inside of engine controller.

NOTE: *If it is necessary to touch injector terminal or inside engine controller, contact your DOOSAN distributor.*

Rollover Protective Structure (ROPS)

The operator's cabin is a ROPS certified structure for protecting the seat-belted operator. It absorbs the impact energy of a rollover impact. Do not allow machine weight (mass) to exceed certified value on certification plate. If weight is exceeded, the ROPS structure will not be able to fulfill its safety function.

Do not increase machine weight beyond certified value by modifying machine or by installing attachments on machine. If weight limit of protective equipment is exceeded, protective equipment will not be able to protect operator, and this can result in death or serious injury. Always observe the following:

- This machine is equipped with a protective structure. Do not remove protective structure and perform operations without it.
- Never modify the operator's cabin by welding, grinding, drilling holes or adding attachments unless instructed by DOOSAN in writing. Changes to the cabin can cause loss of operator protection from rollover and falling objects, and result in death or serious injury.
- When protective structure is damaged or deformed by falling objects or by rolling over, its strength will be reduced and it will not be able to adequately protect the operator. Contact your DOOSAN distributor if you have any questions about the ROPS. Never repair a damaged ROPS cabin.
- Always wear your seat belt when operating machine.

ROPS Certification

This DOOSAN excavator has an operator's cabin that meets ROPS requirements. The seat belt must be worn for rollover protection.

The ROPS certification plate (Figure 19) is found on the left side of the cabin on most models. It may vary slightly in its location on some models.

Check the ROPS cabin, mounting, and hardware for damage.

Never modify the ROPS cabin. Replace the cabin and hardware if damaged. See your DOOSAN distributor for parts.

ROPS – Roll-over Protective Structure complies with ISO 12117-2:2008, EN 13531:2001.

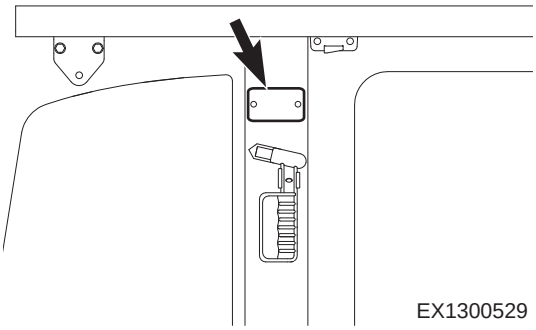


Figure 19

WARNING

AVOID DEATH OR SERIOUS INJURY

Never modify the operator cabin by welding, grinding, drilling holes or adding attachments unless instructed in writing by DOOSAN. Changes to the cabin can cause loss of operator protection from rollover and falling objects, and can result in death or serious injury.

Protecting Cabin from Flying or Falling Objects (Optional)

In a work site where additional operator protection is necessary from falling or flying objects, install adequate protective guards on the cabin.

For breaker operation, install a front guard (1, Figure 20) and apply a laminated coating sheet to front glass. Contact your DOOSAN distributor for recommendations.

When performing demolition or cutting operation, install a front guard and top guard.

Apply a protective laminated coating sheet to outside of front window. This will prevent glass from being scratched by dust when cleaning it or running wipers.

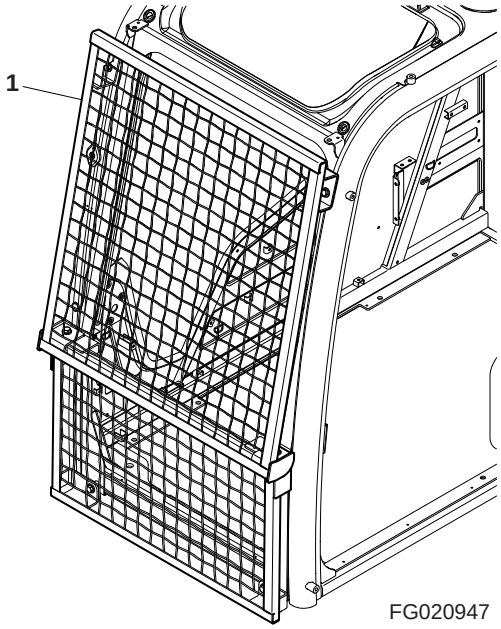


Figure 20

When working in mines, quarries or other work sites where there is a hazard of falling rocks, install Operator Protection Guard (OPG) (2, Figure 21) and apply a laminated coating sheet to front glass.

When OPG is installed, and front window needs to be cleaned, loosen bolts marked with arrows (Figure 21). Be sure to tighten bolts when done.

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 system requires a complete inspection of the structure. Reinstallation, recertification and/or replacement of system may be necessary.

Contact your DOOSAN distributor for available safety guards and/or recommendations to protect against objects that could strike operator's cabin. Make sure that all other work site crew members are kept away from excavator when operating.

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

NOTE: *The preceding instructions assume that conditions are for standard operations, but it may be necessary to add additional guards depending on operating conditions or local rules or regulations for the work site. Always contact your DOOSAN distributor for advice.*

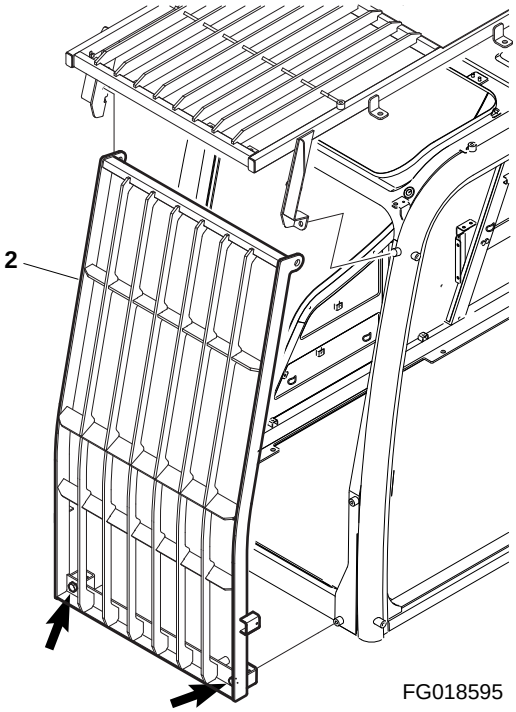
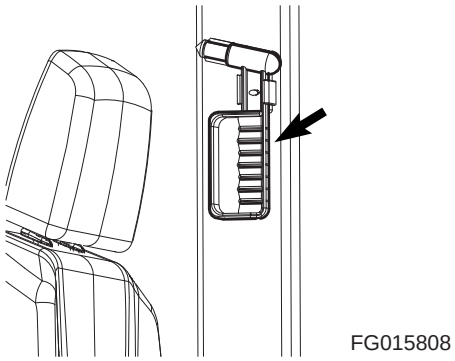


Figure 21

Emergency Exit from Operator's Station

This machine is equipped with a glass breaking tool. It is found on left pillar of cabin. This tool can be used to break the glass to exit from cabin in an emergency. Grip handle firmly and use sharp point to break glass.

- Be careful also not to slip on broken pieces of glass on ground.



FG015808

Figure 22

WARNING

AVOID DEATH OR SERIOUS INJURY

Protect your eyes when breaking the glass.

TRANSPORTATION

Obey State and Local Over-the-Road Regulations

Check federal, state and local laws and regulations regarding weight, width and length of a load before making preparations for transporting on public roads or highways.

The hauling vehicle, trailer and load must be in compliance with applicable regulations for the shipping route.

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

Refer to “Transportation” on page 5-1, for information on loading, unloading and towing.

The machine can be disassembled into parts for transporting. Contact your DOOSAN distributor for assistance with disassembly.

Loading and Unloading

To prevent machine tipping or rollover when loading or unloading machine, always do the following:

- Perform loading and unloading only on firm and level ground. Maintain a safe distance from edge of road or drop-off.
- Never use work equipment to load or unload machine. The machine may fall or tip over.
- Always use loading ramps of adequate strength and capacity. Be sure that ramps are wide, and long enough to provide a safe loading slope. Take steps to prevent ramps from moving out of position or coming off.
- Clean ramp surfaces so they are free of grease, oil, ice and loose materials. Remove dirt from machine tracks and undercarriage. On a rainy day, be careful since ramp surfaces can be slippery.
- Turn auto idle switch "OFF".
- Run engine at low speed and travel slowly.
- When on ramps, do not operate any control lever except for travel lever.
- Never correct your steering on ramps. If necessary, drive off ramps, correct machine direction, then drive back onto ramps.
- When driving up or down ramps, the center of gravity of machine will change suddenly causing the tracks to drop down to the ramps or trailer. This will occur at the joint between the ramps and trailer. Travel slowly over this point.

- For machines equipped with a cabin, always lock door after loading machine to prevent door from suddenly opening during transportation.

Transporting Machine

When transporting machine on a trailer or truck, do the following:

- The weight, transportation height, and overall length of machine may change depending on work equipment attached to it. Always check the machine dimensions and work equipment's dimensions before transporting.
- When passing over bridges or structures on private land, check that structure is strong enough to support weight of machine. Before traveling on public roads, check with appropriate authorities and follow their instructions.

OPERATION

Always make sure that the machine is properly maintained.

Before Engine Starting

Machine Condition

Every day before starting engine for first time, perform the following checks and repair machine before operating, as necessary. If these checks are not properly done death or serious injury could result.

- Check coolant, fuel, and hydraulic tank oil levels, and check for clogged air cleaner and damage to electrical wiring.
- Check operation of gauges, cameras (if equipped) and angle of mirrors, and check that safety lever is in LOCKED position.
- Check that work equipment and travel controls move freely, and work controls return to "NEUTRAL" when released.
- Check that attachment is properly attached and locked.

IMPORTANT

Only use Ultra Low Sulfur Diesel (ULSD) fuel and API-CJ-4/ACEA-E9 grade engine oil with this machine.

Make sure that the machine is equipped with a lighting system that is adequate for job conditions and lights are working properly.

Before moving machine, check position of undercarriage. The normal travel position is with idler wheels to front under cabin and drive sprockets to rear. When undercarriage is rotated in reversed position, directional or travel controls must be operated in opposite directions.

Before performing checks, move machine to an area where there are no obstructions, and operate slowly. Do not allow personnel near machine.

Know maximum operating dimensions of your machine.

Work Site

Before starting operations, thoroughly check work area for any hazards, such as underground utility lines, overhead electrical lines, unstable ground, excessive slopes, etc.

Before starting engine and moving machine, make sure that no one is underneath machine, around machine, or on machine.

Know width and length of your machine and work equipment to maintain proper clearance when you operate machine or work equipment near fences or near boundary obstacles.

Know appropriate work site hand signals and personnel that are authorized to give hand signals. Follow hand signals from only one person.

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 work site.

Erect barricades or fences, post "No Entry" signs, and take other steps to prevent people from coming close to or entering work site. If people come too close to a moving machine, they may be struck or caught by machine, and this can result in death or serious injury.

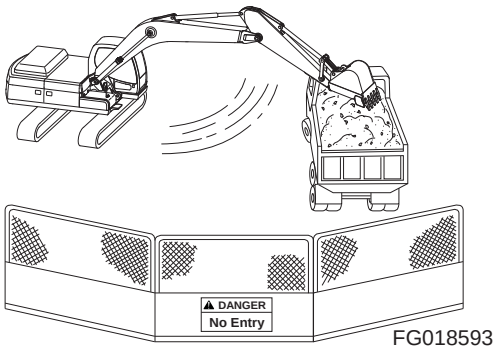


Figure 23

Mounting/Dismounting

Before getting on or off machine, if there is any oil, grease, or mud on handrails, guardrails, 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 machine. In particular, never get on or off a moving machine. These actions can result in death or serious injury.

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

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

Securely latch door. If you grip handrail inside door when moving on top of track shoes, and door latch is not securely engaged, door may move and cause you to fall.

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

Do not carry tools or supplies when you mount or dismount the machine.

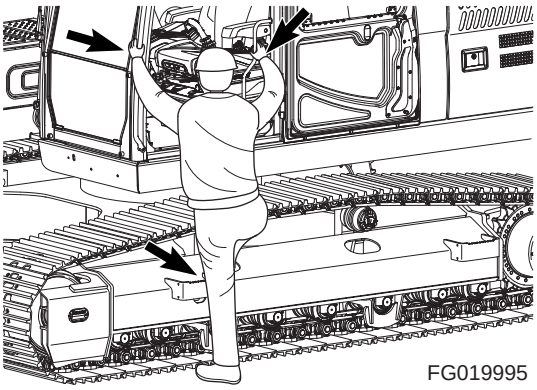


Figure 24

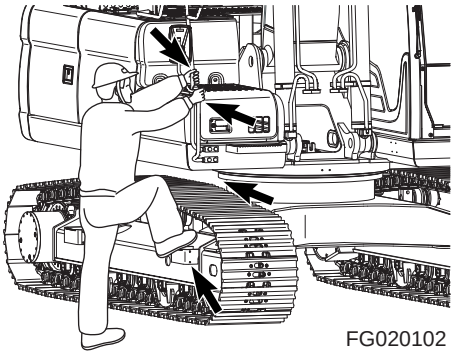


Figure 25

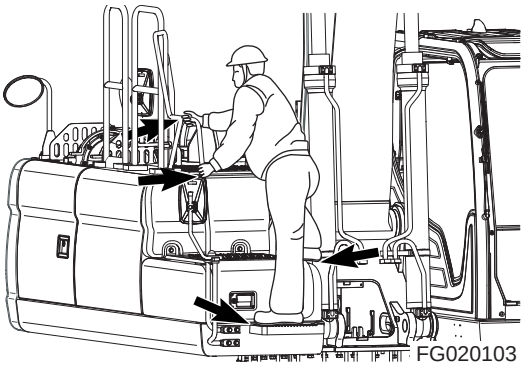


Figure 26

Cleaning

Remove all straw, wood chips, leaves, grass, paper and other flammable debris accumulated in engine compartment, Diesel Particulate Filter (DPF), mufflers and around battery. Remove any dirt from window glass, mirrors, handrails, and steps.

Do not leave tools or spare parts in operator's cabin. Vibration of machine during operation can cause tools or spare parts to fall and damage or break control levers or switches. Tools and spare parts can also get caught in spaces between control levers and cause accidental movement of work equipment causing death or serious injury.

When entering operator's cabin, always remove all mud and oil from your shoes. If you operate travel pedal with mud or oil stuck to your shoes, your foot could slip off the control, or dirt and debris may interfere with proper operation of control levers.

After using ashtray, make sure that any matches or cigarettes are properly extinguished, and be sure to close ashtray.

Clean window glass and working lights for good visibility.

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

Never bring flammable or explosive items into operator's cabin. Do not leave cigarette lighters laying around operator's cabin. If temperature inside operator's cabin becomes too high, there is a potential hazard that lighter could explode.

Secure all loose items such as lunch boxes, and other items that are not a part of equipment.

Operator Station

Inspect condition of seat belt and mounting hardware. Replace any parts that are worn or damaged. Do not use a seat belt extension on a retractable seat belt.

Adjust seat so full pedal travel can be achieved with operator's back against back of seat.

Keep all windows and doors closed on machine.

Adjust operator's seat to a position where it is easy to perform operations, and check that there is no damage or excessive wear to seat belt or mounting clamps.

Adjust and clean mirrors so area to rear of machine can be seen clearly from operator's seat.

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

Seat Belt

Check seat belt daily for correct function.

Inspect seat belt system more often if machine is exposed to severe environmental conditions or applications. Conduct the following inspections and replace seat belt system as necessary:

1. Check webbing. If system is equipped with a retractor, pull webbing completely out and inspect full length of webbing. Look for cuts, wear, fraying, dirt and stiffness.
2. Check buckle and latch for correct operation.
3. Make sure latch plate is not excessively worn, deformed or buckle is not damaged or casing is broken.
4. Check retractor web storage device (if equipped) by extending webbing and checking that it spools out and retracts correctly.
5. Check webbing in areas exposed to ultraviolet (UV) rays from sun or extreme dust or dirt. If original color of webbing in these areas is extremely faded and/or webbing is packed with dirt, webbing strength may be reduced.

NOTE: *Contact your DOOSAN distributor for seat belt system replacement parts.*

WARNING

AVOID DEATH OR SERIOUS INJURY

Failure to properly inspect and maintain seat belt and seat belt system can cause lack of operator restraint and can result in death or serious injury.

Before fastening seat belt, check that there is no problem in belt mounting bracket. If it is worn or damaged, replace seat belt. Fasten seat belt so it is not twisted.

Always wear seat belt when operating machine.

Visibility Information

A rear view camera (if equipped) and mirrors provide the operator with additional means to see the work area.

NOTE: *These devices may vary from one region to another, depending upon local and regional regulations. If a machine is moved or sold into another region or marketplace, it is the owner's responsibility to make sure it complies with all applicable regulations.*

WARNING

AVOID DEATH OR SERIOUS INJURY

Failure to check for and clear people from the surrounding area of a machine can result in death or serious injury. The operator should make sure that visual aids (mirrors and camera(s)) are in proper working condition.

Your machine may be equipped with visual aids such as mirrors or a rear view camera. Even with these aids, there still may be areas around the machine which cannot be seen from the operator's seat. Always keep personnel and bystanders out of the work area. Be careful when operating and always look in direction of travel.

Adjust visual aids for best visibility around machine.

When swinging work equipment or backing up, press camera button (if equipped) to change display mode on display monitor so you can check rear and side of machine.

Before moving machine, look around work site and use mirrors and display monitor to confirm that no one is in the work area.

While operating or traveling in places with poor visibility it may be impossible to confirm condition of work site. Inspect and remove any obstacles around the machine that could be damaged and keep other personnel out of the work area.

Inspect equipment and repair immediately if there are problems with visual aids. If machine cannot be fixed immediately, DO NOT use the machine. Contact your DOOSAN distributor and arrange for repairs.

Work Site Rules

- If visibility cannot be sufficiently assured, use a flagman. The operator should pay careful attention to signals and follow instructions from flagman.
- Signals should only be given by one flagman.
- When working in dark places, turn "ON" work lights and front lights on the machine. Set up additional lighting in area.
- Stop operations if there is poor visibility, such as fog, snow, rain, or sandstorms.

- Check mirrors and rear view camera (if equipped) on machine before starting operations. Clean off any dirt and adjust view for good visibility.

When operating or traveling during poor visibility conditions, follow the preceding work site rules.

It may not be possible to adjust all visual aids to see all the way around the machine. Therefore, additional precautions such as flagman, barricades, etc., must be taken to keep other personnel out of the work area.

Boost Starting or Charging Engine Batteries

Follow these instructions to prevent an explosion or fire when connecting booster cables to batteries:

- Turn "OFF" all electric equipment before connecting leads to battery. This includes electric switches on battery charger or battery booster equipment.
- When boost starting from another machine or vehicle do not allow two machines to touch. Wear safety goggles and gloves while battery connections are made.
- 24 volt battery units consisting of two series connected 12 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 non series connected positive (+) terminals and between the negative (-) terminal of the booster battery and metal frame of the machine being boosted or charged. The final booster cable connection, at metal frame of the machine being charged or boost started, must be as far away from the batteries as possible. Refer to “Starting Engine With a Booster Cable” on page 3-11, for proper procedure in this manual.
- Connect positive (+) cable first when installing cables and disconnect negative (-) cable first when removing them.

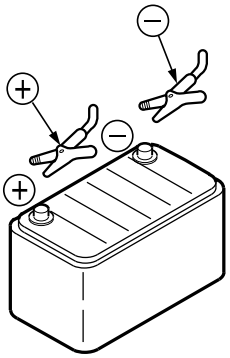


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Figure 27

Starting Engine

Only operate the machine from the operator's seat with your seat belt fastened.

Only operate controls while engine is running.

Check for proper operation of all controls and all protective devices while you operate the machine slowly in an open area.

- Read and understand control pattern before operating. Check that movement of the machine matches display on control pattern label. If it does not match, replace it immediately with correct control pattern label.
- Check operation of work equipment, travel system and swing system.
- Check for any problem with machine. Check for unusual sounds, vibration, heat, odor, or improper readings from gauges. Check for any oil or fuel leaks.
- If any problem is found, stop operation and perform repairs immediately.

Do not use cellular telephones inside operator's cabin when driving or operating the machine.

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

The boom and arm linkage can allow work tool or attachment to contact undercarriage or cabin. Be aware of position of work tool.

- Do not attempt to start engine by short-circuiting engine starting circuit. This can result in death or serious injury, or fire.
- When starting engine, sound horn as a warning to alert personnel in the work area.

If there is a warning tag or "DO NOT OPERATE" tag hanging from work levers (joysticks) or travel control levers, do not start engine or move levers.

- Prevent personnel from walking or standing under raised boom, unless it is properly supported.

NOTE: *When starting engine in cold temperatures, "white engine exhaust smoke" from the tail pipe can occur until engine reaches normal operating temperatures.*

Also, a white residue, because of water vapor inside engine, can form at the engine oil fill location. These conditions will not affect engine performance or damage the engine or other exhaust system components.

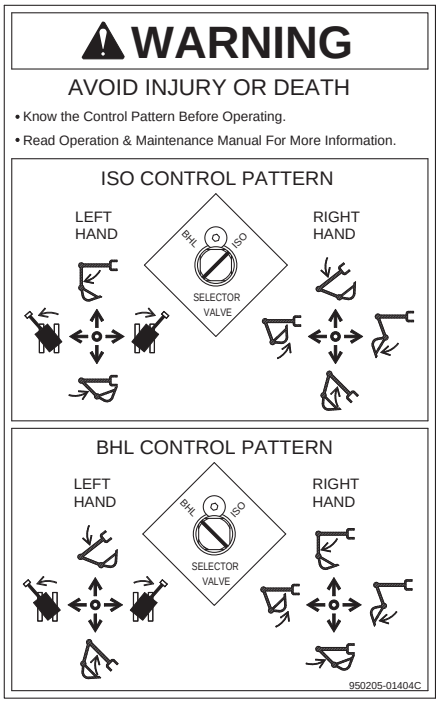

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Figure 28

Swinging or Traveling

As a machine operator, you should know and follow local, state and federal laws and regulations when operating on public roads or highways.

It is important to keep in mind that the machine, in comparison with the rest of traffic, is a slow moving and wide vehicle which can cause traffic delays. Pay attention to traffic behind you and allow traffic to pass you.

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

- When changing travel direction from forward to reverse or from reverse to forward, reduce speed and stop machine before changing travel direction.
- Sound horn to alert people in area.
- Check that there is no one in area around machine. There are restricted visibility areas behind machine so, if necessary, swing upper structure slowly to check that there is no one behind machine before traveling in reverse.
- When operating in areas with poor visibility, designate a flagman to direct work site traffic.
- Keep unauthorized personnel away from turning radius or travel path of the machine.

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

- Check that travel alarm works properly and that mirrors are clean, not damaged and properly adjusted.
- Always latch door and windows of operator's cabin in position (open or closed).
- On work sites where there is a hazard of flying or falling objects, or of objects entering operator's cabin, check that door and windows are securely closed. Install additional guards, if work site application requires them.

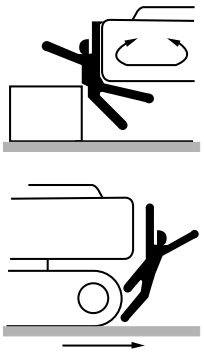

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Figure 29

Never turn starter switch to "O" (OFF) position when traveling. This can lead to a loss of steering control.

Do not operate attachments while traveling.

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

Never travel over obstacles or excessive slopes that will cause machine to tilt severely. Avoid any slope or obstacle that can cause machine to tilt 10° or more to right or left, or 30° or more from front to rear.

Do not operate steering controls suddenly. Work equipment can hit ground and this can damage machine or structures in area.

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

Always operate within permissible water depth. Permissible water depth is up to centerline of upper track roller(s).

When passing over bridges or structures on private land, check that structure is strong enough to support weight of machine. Before traveling on public roads, check with appropriate authorities and follow their instructions.

Never exceed maximum permitted load for bridges.

Always operate machine with idler wheels to front under cabin and drive sprockets to rear.

Know permitted ground pressure. Ground pressure of the machine may change depending on attachment and load.

Keep height and length of attachment in mind.

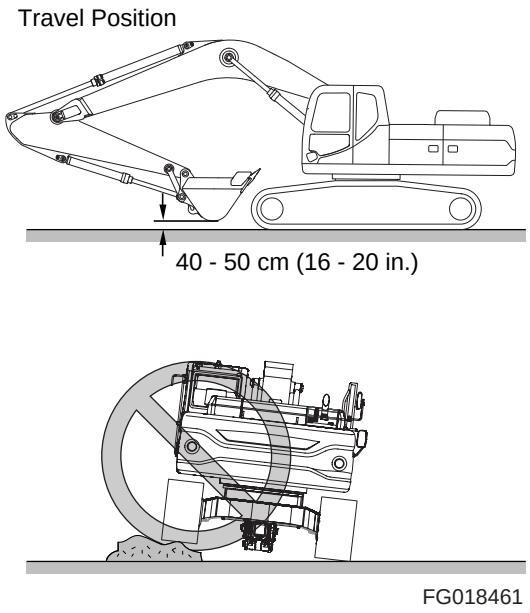

Figure 30

Lifting and Digging

The operator is responsible for any load carried when traveling on public roads and while working with the machine.

- Keep loads secure so they do not fall off while operating.
- Do not exceed maximum load for the machine. Machine operation will be affected when center of gravity changes, caused by extended loads and different attachments.

To lift loads safely when in digging mode, the following must be evaluated by the operator and work site crew.

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

Always watch load. Bring load close to the machine before traveling any distances or swinging load.

Lifting capacity decreases as load is moved further from the machine.

Set tracks at right angles to road shoulder or drop-off with sprocket at rear when performing operations to make it easier to move away from the work area.

Do not suddenly lower, swing, or stop work equipment.

- Do not move bucket over head of other personnel or over the operator's seat of dump trucks or other hauling equipment. The load may spill or bucket can hit dump truck causing property damage or cause death or serious injury.

Operation on Slopes

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

Improper traveling on steep slopes could result in machine tipping, rollover or sliding down the slope. Always fasten your seat belt.

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

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

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

Do not change travel direction on a slope. This could result in tipping or sliding sideways of machine.

Improper operation when working on slopes can cause a tip over. Use caution when swinging or operating work equipment on slopes.

Do not swing work equipment from uphill side to downhill side when bucket is loaded. This could cause machine to tip or rollover.

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

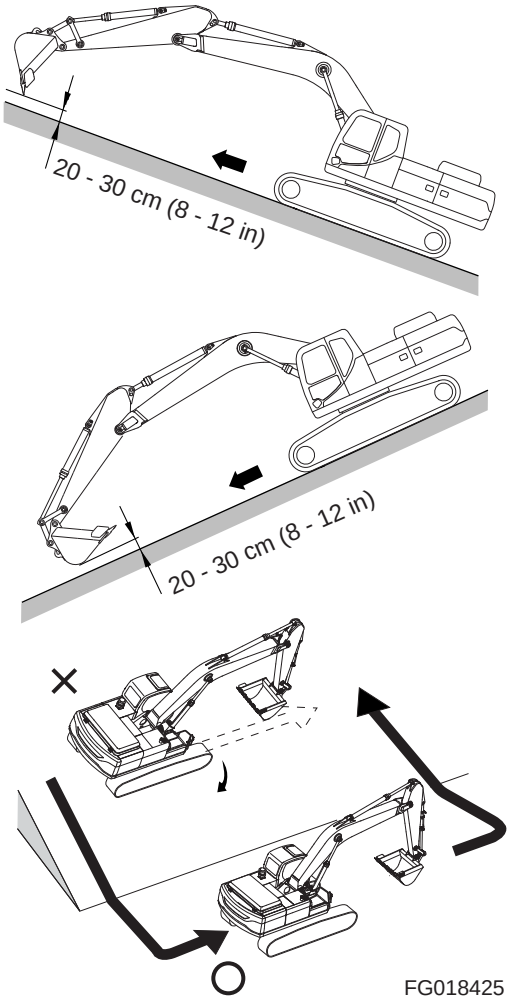

Figure 31

If the machine begins to slide down on a grade, immediately dump load and turn the machine downhill.

Be careful to avoid any ground condition which could cause the machine to tip. Tipping can occur when you work on hills, on banks, or on slopes. Tipping can also occur when you cross ditches, ridges, or travel over unexpected obstructions.

Keep the machine under control. Do not overload the machine beyond capacity.

- When traveling up a steep slope, extend work equipment to front to improve balance, keep work equipment approximately 20 - 30 cm (8 - 12 in) above ground, and travel at low speed.
- Do not turn on slopes or travel across slopes. Always go down to a flat place to change position of the machine, then travel backup the slope again.

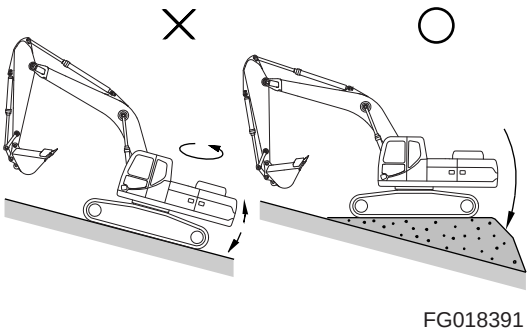

Figure 32

Towing

To prevent death or serious injury when towing, always do the following:

- Follow the instruction given in this manual.
- When performing preparation work for towing with two or more personnel, determine signals to use and correctly follow these signals.
- Always attach wire rope onto left and right hooks and secure in position.
- If engine on problem machine will not start or there is a failure in brake system, always contact your DOOSAN distributor.
- Never go between towing machine and towed machine during towing operation.
- Do not perform towing on steep slopes, so select a place where slope is gradual. If there is no place where slope is gradual, perform operations to reduce angle of slope before starting towing operation.
- When towing a machine, always use a wire rope with a sufficient towing capacity.
- Do not use a wire rope that is kinked or frayed, or a wire rope with any loss of diameter. Wear leather gloves when handling a wire rope.
- Do not use lightweight towing hook for towing another machine.
- Make sure that towing eyes and towing devices are adequate for towing loads.
- Only connect wire rope to a drawbar or to a hitch.
- Operate the machine slowly and be careful not to apply any sudden load to wire rope.

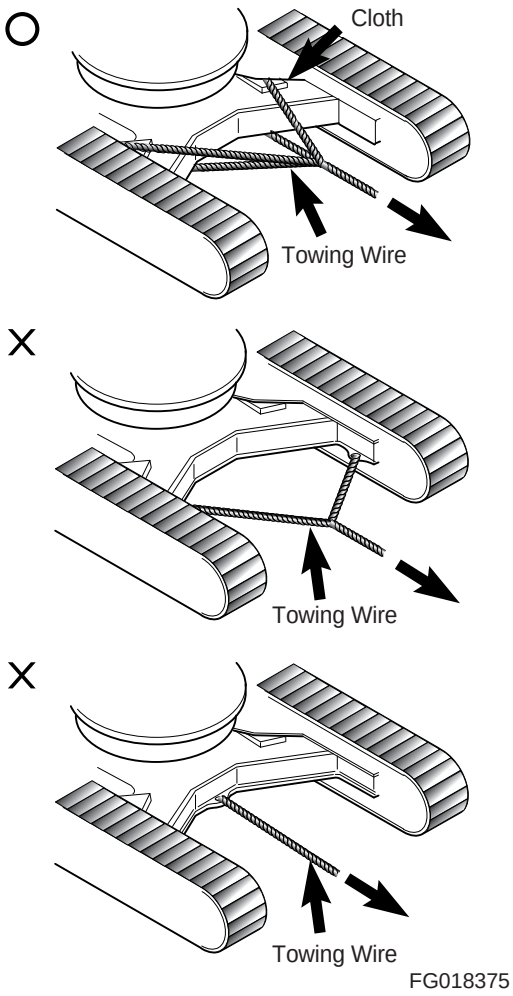

Figure 33

Attachment

Never let anyone ride on any work attachment, such as bucket, crusher, grapple, or clamshell (grab bucket). This creates a falling and crushing hazard, and can result in death or serious injury.

The clamshell, grapple, or magnet can swing in all directions. Move work levers (joysticks) in a continuous motion. Failure to move work levers (joysticks) in a continuous motion can cause clamshell, grapple, or magnet to swing into cabin or into a person in work area. This can result in death or serious injury.

- When using a fork or grapple, do not attempt to pick up an object with its tips. This could damage the machine or cause personal injury, if picked-up object slips off attachment.
- Do not use impact force of work equipment for demolition work. This could damage work equipment, cause broken materials to fly off or tipping. This could result in death or serious injury.
- Do not use work equipment or swing mechanism to pull load in any direction. This could cause the work equipment to move suddenly if the load releases and can result in death or serious injury.

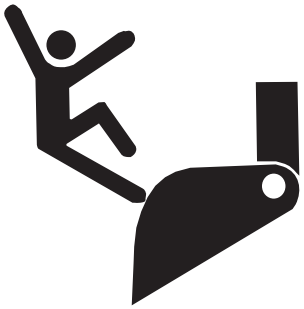

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Figure 34

Equipment Lowering with Engine Stopped

Before lowering any equipment with the engine stopped, clear the area around the equipment of all personnel and bystanders. The procedure to use will vary with the type of equipment to be lowered. Keep in mind most systems use a high-pressure fluid or air to raise or lower equipment. The procedure will cause high-pressure air, or hydraulic pressure, or some other media to be released in order to lower the equipment.

Wear appropriate personal protective equipment and follow the established procedure in the Operation and Maintenance Manual “Equipment Lowering with Engine Stopped” on page 3-74 in the Operation Section of the manual.

Engine Stop

Turn engine starter switch to "O" (OFF) position and remove engine starter switch key.

Before lowering any equipment with engine stopped, clear area around equipment of all personnel and bystanders. This procedure will cause high-pressure air or hydraulic pressure to be released to lower equipment.

Do not stop engine immediately after the machine has been operated under load. This can cause overheating and accelerated wear of engine components.

After the machine is parked, allow engine to run for five minutes before stopping the engine. This allows hot areas of engine to cool gradually.

- Do not leave operator's seat when there is a raised load.

Parking Machine

Avoid making sudden stops, or parking machine wherever it happens to be at end of workday. Park machine on firm and level ground away from traffic and away from high walls, drop-offs and any area of potential water accumulation or runoff. If parking on inclines is unavoidable, block crawler tracks to prevent movement. Lower bucket or other working attachment completely to ground, or to an overnight support saddle. To prevent 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 machine clearly. Park machine so machine, flags, signs and fences do not obstruct traffic.

After front attachment has been lowered to an overnight storage position and all switches and operating controls are in "OFF" position, safety lock lever must be moved to "LOCK" position. This will disable all pilot control functions.

Always close door of operator's cabin and lock all equipment to prevent any unauthorized person from operating the machine.

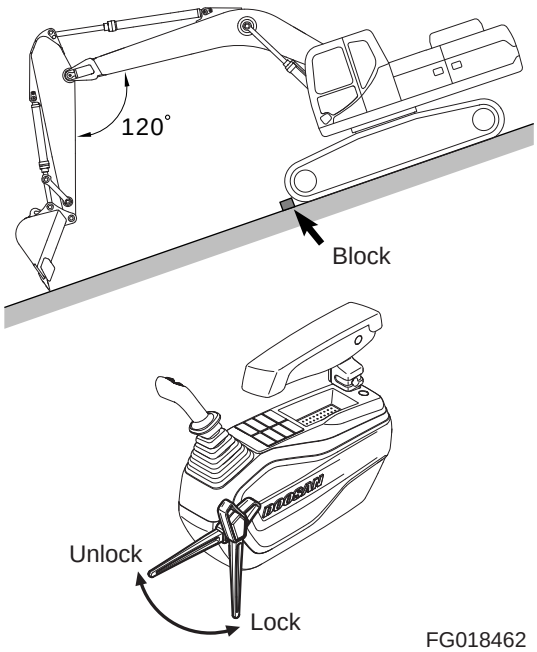

Figure 35

The hydraulic system remains pressurized, provided accumulator, is charged even when engine is not running. Accumulator pressure should decrease in a short time (approximately one minute). While hydraulic system maintains a charge, hydraulic work tools and machine controls remain functional.

Machine movement will occur if any controls are moved. This can result in death or serious injury.

Always move hydraulic lockout control to "LOCK" position before stopping off engine or immediately after engine stops running.

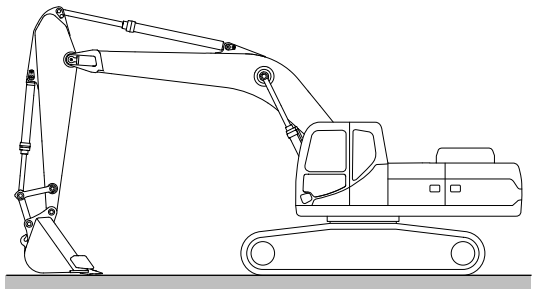

Figure 36

Preservation/Storing Machine

Perform the following if storing excavator for more than one month.

Conditions	Maintenance Required
Cleaning	Pressure wash undercarriage and track assemblies. Inspect for damage or loose or missing parts.
Lubrication	Perform all daily lubrication procedures.
	Apply a coating of light oil to exposed plated metal surfaces, such as hydraulic cylinder rods, etc.
	Apply a coating of light oil to all control linkages and control cylinders (control valve spools, etc.)
Battery	Turn "OFF" the battery disconnect switch.
Cooling System	Inspect coolant recovery tank to make sure that antifreeze level in system is at correct level.
	Every 90 days, use a hydrometer to measure protection level of coolant. Refer to “Antifreeze Concentration Tables” on page 4-94, to determine amount of protection cooling system requires. Add coolant as required.
Hydraulic System	Once a month, start engine and follow procedures in “Hydraulic System Warm-up” on page 3-12, listed in this manual.

1. Complete the preceding steps.
2. Wash machine and touch up paint finish to avoid rusting.
3. Treat exposed parts with antirust agent, lubricate machine thoroughly and apply grease to unpainted surfaces like lifting and tilting cylinders etc.
4. Fill fuel tank and hydraulic oil tank to "FULL" marks.
5. Cover exhaust pipe (parking outside).
6. Make sure that coolant is at proper concentration for expected lowest temperatures.
7. Park machine on level, firm ground where there is no risk of freezing, landslide or flooding. Avoid parking machine on a slope.

   Keep in mind that theft and burglary risk can be minimized by:

   - Removing starter key when the machine is left unattended.
   - Locking doors and covers after working hours.
   - Turning off electrical current with battery disconnect switch.
   - Park machine where risk of theft, burglary and damage is minimized.
   - Removing valuables from cabin such as cellular phone, computer, radio and bags.

See “Long Term Storage” on page 3-77, for more information.

Check After Long-term Parking

- All oil and fluid levels.
- Tension of all belts.
- Air pressure.
- Air cleaner.
- Batteries and electrical connections.
- Lubricate all greasing points.
- Wipe off grease from piston rods.
- Inspect for signs of nests (i.e. birds, rodents, etc.)

MAINTENANCE

Improper operation and maintenance can result in death or serious injury. Read manual and safety decals before operating or maintaining the machine. Follow all instructions and safety messages.

WARNING

AVOID DEATH OR SERIOUS INJURY

Follow instructions before operating or servicing machine. Read and understand the Operation and Maintenance Manual and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments, repairs or service. Untrained operators and failure to follow instructions can result in death or serious injury.

- Never service DOOSAN equipment without instructions.
- Always lower bucket and blade to ground before doing any maintenance.
- Use correct procedure to lift and support excavator.
- Cleaning and maintenance are required daily.
- Welding or grinding painted parts must be done in well ventilated areas.
- Wear a dust mask when grinding painted parts. Toxic dust and gas can be produced.
- Vent exhaust to outside when engine must be running for service.
- Exhaust system must be tightly sealed. Exhaust fumes are hazardous and can cause death or serious injury.
- Stop and allow engine to cool and clean engine of flammable materials before checking fluids.
- Never service or adjust machine with engine running unless instructed to do so in this manual.
- Avoid contact with leaking hydraulic fluid or diesel fuel under pressure. It can penetrate skin or eyes.
- Never fill fuel tank while engine running, while smoking, or when near open flame.
- Keep body, jewelry and clothing away from moving parts, electrical contact, hot parts and exhaust.
- Wear eye protection to guard from battery acid, compressed springs, fluids under pressure and flying debris when engines are running or tools are used. Use eye protection approved for welding.

- Lead-acid batteries produce flammable and explosive gases.
- Keep arcs, sparks, flames and lighted tobacco away from batteries.
- Batteries contain acid which burns eyes or skin on contact.
- Wear protective clothing. If acid contacts body, flush well with water. For eye contact flush well and get immediate medical attention from a physician familiar with this injury.
- The maintenance procedures which are given in this manual can be performed by the owner or operator without any specific technical training. Maintenance procedures which are not in this manual must be performed ONLY BY QUALIFIED SERVICE PERSONNEL. Always use genuine DOOSAN replacement parts.
- Only authorized personnel should service and repair the machine. Do not allow unauthorized personnel into work area.
- Lower work equipment and stop engine before performing maintenance.
- Park machine on firm and level ground.
- Turn starter switch to "ON' position and keep safety lock lever in "UNLOCK" position. Cycle work levers (joysticks) back and forth, left and right at full stroke 2 to 3 times to eliminate remaining internal pressure in hydraulic circuit. Then move safety lock lever to "LOCK" position.
- Check that battery relay is "OFF" and main power is shut off. (Wait for approximately one minute after turning "OFF" engine starter switch key and press horn switch. If horn does not sound, the main power is shut off.)
- Put blocks under track to prevent the machine from moving.
- To prevent injury, do not perform maintenance with engine running. If maintenance must be done with engine running, perform maintenance with at least two workers and do the following:
  - One worker must always sit in the operator's seat and be ready to stop engine at any time. All workers must maintain contact with other workers.
  - When maintenance operations are near fan, fan belt, or other rotating parts, there is a potential hazard of being caught in rotating parts. Keep hands and tools away.
- Never drop or insert tools or other objects into rotating fan or fan belt. Parts can break off and hit someone.
- Do not touch any control levers or control pedals. If any control levers or control pedals must be operated, always give a signal to other workers and instruct them to move away.

- When performing maintenance of engine and you are exposed to engine noise for long periods of time, wear hearing protection while working.
- If noise from the machine is too loud, it can cause temporary or permanent hearing problems.
- Do not smoke when you service an air conditioner or if refrigerant gas is present.
- Inhaling fumes either from a flame or gas from a cigarette that has contacted air conditioner refrigerant can cause death or serious injury.
- Never put maintenance fluids into glass containers.
  Drain all liquids into a suitable containers.
- Unless instructed otherwise, perform maintenance with equipment in servicing position. Refer to this manual for procedure for placing equipment in servicing position.

Warning Tag

Alert others that service or maintenance is being performed by attaching a "DO NOT OPERATE" warning tag to the operator's cabin controls – and other machine areas, if required. Use of a chain or cable to keep the safety lock lever in the fully lowered "LOCK" position, complies with OSHA's lockout requirements.

"DO NOT OPERATE" warning tags, are available from your DOOSAN distributor.

- Always attach "DO NOT OPERATE" warning tag to work equipment control lever in the operator's cabin to alert others that you are performing service or maintenance on the machine. Attach additional warning tags on the machine, if necessary.

  Keep warning tags in tool box while it is not used. If there is not tool box or in the owner manual storage pocket.
- If any other person starts engine, and operates control levers or control pedals while you are performing service or maintenance, it can result in death or serious injury.

Attach a "DO NOT OPERATE" warning tag to starter switch or to controls before servicing or repairing equipment.
Warning tags are available from your DOOSAN distributor.

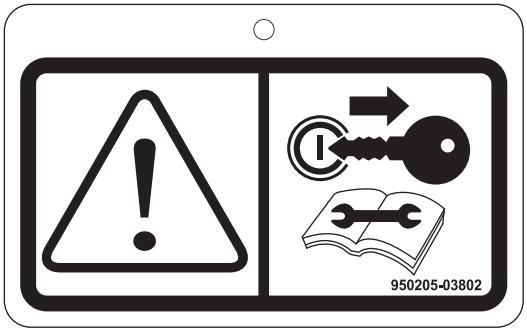

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Figure 37

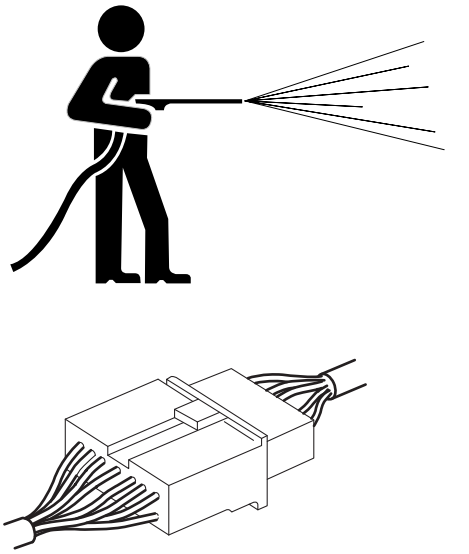
Cleaning

Clean machine before performing inspection and maintenance.

If inspection and maintenance are done when machine is dirty, it will become more difficult to locate problems, and you could slip on steps and work platform areas and injure yourself.

When washing machine, do the following:

- Wear shoes with nonslip soles to prevent slipping and falling.
- Wear safety goggles and protective clothing when washing machine with high-pressure steam or water.
- Do not spray water directly on electrical components (sensors, connectors). If water gets into electrical system, it can cause operation problems.
- Pick up any tools or hammers that are laying in workplace. Wipe up any grease or oil to prevent slippery substances, that can cause tripping or slipping.
- When cleaning cabin top window which is made of polycarbonate material, use tap water. Avoid use of organic solvents for cleaning, such as benzene, toluene or methanol. These solvents can cause a chemical reaction that will dissolve and damage the window.



ARO1330L

Figure 38

Proper Tools and Clothing

Only use tools that are intended for the type of service to be done. Metal pieces from low quality or damaged tools, such as chisels or hammers, can break off and hit a service person in the eyes or face causing serious injury.

HDO1037L

Figure 39

Disassembling Precautions

When using a hammer to remove pins, pins can fly out or metal particles may break off. Always do the following:

- Hitting hard metal pins, bucket teeth, cutting edges or bearings with a hammer, can cause metal pieces to break or fly off resulting in serious injury. Always wear safety goggles and leather gloves. Keep other personnel away.

Use of Lighting

When checking fuel, oil, battery electrolyte, window washer fluid, or coolant, always use proper lighting equipment to prevent arcs or sparks that could cause a fire or explosion resulting in death or serious injury.

HDO1040L

Figure 40

Fire and Explosion Prevention

Fuels, most lubricants and some coolant mixtures are flammable. Flammable fluids that are leaking or spilled onto hot surfaces or onto electrical components can cause a fire resulting in property damage or death or serious injury.

Store all fuels and all lubricants in properly marked and approved containers and keep away from all unauthorized personnel.

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

Tighten all fuel and oil caps.

Do not smoke while you refuel 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 electrical wires daily for wires that are loose or frayed. Tighten all loose, and repair or replace all frayed, electrical wires before operating machine.

Remove all flammable materials and debris from the engine compartment, exhaust system components and hydraulic lines.

HDO1015I

Figure 41

Burn Prevention

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

Using gloves, loosen radiator cap slowly to release internal pressure before removing radiator cap.

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

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

Allow cooling system components to cool before draining cooling system.

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

Vent hydraulic tank only after engine has been stopped and hydraulic tank is cool. Using gloves, slowly tilt hydraulic tank air breather to relieve pressure.

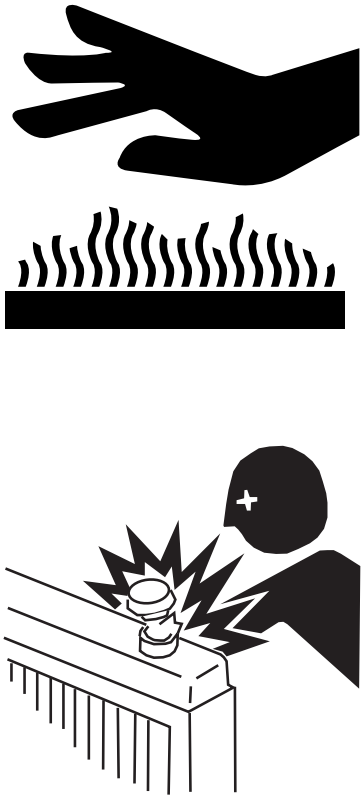
Relieve all pressure in hydraulic oil system, in fuel system, or in cooling system before disconnecting any lines, hoses, fittings, or related components.

Batteries give off flammable fumes that can explode and start a fire.

Do not smoke while you are checking battery electrolyte level.

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

Always wear safety goggles and face protection when working with batteries.



HAAE1980

Figure 42

Rubber That Contains Fluorides

Observe extra great care when it is suspected that you may have to handle rubber that contains fluorides.

Certain seals which have to withstand high operating temperatures (e.g. in engines, transmissions, axles, hydraulic motors and pumps) may be made from rubber that contains fluorides, which, when exposed to high heat (fire), forms hydrogen fluoride and hydrofluoric acid. This acid is very corrosive and cannot be rinsed or washed off from the skin. It causes very severe burns which take a long time to heal.

It usually means that damaged tissue must be surgically removed. Several hours may pass after contact with the acid, before any symptoms appear and therefore one is not given any immediate warning. The acid may remain on the machine parts for several years after a fire.

If swelling, redness or a stinging feeling appears and one suspects that cause may be contact with heated rubber that contains fluorides, contact a medical doctor immediately. If a machine, or part of a machine, has been exposed to fire or severe heat, it must be handled by specially trained personnel. In all handling of machines after a fire, thick rubber gloves and protective goggles must be used.

The area around a part which has been very hot and which may be made of rubber that contains fluorides must be decontaminated by thorough and ample washing with limewater (a solution or suspension of calcium hydroxide, i.e. slaked lime in water). After the work has been completed, the gloves must be washed in limewater and then discarded.

Rubber and Plastics

Polymer materials when heated, can form compounds that create a health hazard and can harm the environment. Scrapped rubber and plastic must never be burned. Extra precautions must be taken when servicing machines that have been in a fire or exposed to extreme heat.

If gas cutting or welding is to be done near such materials, the following safety instructions must be followed:

- Protect the material from heat.
- Use protective gloves, protective goggles and an approved respirator.

Waste Hazardous to the Environment

Painted parts or parts made of plastic or rubber which are to be scrapped must never be burned, but must be taken care of by an approved refuse handling plant.

Batteries, plastic objects and anything else which is suspected of being dangerous to the environment must be taken care of in an environmentally safe way.

Check List After Fire

When handling a machine which has been damaged by fire or been exposed to intense heat, the following protective measures must under all circumstances be followed:

Use thick, gloves made of rubber and wear goggles which are certain to protect your eyes.

Never touch burned components with your bare hands, as there is a risk that you may come into contact with melted polymer materials. First wash thoroughly with plenty of limewater (a solution or suspension of calcium hydroxide, i.e. slaked lime in water).

As a precaution, seals (O-rings and other oil seals) should always be handled as if they were made of rubber that contains fluorides.

Treat skin, which is suspected of having touched burned rubber that contains fluorides, with Hydrofluoric Acid Burn Jelly or something similar. Seek medical advice. Symptoms may not appear until several hours afterwards.

Discard gloves, rags etc. which are suspected of having touched burned rubber that contains fluorides.

IMPORTANT

When disconnecting or connecting connectors between ECU and engine, or connector between ECU and the machine, always disconnect the battery to prevent damage to ECU.

If you do not follow this procedure, the ECU will be damaged and/or the engine will not operate properly.

When performing welding repairs, perform welding in a properly equipped place. Repairs must be performed by a qualified welder. Welding operations, can create potential hazards, including generation of gas, fire, or electric shock. Never let an unqualified welder do welding.

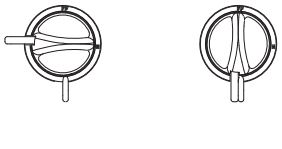
A qualified welder must do the following:

- To prevent battery explosion, turn battery disconnect switch to "OFF" position.
- Disconnect the connector between ECU and machine, and the connector between ECU and engine.
- To prevent generation of gas, remove paint from location of the weld.
- If hydraulic equipment, piping or component ports close to them are heated, a flammable gas or mist could result in an explosion or fire. To prevent this, protect and insulate components from excessive heat.
- Do not weld on pipes or on tubes that contain flammable fluids. Do not flame cut pipes or tubes that contain flammable fluids. Before welding on pipes or tubes, or before flaming cut pipes or tubes, clean them thoroughly with a nonflammable solvent. Make sure pressure inside pipes or tubes does not cause a rupture of the component parts.
- If heat is applied directly to rubber hoses or piping under pressure, they may suddenly break, so cover and insulate them with a fireproof covering.
- Wear protective clothing.
- Make sure there is good ventilation.
- Remove all flammable objects and make sure a fire extinguisher is available.

Preparation for Electrical Welding On Body Structure

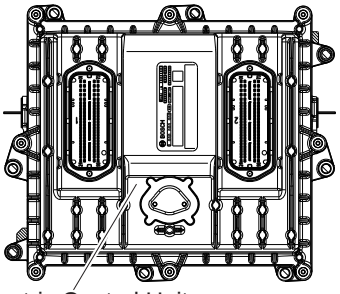
To prevent damage to ECU by electrical welding, observe the following procedures:

1. Turn battery disconnect switch to "OFF" position.
2. Disconnect the connector between ECU and machine, and the connector between ECU and engine.
3. Proceed with welding.
4. After welding, connect the connector between ECU and machine, and the connector between ECU and engine.
5. Clean battery compartment.
6. Turn battery disconnect switch to "ON" position.
7. Close battery compartment door.



FG020630

Figure 43



FG020631

Figure 44

Warning for Counterweight and Front Attachment Removal

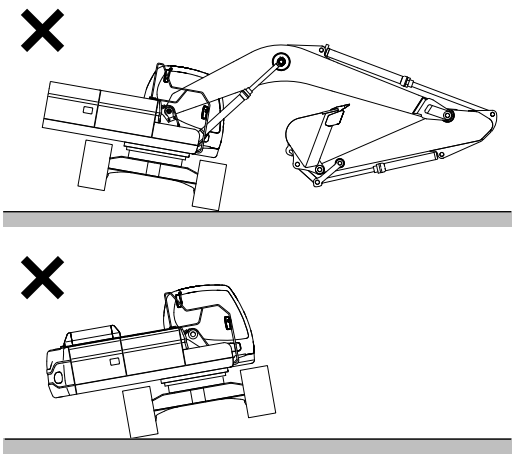
WARNING

AVOID DEATH OR SERIOUS INJURY

Removal of the machine counterweight, front attachment or any other part can affect the stability of the machine. This could cause unexpected movement, and result in death or serious injury.

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.



FG018594

Figure 45

Lock Inspection Covers

When performing maintenance with inspection cover open, use lock bar to secure cover and prevent accidental lowering of the cover caused by wind or movement of the machine.

Working on Machine

When performing maintenance operations on machine, prevent tripping and falling by keeping area around your feet clean and free of objects and debris. Always do the following:

- Do not spill oil or grease.
- Do not leave tools laying around.
- Watch your step when walking.
- Never jump down from machine. When getting on or off machine, use steps and handrails, and maintain a three-point contact (both feet and one hand or both hands and one foot) to support yourself.
- If job requires it, wear protective clothing.
- To prevent injury from slipping or falling, when working on hood or covers, never stand or walk on areas except areas equipped with nonslip pads.
- If it is necessary to work under raised equipment or the machine, support work equipment and machine securely with blocks and stands strong enough to support weight of work equipment and machine.
- Do not work under the machine if track shoes are lifted off ground and the machine is supported only with work equipment. If any control levers are moved, or there is damage to hydraulic system, work equipment or the machine will suddenly drop causing death or serious injury.

ARO1380L

Figure 46

Accumulator

The pilot control system is equipped with an accumulator. For a short period of time after engine has been stopped, accumulator will store a pressure charge that allow hydraulic controls to be activated. Activation of any controls will allow selected functions to operate under force of gravity.

When performing maintenance on pilot control system, release hydraulic pressure in system as described in “Handling of Accumulator” on page 4-99.

The accumulator is charged with high-pressure nitrogen gas. If it is improperly handled it can explode causing death or serious injury. Always observe the following precautions:

- Do not drill or punch holes in accumulator or expose it to any flames, fire or external heat source.
- Do not weld on accumulator.
- When performing disassembly or maintenance of accumulator, or when disposing of accumulator, charged nitrogen gas must be properly released. Contact your DOOSAN distributor for assistance.
- Wear safety goggles and leather gloves when working on an accumulator. Hydraulic oil under pressure can penetrate skin and result in death or serious injury. If fluid enters skin or eyes, get immediate medical attention from a physician familiar with this injury.

FG018458

Figure 47

Compressed Air

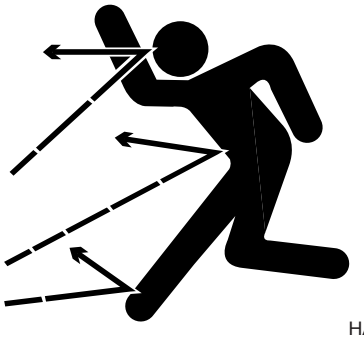
- When cleaning filters, radiator or other components with compressed air, there is a hazard of flying particles that can result in serious injury.
- Always wear safety goggles, dust mask, leather gloves, and other protective devices.

Track Tension Adjustments

Track adjusting systems use grease under high-pressure to keep track under tension. Grease under high-pressure can penetrate body and result in death or serious injury. Watch track or track spring to see if track is being loosened.

NEVER LOOSEN track tension grease valve. To release pressure from crawler frame track tension assembly, you should NEVER attempt to disassemble track adjuster or attempt to remove grease fitting or valve assembly.

Keep your face and body away from grease valve. Refer to “Track Tension” on page 4-100, for proper procedure in this manual or Shop Manual.



HAOA110L

Figure 48

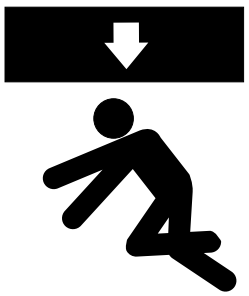
Supports and Blocking for Work Equipment

Do not allow weight or equipment loads to remain suspended and unsupported.

Lower work group to ground before leaving 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 49

High-pressure Lines, Tubes and Hoses

When inspecting or replacing high-pressure piping or hoses, check to verify that pressure has been released from circuit. Failure to release pressure can result in death or serious injury. Release pressure as described in “Handling of Accumulator” on page 4-99.
Always do the following:

- Wear eye protection and leather gloves.
- Fluid leaks from hydraulic hoses or pressurized components can be difficult to see but has enough force to pierce skin and can result in death or serious injury. Always use a piece of wood or cardboard to check for suspected hydraulic leaks. Never use your hands or expose your fingers. Wear safety goggles.
- 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 correctly installed to prevent vibration, rubbing against other parts, and excessive heat during operation.
- Replace hose or components if any of the following problems are found:
  - Damage or leakage from hose end fitting.
  - Wear, damage, cutting of hose covering, or wire braiding is exposed on any hose.
  - Cover portion is swollen in any section.
  - The hose is twisted or crushed.
  - Foreign material is embedded in hose covering.
  - Hose end is deformed.
  - Connection fittings are damaged or leaking.

  NOTE: *Refer to “Hose In-service Lifetime Limit (European Standard ISO 8331 and EN982 (CEN))” on page 4-75, for additional European regulations.*

High-pressure is generated inside engine fuel lines when engine is running. Before performing inspection or maintenance of fuel line system, wait for at least thirty seconds after stopping engine to let internal pressure drop and tip breather cap up to release residual pressure.

Oil or fuel leaks from high-pressure hoses can cause fire or improper operation, which can result in death or serious injury. If any loose bolts are found, stop work and tighten to specified torque. If any damaged hoses are found, stop operations immediately and contact your DOOSAN distributor for replacement parts.

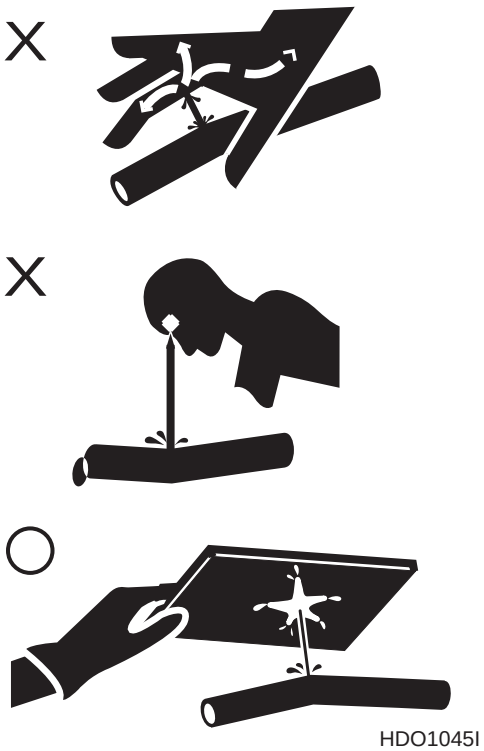

HDO1045I

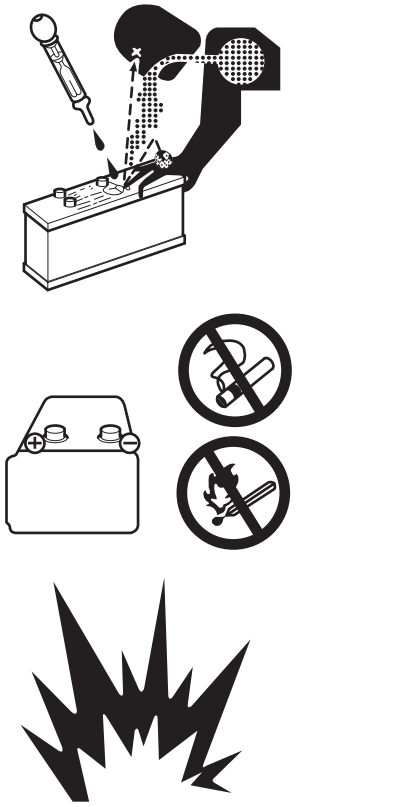
Figure 50

Battery

Battery Hazard Prevention

Battery electrolyte contains diluted sulfuric acid and generates hydrogen gas. Hydrogen gas is highly explosive, and improper handling can cause death or serious injury, or fire. Do not allow electrolyte to contact skin or eyes. Always wear safety goggles and protective clothing when servicing batteries. Wash hands after touching batteries and connectors. Use of acid-resistant gloves is recommended. Always observe the following precautions.

- Do not smoke or bring any flame near battery.
- When working with batteries, Always wear safety goggles, protective clothing, and acid-resistant gloves.
- If you spill battery electrolyte on yourself or your clothes, immediately flush area with water.
- If battery electrolyte gets into your eyes, flush them immediately with large quantities of water and get immediate medical attention from a physician familiar with this injury.
- If you accidentally drink battery electrolyte, call a poison prevention center immediately and get immediate medical attention from a physician familiar with this injury.
- When cleaning top surface of battery, wipe it with a clean, damp cloth. Never use gasoline, thinner, or any other organic solvent or detergent.
- Tighten battery caps.
- If battery electrolyte is frozen, do not charge battery or start engine with power from another source. This could cause the battery to explode and start a fire.
- When charging battery or starting with power from another source, let battery electrolyte thaw and check that there is no leakage of battery electrolyte before starting operation.
- Always remove battery from machine before charging.
- Do not use or charge battery if battery electrolyte level is below LOW LEVEL line. This can cause an explosion. Periodically check battery electrolyte level and add distilled water to bring electrolyte level to FULL LEVEL line.
- Before maintaining or working with batteries, turn starter switch to "O" (OFF) position.



FG018464

Figure 51

Since there is a potential hazard that sparks could be generated, always do the following:

- Do not let tools, rings or other metal objects make any contact between battery terminals. Do not leave tools or other metal objects lying near battery.
- When disconnecting battery terminals, wait for approximately one minute after turning engine starter switch key to "O" (OFF) position, and be sure to disconnect grounding terminal; negative (-) terminal first. Conversely, when connecting them, begin with positive (+) terminal and then grounding (-) terminal, Make sure that all terminals are connected securely.
- Flammable hydrogen gas is generated when battery is charged. Remove battery from machine, take it to a well ventilated place, and remove battery caps, before charging it.
- After charging, tighten battery caps securely.
- After charging, secure battery back in machine.

When repairing or welding electrical system, wait for approximately one minute after turning engine starter switch key "OFF". Then disconnect negative (-) terminal of battery to stop flow of electricity.

ENVIRONMENT AND CIRCUMSTANCES

Work Site Areas Requiring Extra Caution

- Do not operate too close to edge of a quay, ramp, etc.
- Do not operate too close to edge of a steep slope or drop-off. Take care when working in a place where machine may tip over.
- Do not operate on soft ground or near riverbanks that could collapse or where ground may not support weight of excavator.
- Observe changes in ground and traction conditions after a rain or other changes in weather.

Digging Under an Overhang

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

- Do not perform overhead demolition work. This can cause broken objects and debris to fall on top of machine causing death or serious injury, or property damage.

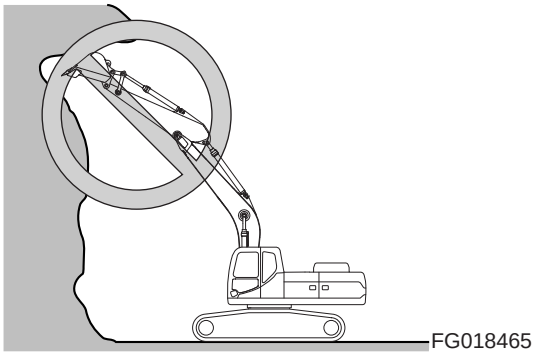


Figure 52

Deep Digging

Do not perform deep digging under front of machine. The ground under machine may collapse and cause machine to fall resulting in death or serious injury.

Working heavy loads on loose, soft or uneven ground, can cause side load conditions resulting in a tip over and injury. Traveling without a load or a balanced load may also be hazardous.

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

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

- Do not perform demolition work under machine. There is a hazard that the machine may become unstable and tip over.
- When working on or from top of buildings or other structures, check if structure can support weight of machine and attachment. If a building structure collapses, this can cause death or serious injury.

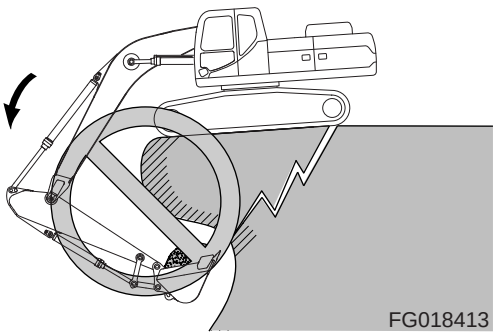


Figure 53

Drop-off or Edge

When working at edge of an excavation or near a drop-off, the machine could tip over, which can result in death or serious injury. Always fasten your seat belt. Check ground conditions of work site before operating to prevent the machine from falling or rollover, and to prevent ground, stockpiles, or banks from collapsing.

Do not travel too close to edge of a drop-off.

Poor Visibility

For good visibility, always do the following:

- When working in dark areas, attach working lights and front lights to the machine. If necessary, set up additional lighting at work site.
- Stop operations when visibility is poor, such as in fog, mist, snow, and rain. Wait for visibility to improve before starting operation.

To avoid hitting work equipment and damaging other property, always do the following:

- When working in tunnels, on bridges, under electrical wires, or when parking the machine or performing other operations in places with limited height, be careful not to hit and damage other equipment or property.
- To prevent hitting objects, operate machine at a slow speed when working in confined spaces, indoors, or in crowded areas.
- Do not swing bucket over the top of personnel or over operator's cabin of dump truck.

Loose or Soft Ground

Do not operate on soft ground or near edge of drop-offs, overhangs, and deep ditches. The ground can collapse because of the weight of the machine causing the machine to fall or rollover.

Check ground conditions before beginning work with the machine. If ground is soft, reposition the machine before operating.

The excavated material must not be dumped too close to edge. How far away from edge of trench excavated material must be dumped depends on soil type and moisture content. If loose clay is being excavated, place it at least 5 m (16 ft) away from edge.

If excavated material is dumped too close to edge, its weight can cause a landslide.

Thawing of frozen ground, rain, traffic, piling and blasting are other factors which increase risk of landslide. The risk also increases on sloping ground. If it is not possible to dig a trench and adequately slope its sides, always install shoring equipment.

Loose ground may easily give way under weight of the machine.

When working on loose or unstable ground, it is important not to dig too deep and to carefully reposition the machine. Do not panic and do not raise bucket, if ground should begin to collapse. Lower work equipment to improve stability of machine.

Never dig under machine, if there is a potential of causing a landslide.

High-voltage Cables

Do not travel or operate machine near electrical cables or overhead power lines. There is a hazard of electric shock, which can cause property damage and result in death or serious injury. The bucket or other attachment does not have to make physical contact with power lines for current to cause an electrocution.

Use a spotter and hand signals to stay away from power lines not clearly visible to operator. On work sites where machine may operate close to electrical cables, always do the following:

- Remember that electrical voltage determines what the minimum distance is to stay away from the power line. See the following table for minimum distances when working near electrical power lines. Electrical flashover can occur and damage machine and cause death or serious injury.

Voltage	Minimum 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")

- Always contact the power company responsible before beginning work near high voltage power lines.

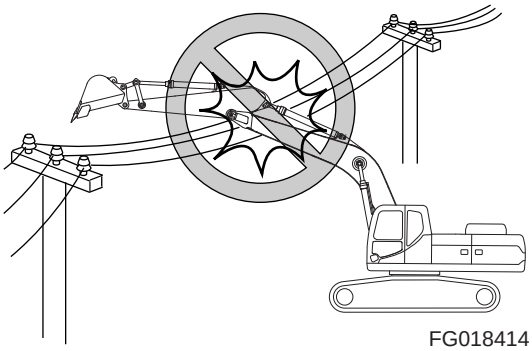

FG018414

Figure 54

Underground Operation

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

Special equipment and engines may be required in some countries. Contact your DOOSAN distributor for more information..

Check that there is sufficient compartment for machine and load.

Move slowly.

Make sure that authorities or companies responsible for underground cables, utilities, and electrical lines have been contacted and that their instructions are followed. Also check which rules apply to ground personnel regarding exposing cables, utilities and electrical lines.

Consider all electrical cables as live.

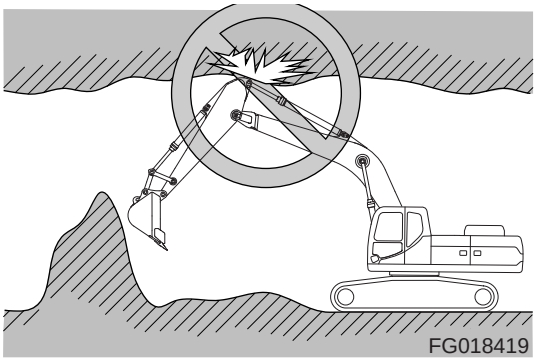


Figure 55

Working in Water

IMPORTANT

Do not exceed maximum permissible water depth. The water level must not reach higher than centerline of upper track roller(s) (1, Figure 56).

After working in water, lubricate all lubrication points on undercarriage, which have been underwater so water is removed. Check that no water has entered travel gearboxes and undercarriage components.

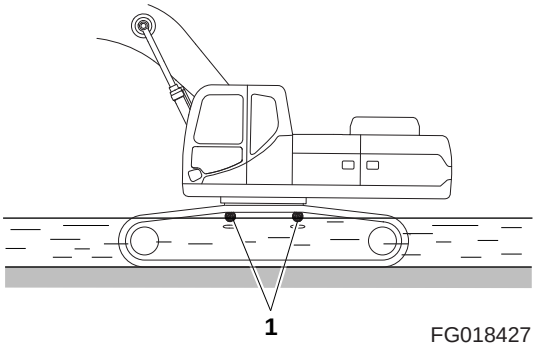


Figure 56

Working in Contaminated Environment

When working within area which is contaminated or where there is a health risk, check local regulations and contact your DOOSAN distributor for assistance with identifying what additional safety precautions need to be taken.

Operation in Extreme Conditions

Operation In Extreme Cold

In extremely cold weather, avoid sudden travel movements and stay away from even slight slopes. The machine could slide down the slope.

Snow accumulation could hide potential hazards and slippery surfaces.

Warming up 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 boom or attachment could cause severe stress in very cold temperatures. Reducing work cycle rate and workload may be necessary.

If machine is to be operated in extremely cold weather temperatures, certain precautions must be taken. The following paragraphs detail checks to be made to be certain machine is capable of operating at these temperatures.

1. Preheat the engine before startup.
   - Preheat the engine before startup. Wait 3 to 4 seconds after preheating until voltage of the battery return, and then actuate the key switch.
2. Keep batteries fully charged to prevent freezing. If distilled water is added to batteries, run engine at least one hour to mix electrolyte solution.
   When temperature drops below -10°C, efficacy of the battery is reduced accordingly. Insulation of the battery prevents reduction of efficacy, and supports improvement of starting power of the starter.

WARNING

AVOID DEATH OR SERIOUS INJURY

Explosion of the battery can cause serious injury or death. Never attempt to directly heat the battery with open fire.

3. Keep engine in good mechanical condition for easy starting and good performance during adverse weather.
4. Use engine oil with proper specifications for expected temperatures. Refer to “Table of Recommended Lubricants” on page 4-19, in this manual or Shop Manual for details.
5. Always keep the fuel tank fully filled after completion of the operation. Always drain water from the fuel tank before and after the operation. In addition, check the water separator, and drain it if required. The fuel filter, if frozen, may interrupt the flow of fuel. Periodically remove water from the fuel tank, drain water from the filter, and replace the

filter upon regular basis. To prevent fuel from being clogged due to formation of wax in fuel, make sure that wax formation point of fuel is lower than atmospheric temperature.

WARNING

AVOID DEATH OR SERIOUS INJURY

Explosion of the fuel tank may cause serious injury or death. Never attempt to directly heat the fuel tank with open fire.

6. Lubricate entire machine according to “Lubrication and Service Chart” on page 4-16, in this manual or lubrication chart on machine.
7. Start engine and allow it to reach normal operating temperature before operating.
   - If mud and ice collects and freezes on any of moving parts while machine is idle, apply heat to thaw frozen material before attempting to operate machine.
   - Operate hydraulic units with care until they have reached a temperature which enable them to operate normally.
   - Check all machine controls and functions to be sure they are operating correctly.
8. An extra outer air filter must be kept in operator's cabin to replace element that could become iced and cause restricted airflow to engine.
9. Clean off all mud, snow and ice to prevent freezing. Cover machine with a tarp if possible, keep ends of tarp from freezing to ground.

Operation in Extreme Heat

Continuous operation of machine in high temperatures can cause machine to overheat. Monitor engine and hydraulic system temperatures and stop machine to let it cool, when necessary.

1. Make frequent inspections and services of fan and radiator. Check coolant level in radiator. Check grilles and radiator fins for accumulation of dirt, debris and insects which could block cooling passages.
   - 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.
   - If necessary, flush cooling system periodically to keep passages 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 to prevent damage to batteries. Use a slightly weaker electrolyte solution in hot climates. 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.

IMPORTANT

Do not store acid type storage batteries near stacks of tires. Acid fumes can damage rubber.

3. Service fuel system as directed in “Check Fuel Level” on page 4-26 and “Check for Leaks in Fuel System” on page 4-27, 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 “Lubrication and Service Chart” on page 4-16, in this manual or Lubrication Decal on machine.
5. Do not park machine in sun for long periods of time. If possible, park machine under cover to protect it from sun, dirt and dust.
   A. Cover machine if no suitable shelter is available. Protect engine compartment and hydraulics from dirt and debris.
   B. In hot, damp climates, corrosion will occur on all parts of machine and will be accelerated during 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 and Sandy Areas

Operation of 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

AVOID DEATH OR SERIOUS INJURY

Wear goggles when using compressed air to prevent face or eye injury.

2. Use care when servicing fuel system to prevent dust and sand from entering tank.
3. Service 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 and Service Chart” on page 4-16. Clean all lubrication fittings before applying lubricant. Sand mixed with lubricant becomes very abrasive and accelerates wear on parts.
5. Protect machine from dust and sand as much as possible. Park machine under cover to keep dust and sand from damaging unit.

Operation in Rainy or Humid Conditions

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

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 Saltwater Areas

Saltwater and saltwater spray is very corrosive. When operating in saltwater areas, or in or around snow, observe the following precautions:

1. When exposed to saltwater, dry machine thoroughly and rinse with freshwater, as soon as possible.
2. Keep all exposed surfaces coated with preservative lubricating oil. Pay attention to damaged paint surfaces.
3. Keep all painted surfaces in good repair.
4. Lubricate machine as prescribed on lubrication chart on machine or “Lubrication and Service Chart” on page 4-16, in this manual. Shorten lubricating intervals for parts exposed to salt water.
5. Check operating controls to ensure proper functionality and that they return to "NEUTRAL" when released.

Operation at High Altitudes

Operation instructions at high altitudes are the same as those provided for 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 radiator cap must make a perfect seal to maintain coolant pressure in cooling system.
    - Perform warming-up operation thoroughly. If machine is not thoroughly warmed up before control levers or control pedals are operated, reaction of machine will be slow.
    - If battery electrolyte is frozen, do not charge battery or start engine with a different power source. There is a potential hazard that could cause a battery explosion or fire.
    - Before charging or starting engine with a different power source, thaw battery electrolyte and check for any leakage of electrolyte before starting.

Operation During Electrical Storms

During electrical storms, do not enter or exit machine.

- If you are off machine, keep away from machine until storm passes.
- If you are in cabin, remain seated with machine stationary until storm passes. Do not touch controls or anything metal.

Exhaust Ventilation

Engine exhaust gases can cause unconsciousness, loss of alertness, judgment and motor control. This can result in death or serious injury.

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

Check for and be aware of any open windows, doors or ductwork where exhaust may be carried, or blown by wind, exposing others to hazardous exhaust gases.

ARO1770L

Figure 57

Ventilation for Enclosed Area

If it is necessary to start engine within an enclosed area, or when handling fuel, flushing oil, or paint; open doors and windows to ensure that adequate ventilation is provided to prevent gas poisoning.

Diesel engine exhaust contains products of combustion which can be harmful to your health.

Always run engine in a well ventilated area. If you are in an enclosed area, vent exhaust to outside.

Asbestos Information

WARNING

AVOID DEATH OR SERIOUS INJURY

Avoid exposure to dust containing asbestos as it can cause death or serious injury to the lungs and other organs (mesothelioma, lung and other cancers, and asbestosis).

ARO1770L

Figure 58

Asbestos dust can be HAZARDOUS to your health if it is inhaled. Materials containing asbestos fiber can be present on work sites. Breathing air that contains asbestos fiber can ultimately cause serious or fatal lung damage or diseases such as mesothelioma, lung and other cancers, and asbestosis. To prevent lung damage from asbestos fiber, observe the following precautions:

- Use an approved respirator that is approved for use in an asbestos-laden atmosphere.
- Use water for cleaning to keep down dust.
- Always observe any regulations related to work site and working environment.
- Avoid brushing or grinding materials that contain asbestos.
- A vacuum cleaner that is equipped with a high efficiency particulate air filter can also be used.
- Comply with applicable laws and regulations for workplace.
- Stay away from areas that might have asbestos particles in air.

Silica Dust Information

WARNING

AVOID DEATH OR SERIOUS INJURY

Avoid exposure to dust containing crystalline silica particles as it can cause serious injury to the lungs (silicosis).

ARO1770L

Figure 59

Cutting or drilling concrete containing sand or rock containing quartz can result in exposure to silica dust. Do not exceed Permissible Exposure Limits (PEL) to silica dust as determined by OSHA or other work site rules, laws and regulations. Use a respirator, water spray or other means to control dust. Silica dust can cause lung disease and is known to the state of California to cause cancer.

Disposal of Hazardous Materials

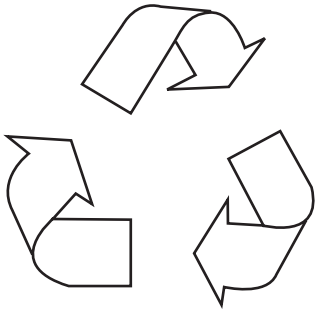
Physical contact with used motor oil or gear oil could create a health risk. Wipe oil from your hands promptly and wash off any remaining residue.

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

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

Improperly disposing of waste can threaten environment. Potentially harmful fluids must be disposed of according to local regulations.

Use all cleaning solutions with care. Report all necessary repairs.



FG009156

Figure 60

Sound

Sound Level Information: Hearing protection may be needed when machine is operated with an open operator station for extended periods or in a noisy environment.

Sound pressure level (LpA) at operator position (Measurement according to ISO 6396)	70 dB(A)
Sound power level (LwA) around the machine (Measurement according to 2000/14/EC with applicable appendices and measuring method according to ISO 6395)	103 dB(A)

Vibration Information

NOTE: *The level of vibration is influenced by many different parameters such as operator training, job site organization, weather, material, environment, machine type, machine and seat suspension system, attachments, and condition of the machine.*

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

Vibration levels were given consideration in accordance with uncertainty (K) determined to manufacturer.

Hand/Arm Vibration Level

The vibration total value to which the hand-arm system is subjected, is less than 2.5 m/s^2.

Whole Body Vibration Level

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

Guidelines for Use and Working Conditions of Earth-moving Machinery to Reduce Vibration Levels (ISO/TR 25398 Annex E)

Properly adjusting and maintaining machines, operating machines smoothly, and maintaining the terrain conditions can reduce whole-body vibrations. The following can help the users of earth-moving machinery reduce whole-body vibration levels.

1. Use the right type and size of machine, equipment, and attachments.
2. Maintain machines according to the manufacturer's recommendations: (for wheeled machine)
   - Tire pressure;
   - Brake and steering systems;
   - Controls, hydraulic system and linkages.
3. Keep the terrain where the machine is working and travelling in good condition:
   - Remove any large rocks or obstacles;
   - Fill any ditches and holes;
   - Provide machines and schedule time to maintain terrain conditions.
4. Use a seat in conformance with ISO 7096 and keep the seat maintained and adjusted:
   - Adjust the seat and suspension for the weight and size of the operator;
   - Inspect and maintain the seat suspension and adjustment mechanisms.

5. Steer, brake, accelerate, shift gears, and move the attachments smoothly. (for wheeled machine)
6. Adjust the machine speed and travel path to minimize the vibration level:
    - Drive around obstacles and rough terrain conditions;
    - Slow down when it is necessary to go over rough terrain.
7. Minimize vibrations for long work cycle or long distance travelling: (for wheeled machine)
    - Use machines equipped with suspension systems;
    - Use lift arm suspensions on wheel loaders;
    - If no suspension system is available, reduce speed to prevent bouncing;
    - Haul machines long distances between worksites.
8. Back pain associated with whole-body vibrations can be caused by other risk factors. To minimize the risk of back pain:
    - Adjust the seat and controls to achieve good posture;
    - Adjust the mirrors to minimize twisted posture;
    - Provide breaks to reduce long periods of sitting;
    - Avoid jumping down from the cab or access system;
    - Minimize repeated handling and lifting of loads;
    - Minimize any shocks and jolts during sports and leisure activities.

Operating Controls

The "Operating Controls" section 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 symbols work besides the gauges on the display monitor. The operator should monitor machine pressure on the display monitor with indicator symbols. These symbols will only show there is a problem.

IMPORTANT

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

COMPONENT LOCATIONS

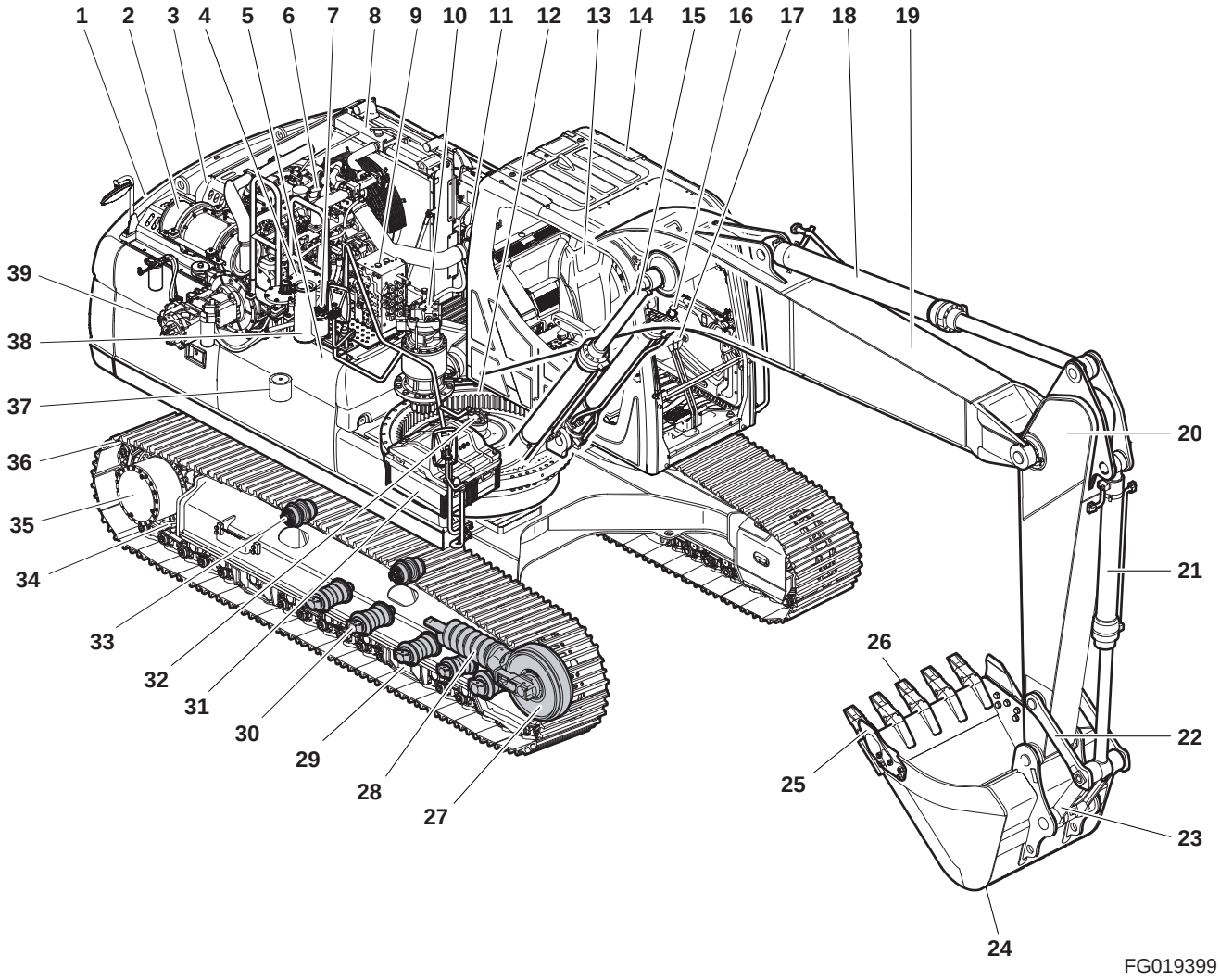


Figure 1

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

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

OPERATOR'S AREA

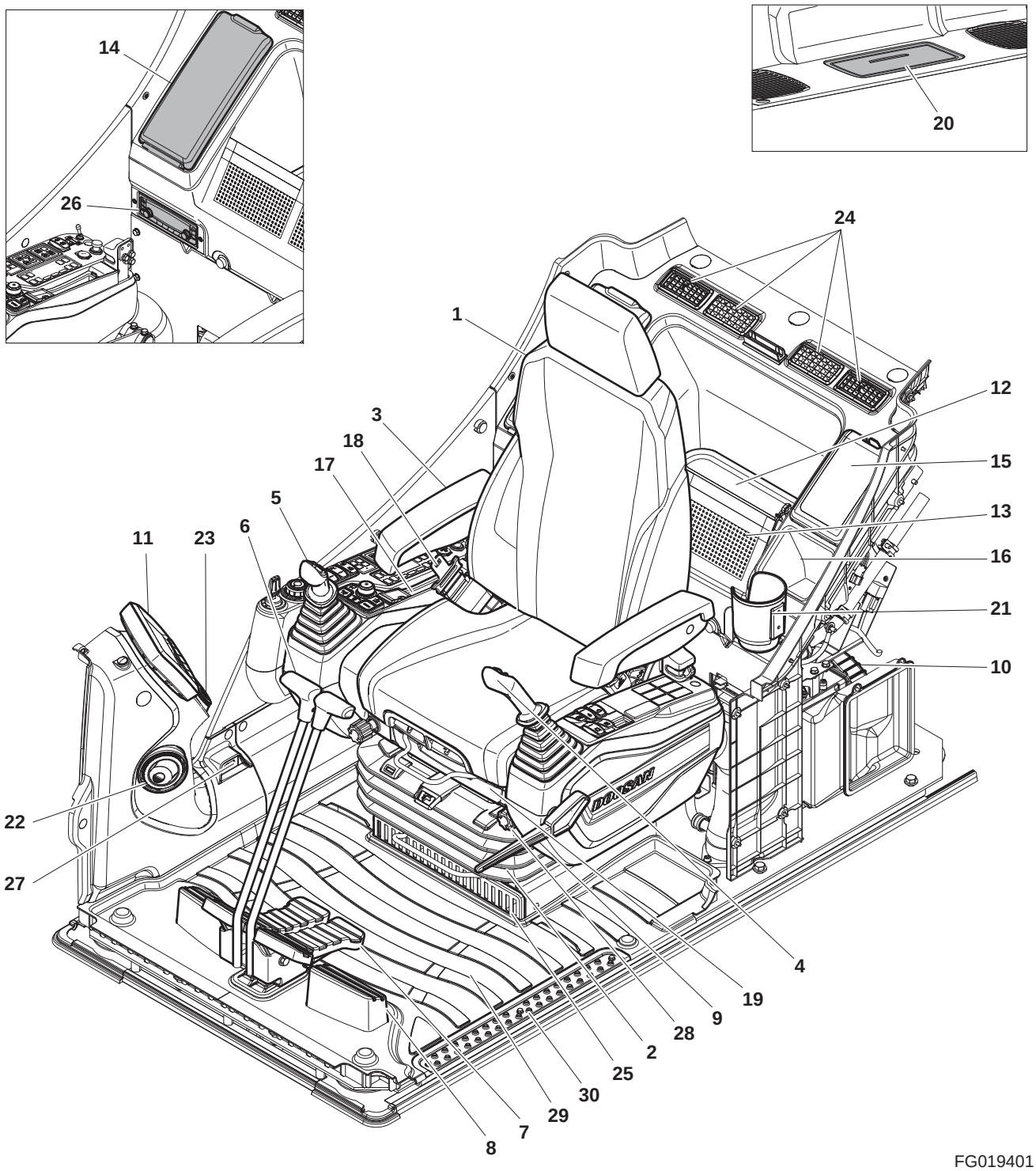
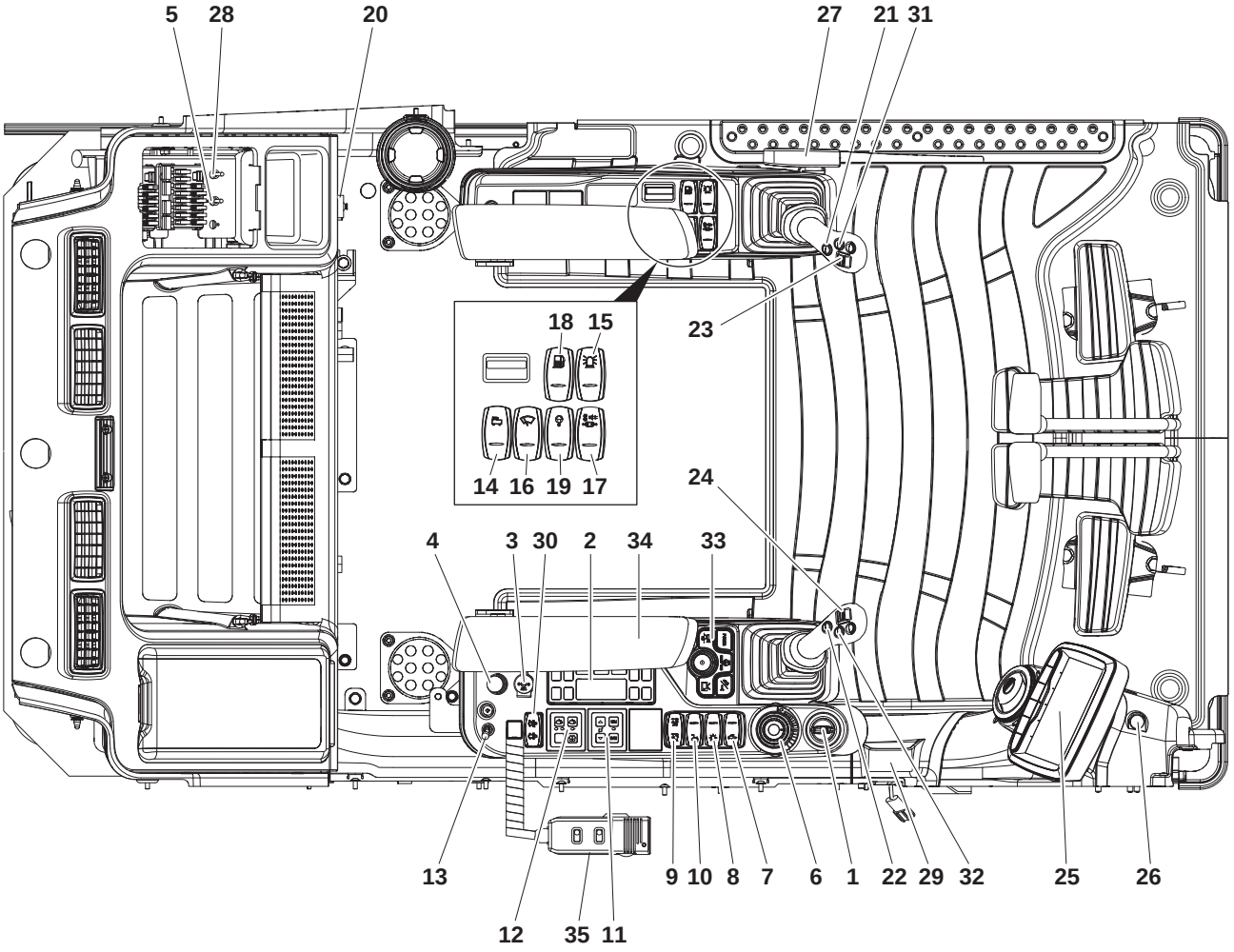


Figure 2

Reference Number	Description
1	Seat
2	Suspension
3	Arm Rest
4	Left-hand Work Lever (Joystick)
5	Right-hand Work Lever (Joystick)
6	Travel Lever
7	Travel Pedal
8	Footrest
9	Safety Lever
10	Air Conditioner Unit
11	Display Monitor
12	Storage Space (Large)
13	Storage Net
14	Storage Space (Heating and Cooling)
15	Fuse Box

Reference Number	Description
16	Storage Compartment (1)
17	Storage Compartment (2)
18	Seat Belt
19	File Case
20	Sunglass Case
21	Cup Holder (PET)
22	Defroster Vent
23	Face Vent
24	Rear Vent
25	Foot Vent
26	Stereo
27	Hour Meter
28	Joystick Height Adjustment Knob
29	Mat
30	Step

OPERATIONAL CONTROLS AND PANELS



EX1300582

Figure 3

Reference Number	Description
1	Starter Switch
2	Heater and Air Conditional Control Panel
3	Power Socket For 12V
4	Cigarette Lighter
5	Engine Emergency Stop Switch
6	Engine Speed Control Dial
7	Travel Speed Selector Switch
8	Light Switch
9	Intelligent Floating Boom Switch (Optional)
10	Cabin Work Light Switch (Optional)
11	Audio Control Panel
12	Wiper Control Panel
13	Quick Coupler Switch (Optional)
14	Air Compressor Switch (Optional)
15	Warning Light Switch (Optional)
16	Lower Wiper Switch (Optional)
17	Travel/Swing Alarm Switch (Optional)

Reference Number	Description
18	Fuel Heater Switch (Optional)
19	Overload Warning Switch (Optional)
20	Power Socket for 12V (Optional)
21	Horn Button
22	Breaker/Booster Button
23	Rotating Switch
24	Shear Switch
25	Display Monitor
26	Photo Sensor
27	Safety Lever
28	Auxiliary Mode Switch
29	Hour Meter
30	Diesel Particulate Filter (DPF) Switch
31	One Touch Deceleration Button
32	Intelligent Floating Boom Temporary Reset Button
33	Jog Switch Control Panel
34	Jack Assembly
35	Micro Phone (Optional)

1. Starter Switch

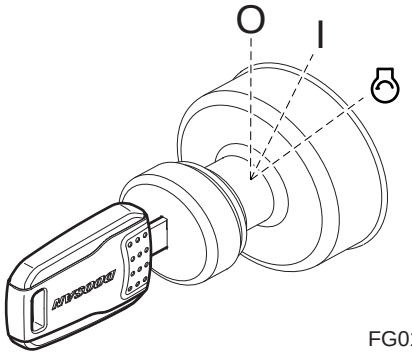
A three-position starter switch is used to start or stop engine for equipment operation.

