

Product: BACKHOE LOADER

Model: 416B BACKHOE LOADER 8SG

Configuration: 416B Backhoe Loader 8SG00001-11999 (MACHINE) POWERED BY 3054 Engine

## **Operation and Maintenance Manual 416B, 426B, 428B, 436B & 438B BACKHOE LOADERS**

Media Number -SEBU6414-03

Publication Date -14/12/1994

Date Updated -18/01/2011

## **Foreword**

SMCS - 7606

### **Literature Information**

This manual should be stored in the operator's compartment in the literature holder or seat back literature storage area.

This manual contains safety, operation, transportation, lubrication and maintenance information.

Some photographs or illustrations in this publication show details or attachments that can be different from your machine. Guards and covers might have been removed for illustrative purposes.

Continuing improvement and advancement of product design might have caused changes to your machine which are not included in this publication. Read, study and keep this manual with the machine.

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

### **Safety**

The Safety Section lists basic safety precautions. In addition, this section identifies the text and locations of warning signs and labels used on the machine.

Read and understand the basic precautions listed in the Safety Section before operating or performing lubrication, maintenance and repair on this machine.

### **Operation**

The Operation Section is a reference for the new operator and a refresher for the experienced one. This section includes a discussion of gauges, switches, machine controls, attachment controls, transportation and towing information.

Photographs and illustrations guide the operator through correct procedures of checking, starting, operating and stopping the machine.

Operating techniques outlined in this publication are basic. Skill and techniques develop as the operator gains knowledge of the machine and its capabilities.

## **Maintenance**

The Maintenance Section 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 topics. Items in the Maintenance Intervals chart are referenced to detailed instructions that follow.

### **Maintenance Intervals**

Use the service hour meter to determine servicing intervals. Calendar intervals shown (daily, weekly, monthly, etc.) can be used instead of service hour meter intervals if they provide more convenient servicing schedules and approximate the indicated service hour meter reading. Recommended service should always be performed at the interval that occurs first.

Under extremely severe, dusty or wet operating conditions, more frequent lubrication than is specified in the Maintenance Intervals chart might be necessary.

Perform service on items at multiples of the original requirement. For example, at Every 500 Service Hours or 3 Months, also service those items listed under Every 250 Service Hours or Monthly and Every 10 Service Hours or Daily.

## **Machine Description**



This machine is equipped with a 3054 diesel engine. It has a four-speed transmission and is designed primarily for moving material.

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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 or work on this machine unless you have read and understand the instructions and warnings in the Operation and Maintenance Manual. Failure to follow the instructions or heed the warnings could result in injury or death. Contact any Caterpillar dealer for replacement manuals. Proper care is your responsibility.**

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Located in the cab.

 **WARNING**

**Do not spray ether into engine when using thermal starting aid to start engine.**

**Personal injury and machine damage could result.**

**Follow procedure in the operation manual.**

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Located in cab.



 **WARNING**

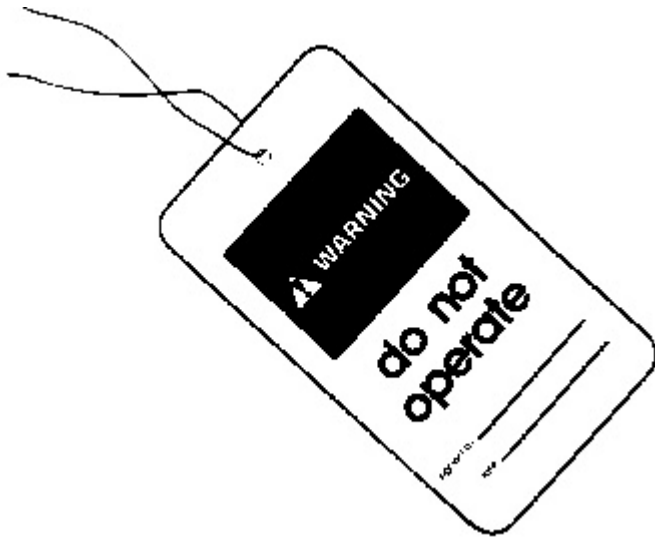
**Stay clear of this area when machine is operating. You can be crushed by swinging boom.**

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Located on rear of machine.

