

SAFETY.CAT.COM™

MAINTENANCE INTERVALS

Operation and Maintenance
Manual Excerpt



Operation and Maintenance Manual

303.5D CR, 304D CR, 305D CR and 305.5D CR Mini Hydraulic Excavators

TYK1-Up (Machine)
RHP1-Up (Machine)
XER1-Up (Machine)
FLZ1-Up (Machine)

i03931870

Maintenance Interval Schedule

SMCS Code: 7000

Ensure that all safety information, warnings, and instructions are read and understood before any operation or any maintenance procedures are performed.

The user is responsible for the performance of maintenance, including all adjustments, the use of proper lubricants, fluids, filters, and the replacement of components due to normal wear and aging. Failure to adhere to proper maintenance intervals and procedures may result in diminished performance of the product and/or accelerated wear of components.

Use mileage, fuel consumption, service hours, or calendar time, **WHICH EVER OCCURS FIRST**, in order to determine the maintenance intervals. Products that operate in severe operating conditions may require more frequent maintenance.

Note: Before each consecutive interval is performed, all maintenance from the previous interval must be performed.

Note: If Cat HYDO Advanced 10 hydraulic oil is used, the hydraulic oil change interval is 3000 service hours. S·O·S services may extend the oil change to a longer interval. Consult your Cat dealer for details.

When Required

Air Conditioner/Cab Heater Filter (Recirculation) - Inspect/Replace	139
Battery - Recycle	139
Battery or Battery Cable - Inspect/Replace	140
Bucket Tips - Inspect/Replace	145
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Engine Air Filter Primary Element - Clean/Replace	154
Engine Air Filter Secondary Element - Replace ..	156
Film (Product Identification) - Clean	160
Fuel System - Prime	162
Fuses - Replace	165
Oil Filter - Inspect	170
Radiator Core - Clean	173
Track Adjustment - Adjust	176
Window Washer Reservoir - Fill	178
Window Wiper - Inspect/Replace	178
Windows - Clean	178

Every 10 Service Hours or Daily for First 100 Hours

Blade Linkage - Lubricate	141
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Every 10 Service Hours or Daily

Fuel System Water Separator - Drain	164
Seat Belt - Inspect	174
Undercarriage - Check	178

Every 10 Service Hours or Daily for Machines Used in Severe Applications

Blade Linkage - Lubricate	141
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Every 10 Service Hours

Cooling System Coolant Level - Check	152
Engine Air Filter Service Indicator - Inspect	157
Engine Oil Level - Check	157
Hydraulic System Oil Level - Check	169
Travel Alarm - Test	177

Every 50 Service Hours

Bucket Linkage - Lubricate	145
Fuel Tank Water and Sediment - Drain	165
Quick Coupler - Clean	171
Quick Coupler - Lubricate	171
Quick Coupler - Lubricate	172
Quick Coupler - Lubricate	172
Swing Frame Pin - Lubricate	174
Track Adjustment - Inspect	176

Initial 100 Service Hours

Engine Oil and Filter - Change	158
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Every 100 Service Hours

Swing Gear and Bearing - Lubricate	175
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Initial 250 Service Hours

Engine Valve Lash - Check	159
Final Drive Oil - Change	161
Hydraulic System Oil Filter (Return) - Replace ...	168

Every 250 Service Hours

Belt - Inspect/Adjust/Replace	140
Cooling System Coolant Sample (Level 1) - Obtain	153
Engine Oil Sample - Obtain	158
Final Drive Oil Level - Check	162

Initial 500 Hours (for New Systems, Refilled Systems, and Converted Systems)

Cooling System Coolant Sample (Level 2) - Obtain	154
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Every 500 Service Hours

Blade Linkage - Lubricate	141
Boom and Stick Linkage - Lubricate	142
Boom, Stick, and Frame - Inspect	142

Boom Swing Cylinder Pins - Lubricate	144
Engine Oil and Filter - Change	158
Final Drive Oil Sample - Obtain	162
Fuel Tank Cap and Strainer - Clean	164
Hydraulic System Oil Filter (Return) - Replace ...	168
Hydraulic System Oil Sample - Obtain	170

Every 500 Service Hours or 3 Months

Fuel System Primary Filter (Water Separator) Element - Replace	163
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Every 1000 Service Hours

Battery Hold-Down - Tighten	139
Engine Valve Lash - Check	159

Every 1000 Service Hours or 6 Months

Battery - Clean	139
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Every 2000 Service Hours or 1 Year

