DOOSAN

950106-00984BNA-2
January 2015

WHEEL LOADER

Operation & Maintenance Manual

DL250-3 / DL250TC-3

Serial Number 10001 and Up

⚠ 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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Operation & Maintenance Manual
DL250-3 / DL250TC-3 WHEEL LOADER

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Table of Contents

Foreword

This Operation & 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

DL250-3, DL250TC-3 has a Doosan DL06K 5.9 liter engine. The engine has intercooling and is fitted with common rail system. The common rail system is positioned at an angle above the pistons and are controlled by the camshaft and a engine management system (EMS). The cylinder head covers all cylinders. The accelerator position is transferred electrically from accelerator pedal.

Electrical System

The machine has three control units. The Gauge Panel provides the operator with information and is integrated with the display unit, warning lights and instruments. The Vehicle Controller (for the machine) receives signals from sensors on the machine and these are transmitted to the Gauge Panel. The E-ECU controls the engine.

Power Transmission

The transmission is electro hydraulically controlled, where all gears are in constant mesh. The gear ranges are achieved by applying different combinations of clutches. Between the engine and transmission gears there is a hydraulic torque converter, which controls the output torque. The front and rear axles have planetary gears in the wheel hubs and this reduces the stress on the respective driveshafts. The axle's differentials use a LSD (Limited Slip Differential) design or DHL (Differential Hydraulic Lock) design (optional).

Brake System

The machine is provided with a dual circuit, all hydraulic, brake system with one circuit for each axle. Each circuit meets the requirements for secondary brake capability.

Parking Brake

The parking brake is a dry disk brake built into the transmission output shaft. The brake is applied by spring force and is released hydraulically.

Power Steering System

The machine uses a load sensing, hydraulic power steering system. It has a steering arc of 40°.

Cabin

The cabin has a heating and ventilation system with defrosting for front and rear windows. Air-conditioning is standard. The cabin has two emergency exits, the door and right side window.

FOPS and ROPS

The cabin is approved as a protective cabin according to FOPS and ROPS standards. (FOPS-ISO 3449, ROPS-ISO 3471) FOPS is an abbreviation of Falling Object Protective Structure (overhead protection) and ROPS is an abbreviation of Roll-over Protective Structure (roll-over protection) for a seat belted operator.

Never perform any unauthorized alterations to the cabin, e.g. lowering the roof height, drilling, welding on brackets for fire extinguisher, radio aerial or other equipment, without Doosan approval.

Hydraulic System

The hydraulic system is load sensing with piston pumps. Working and steering system is composed of integrated hydraulic line using priority valve. However, brake, pilot and fan systems are controlled by one piston pump.

Equipment (Optional)

The machine can be provided with different types of optional equipment, depending on the requirements of different markets. Examples of such equipment are lever steering, Boom Suspension System (LIS), secondary steering, separate attachment locking.

CE MARKING, EMC DIRECTIVE

CE Marking

(Declaration of Conformity)

(Only applies to machines marketed within the EU/EEA)

This machine is CE marked. This means that when delivered the machine meets the applicable "Essential Health and Safety Requirements", which are given in the Machinery Safety Directive, 98/37EC.

Any person performing changes that affect the safety of the machine, is also responsible for the same.

As proof that requirements are met, the machine is supplied with an EU Declaration of Conformity, issued by DOOSAN CE for each machine. This EU declaration also covers attachments manufactured by DOOSAN CE. The documentation must be retained for at least ten years. The document should always accompany the machine when it is sold or transferred.

If the machine is used for other purposes or with other attachments than described in this manual, the person performing such action is also responsible for the action. In some cases, it may require a new CE marking and the issue of a new EU Declaration of Conformity.

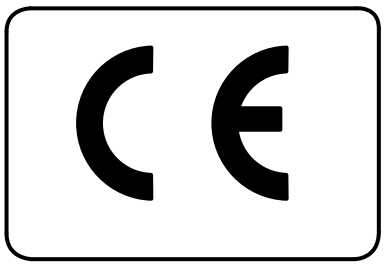

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Figure 1

EU EMC Directive

The electronic equipment of the machine may in some cases cause interference to other electronic equipment, or suffer from external electromagnetic interference, which may constitute safety risks.

The EU EMC directive on "Electromagnetic Compatibility", 89/336/EEC, provides a general description of what requirements the machine must comply with according to international standards.

A machine or device which meets the requirements must be CE marked. Doosan machines have been tested particularly for electromagnetic interference. The CE marking of the machine and the Declaration of Conformity also cover the EMC directive.

If other electronic equipment is fitted to this machine, the equipment must be CE marked and tested on the machine for electromagnetic interference.

COMMUNICATION EQUIPMENT INSTALLATION

IMPORTANT

All installation of optional communication equipment must be done by trained professionals and according to the DOOSAN CE instructions applicable to the machine.

Protection Against Electromagnetic Interference

This machine has been tested according to EU directive 89/336/EEC governing electromagnetic interference. It is therefore important to test all non approved electronic accessories, such as communication equipment, before installation and use, since they could cause electromagnetic interference to the electronic systems of the machine.

PRODUCT PLATES

With the aid of the product plates, shown below, it is possible to identify the machine and its components. The Product Identification Number (PIN) indicates the model designation, engine code and serial number of the machine. The Component Identification Number (CIN) indicates the serial number of the component. Make a note of the identification numbers.

When ordering spare parts, and in all telephone inquiries or correspondence, the PIN and CIN, of the machine, must always be referenced.

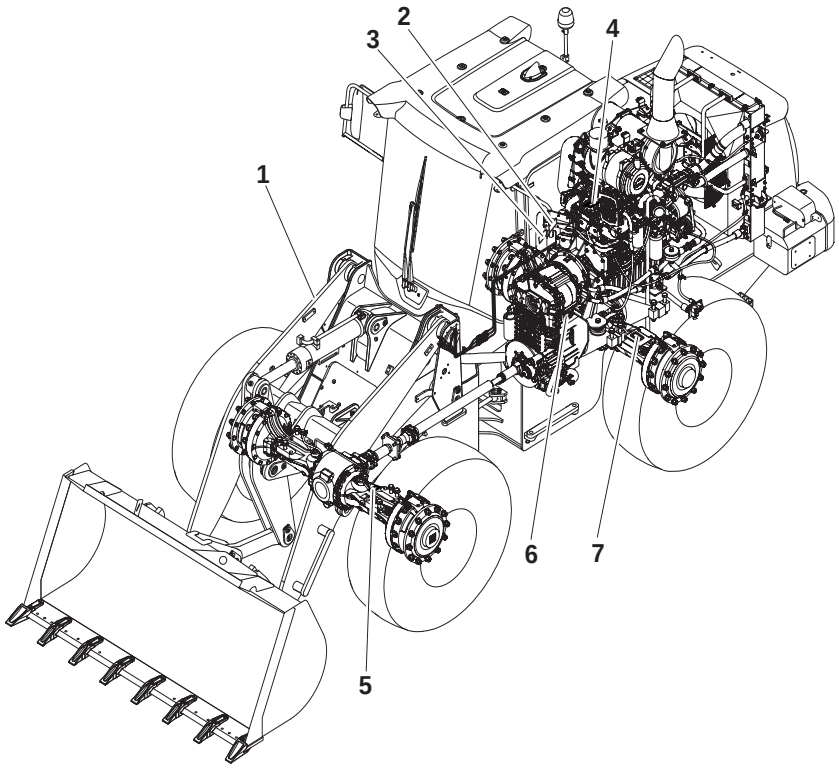

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Figure 2

Reference Number	Description	
1	Product Plate	The manufacturer's name and address, machine PIN. Operating weight, year of manufacture, year of delivery and position of CE mark (EU/EEA countries only) (stamped into right side).
2	Specification Plate	Operating weight, overall length, overall width, overall height, ground clearance engine output, tire, turning radius, bucket capacity, dumping reach, dumping clearance.
3	Cabin	The manufacturer's name and address, serial number, machine model designation, operating weight, cabin serial number, ROPS/FOPS number and ROPS/FOPS certificate number.
4	Engine	The engine type designation and number.
5	Front Axle	The manufacturer's name and address and front drive axle CIN.
6	Transmission	The manufacturer's name and address and transmission CIN.
7	Rear Axle	The manufacturer's name and address and rear drive axle CIN.

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 & Maintenance Manual delivered with the machine.

FG020060

Figure 3

FEDERAL EMISSION CONTROL SYSTEMS

Emission Control System Warranty Statement

General Warranty Provisions

The emission control systems of your new Scania Engines "SCANIA" industrial diesel engine were designed, built and tested using genuine parts, and were certified as being in conformity with federal emission control regulations. Scania warrants to the original owner, and to each subsequent owner, of a new Scania industrial diesel engine "You" that engine:

1. Was designed, built and equipped so as to conform at the time of sale with all applicable regulations under Section 213 of the Clean Air Act, 42 U.S.C. section 7547, for their full useful life and designed, built and equipped so as to conform with all applicable regulations adopted by the California Air Resources Board pursuant to its authority under Chapters 1 and 2, Part 5, Division 26 of the California Health and Safety Code, and:
2. Is free from defects in material and workmanship which would cause such engine to fail to conform to applicable regulations for its warranty period or otherwise cause the failure of a warranted part to be identical in all material respects to the part as described in the engine manufacturer's application for certification.

Where a warrantable condition exists, Scania will repair your heavy-duty off-road engine at no cost to you including diagnosis, parts, and labor.

Warranty Period

This warranty shall apply for one of the following periods, whichever occurs first:

- 3,000 hours of operation as determined by a device to measure hours of use, or
- Five years

Each engine is equipped with a device to measure hours of use. If that device fails to account for hours of use because of defects in materials or workmanship, the engine shall be warranted for a period of five years. The warranty period shall begin on the date the engine is delivered to the first ultimate purchaser who, in good faith, purchases the engine for purposes other than imminent resale.

The Warranty on Emission-related Parts Shall be Interpreted as Follows:

1. Any warranted part which is not scheduled for replacement as required maintenance in Scania's written instructions for maintenance and use of the engine by owner shall be warranted for the warranty period defined above. If any such part fails during the period of warranty coverage, it shall be repaired or replaced by the engine manufacturer according to Subsection (4) below. Any such part repaired or replaced under the warranty shall be warranted for the remaining warranty period.
2. Any warranted part which is scheduled only for regular inspection in Scania's written instructions for maintenance and use of the engine by owner shall be warranted for the warranty period defined above. A statement in such written instructions to the effect of "repair or replace as necessary" shall not reduce the period of warranty coverage. Any such part repaired or replaced under warranty shall be warranted for the remaining warranty period.
3. Any warranted part which is scheduled for replacement as required maintenance in Scania's written instructions for maintenance and use of the engine by owner shall be warranted for the period of time before the first scheduled replacement point for that part. If the part fails before the first scheduled replacement, the part shall be repaired or replaced by the engine manufacturer according to Subsection below. Any such part repaired or replaced under warranty shall be warranted for the remainder of the period before the first scheduled replacement point for the part.
4. Repair or replacement of any warranted part under the warranty provisions of this article shall be performed at no charge to the owner at a warranty station.
5. Notwithstanding the provisions of Subsection (4) above, warranty services or repairs shall be provided at all manufacturer distribution centers that are franchised to serve the subject engines.
6. The owner shall not be charged for diagnostic labor that leads to the determination that a warranted part is in fact defective provided that such diagnostic work is performed at a warranty station.
7. The engine manufacturer shall be liable for damages to other engine components proximately caused by a failure under warranty of any warranted part.
8. Throughout the engine's warranty period defined above, the engine manufacturer shall maintain a supply of warranted parts sufficient to meet the expected demand for such parts.
9. Any replacement part, as defined in Section 1900 (b), Title 13 of the California Code of Regulations, may be used in the performance of any maintenance or repairs and must be provided without charge to the owner.

It is not necessary for replacement parts to be the same brand or by the same manufacturer as the original part sold with the engine. Such use shall not reduce the warranty obligations of the engine manufacturer.

10. Add-on or modified parts, as defined in Section 1900 (b), Title 13 of the California Code of Regulations, that are not exempted by the California Air Resources Board may not be used. The use of any nonexempt add-on or modified parts shall be grounds for disallowing a warranty claim made according to this article. The engine manufacturer shall not be liable under this article to warrant failures of warranted parts caused by the use of a nonexempt add-on or modified part.
11. The Executive Officer of the California Air Resources Board may request, and in such case, the engine manufacturer shall provide, any documents which describe that manufacturer's warranty procedures or policies.

Parts Covered by the Warranty

The following is a list of parts considered to be part of the Emission Control Systems covered by the Emission Warranty for Scania industrial engines which were built to conform to federal and California emission control regulations:

1. Fuel injection system
2. Air Induction System:
   - A. Intake manifold
   - B. Turbocharger system
   - C. Charge air cooling system
3. Exhaust manifold system
4. Smoke puff limiter (included in ECU)
5. Oil fill cap
6. Complete SCR System
   - A. DEF (AdBlue) tank
   - B. DEF (AdBlue) tank level sensor
   - C. DEF (AdBlue) tank pump
   - D. DEF (AdBlue) tank temperature sensor
   - E. DEF (AdBlue) hose
   - F. DEF (AdBlue) injector
   - G. DEF(AdBlue) injector pressure sensor
   - H. DEF (AdBlue) injector temperature sensor
   - I. Catalyst temperature sensor
   - J. SCR control unit (EEC3)
   - K. SCR Catalyst
   - L. NOX sensor

7. Miscellaneous items used in the above systems:

   A. Electronic control unit (ECU), sensors, wiring harnesses

   B. Hoses, belts, connectors, assemblies, clamps, fittings tubing, sealing gaskets or devices and mounting hardware

   C. Pulleys, belts and idlers

   D. Emission control information label

IMPORTANT

This list does not include all expendable maintenance parts.

- **Expendable emission related parts requiring scheduled maintenance are warranted until their first scheduled replacement point.**
- **Emission related parts scheduled for inspection and replacement only as necessary are not considered expendable and if repaired or replaced under warranty shall be warranted for the remaining warranty period.**

See Specific Warranty Exclusions below.

General Warranty Limitations

To retain the dependability of the exhaust emission control originally built into your Scania industrial diesel engine, it is essential that engine is installed according to Scania installation instructions and emission certificates. Your engine is designed to operate on diesel fuel only. Use of any other fuel can result in your engine no longer operating in compliance with state or federal emissions requirements. The use of alternative fuels shall not void the warranties on any engine certified if the fuel is approved for use.

In addition, as the engine owner, you are responsible for the performance of all scheduled maintenance listed in your owner's manual, and all necessary repairs, on your new Scania industrial diesel engine. Scania may deny a warranty claim if the engine or part has failed because of abuse, neglect, improper maintenance or unapproved modifications.

Receipts covering the performance of regular maintenance must be retained in the event questions arise concerning maintenance. The receipts must be transferred to each subsequent owner of the engine with the emission warranted engine. Scania cannot, however, deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

The Warranty covers the cost of diagnosis, repair and replacement parts and services of warranted components and systems performed by an authorized Scania distributor or dealer using genuine Scania parts. You may elect to have maintenance, replacement or repair of these components and systems performed by any repair establishment or individual without invalidating the Warranty.

The use of other than Scania replacement parts also does not invalidate the warranty on other components unless such parts cause damage to warranted parts. However, the cost of such services or parts will not be covered by the Warranty.

You are responsible for initiating the warranty process. The California Air Resources Board suggests that you present your heavy-duty off-road engine to an authorized Scania dealer as soon as a problem exists. The warranty repairs must be completed by the dealer as expeditiously as possible.

WARNING

AVOID DEATH OR SERIOUS INJURY

Use of replacement parts which are not of equivalent quality may impair the effectiveness of emission control systems. Accordingly, it is recommended that only Scania repair or replacement parts be used for maintenance, repair or replacement of emission control systems.

If other than Scania parts are used for maintenance, repair or replacement, the owner should obtain assurance that such parts are warranted by their manufacturer to be equivalent to genuine Scania parts.

Specific Warranty Exclusions

This warranty does not cover:

1. Malfunctions in any part caused by any of the following: misuse, abuse, improper adjustments, modifications, alteration, tampering, disconnection, improper or inadequate maintenance, or use of fuels not recommended for the engine as described in the Operator's Manual.
2. Engine installation, including cooling system, intake system and exhaust system installation, that is not completed according to the Scania installation instructions and emissions certificate for this engine type.
3. Damage resulting from accidents, acts of nature or other events beyond the control of Scania.
4. The replacement of expendable maintenance items such as filters, hoses, belts, oil, thermostat, exhaust system and coolant made in connection with scheduled maintenance services once these parts have been replaced.
5. Replacement items which are not genuine Scania parts or not authorized by Scania.

6. Inconvenience, loss of use of the engine or commercial loss.
7. Any engine on which the actual use cannot be accurately determined because of a failure of the device to track hours of use unrelated to defects in materials or workmanship.
8. Any engine operating outside the United States.

Customer Support

If the you do not receive the warranty service to which you believe you are entitled under the Warranty provisions, or if you need additional support or information concerning the Warranty, contact your Doosan or Scania engine distributor.

California Emission Control Warranty Statement

Your Warranty Rights and Obligations

The California Air Resources Board is pleased to explain the emission control system warranty on your 2011 engine. In California, new heavy-duty off-road engines must be designed, built, and equipped to meet the State's stringent anti-smog standards. Scania CV AB must warrant the emission control system on your engine for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your engine.

Your emission control system may include parts such as the fuel-injection system and the air induction system. Also included may be hoses, belts, connectors and other emission-related assemblies.

Where a warrantable condition exists, Scania CV AB 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 a period of 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 Scania CV AB.

Owner's Warranty Responsibilities

- As the heavy-duty off-road engine owner, you are responsible for the performance of the required maintenance listed in your owner's manual. Scania CV AB recommends that you retain all receipts covering maintenance on your heavy-duty off-road engine, but Scania CV AB 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 Scania CV AB may deny you warranty coverage if your heavy-duty off-road engine or a part has failed because of abuse, neglect, improper maintenance or unapproved modifications.
- Your engine is designed to operate on Diesel fuel only. Use of any other fuel can result in your engine no longer operating in compliance with California's emissions requirements.
- You are responsible for initiating the warranty process. The ARB suggests that you present your heavy-duty off-road engine to a Scania CV AB dealer as soon as a problem exists. The warranty repairs must be completed by the dealer as expeditiously as possible.
- If you have any questions regarding your warranty rights and responsibilities, you should contact Scania USA, Inc at 1-210-403-0007.

Catalytic Converter

WARNING

AVOID DEATH OR SERIOUS INJURY

The SCR catalytic converter contains vanadium pentoxide, a chemical known to the State of California to cause cancer.

The SCR converter is fitted in the silencer and does not constitute a health hazard during normal use and handling.

When performing work on the SCR catalytic converter which can result in exposure to dust, safety precautions must be taken. Such work includes, for example, opening the silencer machining and scrapping the catalytic converter.

Safety precautions when working on the SCR-system.

- Inhalation: If dust is inhaled, the person must be provided with fresh air immediately. Then seek medical attention.
- Eye contact: Rinse eyes with water immediately. If irritation persists, seek immediate medical attention.
- Skin contact: Wash with water and soap. Remove contaminated clothes.
- Ingestion: If large amounts have been ingested, drink plenty of water and induce vomiting. Then seek medical attention.

Environmental hazards

- Vanadium pentoxide is toxic to water organisms and can cause detrimental long term effects to water environment.

Environmental protection measures

- The SCR catalytic converter is a manufactured article that contains vanadium pentoxide, a hazardous substance. Before disposing of, or scrapping, a used SCR catalytic converter, it must be tested for any hazardous characteristics (ignitability, corrosiveness, reactivity, acute hazardousness, and toxicity), as those categories are described in 22 CCR 66261.30. If the spent SCR catalytic converter exhibits hazardous characteristics and is being disposed of, it will be considered by the State of California to be a hazardous waste subject to Title 22, California Code of Regulations. Before disposing of hazardous waste, review and follow all pertinent federal and California requirements.
- Vanadium pentoxide is a listed commercial chemical product - P120 - pursuant to 22 CCR 66261.33 (e). According to the State of California, commercial chemical products that are discarded or intended to be discarded are hazardous wastes and are subject to all provisions of Title 22, California Code of Regulations. Before disposing of vanadium pentoxide, review and follow all pertinent federal and California requirements.
- If the SCR catalytic converter is opened for maintenance, any dust spillages from the catalyst must be collected and tested for the presence of vanadium pentoxide before proper disposal. Dust spillages should also be tested for any hazardous characteristics (ignitability, corrosiveness, reactivity, acute hazardousness, and toxicity), as those categories are described in 22 CCR 66261.30, before proper disposal. If the dust contains either vanadium pentoxide or exhibits hazardous characteristics and is being disposed of, it will be considered by the State of California to be a hazardous waste subject to Title 22, California Code of Regulations. Before disposing of hazardous waste, review and follow all pertinent federal and California requirements.
- Do not dispose of the used SCR catalytic converter or its constituent parts into any waterways, storm drains or sanitary sewers.

WARNING

AVOID DEATH OR SERIOUS INJURY

The SCR catalytic converter contains vanadium pentoxide, a chemical known to the State of California to cause cancer.

Additional considerations when working on the SCR-system

- Perform work on the SCR catalytic converter in a well ventilated area. Use protective goggles and gloves to protect you from splashing or spraying of reductant or coolant.
- When engine is running, the exhaust system parts can reach such high temperatures there is a risk of personal injury. Make sure that exhaust system temperature has cooled before starting to work.
- The SCR system is heated by water from the engine cooling system. The cooling system runs at high pressure and when the engine is hot the coolant is hot. Do not open any coolant hoses without first stopping the coolant flow in the hose.
- A P3 type respirator/filter mask or a type FFP3 fine dust musk, protective goggles and gloves must be used for any work where there is a risk of exposure to dust from the SCR catalytic converter.
- Dispose the SCR catalytic converter properly after machining in a disposable container.
- Eating, drinking or smoking while servicing is not permitted.
- Any dust from the SCR catalytic converter must be removed using a vacuum cleaner with microfilter to minimize exposure.
- Make sure that work surface is cleaned after completed work: Vacuum first then swab.
- Make sure you clean your hands after working with SCR catalytic converter to avoid ingestion.
- Work done on the SCR catalytic converter may generate waste considered by the State of California to be a hazardous waste subject to Title 22, California Code of Regulations. Before disposing of hazardous waste, review and follow all applicable federal and California requirements.

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.

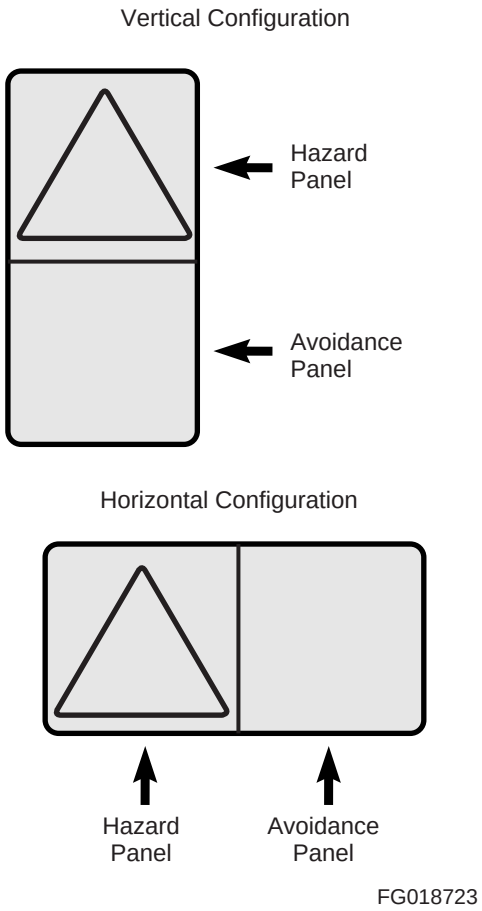


Figure 1

Information and Location for Safety Decals

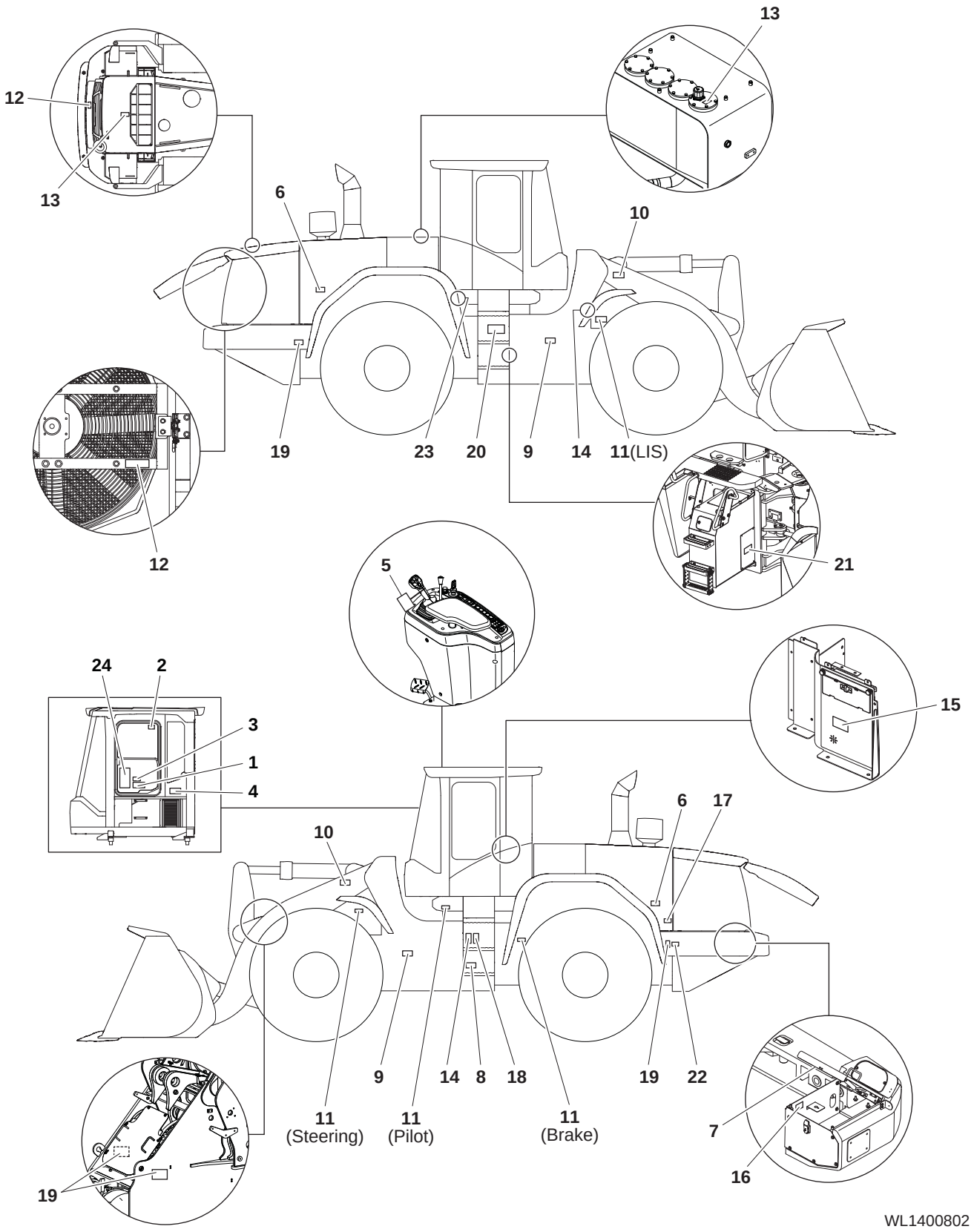
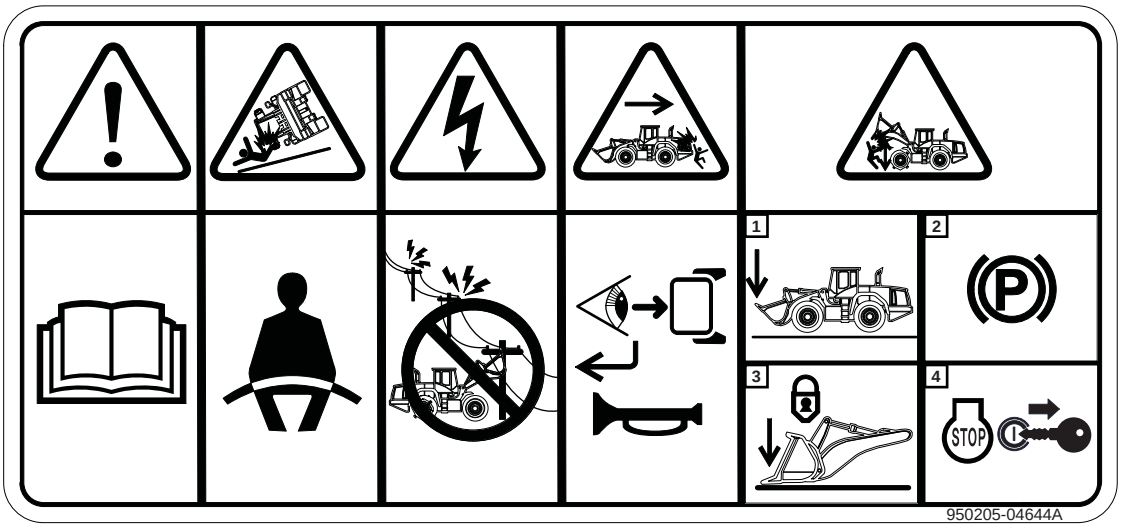


Figure 2

1. General Hazard (950205-04644A)



WL1400812

WARNING

AVOID DEATH OR SERIOUS INJURY

- **Never use wheel loader without instructions.**
- **Read Operation & Maintenance Manual before operation.**
- **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.**
- **Keep bystanders out of travel path and always look in the direction of travel.**
- **Ensure mirrors and rear view camera are clean and working properly.**
- **Sound the horn to alert bystanders before operating**
- **Never operate machine from outside the operator's position.**
- **TO LEAVE THE WHEEL LOADER:**
  1) **Lower the attachment to the ground and make sure all controls are in neutral.**
  2) **Engage the parking brake.**
  3) **Set pilot cutoff switch to OFF position.**
  4) **Stop the engine and remove the key.**

2. Emergency Exit (950205-04643)

IMPORTANT

If the primary exit is blocked, use right side window for secondary exit.

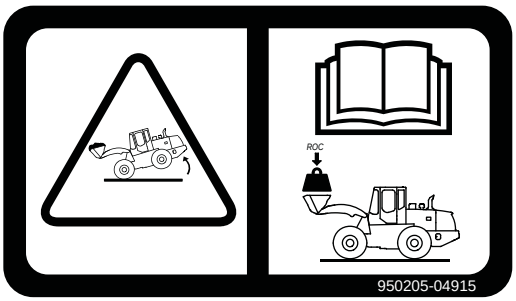
WL1400805

3. Operating Load (950205-04915)

WARNING

AVOID DEATH OR SERIOUS INJURY

- **Do not exceed Rated Operating Capacity (ROC).**
- **Do not travel or turn with lift arms raised.**
- **Load unload and turn on flat level ground.**
- **See Operating & Maintenance Manual for more information.**



WL1400813

4. ROPS Warning (950205-04645)

WARNING

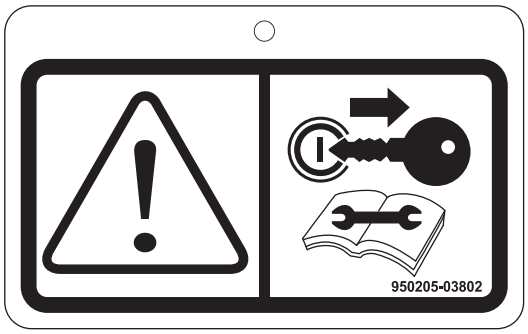
AVOID DEATH OR SERIOUS INJURY

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

Refer to “Rollover Protective Structure (ROPS) / Falling Object Protective Structure (FOPS)” on page 1-23 for more information.

WL1400814

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



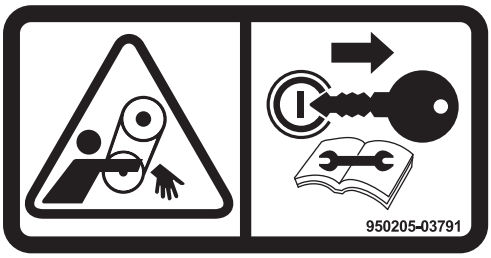
EX1301177

WARNING

AVOID DEATH OR SERIOUS INJURY

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

6. Entanglement in Rotating Parts (950205-03791)



EX1301181

WARNING

ROTATING PARTS CAN CAUSE DEATH OR SERIOUS INJURY

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

7. Battery Explosion (950205-03785)

EX1301183

WARNING

AVOID DEATH OR SERIOUS INJURY

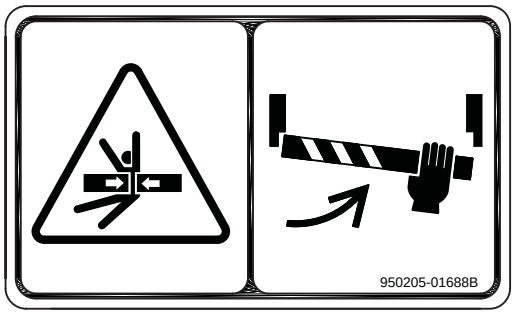
- **Read and follow instructions in Operation & Maintenance Manual for battery maintenance.**
- **Keep arcs, sparks, flames, and lighted tobacco away.**
- **Do not store metal tools or flammable materials on or around batteries.**
- **Wear safety goggles and rubber gloves when working with batteries.**
- **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 immediately.**

8. Articulated Frame Lock (950205-01688B)

WARNING

AVOID DEATH OR SERIOUS INJURY

- **Install articulated frame lock before servicing or transporting.**



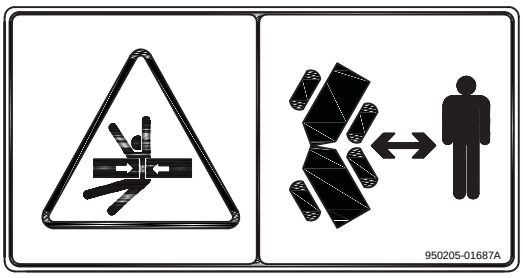
WL1400806

9. Crush Hazard (950205-01687A)

WARNING

CRUSHING HAZARD CAN CAUSE SERIOUS INJURY OR DEATH

- **Keep out of this area unless articulated frame lock is installed.**
- **Install articulated frame lock before servicing or transporting.**



WL1400807

10. Work Equipment (950205-01692A)

WARNING

AVOID DEATH OR SERIOUS INJURY

- **Moving a lift arm control or failure of a part can cause lift arm to drop.**
- **Never reach under or stand under raised lift arm unless the lift arm is properly secured.**

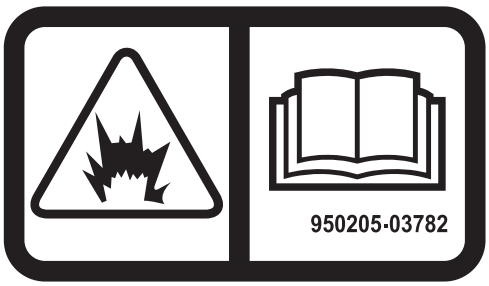
WL1400808

11. Pressurized Gas and Fluid (950205-03782)

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.**



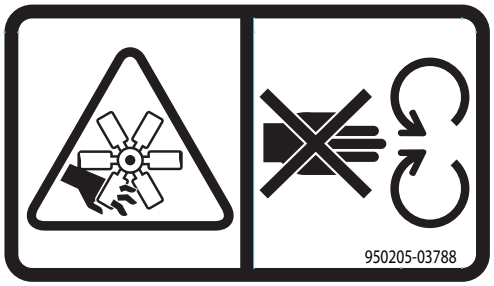
EX1301187

12. 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

13. 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.**

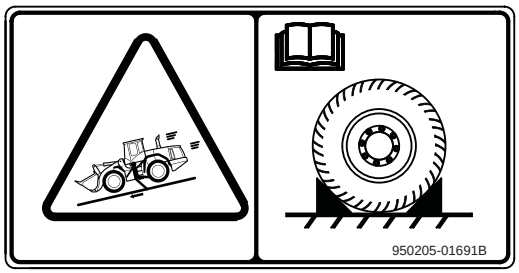
EX1301180

14. Wheel Chock (950205-01691B)

WARNING

ROLL AWAY CAN CAUSE DEATH OR SERIOUS INJURY

- **Before disengaging park brake, block wheels to prevent machine movement.**



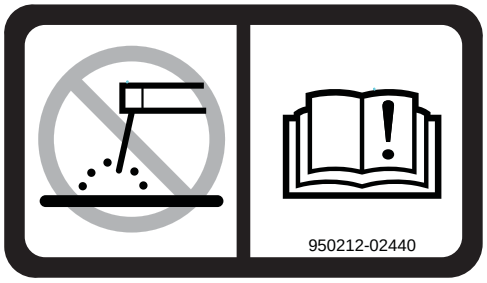
WL1400815

Additional Decal

15. Electric Welding Attention (950212-02440)

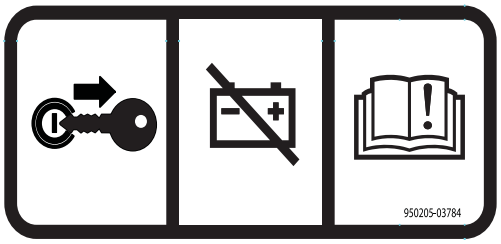
IMPORTANT

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



EX1402396

16. Battery Disconnection (950205-03784)



EX1301184

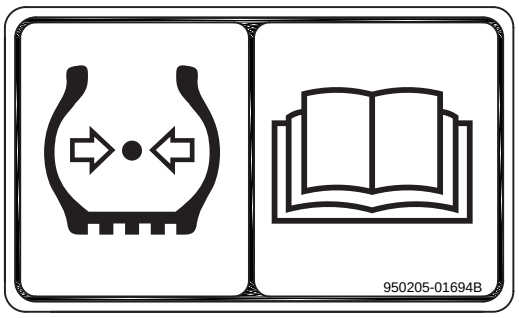
IMPORTANT

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.**

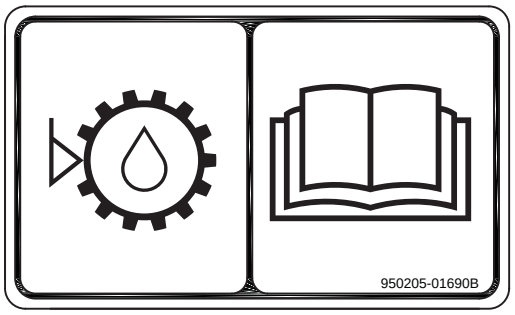
17. Tire Inflation Pressure (950205-01694B)

See“Recommended Air Pressure” on page 4-109.



WL1400809

18. Transmission Oil Level (950205-01690B)



WL1400810

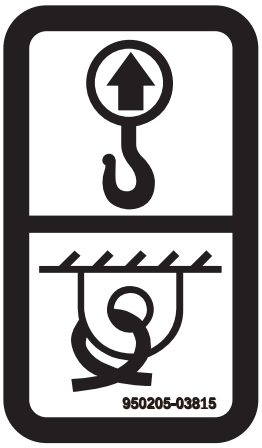
IMPORTANT

- **Check transmission oil level with parking brake "ON".**
  1) **Warm up the machine for 10 minutes or longer.**
  2) **Pace transmission lever in neutral position and engage parking brake.**
  3) **Check the transmission oil level using the dipstick or gauge.**
  4) **If necessary, add transmission oil (Spec. SAE 15W40)**

     Correct oil level (Oil temp. 80°C (176°F)): Hot zone (dipstick type)/Red line (gauge type)

19. Lift/Tie down (950205-03815)

Identifies lift point and tie down point location.



EX1301201

20. DEF (AdBlue) (950205-01489A)

IMPORTANT

- **Use only the specified diesel exhaust fluid.**
- **See the Operation & Maintenance Manual for more information.**

WL1300370

21. DEF (AdBlue) Filter (950205-02449)

IMPORTANT

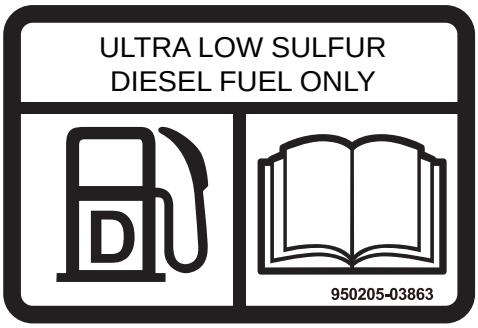
See the Operation & Maintenance Manual for information on the DEF filter.

WL1300373

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

IMPORTANT

Only use Ultra Low Sulfur Diesel (ULSD) fuel and API CI-4/ACEA E5, E7 or API CJ-4/ACEA E9 grade engine oil with this machine.

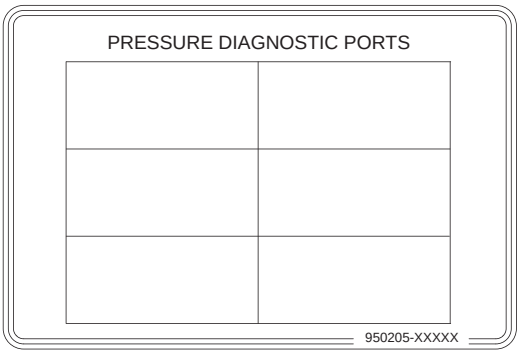


EX1301196

EX1301194

23. Pressure Diagnostic Ports

See “Hydraulic Pressure Checks” on page 4-99.



WL1400826

24. Switch Description (950205-XXXXX)

See the "Operating Controls" section of this Operation & Maintenance Manual for more information.

SWITCH DESCRIPTIONS

LOCATION	SYMBOL	NAME	FUNCTION
STEERING COLUMN		Hazard Lights	Turns ON all turn signals and will flash simultaneously
INSTRUMENT PANEL		Display Screen Control	Up/Down display control
		Display Screen Selector	Select menu item
		Boom Kick-Out (Up or Down)	LED lamp on : Enable boom height Kick-Out LED lamp off : Disable boom height Kick-Out Push the button for (1) second to set boom height position
		Bucket Return to Dig	LED lamp on : Enable bucket return to dig LED lamp off : Disable bucket return to dig Push the button for (1) second to set bucket position
		Transmission Clutch Cut-Off	ICCO(Intelligent Clutch Cut-Off) ON/OFF
		Load Isolation System (LIS)	LIS system ON/OFF
		Torque Converter Lock-up	Torque converter lock-up ON/OFF
		Differential Hydraulic Lock	Differential hydraulic lock auto ON/OFF
		Electric Steering Hi/Lo	Select electric steering speed Left : High speed Right : Normal speed
RH ROOF		Auto Grease (OPT)	Auto Grease ON/OFF
		Quick Clamp (OPT)	Quick Clamp ON/OFF
RH STAND		Parking Brake	Parking brake ON/OFF
		Pilot Cut-Off	Forward : Control valve activated Back : Control valve deactivated
		Lights	Forward : Clearance, tail light, instrument panel, switch lights, and headlights turn "ON" Middle : Clearance, tail light, instrument panel and switch lights turn "ON" (HOMO OPTION ONLY) Back : Clearance, tail light, instrument panel, switch and headlights turn "OFF"
		Engine Mode Selector	Left LED : ECO (Economy ↔ Standard) Middle LED : Normal (Standard ↔ Power) Right LED : Power (P)
		Transmission Mode Selector	Left LED : Manual Middle LED : 1-4 Auto Right LED : 2-4 Auto
		Front Work Light	Front work light ON/OFF
		Rear Work Light	Left LED : On work lights mounted on the top of radiator Right LED : On work lights mounted on the rear top of cabin and on the top of radiator
		Rear Wiper	Middle LED : ON Washer fluid sprays onto windshield while running the rear wiper, when hold the switch
		Reverse Fan Rotation	Left LED : Fan rotation reverses manually Right LED : Fan rotation reverses automatically
		Mirror Heater	Mirror heater ON/OFF
		Fuel Heater	Fuel heater ON/OFF
		Rotating Beacon	Rotating beacon ON/OFF
		Emergency Steering Test	For emergency steering test: Press and hold switch to test steering operation

See Operation and Maintenance Manual for more information

950205-XXXXX

WL1400811

GENERAL

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 the machine.
- When working with other personnel on a work site, be sure that all personnel know the 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 pilot cutoff switch and seat belt. Use them always.
- 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 working.
- 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 for 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 the compatibility of a particular attachment with the 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 operation is 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.

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.

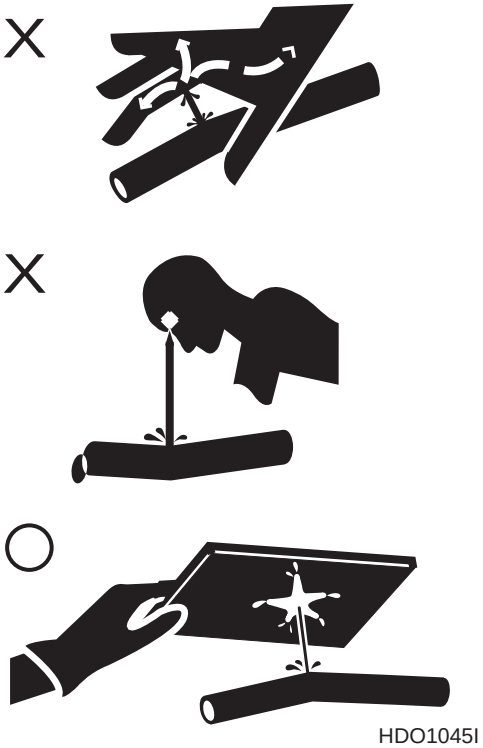


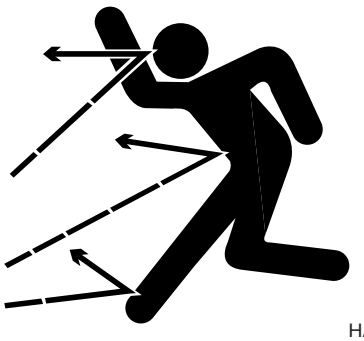
Figure 3

Flying or Falling Objects

On work sites where there is a potential hazard that flying or falling objects can come in contact with 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, can produce hazards of falling rocks or flying objects. Additional protection for operator's cabin may be required such as a Falling Object Protective Structure (FOPS) 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 4

HAOA100L

Figure 5

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 6

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 warming alerts are displayed on display monitor, stop the machine immediately and take the necessary corrective actions. Do not operate the 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.

Always have at least two people working together if the engine must be running during service. One person needs to remain in the operator's seat, ready to work the controls to stop the machine or stop engine, if necessary.

WL1300011

Figure 7

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 8

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

FG019096

Figure 9

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 10

- 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 a dust mask when grinding painted parts.

FG018458

Figure 11

Maintenance

The machine and some attachments have components that reach 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 and maintained properly.

Electrical

Check all electrical wiring and connections for damage daily.

Keep battery terminals clean and tight. Repair or replace any damaged parts 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 all flames and 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, in this manual 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.

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 and prevent sparks.

Always place plastic fuel containers on the ground before filling.

ARO1050S

Figure 12

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 13

Welding and Grinding

Always clean machine and attachment, disconnect battery switch, 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 a 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 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.*

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.

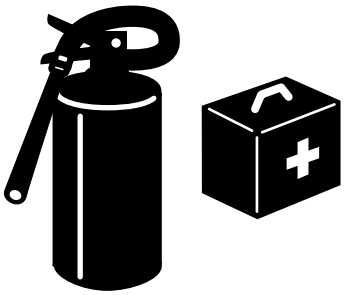


Figure 14 HDO1009L

- Keep a first aid kit in storage compartment (Figure 15) 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.

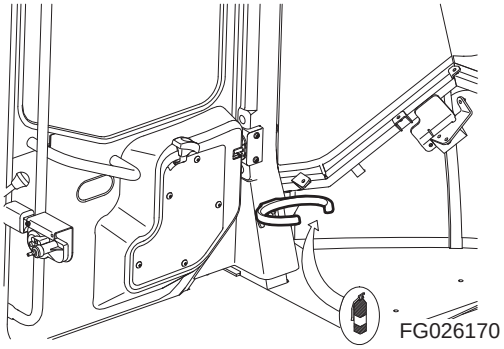


Figure 15

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.*

Figure 16

Rollover Protective Structure (ROPS) / Falling Object Protective Structure (FOPS)

The operator's cabin is a ROPS/FOPS certified structure for protecting the seat-belted operator. It absorbs the impact energy of a roll-over impact or falling object. Do not allow machine weight (mass) to exceed certified value on certification plate (Figure 15). If weight is exceeded, the operator's protective 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 roll-over 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 protective (ROPS/FOPS) cabin.
- Always wear your seat belt when operating machine.

ROPS Certification

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

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

Check the operator's cabin, mounting, and hardware for damage.

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

ROPS - Roll-over Protective Structure complies with ISO 3471

FOPS - Falling Object Protective Structure complies with ISO 3449

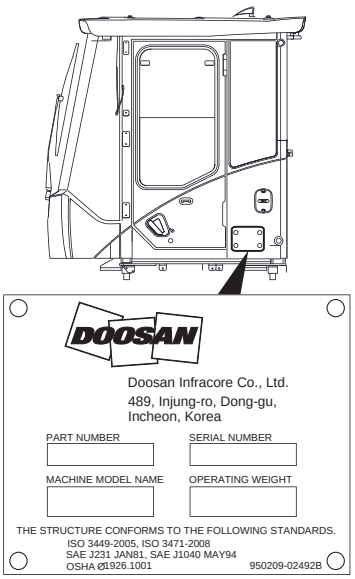


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Figure 17

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.

Emergency Exit from Operator's Station

If the primary exit is blocked, the window on the right side may be used as an alternate exit. Open the window and exit the machine through the window.

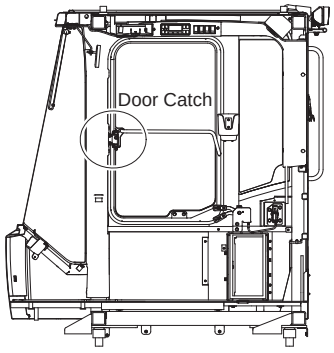

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Figure 18

TRANSPORTATION

Obey State and Local Over-the-Road Laws and 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 the machine 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 tires. 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 shift lever.
- Never correct your steering on ramps. If necessary, drive off ramps, correct machine direction, then drive back onto ramps.
- 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 pilot cutoff switch is set to "O" (OFF) position.
- Check that pedals move freely, and pilot control lever(s) returns 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.

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

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.

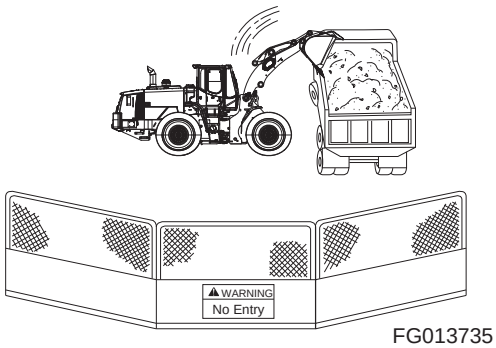

Figure 19

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.

Check Tire Pressure and Condition

Maintain tire pressure but do not overinflate. Inspect tires and wheels daily. When inflating tires, follow procedures in Maintenance Section, which include using an extension to avoid standing in front of or over a tire. Do not change a tire unless you understand proper tire maintenance procedures and are using proper equipment.

Refer to “Recommended Air Pressure” on page 4-109.

Mounting/Dismounting

Before getting on or off machine, if there is any oil, grease, or mud on handrails or steps, 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 a three-point contact (both feet and one hand or one foot and both hands) with handrails and steps 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 platform outside of door, and door latch is not securely engaged, door may move and cause you to fall resulting in death or serious injury.

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.

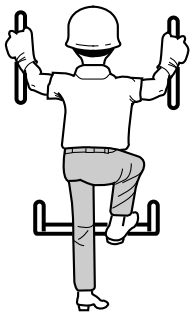

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Figure 20

Cleaning

Remove all straw, wood chips, leaves, grass, paper and other flammable debris accumulated in engine compartment, 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 the machine itself.

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.

Never reach in through a window to work a control. Do not try to operate the machine unless in operator's seat with the seat belt fastened.

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 pilot cutoff switch in "O" (OFF) 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 immediately. 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 laws and 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 laws and 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 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 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 conditions of the work site. Inspect and remove any obstacles around the machine that could be damaged and keep other personnel and bystanders 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 the visual aids to see all the way around the machine. Therefore, additional precautions such as flagman, barricades, etc., must be taken to keep personnel and bystanders 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 nonseries 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, in this manual for proper procedures.
- Connect positive (+) cable first when installing cables and disconnect negative (-) cable first when removing them.

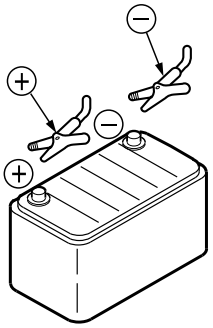

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Figure 21

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.

- Check operation of work equipment and travel system.
- Check for any problems 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.

- 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 pilot control lever (joystick), do not start engine or move lever.

- Prevent personnel and all bystanders 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.

Traveling

When traveling with the machine, always keep lights on; make sure that you are in compliance with all federal, state and local laws and regulations concerning warning flags and signs.

If engine stops while machine is traveling and the machine is not equipped with an emergency steering system, it will be impossible to operate the steering system and control machine movement.

Pilot control valve lever (joystick) should not be operated while traveling.

Lower work equipment so it is 435 mm (17 inches) above ground.

Never travel over obstacles or steep slopes that will cause machine to tilt severely. Travel around any slope or obstacle that causes 10°C tilt, or more.

Do not operate steering 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.

Keep to permissible water depth. See “Working in Water” on page 3-25 in this manual.

When traveling over bridges or structures check first that bridge or structure can withstand weight of machine. Never exceed the maximum permitted load for bridges or structures.

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.
- 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.

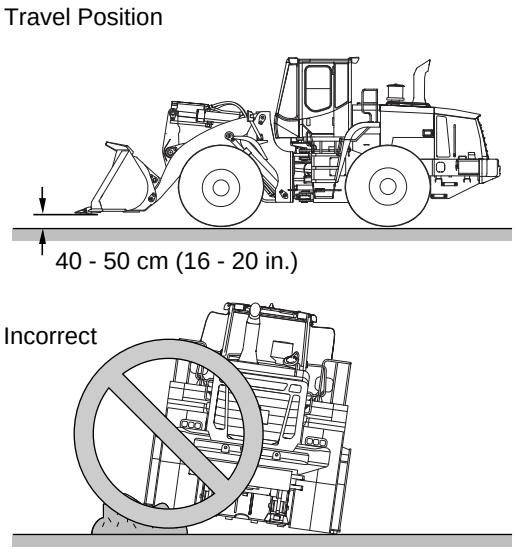

Figure 22

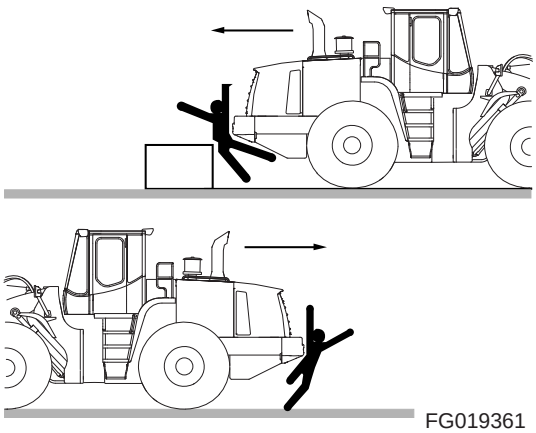

Figure 23

Be sure to observe these precautions even if a backup alarm or mirrors are installed.

- Check that backup 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.

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

Do not operate attachments 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.

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

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

Keep height and length of attachment in mind.

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, the following must be evaluated by the operator and work site crew:

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

Always watch load.

Do not suddenly lower or stop work equipment.

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

Digging Beneath Overhangs

Do not dig beneath an overhang. The overhang could collapse on top of operator and cause death or serious injury.

Reposition the machine to another digging area before steep overhangs are formed. Know height and reach limits of the machine and plan while working. Park the machine away from overhangs before stopping work.

Digging Beneath Wheel Loader

Never dig beneath the machine. The earth beneath the machine could collapse. This could cause wheel loader to tip or rollover, which could cause death or serious injury to operator. Working around deep pits, trenching or along high walls may require support blocks, especially after heavy rains or during spring thaws.

Operation on Slopes

Dig evenly around work site whenever possible, trying to gradually level any existing slope. If it is not possible to level area or avoid working on a slope, it is recommended that you reduce size and cycling rate of workload.

On sloping surfaces, use caution when positioning the machine before starting a work cycle. Always fasten your seat belt. Stay alert for unstable situations and avoid getting into them. For example, you should always avoid positioning the bucket over downhill side of machine when parked perpendicular to slope. Avoid full extensions of bucket in a downhill direction. Lifting bucket too high, or too close to the machine, while the machine is turned uphill can also be hazardous.

When possible, operate machine up slopes and down slopes. Keep the heavy end of the machine uphill. Avoid operating machine across slope.

On hills, banks or slopes, position bucket approximately 400 mm (16 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 directly down the 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 operating work equipment on slopes.

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.

- 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.

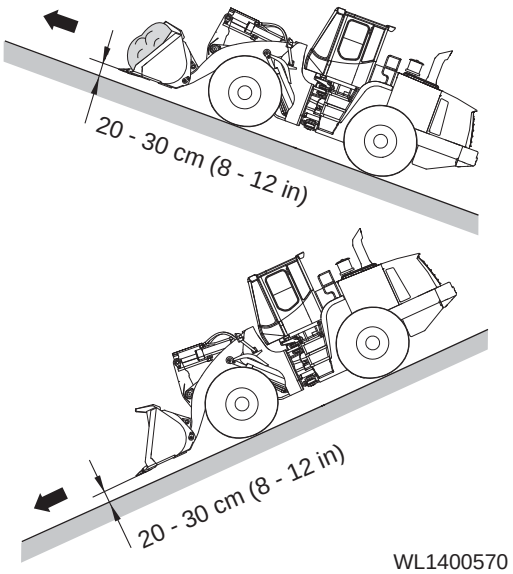

Figure 24

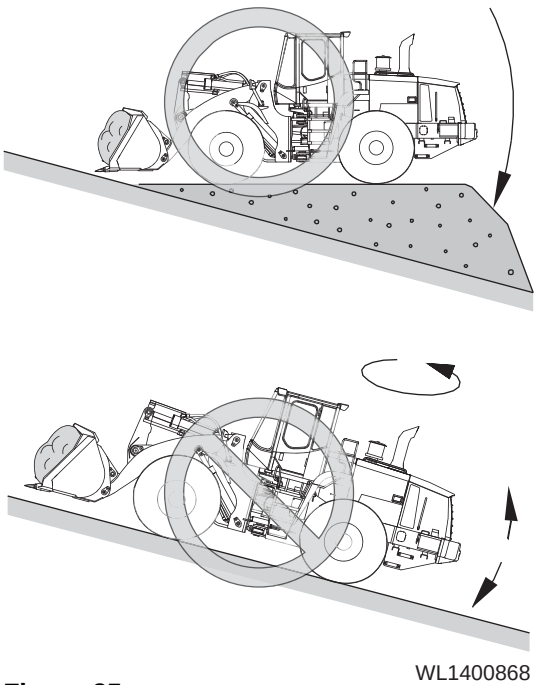

Figure 25

Towing

When necessary to tow another vehicle, towrope must be tied to towing pin on counterweight at rear of vehicle.

NOTE: *The machine must be used for towing only in an emergency.*

WARNING

AVOID DEATH OR SERIOUS INJURY

Do not tow machine at a speed over 10 km/h (6 MPH) and do not tow machine farther than 10 km (6 mi). This will prevent damage to machine transmission caused by the from lack of lubrication.

WARNING

AVOID DEATH OR SERIOUS INJURY

When towing another vehicle on a public road, take necessary precautionary measures to let other vehicles and people know that you are towing another vehicle. Use a flag, rotating beacon light, or hazard light.

NOTE: *Follow all laws and regulations when towing another vehicle with the machine.*

If loader is being towed by another vehicle and engine will not start, remove front and rear driveshafts; otherwise, transmission will rotate without being properly lubricated, causing transmission damage. Before removing the driveshafts, apply parking brake and securely block wheels.

If engine can be started and steering wheel and brakes function normally, have someone get in the machine that is going to be towed to steer it.

Before towing a vehicle, make sure that the following items have been checked:

- Check weights of the machine and the vehicle being towed. Make sure the machine has sufficient braking capacity to stop towed vehicle.
- Check if vehicle being towed can brake and steer. If not, do not allow anyone to ride on towed vehicle.
- Check towrope or tow bar for damage and make sure it has sufficient strength for work.
- When necessary to descend a grade, another towing vehicle must be used in rear to provide additional braking.

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

- Follow the instructions given in this manual.
- When performing preparation work for towing with two or more people, 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 before towing.
- Never go between towing machine and towed machine during towing operation.
- Do not perform towing on steep slopes. 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.

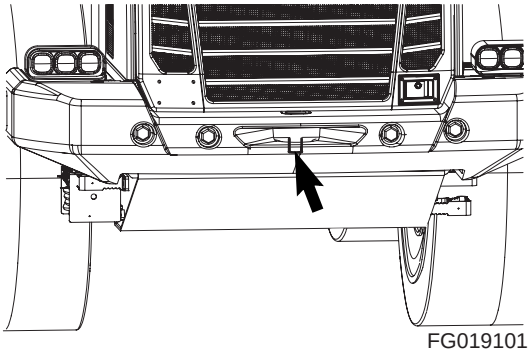

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Figure 26

Attachment

Never let any one ride on any work attachment, such as bucket, forks or grapple. This creates a falling and/or crushing hazard, and 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 falls 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.

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Figure 27

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 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 to lower the equipment.

Wear appropriate personal protective equipment and follow the established procedures.

Preventing Risk of Injuries or Death From Boom and Bucket

DANGER

AVOID DEATH

When operating machine or making repairs, never allow bystanders in work area or repair area. Operation and service personnel must be careful when working around machine, especially around boom and bucket and articulation joint.

An unexpected fall of front structure can cause death or serious injury.

1. While operating a machine, do not let people enter the work area. A sudden collapse of front structure caused from a hydraulic hose failure can result in death or serious injury.
2. When stopping or parking machine, lower front structure to ground. If this is not done, sudden collapse of front structure caused from a hydraulic hose failure can result in death or serious injury.

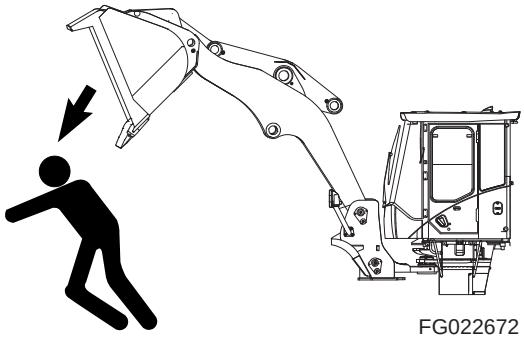

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Figure 28

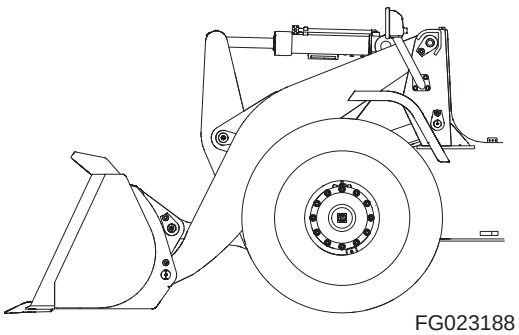

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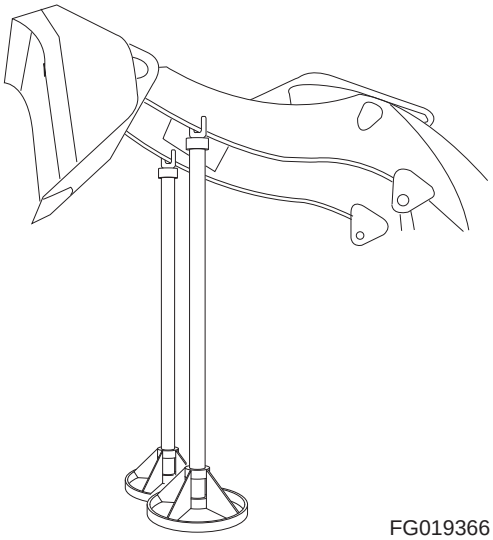
Figure 29

3. When repairing or inspecting machine, with front structure raised in air, firmly support front structure. When installing supporting structure, check that it is rated and approved to support the weight of the structure.

   High-pressure loads between lift arm structure and support can cause support to slip, causing boom to collapse, leading to death or serious injury. Always install the supporting structure on firm and level ground.

   A supporting structure must be used, when disconnecting front hoses or removing any other mechanical component related to front structure. High-pressure oil can be ejected from front hydraulic cylinder that can cause the lift arm to suddenly lower or attachment movement resulting in death or serious injury.



FG019366

Figure 30

WARNING

AVOID DEATH OR SERIOUS INJURY

Pressurized oil has enough force to pierce skin and causes death or serious injury.

If fluid enters skin or eyes, get immediate medical attention from a physician familiar with this injury.

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 at least five (5) minutes before stopping the engine. This allows hot areas of engine to begin to cool gradually.

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

Parking Machine

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 an incline is unavoidable, block wheels to prevent movement. Lower bucket or other working attachment completely to ground, or to an support saddle, to prevent unintended or accidental movement.

When parking on public roads, provide fences barricades, signs, flags, or lights, and put up any other necessary signs to ensure that passing traffic can see machine clearly. Park the machine so that the 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 and place the pilot cutoff switch to "O" (OFF) 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.

The hydraulic system remains pressurized, provided that 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 the engine or immediately after engine stops running.

Preservation/Storing Machine

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

Conditions	Maintenance Required
Cleaning	Pressure wash entire machine. 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 4-93, to determine amount of protection cooling system requires. Add coolant as required.
Hydraulic System	Once a month, start engine and follow procedures listed in “Automatic Warming Up Operation” on page 3-10, in this manual.

