COMPACT EXCAVATOR

AEM
Association of
Equipment Manufacturers

SAFETY MANUAL

FOR OPERATING AND MAINTENANCE PERSONNEL

ISBN 978-1-937029-57-9
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FORM CESE-1009 07/18

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Acknowledgment

We wish to thank the members of the Association of Equipment Manufacturers for their invaluable contributions in preparing this Safety Manual.

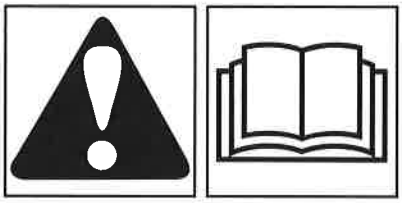
Foreword

This safety manual is intended to point out some of the basic safety situations that may be encountered during the normal operation and maintenance of your machine and to instruct you in safety practices for dealing with these conditions. This manual is **NOT** a substitute for the manufacturer's operating manual(s).

Additional precautions may be necessary, or some instructions may not apply, depending on equipment, attachments and conditions at the job site or in the service area. The manufacturer has no direct control over equipment application, operation, inspection, or maintenance. Therefore, it is **YOUR** responsibility to use good safety practices in these areas.

The information provided in this manual supplements the specific information about your machine that is contained in the manufacturer's operating manual(s). Other information that may affect the safe operation of your machine may be contained in the following:

- Safety signs
- Insurance requirements
- Employer safety and training programs
- Safety codes
- Local, state/provincial, and federal laws, rules, and regulations



Read and understand manuals before operating

IMPORTANT! Before you operate this machine, make sure you have the manufacturer's manual(s) for this machine and all attachments. If the manufacturer's manuals are missing, obtain replacements from your employer, equipment dealer, or directly from the manufacturer. Keep this safety manual and the manufacturer's manuals with the machine at all times. Read and understand all applicable manuals.

Safety videos and other training resources are available from some manufacturers and dealers. Operators are encouraged to periodically review these resources.

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ISBN 978-1-937029-57-9

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Revised 05/03, 09/10, and 03/18

Safety Alerts

Safety Alert Symbol

This Safety Alert Symbol means: **"Attention! Stay alert! Your safety is involved!"**

The Safety Alert Symbol identifies important safety messages on equipment, safety signs, in manuals, or elsewhere. When you see this symbol, be alert to the possibility of death or personal injury. Carefully read the message that follows and inform other operators. Follow instructions in the safety message.

Signal Words

Signal words are distinctive words that are typically found on safety signs on the compact excavator and other job site equipment. These words may also be found in this manual and the manufacturer's manuals. These words are intended to alert the operator to a hazard and the degree of severity of the hazard.

DANGER indicates a hazardous situation that, if not avoided, will result in death or serious injury.

WARNING indicates a hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION indicates a hazardous situation that, if not avoided, may result in minor or moderate injury.

NOTICE is used to address practices not related to physical injury.

A Word to the User/Operator

It is **YOUR** responsibility to read and understand this safety manual and the manufacturer's manual(s) before operating this equipment. This safety manual takes you step by step through the working day.

Graphics have been provided to help you understand the text.

Hazard recognition and accident prevention depend upon you being alert, careful, and properly trained in the inspection, operation, transport, maintenance, and storage of this equipment.

Read and understand manuals before operating

Remember that **YOU** are the key to safety. Good safety practices not only protect you but also protect the people around you. Study this manual and the manufacturer's operating manuals for your specific machine. Make them a working part of your safety program. Keep in mind that this safety manual is written only for compact excavators.

After studying the manufacturer's operating manual(s) and this safety manual, please contact the equipment manufacturer with any remaining questions.

Practice all customary safe working precautions and remember:

Safe operation is up to you!

You can prevent death or serious injury caused by unsafe work practices!

One-Call First

Call

Before starting any digging project, contact the local One-Call service to have underground utilities located.

Call before you dig—dial 811 (USA only) 1-888-258-0808 (USA & Canada)

One-Call will notify participating utility companies that you intend to dig. You must also call any utility companies which do not participate in the One-Call service. Always inspect the job site for evidence of unmarked utilities and contact others if necessary.

Plan the Work

Be aware of the lead time for utility marking in the work area. This time may vary among different states, counties, provinces, or locales. If you do not locate utilities, accidents can occur causing injuries, service interruptions, damage to the environment, or job delays. Classify each job site based on the hazards already in place and use the proper work methods and equipment for the job site.

Dig

Most utilities mark their underground facilities using American Public Works Association (APWA) underground color codes. Verify marks before digging.

In the United States, the Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1926.651 requires that the estimated location of underground utilities be determined before beginning an excavation. When actual excavation approaches an estimated utility location, the exact location of the underground installation must be determined by a safe, acceptable and dependable method. Other OSHA regulations may also apply to the job site.

APWA Underground Color Codes

Color	Description/Meaning
Red	Electric power lines, cables, conduit, lighting cables
Yellow	Gas, oil, steam, petroleum, or gaseous materials
Orange	Communication, alarm or signal lines, cables or conduits
Blue	Potable water
Green	Sewers and drain lines
Purple	Reclaimed water, irrigation, and slurry lines
White	Proposed excavation
Pink	Temporary survey markings

Follow a Safety Program

For Safe Operation

You must be a qualified and authorized operator for safe operation of this machine. You must clearly understand the written instructions supplied by the manufacturer, be trained—including actual operation—and know the safety rules and regulations for the job site. It is a good safety practice to point out and explain safety signs and practices to others, and to make sure they understand the importance of following these instructions.

Never operate while impaired by alcohol or drugs

⚠ **WARNING!** Death or serious injury could result from operating machinery while impaired by drugs or alcohol. Drugs and alcohol affect operator alertness, coordination, and the ability to safely operate the equipment. **Never operate the machine while impaired by use of alcohol or drugs. Never knowingly allow anyone to operate the machine when their alertness or coordination is impaired.**

An operator taking prescriptions or over-the-counter medication must consult a medical professional regarding any side effects of the medication that would hinder their ability to safely operate this equipment.

Be Alert!

Know where to get assistance. Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.

Know how to use a first aid kit and fire extinguisher/fire suppression system; know their location and practice getting to them. Ensure they have been properly tested and maintained.

Let others know where you will be working, and what time you will be returning. In case of an emergency, you want others to know where to find you.

Be Aware!

Take advantage of training programs offered.

Know the proper response to a fire or chemical spill on your machine.

Follow a Safety Program

Be Careful!

Human error is the result of many factors: carelessness, fatigue, sensory overload, preoccupation, unfamiliarity with the machine or attachments, or drugs and alcohol, to name a few. You can avoid death or serious injury caused by these and other unsafe work practices. Be careful; never assume accidents cannot happen to you.

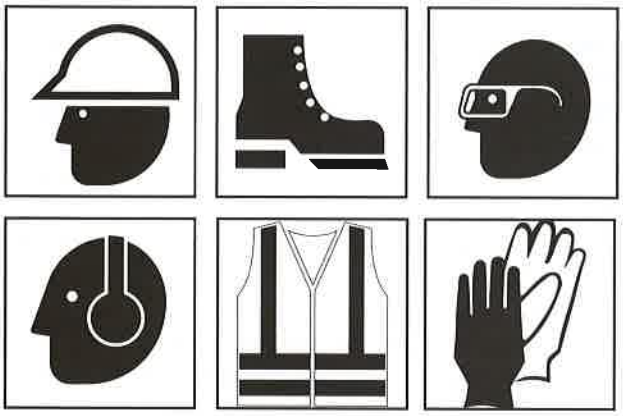
For your safety and the safety of others, act safely and encourage your fellow workers to act safely as well.

Protect Yourself

Wear all the personal protective clothing and Personal Protective Equipment (PPE) issued to you or called for by job conditions.

You may need:

- Hard hat
- Safety shoes
- Safety glasses, goggles, or face shield
- Heavy duty gloves
- Hearing protection
- Reflective clothing
- Wet weather gear
- Respirator or filter mask



Wear whatever is needed to protect yourself—do not take chances.