Final Drive Oil - Change	161
Receiver Dryer (Refrigerant) - Replace	173

Every Year

Cooling System Coolant Sample (Level 2) - Obtain	154
Engine Air Filter Secondary Element - Replace ..	156

Every 3000 Service Hours or 18 Months

Hydraulic System Oil - Change	166
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Every 3 Years After Date of Installation or Every 5 Years After Date of Manufacture

Seat Belt - Replace	174
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Every 3000 Service Hours or 3 Years

Cooling System Coolant Extender (ELC) - Add ..	152
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Every 6000 Service Hours

Cooling System Coolant (ELC) - Change	151
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i02788833

i00934864

Air Conditioner/Cab Heater Filter (Recirculation) - Inspect/Replace

SMCS Code: 1054-040-A/C; 1054-510-A/C

NOTICE

An air recirculation filter element plugged with dust will result in decreased performance and service life to the air conditioner or cab heater.

To prevent decreased performance, clean the filter element, as required.

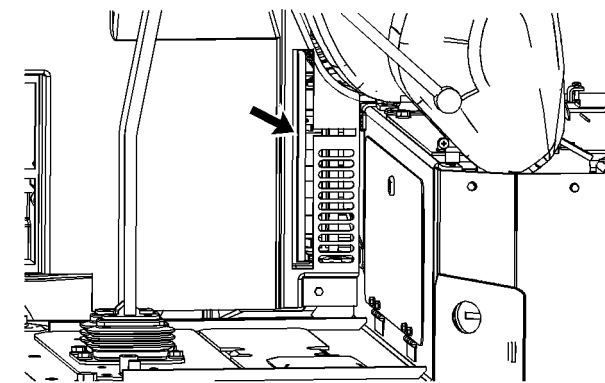


Illustration 158

g01213860

The filter element is located on the lower right side of the cab.

1. In order to remove the filter element, slide the filter element outward.
2. Inspect the filter element. If the filter element is dirty, clean the filter element with a mild solution of soap and warm water.

Note: Do not use organic solvents in order to clean the filter element.

3. The filter element may also be cleaned with a maximum of 200 kPa (30 psi) pressure air.

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" before using pressure air to clean the filter element.

4. After you clean the filter element, inspect the filter element. If the filter element is damaged or badly contaminated, use a new filter element.
5. Make sure that the filter element is dry. Install the filter element into the filter housing. Make sure that the filter element is seated in the bottom of the filter housing before the system is operated.

Battery - Clean

SMCS Code: 1401-070

Clean the battery surface with a clean cloth. Keep the terminals clean and keep the terminals coated with petroleum jelly. Install the post cover after you coat the terminal post with petroleum jelly.

i00993589

Battery - Recycle

SMCS Code: 1401-561

Always recycle a battery. Never discard a battery.

Always return used batteries to one of the following locations:

- A battery supplier
- An authorized battery collection facility
- Recycling facility

i01586700

Battery Hold-Down - Tighten

SMCS Code: 7257

Tighten the hold-downs for the battery in order to prevent the batteries from moving during machine operation.

i01999587

i02385778

Battery or Battery Cable - Inspect/Replace

SMCS Code: 1401-040; 1401-510; 1401-561; 1401; 1402-040; 1402-510

WARNING

Personal injury can result from battery fumes or explosion.

Batteries give off flammable fumes that can explode. Electrolyte is an acid and can cause personal injury if it contacts the skin or eyes.

Prevent sparks near the batteries. Sparks could cause vapors to explode. Do not allow jumper cable ends to contact each other or the engine. Improper jumper cable connections can cause an explosion.

Always wear protective glasses when working with batteries.

1. Turn the engine start switch key to the OFF position. Turn all of the switches to the OFF position. Remove the key.
2. Disconnect the negative battery cable at the battery.
3. Disconnect the positive battery cable at the battery.
4. Disconnect the battery cables from the machine if new cables are needed.
5. Make necessary repairs or replace the battery.
6. Connect the battery cables to the machine if the battery cables were removed.
7. Connect the positive battery cable of the battery.
8. Connect the negative battery cable of the battery.
9. Install the key into the engine start switch.

Belt - Inspect/Adjust/Replace

SMCS Code: 1357-025; 1357-040; 1357-510; 1397-025; 1397-040; 1397-510

NOTICE

The V-belt must be tensioned correctly. Failure to tension the belt properly could cause damage to the belt and/or to the air conditioner compressor.