1. Complete the steps listed above.
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 (if parking outside).
6. Make sure that coolant is at proper concentration for expected lowest temperatures.
7. Parking 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.
   - Parking 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 4-103, 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 & 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 lift arm and attachment to ground before doing any maintenance.
- Use correct procedure to lift and support machine.
- 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 an open flame or sparks.
- Keep body, jewelry and clothing away from moving parts, electrical components, hot parts and exhaust.
- Wear eye protection to guard from battery acid, compressed springs, fluids under pressure and flying debris when engine is 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 access to the machine or 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 set pilot cutoff switch to "I" (ON) 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.
- 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 button. If horn does not sound, the main power is shut off.)
- Put blocks against tire 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 that causes exposure 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 loss and/or other 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 the proper procedure for placing equipment in servicing position.

Warning Tag

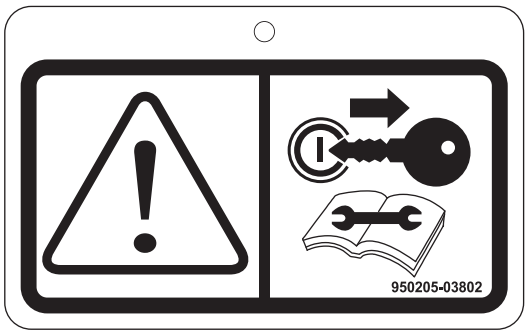
Alert others that service or maintenance is being performed by attaching a "DO NOT OPERATE" warning tag to the operator's cabin controls – and other machine areas, if required. Use of the pilot cutoff switch in the "O" (OFF) position, complies with the Occupational Safety and Health Administration's (OSHA) 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 service or maintenance is being performed on the machine. Attach additional warning tags on the machine, if necessary.

  Keep warning tags in tool box while they are being used. If there is not tool box, store them in the owner manual storage pocket.
- If another 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.



EX1301177

Figure 31

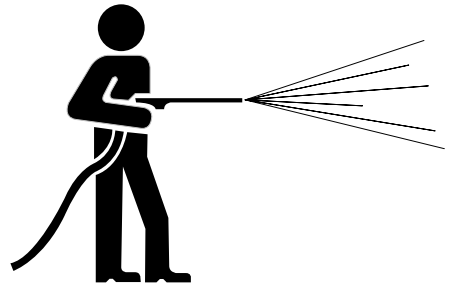
Cleaning

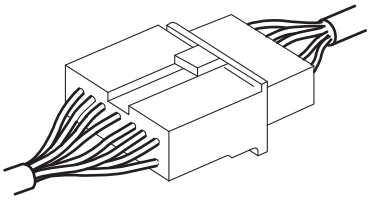
Clean machine before performing inspection and maintenance.

If inspection and/or maintenance are done when machine is dirty, it will become more difficult to locate problems, and this increases the risk of serious injury from slipping on steps and/or the work platform areas.

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 and 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 surfaces, 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.



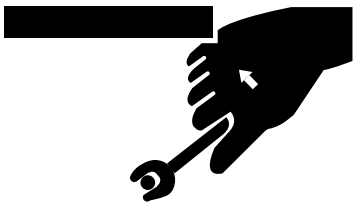


ARO1330L

Figure 32

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 cause death or serious injury.



HDO1037L

Figure 33

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 personnel and bystanders 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 34

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 35

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 other body parts.

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, eyes or other body parts.

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.

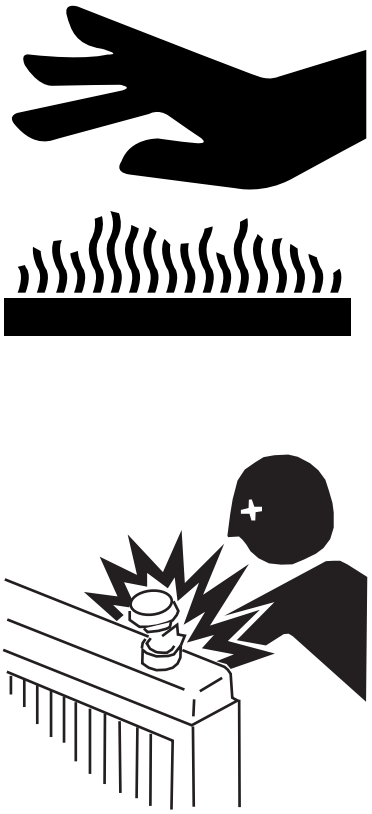
Relieve all pressure in hydraulic oil system, in fuel system, or in cooling system before disconnecting any lines, hoses, fittings, or related components.

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, eyes or other body parts.

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



HAAE1980

Figure 36

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. Symptom may not appear until several hours afterwards.

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

Welding Repairs

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 and well ventilated area. Repairs should only 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.

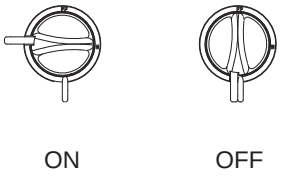
A qualified welder must do the following:

- To prevent battery explosion, disconnect battery terminals and remove batteries.
- 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 cause 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 for immediate use.

Preparation for Electrical Welding on Body Structure

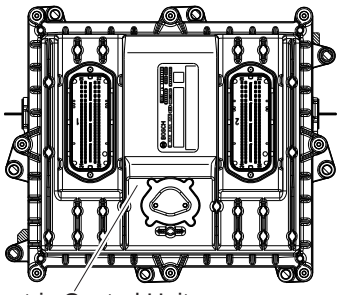
To prevent damage to ECU by electrical welding, observe the following procedures:

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 37



FG020631

Figure 38

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 machine is 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 39

Lock Inspection Covers

When performing maintenance with inspection cover open, use lock bar to secure cover to prevent cover from suddenly closing causing death or serious injury.

If maintenance work is done with the inspection cover open but not locked, it could suddenly close because of the wind or movement of the machine.

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 4-94.

FG018458

Figure 40

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 before beginning such work. 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.

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.

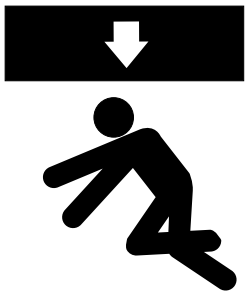
Supports and Blocking for Work Equipment

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

Lower lift arm and attachment to ground before leaving operator's seat.

Do not use hollow, cracked or unstable. Always use an approved support to prevent sudden lowering of the lift arm.

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



HDO1042L

Figure 41

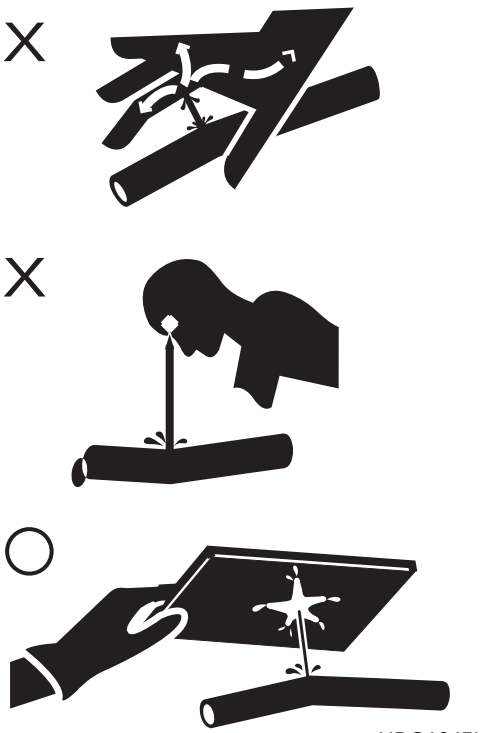
High-pressure Lines, Tubes and Hoses

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 4-94. 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. Always 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 4-88, for additional European regulations.*

High-pressure is generated inside fuel lines when engine is running. Before performing inspection or maintenance of fuel



HDO1045I

Figure 42

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.

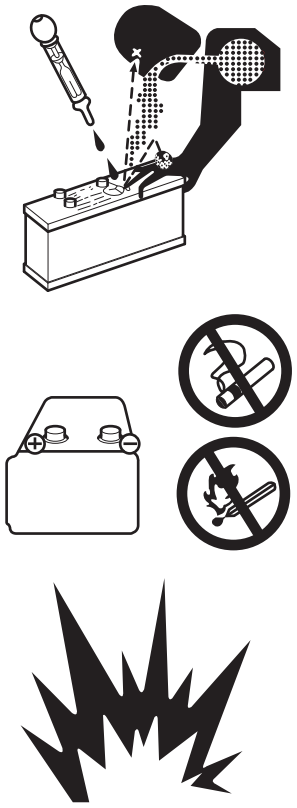
Oil or fuel leaks from high-pressure hoses can cause fire or improper operation, which can result in death or serious injury. If any loose bolts are found, stop work and tighten to specified torque. If any damaged hoses are found, stop operations immediately and contact your DOOSAN distributor for replacement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

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 in cold temperatures 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.



FG018464

Figure 43

- Before maintaining or working with batteries, turn starter switch to "O" (OFF) position.

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 with 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. Use caution when working in a place where machine may tip over.
- Do not operate on soft ground or near riverbank that could collapse or where ground may not support weight of machine.
- 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, resulting in death or serious injury.

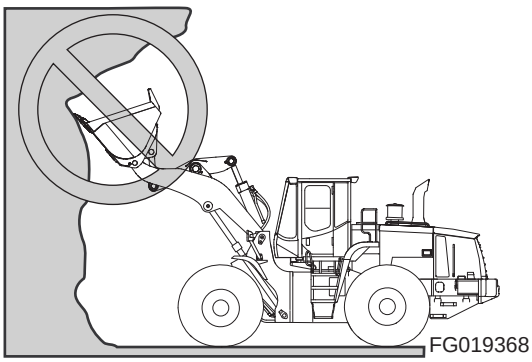


Figure 44

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.

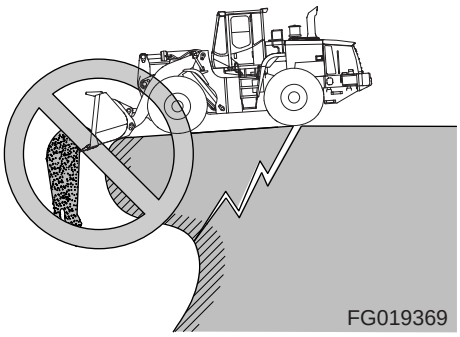


Figure 45

Drop-off or Edge

When working near or at an edge of 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. 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.

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 move bucket over the top of personnel or bystander or over operator's cabin of dump truck or other machines.

Loose or Soft Ground

Do not operate on soft ground or near edge of drop-offs, overhangs, or 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. The distance from an edge of an excavation where the 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 cause damage to the machine or cause 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.

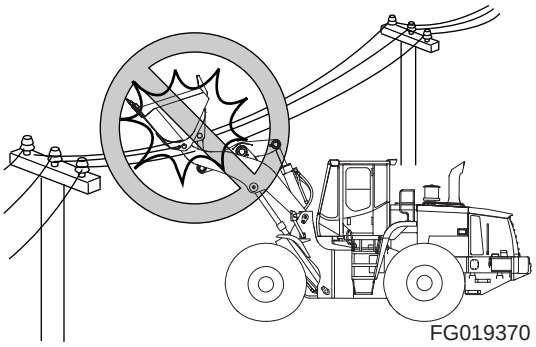


Figure 46

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 room 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.

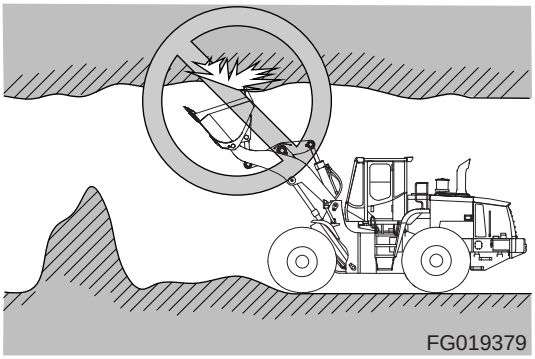


Figure 47

Working in Water

After working in water, lubricate all lubrication points on front and rear frames which have been under water so water is removed.

The water depth is an important factor to take into consideration when the machine is working in swampy areas. Do not enter water whose depth exceeds the machine's minimum ground clearance height or is high enough to wet the bottom of the axle housing.

As a rule of thumb, the allowable water depth is about 435 mm (17 inches). This means that the machine should not be used in a river.

Observe the following conditions:

1. Check the water depth in advance when crossing across a river.
2. Use the same precautions before crossing across a swampy area.
3. Do not enter rivers whose riverbed is steep or has a rapid flow.

IMPORTANT

Avoid use of the machine in salt water. Salt water will cause the development of rust which will shorten the life of the machine.

Working in Contaminated Environment

When working within area which is contaminated or where there is a health risk, check local laws and 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 the engine for a short period may be necessary to avoid operating with sluggish or reduced working capacity. The jolting shocks and impact loads caused by bumping or bottoming 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 checks must be made before operating the machine:

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 the battery fully charged for protecting the battery from freezing in the winter seasons. When you adding distilled water to the battery, run the engine for at least one hour for fully mixing the water with electrolytic 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 may 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 4-24, 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 the “Lubrication and Service Chart” on page 4-31, in this manual and/or the 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, pedals and functions to be sure they are operating correctly before operating.
8. At an oil temperature in the shifting circuit < -12°C, the transmission must be warmed up for some minutes.

   This must be carried out in neutral at an increased engine speed (approximately 1500 min^{-1}).

   Until this oil temperature is reached, the electronics remains in neutral.

   After the full driving program can be utilized out of "NEUTRAL".
9. An extra outer air filter must be kept in operator's cabin to replace existing filter that could become iced and cause restricted airflow to engine.
10. Clean off all mud, snow and ice to prevent freezing. Cover machine with a tarp, if possible and 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. Frequently inspect and maintain 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 “Fill Fuel Tank” on page 4-40 and “Check for Leaks in Hydraulic System” on page 4-40, 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 4-31, of this manual or on Lubrication Decal on the 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 will appear 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 4-31. Clean all lubrication fittings before applying lubricant. Sand mixed becomes very abrasive and accelerates wear on parts if mixed with lubricants.
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 in rainy or humid conditions is similar to that as in extreme heat procedures previously listed in addition:

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 4-31, in this manual. Shorten lubricating intervals for parts exposed to saltwater.
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.

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Figure 48

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 combustible materials 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).

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 laws and regulations related to work site and working environment.
- Avoid brushing or grinding materials that contain asbestos.
- Use a vacuum cleaner that is equipped with a high efficiency particulate air filter.
- Comply with applicable laws and regulations for workplace.
- Stay away from areas that might have asbestos particles in air.

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Figure 49

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).

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.

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Figure 50

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 sewer systems, 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 laws and regulations.

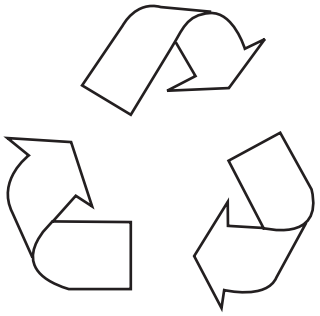

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Figure 51

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)	72 dB(A)
Sound power level (LwA) around the machine (Measurement according to 2001/14/EC with applicable appendices and measuring method according to ISO 6395)	104 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 more than 0.5 m/s^2 (less than 1.15 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:
    - 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.
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:
   - 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 lights are located next to the gauges on the instrument panel. The operator should monitor machine pressures on the instrument panel with indicator lights. These lights will only show there is a problem that needs correction.

IMPORTANT

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

COMPONENT LOCATIONS

The following figure identifies the location of major machine components.

DL250-3

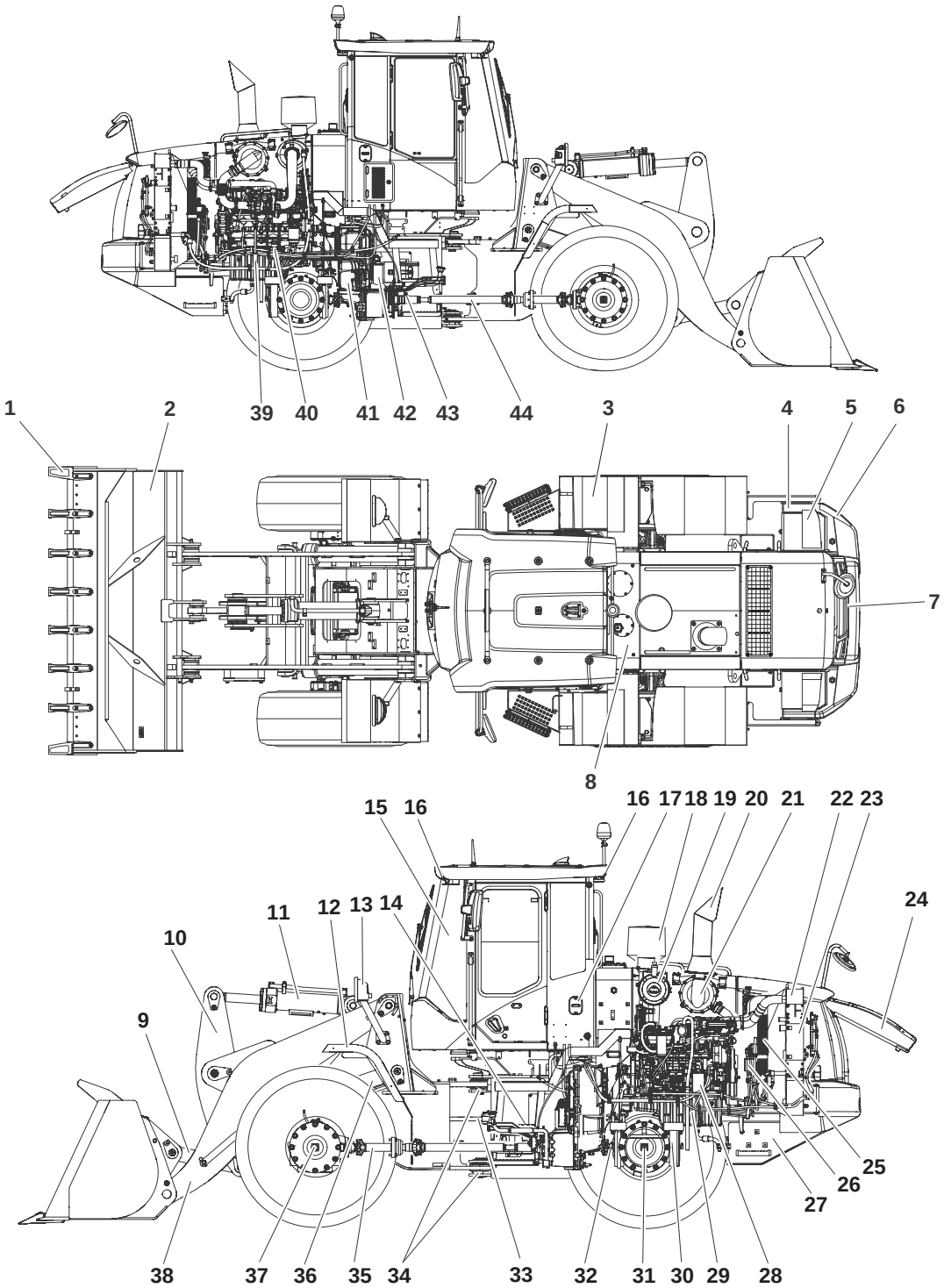

Figure 1

Reference Number	Description
1	Bucket Teeth
2	Bucket
3	Rear Wheel Cover
4	Battery Box
5	Rear Light
6	Counterweight
7	Towing Pin
8	Oil Tank
9	Link
10	Tilt Lever
11	Bucket Cylinder
12	Front Wheel Cover
13	Headlight Support
14	Ladder
15	Operator's Cabin
16	Work Light
17	Air Conditioner Unit
18	Engine Air Intake Precleaner
19	Air Cleaner
20	Muffler Tail Pipe
21	Muffler
22	CAC Cooler

Reference Number	Description
23	Radiator
24	Grille
25	Fan
26	Fan Motor
27	Fuel Tank
28	Engine Oil Filter
29	Engine
30	Rear Axle Pivot
31	Rear Axle
32	Driveshaft (Rear)
33	Steering Wheel Cylinder
34	Center Pin
35	Driveshaft (Front)
36	Boom Cylinder
37	Front Axle
38	Loader Arm
39	Engine Oil Level Dipstick
40	Engine Oil Fill Cap
41	Transmission
42	Transmission Oil Filter
43	Parking Brake
44	Driveshaft (Center)

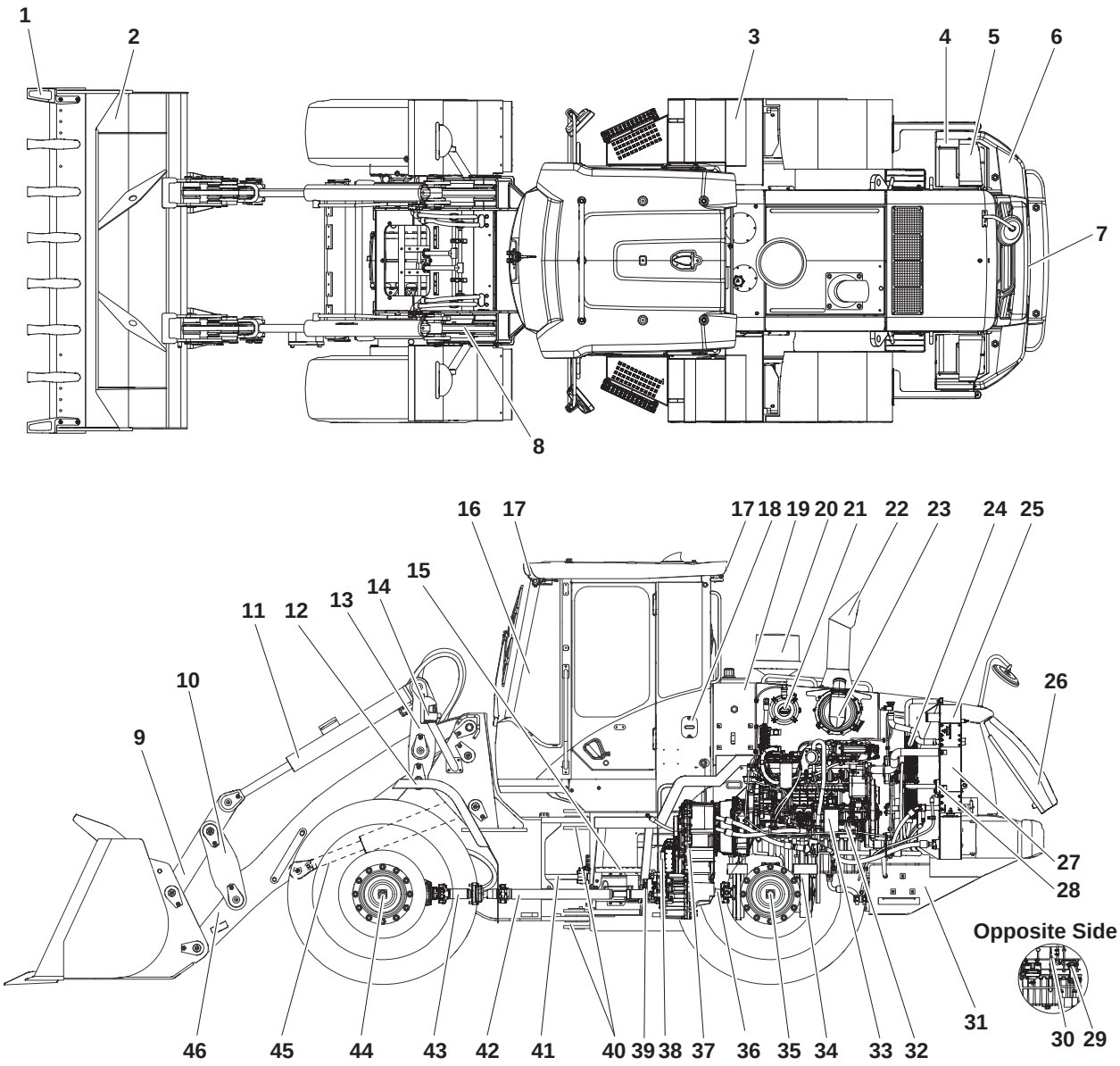
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Figure 2

Reference Number	Description
1	Bucket Teeth
2	Bucket
3	Rear Wheel Cover
4	Battery Box
5	Rear Light
6	Counterweight
7	Towing Pin
8	Parallel Link
9	Push Link
10	Tilt Lever
11	Bucket Cylinder
12	Front Wheel Cover
13	Parallel Lever
14	Headlight Support
15	Ladder
16	Operator's Cabin
17	Work Light
18	Air Conditioner Unit
19	Oil Tank
20	Engine Air Intake Precleaner
21	Air Cleaner
22	Muffler Tail Pipe
23	Muffler

Reference Number	Description
24	Fan
25	CAC Cooler
26	Grille
27	Radiator
28	Fan Motor
29	Engine Oil Fill Cap
30	Engine Oil Level Dipstick
31	Fuel Tank
32	Engine
33	Engine Oil Filter
34	Rear Axle Pivot
35	Rear Axle
36	Driveshaft (Rear)
37	Transmission
38	Transmission Oil Filter
39	Parking Brake
40	Center Pin
41	Steering Wheel Cylinder
42	Driveshaft (Center)
43	Driveshaft (Front)
44	Front Axle
45	Boom Cylinder
46	Loader Arm

OPERATOR'S AREA

Figure 3, identifies controls in operator's cabin.

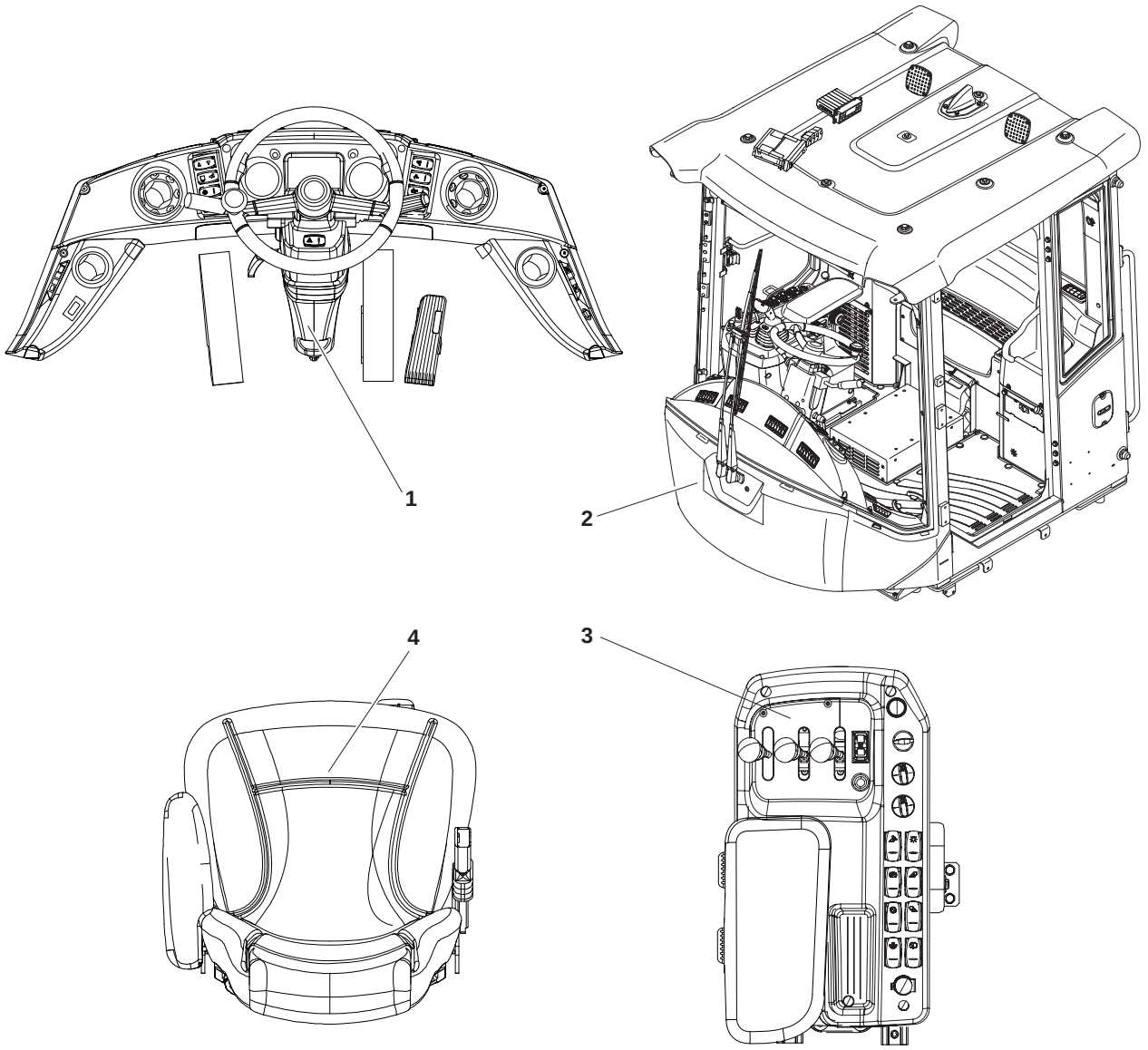

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Figure 3

Reference Number	Description
1	Steering Console and Pedal (See page 3-7)
2	Various Cabin Locations (See page 3-67)

Reference Number	Description
3	Right Side Switch Panel (See page 3-52)
4	Seat Adjustment (See page 3-79)

STEERING CONSOLE AND PEDALS

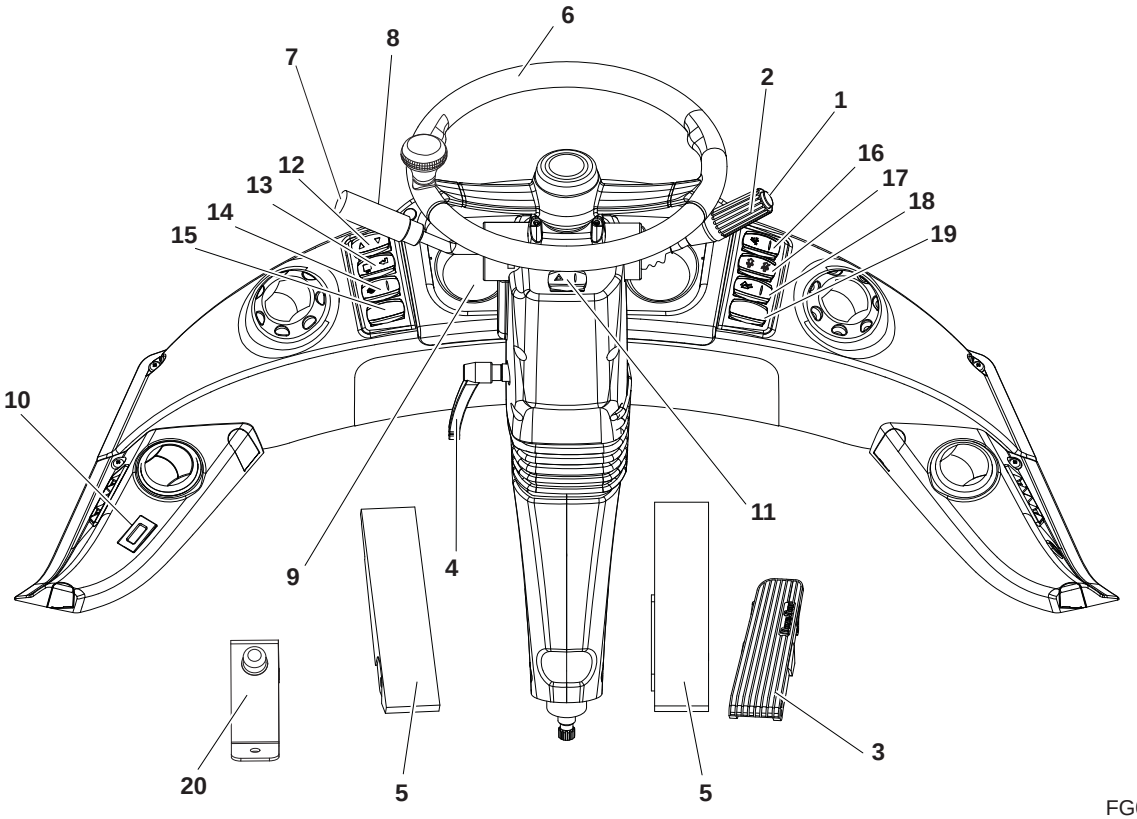

Figure 4

Reference Number	Description
1	Horn Button
2	Combination Switch
3	Accelerator Pedal
4	Steering Wheel Adjustment Lever
5	Brake Pedals
6	Steering Wheel
7	Kick-down Button
8	Transmission Lever
9	Front Instrument Panel (See page 3-18)
10	Hour Meter
11	Hazard Warning Light Switch

Reference Number	Description
12	Display Screen Control Switch (See page 3-23)
13	Display Screen Selector Switch (See page 3-23)
14	Differential Lock Switch (Auto) (Optional)
15	Not Used
16	Boom Kick-out Switch
17	Diesel Particulate Filter (DPF) Switch
18	LIS Switch (Optional)
19	Not Used
20	Differential Lock Button (Manual)

1. Horn Button (Two Places / Optional)

Pressing the button at the end of the combination switch (Figure 5) or the lowest button at tip of FNR lever (joystick) (Figure 6) or the left button at the tip of the finger tip lever (optional) of the two levers (Figure 7), will sound the horn.

NOTE: *Starter switch must be "ON".*

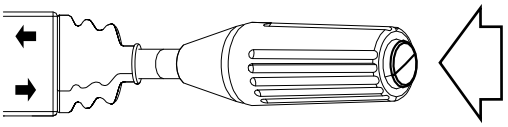

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Figure 5

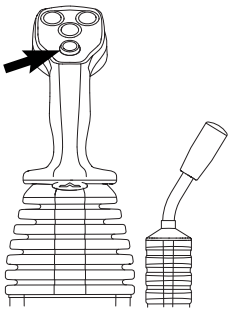

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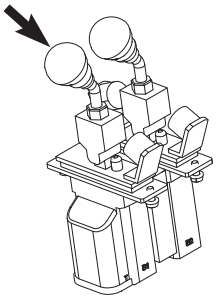
Figure 6



WL1300162

Figure 7

2. Combination Switch

A. Left Side Directional Switch - Pushing lever forward, activates left outside directional lights and directional indicator light on instrument panel.

B. Right Side Directional Switch - Pulling lever back, activates right outside directional lights and directional indicator light on instrument panel.

NOTE: *When turn is completed, the lever automatically returns to "NEUTRAL" position. Should it not, it can be manually returned by hand.*

NOTE: *Turn signals will function with starter switch in "OFF" position.*

C. Window Washer Switch - When the outside area of the lever is pressed, it activates the washer pump and sprays fluid on the windshield. (Only while being pressed.)

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

D. Horn Button - The center button on end of lever activates horn. (Only while being pressed.)

E. Wiper Switch - Activates wipers when outside area of lever is rotated.

J: Intermittent Mode - wipes every five seconds.

0: Stop (Off).

I: Normal Speed Mode.

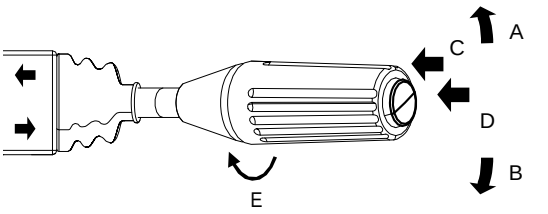
II: High-speed Mode.

F. Neutral Position - Normal low beams.

G. Pull up to 1st step - Momentarily turns "ON" both the low beams and high beams. (It returns to "NEUTRAL" position when released.)

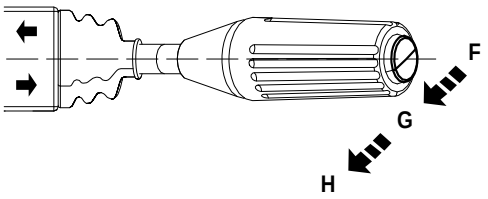
H. Pull up to 2nd step - The high beams turn "ON". (It returns to "NEUTRAL" position when released.) For turn off, pull up 2nd step again.

NOTE: *High and low beams will only function with the headlight switch in the "||" position.*



FG018956

Figure 8



FG018957

Figure 9

3. Accelerator Pedal

Controls the travel speed of loader and working speed of load handling system.

IMPORTANT

The further the pedal is pressed, the more the engine speed will increases. However, do not press the pedal more than necessary otherwise, it will increase fuel consumption.

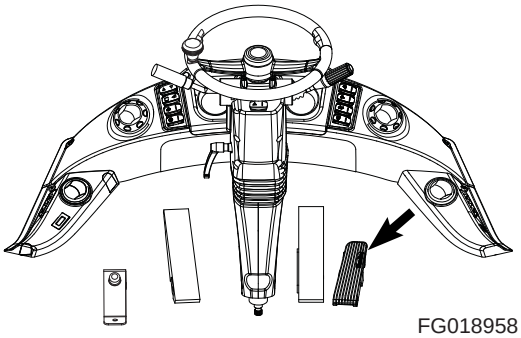


Figure 10

4. Steering Wheel Adjustment Lever

Control lever (1, Figure 11) is used to move wheel to most convenient position for the operator.

Adjusting Steering Wheel Tilt

Pull lever (1, Figure 12) upward and move wheel (2, Figure 12) to desired position. Push lever down (Tilt angle is 21°).

Adjusting Steering Wheel Telescopic

Pull lever (1, Figure 12) upward and move wheel (2, Figure 12) to desired position. Push lever down (telescopic stroke is 80 mm).

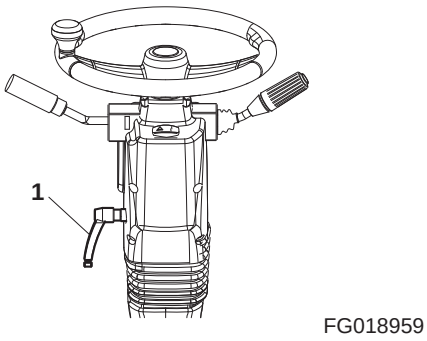


Figure 11

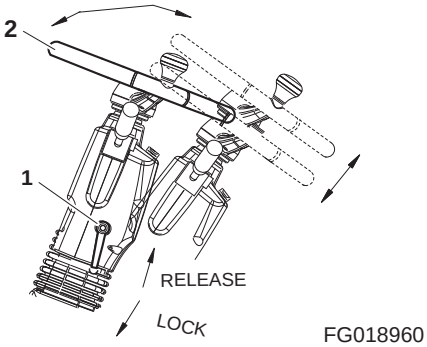


Figure 12

5. Brake Pedal (Right and Left Pedals)

Pressing brake pedal will apply the brakes to the machine. The brake pedal modes can be switched from "INCHING" to "NO INCHING" or vice versa, by using the transmission cutoff switch (See page 3-62).

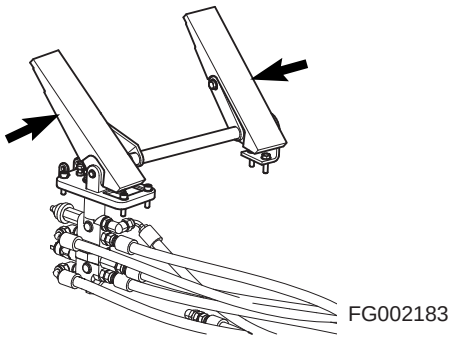


Figure 13

CAUTION

AVOID INJURY

When descending an incline, slow down the machine by using both the brake pedal and the engine as a brake by shifting the transmission to a lower gear. Using the brake pedal too often might lead to insufficient oil pressure, reducing braking capability.

IMPORTANT

Do not use brake pedal as a footrest. This will cause brake disk to wear faster than normal, and this could reduce braking capability.

6. Steering Wheel

Rotating steering wheel controls position of front wheels and this determines direction of machine travel.

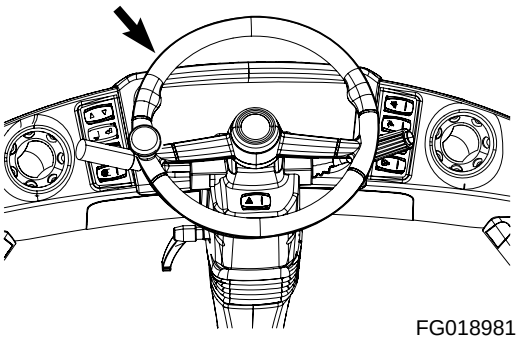


Figure 14

7. Kick-down Button (Two Places / Optional)

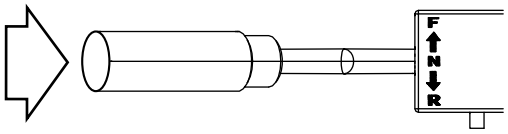
When transmission is in 2nd gear, pressing this switch will shift transmission into 1st gear. This will allow the driver to perform a quick digging movement.

NOTE: *Kick-down is "RELEASED" when transmission is placed in "NEUTRAL" position or the switch is pressed again.*

Kick-down function range:

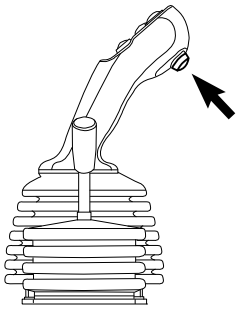
- Automatic: 2nd, 3rd, 4th.
- Manual: 2nd

The second kick-down button is on the reverse side of the pilot control valve lever (joystick).



FG018982

Figure 15

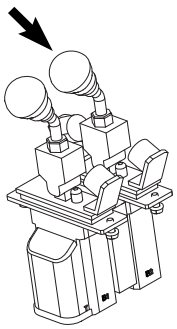


FG019164

Figure 16

A third kick-down button (optional) (Figure 17) is on the right button in the tip of the pilot control valve lever (Right one of two levers).

NOTE: *If the machine is equipped with there is an additional kick-down button. See “2. Kick-down Button (Two Places)” on page 3-58.*



FG023248

Figure 17

8. Transmission Lever

F Forward - When the lever is pushed forward, transmission is in "FORWARD". 1st, 2nd, 3rd and 4th are available.

N Neutral - When the lever is returned to the center position, between forward and reverse, the transmission is in "NEUTRAL".

R Reverse - When the lever is pulled back, transmission is in "REVERSE", 1st, 2nd and 3rd gears are available.

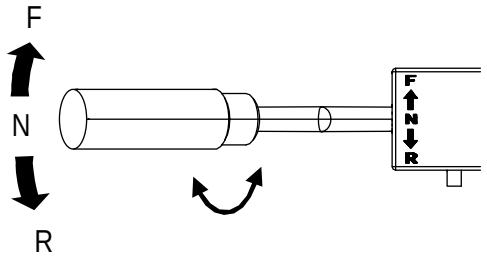
Rotating the switch shifts transmission between 1st, 2nd, 3rd or 4th gears.

NOTE: *There is a transmission display, on the dash, that indicates, gears, direction of travel, error codes and kick-down activation. (See page 3-18)*

A transmission neutral lever lock is located at the base of transmission lever. This neutral lever lock prevents the transmission lever from being moved out of "NEUTRAL".

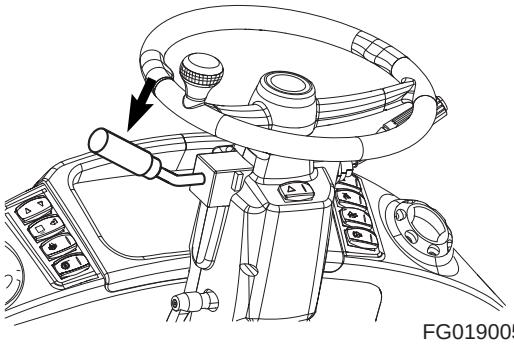
N "NEUTRAL LOCK" position- Prevents lever from being moved out of "NEUTRAL".

D "DRIVE" position- Allows lever to be moved from "NEUTRAL" to "FORWARD and REVERSE".



FG019004

Figure 18



FG019005

Figure 19

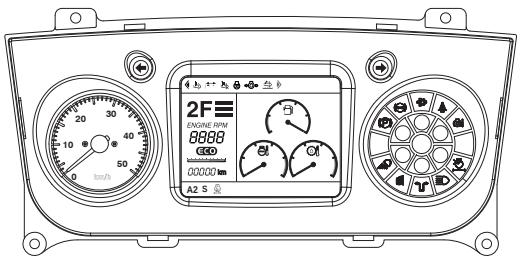
⚠ CAUTION

AVOID INJURY

"LOCK" transmission lever. Whenever machine is parked, "LOCK" transmission lever in "NEUTRAL" to prevent accidental machine movement.

9. Front Instrument Panel

See “Front Instrument Panel” on page 3-18

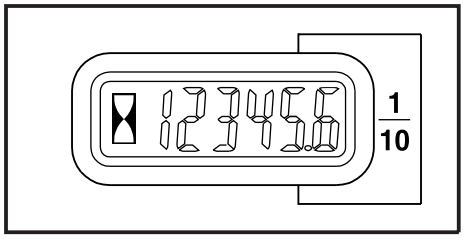


FG024325

Figure 20

10. Hour Meter

The hour meter is used to indicate total number of operating hours on engine. The meter will flash every 4 seconds when engine is running to indicate that it is functioning properly.



HAOA601L

Figure 21

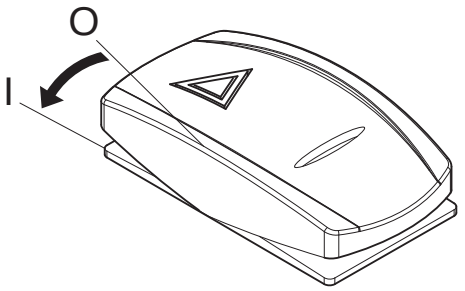
11. Hazard Warning Light Switch

The hazard warning light is used when machine is stopped because of a malfunction or when an emergency occurs. When this switch is pressed, all directional indicator lights on front and back of machine will turn "ON" and "FLASH", warning others in the area. At the same time the directional indicator lights on instrument panel will turn "ON" to warn the operator. The hazard warning light operates independently of starter switch.

O. In this position, all directional indicator lights on front and back of machine, and instrument panel are turned "OFF".

I. In this position, all directional indicator lights on front and back of machine, and instrument panel are turned "ON".

NOTE: *Hazard warning lights will function with starter switch in "OFF" position.*

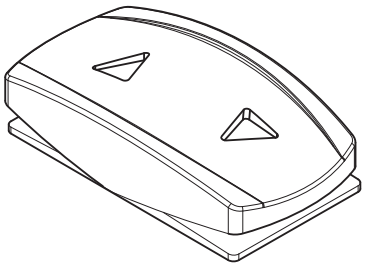


FG019007

Figure 22

12. Display Screen Control Switch

See “Multifunction Gauge and Graphic Information Display” on page 3-23

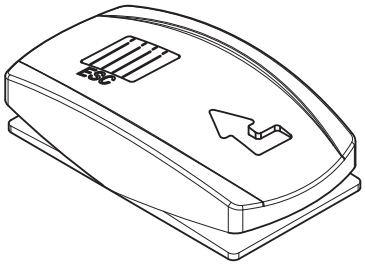


FG019009

Figure 23

13. Display Screen Selector Switch

See “Multifunction Gauge and Graphic Information Display” on page 3-23



FG019008

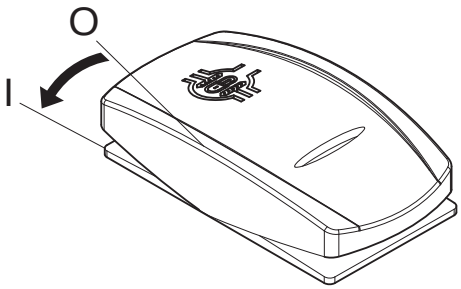
Figure 24

14. Differential Lock Switch (Auto) (Optional)

The automatic differential lock system locks the axles so the left and right front wheels turn together when wheel slip is detected.

O. In this position, automatic differential lock system is turned "OFF", but manual differential lock is available when using foot switch.

I. In this position, automatic differential lock system is tuned "ON". The automatic differential lock is actuated, and lockup symbol on LCD monitor display is turned "ON".



FG019010

Figure 25

CAUTION

AVOID INJURY

The actuation of the differential lock (pressing differential lock button, manual mode) could influence the driveability while steering. Differential lock actuation is only be recommended when driving straight.

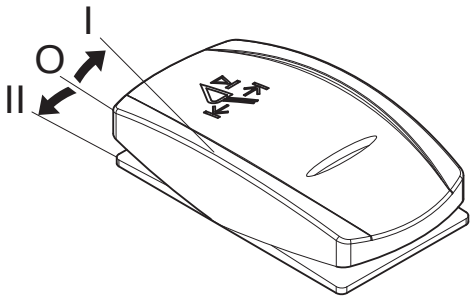
15. Not Used

16. Boom Kick-out Switch

O. In this position, boom kick-out is turned "OFF".

I. Place the boom at the desired position and press the switch towards I direction for at least one second. This will set up the "Boom Kick-out" position.

II. In this position, boom kick-out is turned "ON".



FG019012

Figure 26

17. Diesel Particulate Filter (DPF) Switch

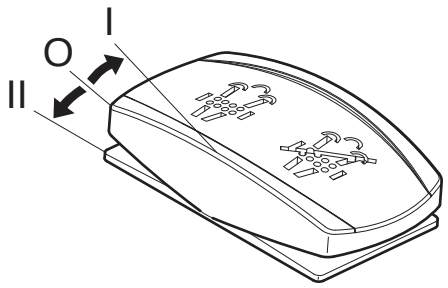
Used for manual (forced) regeneration or the inhibition (non-regeneration) of DPF system.

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 3-14 for more information.*

IMPORTANT

Do not handle the machine until regeneration cycle is completed.

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



FG018280

Figure 27

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

NOTE: *Turn "off" cutoff switch and "on" parking brake 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.

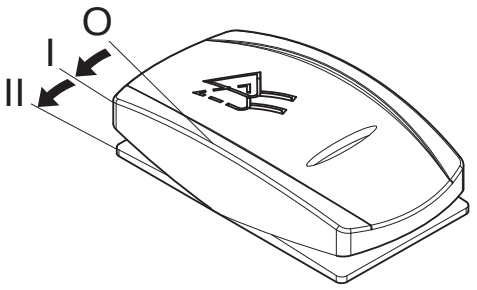
18. Load Isolation System (LIS) Switch (Optional)

This switch enables the boom cylinder to absorb shock loading of the machine when traveling or working. It provides a smoother ride and increase operator comfort. It is most effective when traveling with a loaded bucket.

O. In this position, LIS is turned "OFF".

I. In this position, LIS is turned "ON" at all travel speeds.

II. In this position, LIS will "AUTOMATICALLY TURN ON" if forward travel speed exceeds 6 km/h (3.7 MPH) or reverse travel speed exceeds 4 km/h (2.5 MPH). LIS will automatically turn "OFF" if forward speed is less than 4 km/h (2.5 MPH) or if reverse travel speed is less than 2 km/h (1.2 MPH).



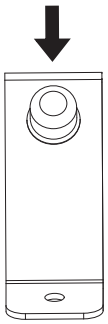
FG019104

Figure 28

19. Not Used

20. Differential Lock Button (Manual)

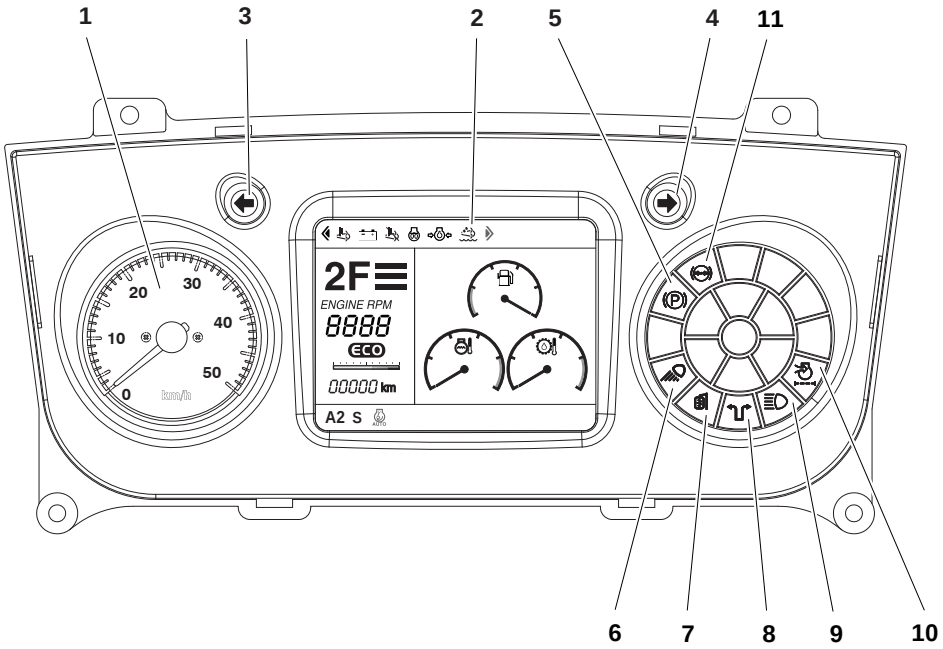
Depress switch to "LOCK" front axle differential and release switch to "UNLOCK" differential.



FG019121

Figure 29

FRONT INSTRUMENT PANEL



FG024326

Figure 30

Gauges

Reference Number	Description
1	Speedometer

Reference Number	Description
2	Multifunction Display

Warning and Indicator Lights

Reference Number	Description
3	Left Turn and Hazard Warning Light
4	Right Turn and Hazard Warning Light
5	Parking Brake Indicator Light
6	Work Light Indicator Light
7	Mirror Heating Indicator Light (Optional)

Reference Number	Description
8	Emergency Steering Indicator Light (Optional)
9	High Beam Indicator Light
10	Air Cleaner Clogged Warning Light
11	Brake Fluid Pressure Warning Light

IMPORTANT

All gauge and warning lights (except for the turn lights, high beam light, work lights and transmission cutoff light) turn "ON" for two seconds with a warning buzzer sound when the starter switch is turned to "I" (ON) position.

If any light fails to turn "ON" check the cause and replace.

Password Activated

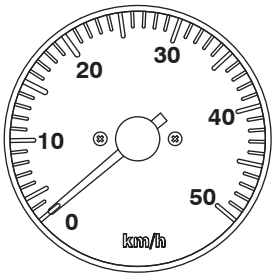
If a password has already been set and the system has been "LOCKED", the password display will appear on the screen once the function check has been completed. Enter the password into the text area and then engage the starter.

NOTE: *Refer to "Set Password (Lock and Unlock)" on page 2-41, for further details.*

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

1. Speedometer

This meter displays speed at which the machine is traveling.

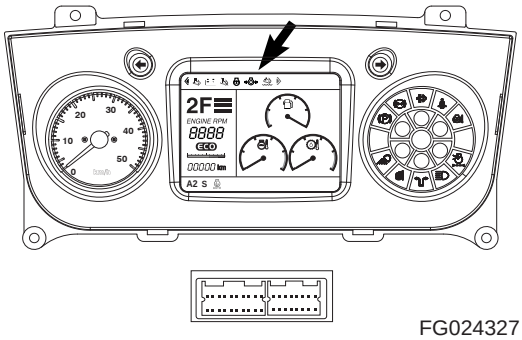


FG004182

Figure 31

2. Multifunction Gauge and Graphic Information Display

See “Multifunction Gauge and Graphic Information Display” on page 3-25 This section will have a more in-depth explanation of the display area.



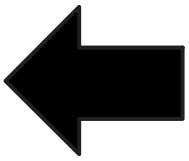
FG024327

Figure 32

3. Left Turn and Hazard Warning Light

This light blinks when left turn signal is turned "ON". Both turn signal lights blink when hazard warning light switch is turned "ON".

NOTE: *If left and right turn indicators blink together, or if they blink faster than normal, a light bulb is not operating or flasher solenoid is damaged.*



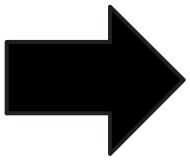
FG004173

Figure 33

4. Right Turn and Hazard Warning Light

This light blinks when right turn signal is turned "ON". Both turn signal lights blink when hazard warning light switch is turned "ON".

NOTE: *If left and right turn indicators blink together, or if they blink faster than normal, a light bulb is not operating or flasher solenoid is damaged.*



FG004174

Figure 34

5. Parking Brake Indicator Light

This indicator light will turn "ON" when the parking brake is "APPLIED". If vehicle is moved while parking brake is applied, a warning alarm will sound.

WARNING

AVOID DEATH OR SERIOUS INJURY

If the machine is moved while this light is turned "ON", it could cause premature wear or damage the brake system.

Always "RELEASE" parking brake and make sure this light is "OFF" before operating machine.

0717A

Figure 35

6. Work Light Indicator Light

This indicator light will turn "ON" when the front and/or rear work lights are activated.

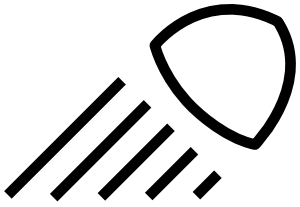


Figure 36

7. Mirror Heater Indicator Light (Optional)

This indicator light will turn "ON" when the mirror heater is activated.

FG004184

Figure 37

8. Emergency Steering Indicator Light (Optional)

This indicator light will turn "ON" when the emergency steering system is activated because of a hydraulic failure. Immediately stop any operation, stop machine, "ENGAGE" parking brake, and stop engine.

WARNING

AVOID DEATH OR SERIOUS INJURY

If the emergency steering indicator light turns "ON" while operating, immediately stop operation. Inspect and repair system before continuing to operate machine.

NOTE: *The light will also turn "ON" when the system is being tested.*

AJO0450L

Figure 38

9. High Beam Indicator Light

This indicator light will turn "ON" when the headlights are turned to "HIGH BEAM".

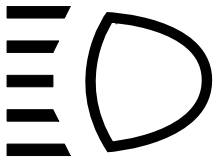
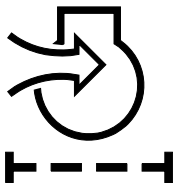


Figure 39

10. Air Cleaner Clogged Warning Light

This warning light will turn "ON" when dirt has built up in air filter, and is beginning to restrict airflow. Clean or replace air filter before continuing to operate machine. To turn indicator light "OFF", turn starter switch "OFF" and then back "ON".



HAOA660L

Figure 40

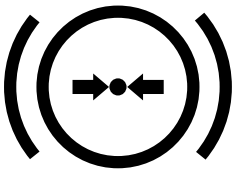
11. Brake Fluid Pressure Warning Light

This warning light will turn "ON" when pressure drops in brake fluid circuit. When light turns "ON", an alarm also sounds.

WARNING

AVOID DEATH OR SERIOUS INJURY

Never operate machine when this light is "ON" or when alarm is sounding. Always check for cause of drop in brake fluid pressure, and repair problem before operating machine.



HA0O2024

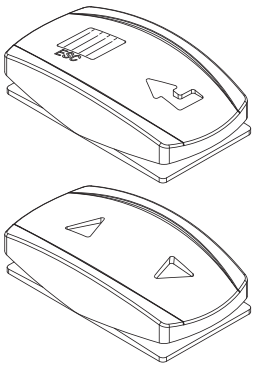
Figure 41

MULTIFUNCTION GAUGE AND GRAPHIC INFORMATION DISPLAY

Multifunction Gauge and Graphic Information Display Switches

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

The buttons are located on the front panel. Refer to the following picture and See “Steering Console and Pedals” on page 3-7 in this manual.



WL1300274

Figure 42

1. Up Arrow Button

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

FG019322

Figure 43

2. Down Arrow Button

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

FG019323

Figure 44

3. Display Selector Button (ESC - Escape)

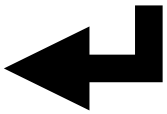
Display selector button ( ) is used as a menu/exit button, it is used to access to main menu or return to a previous screen from each sub-menu.

FG015189

Figure 45

4. Selector Button

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

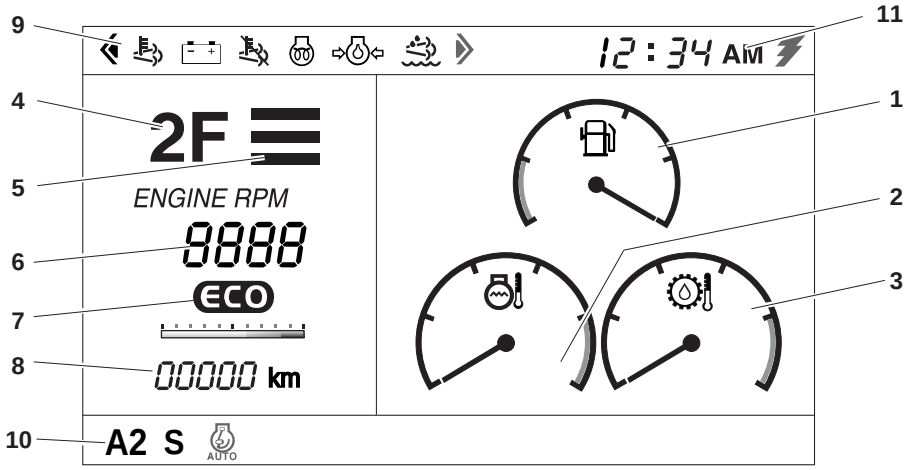


FG019324

Figure 46

Multifunction Gauge and Graphic Information Display

A multifunction display is in the gauge panel on dash. The LCD indicates, gears, direction of travel, error codes, and activated kick-down.



FG024328

Figure 47

Reference Number	Description
1	Fuel Gauge
2	Engine Coolant Temperature Gauge
3	Transmission Oil Temperature Gauge
4	Transmission Actual Gear
5	Transmission Select Gear

Reference Number	Description
6	Engine Speed
7	ECO Bar
8	Multifunction Display
9	Display Warning Symbols
10	Indicator Symbols
11	Digital Clock

1. Fuel Gauge

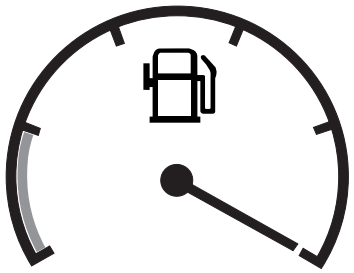
Shows remaining fuel quantity in tank.

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

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

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

Check fuel level on firm and level ground.



FG024329

Figure 48

2. Engine Coolant Temperature Gauge

The colored bands indicate temperature of engine coolant.

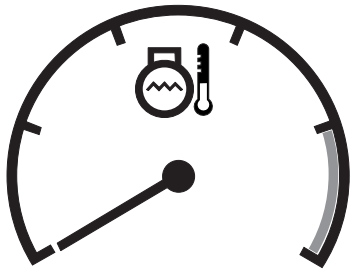
WHITE ZONE (□) - Indicates temperature is within normal operating range.

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

During operation, pointer must be in white zone.

If gauge pointer moves into red zone, engine coolant temperature warning light will turn "ON", engine speed will be automatically reduced. Allow engine to run at "LOW IDLE" until temperature gauge registers in white zone again. When white zone is reached, allow engine to idle for an additional three - five (3-5) minutes before stopping engine. If not allowed to idle, heat surge may develop which will damage engine. Allowing engine to idle will dissipate heat. Check coolant level, look for a loose fan belt, inspect for debris around radiator, etc. before continuing to operate.

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



FG024330

Figure 49

3. Transmission Oil Temperature Gauge

The colored bands indicate temperature of transmission oil.

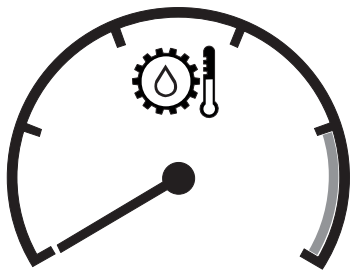
WHITE ZONE (□) - Indicates temperature is within normal operating range.

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

During operation, pointer must be in white zone.

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

NOTE: *See "9. Display Warning Symbols" on page 2-29, for location of this warning symbol and others.*



FG024331

Figure 50

4. Transmission Actual Gear

Indicates travel direction and gear selection. First number displays gear, and letter displays travel direction.

FG019113

Figure 51

5. Transmission Select Gear

Indicates gear range of transmission lever.

FG019114

Figure 52

6. Engine Speed

The engine speed is numerically displayed.

FG014225-1

Figure 53

7. ECO Bar

A. ECO symbol: shows workload when using equipment.

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

FG018119

Figure 54

B. ECO Bar: shows average fuel efficiency for real-time-based operation.

A higher fuel consumption rate will drive this bar closer to maximum position.

– Green color gauge: fuel efficiency is in economy mode.

– Amber color gauge: fuel efficiency is in standard-power mode.

– Red color gauge: fuel efficiency is in power mode.

FG019344

Figure 55

8. Multifunction Gauge

According to operator's choice, either trip meter, battery voltage, or total time of operation can be selected and displayed. Using UP (▲) / DOWN (▼) button, user can switch display selection in order of trip meter ↔ battery voltage ↔ total time of operation.

If the operator presses ESC button while instrument display is flashing, selection window disappears and previously selected item appears in display.

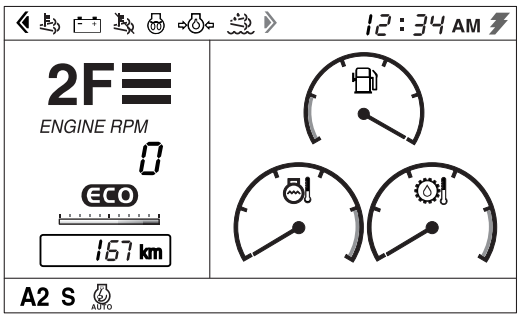
If the operator presses SELECTION (↵) button, for 3 seconds while instrument display is flashing on trip meter, trip meter is reset to zero.

A. Go to Instrument Display

Press DOWN (▼) button to move selection window to instrument display.

B. Press SELECTION (↵) button

If the operator press SELECTION (↵) button, all data in instrument display will flash.

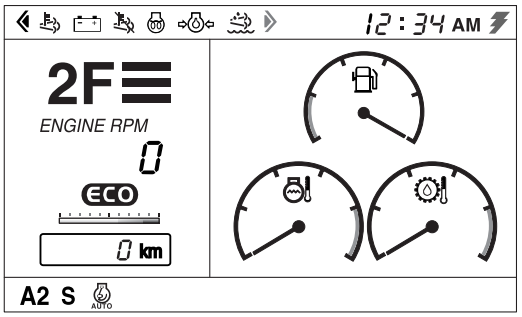


FG024332

Figure 56

C. To initialize trip meter, press SELECTION (↵) button for three (3) seconds.

To reset trip meter to 0 km, press SELECTION (↵) button for 3 seconds while instrument display is flashing.