⚠ **WARNING!** Avoid death or serious injury from entanglement. **Do not wear loose or frayed clothing or accessories that could catch on moving parts.** Examples of items to avoid include flopping cuffs, dangling neckties and scarves, wallets attached to chains, jewelry and wristwatches.

Follow a Safety Program

Know the Rules

Most job sites have rules governing equipment use and maintenance. Before you start work at a new location, check with the supervisor or safety coordinator. Ask about the rules you will be expected to obey.

OSHA enforces federal laws within the United States that apply to the safe operation, application, and maintenance of equipment on some job sites. It is the employer's responsibility to comply with these laws. A federal representative may periodically inspect a job site to see that these laws are being followed.

There may be other local, state/provincial, federal laws or international organizations that regulate the use of this equipment, along with specific job site or employer rules. It is important that you know and comply with all applicable laws and rules, **including those requiring operator training and certification**.

These are some of the rules you must work by:

- Only qualified and authorized individuals may operate this equipment.
- Inspect your machine and attachments before each use as specified by the manufacturer and your employer. Ensure the attachment is properly installed. (See page 8, **Check Attachment and Coupler Installation**.)
- Know the limitations and operating characteristics of your equipment. Do not overload or misuse it.
- Wear proper clothing and PPE. Check that others are also wearing appropriate clothing.
- All shields, guards, air filters, access panels, and doors must be properly installed before each use.
- Know the rules regarding traffic at your job site. Know what all signs, flags, and markings mean. Know hand, flag, horn, whistle, siren, or bell signals, if used.
- Never modify or remove any part of the machine (except for qualified service personnel; then make sure the part is re-installed or replaced if defective or worn out.)

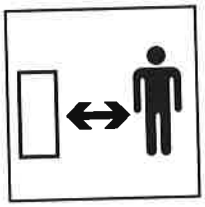
Know and understand rules of operation

Understand job site signals

Follow a Safety Program

Know the Rules (cont.)

- Never allow children to play near, ride on or operate the equipment.
- Keep bystanders away from the machine during operation.
- Know the work area before you use the equipment. Be aware of possible hazards.
- Only use attachments and parts that are approved by the manufacturer.
- Do not allow riders.
- Fasten seat belt before starting. If the compact excavator is equipped with foldable TOPS/ROPS, do not fasten the seat belt when the TOPS/ROPS is in the down position.
- Drive forward whenever possible.
- Always look in the direction of travel.
- Look before backing up.
- Never lift or swing a load or attachment over anyone.
- Whenever you leave your machine, always lower the excavator blade, bucket or other attachments to the ground. Follow all safe shutdown instructions (See page 19, **Safe Shutdown.**)
- Use three-point contact (handholds and steps) and face the equipment when mounting or dismounting. (See page 11, **Mount and Dismount Properly.**)



Keep bystanders away

Fasten your seat belt

Use three points of contact when mounting or dismounting

Follow a Safety Program

Know the Equipment

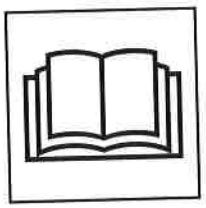
Read and understand the DANGER, WARNING, CAUTION, and NOTICE safety labels and other informational signs on the machine, the attachments, and in the manufacturer's operating manuals. Ask your supervisor or dealer to explain any information you do not understand. Failure to obey safety instructions could result in death or serious injury.

Know the following about your equipment:

- Function, purpose, and use of all controls
- Correct operation speeds
- Slope and uneven terrain capabilities and proper operation. (See page 18, **Slope and Uneven Terrain Operation.**)
- Braking and steering characteristics
- Turning radius and clearances
- How to quickly stop equipment in an emergency
- Rated lift capacity

Keep in mind that rain, snow, ice, loose gravel, soft ground, slopes, and other site conditions can affect your machine's operating capabilities. Make sure you are thoroughly familiar with your machine's stability, braking, traction, and other handling characteristics under any conditions you are likely to encounter.

IMPORTANT: This manual covers safe practices for Compact Excavators. If your machine is equipped with special attachments, read the manufacturer's operating and safety manuals pertaining to that attachment before using it.



Read and understand manuals before operating

Know machine capacity and operating characteristics

Prepare for Safe Operation

Check and Use All Available Safety Devices

To protect you and others around you, your machine may be equipped with the safety equipment listed below. Additional equipment may be required or some items may not apply, depending on attachments used, job site conditions, or applicable job site rules. Check that each required item is securely in place and in operating condition:

- Falling Object Guard Structure (FOGS)
- Falling Object Protective Structure (FOPS)
- Rollover Protective Structure (ROPS)
- Operator Protective Structure (OPS) - side, front and rear shields, screens and doors
- Tip-Over Protective Structure (TOPS)
- Seat belt
- Control locking device
- Access and egress system (e.g., grab handles, handrails)
- Protective covers
- Special enclosures or accessories required for specific applications or job site conditions
- Alternate exit
- Operating and warning lights
- Anti-skid tread/steps
- Safety signs
- Horn
- Guards
- Mirrors
- Travel alarm
- CCTV or visual aids
- Fire extinguisher
- First aid kit
- Rotating beacon
- Windshield wiper/ defroster

Use them! Never remove or disconnect any safety device.

Know which devices are required for protection during your specific operation and use them. If equipped with foldable TOPS/ROPS, the excavator can be operated temporarily with the TOPS/ROPS lowered for access through height restricted openings. Do not fasten the seat belt when the TOPS/ROPS is in the down position.

⚠ **WARNING! Never remove a ROPS, FOPS, OPS, FOGS or TOPS except when servicing the machine.** Reinstall them correctly before allowing the machine back into service. Serious injury or death could result. (See page 24, **Protective Structure Safety**.)

Fasten seat belt

Prepare for Safe Operation

Check the Machine

Before beginning your workday, inspect the machine and have all systems in good operational condition.

- Perform daily and periodic service procedures as instructed by the equipment manufacturer.
- Check that no safety switches or interlocks have been bypassed.
- Ensure no warning tags have been placed on the machine.
- Check for broken, missing, loose, or damaged parts. Make necessary repairs.
- Check the tracks for broken or damaged pins, bushings and other parts. Check for correct track tension.
- Keep the steps and handholds clean and free of grease, oil, dirt, snow or ice.
- Check condition and operation of the seat belt and its mounts, if equipped.
- Make sure that the foldable TOPS/ROPS, if equipped, is properly secured in the raised position.
- Check condition and operation of the attachment quick-coupling device, if equipped. Perform daily cleaning and maintenance following the manufacturer's instructions. (See page 8 **Quick-coupling Device Safety**.)
- Ensure shielding is properly installed and in good condition. Repair or replace if damaged or missing.
- Ensure work lights, if equipped, are kept clean. Check that all lights work properly.
- Ensure the horn and travel alarm, if equipped, are operating correctly. Repair or replace if damaged.
- Ensure any Slow Moving Vehicle (SMV) signs, reflectors, and warning lights are in good condition and can be clearly seen. Repair or replace if damaged.
- Ensure all tools or loose objects are removed or securely fastened while operating the machine.
- Check for damaged or leaky hydraulic systems. Repair or adjust as needed.
- Check the slew/swing brake for proper operation.
- Inspect boom, arm and attachment for wear and damage.
- Make sure all doors, guards and covers are in place and secured properly.

Inspect the machine before each work day

Check Attachment and Coupler Installation

When changing buckets or installing attachments, follow the manufacturer's instructions for proper maintenance and coupling. Only use parts and attachments that are approved by the original equipment manufacturer. Make sure all connectors are securely fastened. Tighten all bolts, nuts and screws to torques recommended.

Check the attachment coupler and the attachment for wear and hydraulic leaks before coupling the attachment.

Ensure the quick-coupler pins, if equipped with a quick-coupler device, or wedges are fully engaged and visibly locked to the attachment before operating.

⚠ **WARNING!** Avoid possible crushing injury. **Failure to properly secure the attachment to the machine coupler can allow the attachment to come off and could result in death or serious injury.** (See page 8, **Quick-coupling Device Safety**.)

Quick-coupling Device Safety

Before using a quick-coupling device you must know and understand proper installation, maintenance and operation.

