



Shop Manual

DX190W-3 Excavator

Serial Number 1001 and Up

DOOSAN and the DOOSAN logo are registered trademarks of DOOSAN Corporation in the United States and various other countries around the world.



950106-00402E

June 2012

Product: 2012 Doosan DX190W-3 Wheeled Excavator Service Repair Workshop Manual

Full Download: <https://www.arepairmanual.com/downloads/2012-doosan-dx190w-3>

[-wheeled-excavator-service-repair-workshop-manual/](https://www.arepairmanual.com/downloads/2012-doosan-dx190w-3-wheeled-excavator-service-repair-workshop-manual/)

Sample of manual. Download All 1210 pages at:

<https://www.arepairmanual.com/downloads/2012-doosan-dx190w-3-wheeled-excavator-service-repair-workshop-manual/>

Table of Contents

Safety

Wheeled Excavator Maintenance Safety.....	SP002611
---	----------

Specifications

Specifications for DX190W-3.....	SP002684
----------------------------------	----------

General Maintenance

General Maintenance Instructions.....	SP002454
Standard Torques.....	SP002404

Upper Structure

Cabin	SP002613
Counterweight.....	SP002688
Fuel Tank.....	SP002687
Fuel Transfer Pump (Option).....	SP002616
Swing Bearing.....	SP002617
Air Compressor.....	SP002619

Lower Structure and Chassis

Ram Lock Valve.....	SP002620
Double Pilot Check Valve	SP002621
Solenoid Valve.....	SP002622
Front Axle	SP002765
Rear Axle	SP002766

Engine and Drivetrain

Transmission	SP002625
Drive Coupling (Main Pump).....	SP002626

Hydraulics

Hydraulic System Troubleshooting, Testing and Adjustment	SP002722
Accumulator.....	SP002628
Center Joint (Swivel).....	SP002629
Cylinders.....	SP002708
Swing Device	SP002498
Main Pump and PTO	SP002633
Main Control Valve	SP002721
Gear Pump	SP002702
Travel Motor.....	SP002724
Counterbalance Valve	SP002637
Service Brake Supply Valve	SP002638
Remote Control Valve (Work Lever / Joystick)	SP002744
Steering Valve	SP002640
Accelerator Pedal Valve (Hydraulic)	SP002641
Solenoid Valve Assembly	SP002642
Breaker EPPR Valve (Option)	SP002691
Intelligent Floating Boom (Option)	SP002645
Quick Fit Valve.....	SP002689
Logic Valve	SP002690
Dozer Valve	SP002529
Service Brake Pedal Valve	SP002723
Hydraulic Schematic (DX190W-3).....	SP002692

Electrical System

Electrical System	SP002649
Electrical Schematic	SP002650

Attachments

Boom and Arm.....	SP002710
Bucket.....	SP002506

Safety

Wheeled Excavator Maintenance Safety

Edition 1

MEMO

Table of Contents

Wheeled Excavator Maintenance Safety

Safety Instructions	5
Applicable Models	5
Safety Messages	7
Safety Decals	8
General	9
Transportation	22
Operation	24
Maintenance	42
Environment and Circumstances.....	58

MEMO

SAFETY INSTRUCTIONS



WARNING

AVOID DEATH OR SERIOUS INJURY

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

APPLICABLE MODELS

The contents of this section apply to the following models and serial number ranges.

MODEL	SERIAL NUMBER RANGE
DX140W-3	1001 and Up, 50001 and Up
DX160W-3	1001 and Up, 50001 and Up
DX170W-3	1001 and Up
DX190W-3	1001 and Up

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.

The word "NOTE" identifies information for effective use.

SAFETY DECALS

Location of safety labels (decals) can vary from unit to unit.

Refer to appropriate Operation and Maintenance Manual, and parts manual for your unit.

Always replace damaged or faded decals.