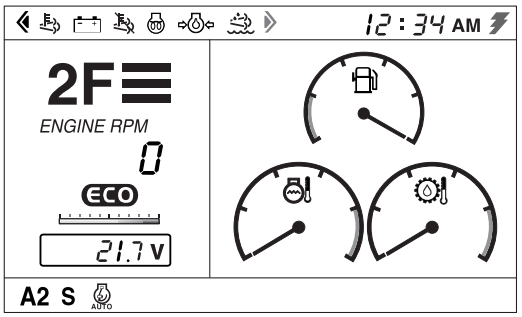


FG024333

Figure 57

D. While instrument display is flashing, press UP (▲) button to switch display to battery voltage.

While instrument display is flashing and trip meter is displayed, press UP (▲) button to switch display to battery voltage. Enter change by pressing SELECTION (↵) button, or cancel change by pressing ESC button.

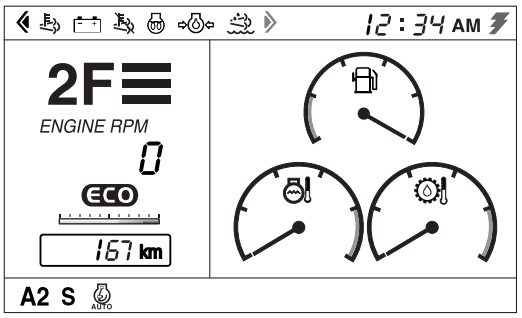


FG024334

Figure 58

E. While instrument display is flashing, press UP (▲) button to switch display to total time of operation.

While instrument display is flashing and battery voltage is displayed, press UP (▲) button to switch display to total time of operation. Enter change by pressing SELECTION (↵) button, or cancel change by pressing ESC button.

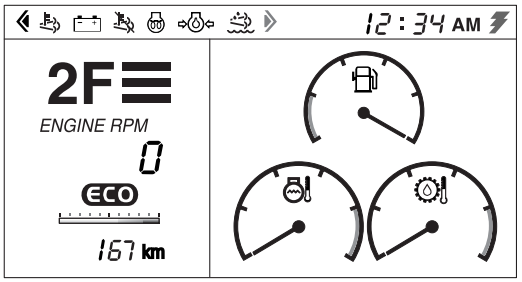


FG024332

Figure 59

9. Display Warning Symbols

Reference Number	Description
A	Charge Warning Symbol
B	Engine Oil Pressure Warning Symbol
C	Transmission Warning Symbol
D	Engine Warning Symbol
E	Water In Fuel Warning Symbol
F	Engine Stop Symbol
G	Preheating Indicator Symbol
H	Diesel Particulate Filter (DPF) Regeneration Warning Symbol
I	Diesel Particulate Filter (DPF) High Temperature Warning Symbol
J	Quick Coupler Release Warning Symbol

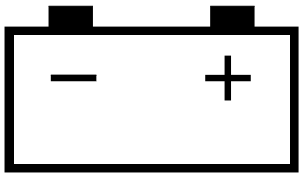


FG024335

Figure 60

A. Charge Warning Symbol

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

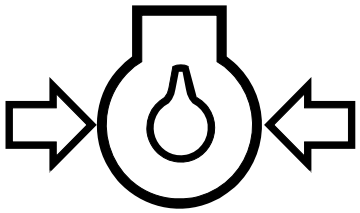


HAOA610L

Figure 61

B. Engine Oil Pressure Warning Symbol

This symbol indicates when engine starter switch is turned "ON", and should go "OFF" after engine starts. For example, if engine oil pressure becomes too low, symbol will turn "ON" and a warning buzzer will sound. If this happens, stop engine immediately and determine cause of problem. If you continue to work when this symbol is "ON", it will result in serious engine damage.



HAOA620L

Figure 62

IMPORTANT

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

C. Transmission Warning Symbol

This symbol indicates that transmission must be checked.

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

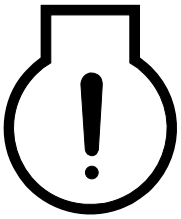
FG019122

Figure 63

D. Engine Warning Symbol

This symbol indicates that engine needs to be checked.

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



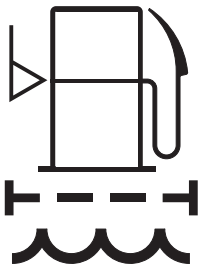
AQO0040L

Figure 64

E. Water In Fuel Warning Symbol

This symbol indicates that water separator is full of water.

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



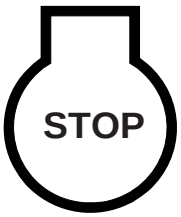
FG013744

Figure 65

F. Engine Stop Symbol

This symbol indicates when the engine needs to be stopped.

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



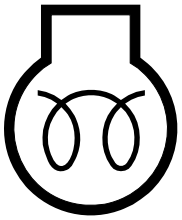
AQO0050L

Figure 66

G. 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.



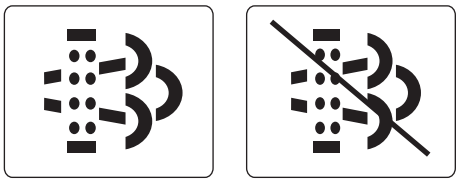
HAAE2000

Figure 67

H. Diesel Particulate Filter (DPF) Regeneration Warning Symbol

The left-hand regeneration symbol (Figure 68) 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 68).

NOTE: *Run machine at "LOW IDLE" and do not stop engine until regeneration cycle is completed. See “Engine Exhaust Emission Control System” on page 3-13 for more information.*



FG018399

Figure 68

IMPORTANT

Do not handle the machine until regeneration cycle is completed.

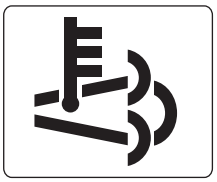
If the equipment is moved or switched off while manual (forced) regeneration, the regeneration will need to be restarted.

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

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.



FG018398

Figure 69

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

Passive 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 3-13.*

J. Quick Coupler Release Warning Symbol

This symbol indicates when the quick coupler is released.

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.

FG002195

Figure 70

10. Indicator Symbols

A. Transmission Shift Mode - Manual

When manual mode is selected, symbol is shown on lower part of screen.

FG019129

Figure 71

B. Transmission Shift Mode - Auto 1-4

When the Auto 1-4 mode is selected, the symbol is shown on lower part of screen.

FG019130

Figure 72

C. Transmission Shift Mode - Auto 2-4

When Auto 2-4 mode is selected, symbol is shown on lower part of screen.

FG019131

Figure 73

D. Engine Power Mode - Power

When power mode is selected, symbol is shown on lower part of screen.

FG019132

Figure 74

E. Engine Power Mode - Standard

When standard mode is selected, symbol is shown on lower part of screen.

FG019133

Figure 75

F. Engine Power Mode - Economy

When economy mode is selected, symbol is shown on lower part of screen.

FG019134

Figure 76

G. Auto Idle

When auto idle is operating, symbol is shown on lower part of screen.

FG019135

Figure 77

H. 2nd Gear Mode

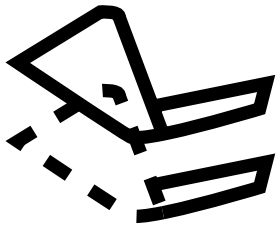
When 2nd gear is selected, symbol is shown on lower part of screen.

BSO0510L

Figure 78

I. Load Isolation System (LIS)

When LIS is operating, symbol indicates on lower part of screen.



FG019136

Figure 79

J. Torque Converter Lockup

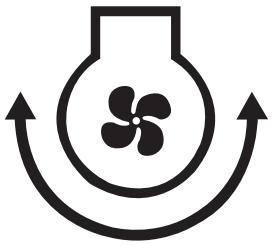
When torque converter lockup is selected, symbol is shown on lower part of screen.

FG019137

Figure 80

K. Reverse Fan

When reverse fan is operating, symbol is shown on lower part of screen.

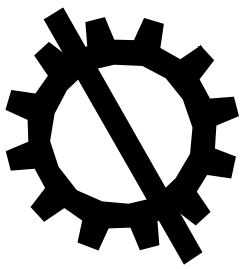


FG004185

Figure 81

L. Transmission Cutoff

When transmission cutoff is selected, symbol is shown on lower part of screen.

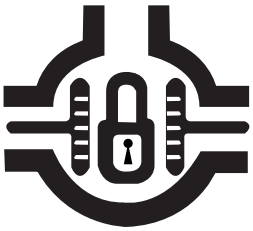


FG019138

Figure 82

M. Differential Hydraulic Lockup (DHL)

When DHL is operating, symbol is shown on lower part of screen.



FG019139

Figure 83

N. Warm Up

When warm up is operating, symbol is shown on lower part of screen.

FG019353

Figure 84

11. Digital Clock

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

Display	Description
HH	Hour
mm	Minute
AM (PM)	AM (PM)

Refer to “User Menu Access and Escape Buttons” on page 2-39 for time.

FG019345

Figure 85

Warning Pop-up

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

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

For multiple warnings and/or alarms, press UP (▲) or DOWN (▼) button to select warning/alarm and read relevant message.

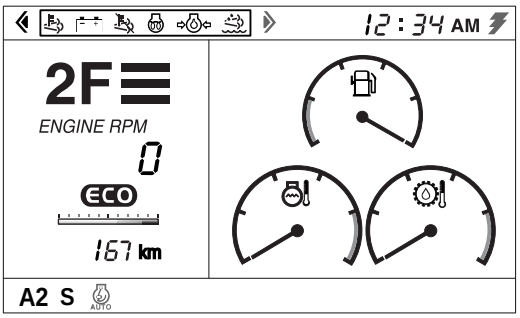
WARNING

AVOID DEATH OR SERIOUS INJURY

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

1. Go to Warning Display

Move selection window to warning display by pressing UP (▲) button.

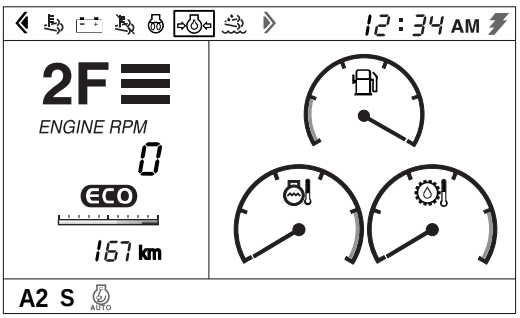


FG024336

Figure 86

2. Enter Checking Mode

Enter individual symbol checking mode by pressing SELECTION (↵) button.

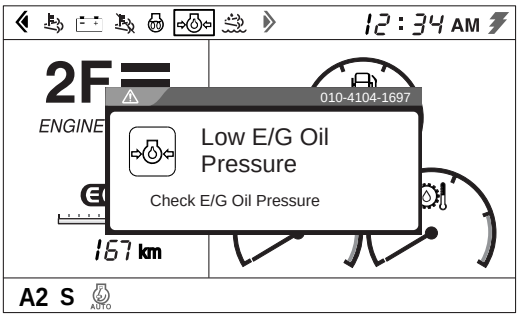


FG024337

Figure 87

3. Read Warning Message

Select warning symbol by pressing SELECTION (↵) button to read warning message.

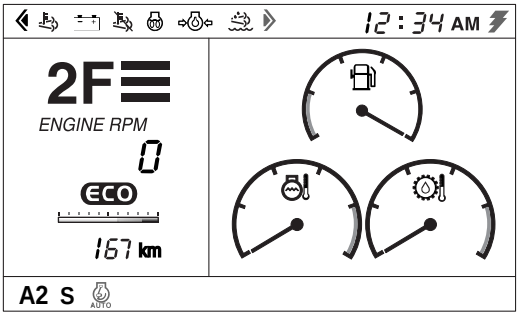


FG024338

Figure 88

4. Delete Warning Pop-up

Press ESC button to delete warning pop-up.



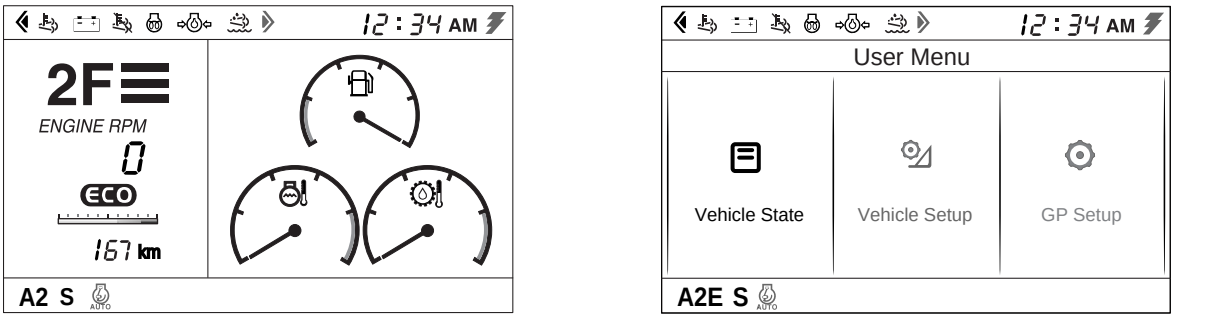
FG024339

Figure 89

User Menu Access and Escape Buttons

Access Method

On normal display screen, press ESC button for 3 seconds to access user menu screen.



<Normal Indication Monitor>

<Main Menu Monitor>

FG024340

Figure 90

Escape (ESC) Buttons

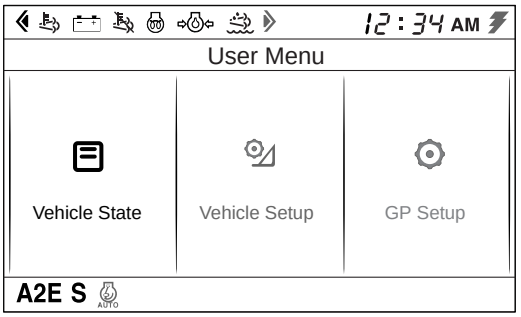
1. Press ESC button to move to normal display screen.
2. If 20 seconds have passed without operating a button, normal display screen will be displayed.
3. Turning "OFF" starter switch to cut off power, will return display screen to normal view.

User Menu

Press UP (▲) or DOWN (▼) button and move cursor to see a reversed display on desired menu. Then, press SELECTION (↵) button to select menu.

Vehicle State ↔ Vehicle Setup ↔ GP Setup

Press ESC button to return to previous screen.



FG019142

Figure 91

WARNING

AVOID DEATH OR SERIOUS INJURY

Do not use buttons to change menu state when traveling or operating machine.

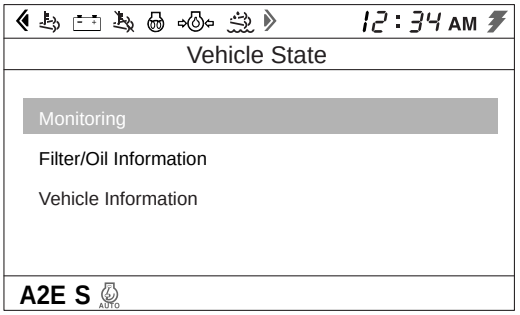
1. Vehicle State

This is used to check current Vehicle State, filter/oil information, vehicle information, etc.

Press UP (▲) or DOWN (▼) button and move cursor to see a reversed display on desired menu. Then, press SELECTION (↵) button to select menu.

Monitoring ↔ Filter/Oil Information ↔ Vehicle Information

Press ESC button to return to previous screen.



FG019143

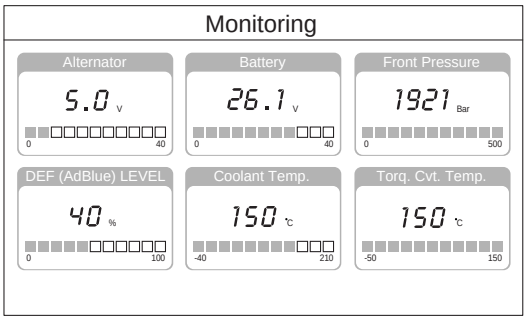
Figure 92

A. Monitoring

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

At Vehicle State, if cursor is placed on Monitoring, press SELECTION (↵) button to display Monitoring screen.

Press ESC button to return to previous screen.



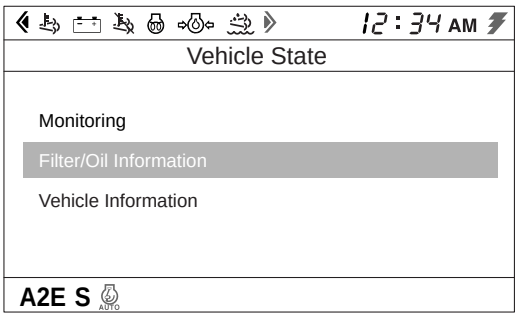
FG019144

Figure 93

B. Filter/Oil Information

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

At Vehicle State, if cursor is placed on Filter/Oil information, press SELECTION (↵) button to display filter/oil information.



FG019145

Figure 94

Reset Method/Replacement Period Change Method

Press UP (▲) or DOWN (▼) button to locate cursor to reset used time or change replacement period.

Press SELECTION (↵) button once to display "Change Period" screen.

Press UP (▲) or DOWN (▼) button to locate cursor at YES. Then, press SELECTION (↵) button to reset period.

NOTE: *Press UP (▲) or DOWN (▼) button to locate cursor at NO. Then, press SELECTION (↵) button to allow pop-up window to disappear without resetting used time.*

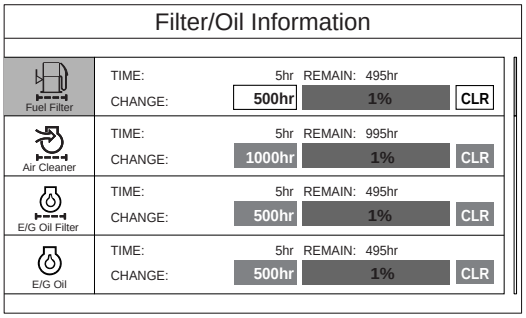
With selection screen being displayed on clear, press UP (▲) or DOWN (▼) button to display selection screen on replacement period.

Press SELECTION (↵) button to change selection screen. It may flashing for a moment. Then, press DOWN (▼) button to reduce period. Press UP (▲) button to extend period.

When replacement period change has been completed, press SELECTION (↵) button to create a pop-up window to select period change.

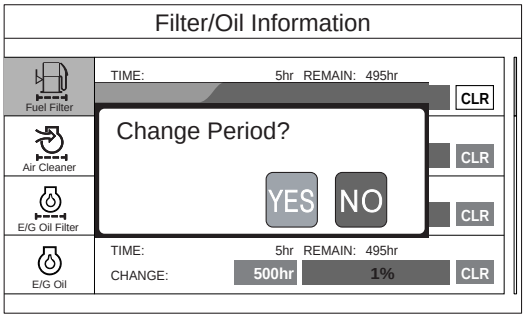
Press UP (▲) or DOWN (▼) button to locate it at YES. Then, press SELECTION (↵) button to change replacement period.

NOTE: *Press UP (▲) or DOWN (▼) button to locate it at NO. Then, press SELECTION (↵) button to allow pop-up window to disappear without changing replacement panel.*



FG019146

Figure 95



FG019147

Figure 96

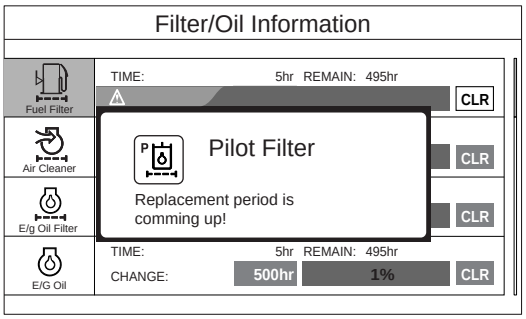
Symbol Description

Filter/Oil Name	Fuel Filter	Air Cleaner	E/G Oil Filter	Engine Oil	Axle Oil	Hydraulic Oil	Coolant	Return Filter	Pilot Filter	Transmission Oil	Transmission Oil Filter	DPF Filter
Icon								R	P			

WL1300168

Figure 97

If remaining time for filter/oil replacement is less than 10 hours, this pop-up window will be displayed. Press ESC button to make pop-up window disappear.

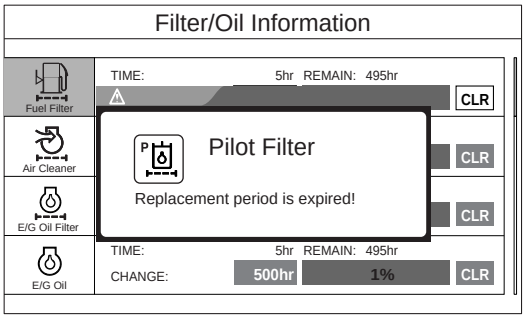


FG019148

Figure 98

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

Press ESC button to make pop-up window disappear.



FG019149

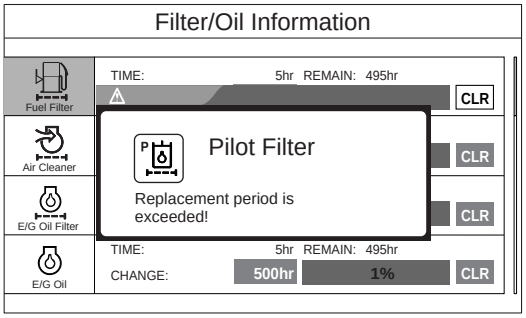
Figure 99

If filter/oil replacement period is exceeded, this pop-up window will be displayed. Press ESC button to make pop-up window disappear.

WARNING

AVOID DEATH OR SERIOUS INJURY

Do not use buttons to change Vehicle State menu when traveling or operating machine.



FG019150

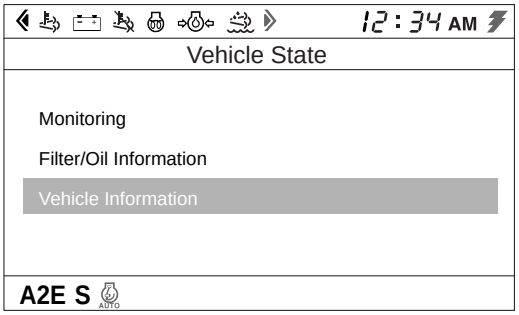
Figure 100

C. Vehicle Information

This is used to check vehicle name, engine type and serial number.

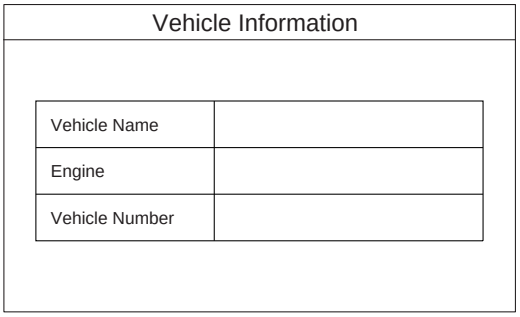
At Vehicle State, if cursor is placed on Vehicle Information, press SELECTION (↵) button to access Vehicle Information screen.

Click ESC button to return to previous screen.



FG019151

Figure 101



FG021978

Figure 102

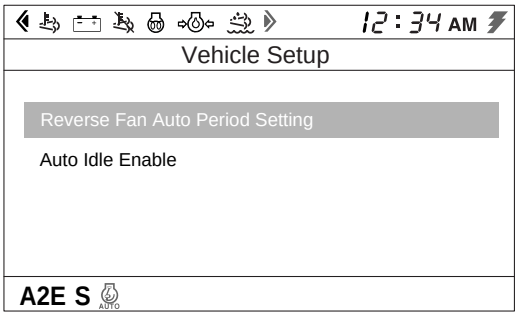
2. Vehicle Setup

This is used when selecting functions such as auto idle enable and reverse fan auto period setting.

Press UP (▲) or DOWN (▼) button and move cursor to see an reversed display on desired menu. Then, Press SELECTION (↵) button to select menu.

Auto Idle Enable State ↔ Reverse FAN Auto Period Setting

Press ESC button to return to previous screen.



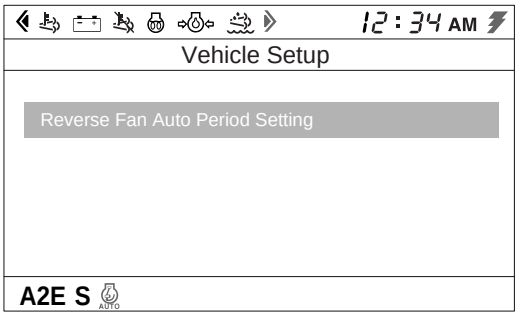
FG019157

Figure 103

A. Reverse Fan Auto Period Setting

"Reverse Fan Auto Period Setting" is used to set up period of time for reversing rotation direction of cooling fan.

In "Vehicle Setup" window, with cursor on "Reverse Fan Auto Period Setting" menu, press SELECTION (↵) button to enter "Reverse Fan Auto Period Setting" window.

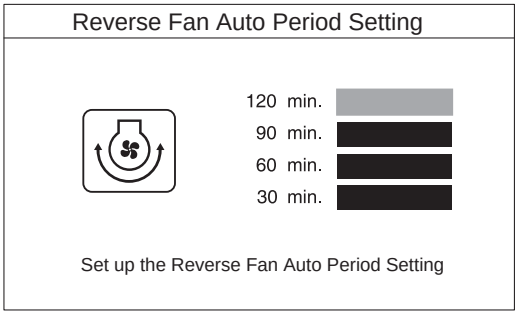


FG021976

Figure 104

Move between period fields using UP (▲) or DOWN (▼) button. The available range of period is between 30 minutes and 2 hours.

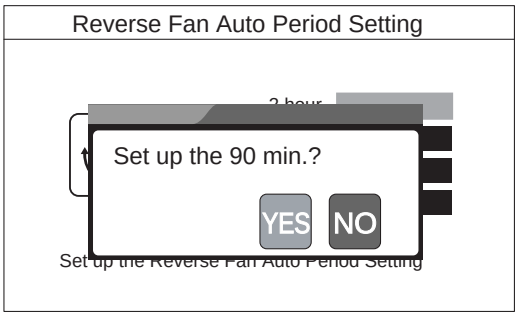
30 min. ↔ 60 min. ↔ 90 min. ↔ 120 min.



FG019158

Figure 105

In time list, it SELECTION (↵) button is pressed, a pop-up dialog will appear to confirm change to selected time period.



FG019159

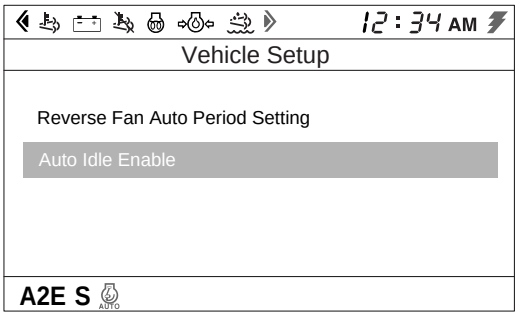
Figure 106

B. Auto Idle Enable / Disable State

"Auto Idle" window is used to "ENABLE" or "DISABLE" auto idle function.

In "Vehicle Setup" window, with cursor on "Auto Idle Enable or Disable" menu, press SELECTION (↵) button to go to "Auto Idle Enable or Disable" window.

Press ESC button to return to previous window.



FG019154

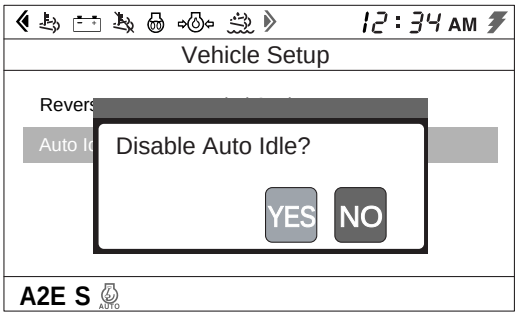
Figure 107

Auto Idle Setting Procedure:

– With cursor on "Auto Idle" setting menu, press SELECTION (↵) button. A pop-up window asking "Disable Auto Idle?" will appear. The user can change setting using UP (▲) or DOWN (▼) button and make selection with SELECTION (↵) button.

– Auto idle disable can be changed with same method described above.

– Pressing ESC button cancels change and removes pop-up window.

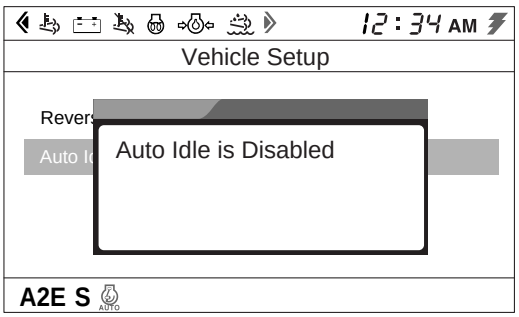


FG019155

Figure 108

– When change has been completed, a pop-up display reading "Auto Idle is Disabled" will appear for 3 seconds, and menu list will be changed according to selected setting.

– **Auto Idle Enable State ↔ Auto Idle Disable State**



FG019156

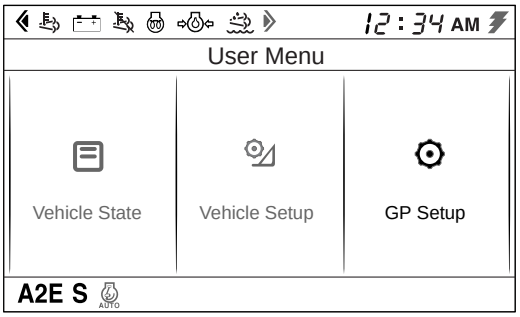
Figure 109

2. GP Setup

This menu is used to set up; password, brightness, default screen and time, and to input service phone number. Press UP (▲) or DOWN (▼) button and move cursor to see a reversed display on desired menu. Then, press SELECTION (↵) button to select menu.

Password Setting ↔ Screen Brightness Setting ↔ Default Screen Setting ↔ Time Setting ↔ Service Phone Number Setting ↔ Unit Setting ↔ Language Setting ↔ Notification Setting

Press ESC button to return to previous screen.



FG019186

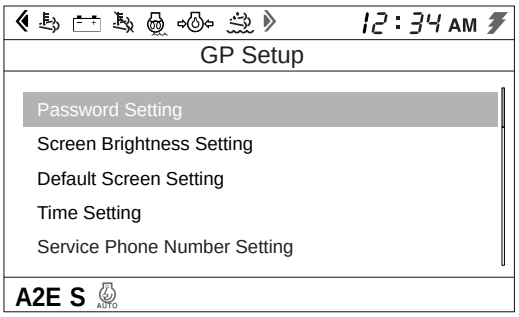
Figure 110

A. Password Setting

On "GP Setup" screen, when cursor is placed on "Password Setting", press SELECTION (↵) button to display screen brightness setting.

This function is used to set up a user password.

If password setting function is used, password must be correctly input to operate vehicle normally.



FG019187

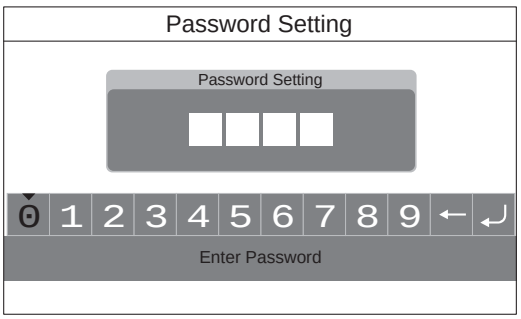
Figure 111

On "Password Setting" screen, when cursor is placed on password setting, press SELECTION (↵) button to display password input screen that was set up at factory. The initial password is set to "1111".

If you have changed the password, you should input the new password you have chosen.

IMPORTANT

If password input errors have been made three times in a row, screen will move to default screen. After that, starting will be locked for 10 minutes.



FG019188

Figure 112

How to Input Password:

– Press UP (▲) or DOWN (▼) button and select numbers of 0 - 9 at bottom. Then, press SELECTION (↵) button and input a password.

– If you erroneously input a password, select (←) key at right bottom and press SELECTION (↵) button to delete input password.

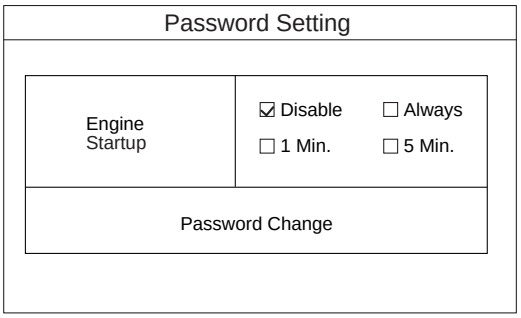
– On password setting screen, input a password to display a screen to select application of function (lock), non-application (unlock) and password change.

– Press UP (▲) or DOWN (▼) button and move cursor to a menu item. Then, press SELECTION (↵) button to move to relevant function or a selected screen.

– Press ESC button to return to previous screen.

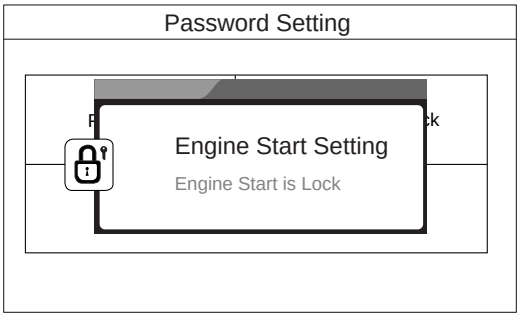
– Select lock (applied) or unlock (not applied) in password setting to enable or disable password setting function accordingly.

– If you select lock (applied) in Password Setting, this pop-up window will appear to confirm lock setup and will then automatically disappear in 3 seconds.



FG019189

Figure 113



FG019190

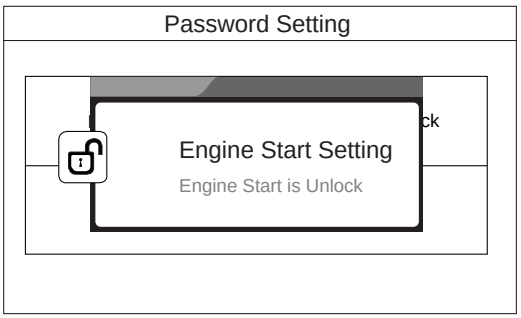
Figure 114

If you select unlock (not applied) in Password Setting, this pop-up window will appear to confirm unlock setup and will then automatically disappear in 3 seconds. To change password, change it on Password Setting screen according to the following procedure:

– Select password change.

– Input a new four-digit password (repeat it twice).

– On Password Setting screen, select lock (applied) or unlock (not applied).



FG019191

Figure 115

IMPORTANT

Be careful not to forget your password.

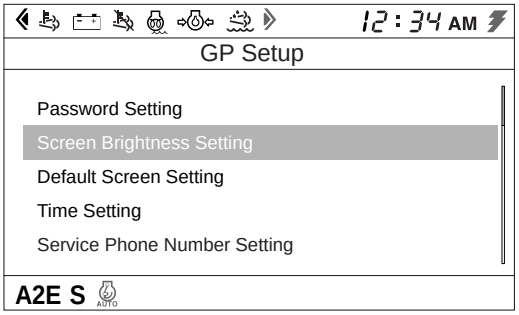
If you have forgotten your password, contact a DOOSAN distributor.

B. Screen Brightness Setting

On "GP Setup" screen, when cursor is placed on "Screen Brightness Setting", press SELECTION (↵) button to display screen brightness setting.

To change screen brightness, select screen brightness setting to display brightness adjustment screen.

Press UP (▲) or DOWN (▼) button and adjust brightness from 10 - 100% at intervals of 10%.

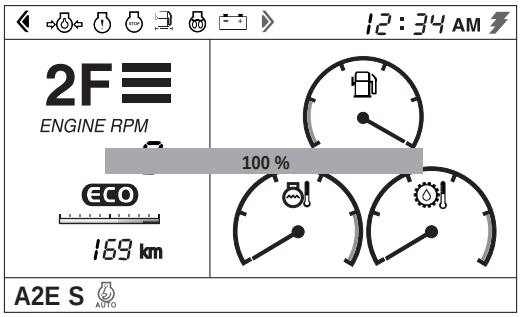


FG019192

Figure 116

NOTE: *The screen brightness is set as 80% at factory.*

Press ESC button to return to previous screen.



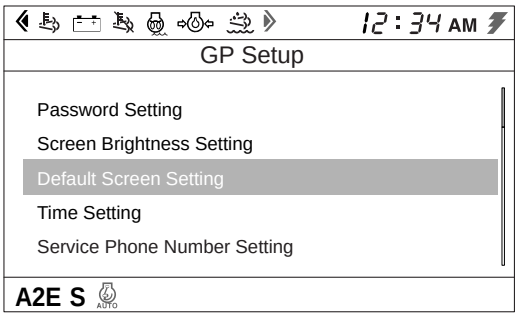
FG024341

Figure 117

C. Default Screen Setting

On "GP Setup" screen, when cursor is placed on "Default Screen Setting", press SELECTION (↵) button switch to access default screen setting.

On default screen setting, press UP (▲) or DOWN (▼) button and locate cursor at a desired style. Then, press SELECTION (↵) button to select style.

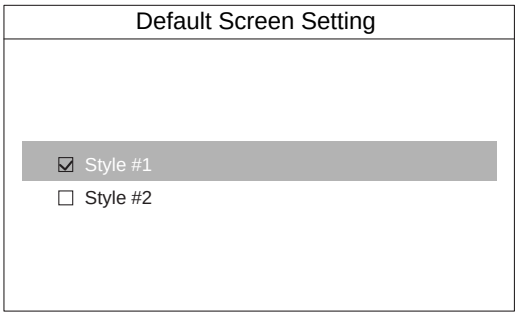


FG019194

Figure 118

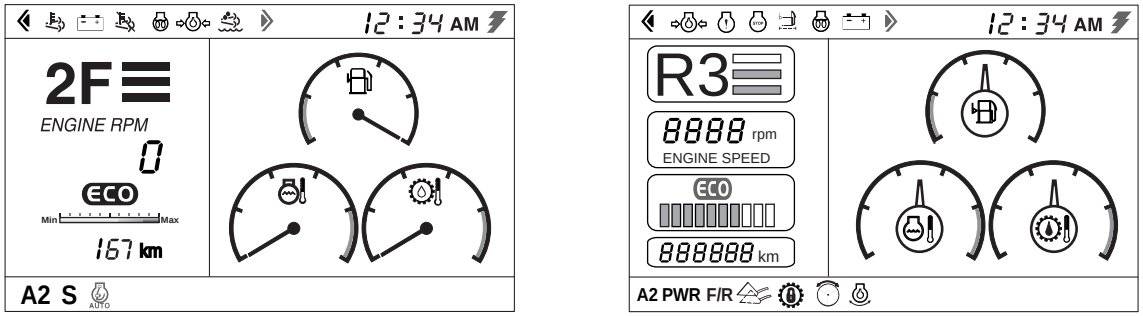
The selected style screen is displayed as normal display screen.

The screen is set as style #1 at factory.



FG019195

Figure 119



<Style #1> <Style #2>

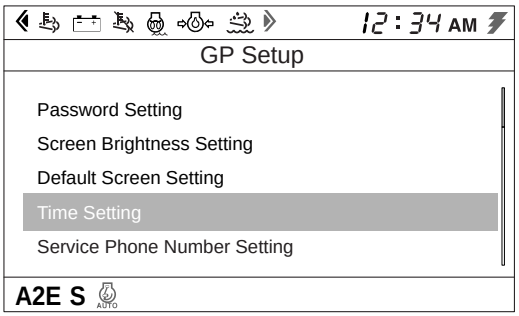
FG024342

Figure 120

D. Time Setting

On "GP Setup" screen, when cursor is placed on "Time Setting", press SELECTION (↵) button to access time setting.

Press UP (▲) or DOWN (▼) button and move cursor to a menu item. Then, press SELECTION (↵) button to change target.



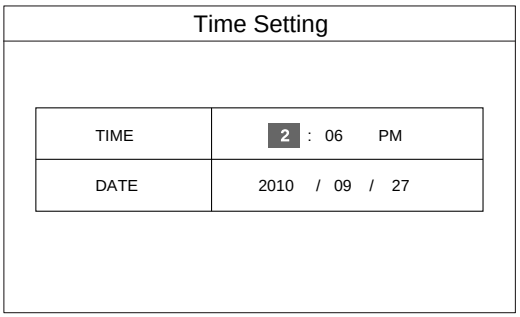
FG019197

Figure 121

Press UP (▲) or DOWN (▼) button to change numbers of each item.

If set up is completed, Press SELECTION (↵) button to store set up details.

Press ESC button to return to previous screen.

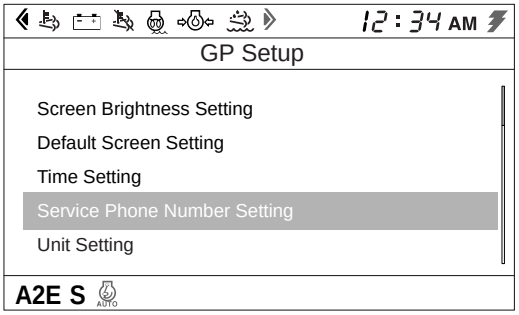


FG018538

Figure 122

E. Service Phone Number Setting

On "GP Setup" screen, when cursor is placed on "Service Phone Number Setting", press SELECTION (↵) button to access service phone number setting.

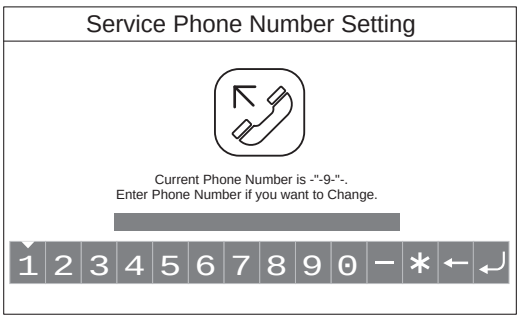


FG019199

Figure 123

Press UP (▲) or DOWN (▼) button and locate cursor at a desired number. Then, press SELECTION (↵) button to input number. If number input is completed, press (↵) key to enter input phone numbers.

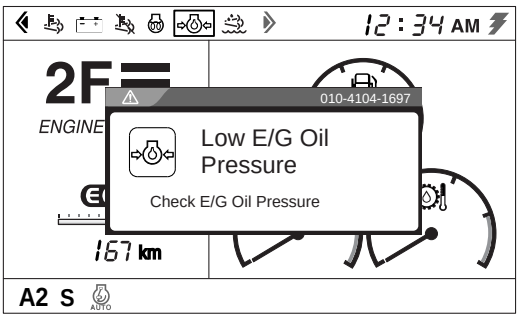
Use (←) key and delete erroneously input numbers.



FG019200

Figure 124

When you input service phone numbers, if warning/ alarm is given, check input phone numbers in pop-up window.

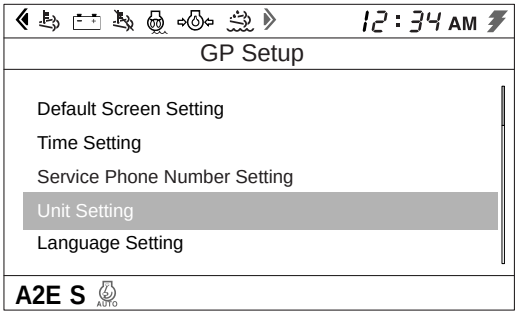


FG024338

Figure 125

F. Unit Setting

On "GP Setup" screen, when cursor is placed on "Unit Setting", press SELECTION (↵) button to access Unit Setting.



FG019201

Figure 126

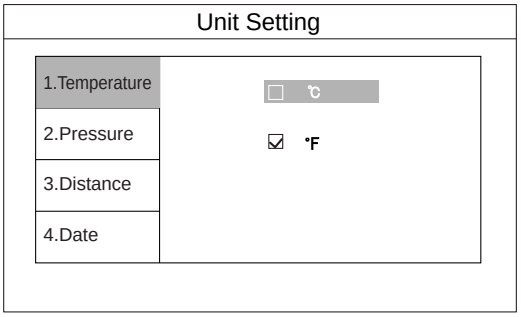
On "Unit Setting" screen, change units of temperature, pressure, distance, and date. The following values are factory settings:

Temperature: °C

Pressure: bar

Distance: km

Date: yy/mm/dd

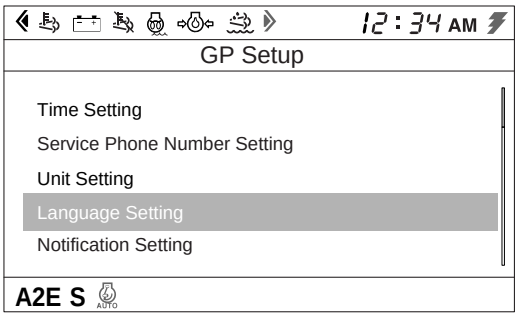


FG019202

Figure 127

G. Language Setting

On "GP Setup" screen, when cursor is placed on "Language Setting", press SELECTION (↵) button to access language setting.

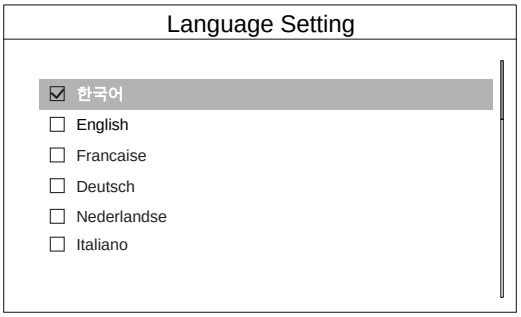


FG019319

Figure 128

On Language Selection screen, press UP (▲) or DOWN (▼) button and move cursor to select a language. Then, press SELECTION (↵) button to select language.

Press ESC button to return to previous screen.

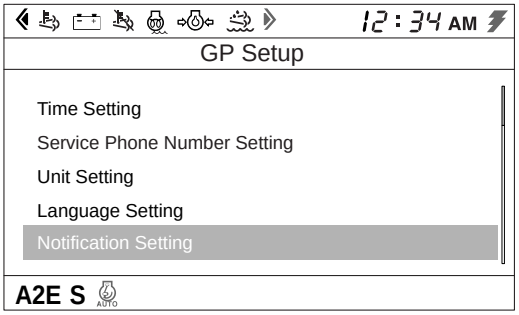


FG019203

Figure 129

H. Notification Setting

On "GP Setup" screen, when cursor is placed on "Notification Setting", press SELECTION (↵) button to access notification setting.



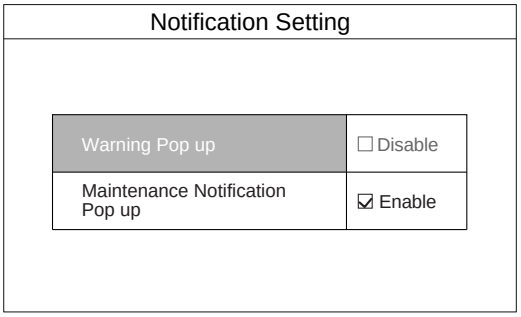
FG019204

Figure 130

Depending on "Notification Setting" screen details, pop-ups are created or not created on main screen when warning is issued, when switch is operated, and when supplies replacement period expires.

On "Notification Setting" screen, press UP (▲) or DOWN (▼) button and move cursor to a desired location. Then, press SELECTION (↵) button to select Enable or Disable.

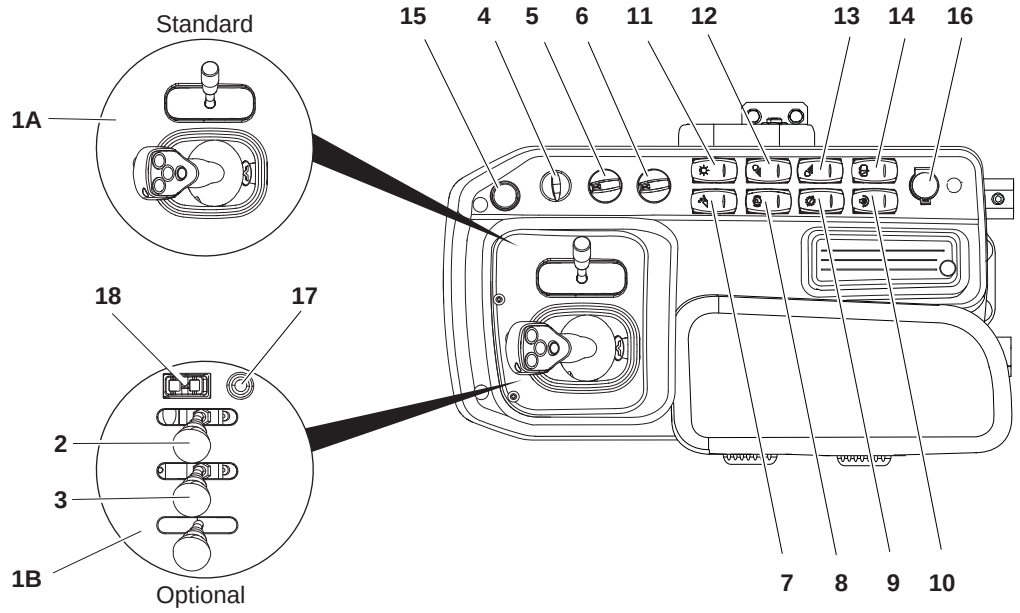
Only Warning Pop-up is enabled as default setting.



FG019205

Figure 131

RIGHT SIDE SWITCH PANEL



FG028818

Figure 132

Reference Number	Description
1A	FNR Lever (Standard)
1B	Finger Tip Lever (Optional)
2	Kick-down Button
3	Horn Button
4	Starter Switch
5	Power Mode Switch
6	Transmission Shift Switch
7	Pilot Cutoff Switch
8	Parking Brake Switch
9	Transmission Cutoff Switch

Reference Number	Description
10	Cooling Fan Reverse Rotation Switch
11	Headlight Switch
12	Front Work Light Switch
13	Rear Work Light Switch
14	Rear Wiper Switch
15	Cigarette Lighter
16	Power Socket for 12 Volt
17	F/R (Forward/Reverse) Selector Switch
18	F/R (Forward/Reverse) Control Switch

1A. FNR Lever (Standard)

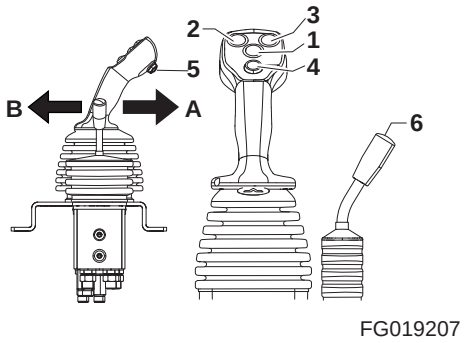


Figure 133

Figure 134

1. In the Case of 2 Spools MCV

A. Loader Arm Bucket Control

A joystick is used to control loader arm and bucket (38, Figure 2). The joystick is capable of raising or lowering loader arm, and crowding or dumping bucket as follows.

Pilot control valve lever (joystick) operating pattern and description of operation.

HL. Hold lever in Lower Mode

L. Lower

HC. Hold lever in Bucket Crowd

C. Bucket Crowd

N. Neutral

D. Bucket Dump

R. Raise

HR. Hold lever in Raise Mode

B. Raise Detent Control

Raise detent control of loader arm works at HR position (HR, Figure 134): Joystick lever remains in this position until loader arm rise to a preset height, then returns to neutral position automatically.

C. Lock Control

To prevent any movement of bucket or boom by unintentional joystick control, place pilot cutoff switch (Figure 148) to "LOCKED" position, especially when you are driving machine.

WARNING

AVOID DEATH OR SERIOUS INJURY

Do not control joystick or lever when people are near the bucket.

2. In the Case of 3 Spools MCV

A. The Joystick has same operation pattern of 2 spools MCV case.

B. To activate one of operation for 3rd spool of MCV (For instance, log forks are to be opened), pushed forward right stick lever (6, Figure 133).

C. To activate the other operation for 3rd spool of MCV (For instance, log forks are to be closed), pull back right stick lever (6, Figure 133).

3. In the Case of 4 Spools MCV

A. The joystick and right stick lever have same operation pattern of 3 spools MCV case.

B. To activate the operation for 4th spool of MCV, push horn button on joystick (4, Figure 133) and simultaneously move joystick left and right as follow.

C. To activate the other operation for 4th spool of MCV (For instance, log forks are to be closed), pull back right stick lever (6, Figure 133).

D. HC: Activate one of operation for the 4th spool MCV with joystick detent. (For instance, turn left log grabber.)

C: Activate one of operation for the 4th spool of MCV. (For instance, turn left log grabber.)

N: Neutral

D: Activate the other operation for the 4th spool of MCV. (For instance, turn right log grabber.)

FG025704

Figure 135

WARNING

AVOID DEATH OR SERIOUS INJURY

Do not use horn button on joystick to honk with 4 spool MCV.

4. Configuration of Joystick

The buttons on this lever (Figure 133) are capable of controlling the following functions:

1. Neutral Button

   When this button is pressed, 2nd gear function will be operational, and 2nd gear indicator light turns "ON".

   When this button is pressed again, 2nd gear function is turned "OFF", and machine is returned to "NEUTRAL".

2. Forward Button

   When this button is pressed for forward travel at same time as "KD" (5, Figure 133) button is pressed, machine can travel forward. When machine is driven, it can change travel direction without pressing "KD" (5, Figure 133) button.

3. Reverse Button

   When this button is pressed for reverse travel at same time as "KD" (5, Figure 133) button is pressed, machine can travel in reverse. When machine is driven, it can change travel direction without pressing "KD" (5, Figure 133) button.

4. Horn Button

   (See page 3-58)

5. Kick-down Button

   (See page 3-58)

   NOTE: *To operate 2nd gear function.*

   – Start engine.

   – Check that transmission lever is neutral.

   – Parking brake switch is off (release).

   NOTE: *Release condition of 2nd gear function.*

   – When transmission lever will be pushed forward or pulled reverse.

   – When parking brake switch turns "ON".

   – When starter switch turns "OFF".

1B. Finger Tip Lever (Optional)

1. In the Case of 2 Levers

1) Loader Arm (38, Figure 2) Control

Move right control lever (L1, Figure 137) push forward (2, Figure 136) to lower loader arm or pull back (3, Figure 136) to raise loader arm.

2) Loader Arm Float Control

Right lever (L1, Figure 137) in full forward detent position (1, Figure 136) allows loader arm to float: This position allows oil flow in and out both ends of cylinders, so bucket can follow contour of ground. To return neutral, manually pull back the lever from the position.

3) Raise Detent Control

Raise detent of loader arm (38, Figure 2) works at 4 position (4, Figure 136). Right lever (L1, Figure 137) remains in this position until loader arm rises to a preset height, then returns to neutral position automatically.

4) Bucket (2, Figure 2) Detent Control

Move left control lever (L2, Figure 137) push forward (5, Figure 136) to dump bucket, or pull back (6, Figure 136) to crowd bucket and pull completely back (7, Figure 136) to crowd bucket with lever detent.

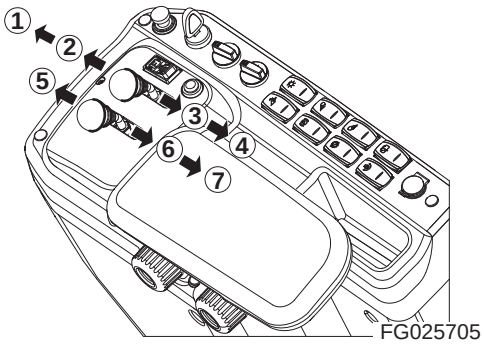


Figure 136

1. LOADER ARM FLOAT
2. LOADER ARM LOWER
3. LOADER ARM RAISE
4. LOADER ARM RAISE WITH DETENT
5. BUCKET DUMP
6. BUCKET CROWD
7. BOOM CROWD WITH DETENT

5) Lock Control

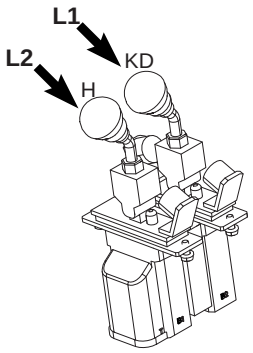
To prevent any movement of bucket or boom by unintentional lever control, place pilot cutoff switch (Figure 148) to "LOCKED" position, especially when you are driving machine.

6) Lever Configuration

A. 2-Lever

a) Horn Button
- H: Horn Button

b) Kick-down
- KD: Kick-down Switch



FG025706

Figure 137

WARNING

AVOID DEATH OR SERIOUS INJURY

Do not control joystick or lever when people are near the bucket.

2. In the Case of 3 Levers with 3 Spools MCV

1) 1st, 2nd lever from the right (L1, L2, Figure 133) have same operation pattern of 2 levers case.

2) To activate one of operation for 3rd spool of MCV (For instance, log forks are to be opened), pushed forward (8, Figure 138) 3rd lever from the right (L3, Figure 139).

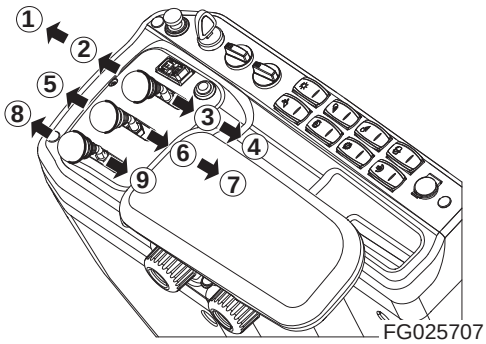
3) To activate the other operation for 3rd spool of MCV (For instance, log forks are to be closed), pull back (9, Figure 138) 3rd lever from the right (L3, Figure 139).

4) Lever Configuration

A. 3-Lever (Optional)

a) Horn Button
- H: Horn Button

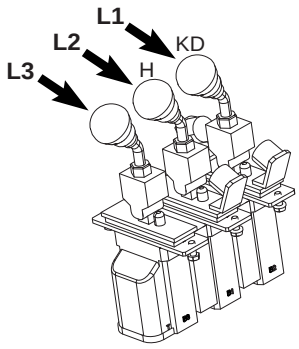
b) Kick-down
- KD: Kick-down Switch



FG025707

Figure 138

1. LOADER ARM FLOAT
2. LOADER ARM LOWER
3. LOADER ARM RAISE
4. LOADER ARM RAISE WITH DETENT
5. BUCKET DUMP
6. BUCKET CROWD
7. BOOM CROWD WITH DETENT
8. ACTIVATE ONR OF OPERATIONS OF OPTIONAL TOOL
9. ACTIVATE THE OTHER OPERATIONS OF OPTIONAL TOOL



FG025708

Figure 139

3. In the Case of 3 Levers with 4 Spools MCV

1st, 2nd, 3rd lever from the right (L1,L2,L3, Figure 139) have same operation pattern of 3 levers with 3 spools MCV case.

To activate the operation for 4th spool MCV, push horn button on lever (H, Figure 139) and simultaneously move 2nd lever from the right (L2, Figure 139) as follow.

- Position 5 (5, Figure 138): Activate one of operations for the 4th spool of MCV. (For instance, turn left log grabber)
- Position 6 (6, Figure 138): Activate the other operations for the 4th spool of MCV. (For instance, turn right log grabber)
- Position 7 (7, Figure 138): Activate the other operations for the 4th spool of MCV with lever detent. (For instance, turn right log grabber)

WARNING

AVOID DEATH OR SERIOUS INJURY

Do not use horn button on joystick to honk with 4 spool MCV.

2. Kick-down Button (Two Places)

Kick-down Button Function - When transmission is in 2nd gear, pressing this button (Figure 140) will shift transmission into 1st gear. This will allow operator to perform a quick digging movement.

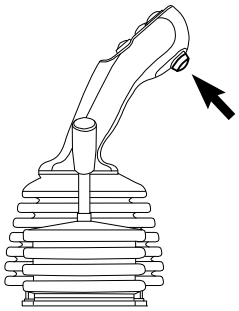
Kick-down function range:

- Automatic: 2nd, 3rd, 4th gears.
- Manual: 2nd gear.

NOTE: *Kick-down is "RELEASED" when transmission is placed in "NEUTRAL" position or switch is pressed again.*

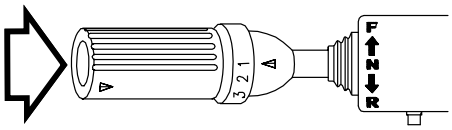
A second kick-down button (Figure 141) is on end of transmission lever**.**

NOTE: *The machine is equipped with there is an additional kick-down button. See “2. Kick-down Button (Two Places)” on page 2-58.*



FG019164

Figure 140



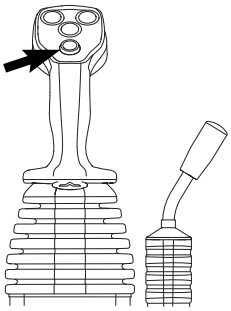
AHO0900L

Figure 141

3. Horn Button (Two Places)

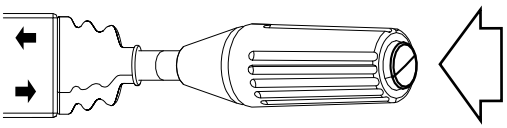
Pressing lowest button at tip of pilot control valve lever (joystick) (Figure 142) or button at end of combination switch (Figure 143) will sound horn.

NOTE: *Starter switch must be "ON".*



FG018937

Figure 142



FG018935

Figure 143

4. Starter Switch

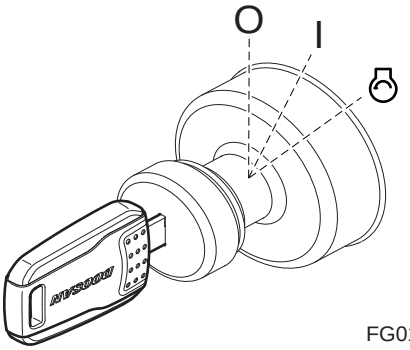
A three-position starter switch is used to start or stop engine for machine operation.

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

I. Turning switch to this position turns engine electrical system "ON". When switch is first turned "ON", six indicator/warning symbols across top of display monitor, will turn "ON" for approximately 2 seconds. The battery warning symbol and engine oil pressure warning symbol will remain "ON" after the other symbols four have turned "OFF".

NOTE: *Preheat Indicator Symbol - The operation of preheat cycle depends on coolant temperature. When engine coolant is cold enough, preheat indicator symbol will remain "ON" until engine preheat cycle is completed. The preheat cycle takes about 20 seconds to complete, and indicator symbol will turn "OFF". When symbol turns "OFF", engage 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 starter switch for more than 15 seconds at a time. This will help prevent damage to starter.



FG018093

Figure 144

WARNING

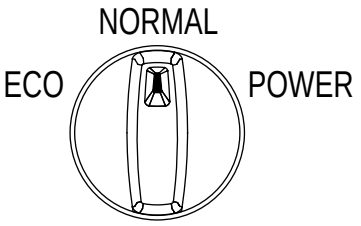
AVOID DEATH OR SERIOUS INJURY

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

5. Power Mode Switch

Work can be done more efficiently if a proper power mode is properly for the type of work and conditions. Choose a mode selection using the following guide.

Mode	Selection Point
Power Mode	• Required to perform heavy work in a short period of time. • Fast speed loading. • Fast speed travel.
Normal Mode	• General work. • Optimize fuel consumption.
Economy Mode	• Light work. • Minimize fuel consumption. • Reduce noise.



FG019208

Figure 145

Optimized Engine/Work Mode

		Engine Mode					
		Power	Normal		-		
			-		ECO		
		P	P		S		E
T/M Shifting Mode	P	O	O	↔	X	↔	X
	S	X	X		O		X
	E	X	X		X		O

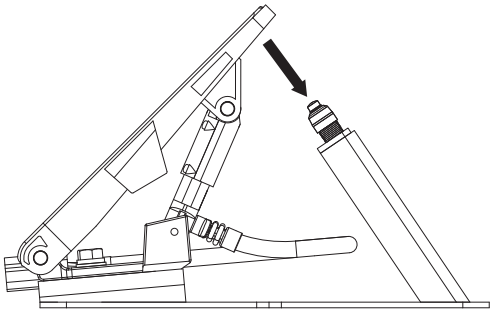
Engine mode: Power (P), Normal (S ↔ P), ECO (E ↔ S)

- P: Highest horsepower
- S: Standard horsepower
- E: Lowest horsepower
- P, S, E is shifted quickly dependent on accelerator pedal operation.

T/M shifting mode

- P: 20% Later shift to higher gear than S mode
- S: Normal mode
- E: 20% Earlier shift to higher gear than S mode

T/M shifting mode is changed automatically related with engine mode.



FG020134

Figure 146

6. Transmission Shift Switch

- Manual (MAN) Mode

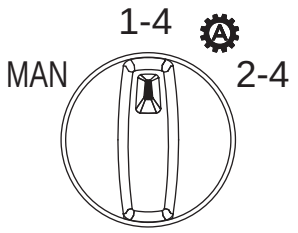
  After starting engine, gear shifting is done manually.

- Auto 1-4 Mode (Working Mode)

  1) Turn gear selector control to gear position #4.
  2) Set shift mode selector to "Auto 1-4"
  3) Select travel directional and accelerate the machine.
  4) Up and down shifts are made automatically between 1st - 2nd - 3rd - 4th gears forward and between 2nd - 3rd - 4th in reverse.
  5) It is unnecessary to use kick-down function for 1st gear.

- Auto 2-4 Mode (Travel Mode)

  1) 1-3 is same as Auto 1-4.
  2) Up and down shifts are made automatically between 2nd - 3rd - 4th gears forward and between 2nd - 3rd - 4th gears in reverse.
  3) Kick-down button must be used for shifting to 1st gear.



FG004181

Figure 147

7. Pilot Cutoff Switch

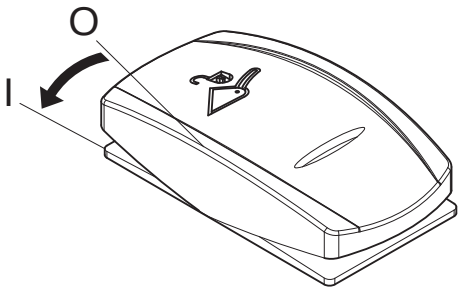
O. In this position, Pilot Control Valve Lever (joystick) is turned "OFF". Operator cannot operate the Pilot Control Valve Lever (joystick) to control all functions.