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 the switch is first turned "ON", six indicator/warning symbols across top of the display monitor, will turn "ON" for approximately two seconds. The battery warning symbol and engine oil pressure warning symbol should remain "ON" after the other four have turned "OFF".

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

. Moving switch to this position will crank engine. When engine starts, release key and allow it to return to "I" (ON) position. Do not operate the starter switch for more than fifteen seconds at a time. This will help prevent damage to starter.



FG018093

Figure 4

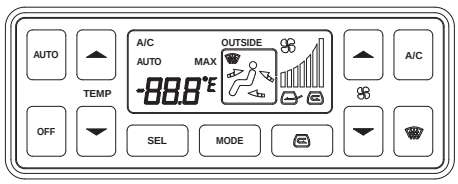
WARNING

AVOID DEATH OR SERIOUS INJURY

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

2. 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 2-74, for more information.



FG000029

Figure 5

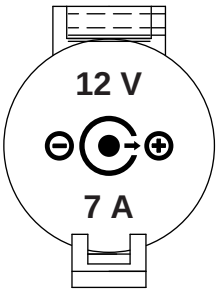
3. Power Socket for 12 Volt

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: *Avoid damage to electrical system.*
This socket is designed for small electrical capacity devices only. Do not use this socket for large electrical capacity devices.



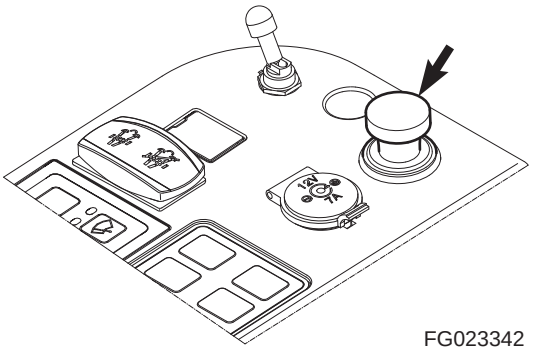
FG017015

Figure 6

4. Cigarette Lighter

Push the lighter all the way into the socket and release. 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.*



FG023342

Figure 7

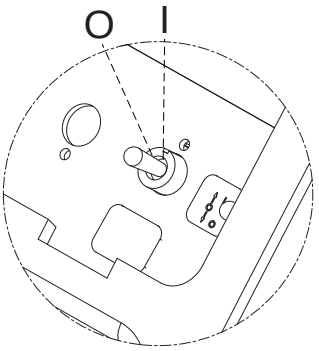
5. Engine Emergency Stop Switch

If the engine does not stop when using the starter switch, it can be stopped by moving the engine emergency stop switch to "I" (EMERGENCY STOP) position.

O. In this position, the engine emergency stop system is "OFF".

I. In this position, "EMERGENCY STOP" is selected. The engine will stop.

NOTE: *When released, the switch will return to its original position "O" (OFF) position.*



FG016039

Figure 8

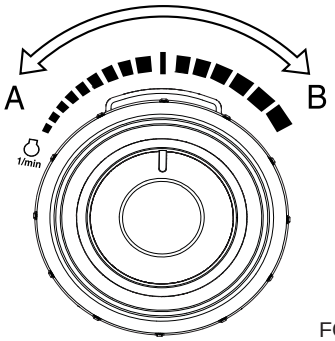
6. Engine Speed Control Dial

The engine speed is controlled by the dial. Rotating it clockwise increases engine speed (rpm) and rotating it 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 "LOW IDLE" approximately four seconds after all the control levers are in the "NEUTRAL" position. This system is designed to reduce fuel consumption and noise. See “4. Auto Idle Selector/Buzzer Stop Button” on page 2-22.*



FG018094

Figure 9

7. Travel Speed Selector Switch

WARNING

AVOID DEATH OR SERIOUS INJURY

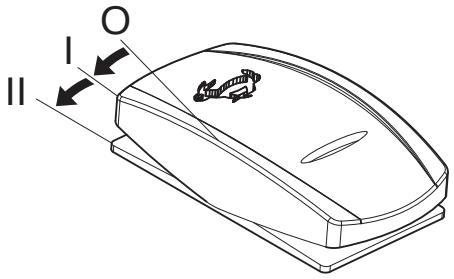
Do not operate the travel speed selector switch when machine is in motion. Temporary loss of control could result.

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.



FG016016

Figure 10

8. Light Switch

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

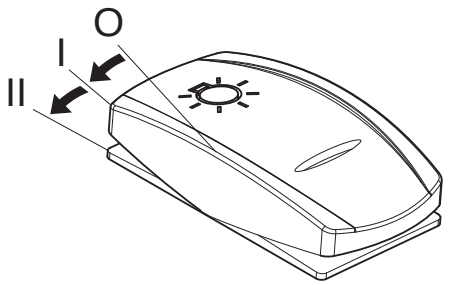
O. In this position, all lights are "OFF".

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

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

IMPORTANT

Do not leave display monitor or work lights "ON" when the engine is not running. Leaving lights "ON" with the engine stopped will discharge batteries.



FG016017

Figure 11

9. Intelligent Floating Boom Switch (Optional)

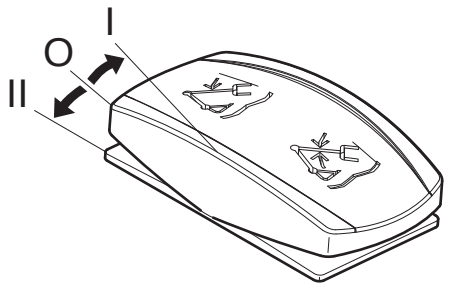
This switch is used to control the Intelligent Floating Boom function.

O. In this position, "NORMAL MODE" is selected.

I. In this position, "INTELLIGENT FLOATING BOOM MODE" is selected. The boom can move freely "UP" and "DOWN".

II. In this position, "BREAKER MODE" is selected.

NOTE: *See "Intelligent Floating Boom Control (Optional)" on page 3-38 for further information.*



FG018272

Figure 12

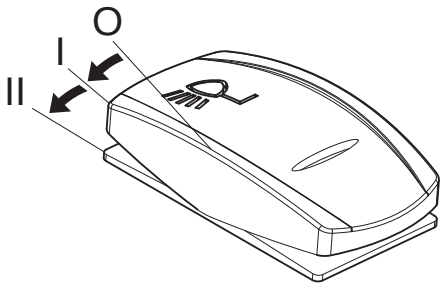
10. Cabin Work Light Switch (Optional)

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".

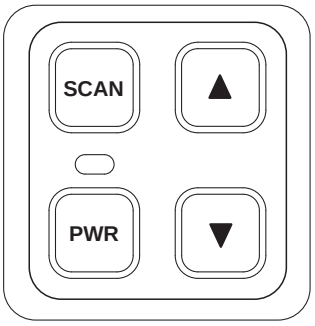


FG016019

Figure 13

11. Audio Control Panel

The audio system can be remotely controlled using this panel.



FG000018

Figure 14

Power Button

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 15

Increase Volume

Press the up button, to "INCREASE" volume.

FG000020

Figure 16

Decrease Volume

Press the down button, to "DECREASE" volume.

FG000021

Figure 17

Scan Button

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.

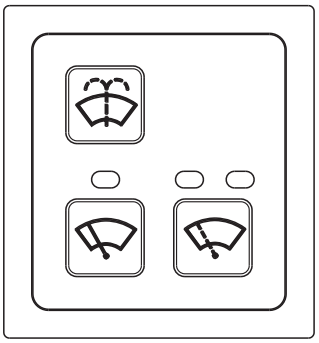
FG000022

Figure 18

12. 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.*



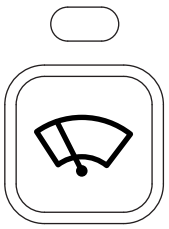
FG000308

Figure 19

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 20

Intermittent Speed Button

Pressing button once (first time):

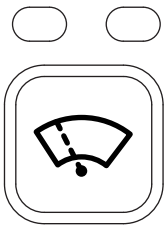
Windshield wiper runs approximately on a three second intermittent cycle. The left side indicator light will turn "ON".

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 21

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 operated 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 can damage the wiper blade or painted surfaces. Use standard window cleaning fluid: SSK703*

FG000243

Figure 22

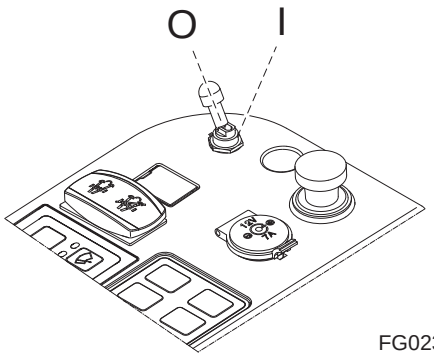
13. Quick Coupler Switch (Optional)

This switch is used for securing or releasing the attachment.

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

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

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



FG023340

Figure 23

WARNING

AVOID DEATH OR SERIOUS INJURY

DO NOT OPERATE machine and attachment if quick coupler switch is in "I" ( ) position.

Attachment can fall off causing death or serious injury.

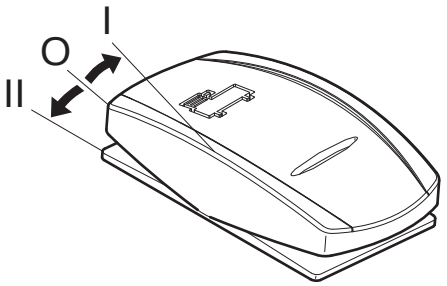
14. Air Compressor Switch (Optional)

This switch is used to activate the air compressor system.

O. The switch is automatically returned to this position when the switch is released.

I. In this position, the air compressor system is turned "OFF".

II. In this position, the air compressor system is turned "ON".



FG018273

Figure 24

IMPORTANT

To prevent air compressor motor from overheating, do not run it or attempt to run it for more than 30 continuous minutes.

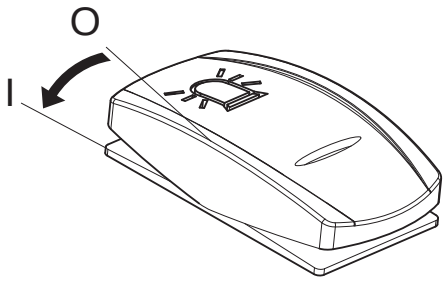
If the air compressor motor runs for more than 30 continuous minutes, the system will automatically shut off.

15. 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.



FG016020

Figure 25

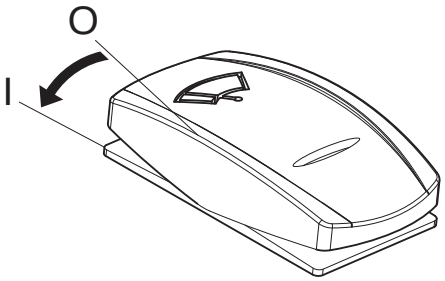
16. Lower Wiper Switch (Optional)

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.*



FG016021

Figure 26

17. Travel/Swing Alarm Switch (Optional)

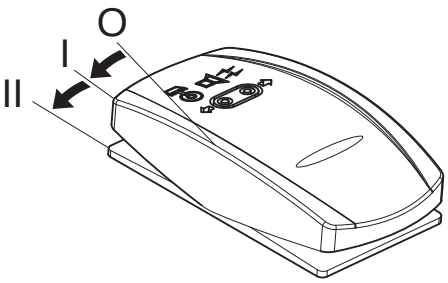
If unit is equipped with a travel/swing alarm, push this switch to active it whenever swinging or traveling.

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 traveling (moving).

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

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



FG016022

Figure 27

18. Fuel Heater Switch (Optional)

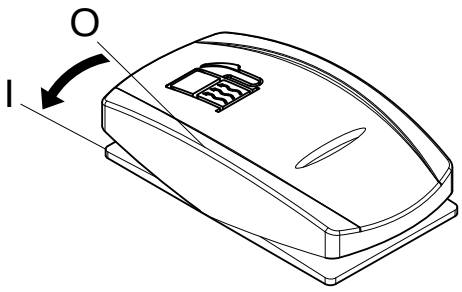
This switch is used to activate the fuel heater system. When the switch is activated, the fuel is warmed, depending upon the temperature of the fuel.

NOTE: *If the fuel temperature is above 5°C (41°F), heating system is not activated.*

O. In this position, the fuel heater system is turned "OFF".

I. In this position, the fuel heater system is turned "ON".

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



FG016024

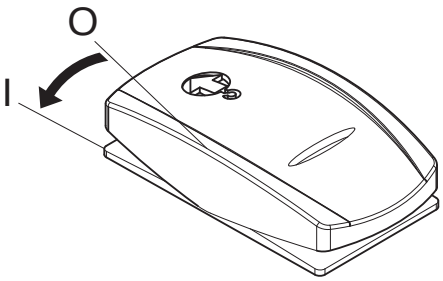
Figure 28

19. Overload Warning Switch (Optional)

If unit is equipped with an overload warning device, push this switch to activate it.

O. In this position, the overload warning device is turned "OFF".

I. In this position, the overload warning device is turned "ON". When a load is lifted that reaches the machine's lifting limit, the warning symbol on the display monitor will turn "ON" and a warning buzzer will sound.



FG016023

Figure 29

WARNING

AVOID DEATH OR SERIOUS INJURY

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. Check for and follow all applicable laws and regulations when lifting objects.

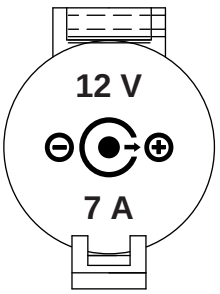
20. Power Socket for 12 Volt (Optional)

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: *Avoid damage to electrical system.*
This socket is designed for small electrical capacity devices only. Do not use this socket for large electrical capacity devices.



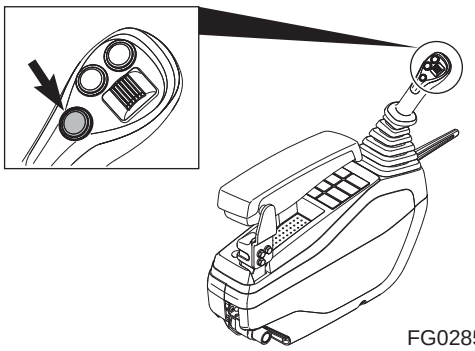
FG017015

Figure 30

21. 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".*



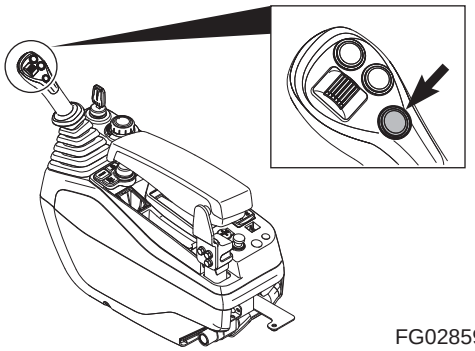
FG028598

Figure 31

22. Breaker/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 3-34.

NOTE: *This button works with the breaker/boost/shear selector switch. See “9. Intelligent Floating Boom Switch (Optional)” on page 2-11.*



FG028599

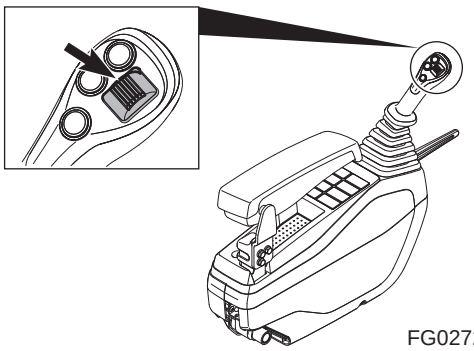
Figure 32

23. Rotating Switch

For a machine equipped with an attachment that rotates, move the thumb wheel switch on top of left-hand work lever (joystick) to rotate the attachment.

Rotating switch "UP" is for "CLOCKWISE ROTATION".

Rotating switch "DOWN" is for "COUNTERCLOCKWISE ROTATION".



FG027215

Figure 33

CAUTION

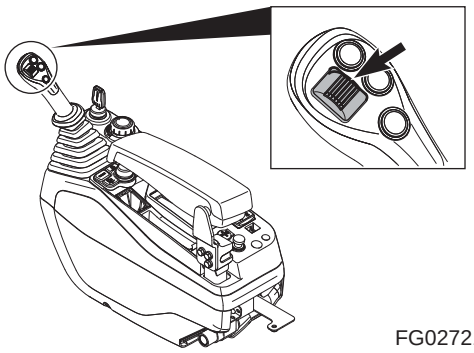
AVOID INJURY

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, clockwise/counterclockwise, crowd/dump, etc.

24. Shear Switch

For a machine equipped with a shear, move the thumb wheel switch on top of right-hand work lever (joystick) to open or close the shear. Rotating switch "UP" is for "OPENING (DUMP)" and rotating switch "DOWN" is for "CLOSING (CROWD)".

NOTE: *This switch also interacts with the jog switch. See “3. Work Mode Selector Button” on page 2-22.*



FG027217

Figure 34

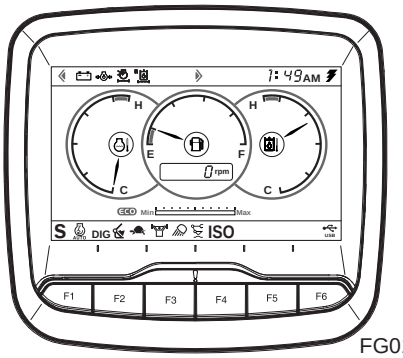
CAUTION

AVOID INJURY

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, clockwise/counterclockwise, crowd/dump, etc.

25. Display Monitor

See “Display Monitor” on page 2-24.



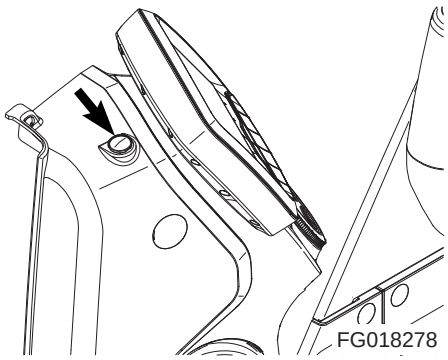
FG018709

Figure 35

26. 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 detected radiant energy.

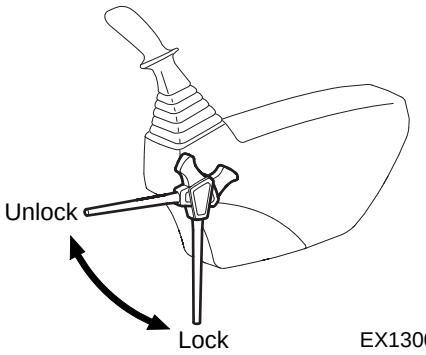


FG018278

Figure 36

27. Safety Lever

See “Safety Lever” on page 3-16.



EX1300566

Figure 37

28. Auxiliary Mode Switch

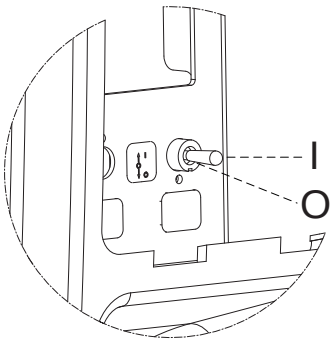
When the control system is out of order, the pump system can be controlled manually.

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

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

IMPORTANT

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

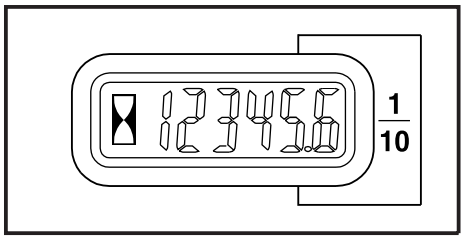


FG016041

Figure 38

29. Hour Meter

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



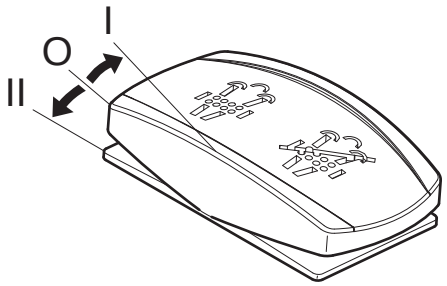
HAOA601L

Figure 39

30. Diesel Particulate Filter (DPF) Switch

Used for manual (forced) regeneration or the inhibition (non-regeneration) of DPF system.

NOTE: *Run machine at "LOW IDLE" and do not stop engine until regeneration cycle is completed. See "Diesel Particulate Filter (DPF) Regeneration Light and Switch" on page 3-24, for more information.*



FG018280

Figure 40

IMPORTANT

Move safety lever to "LOCK" position for manual (forced) regeneration.

If the equipment is moved or switched off while manual (forced) regeneration is in process, the regeneration will need to be restarted.

O. The switch is automatically returned to this position, when it is released.

I. In this position, used for inhibited (non-regeneration) operation of DPF regeneration.

The inhibited (non-regeneration) symbol on the display monitor will turn "ON".

II. In this position, manual (forced) regeneration for DPF system is turned "ON".

When the DPF regeneration warning symbol on the display monitor is turned "ON", use the DPF manual (forced) regeneration switch.

NOTE: *Turn "OFF" cutoff switch before forced regeneration.*

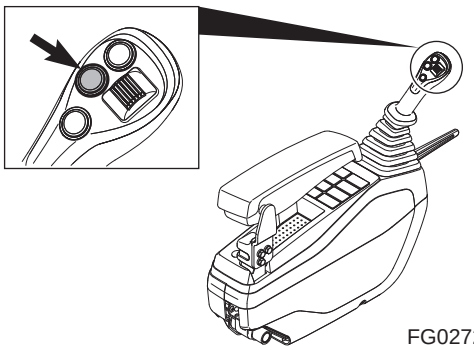
If the machine is moved or stopped while manual (forced) regeneration is in process, the regeneration will need to be restarted.

31. One Touch Deceleration Button

Press the button on the top of the left-hand work lever (joystick) to reduce engine speed to "LOW IDLE".

When the button is pressed, the engine speed is immediately reduce to "LOW IDLE" rpm.

When the button is pressed again, the engine speed will return to the setting of the engine speed control dial.

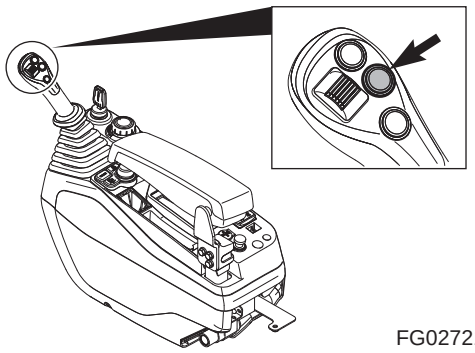


FG027213

Figure 41

32. Intelligent Floating Boom Temporary Reset Button

After selecting Intelligent Floating Boom function, while the boom operating joystick is being held in boom lowering direction, pressing the Intelligent Floating Boom temporary reset button (on the right-hand joystick) will temporarily reset the Intelligent Floating Boom function back to normal operation.

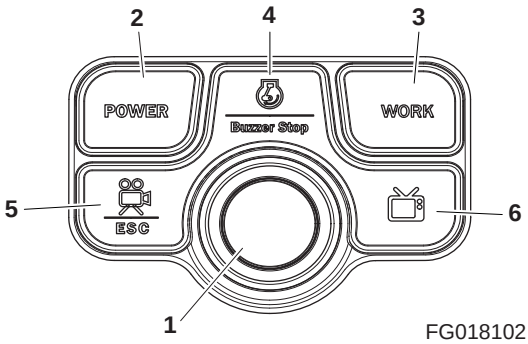


FG027214

Figure 42

33. Jog Switch Control Panel

Reference Number	Description
1	Jog Switch
2	Power Mode Selector Button
3	Work Mode Selector Button
4	Auto Idle Selector/ Buzzer Stop Button
5	Camera Mode Selector/ Escape (ESC) Button
6	Multimedia Button



FG018102

Figure 43

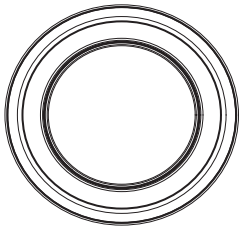
1. Jog Switch

Press or turn the switch to select the menu or to change figures.

Engine speed can be changed according to the setting on the display monitor.

When a pop-up occurs, press the jog switch to remove it.

If this switch is pressed while on the camera screen, the screen will be divided into the windows according to the number of cameras. (Optional)



FG018103

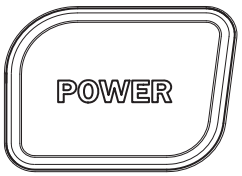
Figure 44

2. Power Mode Selector Button

Used for selecting the power plus mode, power mode, standard mode, or the economy mode.

Pressing the power mode selector button will display the available modes on the main window.

Place the selection bar by turning the jog switch and select the mode by pressing the jog switch.



FG018104

Figure 45

3. Work Mode Selector Button

Used to select the excavation, lifting, or attachment mode.

Pressing the work mode selector button will display the available modes in the main window.

Place the selection bar by turning the jog switch and select the mode by pressing the jog switch.

FG018105

Figure 46

4. Auto Idle Selector/Buzzer Stop Button

Auto Idle Function: When the auto idle system is activated, the engine will automatically reduce speed to "LOW IDLE" approximately four seconds after all 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 "ON" position, an indicator symbol on display monitor turns "ON".

FG018106

Figure 47

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.

Buzzer Stop Function: When warning light appears and the buzzer sounds, use this button to "STOP" buzzer from sounding.

5. Camera Mode Selector/Escape (ESC) Button

Camera window will appear when the button in the main window is operated.

The window will go back to the previous window when the button is operated in any other window than the main window (ESC).

If a pop-up window appears, pressing the button will remove pop-up.

FG018107

Figure 48

6. Multimedia Button

Used to select window for video and music (MP3).

WARNING

AVOID DEATH OR SERIOUS INJURY

Listening to entertainment clips, such as video, music, etc., can cause an accident resulting in death or serious injury.

Do not play entertainment files when operating the machine.

FG018108

Figure 49

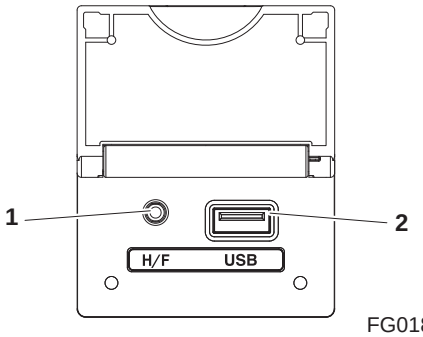
34. Jack Assembly

1. Hands-free Connector Jack

   This jack is applied to korean models only.

2. USB Connection

   Used for recharging a cell phone, or playing a video or MP3 file on the display monitor.



FG018101

Figure 50

35. Micro Phone (Optional)

Used for alerting people around machine when starting up or operating the machine.

How to use the microphone:

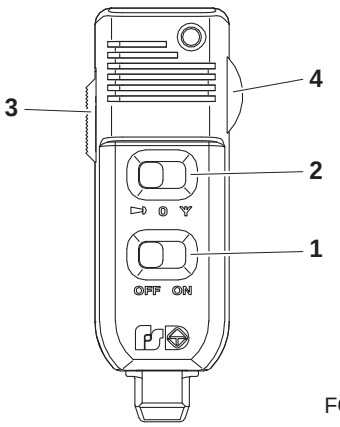
A. Siren

   Turn switch (1, Figure 51) on the bottom to "ON" and set switch (2) on the top to the far left position (⊳), the siren will be triggered.

B. Microphone

   Turn switch (1, Figure 51) on the bottom to "ON", set switch (2) on the top to the center position (⓪), and then press switch (3).

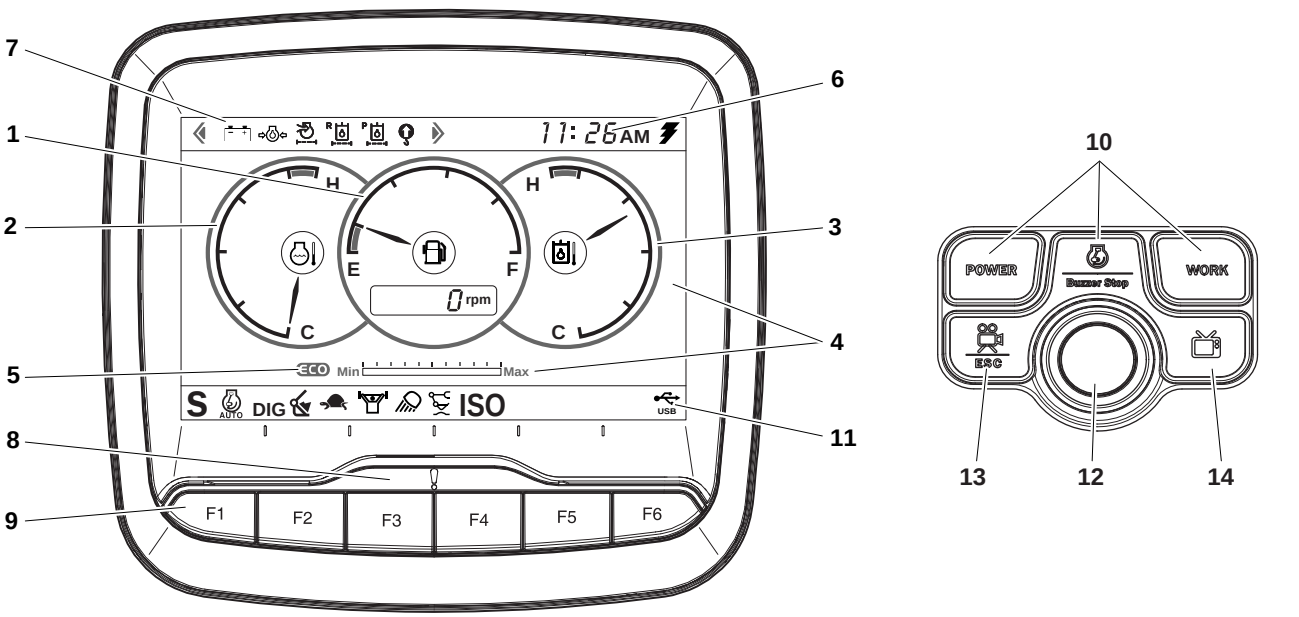
   Turn switch (4, Figure 51) clockwise or counterclockwise to increase or decrease the volume.



FG018112

Figure 51

DISPLAY MONITOR



FG018710

Figure 52

Reference Number	Description
1	Fuel Gauge
2	Engine Coolant Temperature Gauge
3	Hydraulic Oil Temperature Gauge
4	Multifunction Gauge and Graphic Information Area
5	ECO Gauge
6	Digital Clock
7	Display Warning Symbols

Reference Number	Description
8	Warning Light
9	Function Buttons
10	Mode Selector Buttons
11	Selector Function Display
12	Jog Switch
13	Camera Mode Selector/ESC Button
14	Multimedia Selector Button

Functional Check

When the engine starter switch is turned to "I" (ON) position, all gauge bands, switch/button indicator lights and warning lights will turn "ON" and the alarm buzzer will sound for about two (2) seconds.

During this functional check, a LOGO will appear on the multifunction gauge in the graphic information area (3 and 4, Figure 52).

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 "Password Setting" on page 2-62, for further details.*

IMPORTANT

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

1. Fuel Gauge

Shows remaining fuel quantity in tank.

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

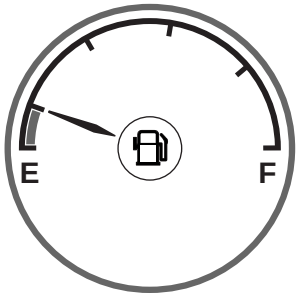
RED ZONE (■) - Indicates that fuel level is low.

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

NOTE: *See "7. Display Warning Symbols" on page 2-29, for location of this warning symbol and others.*

Check the fuel level on firm and level ground.

NOTE: *Only use Ultra Low Sulfur Diesel fuel and API-CJ-4/ACEA-E9 grade engine oil.*



FG018115

Figure 53

2. Engine Coolant Temperature Gauge

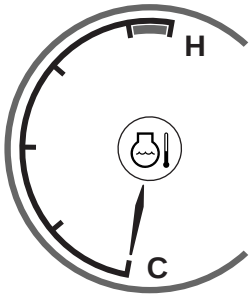
The colored bands indicate the temperature of the engine coolant.

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

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

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

If the gauge pointer moves into the red zone, the engine coolant temperature warning light will turn "ON", a warning buzzer will sound, and the engine speed will be automatically reduced. Allow the engine to run at "LOW IDLE" until temperature gauge registers in the white zone again. When the white zone is reached, allow the engine to idle for an additional three - five minutes before stopping the engine. If not allowed to idle, heat surge may develop



FG018116

Figure 54

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, etc.

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

3. Hydraulic Oil Temperature Gauge

The colored bands indicate the temperature of the hydraulic oil.

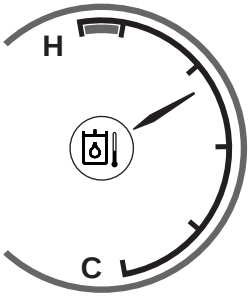
WHITE ZONE ( ) - Indicates temperature is within the normal operating range.

RED ZONE ( ) - Indicates temperature is too high.

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

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

NOTE: *See "7. Display Warning Symbols" on page 2-29, for location of this warning symbol and others.*



FG018117

Figure 55

4. Multifunction Gauge and Graphic Information Area

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

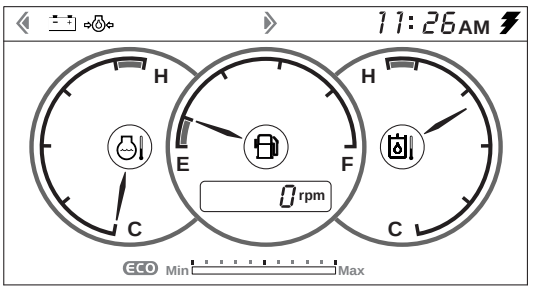
When the LOGO disappears, the multifunction gauge and graphic information screen will appear.

The engine rpm is normally displayed at the bottom of the screen when the starter switch is first turned "ON". 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 "User Menu" on page 2-43 for the language selection and information display sequences.



FG018118

Figure 56

Communication Indicator

Indicates the condition of communication between main controller and display monitor.

1. Normal Condition:

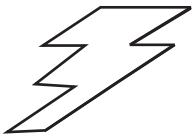
   The symbol will sequentially move like lightening.

   NOTE: *See Figure 57.*

2. Abnormal Condition:

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

   NOTE: *See Figure 58.*



FG000047

Figure 57

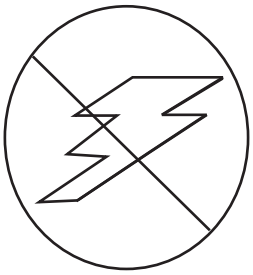
Communication Error Warning

If a communication error is generated between EPOS controller and display monitor, this symbol will be displayed.

When this symbol is displayed, contact a DOOSAN distributor.

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

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



FG000048

Figure 58

Engine Speed

The engine speed is numerically displayed.

FG014225-1

Figure 59

5. ECO Gauge

A. ECO symbol: shows the workload when using the equipment.

- Green color: the green colored ECO symbol indicates that equipment is in normal operating condition.
- Amber color: the amber colored ECO symbol indicates that equipment is a state of idling.
- Red color: the red colored ECO symbol indicates rapid engine load or working with the equipment under load.
- Gray color: the gray colored ECO symbol is displayed in other cases than above 3 color symbols.

FG018119

Figure 60

B. ECO gauge: shows the average fuel efficiency for 1 minute's operation.

A higher fuel consumption rate will drive this gauge closer to the max position.

- Green color gauge: fuel efficiency is in the economy mode.
- Amber color gauge: fuel efficiency is in the standard/power mode.
- Red color gauge: fuel efficiency is in the power plus mode.

FG018120

Figure 61

6. Digital Clock

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

Display	Description
HH	Hour
mm	Minute

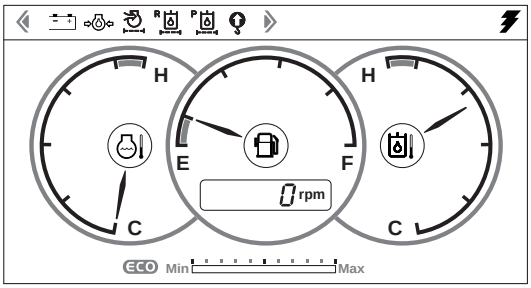
Refer to the “User Menu” on page 2-43 for time setting.

FG018262

Figure 62

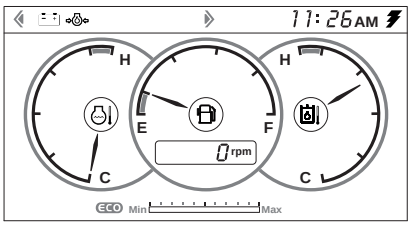
7. Display Warning Symbols

Reference Number	Description
1	Charge Warning Symbol
2	Engine Oil Pressure Warning Symbol
3	Engine Coolant Temperature Warning Symbol
4	Preheating Indicator Symbol
5	Engine Check Warning Symbol
6	Hydraulic Oil Overheat Warning Symbol
7	Pilot Filter Clogged Warning Symbol
8	Fuel Shortage Warning Symbol
9	Return Filter Clogged Warning Symbol
10	Air Cleaner Clogged Warning Symbol
11	Water in Fuel Warning Symbol
12	Quick Coupler Release Warning Symbol (Optional)
13	Diesel Particulate Filter (DPF) Regeneration Warning Symbol
14	Overload Warning Symbol (Optional)
15	Diesel Particulate Filter (DPF) High Temperature Warning Symbol
16	Engine Stop Warning Symbol



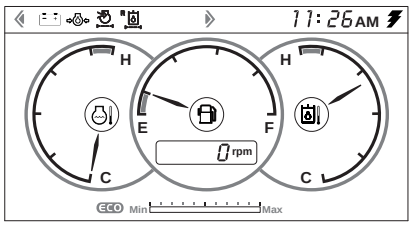
FG018121

Figure 63



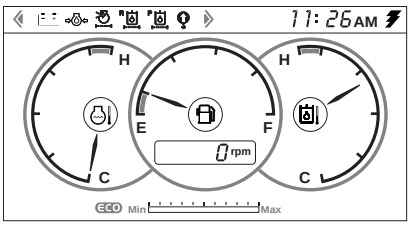
FG018122

<2 kinds of warning displays>



FG018123

<4 kinds of warning displays>



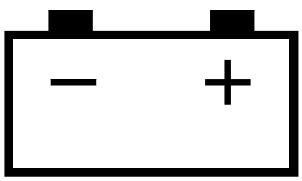
FG018124

<6 kinds of warning displays>

Figure 64

1. Charge Warning Symbol

This symbol indicates when the engine starter switch is turned "ON", and should go "OFF" after the engine starts. If it does not turn "OFF", stop engine immediately and determine the cause of the problem.

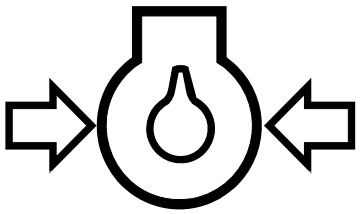


HAOA610L

Figure 65

2. Engine Oil Pressure Warning Symbol

This symbol indicates 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, stop engine immediately and determine the cause of the problem. If work is continued when this light is "ON", it will result in serious engine damage.



HAOA620L

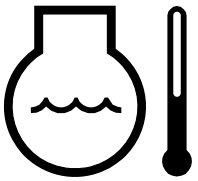
Figure 66

IMPORTANT

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

3. Engine Coolant Temperature Warning Symbol

If engine coolant overheats, this symbol appears on the screen 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 can cause engine to seize up because of heat surge.



HAOD350L

Figure 67

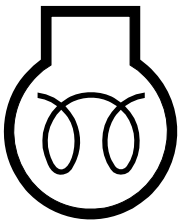
NOTE: *Check the engine coolant temperature gauge. If the gauge pointer moves into the red zone, the engine coolant temperature warning light will turn "ON", a warning buzzer will sound, and the engine speed will be automatically reduced. Allow the engine to run at "LOW IDLE" until temperature gauge registers in the white zone again. When the white zone is reached, allow the engine to idle for an additional three - five minutes before stopping 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, etc.*

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

4. Preheating Indicator Symbol

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

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



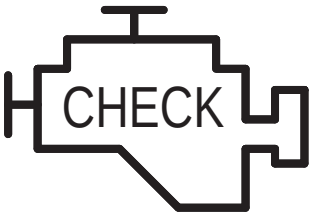
HAAE2000

Figure 68

5. Engine Check Warning Symbol

This symbol indicates when the engine needs to be check.

NOTE: *If this symbol turns "ON" stop the machine and repair the cause of the fault.*

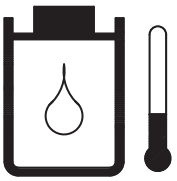


FG000045

Figure 69

6. Hydraulic Oil Overheat Warning Symbol

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



FG000056

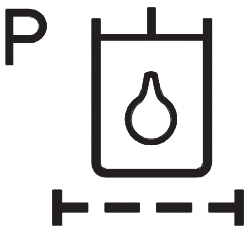
Figure 70

7. Pilot Filter Clogged Warning Symbol

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 warning symbol.



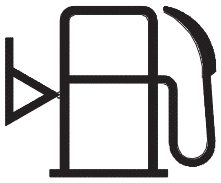
FG000055

Figure 71

8. Fuel Shortage Warning Symbol

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

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



FG000057

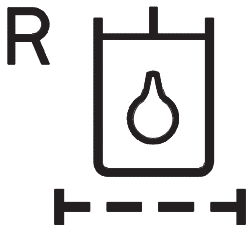
Figure 72

9. Return Filter Clogged Warning Symbol

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 warning symbol.



FG000054

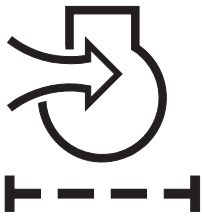
Figure 73

10. Air Cleaner Clogged Warning Symbol

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 warning symbol.



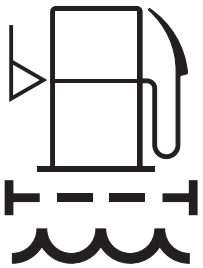
FG000053

Figure 74

11. Water In Fuel Warning Symbol

This symbol indicates when the water is full in the fuel prefilter.

When this symbol appears, drain water from fuel prefilter as soon as possible.

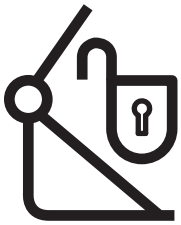


FG013744

Figure 75

12. Quick Coupler Release Warning Symbol (Optional)

This symbol indicates when the quick coupler is released.



FG002195

Figure 76

WARNING

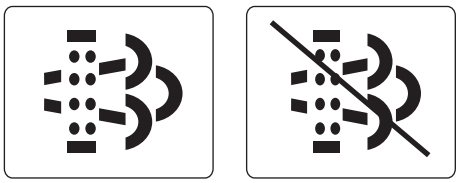
AVOID DEATH OR SERIOUS INJURY

DO NOT OPERATE machine and attachment if quick coupler switch is in "I" ( ) position.

Attachment can fall off causing death or serious injury.

13. Diesel Particulate Filter (DPF) Regeneration Warning Symbol

The left-hand regeneration symbol (Figure 77) turns "ON" when forced regeneration is required, or during the manual (forced) regeneration process. When the operator inhibits the regeneration, the symbol will be displayed as shown in the right-hand view (Figure 77).



FG018399

Figure 77

NOTE: *Run machine at "LOW IDLE" and do not stop engine until regeneration cycle is completed. See "Engine Exhaust Emission Control System" on page 3-23 for more information.*

IMPORTANT

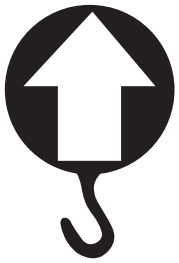
Move safety lever to "LOCK" position for manual (forced) regeneration.

If the equipment is moved or switched off while manual (forced) regeneration, the regeneration will need to be restarted.

NOTE: *If the machine is moved or switched off during regenerating, the regeneration process will need to be restarted.*

14. Overload Warning Symbol (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.



FG000253

Figure 78

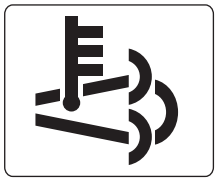
WARNING

AVOID DEATH OR SERIOUS INJURY

If this warning appears on the screen and a warning buzzer sounds, reduce the load immediately.

If you continue to work, tipping of the machine or damage to hydraulic components and structural parts could occur.

15. Diesel Particulate Filter (DPF) High Temperature Warning Symbol



FG018398

Figure 79

WARNING

AVOID DEATH OR SERIOUS INJURY

Exhaust gas temperature and exhaust system components are very hot during regeneration. This can cause a fire or burn hazard and result in death or serious injury or damage to property. Keep flammable material and explosive gases away from exhaust system during regeneration.

This DPF high temperature warning symbol is shown when regeneration is in process.

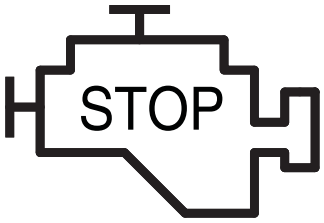
Forced Regeneration - The symbol is amber color.

Active Regeneration - The symbol is green color.

NOTE: *Run machine at "LOW IDLE" and do not stop engine until regeneration cycle is completed. See “Engine Exhaust Emission Control System” on page 3-23, for more information.*

16. Engine Stop Warning Symbol

If this warning symbol appears on the screen and a warning buzzer sounds, stop engine and service the emission control system immediately.



FG019003

Figure 80

8. Warning Light

This warning light appears when the machine or engine needs to be checked.

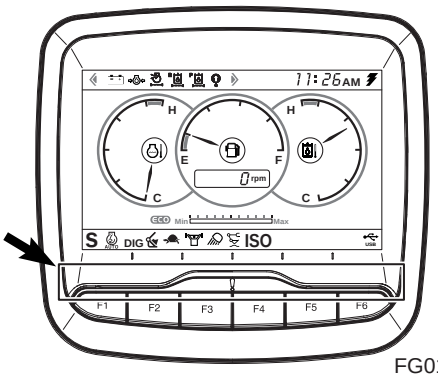
IMPORTANT

If warning light appears, stop the machine and repair the cause of the problem.

IMPORTANT

If necessary depending on the type of problem, contact your DOOSAN distributor for repairs.

NOTE: *For explanation of warnings see "Warning Pop-up Window" on page 2-40.*



FG018711

Figure 81

9. Function Buttons

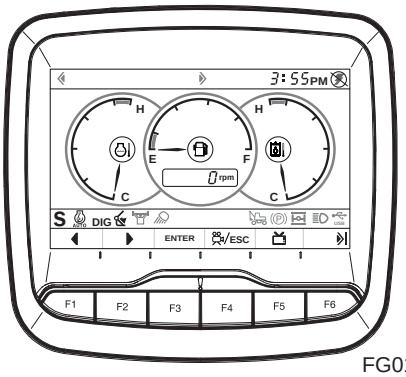
The function buttons has the same functionality as that of a jog switch.

How to Use Function Button

Pressing function button will display "Function Bar" at bottom of screen.

For symbols on function bar, commands can be entered using buttons F1 - F6 in the same positions.

Reference Number	Description
1	Menu 2 Selector Button
2	Power Mode Selector Button
3	Auto Idle Selector Button
4	Work Mode Selector Button
5	Selection Bar Move (◀) Button
6	Selection Bar Move (▶) Button
7	Menu Selector Button
8	Camera Mode Selector/Escape (ESC) Button
9	Entertainment Button
10	Menu 1 Selector Button



FG018129

Figure 82

1. Menu 2 Selector Button

Press this button to change from menu 1 to menu 2.

2. Power Mode Selector Button

Used for selecting the power plus mode, power mode, standard mode, or the economy mode.

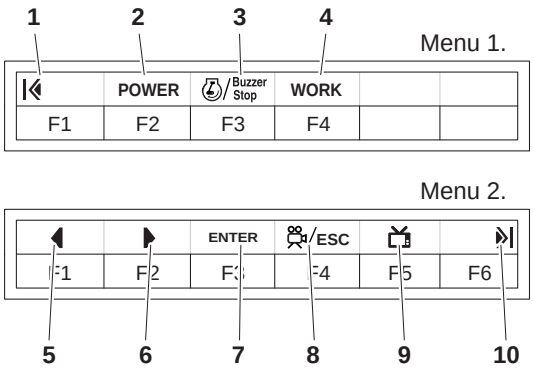
Pressing the power mode selector button will display the available modes on the main window.

Place the selection bar by selection bar move button (5, 6) and select the mode by pressing menu selector button (7).

3. Auto Idle Selector Button

When the auto idle system is activated, the engine will automatically reduce speed to "IDLE" approximately four (4) seconds after all 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 "ON" position, an indicator light above it turns "ON".



FG018652

Figure 83

4. Work Mode Selector Button

Used to select the excavation, lifting, or attachment mode.

Pressing the "Work Mode" selector button will display the available modes in the main window.

Place the selection bar by selection bar move button (5, 6) and select the mode by pressing menu selector button (7).

5. Selection Bar Move (◀) Button

6. Selection Bar Move (▶) Button

7. Menu Selector Button

8. Camera Mode Selector/Escape (ESC) Button

Rear view camera window will appear when the button in the main window is operated.

The window will go back to the previous window when the button is operated in any other window than the main window (ESC).

If a pop-up window appears, pressing the button will remove the pop-up.

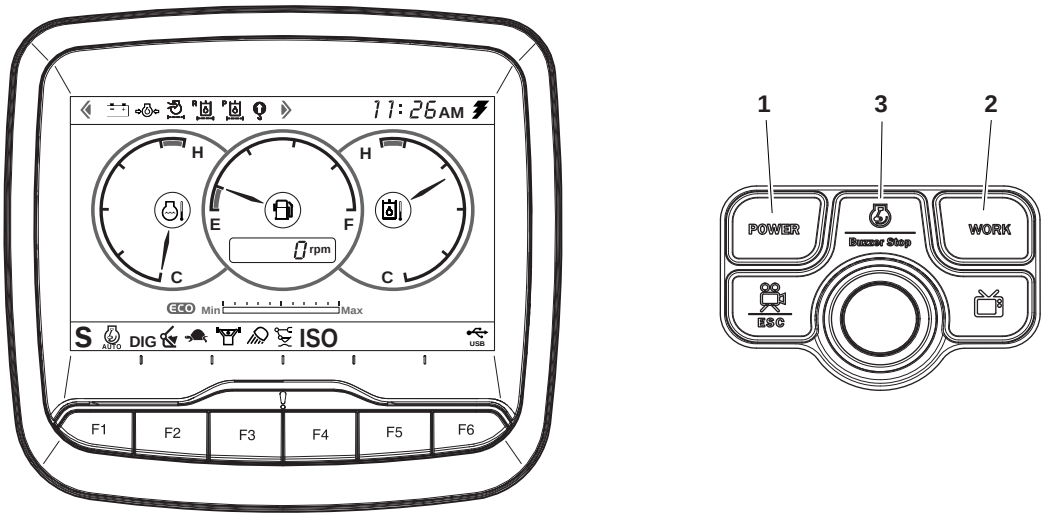
9. Entertainment Button

Used to select entertainment window for video and music (MP3).

10. Menu 1 Selector Button

Press this button to change from menu 2 to menu 1.

10. Mode Selector Buttons



FG018713

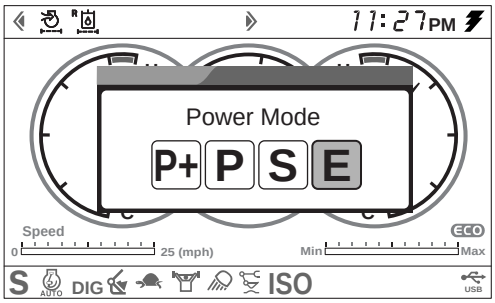
Figure 84

1. Power Mode Selector Button

Used for selecting power plus mode, power mode, standard mode, or economy mode.

Pressing power mode selector button will display available modes on main window.

Scroll through selection bar by turning jog switch and select mode by pressing jog switch.



FG018475

Figure 85

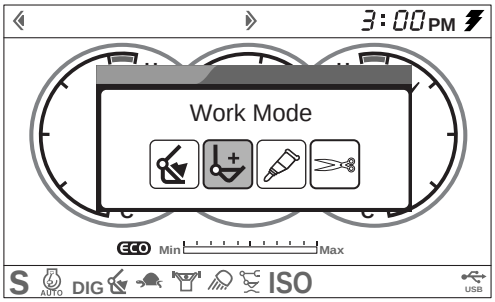
2. Work Mode Selector Button

Used to select the excavation, lifting, or attachment mode.

Pressing the "Work Mode" selector button will display the available modes in the main window.

Scroll through selection bar by turning the jog switch and select the mode by pressing the jog switch.

Changing the starter switch from the "O" to "I" position will automatically reset the work mode to "Excavation Mode".



FG018373

Figure 86

3. Auto Idle Selector Button

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

When the auto idle selector button is pushed to "ON" position, an auto idle symbol will be displayed on the display monitor.

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.

FG018106

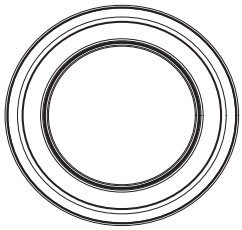
Figure 87

11. Selector Function Display

See “Switch Operation Indication” on page 2-71.

12. Jog Switch

See “1. Jog Switch” on page 2-21.



FG018103

Figure 88

13. Camera Mode Selector/ESC Button

See “5. Camera Mode Selector/Escape (ESC) Button” on page 2-22.

FG018107

Figure 89

14. Multimedia Selector Button

See “6. Multimedia Button” on page 2-23.

FG018108

Figure 90

Warning Pop-up Window

When an alarm or warning is triggered, a pop-up window appears to describe it.

The pop-up window disappears when the warning symbol has disappeared or the ESC button or jog switch is pressed.

For multiple warnings and/or alarms, turn the jog switch to select the warning/alarm and read the relevant message.

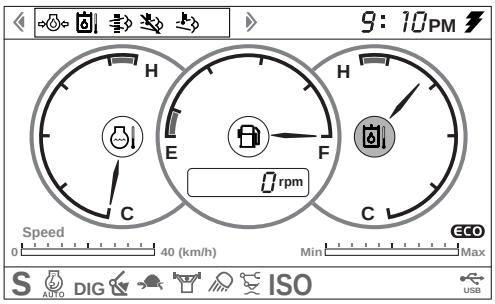
WARNING

AVOID DEATH OR SERIOUS INJURY

If a warning pop-up window appears, stop operation and check the message. Do not read message while traveling or operating machine.

1. Go to Warning Display

Move the selection window to the warning display by rotating the jog switch counterclockwise.

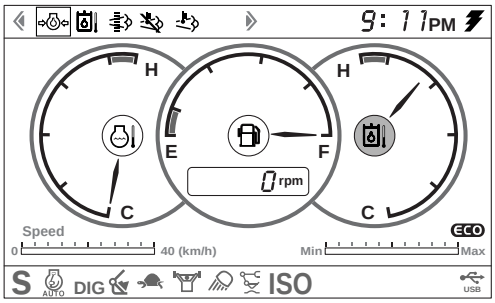


FG018714

Figure 91

2. Enter Checking Mode

Enter individual symbol checking mode by pressing the jog switch.

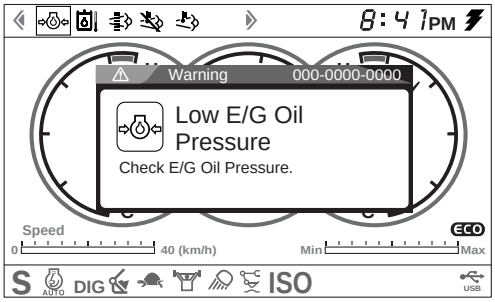


FG018715

Figure 92

3. Read Warning Message

Select the warning symbol by rotating the jog switch and press the jog switch to read the warning message.

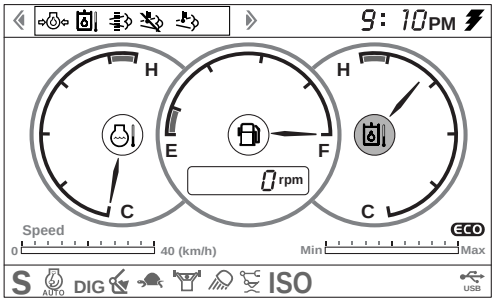


FG018519

Figure 93

4. Delete Warning Pop-up

Press escape or jog switch to delete the warning pop-up window.



FG018714

Figure 94

Warning Pop-up Windows List

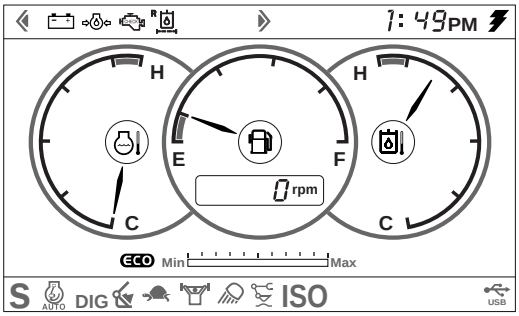
	Warning	Description
1	Charge	Check the battery charging system.
2	Low E/G Oil Pressure	Check the engine oil system.
3	Coolant Overheat	Coolant is overheated. Service/repair the cooling system after fully cooled down.
4	Preheat	Being preheated.
5	E/G Warning	Check the engine system.
6	Water in Fuel	Drain the water in the fuel filter.
7	Hydraulic	Hydraulic oil is overheated. Service/repair the oil system after fully cooled down.
8	Fuel Empty	Refuel.
9	Air Cleaner Clogged	Air cleaner is clogged. Check the air cleaner.
10	Return Filter	Return filter is clogged. Check the return filter.
11	Pilot Filter	Pilot filter is clogged. Check the pilot filter.
12	Brake Oil Pressure Low	Brake oil pressure is too low. Check the brake system.
13	Quick Coupler	Quick coupler is disengaged. Check attachment.
14	Overload Warning Device (OWD)	Check for and follow all applicable laws and regulations when lifting objects.
15	Diesel Particulate Filter (DPF) Regeneration Status	Start forced regeneration.
16	Active Regeneration Inhibited	DPF active regeneration inhibited status.
17	Auto Regeneration	Auto regeneration status.
18	Forceful Regeneration	Forceful regeneration status.
19	Engine Stop	Stop engine and service the emission control system immediately.

USER MENU

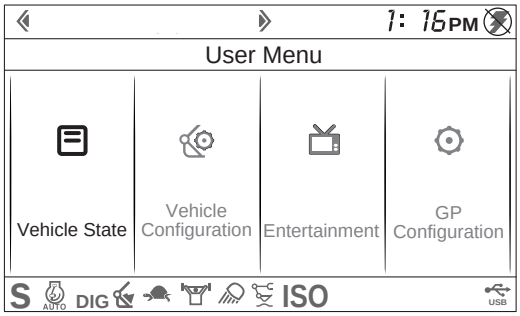
User Menu - Access and Escape Methods

Access Method

On the normal display screen, click on the jog switch to access the user menu screen.



<Normal Indication Monitor>



<Main Menu Monitor>

FG018478

Figure 95

Escape Method

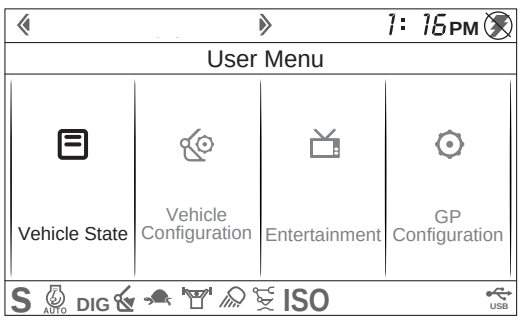
1. Press the ESC button to move to the normal display screen.
2. If 20 seconds have passed without the operation of the button, the normal display screen will be displayed.
3. Turning "OFF" the starter switch to cut off power, you will move to the normal display screen.

User Menu

Turn the jog switch and move the cursor to see an reversed display on the desired menu. Then, click on the jog switch to select the menu.

Vehicle State ↔ Vehicle Configuration ↔ Entertainment ↔ GP Configuration

Press the ESC button to return to the previous screen.



FG018479

Figure 96

WARNING

AVOID DEATH OR SERIOUS INJURY

Do not use vehicle state menu when traveling or operating.

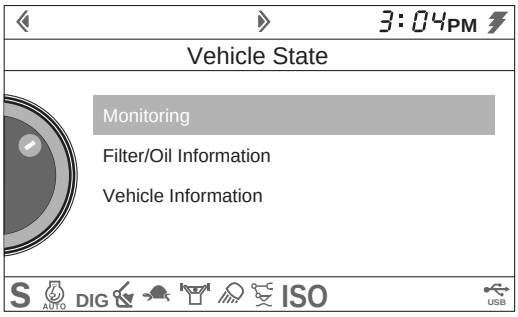
1. Vehicle State

This is used to check the current vehicle state, filter/oil information, vehicle information, etc.

Turn the jog switch and move the cursor to see a reversed display on the desired menu. Then, click on the jog switch to select the menu.

Monitoring ↔ Filter/Oil Information ↔ Vehicle Information

Press the ESC button to return to the previous screen.



FG018480

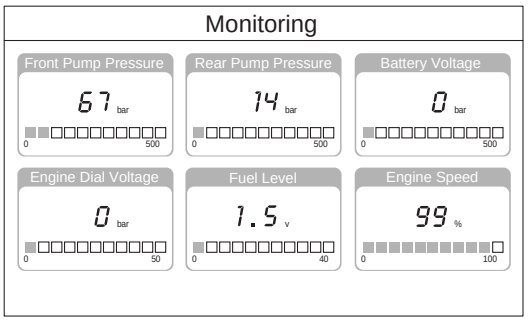
Figure 97

A. Monitoring

The monitoring screen displays the information on vehicle pump pressure, voltage, fuel level, etc.

At the vehicle state, if the cursor is placed on Monitoring, click on the jog switch to display the Monitoring screen.

Press the ESC button to return to the previous screen.



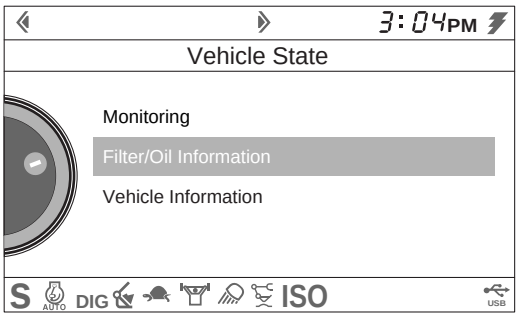
FG018483

Figure 98

B. Filter/Oil Information

The screen displays the information on filter/oil use time, replacement period, and remaining time.

At the vehicle state, if the cursor is placed on the filter/oil information, click on the jog switch to display the filter/oil information.



FG018481

Figure 99

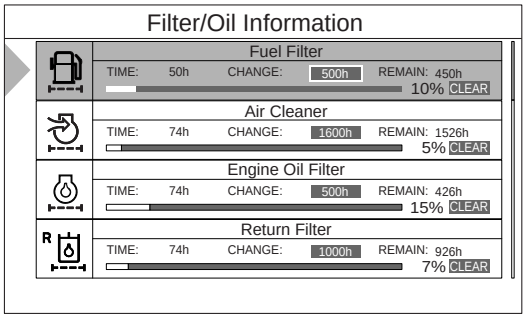
Reset Method/Replacement Period Change Method

Turn the jog switch to locate the cursor to reset the operation hour or change the replacement period.

Click on the jog switch once to display the selection screen on clear at the right bottom. Then, click on the jog switch to display a screen to select the operation hour reset.

Turn the jog switch to locate it at YES. Then, click on the jog switch to reset the operation hour.

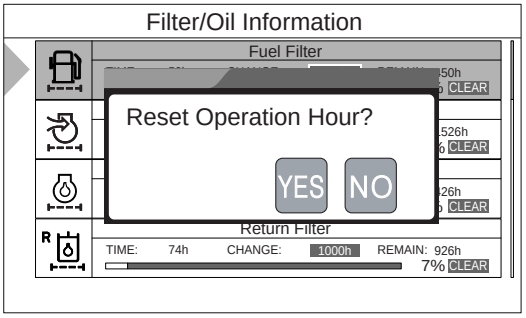
Turn the jog switch to locate it at NO. Then, click on the jog switch to allow the pop-up window to disappear without resetting the operation hour.



FG018484

Figure 100

– The filter/oil use time shows the hours of operation after initializing the engine. It begins again with 0 hr after initialization the following the replacement of filter/oil.



FG018485

Figure 101

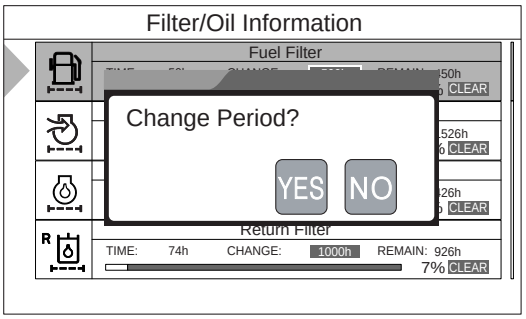
With the selection screen being displayed on clear, turn the jog switch counterclockwise to display the selection screen on the replacement period.

Click on the jog switch to change the selection screen to a flickering state. Then, turn the jog switch counterclockwise to reduce the period. Turn clockwise to extend the period.

With the replacement period change being completed, click on the jog switch to create a pop-up window to select the period change.

Turn the jog switch to locate it at YES. Then, click on the jog switch to change the replacement period.

Turn the jog switch to locate it at NO. Then, click on the jog switch to allow the pop-up window to disappear without the replacement period not being changed.



FG018486

Figure 102

Filter/Oil Period Setup Table

Unit: time (hr)

Kind	Replacement Period		
	Basic Setup Value	Minimum Available Setup Value	Change Value By Step
Fuel filter	500	100	50
Air cleaner	2,000	1,000	50
Engine oil filter	500	100	50
Return filter	1,000	100	50
Pilot filter	500	100	50
Engine oil	500	100	50
Hydraulic oil	2,000	1,000	50
Coolant water	2,000	1,000	50
DPF	4,500	100	50

Symbol Description

Filter/ Oil Name	Fuel Filter	Air Cleaner	ENG Oil Filter	Return Filter	Pilot Filter	ENG Oil	HYD. Oil	Coolant Water	DPF Filter
Icon									

FG024693

Figure 103

If the remaining time for filter/oil replacement is less than 10 hours, this pop-up window will be created. Press the ESC button or the jog switch to allow the pop-up window to disappear.

FG018516

Figure 104

If the filter/oil replacement period is expired, this pop-up window will be created.

Press the ESC button or the jog switch to allow the pop-up window to disappear.

FG018515

Figure 105

If the filter/oil replacement period is exceeded, this pop-up window will be created. Press the ESC button or the jog switch to allow the pop-up window to disappear.

WARNING

AVOID DEATH OR SERIOUS INJURY

Do not use vehicle state menu when traveling or operating.

FG018517

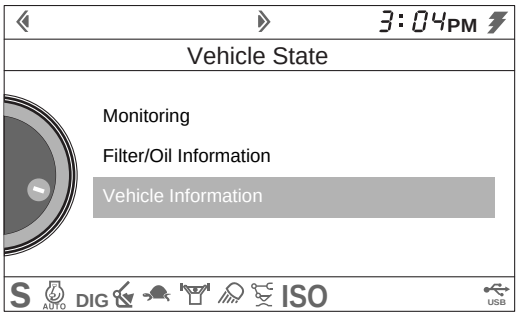
Figure 106

C. Vehicle Information

This is used to check the vehicle name, engine type and attachment options.

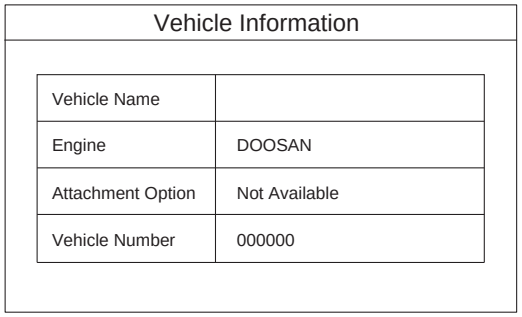
At the vehicle state, if the cursor is placed on the vehicle information, click the jog switch to access the vehicle information screen.

Click the ESC button to return to the previous screen.



FG018482

Figure 107



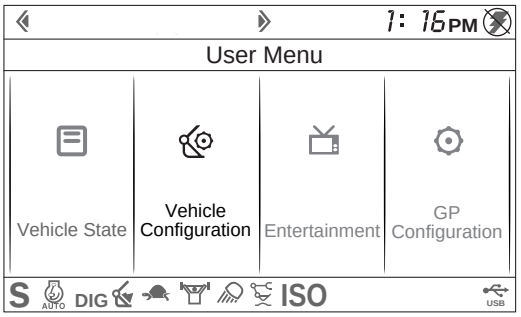
FG024557

Figure 108

2. Vehicle Configuration

This is used when selecting the functions such as attachment select, attachment setting, camera setting, and jog shuttle for dial.

Turn the jog switch and move the cursor to see an reversed display on the desired menu. Then, click the jog switch to select the menu.

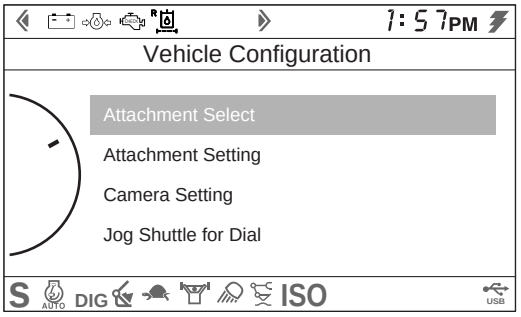


FG018488

Figure 109

Attachment Select ↔ Attachment Setting ↔ Camera Setting ↔ Jog Shuttle for Dial

Press the ESC button to return to the previous screen.



FG018489

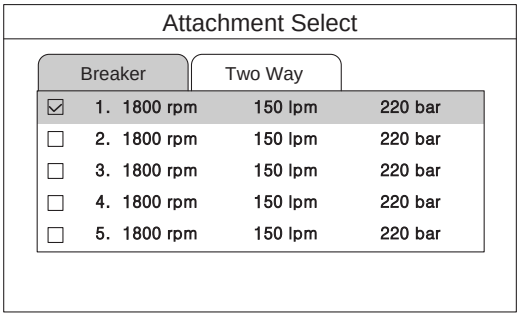
Figure 110

A. Attachment Select (Optional)

The attachment select screen is used to select attachments among the already setup available attachments.

At the vehicle configuration, if the cursor is placed on the attachment select, click on the jog switch to access the attachment select screen.

Press the ESC button to return to the previous screen.



FG020156

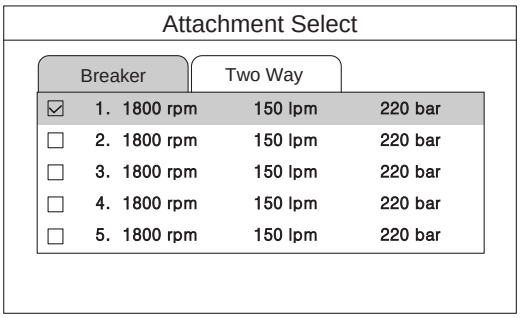
Figure 111

How to Select Attachments

When you access the attachment select screen, the initial screen locates the cursor at breaker/two-way at the top.

Operate the jog switch clockwise/counterclockwise to select breaker/two-way. Then, click on the jog switch to move the cursor to the selectable lists.

When the cursor is placed on the list, operate the jog switch clockwise/counterclockwise to move the cursor. Then, click on the jog switch to select attachments to use.

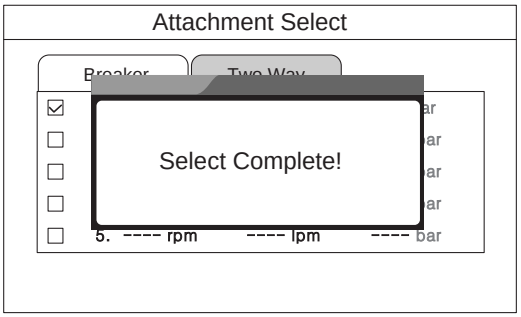


FG020156

Figure 112

When the selection is completed, the "Select Complete!" pop-up window is displayed for 3 seconds, and the checkbox of the selected list is updated.

The cursor can only be moved from the selectable lists. The selectable list items at the attachment setting are set as "Enable" in the use or non-use of attachments in the attachment setting.



FG020153

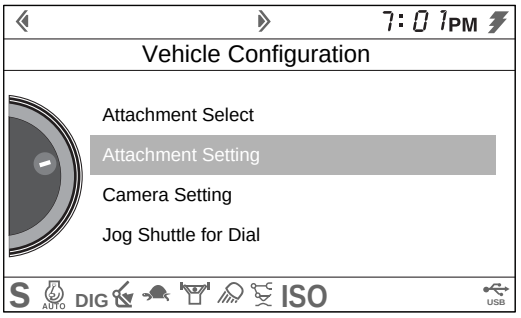
Figure 113

B. Attachment Setting

The attachment setting screen is used to set up the use or non-use of attachments, max. engine limit, and max. attachment flow rate, etc.

At the vehicle configuration, when the cursor is placed on attachment setting, click on the jog switch to access the attachment setting list screen.

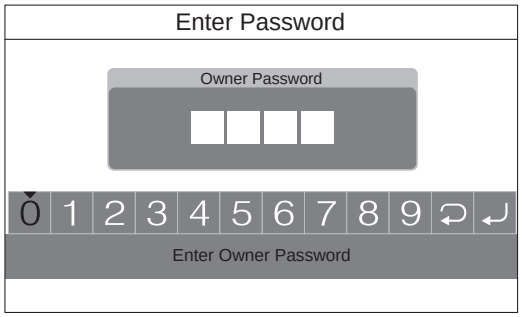
If the system is set up as the owner's password locked, Access the attachment setting list screen by using owner's password input screen.



FG018493

Figure 114

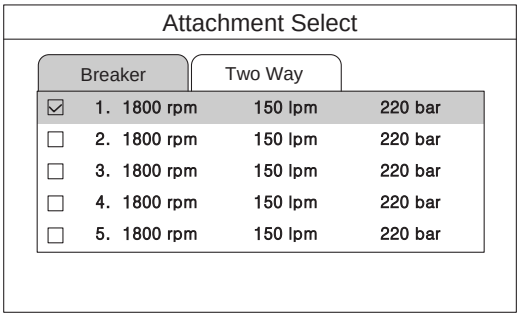
On the owner's password input screen, press the ESC button to return to the previous screen.



FG018474

Figure 115

If you access the attachment setting list screen, the initial screen locates the cursor at breaker/two-way at the top.



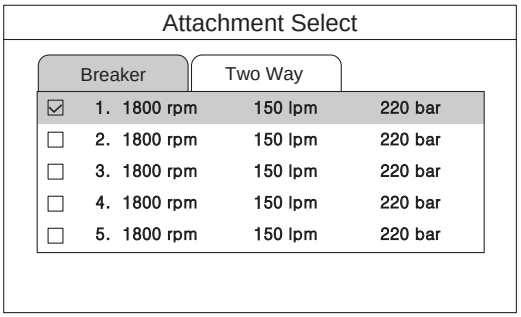
FG020156

Figure 116

Operate the jog switch clockwise/counterclockwise to select breaker/two-way. Then, click on the jog switch to move the cursor to the attachment list.

When the cursor is placed on the list, operate the jog switch clockwise/counterclockwise to move the cursor. Then, click on the jog switch to select the attachments to be set up and move to the attachment setting screen.

On the attachment setting list screen, when cursor is placed on the list, press the ESC button to locate the cursor at breaker/two-way at the top. When the cursor is placed at breaker/two-way at the top, press the ESC button to return to the previous screen.



FG020156

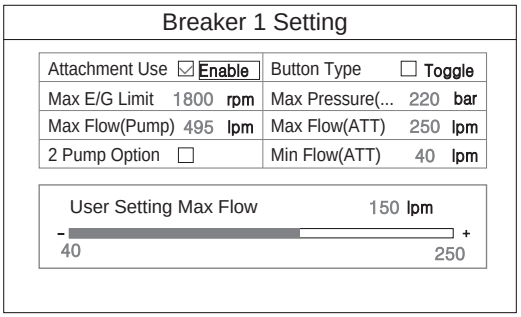
Figure 117

How to Set Up Attachments

Attachment setting items include attachment use, max E/G limit, max pressure (ATT), max flow (ATT), min flow (ATT), and user setting max flow. Operate the jog switch clockwise/counterclockwise to locate the cursor. Then, click on the jog switch to set up relevant items.

The cursor movement order goes like this:

Attachment Use ↔ Toggle ↔ Max E/G Limit ↔ Max Pressure ↔ Max Flow ↔ Min Flow ↔ User Setting Max Flow



FG019412

Figure 118

Attachment Use

The attachment use is designed to determine whether relevant attachments are used or not. If set up as enable, the relevant attachment can be used. If set up as disable, the relevant attachment cannot be used. Locate the cursor at the attachment use. Then, click on the jog switch to set up enable/disable.

NOTE: *If you select an attachment set up as disable, the pop-up window "Currently Used Item!" is displayed for three (3) seconds disabling the setup.*

NOTE: *If an attachment is enabled it can be a selectable attachment in the attachment select.*

Toggle

This item sets the applicability of the toggle of breaker button.

If toggle is selected, the breaker will continue operation when the breaker button is pressed once, and reset when pressed again.

If the toggle is released, the breaker is actuated while the breaker button is being pressed.

Max E/G Limit

The max E/G Limit is set up to define the flow rate limit discharged when using attachments.

Operate the jog switch to move the cursor to the max E/G limit. Then, click on the jog switch to convert into the editing mode.

At the editing mode, operate the jog switch clockwise/ counterclockwise to determine the desired max. engine limit. Then, click the jog switch to complete setup.

At the editing mode, press the ESC button to disable the editing mode and the saving of the setup value.

The change value by stage in the jog switch operation is 100 rpm.

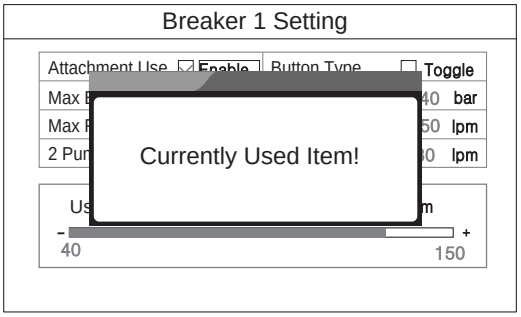
Max Pressure (ATT)

The max pressure (ATT) can be set up as the max pressure of the attachment by the user according to the attachment's specifications.

Max Flow (Pump)

The max flow (pump) is the pump's max. flow rate discharged when using attachments.

It needs not to be set up by the user, and it is automatically determined according to the max. engine limit setup value.



FG018497

Figure 119

Max Flow (ATT)/Min Flow (ATT)

The max flow (ATT) /min flow (ATT) can be set up as the max/min flow rate value of the attachment by the user according to the attachment's specifications.

For instance, if the relevant attachment's use capacity is 90 - 120 lpm (23.8 - 31.7 gpm), the user can set up 120 lpm (31.7 gpm) for the max. flow rate, and 90 lpm (23.8 gpm) for the min. flow rate.

The setup method is the same as the above max. engine limit setup method. The change value by stage in the jog switch operation is 10 lpm (2.6 gpm).

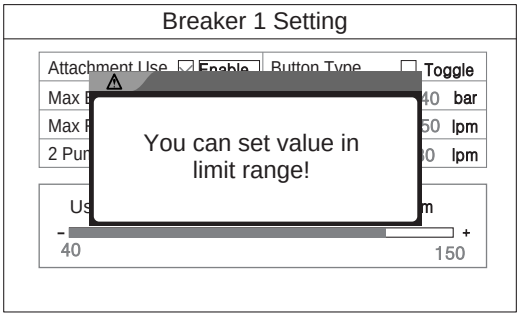
User Setting Max Flow

The user setting max flow is designed to set up the flow rate segment of the attachment to be used by the user.

Within the above setup max. flow rate (pump), max. flow rate (ATT), and min. flow rate (ATT) scope, the user can set up the max. flow rate value of the attachment to be used.

The setup method is the same as the above max. engine limit setup method. The change value by stage in the jog switch operation is 10 lpm (2.6 gpm).

When setting up all above items, the setup limits are outlined as follows. If these limits are exceeded, a pop-up window is displayed for 3 seconds, saying "You can set value in limit range!".



FG018498

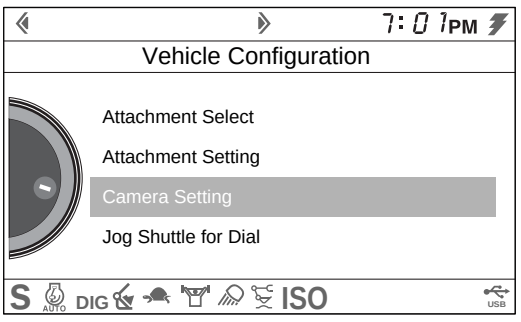
Figure 120

	Max. Limit	Min. Limit
Max E/G Limit	1,500 rpm	1,000 rpm
Max Flow (Pump)	Conforms to the max. engine limit	Conforms to the max. engine limit
Max Flow (ATT)	1,000 lpm (264.2 gpm)	Min. flow rate (ATT) + 10 lpm (2.6 gpm)
Min Flow (ATT)	40 lpm (10.6 gpm)	Of the max. flow rate (pump/ATT), the smaller value - 10 lpm (2.6 gpm)

C. Camera Setting

The camera setting screen is designed to set up various cameras "ON/OFF" and normal/mirror.

From the vehicle configuration, select camera setting to access the camera setting list screen.



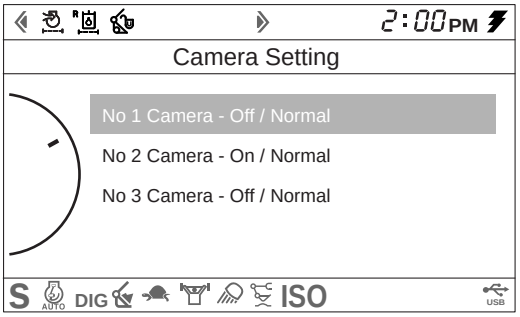
FG018499

Figure 121

The camera setting list screen displays various camera states (ON/OFF, NORMAL/MIRROR).

Select a camera and click the jog switch to access the relevant camera setting screen.

Press the ESC button to return to the previous screen.

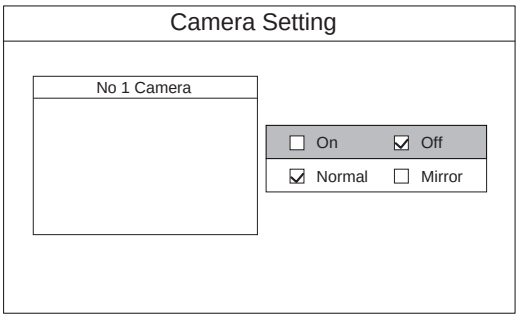


FG018500

Figure 122

On the camera setting screen, set up the camera state (ON/OFF, NORMAL/MIRROR).

Also, see the actual image of the currently installed camera.



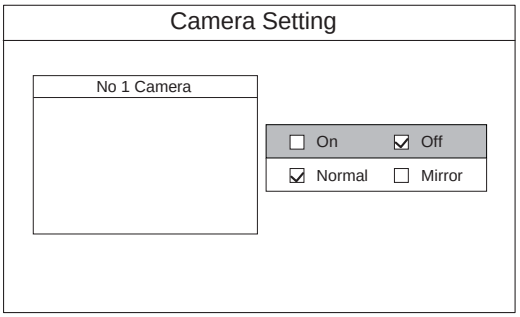
FG018501

Figure 123

If a camera is not installed, the camera image section is shown as a blue screen.

If the cursor is placed on "ON/OFF", click on the jog switch to set up "ON" ↔ "OFF".

