

**320  
320L**

**322**



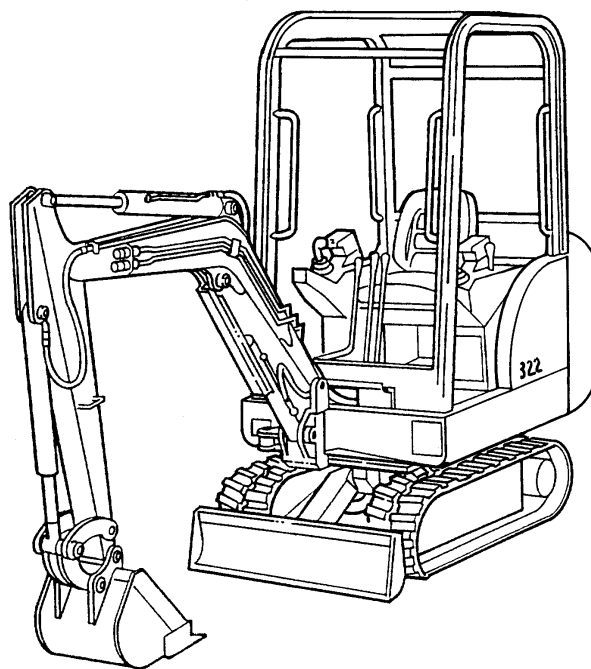
**Bobcat®**

# **Service Manual**

**320/320L (S/N 223811001 & Above)**

**322 (S/N 223511001 & Above)**

**(D Series)**



# MAINTENANCE SAFETY



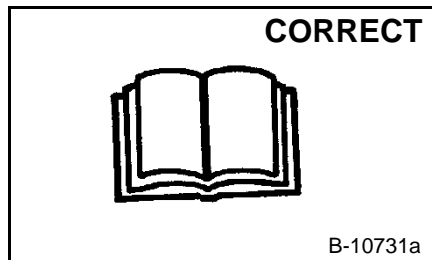
## WARNING

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

W-2003-0903

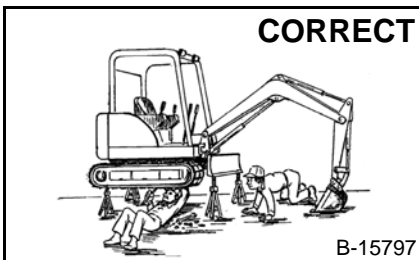


**Safety Alert Symbol:** This symbol with a warning statement, means: "Warning, be alert! Your safety is involved!" Carefully read the message that follows.



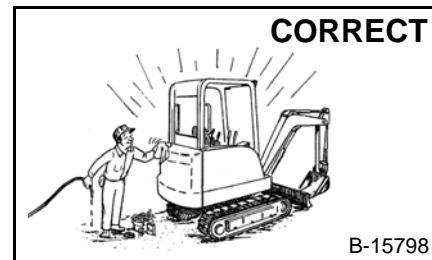
B-10731a

- ⚠ Never service the Bobcat Hydraulic Excavator without instructions.



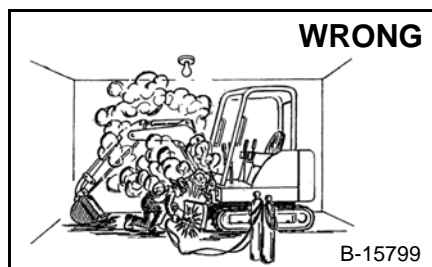
B-15797

- ⚠ Use the correct procedure to lift and support the excavator.
- ⚠ Always lift the blade fully before installing jackstands.



B-15798

- ⚠ Cleaning and maintenance are required daily.



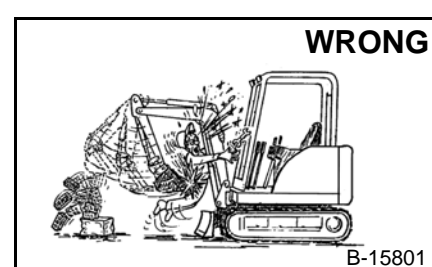
B-15799

- ⚠ Have good ventilation when welding or grinding painted parts.
- ⚠ Wear dust mask when grinding painted parts. Toxic dust and gas can be produced.



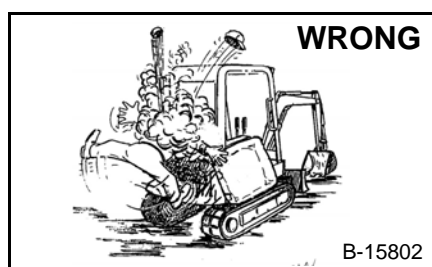
B-15800

- ⚠ Vent exhaust to outside when engine must be run for service.
- ⚠ Exhaust system must be tightly sealed. Exhaust fumes can kill without warning.



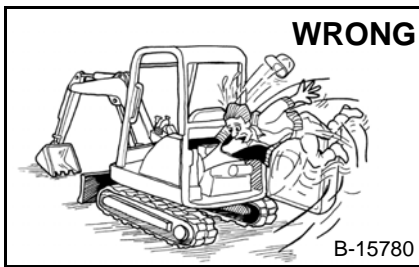
B-15801

- ⚠ Always lower the bucket and blade to the ground before doing any maintenance.
- ⚠ Never modify equipment or add attachments not approved by Bobcat Company.



B-15802

- ⚠ Stop, cool and clean engine of flammable materials before checking fluids.
- ⚠ Never service or adjust machine with the engine running unless instructed to do so in the manual.
- ⚠ Avoid contact with leaking hydraulic fluid or diesel fuel under pressure. It can penetrate the skin or eyes.
- ⚠ Never fill fuel tank with engine running, while smoking or when near open flame.



B-15780

- ⚠ Keep body, jewelry and clothing away from moving parts, electrical contact, hot parts and exhaust.
- ⚠ Wear eye protection to guard from battery acid, compressed springs, fluids under pressure and flying debris when engines are running or tools are used. Use eye protection approved for type of welding.
- ⚠ Keep rear door closed except for service. Close and latch door before operating the excavator.



B-6589

- ⚠ Lead-acid batteries produce flammable and explosive gases.
- ⚠ Keep arcs, sparks, flames and lighted tobacco away from batteries.
- ⚠ Batteries contain acid which burns eyes or skin on contact. Wear protective clothing. If acid contacts body, flush well with water. For eye contact flush well and get immediate medical attention.

Maintenance procedures which are given in the Operation & Maintenance Manual can be performed by the owner/operator without any specific technical training. Maintenance procedures which are **not** in the Operation & Maintenance Manual must be performed **ONLY BY QUALIFIED BOBCAT SERVICE PERSONNEL**. Always use genuine Bobcat replacement parts. The Service Safety Training Course is available from your Bobcat dealer.

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**SAFETY AND  
MAINTENANCE**

**HYDRAULIC  
SYSTEM**

**UNDER-  
CARRIAGE**

**UPPER-  
STRUCTURE &  
SWING SECTION**

**ELECTRICAL  
SYSTEM AND  
ANALYSIS**

**ENGINE  
SERVICE**

**HEATER**

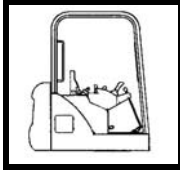
**SPECIFICATIONS**

# FOREWORD

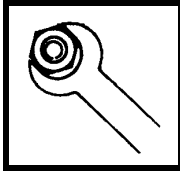
This manual is for the Bobcat Hydraulic excavator mechanic. It provides necessary servicing and adjustment procedures for the hydraulic excavator and its component parts and systems. Refer to the Operation & Maintenance Manual for operating instructions, starting procedure, daily checks, etc.

A general inspection of the following items must be made after the hydraulic excavator has had service or repair:

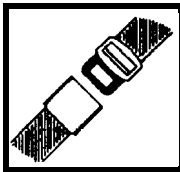
1. Check that the ROPS/TOPS/FOPS is in good condition and is NOT modified.



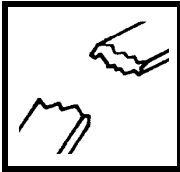
2. Check that ROPS/TOPS mounting hardware is tightened and is Bobcat® approved.



3. The seat belt must be correctly installed, functional and in good condition.



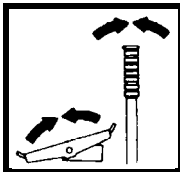
4. Inspect for loose or broken parts or connections.



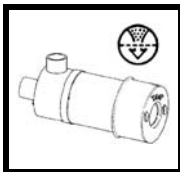
5. Machine signs must be legible and in the correct location.



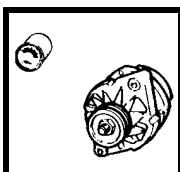
6. Steering levers, control levers and foot pedals must return to neutral. Check that foot pedals lock and control lever locks are in working order.



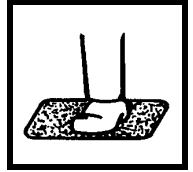
7. Inspect the air cleaner for damage or leaks. Check the condition of the element.



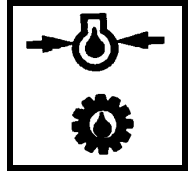
8. Check the electrical charging system.



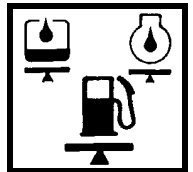
9. Safety treads must be in good condition.



10. Check for correct function of indicator lamps (Optional on some models).



11. Check hydraulic fluid level, engine oil level and fuel supply.



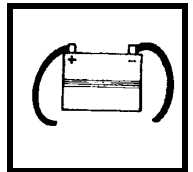
12. Inspect for fuel, oil or hydraulic fluid leaks.



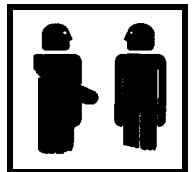
13. Lubricate the excavator.



14. Check the condition of the battery and cables.



Recommend to the owner that all necessary corrections be made before the machine is returned to service.



**CALIFORNIA  
PROPOSITION 65 WARNING**  
Diesel engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects and other reproductive harm.

## SAFETY INSTRUCTIONS



### Safety Alert Symbol

This symbol with a warning statement means:  
“Warning, be alert! Your safety is involved!”  
Carefully read the message that follows.



## WARNING

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

W-2003-0903



## WARNING

Warnings on the machine and in the manuals are for your safety. Failure to obey warnings can cause injury or death.

W-2044-1285

## IMPORTANT

This notice identifies procedures which must be followed to avoid damage to the machine.

I-2019-0284

The following publications provide information on the safe use and maintenance of the Bobcat machine and attachments:

- The Delivery Report is used to assure that complete instructions have been given to the new owner and that the machine is in safe operating condition.
- The Operation & Maintenance Manual delivered with the machine or attachment contains operating information as well as routine maintenance and service procedures. It is a part of the machine and can be stored in a container provided on the machine. Replacement Operation & Maintenance Manuals can be ordered from your Bobcat dealer.
- Machine signs (decals) instruct on the safe operation and care of your Bobcat machine or attachment. The signs and their locations are shown in the Operation & Maintenance Manual. Replacement signs are available from your Bobcat dealer.
- An Operator's Handbook fastened to the operator cab. It's brief instructions are convenient to the operator. The handbook is available from your dealer in an English edition or one of many other languages. See your Bobcat dealer for more information on translated versions.
- The AEM Safety Manual delivered with the machine gives general safety information.
- The Service Manual and Parts Manual are available from your dealer for use by mechanics to do shop-type service and repair work.
- The Compact Excavator Operator Training Course is available through your local dealer or at [www.training.bobcat.com](http://www.training.bobcat.com) or [www.bobcat.com](http://www.bobcat.com). This course is intended to provide rules and practices of correct operation of the Bobcat Excavator. The course is available in English and Spanish versions.
- Service Safety Training Courses are available from your Bobcat dealer or at [www.training.bobcat.com](http://www.training.bobcat.com) or [www.bobcat.com](http://www.bobcat.com). They provide information for safe and correct service procedures.
- The Bobcat Compact Excavator Safety Video is available from your Bobcat dealer or at [www.training.bobcat.com](http://www.training.bobcat.com) or [www.bobcat.com](http://www.bobcat.com).

SI EXC-0206 SM

320/322 Excavator  
Service Manual

## SAFETY INSTRUCTIONS (CONT'D)

### Fire Prevention

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

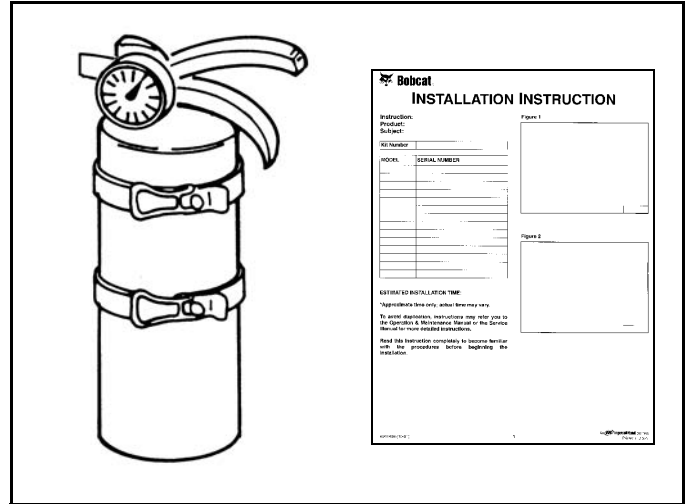
Flammable debris (leaves, straw, etc.) must be removed regularly. If flammable debris is allowed to accumulate, it will increase fire hazard. Clean often to avoid this accumulation. Flammable debris in the engine compartment is a potential hazard.

The spark arrestor muffler is designed to control the emission of hot particles from the engine and exhaust system, but the muffler and the exhaust gases are still hot.

- Do not use the machine where exhaust, arcs, sparks or hot components can contact flammable material, explosive dust or gases.
- The operator cab, engine compartment, and engine cooling system must be inspected every day and cleaned if necessary to prevent fire hazard and overheating.
- Check all electrical wiring and connections for damage. Keep the battery terminals clean and tight. Repair or replace any damaged part.
- Check fuel and hydraulic tubes, hoses and fittings for damage and leakage. Never use open flame or bare skin to check for leaks. Tighten or replace any parts that show leakage. Always clean fluid spills. Do not use gasoline or diesel fuel for cleaning parts. Use commercial nonflammable solvents.
- Do not use ether or starting fluids on any engine which has glow plugs. These starting aids can cause explosion and injure you or bystanders.
- Always clean the machine, disconnect the battery, and disconnect the wiring from the controllers before welding. Cover rubber hoses, battery and all other flammable parts. Keep a fire extinguisher near the machine when welding. Have good ventilation when grinding or welding painted parts. Wear a dust mask when grinding painted parts. Toxic dust or gas can be produced.
- Stop the engine and let it cool before adding fuel. **NO SMOKING!**

- Use the procedure in the Operation & Maintenance Manual for connecting the battery and for jump starting.
- Use the procedure in the Operation & Maintenance Manual for cleaning the spark arrestor muffler (if equipped).