I. In this position, Pilot Control Valve Lever (joystick) is turned "ON". Operator can fully control the movement of all functions.

CAUTION

AVOID INJURY

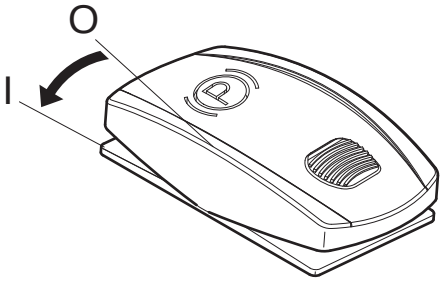
When driving or parking, the pilot cutoff switch must be set to "O" (OFF) position so the operator can fully control the movement of the joystick functions.,



FG019169

Figure 148

8. Parking Brake Switch



WL1300285

Figure 149

This switch is used to park the machine.

O. In this position, parking brake is "RELEASED" and the monitor light on the front display monitor turns "OFF".

I. In this position, parking brake is "APPLIED" and the monitor light on the front display monitor turns "ON".

NOTE: *If parking brake is released, the engine can not be started. To start the engine, engage parking brake first.*

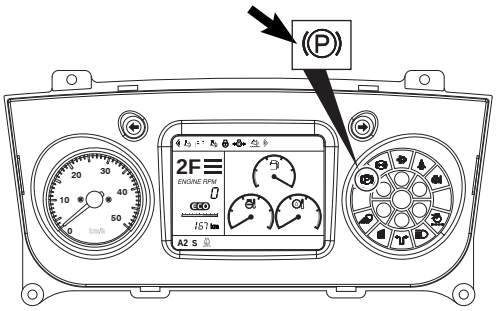
NOTE: *When starting the engine parking brake is engaged automatically.*

To release parking brake, turn parking brake switch "ON" then "OFF" once more although parking brake may look not to be engaged

WARNING

AVOID DEATH OR SERIOUS INJURY

Set the parking brake switch in the "I" (APPLIED) position before leaving the machine. Make sure to "APPLY" the parking brake switch before trying to start the machine.



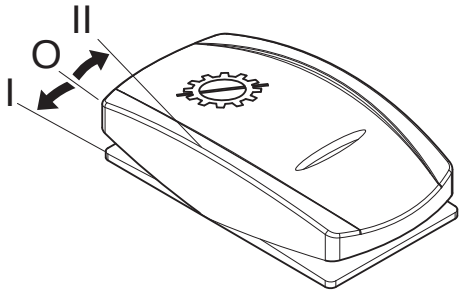
FG024343

Figure 150

IMPORTANT

Do not use the parking brake to stop the loader, except in an emergency; otherwise, it might cause premature wear or damage of the brake.

9. Transmission Cutoff Switch



WL1300048

Figure 151

This switch changes the mode of the brake pedal from "INCHING" to "NO INCHING".

O. In this position, the power transmission line is still connected when the brake pedal is pressed, thus, making it easier to start off on an incline. This mode is also suitable for traveling, because both dynamic engine braking and the service brake can be used when descending grades.

I. With the brake pedal kept pressured to desired position for entering into the "INCHING" mode, turn and press the switch at "I" position for one second or longer to set the desired position.

II. In this position, the "INCHING" mode is selected.
In this mode, the transmission is put in "NEUTRAL" by pressing the left brake pedal. This mode is suitable for a load handling operation. When the

accelerator pedal is pressed in this setting, more power is concentrated on the load handling system to increase the boom lifting speed.

NOTE: *Transmission "CUTOFF" function does not operate in 3rd and 4th gear to prevent transmission damage.*

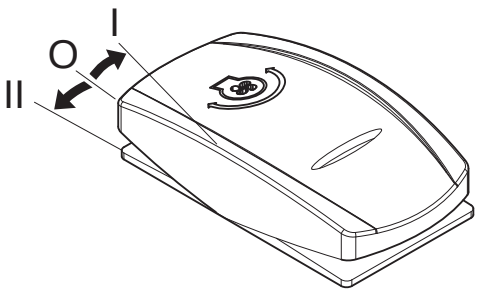
10. Cooling Fan Reverse Rotation Switch

This switch causes the radiator cooling fan to rotate in the reverse direction. The function of reversing the direction of the radiator cooling fan is effective in cleaning the radiator.

O. In this position, reverse fan is turned "OFF".

I. In this position, reverse fan is turned "ON".

II. In this position, automatic reverse fan is turned "ON".



FG019170

Figure 152

IMPORTANT

Never travel or work in the reverse fan rotation mode. This can cause damage to the cooling system. Make sure that this switch is in the "O" (OFF) position before starting the engine and operating the machine.

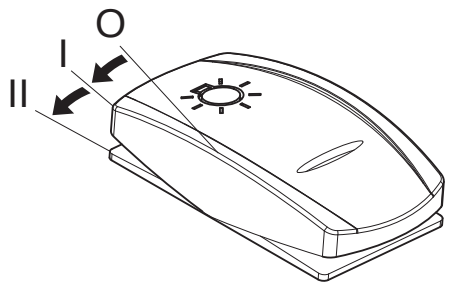
11. Headlight Switch

O. In this position, the switch turns "OFF" clearance, tail, instrument panel, switch and headlights.

NOTE: *If the switch is not in the* "OFF" *position with the engine stopped, the pilot buzzer will sound to warn the operator that batteries are being discharged.*

I. In this position, clearance, tail, instrument panel and switch lights are turned "ON".

II. In this position, clearance, tail, instrument panel, switch lights and headlight are turned "ON".



FG016017

Figure 153

12. Front Work Light Switch

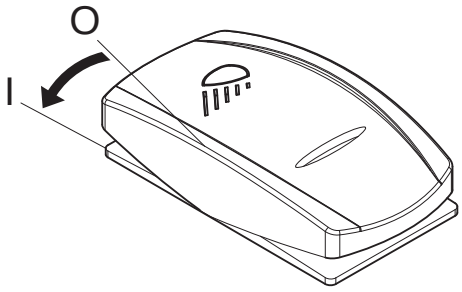
O. In this position, work lights mounted on the front top of cabin are turned "OFF".

I. In this position, work lights mounted on the front top of cabin are turned "ON".

CAUTION

AVOID INJURY

Do not turn "ON" the work lights when traveling on public roads.



FG019212

Figure 154

13. Rear Work Light Switch

O. In this position, work lights mounted on the rear top of cabin and the sides of radiator are turned "OFF".

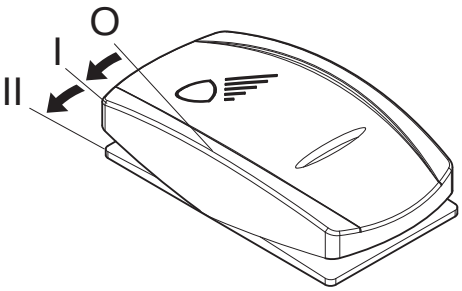
I. In this position, work lights mounted on the sides of radiator are turned "ON".

II. In this position, work lights mounted on the rear top of cabin and the top of the sides of radiator are turned "ON".

CAUTION

AVOID INJURY

Do not turn "ON" the work lights when traveling on public roads.



FG019213

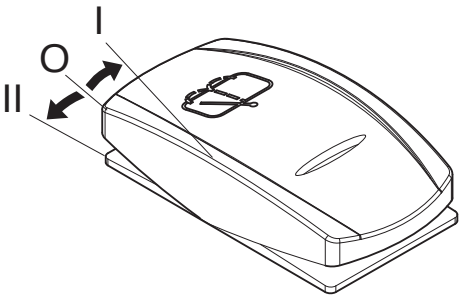
Figure 155

14. Rear Wiper Switch

O. In this position, windshield wiper mounted on rear windshield of operator's cabin is turned "OFF".

I. In this position, windshield washer fluid sprays onto the rear windshield while running the rear wiper. When released, the switch returns to "O" (OFF) position.

II. In this position, windshield wiper mounted on rear windshield of operator's cabin is turned "ON".



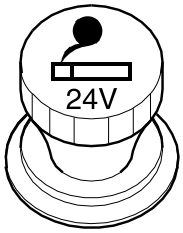
FG019214

Figure 156

15. 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.*



HAOA780L

Figure 157

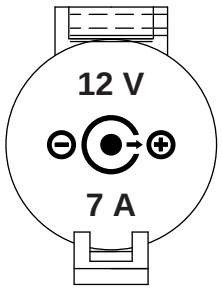
16. Power Socket for 12 Volt

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

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

Open the cap when using it.

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



FG017015

Figure 158

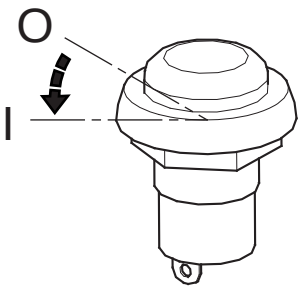
17. F/R (Forward/Reverse) Selector Switch

O. In this position, the F/R control switch is "OFF".

I. In this position, the F/R control switch is turned "ON/ ACTIVATED". When released the switch returns to "O" (OFF) position, but the system is still "ACTIVATED". When this switch is depressed again, F/R control switch is "OFF".

NOTE: *1) When activating system, the transmission lever and F/R control switch must be in "NEUTRAL".*

2) If the transmission lever is actuated (moved), the gearshift functions of the F/R control switch are turned "OFF/DEACTIVATED", and forward/ reverse travel is again controlled by the transmission lever.



FG003977

Figure 159

18. F/R (Forward/Reverse) Control Switch

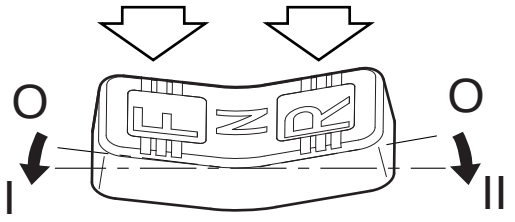
To be able to use the forward/reverse function, the F/R selector switch must first be depressed. When the switch is activated, the F/R selector indicator light will be turned "ON" in the instrument panel.

O. In this position, the machine is in "NEUTRAL".

I. In this position, the machine travels "FORWARD".

II. In this position, the machine travels "REVERSE".

NOTE: *If the transmission lever is moved out of "NEUTRAL" while operating the F/R control switch, the transmission lever will override the switch. The F/R control switch system will require, that F/R selector switch be pressed again, with the transmission lever in "NEUTRAL".*



FG015182

Figure 160

VARIOUS CABIN LOCATIONS

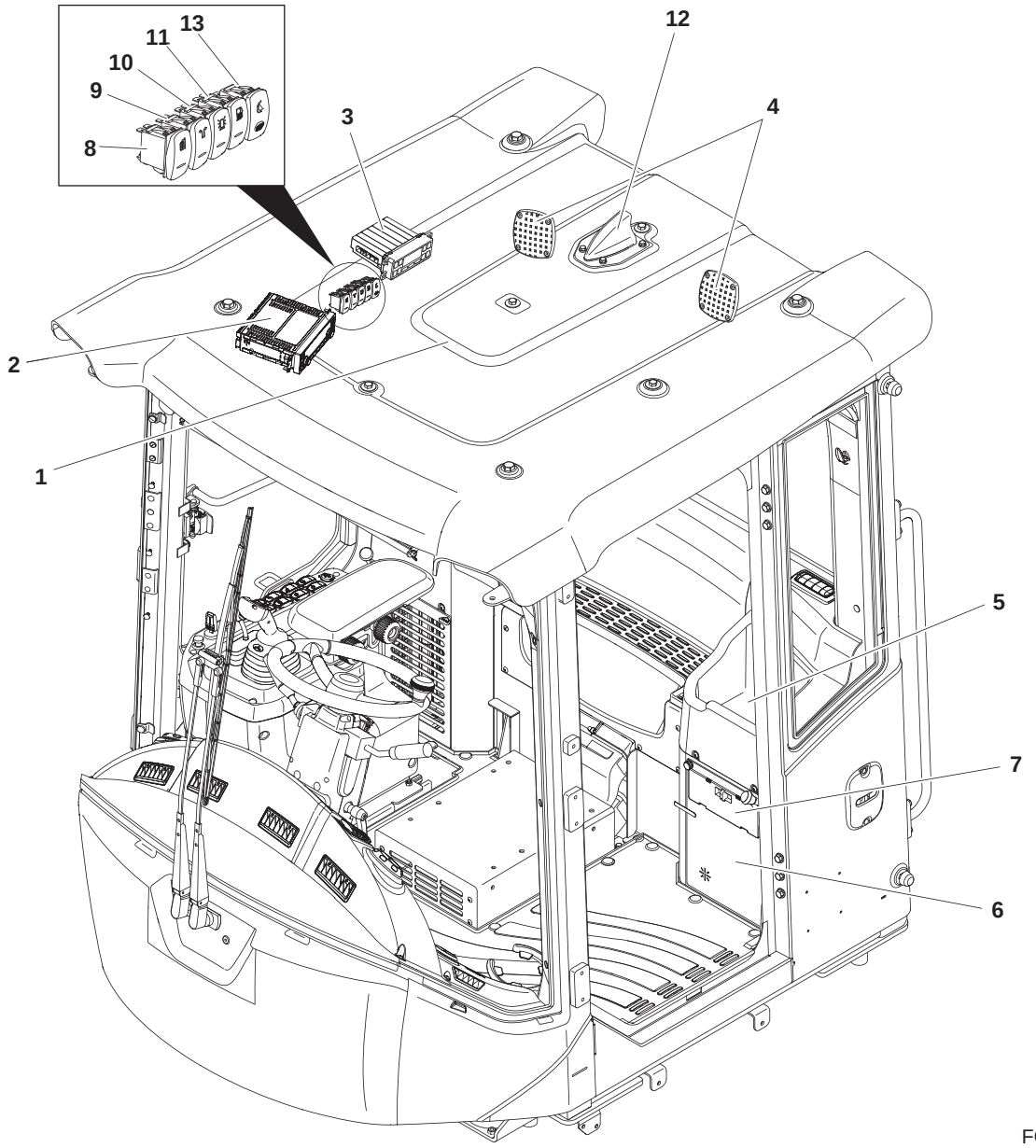


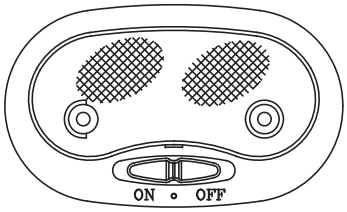
Figure 161

Reference Number	Description
1	Cabin Light
2	Stereo/CD Player (Optional)
3	Heater and Air Conditioner Control Panel
4	Speakers
5	Storage Compartments
6	Electrical Box
7	Fuse Box

Reference Number	Description
8	Mirror Heating Switch
9	Emergency Steering Switch and Automatic Test (Optional)
10	Rotating Beacon Light Switch (Optional)
11	Fuel Heater Switch (Optional)
12	Unified Antenna
13	Quick Coupler Switch (Optional)

1. Cabin Light

Located in the middle of front cabin, it illuminates the cabin for night work. Light turns on when the switch is in the "ON" or "O" position, but are off in the "OFF" position. Cabin light may be turned "ON" and "OFF" irrespective of the position of the starter switch.

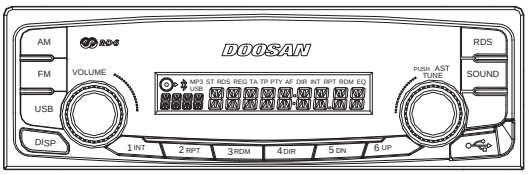


FG004192

Figure 162

2. Stereo/CD Player (Optional)

For operation of stereo see “Stereo/CD Player (Optional)” on page 2-78.

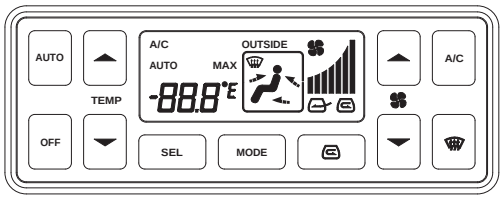


FG017613

Figure 163

3. Heater and Air Conditioner Control Panel

For operation of heater and air conditioner, “Heater and Air Conditioner Operation” on page 2-72.

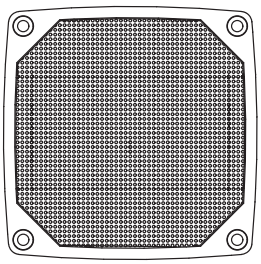


FG019209

Figure 164

4. Speakers

Emits sound generated by stereo.

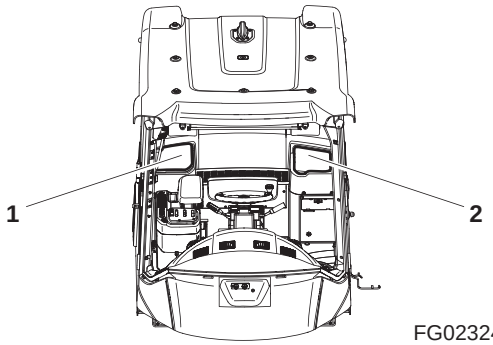


HBOM350L

Figure 165

5. Storage Compartments

There are two storage compartments (1 and 2, Figure 166) located both sides behind of the operator's seat. Keep the operation manual and other documents in this compartment.

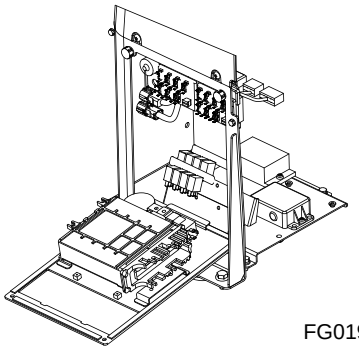


FG023240

Figure 166

6. Electrical Box

Contains relays and electric component. It is located on left side of cabin.

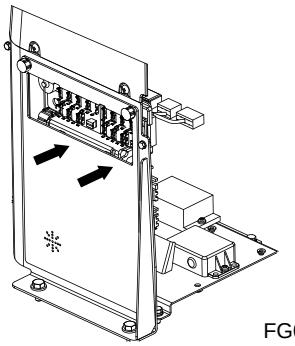


FG019222

Figure 167

7. Fuse Box

The fuse box is on the upper side of electric box. For a detailed explanation of fuses see “Fuse Box/Relay” on page 2-86.



FG019223

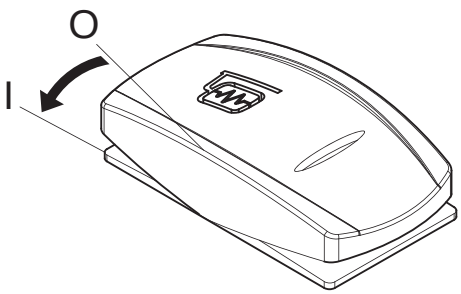
Figure 168

8. Mirror Heating Switch

This switch is used to operate a heater installed in the mirror. Press the switch and the mirror heater will remove frost and ice from mirror.

O. In this position, mirror heater is turned "OFF".

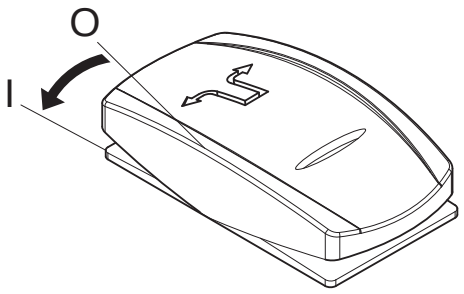
I. In this position, mirror heater is turned "ON".



FG019224

Figure 169

9. Emergency Steering Test Switch and Automatic Test (Optional)



FG019225

Figure 170

Emergency Steering Test Switch

This switch is used to test whether the emergency steering system is properly functioning.

The system must be tested during the start-up procedure to ensure that system is properly functioning.

Test emergency steering system using the following procedure:

A. Turn starter switch to "I" (ON) position.

NOTE: *Do not start engine.*

B. Press emergency steering test switch and turn steering wheel at the same time. If system is functioning properly, the unit should steer. The emergency steering indicator light should turn "ON".

NOTE: *If unit does not steer, do not operate unit until problem is corrected.*

C. Release switch. Switch will automatically return to "O" (OFF) position.

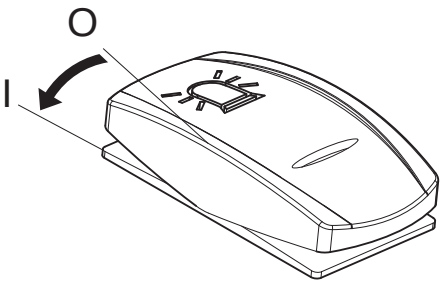
Automatic Test

This is a system check that tests the hydraulic oil pressure in the emergency steering system lines. With starter switch turned to "I" (ON) position, an emergency warning light on the front gauge panel will turn "ON" for about three seconds.

IMPORTANT

Do not press this switch continuously. Continuously pressing switch will cause heavy battery discharge.

10. Rotating Beacon Light Switch (Optional)



FG016020

Figure 171

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

O. In this position, beacon is turned "OFF".

I. In this position, beacon is turned "ON".

11. Fuel Heater Switch (Optional)

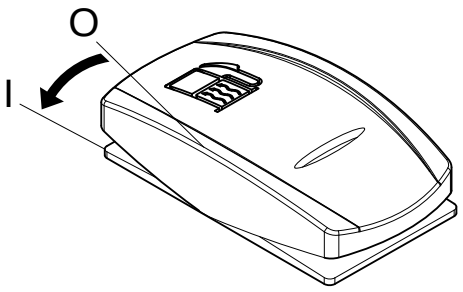
This switch is used to activate the fuel heater system. When the switch is activated, the fuel is warmed, depending upon the temperature of the fuel.

NOTE: *If the fuel temperature is above 5°C (41°F), fuel 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".*

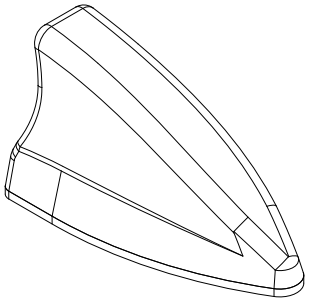


FG016024

Figure 172

12. Unified Antenna

This is a Radio and GPS (Optional) antenna.



FG019226

Figure 173

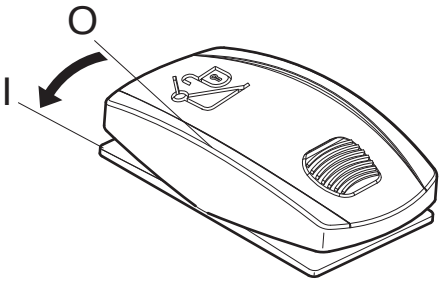
13. Quick Coupler Switch (Optional)

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.*



FG023180

Figure 174

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.

HEATER AND AIR CONDITIONER OPERATION

Location of Controls and Vents

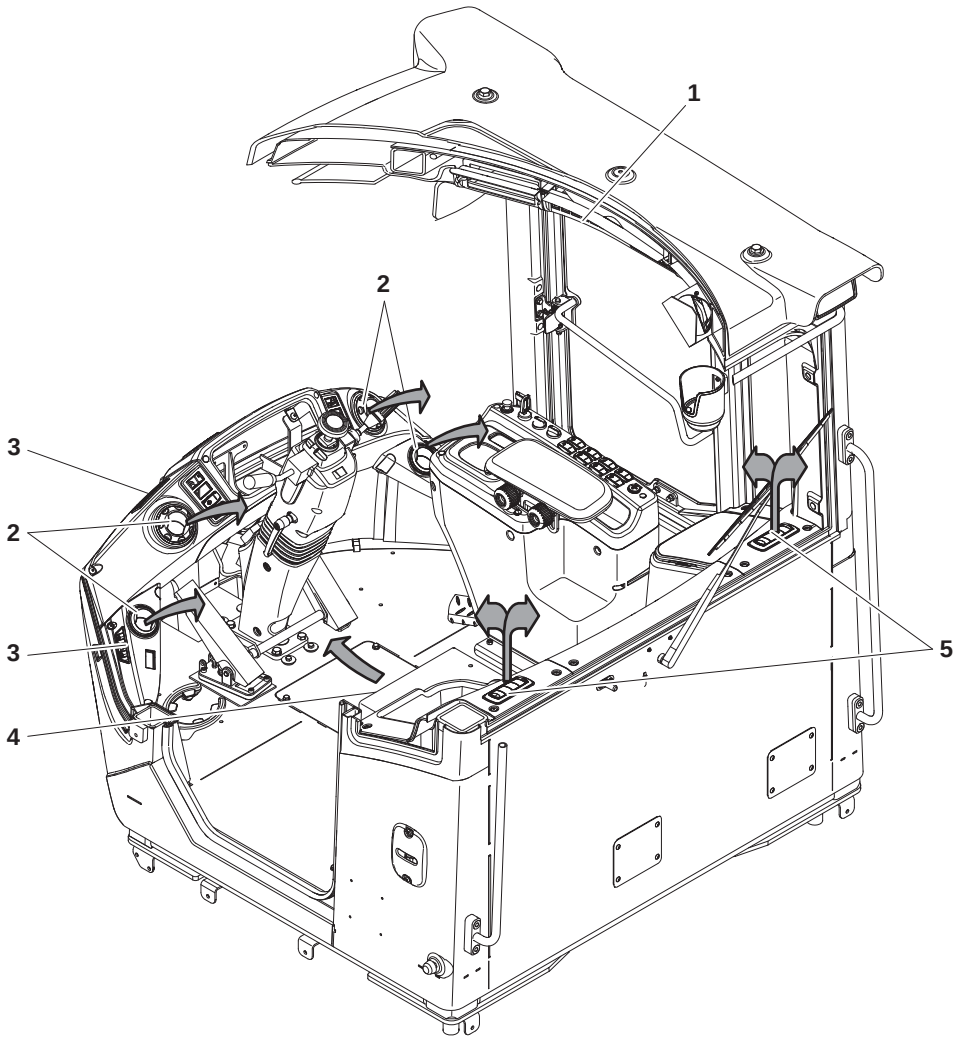
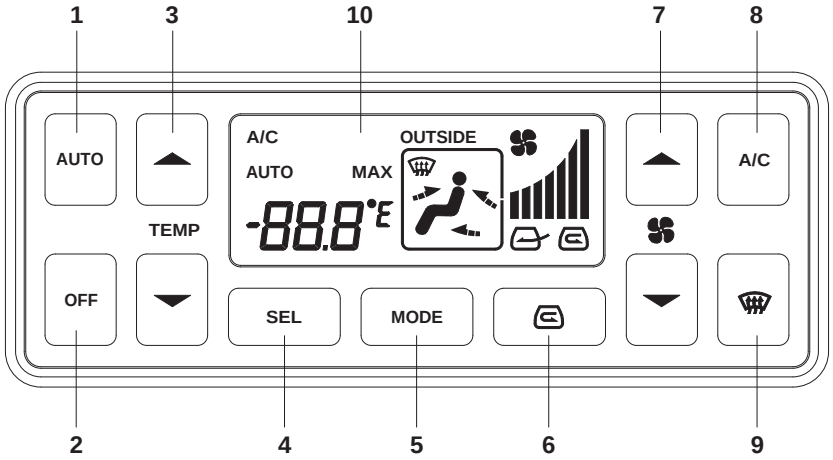


Figure 175

Reference Number	Description
1	Operation Panel
2	Front Nozzle (Air Conditioner)
3	Front Nozzle (Defroster)

Reference Number	Description
4	Foot Nozzle
5	Rear Nozzle

The heater and air conditioner are combined into one unit to the right side of the operator's seat. If necessary, the operator can control interior cabin temperature using the operation panel.



FG000086

Figure 176

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

Reference Number	Description
6	Air Inlet Selector Button
7	Fan Speed Selector Buttons
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, using 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 177

2. Off Button

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

FG000089

Figure 178

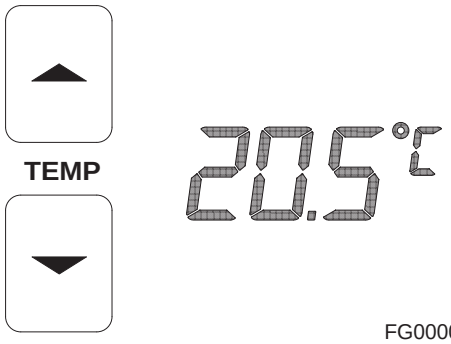
3. Temperature Control Button

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 179

4. Temperature Unit Selector Button

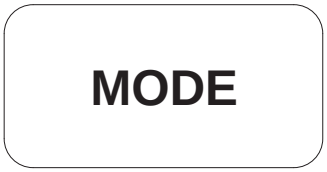
This button gives the choice to select either °C or °F.

FG000094

Figure 180

5. Mode Selector Button

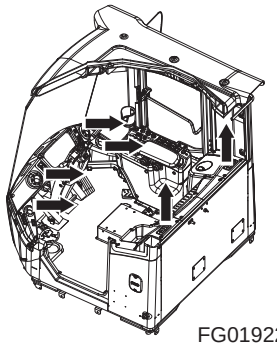
This button is used to select which combination air outlets will be used.



FG000096

Figure 181

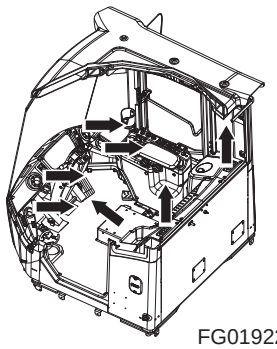
A. Used to direct airflow to upper portion of operator's cabin from both the front and rear.



FG019228

Figure 182

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.

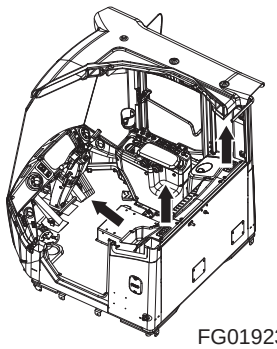


FG019229

Figure 183

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

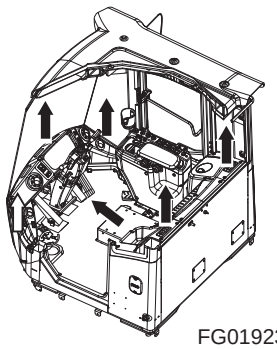
This mode is mainly used for heating.



FG019230

Figure 184

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



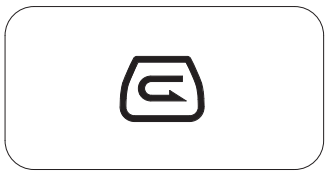
FG019232

Figure 185

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.

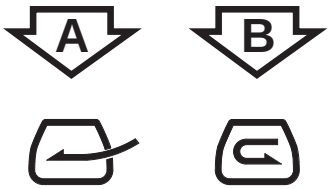


FG000101

Figure 186

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

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



FG000102

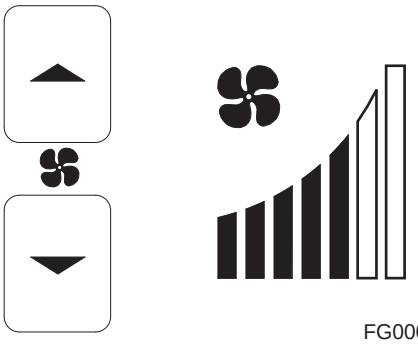
Figure 187

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.



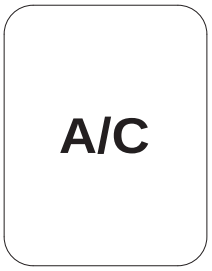
FG000103

Figure 188

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.

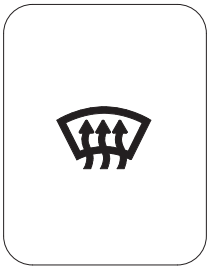


FG000105

Figure 189

9. Defroster Button

Used to direct airflow to front window.

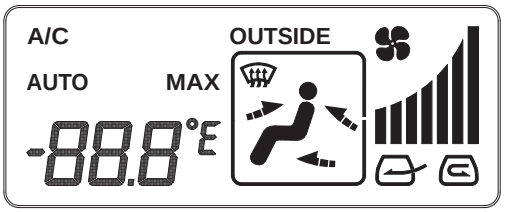


FG000106

Figure 190

10. LCD Display

This display shows the current setting.



FG000107

Figure 191

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 loader 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/CD PLAYER (OPTIONAL)

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

Stereo

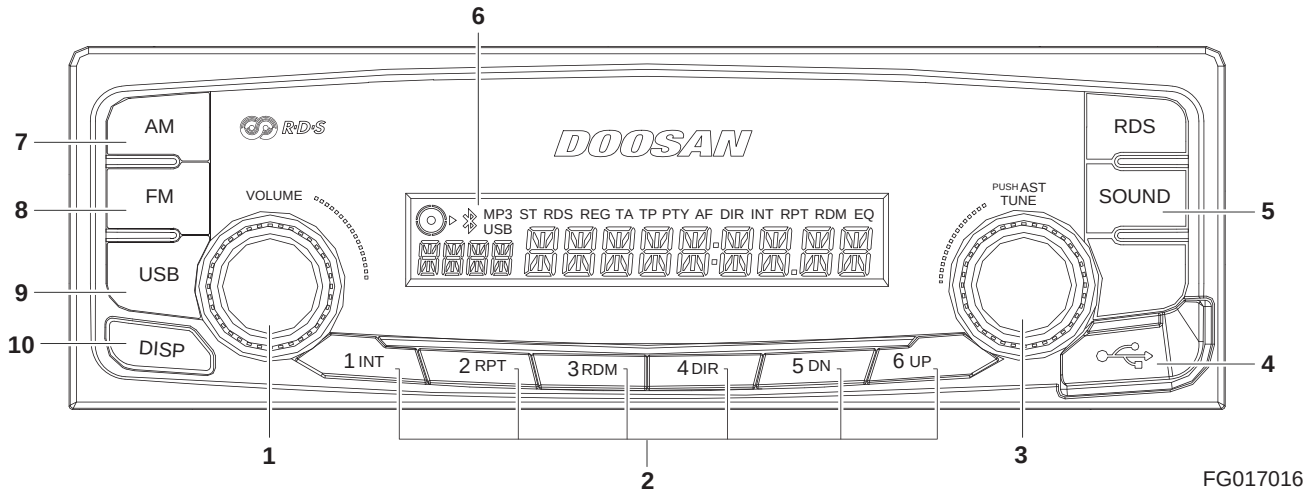


Figure 192

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)

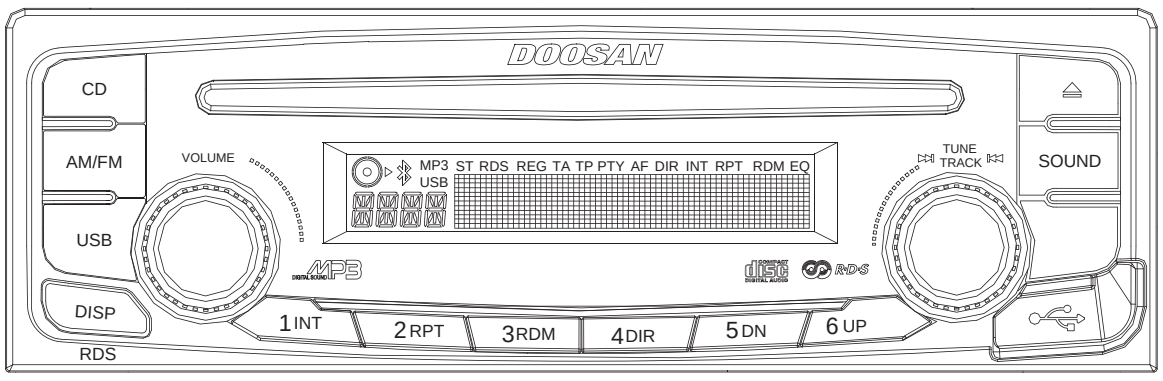


Figure 193

SEAT ADJUSTMENT MECHANICAL SUSPENSION (STANDARD)

WARNING

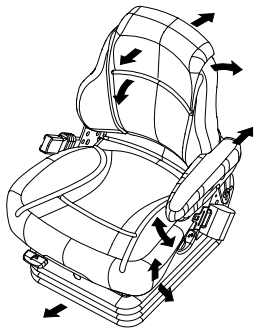
AVOID DEATH OR SERIOUS INJURY

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, "ENGAGE" 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.



FG019233

Figure 194

1. Adjusting Seat Forward/Backward Lever

Holding lever (1, Figure 195), raise it, while pushing or pulling seat to desired position. Release lever once desired position is reached. Adjustment range is 152 mm (6 in).

2. Seat Height and Weight Adjustment Knob

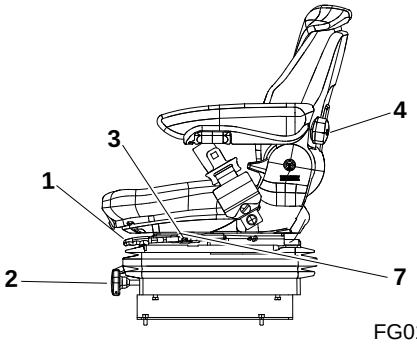
Pushing knob (2, Figure 195) makes suspension harder. Pulling knob makes suspension softer. Adjust using operator's weight. Adjustment range is from 45 - 130 kg (99- 286 lb).

3. Backrest Adjustment Lever

Pulling up left side lever (3, Figure 195) allows seat backrest to be tilted forward or backward.

4. Lumbar Control Knob

Rotate lumbar control knob (4, Figure 195) to increase or decrease or decrease support to lower back.



FG019234

Figure 195

5. Angle Adjustment of Armrest

Adjustment angle of left and right armrest (6, Figure 196) is done by turning a dial in bottom of armrest. When you adjust angle, manually raise armrest before turning dial.

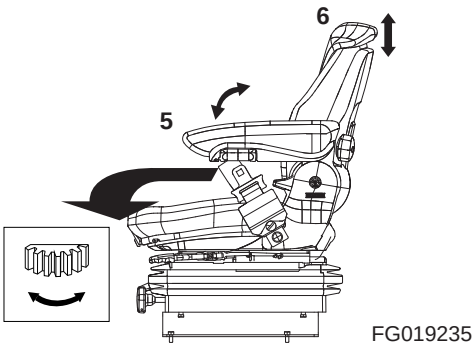


Figure 196

6. Adjustment of Upper Backrest

To raise it, pull up with both hands at the corners on the bottom of upper backrest. To lower it, press with both hands at the corners on the top of upper backrest. Adjustment range is 12.7 mm.

7. Heating Operator's Seat (Optional)

The 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 then normal temperature, have seat serviced immediately.*

Recommendations for Limiting Vibrations

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

SEAT ADJUSTMENT W/AIR SUSPENSION AND HEATER

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, "ENGAGE" 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.

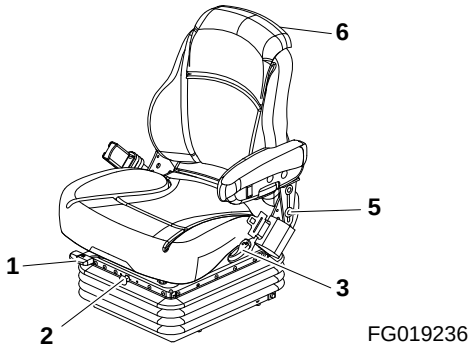


Figure 197

1. Adjusting Seat Forward/Backward Lever

Holding lever (1, Figure 197), raise it, while pushing or pulling seat to desired position. Release lever once desired position is reached. Adjustment range is 152 mm (6 in).

2. Seat Height and Firmness/Adjustment Knob

To raise seat or increase firmness in ride, turn key to "ON" and push in on height/firmness adjustment knob (2, Figure 197).

To lower seat height or decrease firmness in ride, pull out on height/firmness adjustment knob (2, Figure 197). Adjustment range is 76 mm (3 in).

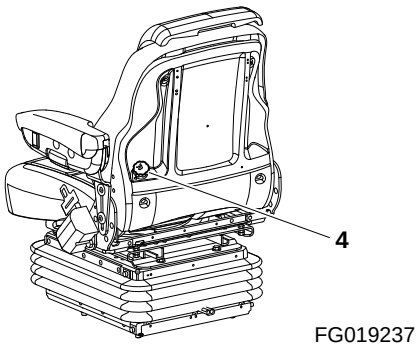


Figure 198

3. Backrest Adjustment Lever

Lift backrest tilt adjustment lever (3, Figure 197) and allow cushion to angle forward or lean backward into desired position and release handle.

4. Lumbar Control Knob

Rotate lumbar control knob (4, Figure 198) to increase or decrease support to lower back.

5. Angle Adjustment of Armrest

Rotate armrest tilt knob (5, Figure 197) to tilt to desired armrest position.

6. Adjustment of Upper Backrest

To raise it, pull up with both hands at the corners on the bottom of upper backrest. To lower it, press with both hands at the corners on the top of upper backrest. Adjustment range is 125 mm (4.9 in).

7. Heating Operator's Seat (Optional)

The 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 38°C - 43°C (100°F - 109°F). At 43°C (109°F), the primary thermostat stops heating the seat. Also seat back is operated between 47°C - 55°C (116°F - 131°F). At 55°C (116°F), the primary thermostat stops heating the seat back.

NOTE: *If the primary thermostat fails, there is a secondary (safety) thermostat that operates between 38° - 43°C (100°F - 109°F). At 43°C (109°F), the secondary (safety) thermostat stops heating the seat. If the seat is heating up to a higher then normal temperature, have seat serviced immediately.*

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 loader.

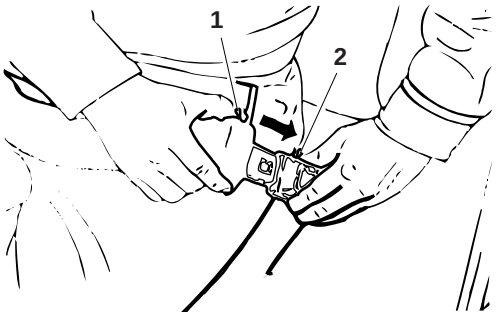
Do not adjust the seat position while the machine is moving because a loss of control can result. Stop the machine, "ENGAGE" parking brake, and then adjust the seat.

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

Seat Belt Locking and Unlocking

Insert belt end (1, Figure 199) into buckle (2). Pull belt to check that belt end is locked into buckle.

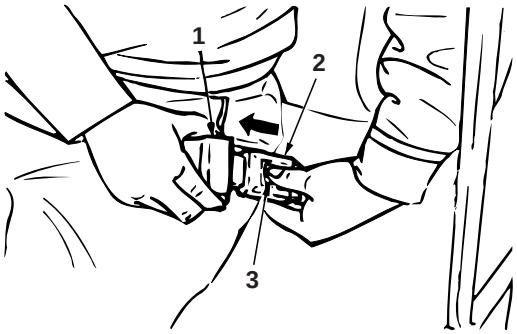
Adjust belt length so it is comfortably tight against operator's pelvic region (hipbone).



HAOB140L

Figure 199

Press button (3, Figure 200) in center of buckle (2) and pull out belt (1) to unlock.

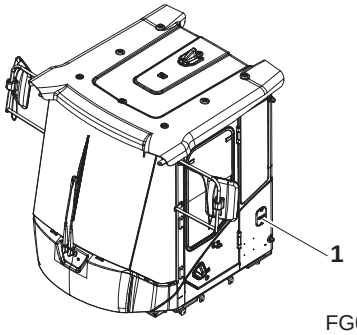


HAOB150L

Figure 200

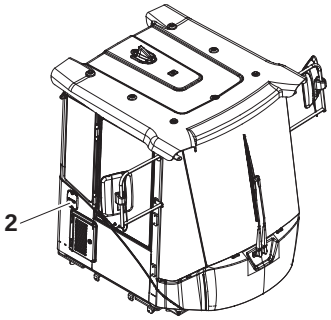
DOOR SIDE LATCH

1. Door side latches (1. LH, Figure 201) and (2. RH, Figure 202) are used to secure the doors (RH, LH) to the side of the cabin when they are opened.
2. Keep the door closed and locked when machine is not in use.



FG019238

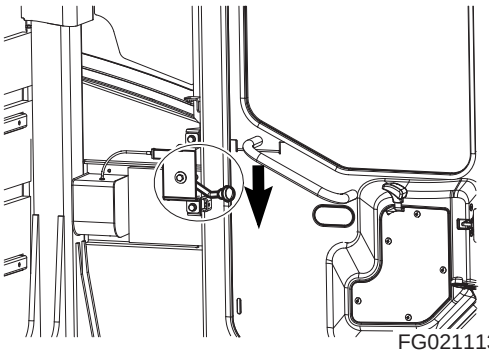
Figure 201



FG019239

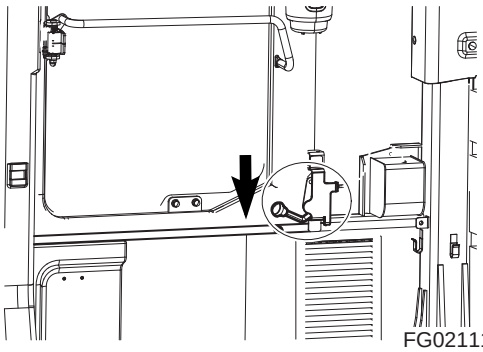
Figure 202

3. To release doors from both sides of the cabin, pull handles (Figure 203 and Figure 204) in direction of arrows. The handles are located on both sides of the operator's seat.



FG021113

Figure 203



FG021114

Figure 204

ARM REST

Knob (1, Figure 205) is used to allow armrest to be moved to the most convenient position for the operator. Loosen knob and move armrest (2, Figure 205) to desired position. Tighten knob.

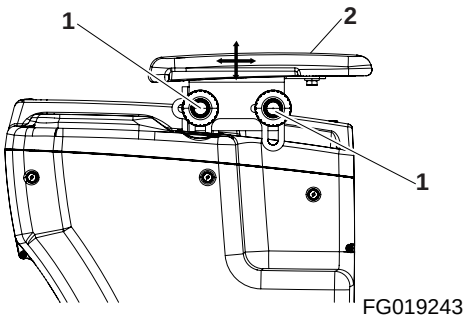


Figure 205

FUSE BOX/RELAY

Fuse Boxes

There are two fuse boxes inside the cabin.

Fuse boxes are on the upper side of the electric box. A usage diagram of fuses is shown inside of fuse box. Spare fuses are mounted on the inside of fuse box cover (10A - Qty. 1, 15A - Qty. 1, 20A - Qty. 1 and 30A - Qty. 1).

WARNING

AVOID DEATH OR SERIOUS INJURY

If any fuse is blown, turn "OFF" the starter switch and shut off the power supply. Repair the cause if needed and replace the fuse with a new one.

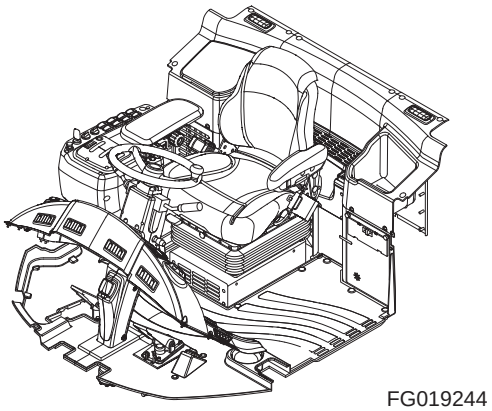


Figure 206

Fuse Box (1) **Fuse Box (2)**

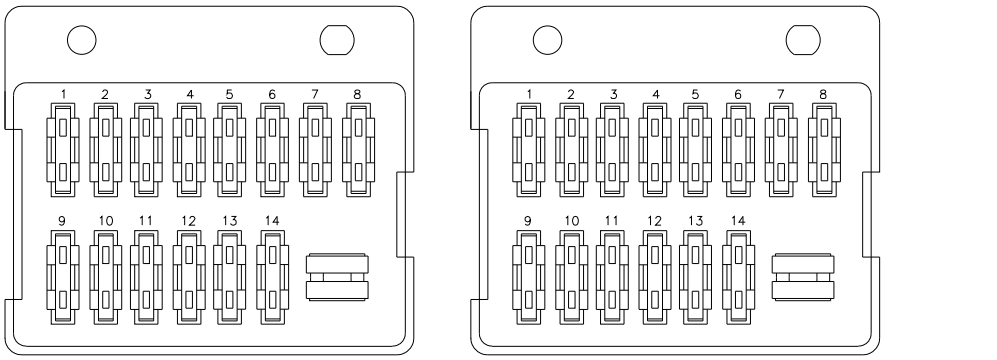


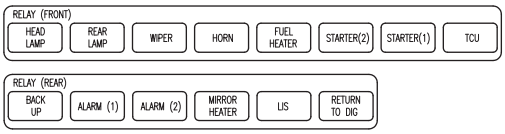
Figure 207

No.	Fuse Box One	
	Name	**Capacity**
1	Rear Wiper	10A
2	Parking Brake, Pilot Cut Off	10A
3	Rotating Beacon (Optional)	10A
4	Spare	10A
5	12V Power Socket	10A
6	Cigarette Lighter	10A
7	Indicator Light, License Light, Blinker Unit	10A
8	Starter Switch, Room Light, Hour meter	10A
9	Air Conditioner, Heater	30A
10	Headlight	20A
11	Spare	15A
12	VCU	15A
13	Engine Controller	15A
14	Engine Controller	15A

No.	Fuse Box Two	
	Name	**Capacity**
1	Gauge Panel	10A
2	Stoplight	10A
3	Auto-detent, LIS (Optional)	10A
4	Reverse Fan	10A
5	Transmission	10A
6	Horn, Front Wiper	10A
7	Position Light (Left)	10A
8	Position Light (Right)	10A
9	Fuel Heater (Optional)	30A
10	Work Light (Rear)	20A
11	Seat Suspension (Optional), Seat Warmer (Optional), Mirror Heater	15A
12	Work Light (Front)	15A
13	GPS, Stereo	15A
14	Memory Backup, Pilot Buzzer	15A

Relays

The relays are in the electrical box on the left side in the operator's cabin. If the problem is not solved after replacing the fuse, check the function of the relay.



WL1300275

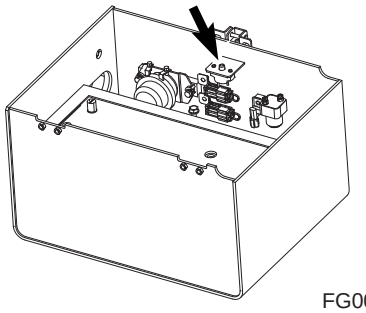
Figure 208

Circuit Breaker

A main circuit breaker is in the battery box. It will automatically cut off power 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.



FG003975

Figure 209

Fusible Link

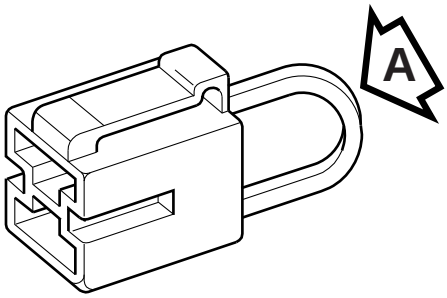
A fusible link is in the battery box.

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

WARNING

AVOID DEATH OR SERIOUS INJURY

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



HAOB100L

Figure 210

WHEEL CHOCKS

A pair of wheel chocks are supplied with the machine, and are stored on the frame.

These wheel chocks must be used always when it is necessary to secure the machine for repairs or for transport.

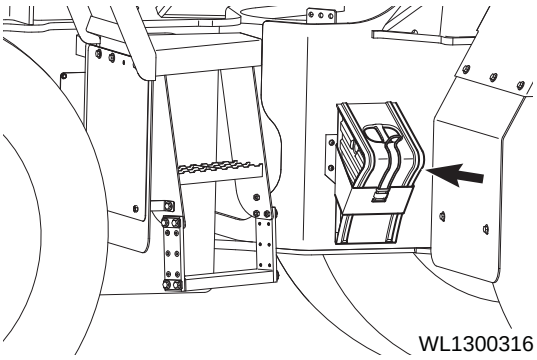


Figure 211

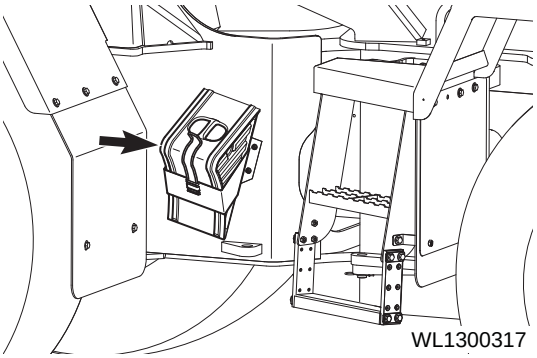


Figure 212

Operation

TO OPERATE A NEW WHEEL LOADER

WARNING

AVOID DEATH OR SERIOUS INJURY

Before operating this machine read and understand "Operating Controls" section of this manual.

Monitoring System

The monitoring system electrical circuits between control system and sensors installed at various machine system locations to monitor selected conditions. The monitoring system's function is to continually inform the operator of machine's condition. Displays and gauge readouts on the instrument panel provide information such as engine speed, engine coolant temperature, transmission oil pressure, and electrical charge status.

New Machine Break-in Procedures

All DOOSAN machines 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.*
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.*

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.

NOTE: *When the engine is started for the first time, perform the inspection points listed under First Start in the Inspection Schedule (See "Maintenance Intervals" on page 4-35).*

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 frame, transmission and axles for; damage, cracks, oil leakage and loose bolts.
   - Check for problems in doors, handrails, steps and loose bolts.

- Clean and check cabin glass, rearview mirrors, rear view camera (if equipped) 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) and condenser.
3. Engine system
   - Check for coolant and oil leakage around the engine and cooling system.
   - Check engine emission control 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. Electrical 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 more information, see “10 Hour / Daily Service” on page 4-37 in this manual.

1. Grease loader 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 transmission.
6. Check cooling system and refill as required.
7. Check level of window washer liquid.
8. Inspect cooling fan blade.
9. Check air intake system.
10. Inspect seat belt for any damage and proper operation.
11. Inspect the structure for cracks and faulty welds.
12. Check the operation of all switches and operating controls.
13. Check the operation of all exterior lights, horn, backup alarm, rear view camera (if equipped) and monitor lights.
14. Check inflation pressure of tires.
15. The level in the reductant tank. (if the engine is equipped with an Selective Catalytic Reduction System. (SCR))

IMPORTANT

Running the engine without reductant will damage the Selective Catalytic Reduction (SCR) system.

Operational Checks Before Starting Engine

WARNING

AVOID DEATH OR SERIOUS INJURY

When leaving operator's seat, set pilot cutoff switch to "O" position and stop engine to prevent accidental activation of the work levers and controls.

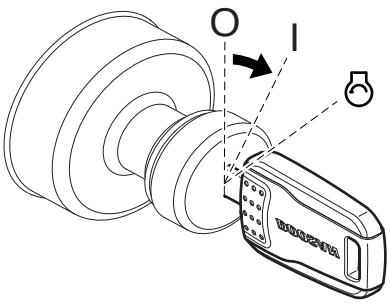
1. Set pilot cutoff switch to "O" position. This will "LOCK" pilot control valve lever (joystick).
2. Fasten seat belt. Check for proper operation and condition.
3. Set all operation levers in "NEUTRAL".

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

4. Rotate the starter switch to "I" (ON) position (Figure 1). Check all indicator lights. A warning buzzer will sound for about two (2) seconds. After two (2) 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, correct the cause of the problem before machine operation.*



FG018147

Figure 1

IMPORTANT

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

If the fuel tank has been run dry or if the engine has not been used for a long time, bleed the fuel system.

WARNING

AVOID DEATH OR SERIOUS INJURY

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

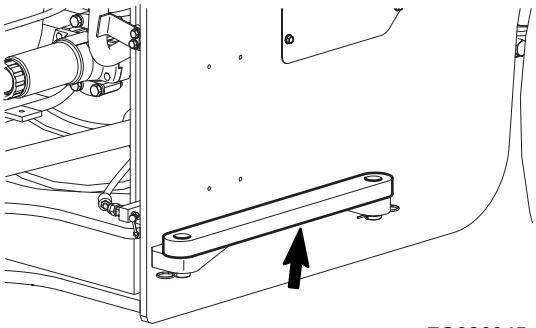
WARNING

AVOID DEATH OR SERIOUS INJURY

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

Perform all steps in “Operational Checks Before Starting Engine” on page 3-5.

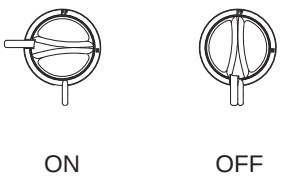
1. Unlatch articulated frame lock bar between front and rear frames. Secure lock plate to rear frame (Figure 2).



FG026945

Figure 2

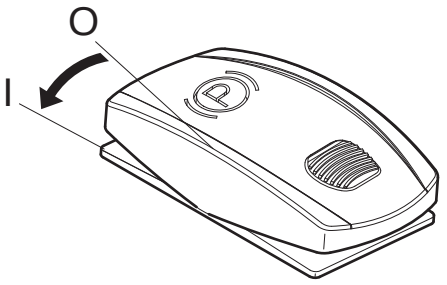
2. If the machine has a battery disconnect switch: Turn "ON" the power using the battery disconnect switch. The battery disconnect switch is located in the battery box of the left side of machine.



FG020630

Figure 3

3. Set parking brake switch to "I" (Engaged) position. This will ensure that parking brake is "Engaged".



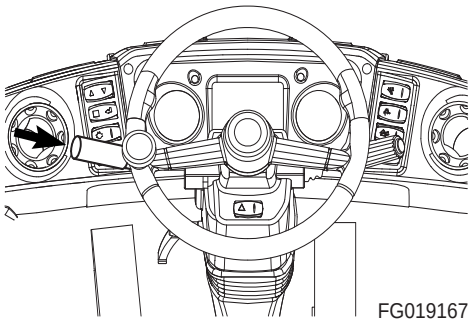
WL1300285

Figure 4

4. Move all control levers to "NEUTRAL" position.

IMPORTANT

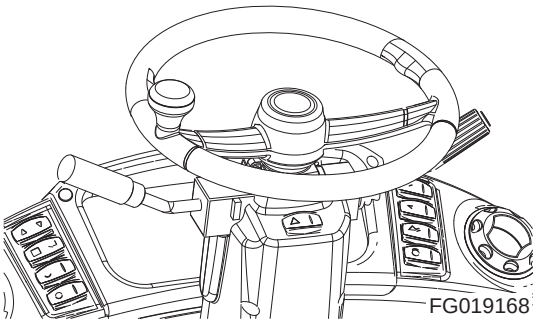
If transmission lever is not in "NEUTRAL" position, engine will not start.



FG019167

Figure 5

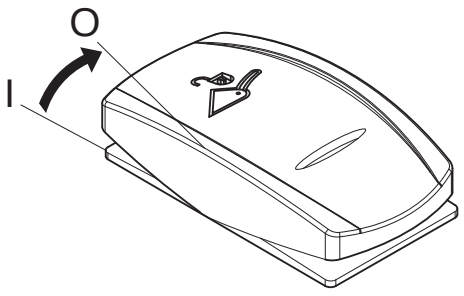
5. Make sure transmission neutral lock is in the "N" (NEUTRAL LOCK) position.



FG019168

Figure 6

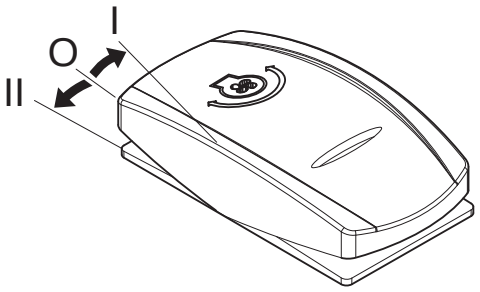
6. Set pilot cutoff switch to "O" position. This will "LOCK" pilot control valve lever (joystick).



FG019178

Figure 7

7. Set cooling fan reverse rotation switch to "O" (OFF) position. This will prevent damage to the cooling system during normal operation.

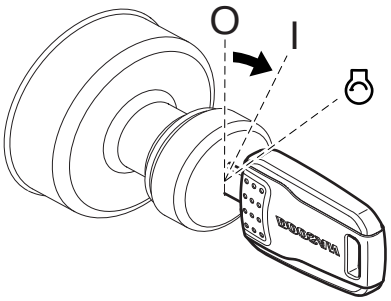


FG019170

Figure 8

8. Rotate starter key to "I" (ON) position. All indicator lights should turn "ON".

   NOTE: *If machine is equipped with and emergency steering system. Test system before starting engine. If system does not function properly, do not start machine. Follow test procedure given with test switch.*

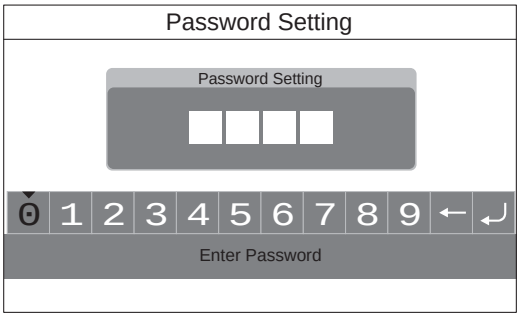


FG018147

Figure 9

9. Sound Horn
10. 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.*



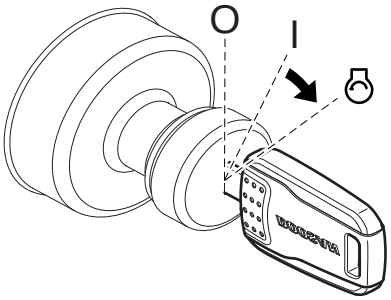
FG019188

Figure 10

11. Turn starter switch to "⏲" (START) position (Figure 11). Engine should start in approximately 5 seconds.

IMPORTANT

The starter motor can only be cranked twice for 30 seconds at a time. After that, it must rest and cool for at least five (5) minutes before attempting to start the engine again.

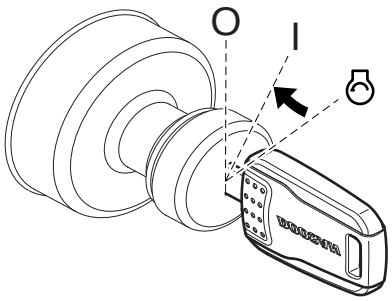


FG018149

Figure 11

12. After engine has started, release key. Key will return to "I" (ON) position (Figure 12).

13. Follow procedures in “Automatic Warming Up Operation” on page 3-10.



FG019173

Figure 12

14. After warming the machine, 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:

Instrument Panel Light or Gauge	Indicator Reading
Fuel Gauge	WHITE RANGE
Engine Coolant Temperature Gauge	
Transmission Oil Temperature Gauge	
Engine Oil Pressure Warning Light	OFF
Charging Warning Light	
Brake Oil Pressure Warning Light	
Diesel Particulate Filter Regeneration Warning Light	
Parking Brake Light	ON

NOTE: *Parking brake indicator light turns "ON" or "OFF" according to parking brake operation, regardless of engine starting.*

15. 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.

16. 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". Take the following action; Discontinue work and allow the engine to run at low idle speed until temperature gauge registers in the green zone again. When the green zone is reached, allow the engine to idle for an additional 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. After engine has cooled, check coolant level, look for signs of leaks, clogged or dirty radiator fins (radiator core), and fan belt tension.*

Automatic Warming Up Operation

This machine has an automatic warming up system.

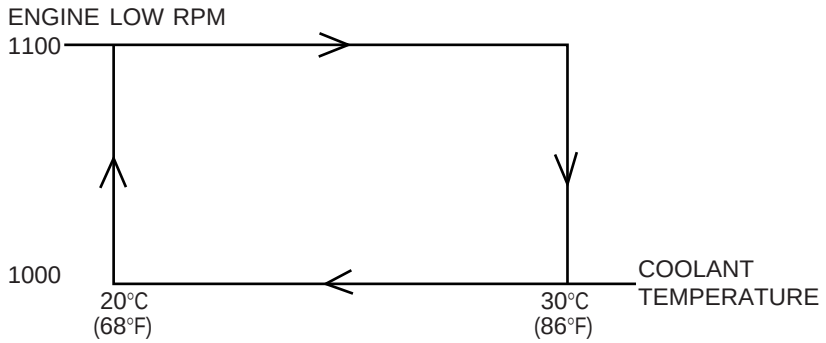


Figure 13

Running the Engine

Check instruments and warning lights at regular intervals.

Engine Speed Range

600 - 800 rpm	Low idling speed. Engine idling is controlled by the EMS control system.
Low Idle - 2,300 rpm	Engine operating speed range. Controlled by the EMS control system.
2,300 - 2,600 rpm	Unsuitable operating speed, but a slightly higher engine speed than normal maximum operating speed can occur when load is low or negative.
2,600 - 3,000 rpm	Prohibited (Too High) engine speed.

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".*

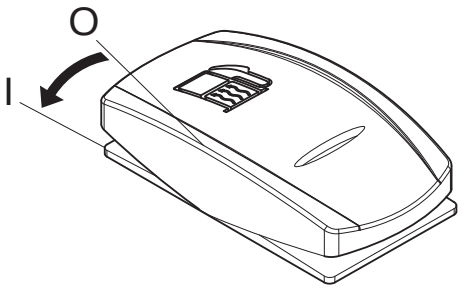


Figure 14

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 and 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.**

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).

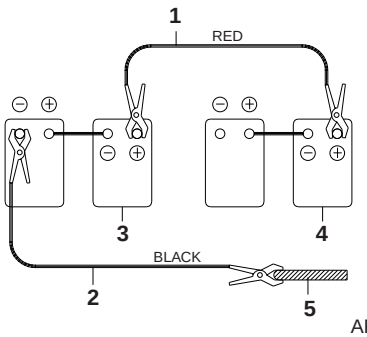


Figure 15

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).

Coolant Temperature

Normal coolant temperature during operation is 80°C - 90°C (176°F - 194°F)

Alarm levels are set in the engine control unit. The default setting for the lowest and highest limit values for high temperature are 103°C (217°F) and 105°C (221°F) respectively.

The following function is standard as alarm for high coolant temperature:

- Alarm and torque reduction at the lowest limit value.

The following alarm functions may also be found, depending on how the engine is ordered:

- Alarm only.
- Alarm and engine shutdown at the highest limit value.
- Alarm, torque reduction at the lowest limit value and engine shutdown at the highest limit value.
- Alarm and engine shutdown at the highest limit value with the possibility of override control.
- Alarm, torque reduction at the lowest limit value and engine shutdown at the highest limit value, with the possibility of engine shutdown override control.