Turn the jog switch to locate the cursor at normal/ mirror. Then, click on the jog switch to set up normal ↔ mirror.



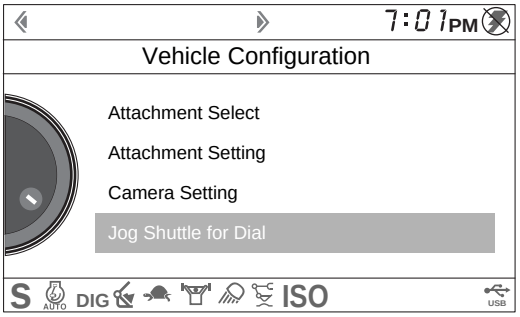
FG018501

Figure 124

D. Jog Shuttle for Dial

The jog shuttle for dial screen provides a method whereby to use the gauge panel's jog switch and control the engine rpm, replacing the engine control dial.

From the vehicle configuration, select the jog shuttle for dial to access it.

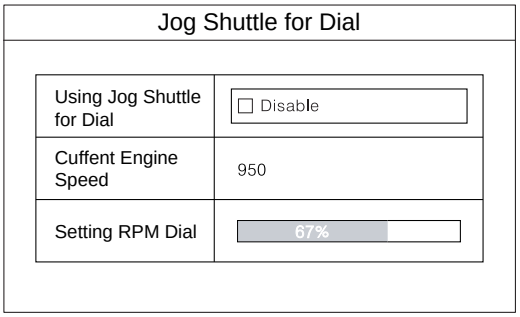


FG018502

Figure 125

If you access the jog shuttle for dial screen, the initial cursor is located at the using jog shuttle for dial.

If the using jog shuttle for dial is shown as disable, the cursor cannot be moved.



FG018503

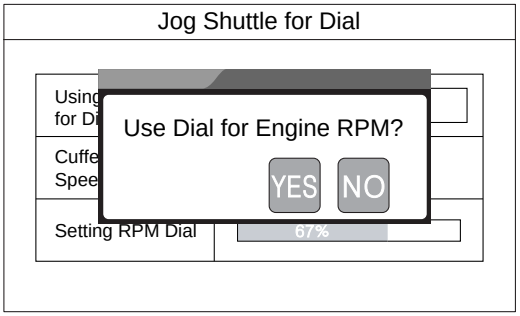
Figure 126

When the cursor is placed at the using jog shuttle for dial, if you click on the jog switch, a pop-up window will be created, saying "Use dial for engine rpm?".

Operate the jog switch and select "YES/NO" to determine whether to use jog shuttle for dial.

If you select "YES", then using jog shuttle for dial is enabled, causing the pop-up window to disappear.

If you select "NO", then using jog shuttle for dial remains disabled, causing the pop-up window to disappear.



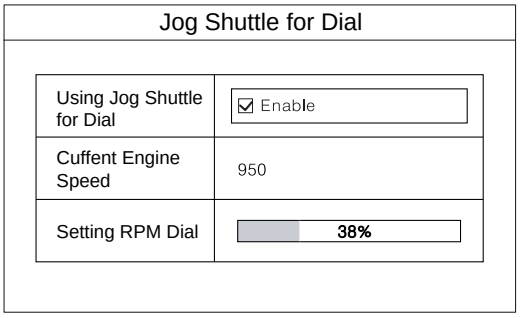
FG018504

Figure 127

If the using jog shuttle for dial is shown as enable, operate the jog switch clockwise and move the cursor to the setting rpm dial. When the cursor is placed at the setting rpm dial, click on the jog switch to cause the cursor to flicker, changing into an editing mode to set up the rpm dial. When the cursor is placed at the editing mode, operate the jog switch clockwise/ counterclockwise, thus setting up the engine rpm.

When the cursor is at the editing mode, press the ESC button to disable the editing mode. When the cursor is not at the editing mode, press the ESC button to return to the previous screen.

Before keying off the gauge panel or disabling the using jog shuttle for dial, control the engine rpm only with the shuttle of the gauge panel's jog shuttle.



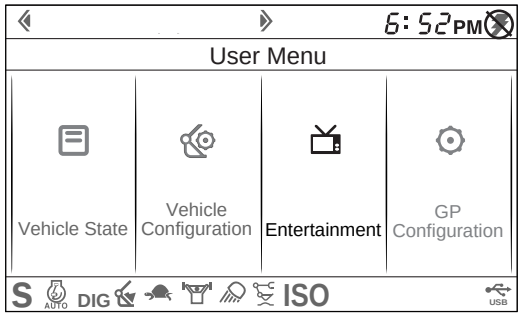
FG018505

Figure 128

3. Entertainment

This menu is used to replay videos and MP3.

Turn the jog switch and move the cursor to see a reversed display on the desired menu. Then, click on the jog switch to select the menu.

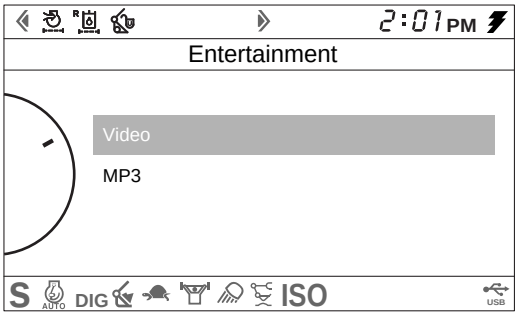


FG018506

Figure 129

Video ↔ MP3

Press the ESC button to return to the previous screen.



FG018507

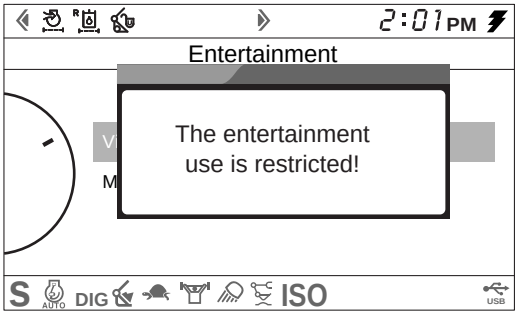
Figure 130

If the use of entertainment is limited, this pop-up window will be created.

To lift the use limits, you should change the limit setup in the GP configuration.

The pop-up window will automatically disappear in 3 seconds. Press the ESC button or the jog switch to remove pop-up window.

For details, See “GP Configuration” on page 2-62.



FG018514

Figure 131

If the use of entertainment is not limited, this pop-up window will be created. The pop-up window will automatically disappear in 3 seconds.

Press the ESC button or the jog switch to remove pop-up window.

WARNING

AVOID DEATH OR SERIOUS INJURY

Listening to entertainment clips, such as video, music, etc., can cause an accident, resulting in death or serious injury.

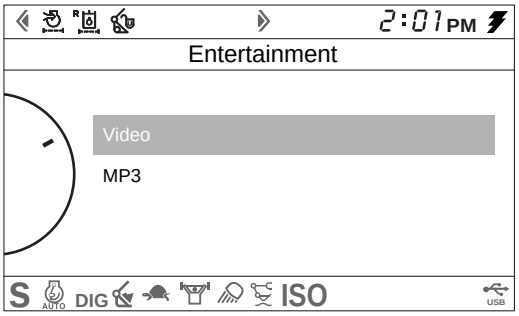
Do not play entertainment files when operating the machine.

FG018508

Figure 132

A. Video

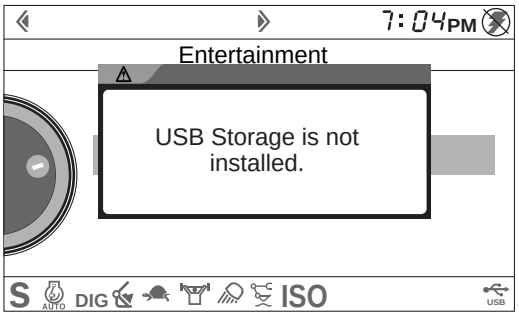
From the entertainment screen, select video to access it.



FG018507

Figure 133

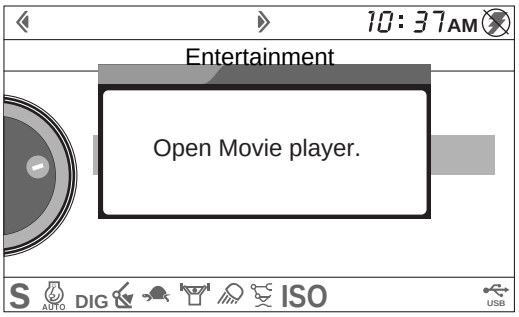
When there is no USB storage system, a pop-up window is displayed for 3 seconds, saying "USB" Storage is not installed". and the video is not played.



FG018510

Figure 134

When there is a USB storage system, a pop-up window will be created, saying "Open Movie player". and the video player is run.

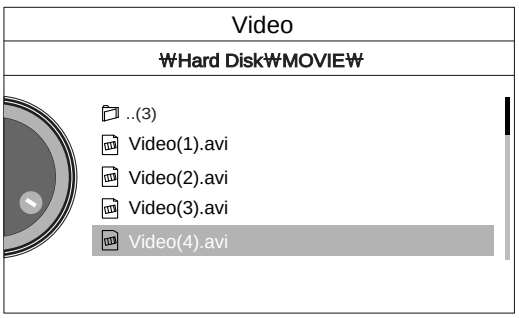


FG018513

Figure 135

When initially accessing the video player, the USB storage system file tree is displayed on the screen, operate the jog switch clockwise/counterclockwise to select and play a video.

If there is a video file that played last, it will automatically be replayed.



FG018511

Figure 136

If the format is not supported, a pop-up window is displayed for 3 seconds, saying "This file is not available!" and the video is not played.

FG020115

Figure 137

Formats that can be supported are given below.

Formats that can be supported	
File Type	AVI (DIVX), MP4, WMV (VERSION 8)
Supported Resolution	720*480, 720*384, 720*304, 704*448, 704*304, 640*480, 640*360, 640*272, 640*352, 672*288, 512*384, 576*432, 480*320, 480*360, 320*240
Supported Video Codec	H.264 (ITU H.264 BASELINE L1.3, L3.0), MPEG4, DIVX4.0, 5.0, WMV8, Xvid
Supported Audio Codec	MPEG L3, AAC
MP3 Bit Rate	128 - 320 Kbps
Supported File Size	Under 1.7 Gbyte

The screen composition of the video player is given below.

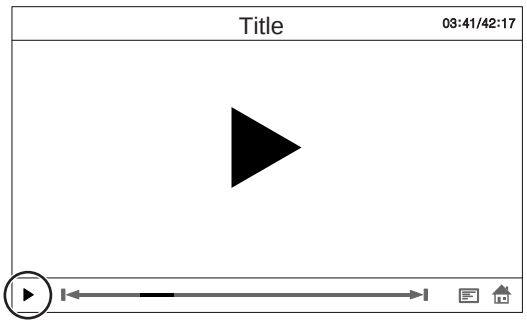
The top section displays the name of the file being played and the current playing time of the total playing time.

The screen center shows the video being played.

The bottom displays the video player function operation symbol and cursor.

The video player function operation symbol and jog switch are operated in the following order.

Play/Pause ↔ Replay the Previous File ↔ Video Progress Bar ↔ Replay the Next File ↔ Video Files List ↔ Adjust Video Brightness

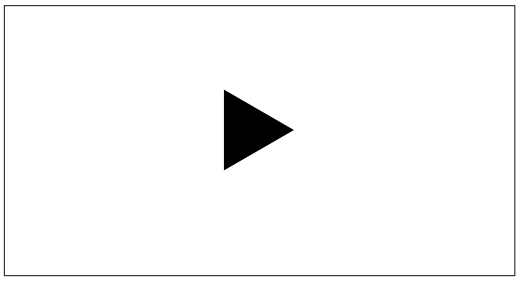


FG020116

Figure 138

If no operation continues for more than 5 seconds, the video will automatically be converted into the whole screen.

On the whole screen, click on the jog switch or the ESC button to remove whole screen.



FG018214

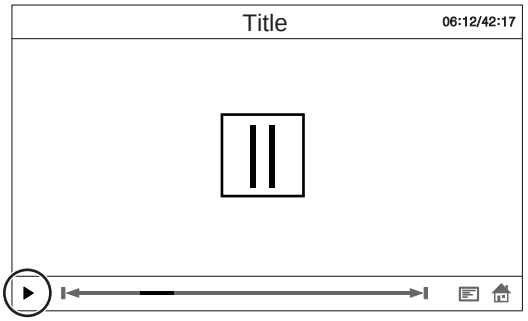
Figure 139

Play/Pause

Locate the cursor on the play/pause symbol and click on the jog switch to execute the video's play/pause functions.

With the play being on, click on the jog switch to display the pause symbol at the center of the screen, thus allowing the video to pause.

With the pause being on, click on the jog switch to cause the pause symbol at the center of the screen to disappear, resuming the video playing.

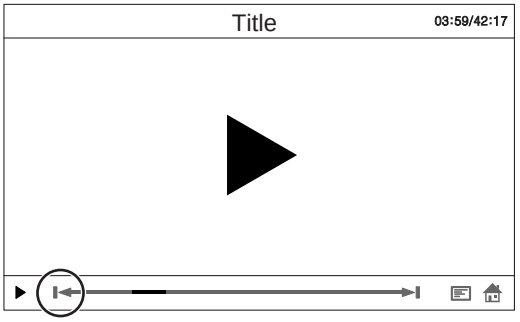


FG020117

Figure 140

Replay the Previous File

Locate the cursor at the replay the previous file symbol and click on the jog switch to replay the previous file.



FG020118

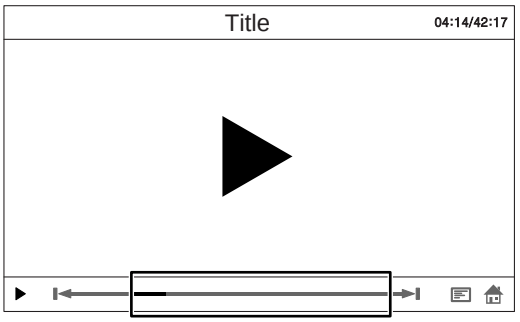
Figure 141

Locate the cursor at the video progress bar and click on the jog switch to convert into the fast winding/ rewinding mode.

On the fast winding/rewinding mode, operate the jog switch clockwise/counterclockwise to conduct fast winding/rewinding.

Fast winding/rewinding can be conducted at an interval of 30 seconds per click during which the jog switch is turned.

On the fast winding/rewinding mode, press the ESC button to disable the fast winding/rewinding mode.

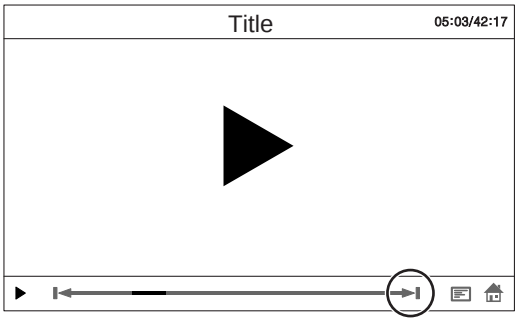


FG020119

Figure 142

Replay the Next File

Locate the cursor at the replay the next file symbol and click on the jog switch to replay the next file.

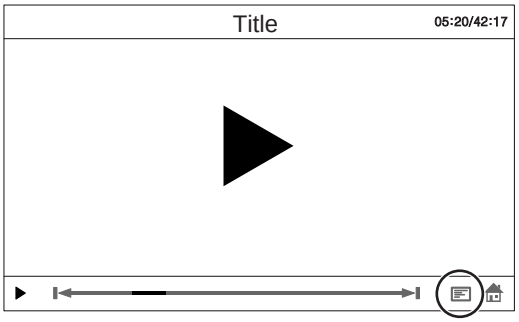


FG020120

Figure 143

Video Files List

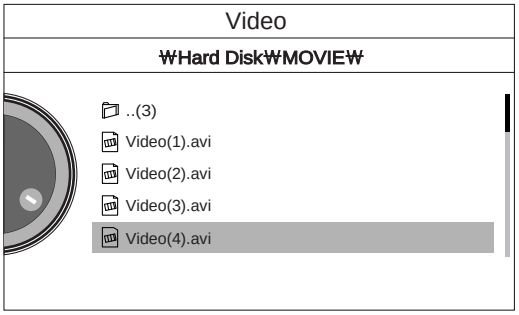
Locate the cursor at the video files list symbol and click on the jog switch to move to the video file list screen.



FG020121

Figure 144

Select and replay a video.



FG018557

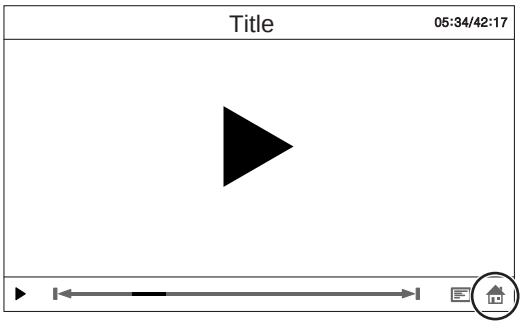
Figure 145

Set Up Video Brightness

Move the cursor to the set up video brightness symbol and click on the jog switch to create the video brightness setup window.

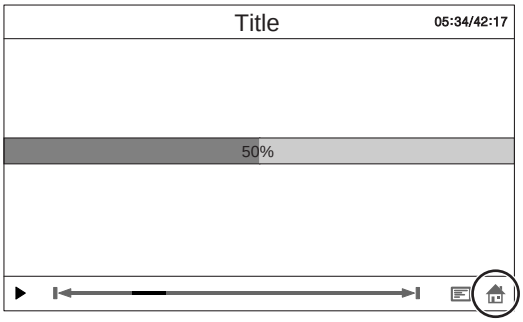
With the video brightness setup window being created, operate the jog switch clockwise/ counterclockwise to set brightness.

After completing the setup, click on the jog switch to return to the previous screen.



FG020122

Figure 146

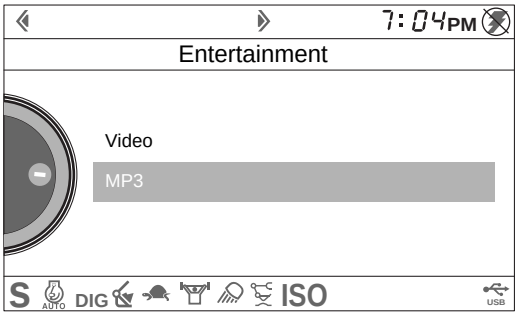


FG020123

Figure 147

B. MP3

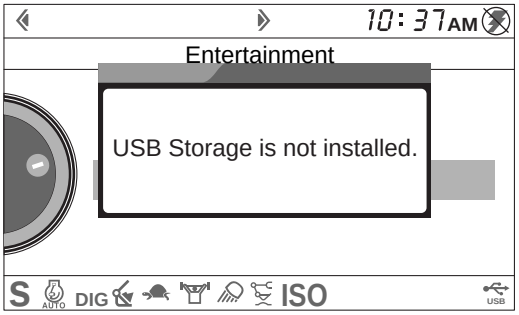
From the entertainment screen, select MP3 to access it.



FG018524

Figure 148

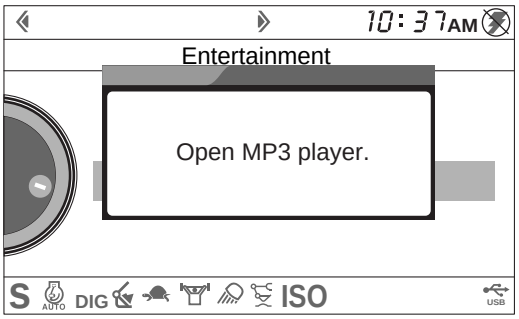
If there is no USB storage system, a pop-up window is displayed for 3 seconds, saying "USB Storage is not installed". and the MP3 player is not run.



FG018523

Figure 149

If there is a USB storage system, a pop-up window is created, saying "Open MP3 player". and the MP3 player is run.

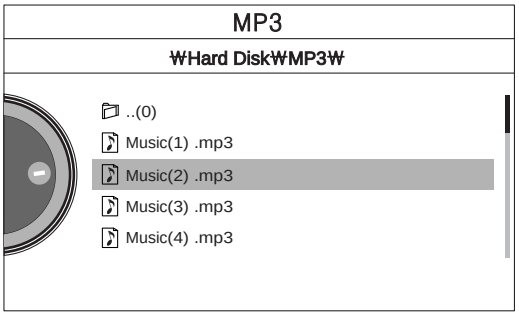


FG018520

Figure 150

When initially accessing the MP3 player, the file tree screen of USB storage system is displayed. Operate the jog switch clockwise/counterclockwise to select and play an MP3 file.

If there is an MP3 file played last, the file will automatically be played.



FG018560

Figure 151

The screen composition of MP3 player is given below.

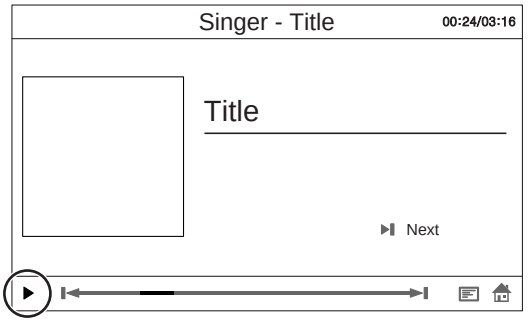
The top section displays the name of the file being played and the current playing time of the total playing time.

The screen center shows the album image of the file being played, the album name, the song name and the name of the next file to be played.

The bottom displays the MP3 player function operation symbol and cursor.

The MP3 player function operation symbol and jog switch are operated in the following order.

Play/Pause ↔ Replay the Previous File ↔ MP3 Progress Bar ↔ Replay the Next File ↔ MP3 Files List ↔ Background MP3 Play



FG020124

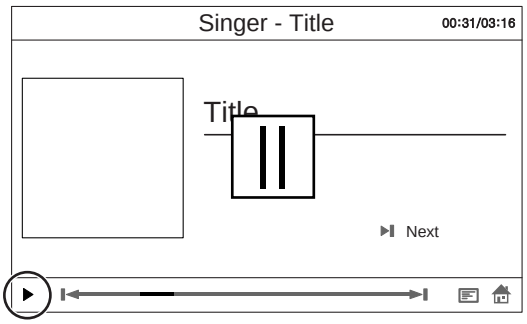
Figure 152

Play/Pause

Locate the cursor at the play/pause symbol and click on the jog switch to execute the MP3 play/pause functions.

With play being on, click the jog switch to display the pause symbol at the center of the screen, causing the MP3 to pause.

With pause being on, click on the jog switch to cause the pause symbol at the center of the screen to disappear, resuming the MP3 playing.

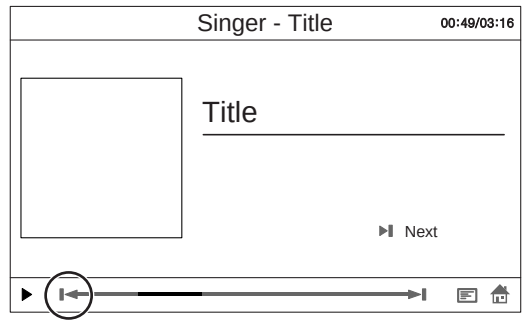


FG020125

Figure 153

Replay the Previous File

Locate the cursor at the replay the previous file symbol, and click on the jog switch to replay the previous file.



FG020126

Figure 154

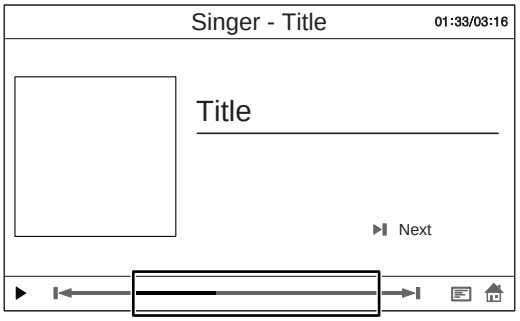
Fast Winding/Rewinding

Locate the cursor at the video progress bar and click on the jog switch to convert into the fast winding/ rewinding mode.

On the fast winding/rewinding mode, operate the jog switch clockwise/counterclockwise to conduct fast winding/rewinding.

Fast winding/rewinding can be conducted at an interval of 30 seconds per click during which the jog switch is turned.

On the fast winding/rewinding mode, press the ESC button to disable the fast winding/rewinding mode.

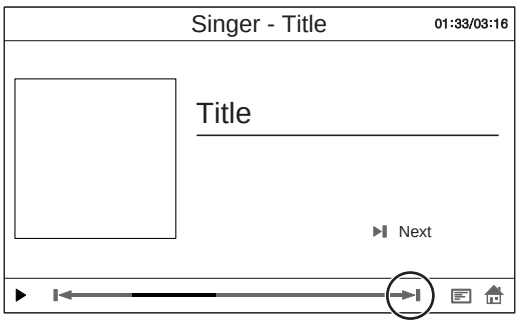


FG020127

Figure 155

Replay the Next File

Locate the cursor at the replay the previous file symbol and click on the jog switch to replay the next file.

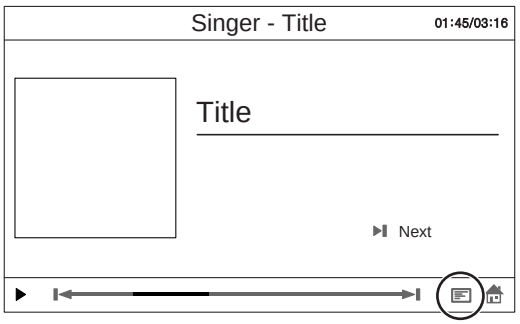


FG020128

Figure 156

MP3 Files List

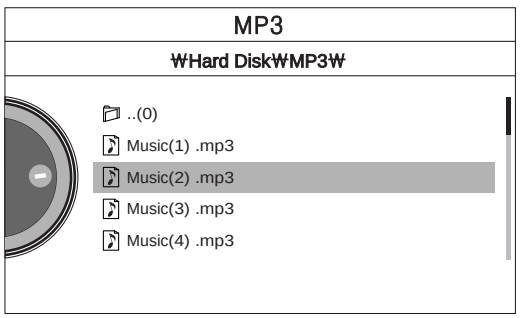
Locate the cursor at the MP3 files list symbol and click on the jog to move to the file list screen.



FG020129

Figure 157

Select a file and replay the MP3.

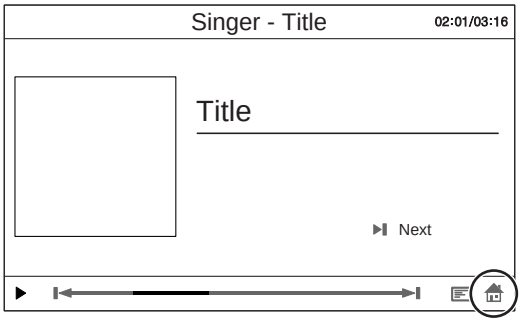


FG018560

Figure 158

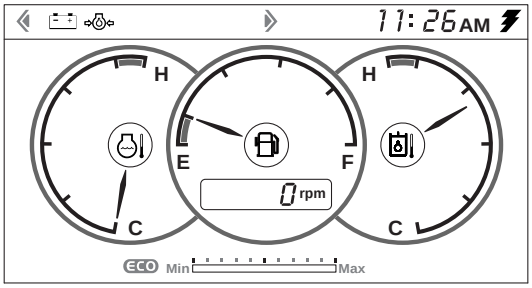
Background MP3 Play

Position the cursor on the "HOME" button and pressing the jog switch, MP3 is played by the initial screen.



FG020130

Figure 159



FG018118

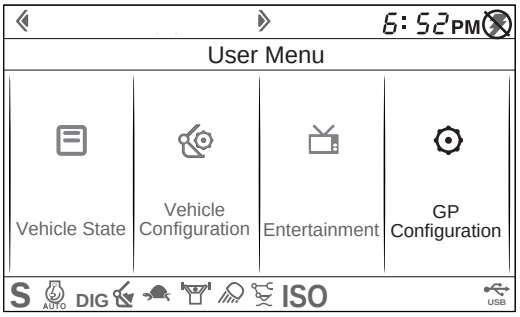
Figure 160

4. GP Configuration

This menu is used to set up password, brightness, default screen and time, and to input service phone number. Turn the jog switch and move the cursor to see an reversed display on the desired menu. Then, click on the jog switch to select the menu.

Password Setting ↔ Brightness Setting ↔ Default Screen Setting ↔ Time Setting ↔ Service Phone Number Setting ↔ Unit Setting ↔ Language Setting ↔ Notification Setting ↔ Entertainment Use Setting

Press the ESC button to return to previous screen.



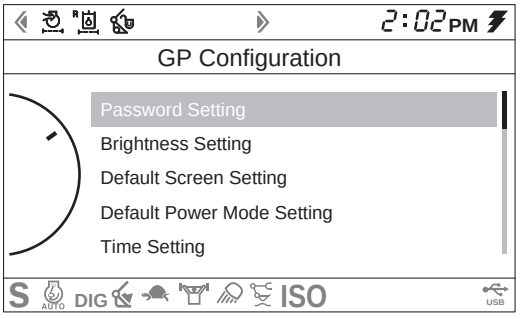
FG018521

Figure 161

A. Password Setting

This function is used to set up a user password or an administrator password.

If the password setting function is used, the password must be correctly input to operate the vehicle normally.



FG022138

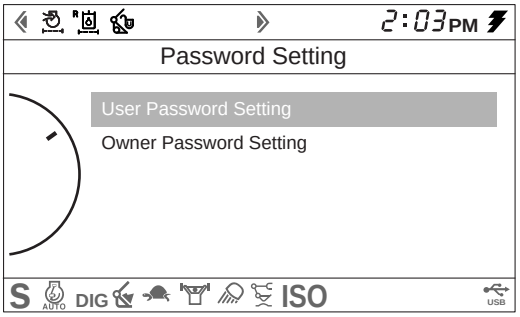
Figure 162

User Password Setting

On the password setting screen, when cursor is placed on the user password setting, click on the jog switch to display the password input screen that was set up at the initial release time. The initial password is set as "1111".

The password input is possible within 10 minutes of turning "ON" the starter switch.

If you have changed the password, you should input it.

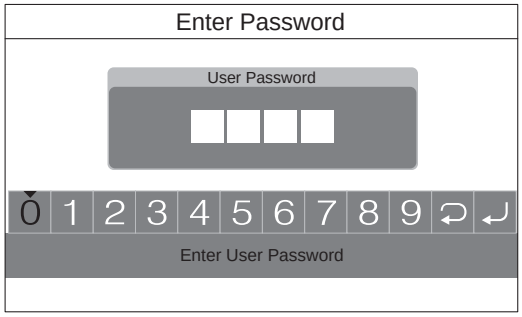


FG018525

Figure 163

IMPORTANT

If password input errors have been made three times in a row, the screen will move to the default screen. After that, starting will be locked for 10 minutes.



FG018473

Figure 164

How to Input Password

Turn the jog switch and select numbers of 0 - 9 at the bottom. Then, click on the jog switch and input a password.

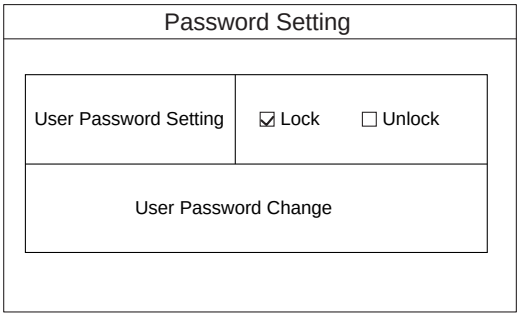
If you erroneously input a password, select ⮌ key at the right bottom and click on the jog switch to delete the input password.

On the password setting screen, input a password to display a screen to select the application of function (lock), non-application (unlock) and password change.

Turn the jog switch and move the cursor to a target. Then, click on the jog switch to move to the relevant function or a selected screen.

Press the ESC button to return to the previous screen.

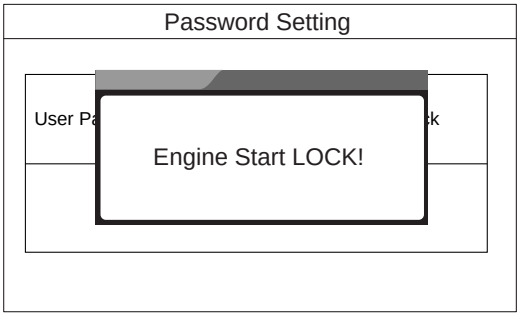
Select the lock (applied) or unlock (not applied) in the password setting to enable or disable the password setting function accordingly.



FG018526

Figure 165

If you select lock (applied) in the password setting, this pop-up window will appear to confirm the lock setup and will automatically disappear in 3 seconds.

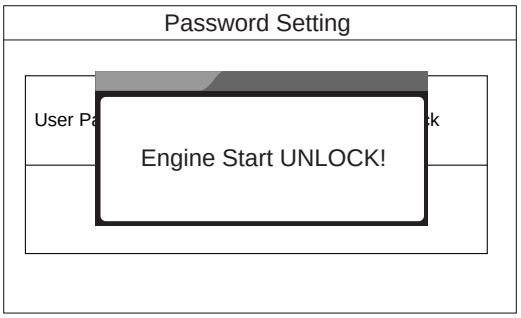


FG018527

Figure 166

If you select unlock (not applied) in the password setting, this pop-up window will appear to confirm the unlock setup and will automatically disappear in 3 seconds. If you want to change your password, please change it on the password setting screen according to the following procedure.

1) Select password change.
2) Input a new four-digit password (repeat it twice).
3) On the password setting screen, select lock (applied) or unlock (not applied).



FG018528

Figure 167

IMPORTANT

Be careful not to forget your password.

If you have forgotten your password, contact a DOOSAN distributor.

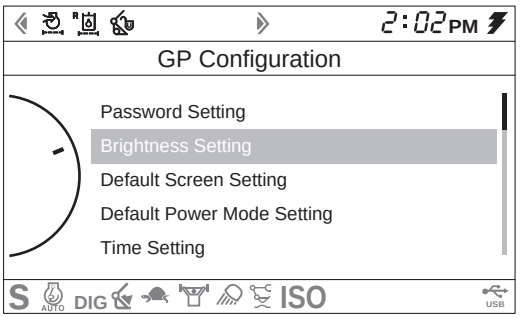
In the case of owner password setting, setting procedure is same with the user password setting.

The owner password setting will determine the password lock and unlock in the attachment setting.

B. Brightness Setting

On the GP configuration screen, when cursor is placed on the brightness setting, click on the jog switch to display the screen brightness setting and camera brightness setting screen.

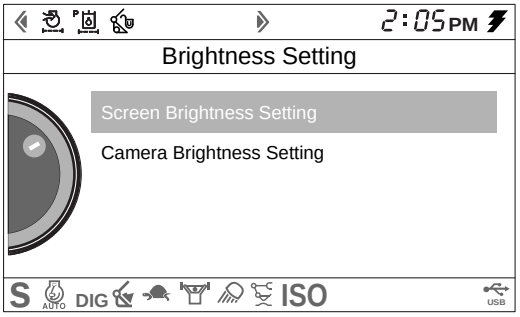
Brightness can be set up in two ways, day/night.



FG022139

Figure 168

If you want to change the screen brightness, select the screen brightness setting to display the brightness adjustment screen.



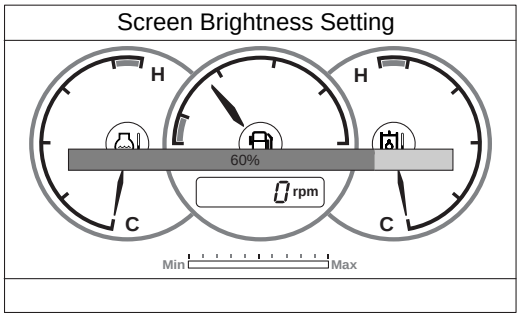
FG018530

Figure 169

Turn the jog switch and adjust the brightness of 0 - 100% at an interval of 10%.

The screen brightness when manufactured is set as 60%.

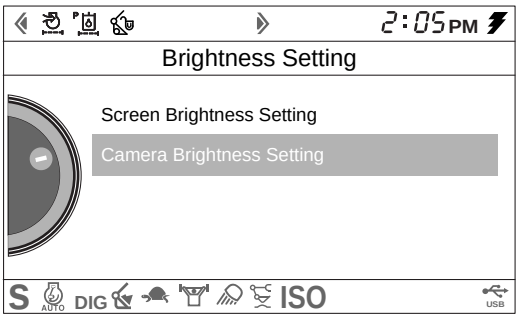
Press the ESC button to return to the previous screen.



FG018532

Figure 170

If you want to change the camera screen brightness, select the camera brightness setting to display the camera screen brightness adjustment screen.



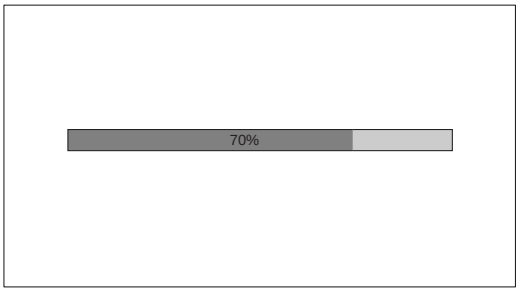
FG018531

Figure 171

Turn the jog switch to adjust the brightness of 0 - 100% at an interval of 10%.

The camera screen brightness at the vehicle release time is set as 60%.

Press the ESC button to return to the previous screen.



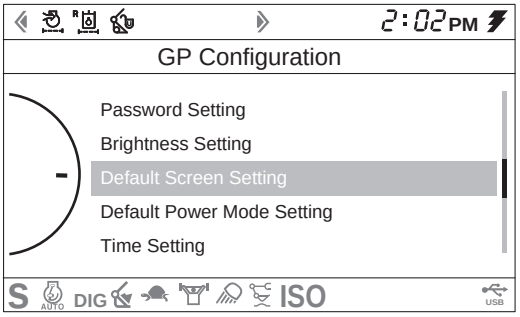
FG018244

Figure 172

C. Default Screen Setting

On the GP configuration screen, when cursor is placed on the default screen setting, click on the jog switch to access the default screen setting.

On the default screen setting, turn the jog switch and locate the cursor at a desired style. Then, click on the jog switch to select the style.

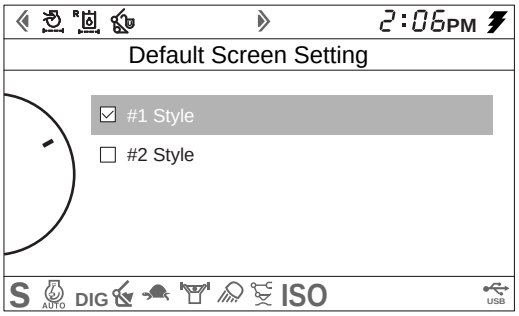


FG022140

Figure 173

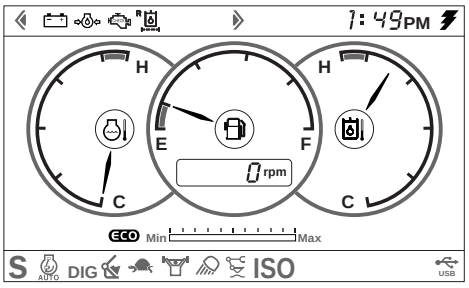
The selected style screen is displayed as the normal display screen.

The screen when manufactured is set as #1 style.

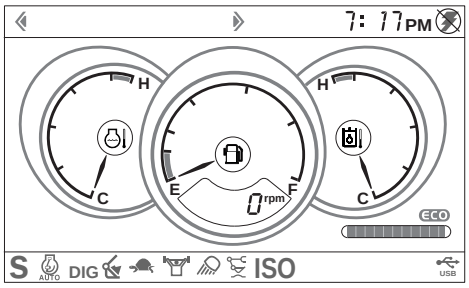


FG018536

Figure 174



<1 Style>



<2 Style>

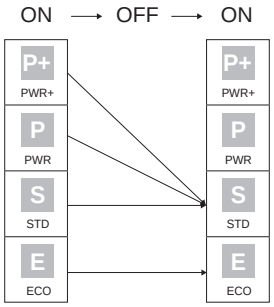
FG018537

Figure 175

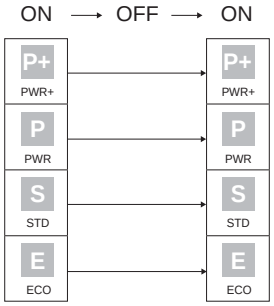
D. Default Power Mode Setting

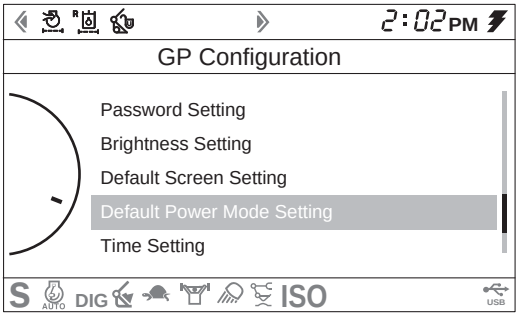
On the GP configuration screen, when cursor is placed on the default power mode setting, click on the jog switch to access the default power mode setting.

Fuel Saving Mode is Enable



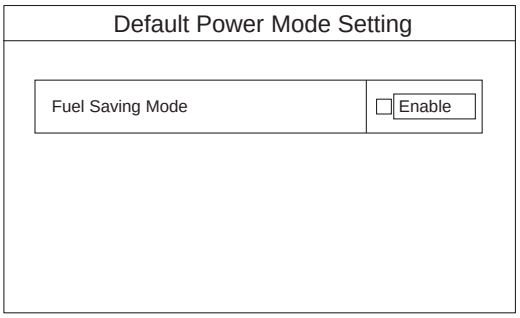
Fuel Saving Mode is Disable





FG022141

Figure 176



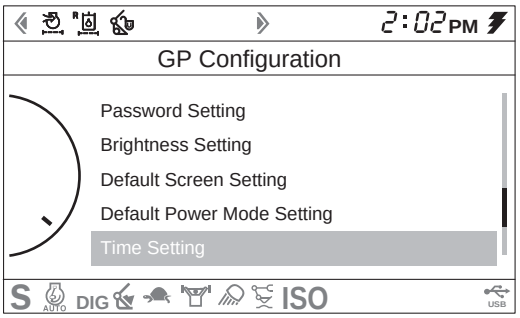
FG022142

Figure 177

E. Time Setting

On the GP configuration screen, when cursor is placed on the time setting, click the jog switch to access the time setting.

Turn the jog switch and locate the cursor at a target of change. Then, click on the jog switch to change the target.



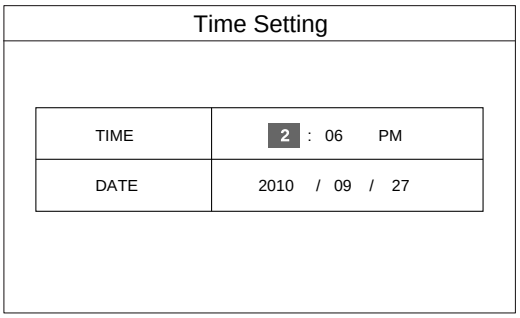
FG022144

Figure 178

Turn the jog switch to change numbers of each item.

If the setup is completed, click on the jog switch to store the setup details.

Press the ESC button to return to the previous screen.

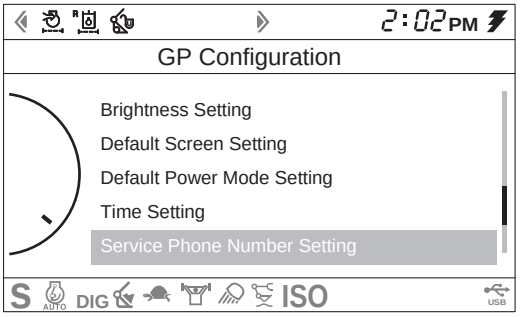


FG018538

Figure 179

F. Service Phone Number Setting

On the GP configuration screen, when cursor is placed on the service phone number setting, click on the jog switch to access the service phone number setting.

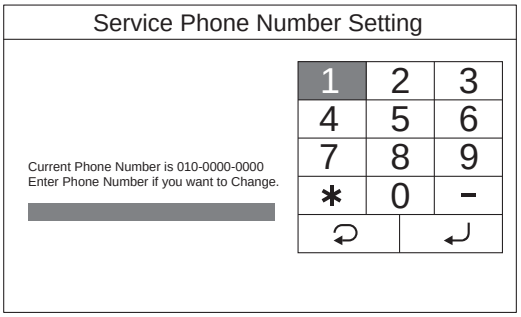


FG022145

Figure 180

Turn the jog switch and locate the cursor at a desired number. Then, click on the jog switch to input the number. If number input is completed, press the ↵ key to enter the input phone numbers.

Use the ↩ key and delete erroneously input numbers.



FG018539

Figure 181

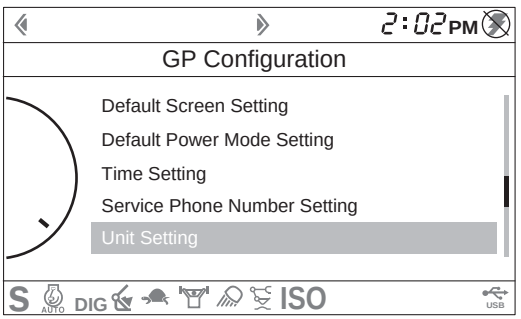
When you input service phone numbers, if warning/ alarm is issued, check the input phone numbers in the pop-up window.

FG018590

Figure 182

G. Unit Setting

On the GP configuration screen, when cursor is placed on the unit setting, click the jog switch to access the unit setting.



FG022146

Figure 183

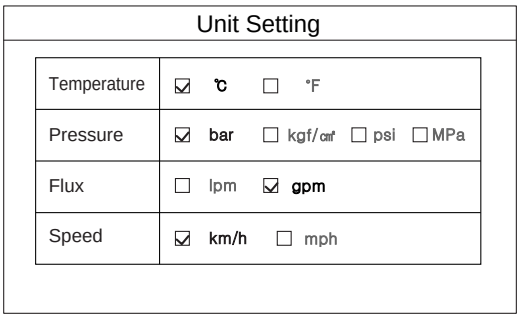
On the unit setting screen, change the units of temperature, pressure, flow rate, and speed. These figures at the vehicle release time are set as below:

Temperature: °C

Pressure: bar

Flow rate: gpm

Speed: km/h

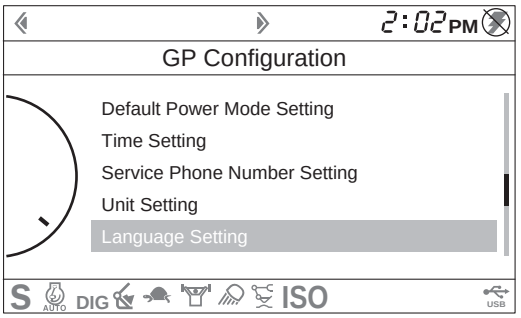


FG018546

Figure 184

H. Language Setting

On the GP configuration screen, when cursor is placed on the language setting, click on the jog switch to access the language setting.

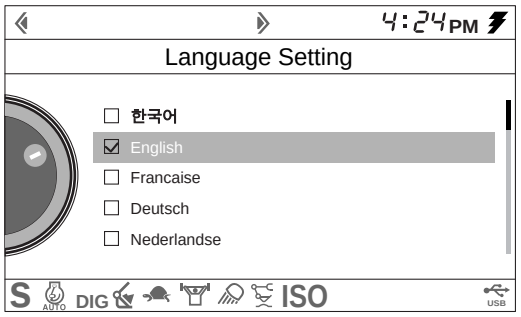


FG022147

Figure 185

On the language selection screen, turn the jog switch and move the cursor to select a language. Then, click on the jog switch to adopt the selected language.

Press the ESC button to return to the previous screen.

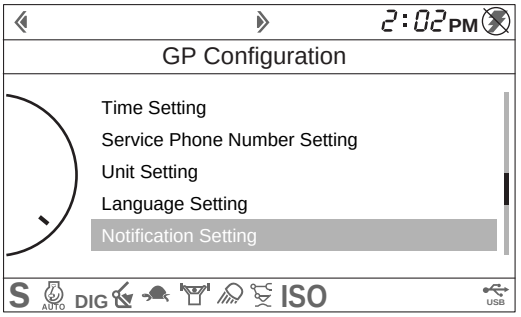


FG018544

Figure 186

I. Notification Setting

On the GP configuration screen, when cursor is placed on the notification setting, click on the jog switch to access the notification setting.



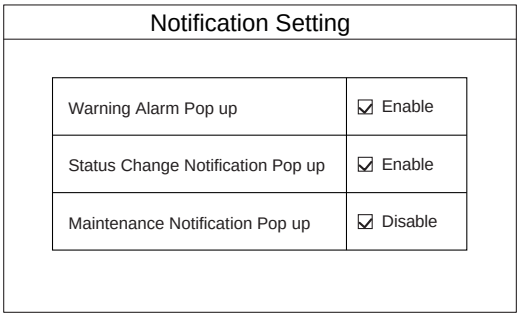
FG018542

Figure 187

Depending on the notification setting screen details, pop-ups are created or not created on the main screen when warning/alarm is issued, when the switch is operated, and when the supplies replacement period expires.

On the notification setting screen, turn the jog switch and move the cursor to a desired location. Then, click on the jog switch to select enable or disable.

All notice items at the vehicle release time are set as Enable.

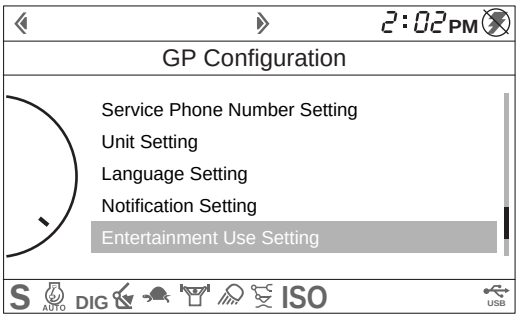


FG018545

Figure 188

J. Entertainment Use Setting

On the GP configuration screen, when the cursor is placed on the entertainment use setting, click on the jog switch to access the entertainment use setting.

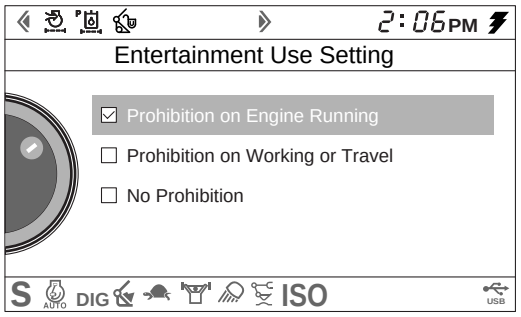


FG018543

Figure 189

Depending on the entertainment use setting details, the use of video and MP3 is limited.

The setup when manufactured is set as not limited.



FG018547

Figure 190

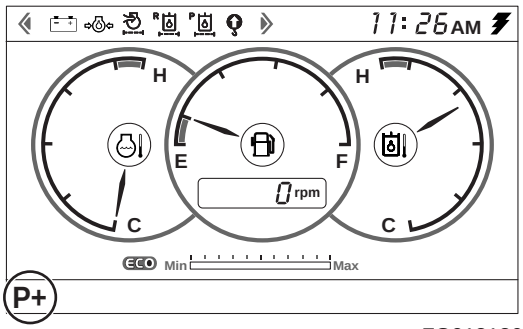
Switch Operation Indication

Enable

During the operation of switches for pressure increase, breaker, shear, travel, working light, parking, ram lock and quick coupler, this function indicates a relevant switch symbol at the left top or bottom. It displays the operation state on the screen.

Operation Indication Examples

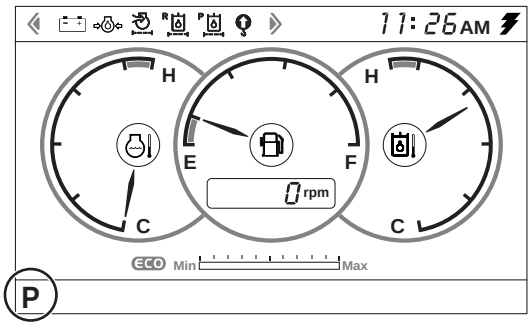
1. Power Plus Mode Selection



FG018136

Figure 191

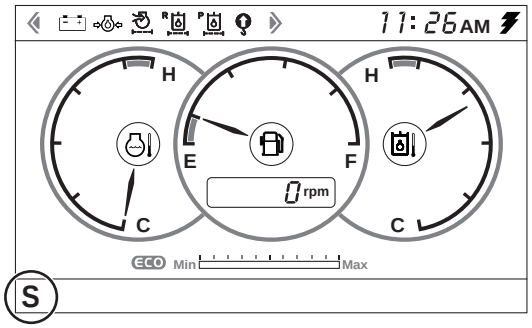
2. Power Mode Selection



FG018137

Figure 192

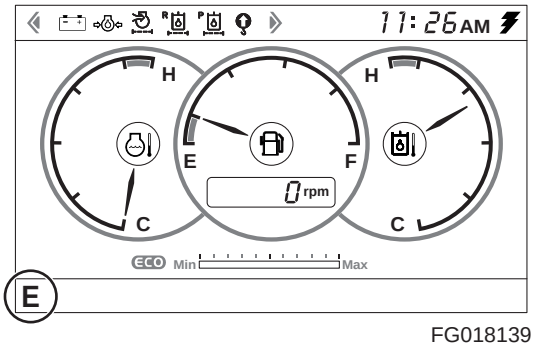
3. Standard Mode Selection



FG018138

Figure 193

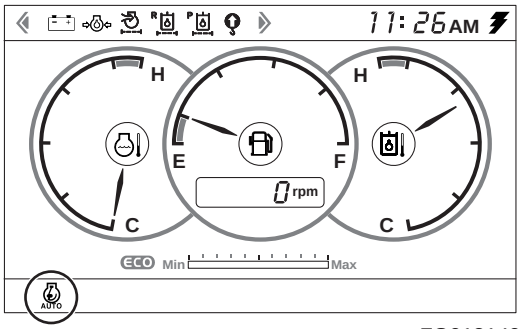
4. Economy Mode Selection



FG018139

Figure 194

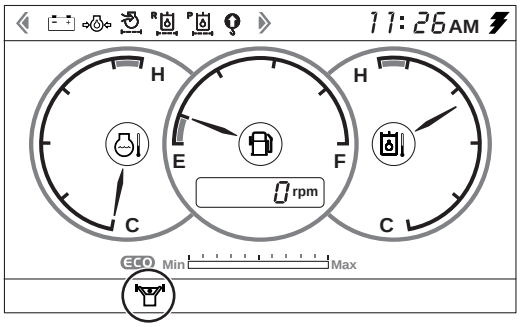
5. Auto Idle Selection



FG018140

Figure 195

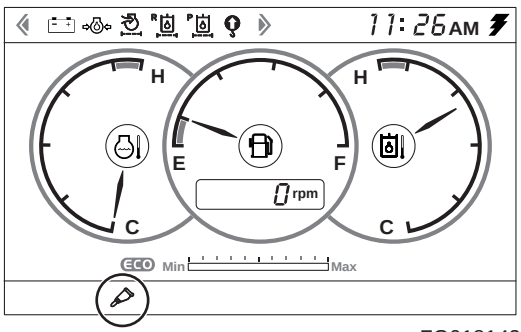
6. Power Boost Selection



FG018141

Figure 196

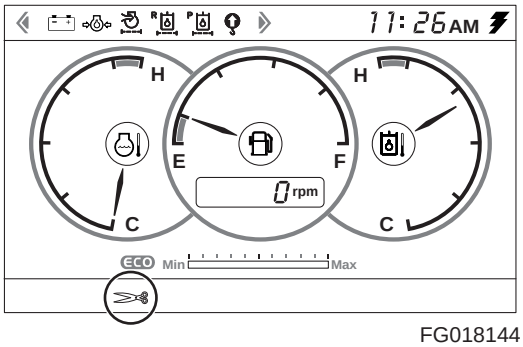
7. Breaker Selection



FG018142

Figure 197

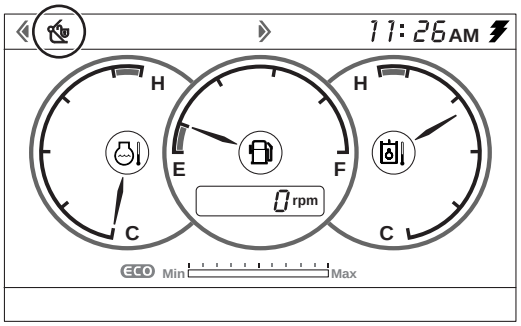
8. Shear Selection (Optional)



FG018144

Figure 198

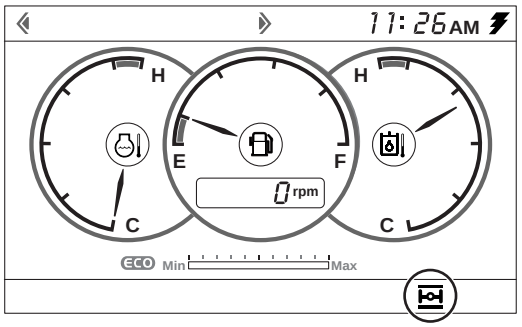
9. Quick Coupler Operation Selection (Optional)



FG018143

Figure 199

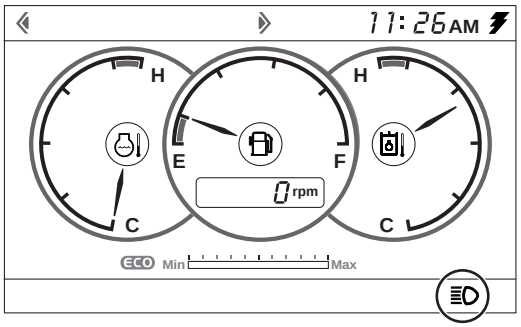
10. Ram Rock Operation Selection (Wheel Machine Only)



FG018264

Figure 200

11. High Beam Light Selection (Wheel Machine Only)

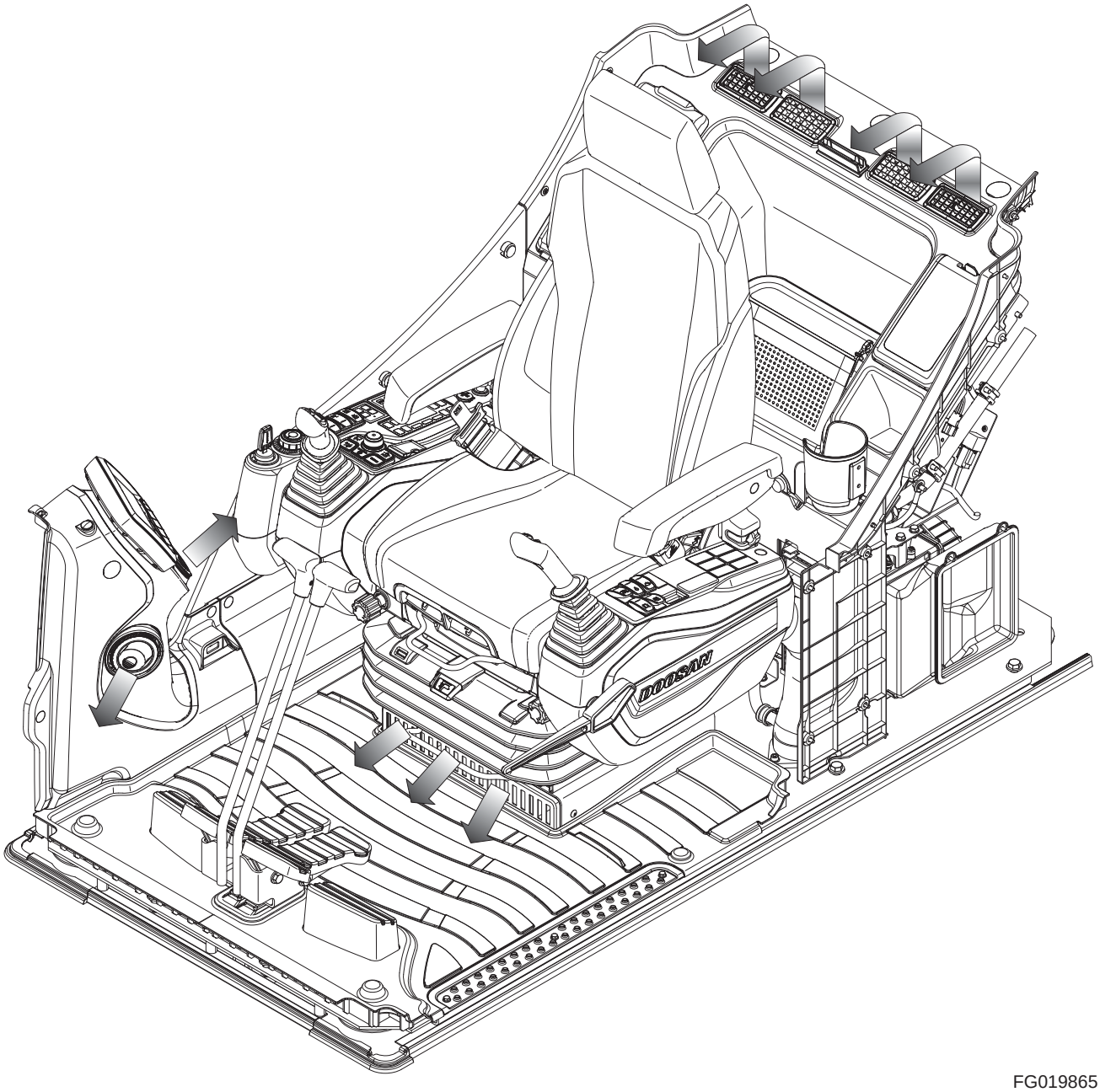


FG018265

Figure 201

HEATER AND AIR CONDITIONER CONTROL PANEL

Location of Controls and Vents



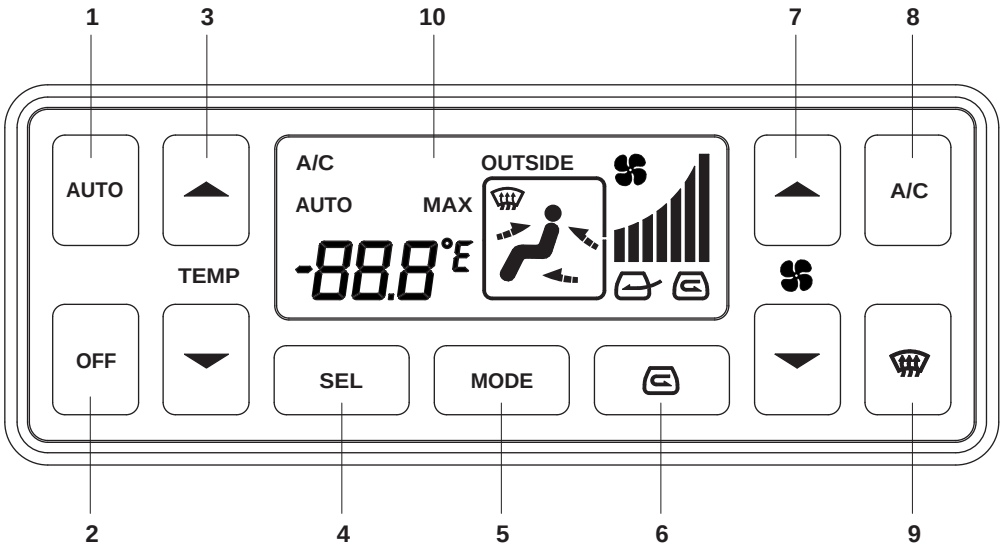
FG019865

Figure 202

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.

Control Panel



FG000086

Figure 203

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 204

2. Off Button

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

FG000089

Figure 205

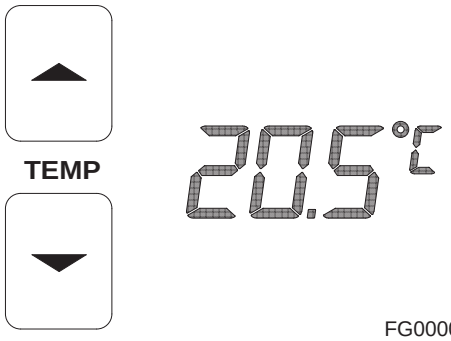
3. Temperature Control Button

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 206

4. Temperature Unit Selector Button

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

FG000094

Figure 207

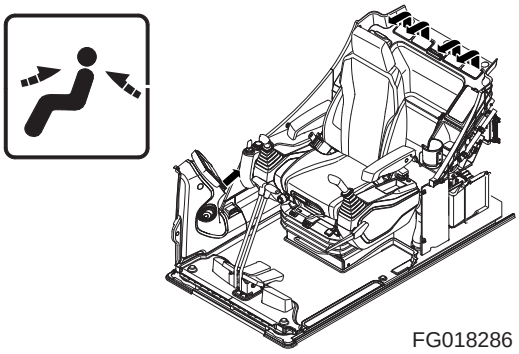
5. Mode Selector Button

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

FG000096

Figure 208

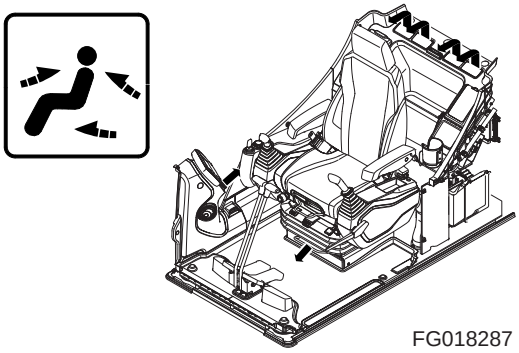
A. Used to direct airflow to upper portion of operator's cabin from both the front and rear.



FG018286

Figure 209

B. Used to direct airflow 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.

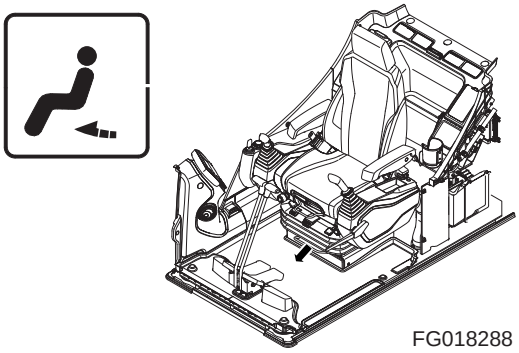


FG018287

Figure 210

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

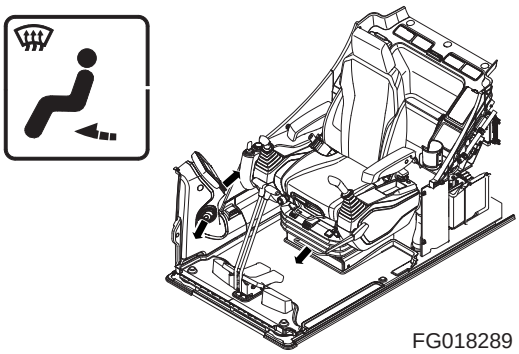
This mode is mainly used for heating.



FG018288

Figure 211

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



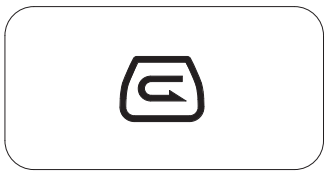
FG018289

Figure 212

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.

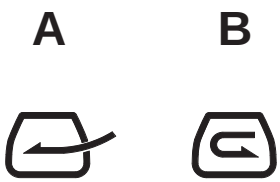


FG000101

Figure 213

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.



FG019042

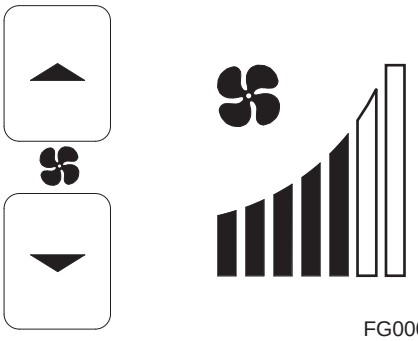
Figure 214

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.



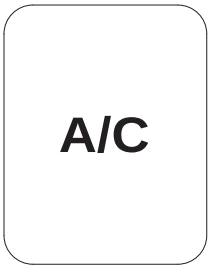
FG000103

Figure 215

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.

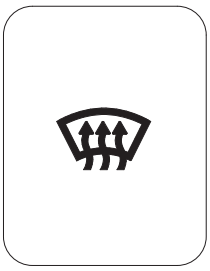


FG000105

Figure 216

9. Defroster Button

Used to direct airflow to front window.

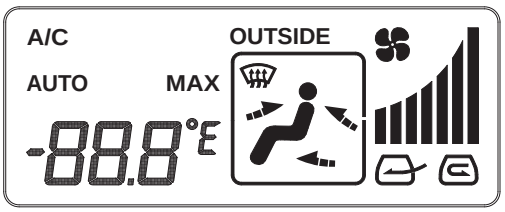


FG000106

Figure 217

10. LCD Display

This display shows the current setting.



FG000107

Figure 218

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) lower than the outdoor temperature.

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

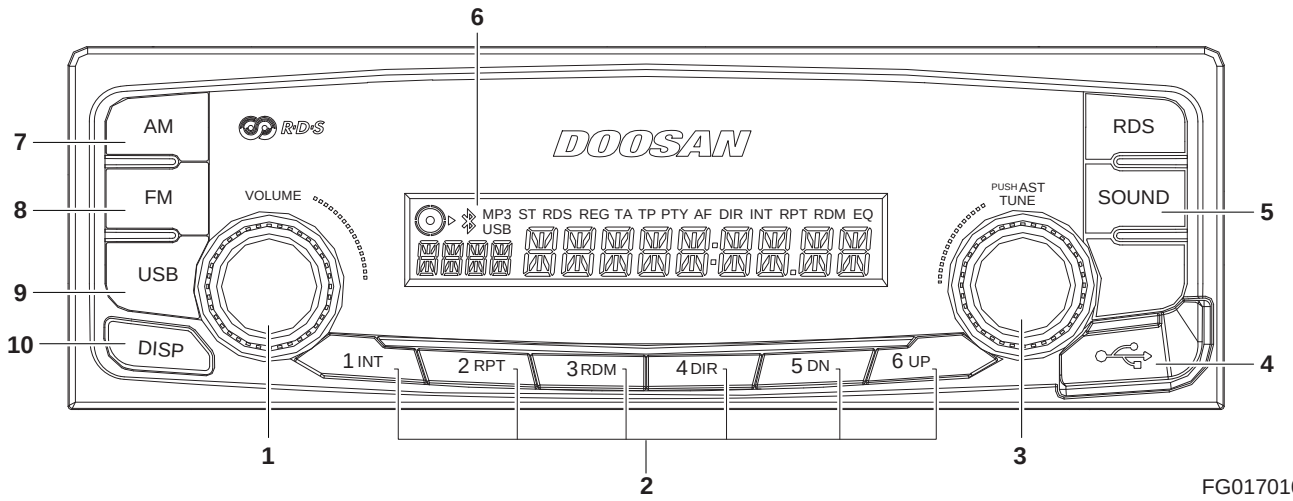
NOTE: *The blower button must be on "Three Bars".*

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



FG017016

Figure 219

Reference Number	Description
1	Power/Volume Control
2	Preset Station
3	Tuning Up/Down
4	USB Loading Port
5	Sound Mode Selector

Reference Number	Description
6	LCD
7	AM Selection
8	FM Selection
9	USB Selection
10	Display Mode Control

CD Player (Optional)

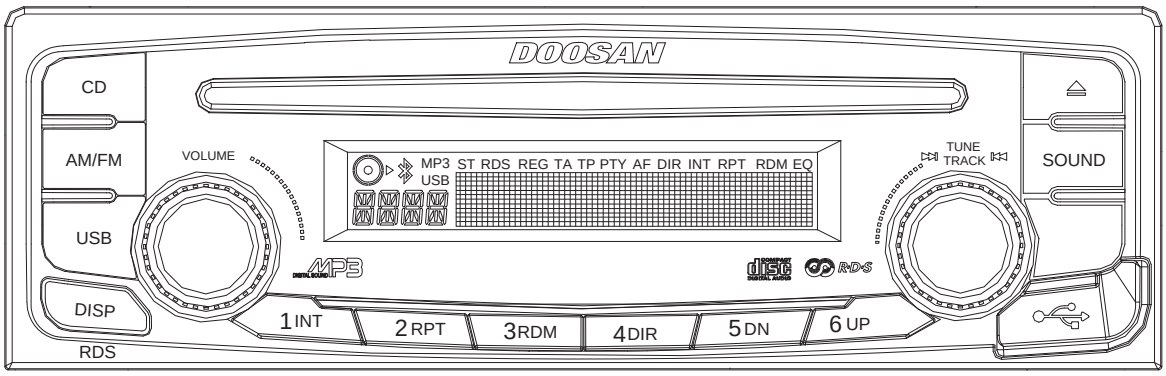


Figure 220

FG017017

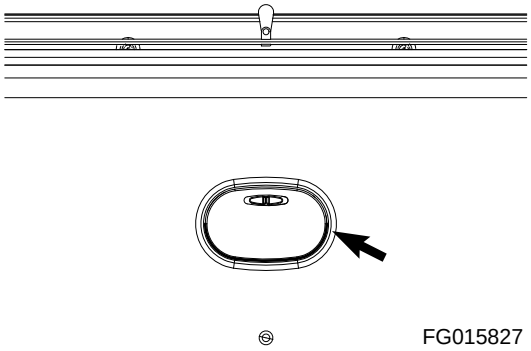
MISCELLANEOUS ELECTRICAL DEVICES

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.*

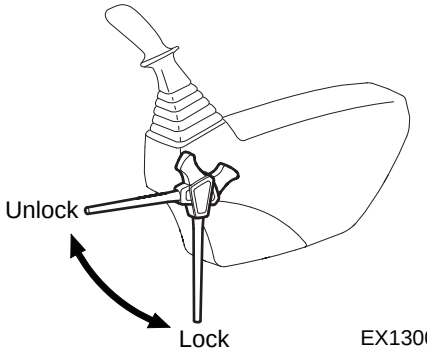


FG015827

Figure 221

Pilot Cutoff Switch

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



EX1300566

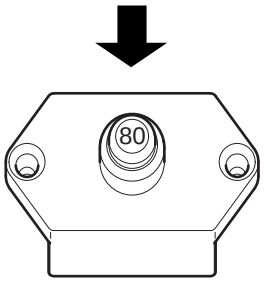
Figure 222

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 and it needs to be repaired.

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



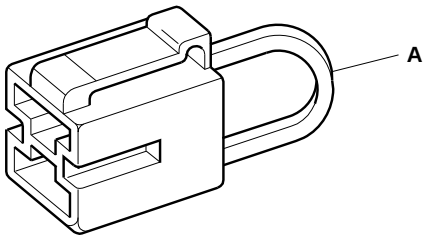
FG018291

Figure 223

Fusible Link

A fusible link is in the battery box.

If the engine does not crank, first check that starter switch is turned "ON" and no power is available (No indicator lights will light.). Check that "A" portion (Figure 224) of the fusible link is not broken or burned through. Replace the fusible link if damage and investigate cause.



HAAE2120

Figure 224

WARNING

AVOID DEATH OR SERIOUS INJURY

Using the wrong fusible link could cause a wire harness short resulting in a fire, death or serious injury.

Fuse Boxes

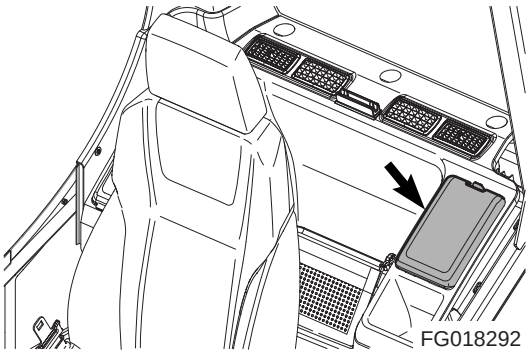
There are two fuse boxes (Figure 225) on the left side of the heater box. The fuses prevent electrical devices from overloading or shorting.

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 4-90.*

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.



FG018292

Figure 225

WARNING

AVOID DEATH OR SERIOUS INJURY

Always replace fuses with the same type and capacity fuse that was removed. Improper fuses can cause electrical damage and result in a fire, death or serious injury.

SEAT ADJUSTMENT

WARNING

AVOID DEATH OR SERIOUS INJURY

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

Do not adjust the seat position while the machine is moving because a loss of control can occur. Always stop the machine, apply the parking brake, and then adjust the seat.

Always fasten your seat belt while operating machine.

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

1. Forward/Backward Adjustment

Holding lever (1, Figure 226), raise it up, move the seat to the desired position. Release lever to lock the seat in the selected position. Adjustment range is 180 mm (7.1 in).

2. Adjusting Height of Seat and Depth of Cushion

Forward Tilt

Press the adjustment lever (3, Figure 226) to adjust the seat cushion angle. (0"/+4"/+8")

Cushion Slide

Press the adjustment lever (4, Figure 226), and adjust the seat cushion forward/backward by max. 50 mm, to fit with the length of the operator's thigh.

Seat Height

It is possible to move the seat up or down by combining adjustments forward and rear tilt. Height adjustment is 60 mm (2.4 in).

Adjust height of seat by moving adjustment lever (2, Figure 226) up or down. Seat height can be adjusted by referring to the weight indication window (A, Figure 226) on the right.

- Green: Standard weight
- Red: Underweight or overweight

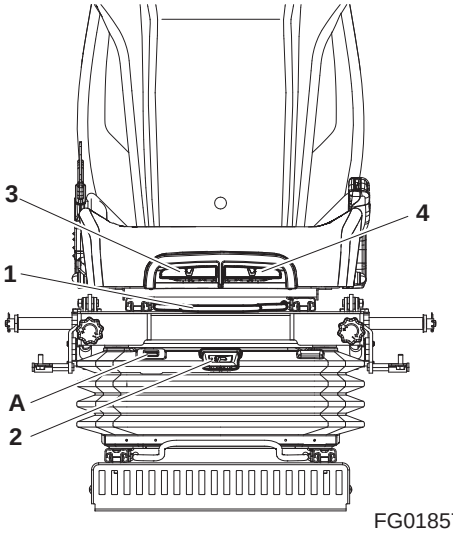


Figure 226

3. Reclining Position Adjustment

Pulling up left lever (3, Figure 227) allows 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.

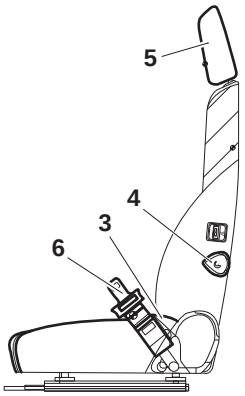
4. Lumbar Support Adjustment

A lumbar support is located in the seat back.

Turn the dial (4, Figure 227) counterclockwise to increase the force of the lumbar support.

5. Headrest

The headrest (5, Figure 227) can be adjusted forward/ backward and up/down. Move it by holding both sides.



FG015815

Figure 227

6. Seat Belt

WARNING

AVOID DEATH OR SERIOUS INJURY

The seat belt is for the operator's safety and should always be worn for operator restraint. 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 can 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 seat belt with twists in it or with damaged or with missing hardware. Replace belt or bracket if damaged or worn.

Seat Belt Locking and Unlocking

Insert belt end (1, Figure 228) into buckle (2, Figure 228). Pull belt to check that belt end is locked into buckle.

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

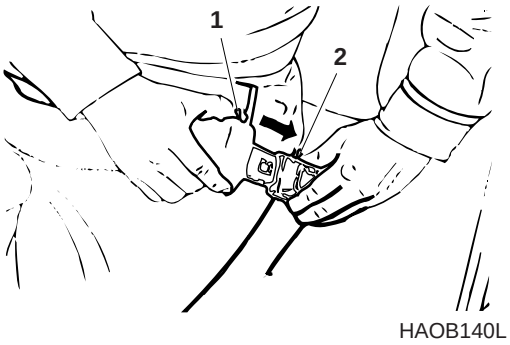


Figure 228

Press button (3, Figure 229) in center of buckle (2, Figure 229) and pull out belt (1, Figure 229) to unlock.

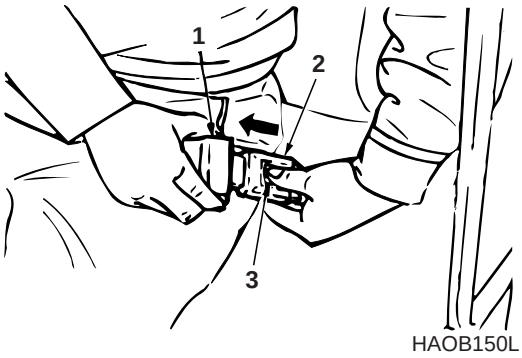


Figure 229

7. Storage Compartment

The seat has a storage compartment (1, Figure 230). It is used for storing the Operation and Maintenance Manual and Safety Manual.

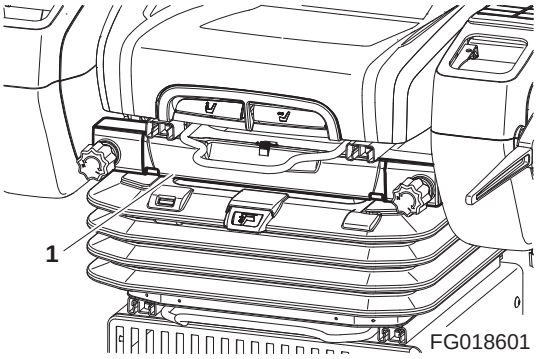


Figure 230

8. 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 (1, Figure 231), raise it up, set the seat to desired position. Release lever to lock seat in selected position.

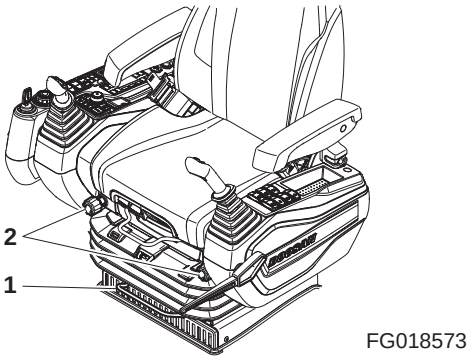


Figure 231

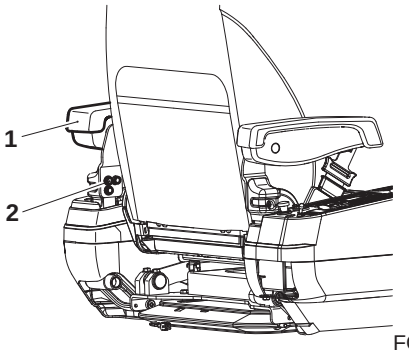
9. Left and Right Control Stand Height Adjustment

The left and right dials (2, Figure 231) at the lower part of the seat can be turned to adjust the elevation height of each control stand. (± 1.2 in (± 30 mm))

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

10. Adjusting Height/Angle of Armrest

It is possible to adjust height of armrest by removing three bolts (2, Figure 232) holding armrest to driver's seat, and moving armrest up or down by intervals of 0.8 in (20 mm), and then installing armrest. Lift armrest slightly (1, Figure 232) and rotate dial on bottom of support to left and right to adjust angle of armrest.



FG019076

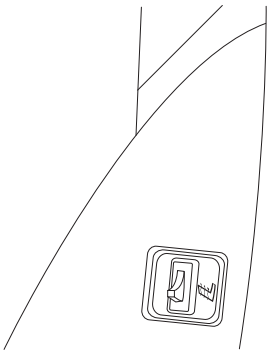
Figure 232

11. Heating Operator's Seat

The air suspension seat can be heated. The heater switch is found on left-hand side of seat back. To heat the seat, press and hold switch until desired heat level is obtained. When heating is not needed or seat is warmed, turn switch to "OFF" position.

The seat warmer has a primary thermostat that allows it to operate between 28° - 37°C (82° - 99°F). At 37°C (99°F) the primary thermostat stops heating the seat.

NOTE: *If the primary thermostat fails, there is a secondary (safety) thermostat that operates between 32° - 41°C (90° - 106°F). At 41°C (106°F) the secondary (safety) thermostat stops heating the seat. If the seat is heating up to a higher than normal temperature, have seat serviced immediately.*



FG015816

Figure 233

CEILING COVER

NOTE: *If machine is equipped with an 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.*

Opening Ceiling Cover

1. Lower bucket or work tool to ground.
2. Move safety lever (Figure 234) to "LOCK" position.
3. Pull lock (1, Figure 235) in front center of ceiling cover and push it up with handle.

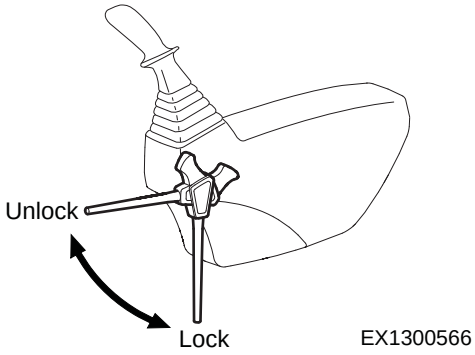


Figure 234

Closing Ceiling Cover

1. Lower bucket or work tool to ground.
2. Move safety lever (Figure 234) to "LOCK" position.
3. Pull down cover with handle (Figure 235) so lock (1, Figure 235) can be locked into bracket in ceiling frame.

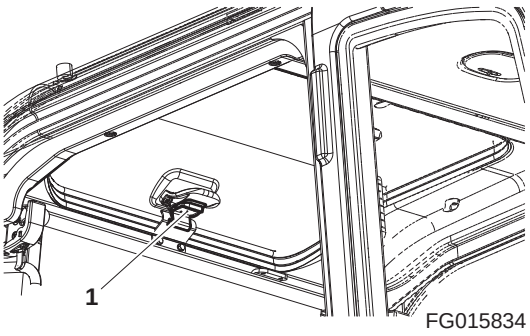


Figure 235

FRONT WINDOWS

WARNING

AVOID DEATH OR SERIOUS INJURY

When leaving operator's seat, move safety lever to "LOCK" position (Figure 236) and stop engine to prevent accidental activation of the work levers and controls.

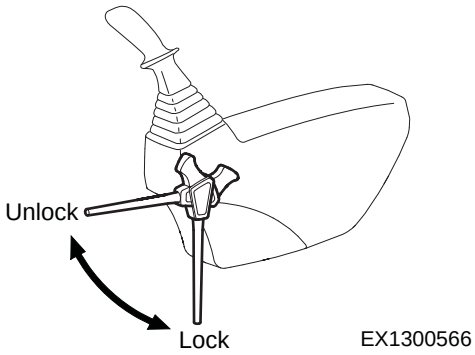


Figure 236

Front Upper Window

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

Opening Window

WARNING

AVOID DEATH OR SERIOUS INJURY

When storing front window in cabin roof, make sure both lock levers (2, Figure 237) are securely latched.

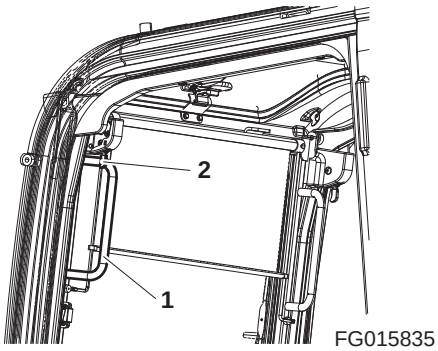


Figure 237

1. Lower bucket or work tool to ground.
2. Move safety lever (Figure 236) to "LOCK" position.
3. Set engine speed control dial to "LOW IDLE". Allow engine to idle for three - five minutes.
4. Stop engine by turning key to "O" (OFF) position.
5. Hold window handles (1, Figure 237), then pull lock levers (2, Figure 237) 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 cabin. Make sure that it is securely latched.
7. Check that lock levers are securely latched in locked position.

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

   NOTE: *If window happens to fall against machine, while some part of your body is extended outside cabin, it can result in serious personal injury.*

   NOTE: *The front window is spring loaded to help ease opening it. To fastening rear lock pin, hold handle and fasten rear lock pin.*

Closing Window

WARNING

AVOID DEATH OR SERIOUS INJURY

Keep hands away from window frame when opening or closing window.

1. Lower bucket or work tool to ground.
2. Move safety lever (Figure 236) to "LOCK" position, and stop engine.
3. Holding upper handles (1, Figure 238) of front window with left and right-hand, pull lock levers (2, Figure 238) to release lock.
4. Push window forward, and lower it slowly.
5. When bottom of window, reaches top of the front bottom window, push front window to engage lock (2, Figure 238).
6. Check that lock levers are securely latched in lock position.

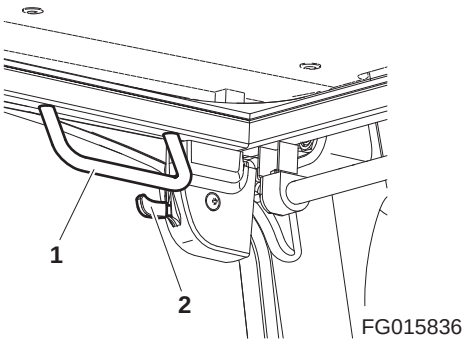


Figure 238

Front Bottom Window

Opening Window

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

1. Open front top window and secure it to ceiling. Press button to open levers on both sides (left and right), and lift bottom window(1, Figure 239) in direction of arrow..

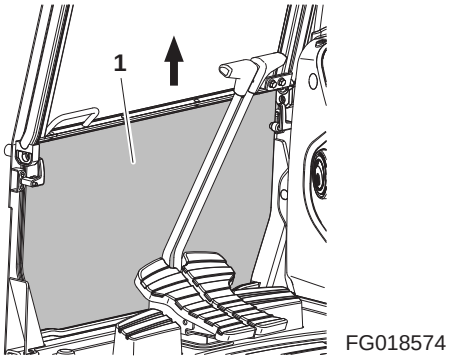


Figure 239

2. Set bottom window in rubber holders (2, Figure 240) behind operator's seat. Secure window with left and right levers (3, Figure 240) with push button (4, Figure 240).

IMPORTANT

Keep hands dry when handling a window. Never drop window or let it come into contact with other parts of machine.

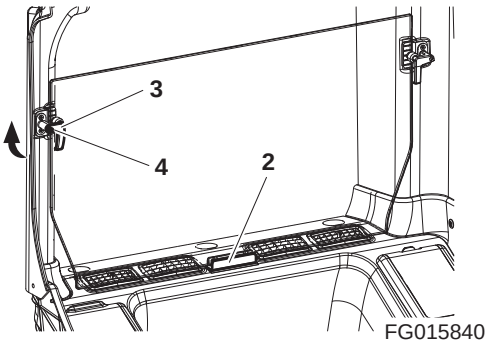


Figure 240

Closing Window

Reverse the removal procedure.