Figure 1



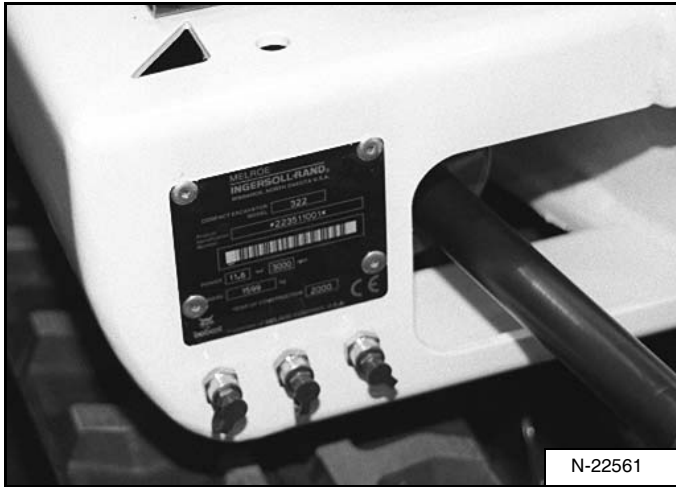
- Know where fire extinguishers and first aid kits are located and how to use them. Fire extinguishers are available from your Bobcat dealer [Figure 1].

## SERIAL NUMBER LOCATIONS

Always use the serial number of the excavator when requesting service information or when ordering parts. Early or later models (identification made by serial number) may use different parts, or it may be necessary to use a different procedure in doing a specific service operation.

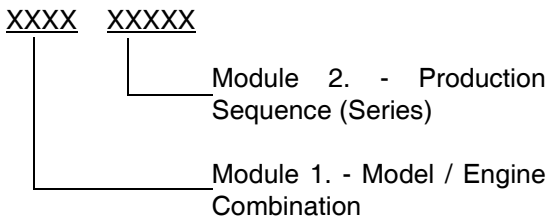
### Excavator Serial Number

Figure 1



The excavator serial number is on the frame of the machine in the location shown **[Figure 1]**.

Explanation of Excavator Serial Number:

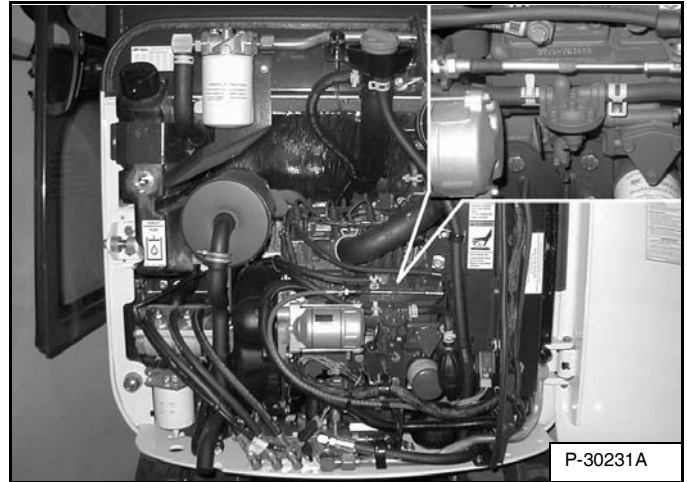


1. The four digit Model/Engine Combination Module number identifies the model number and engine combination.

2. The five digit Production Sequence Number identifies the order which the excavator is produced.

### Engine Serial Number

Figure 2



The engine serial number is located on the engine in the location shown **[Figure 2]**.



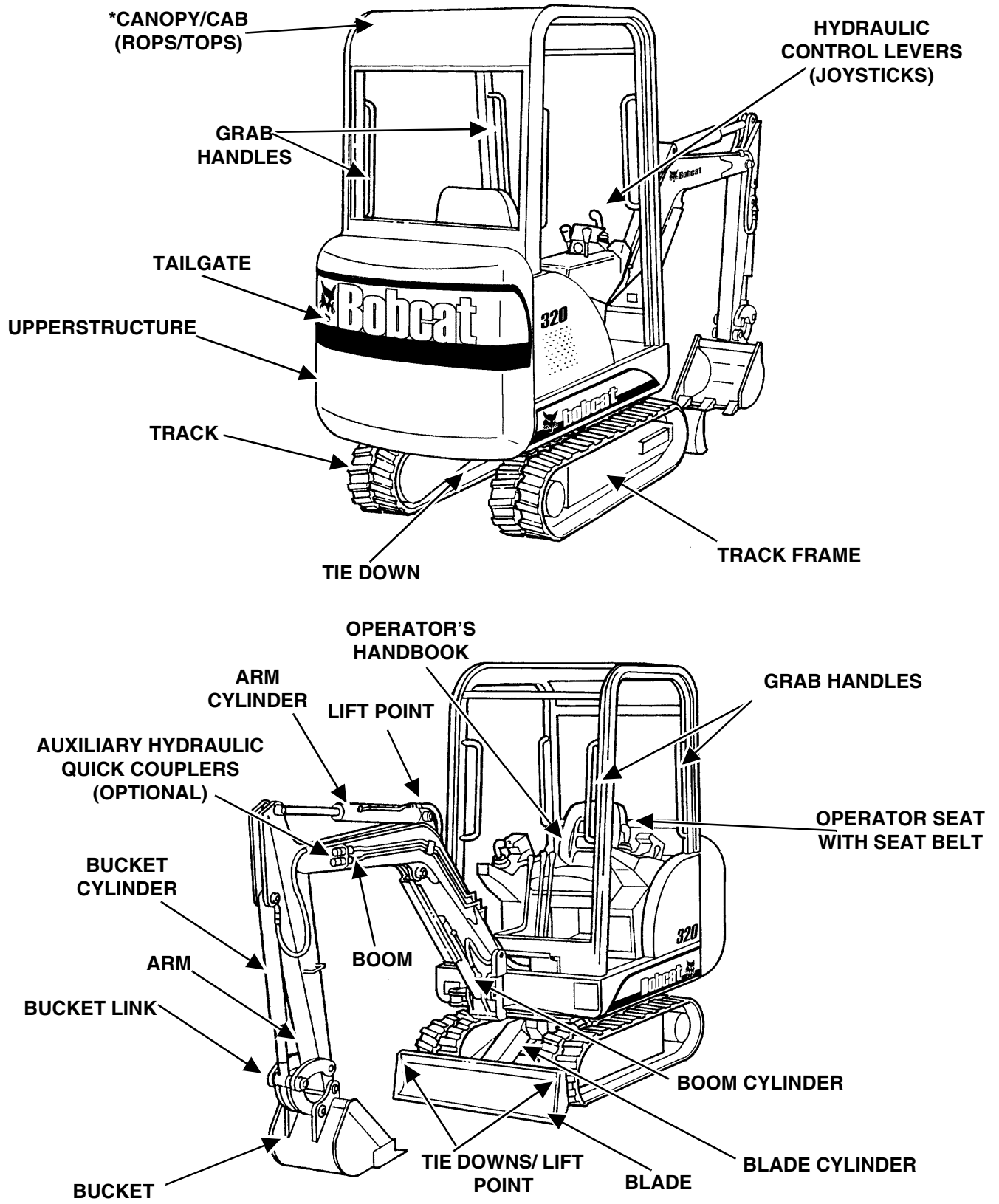
## DELIVERY REPORT

Figure 3

The diagram shows a form titled "DELIVERY REPORT". The form is divided into several sections. At the top, there is a header section with the title "DELIVERY REPORT" and several lines of text. Below this, the form is split into two columns. The left column contains a section with a dark background and the word "WARNING" in white, followed by several lines of text. The right column contains several lines of text. At the bottom of the form, there is a small box containing the number "B-16315".

The delivery report must be filled out by the dealer and signed by the owner or operator when the Bobcat Excavator is delivered. An explanation of the form must be given to the owner. Make sure it is filled out completely **[Figure 3]**.

**BOBCAT EXCAVATOR IDENTIFICATION**



\* FOGS (Falling Object Guards) is available from your Bobcat Excavator dealer.

B-19930  
B-19929

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## LIFTING AND BLOCKING THE EXCAVATOR

### Procedure

Always park the machine on a level surface.

Figure 10-10-1



Raise one side of the machine (approximately 4 inches) using the boom and arm as shown in **[Figure 10-10-1]**.

Raise the blade fully and install jackstands under the blade and the track frame. Lower the machine until all machine weight is on the jackstands.

Stop the engine.

### **WARNING**

**Put jackstands under the blade and rear corners of the undercarriage before working under the machine. Failure to block up the machine may allow it to move or fall and result in injury or death**

W-2218-1195

### **WARNING**

#### **AVOID INJURY OR DEATH**

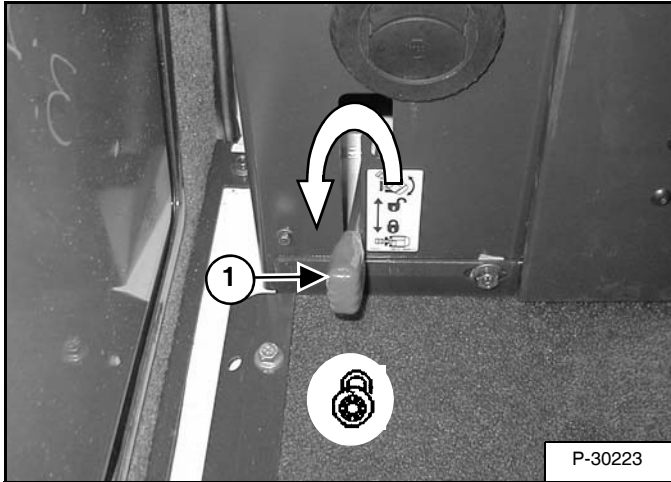
**Keep fingers and hands out of pinch points when checking the track tension.**

W-2142-0189

## SWING LOCK

### Operation

Figure 10-11-1



Move the lever (Item 1) [Figure 10-11-1] *down* to engage the Swing Lock. When the Swing Lock is engaged (locked), the upperstructure of the excavator is locked to the track frame and will not swing. The upper structure must be parallel to the track frame to engage the Swing Lock.

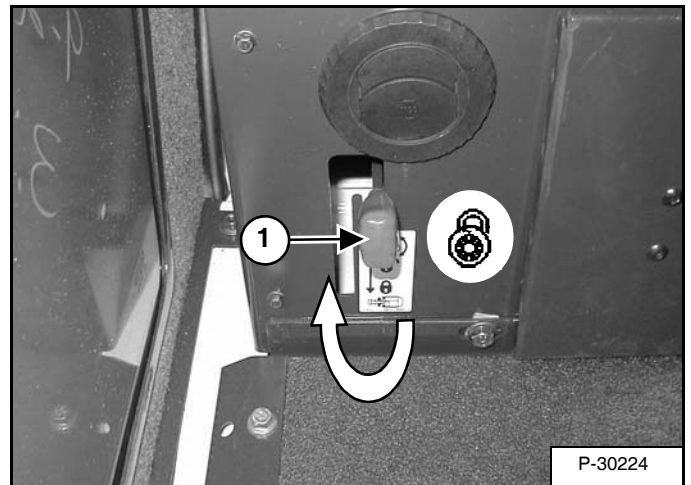
**! WARNING**

#### AVOID INJURY

The upperstructure slew lock lever must be engaged when transporting the machine.

W-2197-0904

Figure 10-11-2



Move the lever (Item 1) [Figure 10-11-2] *up* to disengage the upperstructure from the track frame. Secure the lever in the unlocked position.

**! WARNING**

#### AVOID INJURY

The upperstructure slew lock lever must be engaged when transporting the machine.

W-2197-0904

## LIFTING THE EXCAVATOR

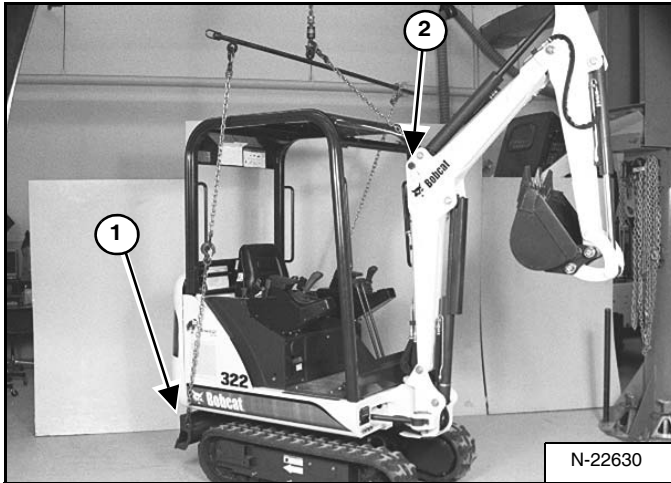
### 3-Point Lift Procedure

Fully extend the cylinders of the bucket, arm & boom.

Raise the blade all the way.

Put all control levers in neutral and engage the swing lock. (See SWING LOCK on Page 10-11-1.)

**Figure 10-12-1**



Fasten chains to the ends of the blade (Item 1) [Figure 10-12-1] and up to a lifting fixture above the canopy/cab. The lifting fixture must extend over the sides of the canopy/cab to prevent the chains from hitting the ROPS/TOPS.

Install a 1 inch (25 mm) bolt (Grade 5) through the holes at the top of the boom (Item 2) [Figure 10-12-1]. Fasten a chain from the bolt to the lift fixture.

## **WARNING**

### **AVOID INJURY OR DEATH**

- **Use a lifting fixture with sufficient capacity for the weight of the excavator plus any added attachments.**
- **Maintain center of gravity and balance when lifting.**
- **Do not swing boom or upperstructure. Engage the swing locking lever.**
- **Never lift with operator on machine.**

W-2202-0595

## OPERATOR CAB

### Emergency Exit

The left door and right rear window provide exits.

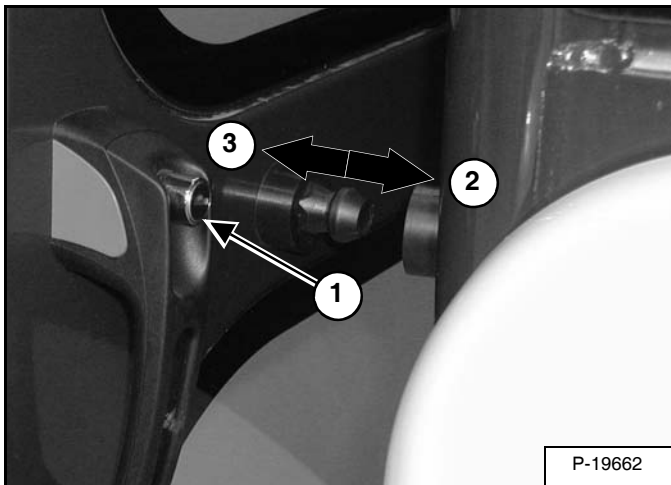
Figure 10-20-1



Slide the window to the front of the excavator and exit through the side window [Figure 10-20-1].