If operated for extended periods under an extremely light load, the engine may have difficulty in maintaining normal operating temperature. At an increased load, the temperature rises to the normal value.

IMPORTANT

An excessively high coolant temperature can damage the engine.

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.

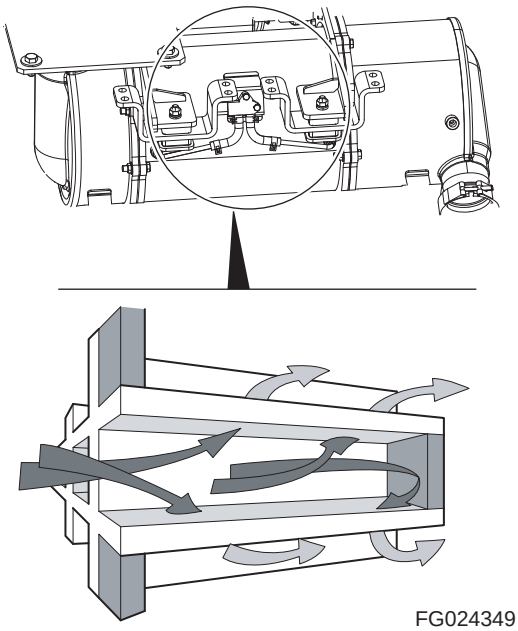
WARNING

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 16)



FG024349

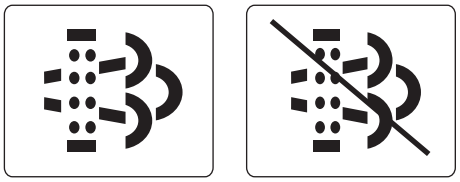
Figure 16

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 17.

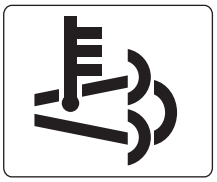


FG018399

Figure 17

2. The high temperature warning light turns "ON" as shown in Figure 18 to alert the operator of hot engine exhaust gases.

Condition	Automatic Regeneration	Selective Manual Regeneration	
		Ready	Conduct
Warning	ON	Flashing	ON
Color	Green	Amber	Amber

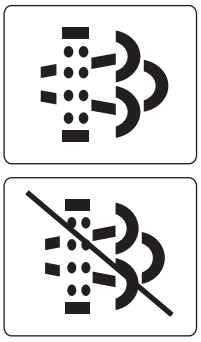


FG018398

Figure 18

3. Manual (forced) regeneration and inhibit switch: the upper symbol in Figure 19 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 19.

   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 19

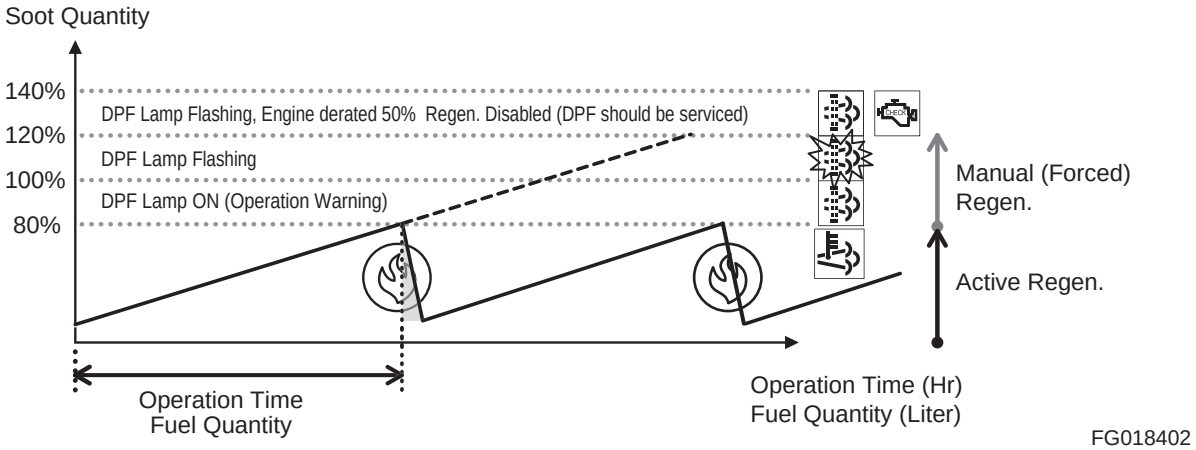


Figure 20 DPF Regeneration Light

- 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%.

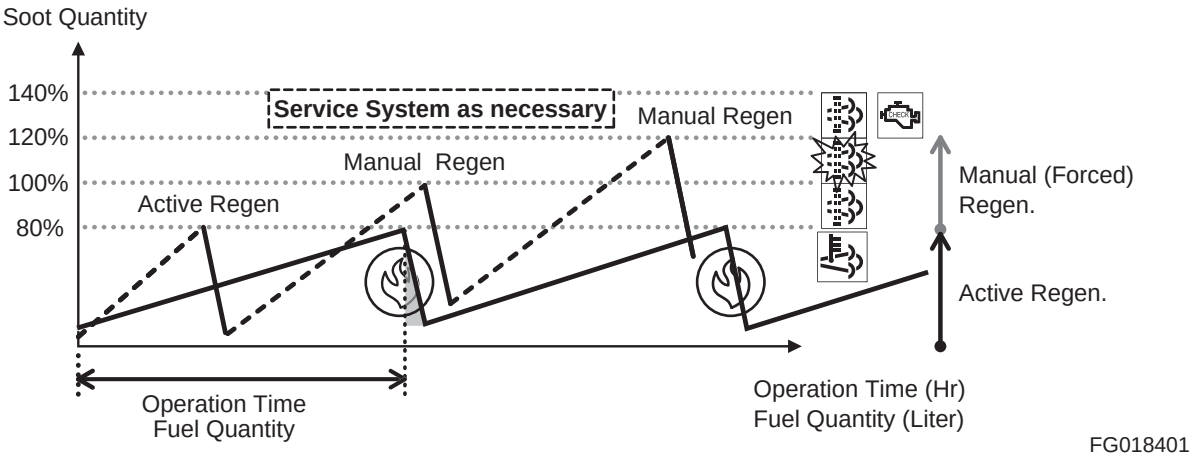


Figure 21 DPF Regeneration Method

- 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 (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).

Procedures for manual (forced) regeneration by the operator

1. Park the machine.

WARNING

AVOID DEATH OR SERIOUS INJURY

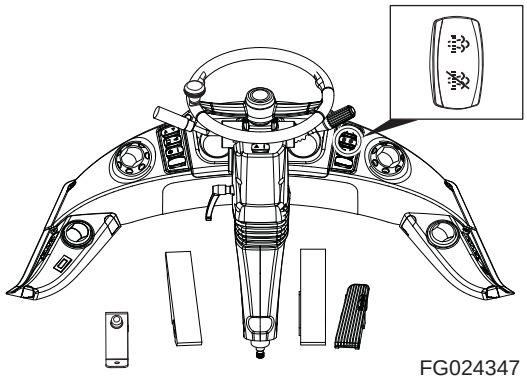
Exhaust gas temperature and exhaust system components are very hot during regeneration. This can cause a fire or burn hazard which can result in death or serious injury or property damage. Keep flammable material and explosive gases away from exhaust system during regeneration.

2. Turn "off" cutoff switch and "ON" parking brake switch.
3. Turn on the manual (forced) regeneration switch on the right side of control console. (Figure 22)
4. Turning the switch "ON" will turn "ON" the regeneration light in the monitor. (Figure 23)

   NOTE: *Engine speed will rise from idling to 1,400 rpm (variable by machine type) and enter regeneration mode.*
   Manual (Forced) regeneration can last up to 35 minutes or more depending on amount of soot build-up.
   Regeneration and high temperature warning lights will light up.

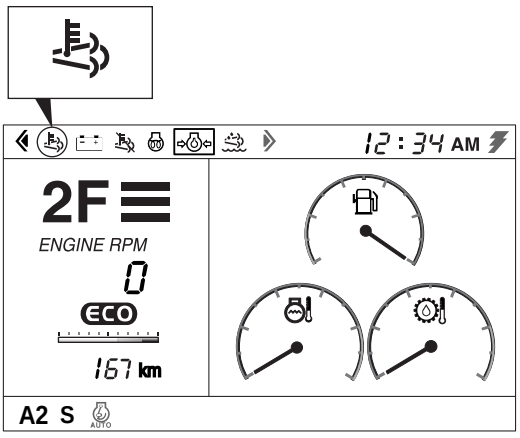
   NOTE: *The engine speed will be reduced to low idle.*
5. Regeneration and high temperature warning lights will be turned off.
6. Turn off the Manual (Forced) regeneration switch

   NOTE: *To deactivate manual (forced) regeneration for an emergency. However, this may reduce the effectiveness of the DPF regeneration. Therefore, choose the proper location and sufficient time to conduct manual (forced) regeneration.*



FG024347

Figure 22



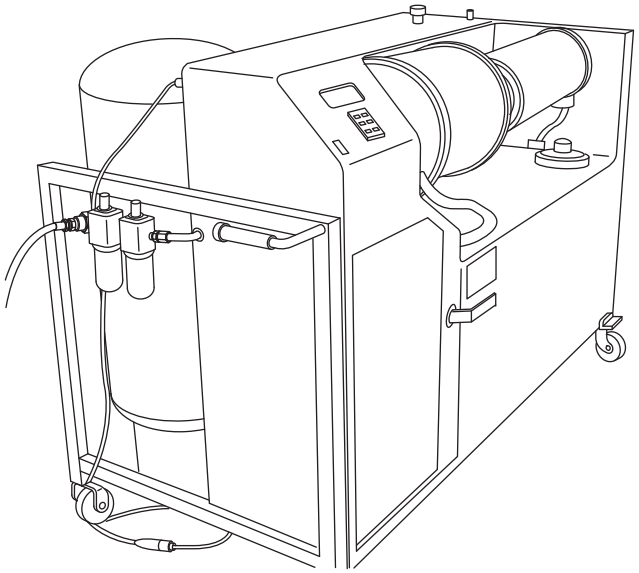
FG024346

Figure 23

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 24 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.

Oil Pressure

Information about the normal and lowest permitted oil pressures is contained in the section headed Technical Data.

The control system has the following alarm levels:

- At an engine speed of less than 1,000 rpm and an oil pressure of less than 0.7 kg/cm^2 (0.7 bar (10 psi)).
- At an engine speed of more than 1,000 rpm and an oil pressure of less than 2.5 kg/cm^2 (2.5 bar (36 psi)) for longer than three (3) seconds.

The following function is standard as alarm for incorrect oil pressure:

- Alarm and torque reduction by 30%.

The following alarm functions may also be found, depending on how the engine is ordered:

- Alarm only.
- Alarm and engine shutdown.
- Alarm and engine shutdown with override control.

NOTE: *High oil pressure (above 6 kg/cm^2 6 bar (85 psi)) is normal when starting a cold engine.*

Charging Indicator Light

If the light comes on during operation:

- Check and adjust the alternator drive belts. For more information refer to the Inspection, Maintenance and Adjustment section in this manual.

If the charging indicator light is still on, this could be because of an alternator fault or a fault in the electrical system.

Stopping Engine

NOTE: *Allow engine to idle for three - five (3 - 5) minutes to cool down, before stopping the engine. If not allowed to idle, heat surge may develop which will damage the engine.*

1. Park machine on firm and level ground.

2. Move transmission lever to "NEUTRAL" position.

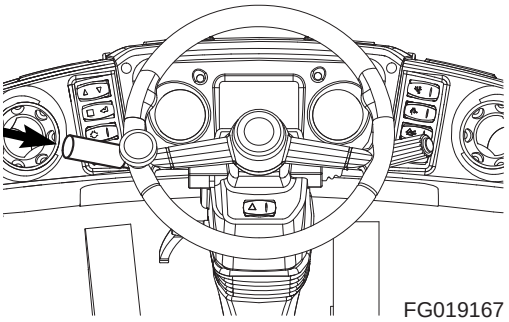


Figure 25

3. Make sure transmission neutral lock is in the "N" (NEUTRAL LOCK) position.

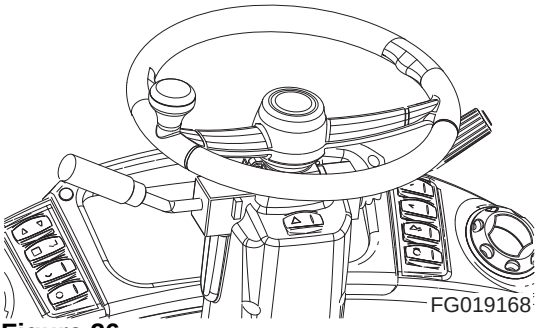


Figure 26

4. Set parking brake switch to "I" (ENGAGED) position. This will ensure that parking brake is "ENGAGED".

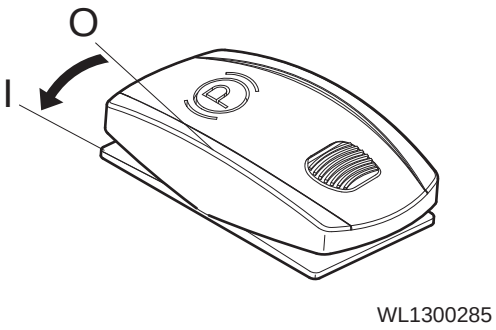


Figure 27

5. Lower bucket or work tool to the ground.
6. Put pilot cutoff switch to "O" (LOCK) position. This will "LOCK" pilot control valve lever (joystick).
7. Allow engine to idle for 3 - 5 minutes to cool down.

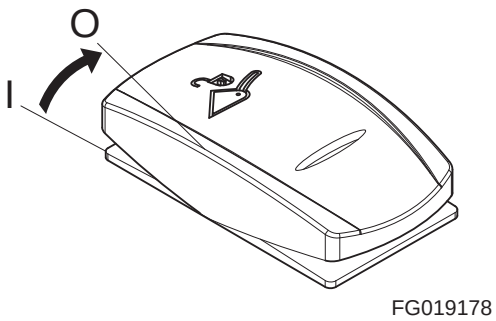
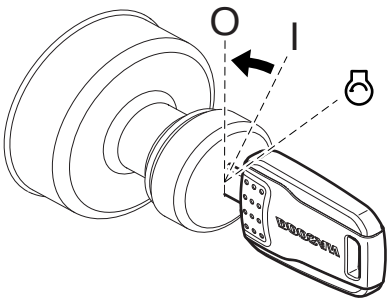


Figure 28

8. Rotate starter key to "O" (OFF) position and stop engine. Remove key.



FG018156

Figure 29

Checks and Maintenance After Stopping Engine

WARNING

AVOID DEATH OR SERIOUS INJURY

Block the starting device when working on the engine. If the engine starts unexpectedly, there is a risk of death or serious injury.

There is always a risk of sustaining burns from hot engine parts (e.g. manifolds, turbocharger, oil, coolant etc.) Allow engine and engine components to cool before servicing.

1. Park the machine on dry, level and hard ground.
2. Repair machine if there are any coolant or oil leaks.
3. Inspect bucket, attachment and frame for damage. Check that bucket or 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.
7. Check that power supply has been turned "OFF".
8. Check the cooling system for the correct antifreeze mixture.
9. At temperatures below 0°C (32°F): prepare for the next start by connecting the engine heater (if equipped).

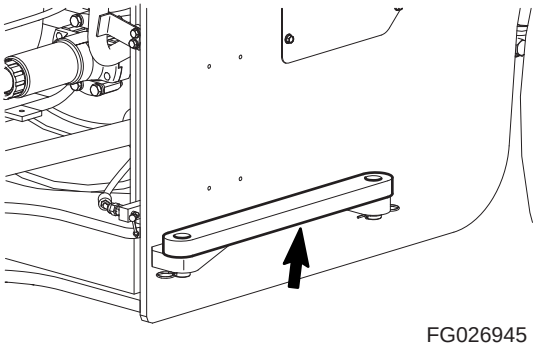
MACHINE TRAVEL

WARNING

AVOID DEATH OR SERIOUS INJURY

1. **Before operating machine, make sure there are no bystanders near the machine 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.**
2. **Always be sure the path is clear during travel.**
3. **If machine is moved while parking brake is engaged, serious damage to parking brake system will result.**
4. **Select a transmission gear that is appropriate for the top speed that will be driven. Choosing a gear that is too high will reduce acceleration and could overheat the transmission converter oil.**
5. **Never place transmission in "NEUTRAL" when going down a hill. Over speeding transmission can damage transmission gears.**
6. **Use extreme caution when reversing travel. Be sure there is a clear path behind the machine. Look in travel direction.**
7. **Never change direction of vehicle travel at high-speed. Serious damage to transmission will result.**
8. **Before leaving the operator's seat, lower the bucket or work tool to the ground. Lock out all control systems and stop engine to avoid accidental activation of controls.**

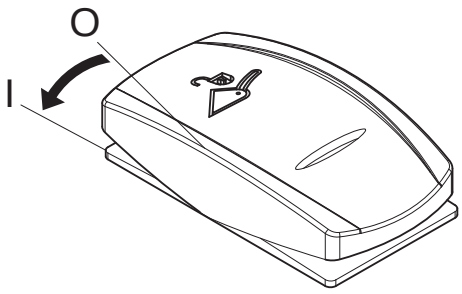
1. Unlatch articulated frame lock bar between front and rear frames before traveling. Secure lock plate to rear frame (Figure 30).



FG026945

Figure 30

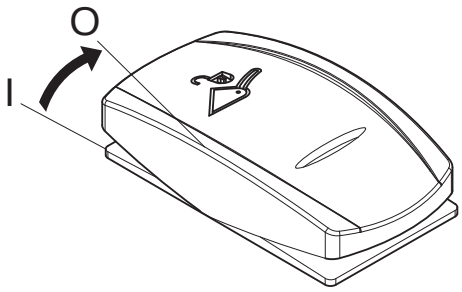
2. Set pilot cutoff switch to "I" (UNLOCKED) position. Raise bucket to a height of 20 - 30 cm (8 - 12 in) above the ground. Tilt bucket completely back.



FG019169

Figure 31

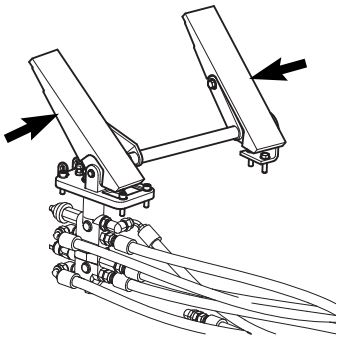
3. Set pilot cutoff switch to "O" (LOCKED) position. This will prevent boom and bucket from accidentally moving during travel, if the pilot control valve lever (joystick) is activated.



FG019178

Figure 32

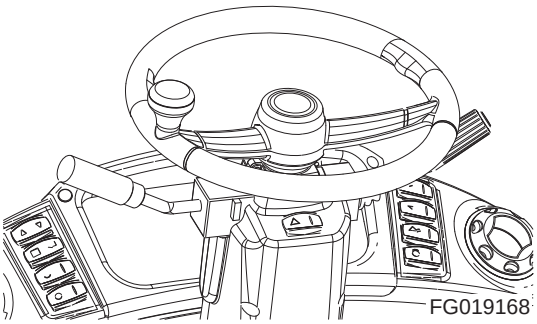
4. Press brake pedal.



FG002183

Figure 33

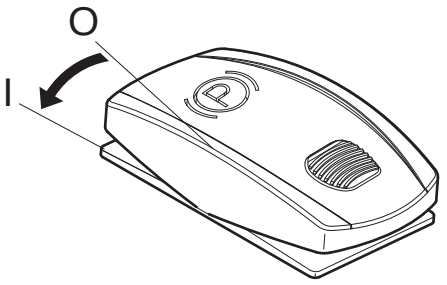
5. Set transmission neutral lock in the "D" (DRIVE) position.



FG019168

Figure 34

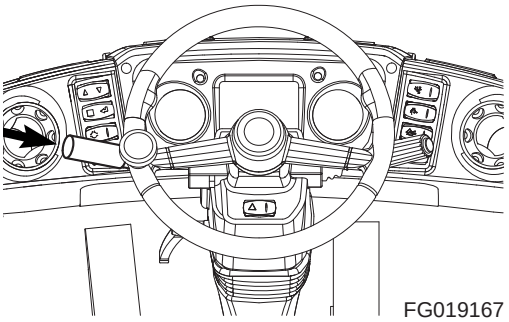
6. Set parking brake switch to "O" (RELEASE) position. This will "RELEASE" the parking brake.



WL1300285

Figure 35

7. Place transmission lever in desired gear. Shift gears one by one. Do not skip from 1st to 3rd, for example.
8. Shift transmission lever to "FORWARD" gear position.



FG019167

Figure 36

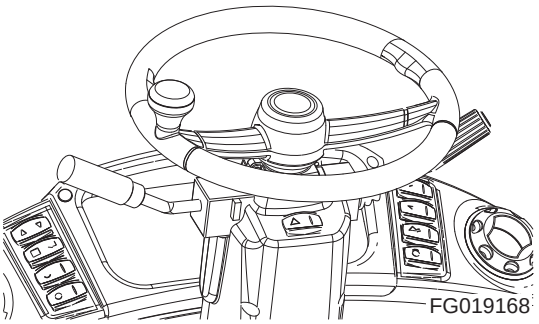
9. Release the brake pedal while slowly pressing the accelerator pedal to move the machine.

WARNING

AVOID DEATH OR SERIOUS INJURY

When traveling at high-speed or on a steep hill, do not make sharp changes in direction. This could cause vehicle to tip or rollover.

When traveling or changing direction, always look in travel direction. Keep bystanders away from work area.



FG019168

Figure 37

IF ENGINE STALLS WHILE TRAVELING

BRAKE SYSTEM: The brakes can be applied approximately nine (9) times by pressing the brake pedal because of the oil pressure stored in the accumulator after engine is turned "OFF". If the engine stalls while traveling, move to an out of traffic area and park the machine. Do not pump the brake pedal now; otherwise the brake oil pressure will be used up, causing the brakes to fail.

WORKING IN WATER

The water depth needs to be taken into consideration when the loader is working in swampy areas. Do not enter water whose depth exceeds the loader's minimum ground clearance height or is high enough to wet the bottom of the axle housing. As a rule of thumb, the allowable water depth is about 435 mm (17 inches). This means that loader should not be used in a river.

Observe the following conditions:

1. Check the water depth in advance when crossing across a river.
2. Use the same precautions before crossing across a swampy area.
3. Do not enter rivers whose riverbed is steep or has a rapid flow.

IMPORTANT

Avoid use of the machine in salt water. Salt water will cause rust which will shorten the life of the machine.

TOWING

When necessary to tow another vehicle, towrope must be tied to towing pin on counterweight at rear of vehicle.

NOTE: *The loader must be used for towing only in an emergency.*

IMPORTANT

Do not tow machine at a speed over 10 km/h (6 MPH) and do not tow machine farther than 10 km (6 mi). This will prevent damage to machine transmission that would result from lack of lubrication.

WARNING

AVOID DEATH OR SERIOUS INJURY

When towing another vehicle on a public road, let other vehicles and people know that you are towing another vehicle. Use a flag, rotating beacon light, or hazard light to alert others.

NOTE: *Always follow applicable laws and regulations about towing another vehicle.*

If machine is being towed by another vehicle and engine will not start, remove front and rear driveshafts otherwise transmission will rotate without being properly lubricated, causing transmission damage. Before removing them, apply parking brake and securely block wheels to prevent machine from moving.

If engine can be started and steering wheel and brakes function normally, have another person seated in the operator's seat to steer the machine when it is towed.

Before towing a vehicle make sure that the following items have been checked:

- Check weights of loader and vehicle being towed. Make sure machine has sufficient braking capacity to stop towed vehicle.
- Check if vehicle being towed can brake and steer. If not, do not allow anyone to ride on towed vehicle.
- Check towrope or tow bar for damage and make sure it has sufficient strength for work.
- When necessary to descend a grade, another towing vehicle must be used in rear to provide additional braking.

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.

If any mistake is made in method of selecting or inspecting wire rope or in method of towing, it can result in death or serious injury.

Always do the following:

- Always use the method of towing given in this Operation & Maintenance Manual. Do not use any other method.
- When towing a problem machine, always use a wire rope with a sufficient towing capacity.

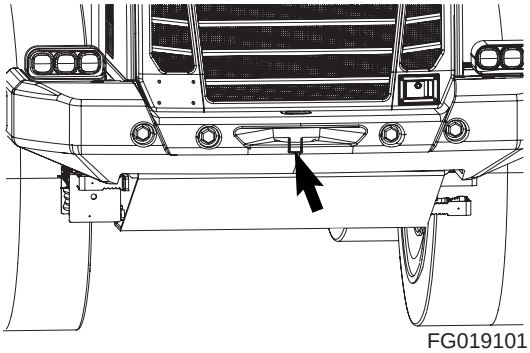

FG019101

Figure 38

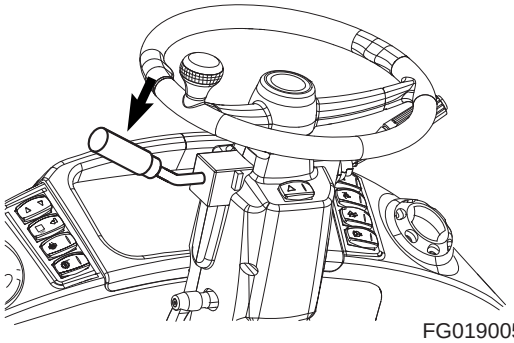
F/R (FORWARD/REVERSE) TRAVEL CONTROL SYSTEM

An optional F/R (Forward/Reverse) travel control system can be installed as an option on the machine. With this system installed, the operator's left-hand can remain on the steering wheel during operation, and not have to manually move the transmission lever between forward and reverse.

To activate system, perform the following steps:

1. Place transmission lever in "NEUTRAL".

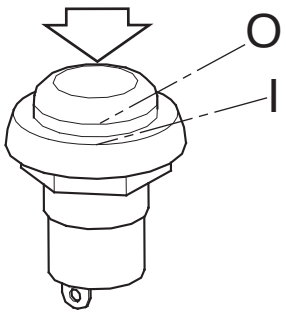
   NOTE: *Do not move the transmission lever out of "NEUTRAL". If the lever is moved, the system will be deactivated.*



FG019005

Figure 39

2. Press F/R selector switch to "I" position, and then release. The switch will return to "O" position, but the system will be activated. When system is activated, the F/R selector indicator light (Figure 40) will be turned "ON".



FG005480

Figure 40

3. The F/R control switch is then used to control the travel direction of the machine.

   O. In this position, the machine is in "NEUTRAL".

   I. In this position, the machine travels "FORWARD".

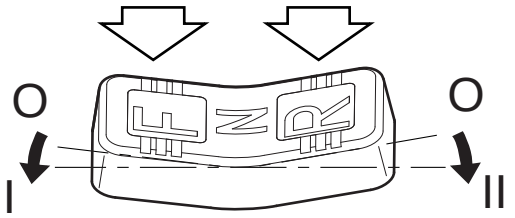
   II. In this position, the machine travels in "REVERSE".

4. The F/R travel control system will stay activated until one of two things happen.

   A. The transmission lever is moved out of "NEUTRAL" into "FORWARD" or "REVERSE".

   B. The starter switch is turned "OFF".

   When the system is deactivated, the F/R selector indicator light will be turned "OFF".



FG015182

Figure 41

MACHINE SHUT DOWN

1. Ease off throttle and apply travel brakes.

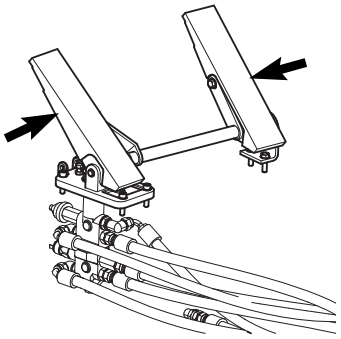


Figure 42

2. Put transmission lever in "NEUTRAL".

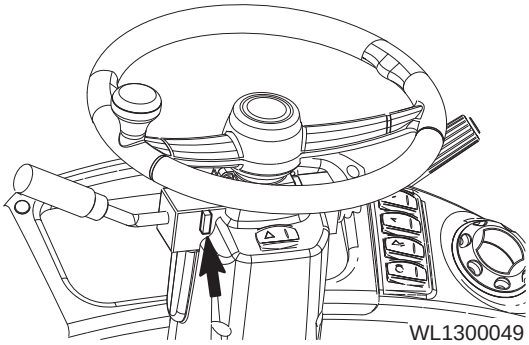


Figure 43

3. Set transmission neutral lock in the "N" (NEUTRAL LOCK) position.

CAUTION

AVOID INJURY

"LOCK" transmission lever. Whenever machine is parked, "LOCK" transmission lever in "NEUTRAL" to prevent accidental machine movement.

4. Set parking brake switch to "I" (ENGAGED) position. This will ensure that parking brake is "ENGAGED".

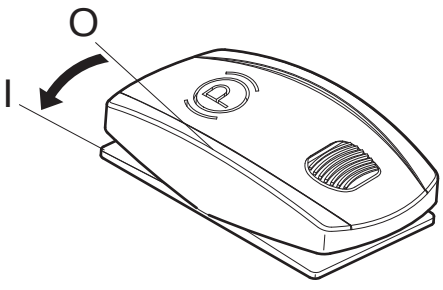
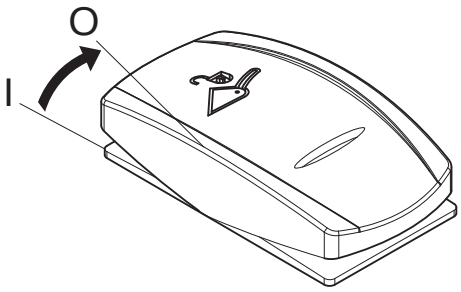


Figure 44

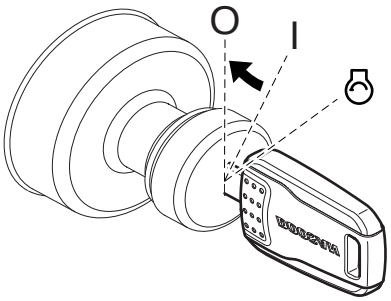
5. Set bucket or work tool on ground.
6. Set pilot cutoff switch to "O" (LOCKED) position. This will lock pilot control valve lever (joystick).
7. Allow engine to idle for 3 - 5 minutes to cool down. Stopping a turbocharged engine without a cool down period can seriously damage turbocharger.



FG019178

Figure 45

8. Rotate starter key to "O" (OFF) position. Remove key.



FG019181

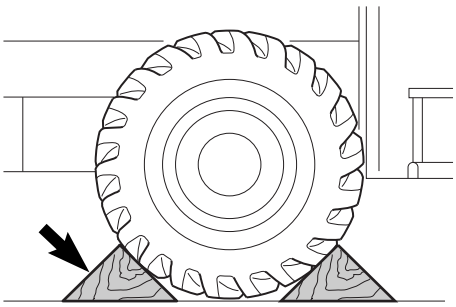
Figure 46

9. If machine is parked on a slope, install wheel chocks in front of and behind wheels.

WARNING

AVOID DEATH OR SERIOUS INJURY

Always secure machine with wheel chocks when parked on a slope. Leaving machine in gear will provide no braking effect because transmission clutch is hydraulically operated. When engine is turned "OFF", there is no hydraulic pressure in transmission and clutch is not engaged.



2876A

Figure 47

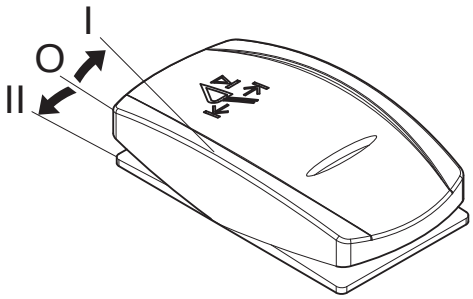
OPERATION OF ATTACHMENT

Arm Angle Sensor Switch

O. In this position, boom kick-out is turned "OFF".

I. In this position (return type), this switch turns "adjusting position".

II. In this position, boom kick-out turned "ON".

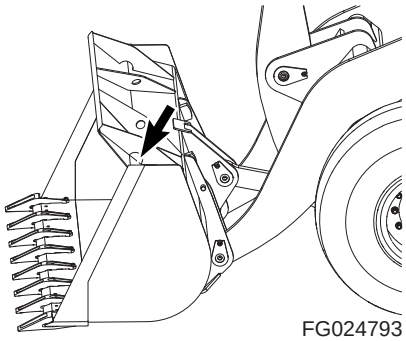


FG019012

Figure 48

BUCKET ANGLE INDICATOR

Top side of bucket indicates angle of bottom of bucket. Top of side plate is parallel with bottom of bucket. If bottom of bucket is not visible, top of side plate will be visible.



FG024793

Figure 49

ADJUSTMENT OF BUCKET POSITION SWITCH

When bucket lever is held in crowd detent position, after bucket has been dumped, bucket will pivot toward crowd position. Once full crowd position has been reached, bucket lever will automatically return to "NEUTRAL" position. If bucket is lowered after lever returns to "NEUTRAL", bucket will automatically position itself to be in a preselected digging position (usually flat). To adjust bucket to desired preselected digging position, perform the following steps.

1. Operate controls to place bucket on ground and in desired digging position (usually flat). Return bucket lever to its "NEUTRAL" position.
2. Stop engine.
3. Loosen bolts (1, Figure 50 and Figure 51) on bracket (2, Figure 50 and Figure 51).
4. Position bracket (2, Figure 50 and Figure 51) so end of arm (3, Figure 50 and Figure 51) is aligned with center of magnetic switch (4, Figure 50 and Figure 51).
5. Tighten bolts (1, Figure 50 and Figure 51).
6. Start engine. Raise boom, dump bucket, then move bucket lever into crowd detent position. Now lower boom and check to see that bucket has stopped at required position. A small readjustment of bracket (2, Figure 50 and Figure 51) may be necessary.

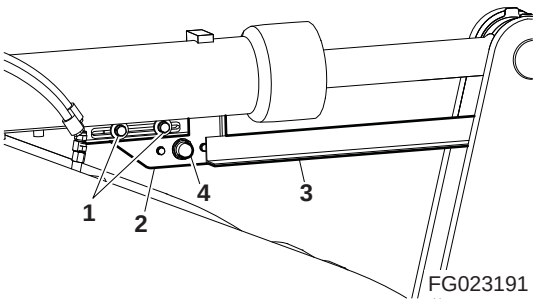


Figure 50 DL250-3

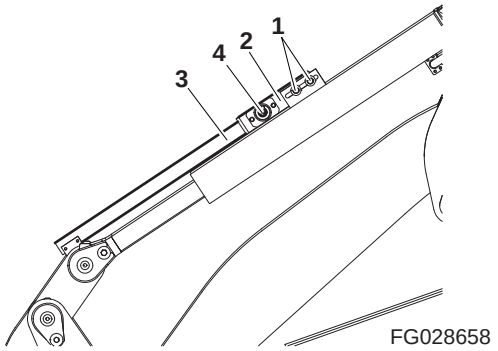


Figure 51 DL250TC-3

OPERATION UNDER ABNORMAL CONDITIONS

NOTE: *See “Severe Conditions Maintenance” on page 4-106 for other recommendations.*

Operation in Extreme Cold

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

Snow and ice accumulation could cause potential hazards such as slippery surfaces.

Warming up engine for a short period may be necessary, to avoid operating with a 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 the 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 ascertain if the 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 the battery fully charged for protecting the battery from freezing in the winter seasons. When you adding distilled water to the battery, run the engine for at least one hour for fully mixing the water with electrolytic 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 may 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 4-24, 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 Periodic Service Table and Chart Section 4, in this manual, or lubrication chart on machine.
7. Start engine and allow it to reach normal operating temperature before 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. At an oil temperature in the shifting circuit < -12°C, the transmission must be warmed up for some minutes.

   This must be carried out in neutral at an increased engine speed (approximately 1500 min^{-1}).

   Until this oil temperature is reached, the electronics remains in neutral.

   After the full driving program can be utilized out of "NEUTRAL".
9. An extra outer air filter must be kept in operator's cabin to replace filter that could become iced and cause restricted airflow to engine.
10. Clean off all mud, snow and ice to prevent freezing. Cover machine with a tarp if possible and 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.

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3. Service fuel system as directed in “Fill Fuel Tank” on page 4-40 and “Check for Leaks in Fuel System” on page 4-41 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 in Section 4, in this manual or on the 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 in Section 4 in this manual. 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 machine.

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 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 the applicable specifications in the 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 engine off until storm passes. Do not touch controls or anything metal.

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 the machine and work equipment outdoors exposed to the filters 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:

Before Storage

Keep the machine in the position 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 machine 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 ensure 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, boom and attachment 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.

- 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 filters.
- 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.

WARNING

AVOID DEATH OR SERIOUS INJURY

Do not perform any inspection and maintenance operation that is not found in this manual.

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

- Turn off power. Wait for approximately one (1) minute after turning off engine starter switch key, and then disconnect negative (-) terminal of battery.
- 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.
- Use proper grounding points to avoid damage to seals or bearings.
- Do not use area around work equipment pins or hydraulic cylinders as a 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 death or serious 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.

Hydraulic Hose Installation

- When removing parts 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.

If inspection or test procedure requires that engine be running, make sure to keep all unauthorized personnel away from the machine.

Arrival Inspections and Delivery Instructions

Before machine leaves the factory, it is Inspected, tested and adjusted as necessary. The dealer must also, if the warranty is to apply, perform complete a Delivery Report form which must be signed by both the dealer and the owner/operator when the machine is delivered by the dealer.

Delivery Instructions

When handing machine over, dealer must give buyer "Delivery Instructions" according to applicable form, which must be signed, if the warranty is to apply.

Service Programs

Warranty Inspection

Two Warranty Inspections must be done if the warranties are to apply. The first within 100 operating hours and the second at the latest at 1,000 operating hours.

The performing of these inspections is a condition for the warranty to apply.

Condition Test

A "Condition Test" is done at authorized dealer workshops and provides information about general condition of machine.

MACHINE SETUP POSITION FOR MAINTENANCE

WARNING

AVOID DEATH OR SERIOUS INJURY

If work has to be done on the machine before it has cooled down, be careful with hot liquids and hot parts of the machine to avoid burns.

Before beginning any service work, park the machine using the following procedure (except for service work requiring the machine to be positioned differently).

1. Park machine on firm and level ground.
2. Move transmission lever to "NEUTRAL" position.

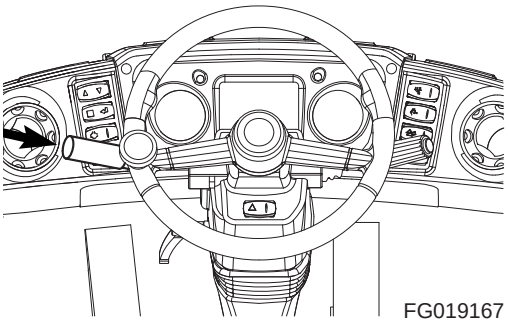


Figure 1

3. Make sure transmission neutral lock is in the "N" (NEUTRAL LOCK) position.

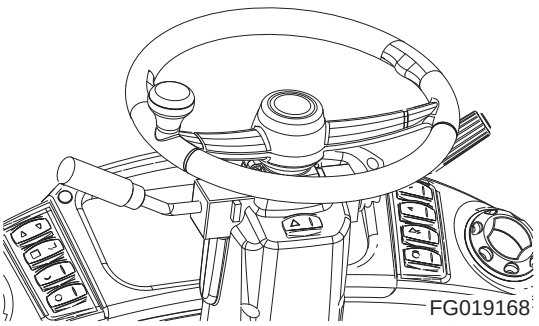
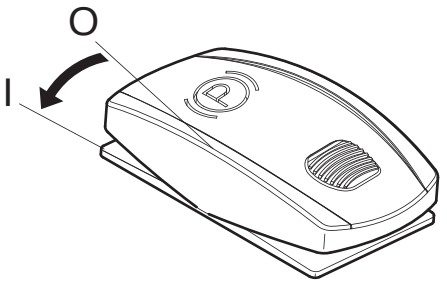


Figure 2

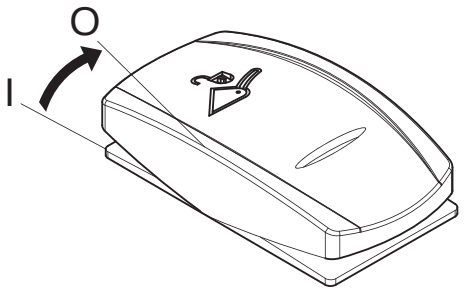
4. Set parking brake switch to "I" (APPLIED) position. This will ensure that parking brake is "APPLIED".



WL1300285

Figure 3

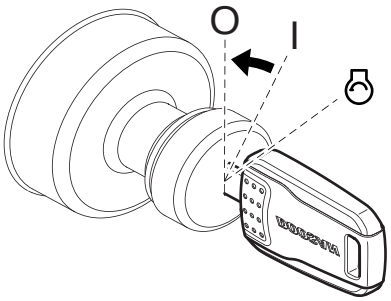
5. Lower bucket or work tool to the ground.
6. Put pilot cutoff switch to "O" (LOCK) position. This will "LOCK" pilot control valve lever (joystick).
7. Allow engine to idle for 3 - 5 minutes to cool down.



FG019178

Figure 4

8. Rotate starter key to "O" (OFF) position. Remove key.



FG018156

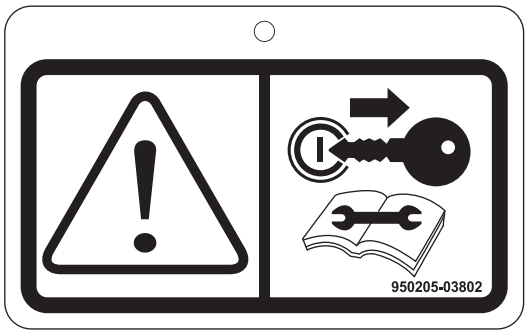
Figure 5

9. 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, always have one person in cabin always. Never leave cabin with engine running.



EX1301177

Figure 6

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 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 7) 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.

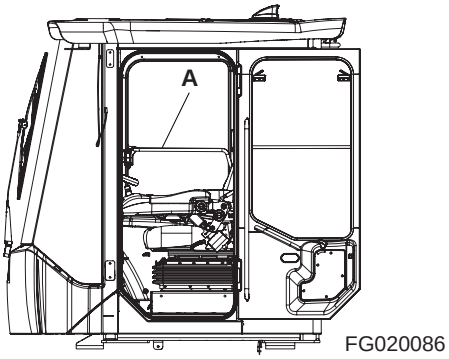


Figure 7

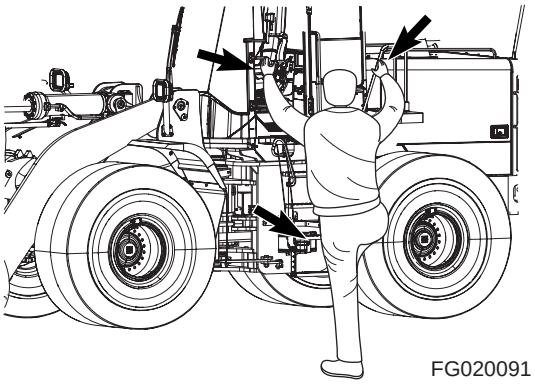


Figure 8

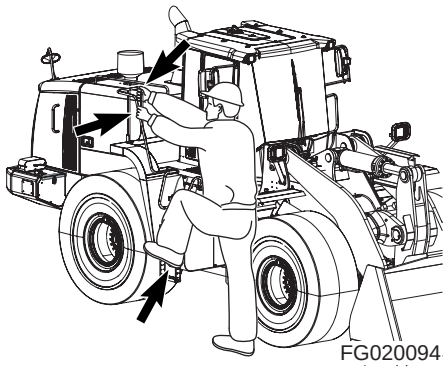


Figure 9

Service Position

BEFORE beginning service work machine must be parked on firm and level ground and positioned as shown below.

AFTER completing service, all guards must be installed and all engine covers must be closed and locked. Articulated frame lock bar must be "UNLOCKED".

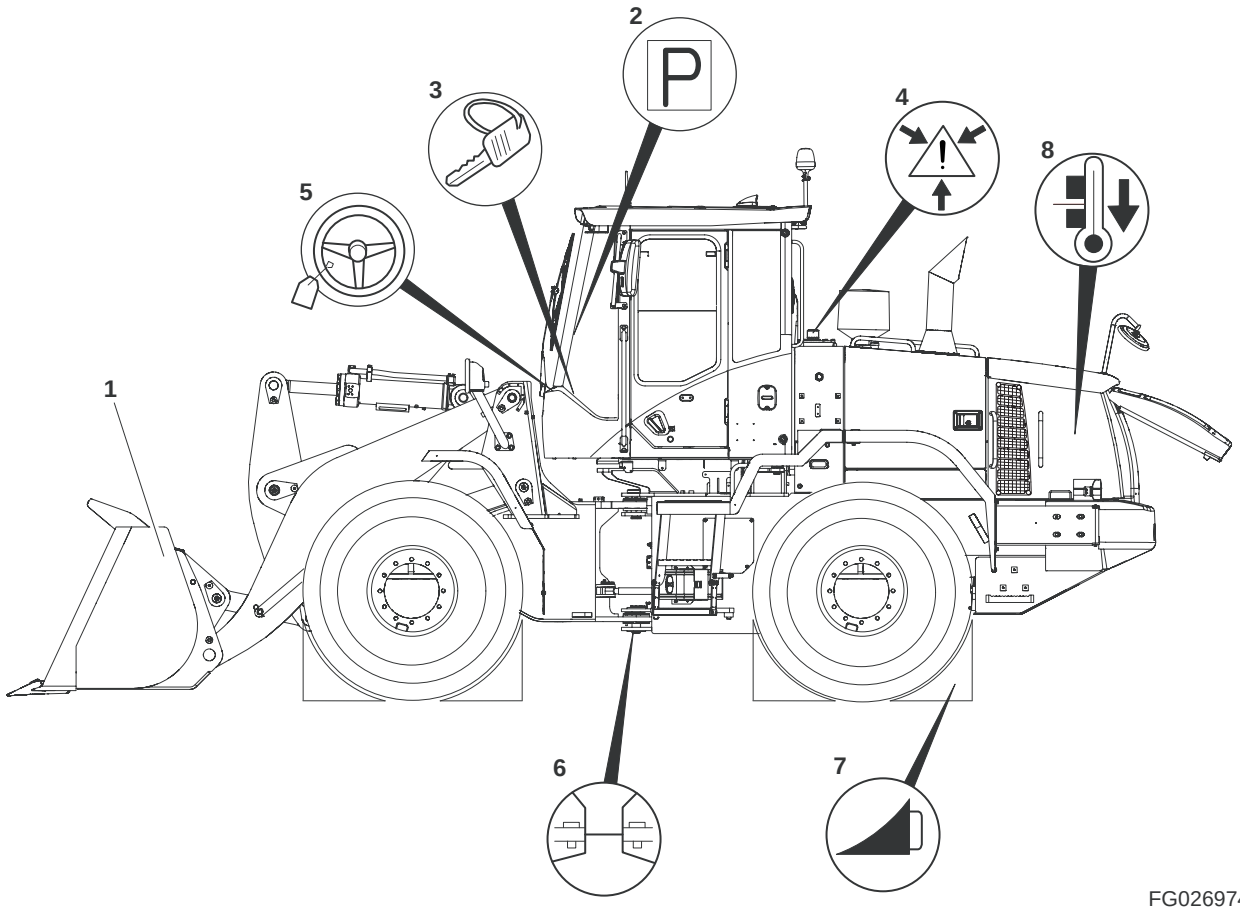


Figure 10

Reference Number	Description
1	The bucket or work tool must be resting on the ground.
2	"ENGAGE" parking brake.
3	Stop engine and remove starter switch key. (Does not apply when checking oil level in transmission).
4	Carefully release the pressure in pressure lines and pressure vessels to avoid risks.
5	Attach a black and yellow label to the steering wheel.
6	Connect the articulated frame lock bar.
7	Block the wheels in a suitable way (with, for example, wheel chocks).
8	Allow the engine and hot machine parts to cool.

Service Points

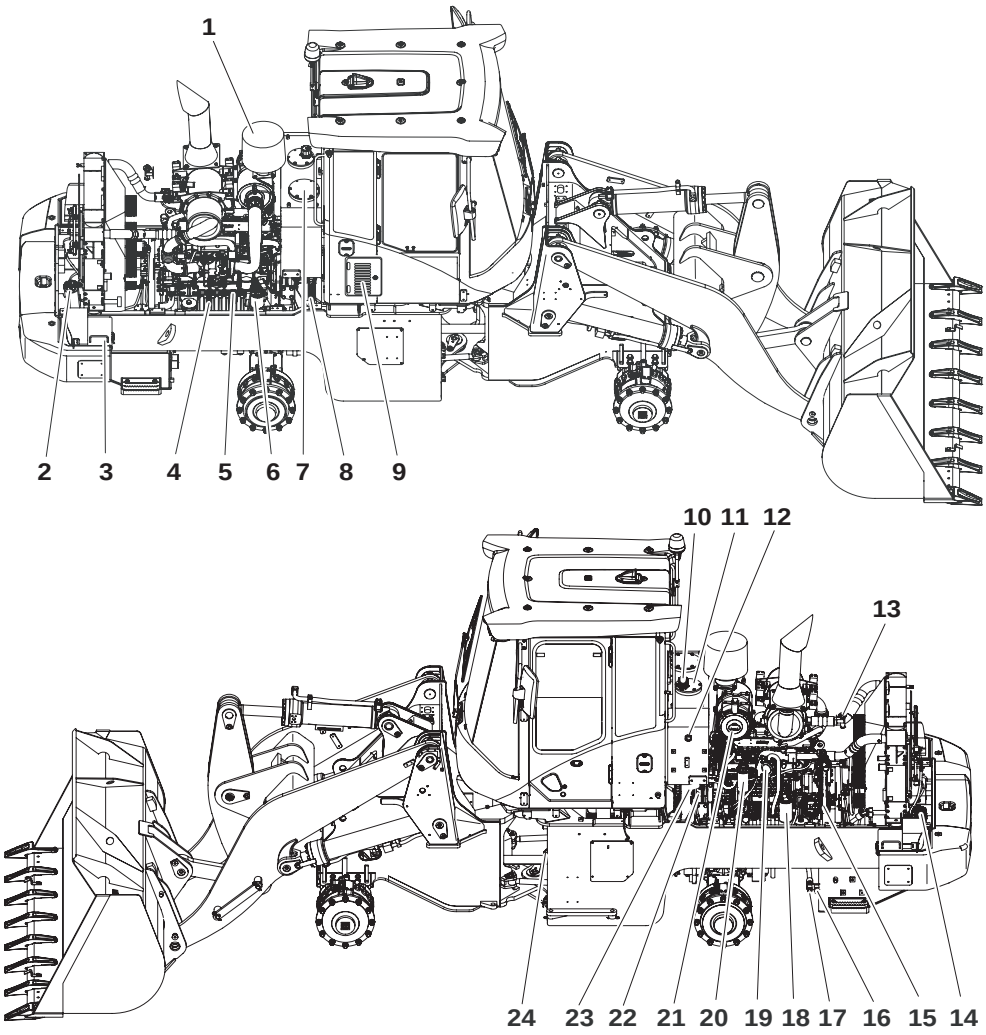


Figure 11

Reference Number	Description
1	Precleaner
2	Fuel Cap Filter
3	Battery
4	Oil Dipstick, Engine
5	Filling Point, Engine Oil
6	Water Separator
7	Return Oil Filter
8	Transmission Oil Filter
9	Ventilation Filters, Cabin
10	Breather of Hydraulic Oil
11	Filling Point, Hydraulic Oil
12	Level Sight Gauge, Hydraulic Oil

Reference Number	Description
13	Filling Point, Coolant
14	Filling Point, Fuel
15	Alternator Belt
16	Draining Coolant
17	Draining Engine Oil
18	Oil Filter, Engine
19	Oil Separator
20	Fuel Filter
21	Air Cleaner
22	Filing Point, Washer Fluid
23	Draining, Hydraulic Oil
24	Filling Point, Transmission

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 into the oil.

  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 is not clear in color, 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.

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

Fuel

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 adversely affected.

- To prevent moisture in air from condensing and forming water inside fuel tank, always fill fuel tank after completing after completing each day's work.
- The fuel pump will not work properly if fuel containing water or dirt is used.
- 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 ten (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 improper 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.

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 4-91.
- 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 4-91 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 4-93.
  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.

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.

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 4-31.

  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 “16. Power Socket for 12 Volt” on page 2-65.

  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 lubricants can also damage the machine. 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 a DOOSAN distributor.
- Only use Ultra Low Sulfur Diesel (ULSD) fuel and API CJ-4/ACEA E9 grade engine oil.
- If ULSD fuels are not used wherever operating, the sulfur contents of fuel being used must be less than 15 ppm.

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 4-31 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.

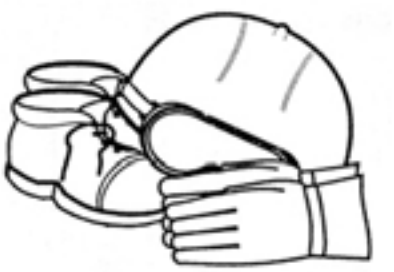
Before Service Instructions

- Read Operation & Maintenance Manual and decals/labels and instructions found on machine to obtain required knowledge and information about machine.
- To be able to properly perform service work it is important that correct tools and equipment be used. Replace or repair broken tools and faulty equipment.
- When lifting machine, the articulated frame joint must be locked and machine lifted at lifting eyes intended for this purpose.

FG001666

Figure 12

- Use a hard hat, safety goggles, protective shoes and gloves and an approved respirator or other protective articles when required.
- Do not wear loose fitting clothing or jewelry.
- Keep service surfaces, handholds and handrails clean from oil, dirt and ice.



FG001667

Figure 13

- Use stepping areas provided with antislip protection to avoid risk of slipping. Worn, painted over, or loose protections must be replaced. Remember that high-pressure water jets when washing and spilled oil can cause protections to loosen. Do not direct water jet against protections and wipe up spilled oil.
- Make sure there is sufficient ventilation when starting engine indoors.
- Do not exceed maximum permissible floor load.
- Do not stand in front or behind machine while engine is running.
- Use a ladder when changing light bulbs or performing other service work high up on the machine.
- Use a long handled window scraper and brush or a ladder when cleaning outside of windows.

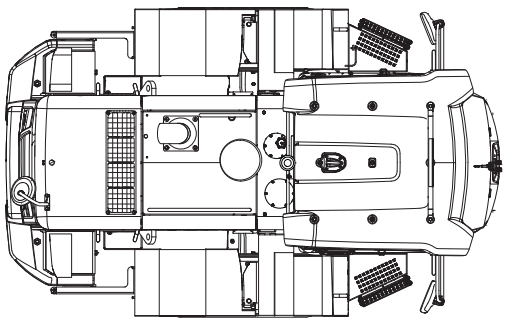


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Figure 14

- The installation of two-way radio, lever steering or similar equipment must be done by a qualified person, because a faulty installation can cause interference with electronic components controlling vital machine functions.
- When performing service work below raised lifting arm system, lifting arms must first be secured (lifting arm support). In addition control lever lockout and parking brake must be applied.
- Use caution when changing oil in engine, hydraulic system or transmission as oil may be hot and cause burns.
- When emptying/draining oil or fuel, use a pump or a hose and collect liquids in a suitable vessel. Spillage will damage environment and can cause a fire or other hazards. Waste oil and other contaminating liquids must be handled and dispose.
- When operating in an area which is contaminated or dangerous to one's health, machine must be specially equipped for this purpose. Special local safety regulations could apply within such areas.
- Stop engine before opening engine covers etc. Make sure no tools or other objects, which can cause damage, have been left in or on machine.
- Check equipment you are using for lifting or supporting parts of machine, e.g. straps, slings, ratchet blocks. Make sure ground support persons need to be properly trained to meet all applicable laws and regulations.
- Release pressure in pressure vessels, components and systems carefully and in prescribed way, so excess pressure is released without risk.
- When connecting hydraulic hoses, check that desired effect has been achieved, i.e. check that hydraulic function operates in expected way.
- Hoses, pipes and quick-connect couplings may be pressurized even if machine is stationary and engine is turned "OFF". Such pipes and hoses should only be disconnected by trained personnel.
- When looking for leaks, use a piece of paper or wood, not your hand. Always wear eye and face protection.

Fire Prevention Measures

There is always a risk of fire. It is important that you use a fire extinguisher approved for your machine and working environment and that you learn how to use it. The fire extinguisher must be placed behind the seat or externally in a lockable box.

If machine is to be provided with a handheld fire extinguisher, it must be a ABE type (ABC in the USA). This means that it is possible to extinguish fires in both solid and liquid carbonaceous material and that active compound does not conduct electricity.

The effectiveness grade I means that time the extinguisher is effective must not be less than eight (8) seconds, grade II at least eleven (11) seconds and grade III at least fifteen (15) seconds.

A handheld fire extinguisher ABE I (in the USA, ABC type) normally corresponds to a powder content of 4 kg (8.8 lb) (EN-grade 13A89BC), the EN 3-1995 standard, parts 1, 2, 4 and 5.

If there is a sign of a possible fire, take the following steps:

1. Drive machine away from fire sensitive area caused by fire.
2. Lower bucket or work tool to ground.
3. Stop engine by turning starter switch key to "0" (OFF) position.
4. Leave cabin.
5. Turn "OFF" battery disconnect switch.
6. Extinguish fire and notify fire brigade/department if necessary.

Do not smoke or have an open flame near a machine when filling with fuel or when the fuel system has been opened and in contact with the surrounding air.

Diesel fuel oil is flammable and must not be used for cleaning. Use an approved solvent and do not inhale fumes. Certain solvents can cause skin rashes and constitute a fire hazard.

Flammable starting aids must not be used because of the possibility of explosion in the induction air system.

Keep area clean where service work is to be done. Oil or water makes the floor slippery and can be hazardous when working with electrical equipment or electrically powered tools. Oily or greasy clothes are a serious fire hazard.

Check daily that the machine and equipment, e.g. underbody plates are free from dust and oil to reduce risk of fire and for easier detection of damaged or loose components.

NOTE: *If a high-pressure jet is used for cleaning prevent damage to electrical connectors and insulation by covering and protecting the components.*

Take extra care when cleaning the machine after it has been used in a fire sensitive environment, e.g. sawmill and refuse dumps. Reduce the risk of spontaneous combustion by installing a silencer guard or high capacity cyclone precleaner.

Sound absorbing material in the engine compartment must be kept clean to minimize the fire hazard.

Fire prevention equipment which is installed on the machine must be maintained.

Check that fuel lines, hydraulic and brake hoses and electrical cables have not been damaged by chafing and are properly installed and clamped.

- Between the batteries.
- Between battery and starter motor.
- Between alternator and starter motor.
- To the preheating element on the engine.

Electrical cables must not rest directly against oil or fuel lines.

The following applies for welding and grinding work:

- A fire extinguisher must be kept near at hand.
- The ventilation must be good when working indoors.
- Approved respirator must be used.
- The work surface must be cleaned.
- Do not weld or grind on components which are filled with flammable liquids, e.g. tanks and hydraulic pipes. Exercise care with such work near these places.

Working on Painted Surfaces

When welding, grinding and gas cutting, the paint finish must first be removed from an area with a radius of at least 10 cm (4 in) from the point where the work is to be done. Paint when heated can cause irritation and be very harmful in case of long or frequent exposure.

In addition to the health hazard, welding over a painted surface will also be of an inferior quality and strength. Never weld directly on a painted surface.

Methods and Precautionary Measures When Removing Paint

Blasting

- Use respirator and eye protection.

Paint remover or other chemicals

- Use a portable air extractor, respirator and protective gloves.

Grinding machine

- Use a portable air extractor, respirator and protective gloves and eye protection.

Rubber That Contains Fluorides

Take precautions 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.

Also, contact with or burns from these chemicals usually cause tissue damage. It usually means that damaged tissue must be surgically removed. Several hours may pass after contact with fluorides, 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 which are dangerous to your health and environment and must therefore never be burned when scrapped. Also, take care when handling machines which have been subjected to fire or other 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 handled and disposed of by an approved refuse handling plant.

Batteries, plastic objects and anything else which is suspected of being dangerous to the environment must be handled and disposed of in an environmentally safe manner.

Check List After a 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 fluorides. 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 immediately. Symptoms may not appear until several hours after initial contact.

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

PREVENTIVE MAINTENANCE

Periodic checks and replacement of oil, grease, filters, etc. must be made at the specific intervals, to keep machine in good working condition. The following pages describe items to be checked, lubricants to be used and time interval between each check.

NOTE: *Time interval between each service check may need to be shortened if machine is operating in severe environmental conditions. Machines working in extremely hot or dusty conditions will require more frequent service checks. Total hours of machine operation are determined by hour meter that is on the front instrument panel.*

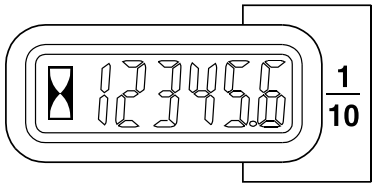

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Figure 15

Product Identification Number (PIN) Location

The PIN is stamped on product identification plate (Figure 16) on the right side of front frame above wheel cover.

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

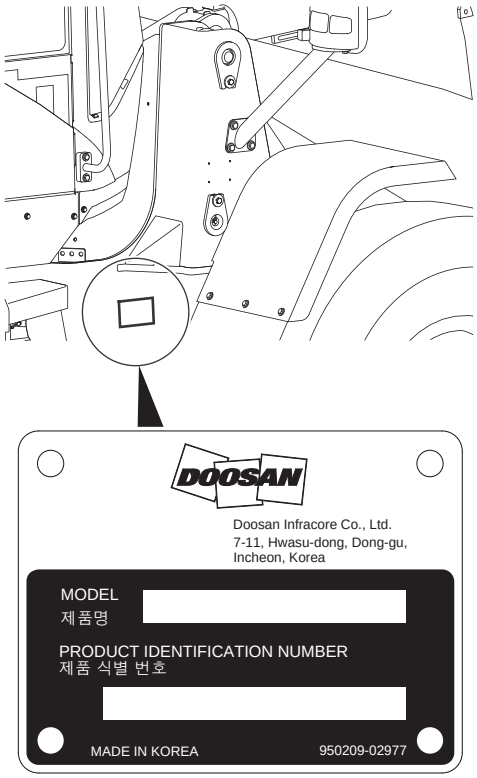

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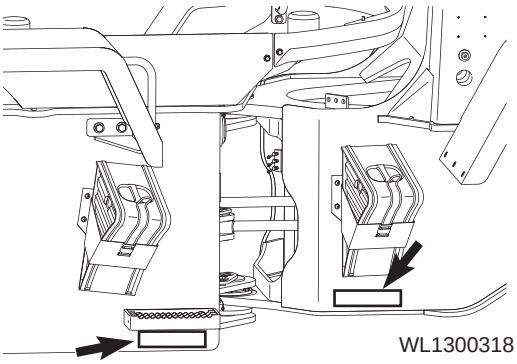
Figure 16

The number is also stamped in the rear frame on the right side just below the cabin (Figure 17).



WL1300318

Figure 17

Component Serial Numbers

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

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

Engine Identification

Engine Data Plate

The engine data plate provides important facts about the engine. The engine serial number (ESN) and control parts list (CPL) provide information for service and ordering parts. The engine data plate **must not** be changed unless approved by DOOSAN.