## General Hazard Information



Attach a Do Not Operate, SEHS7332, or similar warning tag to start switch or controls before servicing or repairing the machine. This tag is available from your Caterpillar dealer.

Know the width of your attachments so proper clearance can be maintained when operating near fences, boundary obstacles, etc.

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 appropriate work site hand signals and who gives them. Accept signals from one person only.

Inhaling air conditioner refrigerant gas through a lit cigarette or other smoking method or inhaling fumes released from a flame contacting air conditioner refrigerant gas can cause bodily harm or death. Do not smoke when servicing air conditioners or wherever refrigerant gas may be present.

Never put maintenance fluids into glass containers.

Use all cleaning solutions with care.

Report all needed repairs.

Do not allow unauthorized personnel on the machine.

- \* The machine parked on level ground.
- \* The attachment controls in HOLD.
- \* The transmission control lever into NEUTRAL.
- \* The parking brake engaged.

- \* The engine stopped.
- \* The start switch key off and the key removed.

### **Pressure Air**

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

The maximum air pressure must be below 205 kPa (30 psi) for cleaning purposes.

### **Fluid Penetration**

Always use a board or cardboard when checking for a leak. Escaping fluid under pressure, even a pin-hole size leak, can penetrate body tissue, causing serious injury, and possible death. If fluid is injected into your skin, it must be treated by a doctor familiar with this type of injury immediately.

### **Asbestos Information**

Caterpillar products and replacement parts shipped from Caterpillar are asbestos free. Caterpillar recommends the use of only genuine Caterpillar replacement parts. If any replacement parts containing asbestos are used, the following guidelines should be used in handling these parts and asbestos debris.

Caution should be used to avoid breathing dust that might be generated when handling components containing asbestos fibers. If this dust is inhaled, it can be hazardous to your health. Components in products that might 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 can contain asbestos is present, there are several common sense guidelines that should be followed.

- \* Never use compressed air for cleaning.
- \* Avoid brushing or grinding of asbestos containing materials.
- \* For clean up, use wet methods or a vacuum equipped with a high efficiency particulate air (HEPA) filter.
- \* Use exhaust ventilation on permanent machining jobs.
- \* Wear an approved respirator if there is no other way to control the dust.
- \* Comply with applicable rules and regulations for the work place (for example in the U.S.A., OSHA requirements as set forth in 29 CFR 1910.1001).
- \* Follow environmental rules and regulations for disposal of asbestos.
- \* Avoid areas where asbestos particles might be in the air.

### **Crushing or Cutting Prevention**

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

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

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

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.

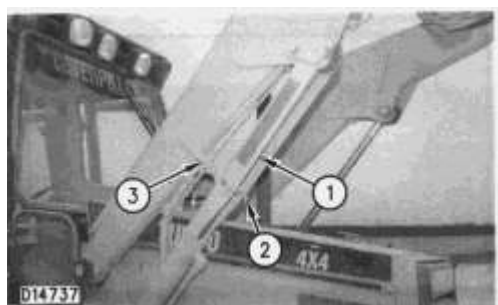
Do not use a kinked or frayed wire rope cable. Wear gloves when handling wire rope cable.

Retainer pins, when struck with force, can fly out and injure nearby persons. Make sure the area is clear of people when driving retainer pins.

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.

### **Lift Arm Brace**



When performing any work underneath a raised loader lift arm, the loader lift arm brace (1) must be in place as shown.