For maximum engine performance and maximum utilization of your engine, inspect the belts for wear and for cracking. Check the belt tension. Adjust the belt tension in order to minimize belt slippage. Belt slippage will decrease the belt life. Belt slippage will also cause poor performance of the alternator and of any driven equipment.

If new belts are installed, recheck the belt adjustment after 30 minutes of operation. If two belts or more are required for an application, replace the belts in belt sets. If only one belt of a pair is replaced, the new belt will carry more load. This is due to the fact that the older belts are stretched. The additional load on the new belt could cause the new belt to break.

Water Pump Belt, Fan Drive Belt, and Alternator Belt

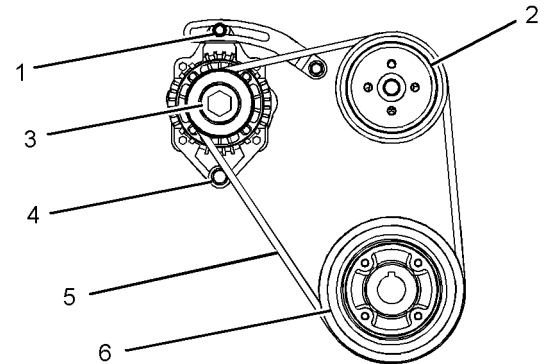


Illustration 159

g01190206

- (1) Adjusting bolt
- (2) Water pump pulley
- (3) Alternator pulley
- (4) Alternator mounting bolt
- (5) Belt
- (6) Crankshaft pulley

1. Open the engine access door.
2. Apply approximately 98 N (22 lb) of force midway between the pulleys.
3. Measure the deflection of the belt. The belt should deflect 8 to 11 mm (5/16 to 7/16 inch).

4. If the deflection is not correct, loosen alternator mounting bolt (4) and adjusting bolt (1). Move the alternator forward and backward in order to adjust belt (5) to the specified tension.
5. When the adjustment is correct, tighten adjusting bolt (1) and mounting bolt (4) securely.
6. Check the deflection of the belt again.
7. Close the engine access door.

Note: If a new belt is installed, check the belt adjustment again after 30 minutes of engine operation at the rated engine speed.

Air Conditioner Belt (If Equipped)

NOTICE

The V-belt must be tensioned correctly. Failure to tension the belt properly could cause damage to the belt and/or to the air conditioner compressor.

1. Open the engine access door.

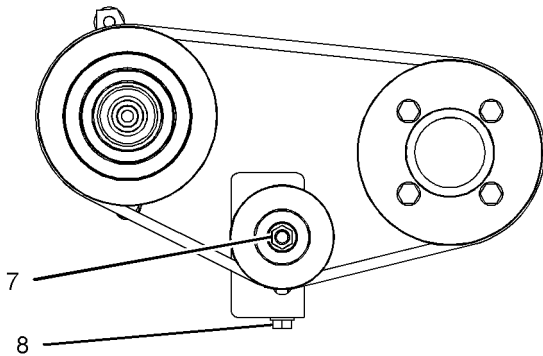


Illustration 160

g01190210

- (7) Nut
(8) Adjustment bolt

2. Check the belt tension.

Note: To check the belt tension, apply 98 N (22 lb) of force midway between the pulleys. Correctly adjusted belts will deflect 8 to 11 mm (5/16 to 7/16 inch).

3. If the deflection is not correct, loosen nut (7). Turn adjusting bolt (8) in order to adjust the belt tension.
4. Adjust the belt tension.
5. When the adjustment is correct, tighten bolt (7) to a torque of 28 ± 7 N·m (21 ± 5 lb ft) and tighten bolts (8) to a torque of 28 ± 7 N·m (21 ± 5 lb ft).
6. Check the deflection again.

7. Close the engine access door.

Note: If a new belt is installed, check the belt adjustment again after 30 minutes of engine operation at the rated speed.

i02304927

Blade Linkage - Lubricate

SMCS Code: 6060-086

Lower all the work tools and the blade to the ground.

Wipe all grease fittings before lubricating.