The data plate is located on the fuel pump side of the engine, on the rocker housing. Have the following engine data available when communicating with a DOOSAN Authorized Repair Location. The following information on data plate is **mandatory** when sourcing service parts:

Reference Number	Description
1	Doosan's "OWN" Engine Plate

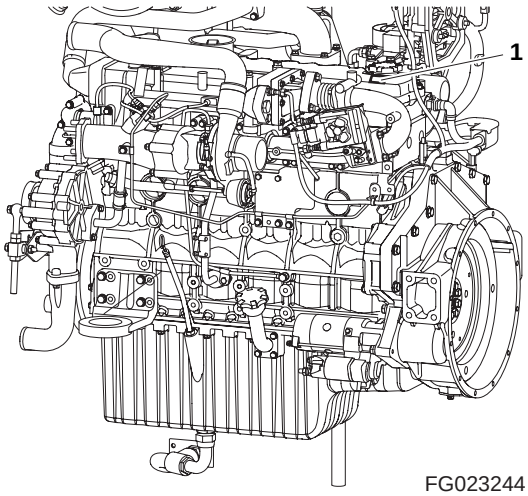


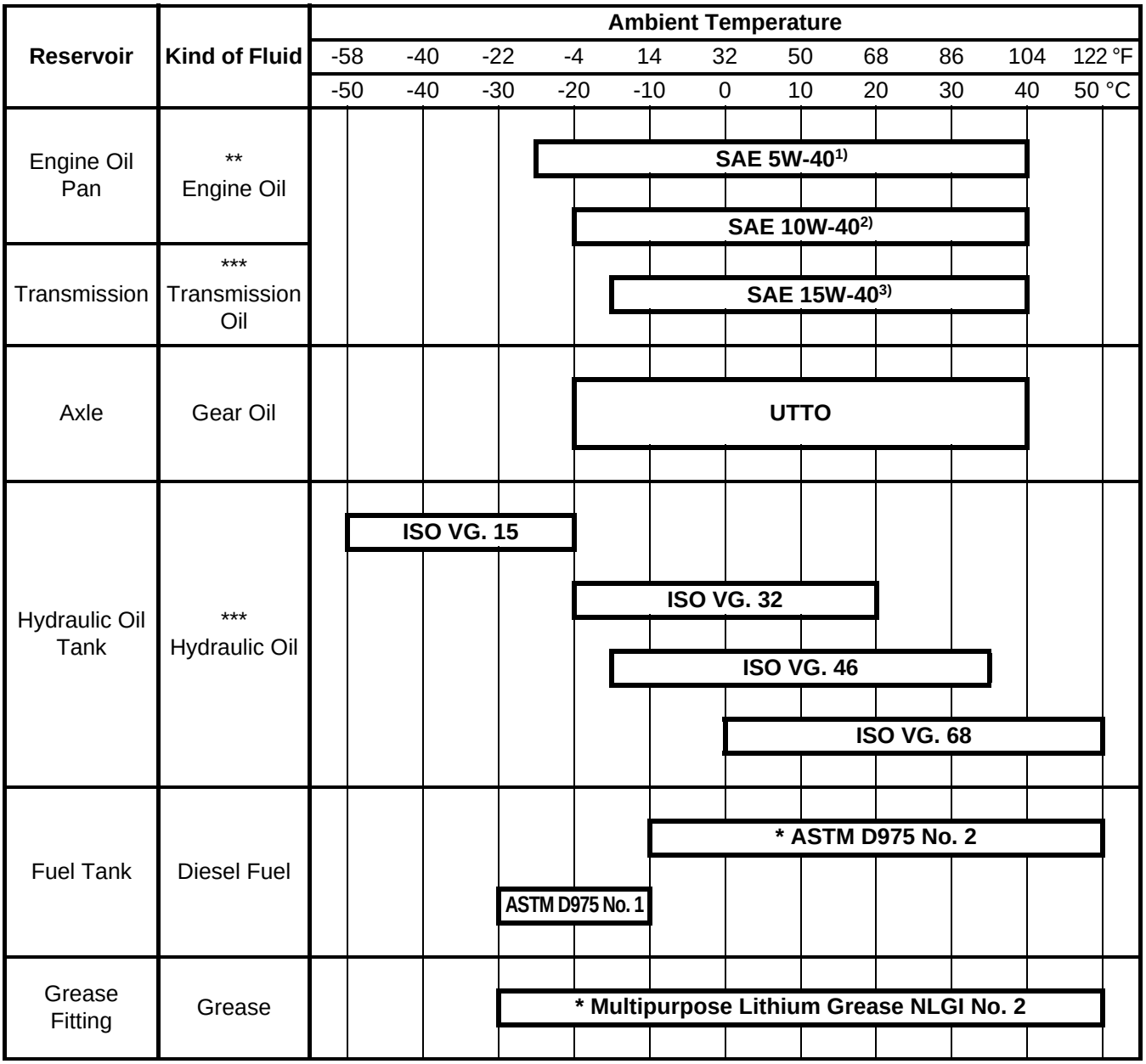
Figure 18

TABLE OF RECOMMENDED LUBRICANTS

IMPORTANT

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

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



Cooling System	Coolant	*** (50% antifreeze - 50% distilled water) (Note that mixing ratio is for reference purpose only, and is not an absolute standard.)**
*****	Installed at factory.	
******	Engine oil for engine must meet API CJ-4/ACEA E9.	
1)	Recommended for use at extremely low temperature below -20°C.	
2)	Filled at factory. Doosan genuine engine oil is recommended for use.	
3)	Doosan genuine engine oil is recommended for use.	
*******	Transmission oil must meet API CI-4/ACEA E5, E7. ZF do not allow to use oils of the API CI-4 Plus, CJ-4, SM, or ACEA specification, category E9.	
********	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.		

Recommended Grease

Following conditions apply to greases

- Grease up to NLGI grade 2 (NLGI Grade 1 to 2 greases with EP additives, compatible with plastics, NBR elastomers, copper and copper alloys, and NLGI Grade 000 to 0 fluid greases).
- Grease containing up to 5% MoS2 as an additive.
- NLGI grade 2 grease containing solids such as graphite and copper (e.g. chisel paste).
- Sodium soap greases must not be used.

NOTE: *Contact your DOOSAN distributor to choose proper greases under -20°C (-4°F).*

Recommended DOOSAN Genuine Grease			
Grease Type	**NLGI Grade**	**°C**	**°F**
		Min.	**Min.**
Multipurpose Grease (EP)	2	-10	14
Grease for Cold Weather	1	-20	-4

Recommended Antifreeze

Antifreeze	
Recommended Concentration	**Manufacturers Meeting ASTM D3306**
50% Antifreeze - 50% Distilled Water	DOOSAN Genuine Solution
	Dexcool ELC by Chevron Texaco
	Alugard G48 by BASF
	Others meeting or exceeding ASTM D3306

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

IMPORTANT

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

IMPORTANT

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

TRANSMISSION OIL

Oil Grade of Transmission

Low Temperature Limits

Property	Oil Type/Viscosity Grades	Use at outside temperatures above
03D	ATF	- 40°C
03F	"UTTO in Accordance with JDM J20D/ John Deere Low Viscosity Hy-Gard"	- 40°C
03E, 03G, 03H	UTTO	- 30°C
03K	SAE 0W-30, 0W-40	- 40°C
03B, 03C, 03K	SAE 5W-30, 5W-40	- 35°C
03A, 03B, 03C, 03K	SAE 10W, 10W-30, 10W-40	- 30°C
03A, 03C, 03K	SAE 15W-30, 15W-40	- 25°C
03A, 03C, 03K	SAE 20W-20, 20W-40	- 20°C
03A, 03C, 03K	SAE 30	- 10°C

Lubricant Classes for Service Fills (1)
"03A, 03B, 03C, 03D, 03E, 03G, 03H, 03K only at Ambient Temperatures Below - 10°C: 03F"

(1) The current list can be requested from any DOOSAN, ZF after-sales service center or accessed on the Internet under www.zf.com

Oil Change Intervals

Lubricant Class	03A, 03B, 03C, 03D, 03E, 03F, 03H, 03K
Load Class	Oil Change Interval
Normal	1500 h
Severe	1000 h

Load Class

Load Class	Examples of Applications
Severe	• Wheel loader operated under extreme braking conditions • At ambient temperatures > 40°C

AXLE OILS

Oil Grade ZF-Powerfluid

Oil intended for axles with built-in brakes

Property	Unit	ZF-Powerfluid
Density at 15°C	$kg \cdot m^3$	881
Viscosity at 40°C	mm^2/s	70
Viscosity at 100°C	mm^2/s	9.1
Brookfield viscosity at -30°C	mPa.s	58,000
Pour point	°C	-39
Flash point (COC)	°C	237
Shear stability Viscosity at 100°C after 100 hrs tapered roller bearing shear test (TRB)	mm^2/s	8.5
Scuffing resistance FZG A/8.3/90°C	fail load stage	11

Examples of oils which meet the requirements according to the table on the next page.

Lubricant Classes for Service Fills (1)
ZF-Powerfluid Plus, 05F

(1) The current list can be requested from any DOOSAN, ZF after-sales service center or accessed on the Internet under www.zf.com

Oil Change Intervals

Lubricant Class	ZF Powerfluid Plus, 05F
Load Class	Oil Change Interval
Normal	1500 h
Severe	1000 h

Load Class

Load Class	Examples of Applications
Severe	• Wheel loader operated under extreme braking conditions • At ambient temperatures > 40°C

Engines Oil

Doosan engine oil have been developed and tested to provide the full performance and life that has ben 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 ar not available, oils meeting ACEA E9 may be used.

ACEA E9 oils met 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 Diesel Particulate Filter (DPF) will plug sooner and require more frequent DRF ash service intervals.

Typical aftertreatment systems include the following:

- Diesel Particulate Filter (DPF)
- Diesel Oxidation Catalvsts (DOC)

Other systems may apply.

Therefore the cost of repairs would not be covered by a DOOSAN warranty.

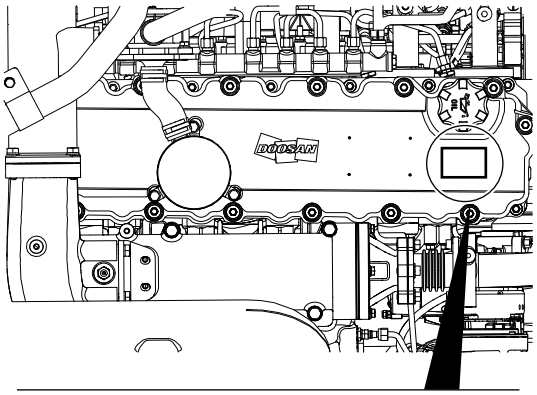


Figure 19

FLUID CAPACITIES

Component		Capacity
Engine	Oil Pan with Filter	Minimum 20 liters (5.3 U.S. gal.) Maximum 27 liters (7.1 U.S. gal.) **NOTE:** *The filter holds an additional 1 liter (1 qt) of oil.*
	Cooling System	40 liters (10.6 U.S. gal.)
Fuel Tank		249 liters (65.8 U.S. gal.)
Hydraulic Oil Tank		176 liters (46.5 U.S. gal.)
Transmission		45 liters (11.9 U.S. gal.)
Axles	Front Axle Differential / Front Hub	35 liters (9.2 U.S. gal.)
	Rear Axle Differential / Rear Hub	21.5 liters (5.7 U.S. gal.)

LUBRICATION AND SERVICE CHART

Greasing Bearings

The service life of bushings and pivot pins can be extended considerably, if the machine is greased regularly and in the correct way.

The greasing of bearings has two main purposes:

- Add grease to the bearing to reduce friction between pin and bushing.
- Replace old grease which may contain dirt. The grease in the space inside the outer seal collects dirt and prevents dirt and water from penetrating into the bearing.

Therefore, grease the bearing until new, clean grease is forced out through the outer seal.

Between 10 and 15 strokes with a normal handheld grease gun is required to grease one of the bearings for the lifting arms.

Wipe off grease fittings and grease gun before greasing, so dirt and sand is not introduced through the grease fittings.

Symbols for Lubrication and Service Chart

These standard symbols are used in the "Lubrication and Service Chart" on next page.

Symbol	Description
	Lubrication
	Transmission Oil
	Engine Oil
	Engine Oil Filter
	Hydraulic Oil
	Hydraulic Oil Return Filter
	Coolant
	Air Cleaner Filter

Symbol	Description
	Fuel Filter
	Air Conditioner Filter
	Drain Water
	Gear Oil (Axle)
	Brake Filter
	Level check
	Hydraulic Oil Tank Breather
	Fuel Cap Filter

Lubrication and Service Chart

DL250-3

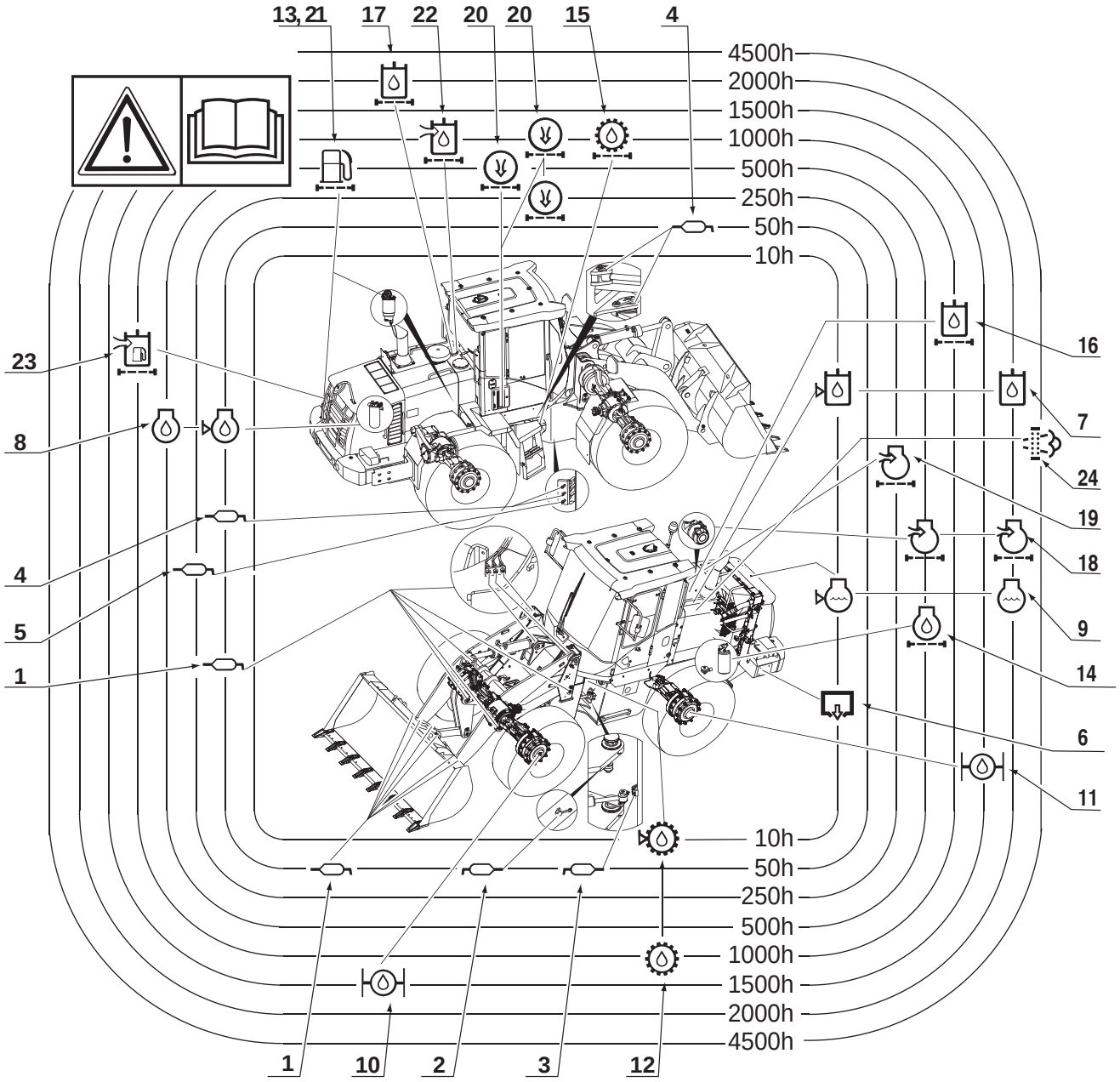


Figure 20

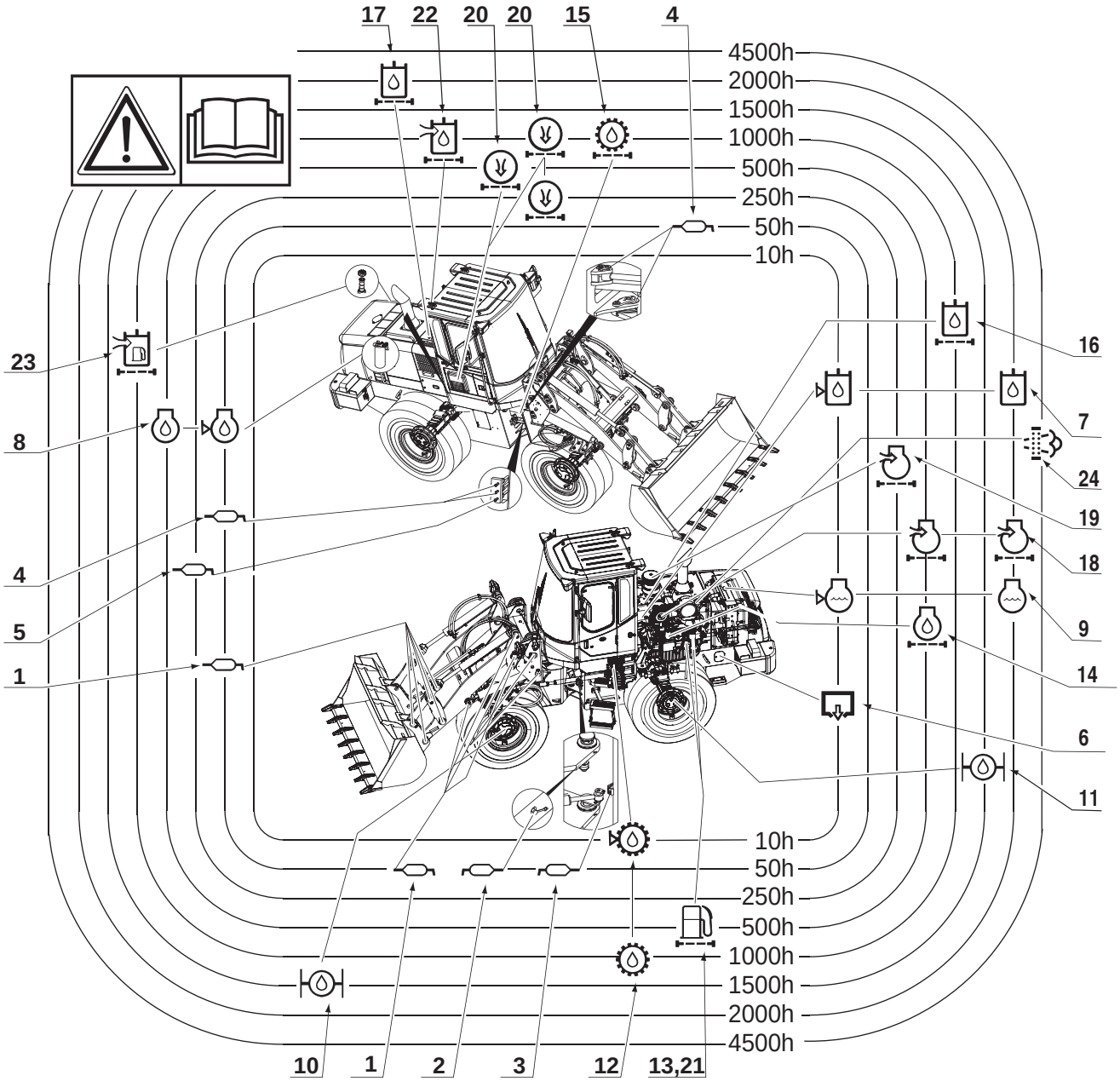

17
22
20
20
15
4
4500h
2000h
1500h
1000h
500h
250h
50h
10h
23
8
4
5
1
16
7
24
19
18
9
14
6
11
10h
50h
250h
500h
1000h
1500h
2000h
4500h
10
1
2
3
12
13,21
WL1300284

Figure 21

Service Data										
No.	Items to Check	Service	Qty.	Service Interval						
				10	50	250	500	1000	1500	2000
1	Front Joint Pin	Grease	4	F100	W10					
	Front Joint Pin	Grease	9	F100	W10					
2	Articulation Pin	Grease	2	F100	W10					
3	Rear Axle Pivot	Grease	3	F100	W10					
4	Steering Cylinder	Grease	4							
5	Front Propeller Soft Bearing	Grease	1							
6	Fuel Tank	Diesel	249ℓ	Lubricant of working final time						
7	Oil Tank	ISO #46	176ℓ	V						
8	Engine Oil Pan	Engine Oil(1)	27ℓ	V	F					
9	Radiator	Coolant	40ℓ	V						
10	Front Axle	Axle Gear Oil	35ℓ	V			F			
11	Rear Axle	Axle Gear Oil	21.5ℓ				F			
12	Transmission	Transmission Oil(1)	45ℓ	V		F				
13	Fuel Filter	Cartridge	1							
14	Engine Oil Filter	Cartridge	1		F					
15	Transmission Filter	Cartridge	1			F				
16	Full Flow Filter	Element	1			F				
17	Oil Suction Filter	Strainer	1							C
18	Air Cleaner	Element (Outer)	1				C			
		Element (Inner)	1							
19	Turbo Precleaner	Case	1	C(Cleaning of working final time)						
20	Air Conditioner Filter	Element(Outer)	1		C					
		Element(Inner)	1				C			
21	Fuel Prefilter	Cartridge	1	F						
22	Air Breather Filter	Element	1							
23	Fuel Cap Filter	Element	1							
24	Oil Cleaner	Case;Centrifugal	1		F					

V: Maintenance and Refill.

C: Cleaning.

F: First Time Exchange Only.

F100: Every 10 Hours For First 100 Hours.

W10: Every 10 Hours If Operating In Water.

: Replacement On Every Interval

NOTE: *For additional service items see list of "Maintenance Intervals" on page 4-35.*

NOTE: *This capacity may include the tank (reservoir), lines, pipes and components and attachment.*

Observe all sight gauge and level indicators in order to ensure that the systems and compartment are refilled to the proper level.

MAINTENANCE INTERVALS

Grease Front Attachment Pins

NOTE: *Fittings must be greased daily, or every 10 hours, for the first 100 hours of operation to comply with new machine break-in requirements. After that, greasing must be done every 50 hours. If bucket is being used in water, grease fittings immediately after machine is removed from water. Follow procedure printed under the 50 hour maintenance interval "Grease Front Attachment Pins" on page 4-45.*

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 22) 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 or 3, Figure 22), if the oil level is below the "LOW" mark.

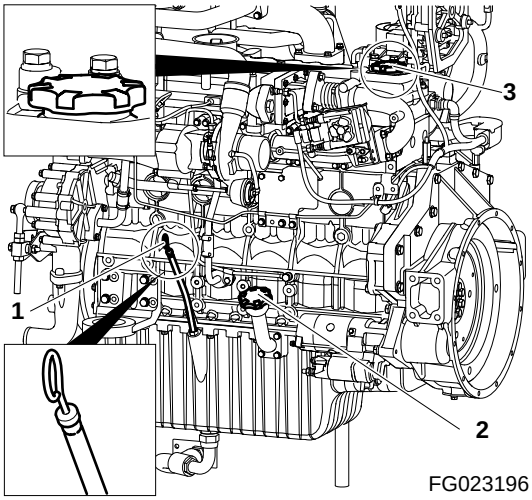


Figure 22

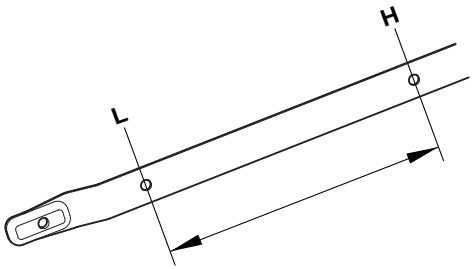


Figure 23

Check Transmission Oil Level

1. Use two (2) people to perform this operation.
2. Start machine and drive it until transmission fluid has warmed to 80°C (176°F). Park machine on firm and level ground. Lower bucket or work tool to ground.
3. Place transmission lever in "NEUTRAL". Engage parking brake. Stop engine.
4. Block tires. Once tires are blocked, start engine and have a person remain in the cabin.

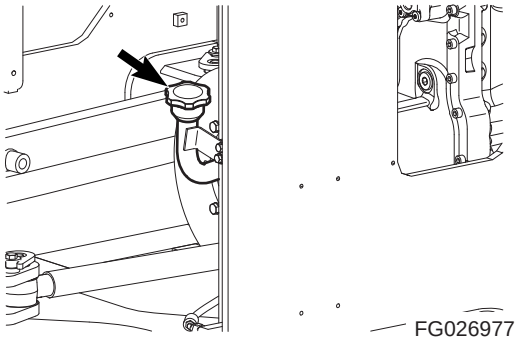


Figure 24

5. With engine running, have second person find transmission oil level sight gauge (1, Figure 25) on transmission fill tube (2).
6. Oil level must be on "HOT" mark or above as shown in Figure 26.

   NOTE: *If oil level is above top end of dipstick (completely filling it), drain oil until level is on "HOT" mark.*

   NOTE: *If transmission cannot reach an operating temperature of 80°C (176°F), then the oil level must be visible in the sight gauge below the "HOT" mark. Periodically check oil level during the workday to ensure that oil level does not rise above top end of sight gauge.*

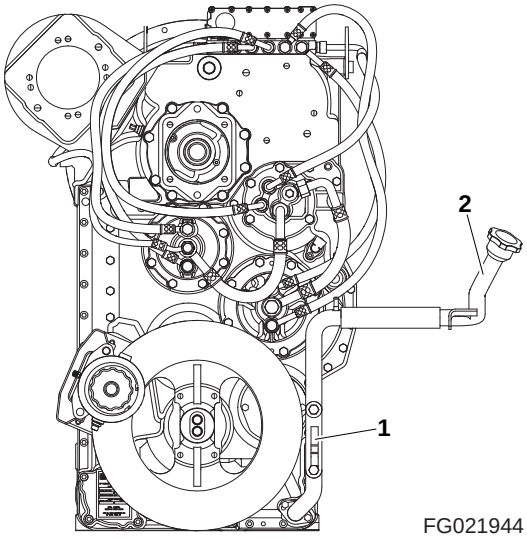


Figure 25

7. To add oil, remove transmission oil dip stick gauge from transmission oil fill pipe. Refer to “Table of Recommended Lubricants” on page 4-24, of this manual for recommended oil for the operation conditions.
8. Stop engine when done.

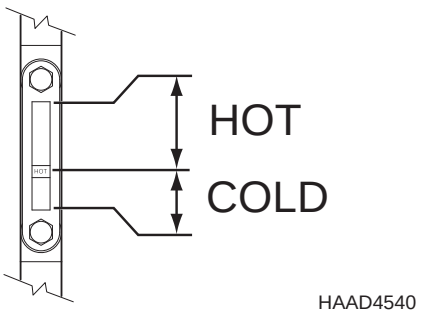


Figure 26

Check Hydraulic System Oil Level

WARNING

AVOID DEATH OR SERIOUS INJURY

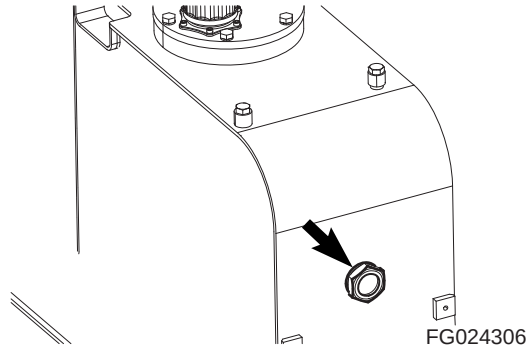
The hydraulic oil will be hot after machine operation. Allow system to cool before attempting to service any of the hydraulic components.

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

HAOA060L

Figure 27

1. Position machine on firm and level ground.
2. "ENGAGE" parking brake.
3. Lower bucket or work tool to ground.
4. Move transmission lever to "NEUTRAL" position.
5. Make sure transmission neutral lock is in the "N" (NEUTRAL LOCK) position.
6. Stop engine.
7. Block tires.
8. Check sight gauge that is attached to hydraulic tank. Oil level must be visible in red centered circle shown on sight gauge (Figure 28).
9. To add hydraulic oil, tip breather cap (1, Figure 29) slowly to allow the pressurized air to vent.
10. Remove upper cover (2, Figure 29) from hydraulic oil tank and add oil to level mark on sight gauge (Figure 28).

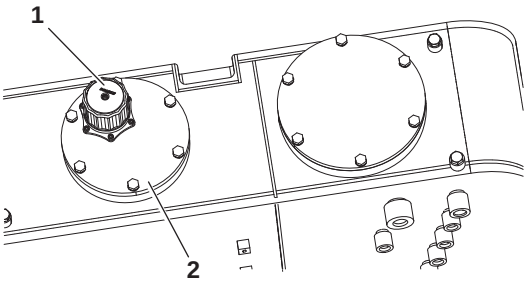


FG024306

Figure 28

IMPORTANT

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



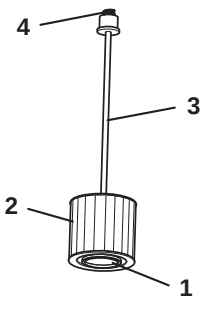
FG024307

Figure 29

The hydraulic oil fill cover also serves as the hydraulic oil strainer access cover. It is important to replace this cover and the components in the proper order and alignment.

The filter (2, Figure 30), retaining rod (3) and spring (4) are assembled as shown in Figure 30. The hole (1) in the base of the filter fits over a circular base in the bottom of the tank. The retaining rod (3) screws into the top of the filter (2), but the spring (4) slides over the top of the rod. Be certain that this spring does not fall into the tank during reassembly.

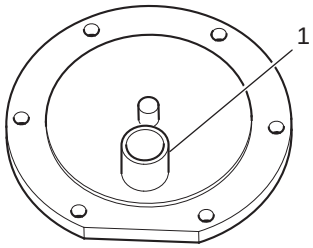
1. If filter assembly was removed, insert assembly into the tank and make sure it is securely in place.
2. Check O-ring for damage and replace if necessary. Check position of O-ring at surface of hole.



FG002188

Figure 30

3. Place the cover on the access hole. Make sure the spring retaining cup (1, Figure 31) in the lower section of the cover is lined up with the spring. The filter assembly rod must be in a vertical position and perpendicular to the base of the tank. The cover can be rotated to align the rod into a vertical position.
4. Tighten mounting bolts to 4.84 kg•m (35 ft lb).



FG002189

Figure 31

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.

Fill Fuel Tank

WARNING

AVOID DEATH OR SERIOUS INJURY

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

Immediately clean up any spilled fuel.

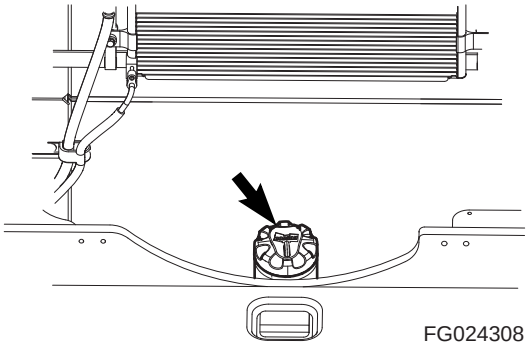
1. At end of each workday, fill fuel tank. Add fuel through fuel fill cap (Figure 32).

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

   NOTE: *See "Fluid Capacities" on page 4-30 for capacity.*

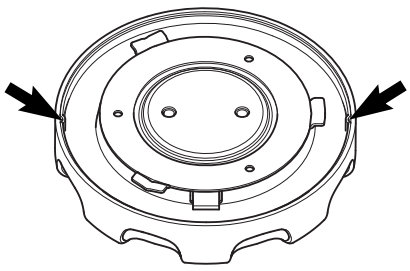
2. Securely tighten cap after fueling.

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



FG024308

Figure 32



FG001690

Figure 33

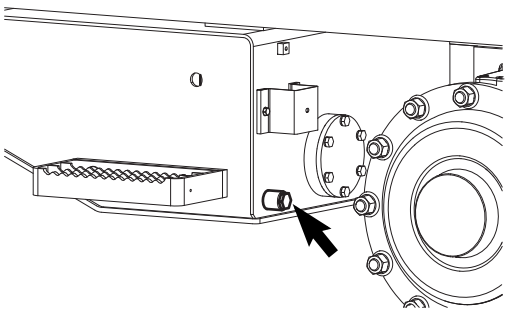
Check for Leaks in Fuel System

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

Drain Fuel Condensation

1. Open fuel tank drain valve. (Figure 34). Allow any condensed water or sediment to drain out of tank.

   NOTE: *Dispose of drained fluids in compliance with all applicable environmental laws and regulations.*



FG024310

Figure 34

Check Coolant Level

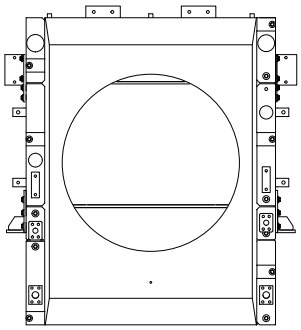
NOTE: *Do not mix ethylene glycol and propylene glycol antifreeze together.*

WARNING

AVOID DEATH OR SERIOUS INJURY

Allow the engine to cool before opening the radiator cap.

Loosen the cap slowly to release any remaining pressure.

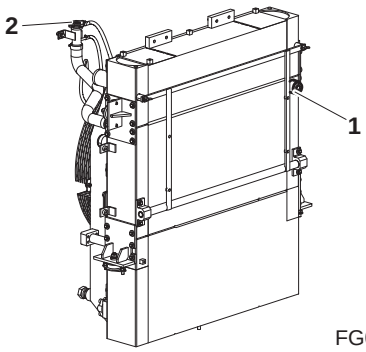


FG023199

Figure 35

1. Check sight gauge (1, Figure 36) that is attached to the radiator. Coolant level must be visible in red centered circle shown on gauge.
2. To add coolant, remove fill cap (2, Figure 36) of the radiator and add genuine part of 50% concentration coolant to proper level by checking sight gauge (1, Figure 36).

   NOTE: *If temperature is below freezing, see "Antifreeze Concentration Tables" on page 4-93 for antifreeze protection. Use the table to calculate a proper mixture of antifreeze and water to provide level of protection necessary for expected temperature.*



FG023200

Figure 36

Check Level of Windshield Washer Liquid

1. Check fluid level in windshield washer tank, below the platform.
2. Open fill cap and add fluid.

   NOTE: *Use a washer liquid that is rated for all seasons. This will prevent freezing during cold weather operation.*

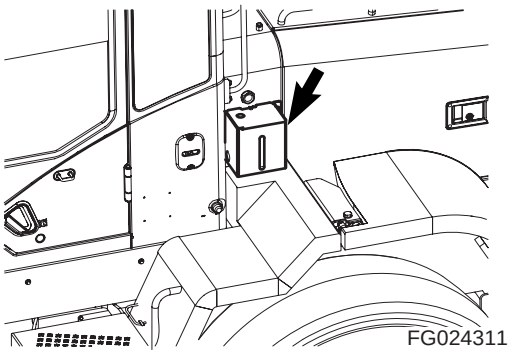


Figure 37

Inspect Bucket Teeth and Side Cutters for Signs of Wear

1. Daily, inspect bucket teeth to make sure that tooth wear or breakage has not developed.
2. Do not allow replaceable bucket teeth to wear down to the point that bucket adapter is exposed. (Figure 38)

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

Figure 38

Inspect Cooling Fan Blade

WARNING

AVOID DEATH OR SERIOUS INJURY

To prevent injury from fan blade failure, never pull or pry on the fan. This can damage the fan blade(s) and cause fan failure.

1. An inspection of the cooling fan is required daily. Check for cracks, loose rivets, 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.

   NOTE: *Stop engine before checking the blades to prevent any injury by the fan rotation.*

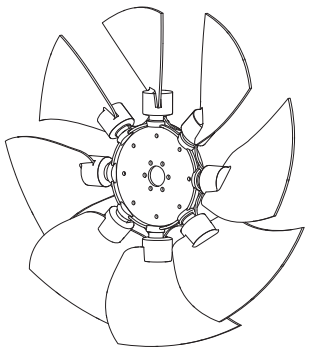
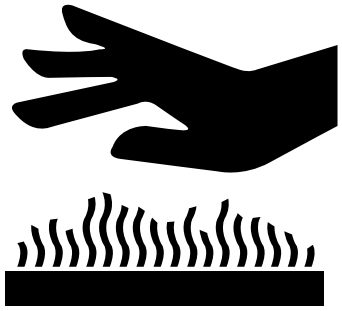


Figure 39

Check Air Intake System



HAOA050L

Figure 40

WARNING

AVOID DEATH OR SERIOUS INJURY

Hot engine components can cause burns.

Avoid contact with hot engine components

1. Position machine on firm and level ground.
2. "ENGAGE" parking brake.
3. Lower bucket or work tool to ground.
4. Move transmission lever to "NEUTRAL" position.
5. Make sure transmission neutral lock is in the "N" (NEUTRAL LOCK) position.
6. Stop engine.
7. Block tires.
8. Check the engine intake hose and hose clamps for damage and tightness.

   NOTE: *If damaged, wrinkled or loose, replace, tighten or contact your DOOSAN distributor.*

IMPORTANT

Severe engine damage will result from running with unfiltered air.

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

Inspect Seat Belt for Proper Operation

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 machine.

Check Operation of All Switches

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

Check Operation of All Exterior Lights, Horn and Control Console Indicator and Monitor Lights

1. Turn engine starter switch to "I" (ON) position and observe all indicator lights.
2. Restore operation of any light bulbs that do not turn "ON".
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

Inspect All Tires for Correct Tire Pressure and Signs of Damage or Abnormal Wear

1. Inflate tires to proper operating pressure for working conditions. See “Tires” on page 4-107

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, pumps. 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 pumps can occur.

1. With 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 all problems before operating.

50 HOUR / WEEKLY SERVICE

Perform All Daily Service Checks

Grease Front Attachment Pins

DL250-3

1. The following fittings must be greased daily, or every 10 hours, for first 100 hours of operation to comply with new machine break-in requirements. After that, greasing must be done every 50 hours. If bucket is being used in water, grease fittings immediately after machine is removed from water.

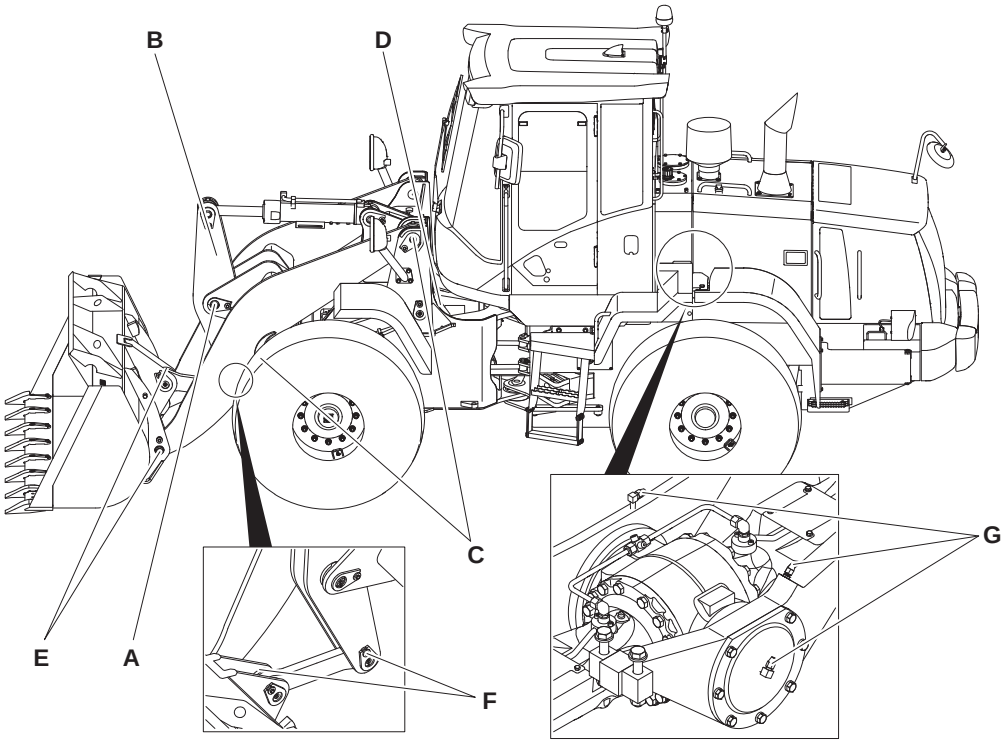
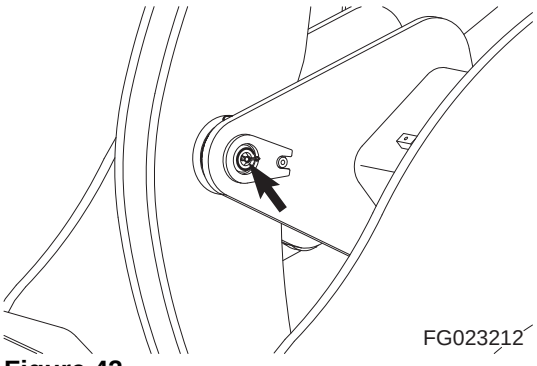


Figure 41 FG023202

A. Arm-Lever connecting pin, 1 location (Figure 53).



FG023212

Figure 42

B. Bucket cylinder rod end, 1 location (Figure 56).

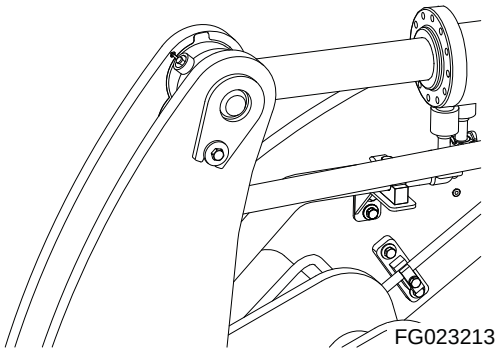


Figure 43

C. Lift cylinder heads (left, right), 2 locations (Figure 44).

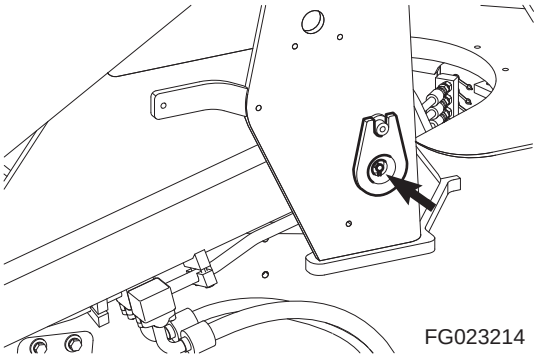


Figure 44

Lift cylinder rod (left, right), 2 locations (Figure 45).

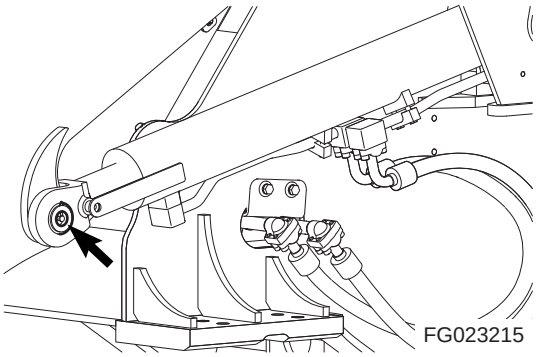


Figure 45

D. Remote location points.

Remote fittings for bucket cylinder head (50 HOUR), (1, Figure 46).

Remote fittings for loader arm foot end (50 HOUR), (2, Figure 46).

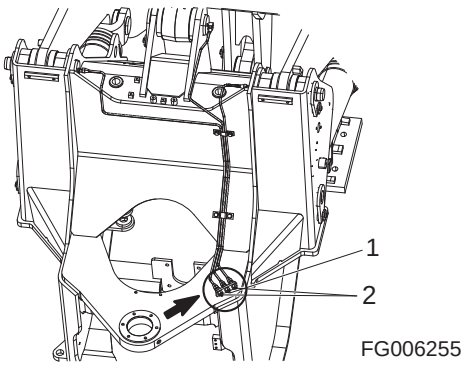


Figure 46

E. Bucket hinge pins, 2 locations (Figure 47).

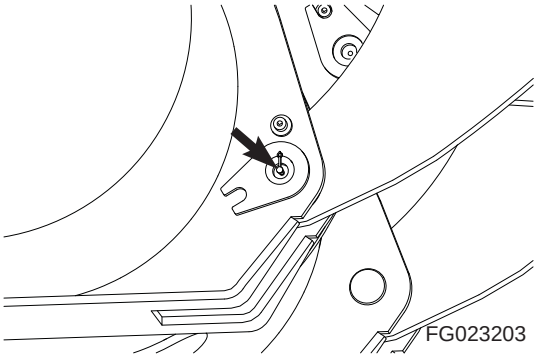


Figure 47

F. Bucket link connecting pin, 1 location (Figure 48).

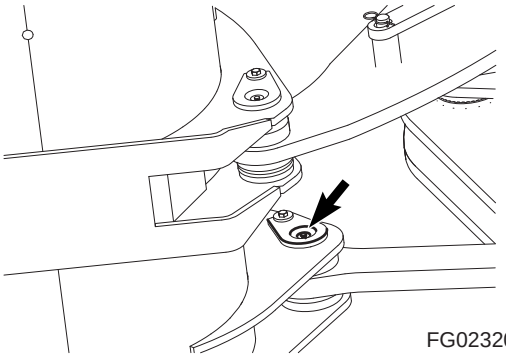


Figure 48

Lever-link connecting pin, 1 location (Figure 49).

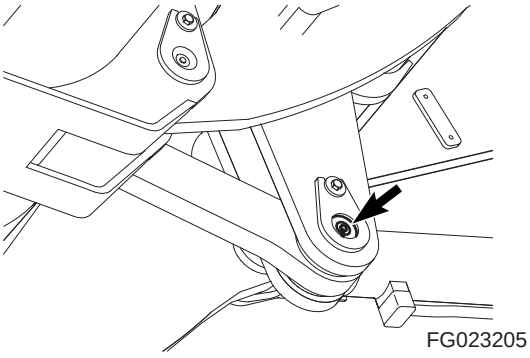


Figure 49

G. Grease rear axle pivot (1, Figure 50), 3 locations on right side of machine. Use remote grease fittings mounted on frame shown in Figure 51.

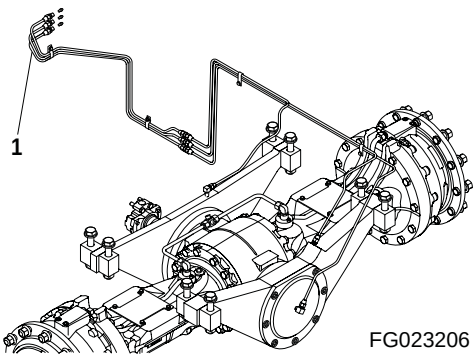


Figure 50

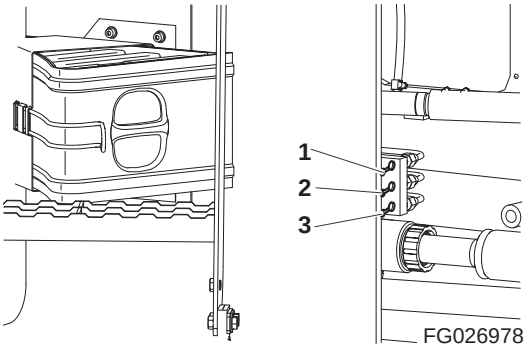


Figure 51

DL250TC-3

1. The following fittings must be greased daily, or every 10 hours, for first 100 hours of operation to comply with new machine break-in requirements. After that, greasing must be done every 50 hours. If bucket is being used in water, grease fittings immediately after machine is removed from water.

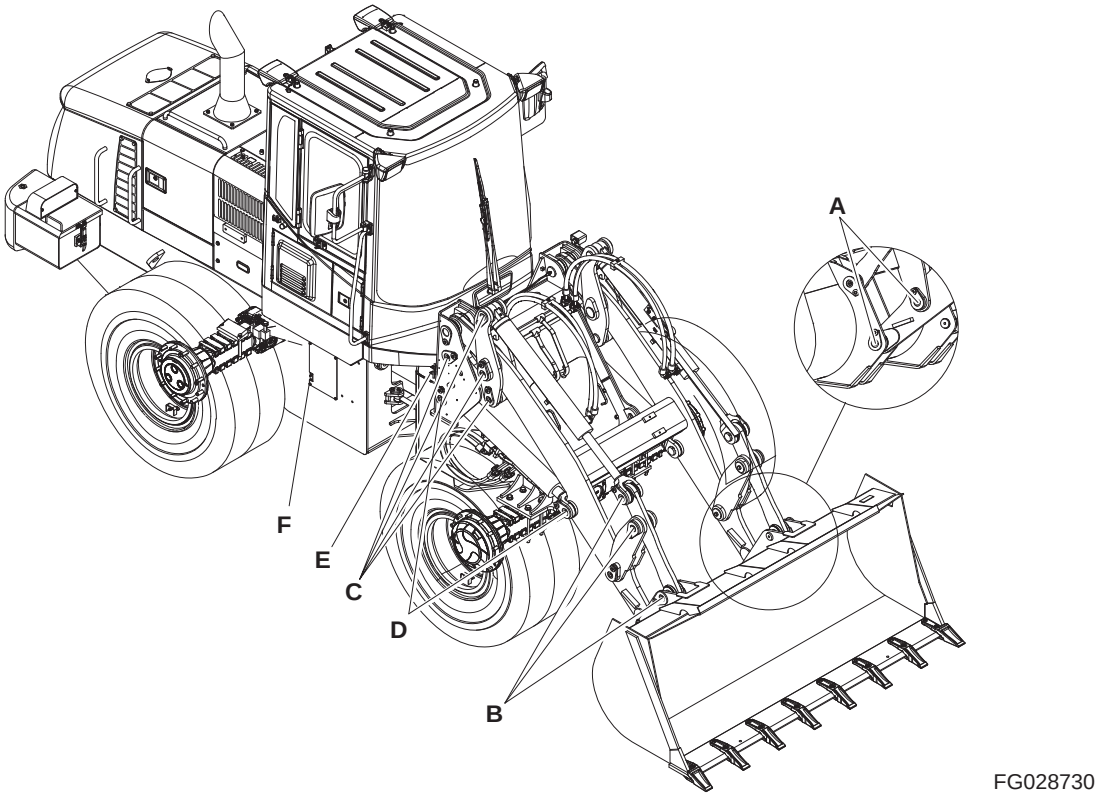


Figure 52

A. Bucket hinge pins, 2 locations on each side of bucket. Arm link connecting pins, 2 locations. (Figure 53).

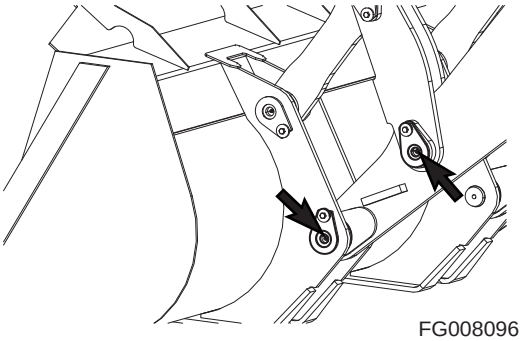


Figure 53

B. Bucket lever connecting pins, 2 locations. Lever link connecting pins, 2 locations. Bucket cylinder rod ends, 2 locations. (Figure 54)

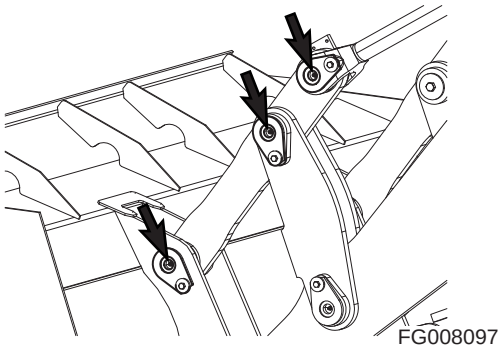


Figure 54

C. Bucket cylinder heads, 2 locations. Arm lever connecting pins, 2 locations. Lever link connecting pins, 2 locations. Link foot pins, 2 locations. (Figure 55)

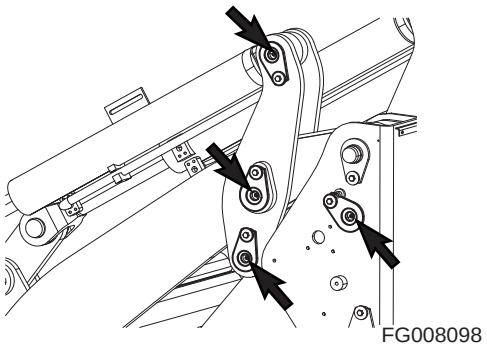


Figure 55

D. Lift cylinder heads (left, right), 2 locations. Lift cylinder rod ends, 2 Llocations. (Figure 56)

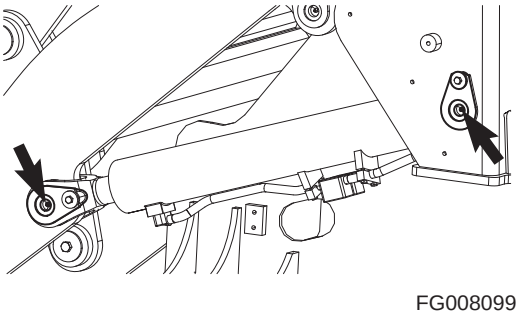
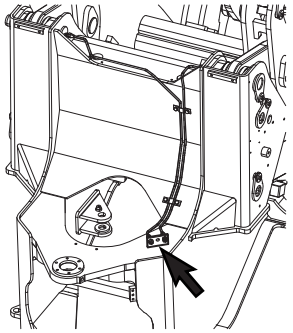


Figure 56

E. Remote location points.

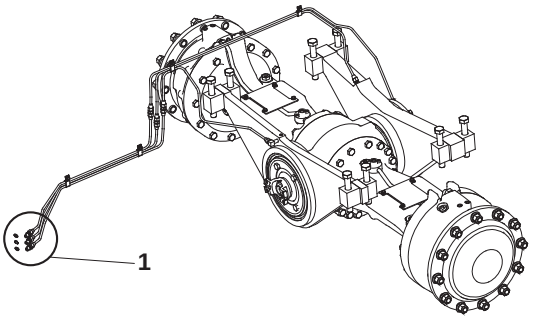
Remote fittings for loader arm foot end (50 HOUR), (Figure 57).



FG008100

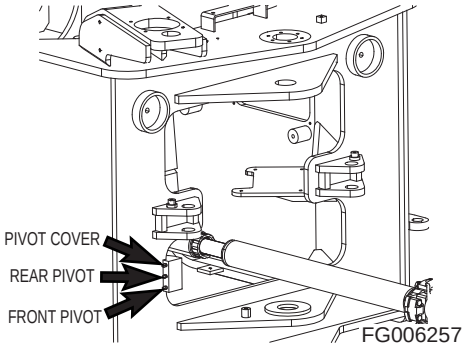
Figure 57

F. Rear axle pivot (1, Figure 58), 3 locations on right side of machine. Use remote grease fittings mounted on frame shown in Figure 59.



FG017601

Figure 58



FG006257

Figure 59

Grease Steering Cylinder Rod and Head Ends

1. Steering cylinder rods, 2 locations, one on each side of machine.

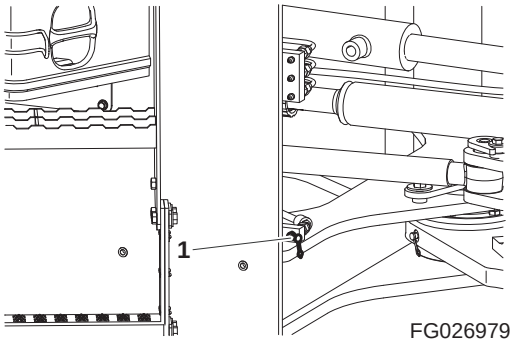


Figure 60

2. Steering cylinder head ends, 2 locations. Use remote grease fittings mounted on frame. (1 and 2, Figure 61).

Reference Number	Remote Grease Fittings
1 and 2, 50 Hours	Steering Cylinder Head Ends
3, 250 Hours	Drive Shaft Center Bearing

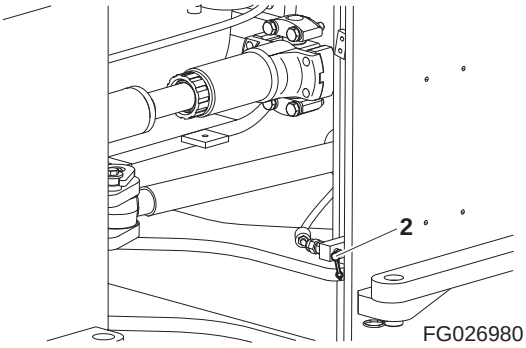


Figure 61

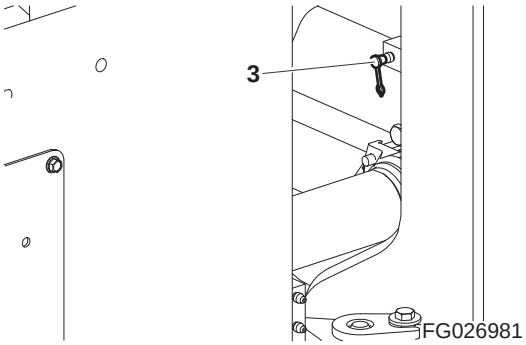


Figure 62

Grease Upper and Lower Center Pins

1. 1. Center pins, upper (Figure 63) and lower (Figure 64). Two locations on right side of machine.

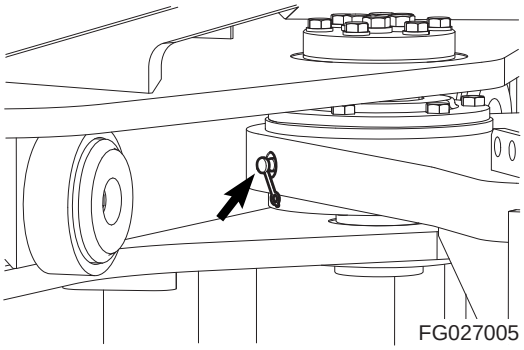


Figure 63

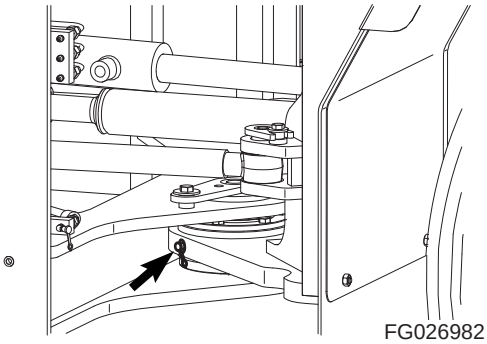


Figure 64

Change Engine Oil and Filter (After First 50 Hours)

1. Change engine oil and filter after first 50 hours of operation or rebuild, then every 500 hours thereafter. For details, *See “Change Engine Oil and Filter” on page 4-64 and See “Change Engine Oil and Filter” on page 4-64.*

Check Air Conditioner and Alternator Belt Tension (After First 50 Hours)

1. Air conditioner and alternator belt tension must be checked after first 50 hours of operation to comply with new machine break-in requirements. After first check, air conditioner and alternator belt must be checked every 250 hours. Follow procedure printed under 250 hour maintenance interval “Check Belt Tension” on page 4-59.

Clean Exterior of Radiator, Oil Cooler and Air Conditioner Condenser

1. Dust and dirt accumulation on fins of radiator (1, Figure 65), CAC cooler (4), oil cooler (2), and transmission cooler (3) greatly reduce their cooling efficiency. Use compressed air, water and steam to clean fins on radiator, oil cooler, and transmission cooler.

   NOTE: *On an especially dusty work site, clean fins every 50 hours. On other work sites, clean fins every 500 hours.*

   NOTE: *You can swing the fan guard out for cleaning it's fan blades or radiator easily and efficiently.*

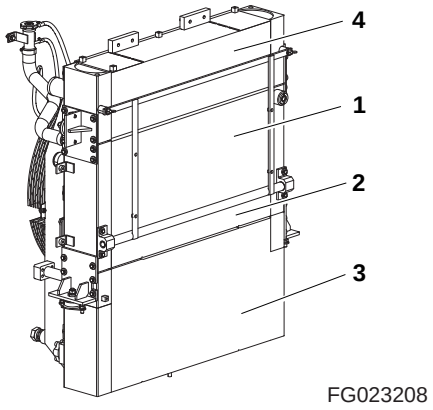


Figure 65

WARNING

AVOID DEATH OR SERIOUS INJURY

Before cleaning, stop cooling fan by stopping engine to prevent death of serious injury from fan rotation.

Clean Air Conditioner Outer Filter

This unit is equipped with an air-conditioning system. There are two filters (1 and 2, Figure 66) for air conditioner. They filter out dirt and dust particles from air being circulated into operator's cabin. The two filters are located under the right side control panel.

1. Open access cover on the lower right side of cabin on the outside, to gain access filter.
2. Remove outer filter (1, Figure 66) and inspect it for damage.
3. Use compressed air to clean filter. If filter is very dirty use a mild soap and water solution to clean it.

   NOTE: *Clean air-conditioning outer filter every 50 hours and replace it with a new one every 500 hours of service.*

   NOTE: *If water was used to clean filter be sure it is completely dry before installation.*

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

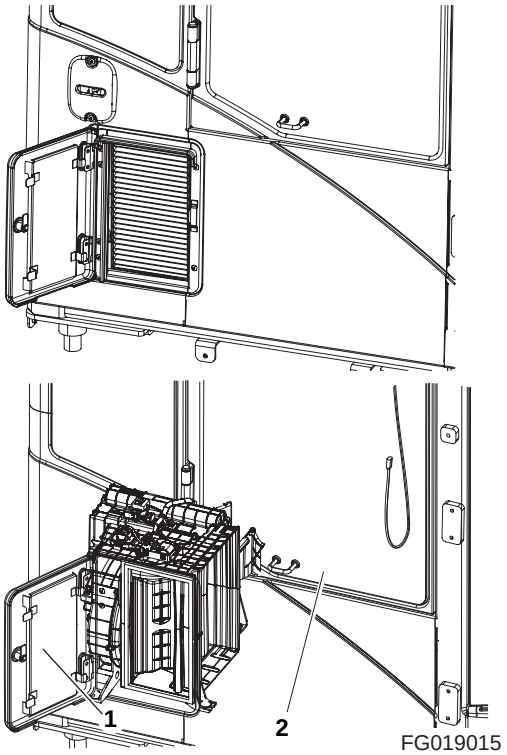


Figure 66

WARNING

AVOID DEATH OR SERIOUS INJURY

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

250 HOUR / MONTHLY SERVICE

Perform All Daily and 50 Hour Service Checks

Braking - Test

WARNING

AVOID DEATH OR SERIOUS INJURY

- **Fasten your seat belt when testing the brake system.**
- **Park the machine on firm and level ground.**
- **Check the area around the machine to ensure it is clear of all personnel and bystanders.**
- **Make sure that articulated frame lock is in the unlocked position.**

The following tests are used to determine whether the braking system is functional. These tests are not intended to measure the maximum brake holding effort. The required brake holding effort for sustaining a machine at a specific engine rpm varies from one machine to another. The variations include differences in the engine setting, the power train, etc.

Service Brake Test

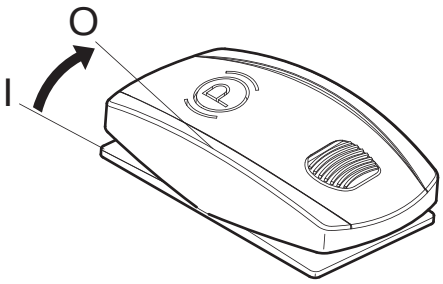
Refer to the Operation & Maintenance Manual, "Operating Controls" section for more information.

1. Start the engine. Raise the work equipment so it is about 400 mm above the ground.
2. Move the machine to a flat and level area.
3. Apply the service brake. (Figure 67)

WL1400677

Figure 67

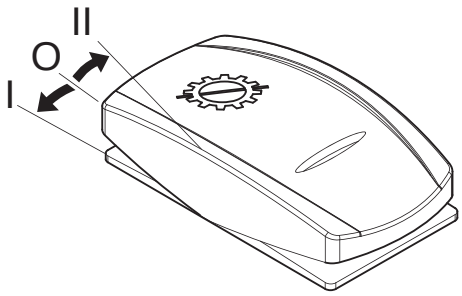
4. Release the parking brake. (Figure 68)



WL1400680

Figure 68

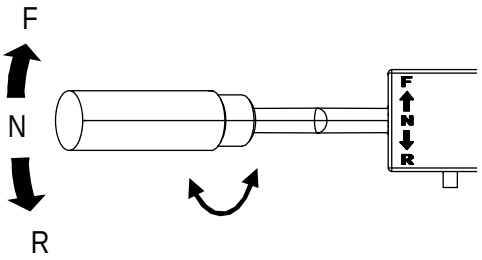
5. Make sure the transmission cutoff switch is in the "OFF" position. (Figure 69)



WL1300048

Figure 69

6. Put the transmission lever in 3rd gear forward while the service brakes are applied. (Figure 70)



FG019004

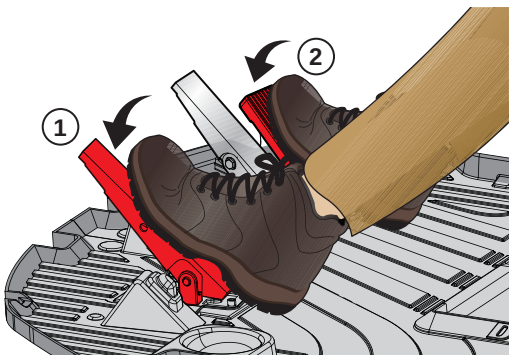
Figure 70

7. With the service brake still applied, gradually increase the engine speed to high idle. **The machine should not move.** (Figure 71)

WARNING

AVOID DEATH OR SERIOUS INJURY

If the machine begins to move during the test, reduce the engine speed immediately and engage the parking brake.



WL1400678

Figure 71
1. Brake Pedal
2. Accelerator Pedal

8. Reduce the engine speed to low idle. Move the transmission lever to the neutral position. Engage the parking brake. Lower the work equipment to the ground.

9. Stop engine. Remove key.

If the machine moved during the test, contact your dealer for a brake inspection. Make any necessary repairs before the machine is returned to operation.

Parking Brake Test

Refer to the Operation & Maintenance Manual, "Operating Controls" section for more information.

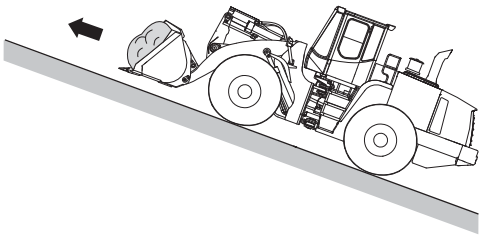
1. Start the engine.
2. Attach the heaviest approved attachment. If using a bucket, fill the bucket with material. **DO NOT** exceed the rated operating load of the wheel loader.
3. Move the machine to an area with a dry, hard surface with a slope equivalent to the maximum authorized slope on the work site where the machine will be operated.

WARNING

AVOID DEATH OR SERIOUS INJURY

- **Keep the heavy end of the machine uphill.**
- **Do not travel on slopes greater than 30 degrees.**
- **Do not exceed Rated Operating Capacity (ROC).**
- **Check for adequate traction.**

4. Drive the wheel loader up the incline with the heavy end of the machine facing uphill. (Figure 72)



WL1400681

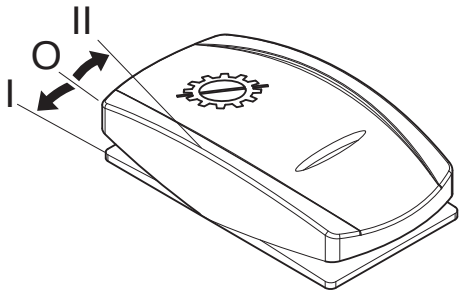
Figure 72

5. Apply the service brake. (Figure 73)

WL1400677

Figure 73

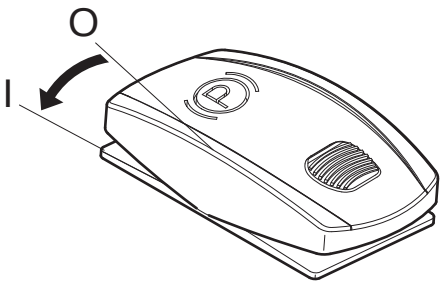
6. Make sure the transmission cutoff switch is in the "OFF" position. (Figure 74)



WL1300048

Figure 74

7. Engage the parking brake. The parking brake indicator light must be illuminated on the dash. (Figure 75)



WL1300285

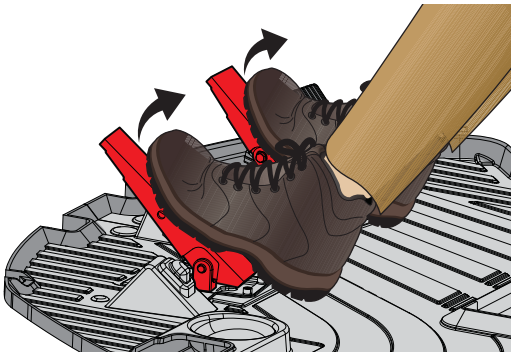
Figure 75

8. Release the service brake. **The machine should not move.** (Figure 76)

WARNING

AVOID DEATH OR SERIOUS INJURY

If the machine begins to move, immediately reapply the service brake.



