

Product: BACKHOE LOADER

Model: 416 BACKHOE LOADER 5PC

Configuration: 416 SERIES II BACKHOE LOADER 5PC10762-UP (MACHINE) POWERED BY 4.236 DIESEL ENGINE

Operation and Maintenance Manual 416, 426, 428, 436 AND 438 SERIES II BACKHOE LOADERS

Media Number -SEBU6338-01

Publication Date -01/11/1990

Date Updated -11/10/2001

Foreword

SMCS - 7606

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

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

Continuing improvement and advancement of product design may have caused changes to your machine which are not included in this publication. Read-study-and keep it 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 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 product.

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, implement 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.) may 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 may 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 designed primarily for excavating and moving material.

Machine Storage

For complete machine storage information refer to Special Instruction SEHS9031, "Storage Procedure for Caterpillar Products."

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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.



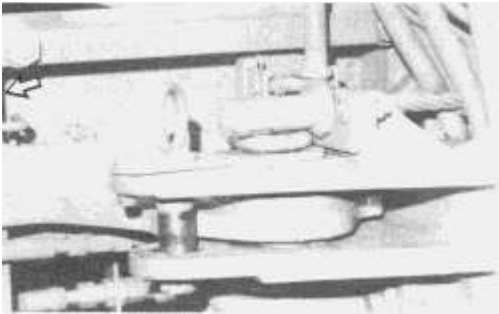
DO NOT OPERATE THIS MACHINE UNLESS YOU HAVE READ AND UNDERSTAND THE INSTRUCTIONS IN THE OPERATION GUIDE. IMPROPER MACHINE OPERATION IS DANGEROUS AND COULD RESULT IN INJURY OR DEATH. THE OPERATION GUIDE IS IN HOLDER IN THE OPERATOR'S COMPARTMENT. CONTACT ANY CATERPILLAR DEALER FOR A REPLACEMENT GUIDE. PROPER OPERATION IS YOUR RESPONSIBILITY.



Located on the dash.

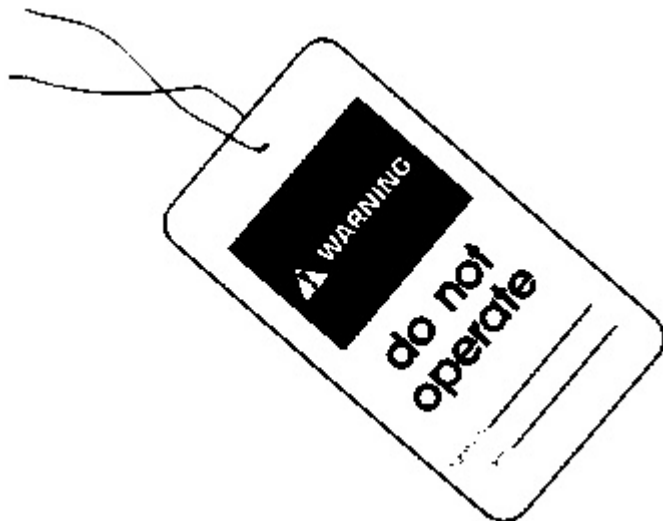


Stay clear of this area when machine is operating. You can be crushed by swinging boom.



Located on rear of machine.

General Hazard Information



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.

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.

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 parking brake engaged.
- * The loader bucket lowered to the ground.
- * The backhoe in transport position.
- * The transmission levers in neutral and forward-reverse (neutral) lock engaged.
- * The engine stopped.
- * The start switch 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

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.

- * 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 may 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 it up. Any 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 the 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.

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

This is an attached guard located above the operator's compartment and secured to the machine.

To avoid possible weakening of the Rollover Protective Structure (ROPS) or Falling Objects Protective Structure (FOPS), consult a Caterpillar dealer before altering the ROPS (FOPS) in any way. 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.

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 water 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 filler cap is cool enough to remove with your bare hand.

Remove the cooling system filler cap slowly to relieve pressure.

Cooling system additive contains alkali that can cause personal injury. Avoid contact with the skin and eyes and do not drink.

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.

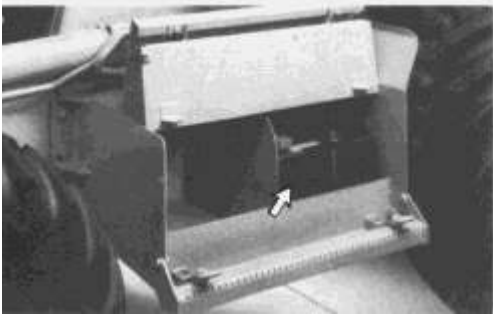
At operating temperature, the hydraulic tank is hot and can be under pressure.

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.

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 in series may 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, 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.

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.

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

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 39°C (102°F).

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

Keep ether cylinders out of the reach of unauthorized personnel.

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.