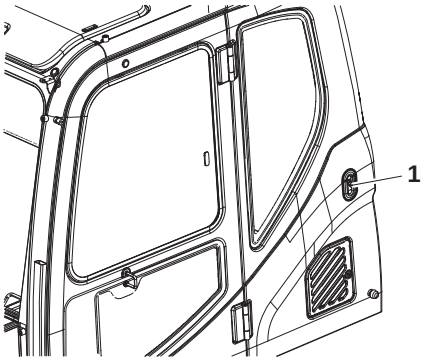
IMPORTANT

Make sure that bottom window is properly seated in bottom of the front cabin window opening. Closing upper window with bottom window unattached can damage bottom window.

DOOR SIDE LATCH

1. The door side latch (1, Figure 241) is used to secure door to side of cabin when it is opened.

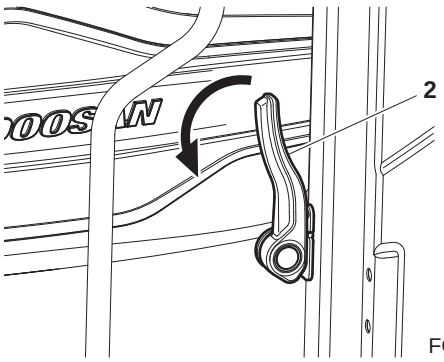
   NOTE: *Keep door closed and locked when machine is not in use.*



FG015841

Figure 241

2. To release door from side of cabin, push latch lever (2, Figure 242) down. The latch lever is to the left of operator's seat.



FG021421

Figure 242

CABIN STORAGE COMPARTMENTS

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

The large compartment (1, Figure 243) is for storing nonperishable items.

The covered other one (2, Figure 243) is interconnected with the air conditioner. It can be supplied with either warm or cool air when air conditioner is turned "ON". The small compartment (3, Figure 243) is for storing small items. A net storage bag (4, Figure 243) is added.

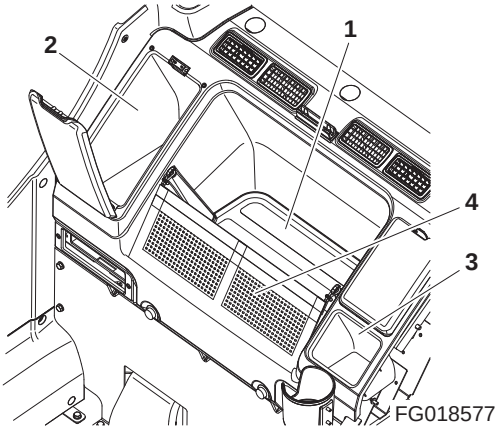


Figure 243

There is a separate small tray on right side (5, Figure 244) of operator's seat.

A document storage case (6, Figure 244) which can store up to A4-size documents is prepared.

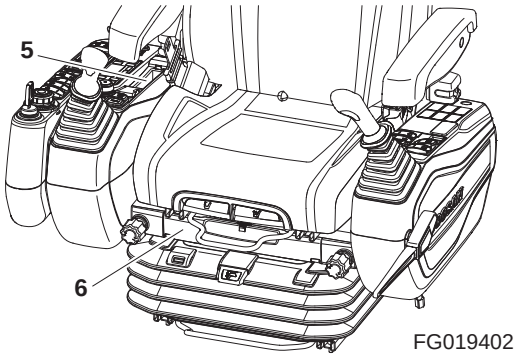


Figure 244

SUNGLASS CASE

The sunglass storage case (1, Figure 245) is on the center top of the rear wall of the operator cabin.

Keep this case lid closed before and after use.

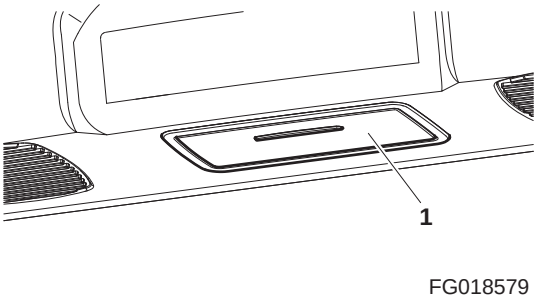


Figure 245

SUN VISOR

The excavator has two sun visors.

Front Window 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 246) down.

When not wanting protection, hold bar with left-hand and push release button (2, Figure 246) with right-hand. This will allow visor to retract.

NOTE: *Do not allow visor to roll backup without holding it. Not holding it can result in damage to visor and retract mechanism.*

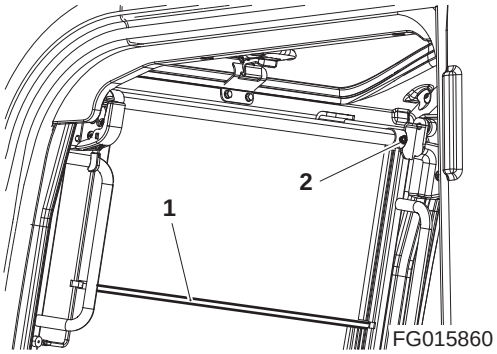


Figure 246

CAUTION

AVOID INJURY

Keep your head away from the retracting area of visor.

Ceiling Window Visor

When you wish to use visor, pull handle on bar (1, Figure 247) to middle holders (2, Figure 247) or the end holders (3, Figure 247). Hook bar on holders to secure visor in place.

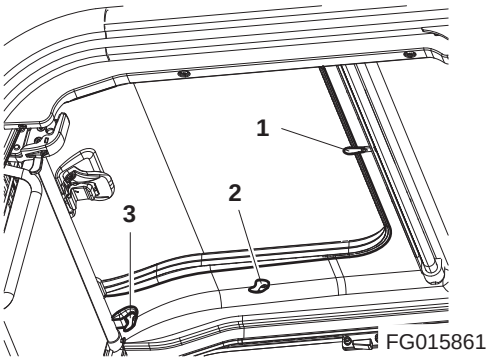


Figure 247

Pull visor to release it. It will return to its original position.

NOTE: *Do not allow visor to roll backup without holding it. Not holding it can result in damage to visor and retract mechanism.*

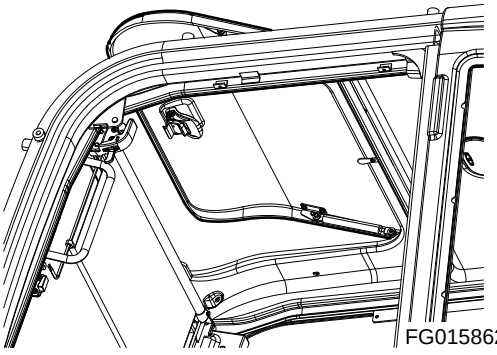


Figure 248

CAUTION

AVOID INJURY

Keep your head away from the retracting area of visor.

HANGER

A hanger (1, Figure 249) is located on upper left side of operator's cabin.

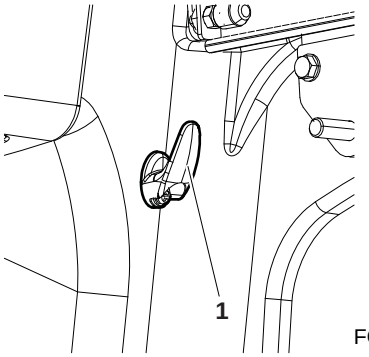


Figure 249

WARNING

AVOID DEATH OR SERIOUS INJURY

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

Always check that hanging objects are secured on hanger.

CUP HOLDER

There is a rubber cup holder inside operator's cabin. Use it to keep your cup firmly in place.

IMPORTANT

When using cup holder, keep the cap closed to prevent spilling.

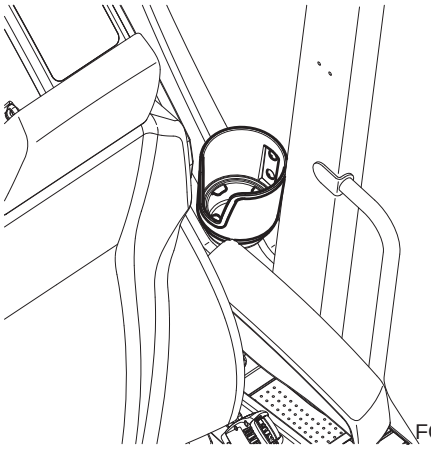


Figure 250

EMERGENCY EXIT GLASS BREAKING TOOL

This machine is equipped with a glass breaking tool. It is found on left pillar of cabin. This tool can be used to break the glass to exit from cabin in an emergency. Grip handle firmly and use sharp point to break glass.

- Be careful also not to slip on broken pieces of glass on ground.

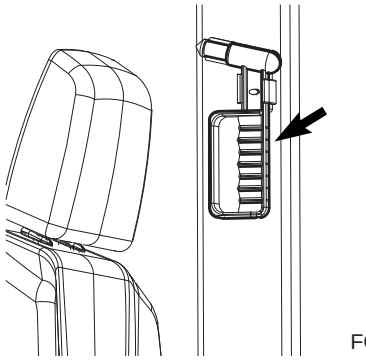


Figure 251

WARNING

AVOID DEATH OR SERIOUS INJURY

Protect your eyes when breaking the glass.

MISCELLANEOUS ACCESS COVERS AND DOORS

Side Door

Open side access door and slide prop rod (1, Figure 252) in slot (2) until it locks at end of slot.

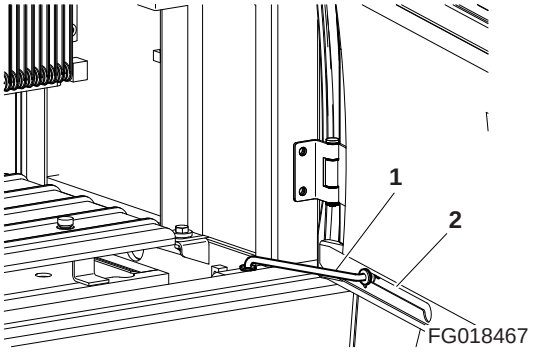


Figure 252

Battery Box Door

Opening

Open door until locking device (1, Figure 253) latches.

Closing

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

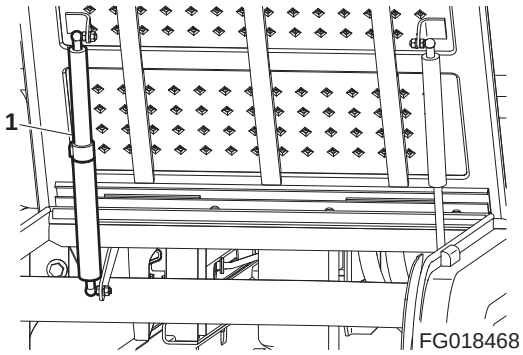


Figure 253

Engine Cover

Open cover and slide prop rod (1, Figure 254) in slot (2) until it locks in notch at end of slot to support cover.

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

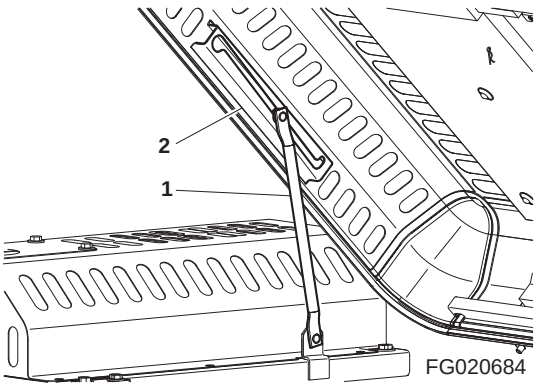


Figure 254

AIR GUN AND COMPRESSOR (OPTIONAL)

Air Gun (Optional)

An air gun can be installed for cleaning the operator cabin and other components.

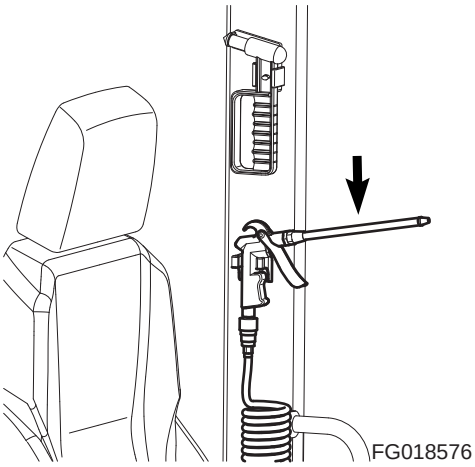


Figure 255

How to Use Air Compressor

1. Start the engine, and set the air compressor operating switch to "II" position.
2. Point the air gun towards the object to be cleaned.
3. Pull the air gun handle to eject compressed air.

WARNING

AVOID DEATH OR SERIOUS INJURY

Do not point air gun at other persons or at yourself.

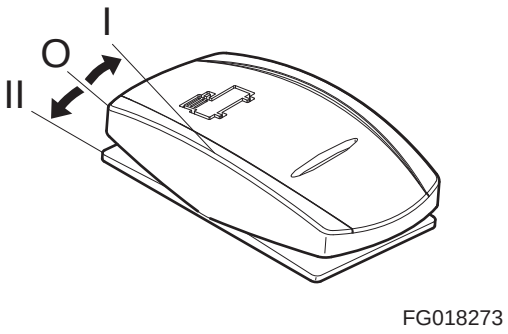


Figure 256

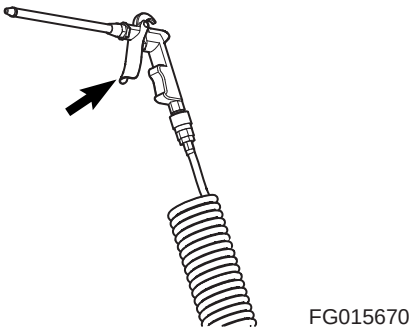


Figure 257

IMPORTANT

Do not run the air compressor for longer than 30 minutes; otherwise, the compressor may be damaged. Cool down the compressor after 30 minutes' continuous operation.

Do not start the air compressor while the engine is not running; otherwise, the battery may be fully discharged. Always start up the air compressor while the engine is running.

Do not run the air compressor in highly humid places or on a rainy day. Drain the water in the air tank periodically, using the drain valve (1, Figure 258).

Check that compressed air is free from moisture before using the air for cleaning.

Keep the area surrounding the air compressor clean. Periodically clean the air suction filter (2, Figure 259).

When cleaning the equipment, do not spray water directly onto the air compressor.

While the air compressor is running, check that needle point of the pressure gauge (3, Figure 259) reads below the maximum pressure (8 kg/cm^2 (114 psi)).

When the air compressor is not to be used over a long time, release the air pressure in the air tank.

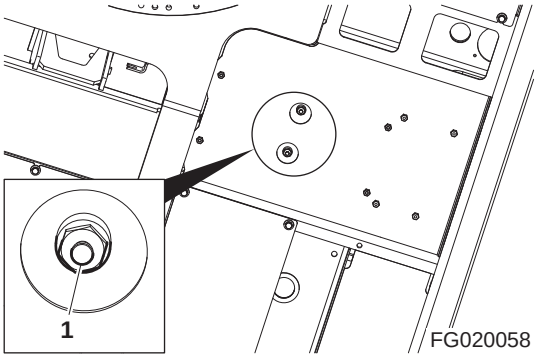


Figure 258

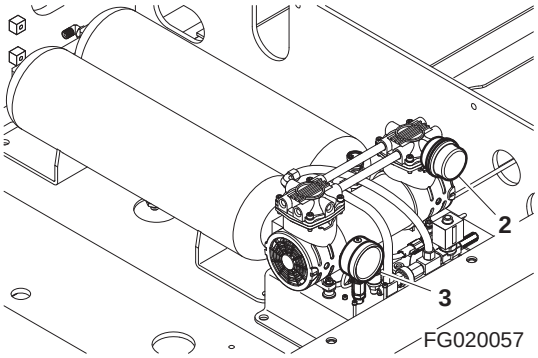


Figure 259

WARNING

AVOID DEATH OR SERIOUS INJURY

Do not allow people or animals inhale compressed air.

Keep away and do not touch the air compressor while the air compressor operating switch is at "II" position (operating). Motor or fan could start suddenly and result in death or serious injury.

How to Connect Air Gun

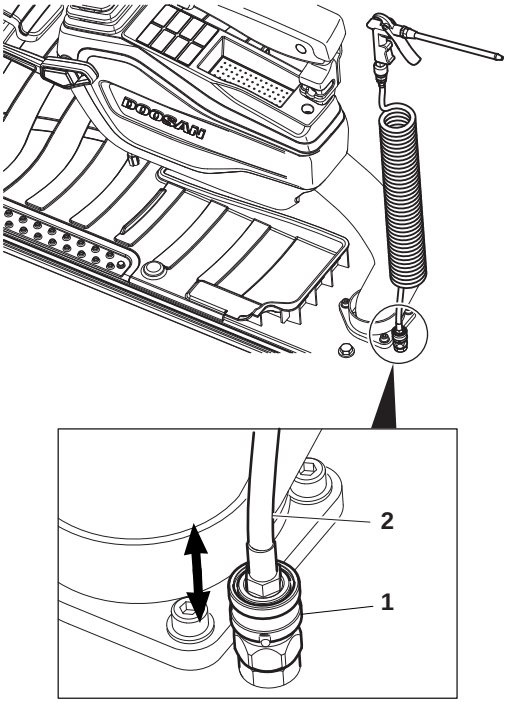
Select and use the quick couplers installed in the operator's cabin and battery box.

1. Push down the release collar (1, Figure 260) of the quick coupler, at the bottom of the air hose behind the left stand in the cabin, and pull the air hose (2) upwards.
2. Open the door of the battery box on the right side of the equipment.
3. Push the bottom of the air hose into the quick coupler (3, Figure 261) until a 'clicking' sound is heard.

CAUTION

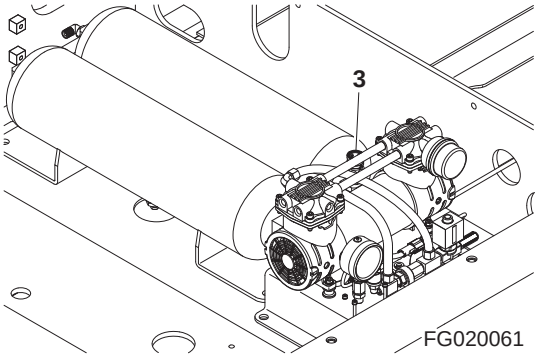
AVOID INJURY

Take care not to squeeze your finger in the coupler gap.



FG018586

Figure 260



FG020061

Figure 261

Operation

TO OPERATE A NEW EXCAVATOR

All DOOSAN excavators are inspected before leaving the factory. However, it is required that operator follow these steps during the initial break-in period. Failure to follow these steps can 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 could affect the overall performance and service life of the machine.

NOTE:

1. *Check daily for leakage of coolant, fuel, engine oil and hydraulic oil.*
2. *Inspect all lubricants daily and 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 temperatures.*
6. *Check that work equipment is operating normally.*
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 ENGINE

Inspection Before Starting Engine

Walk Around Checks

WARNING

AVOID DEATH OR SERIOUS INJURY

If flammable materials such as leaves, paper, etc. are allowed to accumulate on high temperature components, such as the engine muffler and turbo, a fire can occur. Fuel, lubricant, and hydraulic oil leaks can cause a fire. Clean machine, remove all flammable materials from machine, and repair machine before operating.

Before starting engine, inspect the following items. If any problem is found, repair it before machine operation.

1. Overall
   - Check for damage, wear, crack, oil leakage, play in work equipment, cylinders, linkages and hoses.
   - Check the undercarriage for damage, wear, crack, oil leakage and loose bolts.
   - Check for problems in doors, handrails, guardrails, steps and loose bolts.
   - Clean and check cabin glass, rearview mirrors, rear view camera and lights.
   - Clean and check monitor, switches and gauges in the cabin.

2. Cleaning
    - Remove dirt and debris from around engine, radiator, oil cooler and battery.
    - Check and remove flammable material around muffler, turbocharger, battery or other high temperature components.
    - Clean and inspect fins of radiator, oil cooler, CAC (Charged Air Cooler), fuel cooler and condenser.
3. Engine system
    - Check for coolant and oil leakage around the engine and cooling system.
4. Fuel system
    - Drain water and sediment from fuel tank and water separator.
    - Check for fuel leakage in fuel system.
5. Hydraulic system
    - Check for hydraulic oil leaks, damaged tubing and hoses and interference points of components.
6. Electric system
    - Check for damaged electrical cables and loose or missing connectors.
7. Lubrication
    - Perform all daily and periodic maintenance services. Perform services according to reading shown on hour meter.
8. Safety
    - Perform a machine walk-around. Make sure that no one is under the machine or performing any maintenance on it before starting engine.
9. After starting machine
    - Check that all operational controls and components are in proper operating condition and are functioning correctly. Stop operation and correct any problems before continuing work.

Checks Before Starting Engine

Before starting engine, inspect the following items. If any problem is found, repair it before machine operation. If the oil, fuel or coolant level are below the "LOW" mark, add it. For detail method, see “10 Hour / Daily Service” on page 4-24.

1. Grease boom, arm and front attachment pins.
2. Check engine oil level.
3. Check level of hydraulic oil tank.
4. Check fuel level.

5. Check oil level of swing reduction device.
6. Clean dust net in front of oil cooler and intercooler.
7. Check cooling system and refill as required.
8. Check level of window washer liquid.
9. Inspect the bucket teeth and side cutters for signs of wear.
10. Inspect engine fan blade.
11. Check air intake system.
12. Inspect seat belt for any damage and proper operation.
13. Inspect the structure for cracks and faulty welds.
14. Check the operation of all switches.
15. Check the operation of all exterior lights, horn, travel alarm/ swing alarm (if equipped), rear view camera and control console indicator and monitor lights.

Operational Checks Before Starting Engine

WARNING

AVOID DEATH OR SERIOUS INJURY

When leaving operator's seat, move the safety lever to "LOCK" (Figure 1) position and stop engine to prevent accidental activation of the work levers and controls.

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

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

4. Rotate the starter switch to "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 the indicator lights do not come "ON" when the key is first turned, there is a problem.*

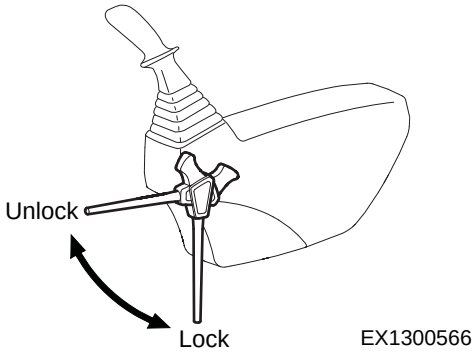


Figure 1

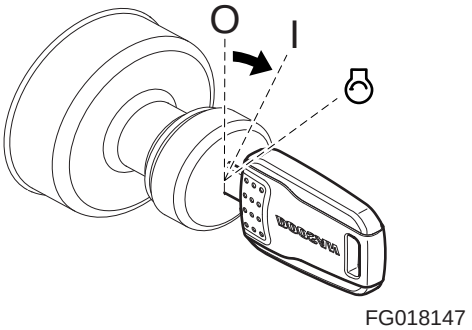


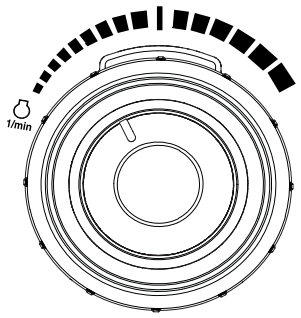
Figure 2

WARNING

AVOID DEATH OR SERIOUS INJURY

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

1. Perform all steps in “Operational Checks Before Starting Engine” on page 3-4.
2. Set engine speed control dial to "LOW IDLE" (Figure 3). If control dial is at "HIGH IDLE", the engine will accelerate suddenly and cause damage to the engine.
3. Sound horn.

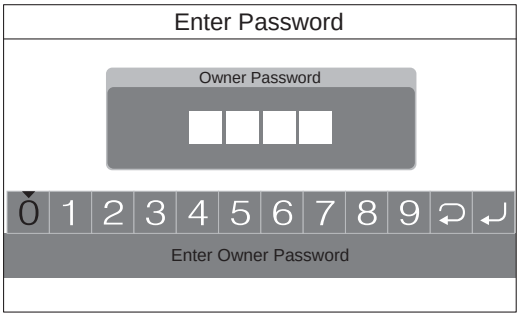


FG018148

Figure 3

4. Turn starter switch to "I" (ON) position.
5. 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.*



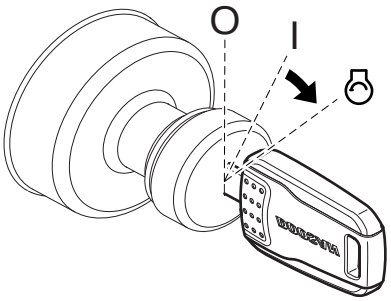
FG018474

Figure 4

6. Turn starter switch to "⏻" (START) position (Figure 5). Engine should start in approximately five (5) seconds.

IMPORTANT

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



FG018149

Figure 5

7. After engine has started, release key. Key will return to "I" (ON) position (Figure 5).
8. Follow procedures in “Hydraulic System Warm-up” on page 3-12.

9. 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, stop engine and correct the problem.

   Normal indicators are:

No.	Instrument Panel Light or Gauge	Indicator Reading
1	Engine Coolant Temperature Gauge	White Range
2	Fuel Gauge	White Range
3	Hydraulic Oil Temperature Gauge	White Range
4	Charging Warning	OFF
5	Engine Oil Pressure Warning	OFF
6	Engine Coolant Temperature Warning	OFF
7	Engine Check Warning	OFF

10. 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.

11. 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 white zone again. When the white zone is reached, allow the engine to idle for an additional three - five (3 - 5) minutes before stopping 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, etc.*

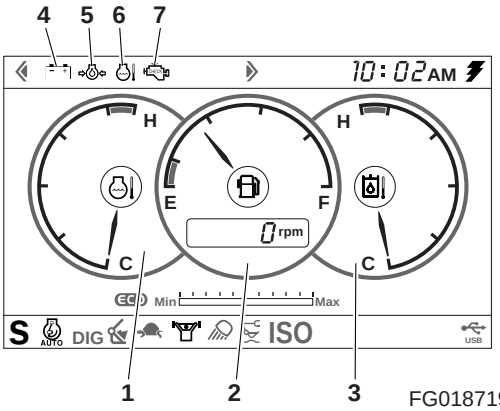
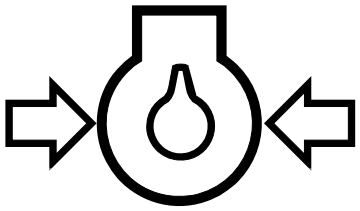


Figure 6

12. Even if the engine starts, wait for the engine oil pressure monitor light to turn "OFF". Do not touch the control levers or control pedal while the engine oil pressure monitor is light turn "ON".

IMPORTANT

If the engine oil pressure monitor light does not turn "OFF", after 4 to 5 seconds have passed, stop engine immediately. Check the oil level, check for leakage of oil, and take necessary corrective action.



HAOA620L

Figure 7

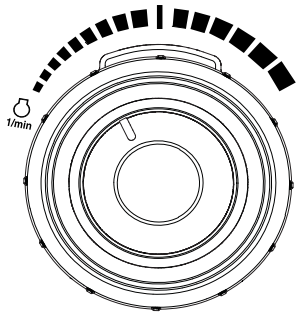
Cold Weather Starting

WARNING

AVOID DEATH OR SERIOUS INJURY

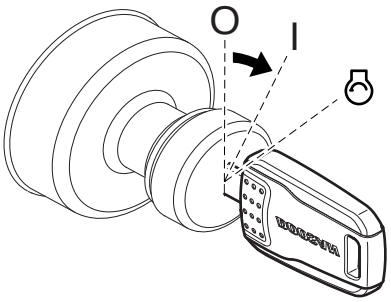
DO NOT USE STARTING FLUIDS. The preheat system could cause the starting fluid to explode.

1. Perform all steps in "Operational Checks Before Starting Engine".
2. Set engine speed control dial to "LOW IDLE" (Figure 8). If control dial is at the "HIGH IDLE", the engine will accelerate suddenly and damage the engine.
3. Sound horn.
4. Turn starter switch to "I" (ON) position (Figure 9). When preheat cycle is completed, the preheat indicator light (1, Figure 10) will turn "OFF".



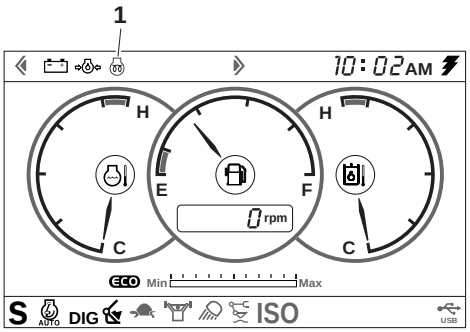
FG018148

Figure 8



FG018147

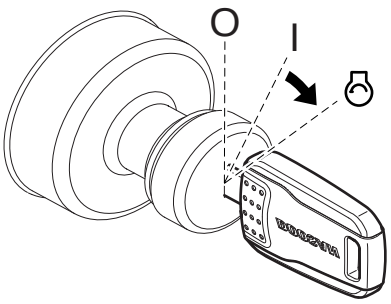
Figure 9



FG018370

Figure 10

5. After the preheat completion, immediately turn starter switch to "⏻" (START) position (Figure 11). Engine should start in approximately five (5) seconds.



FG018149

Figure 11

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

If the engine does not start after approximately fifteen seconds of cranking, release the starter switch. Wait about five (5) minutes and repeat above steps.

6. After engine has started, release key. Key will return to "I" (ON) position (Figure 11).
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, stop engine.
8. Follow "Hydraulic System Warm-up" procedures in this section. (See page 3-12)

Engine Coolant Heater (Optional)

The engine coolant heater helps start-up and operation of the engine and equipment at temperatures below -20°C (-4°F).

1. Operating environment

   A. Operating temperature of the engine coolant heater: -40° - 75°C (-40° - 167°F).

   B. Digital switch display temperature range: -20° - 75°C (-4° - 167°F).

2. Digital switch

   A. Outline

   The digital switch shown in Figure 12 operates the engine coolant heater.

   The operator can turn "ON" or "OFF" the engine coolant heater with the digital switch, or set up 3 desired operating time bands.

   The time is indicated by hours and minutes, while the day is indicated with two letter characters.

   NOTE: *The timer display may not work properly at temperatures below -20°C (-4°F).*

   When the battery is replaced or battery disconnection switch is turned "ON" or "OFF", the display will blink until button 1 (🕘) is pressed. Pressing button 1 (🕘) will reset system to normal condition. (Wake up function)

   B. Button description

   Button 1 (🕘): Time setting and wake up function.

   Button 2 (**P**): Preset query time activation and program.

   Button 3 (♨): Instantaneous heating and switch off.

   Button 4 (▶): The mode to reduce the time, setup time and power on time. Reduce operating time.

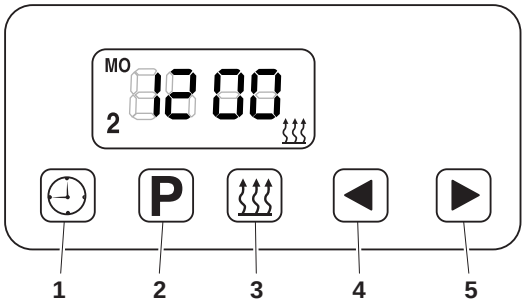
   Button 5 (◀): The mode to increase the time, setup time and power on time. Increase operating time.

   C. Time and date setup

   Pressing the button 1 (🕘) for 2 seconds will enter clock setting mode, where time and date can be set up. When the time/date blinks, use the left (◀) or right (▶) button to do the setting.

   Pressing the left (◀) or right (▶) button for longer than 2 seconds, fast setting is enabled.

   No pressing of buttons for 5 seconds will enter and save the time and date setting automatically.



FG018441

Figure 12 Engine Coolant Heater Digital Switch

3. Operation

While the battery disconnection switch is "ON", the engine coolant heater can be started-up by the following modes:

A. Manual mode: The operator operates the heater by switching "ON/OFF" directly.

Pressing the ( ) button turns on the heater, and pressing it once again will turn it off.

B. Auto mode: The heater turns on or off at preset time.

Pressing the (P) button will make the program number blink. Set up the starting time using the left (◀) or right (▶) button.

Keep press the (P) button to set up program numbers 2 and 3, or switch to time mode.

C. Operating mode: The heater will operate for desired time.

With the heater off, press the left (◀) button for 3 seconds. While the operating time is blinking, set up the desired operating time using the left (◀) or right (▶) button. (10 - 120 minutes).

D. Residual time setting

While the heater is operating, set up the required residual time using the left (◀) or right (▶) button. (1 - 120 minutes).

4. Digital timer error code

If there is a problem in the engine coolant heater, the digital switch will display an error code. Call the nearest service center and inform the center of the error code.

Error Code (Digital Timer)	Description
F 00	Control unit error
F 01	Failure to operate (after 2 successive trial for starting)
F 02	Ignition failure (3 or more failures)
F 03	Over or under current
F 04	Early flame detected
F 05	Combustion monitor broken or short-circuited
F 06	Temperature sensor line broken or short-circuited
F 07	Fuel pump line broken or short-circuited
F 08	Fan motor line broken, short-circuited, overloaded, or blocked
F 09	Ignition plug line broken or short-circuited
F 10	Overheated
F 11	Circulation pump line broken or short-circuited

Starting Engine With a Booster Cable

WARNING

AVOID DEATH OR SERIOUS INJURY

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 death or 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 to the depleted battery positive (+) terminal first. Then connect the auxiliary battery negative (-) terminal to the frame of the depleted battery machine second.**
8. **Connect positive cables first when installing cables and disconnect the negative cables first when removing.**

HAOA440L

Figure 14

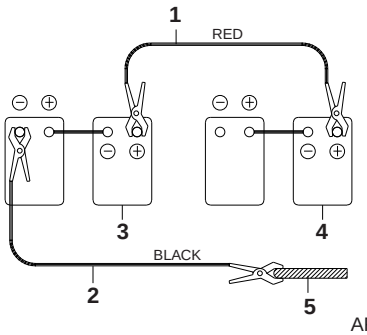
IMPORTANT

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 Booster Batteries

1. Stop engine before booster batteries (3, Figure 15) are mounted.
2. Connect one end of red cable (1, Figure 15) 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 15) 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 15).



ARO0440L

Figure 15

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.

Disconnecting Booster Batteries

1. Disconnect black negative (-) cable (2, Figure 15) from the machine frame (5) first.
2. Disconnect the other end of black negative (-) cable (2, Figure 15) from the booster batteries (3).
3. Disconnect red positive (+) cable (1, Figure 15) from the booster batteries (3).
4. Disconnect red positive (+) cable (1, Figure 15) from the machine batteries (4).

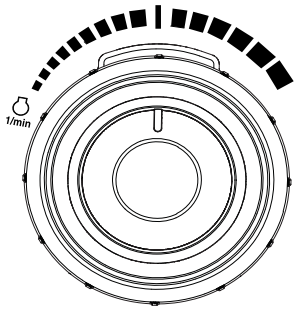
Hydraulic System Warm-up

IMPORTANT

If a problem or abnormal operation occurs, immediately stop 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 (5) minutes set at the middle of the speed range, without a load.



FG018151

Figure 16

2. Move safety lever (Figure 17) to "UNLOCK" position.

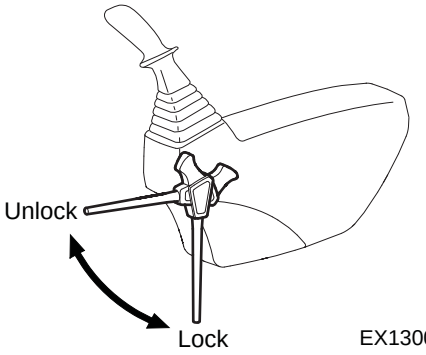


Figure 17

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 (5) minutes.
4. Check for clearance and fully raise the front attachment. Swing clockwise three (3) revolutions.
   Swing counterclockwise three (3) revolutions.
5. Travel forward and reverse at low speed for two (2) revolutions of the drive sprocket.

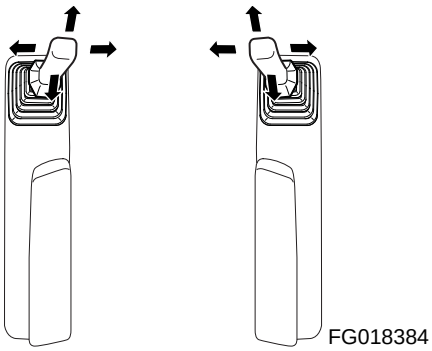


Figure 18

Hydraulic System Warm-up – Cold Weather

1. Run engine at "LOW IDLE" (no load) for five (5) minutes (Figure 19).

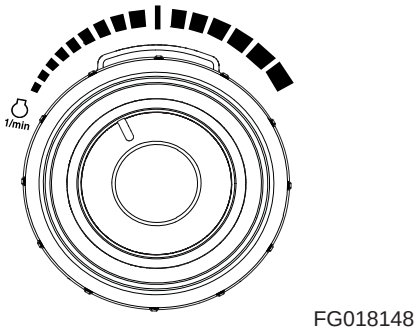


Figure 19

2. Run engine for approximately five (5) minutes set at the middle of the speed range, without a load (Figure 20).

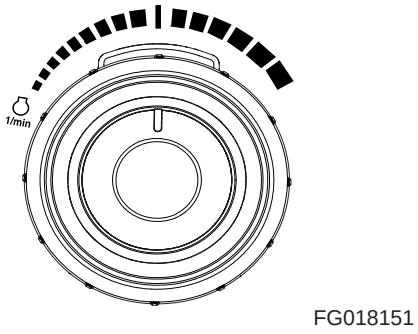


Figure 20

3. Move safety lever (Figure 21) to "UNLOCK" position.

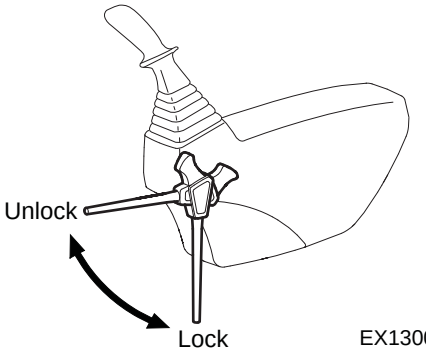


Figure 21

4. Slowly cycle boom, arm and bucket cylinders about five (5) times without a load to circulate the oil through the system. Do this for five (5) minutes.

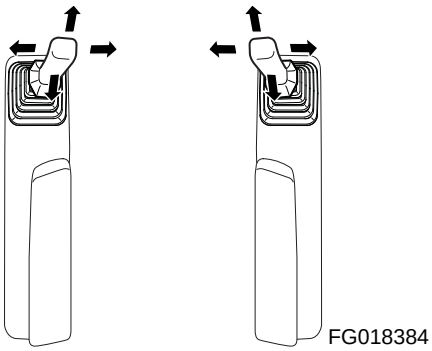


Figure 22

5. Set engine speed control dial to "HIGH IDLE" (Figure 23).
6. Repeat Step 4 for five (5) minutes. If working speeds continue to be slow, continue to operate but use extreme caution because machine function may be erratic.
7. Check for clearance and fully raise the front attachment. Slowly swing clockwise three (3) revolutions. Slowly swing counterclockwise three (3) revolutions.
8. Travel forward and reverse at low speed for two (2) revolutions of the drive sprocket.

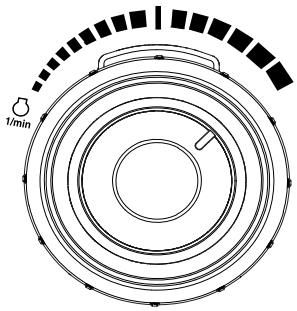
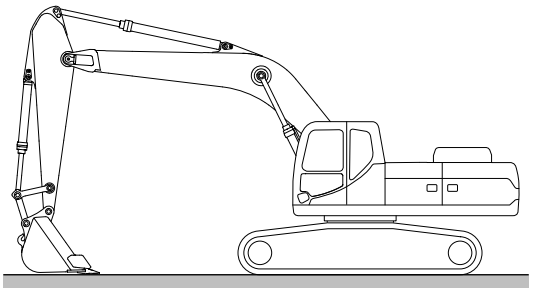


Figure 23

Stopping Engine

NOTE: *Allow engine to idle for three - five (3 - 5) minutes before stopping the engine. If not allowed to idle, heat surge may develop which will damage the engine. Allowing the engine to idle will allow the engine to cool down.*

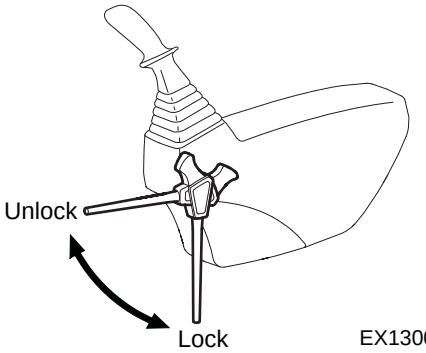
1. Park machine on firm and level ground.
2. Lower front end attachment to ground and make sure all operating controls are in "NEUTRAL".



FG018379

Figure 24

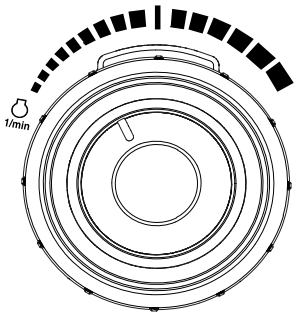
3. Move safety lever to "LOCK" position (Figure 25).



EX1300566

Figure 25

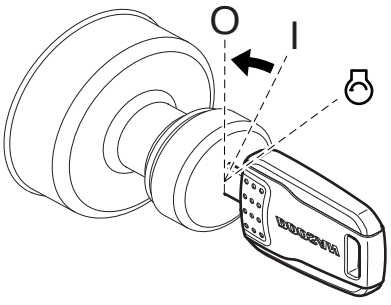
4. Set engine speed control dial to "LOW IDLE" (Figure 26). Allow engine to idle for three - five (3 - 5) minutes.



FG018148

Figure 26

5. Stop engine by turning key to "O" (OFF) position (Figure 27).
6. Remove key from starter switch.



FG018156

Figure 27

Checks and Maintenance After Stopping Engine

1. Park the machine on dry and hard ground.
2. Repair excavator if there are any coolant or oil leaks.
3. Inspect front attachment and undercarriage for abnormal appearances. Check that attachment is secure. Correct any problems.
4. Fill fuel tank and drain any water collected in the fuel system to prevent it from freezing.
5. Inspect and remove accumulated flammable materials, such as leaves, paper etc., in engine compartment.
6. Clean all mud, debris, etc. from undercarriage and tracks. Make sure that all steps and handholds are clean, and that operator's cabin is clean.

SAFETY LEVER

WARNING

AVOID DEATH OR SERIOUS INJURY

When leaving operator's seat move the safety lever to "LOCK" position and stop engine to prevent accidental activation of the work levers and controls.

Be careful not to move the work levers (joysticks) when moving safety lever.

1. Move safety lever (Figure 28) down into "LOCK" position. When safety lever is in the "LOCK" position, the front attachment, work controls, swing and travel movement will be disabled.

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

2. Move safety lever (Figure 28) on "UNLOCK" position, by pulling it up before starting work.

   NOTE: *When the engine is not running, but the safety lever is in the "UNLOCK" and the starter key is turned "ON", moving the work levers (joysticks) can result in movement of the work equipment. The charged accumulators in the system will provide pilot pressure for control valve spool movement.*

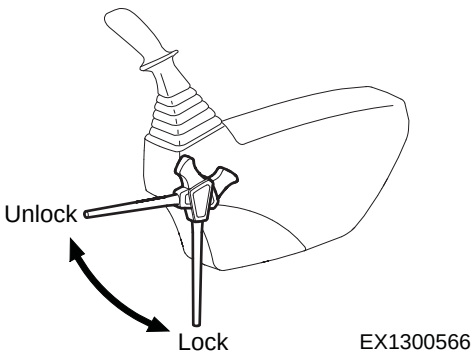


Figure 28

TRAVEL

WARNING

AVOID DEATH OR SERIOUS INJURY

1. **When moving travel controls forward, tracked excavator will move in the direction of the idlers. Wheeled excavator will move in the direction of steering axle.**
2. **Before moving, make sure there are no persons or property in the way or on the machine. No riders. Sound the horn to alert workers and bystanders that you are about to move the machine.**
3. **Always 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. **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 stop engine to avoid accidental activation of controls.**

Automatic Travel Speed Control

WARNING

AVOID DEATH OR SERIOUS INJURY

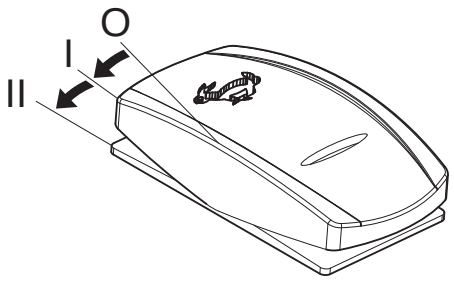
Do not change the travel mode while traveling. Always use speed mode "O" when traveling down a slope. Do not change to speed modes indicated "I" or "II" while going down a slope. Only change travel mode after coming to a complete stop.

Two travel speed ranges can be selected by using the travel speed selector switch on the control panel (Figure 29).

"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.



FG016016

Figure 29

Travel Control Lever Operation

1. To travel straight (Figure 30), 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.*

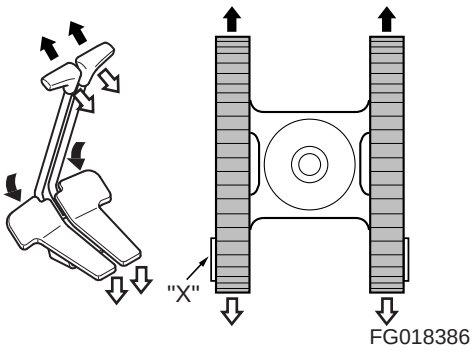


Figure 30

2. Pivot turns (Figure 31) 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.*

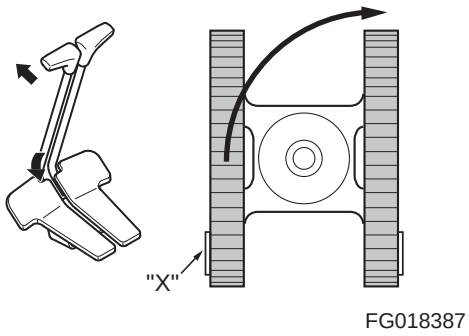


Figure 31

3. Spin turns (counterrotation) (Figure 32) are made by rotating one track forward and one track backward. The machine will spin around its center point.

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

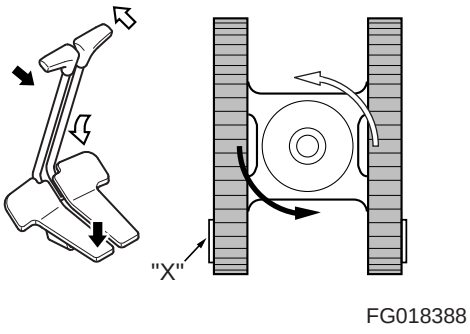


Figure 32

4. Stopping travel (Figure 33) - Returning travel levers to "NEUTRAL" position will automatically apply brakes and stop excavator.

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

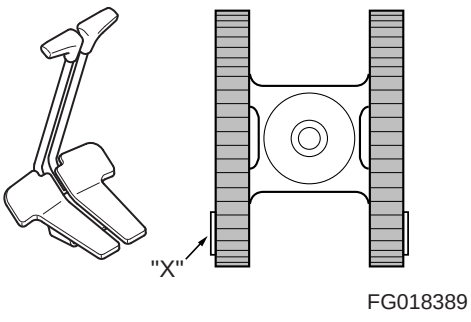
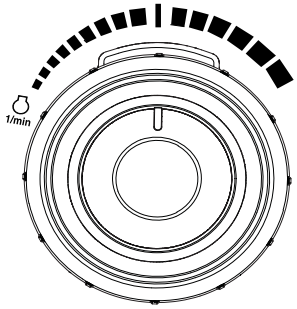


Figure 33

General Travel Instructions

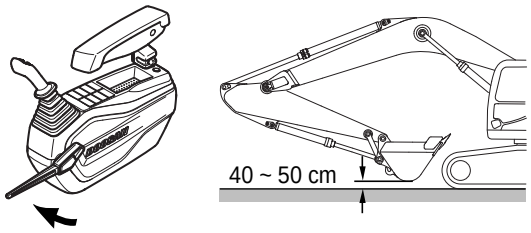
1. Set engine speed control dial (Figure 34) on desired speed.



FG018151

Figure 34

2. Move safety lever to "UNLOCK" position, and folding the front, raise it 40 - 50 cm (16 - 20 in) above ground. See Figure 35.



FG018385

Figure 35

3. When possible, travel on firm and 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)]. Reduce engine speed, to avoid shock loading the equipment. Be careful that an excessive force is not added to equipment by climbing on rocks.

FG018390

Figure 36

5. On rough, frozen, or uneven terrain, travel slowly.

WARNING

AVOID DEATH OR SERIOUS INJURY

When traveling, keep bucket (attachment) raised from 20 - 30 cm (8 - 12 in) above the ground. Fasten your seat belt.

Operator should pay attention when traveling backward on a slope.

Never turn or travel across a slope.

Travel straight up or down the slope.

Choose a safe alternate route before climbing a slope.

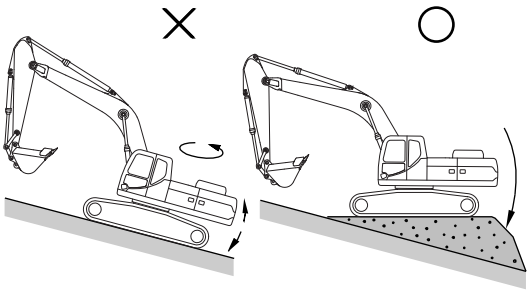
If excavator starts to slip or becomes unstable, lower the bucket immediately into the ground, using it as a brake.

Avoid working on slopes, because there is a risk of rollover while swinging and performing front attachment operations.

Do not 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 37.

Do not travel on slopes more than 30° because of risk of rollover.



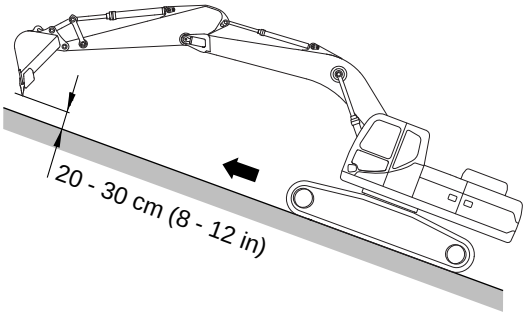
FG018391

Figure 37

6. Travel straight up or down slopes, never diagonally across the slope. See Figure 38 and Figure 39. 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.

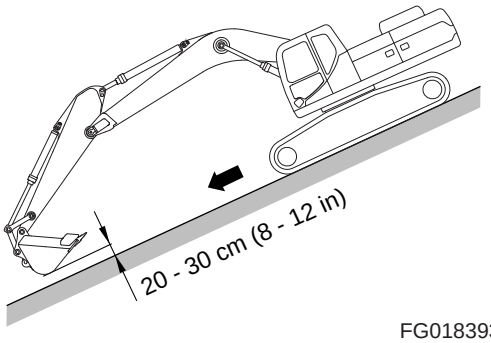
   NOTE: *Even though engine stops on a slope, do not operate swing control. The hydraulic accumulators can cause the unit to swing.*

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



FG018392

Figure 38



FG018393

Figure 39

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

IMPORTANT

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 must be at 90°.

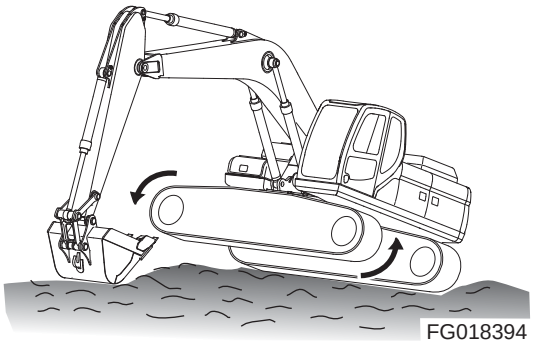


Figure 40

Make sure that material buildup has been cleared. See Figure 40 and Figure 41.

8. The excavator can travel in water that comes up to center of upper carriage rollers. Make sure that footing is solid so the machine will not sink. See “Working in Water” on page 3-49.

   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 DOOSAN distributor.*

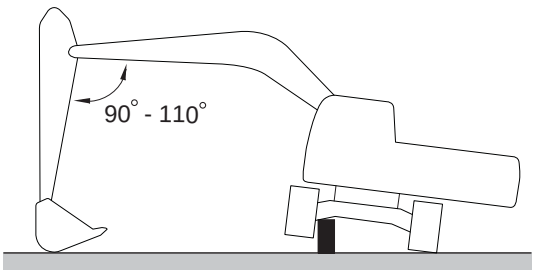


Figure 41

Straight Travel Pedal (Optional)

WARNING

AVOID DEATH OR SERIOUS INJURY

1. **When moving travel controls forward, tracked excavator will move in the direction of the idlers. Wheeled excavator will move in the direction of steering axle.**
2. **Before moving, make sure there are no persons or property in the way or on the machine. No riders. Sound the horn to alert workers and bystanders that you are about to move the machine.**
3. **Always 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. **Operate the travel control pedal smoothly to avoid sudden starts or stops.**
6. **Before leaving the operator's seat, make sure to lock out all control systems and stop engine to avoid accidental activation of controls.**

Operating

1. Forward
2. Reverse

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

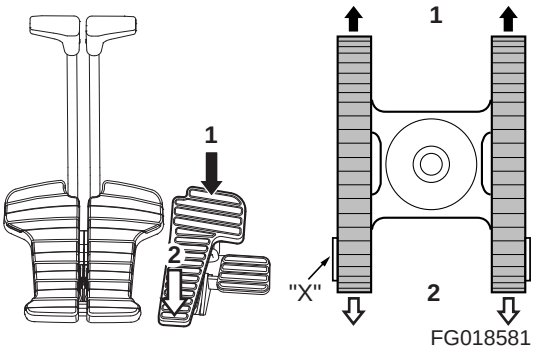


Figure 42

Locking Pedal

When straight travel pedal in not needed, the pedal can be locked by using the prop rod (1, Figure 43) locking device.

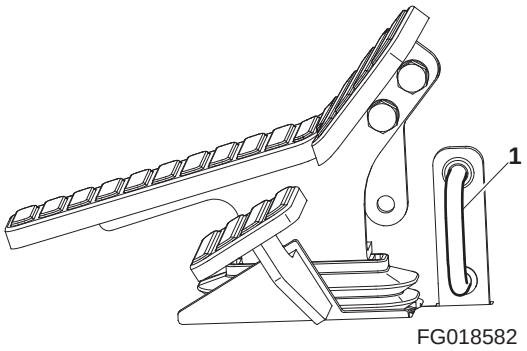


Figure 43

Locking is completed when the top end of the prop (1) is positioned into pedal hole.

A. Location for "UNLOCKING" (Figure 44).

B. Location for "LOCKING" (Figure 44).

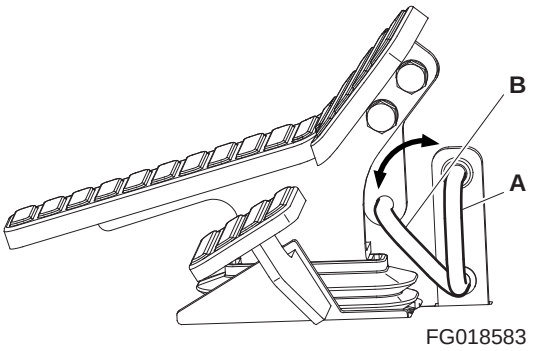
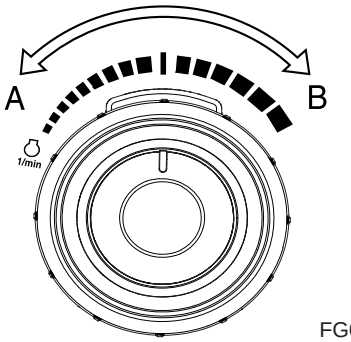


Figure 44

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.



FG018094

Figure 45

IMPORTANT

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

Engine Exhaust Emission Control System

This machine is equipped with an engine exhaust emission control system that meets applicable engine EPA/EU exhaust emission regulations. The owner/operator is responsible for proper operation and maintenance of the emission controls system as provided in this manual and the emissions-related warranty provisions.

The engine exhaust system is equipped with a diesel particulate filter (DPF). The DPF is an emissions reduction device that removes diesel particulate matter or "soot" from the exhaust gases of the diesel engine. The DPF will trap and collect the particulate matter until it is burned off. The process of burning off the collected particulate matter is called "regeneration". After the regeneration process is completed, ash residue will remain and will need to be periodically removed from the DPF. Ultra Low Sulfur Diesel fuel and API-CJ-4/ACEA-E9 grade engine oil must be used with this engine for the emission control system to function properly.

If you have any questions about the operation or maintenance of your emission control system, contact your DOOSAN distributor.

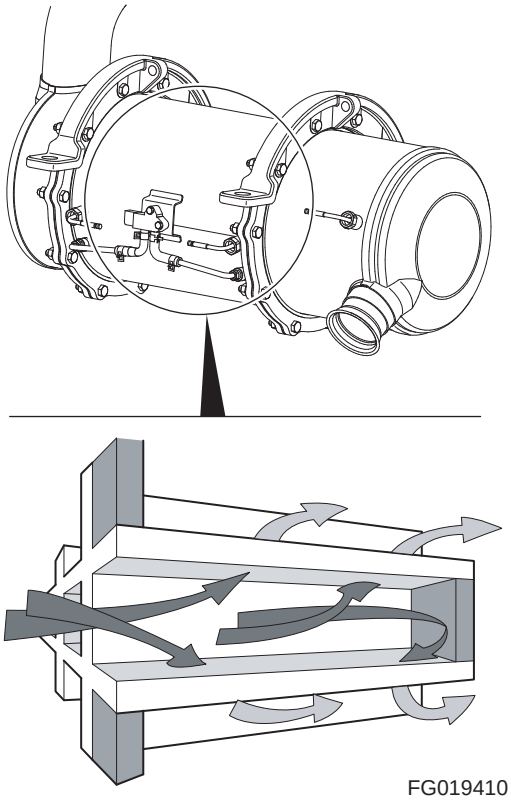
⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Exhaust gas temperature and exhaust system components are very hot during regeneration. This can cause a fire or burn hazard and result in death or serious injury or property damage. Keep flammable material and explosive gases away from exhaust system during regeneration.

Regeneration of Diesel Particulate Filter (DPF)

This is an internal illustration of the DPF and shows how particles (soot) are filtered in arrows' flow direction. (Figure 46)



FG019410

Figure 46

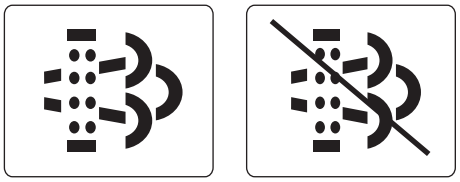
Diesel Particulate Filter (DPF) Regeneration Light and Switch

WARNING

AVOID DEATH OR SERIOUS INJURY

Exhaust gas temperature and exhaust system components are very hot during regeneration. This can cause a fire or burn hazard which can result in death or serious injury or property damage. Keep flammable material and explosive gases away from exhaust system during regeneration.

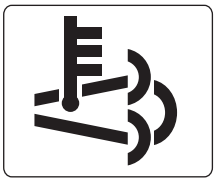
1. Regeneration light: light turns "ON" when regeneration is required, or during the regeneration process. When the operator inhibits regeneration, the symbol will be displayed as shown in the right-hand view of Figure 47.



FG018399

Figure 47

2. The high temperature warning light turns "ON" as shown in Figure 48 to alert the operator of hot engine exhaust gases.

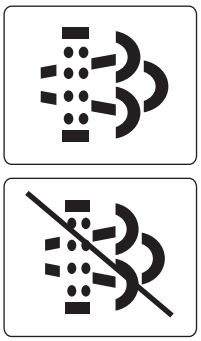


FG018398

Figure 48

3. Manual (forced) regeneration and inhibit switch: the upper symbol in Figure 49 is shown when the operator selects manual (forced) regeneration with the switch. When the operator inhibits regeneration, the lower symbol will be displayed as shown in Figure 49.

   NOTE: *If manual (forced) regeneration is necessary after the inhibited regeneration switch is turned "ON", press inhibited regeneration switch again to turn "OFF" the inhibit symbol. Press switch to manual (forced) regeneration position to activate system.*



FG018400

Figure 49

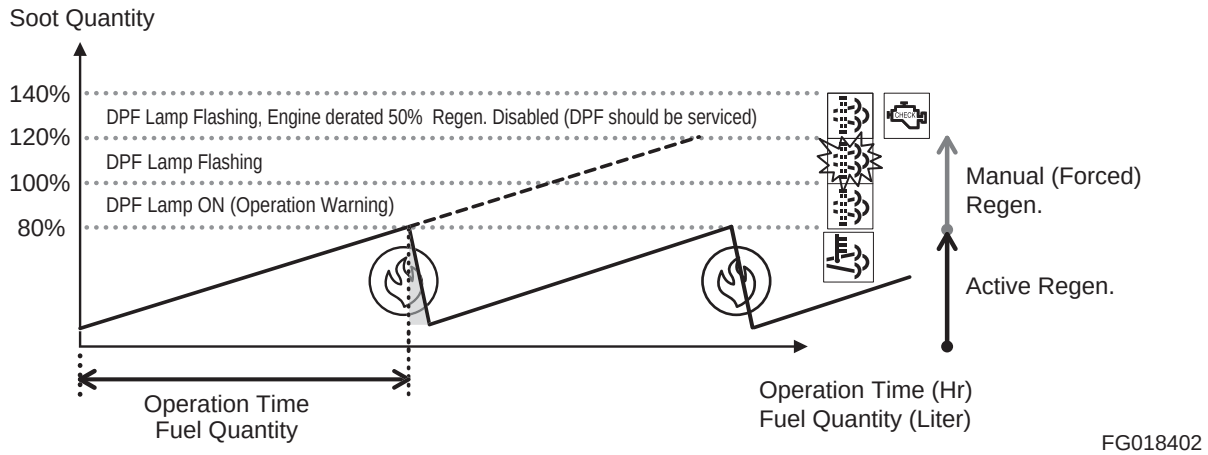


Figure 50 DPF Regeneration Light

- Regeneration light turns "ON" when soot quantity in DPF is 80% or more.
- Regeneration light "FLASHES" when soot quantity in DPF is 100%.
- Regeneration light "FLASHES" + engine output power reduction (50%) occur when soot quantity in DPF exceeds 120%.

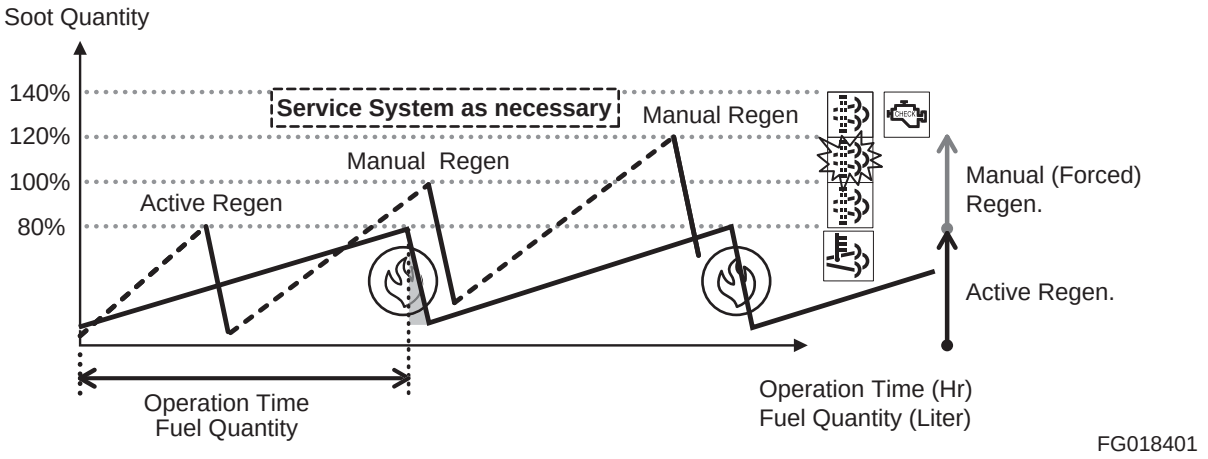


Figure 51 DPF Regeneration Method

- Soot quantity in DPF is 80% or less: active regeneration.
- Soot quantity in DPF is 100% or less: Manual (Forced) regeneration.
- Soot quantity in DPF is 120% or less: Manual (Forced) regeneration.
- Soot quantity in DPF is 120% or more: regeneration is impossible, service the emission control system. Contact your DOOSAN distributor for more information.

Diesel Particulate Filter - Service Chart		
Level/Light Status	**Filter Status**	**Requested Action**
	Soot in DPF is 80% or less	Active Regeneration
"ON" (RED)	Soot in DPF is 100% or less	Manual (Forced) Regeneration (Service Regeneration)
"FLASHING" (RED)	Soot in DPF is 120% or less	Manual (Forced) Regeneration Immediately (Service Regeneration)
"FLASHING" (RED) + Engine Output Power Reduction	Soot in DPF is 120% or more	Service the Emission Control System Immediately

Passive Regeneration

The engine provides adequate exhaust gas temperature for regeneration.

Active Regeneration

No action by the operator is required to start active regeneration. Regeneration of the DPF is automatically activated by the engine control unit (ECU) when particulate matter or "soot" has reached certain levels in the DPF. When the soot quantity in the DPF is near 80%, active regeneration will start. If the soot quantity exceeds 80%, the operator should activate manual (forced regeneration). When the soot quantity exceeds 120%, the engine warning light turns on and the engine's output power is reduced to 50%. If this occurs, service the emission control system. Contact your DOOSAN distributor for more information.

Active regeneration can occur anytime the engine is running, while operating the machine or when the machine is parked. During regeneration, the regeneration light and the high temperature warning light turn "ON" to alert the operator of hot engine exhaust gases. Machine operation can continue, but the operator should keep engine exhaust away from flammable materials. The operator can choose to "inhibit" active regeneration, if operating conditions are not favorable to hot engine exhaust temperatures (e.g. working near flammable materials).

The regeneration process can last for 30 minutes or longer. When completed, the regeneration lights on the monitor will turn "OFF".

IMPORTANT

Do not stop engine during regeneration. This can severely damage the DPF.

Manual (Forced) Regeneration

The regeneration process of the DPF is manually (forced) activated by the operator when the operator chooses to start the regeneration process. Manual (forced) regeneration may be required if the operator "inhibits" the active regeneration process for an extended period of time because the operating conditions are not favorable to hot engine exhaust temperatures (e.g. working near flammable materials).

WARNING

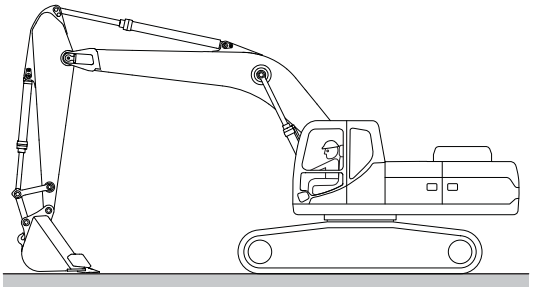
AVOID DEATH OR SERIOUS INJURY OR PROPERTY DAMAGE

Exhaust gas temperature and exhaust system components are very hot during manual (forced) regeneration.

FOLLOW THESE INSTRUCTIONS DURING MANUAL (FORCED) REGENERATION:

- **Keep flammable material and explosive gases away from exhaust system during manual (forced) regeneration.**
- **Park machine in open area that is well ventilated.**
- **Lower boom and position arm in vertical position as shown in Figure 52.**
- **Move safety lever to "LOCK" position.**
- **Engage parking brake (Wheel excavators only).**
- **Operator must be in operator's position during the regeneration process. Keep bystanders away.**

NOTE: ***Slight movement of the bucket (work tool) hydraulic cylinder can occur during the manual (forced) regeneration process.***



FG023282

Figure 52

Procedures for manual (forced) regeneration by the operator.

1. Park machine in a well ventilated area and away from flammable materials. Position machine and lower boom as shown in Figure 52.
2. Set up machine in the following manner:
   A. Operate machine until engine coolant and oil temperatures are above 40°C (104°F).
   B. Move engine speed to "LOW IDLE".
   C. Put transmission lever in "NEUTRAL" and engage parking brake (Wheel excavator only).
3. Move safety lever to "LOCK" position.

4. Activate regeneration switch (Figure 53) to start regeneration process.

   NOTE: *Slight movement of the bucket (work tool) hydraulic cylinder can occur during the manual (forced) regeneration process.*

   NOTE: *Regeneration light on monitor (Figure 54) will be "ON".*

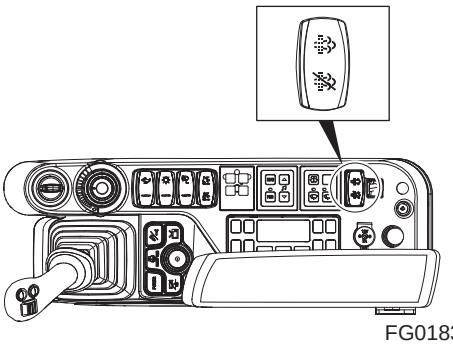
Engine speed will gradually increase from "LOW IDLE" to 1,800 rpm and regeneration process will then start.

Manual (forced) regeneration can last up to 40 minutes or more depending on amount of soot build-up.

During regeneration, high temperature warning light will be "ON".

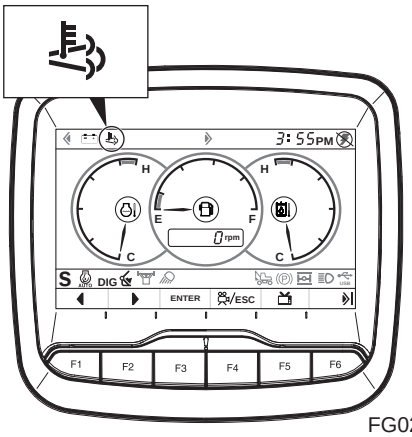
When regeneration stops, regeneration and high temperature warning lights will turn "OFF".

NOTE: *Operator can stop manual (forced) regeneration by raising safety lever to "UNLOCK" position.*



FG018395

Figure 53



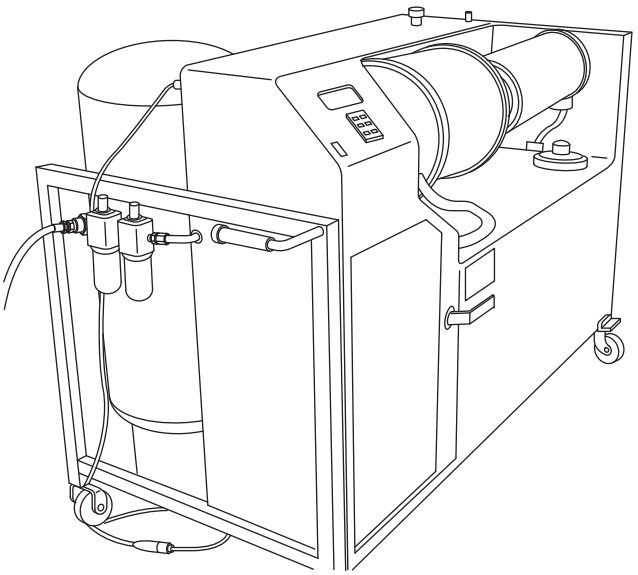
FG021740

Figure 54

DPF Cleaning (Removing Ash in DPF)

Regeneration of soot collected in the DPF leads to the accumulation of ash in the DPF, which in turn results in reduced engine performance and reduced fuel efficiency because of the increase of back pressure. Periodic ash cleaning is necessary to prevent this. The DPF assembly must be removed for cleaning. The frequency of ash cleaning depends upon the operating conditions, environment, and engine oil used. The cleaning is recommended to be done after every 4,500 hours of operation.

Contact your DOOSAN distributor for DPF cleaning.



FG018403

Figure 55 DPF Ash Cleaning Equipment

Removal and Installation of the DPF Assembly

The following instructions must be followed when handling the DPF assembly:

1. The weight is approximately 65 kg (143 lb) and DPF assembly can be easily damaged. Remove and handle assembly carefully.
2. When replacing the differential pressure sensor, check that sensor pipe is free of foreign materials. Foreign materials can trigger a fault signal because of incorrect differential pressure sensing.
3. When removing from the machine, protect the inlet/outlet of the DPF assembly from foreign materials. Foreign materials can damage the DOC/DPF assembly.
4. Do not to damage the differential pressure sensor and temperature sensor on the outside of the DPF assembly during disassembly/assembly work.
5. Replace the DPF gasket when reassembling the DPF. Otherwise, an exhaust leak can result.
6. Observe specified tightening torque of the exhaust system fasteners. Leakage in the exhaust system can result in failure to meet emission control regulations.

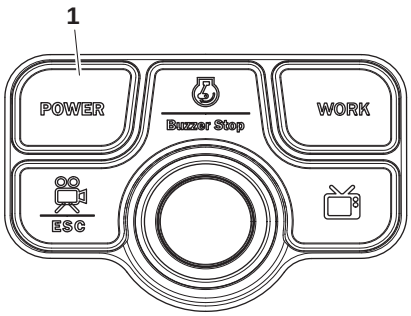
Mode Selection

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 the following guide.

Power Mode

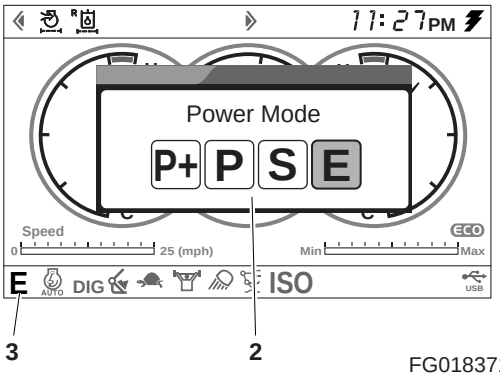
1. When the starter switch is turned "ON" the power mode is automatically defaulted to the standard setting.
2. Select a proper power mode using button (1, Figure 56) before starting work.
3. When the power mode button (1, Figure 56) is pressed, instrument panel displays a power mode selection pop up menu (2, Figure 57).

   When power mode is selected, symbol (3, Figure 57) shows on screen.



FG018157

Figure 56



FG018371

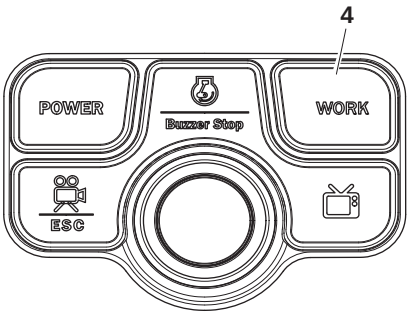
Figure 57

Mode	Selection Point
Power Plus Mode	• Heavy work. • Maximize production with full Power.
Power Mode	• Fast work. • Work in a short period of time.
Standard Mode	• General work. • Optimize speed and fuel consumption.
Economy Mode	• Light work. • Minimize fuel consumption. • Reduce noise.

Work Mode

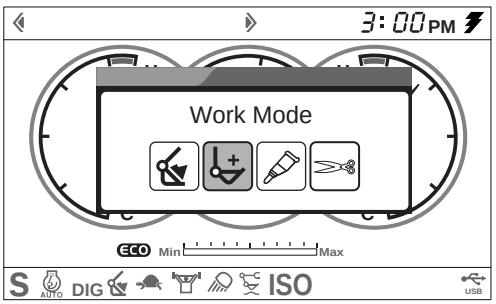
1. When the starter switch is turned "ON" the work mode is automatically defaulted to digging mode.
2. Select a proper work mode using button (4, Figure 58) before starting working.

   (Digging/Lifting/Breaker/Shear Mode)



FG018372

Figure 58

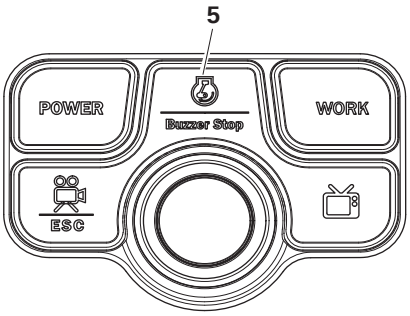


FG018373

Figure 59

Auto Idle Mode

1. The system will automatically reduce engine speed to idle speed approximately four (4) seconds after all the control levers are in the "NEUTRAL" position. When any lever is operated, 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 symbol is turned "ON", the auto idle function is activated. Deactivate the auto idle function by again pressing the auto idle selector button (5, Figure 60). Now the symbol will be turned "OFF".



FG018440

Figure 60

WARNING

AVOID DEATH OR SERIOUS INJURY

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

Boost Mode

1. Power boost switch is used to achieve maximum digging force.
2. The power boost is activated when button is pressed on top of right-hand work lever (joystick).

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

   NOTE: *Do not use this switch for more than seven (7) seconds.*

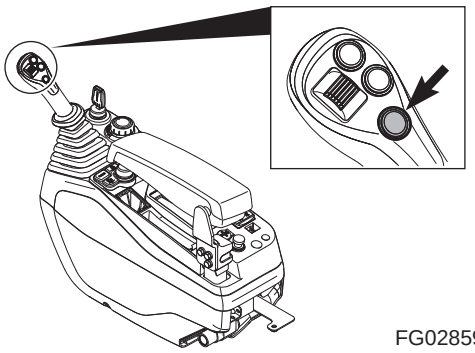


Figure 61 Right-hand Work Lever (Joystick)

Work Levers (Joysticks) (ISO Pattern)

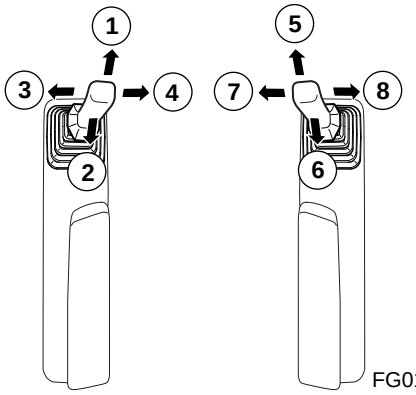
WARNING

AVOID DEATH OR SERIOUS INJURY

Check surrounding area before swinging. When operating a lever while in auto idle, proceed with caution because the engine speed will increase rapidly. Keep bystanders away.

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

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



FG018404

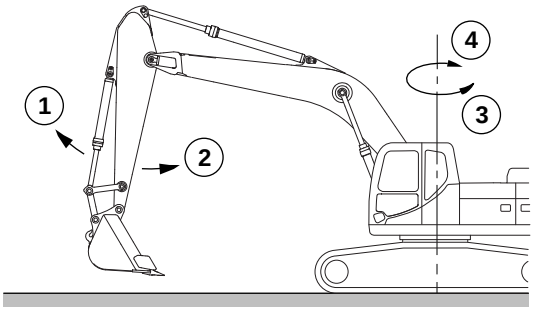
Figure 62

Left-hand Work Lever (Joystick) (Figure 62 and Figure 63)

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 stopped.*

NOTE: *When operating the arm, it may stop momentarily. When the arm is operated, the weight of the arm can cause it to move faster than the amount of oil being supplied.*



FG018405

Figure 63

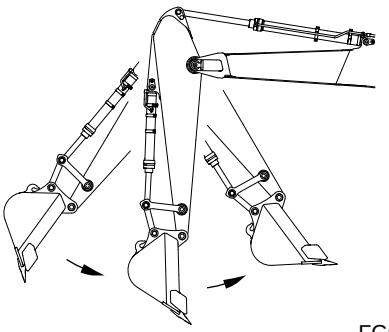
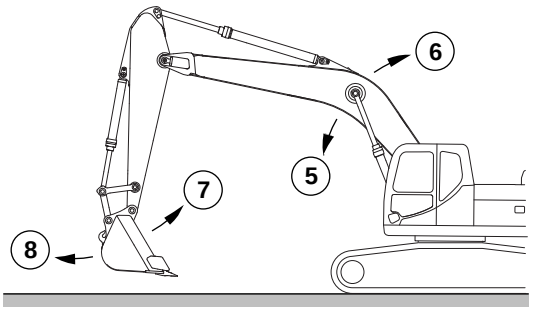

FG000120

Figure 64

Right-hand Work Lever (Joystick) (Figure 62 and Figure 65)

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 the operating work lever (joystick) by moving safety lever to "UNLOCK" position and turning starter switch "ON".*



FG018406

Figure 65

Change Machine Control Pattern By Selector Valve (If Equipped)

WARNING

AVOID DEATH OR SERIOUS INJURY

Check surrounding area before swinging. When operating a lever while in auto idle, proceed with caution because the engine speed will increase rapidly. Keep bystanders away.

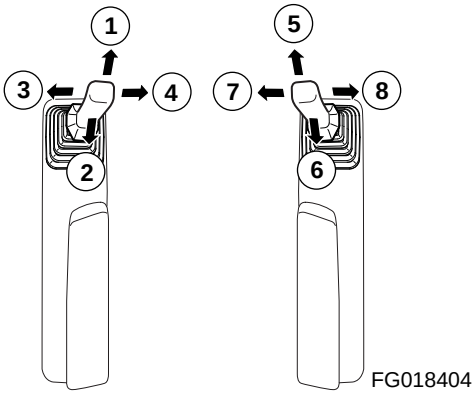


Figure 66

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 pattern or to the BHL pattern by changing the position of the selector valve (if equipped). Use the following procedure to change the position of the select valve.

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

1. Rotate spool to the ISO position or to BHL position.
2. A control pattern symbol shows on the display screen.

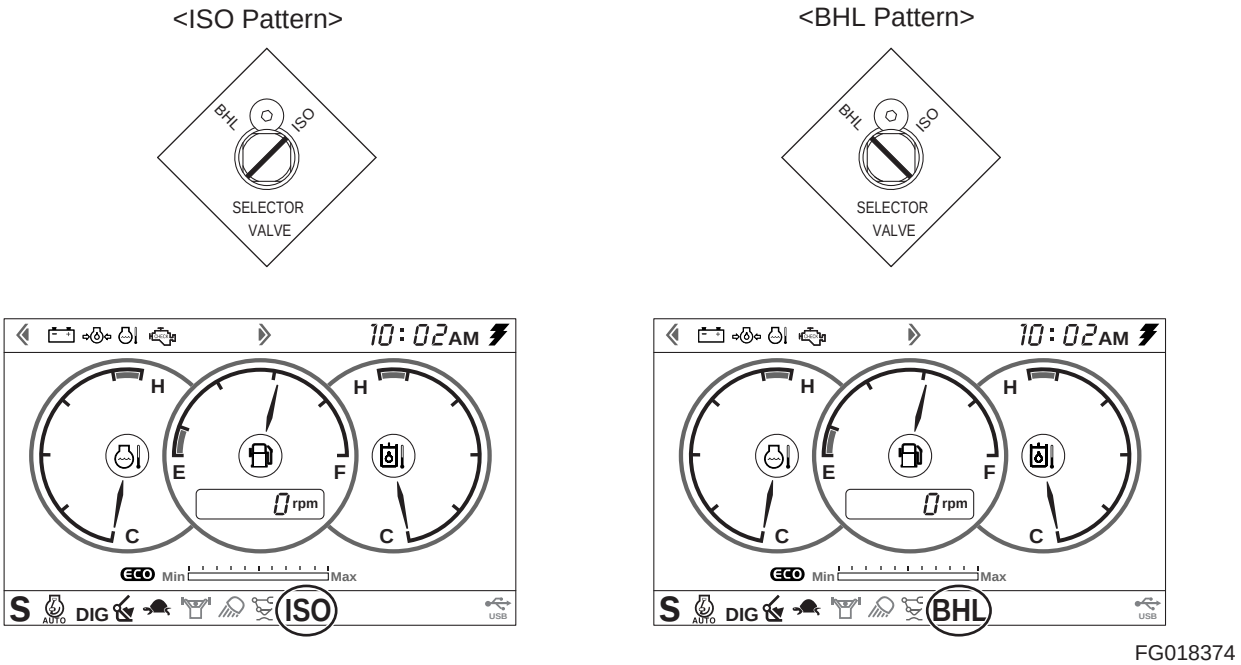


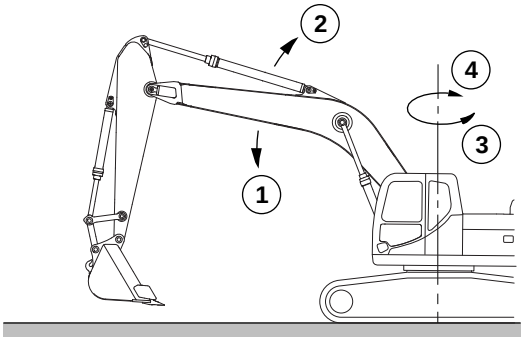
Figure 67

Work Levers (Joysticks) (BHL Pattern)

Left-hand Work Lever (Joystick) (Figure 66 and Figure 68)

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 stopped.*



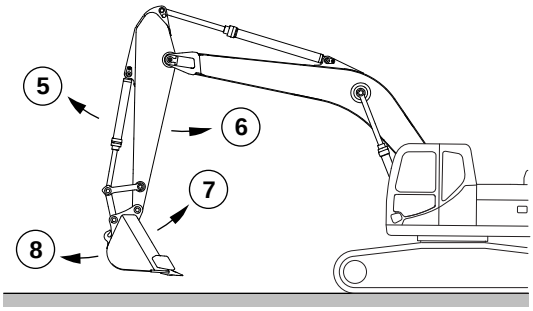
FG018407

Figure 68

Right-hand Work Lever (Joystick) (Figure 66 and Figure 69)

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

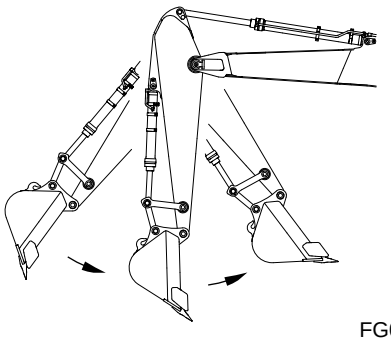
NOTE: *Even after stopping the engine, the front can be lowered to the ground by the operating work lever (joystick) by moving safety lever to "UNLOCK" position and turning starter switch "ON".*



FG018408

Figure 69

NOTE: *When operating the arm, it may stop momentarily. When the arm is operated, the weight of the arm can cause it to move faster than the amount of oil being supplied.*



FG000120

Figure 70

Intelligent Floating Boom Control (Optional)

NOTE:

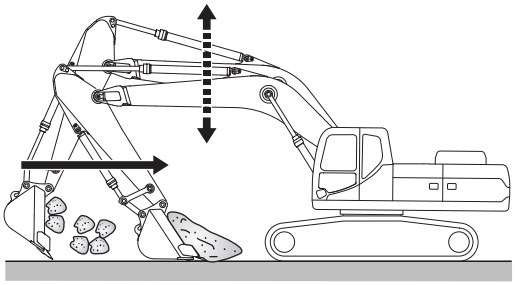
1. *The boom operating joystick must be in "NEUTRAL" position before operating the Intelligent Floating Boom mode selector switch.*
2. *If the tracks are raised up, do not select and use the Intelligent Floating Boom mode. This could cause the tracks to suddenly lower resulting in death or serious injury.*
3. *When the boom operating joystick is in boom lowering position and the bucket or other attachment is in contact with the ground, do not use Intelligent Floating Boom mode (temporary reset button).*

   If the tracks are raised and the Intelligent Floating Boom mode has been selected, pressing the temporary reset button can cause a tip over when the boom lowering control is activated at the same time.

See “9. Intelligent Floating Boom Switch (Optional)” on page 2-11 for further information.

Intelligent Floating Boom Mode

The boom can move freely "UP" and "DOWN" when any external force up or down is applied to the boom. Applications like using a breaker attachment, leveling, or stone gathering are easier and more convenient.



FG018446

Figure 71

WARNING

AVOID DEATH OR SERIOUS INJURY

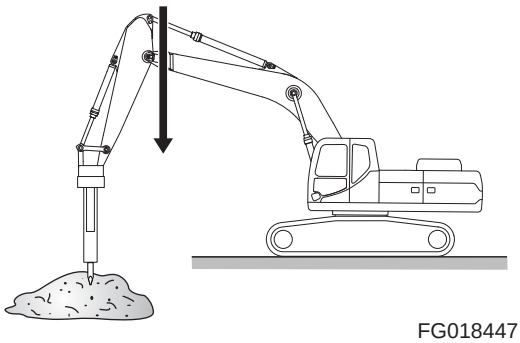
Death or serious injury can result from failure to follow the proper procedures.

While the front of the machine is elevated by front linkage, NEVER activate the Floating mode function and using the work tool joystick control. It could result in unexpected machine motion and serious injury or death.

To avoid the possibility of death or serious injury, follow the established procedures.

Operating a Breaker

The boom can freely move "DOWN". The breaker can be operated with only the weight of the work group on the front without additional force, resulting in less shock and vibration, and extended service life of the breaker. The breaker will remain in constant contact with the object.

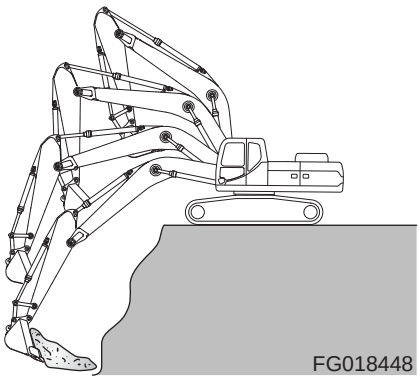


FG018447

Figure 72

Truck Loading

Boom lowering can be controlled without hydraulic pump flow discharge, increasing productivity and fuel efficiency.



FG018448

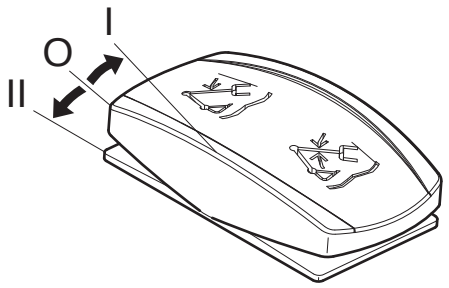
Figure 73

1. Intelligent Floating Boom Mode

   To select the Intelligent Floating Boom mode, set the Intelligent Floating Boom selector switch from "O" (NORMAL MODE) to "I" (INTELLIGENT FLOATING BOOM MODE).