WL1400679

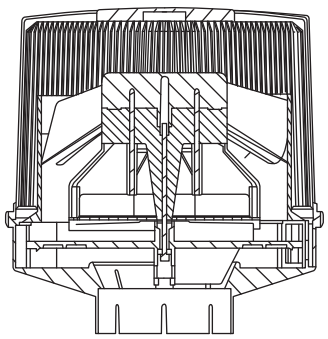
Figure 76

9. Apply the service brake and release the parking brake. Move the machine to a flat area.
10. Reduce the engine speed to low idle. Move the transmission lever to the neutral position. Engage the parking brake. Lower the work equipment to the ground.
11. Stop engine. Remove key.

If the machine moved during the test, contact your dealer for a brake inspection. Make any necessary repairs before the machine is returned to operation.

Check Engine Air Intake Precleaner (Optional)

1. The engine is equipped with a precleaner. Dust, insects, rainwater etc., can be present in the air. The precleaner collects this material and discharges it. This prevents material from being drawn into air cleaner. The precleaner does not need periodic cleaning or replacement.



FG014041

Figure 77

Drain Water From Hydraulic Oil Tank

WARNING

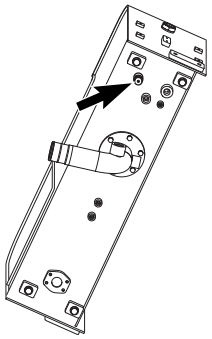
AVOID DEATH OR SERIOUS INJURY

To prevent burn injuries from hot oil splashing, allow hydraulic oil to cool before draining water and sediment.

The hydraulic tank is pressurized. Unscrew the cap of breather on the top of hydraulic tank to allow pressurized air to vent. After pressure has been released, remove either the fill cap or service covers.

1. Position machine on firm and level ground.
2. "ENGAGE" parking brake.
3. Lower bucket or work tool to ground.
4. Move transmission lever to "NEUTRAL" position.
5. Make sure transmission neutral lock is in the "N" (NEUTRAL LOCK) position.
6. Stop engine.
7. Block tires.
8. Position a container under hydraulic tank drain plug. Open hydraulic oil tank cover. (See Figure 29 on page 5-39). Loosen drain valve from bottom of tank (Figure 78). Allow all water and sediment to drain out. Tighten drain valve.

   NOTE: *Dispose of drained fluids according to applicable environmental laws and regulations.*



FG027004

Figure 78

Check Belt Tension

NOTE: *Belt tension must be checked after first 50 hours of operation. After first tension check, belt must be checked every 250 hours.*

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.

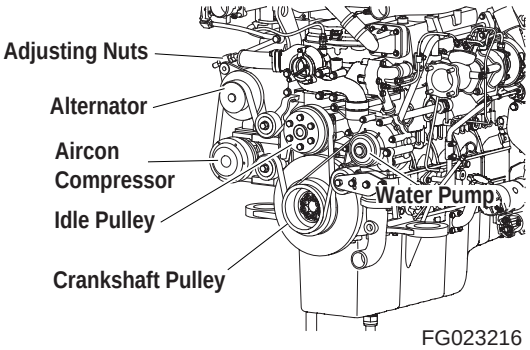


Figure 79

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 Drive Belt Wear

WARNING

AVOID DEATH OR SERIOUS INJURY

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

WARNING

AVOID DEATH OR SERIOUS INJURY

When checking, adjusting or replacing drive belts, care must be taken to prevent accidental cranking of the engine. Be sure the starter switch is in the "O" (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.

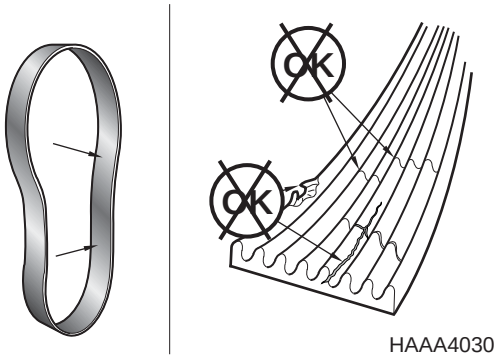


Figure 80

3. All pulley support bearings, shafts, and brackets must be in working order.

4. When replacing belts and pulleys, pulley alignment must be checked with belts tensioned and brackets securely clamped. A misalignment that can be detected by the eye is detrimental to belt performance.

5. Do not force the belts into the pulley grooves by prying with a screwdriver or pry bar. This will damage the belt side cords which will cause the belts to turn and result in complete destruction of the belts in operation.

6. Belts on new machines and replacement belts lose their tension as they seat into the pulley grooves. Check the tension of new belts at 20 hour intervals until tension is stabilized and thereafter, every 250 hours. If the tension falls below the required minimum, the belt will be able to slip, damaging the belts and pulley grooves.

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

Grease Driveshafts

Grease fitting for center bearing, 1 location. Use remote grease fitting mounted on front frame (3, Figure 81).

Reference Number	Remote Grease Fittings
1 and 2, 50 Hours	Steering Cylinder Head Ends
3, 250 Hours	Drive Shaft Center Bearing

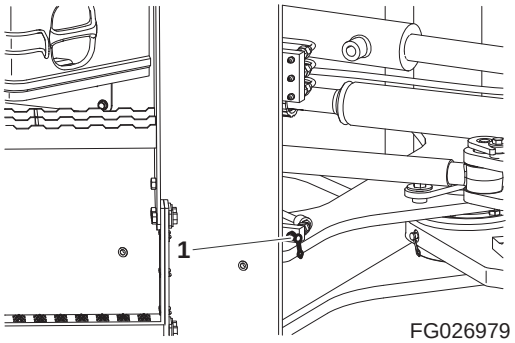


Figure 81

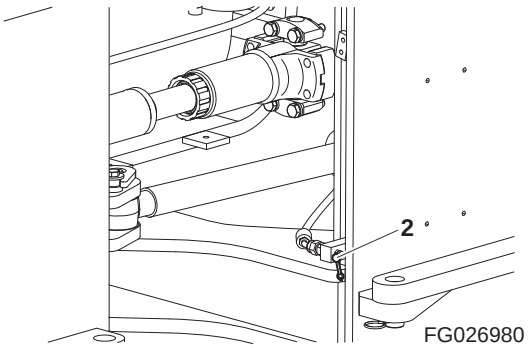


Figure 82

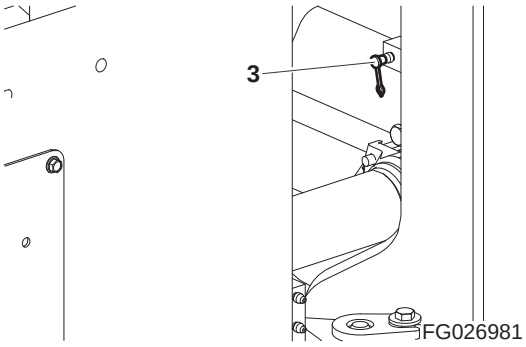


Figure 83

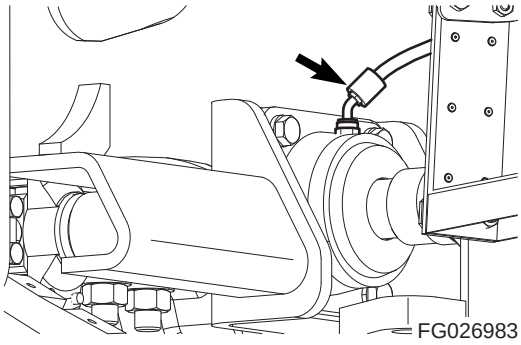


Figure 84

Change Transmission Oil and Filter (After First 250 Hours)

NOTE: *Transmission oil and filter must be changed after first 250 hours of operation to comply with new machine break-in requirements.*

NOTE: *After first change, oil and filter must be changed every 1,000 hours. (See page 5-69)*

NOTE: *The transmission must be recalibrated after every oil change. This is ensure that clutch packs are engaging properly.*

Change Hydraulic Full Flow Filter (After First 250 Hours)

1. Replace hydraulic full flow filter after first 250 hours of operation or rebuild and every 1,000 hours thereafter. Follow procedure under 1,000 hour maintenance interval (See page 5-75).

Fuel Water Trap

Locate fuel filter inside engine compartment.

Position a small container under fuel filter. Drain filter by opening drain valve on bottom of filter.

NOTE: *Dispose of drained fluids according to applicable environmental laws and regulations.*

Drain water trap every 250 hours.

Draining water from the fuel trap must be done by hand.

A nonreturn valve in the filter head prevents the fuel from running back to the tank.

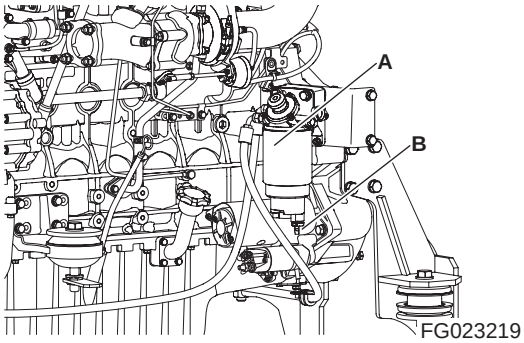


Figure 85

Proceed as follows:

1. Locate fuel filter inside engine compartment.
2. Position a small container under fuel filter.

   NOTE: *Dispose of drained fluids according applicable environmental laws and regulations.*
3. Loosen drain valve (B, Figure 85).
4. Drain water from water trap (A, Figure 85).
5. Tighten draining nipple.

   NOTE: *Take care of waste oil and liquid in an environmentally safe way!*

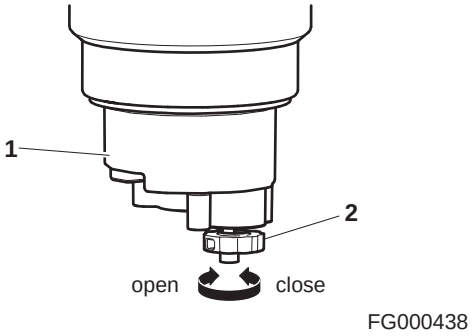


Figure 86

Clean Air Conditioner Inner Filter

This unit is equipped with an air-conditioning system. There are two filters (1 and 2, Figure 87) for air conditioner. The filters out dirt and dust particles from air being circulated into operator's cabin. The two filters are located under the right side control panel.

1. Open access cover on the lower right side of cabin on the outside to gain access filter.
2. Remove inner filter (2, Figure 87) and inspect it for damage.
3. Use compressed air to clean filter. If filter is very dirty use a mild soap and water solution to clean it.

   NOTE: *Clean air-conditioning inner filter every 500 hours and replace with a new one every 1,000 hours of service.*

   NOTE: *If water was used to clean filter be sure it is completely dry before installation.*

   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 with a new one.*

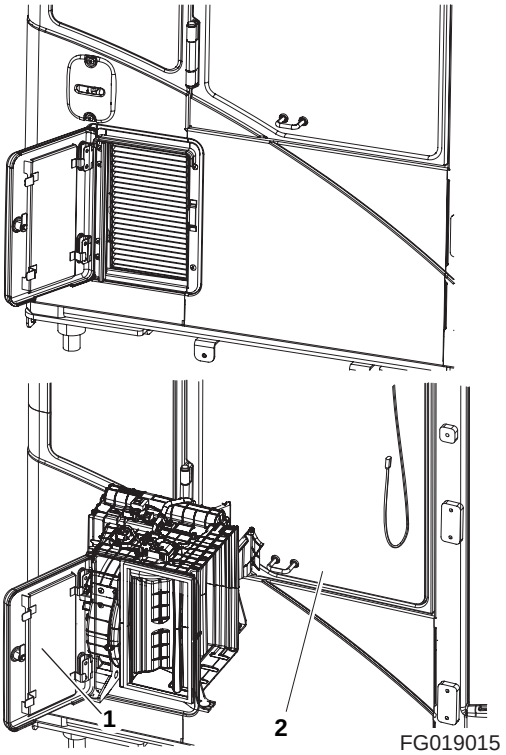


Figure 87

WARNING

AVOID DEATH OR SERIOUS INJURY

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

500 HOUR / 3 MONTH SERVICE

Perform All Daily, 50 and 250 Hour Service Checks

Change Engine Oil and Filter

CAUTION

AVOID INJURY

Never attempt to change oil or filter on a hot engine. Hot oil could splash and cause burns. Allow engine to cool down before changing oil or filter.

NOTE: *Change engine oil and filter after first 50 hours on a new machine and every 500 hours thereafter.*

1. Position a larger container under drain valve beside left wall of fuel tank. Loosen drain valve and allow all engine oil to drain out. Tighten drain valve.

   NOTE: *Oil warming is good when replacing oil. If machine is cold, operate the engine to bring the coolant temperature up to about 40°C (104°F). When the needle of the coolant temperature gauge reaches the middle of the "WHITE ZONE", the temperature is about 40°C (104°F).*

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

2. Replace engine oil filter (Figure 88). Engine oil filter is a spin-on type. Remove and discard filter.

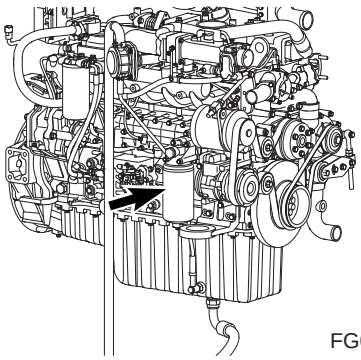
3. Install new filter. Apply a small amount of oil around filter gasket. Screw filter on head until gasket contacts head by hand, turn filter 3/4 - 1 turn more with filter wrench.

   NOTE: *See “Fluid Capacities” on page 4-30, for capacity and “Table of Recommended Lubricants” on page 4-24, of this manual for recommended oil for the operating conditions.*

4. Fill engine with correct oil through oil fill port.

5. Start engine and check engine oil pressure warning light.

6. Stop engine. Look for signs of leaks at filter. Recheck oil level.



FG023217

Figure 88

CAUTION

AVOID INJURY

The lubricating oil filter must be full of oil at start-up to prevent engine damage.

Use clean 15W-40 oil to coat the gasket surface of the filter.

7. Fill the filter with clean 15W-40 oil.

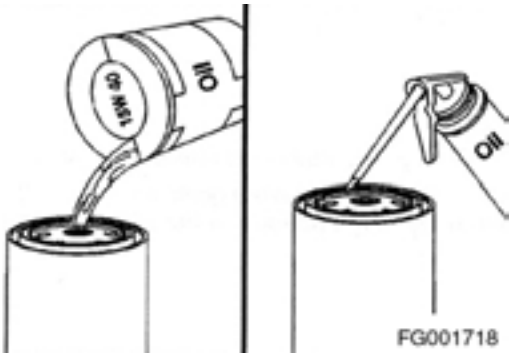


Figure 89

Clean Exterior of Radiator, Oil Cooler and Air Conditioner Condenser

1. Dust and dirt accumulation on fins of radiator, oil cooler, and transmission cooler, greatly reduce their cooling efficiency. Use compressed air, water and steam to clean fins on radiator, oil cooler, and transmission cooler.

   NOTE: *On an especially dusty work site, clean fins every 50 hours. On other work sites, clean fins every 500 hours.*

   NOTE: *Before cleaning, stop the cooling fan by stopping engine to prevent any injury from fan rotation.*

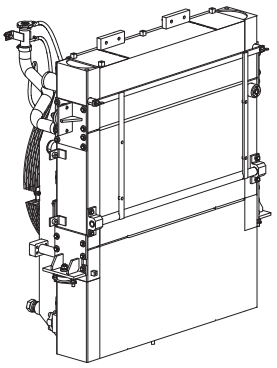


Figure 90

Change Water Separator

WARNING

AVOID DEATH OR SERIOUS INJURY

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

1. Locate fuel filter inside engine compartment.
2. Position a small container under fuel filter. Drain filter by opening drain valve on bottom of filter.

   NOTE: *Dispose of drained fluids in compliance with all applicable environmental laws and regulations.*

3. Unscrew fuel filter from head assembly. Discard fuel filter.
4. After cleaning filter head, install new fuel filter. Screw filter on head until gasket contacts head, turn filter 1/3 - 1/2 turn more.

   NOTE: *Coat fuel filter gasket with fuel. This filter is for trapping water in the fuel return line from engine water separator filter.*

Start engine. After engine has run for a couple of minutes, stop engine and look for signs of leaks. If the engine does not start, fuel system may need priming. Prime hand pump on the engine fuel filter.

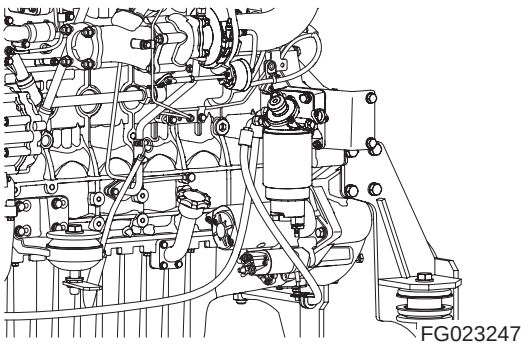


Figure 91

Change Outer Air Cleaner Filter

NOTE: *Clean outer filter every 500 hours / monthly service.*

NOTE: *If air cleaner clogged warning light (Figure 92) on instrument panel comes "ON" the air cleaner must be serviced.*

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

1. Locate the air cleaner assembly.

   NOTE: *When it reaches every 500 hours or If indicator light (Figure 94) on instrument panel comes "ON" the air cleaner must be serviced.*

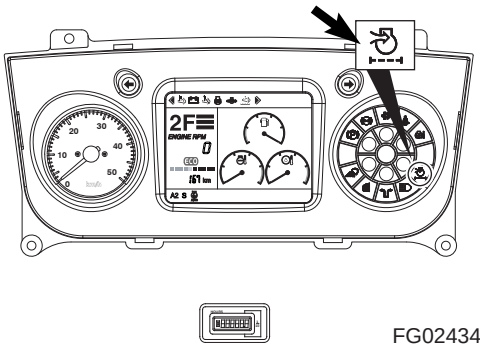
   NOTE: *Replace outer filter after cleaning 4 times or every 2,000 hours / yearly service.*

2. Remove and clean rubber evacuator valve (1, Figure 93) from bottom of air cleaner housing cover (2, Figure 93). Inspect seal lips for wear or damage. Replace valve if necessary.

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

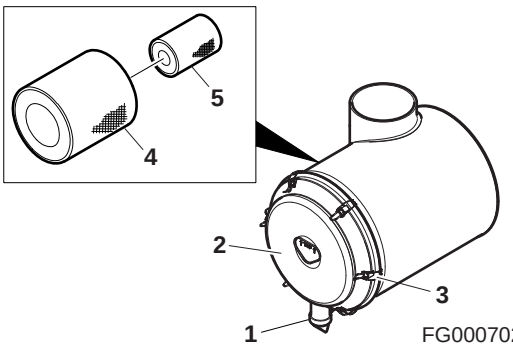
3. Remove access cover (2, Figure 93) by loosening the latches (3).

4. Remove outer filter (4, Figure 93) from the housing. Do not remove inner filter (5).



FG024344

Figure 92



FG000702

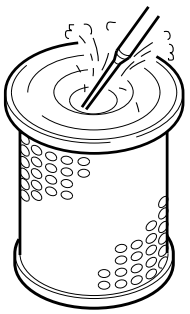
Figure 93

5. Clean the outer filter (4, Figure 93) by blowing compressed air from the inside of the filter towards the outside. Do not use more than 205 kPa (30 psi) air pressure.

WARNING

AVOID DEATH OR SERIOUS INJURY

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

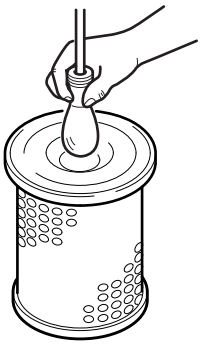


HAOC570L

Figure 94

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

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



FG000412

Figure 95

Clean Air Conditioner Inner Filter

This unit is equipped with an air-conditioning system. There are two filters (1 and 2, Figure 87) for air conditioner. The filters out dirt and dust particles from air being circulated into operator's cabin. The two filters are located under the right side control panel.

1. Open access cover on the lower right side of cabin on the outside to gain access filter.
2. Remove inner filter (2, Figure 87) and inspect it for damage.
3. Use compressed air to clean filter. If filter is very dirty use a mild soap and water solution to clean it.

NOTE: *Clean air-conditioning inner filter every 500 hours and replace with a new one every 1,000 hours of service.*

NOTE: *If water was used to clean filter be sure it is completely dry before installation.*

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 with a new one.*

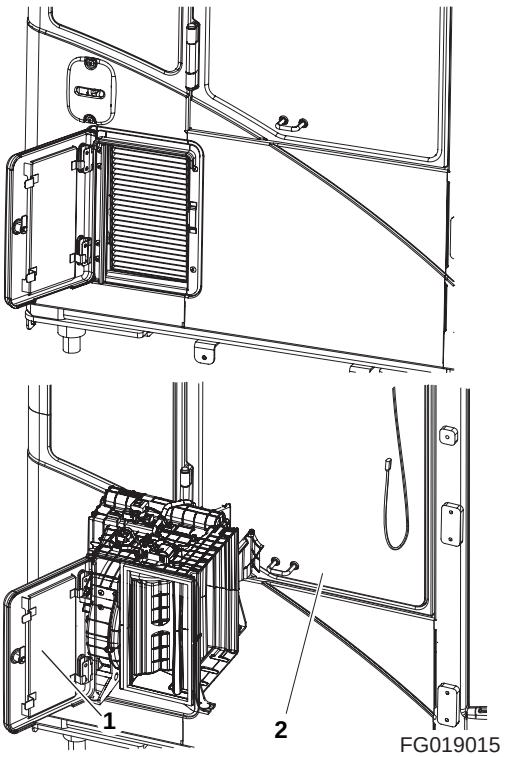


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Figure 96

WARNING

AVOID DEATH OR SERIOUS INJURY

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

Change Axle Differential and Planetaries Oil (After First 500 Hours)

NOTE: *The differential and planetaries oil must be drained and refilled after first 500 hours of operation or rebuild, and every 1,500 hours thereafter. (See page 5-80)*

Change Air Conditioner Outer Filter

NOTE: *Clean air-conditioning filter every 50 hours and replace with a new one every 500 hours of service. See "Clean Air Conditioner Outer Filter" on page 4-53.*

Fuel Filter (Spin-on Type)

The pressure side main fuel filter must have the following characteristics:

- 5-micron rating
- engine mounted

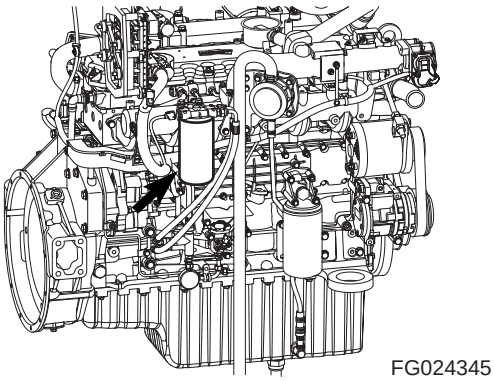


Figure 97

Remove

Disconnect the wiring harness from the fuel heater, if equipped.

Loosen and remove fuel filter.

Make sure the seal ring does **not** stick to the filter head.

Remove ring with an O-ring pick, if necessary.

NOTE: *Both fuel filters must be removed at the same time.*

Install new filter. Apply a small amount of oil around filter gasket.

Screw filter on head until gasket contacts head by hand, turn filter 3/4 - 1 turn more with filter wrench.

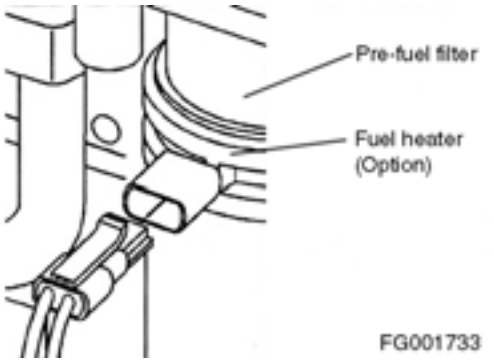


Figure 98

1,000 HOUR / 6 MONTH SERVICE

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

Drain and Change Transmission Oil and Filter

NOTE: *Transmission oil and filter must be changed after first 250 hours of operation to comply with new machine break-in requirements. After first change, oil and filter must be changed every 1,000 hours. Follow procedure under 1,000 hour maintenance interval (See page 5-61).*

1. Use two people to perform this operation.
2. Start machine and drive it until transmission fluid has warmed to 82 - 93°C (180 - 200°F).
3. Position machine on firm and level ground.
4. "ENGAGE" parking brake.
5. Lower bucket or work tool to ground.
6. Move transmission lever to "NEUTRAL" position.
7. Make sure transmission neutral lock is in the "N" (NEUTRAL LOCK) position.
8. Stop engine.
9. Block tires.

   NOTE: *See “Fluid Capacities” on page 4-30 for capacity.*

10. Remove drain plug. Allow all transmission fluid to drain into a receptacle. Clean drain plug.

    NOTE: *Dispose of drained fluids according to applicable environmental laws and regulations.*

11. Install drain plug in transmission.
12. Remove suction strainer. Clean suction strainer and install it.
13. Rotate filter counterclockwise to remove it.
14. Clean filter head.
15. Grease filter gasket and gasket mating surface on filter head.
16. Thread filter onto filter head. Tighten filter 1/2 turn after filter gasket contacts filter head. Filter must be torqued to 1.6 - 2.1 kg•m (11.5 - 15 ft lb).

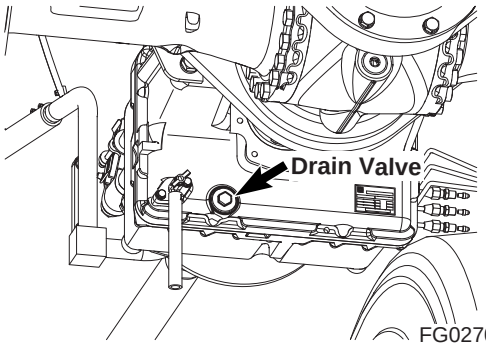


Figure 99

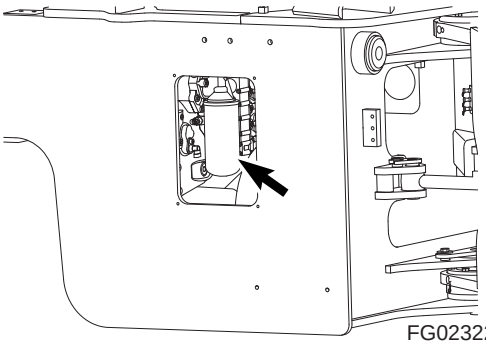


Figure 100

17. Fill transmission with fluid through fluid supply pipe. Add fluid until fluid level reaches low mark on dipstick.
18. Start engine. Idle engine for two minutes.
19. With engine idling, check transmission fluid level. Add fluid until level reaches high mark on dipstick.
20. Idle engine until transmission fluid temperature reaches 82 - 93°C (180 - 200°F). Check fluid level with engine idling. Level must reach high mark on dipstick.
21. Check filter for leaks while engine is running.

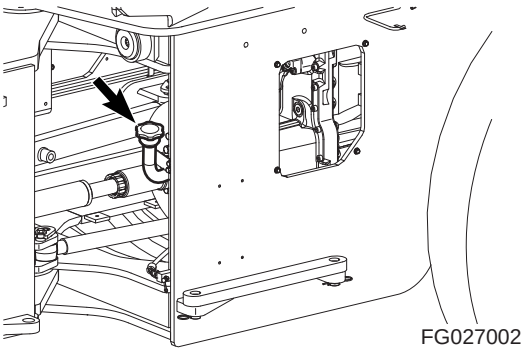


Figure 101

Change Air Conditioner Inner Filter

NOTE: *This machine is equipped with an air filtration system which filters out dirt and dust particles from the air and prevent them from being circulated into operator's cabin. This filter must be cleaned out every 250 hours and replaced with a new one every 1,000 hours. For filter replacement See “Clean Air Conditioner Inner Filter” on page 4-63*

NOTE: *If the machine is being operated in a dusty environment, the cleaning and replacement must be performed more frequently.*

Check and Adjust Engine

Contact your DOOSAN distributor.

Engine dealer for checking and adjusting the following items:

- Engine compression pressure.
- Injection pressure.
- Injection timing.

Clean Fuel Tank and Strainer

WARNING

AVOID DEATH OR SERIOUS INJURY

Fuel is flammable and harmful to skin.

- **Do not smoke while draining moisture and sediment from fuel tank.**
- **Do not drain fuel with engine running.**
- **Do not allow fuel to remain on skin for an extended period of time. Wash thoroughly with soap and water.**

NOTE: *It is easier to clean the fuel tank when it is almost empty.*

1. Position machine on firm and level ground.
2. "ENGAGE" parking brake.
3. Lower bucket or work tool to ground.
4. Move transmission lever to "NEUTRAL" position.
5. Make sure transmission neutral lock is in the "N" (NEUTRAL LOCK) position.
6. Stop engine.
7. Open the drain valve (Figure 102) on the bottom of the fuel tank.
8. Drain the remaining fuel into a suitable container.

   NOTE: *Dispose of drained fluids according to applicable environmental laws and regulations.*
9. Remove bolts, inspection cover and gasket (Figure 103) from fuel tank.
10. Clean inside of the tank and suction stainer.
11. Install the inspection cover with a new gasket. Tighten the bolts. Do not overtighten.
12. Close drain valve.
13. Fill fuel tank.
14. Check for any leaks at cover and plug.

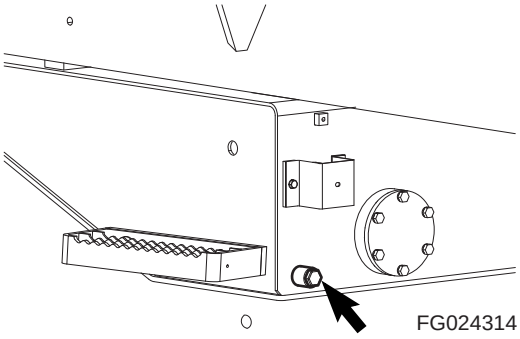


Figure 102

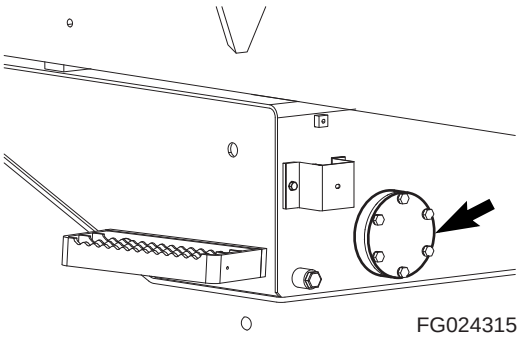


Figure 103

Check Air Conditioner Refrigerant

WARNING

AVOID DEATH OR SERIOUS INJURY

Mixing of tobacco smoke and freon can cause death or serious injury.

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

1. Position machine on firm and level ground.
2. "ENGAGE" parking brake.
3. Lower bucket or work tool to ground.
4. Move transmission lever to "NEUTRAL" position.
5. Make sure transmission neutral lock is in the "N" (NEUTRAL LOCK) position.
6. Block tires.
7. Remove cover.
8. Press the "HI" flow control switch to set maximum airflow.
9. Set the temperature control switch fully to the cool position and fully open the cabin doors.
10. Slightly accelerate the engine to about the middle speed range (compressor speed 1,500 - 1,800 rpm)
11. Compare the flow of bubbles in the sight glass with the drawings in the following table.

IMPORTANT

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

Always maintain refrigerant at normal level.

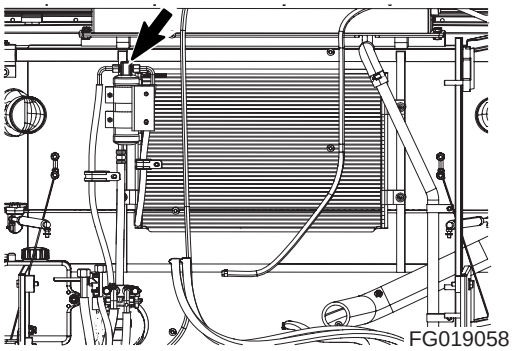
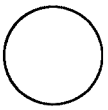
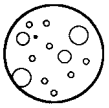


Figure 104

Amount of Refrigerant	Appearance of the Sight Glass	Solutions
Normal	 Almost clear. Any bubbles disappear if the engine speed is increased to 1,500 rpm.	
High	 No bubbles are seen.	Contact your local DOOSAN distributor for inspection and recharging refrigerant.
Low	 A flow of bubbles is visible.	

Air Cleaner

CAUTION

AVOID INJURY

Never remove air cleaner filter while engine is running. This will allow dirt to be sucked into engine and cause serious engine damage. Always turn engine "OFF" before servicing air cleaner.

Engine, Air Cleaner

The degree of engine wear depends largely on the cleanliness of the induction air. The air cleaner prevents dust and other impurities from entering the engine. Therefore, it is very important that air cleaner must be checked regularly and maintained correctly.

Outer Filter, Maintenance and Replacement

When the alarm text "Clogged Air Filter" is shown or every 1,000 hours, the filter must be replaced or be cleaned. The period of operation between filter replacements vary depending on the working environment of the machine. In certain environments the filter needs to be replaced more often.

- The filter can be cleaned according to instructions which your authorized dealer will give you. However, after the filter has been cleaned five times or if it is damaged, it must be replaced.

  NOTE: *Make a mark on the decal at the end of the inner filter every time the outer filter is replaced or cleaned.*

- In connection with replacing the filter, the cover for the air cleaner should also be cleaned. It works as a container for particles which have not been trapped in the filter.
- Check that all hose and pipe connections from the air cleaner to the engine induction manifold are tight. Check tightness of hose clamps.
- If the alarm text remains after replacing the outer filter, also the inner filter must be replaced. See “10. Air Cleaner Clogged Warning Light” on page 2-22.

Do not, under any circumstances, run the engine without a filter or with a damaged one.

Always have a spare filter on hand and keep the filter well protected from dirt.

CAUTION

AVOID INJURY

Never clean the inside of air filter housing while the inner filter is not installed.

Inner Filter

Replace the filter every 2,000 hours or when the main filter has been replaced three times.

The filter cannot be cleaned, but must be replaced.

The inner filter works as a protective filter if the main filter is damaged.

Never remove inner filter unless it is to be replaced.

Change Air Breather Filter

1. Position machine on firm and level ground.
2. "ENGAGE" parking brake.
3. Lower bucket or work tool to ground.
4. Move transmission lever to "NEUTRAL" position.
5. Make sure transmission neutral lock is in the "N" (NEUTRAL LOCK) position.
6. Stop engine.
7. Block tires.
8. Tip breather cap (2. Figure 105) slightly to release the internal pressure.
9. Unscrew the bolt (1, Figure 105) and take off the breather cap (2, Figure 105).
10. Change a filter cartridge (3, Figure 105) and assemble the breather cap by tightening bolt.

    NOTE: *Used filter should always be disposed of according to applicable environmental laws and regulations.*

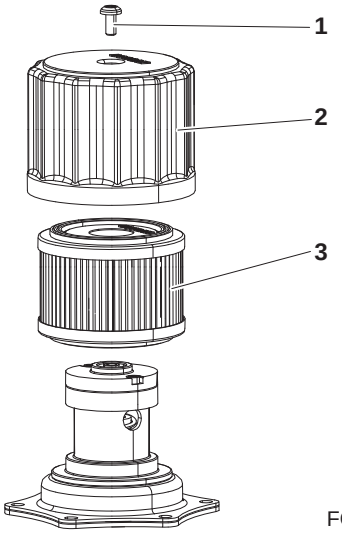


Figure 105

Change Hydraulic Full Flow Filter

WARNING

AVOID DEATH OR SERIOUS INJURY

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

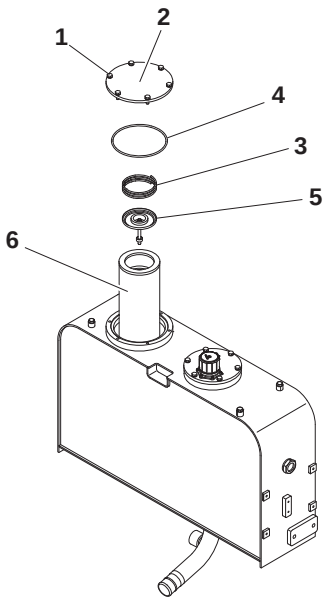
The hydraulic tank is pressurized. Tip breather cap slightly to allow pressurized air to vent. After pressure has been released, Remove service covers or drain water from the tank.

IMPORTANT

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

NOTE: *Replace hydraulic full flow filter after first 50 hours of operation or rebuild and every 1,000 hours thereafter.*

1. Loosen breather cap on hydraulic tank. (See Figure 29 on page 5-39).
2. Clean filter cover (2, Figure 106) and tank around cover.
3. Remove bolts (1, Figure 106) from cover (2).
4. Lift cover (2, Figure 106) and O-ring (4) off tank. A control spring (3) sits beneath cover. Remove spring (3).
5. Remove valve (5, Figure 106) and filter (6) from tank.
6. Clean underside of cover (2, Figure 106).
7. Set a new filter (6, Figure 106) and valve (5) down into tank. Press filter down onto its base until top of filter is approximately 4 mm (0.157") below edge of tank.
8. Install a new O-ring (4, Figure 106) on cover (2). Set spring (3) into place on filter (6).
9. Set cover (2, Figure 106) into place over filter (6). Install bolts (1) through cover (2) and tighten them.
10. Tighten breather cap on tank.



FG024316

Figure 106

Change Fuel Cap Filter

WARNING

AVOID DEATH OR SERIOUS INJURY

External shock or damages to fuel cap may lead to permanent damage to filter.

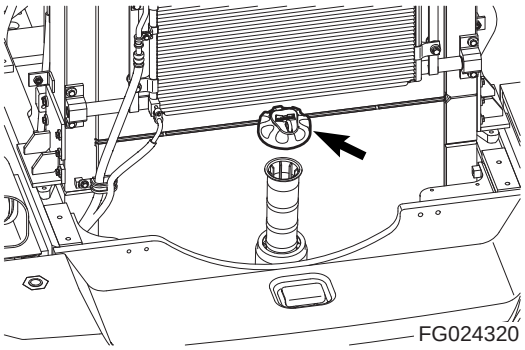


Figure 107

1. Look under the fuel cap as shown on (Figure 108). Rotate bolt to counterclockwise direction to loosen.

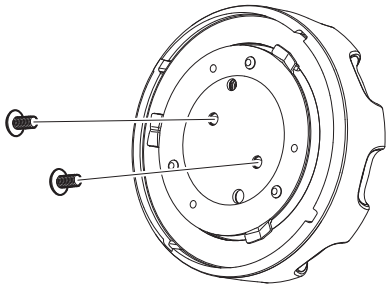


Figure 108

2. After disassembly, carefully lay it as shown in Figure 109.

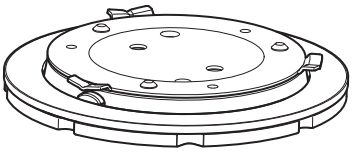


Figure 109

3. After disassembly (Figure 109), disengage rubber as shown on (Figure 110).

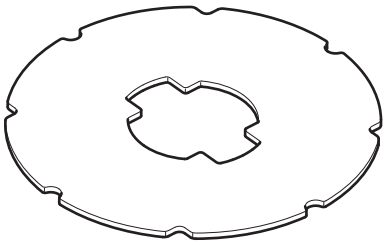
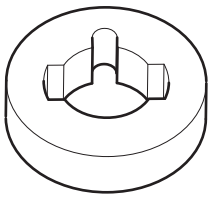


Figure 110

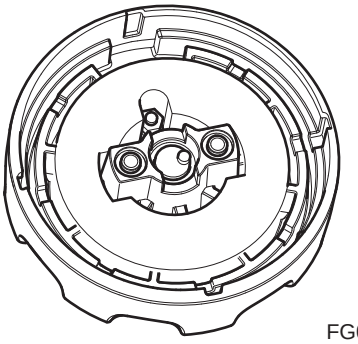
4. After disassembly as shown on (Figure 110), you may now exchange it to a new filter as shown on (Figure 111).



FG015687

Figure 111

5. After exchanging to a new filter, you may now assemble back in reverse order.



FG015688

Figure 112

1,500 HOUR / 9 MONTH SERVICE

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

Change Axle Differential and Planetaries Oil

NOTE: *Oil in both front and rear axles must be replaced after first 500 hours of operation to comply with new machine break-in requirements. After that, axle oil check must be done every 500 hours of operation and replacement must be done every 1,500 hours.*

Each axle contains a center differential, and a planetary on each end. The same oil lubricates the center differential and planetaries. These sections of the axle are connected, but the oil flows very slowly between them. When checked, oil must be checked and refilled at the level/fill plug on the differential housing.

To drain and replace oil in an axle, perform the following steps:

1. Position machine on firm and level ground.
2. "ENGAGE" parking brake.
3. Lower bucket or work tool to ground.
4. Move transmission lever to "NEUTRAL" position.
5. Make sure transmission neutral lock is in the "N" (NEUTRAL LOCK) position.
6. Stop engine.
7. Block tires.
8. Clean areas around drain plugs on both ends of axle. Remove plugs and allow oil to drain into a suitable container.

   NOTE: *See “Fluid Capacities” on page 4-30 for capacity.*

   NOTE: *Dispose of drained fluids according to applicable environmental laws and regulations.*

   NOTE: *Plug Size: M24 x 1.5 Tightening Torque: 7.1 kg•m (51 ft lb)*

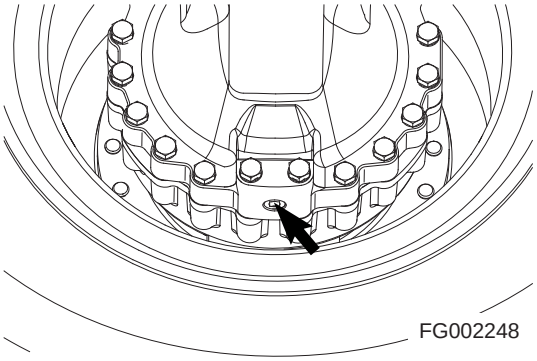


Figure 113

9. Clean area around level plug (1, Figure 114) and drain plug (2) on center differential. Remove level plug (1) and drain plug (2). Allow oil to drain into a suitable container.

   NOTE: *Plug Size* (1, Figure 114)*: M36 x 1.5 Tightening Torque: 13.2 kg•m (95 ft lb)*

10. Install drain plug (1, Figure 114) into center differential, and tighten. Install drain plugs on both ends of axle, and tighten.

11. Pump oil into level plug hole on center differential. Add oil until oil level is even with bottom of plug hole. Recheck level on center differential. Add oil if necessary. When oil level is satisfactory at the level plug hole, install and tighten level plug.

    NOTE: *Allow enough time to fill planetaries with oil.*

12. Repeat procedure for other axle.

    NOTE: *Plug Size* (1, Figure 115)*: M36 x 1.5*

    Tightening Torque: 13.2 kg•m (95 ft lb)

    Plug Size (2, Figure 115)*: M36 x 1.5*

    Tightening Torque: 13.2 kg•m (95 ft lb)

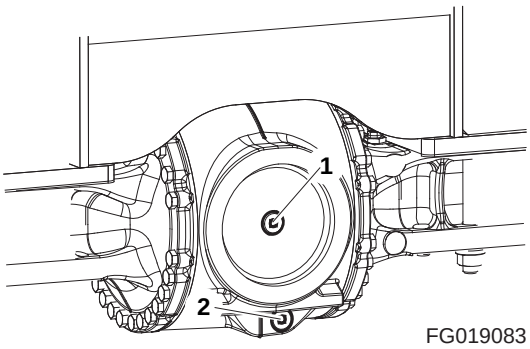


Figure 114 Front Axle

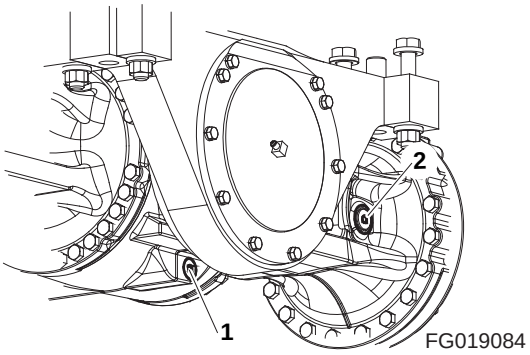


Figure 115 (Rear Axle)

2,000 HOUR / YEARLY SERVICE

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

Change Outer Air Cleaner Filter

CAUTION

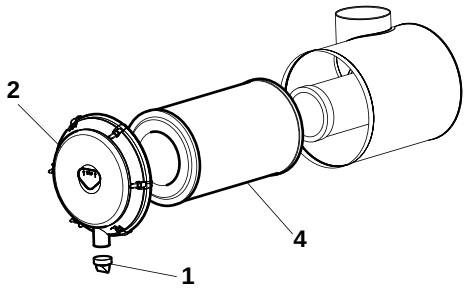
AVOID INJURY

Never remove air cleaner filter while engine is running. This will allow dirt to be sucked into engine and cause serious engine damage. Always turn engine "OFF" before servicing air cleaner.

1. Open the side access cover at the rear of the cabin.
2. Remove evacuator valve (1, Figure 116) and air cleaner cover (2, Figure 116).

   NOTE: *Inspect evacuator valve seal lips for wear or damage. Replace valve if necessary. Install evacuator valve with lips parallel to the cover.*
3. Remove outer filter (4, Figure 116) from the air cleaner housing.
4. Clean the air cleaner cover and the inside of the air cleaner housing. Do not use compressed air to blow out housing.
5. Install new outer filter.
6. Install air cleaner cover and evacuator valve.

   NOTE: *Make sure that all gaskets on wing nuts and cover are properly installed and seated.*



FG000425

Figure 116

Change Inner Air Cleaner Filter

CAUTION

AVOID INJURY

Never remove air cleaner filter while engine is running. This will allow dirt to be sucked into engine and cause serious engine damage. Always turn engine "OFF" before servicing air cleaner.

NOTE: *Replace outer filter after cleaning 4 times or every 1,000 hours.*

1. Replace inner filter when outer filter is replaced.
2. After removing outer filter, remove wing nut and inner filter.
3. Clean out inside of air cleaner housing. Do not use compressed air to blow out housing.
4. Install new inner filter, and secure it into position with wing nut. Do not clean and reuse inner filter.
5. Install new outer filter, and secure it into position with wing nut.
6. Install air cleaner cover.

NOTE: *Make sure that all gaskets on wing nuts and cover are properly installed and seated.*

Check Steering, Brake, Driveshaft, Engine, and Fuel System

Change Pipes and Hoses

1. Replace hoses that carry brake fluid to wheel brakes. Also replace hoses that carry hydraulic fluid to steering cylinders.
2. It may be to determine condition of certain hoses. The best way to ensure safe operation and to maintain maximum performance is to replace hoses regularly. If any brake or steering hoses become damaged or appear defective in any way, replace them immediately despite time interval since their last replacement.

Change Radiator Coolant

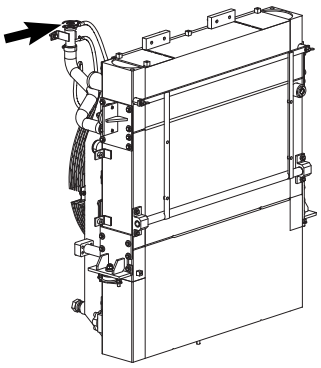
NOTE: *Do not mix ethylene glycol and propylene glycol antifreeze together. See "Engine Cooling System" on page 4-91 for further details.*

IMPORTANT

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.



FG023223

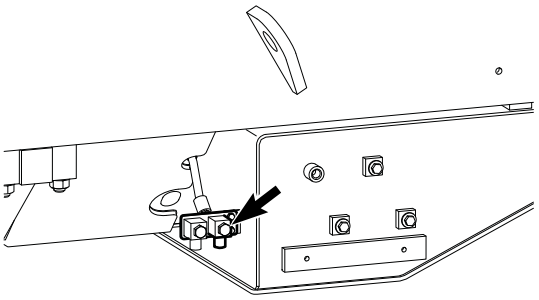
Figure 117

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.



FG023224

Figure 118

1. Slowly open the radiator cap (Figure 117) to allow any pressure to escape.

   NOTE: *See "Fluid Capacities" on page 4-30 for capacity.*

2. Place a container under the radiator and open the drain plug (Figure 118).

   NOTE: *Dispose of drained fluids according to applicable environmental laws and regulations.*

3. Fill cooling system with a flushing solution.
4. Run engine at low idle until coolant temperature gauge reaches the "BLUE ZONE". Run engine for another ten minutes.
5. Allow engine to cool.
6. Drain flushing fluid and fill system with water.
7. Run engine again to allow water to completely circulate.

8. After allowing engine to cool, drain water and fill system with proper antifreeze mixture for ambient temperature. Refer to coolant concentration table. See “Antifreeze Concentration Tables” on page 4-93
9. Run engine without radiator cap installed, so all air will be purged from system. Fill radiator to fill neck.
10. Drain and fill radiator coolant recovery tank.

Change Hydraulic Oil and Clean Oil Suction Strainer

WARNING

AVOID DEATH OR SERIOUS INJURY

Be certain that hydraulic oil has cooled before draining it. Hot oil could splash and cause burns.

1. Raise boom to its highest position. Tilt bucket back as far as possible, and stop engine.

   NOTE: *See “Fluid Capacities” on page 4-30 for capacity.*

2. Position a catch tank beneath hydraulic tank drain plug. Tip breather cap to allow pressurized air to vent. Remove hydraulic oil tank cover. (See Figure 29 on page 5-39). Remove drain plug from bottom of tank. (Figure 120). Allow all hydraulic oil to drain out.

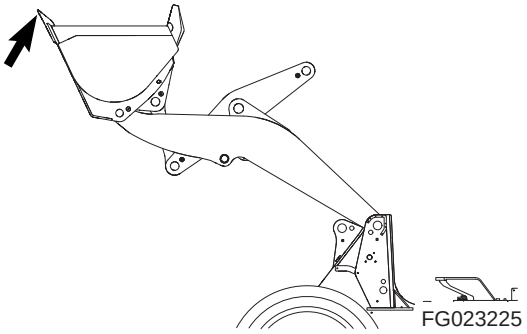


Figure 119

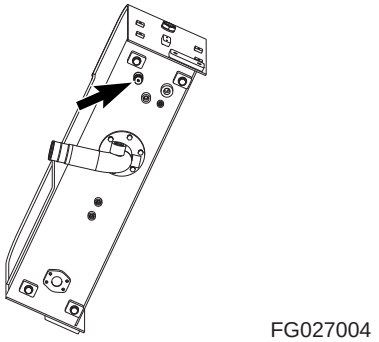


Figure 120

3. Without starting engine, operate controls to dump bucket. (Figure 121). Then operate controls to lower boom. (Figure 122). This will drain oil out of boom and bucket cylinders.
4. Replace full flow hydraulic filters as described under “Change Hydraulic Full Flow Filter” on page 4-75.

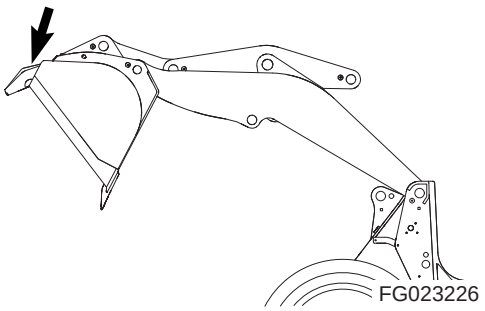
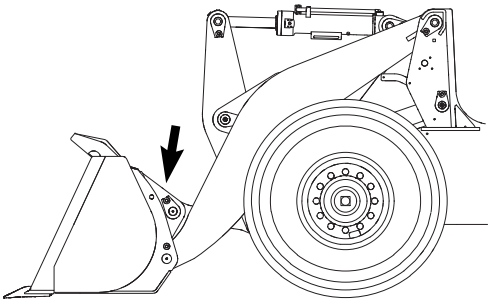


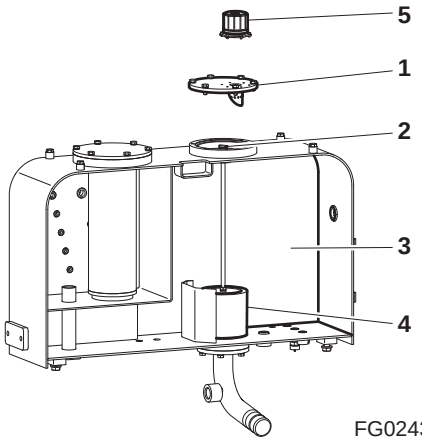
Figure 121



FG023227

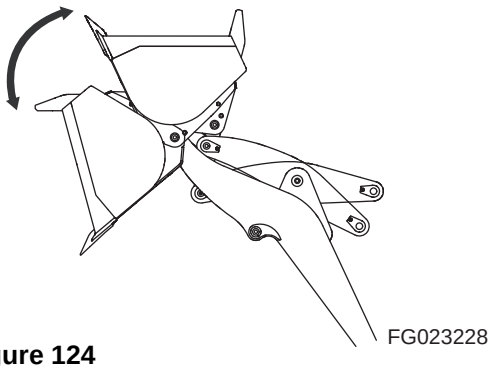
Figure 122

5. Remove and clean pump inlet strainer (Figure 123) inside hydraulic tank.
   A. Carefully remove bolts and cover (1, Figure 123), from top of hydraulic oil tank. There is a spring (2, Figure 123) under the cover that will force the cover up.
   B. Remove spring (2, Figure 123) and suction filter (4, Figure 123), by pulling on rod (3, Figure 123).
   C. Clean inside and outside of strainer. Replace strainer if it is broken.
   D. Position strainer on boss portion of suction pipe.
   E. Fill hydraulic oil tank. Check level using sight gauge on side of tank.
6. Install tank drain plug. Refill tank by pouring oil in through hydraulic oil cover opening. Install and tighten cover.
7. Start engine and operate controls to raise and lower bucket a few times. (Figure 124). Raise and lower boom a few times. (Figure 125). Lower bucket or work tool to ground.
8. Check tank sight gauge. (See Figure 28 on page 5-39). Oil level must be between upper limit and lower limit on sight gauge. Remove cover and add oil if necessary.



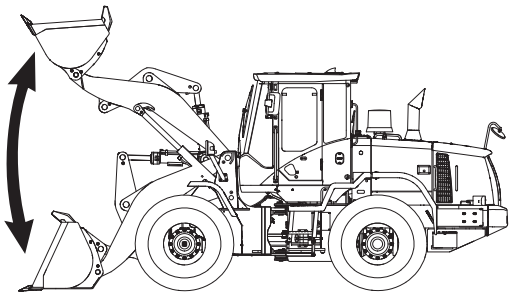
FG024318

Figure 123



FG023228

Figure 124



FG023229

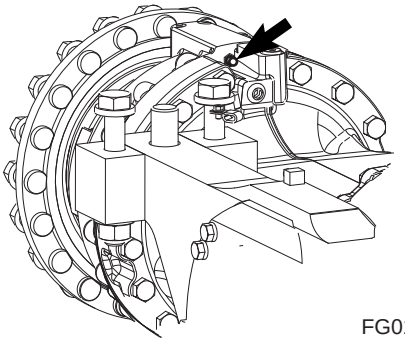
Figure 125

Bleed Brakes

When brake hoses or brake tubes are replaced, air can be introduced into brake hydraulic system and can cause brakes to operate intermittently. Never operate machine with air in brake hydraulic system. A spongy feel when pressing brake pedal is a sign that air is present in the brake hydraulic system.

To bleed air out of brake hydraulic system, perform the following steps:

1. Start engine and place transmission in "NEUTRAL".

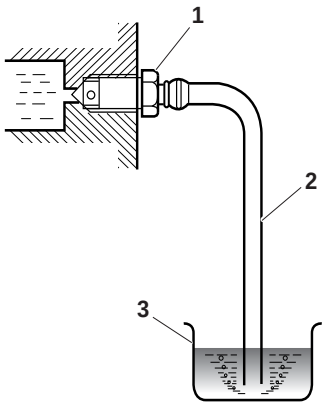


FG019068

Figure 126

2. Remove rubber cap from bleeder (1, Figure 127). Place one end of a plastic hose (2) over bleeder screw. Place end of hose in a container (3) filled with brake fluid.
3. Station one person in operator's cabin, and one person at bleeder screw on axle being bled.
4. Press down on brake pedal as much as possible.
5. Open bleeder screw using 14 mm wrench.
6. Close bleeder screw.
7. Release brake pedal.
8. Repeat steps 4 thru 7, until air bubbles are not seen in the brake line.

Perform bleeding procedure on other three locations.



HLB3018L

Figure 127

Check Brake Accumulator

WARNING

AVOID DEATH OR SERIOUS INJURY

Pressurized Nitrogen gas in brake accumulator can explode causing death or serious injury.

Never service brake accumulator unless properly trained.

Test the brake accumulator for proper precharge of Nitrogen gas:

1. Position machine on firm and level ground.
2. "ENGAGE" parking brake.
3. Lower bucket or work tool to ground.
4. Move transmission lever to "NEUTRAL" position.
5. Make sure transmission neutral lock is in the "N" (NEUTRAL LOCK) position.
6. Block tires.
7. Run the engine at low idle for five minutes to fill the brake accumulator with oil.
8. Stop engine.
9. Turn the starter switch to "ON" position.
10. Count the number of times you can depress the right-hand brake pedal before the brake warning light comes on.
11. If the number counted is less than five (5), there is some problem with the accumulator. Contact your DOOSAN distributor.

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, “DPF Cleaning (Removing Ash in DPF)” on page 3-18.

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 (6) years. DOOSAN recommends the following:

- Hoses at the customer premises cannot be stored more than two (2) years before being discarded or installed on a machine.
- In-service lifetime of hoses fitted on a machine can never exceed six (6) years, but replace hoses described in “Change Pipes and Hoses” on page 4-81, every year. 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.

STANDARD BOLT TORQUE CHART

Tightening Torque Specifications for Metric Bolts (For coated threads, prelubricated assemblies)

Grade	Gr. 8.8		Gr. 10.9		Gr. 12.9	
Dia.	kg•m	ft lb	kg•m	ft lb	kg•m	ft lb
5 mm x std.	0.59	4.3	0.79	5.7	1.0	7.2
6 mm x std.	1.00	7.3	1.38	10	1.66	12
8 mm x std.	2.49	18	3.46	25	4.15	30
8 mm x 1.0	2.76	20	3.87	28	4.56	33
10 mm x std.	4.84	35	6.92	50	8.30	60
10 mm x 1.0	4.84	35	7.05	51	8.30	60
12 mm x std.	8.57	62	11.89	86	14.52	105
12 mm x 1.5	9.00	65	12.59	91	14.94	108
14 mm x std.	13.55	98	18.95	137	23.10	167
14 mm x 1.5	14.94	108	21.02	152	24.89	180
16 mm x std.	20.88	151	29.46	213	35.54	257
16 mm x 1.5	22.54	163	31.53	228	38.03	275
18 mm x std.	28.90	209	40.52	293	48.41	350
18 mm x 1.5	32.50	235	45.92	332	55.04	398
20 mm x std.	40.94	296	57.95	419	69.01	499
20 mm x 1.5	46.05	333	64.03	463	77.03	557
22 mm x std.	54.90	397	77.86	563	93.08	673
22 mm x 1.5	61.00	441	86.02	622	105.00	759
24 mm x std.	71.00	513	100.00	723	120.00	868
24 mm x 2.0	78.00	564	109.95	795	130.00	940
27 mm x 2.0	115.06	832	160.00	1157	195.00	1410

Check Battery Condition

WARNING

AVOID DEATH OR SERIOUS INJURY

Before starting any battery service work, make sure to shut the engine off and turn the starter key to "OFF" position.

The batteries create hydrogen gas. An explosion hazard exists, particularly with a deeply discharged battery. Make sure that open flames, burning objects or sparks are kept away from the battery compartment.

Battery electrolyte is diluted sulfuric acid. Take extreme caution when handling the batteries. The electrolyte can cause severe chemical burns. If any electrolyte gets on your clothing or skin, wash it off immediately with large quantities of water. If the electrolyte gets into your eyes, flush them immediately with a large quantity of water and seek immediate medical attention.

When installing a battery, wear safety goggles always.

When removing a battery, remove Negative (-) or ground terminal first, and then the Positive (+) terminal. This will prevent sparks or arcing that could cause an explosion. When installing a battery, connect the Positive terminal first and then the Negative terminal. Make sure to fully tighten the terminal clamps.

1. In colder weather, a greater drain is placed on the batteries when starting a cold engine. Battery performance decreases as the temperature gets lower.
2. In extremely cold weather, remove batteries at night and move them to a warm location. This will help to keep them at a higher power level.
3. Inspection of battery electrolyte level.

   NOTE: *The battery installed at the factory is a Maintenance Free (MF) type. Electrolyte under normal conditions should remain at its proper level.*

4. Inspect charge condition of battery by looking at the indicator light built into battery.
   - GREEN: Normal.
   - BLACK: Insufficient charging - check alternator.
   - TRANSPARENT: Insufficient battery electrolyte - replace with new battery.

   NOTE: *Colors may vary from one battery manufacturer to another. Always refer to instructions on 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.

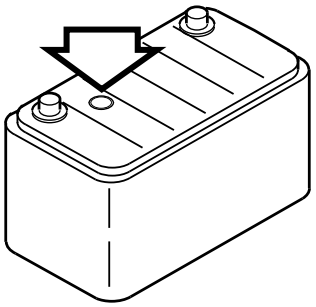


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Figure 128

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 4-93. 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 every 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 reference 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.

HANDLING OF ACCUMULATOR

WARNING

AVOID DEATH OR SERIOUS INJURY

Even though the engine is stopped, the hydraulic accumulators for the pilot, brake and LIS system are still charged. Do not disconnect any hoses until accumulator pressure has been released from the circuit. To release pressure, turn the starter switch to "I" (ON) position and operate pilot control valve lever and brake pedal. Even though the engine is stopped, components actuated by hydraulic pressure may move while releasing pilot pressure. Keep all personnel and bystanders away from machine while performing this operation.

- **Set pilot cutoff switch to "O" (OFF) position after stopping engine.**
- **Do not mishandle accumulators. They contain high-pressure nitrogen gas.**
- **Do not punch a hole or apply heat or fire to accumulators.**
- **Do not weld on accumulators, or try attaching anything to them.**
- **When replacing an accumulators, contact a DOOSAN distributor to ensure that gas is properly released.**
- **Wear safety goggles and protective gloves when working on an accumulator. Hydraulic oil under the pressure can penetrate the skin and cause serious injuries.**

Pilot Accumulator

Release pilot accumulator pressure using the following procedure:

1. Lower bucket or work tool to ground.
2. Stop engine.
3. Set pilot cutoff switch on "I" (ON) position.
4. Turn starter switch to "I" (ON) position.
5. Fully move pilot control valve lever in all directions.
6. Set pilot cutoff switch on "O" (OFF) position.
7. Turn key to "O" (OFF) position and remove from starter switch.
8. Remove accumulator by unscrewing it slowly.

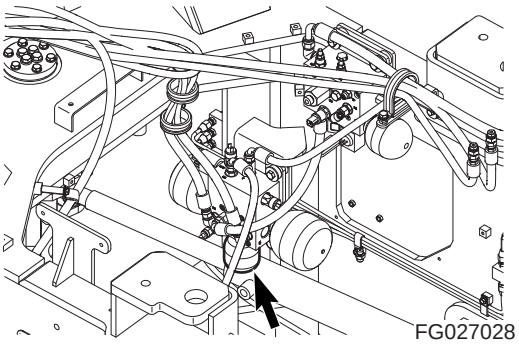

Figure 129

Brake Accumulators

Release brake accumulators pressure using the following procedure:

1. Lower bucket or work tool to ground.
2. Stop engine.
3. Repeatedly press brake until brake oil pressure warning light turns "ON". Press the pedal another eight to nine times.
4. Remove accumulator by unscrewing it slowly.

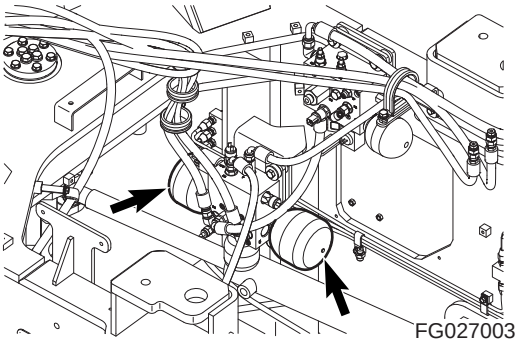

Figure 130

LIS Accumulator

Release LIS accumulator pressure using the following procedure:

1. Lower bucket or work tool to ground.
2. Stop engine.
3. Unscrew the drain valve shown in Figure 131.
4. Remove accumulator by unscrewing it slowly.

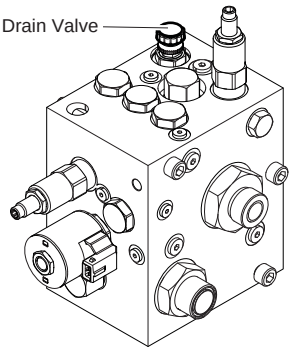

Figure 131

Steering Accumulator

Release steering accumulators pressure using the following procedure:

1. Position the machine in straight position, not articulated.
2. Lower front attachment (bucket) to ground.
3. Stop engine.
4. Allow enough time that steering cylinder pressure is decreasing by own internal leakage.
5. Remove accumulators by unscrewing them very slowly.