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 a machine.
- When working with other personnel on a work site, be sure that all personnel know nature of work and understand all hand signals that are to be used.
- Be sure that all guards and shields are installed in their proper location. Have guards and shields repaired or replaced immediately if damaged.
- Be sure that you understand the use and maintenance of all safety features such as safety lock lever and seat belt. Use them properly.
- Never remove, modify or disable any safety features. Always keep them in good operating condition.
- Always check for and know the location of underground and overhead utility lines before excavating.
- Failure to use and maintain safety features according to instructions in this manual, Safety Manual and Shop Manual can result in death or serious injury.

Know Your Machine

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

Proper Work Tools and Attachments

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

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

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

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

Never use attachment as a work platform or manlift.

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

Pressurized Fluids

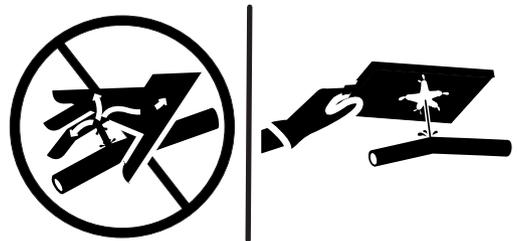
Pressurized air or fluids can cause debris and/or fluids to be blown out. This could result in death or serious injury.

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

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

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

Releasing trapped pressure can cause sudden machine movement or attachment movement. Use caution if you



FG018457

Figure 1

disconnect hydraulic lines or fittings.

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

Obey all local laws and regulations for disposal of liquids.

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

Flying or Falling Objects

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

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

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

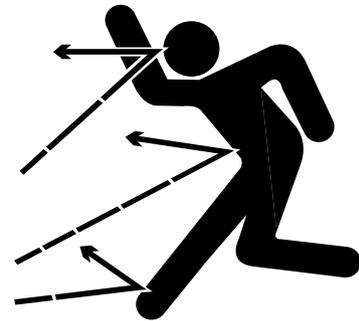


Figure 2

HAOA110L



Figure 3

HAOA100L

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.



Figure 4

Correction of Machine Problems

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

Crushing and Cutting

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

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

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

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

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

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

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



HDO1010L

Figure 5

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 6

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



FG019096

Figure 7

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:

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

Maintenance

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

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

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

Operation

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

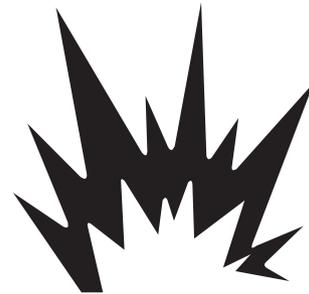
Do not operate machine near any flame.

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



HDO10151

Figure 8



FG018458

Figure 9

Electrical

Check all electrical wiring and connections for damage daily.

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

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

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

Improper jumper cable connections can cause an explosion that can result in death or serious injury. Refer to Operation and Maintenance 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.

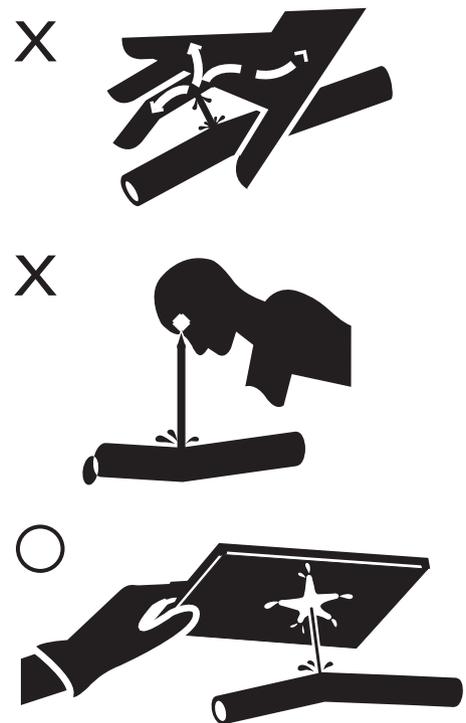
Hydraulic System

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.