⚠ **WARNING! Failure to read and follow manufacturer's instructions for the correct operation and maintenance of the quick-coupler can allow the attachment to come off and cause death or serious injury.**

Protect yourself from injury:

- Install and maintain equipment, attachments and their operating systems according to manufacturers' instructions.
- Securely latch attachments before work begins.
- Follow the manufacturer's instructions for using the lock/secure feature on quick-coupling equipment.
- Make frequent visual inspections of quick-coupling systems—especially after changing attachments.
- Always check for interference limits of the coupler or tool with the carrier before operating.

Do not operate the machine if:

- There exists an incompatibility among components.
- There are broken, damaged or badly worn components
- The lock/secure feature of the quick-coupler is impaired
- The engaging lever or device is not fully engaged in a lock/secure condition.

Prepare for Safe Operation

⚠ **WARNING!** A quick-coupler that is not properly locked/secured could result in death or serious injury. **Perform all steps to lock/secure the device.** The steps to confirm that the device is properly locked/secured may include any or all of the following:

- Manually installing a locking pin, actuating a lever or other device.
- Movement of the attached work tool to confirm its engaged lock/secure condition.
- A visual check of the components as instructed by the quick-coupler manufacturer.

⚠ **WARNING!** A quick-coupler that is disengaged when the attachment is in an unstable position could result in death or serious injury. **Place the attachment in a stable position, as instructed by the manufacturer, whenever coupling or uncoupling the attachment.**

Pressurized Fluid Injection Hazard

⚠ **WARNING!** Accidental injection of pressurized fluid into the hands or body is dangerous and could result in death or serious injury. Pressurized fluids could include oil, hydraulic fluid, water and fuel. **Use caution when checking fluid leaks as pressurized fluids can penetrate skin or eyes, causing serious personal injury.**

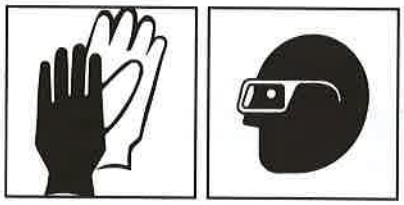
Pressurized fluid can inject into the body

If a leak is discovered:

- Ensure engine is turned off; relieve pressure in fluid system.
- Wear proper hand and eye protection.
- Visually examine the fluid lines in the vicinity of the leak for breaks or cracks. **Do not** use your hand to check for leaks.
- Repair or replace hydraulic lines per manufacturer's recommendation.

Pressurized Fluid Injection Hazard (cont.)

Fluid injection injuries are not always obvious. Victims have reported such injuries feel like a bee sting or splinter under the skin. If you suspect you have a fluid injection injury, do not take chances. Seek proper medical care immediately. Be sure attending medical professional understands that injury may be caused from a fluid injection. If any fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury.



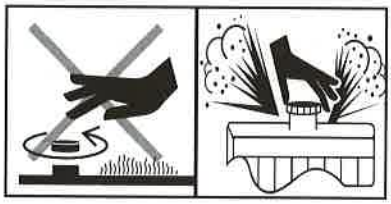
Wear proper hand and eye protection

Check the Cooling System

When checking the cooling system, make sure the engine is turned off and is cool. Remove the key to prevent fans from unexpectedly starting. Ensure the coolers and engine compartment are clean and free from debris, which could ignite and cause a fire.

If the machine is air-cooled, be sure the cooling unit has an unobstructed air flow. If it is liquid-cooled, check coolant level (at overflow tank, if provided).

⚠ **WARNING! Allow the radiator to cool before checking the level**. Hot radiator fluids could escape as steam and burn you. (See page 22, **Engine Coolant Hazards.**)



Allow radiator to cool before removing cap slowly

Prepare for Safe Operation

Clean Up

Clean windows, mirrors, lights, safety signs and other visual aids. Know and follow the manufacturer's recommendations for using cleaning agents other than clean water on polycarbonate glazing.

Make sure the operator's area, steering levers, pedals, joysticks, steps, and grab handles are clean. Oil, grease, snow, ice, mud, or debris in these areas could cause you to slip and fall, or lose control of the machine. Clean your boots of excess mud before entering the machine.

Remove all personal items or other objects from the operator's area. Secure these items in a toolbox or remove them from the machine.

Use Caution When Fueling

⚠ **WARNING!** Avoid injury from fire or explosion. **Never fill the fuel tank with the engine running, while smoking or when near an open flame.**

Never overfill the tank or spill fuel. If fuel is spilled, clean it up immediately.

Be sure to use the correct type and grade of fuel.

Ground the fuel funnel or nozzle against the filler neck to prevent sparks that could ignite fuel vapors. Be sure to replace the fuel fill cap, if equipped, when you are done.

No smoking and no open flames

Ultra-Low Sulfur Diesel (ULSD) Fuel Hazard

Avoid Static Electricity Risk When Fueling

⚠ **WARNING!** Ultra-Low Sulfur Diesel (ULSD) poses a greater static ignition hazard than earlier diesel formulations. Avoid death or serious injury from fire or explosion; **consult with your fuel or fuel system supplier to ensure the delivery system is in compliance with fueling standards for proper grounding and bonding practices.**

Static discharge during fueling can cause explosion

Prepare for Safe Operation

Exhaust Fumes in a Closed Space Can Kill

Vent exhaust and assure a flow of fresh air when an internal combustion engine is used in a closed space.

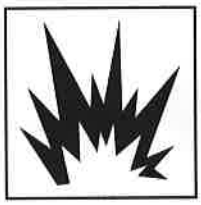
⚠ **WARNING!** Exhaust fumes from diesel, gasoline or LP gas engines can kill. **Do not breathe exhaust fumes from any kind of engine.**

Operating in Flammable/Explosive Atmospheres

⚠ **WARNING! A compact excavator cannot be operated in flammable or explosive atmospheres.** Use in explosive atmospheres can result in fires and/or explosions which could cause serious injury or death.

Use only an approved compact excavator with a label designation of G, GS, D, DS, DY, LP, LPS, G/LP, or GS/LPS. See Code of Federal Regulations (OSHA) 29 CFR Part 1910.178 to determine permissible areas where these machines can be operated.

Ventilate work area



Do not operate in explosive/flammable atmosphere

Prepare for Safe Operation

Avoid Crystalline Silica (quartz) Dust

⚠ **WARNING! Avoid exposure to dust containing crystalline silica particles.** This dust can cause serious injury to the lungs (silicosis).

Because crystalline silica is a basic component of sand and granite, many activities at construction sites produce dust containing crystalline silica. Trenching, sawing and boring of material containing crystalline silica can produce dust containing crystalline silica.

Avoid silica dust

If dust which contains crystalline silica is present, there are guidelines which should be followed.

1. Be aware of the health effects of crystalline silica and that smoking adds to the damage.
2. Be aware of and follow OSHA (or other) guidelines for exposure to airborne crystalline silica.
3. Know the work operations where exposure to crystalline silica may occur.
4. Participate in air monitoring or training programs offered by the employer.
5. Be aware of and use optional equipment controls such as water sprays, local exhaust ventilation, and enclosed cabs with positive pressure air conditioning.
6. Where respirators are required, wear a respirator approved for protection against crystalline silica-containing dust. Do not alter the respirator in any way. Workers who use tight-fitting respirators cannot have beards/mustaches which interfere with the respirator seal to the face.
7. If possible, change into disposable or washable work clothes at the work site; shower and change into clean clothing before leaving the work site.
8. Do not eat, drink, use tobacco products, or apply cosmetics in areas where there is dust containing crystalline silica.
9. Store food, drink and personal belongings away from the work area.
10. Wash hands and face before eating, drinking, smoking, or applying cosmetics after leaving the exposure area.

Prepare for Safe Operation

Know the Working Area

Learn as much about your working area as possible.

Check at Ground or Floor Level

Inspect the surface over which you will travel. Look for holes, drop-offs, and obstacles. Look for rough spots or hidden obstacles on surfaces which could cause a collision or loss of control. Look for weak spots on docks, ramps, or floors. Look for oil spills, wet spots, and slippery surfaces. Look for soft soil, deep mud, or standing water. Watch for anything that might make you lose control or cause the machine to roll over.

