

Product: EXCAVATOR

Model: 235B EXCAVATOR 4ED

Configuration: 235B EXCAVATOR 4ED00001-UP (MACHINE) POWERED BY 3306 ENGINE

Operation and Maintenance Manual 235 & 235B TRACK-TYPE EXCAVATORS

Media Number -SEBU6036-00

Publication Date -01/12/1985

Date Updated -11/10/2001

Foreword

SMCS - 7606

This book is a guide to equipment care. The illustrated, step-by-step instructions are grouped by servicing intervals; items without specific intervals are listed under When Required. Circled numbers in the Lubrication and Maintenance Chart are to key the charted items to the instructions in the book.

Use the service meter to determine servicing intervals. Calendar intervals (daily, weekly, monthly, etc.) shown may be used instead of service meter intervals if it provides more convenient servicing schedules and approximates the indicated service meter reading.

Under extremely severe, dusty or wet operating conditions, more frequent lubrication than is specified in the Lubrication and Maintenance Chart may be necessary.

Perform previous interval items at multiples of the original requirement. For example, at Every 250 Service Hours or Monthly, also perform those items listed under Every 50 Service Hours or Weekly and Every 10 Service Hours or Daily.

Some photographs in this publication may show details or attachments that may be different from your unit.

Continuing improvement and advancement of product design may cause changes to your machine which may not be included in this publication. Each publication is reviewed and revised, as required, to update and include these changes in later editions.

When a question arises regarding your Caterpillar product or this publication, please consult your Caterpillar dealer for the latest available information.

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Safety

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Warning Signs and Labels

There are several specific safety signs on your machine. Their exact location and description of the hazard are reviewed in this section. Please take the time to familiarize yourself with these safety signs.

Make sure that you can read all safety signs. Clean or replace these if you cannot read the words or see the pictures. When cleaning the labels use a cloth, water and soap. Do not use solvent, gasoline, etc.

You must replace a label if it is damaged, missing or cannot be read. If a label is on a part that is replaced, make sure a new label is installed on the replaced part. See your Caterpillar dealer for new labels.



Do not operate this machine unless you have read and understand the instructions in the "Operation" Guide. Improper machine operation is dangerous and could result in injury or death. The "Operation" Guide is in holder located in operator's compartment or on seat back. Contact any Caterpillar dealer for a replacement guide. Proper operation is your responsibility.



Located in the cab.

 **WARNING**

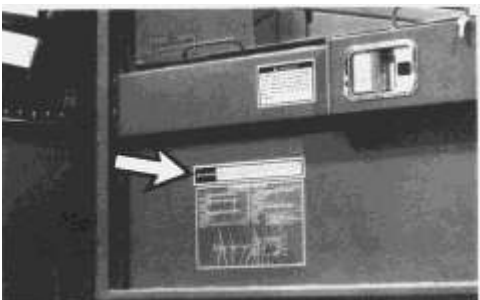
Know the maximum height and reach of your machine. Serious injury or death by electrocution can occur if machine or attachments are not kept a safe distance from electrical power lines. Keep distance at least 3 m (10 feet) plus additional 10 mm (0.4 inch) for each 1,000 volts over 50,000 volts.



Located in the cab.

 **WARNING**

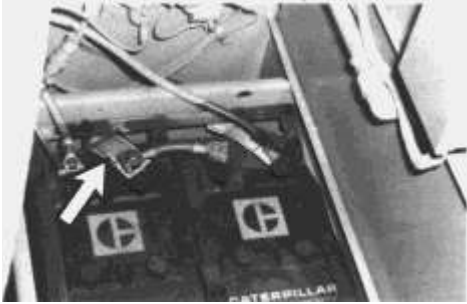
Lubrication, maintenance or repair of this machine can be dangerous unless performed properly. Each person must satisfy himself that he has the necessary skill and information, proper tools and equipment, and that his work method is safe and correct. Caterpillar dealers are available to provide service and information.



Located on the cab door.

 **WARNING**

To prevent possible injury refer to the "Operation" Guide before attempting to boost start this machine.



Located in the battery compartment.

POISON/DANGER CAUSES SEVERE BURNS

Contains sulfuric acid. Avoid contact with skin, eyes or clothing. Antidote: EXTERNAL - Flush with water. INTERNAL - Drink large quantities water or milk. Follow with milk of magnesia, beaten egg or vegetable oil. Call physician immediately. Eyes: Flush with water for 15 minutes and get prompt medical attention. Batteries produce explosive gases. Keep sparks, flame, cigarettes away. Ventilate when charging or using in enclosed space. Always shield eyes when working near batteries.