   Moving joystick in boom-down direction after selecting Intelligent Floating Boom mode will lower boom by using its own weight, and the boom will move upwards naturally by external load forces.

   NOTE: *When the Intelligent Floating Boom selector switch is in "O" (NORMAL MODE) position, the Intelligent Floating Boom will not operate.*



FG018272

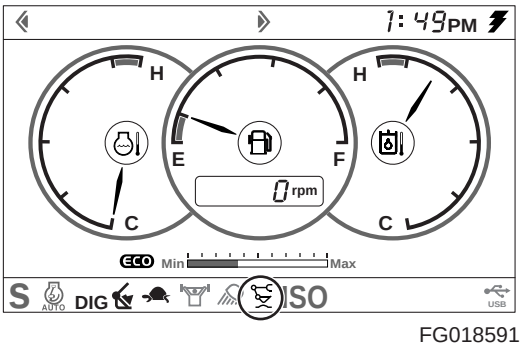
Figure 74

2. Breaker Mode

   To select the breaker mode, set the Intelligent Floating Boom selector switch from "O" (NORMAL MODE) to "II" (BREAKER MODE).
   Moving joystick in boom-down direction, the boom will be lowered by its own weight.

   However, the boom upward movement is not smooth in breaker mode where the operator must move the joystick in boom rising direction.

   NOTE: *When the Intelligent Floating Boom selector switch is in "O" (NORMAL MODE) position, the Intelligent Floating Boom will not operate.*

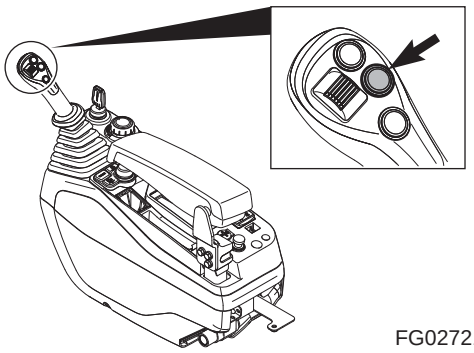


FG018591

Figure 75

3. Temporary Reset Button

   If the Intelligent Floating Boom temporary reset button on the joystick is pressed, additional downward force can be exerted when lowering the boom during Intelligent Floating Boom operation.



FG027214

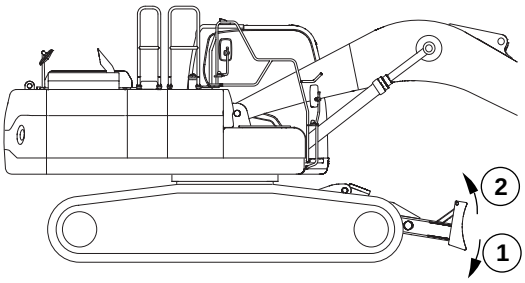
Figure 76

Leveling Blade (Optional)

If the machine is equipped with the optional leveling blade, the leveling blade control lever is on the left control stand. To lower blade, "PUSH" lever forward. To raise blade, "PULL" lever backwards.

Whenever leveling blade is being used to level ground, make sure to set travel speed control to "LOW SPEED". Attempting to use leveling blade in "HIGH-SPEED" will cause damage to drive system.

1. Blade down
2. Blade up



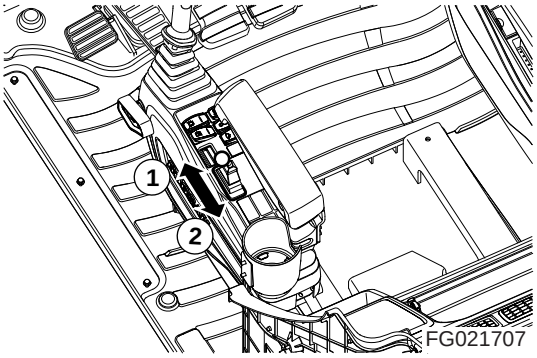
FG021706

Figure 77

WARNING

AVOID DEATH OR SERIOUS INJURY

- **Check the blade location before traveling. When the blade is to the rear, operate the steering levers/foot pedals in the opposite direction to when the blade is in the front.**
- **Move the steering levers/foot pedals slowly. Abrupt lever motion will cause the machine to jerk.**



FG021707

Figure 78

Two-Piece Boom (Optional)

If the machine is equipped with the optional two-piece boom (Figure 79), the two-piece boom foot control pedal is to the left of the travel control levers/pedals. To lower upper boom, press on "BOTTOM" (2, Figure 80) of pedal. To raise upper boom, press on "TOP" (1, Figure 80) of pedal.

1. Upper boom "UP"
2. Upper boom "DOWN"

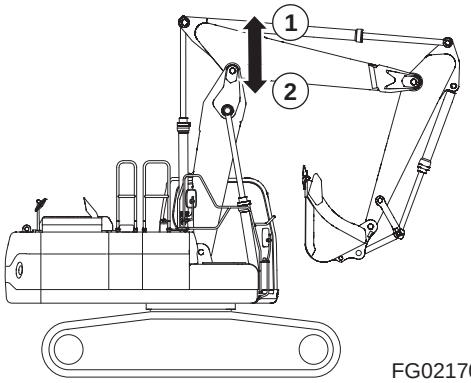


Figure 79

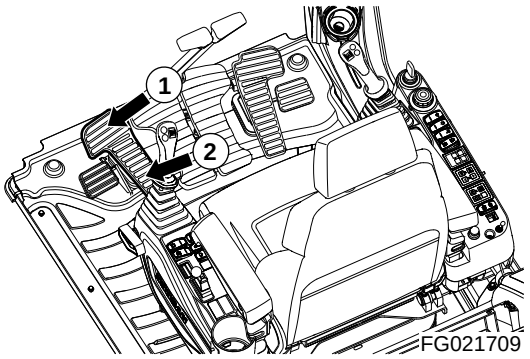


Figure 80

OPERATING PRECAUTIONS

WARNING

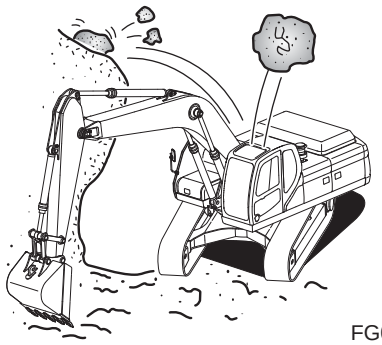
AVOID DEATH OR SERIOUS INJURY

Do not rest your feet on the travel pedals during normal machine operation. Unexpected machine travel can occur.

If levers or pedals are operated when the auto idle is being actuated, the engine rpm will suddenly increase so be careful during operation.

It is possible that 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.

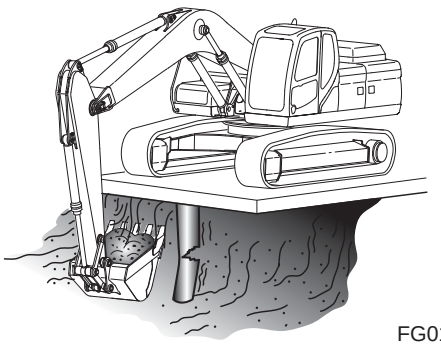
1. Before starting work, inspect terrain and soil conditions. Level ground and drain area if necessary.
2. Install window guards for additional operator protection when working if there is a possibility of falling rocks or other objects. See Figure 81.



FG018409

Figure 81

3. Check strength of supported structures before working on them to avoid collapse of the structure caused by the weight of the excavator. If insufficient, reinforce it. See Figure 82.



FG018410

Figure 82

4. When working close to the excavated edge or drop-off, make sure that the machine is sitting on solid ground. Keep the travel motors (1, Figure 83) to the rear. See Figure 83.

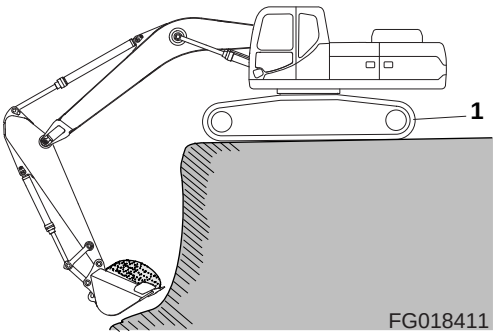


Figure 83

5. Do not allow bottom side of the boom to interfere with or touch the ground or track when digging a deep hole. See Figure 84.

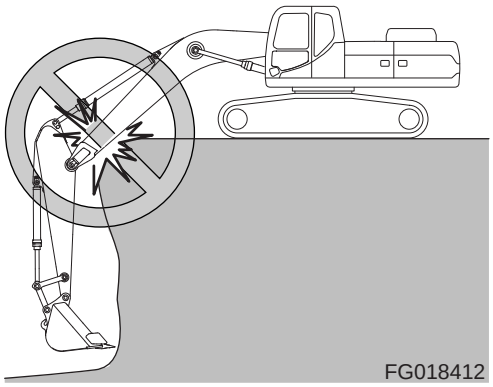


Figure 84

6. When machine is equipped with a leveling blade, and digging a deep hole, operate the machine keeping the leveling blade to the rear. Do not to allow the boom to interfere with the leveling blade. See Figure 85.

   Do not allow bottom side of the boom to interfere with or touch the ground or track blade when digging a deep hole. See Figure 86.

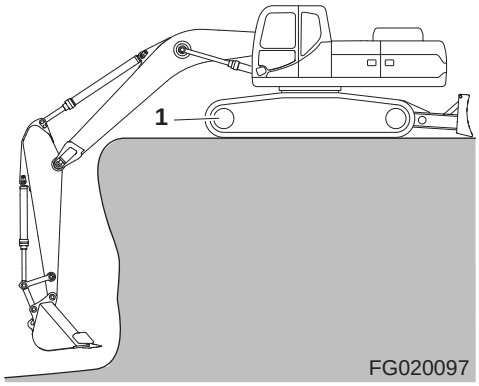


Figure 85

WARNING

AVOID DEATH OR SERIOUS INJURY

When leveling blade is positioned to rear, remember that travel motors (1, Figure 85) are facing edge of drop-off.

- **Check the blade location before traveling. When the blade is to the rear, operate the steering levers/foot pedals in the opposite direction to when the blade is in the front.**
- **Move the steering levers/foot pedals slowly. Abrupt lever motion will cause the machine to jerk.**

7. Do not allow bottom side of the boom to interfere with or touch the ground, track or leveling blade when digging a deep hole. See Figure 86.

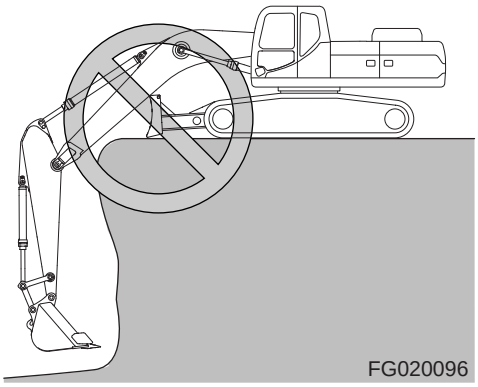


Figure 86

8. Do not excavate underneath the machine. The ground under the machine can collapse and cause the machine to fall and rollover. See Figure 87.

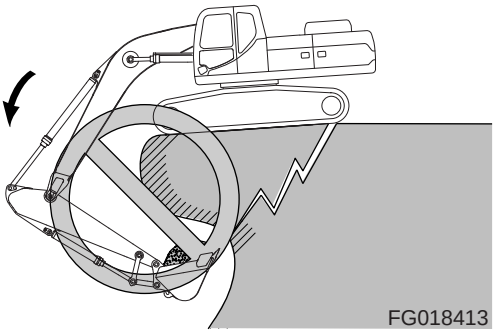


Figure 87

9. Make sure there is adequate clearance from overhead electrical supply lines. Check for underground utility lines before excavating. Call before you dig. See Figure 88.

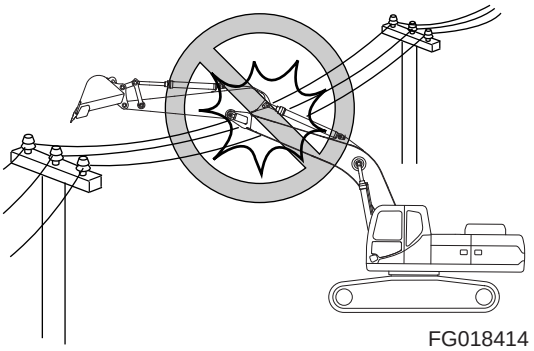


Figure 88

10. 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 89.

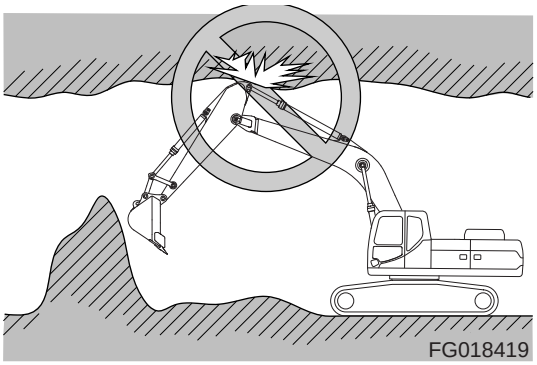


Figure 89

11. Do not continually "bottom out" the hydraulic cylinders. Machine damage can occur if the cylinders are fully extended or retracted. For example: arm cylinder fully retracted and the bucket cylinder is extended to rotate the bucket into the ground. See Figure 90.

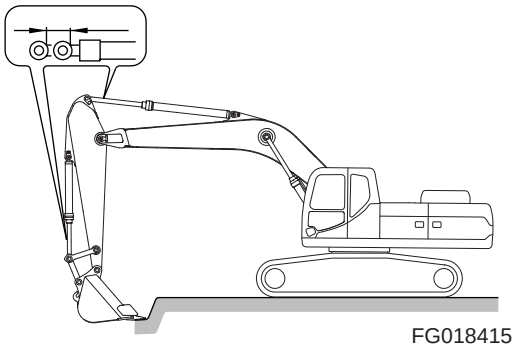

FG018415

Figure 90

12. Do not dig with the excavator tracks raised. This can result in structural and mechanical failures. See Figure 91 and Figure 92.

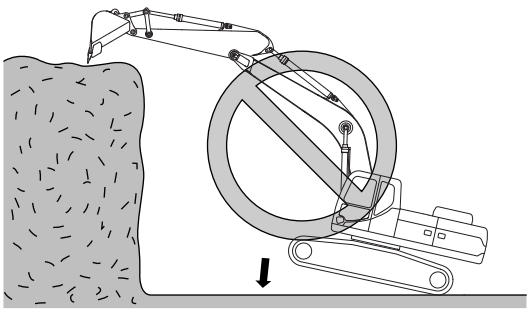

FG018417

Figure 91

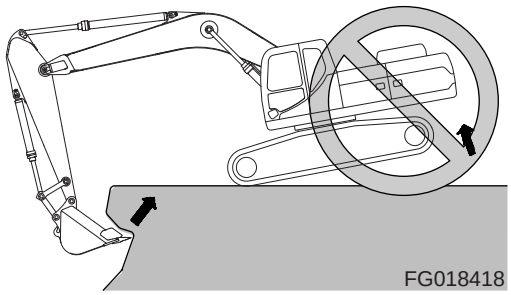

FG018418

Figure 92

13. Do not use the bucket as a hammer or ramming device. This can cause damage to the front attachment. See Figure 93.

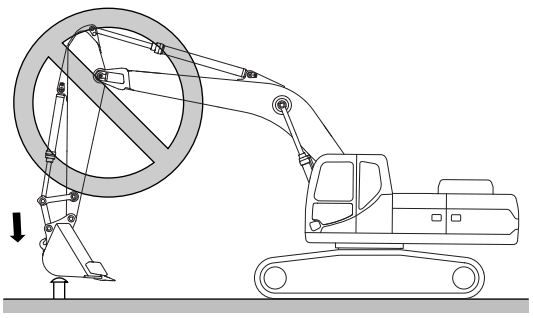
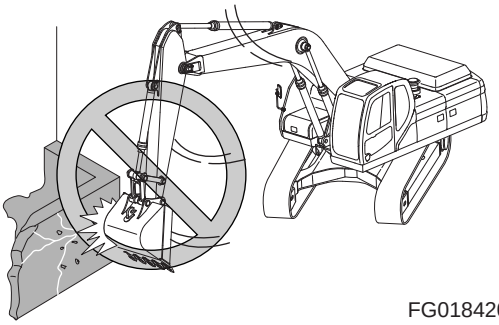

FG018416

Figure 93

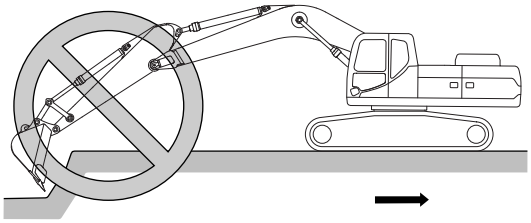
14. Do not move dirt or objects by swinging the excavator into them. This can result in structural and mechanical failures. See Figure 90.



FG018420

Figure 94

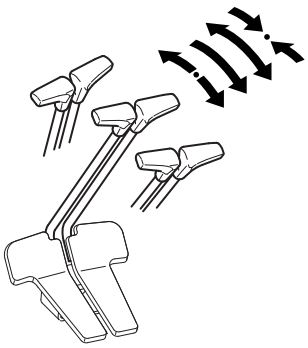
15. Do not use machine travel when the bucket is in the ground to provide additional breakout force. See Figure 95.



FG018421

Figure 95

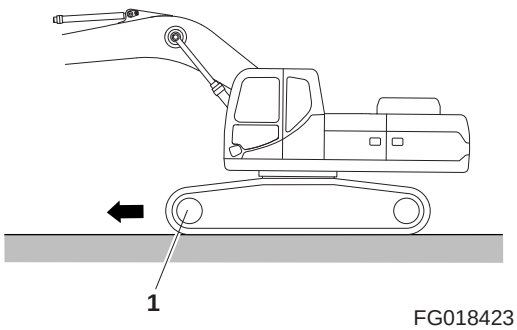
16. Do not operate travel levers quickly or jerk them when traveling in high range. See Figure 96.
    - Avoid sudden starts.
    - When traveling in one direction, come to a complete stop before reversing directions. Do not rock excavator back and forth with levers.
    - Avoid sudden stops. Return levers to neutral by hand. Do not let them snap back to neutral on their own.



FG018422

Figure 96

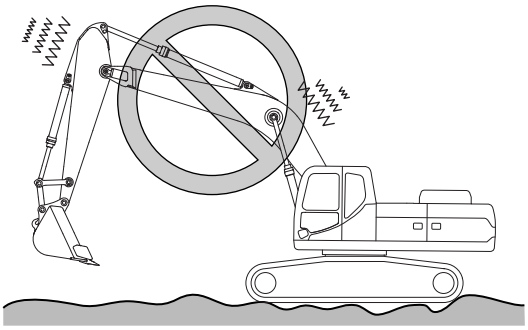
17. To protect undercarriage of the machine when traveling on rough ground or on rocks, set the idler (1, Figure 97) facing in travel direction. The idler and track spring are spring cushioned to absorb direct impacts.



FG018423

Figure 97

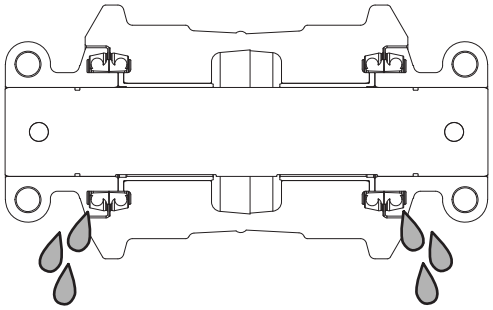
18. Do not travel at high-speed over rough ground or rocks. This can result in structural and mechanical failures and can reduce the service life of the machine. See Figure 98.



FG018424

Figure 98

19. Do not travel continuously for a long time. The lubricating oil temperatures inside the track rollers will rise, and this will cause damage to the oil seal or leakage of oil. If traveling continuously for a long time, it is recommended to stop the machine for 15 minutes every 2 hours to allow the lubricating oil inside the track rollers to cool down. See Figure 99.



FG018452

Figure 99

20. If optional long fronts (arm extensions) or attachments or heavy-duty front end attachments are used, the machine balance will be altered. Follow these additional operating precautions. See Figure 100.

WARNING

AVOID DEATH OR SERIOUS INJURY

Do not travel downhill with front end attachments raised.

Do not travel across slopes. Travel straight up or down slopes.

Use extreme caution when swinging the upper frame when positioned on a slope. Keep bystanders away from swing area.

Allow extra swing stopping compartment. 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.

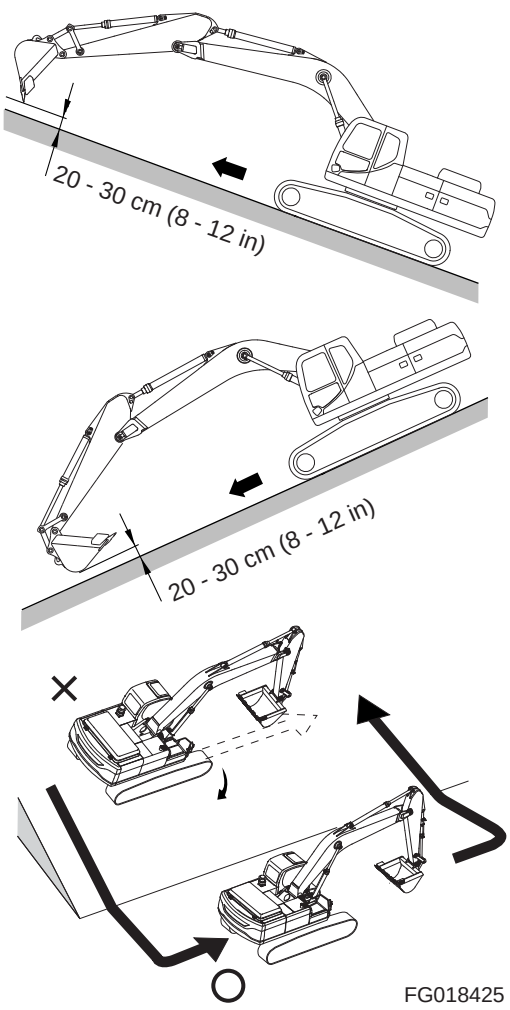
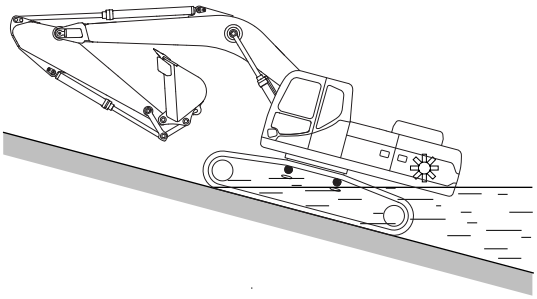


Figure 100

Working in Water

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.



FG018426

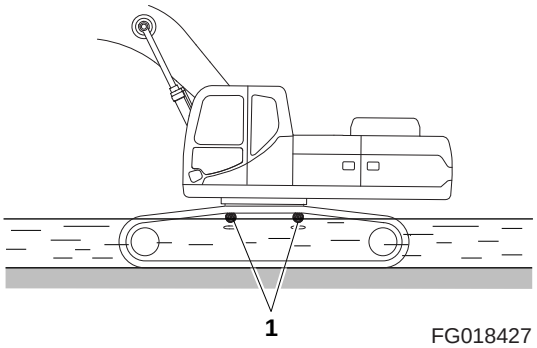
Figure 101

When working in water, do not operate in water higher than the center of upper track roller(s) (1, Figure 102).

If swing bearing gets wet, immediately grease it until all the 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 from bucket pins.



FG018427

Figure 102

Escaping From Mud

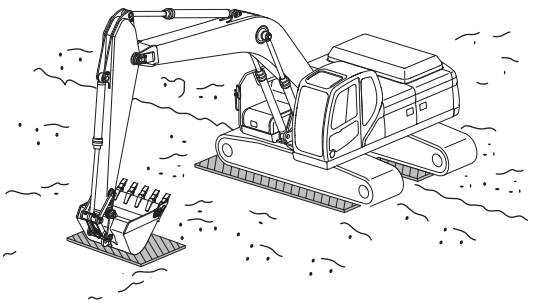
Be very careful to avoid getting stuck in mud.

Track On One Side Stuck

NOTE: *When using the boom or arm to raise the machine, always have the bottom of the bucket in contact with the ground. The angle between the boom and arm must be 90° - 110°.*

The same applies when using the bucket installed in the reverse direction.

When only one side is stuck in mud, use the bucket to raise the track and then lay boards or logs and drive the machine out.

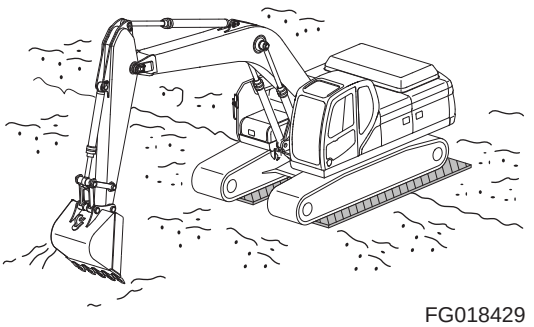


FG018428

Figure 103

Tracks On Both Sides Stuck

When the tracks on both sides are stuck in mud and slipping, making it impossible for the machine to move, lay boards or logs as explained above and dig the bucket into the ground in front. Then pull in the arm as in normal digging operations and put the travel levers in the FORWARD position to pull the machine out.



FG018429

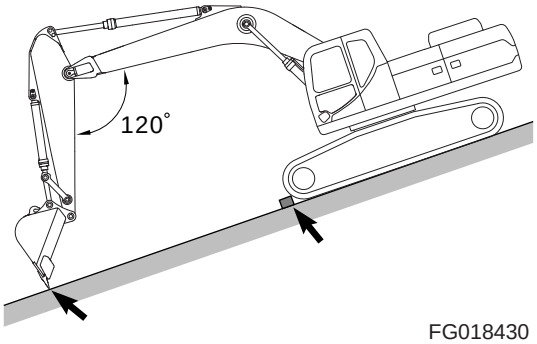
Figure 104

PARKING EXCAVATOR

WARNING

AVOID DEATH OR SERIOUS INJURY

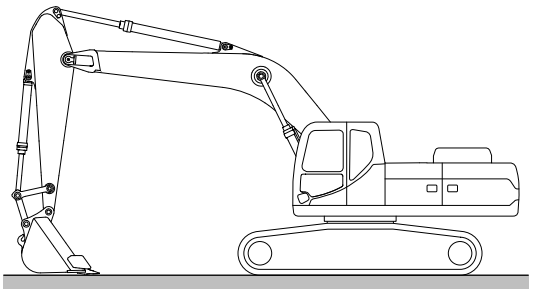
Park machine on firm and level ground. Avoid parking on slopes. If excavator must be parked on a slope, block tracks or wheels and place bucket teeth in ground. See Figure 105.



FG018430

Figure 105

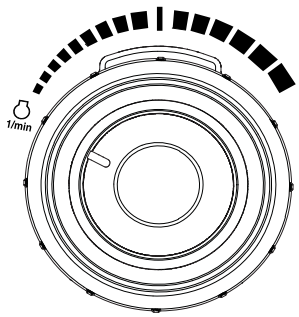
1. Park machine on firm and level ground. Lower bucket or work tool to ground as shown in Figure 106.



FG018379

Figure 106

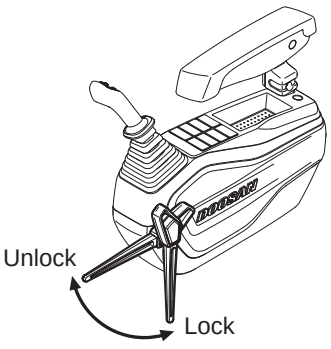
2. Set engine speed control dial on "LOW IDLE".



FG018152

Figure 107

3. If you move the operation lever unintentionally, it can cause accidental movement of the work group on attachment. Before leaving operator's seat, move safety lever to "LOCK" position. Stop engine.



FG018293

Figure 108

TOWING PROCEDURE

WARNING

AVOID DEATH OR SERIOUS INJURY

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 (cable).

When towing the excavator, use a wire rope (cable) or chain capable of handling the load.

Attach chain or wire rope (cable) to track frame.

Insert protective material such as thick cloths between track frame and wire rope (cable) to prevent the wire rope from being damaged.

WARNING

AVOID DEATH OR SERIOUS INJURY

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

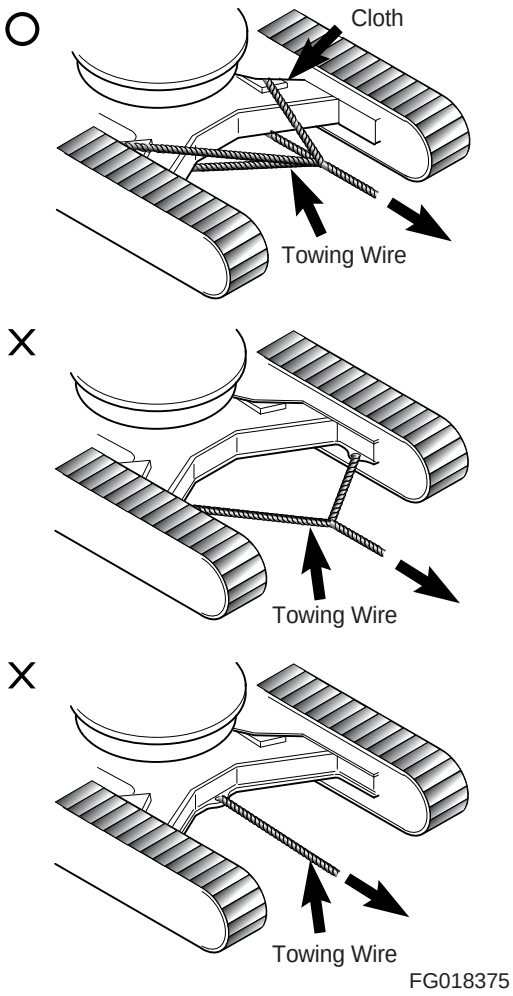


Figure 109

ATTACHMENTS

Bucket Replacement and Reversal

IMPORTANT

Mounting in reverse direction can result in interference during operation, and is not recommended.

WARNING

AVOID DEATH OR SERIOUS INJURY

When pins are knocked in with a hammer, pieces of metal may fly and cause serious injury.

When performing this operation, always wear goggles, hard hat, gloves, and other protective equipment.

When the bucket is removed, place it in a stable condition.

If pins are struck with a hammer, there is a potential hazard that they can fly out and injure a bystander. Make sure there is no one in the surrounding area before starting the operation.

When removing the pins, do not stand behind the bucket. Do not put your foot under the bucket while standing at the side for the work.

When removing or inserting pins, be careful not to get your fingers caught.

Never insert your fingers into the pinholes when aligning the holes.

Stop the machine on a firm and flat surface and do the work. When performing joint work, appoint a lead and follow that person's instructions and signals.

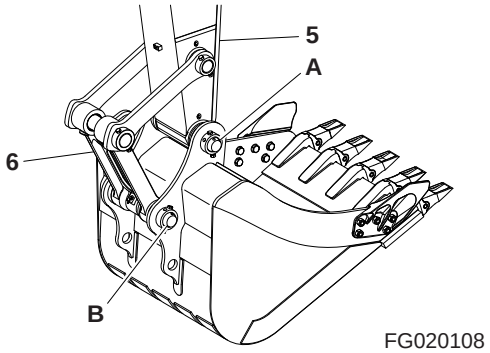
Replacement

1. Place the bucket in contact with a flat surface.

IMPORTANT

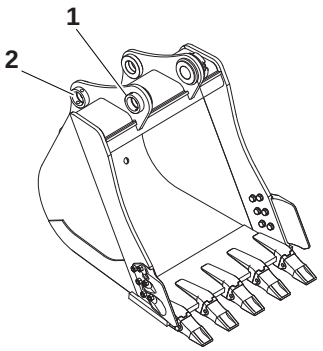
When removing the pins, place the bucket so it is resting slightly on the ground. If down pressure is applied to the bucket, the resistance will be increased and it will be difficult to remove pins. After removing the pins, make sure they are clean and do not allow mud, sand, or other debris to get on them. Dust seals are fitted at both ends of the bushings. Be careful not to damage them.

2. Remove double nut from bolt for arm pin (A, Figure 110) and link pin (B, Figure 110), remove bolt, pull out arm pin (A) and link pin (B, Figure 110), and then remove bucket.
3. Align the arm (5, Figure 110) with holes (1, Figure 111) of the replacement bucket and the link (6, Figure 110) with holes (2, Figure 111), then insert grease coated pins (A, Figure 110) and (B, Figure 110) into hole (1, Figure 111) and hole (2, Figure 111) respectively.



FG020108

Figure 110



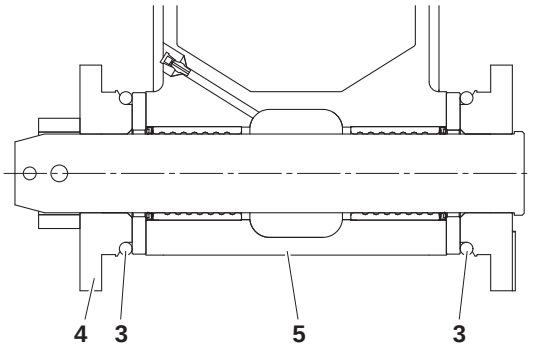
FG018432

Figure 111

4. When installing the bucket, for arm pin portion (A, Figure 110), fit O-rings (3, Figure 112) on bucket (4, Figure 112) in the position shown in the diagram on the right. After inserting the pin, position them in the standard groove.
5. Install the stopper bolts and nuts for each pins.
6. Lubricate with grease thoroughly until grease comes out from the end face.

IMPORTANT

When replacing the bucket, replace the dust seal if it has been damaged. If a damaged seal is used without being replaced, sand and dirt may enter the pin portion and cause abnormal wear of the pin.



FG019639

Figure 112

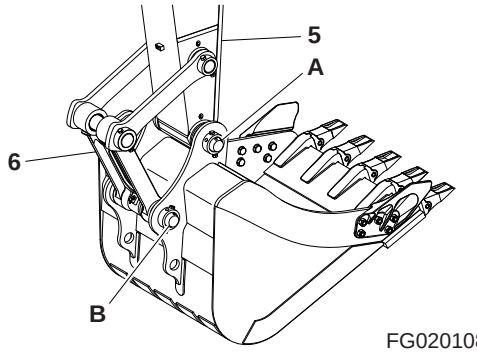
Reversal (If Applicable)

1. Place the bucket on a flat surface.

IMPORTANT

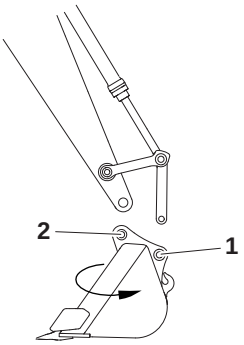
When removing the pins, place the bucket so it is in resting slightly on the ground. If down pressure is applied to the bucket, the resistance will be increased and it will be difficult to remove pins. After removing the pins, make sure they are clean and do not allow mud, sand, or other debris to get on them. Dust seals are fitted at both ends of the bushings. Be careful not to damage them.

2. Remove double nut on the stopper bolt for arm pin (A, Figure 113) and link pin (B, Figure 113), remove bolt, pull out arm pin (A, Figure 113) and link pin (B, Figure 113), and then remove bucket.



FG020108

Figure 113



FG018433

Figure 114

3. After removing the bucket, reverse it.
4. Align arm (5, Figure 113) with replacement bucket hole (1, Figure 114), then align link (6, Figure 113) with hole (2, Figure 114), then insert greased coated pins (A, Figure 113) and (B, Figure 113) into hole (1, Figure 114) and hole (2, Figure 114) respectively.

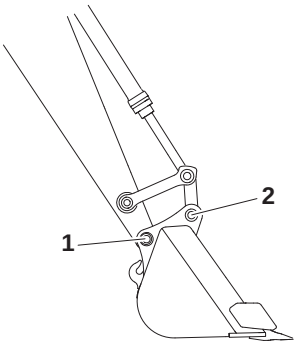
IMPORTANT

When reversing, do not install an O-ring. Keep the O-ring in a safe place until using it next.

5. Install the stopper bolts and nuts for each pin.
6. Lubricate with grease thoroughly until grease comes out from the end face.

IMPORTANT

When replacing the bucket, replace the dust seal if it has been damaged. If a damaged seal is used without being replaced, sand and dirt may enter the pin portion and cause abnormal wear of the pin.



FG018434

Figure 115

HYDRAULIC ATTACHMENTS (OPTIONAL)

Breaker Operation

IMPORTANT

If a hydraulic breaker and hydraulic piping is installed without DOOSAN's written authorization, it can damage the excavator and this 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.

Hydraulic Hoses and Tubing for Breaker

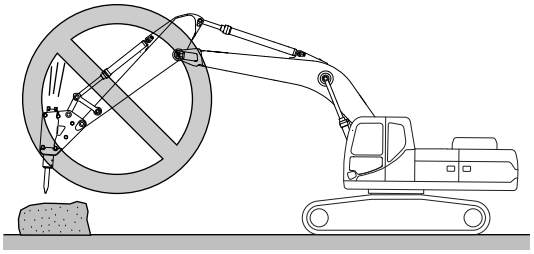
1. When installing hydraulic breaker, assemble according to instructions provided with kit.
2. If breaker is taken off excavator, be sure to plug and cap all hoses and tubing to prevent contamination from entering hydraulic system.
3. Plug and cap all connectors and fittings on breaker to prevent contamination.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

Breaker Operating Precautions

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 operator's manual.
2. Inspect all mechanical and hydraulic connections.
3. Do not use the breaker as a hammer. See Figure 116.
4. Do not drop breaker from extreme heights.

   This can damage breaker or the excavator.

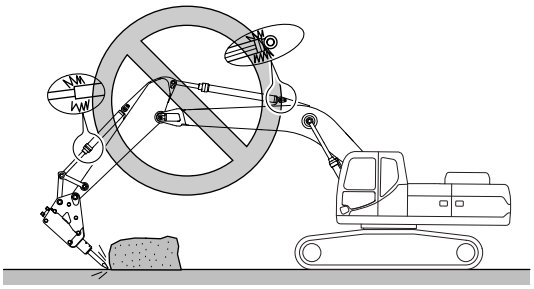


FG018435

Figure 116

5. Do not operate the breaker with the boom or arm cylinders fully extended (bottomed out). See Figure 117.

   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.



FG018436

Figure 117

6. Do not use the breaker if the hydraulic hoses vibrate excessively. See Figure 118. 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.

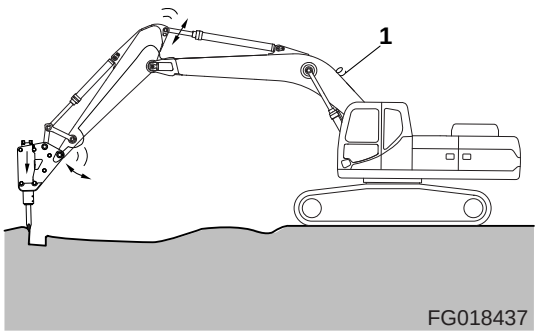
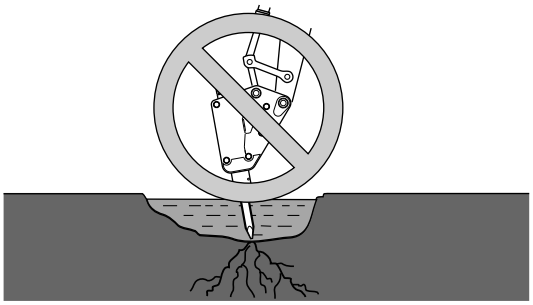


Figure 118

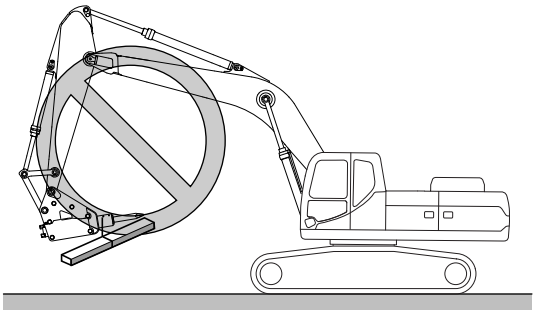
7. Do not allow the breaker body to go into water if not equipped for underwater operation. The breaker seal can be damaged and rust, foreign material or water can enter the hydraulic system and cause damage. Only insert the breaker tool into water. See Figure 119.



HAOB970L

Figure 119

8. Do not lift or tow with a breaker. See Figure 120.



FG018438

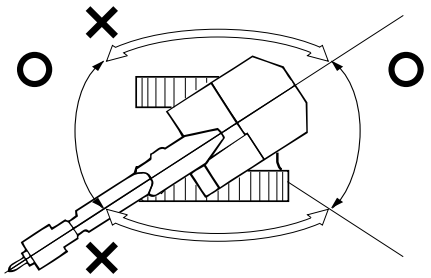
Figure 120

9. 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 121.

WARNING

AVOID DEATH OR SERIOUS INJURY

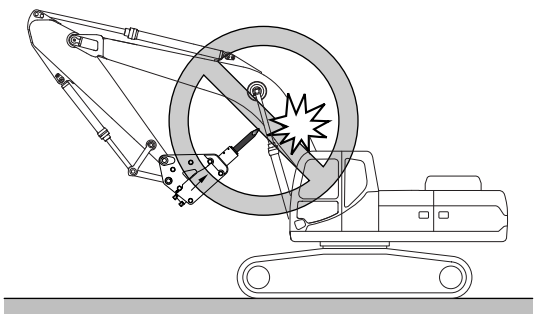
Operating a breaker with the upper structure turned 90° to the tracks can result in tipping over the machine or reduction in service life.



HAOB990L

Figure 121

10. Do not curl the breaker tool tip into the arm or boom when traveling or parking the excavator. See Figure 122.

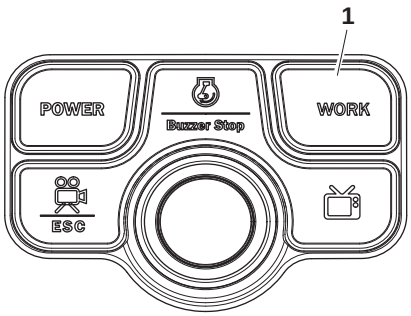


FG018439

Figure 122

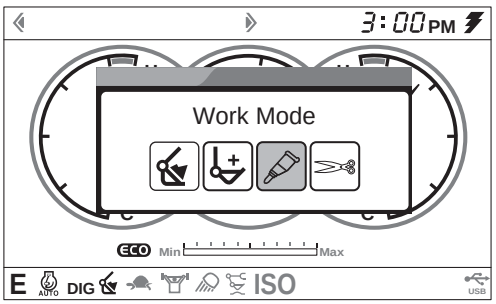
To Activate Breaker

1. Set work mode to breaker position using button (1, Figure 123)
2. Pressure button (3, Figure 125) on the top of right-hand work lever (joystick) to activate hydraulic breaker.
3. Release button (3, Figure 125) on the top of right-hand work lever (joystick) to deactivate hydraulic breaker.



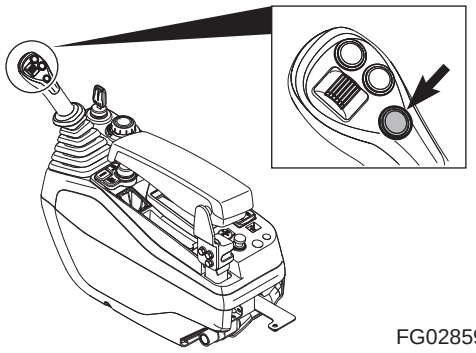
FG018376

Figure 123



EX1300478

Figure 124



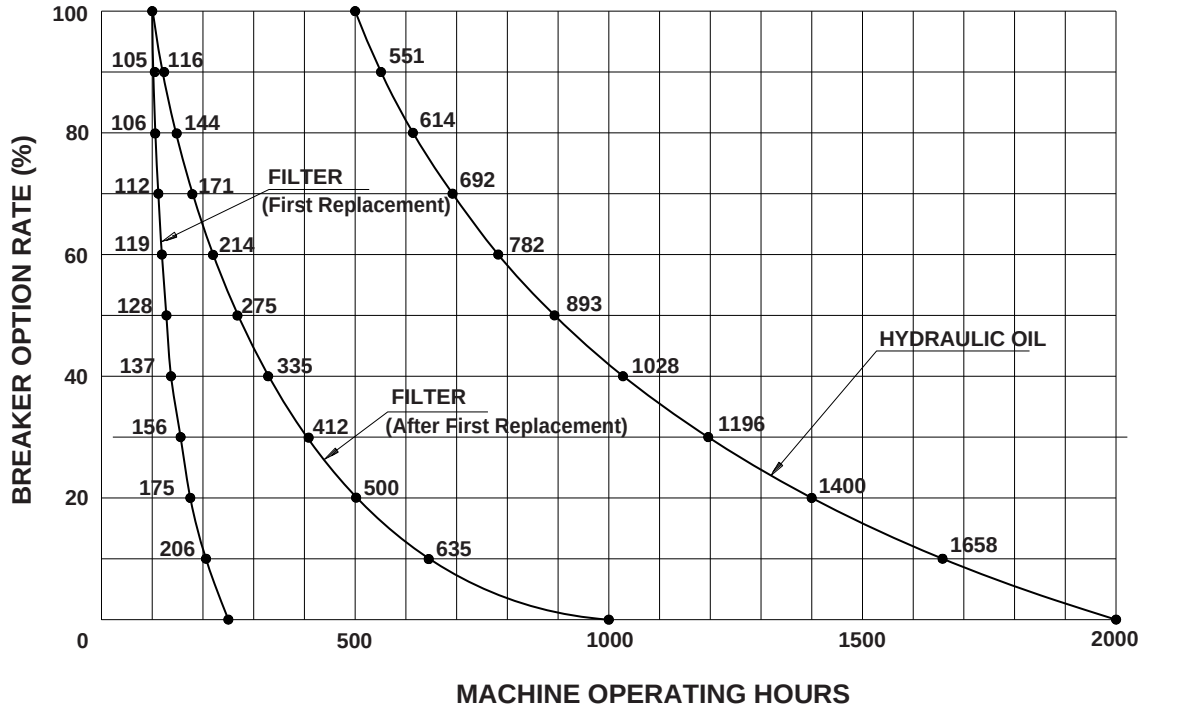
FG028599

Figure 125

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 genuine DOOSAN hydraulic oil and filter are used. If any other brands are used, the guaranteed change interval must be reduced in half.			



FG000767

Figure 126

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

Shear Operation (Optional)

WARNING

AVOID DEATH OR SERIOUS INJURY

Do not operate or work on this work tool unless you have read and understand the instructions and warnings given in this manual for both the work tool and the machine.

Failure to follow the instructions or heed the warnings could result in death or serious injury.

Contact your DOOSAN distributor for replacement manuals. Proper care and maintenance is your responsibility.

NOTE: *Selection of a hydraulic shear must be done with extra care.*

Use of a hydraulic shear not recommended by DOOSAN could result in structural damage to the machine.

Consult your DOOSAN distributor for hydraulic shear information.

Be sure that no one is near the work tool to prevent injury. Keep the work tool under control at all times to prevent injury. When a demolition tool is used, all personnel should maintain a minimum distance of 10 m (33 ft).

Close all windows. Make sure that all required operator protective guards are in place. Wear all required personal protective equipment. Follow the instructions given in this manual for the work tool.

WARNING

AVOID DEATH OR SERIOUS INJURY

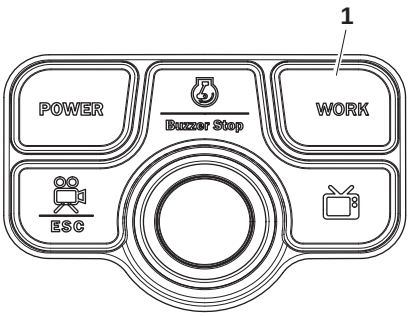
Death or serious injury could occur from the demolition of pipes, vessels, tanks or other containers that may contain gas, flammable materials, or hazardous chemicals.

Do not perform any demolition work on these items until all of their contents have been removed.

Follow all laws and regulations for the removal and disposal of these materials.

To Activate Shear

1. Set work mode to "SHEAR" position using button (1, Figure 127)

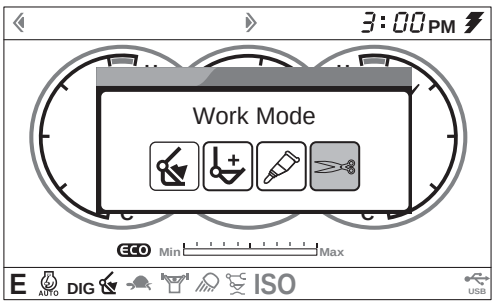


FG018376

Figure 127

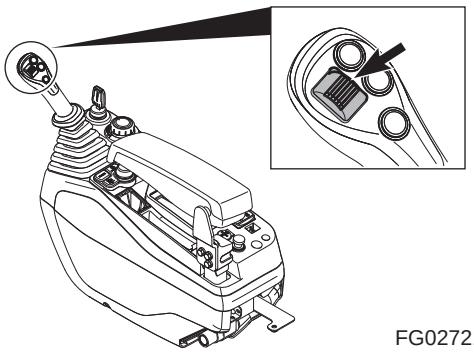
2. Move the thumb switch on the top of the right-hand work lever (joystick) to shear. Moving thumb wheel upward will "OPEN" the work tool.

3. Move the thumb switch on the top of the right-hand work lever (joystick) to shear. Moving thumb wheel downward will "CLOSE" the work tool.



EX1300479

Figure 128



FG027217

Figure 129

IMPORTANT

Cutting train or crane rails, engine crankshafts, welded fabrications, bearing, shafts, and other hard metals will increase the wear rate on the cutting edges and the shear.

IMPORTANT

Using the demolition tool to level the work site or push over standing structures can damage the machine or the demolition tool. Use appropriate equipment to do site preparation or maintenance operations.

Align the machine with the work area. Operate the hydraulic shear while you travel backward.

IMPORTANT

To avoid structural damage to the machine, do not break road surfaces by placing the cutting edge of the hydraulic shear on the ground and moving the machine.

To peel and remove road surface with the hydraulic shear, place the cutting edge of the stationary jaw between the road surface and the road bed. Use the work tool cylinder to separate the road surface and the road bed.

IMPORTANT

Operating the demolition tool with the cylinders fully retracted or fully extended could cause structural damage to the machine.

IMPORTANT

Using the machine hydraulic cylinder or the demolition tool rotating device to aid in the breaking or shearing process can damage the machine or the demolition tool rotating device. Use only the arm hydraulic cylinders to perform demolition operations.

IMPORTANT

Hitting the demolition tool against the ground or solid object to dislodge an obstruction or free the cutting arm can damage the demolition tool or the machine. Use a pry bar or cutting torch to free the cutting arm or dislodge the obstruction.

Always check the cutting edge alignment after the jaws are working properly.

Rotating Operation (Optional)

For a machine equipped with an attachment that rotates, move the thumb wheel switch on the top of the left-hand work lever (joystick) to rotate the attachment clockwise or counterclockwise. Moving thumb wheel upward is for clockwise rotation and moving thumb wheel downward is for counterclockwise rotation.

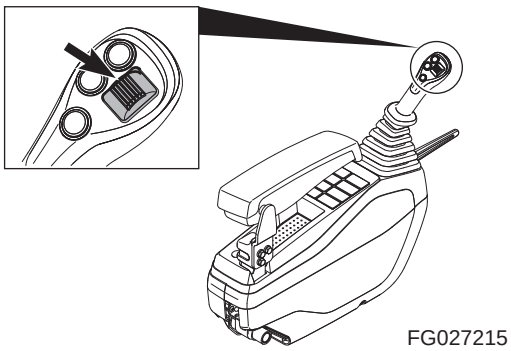


Figure 130

WARNING

AVOID DEATH OR SERIOUS INJURY

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, clockwise/counterclockwise, crowd/dump, etc.

Quick Coupler Operation (Optional)

Securing Work Tool

WARNING

AVOID DEATH OR SERIOUS INJURY

The following safety instructions are for your safety, the safety of bystanders, and to prevent property damage. Read the descriptions before using the machine and make sure you are familiar with all safety notices.

Hydraulic quick couplers must be installed, operated, inspected, serviced, maintained and repaired by qualified, appropriately trained and experienced people only.

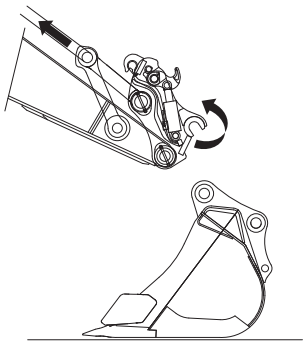
Ensure that the work tool or bucket is not carrying a load. If work tool or bucket is on unstable position or carrying a load, it may cause serious accident.

The buzzer will sound unless the coupler is not locked. Perform physical test by dragging the attachment on the ground to confirm the coupler pins are engaged.

- **Do not operate the machine if there are other workers or people in the work area. Also, never allow people to stand or pass under the bucket or attachment for any reason.**
- **Do not start or perform any work unless you are property trained. You should understand how to use the device according to the instructions.**
- **Make sure that device is correctly and securely engaged every time you change working tools or attachments.**
- **Perform the recommend daily check for safe operation.**

Attaching Quick Coupler to Excavator

1. Place the excavator and quick coupler on the level ground.
2. Retract the bucket cylinder. Align the quick coupler between the hinges of the work tool.



FG019086

Figure 131

3. Move the arm (1, Figure 132) forward and raise it until hook (2, Figure 132) engages the hinges of work tool.

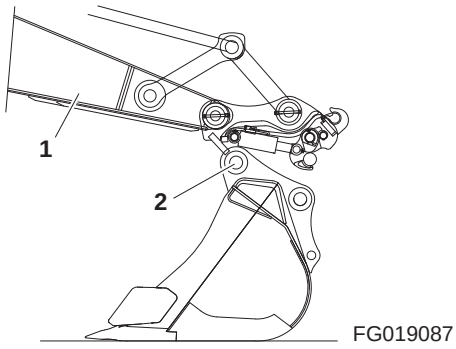


Figure 132

4. Set quick coupler switch to "I" (UNLOCK) position.

   NOTE: *To remove holding pin, maintain hydraulic relief condition for 2 - 3 seconds in bucket crowd position with the switch turned on.*

   NOTE: *Whenever the hitch part is extended, a warning alarm will sound. When setting switch to "O" (LOCK) position, the warning alarm will stop.*

5. Extend the bucket cylinder to move hitch part of quick coupler to bucket pin side.

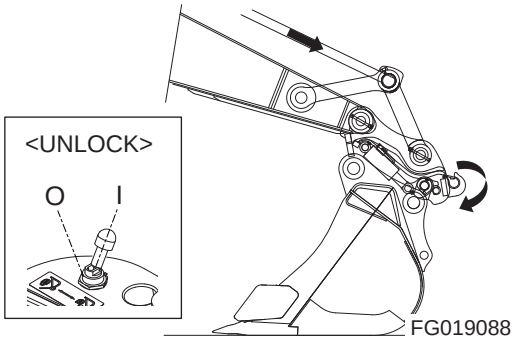


Figure 133

6. Set quick coupler switch to "O" (LOCK) position.
7. Retract the bucket cylinder to attach the hitch completely.
8. Check that hitch is engaged and the work tool is properly locked before operating.

   NOTE: *Insert safety pin (Figure 135) after completion.*

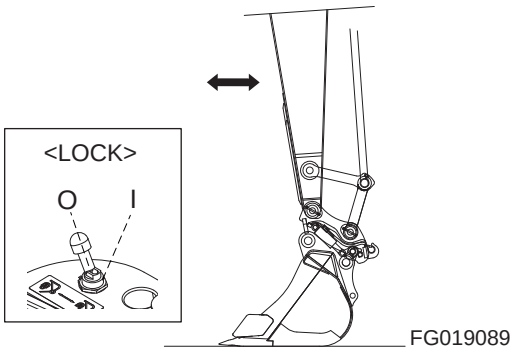


Figure 134

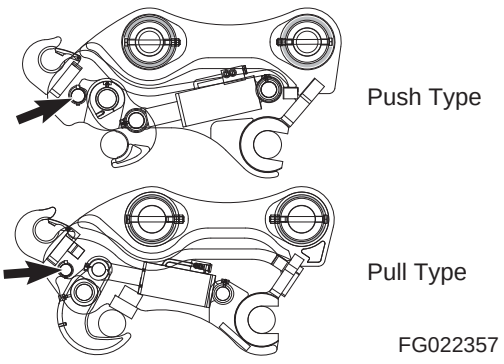


Figure 135

Releasing the Work Tool

1. Place the excavator and quick coupler on the level ground.
2. Set quick coupler switch to "I" (UNLOCK) position.

   NOTE: *To remove holding pin, maintain hydraulic relief condition for 2 - 3 seconds in bucket crowd position, with the switch turned on.*

   NOTE: *Whenever the hitch part is extended, a warning alarm will sound. When setting switch to "O" (LOCK) position, the warning alarm will stop.*

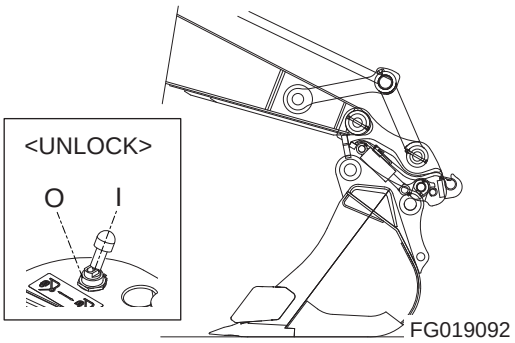


Figure 136

3. Retract the bucket cylinder to move the quick coupler toward the machine.

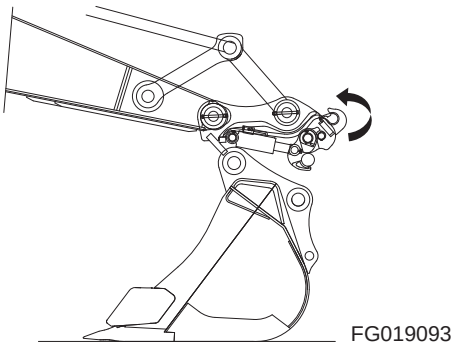


Figure 137

4. Set quick coupler switch to "O" (LOCK) position. Lower and move the arm away from the work tool and toward the machine.

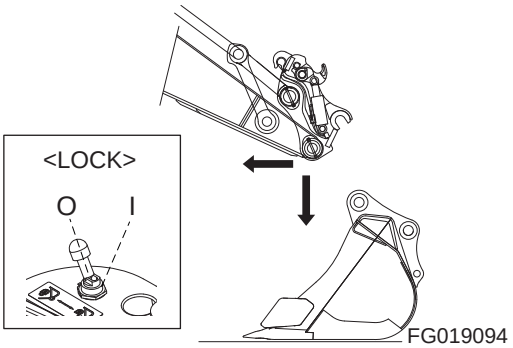


Figure 138

LIFTING OBJECTS

IMPORTANT

There may be local or government laws or regulations governing the use of excavators for the lifting of heavy loads. Always contact local and government agencies and follow all applicable laws and regulations.

When this machine is used in object handling applications, the machine must be properly configured and operated properly. Ensure the following safety working devices equipped and operated.

- Lifting eye for load hooking
- Hose burst protection on both boom and arm
- Overload warning devices

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.

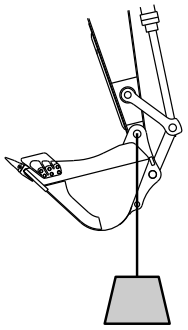
Always try to maintain the lifting eye (Figure 139) straight below the centerline of the arm and bucket pin. In this manner the weight of the load is being primarily held only by the pin, and not by the bucket cylinder, link, and link pins.

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 centerline is increased.



HAAD3830

Figure 139

Lifting Unknown Weight

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

WARNING

AVOID DEATH OR SERIOUS INJURY

If a load is picked-up from the front zone and swung into the side zone, a tip over could result. Do not exceed the rated load capacity for the lift zone that will be used.

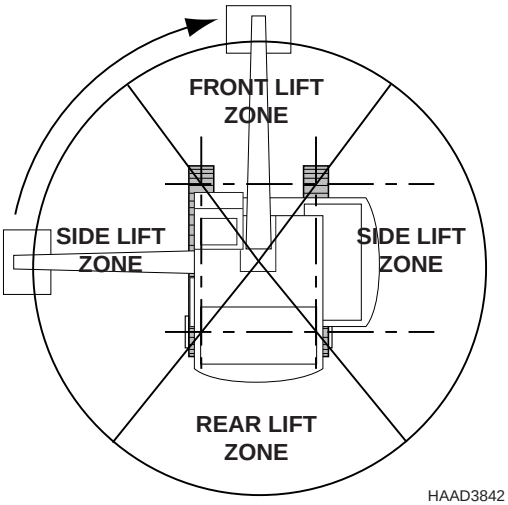


Figure 140

Lifting Known Weight

The load rating chart is the determining factor when lifting known weights. Whenever possible, lift and swing loads between the front idler area.

Pick and Carry

The machine can pick and carry loads. It is recommended that when traveling with a suspended load, you evaluate the prevailing conditions and determine the work site 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 swinging back and forth. This can cause a change in the lift radius could exceed the load chart rating or cause a tip over.
4. Travel speed will depend on work site conditions.
5. Avoid sudden starts and stops.

OPERATION UNDER ABNORMAL CONDITIONS

NOTE: *See "Maintenance in Special Conditions" on page 4-104 for other recommendations.*

Operation in Extreme Cold

In extremely cold weather, avoid sudden travel movements and stay away from even slight slopes. The machine could slide down the slope.

Snow accumulation could hide potential hazards and slippery surfaces.

Warming up 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 boom or attachment could cause severe stress in very cold temperatures. Reducing work cycle rate and workload may be necessary.

If machine is to be operated in extremely cold weather temperatures, certain precautions must be taken. The following paragraphs detail checks to be made to be certain machine is capable of operating at these temperatures.

1. Preheat the engine before startup.
   - Preheat the engine before startup. Wait 3 to 4 seconds after preheating until voltage of the battery return, and then actuate the key switch.
2. Keep batteries fully charged to prevent freezing. If distilled water is added to batteries, run engine at least one hour to mix electrolyte solution.
   When temperature drops below -10°C, efficacy of the battery is reduced accordingly. Insulation of the battery prevents reduction of efficacy, and supports improvement of starting power of the starter.

WARNING

AVOID DEATH OR SERIOUS INJURY

Explosion of the battery can cause serious injury or death. Never attempt to directly heat the battery with open fire.

3. Keep engine in good mechanical condition for easy starting and good performance during adverse weather.
4. Use engine oil with proper specifications for expected temperatures. Refer to "Table of Recommended Lubricants" on page 4-19, in this manual or Shop Manual for details.

5. Always keep the fuel tank fully filled after completion of the operation. Always drain water from the fuel tank before and after the operation. In addition, check the water separator, and drain it if required. The fuel filter, if frozen, may interrupt the flow of fuel. Periodically remove water from the fuel tank, drain water from the filter, and replace the filter upon regular basis. To prevent fuel from being clogged due to formation of wax in fuel, make sure that wax formation point of fuel is lower than atmospheric temperature.

WARNING

AVOID DEATH OR SERIOUS INJURY

Explosion of the fuel tank may cause serious injury or death. Never attempt to directly heat the fuel tank with open fire.

6. Lubricate entire machine according to “Lubrication and Service Chart” on page 4-16, in this manual or lubrication chart on machine.
7. Start engine and allow it to reach normal operating temperature before operating.
   - If mud and ice collects and freezes on any of moving parts while machine is idle, apply heat to thaw frozen material before attempting to operate machine.
   - Operate hydraulic units with care until they have reached a temperature which enable them to operate normally.
   - Check all machine controls and functions to be sure they are operating correctly.
8. An extra outer air filter must be kept in operator's cabin to replace element that could become iced and cause restricted airflow to engine.
9. Clean off all mud, snow and ice to prevent freezing. Cover machine with a tarp if possible, keep ends of tarp from freezing to ground.

Operation in Extreme Heat

Continuous operation of machine in high temperatures can cause machine to overheat. Monitor engine and hydraulic system temperatures and stop machine to let it cool, when necessary.

1. Make frequent inspections and services of fan and radiator. Check coolant level in radiator. Check grilles and radiator fins for accumulation of dirt, debris and insects which could block cooling passages.

- 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.
- If necessary, flush cooling system periodically to keep passages 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 to prevent damage to batteries. Use a slightly weaker electrolyte solution in hot climates. 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.

IMPORTANT

Do not store acid type storage batteries near stacks of tires. Acid fumes can damage rubber.

3. Service fuel system as directed in “Check Fuel Level” on page 4-26 and “Check for Leaks in Fuel System” on page 4-27 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 machine.
5. Do not park machine in sun for long periods of time. If possible, park machine under cover to protect it from sun, dirt and dust.
   A. Cover machine if no suitable shelter is available. Protect engine compartment and hydraulics from dirt and debris.
   B. In hot, damp climates, corrosion will occur on all parts of machine and will be accelerated during 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 and Sandy Areas

Operation of 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

AVOID DEATH OR SERIOUS INJURY

Wear goggles when using compressed air to prevent face or eye injury.

2. Use care when servicing fuel system to prevent dust and sand from entering tank.
3. Service 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 accelerates wear on parts.
5. Protect machine from dust and sand as much as possible. Park machine under cover to keep dust and sand from damaging unit.

Operation in Rainy or Humid Conditions

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

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 Saltwater Areas

Saltwater and saltwater spray is very corrosive. When operating in or around saltwater areas, or in or around snow, observe the following precautions:

1. When exposed to saltwater, dry machine thoroughly and rinse with freshwater as soon as possible.
2. Keep all exposed surfaces coated with preservative lubricating oil. Pay 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 exposed to salt water.
5. Check operating controls to ensure proper functionality and that they return to "NEUTRAL" when released.

Operation During Electrical Storms

During electrical storms, do not enter or exit machine.

- If you are off machine, keep away from machine until storm passes.
- If you are in cabin, remain seated with machine stationary until storm passes. Do not touch controls or anything metal.

Operation at High Altitudes

Operation instructions at high altitudes are the same as those provided for 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 radiator cap must make a perfect seal to maintain coolant pressure in cooling system.
    - Perform warming-up operation thoroughly. If machine is not thoroughly warmed up before control levers or control pedals are operated, reaction of machine will be slow.
    - If battery electrolyte is frozen, do not charge battery or start engine with a different power source. There is a potential hazard that could cause a battery explosion or fire.
    - Before charging or starting engine with a different power source, thaw battery electrolyte and check for any leakage of electrolyte before starting.

Equipment Lowering with Engine Stopped

To lower the boom, place the hydraulic lockout lever in the "UNLOCKED" position and turn starter switch to "I" (ON) position. Move the joystick to "BOOM LOWER" position. If the accumulator is still charged, the boom will lower. Turn key to "O" (OFF) position and remove from starter switch.

If the boom does not lower, the accumulator is empty. Use one of the following methods to lower the boom.

Machine Without a Boom Lowering Control Valve

WARNING

AVOID DEATH OR SERIOUS INJURY

Boom weight can cause cylinder oil pressure to reach relief pressure of the boom lowering control device when the boom is supported by one cylinder. Boom can lower suddenly, causing death or serious injury.

To avoid death or serious injury, be sure no one is under or near the work tool before manually lowering the boom.

Keep all personnel and bystanders away from the boom area when lowering the boom with the engine stopped.

When you must manually lower the boom if the engine has stopped and cannot be started, use the following procedure:

1. Relieve the pressure in the hydraulic system before manually lowering the boom.
   A. Turn starter switch to "I" (ON) position.
   B. Move the hydraulic lockout lever to "UNLOCKED" position.
   C. Move the joysticks and travel levers/pedals forward and backward to relieve accumulator pressure
   D. Turn key to "O" (OFF) position and remove from starter switch.
2. Allow hydraulic oil to cool. Tip breather cap up (1, Figure 141) on the top of the hydraulic tank until internal pressure in the hydraulic tank has been completely relieved.

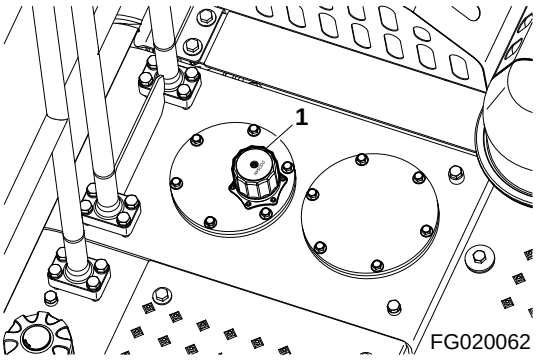


Figure 141

3. Open the oil tank cover.
4. Connect an end of hose (2, Figure 143) to screw of poppet (3, Figure 143).
5. Slowly loosen screw of poppet (3, Figure 143) by 4 - 5 turns. This allows the hydraulic oil in the boom circuit to drain into the hydraulic tank. The boom will now start to lower.

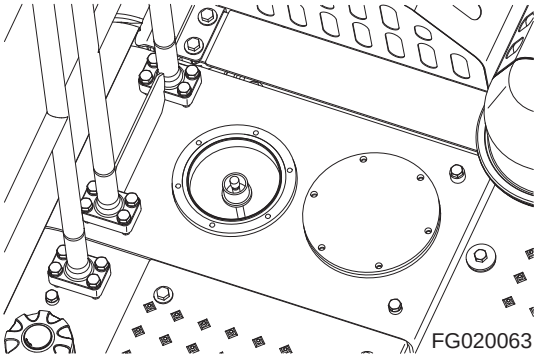


Figure 142

NOTE: *Refer to "Disposal of Hazardous Materials" on page 1-74 for information on containing fluid spillage.*

WARNING

AVOID DEATH OR SERIOUS INJURY

To prevent rapid boom lowering, slowly loosen poppet screw.

6. Make sure that work tool has lowered all the way to the ground. Tighten screw of poppet (3, Figure 143) to a torque of 0.2 kg•m (1.96 Nm, 1.45 ft lb).
7. Disconnect hose (2, Figure 143) from screw of poppet (3, Figure 143). Do not allow the oil that is contained in hose (2, Figure 143) to spill.
8. Connect hose (2, Figure 143) to the original position on the hydraulic tank and install the oil tank cover (1, Figure 143).

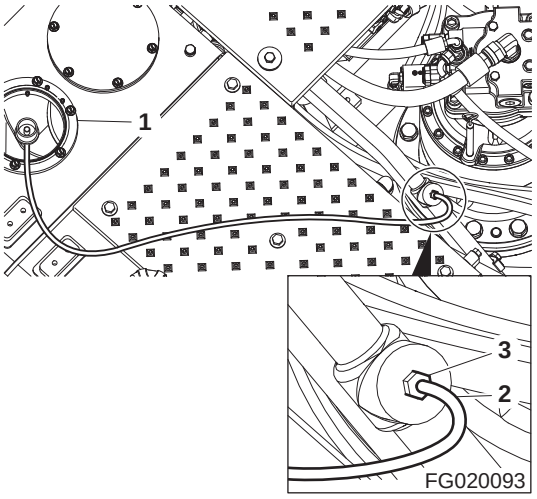


Figure 143

After completion of the manual boom lowering, make necessary repairs before you operate the machine again.

NOTE: *For additional information, contact your DOOSAN distributor.*

WARNING

AVOID DEATH OR SERIOUS INJURY

Boom weight can cause cylinder oil pressure to reach relief pressure of the boom lowering control device when the boom is supported by one cylinder. Boom can lower suddenly, causing death or serious injury.

To avoid death or serious injury, be sure no one is under or near the work tool before manually lowering the boom.

Keep all personnel and bystanders away from the boom area when lowering the boom with the engine stopped.

When you must manually lower the boom if the engine has stopped and cannot be started, or the hydraulic system is disabled, the operator can still lower the boom, using the following procedure, when machine is equipped with a boom lowering control valve.

1. Relieve the pressure in the hydraulic system before manually lowering the boom.
   A. Turn starter switch to "I" (ON) position.
   B. Move the hydraulic lockout lever to "UNLOCKED" position.
   C. Move the joysticks and travel levers/pedals forward and backward to relieve accumulator pressure.
   D. Turn key to "O" (OFF) position and remove from starter switch.
2. Loosen locknut (1, Figure 144) of the lock valve.
3. Slowly turn check valve (2, Figure 144) counterclockwise until check valve stops. The boom will lower to the ground.
4. Make sure that work tool has been completely lowered onto the ground. Tighten check valve (2, Figure 144).
5. Tighten locknut (1, Figure 144) to a torque of 0.23 ± 0.03 kg•m (2.25 ± 0.25 Nm, 1.66 ± 0.18 ft lb).

After completion of the manual boom lowering, make necessary repairs before you operate the machine again.

NOTE: *For additional information, contact your DOOSAN dealer.*

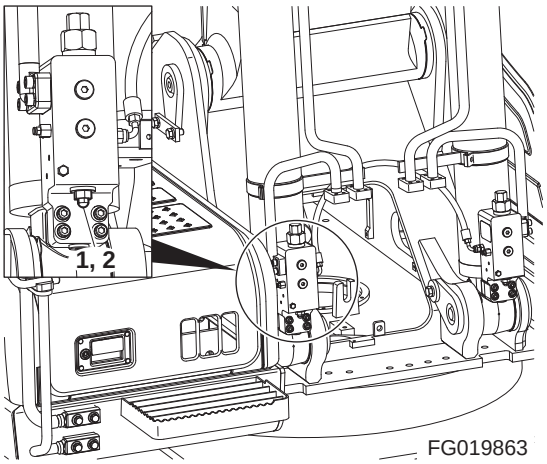


Figure 144

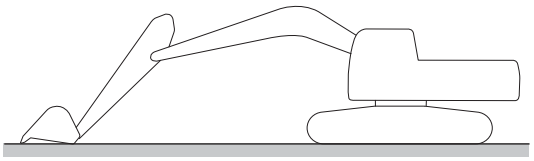
LONG TERM STORAGE

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

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



EX1300542

Figure 145

Before Storage

Keep the excavator in the position shown in Figure 145 to prevent rust of the hydraulic piston rods.

- Inspect for damaged, loose or missing parts.
- Repaint necessary areas to prevent oxidation.
- Wash and clean all parts of machine.
- Store the machine in an indoor, stable place. If stored outside, cover with a waterproof tarp.
- 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 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

- Before 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.
- Inspect for signs of nests. (i.e. birds, rodents, etc.)
- When starting the engine after long-term storage, follow the "Hydraulic Oil Warm-up" procedures listed in this manual.

Inspection, Maintenance and Adjustment

MAINTENANCE INFORMATION

This section deals with information for proper maintenance of the machine. Therefore, ensure that all safety information, warnings, and instructions are read and understood before any operation or any maintenance procedures are performed.

Operational Hour Meter Reading

Check operational hour meter reading every day to see if necessary maintenance is scheduled to be performed.

DOOSAN Genuine Replacement Parts

Use DOOSAN genuine parts specified in Parts Book as replacement parts.

DOOSAN Genuine Lubricants

For lubrication of the machine, use DOOSAN genuine lubricants. Use oil of specified viscosity according to ambient temperature.

Windshield Washer Fluid

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

Fresh and Clean Lubricants

Use clean oil and grease. Keep containers of oil and grease containers clean and keep foreign materials away.

Check Drained Oil and Used Filter

After oil is changed or filters are replaced, check oil and filters for metal particles and foreign materials. If large quantities of metal particles or foreign materials are found, take corrective action.

Fuel Strainer

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

Welding Instructions

- Cut off power. Wait for approximately one minute after turning off engine starter switch key, and then turn battery disconnect switch to "OFF" position.
- Do not apply more than 200 V continuously.
- Connect grounding cable within 1 m (3.3 ft) of area to be welded. If grounding cable is connected near instruments, connectors, etc., instruments can be damaged.
- If a seal or bearing happens to come between part being welded and grounding point, change grounding point to avoid these types of parts.
- Do not use area around work equipment pins or hydraulic cylinders as grounding point.

Do Not Drop Things Inside Machine

- When opening inspection windows or oil filler port of tank to perform inspection, be careful not to drop nuts, bolts, or tools inside the machine.

  If parts are dropped inside machine, it can cause damage and/or improper operation of the machine. If you drop anything inside the machine, always remove it immediately.

Dusty Work Site

When working at a dusty work site, do the following:

- Clean radiator fins and other parts of heat exchange equipment more frequently, and take care not to let fins become clogged.
- Replace fuel filter more frequently.
- Clean electrical components, especially starting motor and alternator, to avoid accumulation of dust.
- When checking and replacing oil or filters, move the machine to a place where there is no dust and take care to prevent dust from entering system.

Avoid Mixing Lubricants

If a different brand or grade of oil has to be added, drain all old oil before adding new brand or grade of oil.

Never mix different brands or grades of oil.

Locking Inspection Covers

Lock inspection cover securely into position with lock bar. If inspection or maintenance is performed with inspection cover not locked in position, it could fall and cause injury.

Hydraulic System - Air Bleeding

When hydraulic equipment has been repaired or replaced, or hydraulic piping has been removed and installed again, air must be bled from circuit. For details, see “Venting and Priming Hydraulic System” on page 4-102.

Hydraulic Hose Installation

- When removing part at locations with O-rings or gasket seals, clean mounting surface and replace with new parts.

  When doing this, be careful not to forget to assemble O-rings and gaskets.

- When installing hoses, do not twist them or bend them sharply. This will extend service life and prevent damaging hoses.

Checks After Inspection and Maintenance Works

Perform checks after inspection and maintenance to prevent operation problems. Always do the following:

- Checks after operation (with engine stopped).
  - Have any inspection and maintenance points been forgotten?
  - Have all inspection and maintenance items been performed correctly?
  - Have any tools or parts been dropped inside the machine? If parts are dropped inside the machine and get caught in lever linkage mechanism, and this could cause improper operation of the machine.
  - Are there any coolant or oil leaks? Have all nuts and bolts been tightened?
- Checks when operating engine.
  - For details of checks when operating engine, see “Safety Precautions” on page 4-4 and pay careful attention to safety.
  - Are inspection and maintenance items working properly?
  - Is there any leakage of fuel or oil when engine speed is raised?

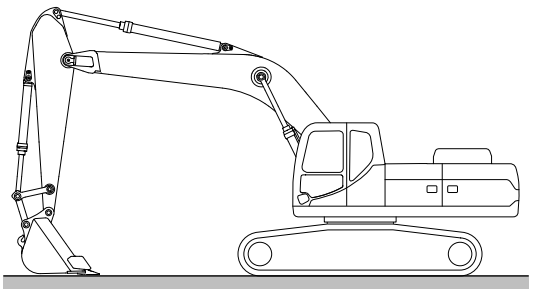
Safety Precautions

1. Make sure to lock out hydraulic controls and place a "DO NOT OPERATE" Warning Tag on the machine to indicate that the machine is being serviced and to prevent any unauthorized operation.
2. Clean up any fluid spills, especially around engine.
3. Inspect all fuel lines to make sure that fittings, lines, filters, O-rings, etc. are tight and are not showing signs of leakage, wear or damage.
4. If inspection or test procedure requires that engine be running, make sure to keep all unauthorized personnel away from the machine.

MACHINE SETUP POSITION FOR MAINTENANCE

Before beginning any service work, park the machine using the following procedure (except for service work requiring the machine to be positioned differently).

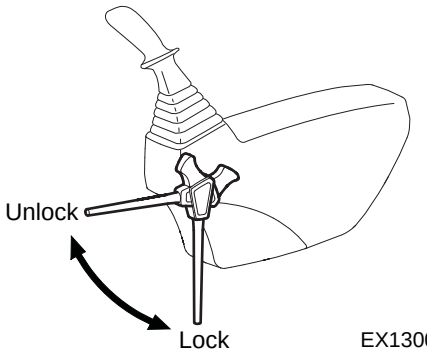
1. Position the machine on even, firm and level ground.
2. Put attachment on ground.



FG018379

Figure 1

3. Move safety lever to "LOCK" position.



EX1300566

Figure 2

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 can occur.

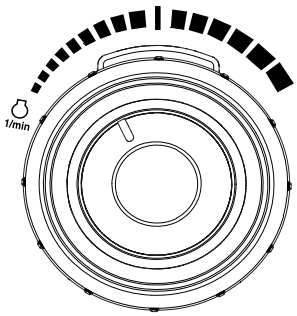


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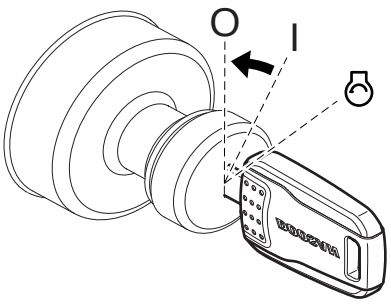
Figure 3

5. Stop engine by turning key to "O" (OFF) position. After releasing hydraulic system and tank pressure, remove starter switch key.



FG018156

Figure 4

6. Before starting maintenance work, place a "DO NOT OPERATE" Warning Tag on cabin door or work lever.

WARNING

AVOID DEATH OR SERIOUS INJURY

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

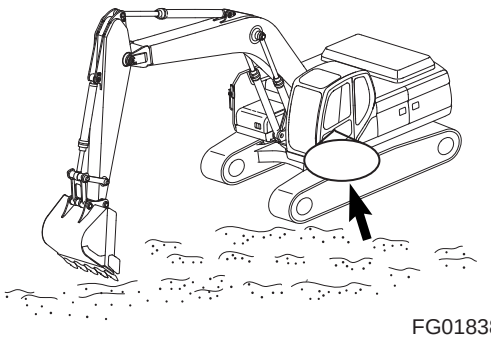


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Figure 5

MAINTENANCE HANDLING ACCESS

Entering/Leaving/Climbing On Machine

WARNING

AVOID DEATH OR SERIOUS INJURY

Do not jump ON/OFF a machine. Never get ON/OFF when the machine is running.

Never grasp control lever to get ON/OFF.

Use handholds and steps when entering, leaving or climbing the machine.

Use three-point grip, i.e. two hands and one foot or two feet and one hand.

Always face machine.

Always wipe mud and oil off all footboards, handrails, guardrails and your footwear, especially when cleaning windows, rearview mirrors and lights.

Clean your boots and wipe your hands before getting on the machine. Always wear proper footgear.

Do not use hand grip (A, Figure 6) of cabin door as a support when entering, leaving or climbing the machine. It is not strong enough to be used as a support. It should only be used for closing the door.

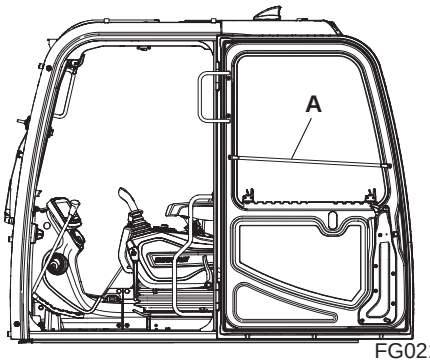

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Figure 6

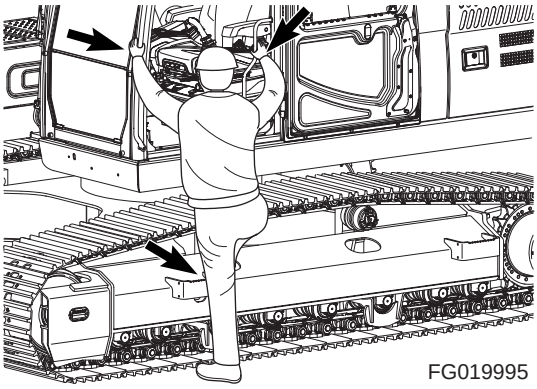
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Figure 7

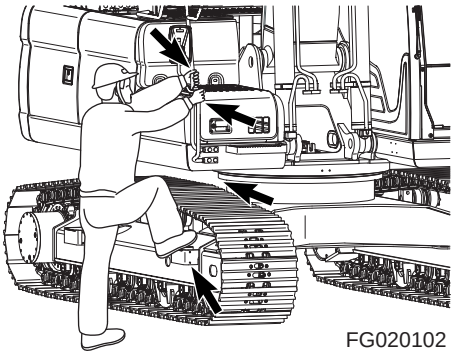
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Figure 8

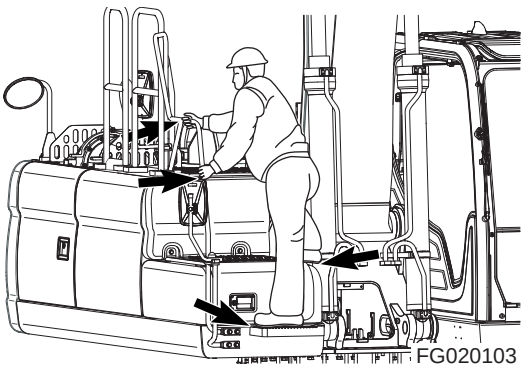
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Figure 9

HANDLING OIL, FUEL, COOLANT

Oil

- Oil is used in the engine and hydraulic equipment under extremely severe conditions (high temperature, high-pressure, etc.) and deteriorates with use. Always use oil that matches the grade and maximum and minimum ambient temperatures recommended in this manual. Even if oil is not dirty, always change oil at specified interval.
- Always be careful when handling oil to prevent any impurities (water, metal particles, dirt, etc.) from getting in.
- Operating problems with the machine can be caused by impurities in oils.
- Take particular care not to let any impurities get in when storing or adding oil.
- Never mix oils of different grades or brands.
- Always add specified amount of oil.
- Having too much or too little oil can cause operational problems.
- If oil in work equipment is not clear, there may be water or air getting into circuit. In such cases, contact your DOOSAN distributor.
- When changing oil, always replace related filters at same time.

Fuel

NOTE: *Only use Ultra Low Sulfur Diesel (ULSD) fuel and API-CJ-4/ACEA-E9 grade engine oil.*

To ensure good fuel consumption characteristics and exhaust gas characteristics, the engine mounted on this machine uses an electronically controlled high-pressure fuel injection device. This device uses high precision parts and lubrication. If low viscosity fuel with reduced lubricating ability is used, the durability of the fuel injection device could be affected.

- To prevent moisture in air from condensing and forming water inside fuel tank, always fill fuel tank after completing day's work.
- The fuel pump is a precision instrument and if fuel containing water or dirt is used, it cannot work properly.
- Be careful not to let impurities get in when storing or adding fuel.
- Always use fuel specified for temperature given in this manual.

  - If fuel is used at temperatures lower than specified temperature (particularly at temperatures below -15°C (5°F), the fuel will gel-up and solidify.
  - If fuel is used at temperatures higher than specified temperature, the viscosity will drop, and this can cause performance problems.
- Before starting engine, or when 10 minutes have passed after adding fuel, drain sediment and water from fuel tank.
- If engine runs out of fuel, or if filters have been replaced, it is necessary to bleed air from circuit.
- If there is any foreign material in fuel tank, wash tank and fuel system.

IMPORTANT

Ultra Low Sulfur Diesel (ULSD) fuel 0.0015 percent (S ≤ 15 ppm (mg/kg)) sulfur is required by regulation for use in engines certified to nonroad Tier 4 standards (U.S. EPA Tier 4 certified) and that are equipped with exhaust aftertreatment systems.

European ULSD 0.0010 percent (≤ 10 ppm (mg/kg)) sulfur fuel is required by regulation for use in engines certified to european nonroad stage IIIB and newer standards and are equipped with exhaust aftertreatment systems.

Using fuels of higher sulfur level can have the following negative effects:

- Shorten the time interval between aftertreatment device service intervals (cause the need for more frequent service intervals)
- Adversely impact the performance and life of aftertreatment devices (cause loss of performance)
- Reduce regeneration intervals of aftertreatment devices
- Reduce engine efficient and durability
- Increase the wear.
- Increase the corrosion.
- Increase the deposits.
- Lower fuel economy.
- Shorten the time period between Oil drain intervals (more frequent oil drain intervals)
- Increase overall operating costs.

Failures that result from use of improper fuels are not DOOSAN factory defects.

Therefore the cost of repairs would not be covered by a DOOSAN warranty.

Engine Oil

DOOSAN engine oils have been developed and tested to provide the full performance and life that has been designed and built into DOOSAN engines.

DOOSAN engine oils that meet API CJ-4 are required for use in the applications listed below.

DOOSAN engine oils meeting the API CJ-4 and ACEA E9 oil categories have been developed with limited sulfated ash, phosphorus, and sulfur.

These chemical limits are designed to maintain the expected aftertreatment device list, performance, and service interval.

If oils meeting the API CJ-4 specifications are not available, oils meeting ACEA E9 may be used.

ACEA E9 oils meet the chemical limits designed to maintain aftertreatment device life.

Failure to meet the listed requirements will damage aftertreatment-equipped engines and can negatively impact the performance of the aftertreatment devices.

The cost of repairs caused by improper engine oils will not be covered by the DOOSAN warranty for your machine.

The Diesel Particulate Filter (DPF) will plug sooner and require more frequent DPF ash service intervals.

Typical aftertreatment systems include the following;

- Diesel Particulate Filter (DPF)
- Diesel Oxidation Catalysts (DOC)

Other systems may apply.

Therefore the cost of repairs would not be covered by a DOOSAN warranty.

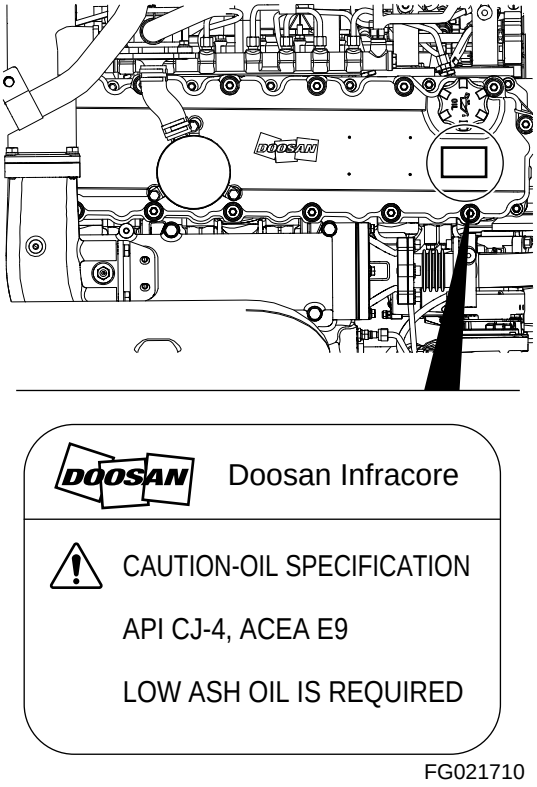


Figure 10

Grease

- Grease is used to prevent seizure and noises at joints.
- This construction equipment is used under heavy-duty conditions. Always use recommended grease and follow change intervals and recommended ambient temperatures given in this manual.
- Always wipe off all old grease that is pushed out when greasing.