Install the lift arm brace, as follows:

1. Raise the loader lift arm.
2. Remove the cotter pin from pin (2). Remove pin (2) from the brace and lower brace down over the lift cylinder rod. Install pin (2) through the lower hole of the brace and install cotter pin in pin (2). Lower lift arms down until the lift arm brace contacts the top of the lift cylinder housing.
3. To remove brace, raise lift arm and remove cotter pin and pin (2) from the brace. Raise the brace back up to storage position so that the upper hole in the brace aligns with the hole in bracket (3). Install Pin (2) and cotter pin.

### **Rollover Protective Structure (ROPS) or Falling Objects Protective Structure (FOPS)**

ROPS or FOPS is a guard located above the operator's compartment and secured to the machine.

To avoid possible weakening of the ROPS or FOPS, consult a Caterpillar dealer before altering, by adding weight to, welding on, or cutting or drilling holes into the structure.

Any alteration not specifically authorized by Caterpillar invalidates Caterpillar's ROPS and FOPS certification. The protection offered by this ROPS/FOPS will be impaired if it has been subjected

to structural damage. Structural damage can be caused by an overturn accident, by falling objects, etc.

Do not mount any item such as fire extinguishers, first aid kits and lights by welding brackets to or drilling holes in any ROPS/FOPS structure. See your Caterpillar dealer for mounting guidelines.

## **Burn Prevention**

### **Coolant**

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

Steam can cause personal injury.

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

Remove the cooling system fill cap slowly to relieve pressure.

Cooling system additive contains alkali that can cause personal injury. Avoid contact with the skin, eyes and mouth.

Allow cooling system components to cool before draining.

### **Oils**



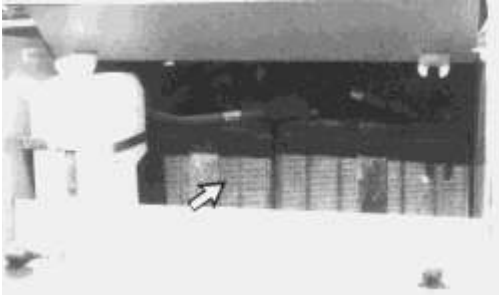
Hot oil and components can cause personal injury. Do not allow hot oil or components to contact the skin.

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

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

### **Batteries**





Batteries give off flammable fumes which can explode.

Do not smoke when observing the battery electrolyte levels.

Electrolyte is an acid and can cause personal injury if it contacts skin or eyes.

Always wear protective glasses when working with batteries.

### **Fire or Explosion Prevention**

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

Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire.

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.

Batteries can be located in separate compartments. When using jumper cables always connect positive (+) cable to positive (+) terminal of battery connected to starter solenoid and negative (-) cable from external source to starter negative (-) terminal. (If not equipped with starter negative (-) terminal, connect to engine block.)

See the Operation Section of this manual for specific starting 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.

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.

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.

### **Fire Extinguisher**

Have a fire extinguisher available and know how to use it. Inspect and have it serviced as recommended on its instruction plate.

On center pivot machines, the fire extinguisher should only be mounted to the fender or in the battery/tool box. Do not weld on or drill holes in the ROPS structure to mount the fire extinguisher on the ROPS.

On sideshift machines, the fire extinguisher can be mounted to the left fender or stabilizer post. The fire extinguisher can either be strapped or welded to the post.

**NOTE:** When welding on the post, the inner leg must be lowered so that it is not affected by welding heat. **DO NOT** drill holes in the post.

## **Ether**

Ether is poisonous and flammable.

Breathing ether vapors or repeated contact of ether with skin can cause personal injury.

Use ether only in well-ventilated areas.

Do not smoke while changing ether cylinders.

Use ether with care to avoid fires.

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

Do not store ether cylinders in direct sunlight or at temperatures above 40°C (102°F).

Discard cylinders in a protective place. Do not puncture or burn cylinders.

Keep ether cylinders out of the reach of unauthorized personnel.

Do not spray ether into engine when using thermal starting aid to start engine.