### Cab Door

Figure 10-20-2



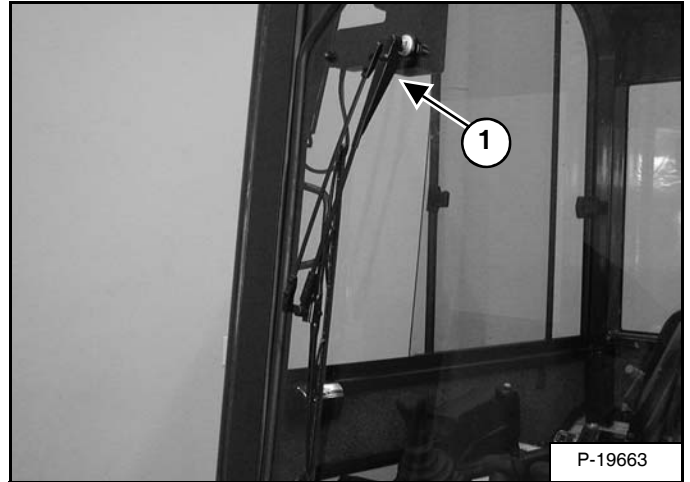
The cab door can be locked (Item 1) [Figure 10-20-2] with the same key as the starter switch.

Push the door all the way open (Item 2) [Figure 10-20-2] until the latch engages to hold the door in the open position.

Pull the door away from the cab (Item 3) [Figure 10-20-2] to disengage the latch and close the door.

### Front Window

Figure 10-20-3

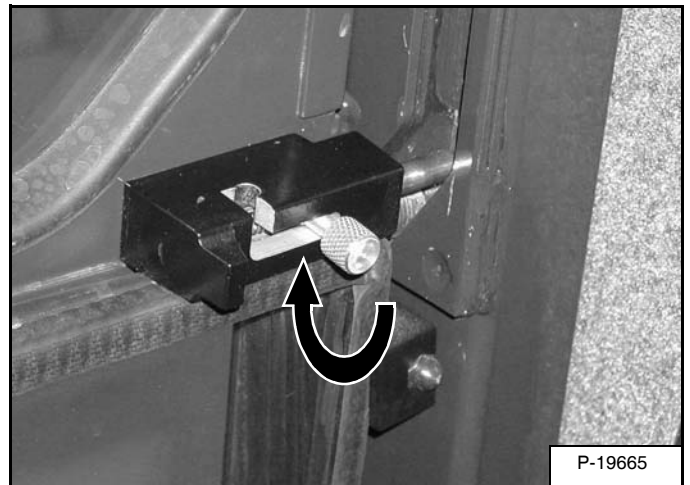


The front window is equipped with a wiper (Item 1) [Figure 10-20-3] and washer.

**NOTE: A Special Application Kit, which includes a Lexan upper window and a lower screen guard, is available and recommended for use with the hydraulic breaker attachment. See your dealer for availability.**

### Opening The Front Window

Figure 10-20-4



Release the window latch pins and turn the handle to the unlocked position [Figure 10-20-4].

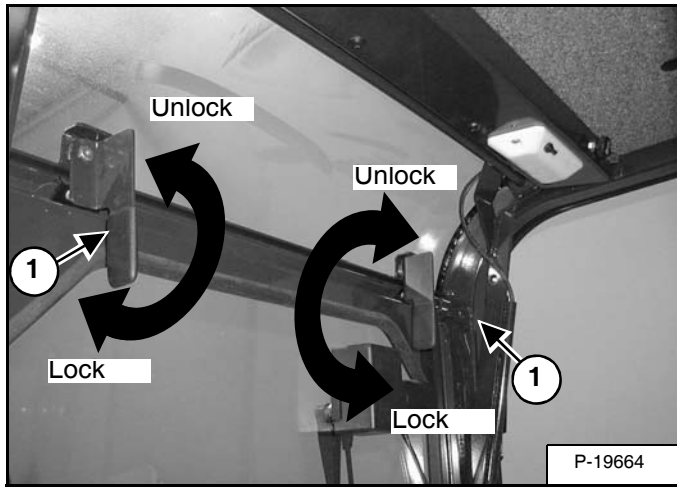


## OPERATOR CAB (CONT'D)

### Front Window (Cont'd)

#### Opening The Front Window (Cont'd)

Figure 10-20-5



Turn the two top latches (Item 1) [Figure 10-20-5] to the unlocked position.

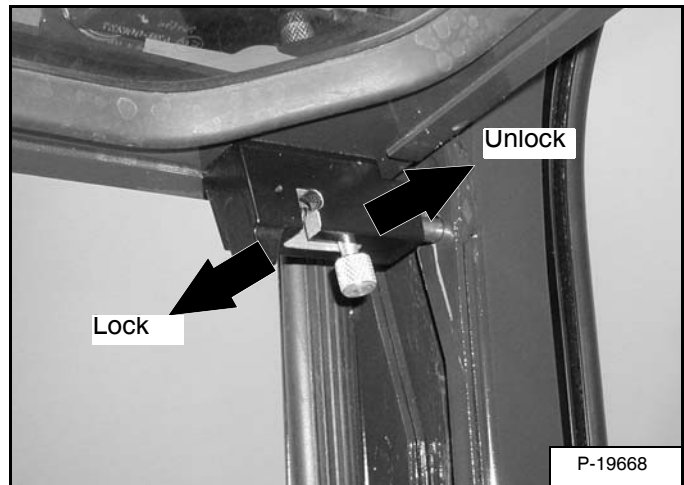
Figure 10-20-6



Use both window handles to pull the top of the window in [Figure 10-20-6].

Continue moving the window in and up over the operator's head until the window engages the pocket at the top, rear of the cab.

Figure 10-20-7



Hold the bottom of the window up and lock the two window latch pins. Make sure that the pins are secured to hold the window up [Figure 10-20-7].

#### Closing The Front Window

Hold the bottom of the window up and release both window latch pins and put them in the unlocked position [Figure 10-20-7].

Use both window handles to pull the bottom of the window down [Figure 10-20-6].

Rotate the top latches (Item 1) [Figure 10-20-5] to the locked position.

Lock the window latch pins [Figure 10-20-4 on Page 1] at the bottom of the window.

## TRANSPORTING THE EXCAVATOR

When transporting the machine, observe the rules, motor vehicle laws and vehicle limit ordinances. Use a transport and towing vehicle of adequate length and capacity.

Secure the parking brakes and block the wheels of the transport vehicle.

Remove the blade extensions. (See Extension Removal And Installation on Page 30-10-1.)

Align the ramps with the center of the transport vehicle. Secure the ramps to the truck bed and be sure ramp angle does not exceed 15 degrees.

Use metal loading ramps with a slip resistant surface.

Use ramps that are the correct length and width, and can support the weight of the machine.

The rear of the trailer must be blocked or supported when loading or unloading the excavator to prevent the front of the transport vehicle from raising.

Determine the direction of the track movement before moving the machine (blade forward). Engage the swing lock (See SWING LOCK on Page 10-11-1.).

**Figure 10-30-1**



Move the machine forward onto the transport vehicle [Figure 10-30-1].

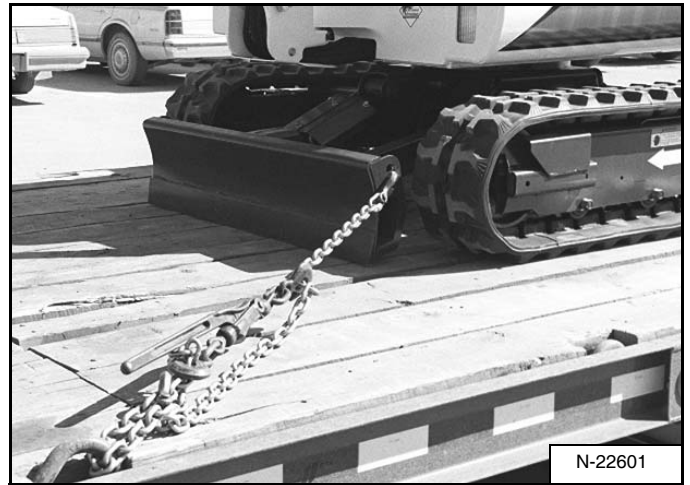
Do not change direction of the machine while it is on the ramps.

Lower the boom, arm and bucket to the transport vehicle.

Stop the engine and remove the key.

Put blocks under the front and rear of the track shoes.

**Figure 10-30-2**



**Figure 10-30-3**



Fasten chains to the front corners of the blade and to the tie down loop at the rear [Figure 10-30-2] & [Figure 10-30-3] to prevent it from moving when going up or down slopes, or during sudden stops.

Use chain binders to tighten the chains and then safely tie the chain binder levers to prevent loosening.

## **WARNING**

**Adequately designed ramps of sufficient strength are needed to support the weight of the machine when loading onto a transport vehicle. Wood ramps can break and cause personal injury.**

W-2058-0494

## TAILGATE

### Opening And Closing The Tailgate (S/N 223513558 & Below And 223812078 & Below)



#### AVOID INJURY OR DEATH

Never service or adjust the machine when the engine is running unless instructed to do so in the manual.

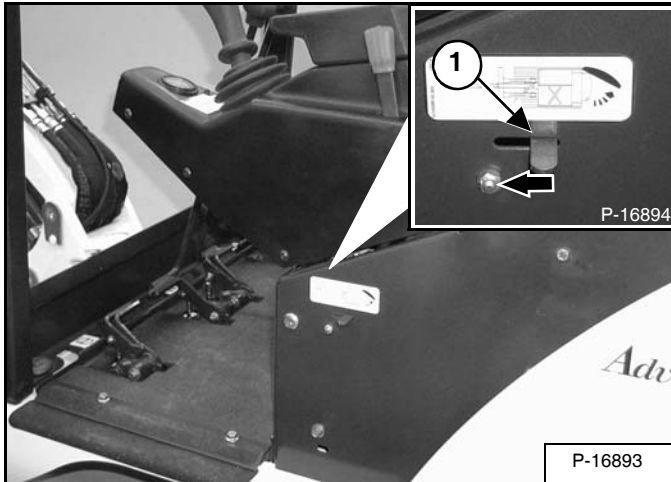
W-2012-0497



Keep the rear door closed when operating the machine. Failure to do so could seriously injure a bystander.

W-2020-1285

Figure 10-40-1

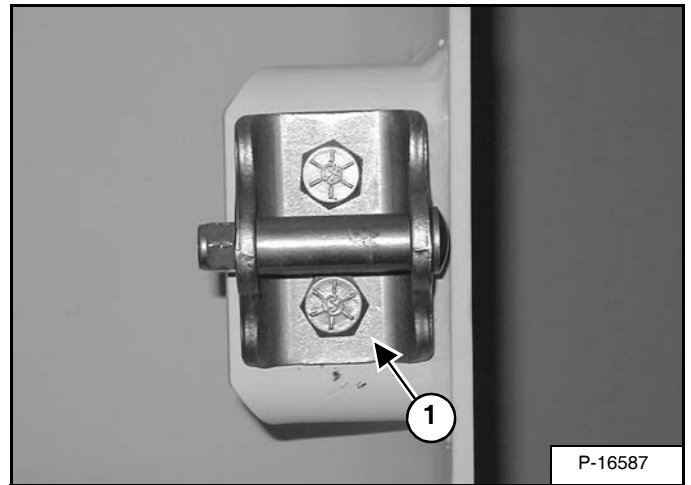


Release the latch [Figure 10-40-1] and pull the rear door open.

Push firmly to close the rear door.

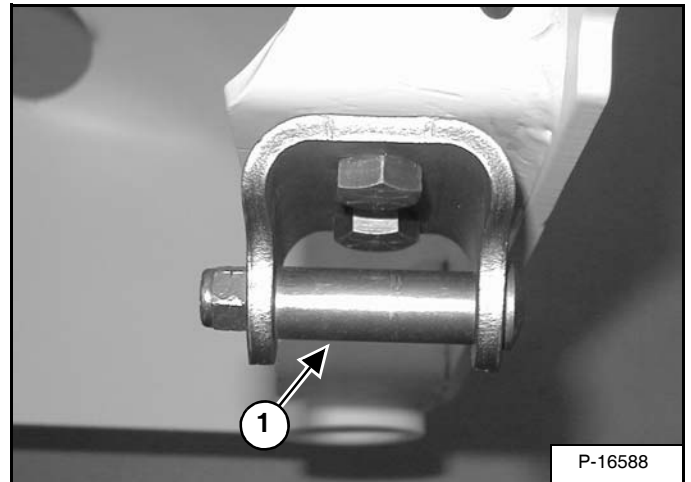
### Adjusting The Tailgate Latch (S/N 223513558 & Below And 223812078 & Below)

Figure 10-40-2



The door catch (Item 1) [Figure 10-40-2] can be adjusted in either direction alignment with the door latch.

Figure 10-40-3



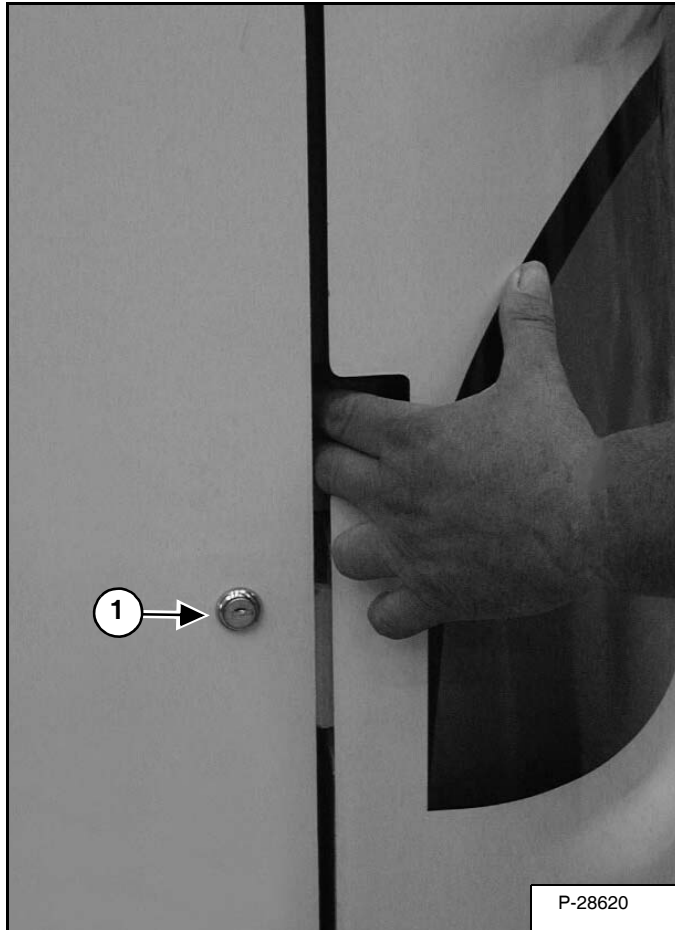
The door catch cylinder (Item 1) [Figure 10-40-3] can be adjusted by loosening the nut and moving the cylinder and tightening nut.

Close the rear door before operating the excavator.

## TAILGATE (CONT'D)

Opening And Closing The Tailgate (S/N 223513559 & Above And 223812079 & Above)

Figure 10-40-4



Release the latch [Figure 10-40-4] and pull the tailgate open.

Push firmly to close the tailgate.

The tailgate can be locked (Item 1) [Figure 10-40-4]. Use the start key to lock/unlock the tailgate.

## WARNING

### AVOID INJURY OR DEATH

Never service or adjust the machine when the engine is running unless instructed to do so in the manual.