KEEP OUT OF REACH OF CHILDREN.



Swing lock must be engaged before shipping machine. If lock is not engaged, upper structure can swing, resulting in possible personal injury.



Located in the cab.



CLAMSHELL SWING

Personal injury may result if clamshell swings into the cab or a person in the work area.

Clamshell can swing in all directions.



Located in the cab.

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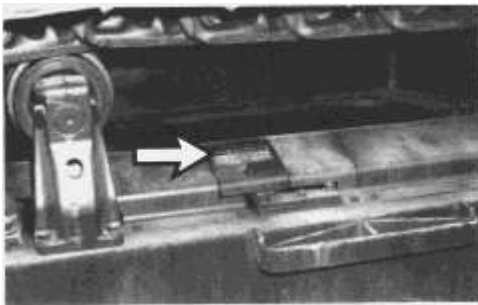
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WARNING

HIGH PRESSURE CYLINDER

Apply lubricant through fitting only to tighten track. Track sag should be between 25 and 38 mm (1 and 1 1/2 inches). When track is too tight relieve pressure by opening relief valve 1 turn.

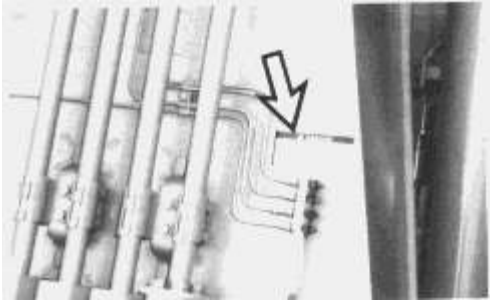


Located on the roller frame.



WARNING

Covered external vent plugs may be under high pressure. Do not loosen or remove without consulting your CATERPILLAR DEALER for proper procedure.



Located on the boom.

 **WARNING**

With final drive disconnected machine has no brakes and will roll free on a slope or while towing.

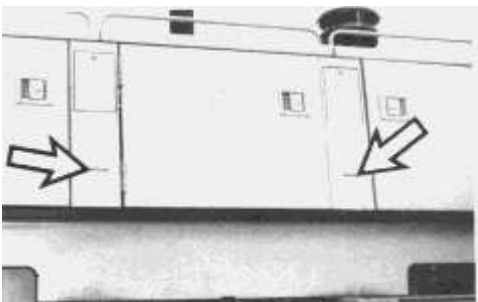
When final drive is disconnected always block both tracks.



Located on the cab door.

 **WARNING**

Do not lift vehicle by counterweight eyes. See Operator's Guide for proper method for lifting vehicle.



Located on the counterweight.

General

Attach a "DO NOT OPERATE" or similar warning tag to start switch or controls before servicing or repairing the machine. These tags, Form SEHS7332, are available from your Caterpillar dealer.

Caution should be used to avoid breathing dust that may be generated when handling components containing asbestos fibers. If this dust is inhaled, it can be hazardous to your health. Components in Caterpillar products that may contain asbestos fibers are brake pads, brake band and lining assemblies, clutch plates and some gaskets. The asbestos used in these components is usually bound in a resin or sealed in some way. Normal handling is not hazardous as long as airborne dust which contains asbestos is not generated.

If dust which may contain asbestos is present, there are several common sense guidelines that should be followed.

1. Never use compressed air for cleaning.
2. Use vacuum or wet methods for cleanup.
3. Use exhaust ventilation on permanent machining jobs.
4. Wear an approved respirator if there is no other way to control the dust.
5. Follow environmental rules and regulations for disposal of asbestos.
6. Avoid areas where asbestos particles may be in the air.

Perform all maintenance unless otherwise specified as follows:

The parking brake engaged.

The engine stopped.

The disconnect switch off and the key removed.

Wear a hard hat, protective glasses and other protective equipment as required by job conditions.

Do not wear loose clothing or jewelry that can catch on controls or other parts of the machine.

Make certain all protective guards and covers are secured in place on the machine.

Keep the machine, especially the deck, walkways and steps, free of foreign material, such as debris, oil, tools and other items which are not part of the machine.

Secure all loose items such as lunch boxes, tools and other items which are not part of the machine.

Know the hand signals and who gives them. Accept signals from one person only.

Never put maintenance fluids into glass containers.