   NOTE: *This also applies to the hoses related with accumulators.*

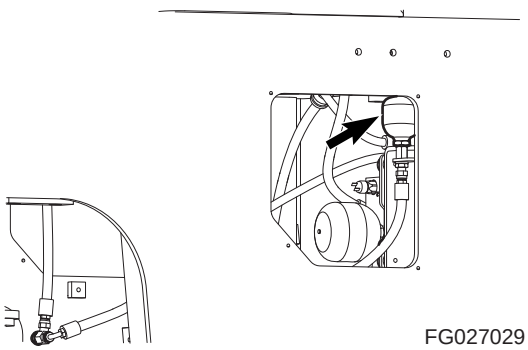

Figure 132

FUEL TRANSFER PUMP (OPTIONAL)

IMPORTANT

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

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

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

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

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

Be careful not to overfill or spill fuel.

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

Any pump parts or components that become lost, damaged or inoperable, must be immediately replaced.

Do not stand on fuel transfer pump box.

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.

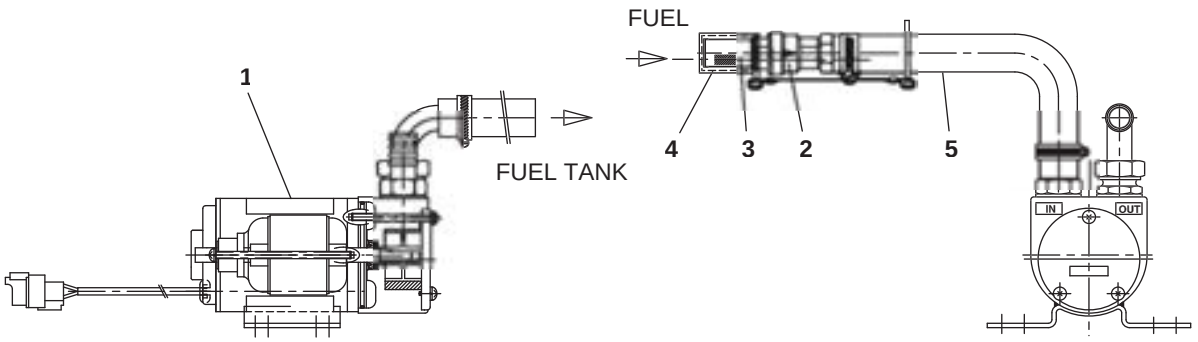

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Figure 133

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 133) from strainer (3, Figure 133) on end of inlet hose (5, Figure 133).

   NOTE: *Keep strainer cap (4, Figure 133) in a safe location to reseal strainer (3, Figure 133) after refueling is complete.*

2. Insert inlet hose (5, Figure 133) into refueling tank.
3. Select fuel pump "ON" switch (Figure 134) inside of battery box.
4. Once fuel transfer is completed, automatically "OFF" position to stop pump.
5. Lift inlet hose (5, Figure 133) from fueling source and push "ON" switch and push "OFF" switch after two - three seconds to drain remaining fuel from hose to fuel tank.
6. Install strainer cap (4, Figure 133) on inlet strainer (3, Figure 133) and return hose (5, Figure 133) to storage position.

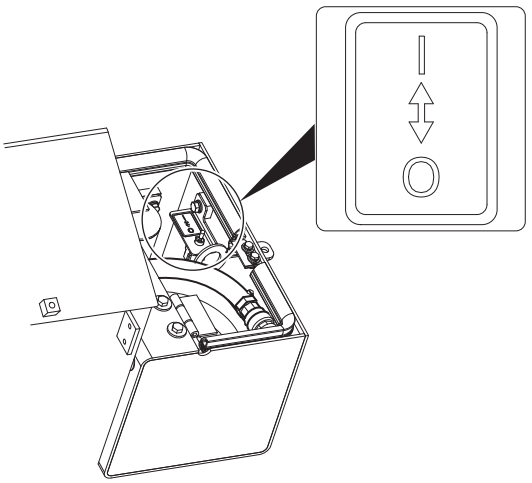

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Figure 134

HYDRAULIC PRESSURE CHECKS

Hydraulic pressure for most systems can be check by using the remote test ports shown in (Figure 135).

Reference Number	Description	Pressure
1	Brake Charging Pressure Check	122-143 kg/cm^2 (120-140 bar (1,707-2034 psi))
2	Pilot Pressure Supply	30 ±2 kg/cm^2 (29 ±2 bar (427 ±28 psi))
3	Transmission Clutch Pressure ™	16 +2 kg/cm^2 (16 ±2 bar (228 ±28 psi))
4	Main Pump Pressure (after Priority V/V)	At relief:255 ±5 kg/cm^2 (250 ±5 bar (3,625 ±71 psi)) At idle:20 ±5 kg/cm^2 (20 ±5 bar (284 ±71 psi))
5	Main Pump Pressure (before Priority V/V)	At relief:255 ±5 kg/cm^2 (250 ±5 bar (3,625 ±71 psi)) At idle:25 ±5 kg/cm^2 (25 ±5 bar (363 ±71 psi))
6	Steer Pump Load Sensing Pressure	At relief:175 ±5 kg/cm^2 (171 ±5 bar (2,489 ±142 psi)) At idle:5 ±5 kg/cm^2 (5 ±5 bar (71 ±71 psi))
7	Main Pump Load Sensing Pressure	At relief:255 ±5 kg/cm^2 (250 ±5 bar (3,625 ±71 psi)) At idle:0 ±5 kg/cm^2 (0 ±5 bar (0 ±71 psi))

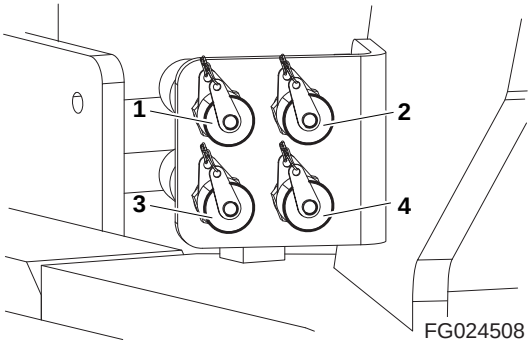

Figure 135

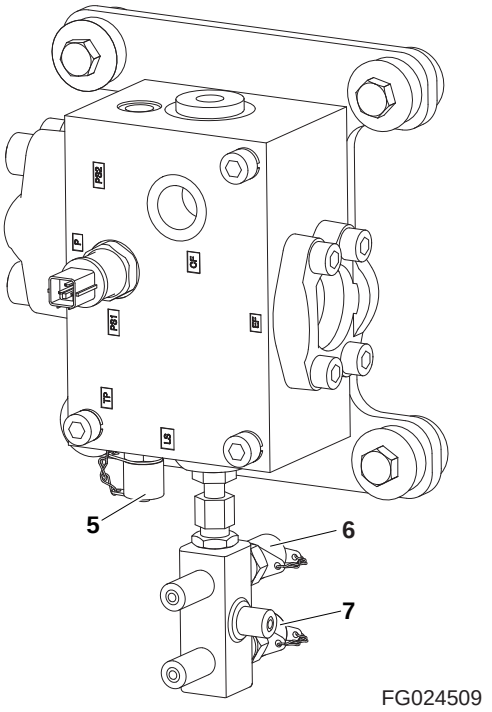

Figure 136

Transmission Clutch Pressure

1. Attach gauge to port (TM, Figure 135).
2. Clutch pressure cannot be adjusted.

NOTE: *Transmission clutch pressure is 16 - 18 kg/cm^2 (16 ±18 bar (228 - 256 psi)).*

Brake Charge Pressure

1. Attach gauge to port (6, Figure 135).
2. Adjust relief valve cartridge on brake and pilot and fan motor supply valve (Figure 137). The minimum set pressure (Figure 137) for brake charging is 120-143 kg/cm^2 (120-140 bar (1,707-2034 psi)) (Marked C3 on the block).

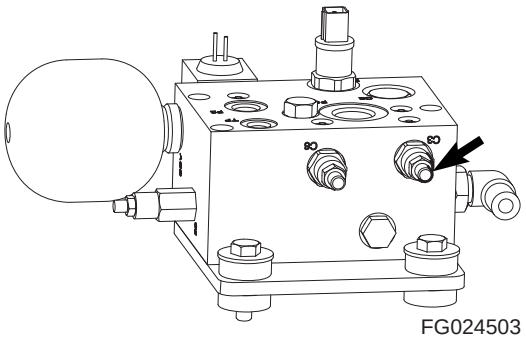

Figure 137

Control Lever Activation Pressure

1. Attach gauge to port (5, Figure 135).
2. Adjust relief cartridge (Figure 138) on brake and pilot and fan motor supply valve. Pressure must be set at 30 - 32 kg/cm^2 (29 ±31 bar (427- 455 psi)) (Marked C6 on the block).
3. Loosen locknut on adjusting screw. Turn adjusting screw clockwise to raise relief pressure. Turn adjusting screw counterclockwise to lower relief pressure.
4. Tighten locknut after adjustment.
5. If the pressure doesn't change, the maximum current value of pump control must be changed by DMS.

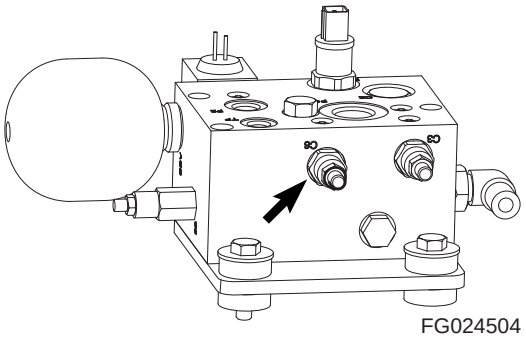

Figure 138

Service Brake Outlet Pressure

1. Attach gauge to brake pressure test port (Figure 139) of front axle.
2. Outlet pressure must be 75 ±5 kg/cm^2 (74 ±5 bar (1,138 ±71 psi)).

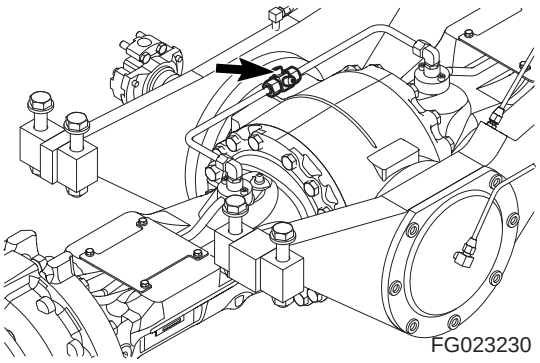

Figure 139

Fan Motor Pressure and Fan Speed

The motor incorporates proportional pressure relief valve, the fan speed (and the cooling performance) can be infinitely controlled in dependence on two different simultaneously input signals from temperature sensors.

The vehicle control unit (VCU) processes the input signals and controls the valve coil current. The proportional pressure reducing valve has a fail-safe characteristic, this means, the less current, the higher fan speed.

If the electrical wire is broken, the fan speed will increase to maximum speed and therefore maximum cooling performance.

		Maximum Speed
Fan Speed	rpm	1600 ±50
Fan Motor Pressure	kg/cm^2 (bar (psi))	163 ±10 (160 ±10 (2,318 ±142))
Control Current	mA	200 ±25

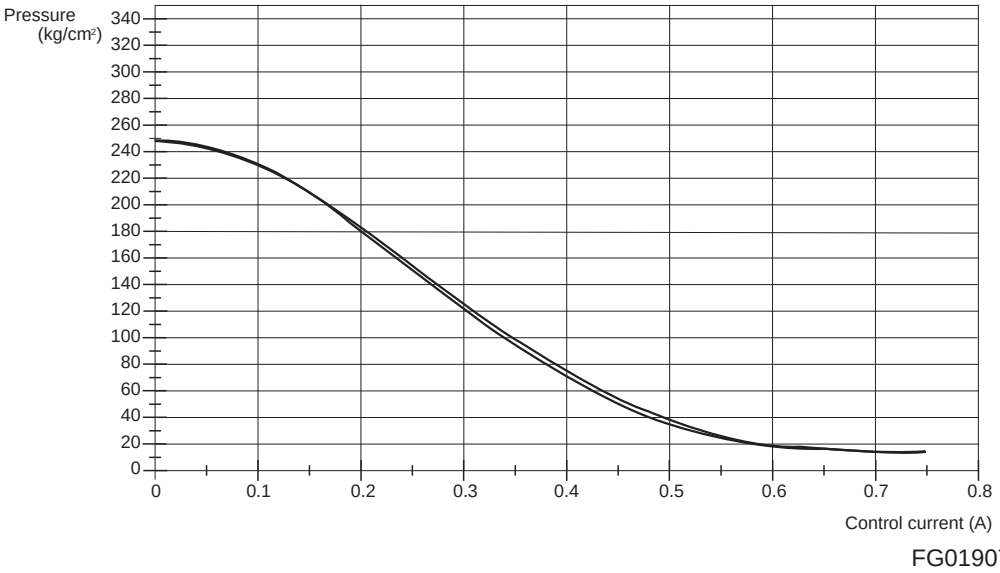

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Figure 140

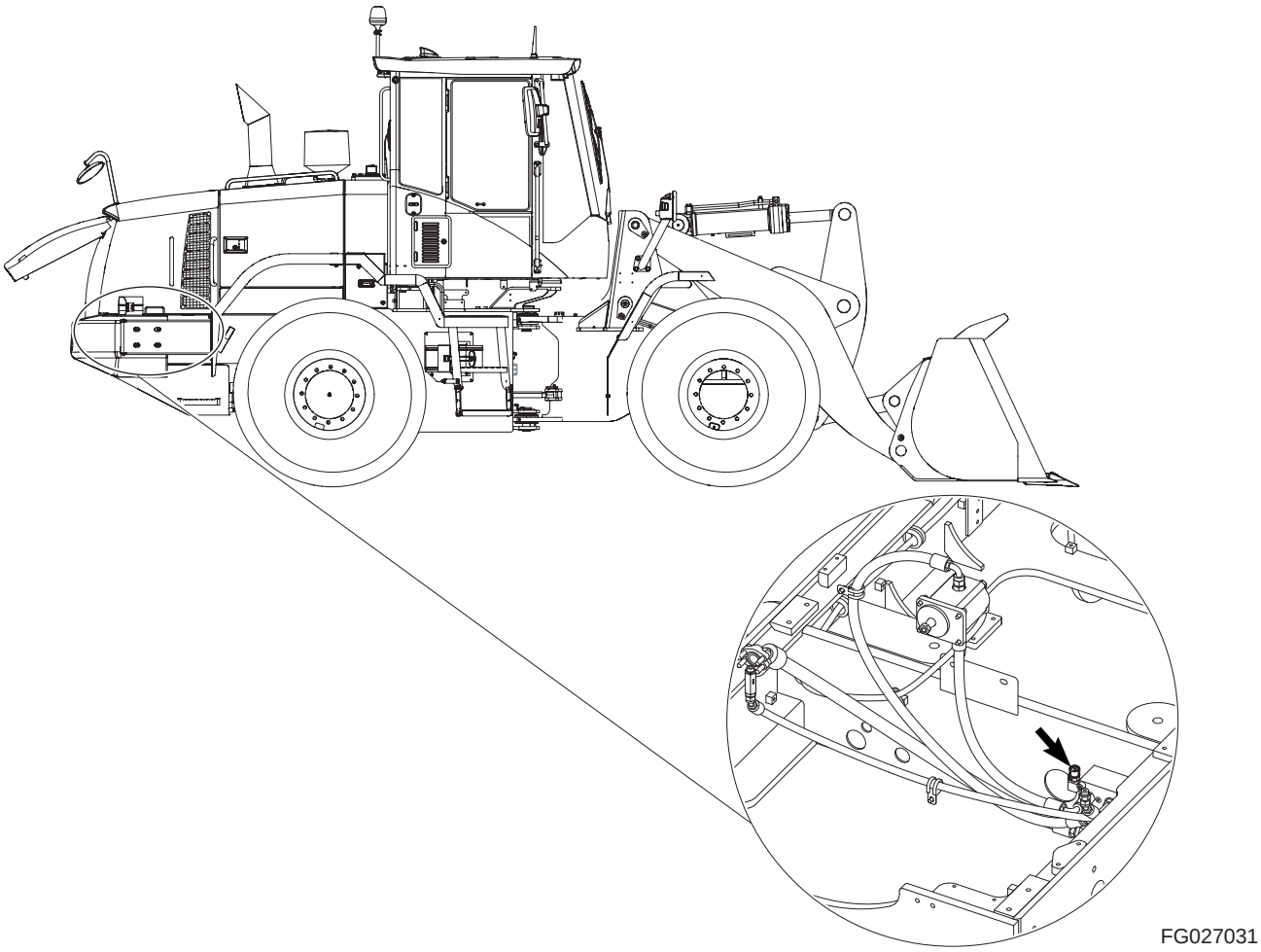

Figure 141

Checking Maximum Fan Speed, Checking

1. Open the radiator side grille to connect the pressure gauge.
2. Connect the pressure gauge to the pressure port shown in Figure 141.
3. Check the maximum pressure by pressing accelerator pedal to "HIGH IDLE", and reading the pressure on gauge.
4. If fan speed requires adjusting, adjust control current by DMS.

LONG TERM STORAGE

Cleaning

Pressure wash machine. Inspect machine for any damage or missing parts. Drive machine to check steering linkage for damage.

Hydraulic System

Start engine and allow it to idle for a few minutes. Drive machine around for two - three minutes. Raise and lower boom two - three (2-3) times. Crowd and dump bucket two - three times. This will circulate hydraulic fluid through all hydraulic systems.

Lubrication

Perform all daily maintenance procedures listed in this section (Section 4.) Grease all grease fittings in steering linkage. Apply a coating of light oil to all exposed cylinder rods. Apply a coating of light oil to all control linkages and all control valve spools. Check condition of oil coating each month and add to coating where necessary.

Battery

Disconnect cables from battery, or remove battery from machine. If battery is removed, fully charge battery and store it.

Cooling System Care

If cooling system does not need antifreeze and is filled with water only, add an antirust additive. If temperatures below freezing are expected, add antifreeze to protect system to level of cold expected. See antifreeze protection Table 4-1. Use a hydrometer to check level of antifreeze protection once each month. If desired, cooling system can be completely drained. If system is drained, place a sign in operator's cabin to warn operator there is no coolant in engine.

PARKING BRAKE ADJUSTMENT

Emergency Release of Parking Brake

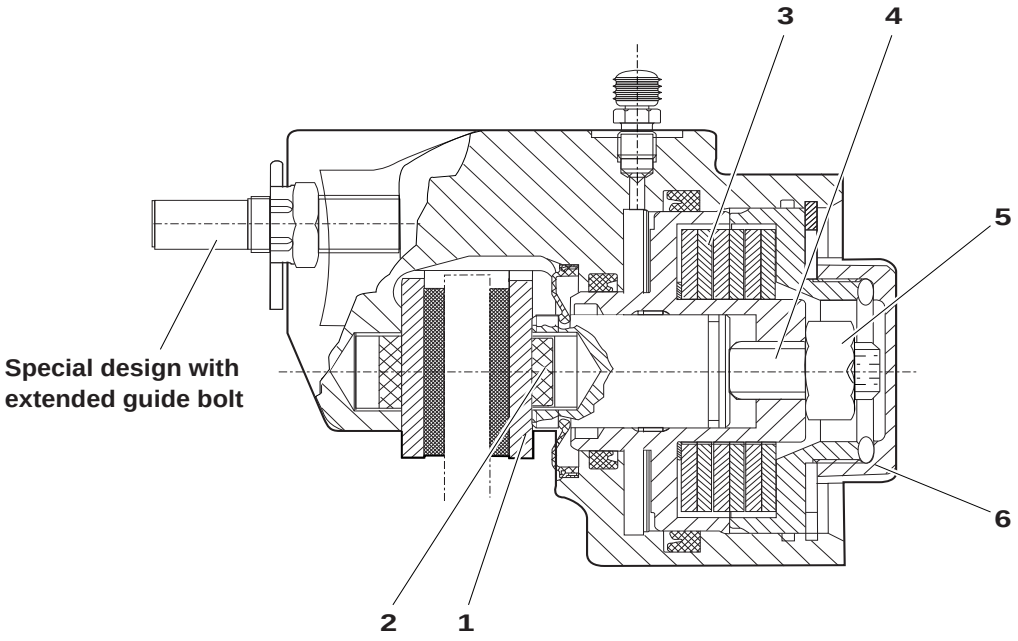

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Figure 142

If the parking brake cannot be released by normal hydraulic system pressure, or if the engine will not start, it must be manually released before towing can take place.

1. Before releasing parking brake make sure that wheels have wheel chocks placed in front of and behind them, to prevent machine from moving when parking brake is released.
2. Release the screw cap (6, Figure 142) and unscrew.
3. Release the locknut (5, Figure 142) and turn the adjusting screw (4) counterclockwise until brake disk is free.
4. Install locknut (5, Figure 142) and screw cap (6) and tighten both as far as possible. This will protect the parking brake assembly from dirt.

   NOTE: *The machine does not have any brake function and must be secured, by proper means, against moving. Before putting the machine into operation again, the brake has to be properly adjusted according to specifications.*

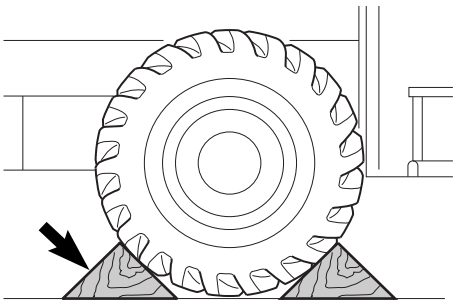

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Figure 143

Adjustment Procedure for Parking Brake

During this adjusting process, the parking brake must be released, i.e. the bank of cup springs (3, Figure 142) must be completely pretensioned.

1. Park vehicle on an even surface and place wheel chocks in front of and behind tires. Only then release the parking brake.
2. Release the screw cap (6, Figure 142) and unscrew.
3. Release the locknut (5, Figure 142) (size 24 or 30) and turn the adjusting screw (4) with socket wrench (size 8 or 10) clockwise until two brake pads (1) and (2) contact the brake disk.
4. Turn the adjusting screw (4, Figure 142) counterclockwise and set the clearance specified in the following table.

Type	Adjusting Screw	Clearance (mm)		Revolutions
Small	M 16 (size 8)	Minimum	0.5	1/4
		Rated Clearance	1.0	1/2
		Maximum	1.5	3/4
Large	M 20 (size 10)	Minimum	1.0	2/5
		Rated Clearance	2.0	4/5
		Maximum	3.0	1 1/5

5. Hold the adjusting screw (4, Figure 142) in position with the hexagonal socket wrench and lock with the locknut (5).
6. Mount the screw cap (6, Figure 142) and manually tighten as far as possible manually.
7. Actuate the brake valve several times and check the braking efficiency of the parking brake a slope.

SEVERE CONDITIONS MAINTENANCE

OPERATING CONDITION	REQUIRED MAINTENANCE
Mud, Water, Rain	1. Check for loose fittings, obvious damage to machine, or any fluid leakage.
	2. After completing operations, clean mud, rocks, or debris from machine. Inspect for damage, cracked welds, or loosened parts.
	3. Perform all daily lubrication and service.
	4. If machine was working in or exposed to salt water or other corrosive materials, be sure to flush equipment with fresh water and dry areas completely.
Extremely Dusty or Hot Environment	1. Clean engine air filter on a more frequent basis.
	2. Clean radiator and oil cooler fins to remove dirt and dust.
	3. Clean fuel system intake strainer and fuel filter more frequently.
	4. Inspect starter motor and alternator, and clean as often as necessary.
Rocky Terrain	1. Check wheels, tires, rims and valve stems for damage or excessive wear.
	2. Inspect for loose or damaged fittings and bolts.
	3. On a more frequent basis, inspect bucket and boom for damage or excessive wear.
	4. Install a top guard and front guard as necessary for protection against falling objects.
Extreme Cold	1. Use proper grade of fuel for cold temperatures.
	2. Use a gauge to check antifreeze to be sure that it will provide protection for coldest temperature expected.
	3. Use a hydrometer to check condition of batteries. In extremely cold weather, remove batteries at night and store them in a warm area.

TIRES

Inflating Tires

Recommended tire pressures should normally be followed. Special operations may justify a different pressure. In such cases, follow the instructions from the tire manufacturer and do not exceed the maximum permissible pressures, See page 5-109.

The tire pressure may have been raised before the machine was delivered from the factory. Therefore, check and adjust the tire pressure according to recommendations, before putting the machine in operation for the first time.

WARNING

AVOID DEATH OR SERIOUS INJURY

Repair work on tires and rims must be done by service persons who have been properly trained for this.

The instructions below apply to an inflated tire where the pressure needs to be increased. If the tire has lost all pressure, a trained service person must be contacted.

- When checking the air pressure, the tire must be cold and the machine not have a load.
- Ask all other persons to leave the danger area (in front of the rim).
- Stand by the tire tread. Tire installed on a split rim can explode causing death or serious injury. (Figure 144)
- Use a long air hose (with a self-attaching air chuck) which allows you to stand outside the danger area.
- Tires on stored wheels (spare wheels) must be kept laying down on their side and only be inflated sufficiently to keep the rim parts in position.

Wheel Nut, Tightening Check

After having changed a tire or if the wheel has been removed and installed for any other reason, the wheel bolts must be checked for tightness after eight hours of operation.

Tighten wheel nuts to 85 kg•m (615 ft lb).

Wheel Nut Torque

Tighten wheel nuts to 85 kg•m (615 ft lb).

WARNING

AVOID DEATH OR SERIOUS INJURY

If a wheel and tire must be removed from machine and replaced, or if a tire must be replaced on wheel, use only experienced and trained service personnel. A tire rim could be propelled off wheel and cause death or serious injury. See Figure 144.

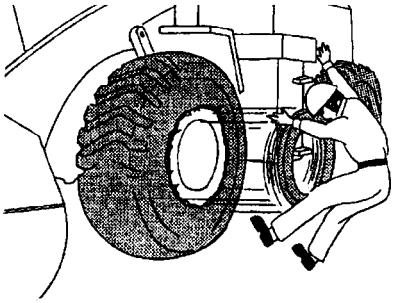

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Figure 144

Check Tire for Damage

WARNING

AVOID DEATH OR SERIOUS INJURY

Improper servicing or changing tires and rims can cause explosion resulting in death or serious injury.

Do not service or change tires and rims unless properly trained and equipped.

Contact your DOOSAN distributor or tire manufacturer's local dealer for tire servicing or changing.

WARNING

AVOID DEATH OR SERIOUS INJURY

Overheated tires can explode causing death or serious injury.

If an overheated tire is suspected, keep away at least 15m (50 ft).

Stay away until tire and rim cools down.

If the following problems are found in tires, for safety reasons the tires must be replaced with new tires.

For the replacement contact DOOSAN distributor or a tire manufacturer's local dealer.

- Bead wire is broken or bent, or the tire is greatly deformed.
- Wear is excessive and the carcass ply (including breaker) is exposed for more than 1/4 of the circumference.
- Damage to the carcass exceeds 1/3 of the tire width.
- Tire layers are separated.
- Radial cracks reach the carcass.
- Deformation or damage which makes the tire unsuitable for use.

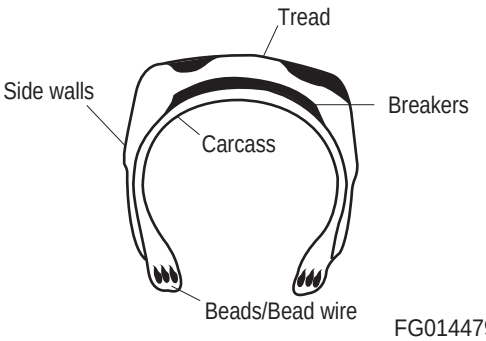

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Figure 145

Recommended Air Pressure

Tire	Working Pressure		Driving Pressure		Remarks
	Front Tire	Rear Tire	Front Tire	Rear Tire	
Bias Ply Tire	$4.1^{+0.1}_{+0}$ kg/cm^2 ($4.1^{+0.1}_{+0}$ bar (60^{+2}_{+0} psi))	$3.5^{+0.1}_{+0}$ kg/cm^2 ($3.5^{+0.1}_{+0}$ bar (50^{+2}_{+0} psi))	$4.1^{+0.1}_{+0}$ kg/cm^2 ($4.1^{+0.1}_{+0}$ bar (60^{+2}_{+0} psi))	$3.5^{+0.1}_{+0}$ kg/cm^2 ($3.5^{+0.1}_{+0}$ bar (50^{+2}_{+0} psi))	20.5-25-16PR (Standard)
Radial Ply Tire	$3.5^{+0.1}_{+0}$ kg/cm^2 ($3.5^{+0.1}_{+0}$ bar (50^{+2}_{+0} psi))	$3.0^{+0.1}_{+0}$ kg/cm^2 ($2.9^{+0.1}_{+0}$ bar (43^{+2}_{+0} psi))	$3.5^{+0.1}_{+0}$ kg/cm^2 ($3.5^{+0.1}_{+0}$ bar (50^{+2}_{+0} psi))	$3.0^{+0.1}_{+0}$ kg/cm^2 ($2.9^{+0.1}_{+0}$ bar (43^{+2}_{+0} psi))	20.5R25 (Optional)

The recommended tire pressures are based on the rated load for each handling case.

In case of heavier loads, especially during loading and carrying operations, a higher tire pressure is required. Contact the tire manufacturer for information about which air pressure is the correct one for the load to be handled and transported over a particular distance.

If L5 tires are used for loading and carrying operations, special attention must be paid to the transporting distances.

Radial tires are preferred for loading and carrying operation, as the build up of heat is less with this type of tire.

Transportation

When transporting the machine, observe all laws regarding weight, width, height and length of towing vehicle, trailer and load. Use a towing vehicle and trailer of adequate length and capacity.

Check the travel route for road width, overpass clearances, weight restrictions. Special approval or permits may be required.

TRANSPORTING MACHINE

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.

Machine must be operated by a qualified operator.

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 the 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 machine.

Never correct your steering on the ramps. There is a danger that the machine may tip over. If necessary, drive off the ramps or back on to the bed of the trailer and correct the direction.

Make sure to secure the machine 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 1.
2. Make sure that ramps that are being used are designed to handle the weight of the machine. 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.

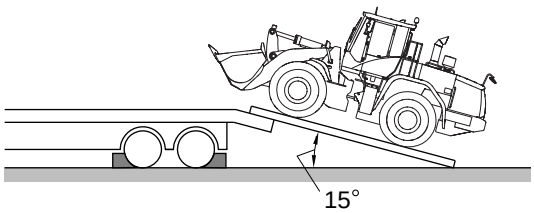

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Figure 1

4. Set the travel direction toward the ramps and drive slowly for loading.
5. Load the machine correctly in the specified position on the trailer.
6. Set parking brake switch to "I" (ENGAGED) position. (Figure 2).

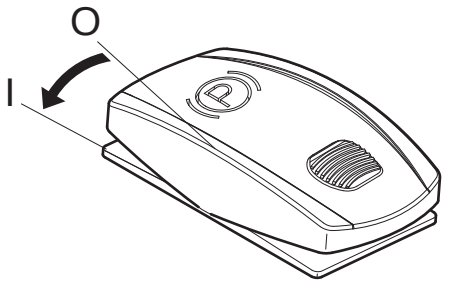

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Figure 2

7. Lower bucket or work tool slowly on the trailer.
8. Set pilot cutoff switch to "O" (LOCKED) position. (Figure 3).

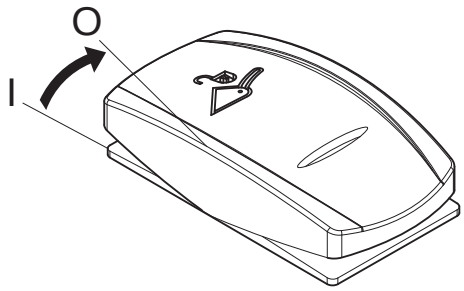

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Figure 3

9. Stop engine by turning key to "O" (OFF) position (Figure 4).
10. Remove key from starter switch.

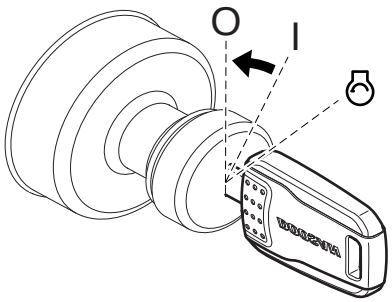

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Figure 4

11. Install articulated frame lock. (Figure 5).

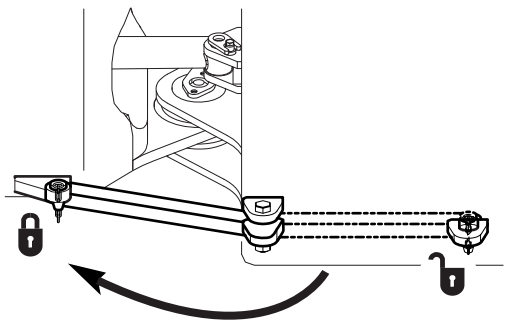

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Figure 5

12. Turn battery disconnect switch to "OFF" direction (Figure 6).
13. Lock all doors and covers.
14. Adjust direction of rotating beacon and TMS antenna.

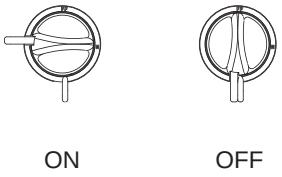

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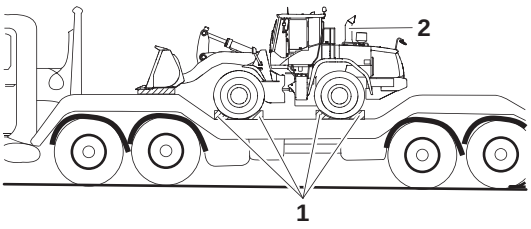
Figure 6

15. Make sure to secure the machine onto the trailer before transporting. Use the wheel chocks (1, Figure 7) supplied with the machine to secure machine See “Wheel Chocks” on page 3-89. Tie front and rear tie down point (3, Figure 8) on the frame with wire cables or chains as required by local transportation regulations.

IMPORTANT

When tying down the machine, ensure machine does not come into contact with cables and chains. Machine can be damaged by inappropriate tie down method. Do not use the cylinder as tie down points.



FG028820

Figure 7

16. 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.

NOTE: *To avoid air being forced down the exhaust pipe when transporting, it must be covered with suitable protection (2, Figure 7) (not plastic). This will prevent turbocharger damage.*

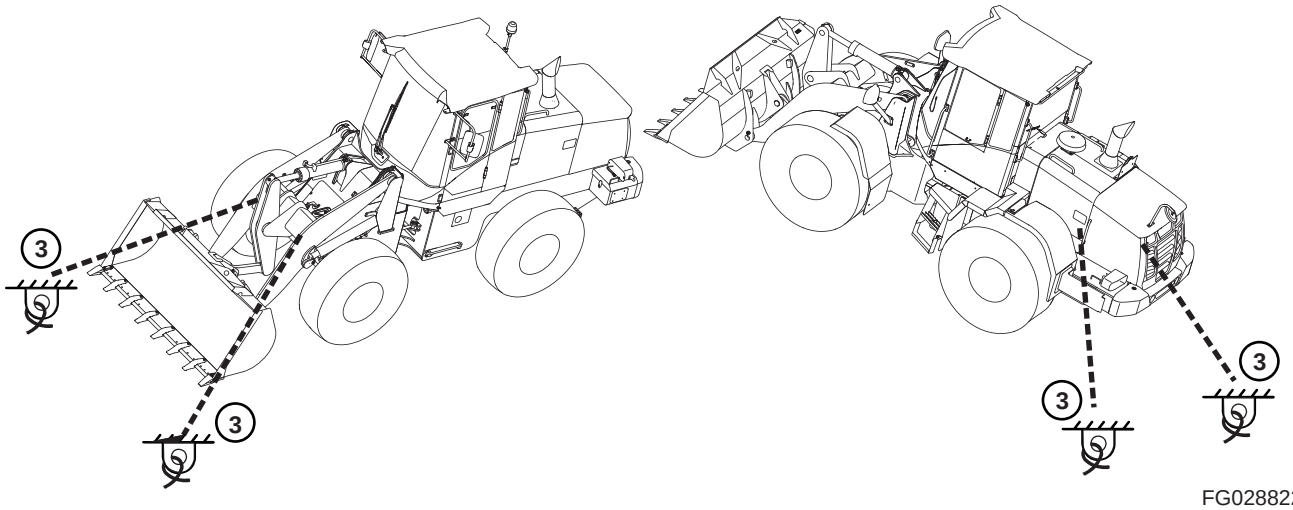


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Figure 8

Unloading

1. Make sure that trailer is parked on firm and level ground. See Figure 9.
2. Make sure that ramps that are being used are designed to handle the weight of the machine. 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.

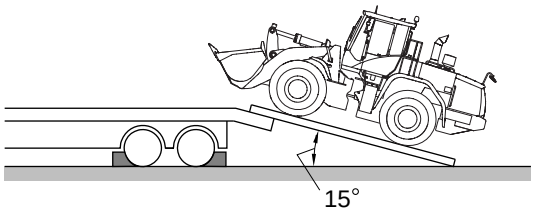

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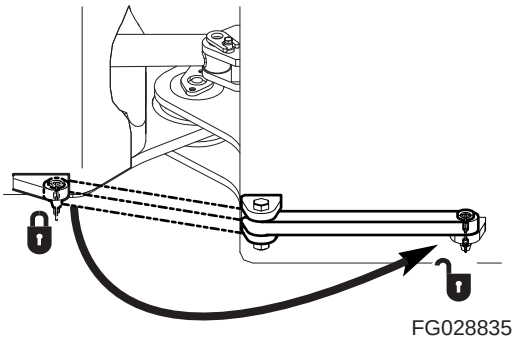
Figure 9

4. Remove wheel chocks and tie down wire cables.
5. Set articulated frame lock to "UNLOCK" position.
6. Turn battery disconnect switch to "ON" direction.
7. Start the engine.
8. Set pilot cutoff switch to "I" (UNLOCKED) position.
9. Set parking brake switch to "O" (DISENGAGED) position.
10. Drive machine slowly for unloading.



FG028835

Figure 10

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.

Do not use handrails or ladders to lift the machine.

1. Refer to "Specification" section of this manual for weight and dimensional information. Machine weight may vary with optional equipment.
2. Place the machine on firm and level ground. Engage parking brake and lock the work equipment.
3. Stop engine and remove key.
4. Install articulated frame lock before lifting the machine. (Figure 10).
5. Secure any equipped attachments.
6. Always lift the machine as shown Figure 11. Use lifting point provided on machine.
7. Use properly rated cables, slings and fixtures. Use lifting cables that are long enough to prevent contact with the machine. Spreader bars may be required.
8. Place protective material between the cables and the machine to prevent damage.
9. The maximum angle between the cables must not exceed 45°.
10. While machine is lifted, keep the machine horizontal and lift the machine slowly to keep it balanced.

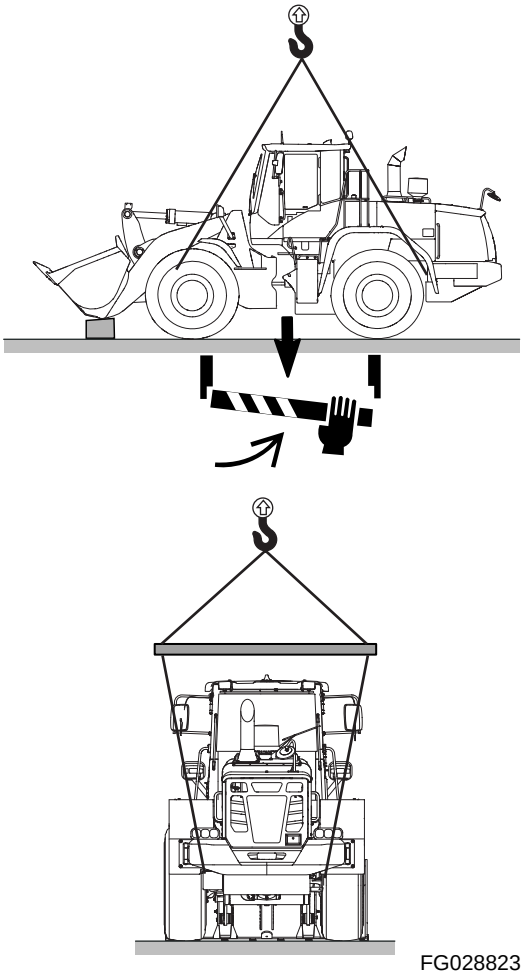


Figure 11

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 & 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.

BRAKING

Problem	Cause	Remedy
Reduced brake action.	Low secondary pressure in brake valve.	Repair or replace brake valve.
	Worn brake disks.	Replace brake disks.
	Damaged brake disks.	Replace brake disks.
	Damaged brake valve block.	Replace valve.
	Air in brake hydraulics because of leak in brake hose.	Repair leak, bleed system.
After bleeding brakes, brakes are not fully released.	Damaged brake disks.	Replace disks.
	Damaged brake disk return spring.	Replace return springs.

ELECTRICAL SYSTEM

Problem	Cause	Remedy
Battery will not hold a charge.	Low battery power.	Clean and retighten.
	Alternator belt loose or bad.	Tighten or replace belt.
	Loose or corroded terminals.	Tighten or replace as required.
	Alternator faulty.	Repair or replace as required.
Low battery power.	Internal battery short.	Replace battery.
	Short-circuit in wiring.	Repair as required.

ENGINE

Problem	Cause	Remedy
Starter does not operate.	Low battery power.	Charge battery.
	Poor terminal contact.	Clean and tighten connections.
	Starter switch failed.	Replace switch.
	Starter 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.	Drain water, clean or replace the fuel filter and new fuel.
	Air in fuel system.	Purge air from system.
	Engine stop control failed.	Contact your DOOSAN dealer.
	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.	Contact your DOOSAN dealer.
	Fuel filters plugged.	Replace filters.
	Exhaust system after-treatment parts faulty.	Check connectors and clean DEF (AdBlue) filter or replace filter.
	Low DEF (AdBlue) level.	Add DEF (AdBlue).

Problem	Cause	Remedy
Engine knocks, runs unevenly or surges.	Low engine oil.	Add oil.
	Plugged air intake system.	Clean system and replace filter.
	Plugged fuel filter.	Replace fuel filter.
	Water or dirt in fuel system.	Clean system and add new fuel.
	Clogged or dirty fuel injectors.	Contact your DOOSAN distributor.
Engine has poor power.	Plugged air intake system.	Clean system and replace filter.
	Clogged or dirty fuel injectors.	Contact your DOOSAN distributor.
	Fuel filters plugged.	Replace filters.
	Valve backlash faulty.	Adjust backlash.
	Exhaust system after-treatment parts faulty.	Check connectors and clean DEF (AdBlue) filter or replace filter.
	Low DEF (AdBlue) level.	Add DEF (AdBlue).
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.
Engine oil pressure warning light turns "ON", and buzzer sounds.	Low engine oil level.	Add oil.
	Wrong grade oil for weather.	Change oil.
	Clogged oil filter.	Change filter and oil.
	Defective alarm switch.	Contact your DOOSAN distributor.
	Oil leakage from pipe or joint.	
	Clogged suction strainer.	
	Excessive engine wear.	
	Defective oil pump.	

Problem	Cause	Remedy
Coolant temp. warning light turns "ON".	Low engine coolant level.	Add coolant.
	Loose/slipping/broken fan belt.	Adjust or replace belt.
	Clogged radiator fins.	Clean.
	Scale or mineral build up inside radiator.	Flush or professionally clean.
	Defective alarm switch (gauge is in green).	Contact your DOOSAN distributor.
	Low water pump flow.	
	Thermostat stuck or missing.	
Engine does not start when the starter motor is turning. (Also see ELECTRICAL TROUBLESHOOTING.)	Fuel filter clogged.	Replace fuel filter.
	Starter motor speed too low.	Booster Battery may be used.
	Defective engine shutoff solenoid.	Contact your DOOSAN distributor.
	Fuel pump failure.	
	Incorrect fuel injection timing.	
	Compression pressure too low.	
	Defective injectors.	
Unstable (rough) idling.	Air in fuel lines.	Tighten fuel connections and filter.
	Fuel filter clogged.	Replace fuel filter.
	Fuel pump failure.	Contact your DOOSAN distributor.
	Incorrect fuel injection timing.	
Insufficient power.	Air cleaner clogged.	Clean or replace element.
	Fuel filer clogged.	Replace fuel filter.
	Engine oil level too high.	Check dipstick and correct level.
	Incorrect valve clearance.	Contact your DOOSAN distributor.
	Piston ring wear.	
	Defective injectors.	
	Fuel pump failure.	

HYDRAULIC SYSTEM

Problem	Cause	Remedy
None of the controls function (loud noise from pumps).	Hydraulic pump failed.	Contact your DOOSAN dealer.
	Low hydraulic oil level.	Add hydraulic oil as required.
	Suction line plugged or damaged.	Clean or replace as required.
None of the controls function (no noise from pumps).	Pilot pump failure.	Contact your DOOSAN distributor.
	Cutoff solenoid valve failed.	Replace solenoid.
	Relief cartridge of pilot parking valve stuck.	Clean or replace as required.
	Safety Limit Switch is ON.	Adjust Limit 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 distributor.
	Main relief pressure too low.	Contact your DOOSAN distributor.
	Hydraulic pumps cavitating.	Bleed air from hydraulic pumps.
Only one or two actuators 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.	Debris in exterior of cooler.	Clean exterior of cooler.
	Oil cooler faulty.	Contact your DOOSAN distributor.
	Fan belt loose.	Tighten fan belting as required.

Problem	Cause	Remedy
Actuators on one side of boom have little power or do not operate.	Overload relief valve is not operating properly.	Repair valve or replace.
	Damaged hydraulic hose.	Replace hose.
	Loose hydraulic fittings.	Tighten fittings.
	Internal damage to control valve housing.	Replace control valve.
	Control valve spool damaged.	Replace control valve.
	Sediment inside control valve.	Clean and repair valve.
	Check valve internal leakage.	Repair or replace valve.
	Damaged cylinder or pump.	Repair or replace pump or cylinder.
	Cylinder internal leakage.	Repair or replace cylinder.
	Damaged cylinder rod.	Replace rod.
	Pilot valve failure.	Replace pilot valve.

STEERING

Problem	Cause	Remedy
Steering wheel is hard to turn.	Sediment blocking direction change spool orifice, inside priority valve.	Clean and repair.
	Sediment blocking amplifying spool orifice, inside priority valve.	Clean and repair.
	Sediment blocking load sensing line orifice, inside priority valve.	Clean and repair.
	Priority valve spool sticking, inside steering valve.	Clean and repair.
	Incorrect relief valve pressure drop, inside priority valve.	Adjust pressure.
	Steering pump failure.	Repair or replace.
	Leaking steering cylinder.	Repair cylinder.
	Rust on steering column bearing and spline.	Lubricate.
	Tire air pressure is low.	Inflate to proper pressure.
High initial resistance to movement of steering wheel.	Air in load sensing line, inside priority valve.	Bleed system to remove air.
	Sediment blocking orifice of load sensing line, inside priority valve.	Clean and repair.
	Sediment in direction change spool, inside priority valve.	Clean and repair.
	Damage to control spring damping inside priority valve.	Replace priority valve.
Steering wheel shakes.	Bearing chattering in axle end differential.	Replace bearing.
	Tire pressure not equal in left side and right side tires.	Equalize tire pressure.

TRAVEL SYSTEM

General

Problem	Cause	Remedy
Machine will not travel.	Transmission clutch pressure incorrect.	Adjust pressure.
	Transmission charge pump damaged.	Replace pump.
	Damage to transmission control valve wiring harness.	Repair wiring.
	Burned travel relay or fuse.	Replace relay or fuse.
	Forward/Reverse solenoid for transmission control valve sticking.	Clean and repair.
	Damaged transmission clutch.	Repair or replace clutch.
	Damaged driveshaft.	Repair or replace.
	Damaged transmission or axle.	Repair or replace.
	Wheel brakes not releasing.	Repair brakes.
	Parking brake not releasing.	Repair parking brake.
Machine will travel but has little power.	Fluid pressure low in transmission clutch.	Repair clutch.
	Transmission fluid low.	Add fluid.
	Damage to torque converter.	Repair or replace.
	Engine malfunction.	See Engine Troubleshooting Table.
	Brake valve.	Disassemble and clean.
Unusual transmission noise.	Low transmission fluid, or low quality fluid.	Add fluid or change fluid.
	Worn transmission parts.	Replace parts.
	Broken gears or bearings.	Replace parts.
Transmission fails to operate.	Damaged transmission clutch disks.	Replace disks.
	Damaged wires in transmission control wire harness.	Repair wires.

Problem	Cause	Remedy
Driveshaft vibration Noisy universal joints.	Bent driveshaft.	Replace driveshaft.
	Loose universal joints.	Tighten bolts that secure joints.
	Worn or damaged universal joint.	Replace universal joint.
	Loose universal joints.	Tighten bolts that secure universal joints.
	Lack of lubrication.	Lubricate universal joints.
	Worn slip joint spline.	Replace slip joint.
Noisy Front or Rear Axle.	Worn or broken gears.	Replace gears.
	Low oil level, poor quality oil.	Add oil, change oil.
	Worn bearings.	Replace bearings.
	Worn shaft spline.	Replace spline.

Specification

GENERAL SPECIFICATIONS

DL250-3		
Item		**Specification**
Standard Bucket Capacity (BOT / BOC)		2.5 m^3 (3.3 yd^3) / 2.6 m^3 (3.4 yd^3)
Vehicle Weight		14,200 kg (31,310 lb)
Engine		
Emission		US EPA Tier 4i (EU Stage IIIB)
Maker and Model		Doosan Infracore / DL06K
Type		4-Cycle Water Cooled, Turbocharge, Direct Injection, Exhaust Gas Recirculation
Rated Gross Power		128 kW (172 HP) @ 2,100 rpm (SAE J1995)
Transmission		
Full Automatic Power -Shift		Full Automatic Power Shift
Speeds		4 Forward, 3 Reverse
Brake Systems		
Travel Brakes		4 Wheel, Wet Disk
Parking Brake		SAHR, Dry Disk Type
Performance		
Travel Speed km/h (MPH)	4 speed (Forward)	8.1 (5.0) / 13.7 (8.5) / 26.5 (16.5) / 38 (23.6)
	3 speed (Reverse)	8.5 (5.3) / 14.4 (8.9) / 27.7(17.2)
Steering Angle		±40°
Minimum Tire Turning Radius (Out Tire Edge)		5,475 mm (18')
Rated Operating Load		4,700 kg (10,360 lb)
Maximum Breakout Force (Bucket)		121 kN (27,200 lb•f)
Arm Raise Time		6.0 ±0.5 Sec.
Bucket Dump Time		1.3 ±0.3 Sec.
Arm Lowering Time		2.7 ±0.4 Sec.
Maximum Gradeability		30° (58%)

DL250TC-3		
Item		**Specification**
Standard Bucket Capacity (BOT / BOC)		2.5 m^3 (3.3 yd^3) / 2.6 m^3 (3.4 yd^3)
Vehicle Weight		14,100 kg (31,090 lb)
Engine		
Emission		US EPA Tier 4i (EU Stage IIIB)
Maker and Model		Doosan Infracore / DL06K
Type		4-Cycle Water Cooled, Turbocharge, Direct Injection, Exhaust Gas Recirculation
Rated Gross Power		128 kW (172 HP) @ 2,100 rpm (SAE J1995)
Transmission		
Full Automatic Power -Shift		Full Automatic Power Shift
Speeds		4 Forward, 3 Reverse
Brake Systems		
Travel Brakes		4 Wheel, Wet Disk
Parking Brake		SAHR, Dry Disk Type
Performance		
Travel Speed km/h (MPH)	4 speed (Forward)	8.1 (5.0) / 13.7 (8.5) / 26.5 (16.5) / 38 (23.6)
	3 speed (Reverse)	8.5 (5.3) / 14.4 (8.9) / 27.7(17.2)
Steering Angle		±40°
Minimum Tire Turning Radius (Out Tire Edge)		5,475 mm (18')
Rated Operating Load		3,885 kg (8,565 lb)
Maximum Breakout Force (Bucket)		115.6 kN (25,980 lb·f)
Arm Raise Time		5.8 ±0.5 Sec.
Bucket Dump Time		2.9 ±0.3 Sec.
Arm Lowering Time		2.9 ±0.4 Sec.
Maximum Gradeability		30° (58%)

WORKING RANGE AND DIMENSIONS

DL250-3

Figure 1, illustrates exterior machine dimensions and working range of machine when it is equipped with a standard bucket.

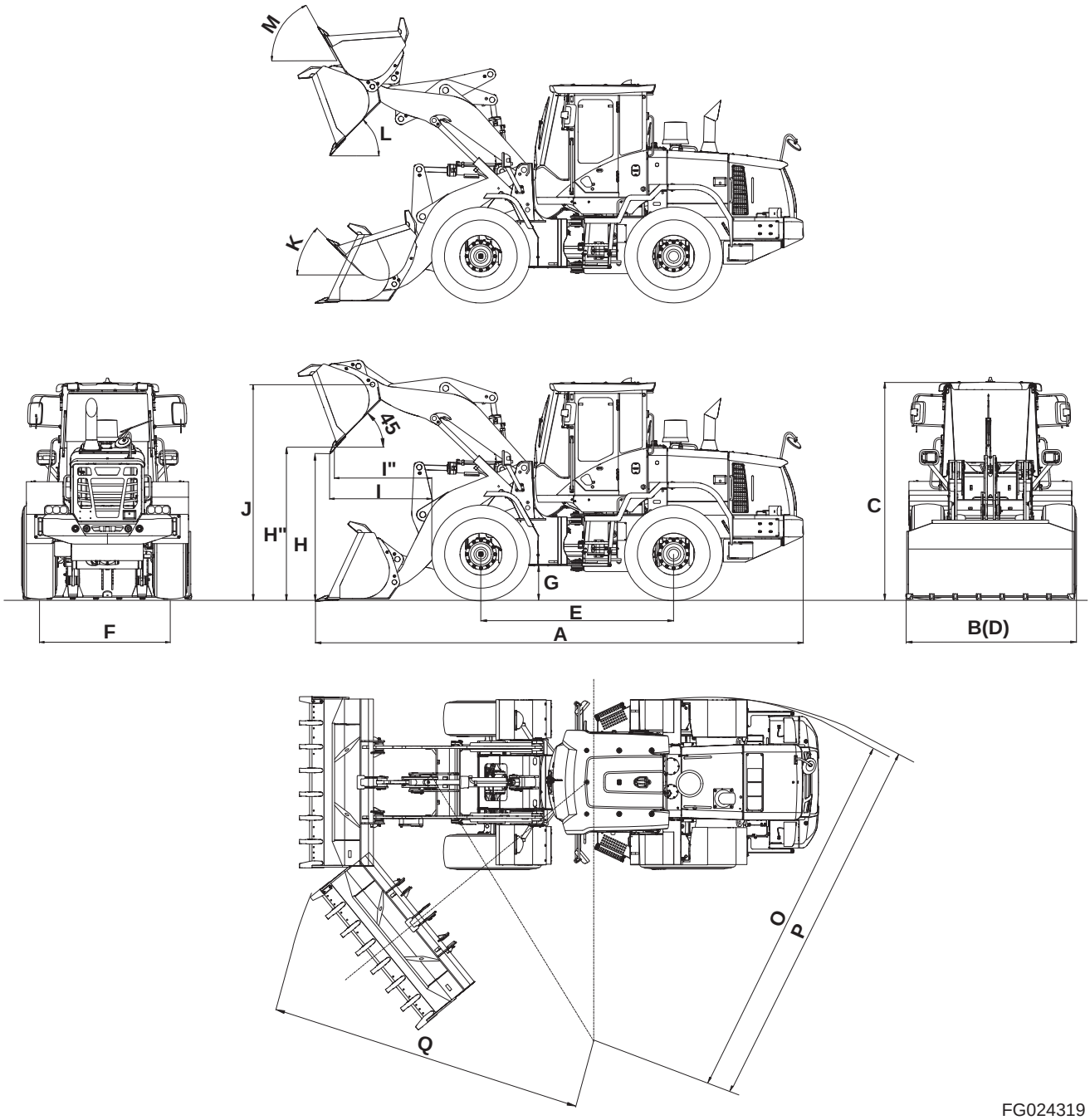


Figure 1

Category		Dimension	
Tire Size		20.5R25 (L3)	
Bucket		2.5 m^3 (BOT)	2.6 m^3 (BOC)
Overall Length	(A)	7,715 mm (25' 4")	7,610 mm (25')
Overall Width	(B)	2,740 mm (9')	
Overall Height	(C)	3,280 mm (10' 9")	
Bucket Width	(D)	2,740 mm (9')	
Wheel Base	(E)	3,020 mm (9' 11")	
Tread	(F)	2,040 mm (6' 8")	
Ground Clearance	(G)	415 mm (1' 4")	
Dump Height, at 45° (to BOT / BOC)	(H)	2,745 mm (9')	2,825 mm (9' 2")
Dump Height, at 45° (to Bucket edge)	(H")	2,898 mm (9' 6")	
Dump Reach, at 45° (to BOT/ BOC)	(I)	1,122 mm (3' 8")	
Dump Reach, at 45° (to Bucket Edge)	(I")	980 mm (3' 3")	995 mm (3' 3")
Bucket Hinge Height	(J)	3,900 mm (12' 10")	
Maximum Tilt Angle at Carry	(K)	50 °	
Maximum Dump Angle at Fully Raised	(L)	47 °	
Maximum Tilt Angle at Fully Raised	(M)	61 °	
Turning Radius			
(Outer Tire Edge)	(O)	5,475 mm (18')	
(Counterweight Edge)	(P)	5,415 mm (17' 9")	
(Bucket Edge)	(Q)	6,095 mm (20'	6,070 mm (19' 11")

DL250TC-3

Figure 2, illustrates exterior machine dimensions and working range of machine when it is equipped with a standard bucket.

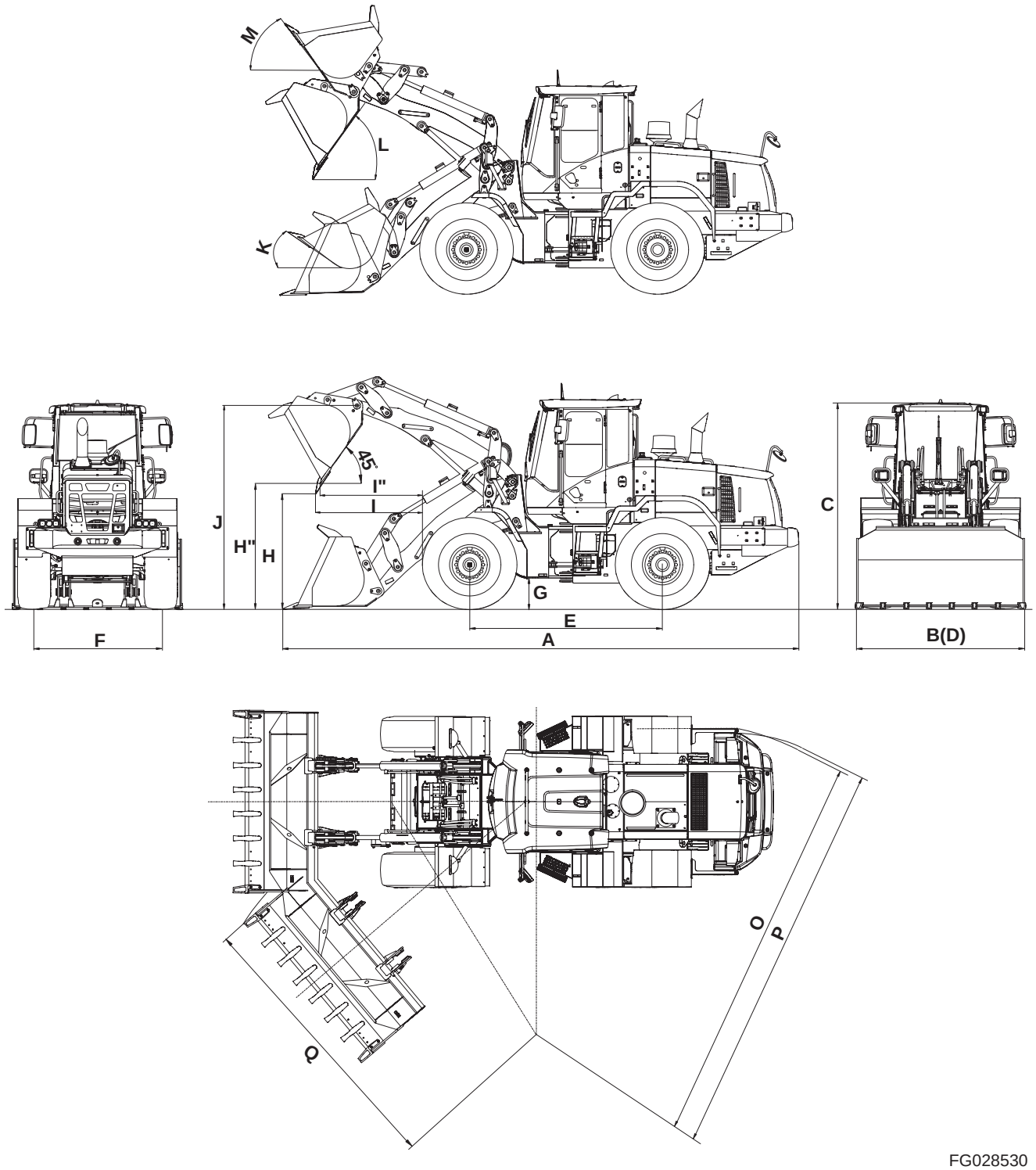


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Figure 2

Category		Dimension	
Tire Size		20.5R25 (L3)	
Bucket		2.5 m^3 (BOT)	2.6 m^3 (BOC)
Overall Length	(A)	7,945 mm (26' 1")	7,840 mm (25' 9")
Overall Width	(B)	2,740 mm (9')	
Overall Height	(C)	3,280 mm (10' 9")	
Bucket Width	(D)	2,740 mm (9')	
Wheel Base	(E)	3,020 mm (9' 11")	
Tread	(F)	2,040 mm (6' 8")	
Ground Clearance	(G)	415 mm (1' 4")	
Dump Height, at 45° (to BOT / BOC)	(H)	2,670 mm (8' 9")	2,750 mm (9')
Dump Height, at 45° (to Bucket edge)	(H")	2,820 mm (9' 3")	
Dump Reach, at 45° (to BOT/ BOC)	(I)	1,370 mm (4' 6")	1,300 mm (4' 3")
Dump Reach, at 45° (to Bucket Edge)	(I")	1,270 mm (4' 2")	
Bucket Hinge Height	(J)	3,935 mm (12' 11")	
Maximum Tilt Angle at Carry	(K)	48 °	
Maximum Dump Angle at Fully Raised	(L)	50 °	
Maximum Tilt Angle at Fully Raised	(M)	51 °	
Turning Radius			
(Outer Tire Edge)	(O)	5,475 mm (18')	
(Counterweight Edge)	(P)	5,415 mm (17' 9")	
(Bucket Edge)	(Q)	6,095 mm (20'	6,070 mm (19' 11")

WORKING CAPACITIES

Bucket Capacity

Standard bucket (BOC) has a capacity of 2.6 m^3 (3.4 yd^3).

Stability

DL250-3

[Unit: kg (lb)]

Bucket Mount	Pin On	Remark
Configuration	Bolt-on Edge (2.6 m^3)	* Base On 20.5R25 (L2) ** This data is applicable on firm and level ground.
Lifting Capacity @ Max. Height	7,610 (16,780)	
Static Tipping Load @ Max. Reach - Straight	10,840 (23,900)	
Static Tipping Load @ Max. Reach - Full Turn	9,400 (20,720)	
Rated Operating Load	4,700 (10,360)	

DL250TC-3

[Unit: kg (lb)]

Bucket Mount	Pin On	Remark
Configuration	Bolt-on Edge (2.6 m^3)	* Base On 20.5R25 (L2) ** This data is applicable on firm and level ground.
Lifting Capacity @ Max. Height	7,200 (15,870)	
Static Tipping Load @ Max. Reach - Straight	8,930 (19,690)	
Static Tipping Load @ Max. Reach - Full Turn	7,770 (17,130)	
Rated Operating Load	3,885 (8,565)	

Material Weight

The data below describes weight of a cubic meter (cubic yard) of many types of workload materials.

APPROXIMATE WEIGHT OF WORKLOAD MATERIALS

IMPORTANT

Weights are approximations of estimated average volume and mass. Exposure to rain, snow or ground water; settling or compaction 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/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
Charcoal	401 kg/m³ (695 lb/yd³)	-	-	-
Coke, blast furnace size	433 kg/m³ (729 lb/yd³)	-	-	-
Coke, foundry size	449 kg/m³ (756 lb/yd³)	-	-	-
Coal, bituminous slack, piled	801 kg/m³ (1,350 lb/yd³)	-	-	-
Coal, bituminous r. of m., piled	881 kg/m³ (1,485 lb/yd³)	-	-	-
Coal, anthracite	897 kg/m³ (1,512 lb/yd³)	-	-	-
Clay, DRY, in broken lumps	1,009 kg/m³ (1,701 lb/yd³)	-	-	-
Clay, DAMP, natural bed	-	-	1,746 kg/m³ (2,943 lb/yd³)	-
Cement, portland, DRY granular	-	-	1,506 kg/m³ (2,583 lb/yd³)	-
Cement, portland, DRY clinkers	-	1,362 kg/m³ (2,295 lb/yd³)	-	-
Dolomite, crushed	-	-	1,522 kg/m³ (2,565 lb/yd³)	-
Earth, loamy, DRY, loose	-	1,202 kg/m³ (2,025 lb/yd³)	-	-
Earth, DRY, packed	-	-	1,522 kg/m³ (2,565 lb/yd³)	-
Earth, WET, muddy	-	-	1,762 kg/m³ (2,970 lb/yd³)	-
Gypsum, calcined, (heated, powder)	961 kg/m³ (1,620 lb/yd³)	-	-	-

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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