W-2012-0497

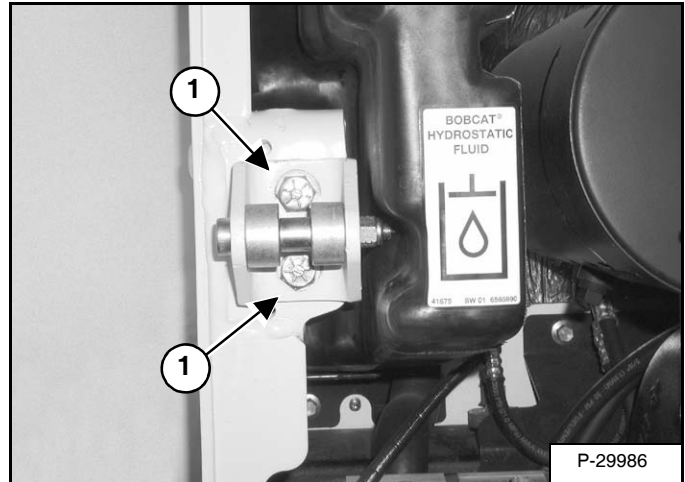
## WARNING

Keep the rear door closed when operating the machine. Failure to do so could seriously injure a bystander.

W-2020-1285

Adjusting The Tailgate Latch (S/N 223513559 & Above And 223812079 & Above)

Figure 10-40-5



Loosen the two bolts (Item 1) [Figure 10-40-5] and move the roller bracket up or down and side to side as needed.

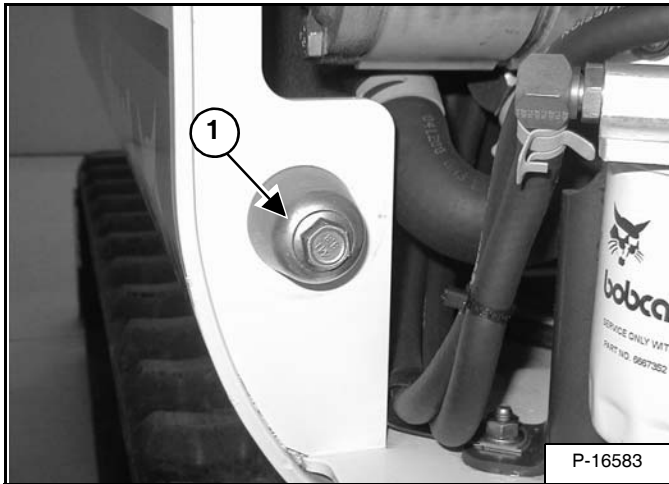
Tighten the rear door before operating the excavator.

Close the rear door before operating the excavator.

## TAILGATE (CONT'D)

### Adjusting The Bumper

Figure 10-40-6



Loosen the bolt (Item 1) [Figure 10-40-6] and adjust the bumper to align with the socket in the door.

## SERVICE SCHEDULE

### Chart

Maintenance work must be done at regular intervals. Failure to do so will result in excessive wear and early failures. The service schedule is a guide for correct maintenance of the Bobcat excavator.



# WARNING

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

W-2003-0199

SERVICE SCHEDULE		HOURS					
ITEM	SERVICE REQUIRED	8-10	50	100	250	500	1000
Engine Coolant	Check coolant level. Add premixed coolant as needed.						
Engine Oil	Check the engine oil level and add as needed.						
Hydraulic Fluid, Hoses and Tubelines	Check the hydraulic fluid level and add as needed. Check for damage and leaks. Repair or replace as needed.						
Engine Air Filter and Air System	Check condition indicator and empty dust cup as needed. Check air system for leaks.						
Tracks	Check and adjust track tension as needed.						
Indicators and Lights	Check for correct operation of all indicators and lights.						
Operator Canopy / Cab	Check condition. Check mounting hardware.						
Seat Belt	Check condition. Check mounting hardware.						
Safety Signs and Safety Treads	Check for damaged signs (decals) and safety treads. Replace any signs or safety treads that are damaged or worn.						
Control Console Lockout(s)	Check for correct operation						
Pivot Points	Grease all machinery pivot points. (21 places)						
Cab Heater Air Filter	Clean the filter as needed.						
Swing Circle and Pinion	Grease three fittings.						
Fuel Tank & Filter	Drain water and sediment from fuel tank and fuel filter.						
Battery	Check battery, cables, connections and electrolyte level. Add distilled water as needed.						
Engine Oil and Filter	Replace oil & filter. Use CD or better grade oil and Bobcat filter.		•				
Alternator / Fan Belt	Check condition of belt and adjust as needed.		•				
Spark Arrestor Muffler	Clean the spark chamber.						
Fuel Filter	Replace fuel filter.						
Final Drive Case	Check lubricant level in both final drive cases.			••			
Radiator and Oil Cooler	Clean debris from the radiator and oil cooler fins.						
Hydraulic Filter	Replace the filter element.			••			
Engine Air Cleaner	Replace the air cleaner element.						
Alternator & Starter	Check the alternator and starter connections.			••			
Engine Valves	Check and adjust the engine valve clearance.						
Final Drive Case	Replace lubricant in both final drive cases.						
Engine Cooling System	Drain and flush the cooling system. Replace the coolant.						
Hydraulic System	Replace the hydraulic fluid and filter. Clean the Reservoir.			••			

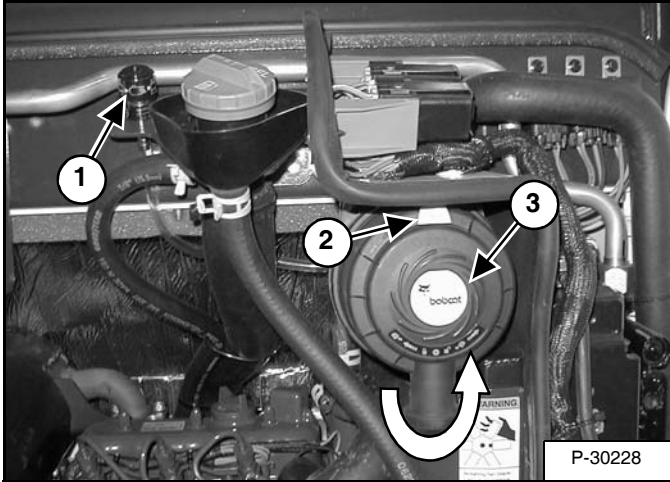
- Also at *first 50 Hours*
- Also at *first 100 Hours*
- Or every 6 months.

## AIR CLEANER SERVICE

See SERVICE SCHEDULE on Page 10-50-1 for the correct service interval.

### Daily Check

Figure 10-60-1



Check the condition indicator (Item 1) [Figure 10-60-1]. If the red ring shows in the condition indicator, the filter element needs to be replaced.

Replace the inner filter every third time the outer filter is replaced or as indicated.

### Replacing The Filters

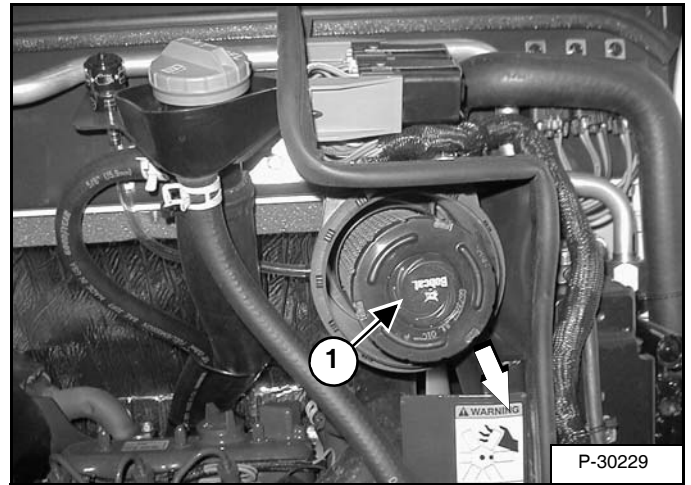
#### Outer Filter

Pull the locking tab (Item 2) [Figure 10-60-1].

Turn the dust cup (Item 3) [Figure 10-60-1] counterclockwise about 1/8 turn.

Remove and clean the dust cup.

Figure 10-60-2



Pull the outer filter (Item 1) [Figure 10-60-2] from the air cleaner housing.

Check the housing for damage.

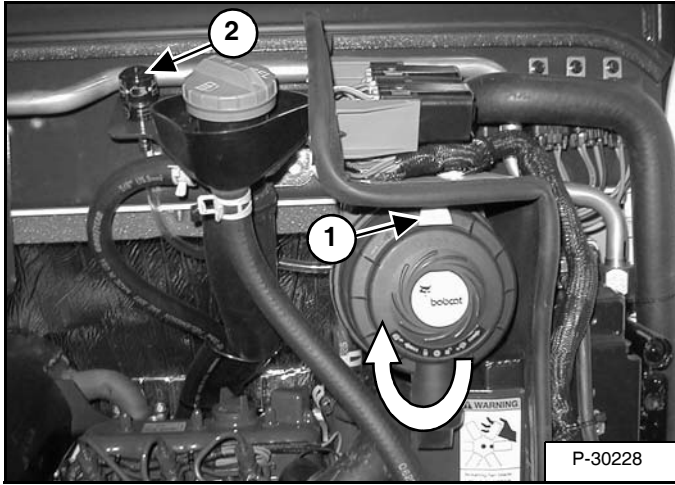
Clean the housing and the seal surface. Do Not use compressed air.

Install a new element.

## AIR CLEANER SERVICE (CONT'D)

### Replacing The Filters (Cont'd)

Figure 10-60-3



Install the dust cup and turn about 1/8 turn [Figure 10-60-3].

Push locking tab in (Item 1) [Figure 10-60-3].

Check the air intake hose and the air cleaner housing for damage. Make sure all connections are tight.

#### Inner Filter

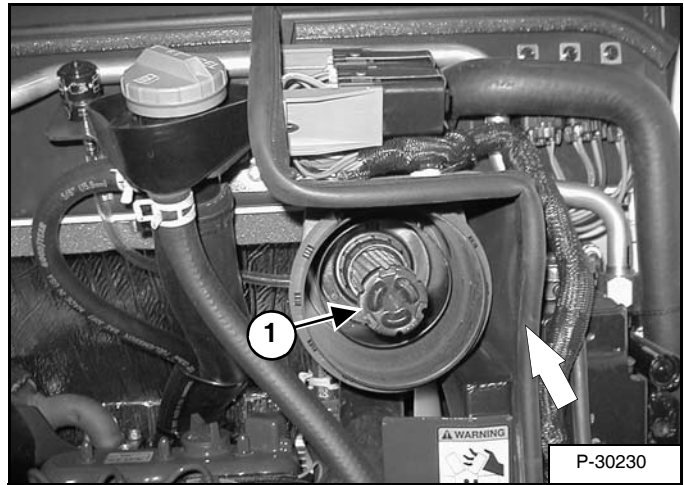
Only replace the inner filter element under the following conditions:

- Replace the inner filter element every *third* time the outer filter is replaced.
- After the outer element has been replaced, press the button (Item 2) [Figure 10-60-3] on the top of the condition indicator and start the engine. Run at full RPM, then reduce engine speed and stop the engine. If the red ring shows in the condition indicator, replace the inner filter element.

Remove the dust cup, outer filter and inner filter.

**NOTE: Make sure all sealing surfaces are free of dirt and debris.**

Figure 10-60-4



Install the new inner element [Figure 10-60-4].

Install the outer element and the dust cup.

Press the button on the condition indicator to remove the red ring.

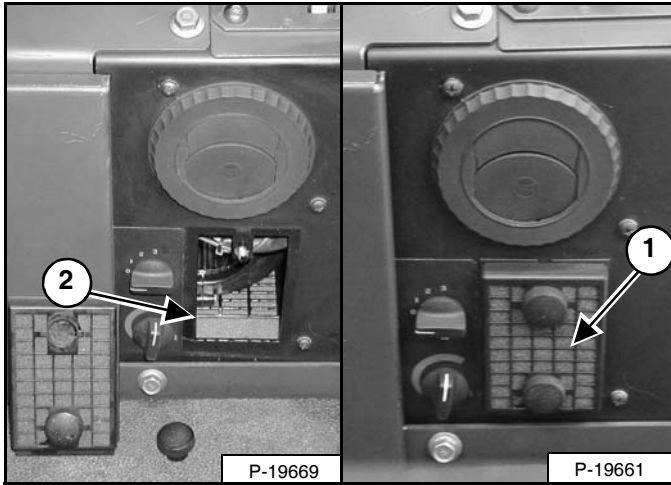


## HEATER AIR FILTERS

The heater filters must be cleaned regularly.

### Recirculation Filter

**Figure 10-61-1**



The recirculation filter is located on the front of the heater panel (Item 1) **[Figure 10-61-1]**.

Remove the knobs and remove the filter. Wash the filter with a mild detergent and water. Dry the filter before installing. Install the filter and tighten knobs.

### Fresh Air Filter

The fresh air filter is located on the bottom of the heater, inside the compartment under the seat (Item 2) **[Figure 10-61-1]**.

Remove the filter. Wash the filter with a mild detergent and water. Dry the filter before installing. Install the filter and secure.

## ENGINE COOLING SYSTEM

Check the cooling system every day to prevent overheating, loss of performance or engine damage.

### Cleaning The Cooling System

Open the rear door.

Use air pressure or water pressure to clean the radiator and oil cooler.

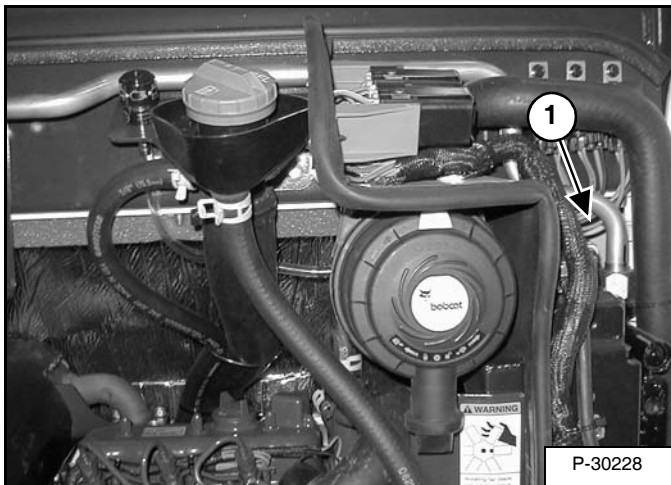
### Checking Coolant Level



**Do not remove radiator cap when the engine is hot. You can be seriously burned.**

W-2070-1285

Figure 10-70-1



When the engine is cool, remove the radiator cap (Item 1) [Figure 10-70-1].

The coolant level must be 3/4 to 1 in. (20 to 25 mm) below the filler neck.

If the coolant level is low, add premixed coolant to the radiator.

# IMPORTANT

## AVOID ENGINE DAMAGE

**Always use the correct ratio of water to antifreeze.**

**Too much antifreeze reduces cooling system efficiency and may cause serious premature engine damage.**

**Too little antifreeze reduces the additives which protect the internal engine components; reduces the boiling point and freeze protection of the system.**

**Always add a premixed solution. Adding full strength concentrated coolant can cause serious premature engine damage.**

I-2124-0497

# ! WARNING

**Wear safety glasses to prevent eye injury when any of the following conditions exist:**

- When fluids are under pressure.
- Flying debris or loose material is present.
- Engine is running.
- Tools are being used.