When operating inside a building, make certain you are within weight limitations of floors and ramps. Be aware of overhead clearances, doorways, aisles, etc. Plan travel routes ahead of time, in order to make sure you can see and protect bystanders. Pick up debris that can damage tracks.

Plan Your Work

Before you raise an excavator bucket, know where you will dump it.

Check Overhead

Check the clearances of doorways, canopies, and overheads. Know exactly how much clearance you have under power and telephone cables.

⚠ **DANGER!** Death or serious injury will result from touching or being near a machine that is in contact with or near an energized electrical source. **Never approach power lines with any part of the machine or load unless all local, state/provincial and federal (OSHA) required safety precautions have been taken.** Use extreme caution because high voltage sources can arc without contact.

When working near power lines, you must assume all lines are energized.

Other Buried Hazards

CHECK UNDERGROUND. Know the location of gas lines and water pipes, or cables before digging.

Always contact your local One-Call system and any utility companies that do not subscribe to One-Call before doing any digging. (See page 4, **One-Call First**.)

Prepare for Safe Operation

Mount and Dismount Properly

Always use three-point contact when mounting or dismounting the machine. Three-point contact means one hand and two feet, or two hands and one foot, in contact with the machine at all times.

Never mount or dismount while carrying tools or objects that prevent three-point contact. Put parts or tools down. Maintaining proper contact, climb or dismount, and then pick up the object.

Face the machine when you enter or leave the machine.

Clean shoes and wipe hands. Clean steps and handholds of chemical residue, snow, ice, mud or oil.

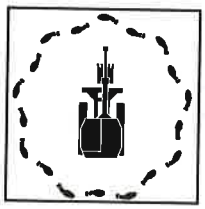
During mounting and dismounting:

- Use handholds and step plates.
- Never use joysticks or controls as handholds.
- Never jump on or off the machine.
- Never mount or dismount from a moving machine.

Use three points of contact when mounting or dismounting

Warn Personnel Before Starting

Before starting, walk completely around the machine. **Make sure no one is under the machine, on it, or close to it.** Let others know you are starting up and do not start until everyone is completely clear of the machine. As the equipment operator, you are responsible for the safe use of the machine, so always make sure you have communicated your work plans to others on the site.



Before starting, walk completely around excavator

Starting the Engine

⚠ **WARNING!** Start the engine from the operator's seat only. **Never attempt to start the engine by shorting across starter terminals or reaching for the key from outside the cab.** The machine may move unexpectedly, which could cause serious injury or death to anyone in its path.

Know the exact starting procedure for your machine. See the manufacturer's operating manual(s) for starting.

- Clear the area of all persons.
- Sit in the operator's seat and adjust the seat so you can operate all the controls properly.
- Fasten the seat belt. If the compact excavator is equipped with foldable TOPS/ROPS, do not fasten the seat belt when the TOPS/ROPS is in the down position.
- Familiarize yourself with warning devices, gauges and operating controls.
- Make sure all controls, including those for auxiliary equipment, are in the neutral/locked position.
- Sound horn.
- Activate controls by releasing the control lock, if equipped.
- Start the engine following the instructions in the manufacturer's operating manual(s).

Never start engine by shorting across starter terminals

If necessary to run the engine or operate the machine an enclosed area, ensure there is adequate ventilation.

⚠ **WARNING!** Exhaust fumes can kill. **Do not breath exhaust fumes!**

Starting Aids

If you have trouble starting the engine and need to use jumper cables, follow the instructions in manufacturer' operating manual(s). **Jump-starting is a two-person operation.** The operator must be in the operator's sea when jump-starting so the machine will be under cont when the engine starts.

⚠ **WARNING!** Improper jump-starting procedures may cause serious injury or death from a battery explosion or a run-away machine. **Always use proper jump-starting procedure.** (See page 23, **Battery Hazards**.)

Start Safely

Ether/cold start fluid is HIGHLY FLAMMABLE. Before using it, always read the instructions on the ether/ cold start fluid container and the instructions in the manufacturer's operating manual(s).

⚠ **WARNING!** Avoid injury from explosion or fire. If the engine is equipped with a glow plug pre-heater or other intake manifold type pre-heater, follow manufacturer's instructions before using ether/cold start fluid.

After Starting Engine

Observe gauges, instruments, and warning lights to assure that they are functioning and their readings are within the operating range.

Run an Operating Check

Do not use a machine that is not in proper operating condition. It is your responsibility to check the condition of all systems and to run the check in a safe area.

Test Controls

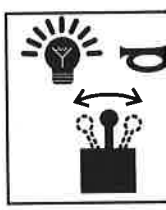
Compact excavators come equipped with various control configurations, patterns, and operating modes, each with their own handling characteristics. Some have selectable or configurable controls, to suit personal preferences or specific applications.

Make sure that you know which control pattern you have selected and that you understand how the machine will handle when using that control pattern.

Make sure the machine is operating properly by doing the following:

- With the control levers or joysticks in neutral, test engine speed control.
- Operate each machine control to check all functior are correct.
- Check for possible interference between the attachment and the cab and operate appropriately.
- Check the blade location, if equipped, before travel to understand which direction the machine will m when you operate the travel controls.
- Operate the travel control lever(s) or joysticks to ens correct operation in forward and reverse. Test steer to the right and to the left, while moving slowly i clear, safe area.

⚠ **WARNING!** Before operating the machine under working conditions, **be certain you can control speed, direction and boom motion of the machine.** Any loss of control could result in death or serious injury.



Operate Safely

Masked Visibility Areas

Machines have areas where the operator's visibility of the job site can be affected by the machine itself. TOPS/ROPS posts, attachments, boom, even items in the cab, could limit your view of the surrounding area and possibly mask hazards or people around you. These masked visibility areas vary from machine to machine, and it is very important you be aware of these areas before operating your machine. Refer to the manufacturer's manual for information regarding various visibility aids that may be installed on the machine.

Follow these safety precautions to reduce the hazards posed by masked visibility areas:

- Pay particular attention when slewing the machine because masked visibility areas can change.
- Look around the machine before operating. Objects near the machine and close to the ground can be difficult to see from the cab.
- Always look in the direction of travel, including reverse, or use available visibility aids, if equipped. A travel alarm is no substitute for looking behind you when operating the machine in reverse.
- Keep bystanders away, even if your machine is equipped with a travel alarm.

Remember These Rules

Stay in the operator's seat, with the seat belt fastened, if equipped. If the compact excavator is equipped with a foldable TOPS/ROPS, do not fasten the seat belt when the TOPS/ROPS are in the down position.

Understand the machine's limitations. Be in control of the machine at all times.

If a failure that causes loss of control occurs, stop all machine motion as quickly as possible. Shut the machine down and remove the key. Correct or report the problem immediately.

Remember the Other Person

Never allow an untrained or unqualified person to operate the machine. If operated improperly, this machine can cause serious injury or death.

Never use a bucket or other attachment as a work platform or personnel carrier.

⚠ **WARNING! Do not allow anyone within the operating work radius of the machine.** Contact with moving parts can cause death or serious injury.

⚠ **WARNING!** The compact excavator is a one-person machine. Avoid death or serious injury—**never permit riders!**

Operate Safely

Back up Safely

Check that the travel alarm and visibility aids, if equipped, are working properly. Remember, **a travel alarm is not a substitute for looking to the rear when operating the machine in reverse.** Utilize all visibility aids. Always look around before you back up the machine or move the boom. Be sure that everyone is in the clear. Slew the excavator to face the direction of travel whenever possible. **ALWAYS LOOK IN THE DIRECTION OF TRAVEL.**

Follow Safe Operating Practices

Make these safe practices part of your daily routine:

- Keep your seat belt fastened.
- Operate the controls smoothly—don't jerk the steering levers or joysticks.
- Avoid sudden stops, starts or turns.
- Use care and good judgment.
- Never attempt to operate the controls unless properly seated in the cab.