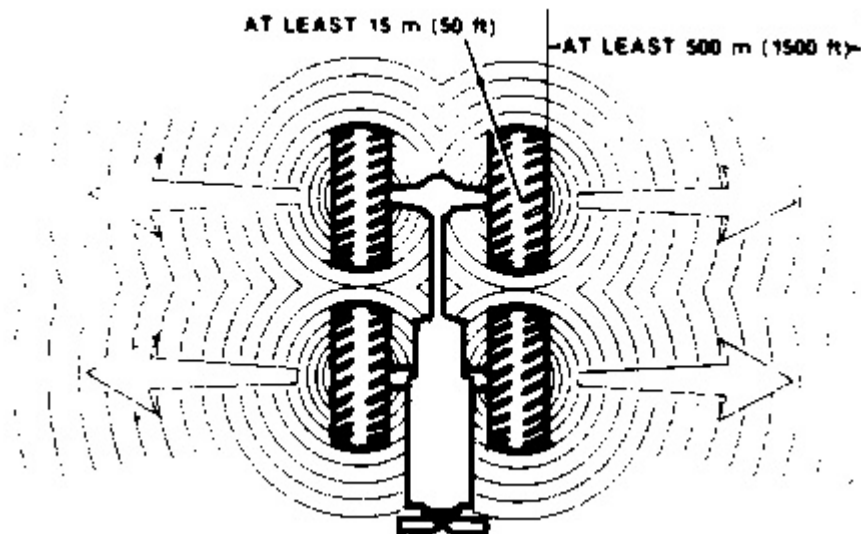
- * End fittings damaged or leaking.
- * Outer covering chafed or cut and wire reinforcing exposed.
- * Outer covering ballooning locally.
- * Evidence of kinking or crushing of the flexible part of hose.
- * Armouring embedded in the outer cover.
- * End fittings displaced.

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 above drawing.

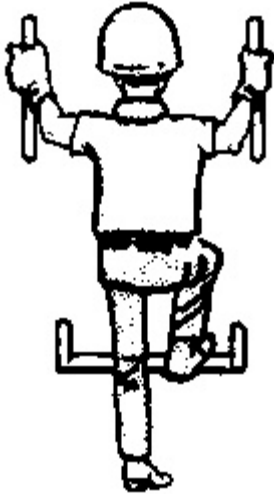
Stand behind the tread and use a self-attaching chuck when inflating a tire.

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 man 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.

Secondary Exit

Machines equipped with cabs are equipped with secondary exits. For additional secondary exit information, refer to topics "Right Cab Window" and "Cab Rear Window" 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, because of deterioration of material.

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

Make sure the pedal lock bar is in locked position above 1st gear to prevent sudden turning.

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

Make sure all lights are working properly.

Check for leaks, cracks, loose or missing bolts, tire or machine damage.

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.

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 attachment controls to the HOLD position before starting the engine.

Engage the parking brake. Shift the transmission control levers to NEUTRAL and engage the FORWARD-REVERSE (NEUTRAL) lock.

Do not operate the engine at HIGH IDLE with cold transmission oil. The cold oil could prevent the neutralizer valve from functioning properly and the machine could move.

Avoid possible injury or death from a runaway machine. Start the engine only while facing forward and seated in the operator's seat. Turn seat to backhoe operation after starting.

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

Before Operating the Machine

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

Clear all personnel from the machine and the area. Make sure personnel are not in reach of backhoe or in path of loader.

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

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

On cab equipped machines, be sure all windows are clean. Secure the doors and windows in either the open or shut position while operating.

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

Make sure the machine horn, the back-up alarm (if equipped) 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.

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

Machine Operation

When operating the backhoe, engage the parking brake, put transmission in neutral, and ENGAGE FORWARD-REVERSE LOCK.

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

Operate the controls only with the engine running unless servicing machine.

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.

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 loader bucket close to the ground. Backhoe should be in transport position.

Do not operate the machine above 2nd gear with a loaded bucket.

Do not negotiate turns at higher machine speeds with a loaded bucket more than 380 mm (15 in) off the ground to avoid possible tipping.

Raise the loader bucket to maximum height only for loading a hauling unit.

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

Avoid conditions 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.

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.

Machine Parking



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

Apply the service brakes to stop the machine. Engage the parking brake.

Shift the transmission control levers to NEUTRAL. Apply the neutral lock.

Lower the loader bucket to the ground and apply slight down pressure.

Put the backhoe in the "transport position". Install the swing lock pin in backhoe.

Stop the engine.

Turn the start switch key to the OFF position.