W-2019-1285

## ENGINE COOLING SYSTEM (CONT'D)

### Replacing The Coolant

See SERVICE SCHEDULE on Page 10-50-1 for the correct service intervals.

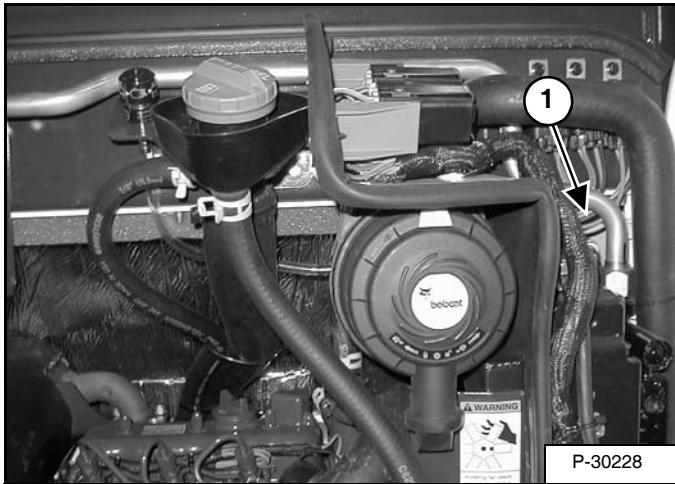
Turn the upperstructure so there is access to the engine and radiator from between the tracks. Stop the engine.

# WARNING

Do not remove radiator cap when the engine is hot. You can be seriously burned.

W-2070-1285

Figure 10-70-2



When the engine is cool, loosen and remove the radiator cap (Item 1) [Figure 10-70-2].

Figure 10-70-3

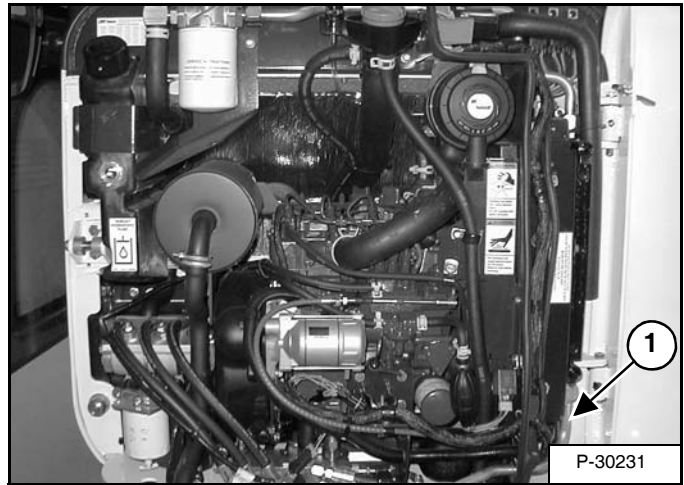
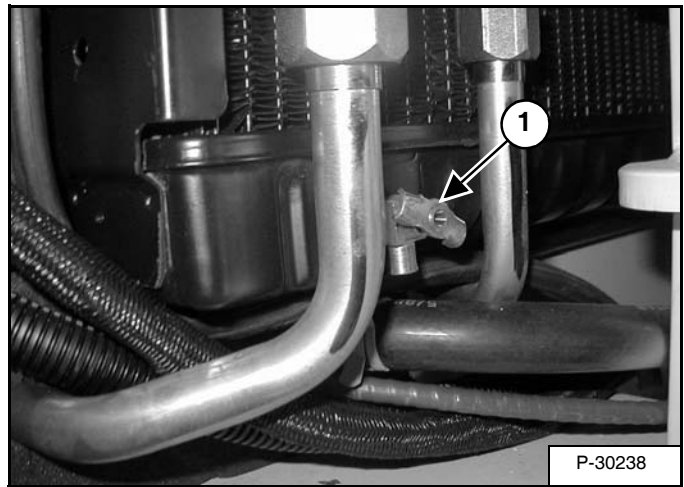


Figure 10-70-4

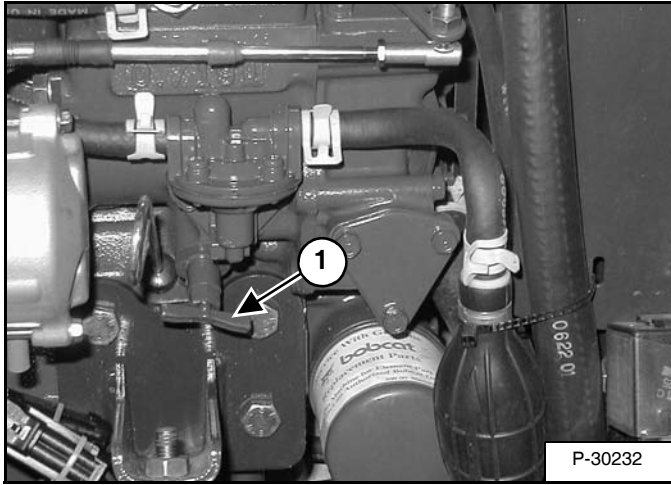


Open the drain valve (Item 1) [Figure 10-70-3] & [Figure 10-70-4] at the bottom of the radiator and drain the coolant into a container.

## ENGINE COOLING SYSTEM (CONT'D)

### Replacing The Coolant (Cont'd)

Figure 10-70-5



Open the drain valve (Item 1) [Figure 10-70-5] on the engine block and drain the coolant into a container.

After all the coolant is removed, close both drain valves.

Recycle or dispose of the used coolant in an environmentally safe manner.

Mix the coolant in a separate container. (See FUEL, COOLANT AND LUBRICANTS on Page SPEC-60-1.)

**NOTE: The cooling system is factory filled with propylene glycol (purple color). DO NOT mix propylene glycol with ethylene glycol.**

Add premixed coolant; 47% water and 53% propylene glycol to the recovery tank if the coolant level is low.

The correct mixture of coolant to provide a -34°F (-37°C) freeze protection is 1 gallon and 1 pint of propylene glycol mixed with 1 gallon of water.

# IMPORTANT

## AVOID ENGINE DAMAGE

Always use the correct ratio of water to antifreeze.

Too much antifreeze reduces cooling system efficiency and may cause serious premature engine damage.

Too little antifreeze reduces the additives which protect the internal engine components; reduces the boiling point and freeze protection of the system.

Always add a premixed solution. Adding full strength concentrated coolant can cause serious premature engine damage.

I-2124-0497

Use a refractometer to check the condition of propylene glycol in your cooling system.

Add premixed coolant until the level is correct.

Run the engine until it is at operating temperature. Stop the engine. Check the coolant level and add as needed. Install the radiator cap and tighten.

Add coolant to the recovery tank as needed.

Close the tailgate.

## FUEL SYSTEM

### Fuel Specifications

Use only clean, high quality diesel fuel, Grade No. 2 or Grade No. 1.

The following is a suggested blending guideline which should prevent fuel gelling problems during freezing temperatures:

TEMP. F° (C°)	No. 2	No. 1
+15° (9°)	100%	0%
Down to -20° (-29°)	50%	50%
Below -20° (-29°)	0%	100%

See your fuel supplier for local recommendations.



Stop and cool the engine before adding fuel. **NO SMOKING!** Failure to obey warnings can cause an explosion or fire.

W-2063-0887

### Filling The Fuel Tank

Open the tailgate.

Figure 10-80-1

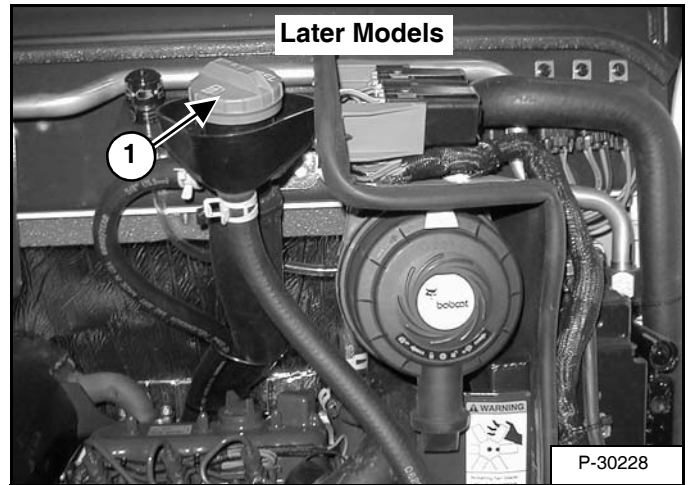
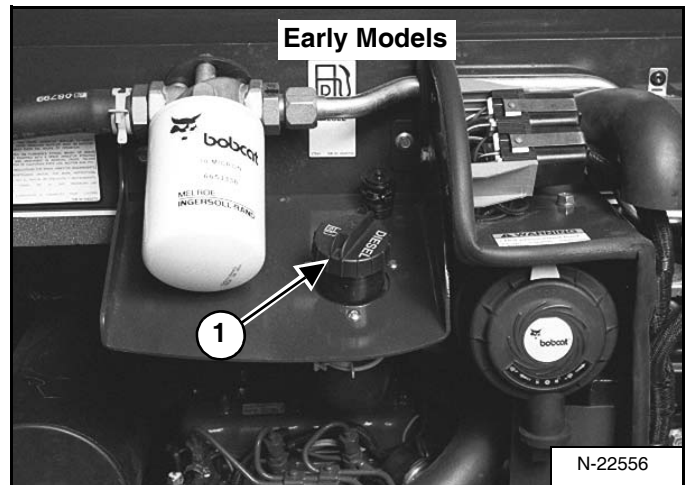


Figure 10-80-2



Remove the fuel fill cap (Item 1) [Figure 10-80-1] & [Figure 10-80-2].

Use a clean, approved safety container to add fuel. Add fuel only in an area that has a free movement of air and no flames or sparks. **NO SMOKING!**

Install and tighten the fuel fill cap. Close the tailgate.

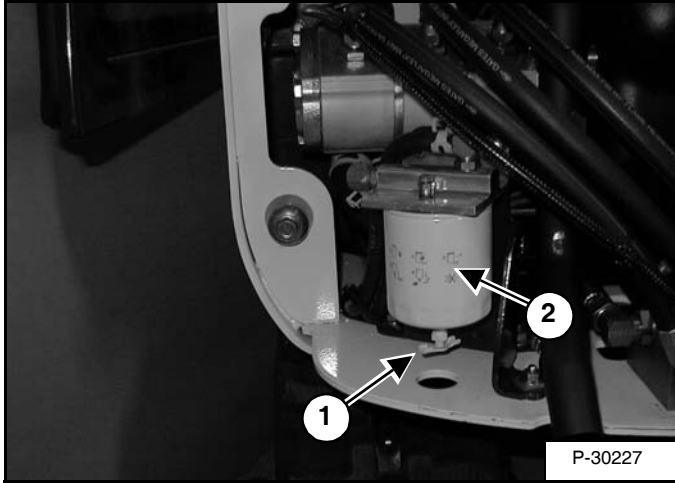
See Fuel, Coolant And Lubricants chart for the service interval when to remove water from, or replace the fuel filter. (See FUEL, COOLANT AND LUBRICANTS on Page SPEC-60-1.)

## FUEL SYSTEM (CONT'D)

### Removing Water From The Fuel Filter

Open the rear door.

**Figure 10-80-3**



Loosen the drain (Item 1) [Figure 10-80-3] at the bottom of the filter element to drain water from the filter.

### Replacing The Fuel Filter

Remove the filter element (Item 2) [Figure 10-80-3].

Clean the area around the filter housing. Put clean oil on the seal of the new filter element. Install the fuel filter and hand tighten.

Remove the air from the fuel system. (See Removing Air From The Fuel System on Page 10-80-3.)

## **WARNING**

**Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire which can result in injury or death.**

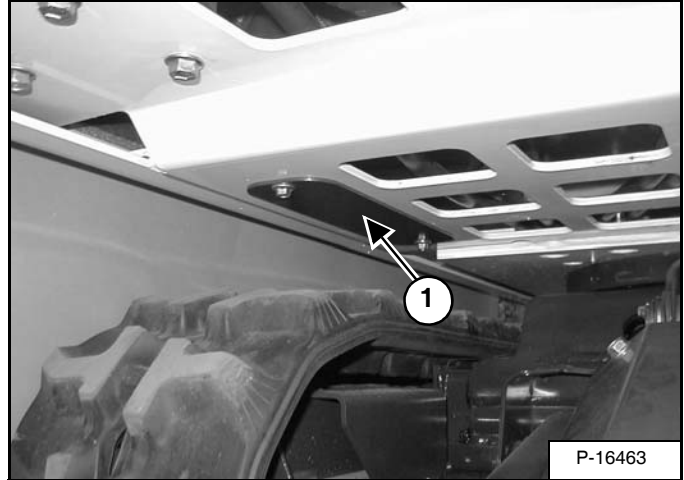
W-2103-1285

### Draining The Fuel Tank

See SERVICE SCHEDULE on Page 10-50-1 for the correct service interval.

Turn the upperstructure until the fuel tank drain is centered between the rear tracks.

**Figure 10-80-4**



**Figure 10-80-5**



Remove the access panel (Item 1) [Figure 10-80-4] on the bottom of the engine compartment. Loosen the clamp and disconnect either fuel hose [Figure 10-80-5].

Drain the fuel into a container.

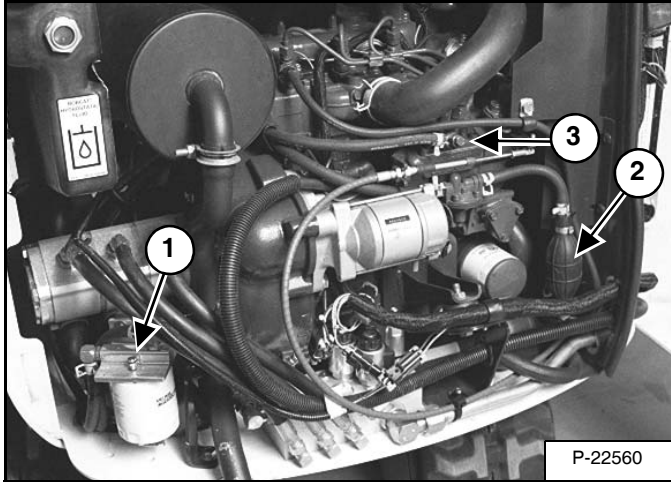
Reuse, recycle or dispose of fuel in an environmentally safe manner.

## FUEL SYSTEM (CONT'D)

### Removing Air From The Fuel System

After replacing the fuel filter or when the fuel tank has run out of fuel, air must be removed from the fuel system before starting the engine.

Figure 10-80-6



Open the fuel filter vent (Item 1) [Figure 10-80-6].

Operate the hand pump (priming bulb) (Item 2) [Figure 10-80-6] until the fuel flows from the vent with no air bubbles.

Close the vent (Item 1) [Figure 10-80-6] on the fuel filter housing.

Start the engine. It may be necessary to open the vent (Item 3) [Figure 10-80-6] (at the fuel injection pump) briefly until the engine runs smoothly.