⚠ **WARNING!** Avoid serious injury or death! **Keep your entire body inside the operator's cab while operating the machine.** Never work with your head, arms, feet, or legs beyond the operator's compartment.

Watch Out for Hazardous Working Conditions

Be alert for hazards. Know where you are at all times. Watch for branches, cables, or doorways.

Caution is required when working near the edge of an excavation. Keep the machine a safe distance away from the edge. Avoid undercutting.

Never undercut a high bank

⚠ **WARNING! Never undercut a high bank.** The edges could collapse or a slide could occur, resulting in death or serious injury.

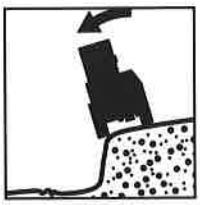
Caution should be used when working along the tops of banks or slopes. Always operate the machine perpendicular to the bank. Keep away from the edge.

Use caution when working along docks or runways. Keep away from the edges of drop-offs. Immediately move the machine back at any indication the edge may be unstable.

Watch Out for Hazardous Working Conditions (cont.)

⚠ **WARNING! Never operate the machine close to the edge of an overhang or gully.** The edges could collapse or a slide could occur causing serious injury or death.

Operate perpendicular to banks – stay back from the edge



Use caution – stay safely away from bank or excavation edge

When working near hazardous conditions, have a spotter work with you to look for dangers. Make certain they stay a safe distance from your machine.

⚠ **WARNING! Do not dig under the machine.** A cave-in could result and the machine could fall into the excavation, resulting in death or serious injury.

Traveling on Job Site

Check blade location before traveling. When blade is positioned to the rear, operate the steering levers in the opposite direction as when the blade is in the front.

Take it slow and easy when traveling through congested areas. Traffic courtesy pays off.

Give the right-of-way to loaded machines. Maintain a safe distance from other machines. Pass cautiously.

The retractable track frame, if equipped, should be extended for traveling on the work site. The track frame can be retracted to access narrow areas. Read and know the manufacturer's instructions before operation.

Always look around before you travel or move the boom.

Know the maximum height and width of the machine. Don't obstruct your vision when traveling or working. (See page 13, **Masked Visibility Areas**.) Always look in the direction of travel. Drive facing the travel direction when possible.

Operate Safely

When moving the machine, watch that enough clearance is available on both sides and above the boom and cab. Be especially careful to allow extra clearance on uneven ground.

⚠ **WARNING!** Avoid possible injury. The weight of the machine may cause the ground , dock, ramp or floor to give way, causing loss of control, fall or tip-over. **Know weight limits and stay clear of the edges of excavations and drop-offs.** Failure to know and observe weight limits could result in serious injury or death.

Travel Safely

When traveling over rough terrain, **SLOW DOWN** to prevent losing control.

Make sure all surfaces will support the weight of the machine.

Do not cross ditches, creeks or wet draws without an adequate fill or bridge crossing.

Avoid steep slopes or unstable surfaces. Do not drive across a steep slope under any circumstances. Travel straight up and down the slope.

Before operating on slopes, check the surface conditions for adequate traction. Loss of traction can cause the machine to slide and tip.

If it is necessary to travel on a slope, follow the manufacturer's specific instructions. When on a slope, keep the boom centered and attachment as low and as close to the machine as possible. Proceed with caution.

Drive straight up and down - NOT ACROSS - steep slopes

Avoid turning on a slope. If it is necessary, use caution and make the turn **WIDE** and **SLOW** with the boom centered and attachment as low and as close to the machine as possible.

Avoid sudden movement of the travel controls. Rapid and jerky movement of the controls can cause loss of both machine stability and control of the load.

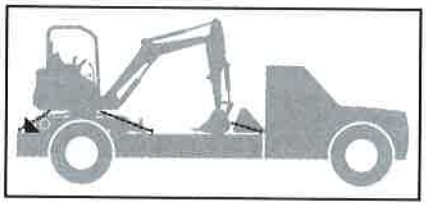
Transporting Safety Tips

Always wear your seat belt when loading or unloading your machine from a transport device, such as a flatbed truck. If TOPS/ROPS are foldable, they must be in the up position.

When transporting a machine, follow the manufacturer's recommended loading and unloading procedures.

Several precautions are applicable to all machines:

- Keep bystanders away.
- Load and unload on a level surface.
- Maintain proper visibility by loading or unloading in well-lit areas, and away from other vehicles, equipment or buildings.
- Block transport vehicle so it cannot move.
- Ensure trailer bed and ramps are in good condition.
- Use ramps of adequate size and strength, with a low angle and proper height.
- Rear of trailer must be blocked or supported.
- Keep trailer bed and ramps free of clay, oil, ice, snow, and other materials which can become slippery.
- Position the attachment to the front of the machine.
- Drive forward up the ramps, raising the blade high enough for clearance.
- Cover or remove rear-facing SMV sign on the machine, if equipped, to avoid confusing drivers following the transport vehicle.
- Engage upperstructure slew lock, if equipped.
- Chain and block the machine securely for transport. Use tie-down points as marked on the machine by the manufacturer. Follow the manufacturer's instructions in the operator's manual for tying down.
- Unload the machine by driving off in the opposite direction; do not turn the machine around.



Chain and block excavator securely for transport

Towing

Many compact excavators may not be towed. Refer to the manufacturer's manual(s) for specific towing instructions.

Never straddle a towline or stand near a towline under tension.

Operate Safely

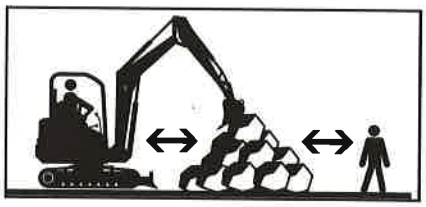
Safety Precautions

Never reach into the compact excavator and attempt to operate the controls from outside the cab.

Before starting to excavate, set up safety barriers to the sides and rear area of the swing pattern to prevent anyone from walking into the working area.

Read and know manufacturer's instructions before operation.

Make sure you are aware of personnel or machines that may be hidden in blind spots on the work site, such as piles or stacks of material.



Check clearance, Look out for others

Make sure the machine has sufficient clearance from other machines or material on the work site to prevent contact during machine or attachment movement.

⚠ **WARNING!** Prevent death or serious injury. **Never lift, move or swing a load over any person or any machine cab.**

Do not lift or swing a load or attachment over anyone

Know and use the hand signals required for particular jobs. Know who has the responsibility for signaling. Take signals from one person only.

Do not operate during storms with high winds or lightning strikes. Do not mount or dismount during a period of lightning strikes. If you are on the machine, stay on it. Warn others to stay clear of the machine in case of a lightning strike.

Load Lifting

Consult the rated lift capacity chart. Do not overload this machine. Know the exact lifting capacity of the machine as equipped. Make sure you have and know how to use a current lift capacity chart for the machine.

Changing conditions such as slopes, wind, ice, mud, soft ground, type of load or the weight of attachments will affect the capacity and operating characteristics of the machine.

Consult your lift chart. The machine has greater lift capacity over the end of the tracks than over either side of the machine.

The retractable track frame, if equipped, should be fully extended for increased lifting performance.

Attach loads only to the manufacturer's designated lifting points, if equipped.

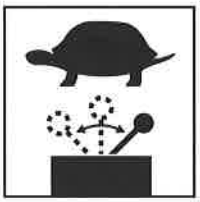
If equipped, keep blade lowered for increased lifting performance. If ground is soft, place pads or timbers under the blade.

Operate the controls smoothly and slowly. Rapid and jerky movement of the controls can cause loss of both machine stability and control of the load.

When lifting, be sure the load is properly balanced. Move slowly so the load does not sway or swing around. Use a tag line for control.

If tracks or blade leave the ground, slowly lower the load to return the machine to the ground. Do not drop the load suddenly, because this can lead to loss of control.

Do not exceed rated lift capacity. Excessive load can cause tipping or loss of control.



Operate controls smoothly and slowly

Carry the load/attachment low and as close to the machine as possible. You must allow for movement in all directions. Be careful to maintain clearance of the attachment and load from the cab.

Keep all guards in place and windows closed or locked open. Keep cab doors closed or otherwise secured, if equipped.