Follow procedure in this manual.

## **Lines, Tubes and Hoses**

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. Contact your Caterpillar dealer for repair or replacement.

Check lines, tubes and hoses carefully. Do not use your bare hand to check for leaks. Use a board or cardboard to check for leaks. See Fluid Penetration in the Safety Section for more details. Tighten all connections to the recommended torque. Replace if any of the following conditions are found.

- \* End fittings damaged or leaking.
- \* Outer covering chafed or cut and wire reinforcing exposed.
- \* Outer covering ballooning locally.
- \* Evidence of kinking or crushing of the flexible part of hose.
- \* Armoring embedded in the outer cover.

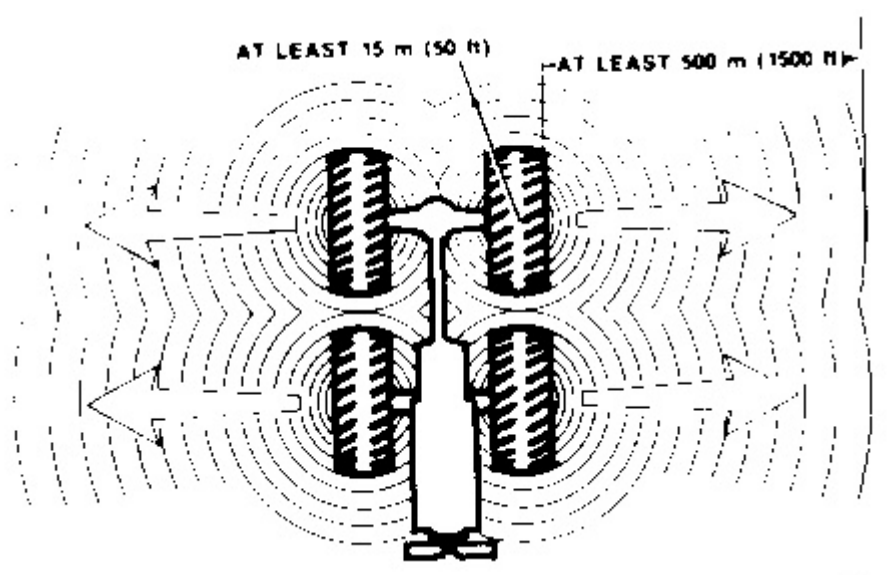
\* End fittings displaced.

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

### **Tire Information**

Explosions of air inflated tires have resulted from heat-induced gas combustion inside the tires. The heat, generated by welding or heating rim components, external fire, or excessive use of brakes can cause gaseous combustion.

A tire explosion is much more violent than a blowout. The explosion can propel the tire, rim and axle components as far as 500 m (1500 ft) or more from the machine. Both the force of the explosion and the flying debris can cause personal injury or death, and property damage.



Do not approach a warm tire closer than the outside of the area represented by the shaded area in the illustration.

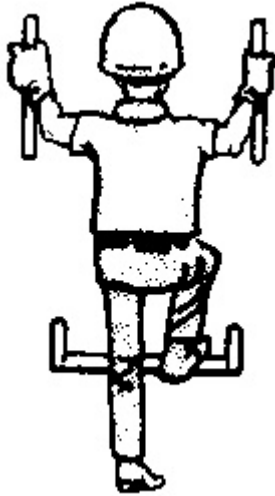
Stand behind the tread and use a self-attaching chuck when inflating a tire.

Servicing and changing tires and rims can be dangerous and should be done only by trained personnel using proper tools and procedures. If correct procedures are not followed while servicing tires and rims, the assemblies could burst with explosive force and cause serious personal injury or death. Follow carefully the specific information provided by your tire or rim servicing personnel or dealer.

### **Mounting and Dismounting**



- \* Mount and dismount the machine only where steps and/or handholds are provided.
- \* Inspect, and when necessary, clean and have repairs made to steps and handholds before mounting and dismounting.