Report all needed repairs.

Do not allow unauthorized personnel on the machine.

Pressure air can cause personal injury. When using pressure air for cleaning, wear a protective face shield and protective clothing.

Crushing or Cutting Prevention

Never attempt adjustments while the machine is moving or the engine is running unless otherwise specified.

Support equipment and implements properly when working beneath them. Do not depend on hydraulic cylinders to hold it up. Any implement can fall if a control is moved, or a hydraulic line breaks.

Where there are implement linkages, the clearance in the linkage area will increase or decrease with movement of the implement.

Stay clear of all rotating and moving parts.

Keep objects away from moving fan blades. They will throw or cut any object or tool that falls or is pushed into them.

Do not use a kinked or frayed wire rope cable. Wear gloves when handling the wire rope cable.

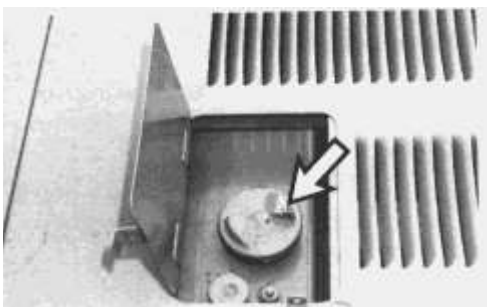
Retainer pins, when struck with force, can fly out and injure nearby persons.

Wear protective glasses when striking a retainer pin to avoid injury to your eyes.

Chips or other debris can fly off objects when struck. Make sure no one can be injured by flying debris before striking any object.

Burn Prevention

At operating temperature, the engine coolant is hot and under pressure. The radiator and all lines to heaters or the engine contain hot water or steam. Any contact can cause severe burns.



Check the coolant level only after the engine has been stopped and the filler cap is cool enough to remove with your bare hand.

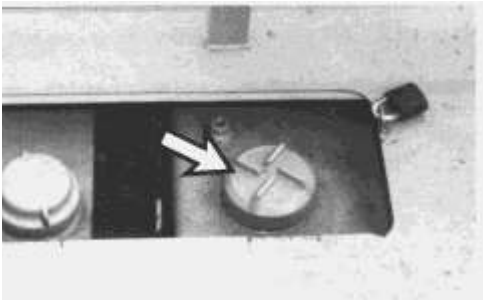
Remove the cooling system filler cap slowly to relieve pressure.

Cooling system conditioner contains alkali. Avoid contact with the skin and eyes and do not drink, to prevent personal injury.

Allow cooling system components to cool before draining.

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

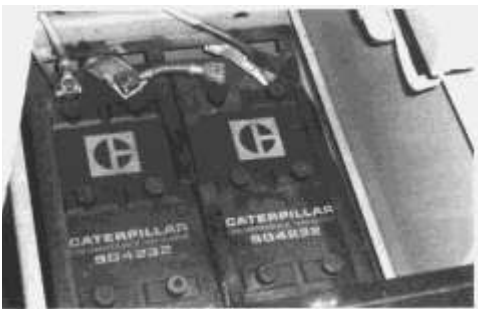
At operating temperature, the hydraulic tank is hot and can be under pressure.



Remove the hydraulic tank filler cap only after the engine has been stopped and the filler cap is cool enough to remove with your bare hand.

Remove the hydraulic tank filler cap slowly to relieve pressure.

Relieve all pressure in air, oil, fuel or cooling systems before any lines, fittings or related items are disconnected or removed.



Battery electrolyte contains acid and can cause injury. Avoid contact with the skin and eyes.

Fire or Explosion Prevention

All fuels, most lubricants and some coolant mixtures are flammable.

Do not smoke while refueling or in a refueling area.

Do not smoke in areas where batteries are charged, or where flammable materials are stored.

When starting from an external source, always connect the positive (+) boost cable to the positive (+) terminal of the battery of the engine to be started.

Attach the negative (-) boost ground cable last, away from the battery. See the Operation Guide for specific instructions.

Clean and tighten all electrical connections. Check daily for loose or frayed electrical wires. Have all loose or frayed electrical wires tightened, repaired or replaced before operating the machine.

Keep all fuels and lubricants stored in properly marked containers and away from all unauthorized persons.

Store all oily rags or other flammable material in a protective container, in a safe place.

Do not weld or flame cut on pipes or tubes that contain flammable fluids. Clean them thoroughly with nonflammable solvent before welding or flame cutting on them.