Never leave the operator's seat with a load suspended. (See page 19, **Safe Shutdown.**)

Operate Safely

Trenching Safety Precautions

Follow the work site plan for proper construction of the trench. Check with your supervisor if you are unsure of correct trench construction or if operating conditions change.

Stay alert to changes in soil conditions. Trench collapse is hazardous to all workers in the area and could cause the machine to slide into the trench.

Keep heavy loads and equipment as far from the trench as possible.

Keep spoil and stored materials such as pipe at least two feet from the edge of the trench.

Keep personnel away from the equipment and attachments.

Never swing a load or attachment over anyone.

Do not undercut the machine.

⚠ **WARNING! Do not dig under the machine or blade.** A resulting cave-in could cause death or serious injury.

⚠ **WARNING!** Avoid possible death or serious injury from trench wall collapse. **Before backfilling, see the manufacturer's manual for any specific instructions. Do not get too close to the edge of the cut.** The weight of the machine plus the fill could cause the trench wall to collapse.

Keep personnel away from equipment and attachments

Utilities

Above Ground

Electrocution can result from contacting or approaching overhead power cables. Maintain minimum approach distance. (See chart.)

⚠ **DANGER!** Never approach overhead power lines with any part of your machine or load unless all local, state/provincial, and national (OSHA) required safety precautions have been taken. Use caution.

Required Clearance for Operation Near High-Voltage Power Lines

Normal Voltage kV (Phase to Phase)	Minimum Approach Distance† ft.	(m)
Up to 50 kV	10	(3.0)
Over 50 to 200 kV	15	(4.6)
Over 200 to 350 kV	20	(6.1)
Over 350 to 500 kV	25	(7.6)
Over 500 to 750 kV	35	(10.7)
Over 750 to 1,000 kV	45	(13.7)
Over 1,000 kV	*	*

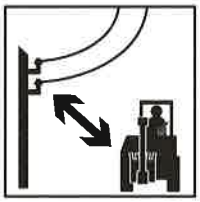
†Environmental conditions such as fog, smoke or precipitation may require increased clearances.

*As established by the utility owner/operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution.

Check overhead clearances: know your required clearance. (See page 11, **Check Overhead.**) If possible, have power to the lines disconnected. If not possible, request a signal person for guidance.

⚠ **DANGER!** If your machine has been energized from being in contact with OR near an electrical source, **DO NOT leave machine until power has been disconnected.**

⚠ **DANGER! Keep Away!** Electrocution will result from touching or being near a machine that is in contact or near an electrical source.



Maintain minimum approach distance

Operate Safely

Underground

CHECK UNDERGROUND. Know the locations of gas lines, water pipes, and cables before digging.

Always contact your local One-Call system and any utility companies which do not subscribe to One-Call before doing any digging. (See page 4, **One-Call First.**)

Call before you dig—dial 811 (USA only) 1-888-258-0808 (USA & Canada)

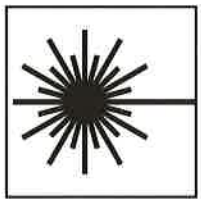
When excavating near underground services, expose the service by hand-digging or by using soft excavation, such as vacuum excavation, if permitted by local utilities.

When gas lines are present on the site, do not smoke or do anything to cause a spark in the vicinity of a gas line.

Make plans to restrict working area access—with cones and tape, barriers, warning signs, fences, etc.—until the job is complete.

Make certain that you are in compliance with all local, state/provincial, national and other requirements and regulations, including those regarding open excavations, or "potholes."

⚠ **WARNING!** Fiber optic cables are often made of glass, which can be very sharp when broken. They frequently carry infrared or laser light, which may not be visible, but is still very dangerous. To avoid serious injury, **do not handle or look directly into the exposed ends of damaged fiber optic cables.**

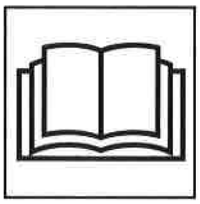


Do not look into fiber optic cables

Slope and Uneven Terrain Operation

Compact excavator stability and load capacity are greatly reduced on slopes. Ensure the operation can be done safely. Prevent overturns and maintain stability control:

- Use machines equipped with TOPS/ROPS and a seat belt. Make sure folding TOPS/ROPS are raised and locked in place—always use the seat belt. Never operate on a slope with a foldable TOPS/ROPS in the down position.
- The retractable track frame, if equipped, should be extended for operating on slopes or uneven terrain. Read and know manufacturer's instructions before operation.
- Review the manufacturers' manual for specific instructions and limitations, including those for proper operation of alternate/emergency exits.
- Avoid extremely steep slope operation.
- Keep machine movements slow and smooth.
- Level the working area and machine as much as possible.
- Avoid working with the tracks across a slope. This will reduce stability and increase the tendency of the machine to slide. Position the machine with the tracks running up and down the slope—blade downhill and lowered.



Always check manuals for specific instructions

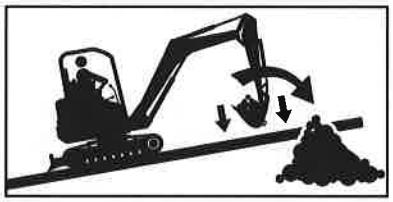
Fasten seat belt, use TOPS/ROPS

Level the work area if possible

Operate Safely

- Avoid slippery ground conditions.
- Travel straight up and down the slope with the attachment low and close to the machine. Do not move the boom while traveling.
- Avoid swinging to the downhill side of a slope. Always keep the boom and attachment as low and close to the machine as possible.

If the machine begins to tip, roll or slide, stay in the machine with the seat belt securely fastened. Lower the attachment immediately. Hold on firmly and brace your feet on the floor. Lean away from the point of impact.



Swing load uphill when on a slope

When operating the compact excavator on a slope, swing to the uphill side to dump load, if possible. If downhill dumping is necessary, swing only as far as required to dump the bucket. Use caution. Always drop soil a sufficient distance from a trench to prevent cave-ins.

If possible, avoid working with the tracks across a slope.

Before moving the machine, raise the blade sufficiently to clear the ground, and then drive the machine forward or backward as required. Lower the blade to level the machine.

Operate Safely

Emergency Procedures

Electrical strike and you are on the excavator:

- **DO NOT LEAVE the machine. WARN OTHERS that an electrical strike has occurred and to stay away.**
- **RAISE ATTACHMENTS to break contact.**

Electrical strike and you are on the ground:

- **STAY where you are and DON'T MOVE.**
- **DO NOT TOUCH the machine or anything connected with the machine.**
- **WARN OTHERS that an electrical strike has occurred.**

Gas Strike Procedure

- **WARN** others that a gas strike has occurred.
- **WARN** bystanders that a gas strike has occurred and to stay away.
- **IMMEDIATELY SHUT OFF** engine(s) and remove any ignition sources.
- **DO NOT SMOKE** or do anything that could cause a spark.
- **EVACUATE** and **SECURE** the area.
- **CALL** or have someone call 911 and other local **EMERGENCY NUMBER(S).**

Fiber-optic Strike Procedure

- **DO NOT LOOK into the cut ends of a fiber-optic or unidentified cable.**

A cut fiber-optic cable can cause severe eye injury if you look into the damaged end of the cable.

- **WARN OTHERS that a fiber-optic strike has occurred.**

Water or Sewage Strike Procedure

- **WARN OTHERS that a water or sewage strike has occurred.**

Sewage may contain pathogens. It may be advisable to seek medical attention for personnel coming in contact with sewage.

In all cases:

- **CALL or have someone call 911 or other local EMERGENCY NUMBER(S).**
- **CALL or have someone call the affected utility and the statewide One-Call System.**
- **DO NOT RESUME work until the utility has cleared you to do so.**

Shut Down Safely

Select a Proper Parking Site

When shutting down, park the machine in a designated area out of traffic, select level ground whenever possible.

If you must park on a slope or incline, position the machine at right angles to the slope and block the tracks.

If freezing conditions are expected, the tracks should be first cleared of mud and dirt and the machine parked on planks or suitable debris.