HDO1045I

Figure 10

Fueling

Use caution when you are refueling a machine.

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

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

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

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

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

Always place plastic fuel containers on the ground before filling.



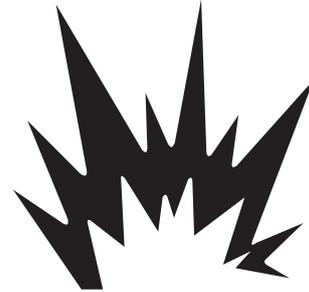
ARO1050S

Figure 11

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 12

Welding and Grinding

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

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

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

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

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

If a Fire Occurs

If a fire occurs:

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

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



FG018459

Figure 13

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

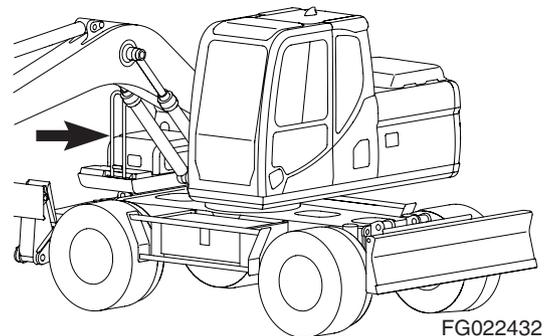
To be prepared in the event of a fire:

- Be sure that fire extinguishers have been provided and read labels to ensure that you know how to use them. It is recommended that an appropriately sized (2.27 kg (5 lb) or larger) multipurpose A/B/C fire extinguisher be mounted in cabin. Check and service fire extinguisher at regular intervals and make sure that all work site crew members are adequately trained in its use.
- Inspect fire extinguisher and service fire extinguisher regularly.
- Follow instructions on extinguisher instruction plate.
- Keep a first aid kit in storage compartment (Figure 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.



HDO1009L

Figure 14



FG022432

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.*

Rollover Protective Structure (ROPS)

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

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

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

ROPS Certification

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

The ROPS certification plate (Figure 16) is found on the left side of the cabin on most models. It may vary slightly in its location on some models.

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

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

ROPS – Rollover Protective Structure complies with ISO 12117-2:2008.

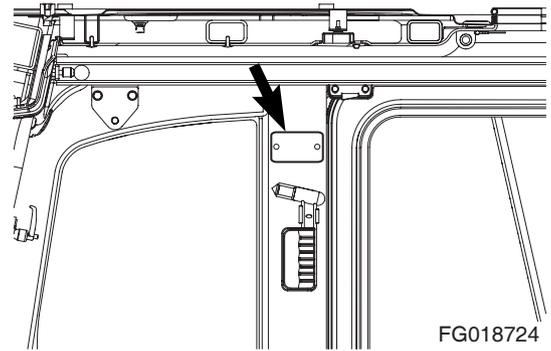


Figure 16



WARNING

AVOID DEATH OR SERIOUS INJURY

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

Protecting Cabin from Flying or Falling Objects (Optional)

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

For breaker operation, install a front guard (1, Figure 17) and apply a laminated coating sheet to front glass. Contact your DOOSAN distributor for recommendations.

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

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

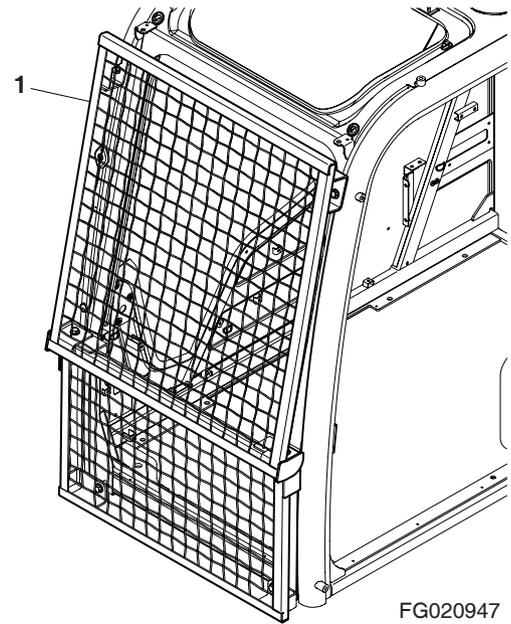


Figure 17

When working in mines, quarries or other work sites where there is a hazard of falling rocks, install Operator Protection Guard (OPG) (2, Figure 18) and apply a laminated coating sheet to front glass.