- \* Face the machine when mounting and dismounting.
- \* Maintain a three-point contact (two feet and one hand or one foot and two hands contact) with the steps and handholds.
- \* 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.
- \* Do not use any controls as handholds when entering or leaving the operator's station.

### **Alternate Exit**

Machines equipped with cabs are equipped with alternate exits. For additional alternate exit information, refer to topic Alternate Exit in the Monitoring Systems and Cab Features section of this manual.

### **Before Starting the Engine**

Start the engine only from the operator's station. Never short across the starter terminals or across the batteries, as this could bypass the engine neutral-start system as well as damage the electrical system.

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.

Make sure there is no debris in or around the backhoe controls.

Adjust the seat so that full 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.



When moving the machine in any transmission gear speed other than first gear, have the brake pedal lock bar engaged. The machine can swerve out of control if only one brake is applied for a quick stop.

### **Engine Starting**

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 hydraulic controls to the HOLD position before starting the engine.

Move the transmission control lever into NEUTRAL.

Engage the parking brake.

Diesel engine exhaust contains products of combustion which can be harmful to your health. Always start and operate the engine in a well-ventilated area. If in an enclosed area, vent the exhaust to the outside.

### **Before Operating 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.

Stabilizers must be in the correct position before operating the machine. Raise the stabilizers completely for transport or for loader operation. Lower the stabilizers before operating the backhoe. **DO NOT DIG UNDER THE STABILIZERS!**

Reposition the flip-over stabilizer pads by standing outside of the machine, on the ground only. **DO NOT REPOSITION THE PADS WHILE IN THE CAB!**

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

Adjust the rear view mirrors (if equipped) for best vision, especially close to the machine.

Make sure the machine horn, the back-up alarm (if equipped) and all other warning devices are working properly.

Fasten the seat belt securely.

## **Machine Operation**

When operating the backhoe, engage the parking brake, move the transmission control lever into neutral and engage the forward-reverse or neutral lock.

Operate the machine only while seated and with the seat belt fastened.

Operate the controls only with the engine running.

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

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

Never swing a load over a truck cab or workers.

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

Report any needed repairs noted during operation.

Carry attachments close to the ground, approximately 40 cm (15 in) above ground level.

Stay an adequate 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.

No personnel should 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.

Know the maximum height and reach of your machine.

Always keep the Rollover Protective Structure (ROPS) (if equipped) installed when operating the machine.

## **All Wheel Steer (AWS) Machines**

When roading an All Wheel Steer (AWS) machine, OPERATE IN FRONT WHEEL STEER MODE ONLY.

When changing to or from any steering mode, make sure rear wheels are centered.

## **Lifting Objects With Bucket**

There may be some local government regulations regarding the use of Backhoe Loaders to lift heavy objects. Those regulations must be followed.

## **Machine Parking**



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

Apply the service brake to stop the machine.

Move the transmission control lever into NEUTRAL and engage the transmission neutral lock.

Move the speed control to LOW IDLE.

Engage the parking brake.

Lower all attachments to the ground with loader bucket level.

Stop the engine.

Turn the engine start switch key to OFF and remove.

Move all hydraulic control levers back and forth to relieve hydraulic pressure.

Move all hydraulic control levers into the hold position.

## **Sound and Vibration Information**

### **Sound Level**

The operator sound pressure level for this machine with a properly installed and maintained closed cab configuration is:

<b>Model</b>	<b>Non A/C</b>	<b>A/C</b>
416B (NA) <sup>1</sup> , 428B (NA) <sup>1</sup>	82 dB (A)	84 dB (A)
416B (T) <sup>2</sup> , 428B (T) <sup>2</sup> , 426B	82 dB (A)	84 dB (A)
436B, 438B	82 dB (A)	84 dB (A)

1 (NA)-Naturally Aspirated.

2 (T)-Turbocharged.