Public roads are not suitable for parking. If the machine is disabled or you must park on a public road, barricade and mark the machine according to local and work site regulations.

⚠ **WARNING!** Avoid death or serious injury from unintended movement of the machine. **Never leave a machine unattended with the engine running.**

Shut engine off, remove key

Safe Shutdown

The detailed shutdown procedure is given in your manufacturer's manual(s). In general, this includes:

- Stop machine.
- Ensure tracks are flat on the ground.
- Position controls in neutral or locked position.
- Lower the attachment and blade to the ground with slight down-pressure.
- Idle engine for short cool-down period.
- Stop engine and remove ignition key, if equipped.
- Cycle hydraulic controls to eliminate pressure.
- Unbuckle seat belt.
- Lock covers and enclosures.
- Shut off master electric switch, if equipped.
- When you leave the machine, always maintain three-point contact with the steps and grab handles. Face the machine as you dismount. Never jump off machine.
- Block tracks if on a slope or incline.

Perform Maintenance Safely

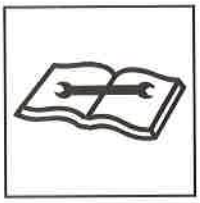
Know What You're Doing

Maintenance on this type of machine is not for inexperienced or untrained personnel. It can be hazardous unless performed properly. Be sure you have the necessary skill, information, correct tools, and proper equipment to do the job safely.

Be sure to maintain the equipment according to the manufacturer's instructions. Regularly check the operation of the protective and safety devices.

Do not perform any work on a machine unless you are authorized and qualified to do so.

If you have been authorized to perform maintenance, **read the manufacturer's operating and service manuals.** Study the instructions: check the lubrication charts, examine all the instruction messages on the machine.



Maintain equipment

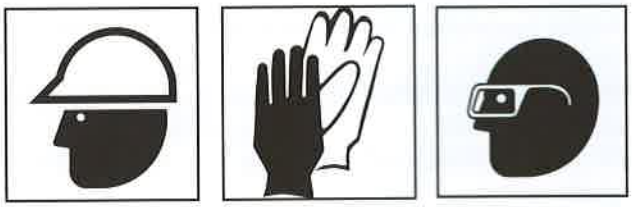
Protect Yourself

Wear all the personal protective clothing and PPE issued to you or called for by job conditions.

You may need:

- Hard hat
- Safety shoes
- Safety glasses, goggles or face shield
- Heavy duty gloves
- Hearing protection
- Reflective clothing
- Wet weather gear
- Respirator or filter mask

Wear whatever is needed to protect yourself. Do not take chances.



Perform Maintenance Safely

⚠ **WARNING!** Avoid death or serious injury from entanglement. **Do not wear loose clothing or accessories. Stay away from all rotating components when the engine is running.** Contact, wrapping or entanglement with rotating or moving parts could result in death or serious injury.

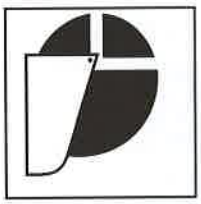
Wear a rubber apron and rubber gloves when working with corrosives. Wear cut resistant gloves and safety shoes when handling wooden blocks or sharp-edged metal.

Always use safety glasses, goggles or a face shield. They provide eye protection from fluids under pressure, during grinding and while servicing batteries. Protection is also needed from flying debris, liquids and loose material produced by equipment, tools and pressurized air/water.

Wear a face shield and follow manufacturer's instructions when you disassemble spring-loaded components or work with battery acids. Keep pockets free of all objects that could fall out and drop into machinery.

Handle tools and heavy parts sensibly, with regard for the safety of yourself and others. Lower items; don't drop them.

Avoid rotating parts



Wear eye protection

Do not loosen radiator cap until cool

Perform Maintenance Safely

Prepare the Work Area

- Position the machine in a level area out of the way of other working equipment.
- Make sure there is adequate light, ventilation and clearance.
- Remove oil, grease or water to eliminate any slippery surfaces.
- Clean around the area to be serviced to minimize contamination.

Prepare the Machine

Stored energy sources (electrical, mechanical, hydraulic, pneumatic, chemical, thermal, etc.) must be controlled or reduced to a practical minimum before performing any maintenance, repair, or service procedures.

Safety practices to prevent potential injuries from energy-releasing sources include:

- Place controls in NEUTRAL or LOCKED position before shutting off engine
- Allow all moving parts to stop
- Shut off engine
- Block the tracks
- Follow your manufacturer's recommendations for relieving hydraulic system pressure.
- Lock ignition, remove key, if equipped, and take it with you.
- Look and listen for evidence of moving parts before dismounting.
- Shut off master electrical switch, if equipped.
- Securely support or block up machine before working underneath machine.
- Lower the equipment and attachment before working near them.
- Relieve pressure before disconnecting or disassembling any pressurized system.
- Block or relieve spring pressure before disassembling any spring-loaded mechanism.
- Avoid flames, sparks, or smoking near any fuel, hydraulic fluid or other flammable material such as spraying debris.

Avoid falls, clean slippery surfaces

Perform Maintenance Safely

Attach a "DO NOT OPERATE" warning tag to the control levers. Lockout/tagout the unit according to the manufacturer's operating manual. If there is a key, remove it and take it with you.

⚠ **WARNING!** Unsupported, raised machines or other equipment may drop unexpectedly. **Never go under equipment when raised. Excavator, bucket and/or other attachments must be lowered to the ground before going under equipment.** Death or serious crushing injury could result from falling equipment.

Remove only guards or covers that provide access to the area being serviced. Replace all guards and covers when work is complete.

⚠ **WARNING!** Avoid injury or death from unintended movement of the machine. **Never work on machinery with the engine running unless instructed by the manufacturer's manuals for specific service.**

Use a "DO NOT OPERATE" tag

Common Maintenance Safety Practices

Use Proper Ventilation

If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.

Ventilate work area

⚠ **WARNING!** Exhaust fumes contain carbon monoxide which could be deadly if inhaled. **Never operate any type of engine without proper ventilation.** EXHAUST FUMES CAN KILL.

Perform Maintenance Safely

Use Jacks and Hoists Carefully

Safety stands or blocks must be located on a rigid part of the machine. Do not position stands under tracks that may rotate.

⚠ **WARNING!** Prevent crushing injury. **Never use concrete blocks for supports. They could collapse under even light loads which may cause serious injury or death.**

If you must work beneath raised equipment, always use hoists, jack-stands or other rigid and stable supports designed and approved for the intended load. When using jacks or hoists, always be sure they are adequately supported.

Make sure the hoists or jacks you use are in good repair. Never use jacks with cracked, bent, or twisted parts. Never use frayed, twisted or pinched cables. Never use bent or distorted hooks.

Avoid crushing, use proper support for raised equipment

No smoking and no open flames

Fuel Hazards

⚠ **WARNING!** Avoid serious injury or death. **Always use approved fuel containers and/or fuel dispensing equipment to reduce the risk of explosion or fire.**

Always observe these practices to reduce the possibility of a serious accident:

- Shut off engine and ignition during refueling.
- Turn off all electrical switches.
- Ground the fuel nozzle against the filler neck.
- Keep sparks and open flames away from fuel. Do not smoke while refueling or when handling fuel containers.
- Do not cut or weld on or near fuel lines, tanks or containers.
- Do not overfill the tank or spill fuel. Clean up spilled fuel immediately.

Perform Maintenance Safely

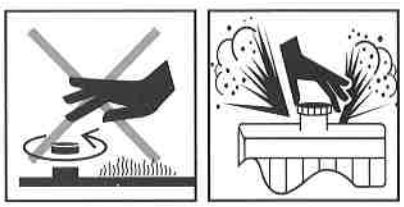
Ultra-Low Sulfur Diesel (ULSD) Hazard

⚠ **WARNING!** Ultra-Low Sulfur Diesel (ULSD) poses a greater static ignition hazard than earlier diesel formulations with higher sulfur content. Avoid death or serious injury from fire or explosion; **consult with your fuel or fuel system supplier to ensure the delivery system is in compliance with fueling standards for proper grounding and bonding practices.**

Engine Coolant Hazards

⚠ **WARNING!** Avoid serious injury or death. Liquid cooling systems build up pressure as the engine gets hot, so **use caution before removing the radiator cap.**

- Stop the engine and wait for the system to cool.
- Wear protective clothing and safety glasses.
- Turn the radiator cap slowly to the first stop to allow the pressure to escape before removing completely.