Remove all flammable materials such as fuel, oil and other debris before they accumulate on the machine.

Do not expose the machine to flames, burning brush, etc., if at all possible.

Do not bend or strike high pressure lines. Do not install bent or damaged lines, tubes or hoses.

Repair any loose or damaged fuel and oil lines, tubes and hoses. Leaks can cause fires.

Inspect all lines, tubes and hoses carefully. Do not use your bare hand to check for leaks. Tighten all connections to the recommended torque.

Make sure that all clamps, guards and heat shields, are installed correctly to prevent vibration, rubbing against other parts and excessive heat during operation.

Shields, which protect hot exhaust components from oil or fuel spray in the event of a line, tube or seal failure, must be installed correctly.

Ether is flammable. Do not smoke while changing ether cylinders.

Do not store replacement ether cylinders in living areas or in the operator's compartment.

Use ether only in well ventilated areas.

Keep ether cylinders out of the reach of unauthorized persons.

Do not store ether cylinders in direct sunlight. Discard cylinders in a safe place. Do not puncture or burn cylinders.

Fire Extinguisher

Always have a fire extinguisher on the machine and know how to use it. Inspect and have it serviced as recommended on its instruction plate.

Mounting and Dismounting



Mount and dismount the machine only where steps and/or handholds are provided.

Use both hands and face the machine, when mounting and dismounting.

Never get on or off a moving machine. Never jump off the machine.

Do not try to climb on or off the machine when carrying tools or supplies. Use a hand line to pull equipment up onto the platform.

Preparing to Start the Engine



Inspect the condition of the seat belt and mounting hardware. Replace any damaged or worn parts. Replace the seat belt regardless of appearance, after three years of use.

Adjust the seat so that full brake pedal travel can be obtained with the operator's back against the seat back.

Make sure the machine is equipped with a lighting system as required by conditions.

Make sure all lights are working properly.

Make sure no one is working on, underneath or close to the machine before starting the engine or beginning to move the machine. Make sure the area is free of personnel.

Starting the Engine



Do not start the engine or move any of the controls if there is a "DO NOT OPERATE" or similar warning tag attached to the start switch or controls.

Move all implement controls to the HOLD position before starting the engine.

Engage the hydraulic and directional control. Engage the swing brake control.

Start and operate the engine in a well ventilated area only. In an enclosed area, vent the exhaust to the outside.

Preparing to Operate the Machine

Clear all personnel from the machine and the area.

Clear all obstacles from the path of the machine. Beware of hazards such as wires, ditches, etc.

Be sure all windows are clean. Secure the doors and windows in either the open or shut position.

For best vision, especially close to the machine, adjust the rear view mirrors.

Make sure the machine horn, the backup alarm and all other warning devices are working properly.

Fasten the seat belt securely.

Check for proper operation of all controls and protective devices while moving slowly in an open area.

Operating the Machine

The operator must satisfy himself that no one will be endangered before moving the machine.

Operate the machine only while seated.

Operate the controls only with the engine running.

Do not allow riders on the machine unless additional seat, seat belt and Falling Object Protective Structure (FOPS) are provided.

Report any needed repairs noted during operation.

Carry implements close to the ground, approximately 40 cm (15 inches) above ground level.

Stay a safe distance from the edge of cliffs, overhangs and slide areas.

If the machine begins to sideslip on a grade, immediately dispose of the load and turn the machine downhill.

Be careful to avoid the condition which could lead to tipping when working on hills, banks or slopes, and when crossing ditches, ridges or other obstructions.

Work up and down slopes, rather than sideways, whenever possible.

Keep the machine under control and do not work it over its capacity.

Be sure hitch points and the towing device are adequate.

Connect trailing equipment to a drawbar or hitch only.

Never straddle a wire rope cable or similar device, nor allow others to do so.

Personnel should not be between the machine and trailing equipment when maneuvering to connect them. Block the tongue or hitch of trailing equipment to align it with the drawbar or hitch.

Parking the Machine

Park on a level surface. If necessary to park on a grade, block the machine.

Release the directional pedals to stop the machine.

Engage the hydraulic and directional control

Engage the swing brake control.

Lower all implements to the ground and apply slight down pressure.

Stop the engine.

Turn the start switch key to the OFF position.

Remove the start switch key and the disconnect switch key.

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Maintenance Recommendations

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Cooling System

NOTICE

Never add coolant to an overheated engine. Allow the engine to cool first.

Measure the specific gravity of antifreeze solution frequently in cold weather to ensure adequate protection.