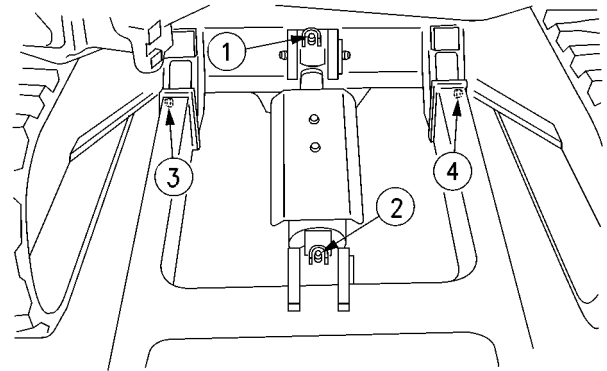


Illustration 161

g00823677

1. Apply lubricant to grease fitting (2) at the head end of the blade cylinder. Apply lubricant to grease fitting (1) at the rod end of the blade cylinder.
2. Apply lubricant to grease fittings (3) and (4) for the blade linkage.

Angle Blade (If Equipped)

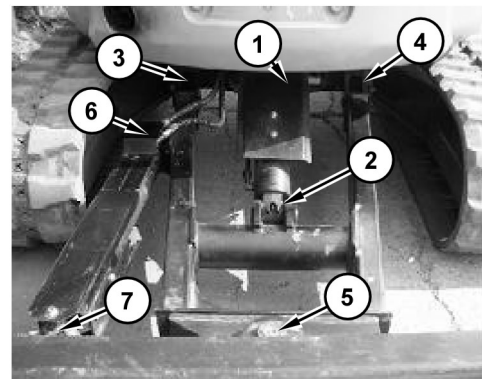


Illustration 162

g01154347

1. Apply lubricant to grease fitting (2) at the head end of the blade cylinder. Apply lubricant to grease fitting (1) at the rod end of the blade cylinder.

2. Apply lubricant to grease fittings (3) and (4) for the blade linkage. Apply lubricant to grease fittings (5) for the center pin of the angle blade.
3. Apply lubricant to grease fitting (6) at the head end of the cylinder of the angle blade. Apply lubricant to grease fitting (7) at the rod end of the cylinder of the angle blade.

i02386747

Boom and Stick Linkage - Lubricate

SMCS Code: 6501-086; 6502-086

Note: Caterpillar recommends the use of 5% molybdenum grease for lubricating the boom and stick linkage. Refer to Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations" for more information on grease.

Position the machine into the service position.

Wipe all fittings before you apply lubricant.

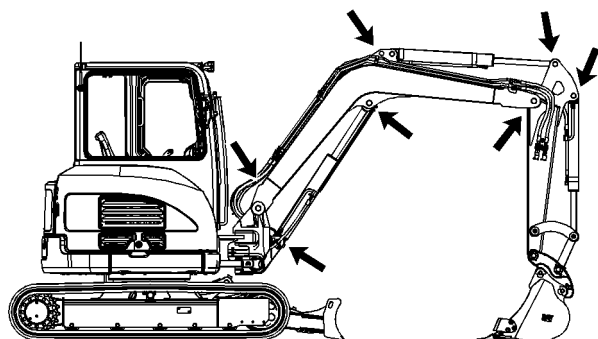


Illustration 163

g01190209

Apply lubricant to the grease fittings.

i02860835

Boom, Stick, and Frame - Inspect

SMCS Code: 6501; 6502; 6506

All earthmoving equipment is prone to a high degree of wear. Regular inspections for structural damage are necessary.

The interval between these inspections depends on the factors that follow.

- The age of the machine

- The severity of the application
- The loads that have been carried on the machine
- The amount of routine servicing that has been carried out

If the machine has been involved in any kind of accident, the machine must be inspected thoroughly. Inspect the machine regardless of the date of the last inspection.

The machine must be clean before the machine is inspected.

Proper repair of frames and structures requires specific knowledge of the following subjects.

- Materials that have been used to manufacture the frame members
- Frame member construction
- Repair techniques that are recommended by the manufacturer.

Consult your Caterpillar dealer if repairs are necessary. Your Caterpillar dealer is qualified to carry out repairs on your behalf.

All repairs should be carried out by a Caterpillar dealer. If you carry out your own repairs, contact your Caterpillar dealer for advice about proper repair techniques.

Particular attention should be given to all welded structures. The following items should be thoroughly inspected for cracks and for defects:

- Boom
- Stick
- Blade
- Lifting points
- Upper frame
- Lower frame

NOTICE

The areas highlighted are of particular importance but other areas must not be neglected. The entire structure must be carefully examined.