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Specifications and Model Views

SMCS - 7606



416 Backhoe Loader	
Weight (approximate)	5938 kg (13,064 lb)
Length (maximum)	6814 mm (22.4 ft)
Width (across tires)	2192 mm (7.2 ft)
Height	3423 mm (11.2 ft)

426 Backhoe Loader	
Weight (approximate)	6317 kg (13,897 lb)
Length (maximum)	6895 mm (22.6 ft)
Width (across tires)	2192 mm (7.2 ft)
Height	3715 mm (12.2 ft)

428 Backhoe Loader	
Weight (approximate)	6885 kg (15.147 lb)
Length (maximum)	5636 mm (18.5 ft)
Width (across stabilizers)	2384 mm (7.8 ft)
Height	3566 mm (11.7 ft)

436 Backhoe Loader	
Weight (approximate)	6685 kg (14.707 lb)
Length (maximum)	7072 mm (23.2 ft)
Width (across tires)	2262 mm (7.4 ft)
Height	3810 mm (12.5 ft)

438 Backhoe Loader	
Weight (approximate)	7200 kg (15.840 lb)
Length (maximum)	7377 mm (24.2 ft)
Width (across stabilizers)	2360 mm (7.7 ft)
Height	3692 mm (12.1 ft)

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.

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 4wd.

Pallet Forks (Europe Only)

The safe working load for the fold down pallet forks used with the multi-purpose bucket on the backhoe loader is 1000 kg (2200 lb) at 610 mm (24 in) load centers.

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

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

Travel Speed

The following travel speeds are for a standard 416 backhoe loader, equipped with 16.9 × 24 rear tires, at full throttle.

	1st		2nd		3rd		4th	
	Km/H	MPH	Km/H	MPH	Km/H	MPH	Km/H	MPH
Forward	5.6	3.5	10.5	6.5	20.3	12.6	31.8	19.7
Reverse	5.6	3.5	10.6	6.6	20.4	12.7	31.9	19.8

The following travel speeds are for a standard 426 backhoe loader, equipped with 16.9 × 24 rear tires, at full throttle.

	1st		2nd		3rd		4th	
	Km/H	MPH	Km/H	MPH	Km/H	MPH	Km/H	MPH
Forward	5.2	3.3	9.8	6.1	19.0	11.8	29.7	18.4
Reverse	5.2	3.3	9.8	6.1	19.1	11.9	29.9	18.5

The following travel speeds are for a standard 428/436 backhoe loader, equipped with 16.9 × 28 rear tires, at full throttle.

	1st		2nd		3rd		4th	
	Km/H	MPH	Km/H	MPH	Km/H	MPH	Km/H	MPH
Forward	5.2	3.2	9.8	6.1	19.0	11.8	29.7	18.4
Reverse	5.2	3.2	9.9	6.2	19.1	11.9	29.8	18.5

The following travel speeds are for a standard 438 backhoe loader, equipped with 18.4/15 × 26 rear tires, at full throttle.

	1st		2nd		3rd		4th	
	Km/H	MPH	Km/H	MPH	Km/H	MPH	Km/H	MPH
Forward	5.3	3.3	10.1	6.3	19.5	12.1	30.5	18.9
Reverse	5.4	3.3	10.1	6.3	19.6	12.2	30.6	19.0

Steering - Steering unit provides manual steering capability in case of power failure.

Type ... Front wheel

Power steering ... Hydrostatic

Cylinder ... Double acting

Backhoe Buckets

Width		Rated		Struck		Weight		No. of Teeth
mm	in	L	cu ft	L	cu ft	kg	lb	
305	12	71	2.5	57	2.0	84	185	3
457	18	142	5.0	113	4.0	114	251	4
610	24	198	7.0	156	5.5	130	286	4
762	30	283	10.0	198	7.0	146	321	5
914	36	340	12.0	255	9.0	162	356	6

Width		Rated		Struck		Weight		No. of Teeth
mm	in	L	cu ft	L	cu ft	kg	lb	
305	12	71	2.5	57	2.0	107	236	3
457	18	160	5.5	130	4.5	138	304	4
610	24	220	8.0	180	6.5	176	388	5
762	30	300	11.0	220	8.0	209	461	6
914	36	340	12.0	255	9.0	203	447	7

Width		Rated		Struck		Weight		No. of Teeth
mm	in	L	cu ft	L	cu ft	kg	lb	
457	18	142	5.0	99	3.5	148	326	4
610	24	198	7.0	142	5.0	170	375	4

Loader Buckets

General Purpose Capacities						
Machine	Heaped		Width		Weight	
	cu m	cu yd	mm	in	kg	lb
416	0.76	1.00	2262	89.0	368	810
426	0.96	1.25	2262	89.0	418	920
428 & 436	1.00	1.35	2396	94.3	447	983
436	1.00	1.37	2262	89.0	444	976

Multi-Purpose Capacities						
Machine	Heaped		Width		Weight	
	cu m	cu yd	mm	in	kg	lb
416/426	0.76	1.00	2262	89.0	540	1188
428/436	0.92	1.20	2396	94.3	597	1313
428 & 436 w/forks	0.92	1.20	2396	94.3	757	1666

9R5866 uni-tooth special is available for all loader buckets.

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