## **WARNING**

Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical attention from a physician familiar with this injury.

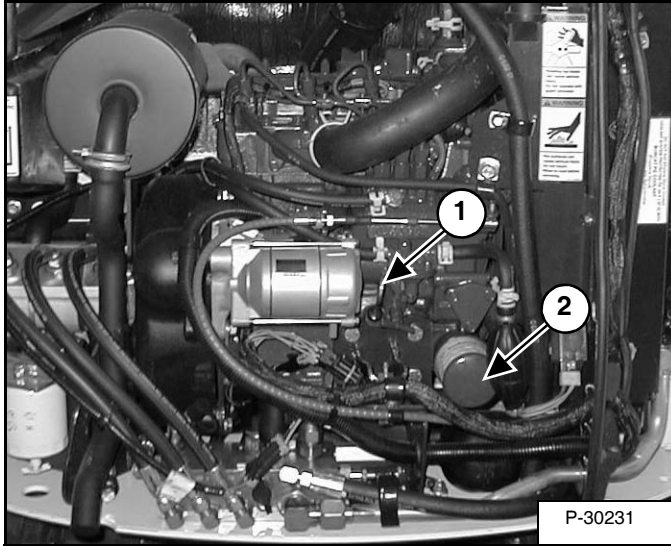
W-2027-1285

## ENGINE LUBRICATION SYSTEM

### Checking Engine Oil

Check the engine oil every day before starting the engine for the work shift.

**Figure 10-90-1**



Open the tailgate and remove the dipstick (Item 1) **[Figure 10-90-1]**.

Keep the oil level between the marks on the dipstick.

Use a good quality motor oil that meets the correct API Service Classification. (See FUEL, COOLANT AND LUBRICANTS on Page SPEC-60-1.)

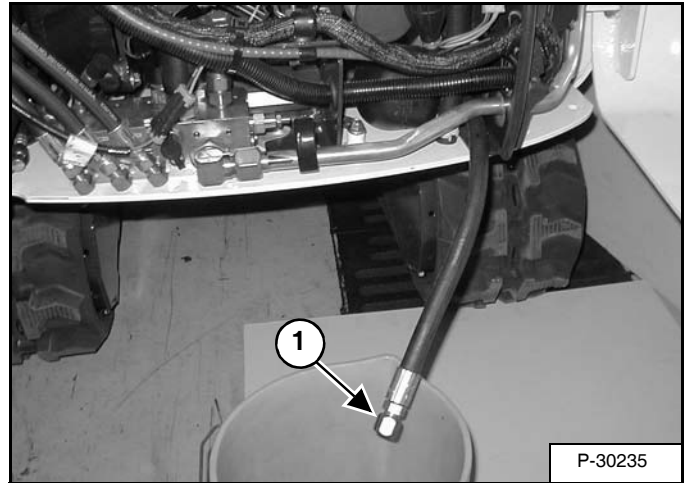
### Replacing Oil And Filter

See SERVICE SCHEDULE on Page 10-50-1 for the service interval for replacing the engine oil and filter.

Run the engine until it is at operating temperature. Stop the engine.

Open the tailgate.

**Figure 10-90-2**



Remove the drain plug (Item 1) **[Figure 10-90-2]**. Drain the oil into a container and recycle or dispose of used oil in an environmentally safe manner.

Remove the oil filter element (Item 2) **[Figure 10-90-1]** and clean the filter housing surface.

Use a genuine Bobcat filter element.

Put clean oil on the filter gasket.

Install the filter and hand tighten.

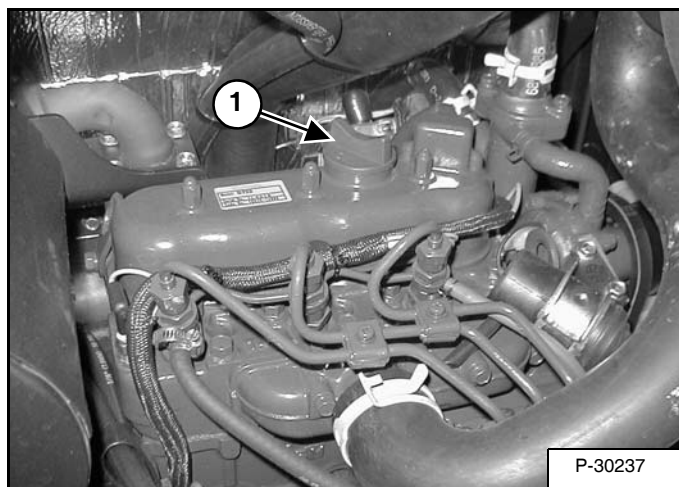
Install and tighten the oil drain plug.



## ENGINE LUBRICATION SYSTEM (CONT'D)

### Replacing Oil And Filter (Cont'd)

Figure 10-90-3



Remove the fill cap (Item 1) [Figure 10-90-3].

Put in 3.4 qt. (3,2 L) of oil into the engine. (See FUEL, COOLANT AND LUBRICANTS on Page SPEC-60-1.)

Install the fill cap.

Start the engine and let it run for several minutes.

Stop the engine. Check for leaks at the oil filter. Check the oil level.

Add oil as needed if it is not at the top mark on the dipstick.

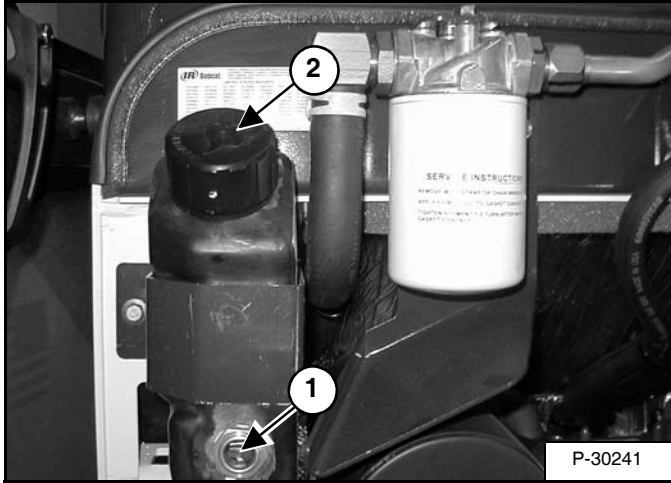
## HYDRAULIC SYSTEM

### Checking And Adding Fluid.

Put the machine on a level surface.

Retract the arm and bucket cylinders, put the bucket on the ground and raise the blade. Stop the engine.

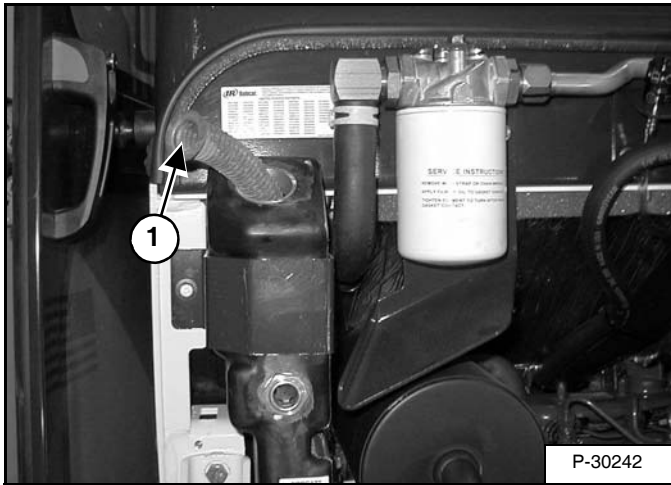
Figure 10-100-1



Open the tailgate. The fluid must be at the center of the sight gauge (Item 1) [Figure 10-100-1].

Remove the oil fill cap (Item 2) [Figure 10-100-1].

Figure 10-100-2



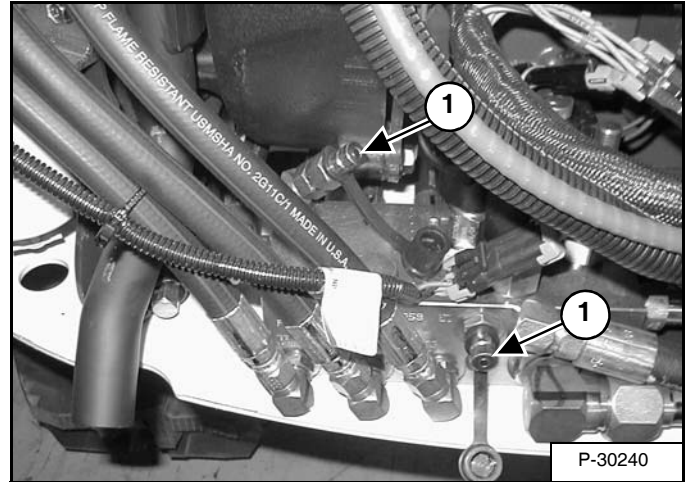
Check the condition of the screen (Item 1) [Figure 10-100-2] in the fill neck of the reservoir. The screen must be installed in the fill neck when adding oil.

Add the correct fluid to the reservoir until it is at the center of the sight gauge (Item 1) [Figure 10-100-1]. See FUEL, COOLANT AND LUBRICANTS on Page SPEC-60-1 for capacity and type.

Install the oil fill cap. Close the tailgate.

## Diagnostic Couplers

Figure 10-100-3



The diagnostic couplers (Item 1) [Figure 10-100-3] are located on the hydraulic block.

The couplers can be used by your Bobcat dealer to check circuit pressures.

## WARNING

Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire which can result in injury or death.

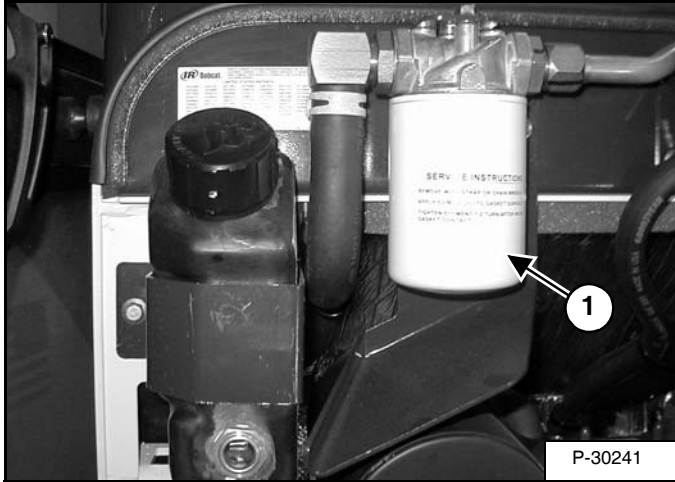
W-2103-1285

## HYDRAULIC SYSTEM (CONT'D)

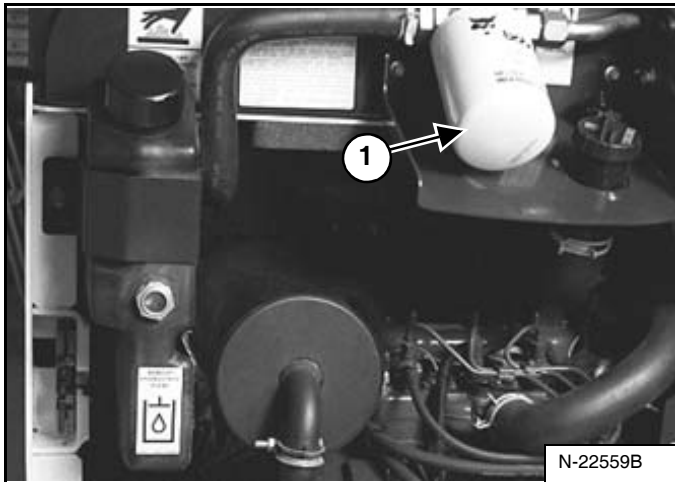
### Replacing The Hydraulic Filter

See SERVICE SCHEDULE on Page 10-50-1 for the correct service interval.

**Figure 10-100-4**



**Figure 10-100-5**



Open the tailgate. Remove the filter (Item 1) [Figure 10-100-4] or [Figure 10-100-5].

Clean the housing where the filter gasket makes contact.

Put clean hydraulic fluid on the gasket. Install the new filter element and hand tighten only.

Start the engine. Run the excavator through the hydraulic functions. Stop the engine. Check the fluid level at the sight gauge and add as needed. Check the filter area for leaks.

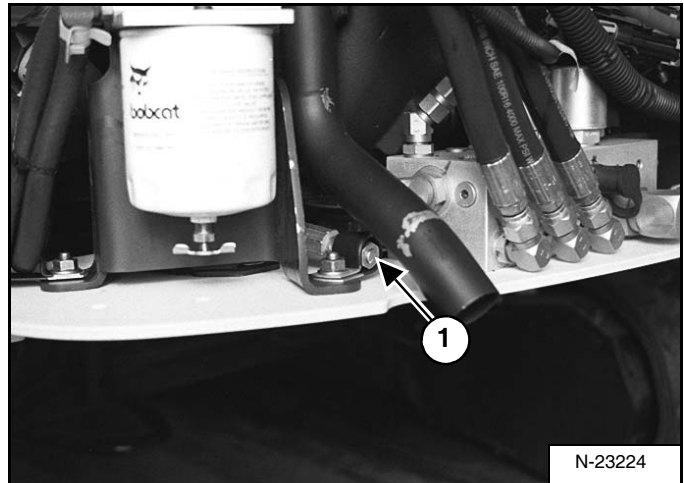
### Replacing The Hydraulic Fluid (S/N 223512346 & Below and 223814376 & Below)

See SERVICE SCHEDULE on Page 10-50-1 for the correct service interval.

Retract the arm and bucket cylinders, lower the bucket to the ground. Stop the engine.

Remove and replace the hydraulic filter.

**Figure 10-100-6**



Remove the drain hose (Item 1) [Figure 10-100-6] from the clamp by sliding the hose back (towards the front of the excavator) out of the clamp.

## IMPORTANT

Fluid such as engine oil, hydraulic fluid, coolants, grease, etc. must be disposed of in an environmentally safe manner. Some regulations require that certain spills and leaks on the ground must be cleaned in a specific manner. See local, state and federal regulations for the correct disposal.

I-2067-0499

## IMPORTANT

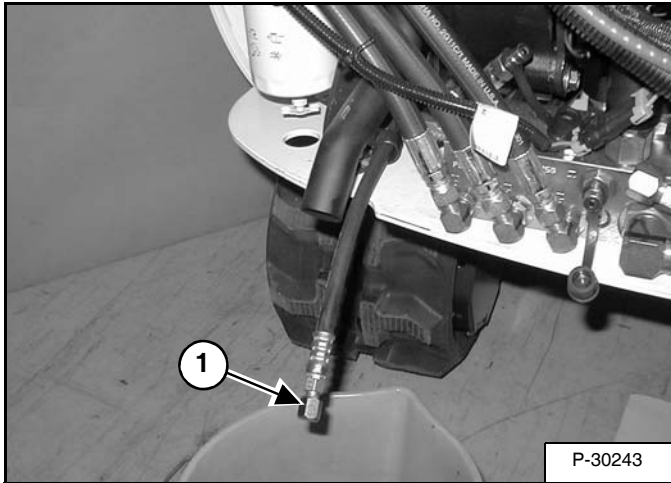
If the fluid is being drained because of a system failure, remove and clean all hydraulic lines.