  Wipe off old grease where sand or dirt sticking in the grease can cause wear of rotating parts.

Coolant and Water for Dilution

- The coolant has the important function of preventing corrosion and preventing freezing.
  Even in areas where freezing is not an issue, use of antifreeze coolant is essential.
  DOOSAN machines are supplied with DOOSAN coolant. DOOSAN coolant has excellent anticorrosion, antifreeze and cooling properties and can be used continuously for 1 year or 2,000 hours. Therefore, it is recommended to use authorized genuine DOOSAN antifreeze solution.
  When using DOOSAN coolant, there is no need to use a corrosion resistor. For details, see “Engine Cooling System” on page 4-92.
- When diluting antifreeze coolant, use distilled water.
  Natural water, such as a river water or well water (hard water), contains large amounts of minerals (calcium, magnesium, etc.), and this makes it easier for scale to form inside engine or radiator. Once scale is deposited inside engine or radiator, it is extremely difficult to remove.
  If tap water needs to be used, refer to “Engine Cooling System” on page 4-92 for further information on standards and precautions.
- When using antifreeze, always observe precautions given in this manual.
- Antifreeze coolant is flammable, so be sure to keep it away from any flame.
- The ratio of DOOSAN coolant to water differs according to ambient temperature.
  For details of ratio when mixing, see “Antifreeze Concentration Tables” on page 4-94.
  DOOSAN coolant may be supplied premixed. Never add distilled water.
- If engine overheats, wait for engine to cool before adding coolant.
- If coolant level is low, it will cause overheating and corrosion problems because of air entering coolant.
- Never mix lime (hard water), salt or water contained metal material with coolant.

Filters

- Filters are extremely important safety parts. They prevent impurities in hydraulic oil, fuel and air circuits from causing problems.

  Replace all filters periodically. See details given in “Lubrication and Service Chart” on page 4-16.

  When working in severe conditions, replace filters at shorter intervals according to oil and fuel (sulfur content) being used.

- Never try to clean filter (cartridge type) and use them again. Always replace with new filters.
- When replacing oil filters, check if any metal particles are attached to oil filter. If any metal particles are found, contact your DOOSAN distributor.
- Do not open packages of spare filters until just before they are to be used.
- Always use DOOSAN genuine filters.

ELECTRICAL SYSTEM MAINTENANCE

- If electrical equipment becomes wet or covering of wiring is damaged, this will cause an electrical short circuit and result in improper machine operation. Do not wash inside of operator's cabin with water. When washing the machine, be careful not to let water get into electrical components.
- Service relating to the electrical system is: checking fan belt tension, checking damage or wear to the fan belt, and checking battery electrolyte level.
- Never install any electric components other than those specified by DOOSAN.
- External electromagnetic interference can cause malfunction of the control system controller. Before installing a radio receiver or other wireless equipment, contact your DOOSAN distributor to prevent electromagnetic interference.
- When working in saltwater areas or in or around snow, carefully clean the electrical system to prevent corrosion.
- When installing electrical equipment, connect it to the special power source connector. See “20. Power Socket for 12 Volt (Optional)” on page 2-16.

  Do not connect the optional power source to a fuse, starter switch, or battery relay.

RECOMMEND FUEL, COOLANT, AND LUBRICANT

- Lubrication is an important part of preventive maintenance. To keep your machine in the best condition for long periods of time, it is essential to follow the instructions given in this manual.
- Failure to follow these recommendations can result in shortened life or excess wear of the engine, power train, cooling system, and/or other components.
- Commercially available lubricant may be good for the machine, but it can also cause harm. DOOSAN does not recommend any commercially available lubricant additive.
- When starting the engine in temperatures below 0°C (32°F), be sure to use recommended multigrade oil, even if the ambient temperature may become higher during the course of the day.
- If the machine is operated at temperatures below -20°C (-4°F), a separate device is needed, so discuss with DOOSAN distributor.
- Only use Ultra Low Sulfur Diesel (ULSD) fuel and API-CJ-4/ACEA-E9 grade engine oil.

Lubrication

Lubrication is an important part of preventive maintenance. If the machine is lubricated in a specified way, the life of equipment and components can be considerably extended. The “Lubrication and Service Chart” on page 4-16 makes lubrication work much easier and reduces the risk of forgetting lubrication intervals.

IMPORTANT

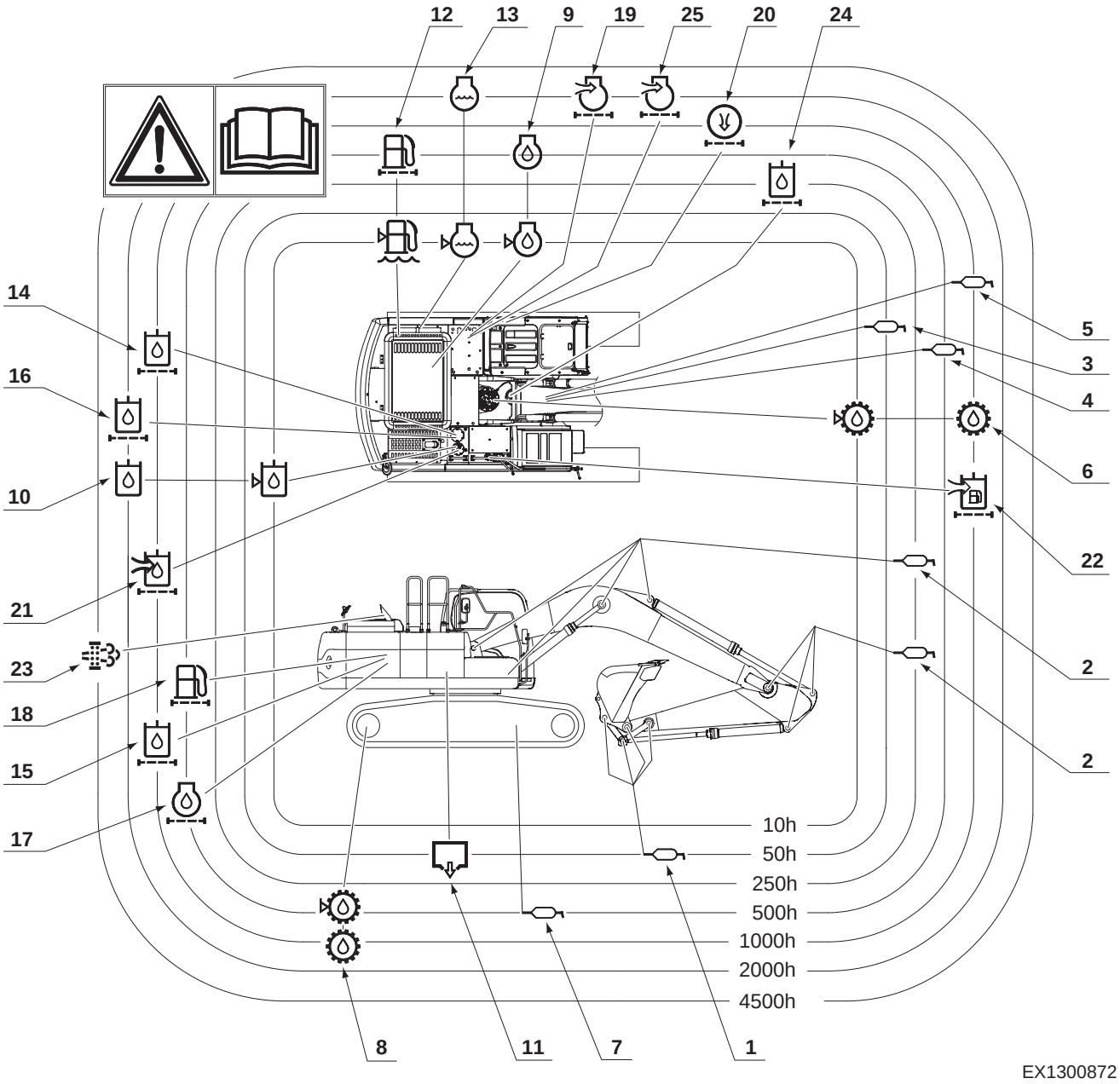
Wipe off grease fittings and grease gun before greasing to prevent sand and dirt particles from penetrating into components.

Symbols for "Lubrication and Service Chart"

The lubrication and service chart is on the inside of the battery box cover. The symbols used in the lubrication and service chart are illustrated in the following table.

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

Symbol	Description
	Coolant
	Air Cleaner Filter
	Fuel Filter
	Air Conditioner Filter
	Drain Water
	Fuel Cap Filter
	Diesel Particulate Filter


12
13
9
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24
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16
10
21
23
18
15
17
5
3
4
6
22
2
2
10h
50h
250h
500h
1000h
2000h
4500h
8
11
7
1
EX1300872

Figure 11

SERVICE DATA										
No.	Items to Check	Service	Qty.	Service Interval						
				10	50	250	500	1000	2000	4500
1	Arm, Bucket Joint Pin	Grease	6	F100	W10					
2	Boom, Arm Joint Pin	Grease	11	F100		W10				
3	Swing Bearing	Grease	2		W10					
4	Pinion Gear (Swing)	Grease	1							
5	Swing Reduction Gear	Grease	1					W10		
6	Swing Reduction Gear	Gear Oil	5 ℓ	V			F			
7	Track Spring	Grease	2				W10			
8	Travel Reduction Gear	Gear Oil	2 x 4 ℓ				F, V			
9	Engine Oil	Engine Oil	27 ℓ	V	F					
10	Hydraulic Oil Tank (Full)	Hydraulic Oil	200 ℓ	V						
11	Fuel Tank	Diesel	400 ℓ	V						
12	Water Separator & Pre Fuel Filter (Fuel Prefilter)	Cartridge	1	D, V						
13	Radiator	Coolant	30 ℓ	V						
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	Main Fuel Filter	Cartridge	1							
19	Air Cleaner (Outer)	Element	1				C			
	Air Cleaner (Inner)	Element	1							
20	Air Conditioner Filter (Outer)	Element	1				C			
	Air Conditioner Filter (Inner)	Element	1				C			
21	Air Breather Filter*	Element	1							
22	Fuel Cap Filter	Element	1							
23	DPF	Cartridge	1							C
24	Breaker Filter (Opt)	Cartridge	1							
25	Air Compressor Filter (Opt)	Cartridge	1				C			

V: Maintenance and Refill.

C: Cleaning.

D: Drain Water.

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 4-92, for further explanation.

: Replacement On Every Interval.

NOTE: *For additional service items see list of “Maintenance Intervals” on page 4-21.*

*: When the machine is operated under dusty work sites, the air breather filter needs to be cleaned or replaced on a regular basis even before the expected replacement date.

FLUID CAPACITIES

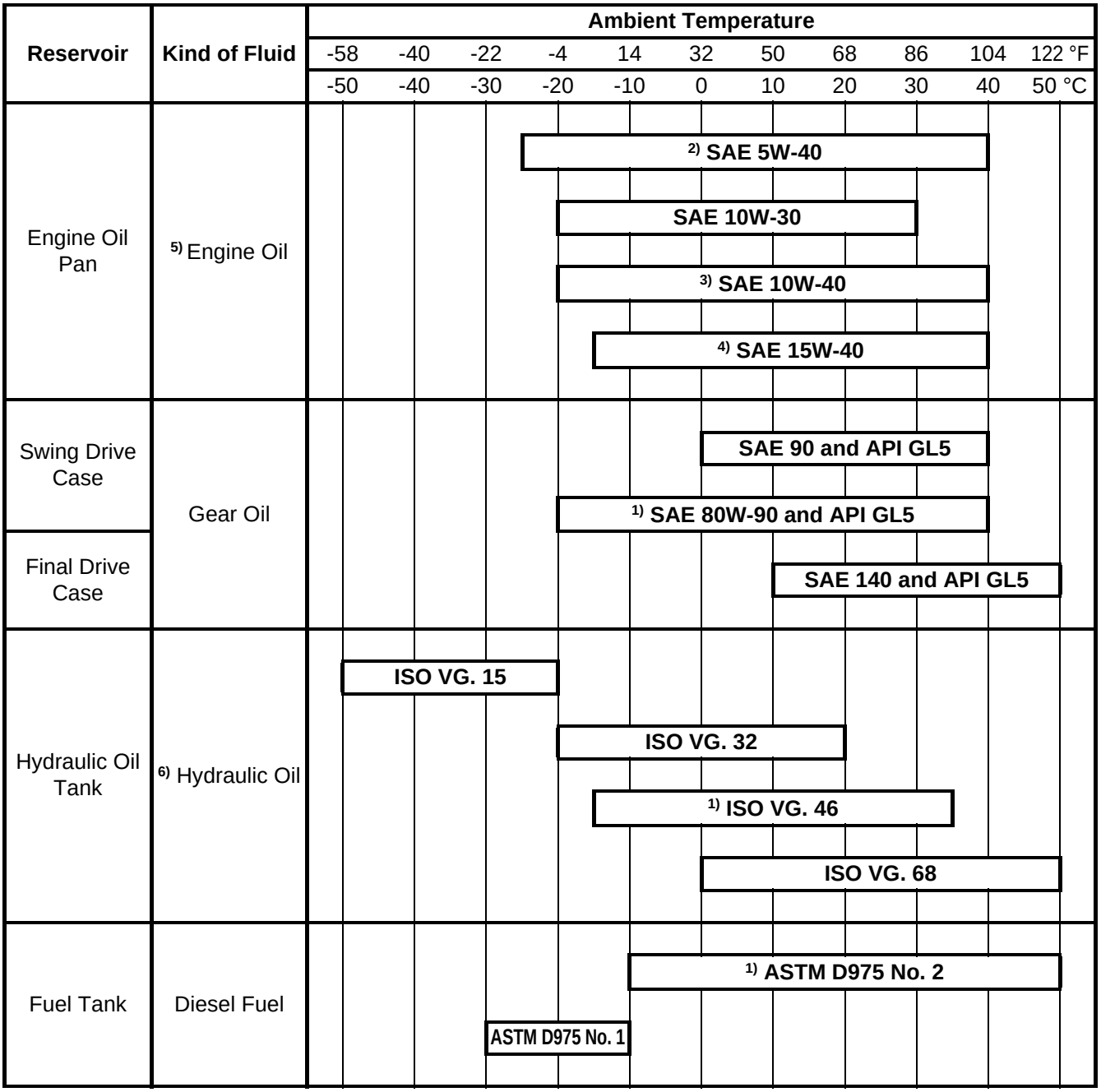
Component		Capacity
Engine	Oil Pan with Filter	27 liters (7.2 U.S. gal.)
	Cooling System	30 liters (8 U.S. gal.)
Fuel Tank		400 liters (106 U.S. gal.)
Hydraulic Oil	Tank Level	140 liters (37 U.S. gal.)
	Full	200 liters (53 U.S. gal.)
	System	240 liters (63.4 U.S. gal.)
Travel Reduction Gear (Each)		4 liters (1.05 U.S. gal.)
Swing Reduction Gear		5 liters (1.3 U.S. gal.)

TABLE OF RECOMMENDED LUBRICANTS

IMPORTANT

It is highly recommend to use DOOSAN Genuine Products or products which meet the following specifications. Using other products can damage the equipment.

NOTE: *Refer to the "Lubrication and Service Chart" on page 4-16 for locations.*



Grease Fitting	Grease				[1] **Multipurpose Lithium Grease NLGI No. 2**								
Cooling System	Coolant	Add Antifreeze [1] (50% antifreeze - 50% distilled water)											

[1] Installed at factory.

[2] (5W40) - Recommended for use at extremely low temperature below -20°C.

[3] (10W40) - Filled at factory. Doosan genuine engine oil is recommended for use.

[4] (15W40) - Doosan genuine engine oil is recommended for use.

[5] (Engine oil) - Engine oil must meet ACEA-E9 or API-CJ-4.

[6] 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. Note that mixing ratio is for reference purpose only, and is not an absolute standard.

API: American Petroleum Institute.

ACEA: Association des Constructeurs Europens d'Automobiles.

ASTM: American Society of Testing and Materials.

ISO: International Organization for Standardization.

NLGI: National Lubricating Grease Institute.

SAE: Society of Automotive Engineers.

IMPORTANT

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

IMPORTANT

Fluctuating daily or weekly extremes of temperature, or operation in subzero freezing temperatures, may make it impractical to use straight weight lubricants. Select lubricants that are appropriate for climate conditions.

MAINTENANCE INTERVALS

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

10 HOUR / DAILY SERVICE

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

Grease every 10 hours for first 100 hours and every 50 or 250 hours thereafter (See page 4-36).

NOTE: *If the unit has been running or working in water, the front attachment must be greased daily.*

Check Engine Oil Level

WARNING

AVOID DEATH OR SERIOUS INJURY

Allow engine to cool before checking oil level to avoid burn injury.

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

1. Stop engine and wait for fifteen minutes. This will allow all oil to drain back to oil pan.
2. Remove dipstick (1, Figure 12) and wipe the oil off with a clean cloth.
3. Insert dipstick fully in 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, oil must be drained to return oil to proper level.*

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

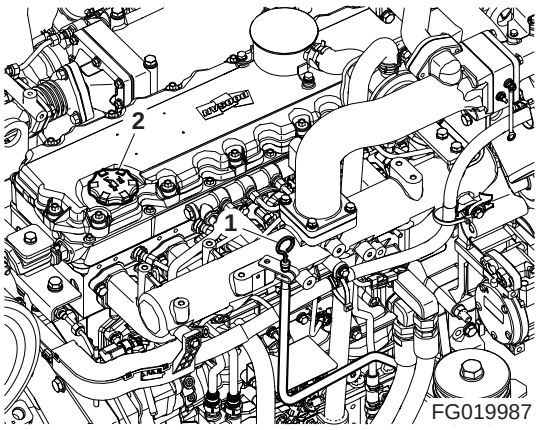


Figure 12

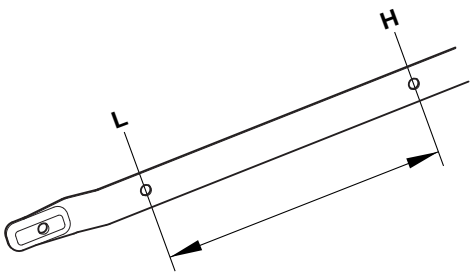


Figure 13

Check Level of Hydraulic Oil Tank

WARNING

AVOID DEATH OR SERIOUS INJURY

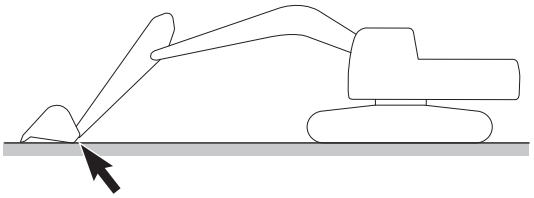
The hydraulic oil will be hot after machine operation. Allow system to cool before attempting to service any hydraulic components.

The hydraulic tank is pressurized. Tip breather cap up slowly to allow the pressurized air to vent. After the pressure has been released, remove service covers.

ARO1760L

Figure 14

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



EX1300541

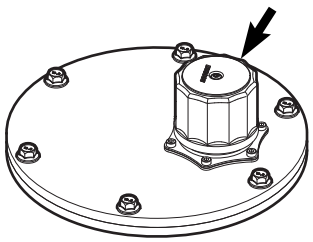
Figure 15

3. Move safety lever to "LOCK" position.
4. Have a second person, check hydraulic oil level gauge by opening right access door. Oil level must be between marks on sight gauge.

FG020182

Figure 16

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



FG020183

Figure 17

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.

IMPORTANT

When refilling the oil, use the same hydraulic oil as the system is filled with.

6. If oil level is above the "H" mark drain oil.
   A. Stop engine and wait for the hydraulic oil to cool down.
   B. Drain the excess oil from drain plug (Figure 18) at the bottom of the tank into an approved container, using a hose at the point (plug).

NOTE: *Dispose of drained fluids in compliance with all applicable environmental laws and regulations*

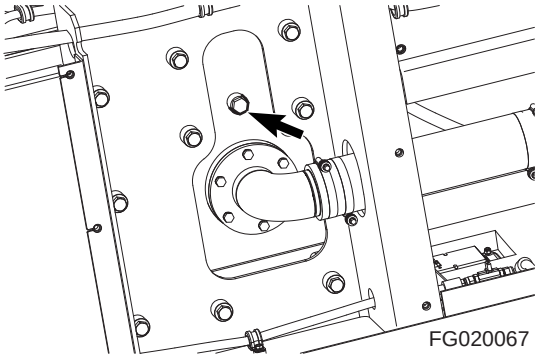


Figure 18

IMPORTANT

Dispose of waste oil/liquids in compliance with all applicable environmental laws and regulations.

Disconnect the drain hose and install the protecting cap.

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

AVOID DEATH OR SERIOUS INJURY

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

Immediately clean up any spilled fuel.

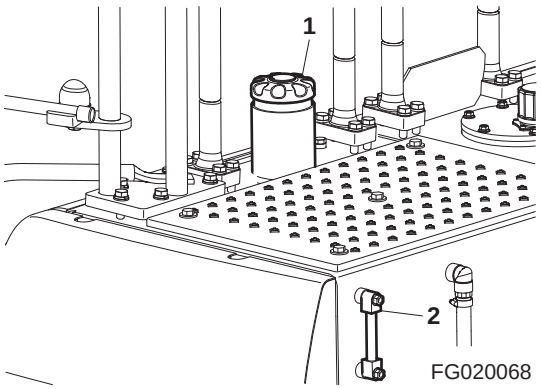


Figure 19

WARNING

AVOID DEATH OR SERIOUS INJURY

Stop engine when refueling.

Turn engine coolant heater "OFF" before filling fuel, to prevent a fire or explosion.

1. At end of each workday, fill fuel tank. Add fuel through fuel fill tube (1, Figure 19). When working at a temperature of 0°C (32°F) or higher, use ASTM No. 2-D or its equivalent. At temperatures below 0°C (32°F) use ASTM No. 1-D or its equivalent.

   NOTE: *Only use Ultra Low Sulfur Diesel (ULSD) fuel and API-CJ-4/ACEA-E9 grade engine oil.*

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 19).

   NOTE: *See "Fluid Capacities" on page 4-18. 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 4-96, for further information.*

5. Do not overfill the tank.

6. Securely tighten cap after fueling.

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

   NOTE: *Be careful not to damage the fuel level gauge on the fuel tank by allowing it to becoming stained from thinner or oil.*

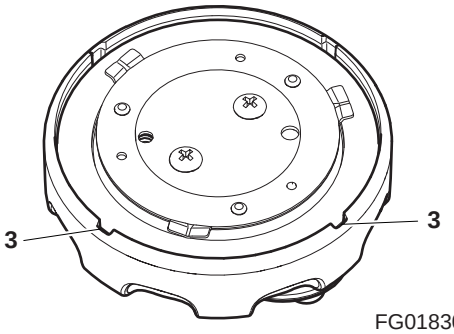


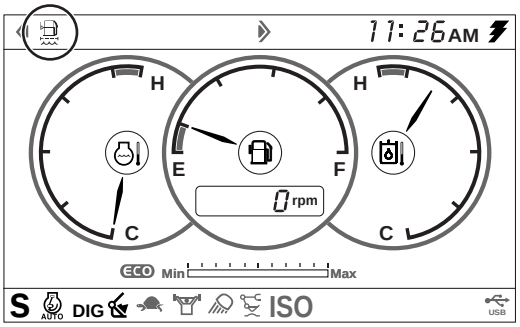
Figure 20

Check for Leaks in Fuel System

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

Check Water Separator & Pre Fuel Filter (Fuel Prefilter) and Drain Water as Required

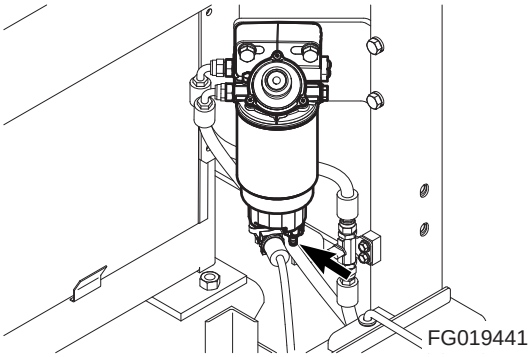
NOTE: *If water in fuel warning symbol (Figure 21) on display monitor comes "ON", drain the collected water in fuel prefilter.*



FG018303

Figure 21

1. A fuel prefilter is inside the left rear side access door.
2. Open the access door on left side of the machine.



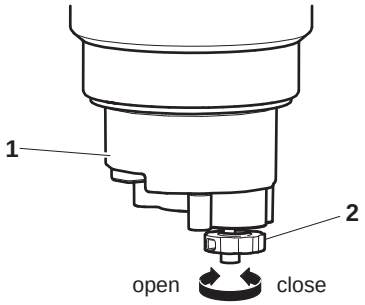
FG019441

Figure 22

3. It is necessary to drain collected water if bowl is full of water or sediment.
4. Position a small container under fuel prefilter. Drain water or sediment by opening drain valve (2, Figure 23) on bottom of bowl (1).

   NOTE: *Dispose of drained fluids in compliance with all applicable environmental regulations.*

5. Close drain valve.



FG000438

Figure 23

Check Oil Level of Swing Reduction Device

WARNING

AVOID DEATH OR SERIOUS INJURY

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, use a dipstick and 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.
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).

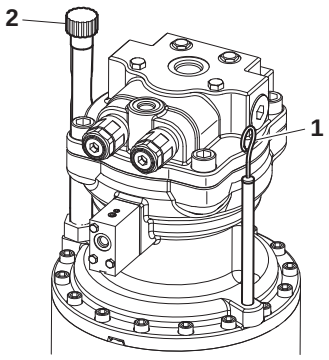


Figure 24

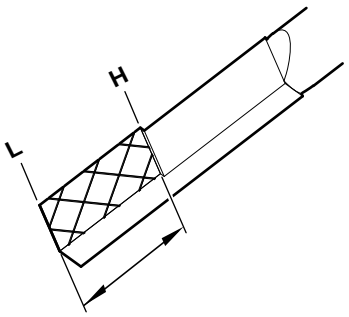


Figure 25

5. If the oil level exceeds the "H" mark on the dipstick, release the drain plug (3, Figure 26). Drain the excessive oil into an approved container.

   NOTE: *Dispose of drained fluids in compliance with all applicable environmental laws and regulations.*

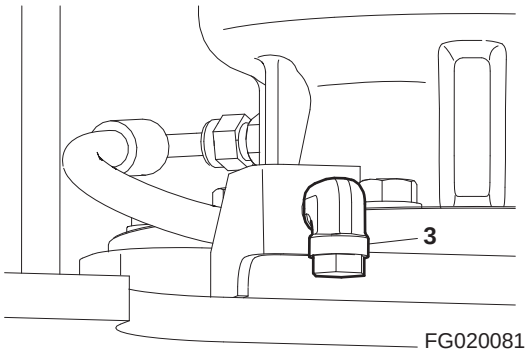


Figure 26

Clean Dust Net in Front of Oil Cooler and Intercooler

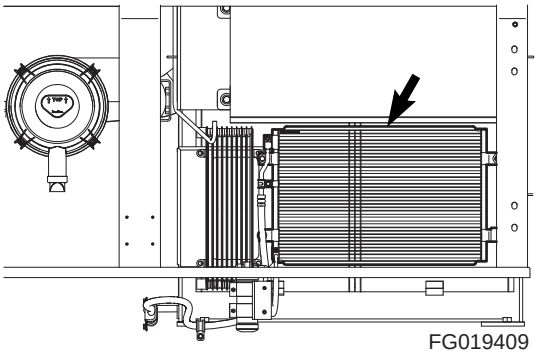


Figure 27

IMPORTANT

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

WARNING

AVOID DEATH OR SERIOUS INJURY

If using compressed air or water to clean the dust net, wear safety goggles for proper eye protection.

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

Check Cooling System and Refill as Required

WARNING

AVOID DEATH OR SERIOUS INJURY

Allow the engine to cool before releasing the radiator cap. Loosen the cap slowly to release any remaining pressure.

Radiator cleaning is performed while the engine is running. Lock out and tag the controls alerting 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.

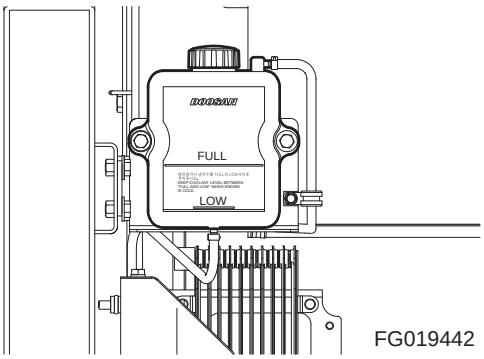


Figure 28

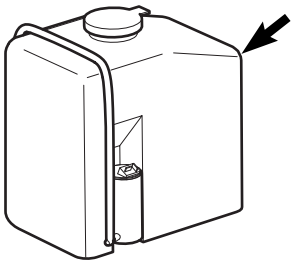
NOTE: *Do not mix ethylene glycol and propylene glycol antifreeze together.*

1. When the engine is cold, remove 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 4-94)
2. Check to make sure that coolant transfer line from the coolant recovery tank to the radiator is free and clear of obstructions, or is not pinched.
3. Observe the level of coolant in the coolant recovery tank. The normal cold engine fluid level must be between "FULL" and "LOW" marks on tank.
4. If the coolant is below the "LOW" mark, add genuine part of 50% concentration coolant to the tank.

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.*



FG020184

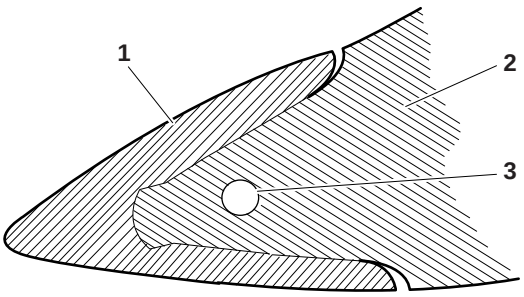
Figure 29

Inspect Bucket Teeth and Side Cutters for Signs of Wear

1. Inspect the bucket teeth daily 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.*

Reference Number	Description
1	Point
2	Adapter
3	Pin



HAOE870L

Figure 30

Inspect Cooling Fan Blade

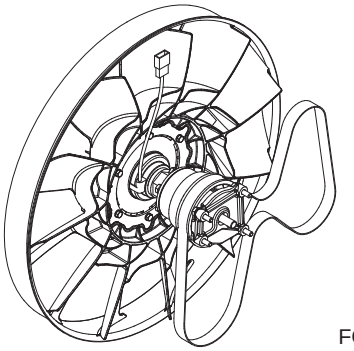
WARNING

AVOID DEATH OR SERIOUS INJURY

Death or serious 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.

NOTE: *Manually rotate the crankshaft by using a wrench on the accessory drive pulley nut.*

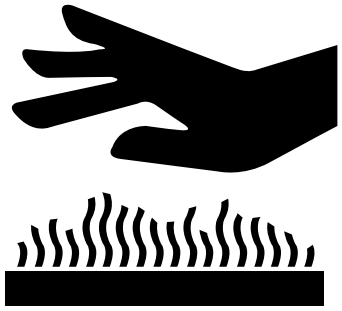
1. An inspection of the cooling fan is required daily. Check for cracks, loose bolts, bent or loose blades, and for contact between the blade tips and the fan shroud. Check the fan to make sure it is securely mounted. Tighten the bolts if necessary. Replace any fan that is damaged.



FG020726

Figure 31

Check Air Intake System and Emission Control System Components



HAOA050L

Figure 32

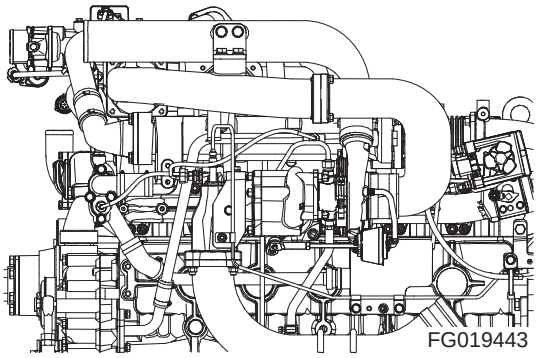
WARNING

AVOID DEATH OR SERIOUS INJURY

Hot engine components can cause burns.

Avoid contact with hot engine components

1. Park the machine on a firm and level surface, lower the attachment to the ground, move safety lever to "LOCK" position, and stop engine.
2. Check the engine intake hose and hose bands for damage and tightness.
3. Check the exhaust pipe and dosing unit for regeneration, and V-clamp dosing unit gasket for damage and tightness.
4. If damaged, wrinkled, or loose, replace or retighten or contact your nearest DOOSAN distributor.



FG019443

Figure 33

IMPORTANT

Severe engine damage will result from running with unfiltered air.

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

Inspect Seat Belt for Proper Operation

See “Seat Belt” on page 1-35 for further information.

Inspect Rear View Camera for Proper Operation (If Equipped)

WARNING

AVOID DEATH OR SERIOUS INJURY

When access to the rear view camera, use external ladder or platform to prevent slipping and falling. The counterweight and engine hood is not an appropriate maintenance platforms.

Inspect Mirrors for Damage and Adjust and Clean as Required

Inspect 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 Operation of All Switches and Travel Alarm (If Equipped)

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

Check the Operation of Pilot Cutoff Switch

A pilot cutoff switch has a pivoting safety lever that deactivates the work group, swing and travel control functions.

When the safety lever is moved down into "LOCK" position, the work group, swing and travel control functions are deactivated.

When the safety lever is moved up into "UNLOCK" position, the work group, swing and travel control functions can be operated.

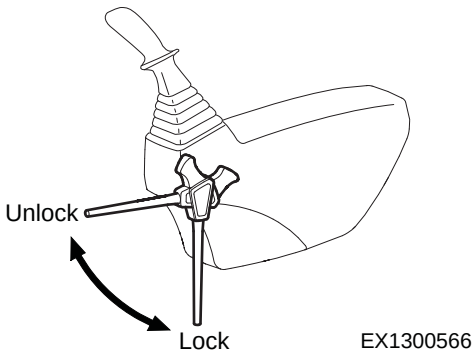


Figure 34

WARNING

AVOID DEATH OR SERIOUS INJURY

The PILOT CUTOFF SWITCH (safety lever) must deactivate the work group, swing and travel control functions when the safety lever is moved down into "LOCK" position.

Contact your DOOSAN distributor immediately if the controls do not deactivate. DO NOT MODIFY THE SYSTEM.

Inspection and Maintenance of the Pilot Cutoff Switch

1. Check for and keep bystanders away from the work area. Sit in operator's seat and fasten seat belt.
2. Start engine and move safety lever up into "UNLOCK" position.
3. Operate the work group (joystick) levers in all directions to check that the boom, arm, bucket (or other attachment) and swing functions operate correctly. Also, check that the travel controls operate properly.

NOTE: *Hydraulic system must be warmed up to operating temperatures.*

4. Raise the boom and arm so the bucket (or other attachment) is about 1 m (3 ft.) off the ground.
5. Move the safety lever down into "LOCK" position to deactivate the work group and travel functions. Move the work group (joystick) levers. There must be no movement of the boom, arm, and attachment or swing functions when the controls are moved.
6. With the safety lever still in the "LOCK" position, move the travel controls. There must be no movement of the excavator tracks.
7. Move safety lever up into "UNLOCK" position. Raise the boom so the bucket (or other attachment) is about 3 m (10 ft.) off the ground. Operate the work group (joystick) lever to lower the boom slowly. While boom is lowering, move the safety lever down into "LOCK" position. Boom movement must stop. Repeat these steps for arm, bucket (attachment), swing and travel functions.
8. Lower work group to the ground and stop engine.

NOTE: *If the PILOT CUTOFF SWITCH (safety lever) does not deactivate the work group and travel functions as described above or if any parts are damaged, bent or missing, contact your DOOSAN distributor immediately for service. DO NOT MODIFY THE SYSTEM.*

Check Operation of All Exterior Lights, Horn and Control Console Indicator and Display Monitor

1. Turn engine starter switch to "I" (ON) position and observe all 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 and Linkages

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 the components, including all cylinders, both travel motors and the swing motor. Cold hydraulic oil in the lines and components needs to be warmed before beginning full operation. If this is not done, damage to the cylinders or hydraulic motors can occur.

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

50 HOUR / WEEKLY SERVICE

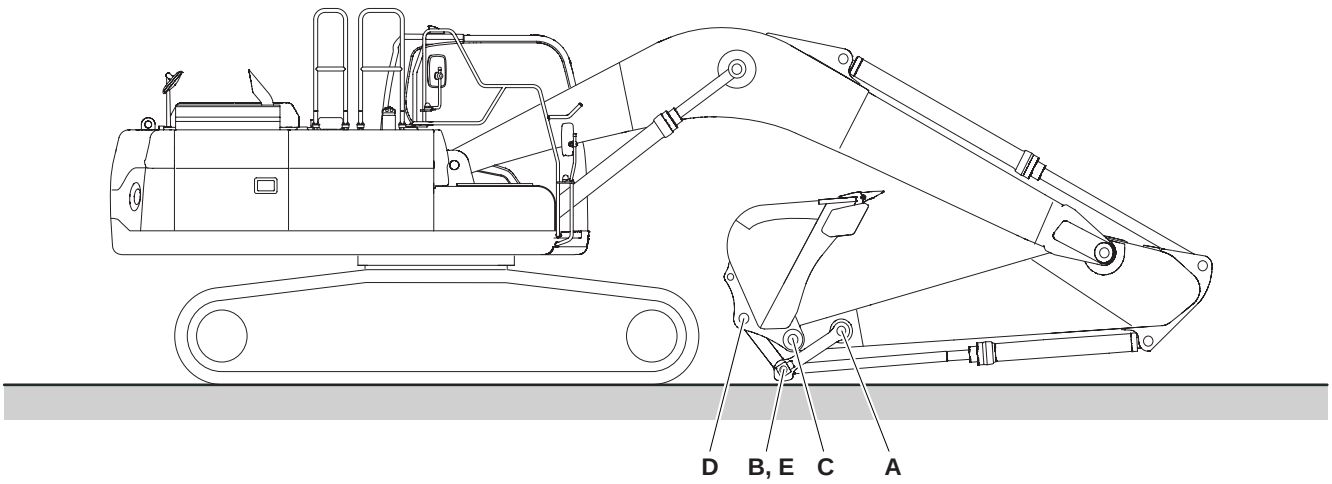
Perform All Daily Service Checks

Grease Arm and Bucket Joint 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 must be greased on a 10 hour/daily basis.*

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



FG020112

Figure 35

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)

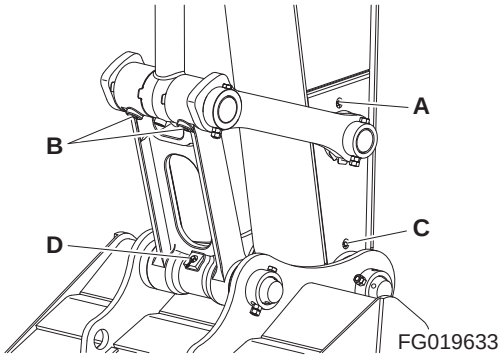


Figure 36

E. Bucket cylinder rod pin (1 point)

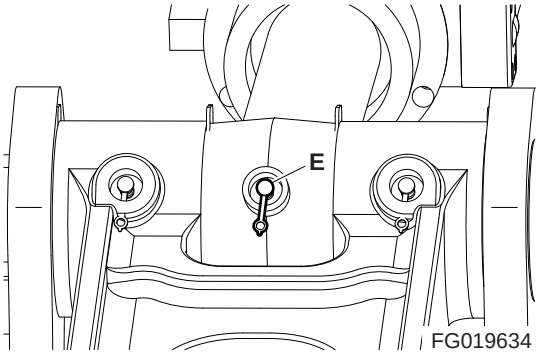


Figure 37

Grease Swing Bearing

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

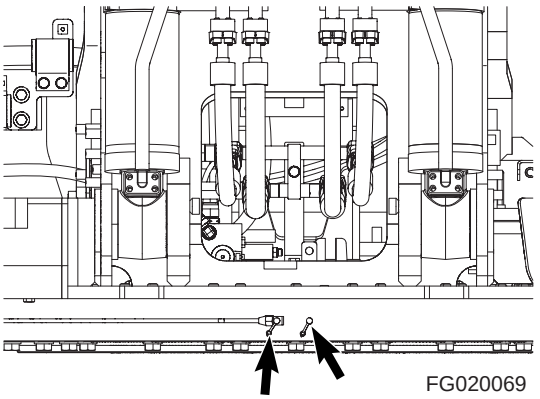


Figure 38

Grease Leveling Blade Pins (Optional)

NOTE: *Grease leveling blade every 10 hours during initial break-in period of 100 hours. After break-in period grease it every 50 hours thereafter.*

NOTE: *In case of performing work in water, grease it every 10 hours.*

1. Lower leveling blade to the ground.
2. Inject grease at 3 points per blade cylinder (6 points total) using grease gun.
3. Remove old grease that has been purged out after greasing.

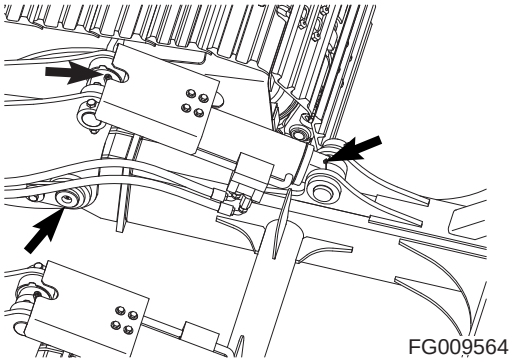


Figure 39

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 an approved container.

   NOTE: *Dispose of drained fluids in compliance with all applicable environmental laws and regulations.*

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

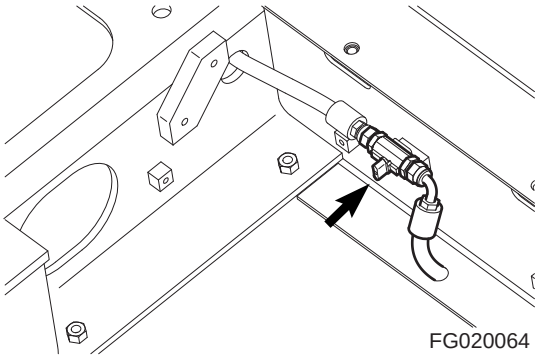


Figure 40

Check Air Compressor and Drain Water as Required

1. Set air compressor operating switch to "I" (OFF) position.
2. Using air gun in the cabin, completely release all air in compressor tank.
3. The air compressor drain valve (1, Figure 41) is on the bottom of the battery box, on right side of the machine.
4. Put a pan under the drain valve, push valve handle (1, Figure 41) sideways to drain water.

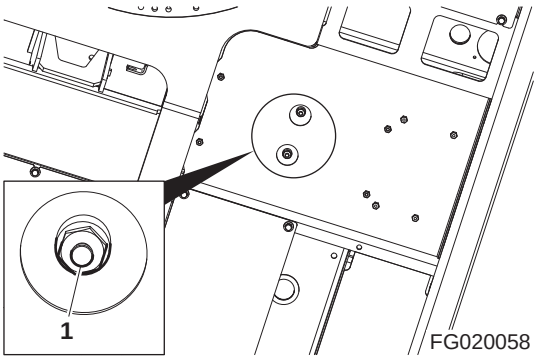


Figure 41

WARNING

AVOID DEATH OR SERIOUS INJURY

The drain valve does not work when the pressure in the air compressor tank is 1.0 bar (14 psi) or above. Compressed air inside tank must be released first.

Wear safety goggles to protect your eyes from water and/or flying objects from drain valve.

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 and Alternator Belts Tension” on page 4-42.

Change Engine Oil and Filter (After First 50 Hours)

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 4-47.

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 4-100.
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

Grease Boom and Arm Joint 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 must be greased on a 10 hour/daily basis.*

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

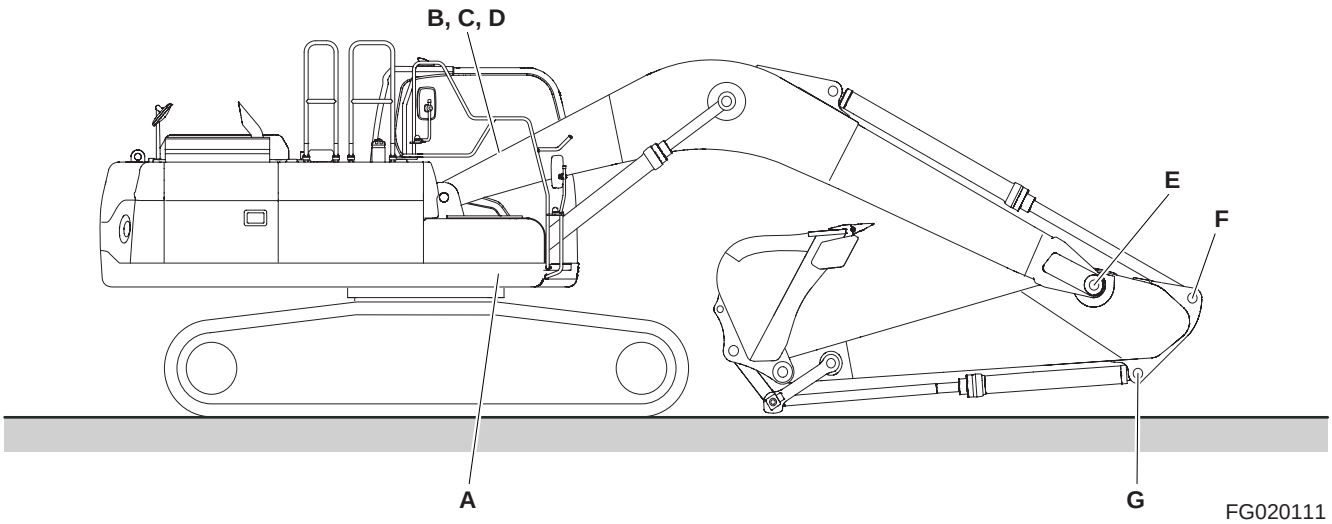


Figure 42

Reference Number	Description
A	Boom Cylinder Head Pin (2 Points)
B	Boom Foot Pin (2 Points)
C	Boom Cylinder Rod Pin (2 Points)
D	Arm Cylinder Head Pin (1 Point)

Reference Number	Description
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)

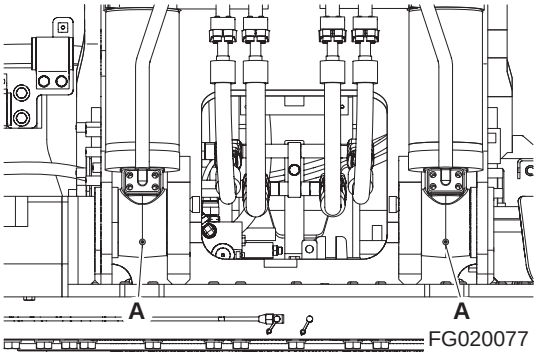


Figure 43

B. Boom foot pin (2 points)

C. Boom cylinder rod pin (2 points)

D. Arm cylinder head pin (1 point)

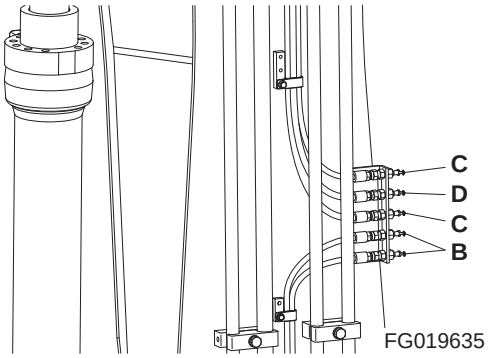


Figure 44

E. Boom arm joint pin (2 points)

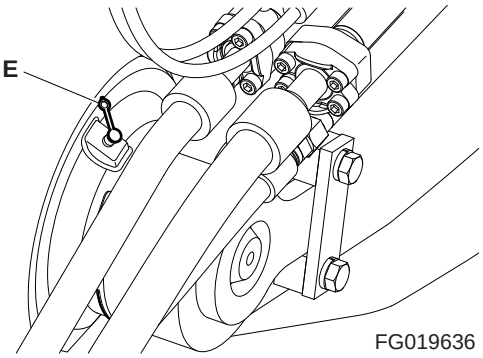


Figure 45

F. Arm cylinder rod pin (1 point)

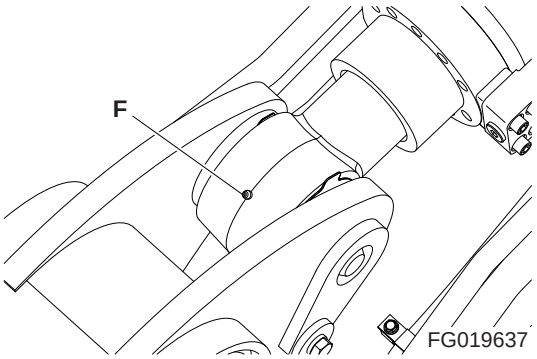


Figure 46

G. Bucket cylinder head pin (1 point)

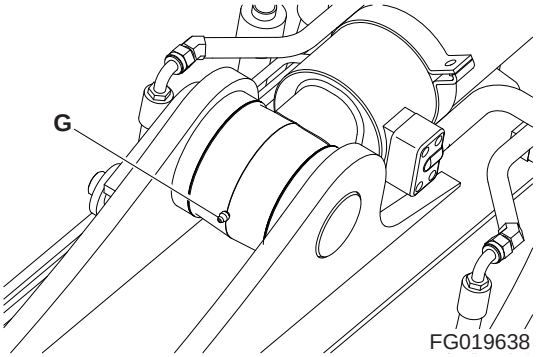


Figure 47

Check Engine Fan and Alternator Belts 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. To adjust the belt, loosen the alternator adjustment plate bolts, adjust the belt tension and retighten the bolts.

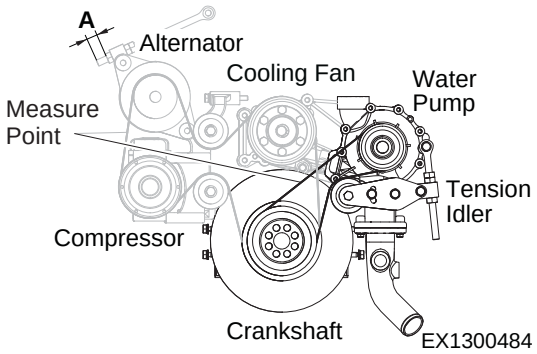


Figure 48

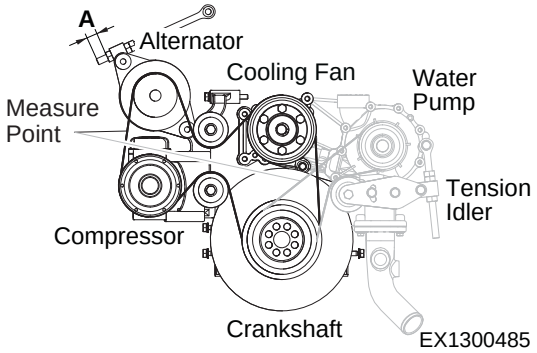


Figure 49

Model	Belt Tension (N)		How to Measure (Alternator Belt)	
			Depressible Distance (5 kgf)	A
DL06K	New	800 ±50 N (82 ±5 kgf)	2.4 mm	62 - 64 mm
	Used	600 ±50 N (61 ±5 kgf)	3.7 mm	58 - 60 mm

Check Engine Fan and Alternator Belts Wear

WARNING

AVOID DEATH OR SERIOUS INJURY

Keep clear of engine fan and fan drive belts when the engine is running. Contact with rotating belt can cause injury.

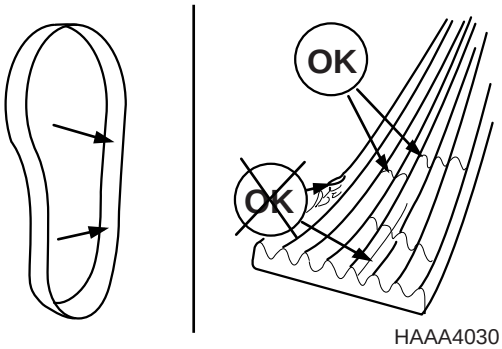
WARNING

AVOID DEATH OR SERIOUS INJURY

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

1. Replace badly worn, greasy, or severely cracked belts immediately. These conditions prevent proper belt function. Visually inspect the belt. Check the belt for intersecting cracks. Transverse (across the belt width) cracks are acceptable. Longitudinal (direction of belt length) cracks that intersect with transverse cracks are not acceptable. Replace the belt if it is frayed or has pieces of material missing.
2. Before installing new belts, make sure all pulley grooves are clean and not worn. Replace pulley, if damaged, or if the grooves are worn.
3. All pulley support bearings, shafts, and brackets must be in working order.
4. When replacing belts and pulleys, pulley alignment must be checked with belts tensioned and brackets securely clamped. A misalignment that can be visually detected and will reduce 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 severe belt damage or breakage during 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 can slip damaging the belts and pulley grooves.

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



HAAA4030

Figure 50

Change Breaker Filter (Optional)

WARNING

AVOID DEATH OR SERIOUS INJURY

The hydraulic oil will be hot after machine operation.

Allow the system to cool down before changing pilot filter.

1. Park machine on firm and level ground. Lower the front attachment to the ground and stop engine.
2. Tip the hydraulic oil tank breather cap up to release pressure.
3. Locate breaker filter assembly (Figure 51).
4. Position a container under the filter assembly. Remove drain plug and completely drain the assembly.
5. Using a 30 mm wrench, unscrew filter housing from filter head.
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.

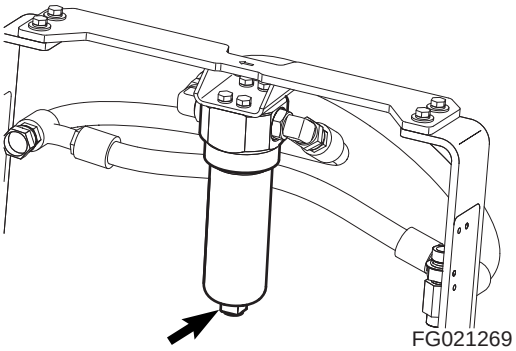


Figure 51

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 4-58).*

Change Pilot Filter (After First 250 Hours)

NOTE: *Change pilot filter after first 250 hours and every 1,000 hours thereafter (See page 4-59).*

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

Check Fluid Levels in Batteries

See “Inspection of Battery Electrolyte Level” on page 4-89 for further information.

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

AVOID DEATH OR SERIOUS INJURY

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

1. Remove inspection cover and inspect the condition of the grease. Inspect for water or other contaminants on the gear teeth.

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

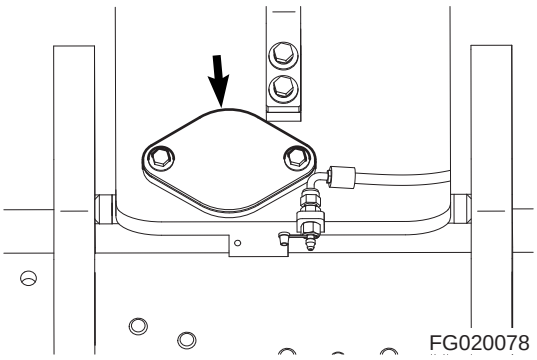


Figure 52

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.

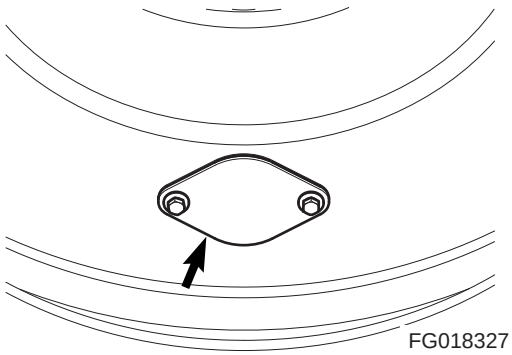


Figure 53

Change Engine Oil and Filter

NOTE: *Change engine oil and filter after first 50 hours of operation or rebuild, then every 500 thereafter.*

WARNING

AVOID DEATH OR SERIOUS INJURY

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 54) and install hose (2) to drain the engine oil. Remove hose (2) and install cap (1).

   NOTE: *Dispose of drained fluids in compliance with all applicable environmental laws and regulations.*

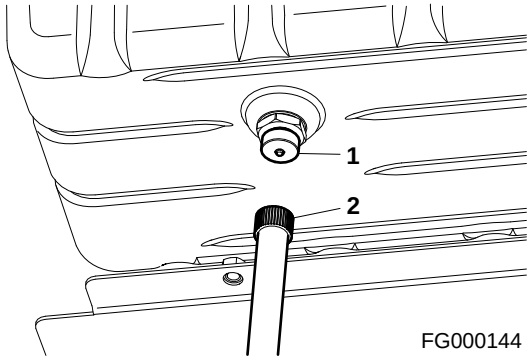


Figure 54

IMPORTANT

Dispose of filters/oils/liquids in compliance with all applicable environmental laws and regulations.

2. Replace engine oil filter by using filter wrench. The engine oil filter is a spin-on type. See Figure 55. 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.

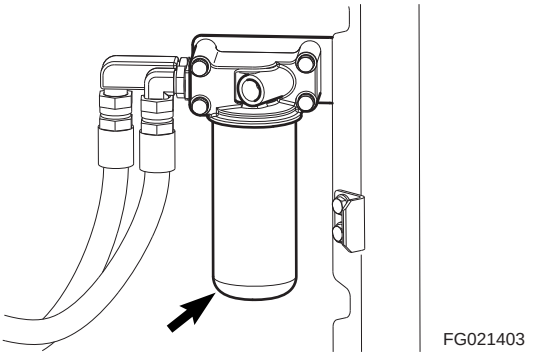


Figure 55

4. Refill the engine with the correct oil through the oil fill port (Figure 56). Refer to the Lubrication Table of this manual for the recommended oil for the operating conditions.

   NOTE: *See "Fluid Capacities" on page 4-18. for capacity.*

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

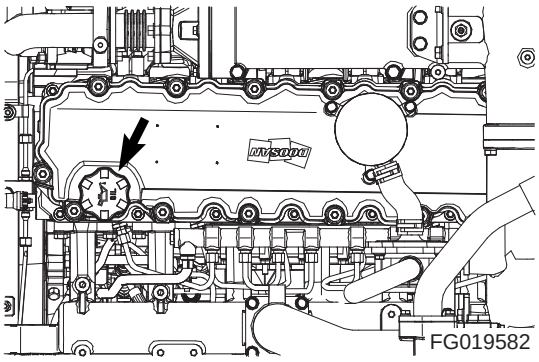


Figure 56

Clean Air-conditioning Outer Filter

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

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

WARNING

AVOID DEATH OR SERIOUS INJURY

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

WARNING

AVOID DEATH OR SERIOUS INJURY

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 cover by using the starter KEY in the left side of the cabin.

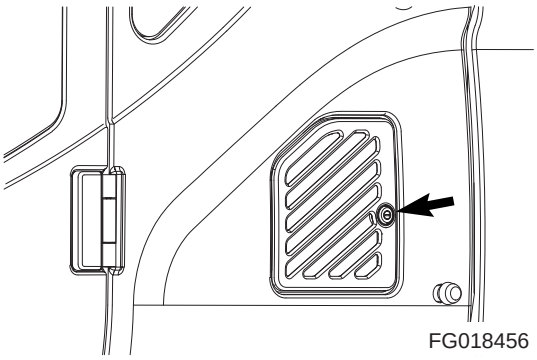


Figure 57

2. Remove filter (Figure 58) and inspect for any damage.
3. Use compressed air to clean filter. If filter is still dirty, then replace filter.
4. Reassemble in reverse order.

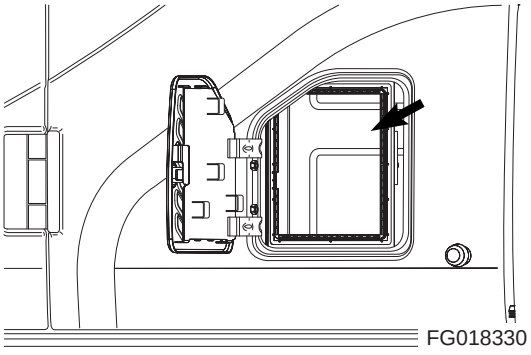


Figure 58

Check and Clean Air-conditioning Inner Filter

WARNING

AVOID DEATH OR SERIOUS INJURY

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

WARNING

AVOID DEATH OR SERIOUS INJURY

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

1. Remove filter by pulling knob outward while pressing the upperpart and lower part of the filter handle which is inside of the left rear part of the cabin.
2. Use compressed air to clean filter. If the filter is damaged, replace with 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 that filter is completely dry before installing.

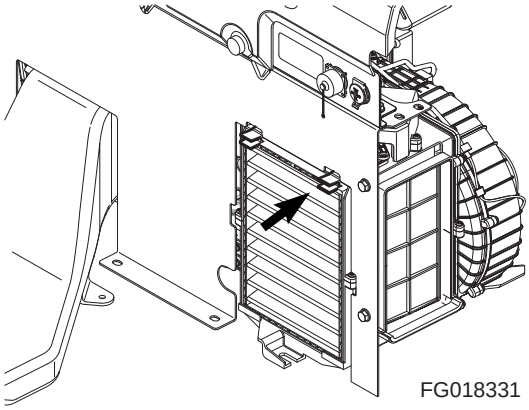


Figure 59

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

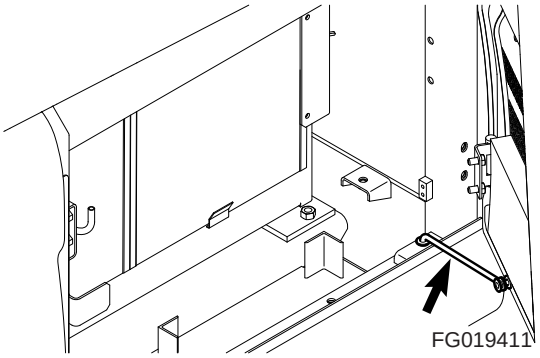


Figure 60

WARNING

AVOID DEATH OR SERIOUS INJURY

Using compressed air, steam or water to clean can cause serious injury. Always wear safety goggles, mask and safety shoes during the cleaning precess. Keep personnel and bystanders clear of work area.

1. Open the rear left door and engine cover and loosen the bolt(s) on the upper cover of oil cooler.
2. Loosen wing bolt(s) and remove dust net from in front of oil cooler and radiator.

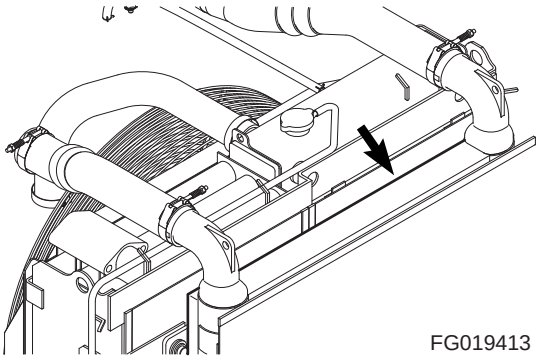


Figure 61

3. Remove wing bolts and plate (Figure 62) between radiator and oil cooler.
4. 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 towards the inside. Repeat the cleaning process from the inside of the engine compartment towards the outside to remove all dirt and debris.

   NOTE: *Clean dust net and install it after cleaning radiator, oil cooler, intercooler and fuel cooler.*

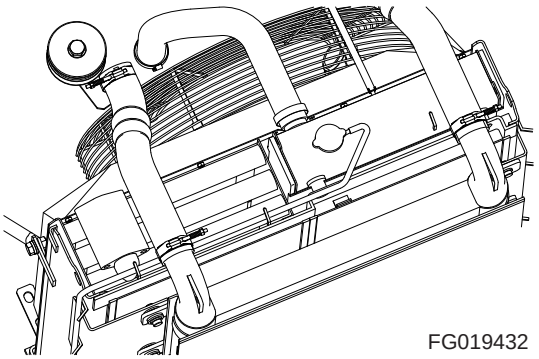


Figure 62

5. Clean air conditioner condenser core with compressed air, steam or water.

IMPORTANT

To prevent damage to the cores, apply compressed air from an appropriate distance. Damaged cores can cause leakage or overheating. In dusty conditions, check the cores daily.

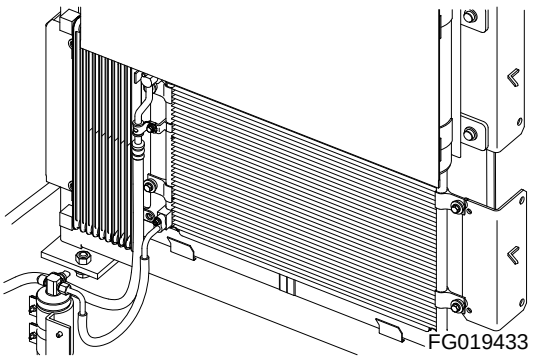


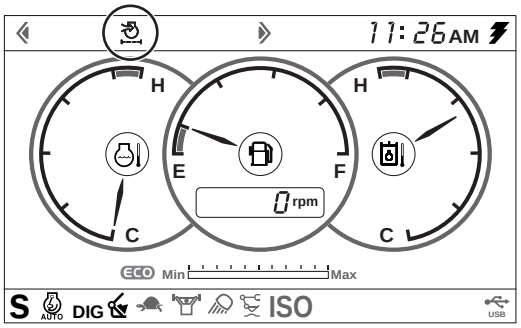
Figure 63

Clean Outer Filter of Air Cleaner

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

NOTE: *If air cleaner clogged warning symbol (Figure 64) on display monitor comes "ON", the air cleaner must be serviced.*

NOTE: *When working in very dusty conditions, the service interval must be shortened.*



FG018716

Figure 64

WARNING

AVOID DEATH OR SERIOUS INJURY

Never clean or attempt to remove 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 symbol (Figure 64) on display monitor comes "ON" the air cleaner must be serviced.*

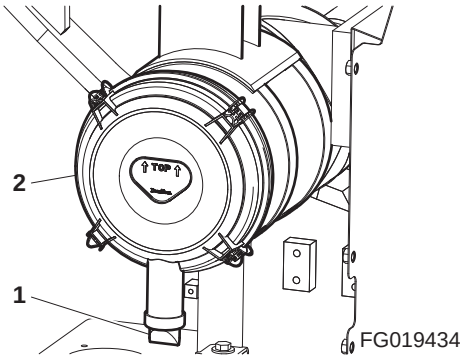
   NOTE: *Replace outer filter after cleaning 5 times or every 2,000 hours/1 year of service.*

2. Remove and clean rubber evacuator valve (1, Figure 65) 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.*

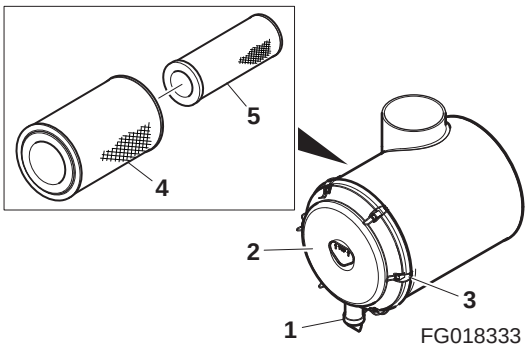
3. Remove access cover (2, Figure 66) by loosening the latches (3).

4. Remove outer filter (4, Figure 66) from the housing. Do not remove inner filter (5).



FG019434

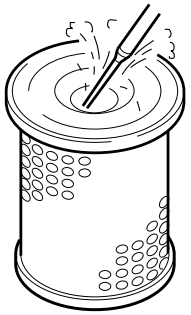
Figure 65



FG018333

Figure 66

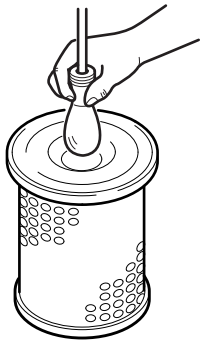
5. Clean the outer filter (4, Figure 66) by blowing compressed air from the inside of the filter towards the outside. Do not use more than 205 kPa (30 psi) air pressure.



HAOC570L

Figure 67

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.



FG000412

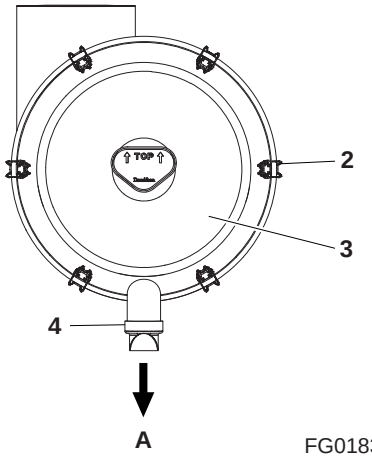
Figure 68

9. Install cover (3, Figure 69) as follows.
   A. Align cover with the element.
   B. Hook the tip of latches (2, Figure 69) to the protruding part of the air cleaner body and lock it in position.
   C. When locking latches (2, Figure 69) in position, attach them in turn on opposite sides (top, bottom, left, right) in the same way as when tightening bolts.
   D. Always install cover (3, Figure 69) so evacuator (4) is facing the ground (A).

      NOTE: *Make sure that lips of evacuator are parallel to cover.*

   E. When cover (3, Figure 69) is installed, check that cover (3) is properly seated in air cleaner body. If it is seated, install again.

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.*



FG018334

Figure 69

Change of Water Separator & Pre Fuel Filter (Fuel Prefilter)

1. Open the pump room door to access fuel prefilter.
2. Close fuel drain valve.
3. Position a small container under prefilter. Drain fuel by opening drain valve on bottom of filter.

   NOTE: *Dispose of drained fluids in compliance with all applicable environmental laws and regulations.*

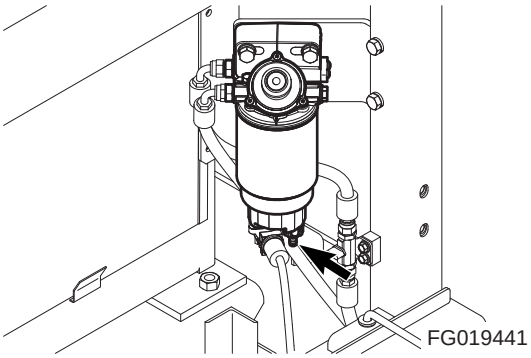


Figure 70

4. Remove bowl using supplied tool.
5. Remove cartridge.

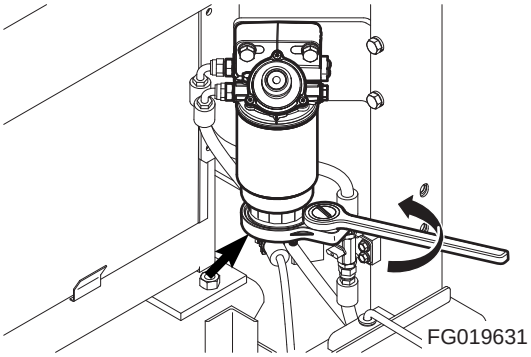


Figure 71

6. Coat surface of packing (2, Figure 72) with fuel on new cartridge (1).
7. Tighten cartridge by hand until packing comes into contact with surface of filter housing head.
8. When packing contacts surface, tighten the cartridge about 3/4 of a turn more.
9. Coat surface of seal (3, Figure 72) with fuel, and tighten the bowl with tool.

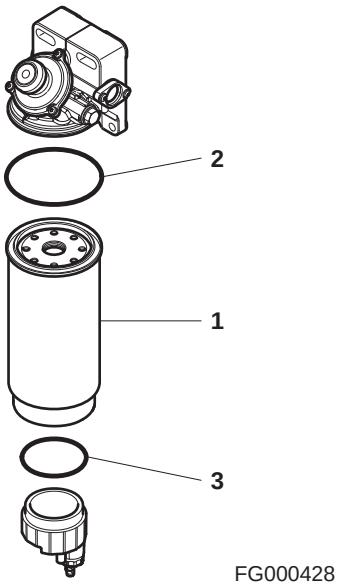


Figure 72

Change Main Fuel Filter

WARNING

AVOID DEATH OR SERIOUS INJURY

Change 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.
3. Unscrew fuel filter from head assembly. Discard fuel filter.

   NOTE: *Dispose of drained fluids in compliance with all applicable environmental 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.*

   NOTE: *Only use Ultra Low Sulfur Diesel (ULSD) fuel and API-CJ-4/ACEA-E9 grade engine oil.*

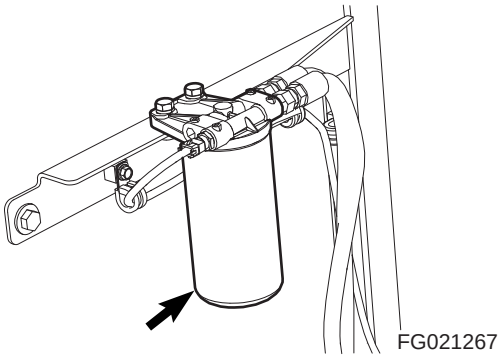


Figure 73

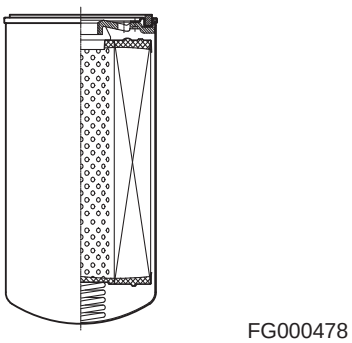


Figure 74

Fuel System Priming

If air remains in the fuel inlet line to the engine, it can 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, bleed the air out using the following procedure:

1. Stop engine.
2. Check that fuel valve is open.
3. Open fuel drain valve.
4. Loosen plug (1, Figure 75) on the fuel prefilter head.
5. Pump the hand-operated primer pump (2, Figure 75) on the fuel prefilter. Pump primer until fuel is present at plug hole in fuel prefilter head.
6. Tighten plug (1, Figure 75) in fuel prefilter head.
7. Continue to pump primer pump until a strong resistance is felt.
8. Start engine and look for signs of leaks.
9. Repeat procedure if necessary.

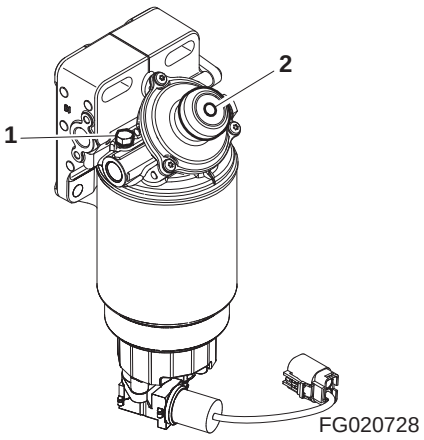


Figure 75

Clean Air Compressor Filter (Optional)

1. Set air compressor operating switch to "I" (OFF) position.
2. Open the door of the battery box on the right side of the machine.
3. Remove filter cap (1, Figure 76) manually, remove air filter (2, Figure 77) in the housing, and clean the cap and inside (3, Figure 76) of the housing.
4. Clean and dry the filter with clean, dry, compressed air (2 kg/cm^2 or lower).
5. After the cleaning, illuminate the inside of the filter and inspect it for is any holes, tears, or other damage. If any, replace the filter.
6. Assemble the filter and filter cap in the reverse order of disassembly.

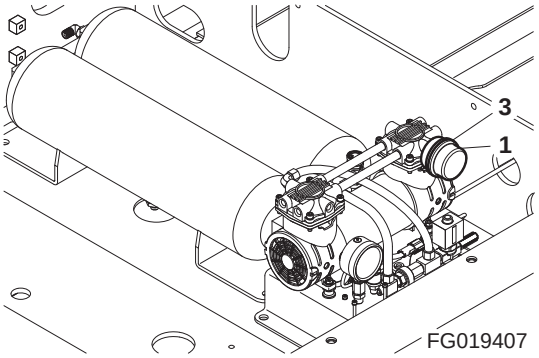


Figure 76

WARNING

AVOID DEATH OR SERIOUS INJURY

Do not clean or replace the filter while the air compressor is running.

Wear safety goggles to protect your eyes from flying dust when cleaning or replacing the filter.

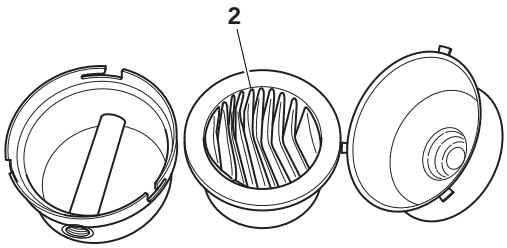


Figure 77

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

WARNING

AVOID DEATH OR SERIOUS INJURY

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

Before removing the motor case, loosen the plug slightly to allow pressurized air to escape. Residual pressure in the travel reduction device can cause the plug to be dislodged and oil to squirt out suddenly.

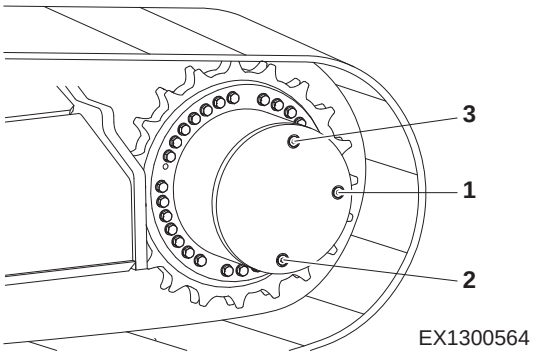


Figure 78

Reference Number	Description
1	Oil Level Plug
2	Drain Plug
3	Fill Plug

1. Make sure that the machine is on firm and level ground.
2. Rotate the track until ports (1 thru 3, Figure 78) are in their proper positions as shown.
3. Loosen fill plug (3, Figure 78) slightly to allow pressurized air to escape.
4. Remove oil level plug (1, Figure 78).
5. Check oil level. The oil must be near the bottom of the level plug opening.
6. Add oil through the fill plug (3, Figure 78) opening, if necessary.
7. Clean and install oil level and fill plugs (1 and 3, Figure 78).
8. Repeat this procedure on the other travel reduction device.

Change Oil in Travel Reduction Device (One on Each Side of Unit) (After First 500 Hours)

NOTE: *Drain and refill oil after first 500 hours of operation or rebuild, and every 1,000 hours thereafter (See page 4-60).*

Change Swing Reduction Device Oil (Drain and Refill After First 500 Hours)

NOTE: *Change swing reduction device oil after first 500 hours on a new machine and every 1,000 hours thereafter (See page 4-61).*

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 and level ground. Lower the front attachment to the ground and stop engine.
2. Remove air vent plug (1, Figure 79) from swing reduction device.

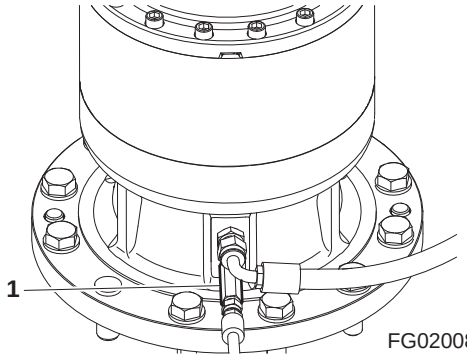


Figure 79

3. Press grease fitting and inject grease with the grease gun on the marked point (2, Figure 80).
4. Install air vent plug (1, Figure 79) in swing reduction device.

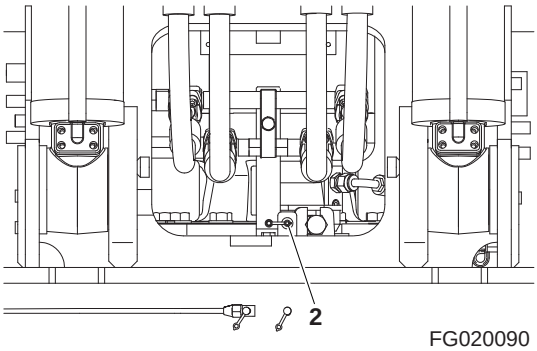


Figure 80

Change Hydraulic Oil Tank Breather Filter

1. Park machine on firm and level ground. Lower the front attachment to the ground and stop engine.
2. Tip breather cap up (2. Figure 81) slightly to release the internal pressure.
3. Unscrew the bolt (1, Figure 81) and take off the breather cap (2).
4. Change a filter cartridge (3, Figure 81) and assemble the breather cap by tightening the bolt.

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

   NOTE: *When the machine is operated under dusty work sites, the air breather filter needs to be cleaned or replaced on a regular basis even before the expected replacement date.*

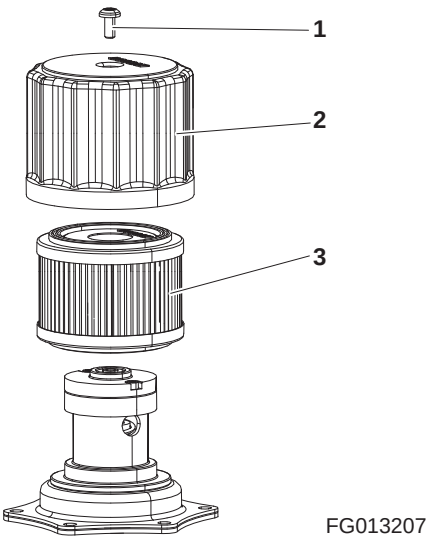
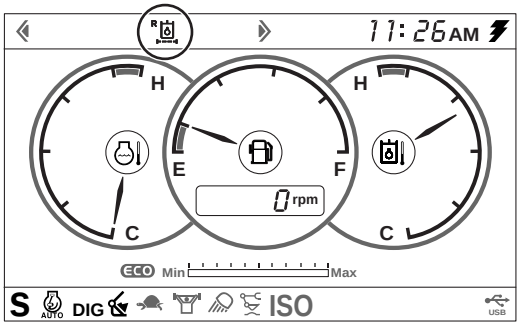


Figure 81

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 symbol (Figure 82) on display monitor comes "ON" the return filter must be serviced.*



FG018717

Figure 82

WARNING

AVOID DEATH OR SERIOUS INJURY

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

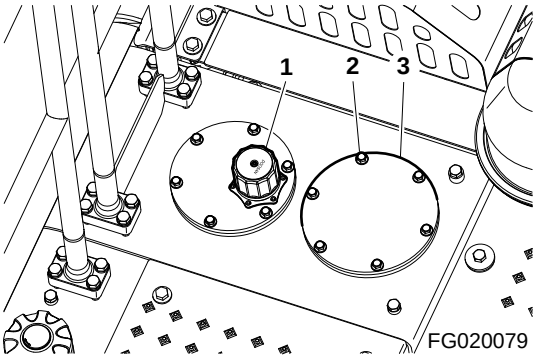
The hydraulic tank is pressurized. Tip the hydraulic breather cap up slightly to allow the pressurized air to vent. After the pressure has been released, remove service covers or drain water from tank.

IMPORTANT

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

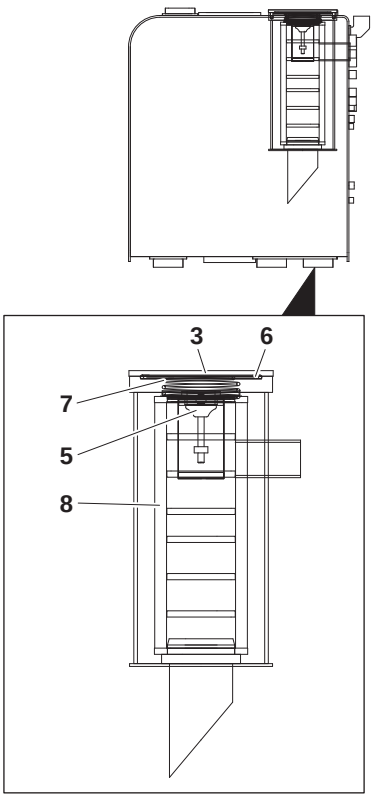
1. Park machine on firm and level ground. Lower the front attachment to the ground and stop engine.
2. Tip breather cap up (1, Figure 83) slightly to release the internal pressure.
3. Remove bolts (2, Figure 83) and service cover (3). Remove spring (4), valve (5) O-ring (6), and bypass strainer (7), and then filter (8).
4. Remove filter and discard.

   NOTE: *Used filter should always be disposed of according to local laws and regulations.*
5. Install new filter and a new O-ring. Install bypass strainer, valve and spring. Install service cover plate.
6. Run engine for ten minutes at "LOW IDLE" to purge air from circuit.
7. Check level in hydraulic oil tank (See page 4-25). Add oil if necessary.



FG020079

Figure 83



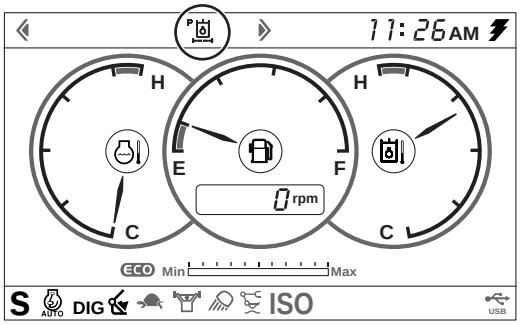
FG021266

Figure 84

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 symbol (Figure 85) on display monitor comes "ON" the pilot filter must be serviced.*



FG018718

Figure 85

WARNING

AVOID DEATH OR SERIOUS INJURY

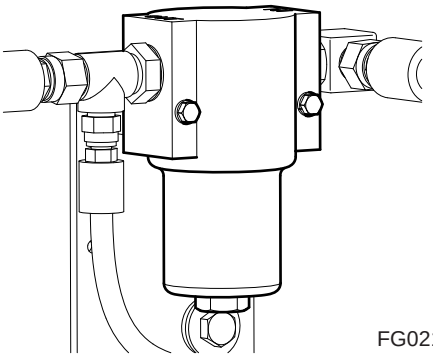
The hydraulic oil will be hot after machine operation.

Allow the system to cool down before changing pilot filter.

1. Park machine on firm and level ground. Lower the front attachment to the ground and stop engine.
2. Tip breather cap up (1, Figure 83) slightly to release the internal pressure.
3. Locate pilot system filter assembly. See Figure 86.
4. Unscrew canister (5, Figure 87) and remove O-ring (3) and filter cartridge (4).

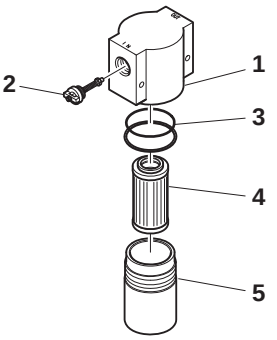
   NOTE: *The canister will be filled with oil. Use caution when removing this assembly.*
5. Insert a new filter cartridge and O-ring. Apply a small amount of oil around the entire O-ring and install the canister assembly onto the filter head (1, Figure 87).

   NOTE: *Used filter should always be disposed of according to local laws and regulations.*
6. After changing pilot filter, vent air from pump and check level of hydraulic oil tank.



FG021737

Figure 86



FG021270

Figure 87

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

WARNING

AVOID DEATH OR SERIOUS INJURY

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

Before removing the motor case, loosen the plug slightly to allow pressurized air to escape. Residual pressure in the travel reduction device can cause the plug to be dislodged and oil to squirt out suddenly.

Reference Number	Description
1	Oil Level Plug
2	Drain Plug
3	Fill Plug

NOTE: *Drain oil after first 500 hours of operation or rebuild, and every 1,000 hours thereafter.*

1. Make sure that the machine is on firm and level ground.
2. Rotate the track until ports (1 thru 3, Figure 88) are in their proper positions as shown.
3. Place a container under drain plug (2, Figure 88) and remove plugs (1 thru 3) to drain the travel reduction gear oil.

   NOTE: *Dispose of drained fluids in compliance with all applicable environmental regulations.*
4. Install drain plug (2, Figure 88). Refill the travel reduction gear case with fluid through fill port (3) until fluid level is at port (1). Install level plug (1) and fill plug (3).

   NOTE: *See “Fluid Capacities” on page 4-18. for capacity.*
5. Repeat this procedure on the other travel reduction device.

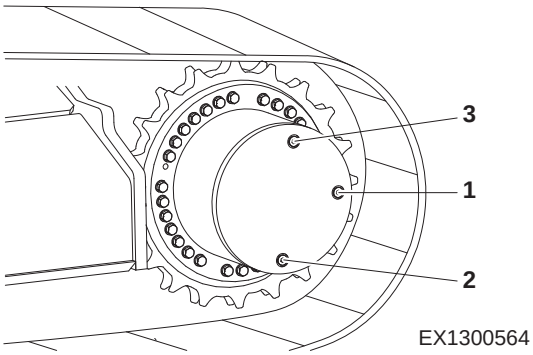
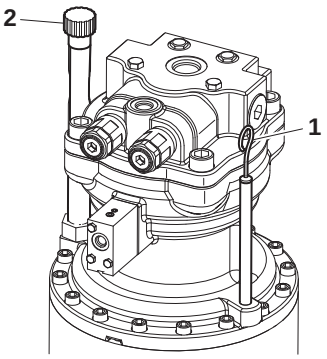


Figure 88

Change Swing Reduction Device Oil

NOTE: *Change swing reduction device oil after first 500 hours of operation or rebuild, and every 1,000 hours thereafter.*



FG020080

Figure 89

WARNING

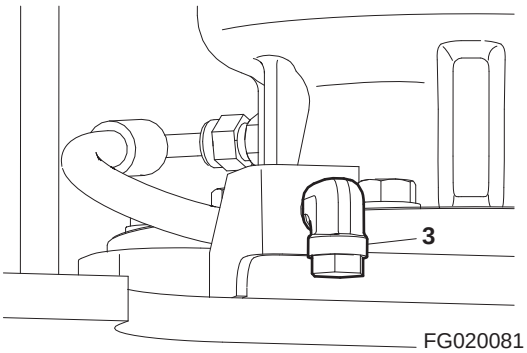
AVOID DEATH OR SERIOUS INJURY

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 (3, Figure 90) and drain the swing reduction device oil into a container.

   NOTE: *Dispose of drained fluids in compliance with all applicable environmental regulations.*

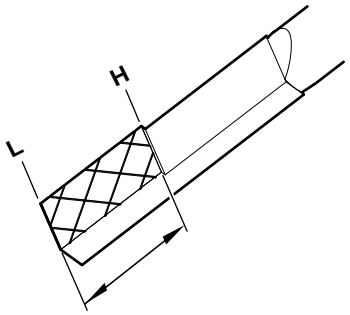
3. After draining oil, tighten the drain plug.