When permanent-type antifreeze and water solutions are used in the cooling system, drain and replace the solution Every 2000 Service Hours or Yearly. When additions of conditioner are made as recommended, the drain and refill period can be extended to every 4000 service hours or two years.

The cooling system should contain a 3% to 6% concentration of conditioner at all times, regardless of the concentration of antifreeze.

Do not use Caterpillar cooling system conditioner with Dowtherm 209 coolant.

If the machine is shipped to or stored in an area with freezing temperatures, the cooling system must either be protected to the lowest expected outside temperature or drained completely.

The engine cooling system is protected to -20°F (-29°C) with permanent-type antifreeze when shipped from the factory.

Pure undiluted antifreeze will freeze at -10°F (-23°C).

Use clean water that is low in scale-forming minerals-not softened water.

When refilling the cooling system, always check the coolant level when the engine reaches normal operating temperature.

Filling the cooling system at over a 5 gpm (19 liter/min) rate can cause air pockets in the cooling system.

When measuring the coolant level, inspect the fill cap gasket. Replace the cap if the gasket is damaged.

Premix antifreeze solution to provide protection to the lowest expected outside temperature.

Operate with a thermostat in the cooling system all year round. Cooling system problems can develop without a thermostat.

It provides a larger capacity radiator that helps protect the system from overheating at temperatures up to +125°F (+55°C).

Engine Air Cleaner

Service the air cleaner when the indicator light goes on.

Inspect the air precleaner cup daily for accumulation of dust and debris.

Fuel System

Fill the fuel tank at the end of each day of operation to drive out moisture laden air.

Measure the fuel level with the dipstick in the fill opening.

Drain water and sediment from the fuel tank at the start of each shift or after the tank has been filled and allowed to stand 5 to 10 minutes. Drain moisture and sediment as required by prevailing conditions.

Drain water and sediment from the main fuel storage tank weekly. Also, drain the tank before it is refilled. This will help prevent water and sediment from being pumped into the machine fuel tank.

Always bleed the fuel system after changing fuel filters.

Fire Prevention

Accumulated grease and oil on a machine is a fire hazard. Remove this debris with steam cleaning or high pressure water at least every 1000 service hours or any time a large quantity of oil is spilled on the machine.

Have job sight fuel tanks protected by an embankment or steel posts so tanks are not hit by equipment when fueling.

Collect drained oil and wipe up spills when draining oil.

Electrical System

When using an external electrical source to start the machine, turn the disconnect switch off and remove the key before attaching the cable to the emergency starting receptacle.

When using jumper cables, be sure to connect in parallel; POSITIVE (+) to POSITIVE (+) and NEGATIVE (-) to NEGATIVE (-).

Hydraulic System

NOTICE

Make-up hydraulic fluid must mix with the fluid in the tank. Use only petroleum products unless the machine is equipped for use with special products.

Water or air in the hydraulic system can cause pump failure.

If hydraulic system drift is experienced, while operating at high outside temperatures, SAE 30 hydraulic oil should be used.

NOTICE

SAE 30 is NOT recommended if start-up temperatures will be below +40°F (+4°C).

Use of SAE 30 hydraulic oil in high temperatures will minimize drift, and increase pump life, at temperatures up to +125°F (+55°C).

A mixture of 55% SAE 40 and 45% SAE 10 oil is the equivalent of SAE 30 oil.

The equivalent of SAE 30 oil in the hydraulic system can be obtained by draining oil from the hydraulic tank and replacing it with SAE 40 oil.

NOTE: Before draining the tank, retract as many hydraulic cylinders as possible.

Drain 105 U.S. gallons (400 liters) from the hydraulic tank and replace it with SAE 40 oil.

Consult the "235 Excavator Lubrication and Maintenance Guide" for hydraulic tank drain and refill instructions.

If the hydraulic oil is cloudy, water or air is entering the system. Purge and refill the system. Tighten the suction hose clamps and flanges. Consult your Caterpillar dealer for the correct purging instructions.

The oil level should be between the ADD and FULL marks on the ENGINE RUNNING side of the dipstick.

Scheduled Oil Sampling

Use scheduled oil sampling to monitor machine condition and maintenance requirements.

Each sample should be taken when the oil is hot and well mixed. This will ensure that the sample is representative of the oil in the compartment.

Consult your Caterpillar dealer for complete information and assistance in establishing a scheduled oil sampling program for your equipment.

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