I-2045-0788

## HYDRAULIC SYSTEM (CONT'D)

### Replacing The Hydraulic Fluid (S/N 223512346 & Below and 223814376 & Below) (Cont'd)

Figure 10-100-7



Pull the drain hose (Item 1) [Figure 10-100-7] out for ease of draining the fluid.

## IMPORTANT

If the fluid is being drained because of a system failure, remove and clean all hydraulic lines.

I-2045-0788

Drain the fluid into a container. Recycle or dispose of the fluid in an environmentally safe manner.

Install the drain plug.

Figure 10-100-8

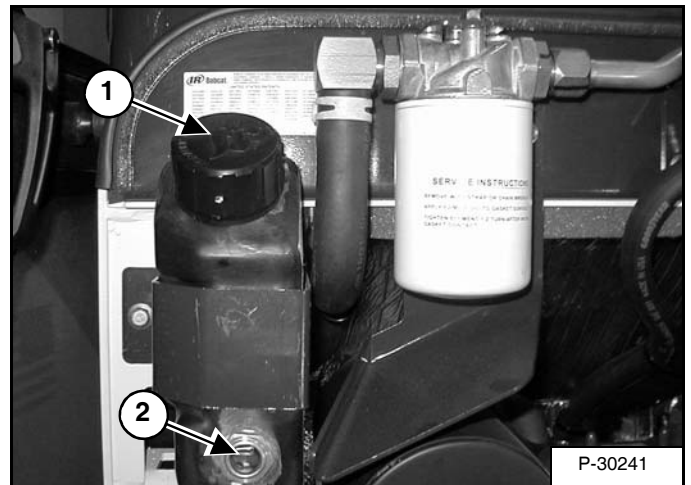
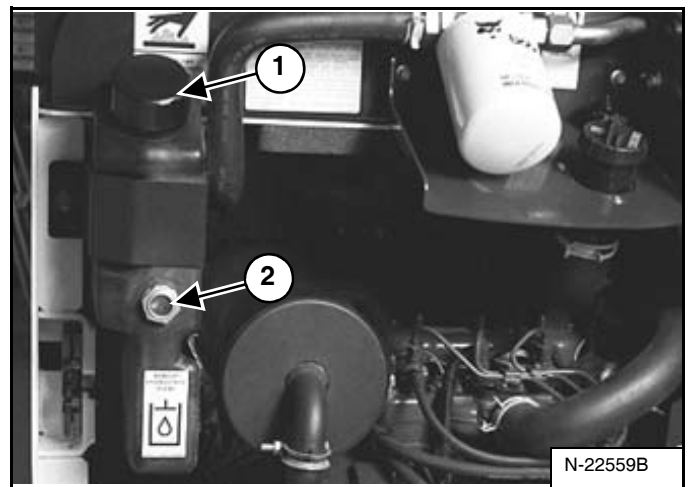


Figure 10-100-9



Add fluid to the reservoir (Item 1) until it is at the center of the sight gauge (Item 2) [Figure 10-100-8] or [Figure 10-100-9]. See FUEL, COOLANT AND LUBRICANTS on Page SPEC-60-1 for capacity and type.

Run the excavator through the hydraulic functions. Stop the engine. Check the fluid level and add as needed.

## HYDRAULIC SYSTEM (CONT'D)

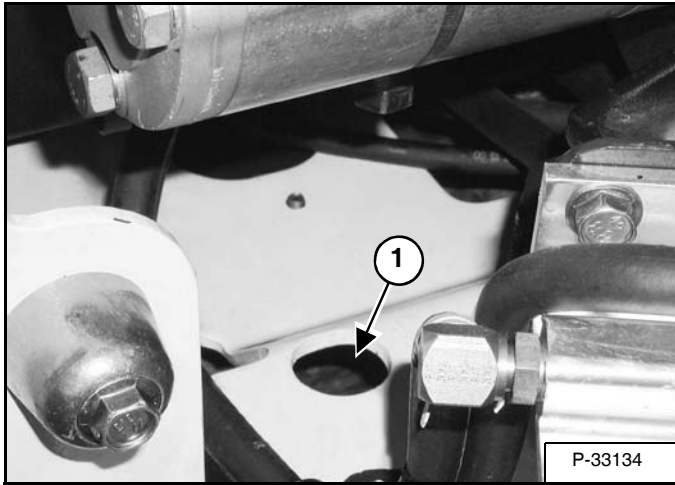
### Replacing The Hydraulic Fluid (S/N 223512347 & Above and 22384377 & Above)

See SERVICE SCHEDULE on Page 10-50-1 for the correct service interval.

Retract the arm and bucket cylinders, lower the bucket to the ground. Stop the engine.

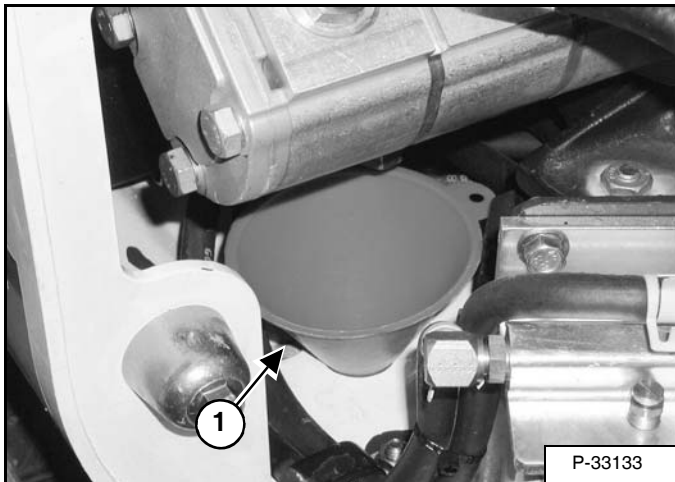
Remove and replace the hydraulic filter. (See Replacing The Hydraulic Filter on Page 10-100-2.)

**Figure 10-100-10**



A hole (Item 1) [Figure 10-100-10] is provided in the housing for ease of draining the hydraulic fluid.

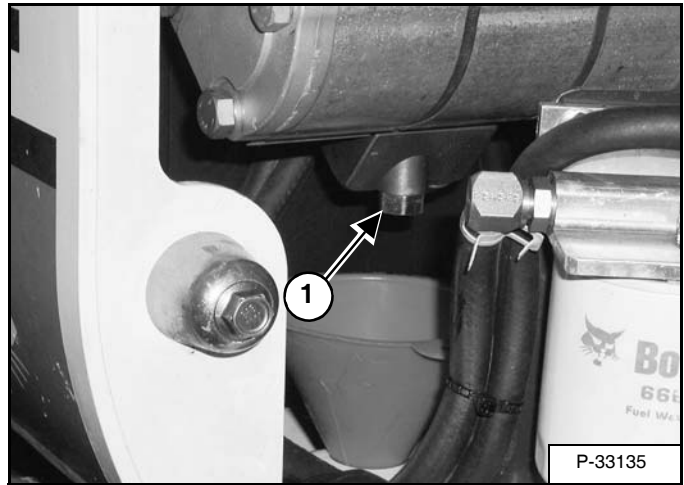
**Figure 10-100-11**



Install a funnel (Item 1) [Figure 10-100-11] in the hole (Item 1) [Figure 10-100-10].

Place a container under the funnel.

**Figure 10-100-12**



Remove the drain plug (Item 1) [Figure 10-100-12] and drain the hydraulic fluid into the container.

## IMPORTANT

Fluid such as engine oil, hydraulic fluid, coolants, grease, etc. must be disposed of in an environmentally safe manner. Some regulations require that certain spills and leaks on the ground must be cleaned in a specific manner. See local, state and federal regulations for the correct disposal.

I-2067-0499

## IMPORTANT

If the fluid is being drained because of a system failure, remove and clean all hydraulic lines.

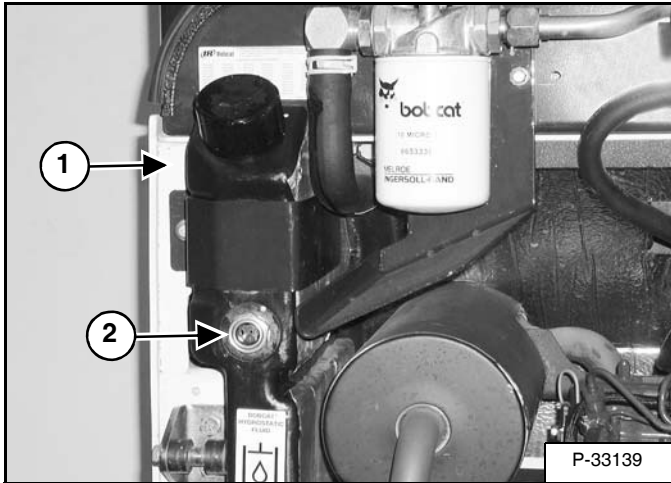
I-2045-0788

Install the drain plug.

## HYDRAULIC SYSTEM (CONT'D)

### Replacing The Hydraulic Fluid (S/N 223512347 & Above and 22384377 & Above) (Cont'd)

Figure 10-100-13



Add fluid to the reservoir (Item 1) until it is at the center of the sight gauge (Item 2) [Figure 10-100-13]. See FUEL, COOLANT AND LUBRICANTS on Page SPEC-60-1 for capacity and type.

Run the excavator through the hydraulic functions. Stop the engine. Check the fluid level and add as needed.

## LUBRICATING THE EXCAVATOR

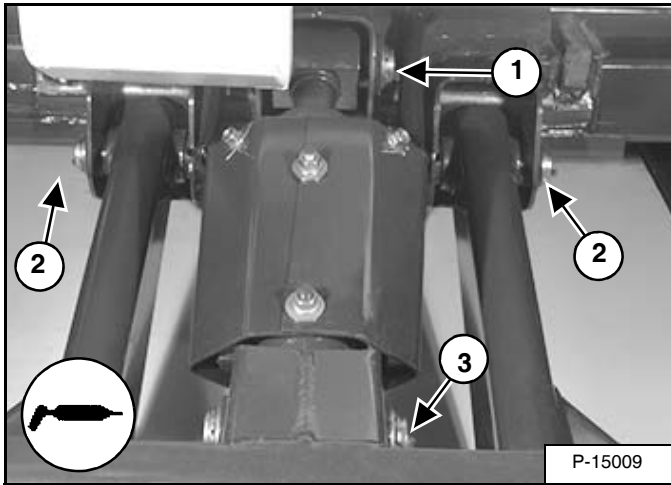
Lubricate the Hydraulic Excavator (See SERVICE SCHEDULE on Page 10-50-1) for the best performance of the machine.



Record the operating hours each time you lubricate the Hydraulic Excavator.

Always use a good quality lithium based multi-purpose grease when lubricating the excavator. Apply the lubricant until extra grease shows.

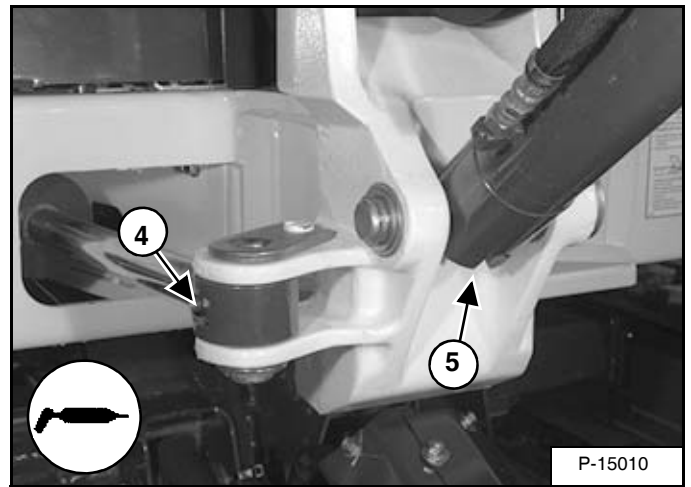
**Figure 10-110-1**



### **Ref. Description (# of Fittings)**

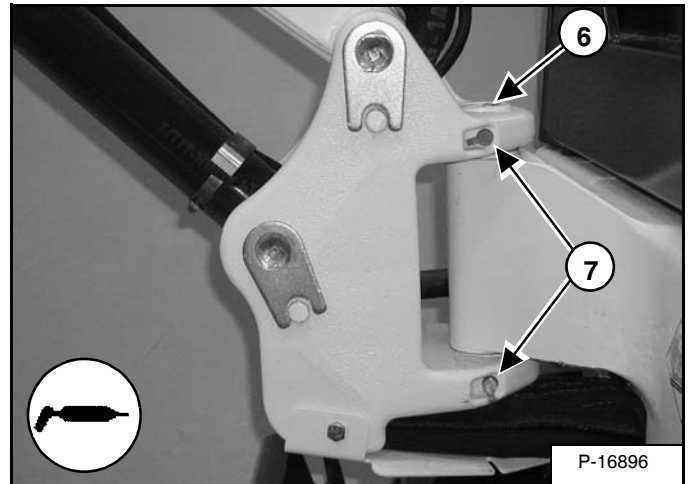
1. Blade Cylinder-Rod End, every 8-10 hours (1) [Figure 10-110-1].
2. Blade Pivots, every 8-10 hours (2) [Figure 10-110-1].
3. Blade Cylinder-Base End, every 8-10 hours (1) [Figure 10-110-1].

**Figure 10-110-2**



4. Boom Swing Cylinder-Rod End, every 8-10 hours (1) [Figure 10-110-2].
5. Boom Cylinder-Base End, every 8-10 hours (1) [Figure 10-110-2].

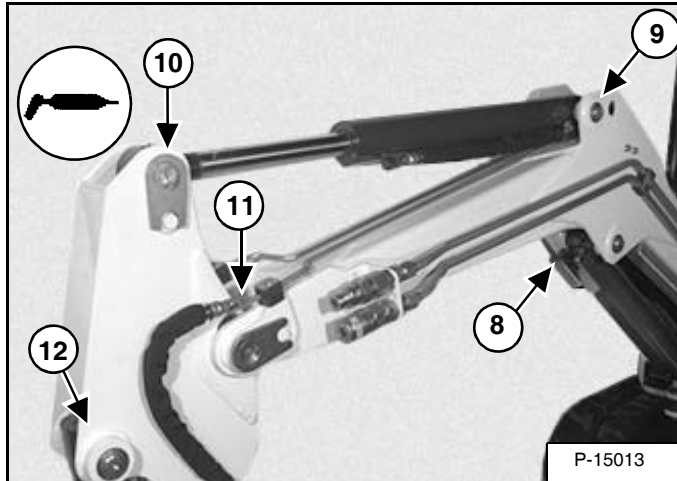
**Figure 10-110-3**



6. Boom Base Pivot, every 8-10 hours (1) [Figure 10-110-3].
7. Boom Swing Pivot, every 8-10 hours (2) [Figure 10-110-3].

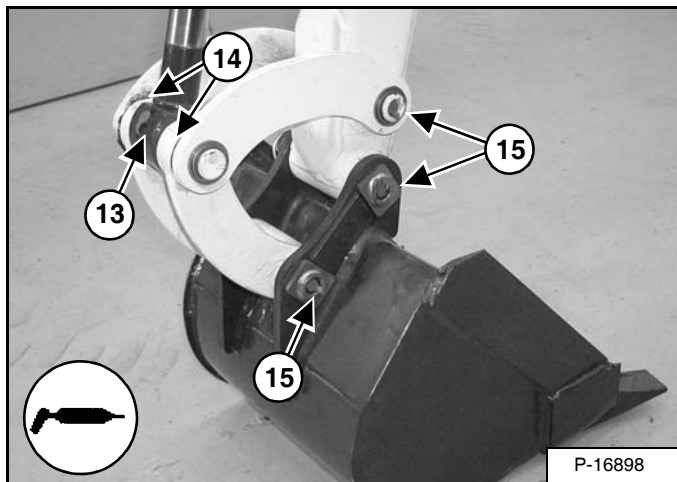
## LUBRICATING THE EXCAVATOR (CONT'D)

Figure 10-110-4



8. Boom Cylinder-Rod End, every 8-10 hours (1) [Figure 10-110-4].
9. Arm Cylinder-Base End, every 8-10 hours (1) [Figure 10-110-4].
10. Arm Cylinder-Rod End, every 8-10 hours (1) [Figure 10-110-4].
11. Arm Base Pivot, every 8-10 hours (1) [Figure 10-110-4].
12. Bucket Cylinder-Base End, every 8-10 hours (1) [Figure 10-110-4].