When OPG is installed, and front window needs to be cleaned, loosen bolts marked with arrows (Figure 18). Be sure to tighten bolts when done.

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

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

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

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

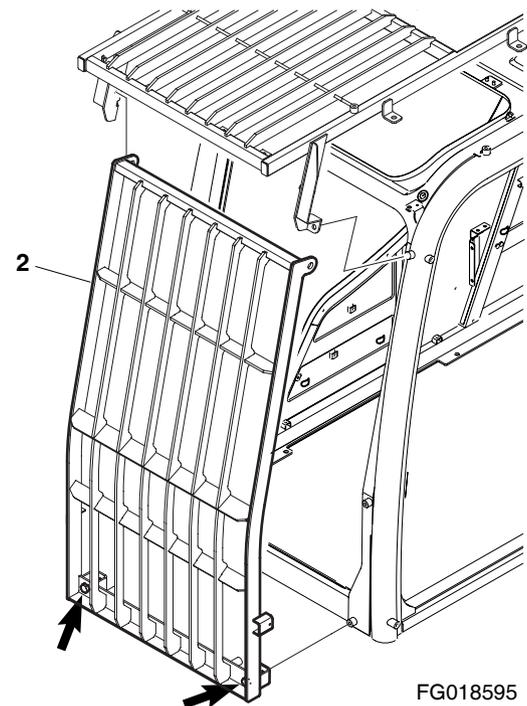


Figure 18

Emergency Exit from Operator's Station

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

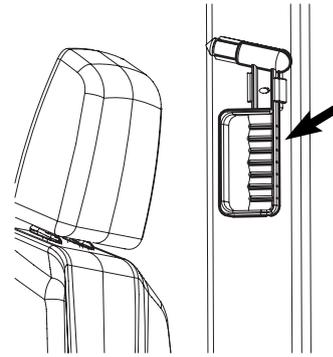
- Be careful also not to slip on broken pieces of glass on ground.



WARNING

AVOID DEATH OR SERIOUS INJURY

Protect your eyes when breaking the glass.



FG015808

Figure 19

TRANSPORTATION

Obey State and Local Over-the-Road Regulations

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

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

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

Refer to Operation and Maintenance Manual, 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, dozer, outriggers and lower structure. On a rainy day, be careful since ramp surfaces can be slippery.
- Turn auto idle selector button "OFF".
- Set machine travel speed to "LOW".
- "ENGAGE" swing lock to prevent upper structure from moving.
- Run engine at low speed and travel slowly.
- When on ramps, do not operate any control lever except for travel lever.
- Never correct your steering on ramps. If necessary, drive off ramps, correct machine direction, then drive back onto ramps.

- When driving up or down ramps, the center of gravity of machine will change suddenly causing the tires to drop down to the ramps or trailer. This will occur at the joint between the ramps and trailer. Travel slowly over this point.
- Cover the exhaust pipe to prevent turbocharger damage. Lock the cabin door and lower the antenna.
- After loading, block each tire and secure the machine with tie-downs of adequate load rating, so the machine cannot move.
- 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.

Before Engine Starting

Machine Condition

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

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

IMPORTANT

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

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

Before moving machine, check position of lower structure. The normal travel position is with dozer blade to front under cabin and outriggers (stabilizers) to rear. When lower structure is rotated in reversed position, directional or travel controls must be operated in opposite directions.

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

Know maximum operating dimensions of your machine.