Allow radiator to cool before removing cap slowly

Hydraulic System Hazards

Be sure to follow manufacturer's instructions for relieving fluid pressure before performing any maintenance. The hydraulic system is pressurized whenever the engine is on and may hold pressure even after the engine is shut off. Cycle hydraulic controls, including auxiliary hydraulic control, if equipped, after the engine is shut off.

Check for leaks and inspect hoses

During inspection of the hydraulic system:

- Wait for fluid to cool before disconnecting the lines Hot hydraulic fluid can cause **severe burns.**
- Wear appropriate eye protection. Hydraulic fluid can cause permanent eye injury.
- When venting or filling the hydraulic system, loosen the filler cap slowly and remove it gradually.
- **Never** reset any relief valve in the hydraulic system to a pressure higher than recommended by the manufacturer.

Perform Maintenance Safely

Pressurized Fluid Injection Hazard

⚠ **WARNING!** Accidental injection of pressurized fluid into the hands or body is dangerous and could result in death or serious injury. Pressurized fluids could include oil, hydraulic fluid, water and fuel. **Use caution when checking fluid leaks as pressurized fluids can penetrate skin or eyes, causing serious personal injury.**

If a leak is discovered:

- Ensure engine is turned off; relieve pressure in fluid system.
- Wear proper hand and eye protection.
- Visually examine the fluid lines in the vicinity of the leak for breaks or cracks. **Do not** use your hand to check for leaks.
- Repair or replace fluid lines according to the manufacturer's recommendations.

Pressurized fluid can inject into the body

Fluid injection injuries are not always obvious. Victims have reported such injuries feel like a bee sting or splinter under the skin. If you suspect you have a fluid injection injury, do not take chances. Seek proper medical care immediately. Be sure attending medical professional understands that injury may be caused from a fluid injection. If any fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury.

Electrical System Hazards

Light Bulbs and Illumination

Some machines are equipped with High-Intensity Discharge (HID) Xenon light bulbs which operate at very high voltage. Do not begin installation of HID-Xenon lamps unless the lamps are turned off, the engine is turned off, the key is removed, if equipped, and you are wearing appropriate eye protection.

⚠ **WARNING! Do not look directly into HID-Xenon lamps.** Eye damage could occur.

Wear gloves and safety glasses when handling bulbs. Dangerous voltage sparks may occur and cause injury or damage to the connector. See manufacturer's warnings packaged with replacement bulbs.

Perform Maintenance Safely

Before working on the electrical system, disconnect the battery cable(s).

- Remove the battery negative (–) cable(s) first.
- When reconnecting the battery, connect the battery negative (–) cable(s) last.

Battery Hazards

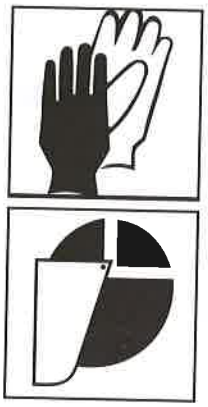
The liquid in batteries contains acid, which is a POISON and could cause SEVERE CHEMICAL BURNS.

Avoid injury:

- Wear a face shield to prevent contact with your eyes.
- Wear chemical-resistant gloves and clothing to keep electrolyte off your skin and regular clothing.

⚠ **WARNING!** Liquid from the battery will damage eyes or skin on contact. **Always wear a face shield to avoid liquid in eyes.**

If liquid from the battery contacts your eyes, flush immediately with clean water and get medical attention. Wear chemical-resistant gloves and protective clothing to keep liquid off your skin. If liquid contacts exposed skin or clothing, wash off immediately with clean water. If liquid is ingested, drink large quantities of water or milk. DO NOT induce vomiting. Seek medical attention immediately.



Wear hand protection

Wear face protection

Avoid Explosion

⚠ **WARNING!** Avoid serious injury from explosion. Lead-acid batteries produce extremely explosive gases especially when being charged. **Keep arcs, sparks, flames and lighted tobacco away.**

- **Do not** smoke near batteries.
- Keep them away from arcs, sparks and open flames.
- Provide adequate ventilation.

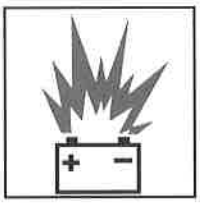
Never check the battery by placing a metal object across the battery posts. The resulting spark could cause an explosion.

⚠ **WARNING!** Avoid serious injury from battery explosion. **Do not charge a battery or jump-start the engine if the battery is frozen.**

Warm to 60°F (15.5°C) or the battery may explode and could cause serious injury.

Safety rules during battery jump-starting:

- Follow the instructions for proper battery jump-starting, as specified in the manufacturer's manual.
- Be sure the machines are not touching.
- Observe the polarity of the batteries and connections.
- Make the final cable connection to the engine or the farthest ground point away from the battery. Never make the final connection at the starter or dead battery. Sparks may ignite the explosive gases present at the battery.
- When disconnecting cables, remove the cables in reverse order of connection (e.g., final connection first).



Avoid sparks and open flames near batteries

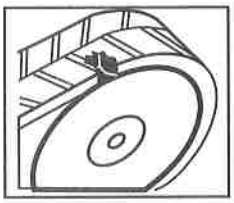
When jump-starting, observe polarity and make final connection at ground point

Perform Maintenance Safely

Track Maintenance

Track tension is important for good track performance, reducing excessive track wear and preventing tracks from derailing.

Tracks under tension can store an incredible amount of energy, and although some machines have automatic track tensioners, special tools and procedures may be required to check or adjust track tension.



Check for track damage

Removing and installing tracks also requires following safe and proper servicing procedures. Always follow the manufacturer's instructions for track maintenance and servicing, including adjusting track tension.

⚠ **WARNING!** Most track tensioning systems have compressed springs or pressurized fluid (oil or grease). **Improperly releasing track tension forces could cause serious injury or death.** Always follow the manufacturer's warnings and instructions for track adjustment and other maintenance and servicing procedures.

Tip-Over Protective Structure (TOPS), Roll-Over Protective Structure (ROPS) and Falling Object Protective Structure (FOPS) Safety Precautions

Do not remove the TOPS/ROPS/FOPS except for service. Reinstall them correctly before allowing the machine back into service.

Do not modify TOPS/ROPS/FOPS in any manner. Unauthorized modifications such as welding, drilling, cutting or adding attachments could weaken the structure and reduce your protection. Replace TOPS/ROPS/FOPS if subjected to rollover or damage. Do NOT attempt to repair them. See the manufacturer's manual(s) for complete instructions and inspection requirements.

Complete Service and Repairs Before Machine is Released

Tighten all bolts, fittings, and connections to torques specified by the manufacturer.

Inspect for leftover components such as cotter pins, washers, locknuts, etc., after completing service. Replace any missing parts.

Pressurized fluid can inject into the body

Start the engine and check for leaks. (See page 22, **Hydraulic System Hazards**.) Operate all controls to make sure the machine is functioning properly. Test the machine if necessary. After testing, shut down and check the work you performed.

Recheck all fluid levels before releasing the equipment for operation.

All parts should be inspected during repair and replaced if worn, cracked or damaged. Excessively worn or damaged parts could fail and cause injury or death.

Install all guards, covers, and shields after servicing. Refill and recharge pressure systems only with manufacturer-approved or recommended fluids.

Verify service work when completed

A Final Word to the User

You have just finished reading the AEM Compact Excavator Safety Manual. It is impossible for this manual to cover every safety situation that you may encounter on a daily basis. Your knowledge of these safety precautions and your application to the basic rules of safety will help to build good judgment in all situations. Our objective is to help you develop, establish, and maintain good safety habits to make operating a compact excavator easier and safer for you.

Many pictorials in this safety manual can be downloaded at http://pictorials.aem.org.

For additional publications, visit our website at www.safetymaterials.org.