FG020081

Figure 90

4. Remove breather/fill cap (2, Figure 89) and add oil to "H" mark on dipstick (1).



FG000419

Figure 91

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 must be cleaned.

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

WARNING

AVOID DEATH OR SERIOUS INJURY

All service and inspection of air-conditioning system must 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 cover by using the starter KEY in the left side of the cabin.
2. Remove filter (Figure 93) and replace with new one.
3. Reassemble in reverse order.

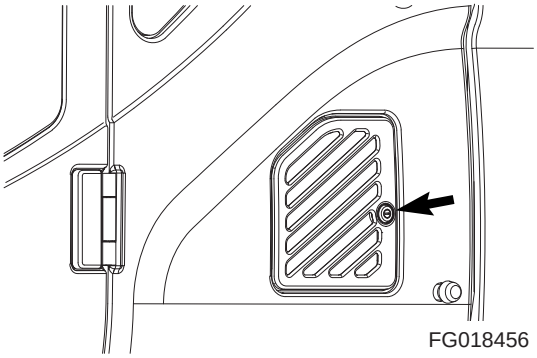


Figure 92

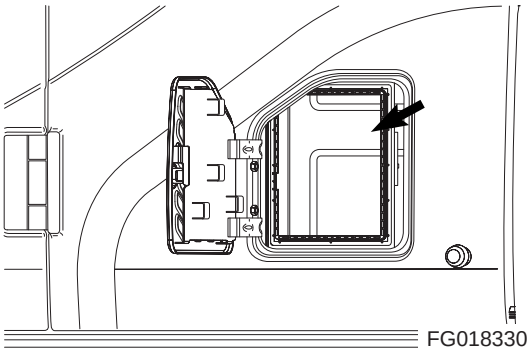


Figure 93

Change Air-conditioning Inner Filter

WARNING

AVOID DEATH OR SERIOUS INJURY

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

1. Remove filter by pulling knob outward while pressing the upperpart and lower part of the filter handle which is inside of the left rear part of the cabin.
2. Replace with new one.
3. Reassemble filter in reverse order.

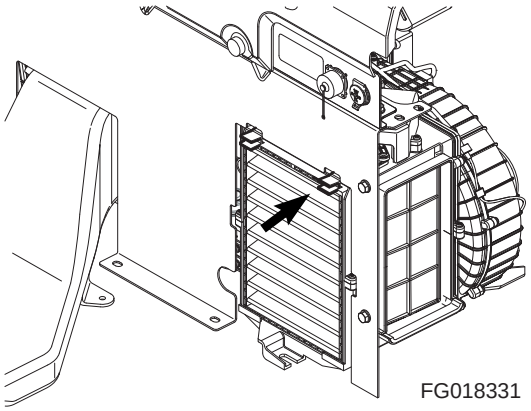


Figure 94

Check Air Conditioner Refrigerant

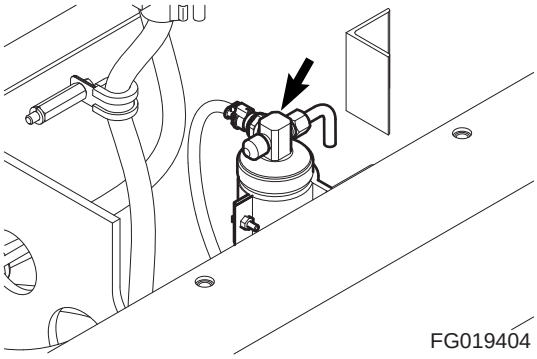


Figure 95

WARNING

AVOID DEATH OR SERIOUS INJURY

Mixing of tobacco smoke and freon is deadly.

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

Contact with refrigerant can result personal injury, frost bite. Wear Protective glasses when refrigerant lines are opened.

System may still under pressure, release it slowly in a well ventilated area.

Inhaling air conditioner refrigerant gas through a lit cigarette or other smoking method or inhaling fumes released from a flame contacting air conditioner refrigerant gas, can cause bodily harm or death.

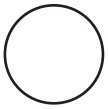
Use a certified recovery and recycling cart to properly remove the refrigerant from the air conditioning system.

1. Run engine at about 1,800 rpm. Operate for a minimum of ten minutes to stabilize the system.
2. Press the "HI" fan speed switch to set maximum airflow.
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.

IMPORTANT

Overfilling refrigerant can cause dangerous high-pressure and poor cooling action. Low refrigerant level can cause compressor damage.

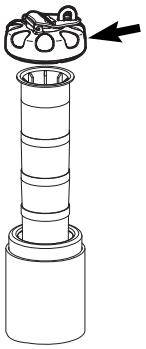
Always maintain refrigerant at normal level.

Amount of Refrigerant	Appearance of the Sight Glass	Solutions
Normal	 Almost clear. All 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.	

Change Fuel Cap Filter

IMPORTANT

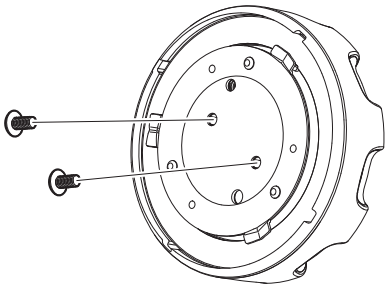
External shock or damage to fuel cap can cause permanent damage to filter.



FG020189

Figure 96

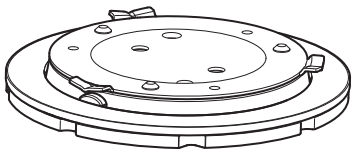
1. Remove screws and filter assembly from fuel cap (Figure 97).



FG015684

Figure 97

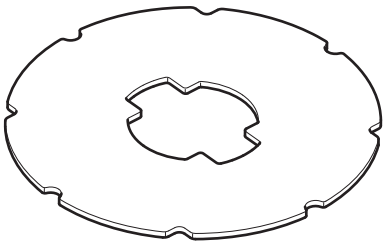
2. After disassembly, carefully lay it as shown in Figure 98.



FG015685

Figure 98

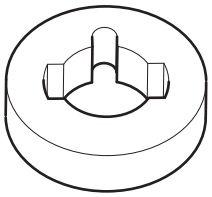
3. After disassembly (Figure 98), remove rubber piece as shown on (Figure 99).



FG015686

Figure 99

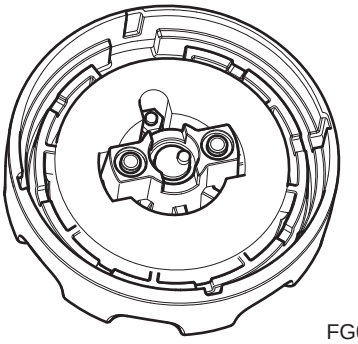
4. After disassembly as shown in (Figure 99), replace filter (Figure 100) with a new one.



FG015687

Figure 100

5. After installing new filter, assemble fill cap in reverse order.



FG015688

Figure 101

Check and Adjust Engine**

Contact your DOOSAN distributor for checking and adjusting the following items:

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

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

2,000 HOUR / YEARLY SERVICE

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

Replace Outer and Inner Air Cleaner Filters

WARNING

AVOID DEATH OR SERIOUS INJURY

Never clean or attempt to remove air cleaner filter 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.*

1. Open the side door of the machine, remove 6 hooks (2, Figure 102), then remove cover.
2. Remove evacuator valve (1, Figure 103) from the 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. Hold the outer element (4, Figure 103), rock it lightly up and downward, and swing the element to pull it out. Remove inner element (5) after doing this.
4. Wipe off the dirt stuck to the air cleaner cover and the inside of the air cleaner housing.

   NOTE: *When replacing the outer element, replace the inner element simultaneously. Do not reuse the inner element.*

   NOTE: *If the inner element is not installed properly and the outer element and cover are installed, the outer element will be damaged.*
5. Remove inner element (5, Figure 104), then install a new inner element. Insert the inner element properly so it does not move.
6. Push the new outer element (5, Figure 104) in straight to the air cleaner body.

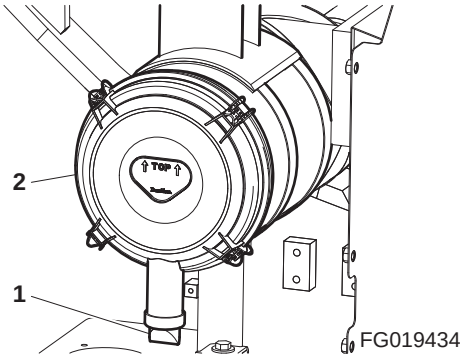


Figure 102

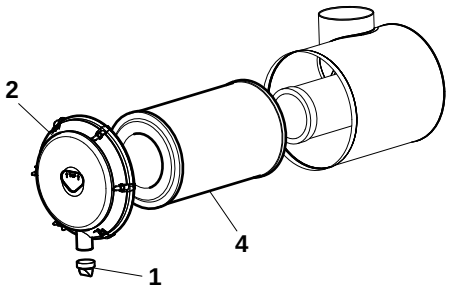


Figure 103

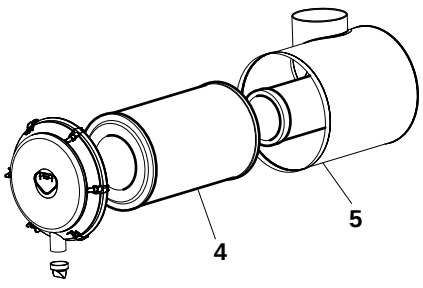


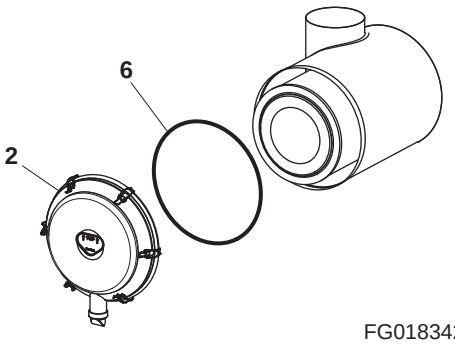
Figure 104

IMPORTANT

Be sure to install the air cleaner filters facing in the correct direction. If the direction of installation is incorrect, this will damage the air cleaner filters or the engine.

7. Replace O-ring (6) of cover (2) with a new part.

   NOTE: *When inserting the element, if the rubber at the end is wedged or the outer element is not pushed in straight, and cover is assembled by force of hook afterward, the hook and air cleaner body can be damaged.*



FG018342

Figure 105

8. Install cover (3) as set forth bellow.

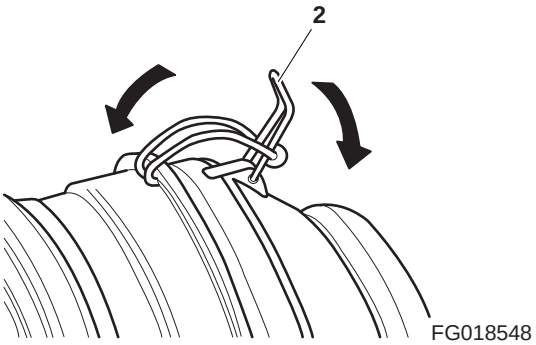
   A. Align cover with the element.

   B. Hook the tip of hook (2) to the protruding part of the air cleaner body and lock it in position.

   C. When locking hooks (2) in position, apply the hooks in turn on opposite sides (top, bottom, left, right) in the same way as when tightening bolts.

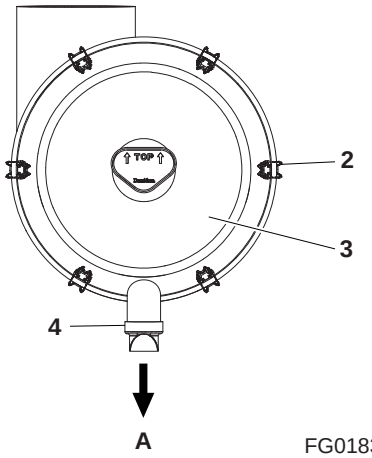
   D. Always install cover (3) so evacuator (4) is facing the ground (A).

   E. When cover (3) is installed, check that clearance between the air cleaner body and cover (3) is not too large. If it is too large, remove cover and install again.



FG018548

Figure 106



FG018334

Figure 107

Change Radiator Coolant

NOTE: *Do not mix ethylene glycol and propylene glycol antifreeze together. See "Engine Cooling System" on page 4-92, for further details.*

ARO1760L

Figure 108

WARNING

AVOID DEATH OR SERIOUS INJURY

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. Check the coolant level in the coolant recovery tank.

IMPORTANT

Do not mix up the antifreeze from different makers. Mixing the two compounds can cause generation of foreign material which can damage the system. Therefore, it Is recommended to use authorized DOOSAN genuine antifreeze solution.

To achieve the best cooling performance, keep the mixing ratio of the antifreeze and water by 50 : 50. Using water only can corrode the coolant circuit.

In bitterly cold working conditions, 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 (1, Figure 109).

   NOTE: *Dispose of drained fluids in compliance with all applicable environmental laws and regulations.*

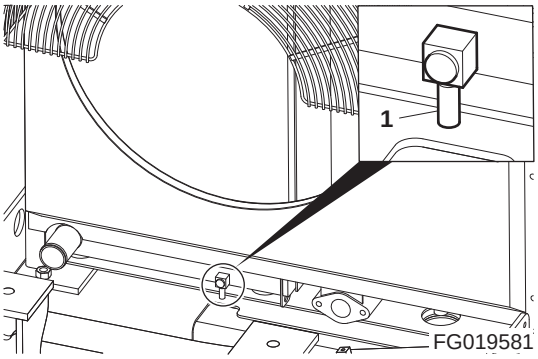


Figure 109

3. Remove coolant drain plug (2, Figure 110) 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 coolant temperature gauge reaches the "WHITE 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 solution for ambient temperature. Refer to coolant concentration table. See “Antifreeze Concentration Tables” on page 4-94.
11. Run engine without radiator cap installed, so all air will be purged from system. Fill radiator to fill neck.
12. Drain and fill radiator coolant recovery tank.

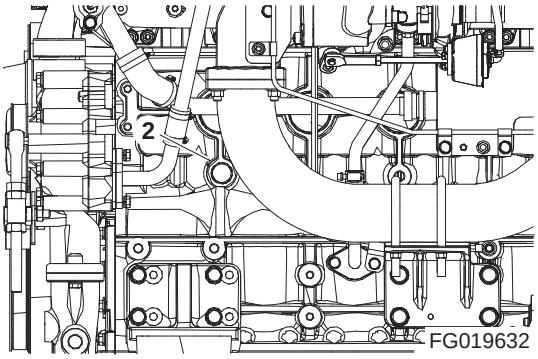


Figure 110

ChangeAir Compressor Filter (Optional)

1. Open the door of the battery box on the right side of the machine.
2. Remove filter cap (1, Figure 112) manually, remove air filter (2, Figure 111) in the housing, and clean the cap and inside (3, Figure 112) of the housing.
3. Replace the air filter (2, Figure 111), and assemble the filter cap (1, Figure 112).

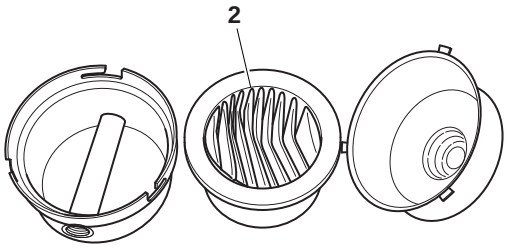


Figure 111

WARNING

AVOID DEATH OR SERIOUS INJURY

Do not try to clean or replace the filter while the air compressor is running.

Wear safety goggles to protect your eyes from flying dust when cleaning or replacing the filter.

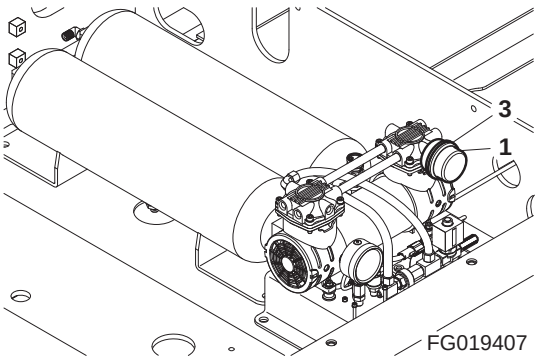


Figure 112

Hydraulic Oil Exchange and Suction Strainer Cleaning

WARNING

AVOID DEATH OR SERIOUS INJURY

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

The hydraulic tank is pressurized. Tip breather cap up to allow the pressurized air to vent. After the pressure has been released, remove 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.

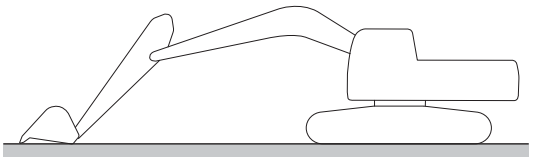
Hydraulic oil change interval is 2,000 hours only when DOOSAN Genuine Oil is used. If another brand of oil is used, a change interval of 1,000 hours is necessary.

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

1. Park machine on firm and level ground. Swing upper structure parallel to tracks. Lower boom and position bucket on ground as shown in Figure 114.
2. Move safety lever to "LOCK" position.
3. Stop engine.
4. Release pressurized air from hydraulic tank by tip breather cap up (1, Figure 117).

ARO1760L

Figure 113



EX1300542

Figure 114

5. Drain hydraulic oil from tank into a container capable of holding 200 liters (52.8 U.S. gal.). After draining tank, install drain plug.

WARNING

AVOID DEATH OR SERIOUS INJURY

Be careful of squirting oil when removing drain plug.

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

6. Carefully remove bolts and cover (2, Figure 117) from top of hydraulic oil tank. There is a spring (3, Figure 117) under the cover that will force the cover up.
7. Remove spring (3, Figure 117) and strainer (5, Figure 117), by pulling on rod (4, Figure 117).
8. Clean inside and outside of strainer. Replace strainer if it is broken.
9. Position strainer (5, Figure 117) on boss portion of suction pipe (6, Figure 117).

   NOTE: *Measurement "A" is 614 mm (24.17 in).*

10. Fill the hydraulic oil tank. Check level using sight gauge on side of tank.
11. Place spring (3, Figure 117) on rod (4, Figure 117) and assemble cover (2, Figure 117).
12. After replacing and cleaning the hydraulic oil, filter, and strainer, vent the system. See “Venting and Priming Hydraulic System” on page 4-102.

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 3-59.

13. Check level of hydraulic oil tank. (See page 4-25)

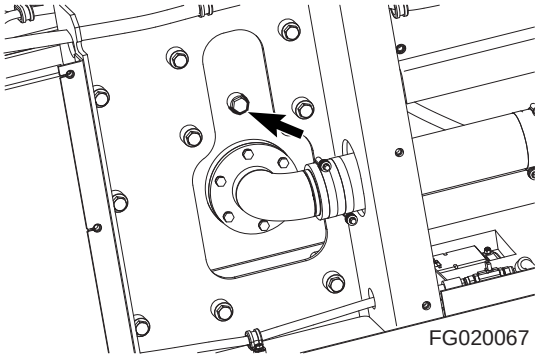


Figure 115

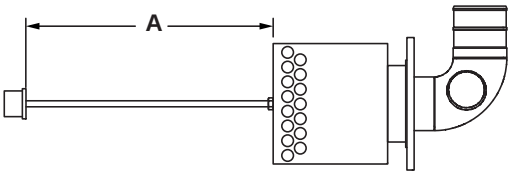


Figure 116

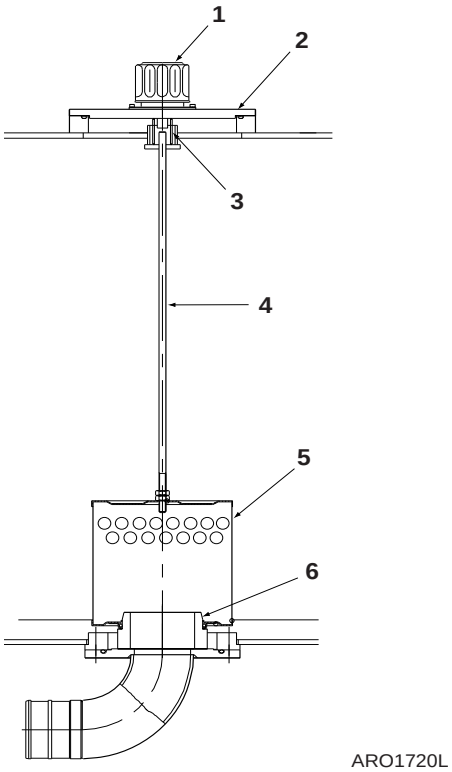


Figure 117

Check Alternator and Starter**

Check All Rubber Antivibration Shock Mounts

Perform and Record Results of Cycle Time Tests

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

Check, Adjust Valve Clearance**

Check Head Bolt Torques

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

4,000 HOUR / BIENNIAL SERVICE

Major Parts - Periodic Replacement

For proper operation and work, perform periodic inspections. These parts are those most often subjected to abrasion, heat and fatigue. Replace these parts with new ones at the designated time intervals, even if the old parts look satisfactory.

Replace all related parts such as gaskets and O-rings with original equipment manufacturer's parts.

Major Component		Parts Name to be Replaced Periodically	Time to Replace
Engine		Fuel hose (Tank to fuel prefilter)	
		Fuel hose (Fuel prefilter to fuel cooler)	
		Fuel hose (Fuel cooler to ECU)	
		Fuel hose (Tank to CP pump)	
		Heater hose (Heater to engine)	
		Heater hose (Heater to radiator)	
		Air Conditioner hose	
Hydraulic System	Body	Pump suction hose	2 years or 4,000 hours
		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	

4,500 HOUR / BIENNIAL SERVICE

Clean Diesel Particulate Filter (DPF)

IMPORTANT

Regular ash cleaning is necessary to prevent engine performance and fuel efficiency from deteriorating.

IMPORTANT

When DPF cleaning is needed, contact DOOSAN distributor for more information.

For details, See “DPF Cleaning (Removing Ash in DPF)” on page 3-30.

12,000 HOUR / 6 YEAR SERVICE

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

European regulations state that 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 4-73, 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 4-48.*

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. Replace if necessary.

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 Cores” on page 4-50.*

Check Magnetic Clutch

Check the magnetic clutch for dirt and interference.

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

Check Belt Tension

NOTE: *See “Check Engine Fan and Alternator Belts Tension” on page 4-42.*

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.

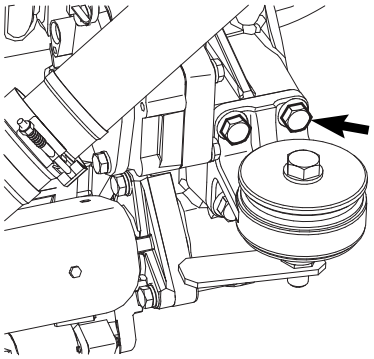
If counterweight is loose, contact a DOOSAN distributor for maintenance information.

No.	Point to be Inspected		Bolt Dia. mm	Qty.	Bolt Head Size	Torque		
						kg·m	Nm	ft lb
1	Joint bolt with engine mounting bracket and engine	pump side	16	8	24	24.5	240	177
		fan side	10	8	17	6.0	58.8	43.4
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	30	55	539	398
4	Mounting bolt for hydraulic oil tank		16	6	24	27	265	195
5	Mounting bolt for fuel tank		16	6	24	27	265	195
6	Mounting bolt for pump		20	4	17 (S)	44	431	318
7	Mounting bolt for control valve		16	4	24	27	265	195
8	Mounting bolt for swing reduction device		20	11	30	55	539	398
9	Mounting bolt for swing motor		12	16	10 (S)	11	108	80
10	Mounting bolt for battery		10	2	17	5	49	36
11	Joint bolt with cabin mounting rubber and frame		10	16	17	6.5	64	47
	Joint nut with cabin mounting rubber and cabin		16	4	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	Mounting bolt for travel device		16	60	24	28.5	279	206
	Mounting bolt for sprocket		16	60	24	30	294	217
14	Mounting bolt for upper track roller(s)		20	4	30	55	539	398
15	Mounting bolt for lower track roller(s)		16	64	24	27	265	195
16	Mounting bolt for track guard		16	16	24	27	265	195
17	Bolt for track shoes		20	384	27	78	765	564
18	Retainer 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
21	Mounting bolt for the ROPS		39 x 3 (Thin Screw)	1	60	13	127.5	94.2
			12	1	19	11.2	110	81
22	Mounting bolt for Diesel Particulate Filter (DPF)	Rubber MTG bolt	10	4	17	6.5	64	47
		Bracket - Support	12	8	19	11	108	80
23	Mounting bolt for air compressor		12	8	19	11	108	80

1. Joint bolt with engine mounting bracket and engine.

   1) Pump side

   - Tool: 24 mm ( )
   - Torque: 24.5 kg•m (240 Nm, 177 ft lb)

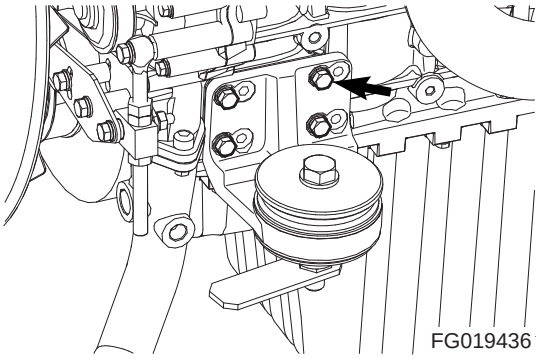


FG019435

Figure 118

   2) Fan side

   - Tool: 17 mm ( )
   - Torque: 6.0 kg•m (58.8 Nm, 43.4 ft lb)



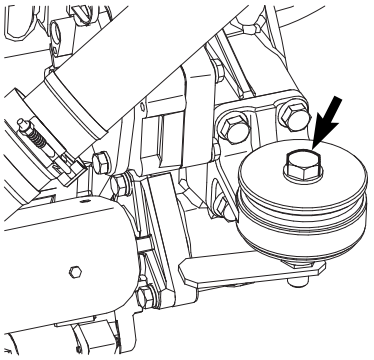
FG019436

Figure 119

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

   1) Pump side

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

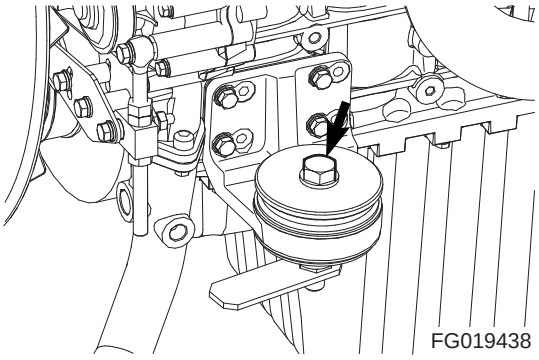


FG019437

Figure 120

   2) Fan side

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



FG019438

Figure 121

3. Radiator mounting bolt.
   - Tool: 30 mm ( )
   - Torque: 55 kg•m (539 Nm, 398 ft lb)

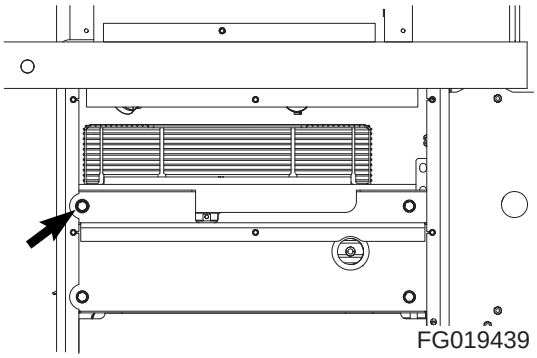


Figure 122

4. Mounting bolt for hydraulic oil tank.
   - Tool: 24 mm ( )
   - Torque: 27 kg•m (265 Nm, 195 ft lb)

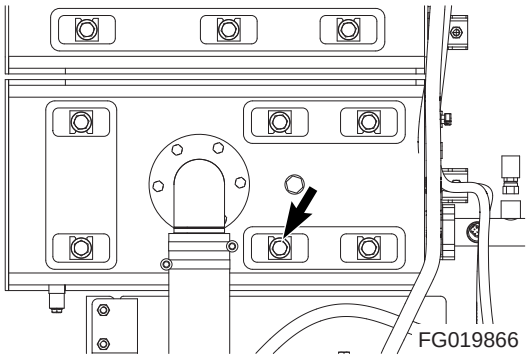


Figure 123

5. Mounting bolt for fuel tank.
   - Tool: 24 mm ( )
   - Torque: 27 kg•m (265 Nm, 195 ft lb)

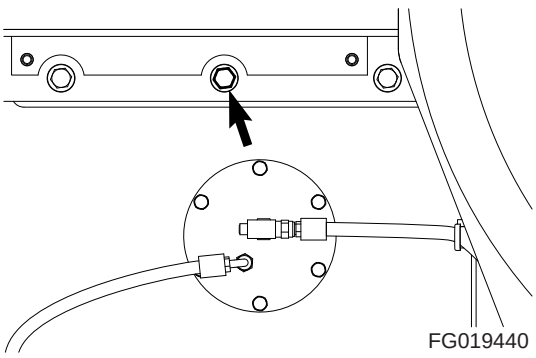


Figure 124

6. Mounting bolt for pump.
   - Tool: 17 mm ( )
   - Torque: 44 kg•m (431 Nm, 318 ft lb)

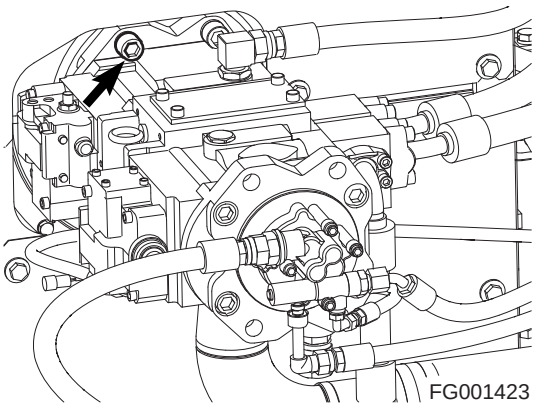


Figure 125

7. Mounting bolt for control valve.
   - Tool: 24 mm ( )
   - Torque: 27 kg•m (265 Nm, 195 ft lb)

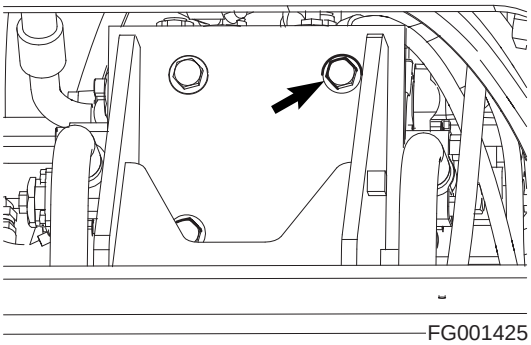


Figure 126

8. Mounting bolt for swing reduction device.
   - Tool: 30 mm ( )
   - Torque: 55 kg•m (539 Nm, 398 ft lb)

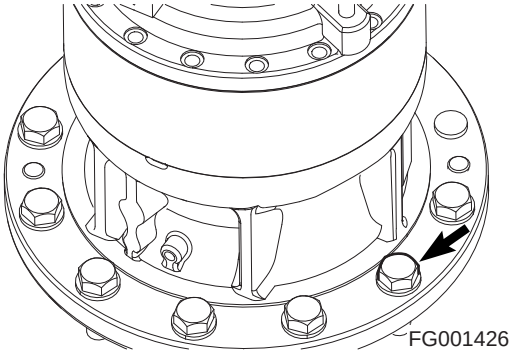


Figure 127

9. Mounting bolt for swing motor.
   - Tool: 10 mm ( )
   - Torque: 11 kg•m (108 Nm, 80 ft lb)

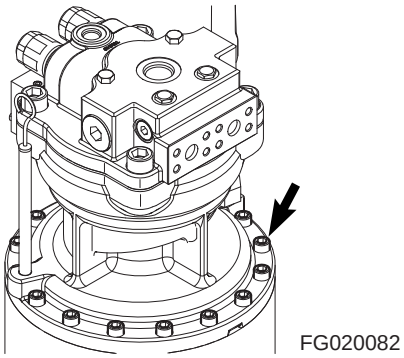


Figure 128

10. Mounting bolt for battery.
    - Tool: 17 mm ( )
    - Torque: 5 kg•m (49 Nm, 36 ft lb)

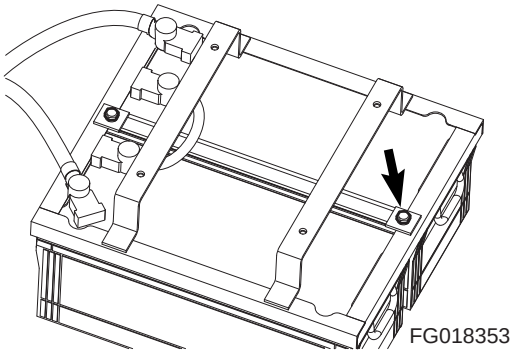


Figure 129

11. Joint bolt with cabin mounting rubber and frame.

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

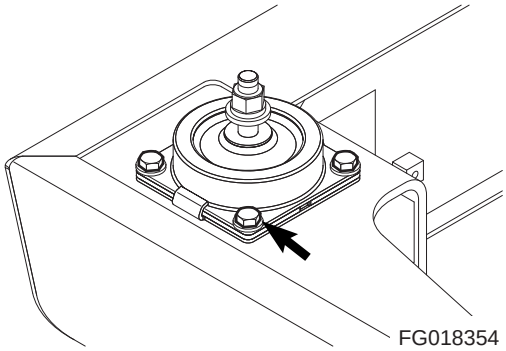


Figure 130

Joint nut with cabin mounting rubber and cabin.

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

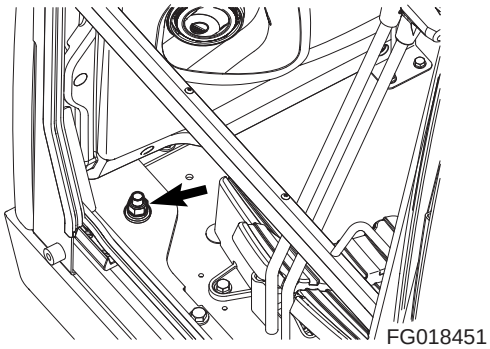


Figure 131

12. Joint bolt with swing bearing and upper frame.

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

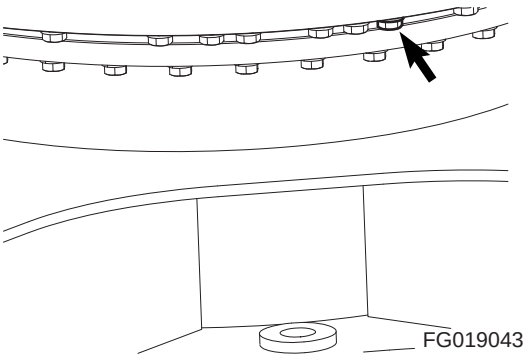


Figure 132

Joint bolt with swing bearing and bottom frame.

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

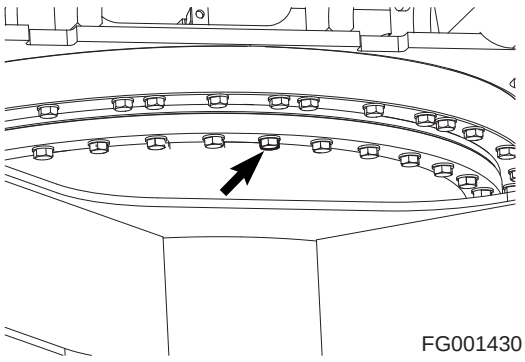


Figure 133

13. Mounting bolt for travel device.
    - Tool: 24 mm ( )
    - Torque: 28.5 kg•m (279 Nm, 206 ft lb)

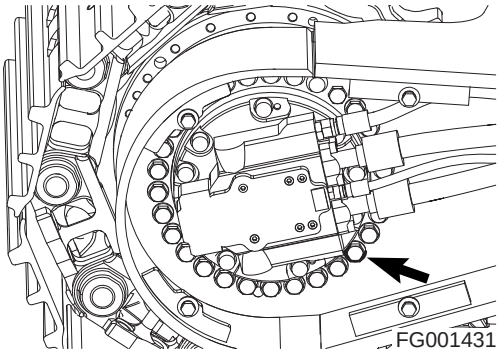


Figure 134

Mounting bolt for sprocket.
- Tool: 24 mm ( )
- Torque: 30 kg•m (294 Nm, 217 ft lb)

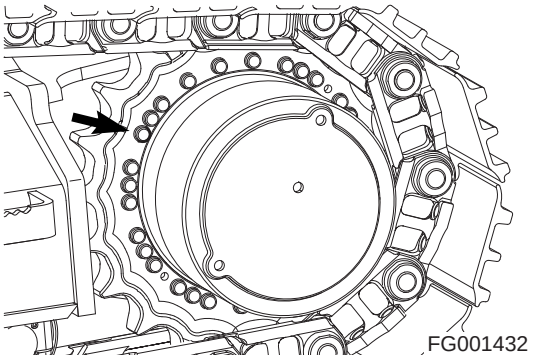


Figure 135

14. Mounting bolt for upper track roller(s).
    - Tool: 30 mm ( )
    - Torque: 55 kg•m (539 Nm, 398 ft lb)

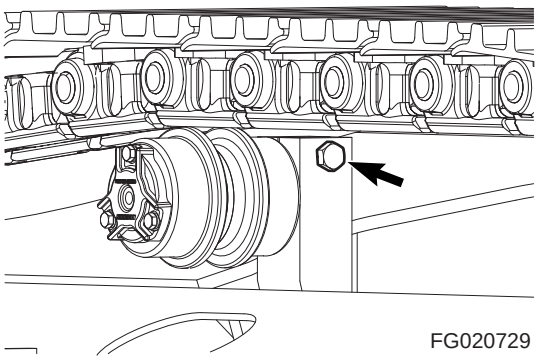


Figure 136

15. Mounting bolt for lower track roller(s).
    - Tool: 24 mm ( )
    - Torque: 27 kg•m (265 Nm, 195 ft lb)

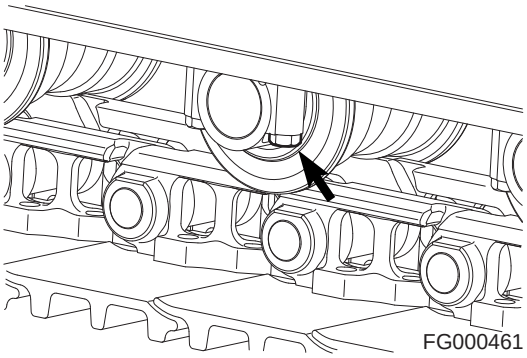
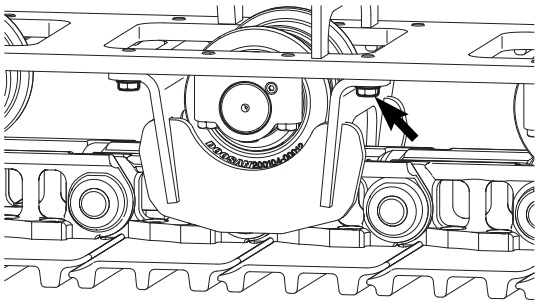


Figure 137

16. Mounting bolt for track guard.

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



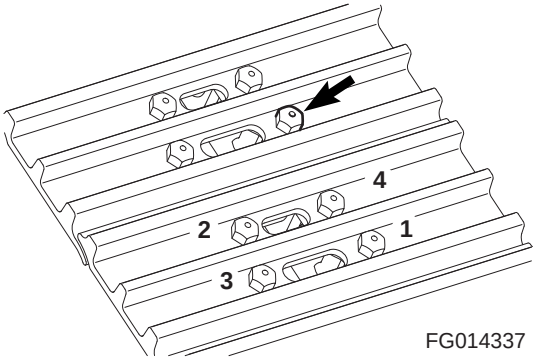
FG019869

Figure 138

17. Bolt for track shoes.

    Tighten the bolts in the order as shown in the Figure 139 (1 → 4)

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

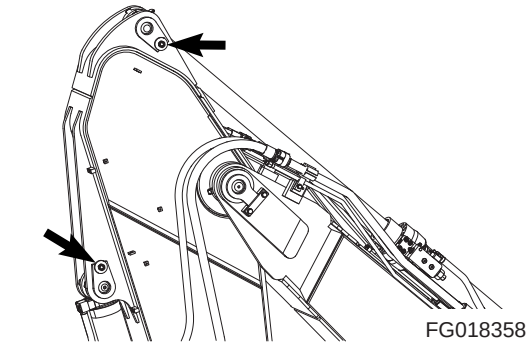


FG014337

Figure 139

18. Retainer bolt for front pin.

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

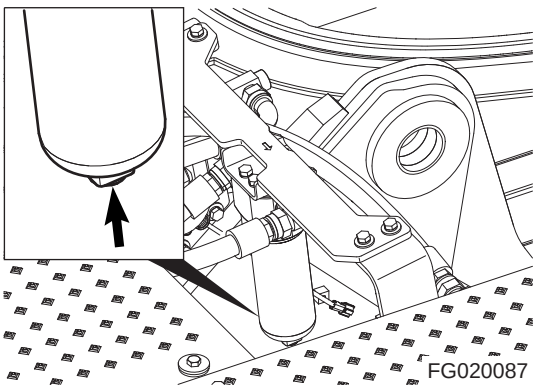


FG018358

Figure 140

19. Breaker filter (Optional)

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



FG020087

Figure 141

20. Grease valve for track adjuster.

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

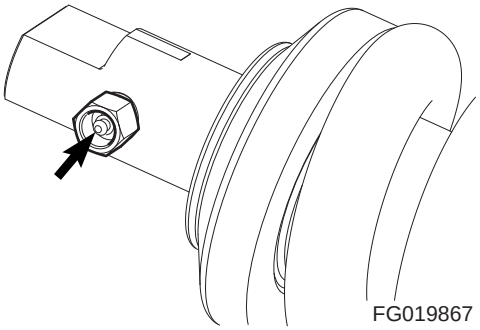


Figure 142

21. Mounting bolt for the ROPS.

    - Tool: 60 mm ( )
    - Torque: 13 kg•m (127.5 Nm, 94.2 ft lb)

    - Tool: 19 mm ( )
    - Torque: 11.2 kg•m (110 Nm, 81 ft lb)

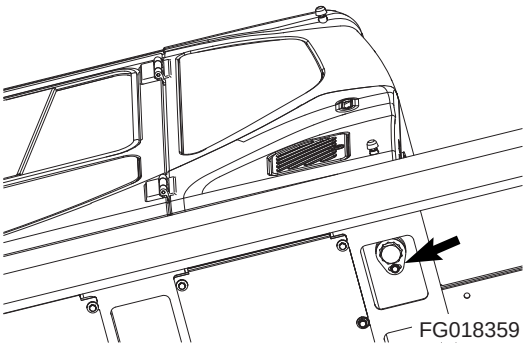


Figure 143

22. Mounting bolt for Diesel Particulate Filter (DPF).
    1) Rubber mounting bolt

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

    2) Bracket - Support

    - Tool: 19 mm ( )
    - Torque: 11 kg•m (108 Nm, 80 ft lb)

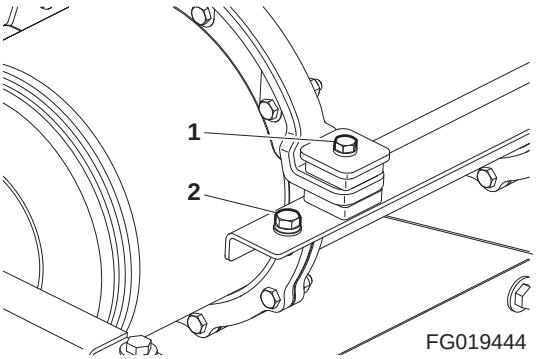
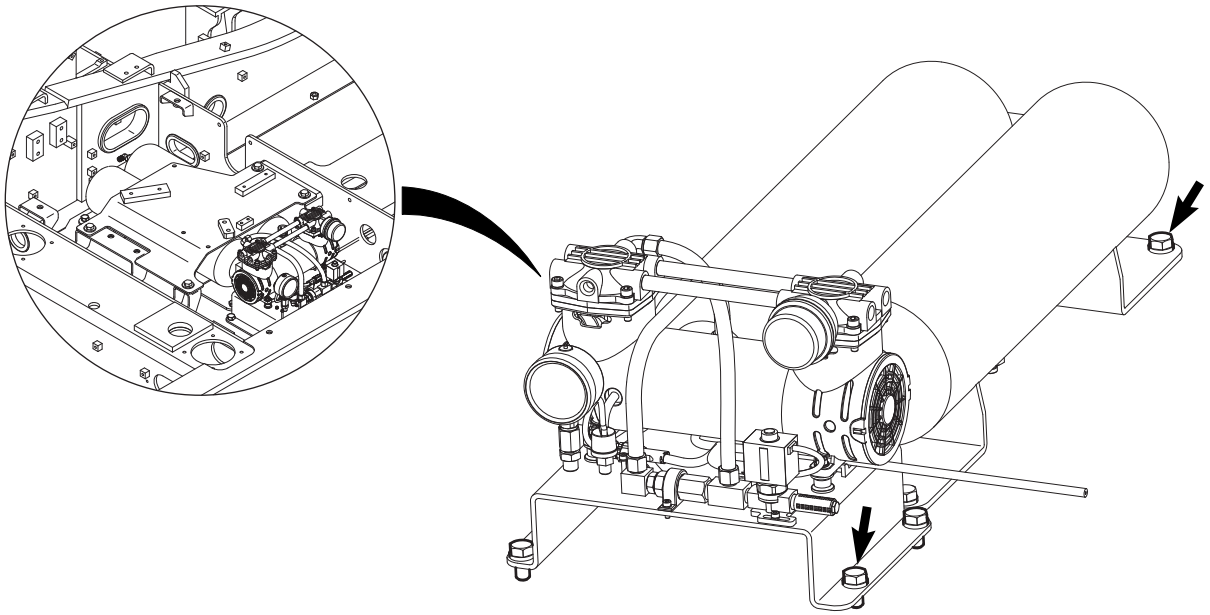


Figure 144

23. Mounting bolt for air compressor.
    - Tool: 19 mm ( )
    - Torque: 11 kg•m (108 Nm, 80 ft lb)



FG020056

Figure 145

BUCKET

Bucket Tooth Replacement

WARNING

AVOID DEATH OR SERIOUS INJURY

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

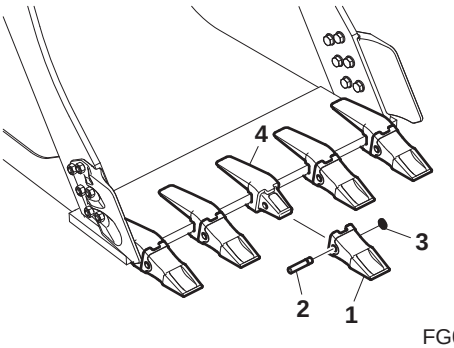
Curl the bucket upwards and place the round rear surface of the bucket firmly on the ground. Stop engine and lock out the hydraulic controls before working on the bucket.

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

HAOC680L

Figure 146

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 146.
2. To replace a tooth (1, Figure 147), 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 use a hammer, to drive pin in until lock washer seats in locking groove.



FG018361

Figure 147

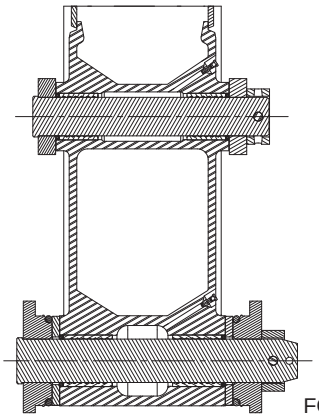
Bucket O-ring Replacement

WARNING

AVOID DEATH OR SERIOUS INJURY

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

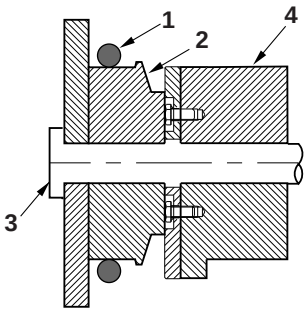
1. Inspect bucket O-rings on a routine basis. If worn or damaged, replacement is necessary.



FG019862

Figure 148

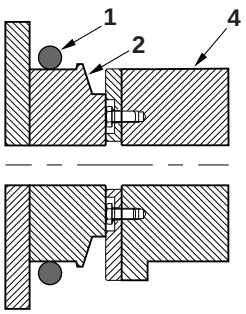
2. Roll old O-ring (1, Figure 149) onto boss (2, Figure 149) around bucket pin (3, Figure 149). Remove bucket pin and move arm or bucket link (4, Figure 149) out of way.



FG019071

Figure 149

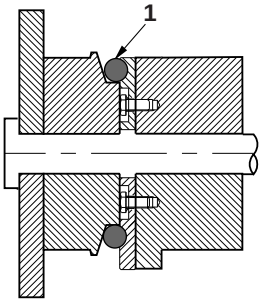
3. Remove old O-ring and temporarily install new O-ring (1, Figure 150) onto bucket boss (2, Figure 150). Make sure that O-ring groove on both bucket link (4, Figure 150) and boss have been cleaned.
4. Realign arm or link with bucket pinhole and insert bucket pin (3, Figure 149).



FG019074

Figure 150

5. Roll new O-ring (1, Figure 151) into O-ring groove.



FG019075

Figure 151

ELECTRICAL SYSTEM

NOTE: *Never disassemble electrical or electronic parts. Consult a DOOSAN distributor before servicing.*

Battery

WARNING

AVOID DEATH OR SERIOUS INJURY

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 seek professional medical attention immediately.

If you accidentally ingest acid, call a doctor or poison prevention center immediately.

When working with batteries, always wear safety goggles.

Battery generates hydrogen gas, so there is a danger of an explosion. Do not smoke near batteries, or do anything that will cause sparks.

Before working with batteries, stop engine and turn the starter switch to "O" (OFF) position.

Avoid short-circuiting the battery terminals through accidental contact with metallic objects, such as tools.

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 a danger that defective contact may generate sparks that will cause an explosion. When installing the terminals, install them tightly.

Batteries in Cold Weather

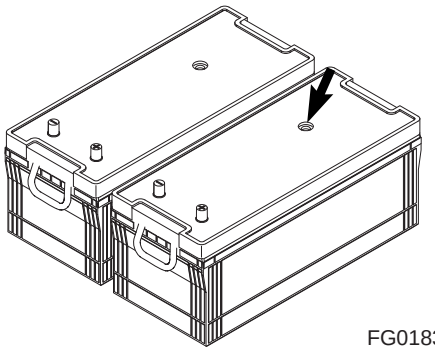
In colder weather, a greater drain is placed on the batteries when they are used for the preheat cycle and when starting a cold engine. Battery performance decreases as the temperature gets lower.

In extremely cold weather, remove batteries at night and move them to a warm location. This will help to keep them at a higher energy 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 transparent, this indicates a low electrolyte state because of a leakage or charging system error. Determine the cause of problem and replace the batteries immediately.



FG018362

Figure 152

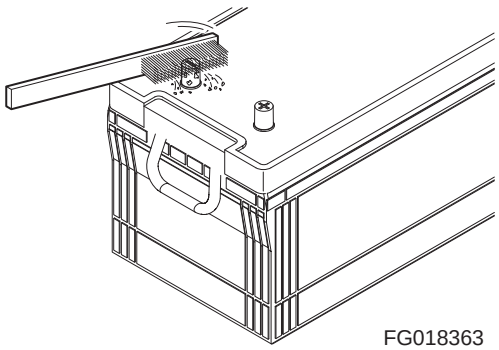
Check Charging State

Check charging state through the charging indicator.

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

Check 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.



FG018363

Figure 153

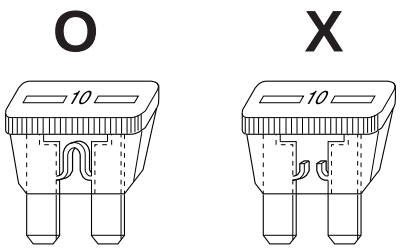
Battery Replacement

When the charging indicator indicates a 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 154. The fuses used are standard automotive type fuses.
2. The section on “Fuse Identification” on page 4-91 lists the circuits and the fuse amperage required for each circuit. If a fuse blows, determine the cause and repair any electrical 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 154

IMPORTANT

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

Fuse Boxes

There are two fuse boxes (Figure 155) 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.

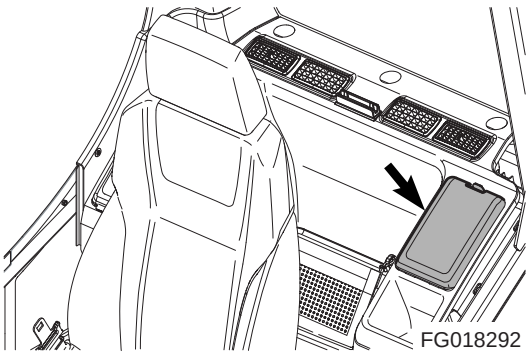


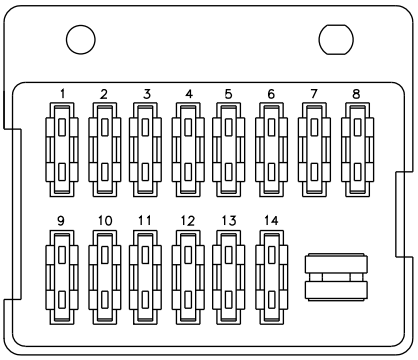
Figure 155

WARNING

AVOID DEATH OR SERIOUS INJURY

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

Fuse Box (1)



Fuse Box (2)

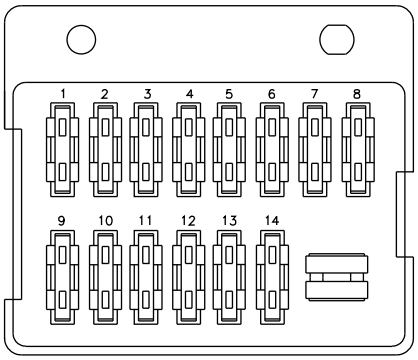


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Figure 156

No.	Fuse Box One	
	Name	**Capacity**
1	Cigarette Lighter	10A
2	Rotating Beacon (Optional)	10A
3	Hands-free (Optional), Lower Wiper (Optional)	10A
4	Wiper Controller, Window Washer	10A
5	12V Power	10A
6	12V Power (Optional)	10A
7	Stereo, Engine Coolant Heater (Optional)	10A
8	Starter Switch, Hour Meter	10A
9	Air Conditioner, Heater	30A
10	Micro Phone (Optional)	20A
11	ECU	20A
12	Seat Warmer, Air suspension	15A
13	EPOS, Travel Speed changer	15A
14	ECU	15A

No.	Fuse Box Two	
	Name	**Capacity**
1	Alarm Buzzer (Optional)	10A
2	Horn	10A
3	Quick Coupler (Optional)	10A
4	Breaker, One Touch Deceleration	10A
5	Pilot Cutoff	10A
6	Auxiliary Mode, Engine Coolant Heater Timer (Optional)	10A
7	Memory Back up	10A
8	Room Light, Satellite Antenna (Optional)	10A
9	Cabin Light (Optional)	30A
10	Working Light	30A
11	Fuel Heater (Optional)	20A
12	Air Compressor (Optional)	20A
13	Pilot Buzzer	15A
14	Wiper motor, Fuel Pump (Optional)	15A

ENGINE COOLING SYSTEM

General

Keeping an engine's cooling system in peak operating condition can have many benefits in keeping a machine in good operating condition. A properly functioning cooling system will improve fuel efficiency, reduce engine wear, and extend component life.

Always use distilled water in the radiator. Contaminants in tap water neutralize the corrosion inhibitor components. If tap water must be used, Refer to “Table of Standards for Allowed Tap Water” on page 4-94. 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 contain dirt, minerals and/or organic material that are deposited in the cooling system and impair cooling efficiency. As such, the use of distilled water is recommended.

Engine coolant shall be mixed with antifreeze solution and water in ratio of 50 : 50.

Coolant shall be checked every 500 hours of operation for ensuring adequate concentration of antifreeze solution and additives.

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 bonding joint between the fins and the tubes.

WARNING

AVOID DEATH OR SERIOUS INJURY

Pressure at air nozzle must not exceed 2 kg/cm^2 (28 psi). Always wear goggles when using compressed air.

Do not pour cold water into radiator when engine is 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 1 year or 2,000 hours of operation, whichever comes first. This will eliminate buildup of harmful chemicals.

Antifreeze is essential in any climate. It broadens the operating temperature range by lowering the coolant's freezing point and by raising its boiling point. Do not use more than 50% antifreeze in the mixture unless additional antifreeze protection is required. Never use more than 60% antifreeze under any condition.

Types of Antifreeze

Ethylene Glycol - DOOSAN Genuine Antifreeze Solution
(for all seasons)

Ethylene glycol is a very hazardous material to human beings, animals and environment. Drain of coolant must be disposed of by an authorized waste material treatment service provider.

The color does not provide a standard. Unauthorized coolant may have the same color. Please check the label on the container. Use genuine product.

IMPORTANT

Do not mix solutions from different manufacturers. Otherwise, the performance may be deteriorated. It is recommended to use the standard product from DOOSAN.

In extreme temperatures, the performance of the coolant must be checked frequently and the coolant change cycle adjusted as necessary.

Engine parts that are made of aluminum are quickly worn out by nitrite, and therefore you should make sure to use nitrite-free coolant.

Antifreeze Concentration Tables

Ethylene Glycol - DOOSAN Genuine Antifreeze Solution (for all seasons) (2,000 Hour/1 Year)		
Ambient Temperature	**Cooling Water**	**Antifreeze**
-20°C (-4°F)	67%	33%
-25°C (-13°F)	60%	40%
-30°C (-22°F)	56%	44%
-40°C (-40°F)	50%	50%

NOTE: *The concentration shall be kept at 50% and in worst case at 30% minimum for the least corrosion resistance.*

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

Table of Standards for Allowed Tap Water

Requirement					
Item	**Inorganic chloride**	**Sulfates**	**Total Hardness**	**Total Solids**	**Acidity**
Value	< 40 ppm	< 50 ppm	< 9.5° d.H	< 340 ppm	5.5 - 9.0

PPM (Parts Per Million) - Unit of concentration of minor materials.

- 1 ppm = 1 mg/1 kg, 1 mL/1 L

° d.H - Unit of concentration of minor materials.

- 1° d.H = 17 ppm

CAUTION

AVOID INJURY

The standard of tap water is for referece only, and may not be regarded as a standard.

If quality of the water is not trustable, stop using tap water whenever possible and use distilled water.

Electric Viscous Fan Clutch

The electrically controlled viscous fan clutch provides optimum cooling fan speeds. This also results in lower fan noise and better fuel efficiency. Coolant, hydraulic oil, and cooled charged air temperatures, together with engine speeds, are monitored for optimum fan speeds.

When the electrical wire is broken, the fan speed works at its maximum speed to protect entire cooling system from overheating in any operating condition. The maximum and minimum fan speeds are shown below:

	Minimum Speed	Maximum Speed
Fan Speed (rpm)	600 ±50	1,800 ±50

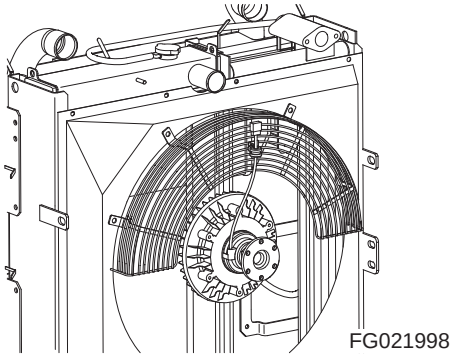

Figure 157

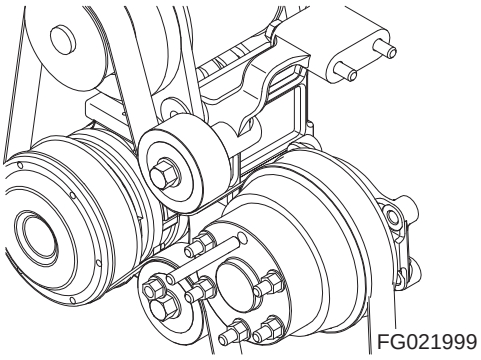

Figure 158

Removal and Installation of the Cooling Fan Assembly

The the following instruction must be followed when handling the cooling fan assembly.

1. The weight of the cooling fan assembly is approximately 9 kg (20 lb), which is heavier than a cooling fan assembly without electric fan clutch. Remove and handle assembly carefully not to damage cooling fan and radiator.
2. If not correctly secured with a tie strap, the electrical harness can be damaged by the cooling fan during operation. Properly secure the electrical harness to fan guard when assembling.
3. The cooling fan assembly must be assembled with 12 bolts using torque values shown below.
   A. Before installation, cooling fan subassembly needs to be assembled by using 6 x M8 bolts.
   (Tightening torque 22 N.m (2.2 kg.m, 16 ft lb))
   B. Use 6 x M10 bolts (tightening torque 43 N.m (4.4 kg.m, 32 ft lb)) when installing the cooling fan assembly to the engine.

Reference Number	Description	Torque
1	Cooling Fan (to Clutch) M8 Bolt	22 N.m (2.2 kg.m, 16 ft lb)
2	Clutch (to Engine Pulley) M10 Bolt	43 N.m (4.4 kg.m, 32 ft lb)

NOTE: *If electrical wire is not properly connected, the cooling fan will run at maximum fan speed. Check fan speed after assembly.*

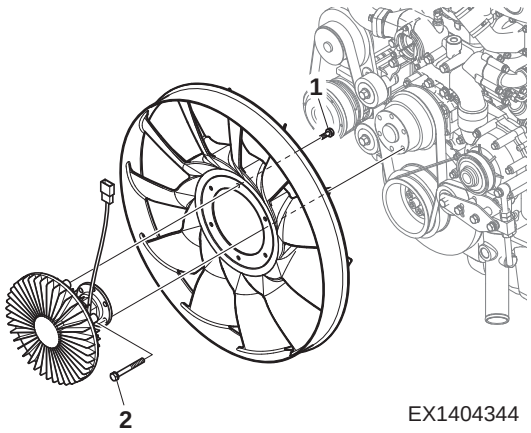

Figure 159

FUEL TRANSFER PUMP (OPTIONAL)

IMPORTANT

Dry operating fuel pump for more than fifteen seconds can cause wear and/or damage to pump.

- **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.**

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 motor damage.**

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

- **Do not use fueling pump for other types of fuel which have a low flash point.**
- **Do not use fueling 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, they 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.

Any pump parts or components that become lost, damaged or inoperable must be immediately replaced.

WARNING

AVOID DEATH OR SERIOUS INJURY

If there is any sign of leakage while operating transfer pump, inspect the following components to prevent fire or hazardous fuel spill:

- **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.

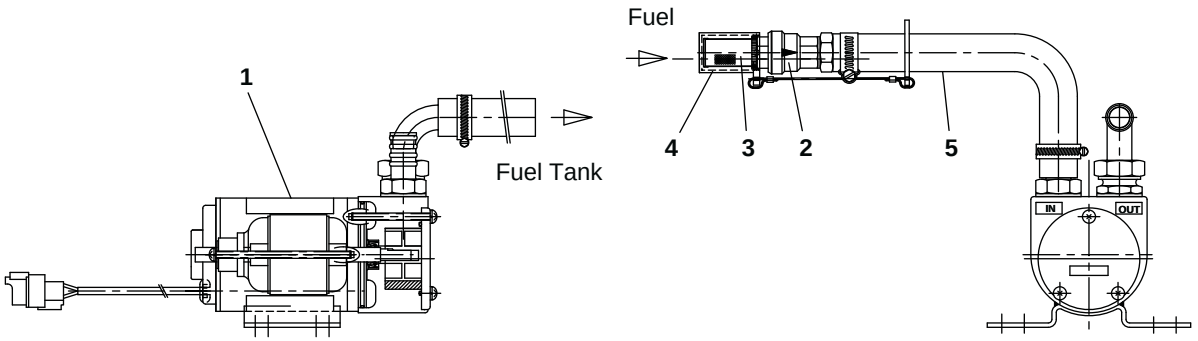

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Figure 160

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 160) from strainer (3, Figure 160) on end of inlet hose (5, Figure 160).

   NOTE: *Keep strainer cap (4, Figure 160) in a safe location to reseal strainer (3, Figure 160) after refueling is complete.*

2. Insert inlet hose (5, Figure 160) into refueling tank.
3. Push fuel pump "START" switch (Figure 161) inside of battery box on front side.
4. Once fuel transfer is completed, the pump will automatically turn "OFF".
5. Lift inlet hose (5, Figure 160) from fueling source and push "START" switch and push "STOP" switch after two - three seconds to drain remaining fuel from hose to fuel tank.
6. Install strainer cap (4, Figure 160) on inlet strainer (3, Figure 160) and return hose (5, Figure 160) to storage position.

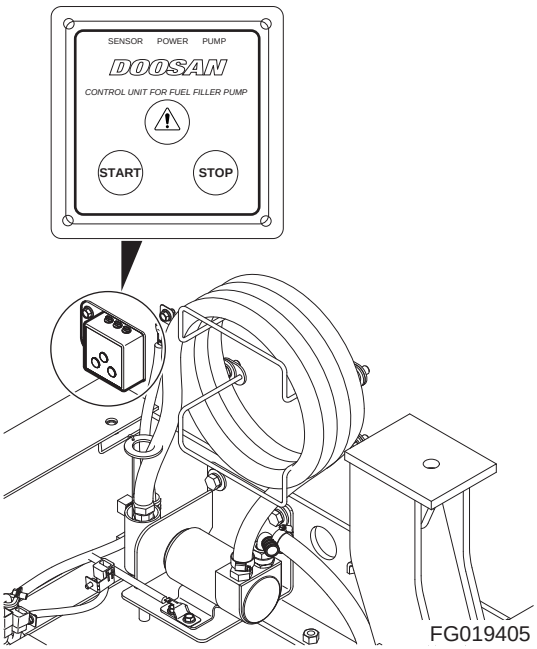


Figure 161

HANDLING OF ACCUMULATOR

WARNING

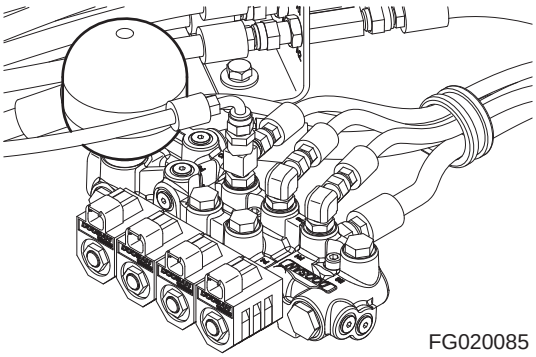
AVOID DEATH OR SERIOUS INJURY

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 "I" (ON) position and operate all hydraulic control levers and forward/reverse travel levers. Even though the engine is stopped, hydraulic actuated components may move while releasing pilot pressure. Keep all personnel and bystanders away from excavator while performing this operation.

- **Move safety lever to "LOCK" position after stopping engine.**
- **DO NOT mishandle accumulator(s), because they contain high-pressure nitrogen gas.**
- **DO NOT puncture 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 death or serious injury.**

Release pilot accumulator pressure using the following procedure:

1. Park machine on firm and level ground. Lower the front attachment to the ground and stop engine.
2. Move safety lever to "UNLOCK" position.
3. Turn starter switch to "I" (ON) position.
4. Fully stroke work and travel levers in all directions.
5. Move safety lever to "LOCK" position.
6. Turn key to "O" (OFF) position and remove from starter switch.
7. Remove accumulator by unscrewing it slowly.



FG020085

Figure 162

TRACK TENSION

WARNING

AVOID DEATH OR SERIOUS INJURY

Measurement of track tension requires two people. Always follow these instructions:

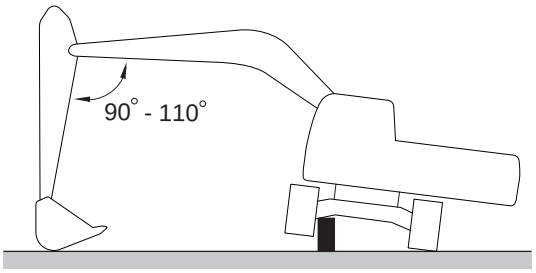
- **One person must be in the operator's seat running the controls to keep one side frame in the air, while the other person makes dimensional checks.**
- **Take all necessary precautions to make sure the machine does not move or shift position during service.**
- **Warm up the engine to prevent stalls.**
- **Position excavator in 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 (1) complete turn from the fully tightened 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 163. Place blocking under frame while taking measurement.

   Turn the track backward 1 - 2 turns.



EX1300534

Figure 163

2. Measuring the distance (A, Figure 164) 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 290 - 310 mm (11.42 - 12.20 in).

   NOTE: *This measurement can be inaccurate if there is too much mud or dirt or other material in the track assembly. Clean off the tracks before checking clearance.*

3. The increased clearance recommended for muddy, sandy or snowy ground conditions is between 310 - 340 mm (12.20 - 13.39 in).

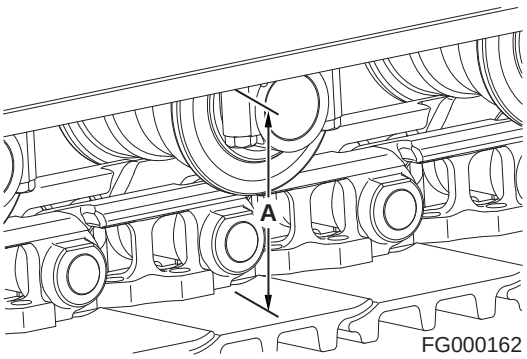


Figure 164

WARNING

AVOID DEATH OR SERIOUS INJURY

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 (1) complete turn from the fully tightened down position. Bleed off pressure slowly and keep your body away from the valve at all times. If there is problem in the valve thread, the valve might be ejected at high-speed and cause death or serious injury.

4. Track tension adjustments are made through the grease fitting (1, Figure 165) in the middle of each side frame. Adding grease increases the length of an adjustment cylinder (2, Figure 165). The longer the adjustment cylinder, the greater the pressure on the tension spring pushing the track idler wheel outward.

5. 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 165) by loosening valve slowly (3, Figure 165). When grease starts to leak out, stop loosening it.

   NOTE: *After track tension is adjusted by loosening valve, be sure to tighten valve (3, Figure 165) to 14 kg•m (137 Nm, 101 ft lb).*

   If tightened to a lower torque than standard value, grease may leak.

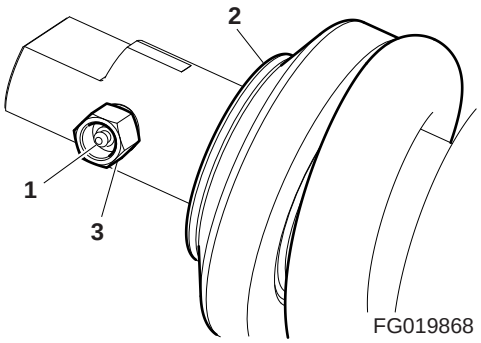


Figure 165

WARNING

AVOID DEATH OR SERIOUS INJURY

Do not loosen or remove grease fitting (1, Figure 165) until pressure is entirely bled off by loosening valve (3, Figure 165) 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. With the engine stopped, remove vent plug (Figure 166) to see if any oil is present.
2. If oil is not present, fill pump with oil through port (Figure 166).
3. Install vent plug (Figure 166) first.
4. Start engine and run it for several minutes at "LOW IDLE". This will pressurize the hydraulic oil tank and system.
5. Slowly loosen vent plug (Figure 166) several turns, until hydraulic oil flows out of plug. This shows that air has been released.
6. Tighten the plug (Figure 166).

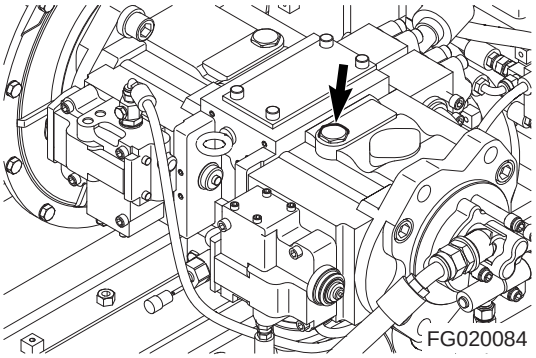


Figure 166

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 can 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. Stop 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.

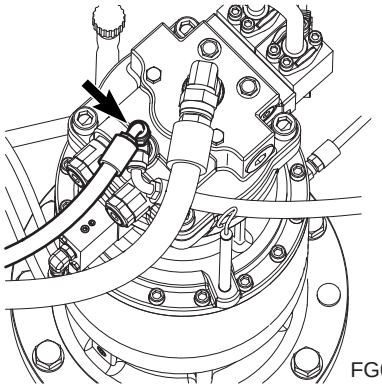


Figure 167

Travel Motor

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

1. Stop engine.
2. Disconnect drain hose (Figure 168) 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.

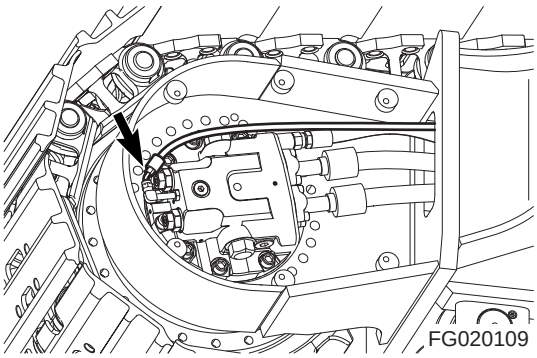


Figure 168

General Venting

1. After venting air from all components, stop engine and check the hydraulic oil level. Fill hydraulic oil tank to "H" mark on sight gauge.
2. Start engine and operate all controls again, and run engine for five minutes to ensure all systems have been vented and purged of air. Move 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.

MAINTENANCE IN SPECIAL CONDITIONS

NOTE: *See "Operation Under Abnormal Conditions" on page 3-69 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 and check that all control systems operate properly.
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 extreme cold weather, remove 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

Check federal, state and local laws and regulations regarding weight, width, and length of a load before making preparations for transporting on public roads or highways.

The hauling vehicle, trailer, and load must comply with all applicable laws and regulations.

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

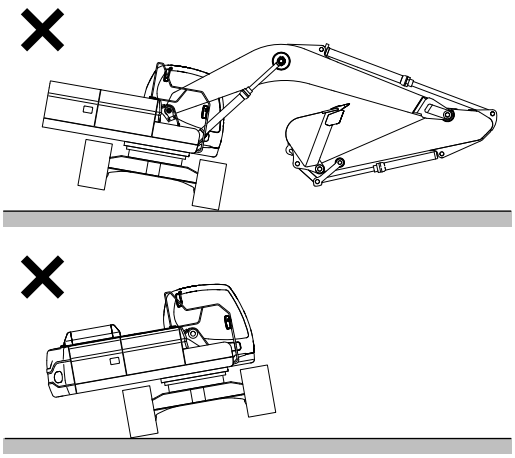
WARNING

AVOID DEATH OR SERIOUS INJURY

DO NOT remove machine counterweight, front attachment or any other part. This could cause tipping or rollover resulting in death or serious injury.

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.



FG018594

Figure 1

Counterweight

WARNING

AVOID DEATH OR SERIOUS INJURY

Death or serious injury can occur from a counterweight falling during removal or installation. Do not allow personnel under or around the counterweight during removal or installation.

Use certified cables and shackles of adequate load rating. Improper lifting can allow the load to shift and cause death or serious injury.

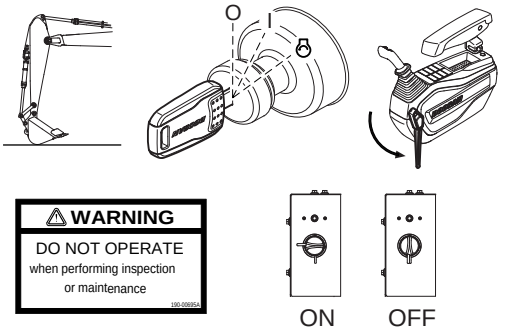


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Figure 2

Removal

1. Park on firm and level ground.
2. Lower front attachment (bucket) to ground.
3. Stop engine.
4. Move safety lever to "UNLOCK" position.
5. Turn starter switch to "I" (ON) position.

WARNING

AVOID DEATH OR SERIOUS INJURY

If engine must be running 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. Fully stroke work levers (joysticks) in all directions to relieve any pressure from accumulators.
7. Move safety lever to "LOCK" position.
8. Turn key to "O" (OFF) position and remove from starter switch.
9. Attach maintenance warning tag on controls.
10. Turn battery disconnect switch to "OFF" position.
11. Make sure all electrical lines and other items are disconnected.
12. Using a suitable lifting device capable of handling a heavy load, partially support counterweight (1, Figure 3) before loosening four bolts (2, Figure 3). Stop lifting with assist crane as soon as lifting slings are taut.
13. Remove four bolts (2, Figure 3) and washers (3) from counterweight (1, Figure 3).

    NOTE: *Heat bolts, if necessary, to free them.*

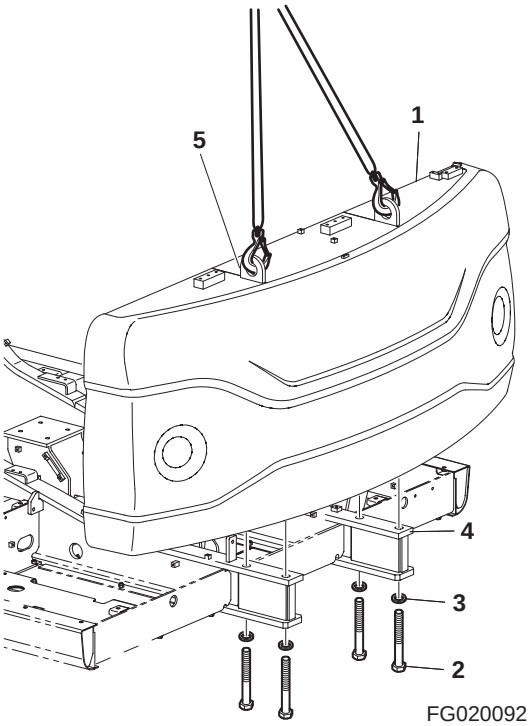

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Figure 3

14. When bolts (2, Figure 3) and washers (3) have been removed, lift counterweight (1) a very short distance above support frame (4) and stop. Check slings and make sure counterweight is being supported evenly.

Installation

1. Using suitable lifting device capable of handling the weight of the counterweight. Raise counterweight (1, Figure 4) into position just above support frame (4) leaving counterweight suspended. Verify that counterweight is level and even.

   NOTE: *Leave counterweight (1, Figure 4) suspended 3 mm (0.125") above support frame (4) until all four mounting bolts (2) are started in counterweight mounting holes.*

2. Slide washers (3, Figure 4) onto bolts (2). Apply Loctite #242 to mounting bolt threads.

3. Install four bolts (2, Figure 4) with washers (3) into counterweight until washers contact support frame. Fully lower counterweight onto support frame and finish tightening bolts.

   NOTE: *Torque bolts (2,* Figure 4*) to values shown in the following table.*

Model	Bolt Torque
DX225LC-3	150 kg•m (1,085 ft lb)

4. Remove lifting device and lifting eyes from counterweight lifting holes. (5, Figure 4)

5. Make sure all electrical lines and other items are connected.

6. Turn battery disconnect switch to "ON" position.

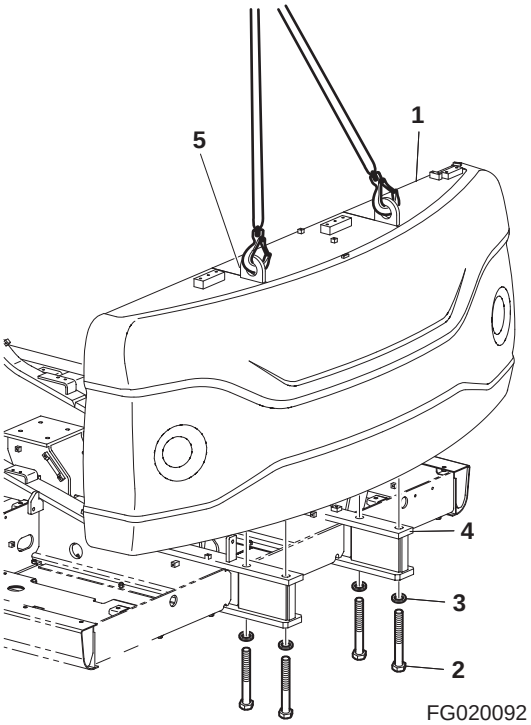

Figure 4

WARNING

AVOID DEATH OR SERIOUS INJURY

When transporting the machine, know the width, height, length, and weight.

When loading or unloading the machine, 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, debris, or mud that could cause the machine to slip or slide.

Make sure that trailer is parked on firm and level ground before attempting to load/unload the excavator.

If it is necessary 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 and regulations.

1. Make sure that trailer is parked on firm and level ground. See Figure 5.
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 must be less than a 15° angle. Ramps steeper than this can cause traction or stability problems when loading or unloading.

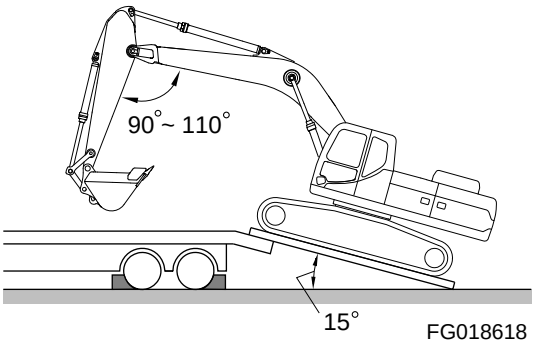

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Figure 5

4. Set the travel speed selector switch to "O" (OFF) position. See Figure 6.

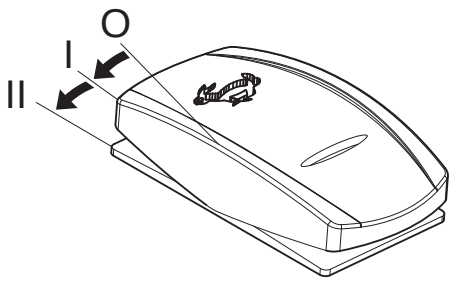

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Figure 6

5. Turn "OFF" auto idle selector button (1, Figure 7). The indicator symbol will disappear.

6. Move engine speed to "LOW IDLE".

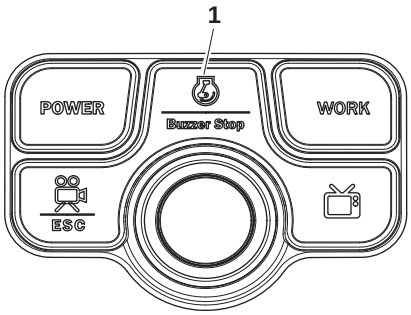

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Figure 7

7. If the machine is equipped with work equipment, position the work equipment toward the front of the excavator, and travel forward to load it.

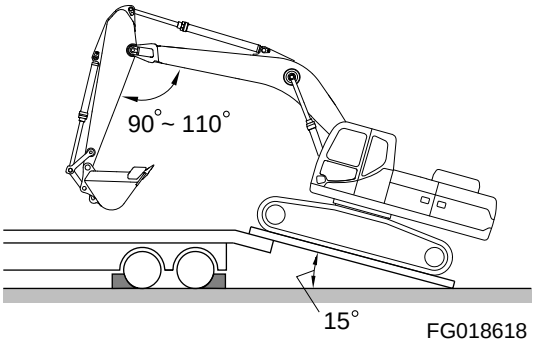

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Figure 8

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 (heavy end) of the excavator is positioned on the ramp first. See Figure 9.

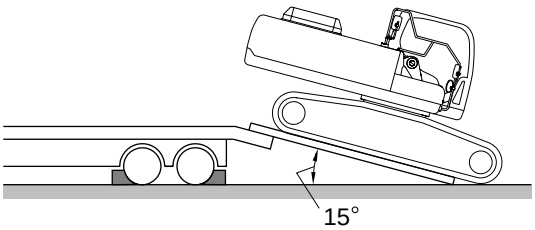

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Figure 9

9. Extend bucket and arm cylinders to maximum length and then lower the boom slowly.

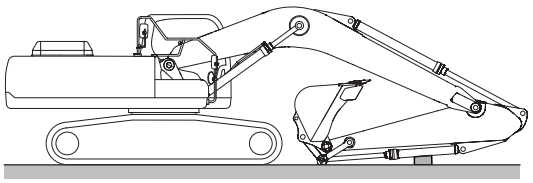

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Figure 10

10. Move safety lever to "LOCK" position.

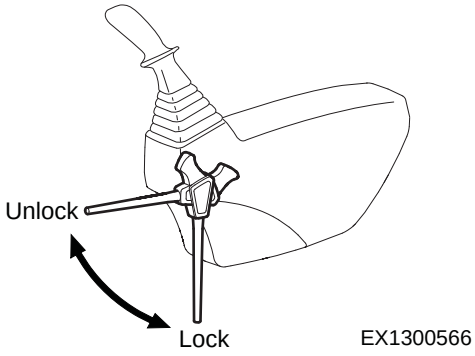


Figure 11

11. Stop engine by turning key to "O" (OFF) position (Figure 12).
12. Remove key from starter switch.

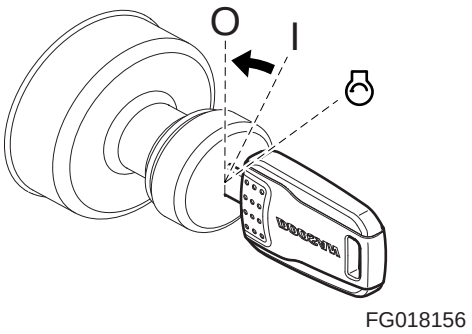


Figure 12

13. Turn battery disconnect switch to "OFF" direction (Figure 13).
14. Lock all doors and covers.
15. Adjust direction of rotating beacon and TMS antenna.

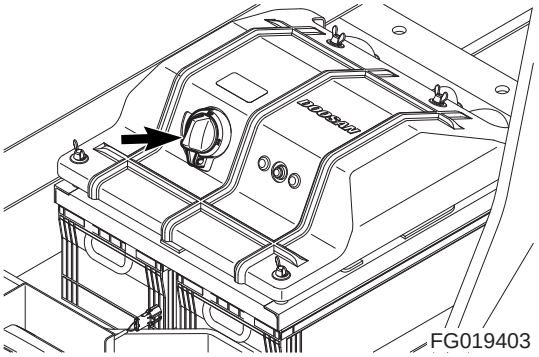


Figure 13

16. Make sure to secure the excavator onto the trailer before transporting. Place blocking (1, Figure 14) in front of and behind each track. Tie front and rear (2, Figure 15) and tie down point (3, Figure 15) on the lower frame with wire cable as required by local transportation regulations.
17. Refer to "Specification" section of this manual for overall machine height and width dimensions. Make sure to position the excavator as shown. If not transported in this position, the height measurements may be different.

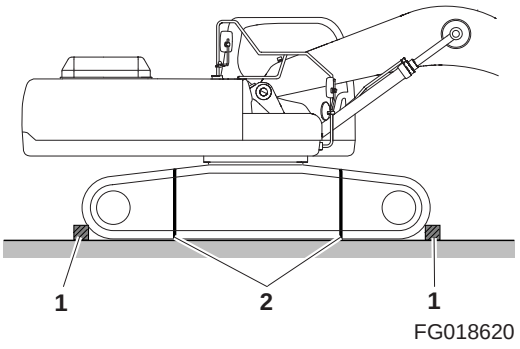


Figure 14

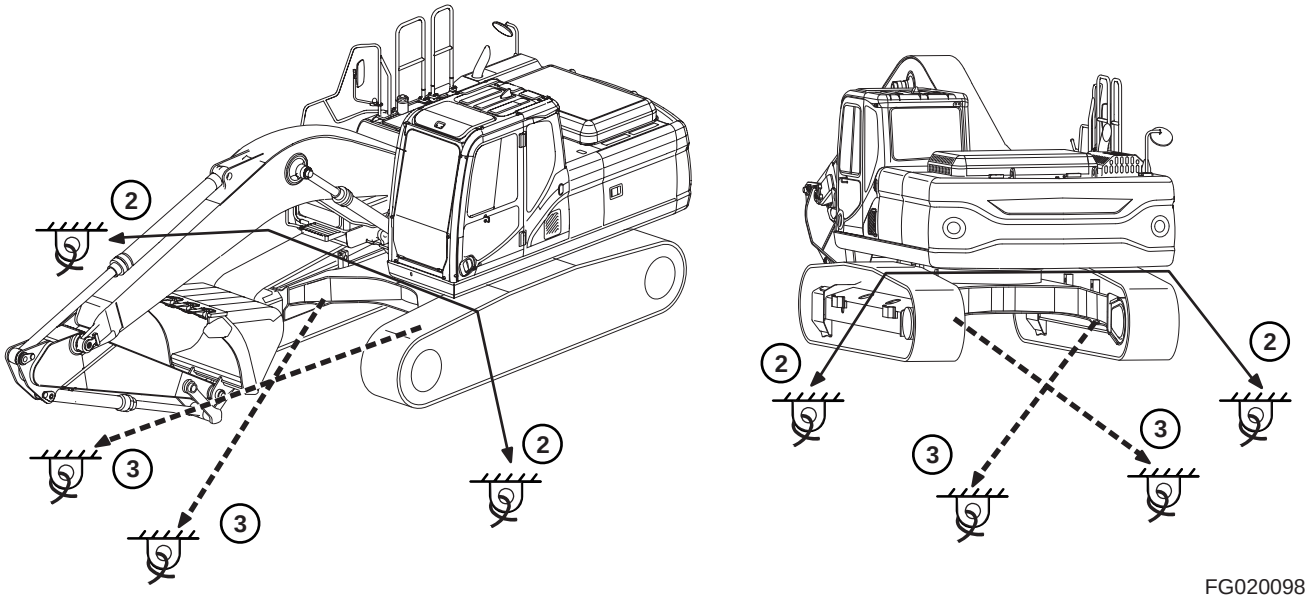


Figure 15

LIFTING MACHINE

WARNING

AVOID DEATH OR SERIOUS INJURY

Never lift the machine with a person in the cabin or on the machine.

Never enter the area under or around a raised machine.

Improper lifting can allow load to shift and cause death or serious injury or property damage.