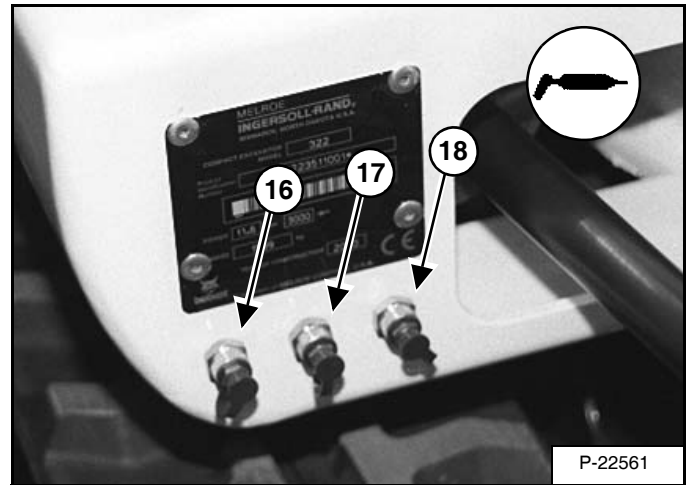
Figure 10-110-5



13. Bucket Cylinder-Rod End, every 8-10 hours (1) [Figure 10-110-5].
14. Bucket Link Pivots, every 8-10 hours (2) [Figure 10-110-5].

15. Bucket Pivots, every 8-10 hours (3) [Figure 10-110-5].

Figure 10-110-6

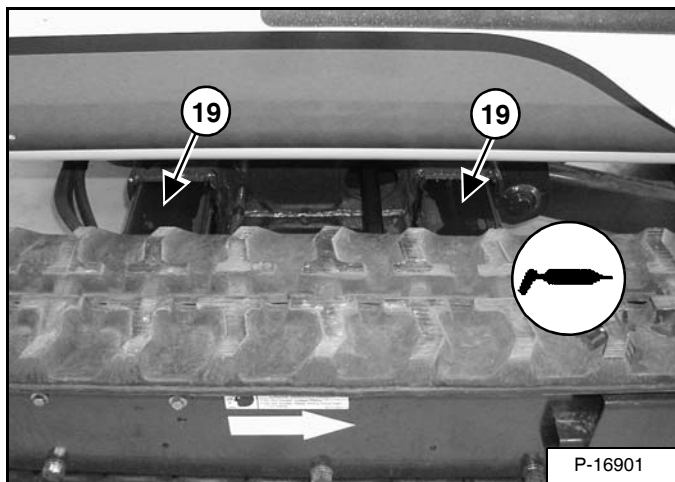


16. Swing Circle Pinion, every 50 hours (1) [Figure 10-110-6]. Pump 4 times with a grease gun. Rotate the upperstructure 180x and repeat.
  17. Swing Circle Bearing, every 50 hours (1) [Figure 10-110-6].
- NOTE: Do not over-grease the swing circle; damage to the seal could result. Pump 4 to 5 times with a grease gun. Rotate the upperstructure 90° and repeat three more times.**
18. Boom Swing, every 50 hours (1) [Figure 10-110-6].



## LUBRICATING THE EXCAVATOR (CONT'D)

Figure 10-110-7



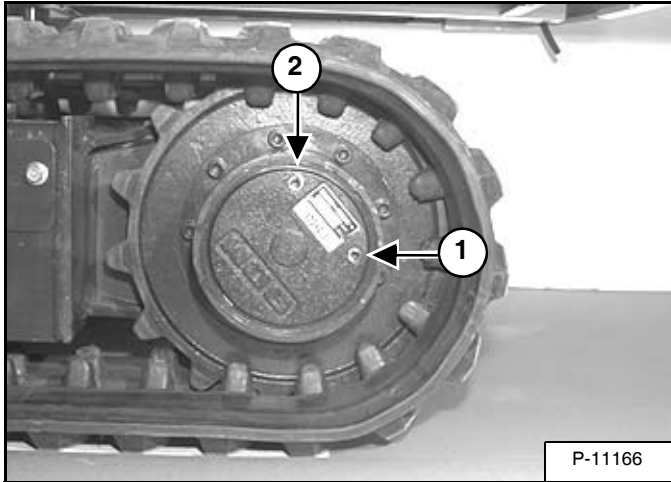
19. Track Expansion Tube, as required (2) [Figure 10-110-7].

**NOTE:** Spread lubriplate gearshield extra heavy grease evenly on wear surfaces on both sides of the excavator as required.

## FINAL DRIVE CASE

### Checking Oil Level

Figure 10-120-1



Put the machine on a level surface with the plugs positioned as shown (Items 1 & 2) [Figure 10-120-1].

Remove the plug (Item 1) [Figure 10-120-1]. The oil level should be at the bottom edge of the plug hole.

Add gear lube through the hole if the oil level is below the hole. (See FUEL, COOLANT AND LUBRICANTS on Page SPEC-60-1.)

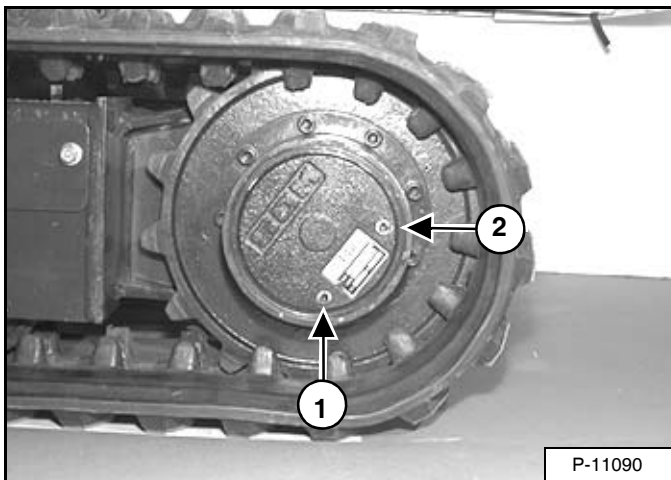
Install and tighten both plugs.

Repeat the procedure for the other side.

### Draining Final Drive Case

See FUEL, COOLANT AND LUBRICANTS on Page SPEC-60-1.

Figure 10-120-2



Put the machine on a level surface with the plugs positioned as shown (Items 1 & 2) [Figure 10-120-2].

Remove the bottom plug (Item 1) [Figure 10-120-2] and top plug (Item 2) [Figure 10-120-2] and drain into a container. Recycle or dispose of the used lubricant in an environmentally safe manner.

After all the gear lube is removed, install plug (Item 1) [Figure 10-120-2].

Add gear lube to the plug hole (Item 2) [Figure 10-120-2] until the gear lube level is at the bottom edge of the plug hole (Item 1) [Figure 10-120-2]. (See FUEL, COOLANT AND LUBRICANTS on Page SPEC-60-1.)

Install and tighten the plugs.

Repeat the procedure for the other side.

## SPARK ARRESTOR MUFFLER

See SERVICE SCHEDULE on Page 10-50-1 for the correct service interval.

Do not operate the excavator with a defective exhaust system.

Stop the engine. Open the tailgate.

Figure 10-130-1

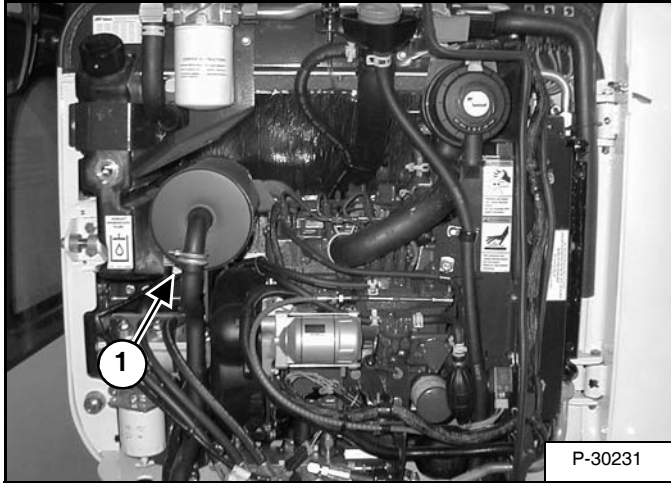
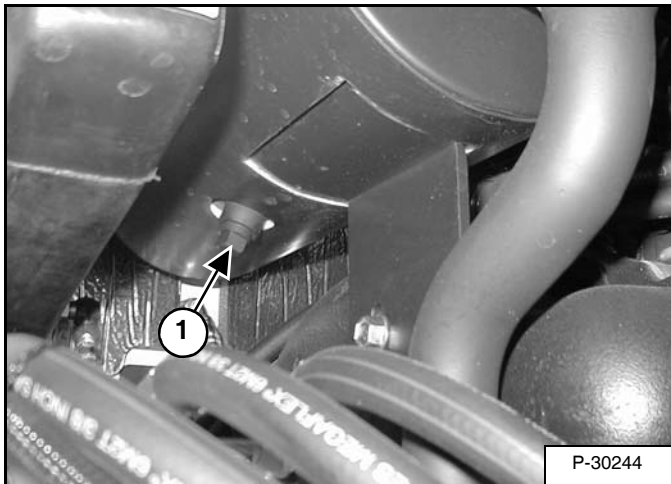


Figure 10-130-2



Remove the plug (Item 1) [Figure 10-130-1] & [Figure 10-130-2] from the bottom of the muffler.

Start the engine and run for about 10 seconds while a second person, wearing safety glasses, holds a piece of

wood over the outlet of the muffler. (The carbon deposits will be forced out of the muffler cleanout hole.)

Stop the engine. Install and tighten the plug.

Close the tailgate.

## WARNING

When an engine is running in an enclosed area, fresh air must be added to avoid concentration of exhaust fumes. If the engine is stationary, vent the exhaust outside. Exhaust fumes contain odorless, invisible gases which can kill without warning.

W-2050-1285

## WARNING

Stop engine and allow the muffler to cool before cleaning the spark chamber. Wear safety goggles. Failure to obey can cause serious injury.

W-2011-1285

## WARNING

Never use machine in atmosphere with explosive dust or gases or where exhaust can contact flammable material. Failure to obey warnings can cause injury or death.

W-2068-1285

## WARNING

When the engine is running during service, the steering levers must be in neutral.

Failure to do so can cause injury or death.

W-2203-0595

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## HYDRAULIC SYSTEM

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# HYDRAULIC/HYDROSTATIC SCHEMATIC

**320/320L (S/N 223811001 - 223812346)**

**322 (S/N 223511001 - 223514376)**

(PRINTED JUNE 2005)

V-0032legend

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## LEGEND

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- ① HYDRAULIC RESERVOIR  
(PRESSURIZED)with FILL  
STRAINER  
Capacity . . . . . 6.8 Qts. (6,5 L)
- ② PRESSURIZED BREATHER/FILL CAP  
with FILTER  
5 PSI (0,34 Bar) - Outlet  
0.435 PSI (0,03 Bar) - Inlet
- ③ SOLENOID VALVE - SYSTEM BY-PASS
- ④ MAIN RELIEF VALVE  
2500 PSI (172 Bar)
- ⑤ SOLENOID VALVE - TWO SPEED
- ⑥ HYDRAULIC FILTER ELEMENT  
10 Micron
- ⑦ FILTER BY-PASS 25 PSI (1,72 Bar)
- ⑧ SWING MOTOR CROSS PORT RELIEF  
VALVE . . . . . 1150 PSI (79,3 Bar)  
When Tested at "G" Port
- ⑨ HYDRAULIC PUMP . Triple Section -  
Gear Pump:  
Pump Sections 1 & 2  
4.0 GPM (15,0 L/min.) at 3000 RPM  
Pump Section 3  
8.0 GPM (30,0 L/min.) at 3000 RPM
- ⑩ TRAVEL MOTOR SPOOL - RIGHT HAND
- ⑪ TRAVEL MOTOR SPOOL - LEFT HAND
- ⑫ ORIFICE . . . . . 320/320L ONLY  
0.040 inch (1,02 mm)
- ⑬ PORT RELIEF VALVE  
Boom Cylinder (Rod End)  
3400 PSI (235 Bar)
- ⑭ PORT RELIEF VALVE  
Boom Cylinder (Base End)  
2950 PSI (204 Bar)
- ⑮ PORT RELIEF VALVE  
Bucket Cylinder (Rod End)  
3400 PSI (235 Bar)
- ⑯ PORT RELIEF VALVE  
Bucket Cylinder (Base End)  
2950 PSI (204 Bar)
- ⑰ PORT RELIEF VALVE  
Arm Cylinder (Rod End)  
3400 PSI (235 Bar)
- ⑱ PORT RELIEF VALVE  
Arm Cylinder (Base End)  
2950 PSI (204 Bar)
- ⑲ LOAD CHECK VALVE  
Boom Swing Cylinder
- ⑳ PRESSURE REDUCING VALVE  
365 PSI (25 Bar)
- ㉑ ACCUMULATOR  
Nitrogen . . . . . 165 PSI (11,4 Bar)  
non-rechargeable
- ㉒ CONSOLE LOCK OUT SOLENOID
- ㉓ BUILD UP VALVE . 225 PSI (15,5 Bar)
- ㉔ ORIFICE . . . . . 0.063" (1.70 mm)  
Bore of Tee Fitting
- ㉕ OIL COOLER
- ㉖ TEST PORT - "F" Port - Factory Fill Port
- ㉗ TEST PORT - "G" Port - Gauge Test Port
- ㉘ SOLENOID VALVE . . . . . 322 ONLY  
Blade/Track Expansion
- ㉙ ACCUMULATOR (2)  
Nitrogen . . . . . non-rechargeable  
Used on the following serial numbers only:  
320/320L (223811055 - 223811259)  
322 (223511138 - 223511609)

NOTE: Unless otherwise specified  
springs have NO significant  
pressure value.

**Thank you very much  
for your reading.**

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