Measurement is obtained on a static machine with the procedures and cab conditions as described in ISO 6394 or 86/662/EEC.

### **Vibration Level**

Hands/Arms: The weighted root mean square acceleration to which the hands/arms are subjected, is less than the 2.5 m/s<sup>2</sup>.

Whole Body: The weighted root mean square acceleration to which the whole body is subjected is less than 0.5 m/s<sup>2</sup>.

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

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## Specifications and Model Views

SMCS - 7606



Basic machine shipping specifications are listed below. Actual machine specifications will vary based on attachments used.

<b>416B Backhoe Loader</b>	
Weight (approximate)	6311 kg (13,900 lb)
Length (maximum)	6814 mm (22.4 ft)
Width (across tires)	2146 mm (7 ft)
Height	3423 mm (11.2 ft)

<b>426B Backhoe Loader</b>	
Weight (approximate)	6719 kg (14,800 lb)
Length (maximum)	6895 mm (22.6 ft)
Width (across tires)	2146 mm (7 ft)
Height	3715 mm (12.2 ft)

<b>428B Backhoe Loader</b>	
Weight (approximate)	7264 kg (16,000 lb)
Length (maximum)	5636 mm (18.5 ft)
Width (across stabilizers)	2360 mm (7.7 ft)
Height	3566 mm (11.7 ft)

<b>436B Backhoe Loader</b>	
Weight (approximate)	6810 kg (15,000 lb)
Length (maximum)	7072 mm (23.2 ft)
Width (across tires)	2156 mm (7.1 ft)
Height	3810 mm (12.5 ft)

<b>438B Backhoe Loader</b>	
Weight (approximate)	7400 kg (16,300 lb)
Length (maximum)	7377 mm (24.2 ft)
Width (across stabilizers)	2360 mm (7.7 ft)
Height	3706 mm (12.2 ft)

<b>Engine Power Ratings</b>			
<b>Model</b>	<b>Gross Engine Power</b>	<b>Net Engine Power</b>	<b>EU Net Engine Power</b>
416B & 428B NA Engines	57.4 kW (77 hp)	55.2 kW (74 hp)	54.31 kW (72.8 hp)
416B & 428B T Engines	61.2 kW (82 hp)	58.9 kW (79 hp)	59.83 kW (80.2 hp)
436B & 438B	64.9 kW (87 hp)	62.7 kW (84 hp)	63.34 kW (84.9 hp)



**Transmission** - 4-speed forward and reverse - full synchromesh gearbox. Constant mesh gears on all ratios permits on-the-go shifting 1st through 4th and down 4th through 1st. Neutral start provision prevents starting machine in gear.

#### **Transmission Disconnect**

Hand operated power disconnect for on-the-go shifting and fast loader lift, dump and lower with engine running at high rpm.

#### **Reversing Shuttle**

Conveniently placed, hand operated lever provides instant direction changes from forward to reverse with power hydraulic clutches.

#### **Rear Axle**

Heavy duty industrial axle with inboard planetary reduction and differential lock.

#### **Rear Axle (AWS)**

Heavy duty industrial axle with planetary reduction in the wheel hub and limited slip differential.



**Brakes** - Two oil disc brakes on final drive output shafts.

Fully enclosed, hydraulic self-energizing oil disc brakes on final drive output shaft. Foot operated, pedal interlock for roading, or independently for working applications.

#### **Front Axle**

Oscillation 11° each direction from centerline.

Switch on instrument panel engages front wheel drive (if equipped), on the move, in any gear, forward or reverse.

Final drive from differential to front wheels by way of planetary reduction in each wheel. Planetary units can be removed independently of wheels. On-the-go shifting 1st through 4th and down 4th through 1st is retained in 4-WD.

#### **Travel Speed**

The following travel speeds are for a standard 416B Backhoe Loader, equipped with 16.9 x 24 rear tires, at full throttle.

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