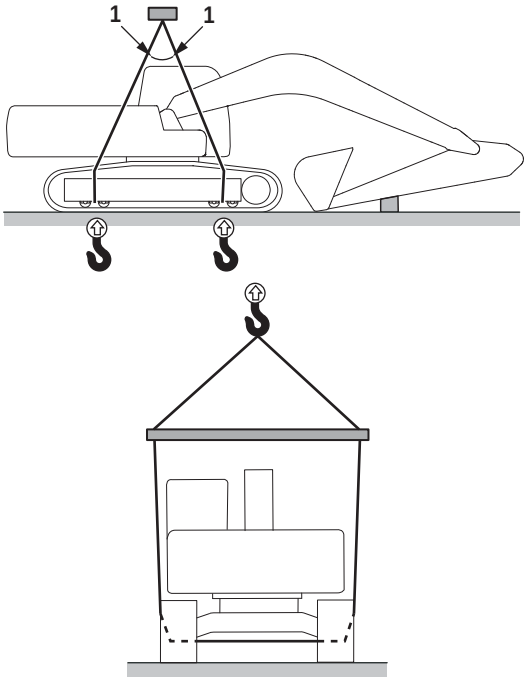
When lifting, move the safety lever to "LOCK" position to prevent the machine from moving unexpectedly.

Use only properly rated cables and slings

Never go in the area under or around the machine when it is raised.

Always use the posture given in the procedure below and use the proper lifting equipment to lift the machine.

1. Refer to "Specification" section of this manual for weight and dimensional information.
2. Lower the work equipment to the ground as shown in the diagram on the right
3. Lower the dozer blade to the ground. (if equipped)
4. Move safety lever to "LOCK" position. Stop engine.
5. Ensure that there is nothing around the operator's compartment, close the cab door and front glass securely.
6. Bind wire ropes between the 1st and 2nd track rollers from the front and between the 1st and 2nd track rollers from the rear.
7. Use spreader bars between the wire rope and the machine to prevent damage to the rope or machine. Set the lifting angle (1, Figure 16) of the wire rope to 30° - 40°.
8. After the machine comes off the ground, check the hook condition and the lifting posture, and then lift slowly.



EX1300751

Figure 16

Troubleshooting

Whenever an operating problem with the machine occurs, take corrective action immediately by checking for the cause of the problem.

If the cause of the operating problem cannot be determined, contact your DOOSAN distributor. Never perform an adjustment or the disassembly of the hydraulic, electrical or electronic components without first contacting a DOOSAN distributor.

WARNING

AVOID DEATH OR SERIOUS INJURY

Instructions are necessary before operating or servicing machine. Read and understand the Operation and Maintenance Manual and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments, repairs or service. Untrained operators and failure to follow instructions can cause death or serious injury.

ELECTRICAL SYSTEM

Problem	Cause	Correction
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.

Problem	Cause	Correction
Work mode (Power mode or Economy mode) selector does not work.	Blown fuse.	Replace fuse.
	Work mode selector switch failed.	Replace switch.
	Connector failed.	Replace connector.
	Wiring harness damaged.	Repair or replace as required.
	EPOS controller failed.	Repair or replace as required.
Working mode selector does not work.	Blown fuse.	Replace fuse.
	Working mode selector switch.	Replace switch failed.
	Connector failed.	Replace connector.
	Wiring harness damaged.	Repair or replace as required.
	EPOS controller failed.	Repair or replace as required.

ENGINE

Problem	Cause	Correction
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.

Problem	Cause	Correction
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.
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.
Starting difficult.		
Starting motor trouble.	Refer to diagnostics.	
Fuel system trouble.	Refer to diagnostics.	
Lack of compression pressure	Valve's poor shut, stem distortion.	Repair or replace.
	Valve spring damage.	Replace valve spring.
	Cylinder head gasket's leak.	Replace gasket.
	Wear of piston, piston ring or liner.	Adjust.
Idle operation abnormal.	Injection timing incorrect.	Check by SCAN-200.
	Air mixing at high-pressure pump.	Remove air.
Engine output insufficient.		
Continuous output insufficient.	Valve clearance incorrect.	Adjust.
	Valve tightness poor.	Repair.
	Cylinder head gasket's leak.	Replace gasket.

Problem	Cause	Correction
Continuous output insufficient.	Wear, stick, damage of piston ring.	Replace piston ring.
	Injection timing incorrect.	Check.
	Fuel injection amount insufficient.	Check.
	Injector injection pressure improper or stuck.	Adjust or replace.
	Supply pump's function lowered.	Repair or replace.
	Fuel pipe system clogged.	Repair.
	Air suction amount insufficient.	Clean or replace air cleaner.
	Turbo charger poor.	Repair or replace.
	Intercooler pipe air leak.	Hose clamp adjust.
Output insufficient when in acceleration.	Compression pressure insufficient.	Disassemble engine.
	Injection timing incorrect.	Check.
	Fuel injection amount insufficient.	Check.
	Injector infection pressure, infection angle improper.	Repair, replace.
	Supply pump's function lowered.	Repair or replace.
	Air intake amount insufficient.	Clean or replace air cleaner.
Overheating.	Engine oil insufficient or poor.	Replenish or replace.
	Cooling water insufficient.	Replenish or replace.
	Fan belt loosened, worn, damaged.	Adjust or replace.
	Cooling water pump's function lowered.	Repair or replace.
	Water temperature regulator's operation poor.	Replace.
	Valve clearance incorrect.	Adjust.
	Exhaust system's resistance increased.	Clean or replace.
Engine noisy.	For noises arise compositely such as rotating parts, lapping parts etc., there is necessity to search the cause of noises accurately.	
Crankshaft.	As the wear of bearing or crankshaft progress, the oil clearances increase.	Replace bearing and grind crankshaft.
	Uneven wear of crankshaft	Grind or replace.
	Oil supply insufficient because of oil passage clogging.	Clean oil passage.
	Stuck bearing.	Replace bearing and grind.

Problem	Cause	Correction
Connecting rod and connecting rod bearing.	Uneven wear of con rod bearing.	Replace bearing.
	Uneven wear of crank pin.	Grind crankshaft.
	Connecting rod distortion.	Repair or replace.
	Stuck bearing.	Replace and grind crankshaft.
	Oil supply insufficiency as clogging at oil passage progresses.	Clean oil passage.
Piston, piston pin and piston ring.	Piston clearance increase as the wear of piston and piston ring progresses.	Replace piston and piston ring.
	Wear of piston or piston pin.	Replace.
	Piston stuck.	Replace piston.
	Piston insertion poor.	Replace piston.
	Piston ring damaged.	Replace piston.
Others.	Wear of crankshaft, thrust bearing.	Replace thrust bearing.
	Camshaft end play increased.	Replace thrust plate.
	Idle gear end play increased.	Replace thrust washer.
	Timing gear backlash excessive.	Repair or replace.
	Valve clearance excessive.	Adjust valve clearance.
	Abnormal wear of tappet, cam.	Replace tappet, cam.
	Turbo charger inner part damaged.	Repair or replace.
Fuel consumption excessive.	Injection timing incorrect.	Check.
	Fuel injection amount excessive.	Adjust.
Oil consumption excessive.		
Oil level elevated.	Clearance between cylinder liner and piston.	Replace.
	Wear of piston ring, ring groove.	Replace piston, piston ring.
	Piston ring's damage, stick, wear.	Replace piston ring.
	Piston ring opening's disposition improper.	Correct position.
	Piston skirt part damaged or abnormal wear.	Replace piston.
	Oil ring's oil return hole clogged.	Replace piston ring.
	Oil ring's contact poor.	Replace piston ring.
Oil level lowered.	Looseness of valve stem and guide.	Replace in set.
	Wear of valve stem seal.	Replace seal.
	Cylinder head gasket's leak.	Replace gasket.

Problem	Cause	Correction
Oil leak.	Looseness of connection parts.	Replace gasket, repair.
	Various part's packing poor.	Replace packing.
	Oil seal poor.	Replace oil seal.

TURBOCHARGER

Problem	Cause	Correction
Excessive black smoke.	Air cleaner element clogged.	Replace or clean.
	Restrictions in air duct.	Check and correct.
	Leakage at intake manifold.	Check and correct.
	Turbo charger seized up and not rotating.	Disassemble/repair or replace.
	Turbine blades and compressor blades coming in contact with each other or damaged.	Disassemble/repair or replace.
	Exhaust piping deformed or clogged.	Check and correct.
Excessive white smoke.	Oil leak into turbine and compressor.	Disassemble/repair or replace.
	Worn or damaged seal ring because of excessive wear of bearing.	Disassemble/repair or replace.
Low engine output.	Gas leak at each part of exhaust system.	Check and correct.
	Air cleaner element restricted.	Replace or clean.
	Turbo charger fouled or damaged.	Disassemble/repair or replace.
	Leakage at discharge port on compressor side.	Check and correct.
Unusual sound or vibration.	Rotor assembly coming in contact.	Disassemble/repair or replace.
	Unbalanced rotation of rotor.	Disassemble/repair or replace.
	Seized up.	Disassemble/repair or replace.
	Each joint loosened.	Check and correct.

COOLING FAN

Problem	Cause	Correction
Cooling fan always runs at maximum speed.	Fan clutch harness is not connected.	Reconnect the connector.
	Fan clutch harness damaged.	Replace as required.
Fan speed is oscillating or lower than minimum speed.	Fan clutch damaged.	Replace as required.

LUBRICATION SYSTEM

Problem	Cause	Correction
Oil consumption excessive.	Poor oil.	Use suggested oil.
	Oil seal or packing leaky.	Replace.
	Pistons or piston rings worn.	Replace pistons and/or piston rings.
	Cylinder liner worn.	Replace cylinder liner.
	Piston rings sticking.	Replace pistons and/or piston rings.
	Valve guide oil seals or valve guides, or valve stem worn.	Replace.
Oil pressure too low.	Poor oil.	Use suggested oil.
	Relief valve sticking.	Replace.
	Restrictions in oil pump strainer.	Clean strainer.
	Oil pump gear worn.	Replace.
	Oil pump feed pipe cracked.	Replace.
	Oil pump defective.	Correct or replace.
	Oil pressure gauge defective.	Correct or replace.
	Various bearings worn.	Replace.
Oil deteriorates quickly.	Restriction in oil filter.	Replace filter.
	Gases leaking.	Replace piston rings and cylinder liner.
	Poor oil.	Use suggested oil.

HYDRAULIC SYSTEM

Problem	Cause	Correction
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 motor or fan pump failure.	Contact your DOOSAN dealer.

AIR COMPRESSOR (OPTIONAL)

Problem	Cause	Correction
Compressor does not run.	Power supply failure.	Check power connection.
	Blown fuse.	Check the power supply line polarity (+, -), and replace the fuse.
	Motor overheat.	Let the motor be cooled down for about 10 minutes, and restart it.
	Motor operated for more than 30 minutes continuously.	Let the motor be cooled down for about 10 minutes, and restart it.
	Purge valve failure.	Check/replace the purge valve.
Motor hums or runs slowly.	Low voltage.	Check the input voltage. (24V min.)
	Worn brush.	Replace the brush.
Tank pressure is lowered when the compressor is turned off - pressure gauge.	Loose joint.	Check pipeline joints.
Excessive moisture in the air ejected from the air gun.	Drain valve open/leak.	Check the drain valve.
	Check valve leak.	Overhaul or replace the check valve. Warning! Never remove check valve when the tank is pressurized.
	Too much water in the tank.	Drain the tank. Warning! Drain the tank when the pressure in the tank is less than 1 bar.
Compressor keeps running.	Pressure switch failure.	Replace the pressure switch.
	Excessive air use.	Restart the compressor after checking that air tank pressure is charged up to 8 bar.
Compressor vibrates.	Loose mounting bolt(s).	Tighten the mounting bolt(s).
	Mounting rubber pad is worn or missing.	Replace the mounting rubber pad.
Air pressure is lower than normal.	Drain valve is open.	Close the drain valve.
	Clogged air suction filter.	Clean/replace suction air filter.
	Leak at joint.	Check/tighten the joints.

SWING SYSTEM

Problem	Cause	Correction
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	Correction
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
	SAE (PCSA)		0.92 m^3	1.20 yd^3
Operating Weight			21.9 metric tons	24.1 tons
Engine	Model		DL06K	
	Type		4-cycle Water Cooled, Turbocharge, Direct Injection, Exhaust Gas Recirculation	
	Rated Output		169 ps @1,800 rpm	167 hp @1,800 rpm
	Maximum Torque		77 kg•m @ 1,400 rpm	557 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	4,978 psi
	Maximum Discharge Quantity		2 x 206.5 liters/min	2 x 54.6 U.S. gpm
	Hydraulic Oil Capacity	Tank Level	140 liters	37 U.S. gal.
		Full	200 liters	53 U.S. gal.
		System	240 liters	63.4 U.S. gal.
Performance	Digging Capability (SAE)	Bucket (STD)	12.6/*13.4 metric tons	13.9/*14.8 tons
		Arm (STD)	9.9/*10.5 metric tons	10.9/*11.6 tons
	Digging Capability (ISO)	Bucket (STD)	14.3/*15.2 metric tons	15.8/*16.8 tons
		Arm (STD)	10.2/*10.8 metric tons	11.2/*11.9 tons
	Swing Speed		11.0 rpm	
	Travel Speed	High-speed	5.5 km/h	3.32 MPH
		Low-speed	3.0 km/h	1.86 MPH
	Traction Force	High-speed	12.8 metric tons	14.1 tons
		Low-speed	22.4 metric tons	24.7 tons
	Gradeability		35° (70% slope)	
	Ground Pressure		0.46 kg/cm^2	6.53 psi
Ground Clearance			480 mm	18.9 in
Track Shoe Width			600 mm	23.6 in
Upper Roller Qty.			2 per side	
Lower Roller Qty.			8 per side	

* Power Boost

OVERALL DIMENSIONS

One - Piece Boom

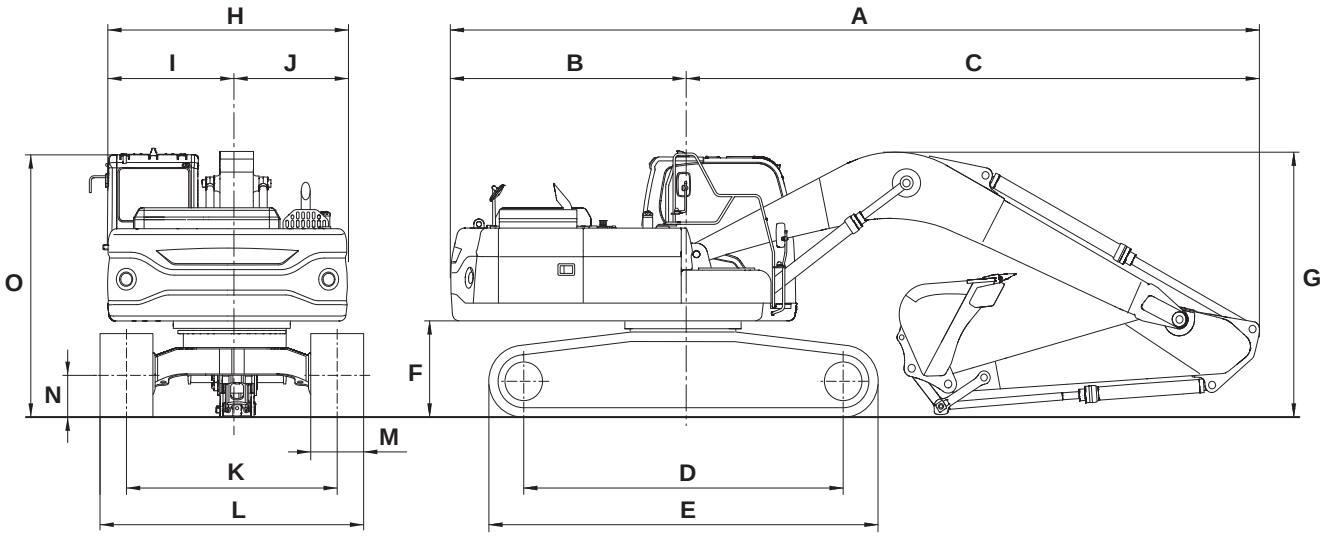


Figure 1

Dimension	5.7 m (18' 8") Boom			8.5 m (27' 11") Boom
	2.9 m (9' 6") Arm	**2.4 m (7' 10") Arm**	**3.5 m (11' 6") Arm**	**6.2 m (20' 4") Arm**
A	9,490 mm (31' 2")	9,540 mm (31' 3")	9,540 mm (31' 4")	12,355 mm (40' 6")
B	2,790 mm (9' 2")			
C	6,710 mm (22')	6,750 mm (22' 2")	6,750 mm (22' 2")	9,565 mm (31' 5")
D	3,650 mm (12' 12")			
E	4,445 mm (14' 7")			
F	1,055 mm (3' 6")			
G (Boom)	2,870 mm (9' 5")	2,970 mm (9' 9")	3,130 mm (10' 3")	3,190 mm (10' 6")
G (Hose)	3,005 mm (9' 10")	3,130 mm (10' 3")	3,330 mm (10' 11")	3,275 mm (10' 11")
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")			

Two - Piece Boom

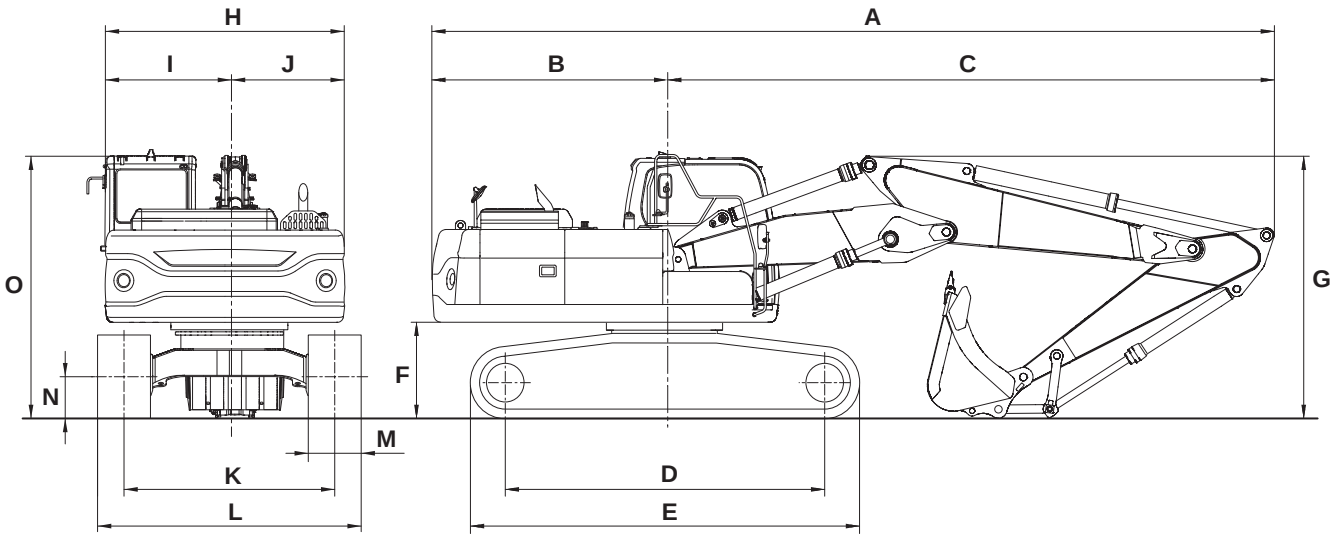


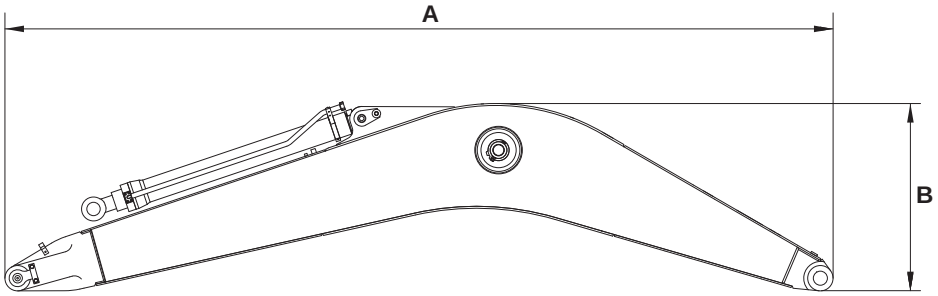
Figure 2

Dimension	5.85 m (19' 2") Boom	
	2.4 m (7' 10") Arm	**2.9 m (9' 6") Arm**
A	9,690 mm (31' 9")	9,680 mm (31' 9")
B	2,790 mm (9' 2")	
C	6,900 mm (22' 8")	6,890 mm (22' 7")
D	3,650 mm (12' 12")	
E	4,445 mm (14' 7")	
F	1,055 mm (3' 6")	
G (Boom)	3,100 mm (10' 2")	3,080 mm (10' 1")
G (Hose)	3,100 mm (10' 2")	3,080 mm (10' 1")
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")	

DISASSEMBLED PARTS, DIMENSION AND WEIGHT

Components

Boom

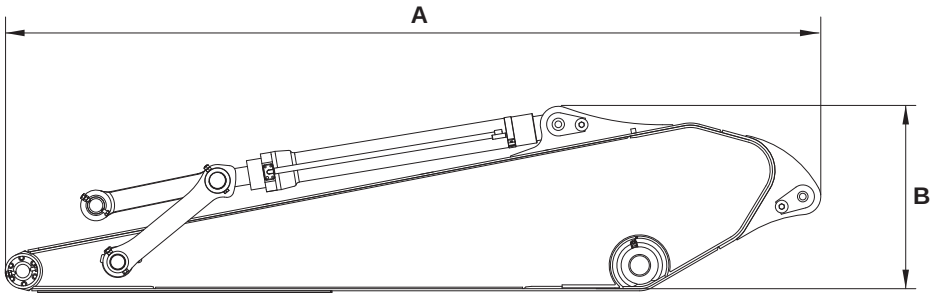


FG019640

Figure 3

Description		5.7 m (18' 8") STD	5.85 m (19' 2") ARTICULATED	8.5 m (27" 11") SLR
Length (A)	mm (ft-in)	5,880 (19' 3")	6,060 (19' 11")	8,686 (28' 6")
Length (B)		1,343 (4' 5")	1,410 (4' 8")	1,368 (4' 6")
Width		628 (2' 1")	628 (2' 1")	628 (2' 1")
Weight	kg	1,730	2,270	2,180
	lb	3,814	5,004	4,806

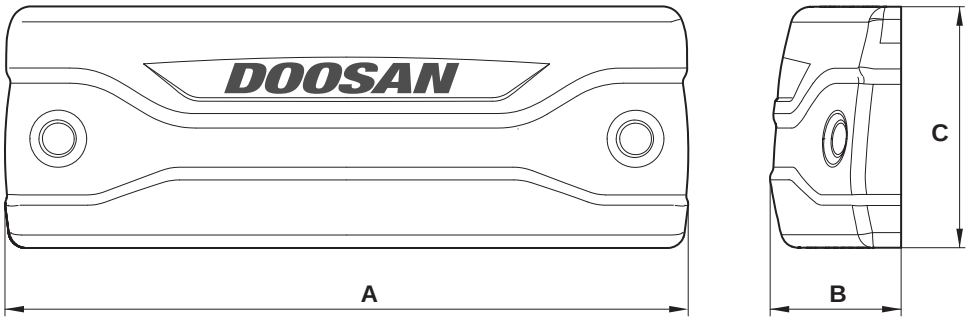
Arm



FG019861

Figure 4

Description		2.9 m (9' 6")	2.4 m (7' 10")	3.5 m (11' 6")	6.2 m (20' 4") SLR
Length (A)	mm (ft-in)	3,850 (12' 8")	3,337 (10' 11")	4,474 (14' 8")	7,203 (23' 8")
Length (B)		868 (2' 10")	868 (2' 10")	902 (2' 12")	979 (3' 3")
Width		344 (1' 2")	344 (1' 2")	344 (1' 2")	344 (1' 2")
Weight	kg	1,000	880	1,210	1,370
	lb	2,205	1,940	2,668	3,020



FG018629

Figure 5

Description		Counterweight	
Length (A)	mm (ft•in)	2,711 (8' 9")	2,711 (8' 9")
Length (B)		572 (1' 9")	572 (1' 9")
Length (C)		1,047 (3' 4")	1,047 (3' 4")
Weight	kg	4,300	5,300
	lb	9,480	11,685

GROUND PRESSURE

Description	Shoe Width mm	Boom Length mm (ft-in)	Arm Length mm (ft-in)	Bucket Capacity m^3 (yd^3)	Couterweight kg (lb)	Operating Weight kg (lb)	Ground Pressure kg/cm^2 (psi)
Triple Grouser	600	5,700 (18' 8")	2,900 (9' 6")	0.92 (1.20)	4,300 (9,480)	21,910 (48,300)	0.46 (6.54)
	700					22,195 (48,930)	0.40 (5.73)
	800					22,475 (49,550)	0.36 (5.12)
	900					22,760 (50,175)	0.32 (4.55)

DIGGING FORCE

Description		Unit	5.7 m (18' 8") Boom			8.5 m (27' 11") Boom
			2.9 m (9' 6") Arm	2.4 m (7' 10") Arm	3.5 m (11' 6") Arm	6.2 m (20' 4") Arm
Bucket Radius		mm (in)	1,457 (4' 10")			1,233 (4' 1")
Breakout Force	Normal (SAE)	kN	123.6	123.6	123.6	79.5
		kg	12,604	12,604	12,604	8,107
		lb	27,786	27,786	27,786	17,872
	Power Boost (SAE)	kN	131.1	131.1	131.1	84.3
		kg	13,368	13,368	13,368	8,596
		lb	29,472	29,472	29,472	18,951
	Normal (ISO)	kN	140.3	140.2	140.2	92.2
		kg	14,307	14,296	14,296	9,402
		lb	31,541	31,518	31,518	20,727
	Power Boost (ISO)	kN	148.8	148.7	148.7	97.8
		kg	15,173	15,163	15,163	9,973
		lb	33,452	33,429	33,429	21,986
Tearout Force	Normal (SAE)	kN	97.1	112.5	87	54.5
		kg	9,901	11,472	8,872	5,557
		lb	21,829	25,291	19,558	12,252
	Power Boost (SAE)	kN	102.9	119.3	92.3	57.8
		kg	10,493	12,165	9,412	5,894
		lb	23,133	26,820	20,750	12,994
	Normal (ISO)	kN	100	116.5	87.3	55.3
		kg	10,197	11,880	8,902	5,639
		lb	22,481	26,190	19,626	12,432
	Power Boost (ISO)	kN	106.1	123.6	94.7	58.6
		kg	10,819	12,604	9,657	5,976
		lb	23,852	27,786	21,289	13,174
Rotation Angle - Bucket		deg	176.9	176.9	177	170.7

WORKING RANGE

One - Piece Boom

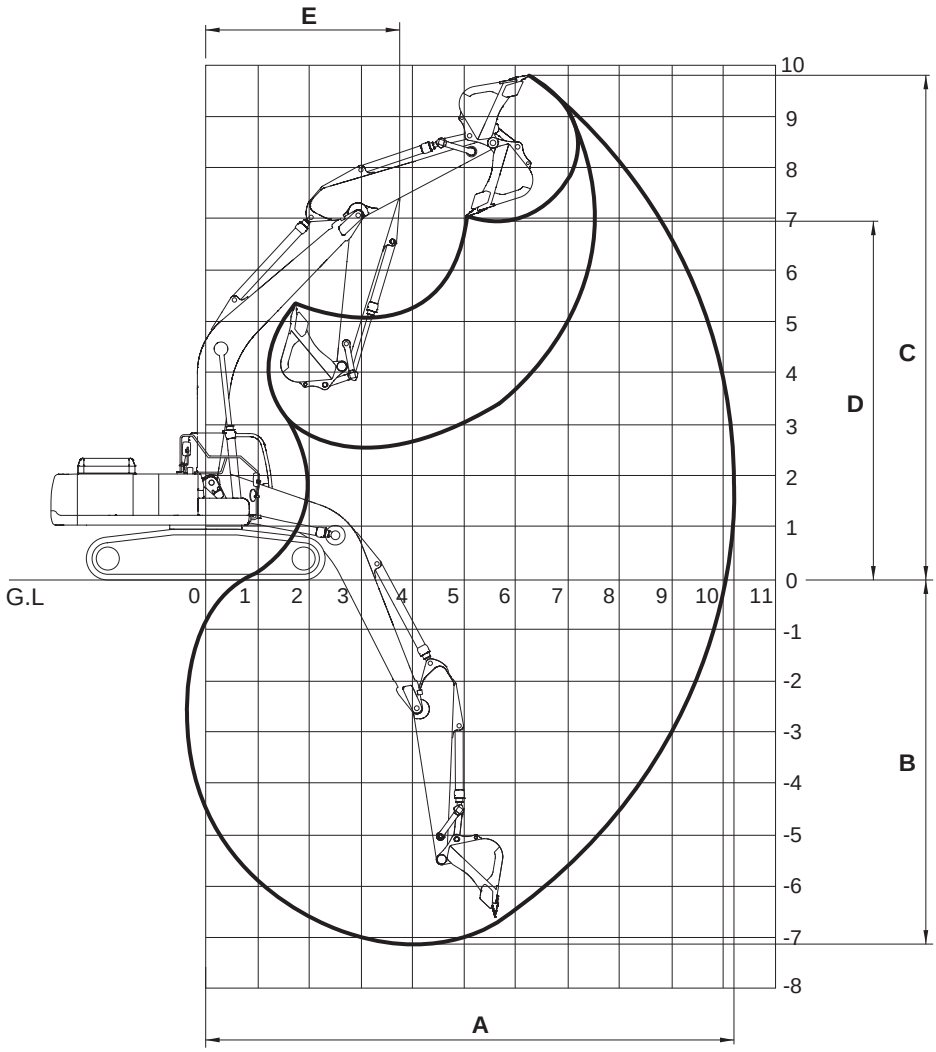


Figure 6

DIM.	Boom	5.7 m (18' 8")			8.5 m (27' 11")
	Arm	2.9 m (9' 6")	2.4 m (7' 10")	3.5 m (11' 6")	6.2 m (20' 4")
A	Max. Digging Reach	9,885 mm (32' 5")	9,470 mm (30' 12")	10,390 mm (31' 4")	15,380 mm (50' 5")
B	Max. Digging Depth	6,585 mm (21' 7")	6,080 mm (19' 11")	7,190 mm (23' 7")	11,650 mm (38' 3")
C	Max. Digging Height	9,560 mm (31' 4")	9,450 mm (31')	9,660 mm (31' 8")	13,075 mm (42' 11")
D	Max. Loading Height	6,840 mm (22' 5")	6,700 mm (21' 12")	6,980 mm (22' 11")	10,845 mm (35' 7")
E	Min. Swing Radius	3,560 mm (11' 8")	3,580 mm (11' 9")	3,620 mm (11' 10")	4,960 mm (16' 3")

Two - Piece Boom

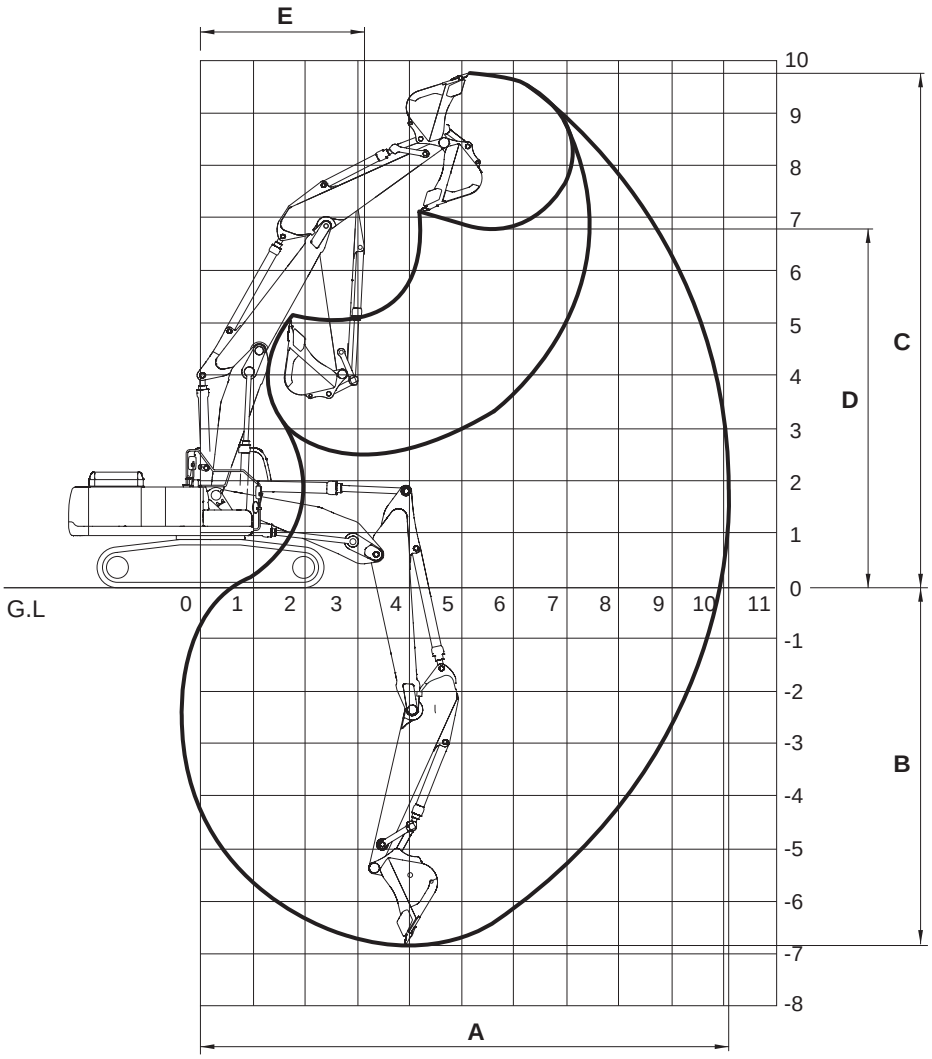


Figure 7

DIM.	Boom	5.85 m (19' 2")	
	Arm	**2.4 m (7' 10")**	**2.9 m (9' 6")**
A	Max. Digging Reach	9,680 mm (31' 9")	10,110 mm (33' 2")
B	Max. Digging Depth	5,980 mm (19' 8")	6,460 mm (21' 2")
C	Max. Digging Height	10,910 mm (35' 9")	11,200 mm (36' 9")
D	Max. Loading Height	8,010 mm (26' 3")	8,310 mm (27' 3")
E	Min. Swing Radius	2,790 mm (9' 2")	2,625 mm (8' 7")

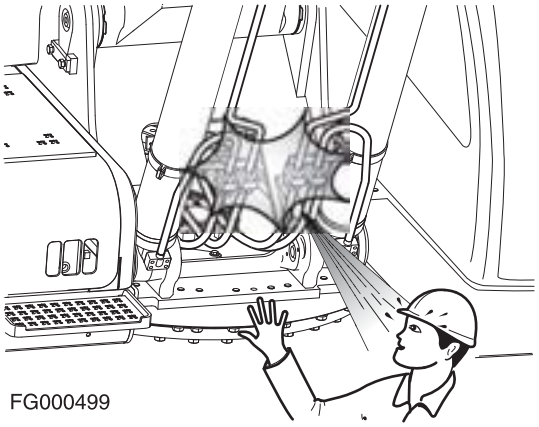
EXCAVATOR RATED LIFT CAPACITY TABLES

WARNING

AVOID DEATH OR SERIOUS INJURY

Keep bystanders away from the boom cylinder. While operating, boom, arm or bucket hydraulic hoses could burst causing high-pressure oil to spray or sudden lowering of the load or front structure. This could cause death or serious injury.

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



FG000499

Figure 8

WARNING

AVOID DEATH OR SERIOUS INJURY

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 tipping, equipment failure and/or structural failure of the machine.

Operate the excavator on firm and level ground and surfaces that can support the weight of the excavator and the loads that will be lifted. Avoid operating the excavator, if these conditions exist:

- 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:

- Avoid use of uneven slings that can cause side loads when traveling with a load or swinging the load.
- Avoid lifting loads that 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 arm end point directly over the load. Use tag lines on opposite sides of the load to help stabilize the load and prevent side loads caused by wind gusts.

The following rated loads are in compliance with ISO 10567 and applicable ISO standards for hydraulic excavators performing lifting operations on firm supporting surfaces. An asterisk (*) next to the load rating indicates rated load does not exceed 87% of hydraulic capacity. All other ratings do not 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 centerline and height - see "Lifting Radius" and "Lifting Point Height" in the reference drawing, Figure 9).

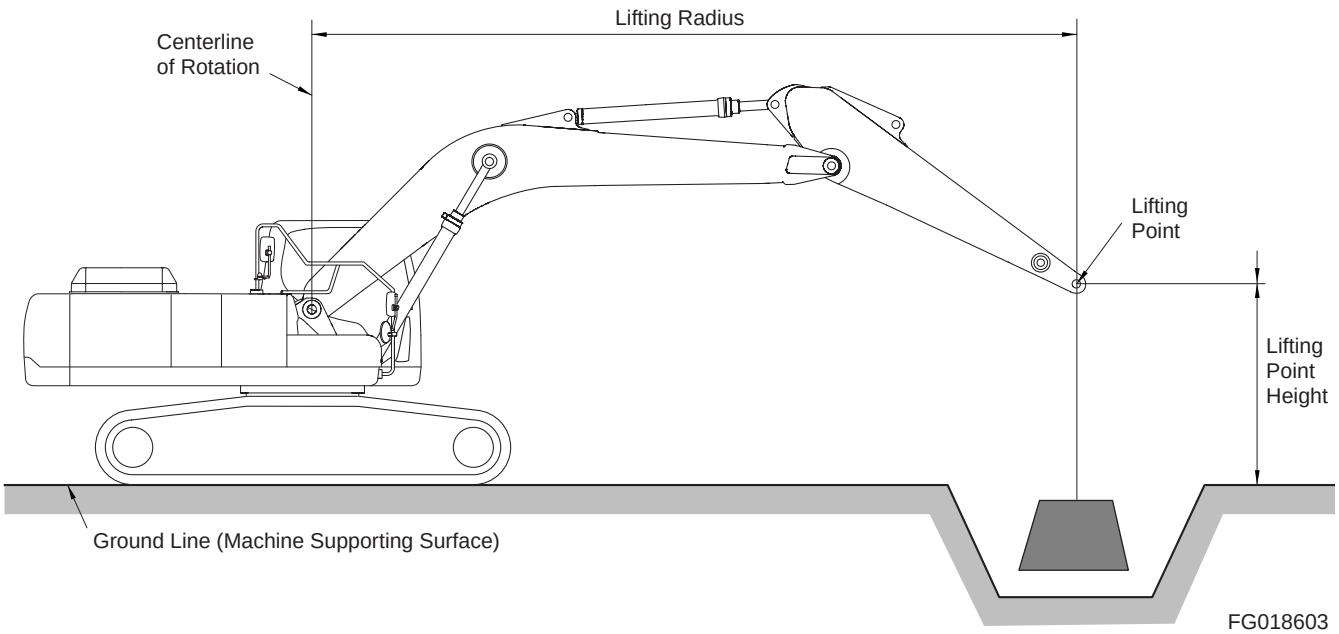
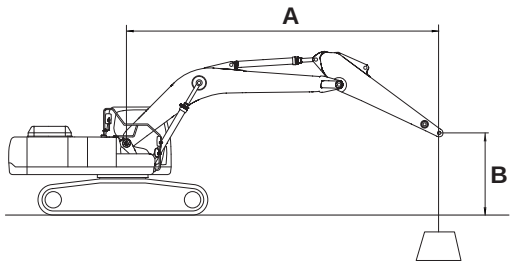


Figure 9

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 net lifting load. The lift point must be on the end of the arm, as shown in Figure 9.

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 operating.



Track Width : 2.99 m (9' 10") STD Track
Boom : 5.7 m (18' 8")
Arm : 2.9 m (9' 6")
Bucket : Without Bucket
Counterweight : 4,300 kg (9,480 lb)
Shoe : 600 mm (24")
Dozer : Without Dozer
: Rating Over Front
: Rating Over Side or 360 degree
Unit : 1,000 kg (1,000 lb)

FG019990

Figure 10

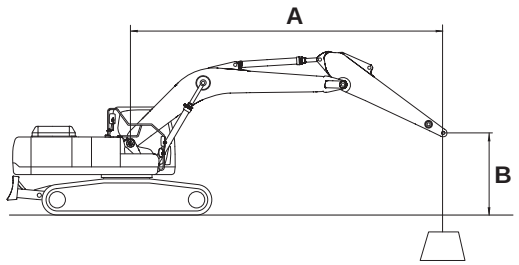
METRIC 1,000 kg

A (m) / B (m)	1.5		3		4.5		6		7.5		MAX. REACH		
													A (m)
7.5							* 4.96	* 4.96			* 4.27	* 4.27	6.22
6							* 5.39	5.33			* 3.98	3.81	7.32
4.5							* 5.92	5.16	* 5.47	3.62	* 3.92	3.24	8.00
3					* 8.68	7.51	* 6.74	4.91	5.45	3.51	* 4.03	2.96	8.35
1.5					* 10.29	7.00	7.45	4.67	5.32	3.39	* 4.30	2.86	8.42
0			* 6.15	* 6.15	* 11.05	6.73	7.26	4.50	5.22	3.31	4.59	2.92	8.22
-1.5	* 6.72	* 6.72	* 10.61	* 10.61	* 10.94	6.66	7.18	4.43	5.20	3.29	5.00	3.17	7.72
-3	* 11.43	* 11.43	* 13.89	13.11	* 9.98	6.73	7.23	4.47			5.98	3.77	6.86
-4.5			* 10.55	* 10.55	* 7.69	6.97					* 5.92	5.31	5.47

FEET 1,000 lb

A (ft) / B (ft)	5		10		15		20		25		MAX. REACH		
													A (ft)
25							* 9.55	* 9.55			* 9.48	* 9.48	20.06
20							* 11.83	11.47			* 8.79	8.51	23.85
15							* 12.89	11.12	* 11.81	7.78	* 8.64	7.19	26.16
10					* 18.71	16.21	* 14.63	10.60	11.73	7.56	* 8.86	6.54	27.37
5					* 22.23	15.10	16.03	10.07	11.46	7.32	* 9.46	6.31	27.63
0			* 14.11	* 14.11	* 23.94	14.50	15.62	9.70	11.26	7.13	10.11	6.43	26.96
-5	* 15.03	* 15.03	* 24.09	* 24.09	* 23.72	14.34	15.45	9.56	11.22	7.10	11.05	7.00	25.29
-10	* 25.67	* 25.67	* 30.10	28.10	* 21.57	14.50	15.58	9.67			13.29	8.37	22.38
-15			* 22.54	* 22.54	* 16.31	15.05					* 12.98	11.99	17.66

1. Load point is the end of the arm.
2. Capacities marked with an asterisk (*) are limited by hydraulic capacities.
3. Lift capacities shown do not exceed 75% of minimum tipping loads or 87% of hydraulic capacities.
4. The least stable position is over the side.
5. The total weight of machine is 21,100 kg (46,500 lb). Included are the; boom 5.7 m (18' 8"), arm 2.9 m (9' 6"), 4,300 kg (9,480 lb) counterweight, without bucket, all operating fluids and a 75 kg (165 lb) operator.
6. Lift capacities are in compliance with ISO 10567.



Track Width : 2.99 m (9' 10") STD Track
Boom : 5.7 m (18' 8")
Arm : 2.9 m (9' 6")
Bucket : Without Bucket
Counterweight : 4,300 kg (9,480 lb)
Shoe : 600 mm (24")
Dozer : Dozer Up (Rear)
: Rating Over Front
: Rating Over Side or 360 degree
Unit : 1,000 kg (1,000 lb)

FG019991

Figure 11

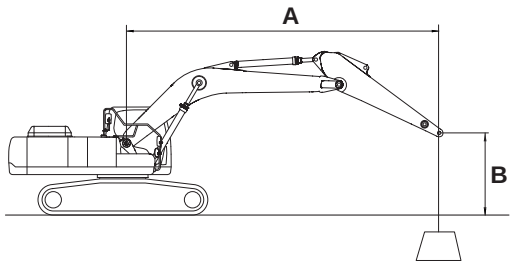
METRIC 1,000 kg

A (m) / B (m)	1.5		3		4.5		6		7.5		MAX. REACH		
													A (m)
7.5							* 4.96	* 4.96			* 4.27	* 4.27	6.22
6							* 5.39	* 5.39			* 3.98	* 3.98	7.32
4.5							* 5.92	5.49	* 5.47	3.87	* 3.92	3.47	8.00
3					* 8.68	7.99	* 6.74	5.24	* 5.81	3.76	* 4.03	3.18	8.35
1.5					* 10.29	7.48	* 7.56	5.00	6.15	3.64	* 4.30	3.08	8.42
0			* 6.15	* 6.15	* 11.05	7.21	* 8.08	4.83	6.05	3.56	* 4.79	3.14	8.22
-1.5	* 6.72	* 6.72	* 10.61	* 10.61	* 10.94	7.14	* 8.11	4.76	6.03	3.54	* 5.68	3.41	7.72
-3	* 11.43	* 11.43	* 13.89	* 13.89	* 9.98	7.21	* 7.41	4.80			* 6.09	4.05	6.86
-4.5			* 10.55	* 10.55	* 7.69	7.45					* 5.92	5.68	5.47

FEET 1,000 lb

A (ft) / B (ft)	5		10		15		20		25		MAX. REACH		
													A (ft)
25							* 9.55	* 9.55			* 9.48	* 9.48	20.06
20							* 11.83	* 11.83			* 8.79	* 8.79	23.85
15							* 12.89	11.84	* 11.81	8.32	* 8.64	7.70	26.16
10					* 18.71	17.25	* 14.63	11.31	* 12.66	8.10	* 8.86	7.03	27.37
5					* 22.23	16.15	* 16.39	10.78	13.24	7.86	* 9.46	6.79	27.63
0			* 14.11	* 14.11	* 23.94	15.54	* 17.51	10.41	13.04	7.68	* 10.56	6.93	26.96
-5	* 15.03	* 15.03	* 24.09	* 24.09	* 23.72	15.38	* 17.56	10.27	13.01	7.64	* 12.56	7.54	25.29
-10	* 25.67	* 25.67	* 30.10	30.04	* 21.57	15.55	* 15.93	10.38			* 13.44	8.99	22.38
-15			* 22.54	* 22.54	* 16.31	16.09					* 12.98	12.83	17.66

1. Load point is the end of the arm.
2. Capacities marked with an asterisk (*) are limited by hydraulic capacities.
3. Lift capacities shown do not exceed 75% of minimum tipping loads or 87% of hydraulic capacities.
4. The least stable position is over the side.
5. The total weight of machine is 22,800 kg (50,300 lb) Included are the; boom 5.7 m (18' 8"), arm 2.9 m (9' 6"), 4,300 kg (9,480 lb) counterweight, without bucket, all operating fluids and a 75 kg (165 lb) operator.
6. Lift capacities are in compliance with ISO 10567.



Track Width : 2.99 m (9' 10") STD Track
Boom : 5.7 m (18' 8")
Arm : 2.4 m (7' 10")
Bucket : Without Bucket
Counterweight : 4,300 kg (9,480 lb)
Shoe : 600 mm (24")
Dozer : Without Dozer
: Rating Over Front
: Rating Over Side or 360 degree
Unit : 1,000 kg (1,000 lb)

FG019992

Figure 12

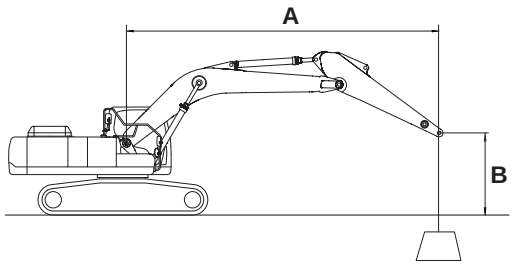
METRIC 1,000 kg

A (m) / B (m)	3		4.5		6		7.5		MAX. REACH		
											A (m)
7.5									* 6.19	5.81	5.64
6					* 5.93	5.27			* 5.94	4.23	6.84
4.5			* 7.61	* 7.61	* 6.39	5.12	5.53	3.60	5.47	3.55	7.56
3			* 9.38	7.40	* 7.16	4.89	5.45	3.52	5.00	3.23	7.93
1.5			* 10.78	6.97	7.45	4.68	5.35	3.43	4.86	3.12	8.00
0			* 11.21	6.78	7.30	4.54	5.28	3.36	5.01	3.20	7.78
-1.5	* 10.51	* 10.51	* 10.79	6.76	7.26	4.51			5.54	3.53	7.26
-3	* 12.73	* 12.73	* 9.49	6.88	* 6.95	4.60			* 6.32	4.31	6.33
-4.5			* 6.35	* 6.35					* 5.70	* 5.70	4.78

FEET 1,000 lb

A (ft) / B (ft)	10		15		20		25		MAX. REACH		
											A (ft)
25									* 13.73	13.29	18.08
20					* 13.04	11.34			* 13.12	9.47	22.23
15			* 16.42	* 16.42	* 13.92	11.04			12.12	7.88	24.70
10			* 20.22	15.99	* 15.53	10.56	11.73	7.58	11.04	7.14	25.98
5			* 23.29	15.03	16.04	10.10	11.52	7.39	10.72	6.89	26.25
0			* 24.30	14.61	15.71	9.80	11.38	7.26	11.05	7.07	25.54
-5	* 24.01	* 24.01	* 23.41	14.57	15.63	9.74			12.25	7.79	23.77
-10	* 27.60	* 27.60	* 20.49	14.83	* 14.80	9.96			* 13.91	9.59	20.65
-15			* 13.06	* 13.06					* 12.89	* 12.89	15.11

1. Load point is the end of the arm.
2. Capacities marked with an asterisk (*) are limited by hydraulic capacities.
3. Lift capacities shown do not exceed 75% of minimum tipping loads or 87% of hydraulic capacities.
4. The least stable position is over the side.
5. The total weight of machine is 21,000 kg (46,300 lb). Included are the; boom 5.7 m (18' 8"), arm 2.4 m (7' 10"), 4,300 kg (9,480 lb) counterweight, without bucket, all operating fluids and a 75 kg (165 lb) operator.
6. Lift capacities are in compliance with ISO 10567.



Track Width : 2.99 m (9' 10") STD Track
Boom : 5.7 m (18' 8")
Arm : 3.5 m (11' 6")
Bucket : Without Bucket
Counterweight : 4,300 kg (9,480 lb)
Shoe : 600 mm (24")
Dozer : Without Dozer
: Rating Over Front
: Rating Over Side or 360 degree
Unit : 1,000 kg (1,000 lb)

FG019993

Figure 13

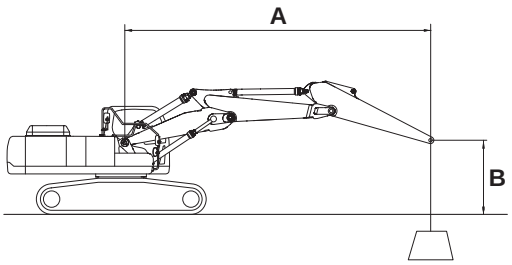
METRIC 1,000 kg

A (m) / B (m)	1.5		3		4.5		6		7.5		MAX. REACH		
													A (m)
7.5											* 4.91	4.29	6.89
6									* 4.81	3.72	* 4.87	3.38	7.90
4.5							* 5.34	5.23	* 5.00	3.65	4.52	2.92	8.53
3			* 11.80	* 11.80	* 7.78	7.67	* 6.21	4.96	* 5.41	3.52	4.19	2.68	8.86
1.5					* 9.59	7.07	* 7.13	4.67	5.30	3.37	4.07	2.59	8.92
0			* 7.42	* 7.42	* 10.70	6.69	7.22	4.46	5.18	3.26	4.15	2.62	8.73
-1.5	* 6.56	* 6.56	* 10.42	* 10.42	* 10.95	6.54	7.09	4.34	5.11	3.20	4.47	2.81	8.26
-3	* 10.17	* 10.17	* 14.96	12.77	* 10.37	6.56	7.09	4.34			5.18	3.25	7.47
-4.5	* 14.90	* 14.90	* 12.24	* 12.24	* 8.74	6.73	* 6.24	4.48			* 5.85	4.29	6.22

FEET 1,000 lb

A (ft) / B (ft)	5		10		15		20		25		MAX. REACH		
													A (ft)
25											* 10.84	9.71	22.26
20									* 10.63	7.98	* 10.73	7.55	25.74
15							* 11.63	11.28	* 10.94	7.85	10.02	6.48	27.90
10			* 25.17	* 25.17	* 16.79	16.54	* 13.48	10.69	11.76	7.57	9.25	5.92	29.03
5					* 20.73	15.25	* 15.45	10.08	11.42	7.27	8.97	5.70	29.28
0			* 16.89	* 16.89	* 23.18	14.42	15.54	9.61	11.15	7.02	9.15	5.78	28.65
-5	* 14.65	* 14.65	* 23.60	* 23.60	* 23.73	14.09	15.27	9.37	11.02	6.90	9.86	6.20	27.08
-10	* 22.79	* 22.79	* 32.40	27.37	* 22.44	14.13	15.27	9.37			11.49	7.21	24.41
-15	* 33.62	* 33.62	* 26.29	* 26.29	* 18.71	14.52	* 13.10	9.72			* 12.89	9.62	20.16

1. Load point is the end of the arm.
2. Capacities marked with an asterisk (*) are limited by hydraulic capacities.
3. Lift capacities shown do not exceed 75% of minimum tipping loads or 87% of hydraulic capacities.
4. The least stable position is over the side.
5. The total weight of machine is 21,300 kg (47,000 lb). Included are the; boom 5.7 m (18' 8"), arm 3.5 m (11' 6"), 4,300 kg (9,480 lb) counterweight, without bucket, all operating fluids and a 75 kg (165 lb) operator.
6. Lift capacities are in compliance with ISO 10567.



Track Width : 2.99 m (9' 10") STD Track
Boom : Upper 2.8 m (9' 2"), Lower 3.1 m (10' 2")
Arm : 2.9 m (9' 6")
Bucket : Without Bucket
Counterweight : 4,300 kg (9,480 lb)
Shoe : 600 mm (24")
Dozer : Without Dozer
: Rating Over Front
: Rating Over Side or 360 degree
Unit : 1,000 kg (1,000 lb)

FG019988

Figure 14

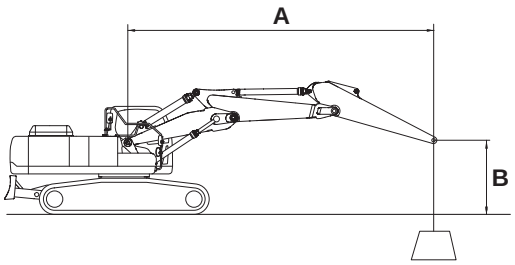
METRIC 1,000 kg

A (m) / B (m)	3		4.5		6		7.5		MAX. REACH		
											A (m)
9			* 5.69	* 5.69					* 4.89	* 4.89	4.80
7.5			* 6.14	* 6.14	* 5.53	5.44			* 4.09	* 4.09	6.53
6			* 6.26	* 6.26	* 6.31	5.40	* 4.23	3.66	* 3.80	3.58	7.59
4.5	* 11.29	* 11.29	* 8.71	8.17	* 6.76	5.19	* 5.39	3.61	* 3.72	3.06	8.24
3			* 10.18	7.47	* 7.60	4.89	5.48	3.48	* 3.78	2.79	8.58
1.5			* 10.87	6.88	7.46	4.60	5.33	3.34	* 3.99	2.70	8.65
0			* 10.53	6.59	7.25	4.41	5.22	3.24	* 4.39	2.75	8.45
-1.5	* 9.36	* 9.36	* 9.28	6.53	* 7.11	4.34	5.19	3.22	* 4.55	2.98	7.97
-3			* 7.14	6.63	* 5.48	4.39			* 3.79	3.53	7.13

FEET 1,000 lb

A (ft) / B (ft)	10		15		20		25		MAX. REACH		
											A (ft)
30									* 11.08	* 11.08	15.01
25			* 13.58	* 13.58	* 11.42	* 11.42			* 9.14	* 9.14	21.06
20			* 13.77	* 13.77	* 13.70	11.62			* 8.39	8.00	24.72
15	* 22.06	* 22.06	* 18.54	17.62	* 14.60	11.18	* 11.68	7.77	* 8.20	6.79	26.95
10			* 22.00	16.13	* 16.31	10.54	11.80	7.50	* 8.33	6.17	28.13
5			* 23.56	14.85	16.07	9.93	11.48	7.20	* 8.79	5.95	28.38
0			* 22.87	14.20	15.60	9.51	11.25	6.99	* 9.67	6.06	27.72
-5	* 21.26	21.26	* 20.14	14.06	* 15.36	9.36	11.20	6.95	* 10.00	6.59	26.11
-10			* 15.38	14.28	* 11.66	9.49			* 8.28	7.82	23.32

1. Load point is the end of the arm.
2. Capacities marked with an asterisk (*) are limited by hydraulic capacities.
3. Lift capacities shown do not exceed 75% of minimum tipping loads or 87% of hydraulic capacities.
4. The least stable position is over the side.
5. The total weight of machine is 22,100 kg (48,700 lb). Included are the; lower boom 3.1 m (10' 2"), upper boom 2.8 m (9' 2"), arm 2.9 m (9' 6"), 4,300 kg (9,480 lb) counterweight, without bucket, all operating fluids and a 75 kg (165 lb) operator.
6. Lift capacities are in compliance with ISO 10567.



Track Width : 2.99 m (9' 10") STD Track
Boom : Upper 2.8 m (9' 2"), Lower 3.1 m (10' 2")
Arm : 2.9 m (9' 6")
Bucket : Without Bucket
Counterweight : 4,300 kg (9,480 lb)
Shoe : 600 mm (24")
Dozer : Dozer Up (Rear)
: Rating Over Front
: Rating Over Side or 360 degree
Unit : 1,000 kg (1,000 lb)

FG019989

Figure 15

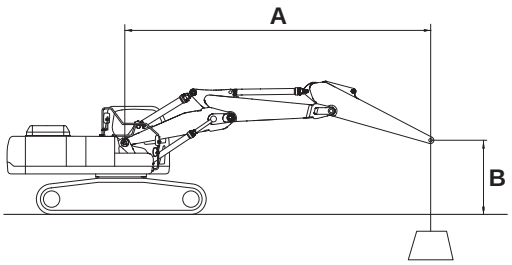
METRIC 1,000 kg

A (m) / B (m)	3		4.5		6		7.5		MAX. REACH		
											A (m)
9			* 5.69	* 5.69					* 4.89	* 4.89	4.80
7.5			* 6.14	* 6.14	* 5.53	* 5.53			* 4.09	* 4.09	6.53
6			* 6.26	* 6.26	* 6.31	5.71	* 4.23	3.89	* 3.80	* 3.80	7.59
4.5	* 11.29	* 11.29	* 8.71	8.61	* 6.76	5.49	* 5.39	3.85	* 3.72	3.27	8.24
3			* 10.18	7.91	* 7.60	5.19	* 5.66	3.71	* 3.78	2.99	8.58
1.5			* 10.87	7.32	* 7.99	4.90	* 6.01	3.57	* 3.99	2.89	8.65
0			* 10.53	7.03	* 7.86	4.71	6.03	3.47	* 4.39	2.95	8.45
-1.5	* 9.36	* 9.36	* 9.28	6.97	* 7.11	4.64	* 5.26	3.45	* 4.55	3.20	7.97
-3			* 7.14	7.07	* 5.48	4.70			* 3.79	3.77	7.13

FEET 1,000 lb

A (ft) / B (ft)	10		15		20		25		MAX. REACH		
											A (ft)
30									* 11.08	* 11.08	15.01
25			* 13.58	* 13.58	* 11.42	* 11.42			* 9.14	* 9.14	21.06
20			* 13.77	* 13.77	* 13.70	12.28			* 8.39	* 8.39	24.72
15	* 22.06	* 22.06	* 18.54	* 18.54	* 14.60	11.84	* 11.68	8.27	* 8.20	7.24	26.95
10			* 22.00	17.09	* 16.31	11.20	* 12.21	8.00	* 8.33	6.61	28.13
5			* 23.56	15.81	* 17.31	10.58	* 12.94	7.70	* 8.79	6.38	28.38
0			* 22.87	15.16	* 17.04	10.17	12.99	7.49	* 9.67	6.50	27.72
-5	* 21.26	* 21.26	* 20.14	15.02	* 15.36	10.01	* 11.20	7.45	* 10.00	7.06	26.11
-10			* 15.38	15.24	* 11.66	10.15			* 8.28	* 8.28	23.32

1. Load point is the end of the arm.
2. Capacities marked with an asterisk (*) are limited by hydraulic capacities.
3. Lift capacities shown do not exceed 75% of minimum tipping loads or 87% of hydraulic capacities.
4. The least stable position is over the side.
5. The total weight of machine is 23,700 kg (52,200 lb). Included are the; lower boom 3.1 m (10' 2"), upper boom 2.8 m (9' 2"), arm 2.9 m (9' 6"), 4,300 kg (9,480 lb) counterweight, without bucket, all operating fluids and a 75 kg (165 lb) operator.
6. Lift capacities are in compliance with ISO 10567.



Track Width : 2.99 m (9' 10") STD Track
Boom : Upper 2.8 m (9' 2"), Lower 3.1 m (10' 2")
Arm : 2.4 m (7' 10")
Bucket : Without Bucket
Counterweight : 4,300 kg (9,480 lb)
Shoe : 600 mm (24")
Dozer : Without Dozer
: Rating Over Front
: Rating Over Side or 360 degree
Unit : 1,000 kg (1,000 lb)

FG022014

Figure 16

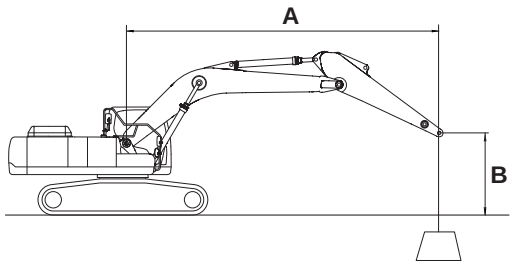
METRIC 1,000 kg

A (m) / B (m)	3		4.5		6		7.5		MAX. REACH		
											A (m)
9									* 9.58	* 9.58	3.94
7.5			* 8.15	* 8.15					* 6.99	5.37	5.93
6			* 8.49	8.48	* 6.73	5.30			* 5.99	3.97	7.08
4.5			* 9.48	7.96	* 7.19	5.11	5.57	3.57	5.23	3.34	7.78
3			* 10.61	7.29	7.71	4.83	5.46	3.46	4.79	3.04	8.14
1.5			* 10.97	6.79	7.43	4.58	5.33	3.35	4.66	2.94	8.21
0			* 10.23	6.60	7.26	4.43	5.25	3.28	4.80	3.01	8.00
-1.5	* 8.96	* 8.96	* 8.67	6.61	* 6.77	4.40			* 4.64	3.31	7.49
-3			* 6.21	* 6.21	* 4.69	4.50			* 3.58	* 3.58	6.60

FEET 1,000 lb

A (ft) / B (ft)	10		15		20		25		MAX. REACH		
											A (ft)
30									* 22.20	* 22.20	12.04
25			* 17.82	* 17.82					* 15.67	12.21	19.09
20			* 18.44	18.25	* 14.63	11.40			* 13.29	8.88	23.05
15			* 20.50	17.19	* 15.52	11.01	11.96	7.66	11.60	7.41	25.44
10			* 22.94	15.76	16.61	10.42	11.75	7.46	10.59	6.71	26.68
5			* 23.80	14.67	16.00	9.88	11.49	7.22	10.28	6.47	26.95
0			* 22.27	14.23	15.63	9.56	11.33	7.08	10.59	6.64	26.26
-5	* 20.51	* 20.51	* 18.86	14.23	* 14.62	9.49			* 10.20	7.30	24.55
-10			* 13.35	* 13.35	* 9.82	9.74			* 7.81	* 7.81	21.55

1. Load point is the end of the arm.
2. Capacities marked with an asterisk (*) are limited by hydraulic capacities.
3. Lift capacities shown do not exceed 75% of minimum tipping loads or 87% of hydraulic capacities.
4. The least stable position is over the side.
5. The total weight of machine is 22,000 kg (48,500 lb). Included are the; lower boom 3.1 m (10' 2"), upper boom 2.8 m (9' 2"), arm 2.4 m (7' 10"), 4,300 kg (9,480 lb) counterweight, without bucket all operating fluids and a 75 kg (165 lb) operator.
6. Lift capacities are in compliance with ISO 10567.



Track Width : 2.99 m (9' 10") STD Track
Boom : 5.7 m (18' 8")
Arm : 2.9 m (9' 6")
Bucket : Without Bucket
Counterweight : 4,300 kg (9,480 lb)
Shoe : 800 mm (32")
Dozer : Without Dozer
: Rating Over Front
: Rating Over Side or 360 degree
Unit : 1,000 kg (1,000 lb)

FG022015

Figure 17

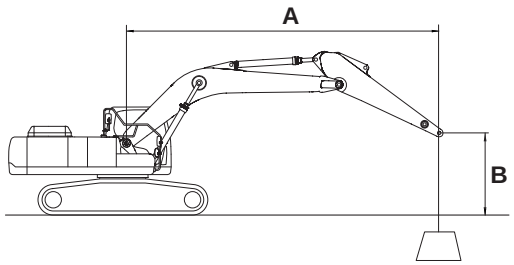
METRIC 1,000 kg

A (m) / B (m)	1.5		3		4.5		6		7.5		MAX. REACH		
													A (m)
7.5							* 5.47	5.45			* 5.54	5.12	6.22
6							* 5.39	* 5.39			* 5.41	3.90	7.32
4.5							* 5.92	5.28	* 5.47	3.71	5.13	3.32	8.00
3					* 8.68	7.68	* 6.74	5.03	5.59	3.60	4.72	3.04	8.35
1.5					* 10.29	7.17	* 7.56	4.78	5.46	3.48	4.60	2.94	8.42
0			* 6.15	* 6.15	* 11.05	6.90	7.45	4.61	5.37	3.39	4.71	3.00	8.22
-1.5	* 6.72	* 6.72	* 10.61	* 10.61	* 10.94	6.83	7.37	4.54	5.34	3.37	5.14	3.26	7.72
-3	* 11.43	* 11.43	* 13.89	13.43	* 9.98	6.90	* 7.41	4.59			* 6.10	3.86	6.86
-4.5			* 10.55	* 10.55	* 7.69	7.14					* 5.92	5.44	5.47

FEET 1,000 lb

A (ft) / B (ft)	5		10		15		20		25		MAX. REACH		
													A (ft)
25							* 12.26	11.66			* 12.26	11.61	20.06
20							* 11.83	11.72			* 11.94	8.70	23.85
15							* 12.89	11.37	* 12.00	7.97	11.37	7.37	26.16
10					* 18.71	16.58	* 14.63	10.84	12.03	7.75	10.43	6.71	27.37
5					* 22.23	15.47	* 16.39	10.32	11.76	7.50	10.13	6.47	27.63
0			* 14.11	* 14.11	* 23.94	14.86	16.03	9.95	11.56	7.32	10.39	6.60	26.96
-5	* 15.03	* 15.03	* 24.09	* 24.09	* 23.72	14.70	15.87	9.80	11.53	7.29	11.35	7.19	25.29
-10	* 25.67	* 25.67	* 30.10	28.77	* 21.57	14.87	* 15.93	9.91			* 13.44	8.59	22.38
-15			* 22.54	* 22.54	* 16.31	15.41					* 12.98	12.28	17.66

1. Load point is the end of the arm.
2. Capacities marked with an asterisk (*) are limited by hydraulic capacities.
3. Lift capacities shown do not exceed 75% of minimum tipping loads or 87% of hydraulic capacities.
4. The least stable position is over the side.
5. The total weight of machine is 21,700 kg (47,800 lb). Included are the; boom 5.7 m (18' 8"), arm 2.9 m (9' 6"), 4,300 kg (9,480 lb) counterweight, without bucket, all operating fluids and a 75 kg (165 lb) operator.
6. Lift capacities are in compliance with ISO 10567.



Track Width : 2.99 m (9' 10") STD Track
Boom : 5.7 m (18' 8")
Arm : 2.4 m (7' 10")
Bucket : Without Bucket
Counterweight : 4,300 kg (9,480 lb)
Shoe : 800 mm (32")
Dozer : Without Dozer
: Rating Over Front
: Rating Over Side or 360 degree
Unit : 1,000 kg (1,000 lb)

FG022016

Figure 18

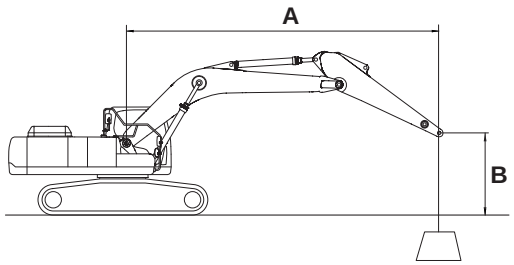
METRIC 1,000 kg

A (m) / B (m)	3		4.5		6		7.5		MAX. REACH		
											A (m)
7.5									* 6.19	5.93	5.64
6					* 5.93	5.39			* 5.94	4.33	6.84
4.5			* 7.61	* 7.61	* 6.39	5.24	5.68	3.68	5.61	3.64	7.56
3			* 9.38	7.57	* 7.16	5.01	5.59	3.61	5.13	3.31	7.93
1.5			* 10.78	7.13	7.64	4.79	5.49	3.51	4.99	3.20	8.00
0			* 11.21	6.95	7.49	4.66	5.42	3.45	5.15	3.29	7.78
-1.5	* 10.51	* 10.51	* 10.79	6.93	7.45	4.63			5.69	3.62	7.26
-3	* 12.73	* 12.73	* 9.49	7.05	* 6.95	4.72			* 6.32	4.42	6.33
-4.5			* 6.35	* 6.35					* 5.70	* 5.70	4.78

FEET 1,000 lb

A (ft) / B (ft)	10		15		20		25		MAX. REACH		
											A (ft)
25									* 13.73	13.57	18.08
20					* 13.04	11.59			* 13.12	9.69	22.23
15			* 16.42	* 16.42	* 13.92	11.29			12.44	8.07	24.70
10			* 20.22	16.35	* 15.53	10.80	12.04	7.77	11.33	7.32	25.98
5			* 23.29	15.39	16.45	10.34	11.82	7.57	11.01	7.06	26.25
0			* 24.30	14.97	16.13	10.05	11.69	7.45	11.35	7.25	25.54
-5	* 24.01	* 24.01	* 23.41	14.93	16.05	9.98			12.58	7.99	23.77
-10	* 27.60	* 27.60	* 20.49	15.19	* 14.80	10.21			* 13.91	9.83	20.65
-15			* 13.06	* 13.06					* 12.89	* 12.89	15.11

1. Load point is the end of the arm.
2. Capacities marked with an asterisk (*) are limited by hydraulic capacities.
3. Lift capacities shown do not exceed 75% of minimum tipping loads or 87% of hydraulic capacities.
4. The least stable position is over the side.
5. The total weight of machine is 21,600 kg (47,600 lb). Included are the; boom 5.7 m (18' 8"), arm 2.4 m (7' 10"), 4,300 kg (9,480 lb) counterweight, without bucket, all operating fluids and a 75 kg (165 lb) operator.
6. Lift capacities are in compliance with ISO 10567.



Track Width : 2.99 m (9' 10") STD Track
Boom : 5.7 m (18' 8")
Arm : 3.5 m (11' 6")
Bucket : Without Bucket
Counterweight : 4,300 kg (9,480 lb)
Shoe : 800 mm (32")
Dozer : Without Dozer
: Rating Over Front
: Rating Over Side or 360 degree
Unit : 1,000 kg (1,000 lb)

FG022017

Figure 19

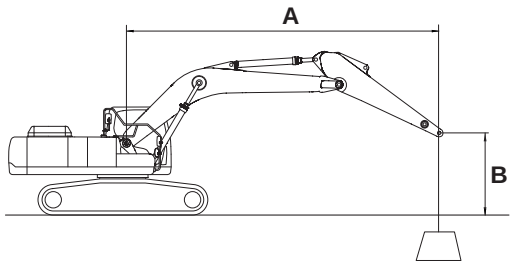
METRIC 1,000 kg

A (m) / B (m)	1.5		3		4.5		6		7.5		MAX. REACH		
													A (m)
7.5											* 4.91	4.39	6.89
6									* 4.81	3.81	* 4.87	3.47	7.90
4.5							* 5.34	* 5.34	* 5.00	3.74	4.64	3.00	8.53
3			* 11.80	* 11.80	* 7.78	* 7.78	* 6.21	5.07	* 5.41	3.60	4.30	2.75	8.86
1.5					* 9.59	7.24	* 7.13	4.79	5.45	3.46	4.18	2.66	8.92
0			* 7.42	* 7.42	* 10.70	6.86	7.41	4.57	5.32	3.34	4.27	2.69	8.73
-1.5	* 6.56	* 6.56	* 10.42	* 10.42	* 10.95	6.71	7.29	4.46	5.25	3.28	4.59	2.89	8.26
-3	* 10.17	* 10.17	* 14.96	13.09	* 10.37	6.73	7.28	4.46			5.33	3.34	7.47
-4.5	* 14.90	* 14.90	* 12.24	* 12.24	* 8.74	6.90	* 6.24	4.60			* 5.85	4.40	6.22

FEET 1,000 lb

A (ft) / B (ft)	5		10		15		20		25		MAX. REACH		
													A (ft)
25											* 10.84	9.93	22.26
20									* 10.63	8.16	* 10.73	7.74	25.74
15							* 11.63	11.52	* 10.94	8.04	10.29	6.64	27.90
10			* 25.17	* 25.17	* 16.79	* 16.79	* 13.48	10.94	* 11.80	7.76	9.50	6.08	29.03
5					* 20.73	15.61	* 15.45	10.32	11.73	7.45	9.23	5.86	29.28
0			* 16.89	* 16.89	* 23.18	14.78	15.95	9.86	11.46	7.21	9.40	5.94	28.65
-5	* 14.65	* 14.65	* 23.60	* 23.60	* 23.73	14.45	15.68	9.61	11.33	7.09	10.14	6.37	27.08
-10	* 22.79	* 22.79	* 32.40	28.04	* 22.44	14.49	15.69	9.62			11.80	7.40	24.41
-15	* 33.62	* 33.62	* 26.29	* 26.29	* 18.71	14.88	* 13.10	9.96			* 12.89	9.87	20.16

1. Load point is the end of the arm.
2. Capacities marked with an asterisk (*) are limited by hydraulic capacities.
3. Lift capacities shown do not exceed 75% of minimum tipping loads or 87% of hydraulic capacities.
4. The least stable position is over the side.
5. The total weight of machine is 21,800 kg (48,100 lb). Included are the; boom 5.7 m (18' 8"), arm 3.5 m (11' 6"), 4,300 kg (9,480 lb) counterweight, without bucket, all operating fluids and a 75 kg (165 lb) operator.
6. Lift capacities are in compliance with ISO 10567.



Track Width : 2.99 m (9' 10") STD Track
Boom : 8.5 m (27' 11")
Arm : 6.2 m (20' 4")
Bucket : Without Bucket
Counterweight : 5,300 kg (11,685 lb)
Shoe : 800 mm (32")
Dozer : Without Dozer
: Rating Over Front
: Rating Over Side or 360 degree
Unit : 1,000 kg (1,000 lb)

FG022018

Figure 20

METRIC

1,000 kg

A (m) / B (m)	1.5		3		4.5		6		7.5	
12										
10.5										
9										
7.5										
6										
4.5										
3			* 9.26	* 9.26	* 6.25	* 6.25	* 4.66	* 4.66	* 3.82	* 3.82
1.5					* 7.91	7.15	* 5.58	4.85	* 4.38	3.56
0			* 3.74	* 3.74	* 7.36	6.45	* 6.30	4.41	* 4.86	3.27
-1.5	* 3.61	* 3.61	* 4.53	* 4.53	* 7.13	6.13	* 6.75	4.14	5.14	3.07
-3	* 4.58	* 4.58	* 5.50	* 5.50	* 7.78	6.02	6.93	4.00	5.00	2.95
-4.5	* 5.59	* 5.59	* 6.62	* 6.62	* 8.89	6.04	* 6.87	3.96	4.95	2.90
-6	* 6.69	* 6.69	* 7.90	* 7.90	* 8.64	6.15	* 6.57	4.00	4.97	2.91
-7.5	* 7.90	* 7.90	* 9.42	* 9.42	* 7.75	6.35	* 5.99	4.12	* 4.79	2.99
-9			* 8.57	* 8.57	* 6.37	* 6.37	* 5.00	4.32	* 3.96	3.16

METRIC 1,000 kg

A (m) / B (m)	9		10.5		12		13.5		MAX. REACH		
											A (m)
12									* 2.06	* 2.06	9.81
10.5			* 2.39	* 2.39					* 1.91	* 1.91	11.17
9			* 2.34	* 2.34	* 2.27	1.98			* 1.83	* 1.83	12.19
7.5			* 2.40	* 2.40	* 2.40	1.98			* 1.79	1.65	12.97
6			* 2.54	2.52	* 2.47	1.94	* 1.84	1.49	* 1.79	1.48	13.52
4.5	* 2.96	* 2.96	* 2.74	2.40	* 2.58	1.87	2.39	1.46	* 1.81	1.36	13.90
3	* 3.31	2.93	* 2.97	2.27	* 2.73	1.78	2.34	1.41	* 1.86	1.28	14.10
1.5	* 3.67	2.72	* 3.21	2.13	2.77	1.69	2.28	1.36	* 1.95	1.23	14.14
0	* 4.00	2.53	3.29	2.01	2.69	1.61	2.23	1.31	* 2.07	1.22	14.02
-1.5	3.97	2.39	3.19	1.91	2.62	1.55	2.20	1.28	2.14	1.24	13.74
-3	3.87	2.29	3.12	1.84	2.58	1.51			2.24	1.30	13.27
-4.5	3.83	2.25	3.09	1.81	2.57	1.50			2.41	1.41	12.62
-6	3.84	2.26	3.11	1.83					2.70	1.59	11.73
-7.5	* 3.87	2.33	* 3.05	1.92					* 3.00	1.91	10.57
-9	* 2.99	2.50							* 2.99	2.50	9.00

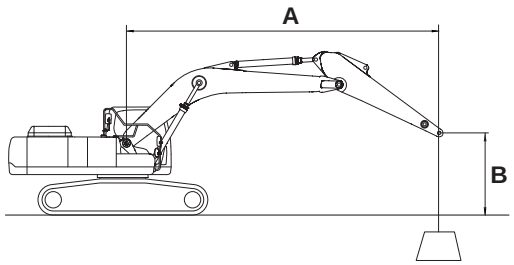
FEET 1,000 lb

A (ft) / B (ft)	5		10		15		20		25	
										
35										
30										
25										
20										
15										
10			* 21.84	* 21.84	* 13.42	* 13.42	* 10.07	* 10.07	* 8.28	* 8.28
5					* 17.04	15.47	* 12.05	10.49	* 9.49	7.67
0			* 8.41	* 8.41	* 16.84	13.93	* 13.62	9.53	* 10.53	7.06
-5	* 8.00	* 8.00	* 10.12	* 10.12	* 16.14	13.20	* 14.61	8.92	11.07	6.62
-10	* 10.18	* 10.18	* 12.31	* 12.31	* 17.57	12.96	14.90	8.62	10.78	6.36
-15	* 12.46	* 12.46	* 14.82	* 14.82	* 19.93	13.00	14.81	8.54	10.67	6.25
-20	* 14.93	* 14.93	* 17.73	* 17.73	* 18.68	13.25	* 14.21	8.63	10.71	6.29
-25	* 17.68	* 17.68	* 21.21	* 21.21	* 16.65	13.69	* 12.87	8.90	* 10.27	6.48
-30			* 18.14	* 18.14	* 13.52	* 13.52	* 10.58	9.36	* 8.30	6.86

FEET 1,000 lb

A (ft) / B (ft)	30		35		40		45		MAX. REACH		
											A (ft)
35			* 5.34	* 5.34					* 4.24	* 4.24	36.24
30			* 5.18	* 5.18					* 4.05	* 4.05	39.72
25			* 5.28	* 5.28	* 5.29	4.22			* 3.95	3.68	42.37
20			* 5.56	5.40	* 5.41	4.14			* 3.94	3.28	44.27
15	* 6.43	* 6.43	* 5.97	5.16	* 5.65	4.00	* 5.02	3.10	* 3.99	3.01	45.54
10	* 7.19	6.30	* 6.46	4.87	* 5.96	3.82	5.01	3.00	* 4.10	2.82	46.25
5	* 7.96	5.85	* 6.97	4.58	5.97	3.63	4.90	2.90	* 4.29	2.72	46.40
0	* 8.67	5.45	7.09	4.31	5.79	3.46	4.80	2.80	* 4.56	2.69	46.00
-5	8.56	5.14	6.86	4.10	5.64	3.33	4.74	2.74	4.73	2.74	45.06
-10	8.34	4.94	6.72	3.96	5.56	3.25			4.95	2.87	43.49
-15	8.25	4.85	6.66	3.91	5.56	3.25			5.34	3.12	41.29
-20	8.28	4.88	6.72	3.96					6.00	3.55	38.28
-25	* 8.25	5.05							* 6.63	4.28	34.31
-30									* 6.57	5.71	28.91

1. Load point is the end of the arm.
2. Capacities marked with an asterisk (*) are limited by hydraulic capacities.
3. Lift capacities shown do not exceed 75% of minimum tipping loads or 87% of hydraulic capacities.
4. The least stable position is over the side.
5. The total weight of machine is 23,500 kg (51,800 lb). Included are the; boom 8.5 m (27' 11"), arm 6.2 m (20' 4"), 5,300 kg (11,684 lb) counterweight, without bucket, all operating fluids and a 75 kg (165 lb) operator.
6. Lift capacities are in compliance with ISO 10567.



Track Width : 2.99 m (9' 10") STD Track
Boom : 8.5 m (27' 11")
Arm : 6.2 m (20' 4")
Bucket : Without Bucket
Counterweight : 5,300 kg (11,685 lb)
Shoe : 900 mm (36")
Dozer : Without Dozer
: Rating Over Front
: Rating Over Side or 360 degree
Unit : 1,000 kg (1,000 lb)

FG022019

Figure 21

METRIC

1,000 kg

A (m) / B (m)	1.5		3		4.5		6		7.5	
12										
10.5										
9										
7.5										
6										
4.5										
3			* 9.26	* 9.26	* 6.25	* 6.25	* 4.66	* 4.66	* 3.82	* 3.82
1.5					* 7.91	7.24	* 5.58	4.91	* 4.38	3.60
0			* 3.74	* 3.74	* 7.36	6.54	* 6.30	4.47	* 4.86	3.32
-1.5	* 3.61	* 3.61	* 4.53	* 4.53	* 7.13	6.21	* 6.75	4.20	* 5.21	3.12
-3	* 4.58	* 4.58	* 5.50	* 5.50	* 7.78	6.11	* 6.93	4.06	5.08	2.99
-4.5	* 5.59	* 5.59	* 6.62	* 6.62	* 8.89	6.12	* 6.87	4.02	5.02	2.94
-6	* 6.69	* 6.69	* 7.90	* 7.90	* 8.64	6.24	* 6.57	4.06	5.04	2.96
-7.5	* 7.90	* 7.90	* 9.42	* 9.42	* 7.75	6.43	* 5.99	4.17	* 4.79	3.04
-9			* 8.57	* 8.57	* 6.37	* 6.37	* 5.00	4.38	* 3.96	3.20

METRIC 1,000 kg

A (m) / B (m)	9		10.5		12		13.5		MAX. REACH		
											A (m)
12									* 2.06	* 2.06	9.81
10.5			* 2.39	* 2.39					* 1.91	* 1.91	11.17
9			* 2.34	* 2.34	* 2.27	2.01			* 1.83	* 1.83	12.19
7.5			* 2.40	* 2.40	* 2.40	2.01			* 1.79	1.68	12.97
6			* 2.54	* 2.54	* 2.47	1.96	* 1.84	1.51	* 1.79	1.50	13.52
4.5	* 2.96	* 2.96	* 2.74	2.43	* 2.58	1.89	2.42	1.48	* 1.81	1.38	13.90
3	* 3.31	2.96	* 2.97	2.30	* 2.73	1.81	2.37	1.43	* 1.86	1.30	14.10
1.5	* 3.67	2.75	* 3.21	2.16	2.82	1.72	2.32	1.38	* 1.95	1.26	14.14
0	* 4.00	2.57	3.34	2.04	2.73	1.64	2.27	1.33	* 2.07	1.24	14.02
-1.5	4.03	2.42	3.23	1.94	2.66	1.57	2.23	1.30	2.18	1.26	13.74
-3	3.93	2.33	3.16	1.87	2.62	1.53			2.28	1.32	13.27
-4.5	3.88	2.29	3.14	1.84	2.61	1.53			2.45	1.43	12.62
-6	3.89	2.30	3.16	1.86					2.74	1.62	11.73
-7.5	* 3.87	2.37	* 3.05	1.95					* 3.00	1.94	10.57
-9	* 2.99	2.53							* 2.99	2.54	9.00

FEET 1,000 lb

A (ft) / B (ft)	5		10		15		20		25	
										
35										
30										
25										
20										
15										
10			* 21.84	* 21.84	* 13.42	* 13.42	* 10.07	* 10.07	* 8.28	* 8.28
5					* 17.04	15.65	* 12.05	10.61	* 9.49	7.77
0			* 8.41	* 8.41	* 16.84	14.11	* 13.62	9.66	* 10.53	7.16
-5	* 8.00	* 8.00	* 10.12	* 10.12	* 16.14	13.39	* 14.61	9.05	11.23	6.72
-10	* 10.18	* 10.18	* 12.31	* 12.31	* 17.57	13.14	* 15.01	8.74	10.94	6.45
-15	* 12.46	* 12.46	* 14.82	* 14.82	* 19.93	13.19	* 14.88	8.66	10.82	6.35
-20	* 14.93	* 14.93	* 17.73	* 17.73	* 18.68	13.43	* 14.21	8.76	10.86	6.38
-25	* 17.68	* 17.68	* 21.21	* 21.21	* 16.65	13.88	* 12.87	9.02	* 10.27	6.57
-30			* 18.14	* 18.14	* 13.52	* 13.52	* 10.58	9.48	* 8.30	6.95

FEET 1,000 lb

A (ft) / B (ft)	30		35		40		45		MAX. REACH		
											A (ft)
35			* 5.34	* 5.34					* 4.24	* 4.24	36.24
30			* 5.18	* 5.18					* 4.05	* 4.05	39.72
25			* 5.28	* 5.28	* 5.29	4.28			* 3.95	3.73	42.37
20			* 5.56	5.46	* 5.41	4.20			* 3.94	3.33	44.27
15	* 6.43	* 6.43	* 5.97	5.22	* 5.65	4.05	* 5.02	3.15	* 3.99	3.06	45.54
10	* 7.19	6.38	* 6.46	4.93	* 5.96	3.87	5.09	3.05	* 4.10	2.87	46.25
5	* 7.96	5.93	* 6.97	4.64	6.05	3.69	4.98	2.95	* 4.29	2.77	46.40
0	* 8.67	5.53	7.19	4.38	5.87	3.52	4.88	2.85	* 4.56	2.74	46.00
-5	8.68	5.22	6.97	4.16	5.73	3.38	4.81	2.79	4.80	2.78	45.06
-10	8.46	5.02	6.82	4.03	5.65	3.30			5.03	2.92	43.49
-15	8.37	4.93	6.76	3.97	5.65	3.30			5.42	3.17	41.29
-20	8.40	4.96	6.82	4.03					6.09	3.60	38.28
-25	* 8.25	5.13							* 6.63	4.35	34.31
-30									* 6.57	5.79	28.91

1. Load point is the end of the arm.
2. Capacities marked with an asterisk (*) are limited by hydraulic capacities.
3. Lift capacities shown do not exceed 75% of minimum tipping loads or 87% of hydraulic capacities.
4. The least stable position is over the side.
5. The total weight of machine is 23,800 kg (52,500 lb). Included are the; boom 8.5 m (27' 11"), arm 6.2 m (20' 4"), 5,300 kg (11,684 lb) counterweight, without bucket, all operating fluids and a 75 kg (165 lb) operator.
6. Lift capacities are in compliance with ISO 10567.

APPROXIMATE WEIGHT OF WORKLOAD MATERIALS

IMPORTANT

Weights are approximations of estimated average volume and mass. Exposure to rain, snow or groundwater; settling or compaction because of overhead weight and chemical or industrial processing or changes because of thermal or chemical transformations could all increase value of weights listed in table.

Material	Density 1,200 kg/m^3 (2,000 lb/yd^3), or less	Density 1,500 kg/m^3 (2,500 lb/yd^3), or less	Density 1,800 kg/m^3 (3,000 lb/yd^3), or less	Density 2,100 kg/m^3 (3,500 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)	-
Gypsum, calcined, (heated, powder)	961 kg/m^3 (1,620 lb/yd^3)	-	-	-

Material	Density 1,200 kg/m³ (2,000 lb/yd³), or less	Density 1,500 kg/m³ (2,500 lb/yd³), or less	Density 1,800 kg/m³ (3,000 lb/yd³), or less	Density 2,100 kg/m³ (3,500 lb/yd³), or less
Gypsum, crushed to 3 inch size	-	-	1,522 kg/m³ (2,565 lb/yd³)	-
Gravel, DRY, packed fragments	-	-	-	1,810 kg/m³ (3,051 lb/yd³)
Gravel, WET, packed fragments	-	-	-	1,922 kg/m³ (3,240 lb/yd³)
Limestone, graded above 2	-	1,282 kg/m³ (2,160 lb/yd³)	-	-
Limestone, graded 1-1/2 or 2	-	1,362 kg/m³ (2,295 lb/yd³)	-	-
Limestone, crushed	-	-	1,522 kg/m³ (2,565 lb/yd³)	-
Limestone, fine	-	-	1,602 kg/m³ (2,705 lb/yd³)	-
Phosphate, rock	-	1,282 kg/m³ (2,160 lb/yd³)	-	-
Salt	929 kg/m³ (1,566 lb/yd³)	-	-	-
Snow, light density	529 kg/m³ (891 lb/yd³)	-	-	-
Sand, DRY, loose	-	-	1,522 kg/m³ (2,565 lb/yd³)	-
Sand, WET, packed	-	-	-	1,922 kg/m³ (3,240 lb/yd³)
Shale, broken	-	1,362 kg/m³ (2,295 lb/yd³)	-	-
Sulfur, broken	529 kg/m³ (891 lb/yd³)	-	-	-

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