Boom

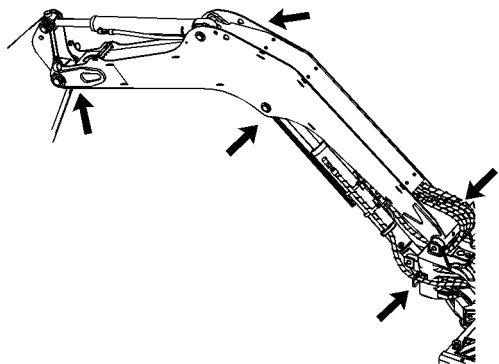


Illustration 164

g01425291

Check all welded joints and check the mounting points for the cylinder.

Stick

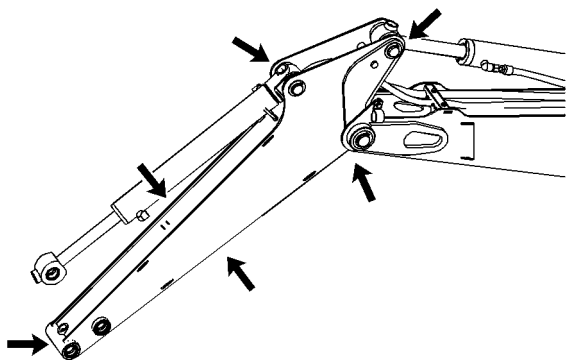


Illustration 165

g01425293

Check all welded joints and check the mounting points for the cylinder.

Blade

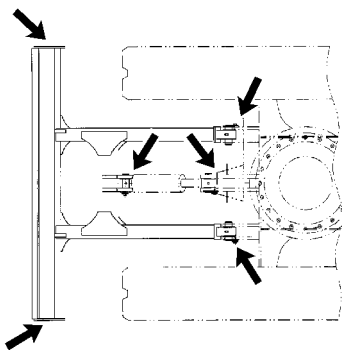


Illustration 166

g01425286

Check all welded joints and check the mounting points for the cylinder.

Lifting Points

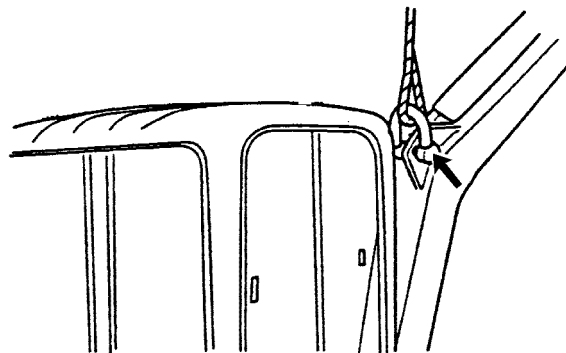


Illustration 167

g01425213

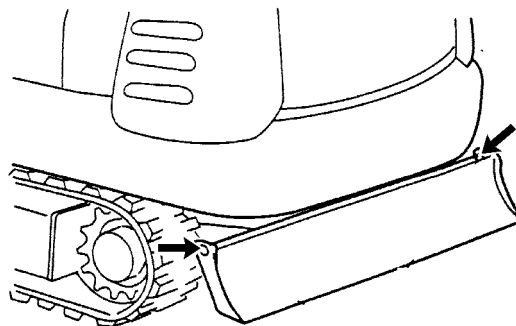


Illustration 168

g00309343

Check the approved lifting points carefully. Check the welds. Check that the plates are not excessively bent. Check that the lifting holes are not deformed.

Upper Frame

i03997198

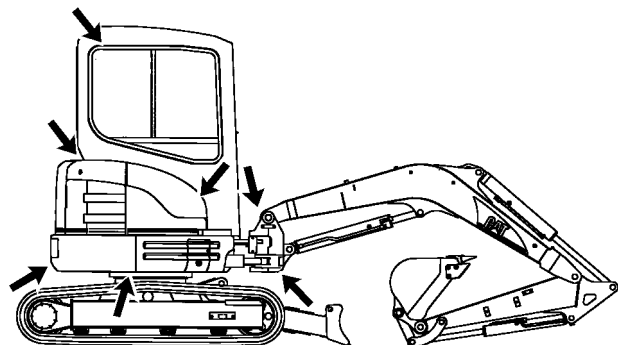


Illustration 169

g01425289

Check for damaged panels. Specifically look for any damage to the cab or damage to the canopy that might invalidate the certification. The cab or the canopy is a safety device that must be maintained in good condition. Check for loose hardware or missing hardware.

Lower Frame

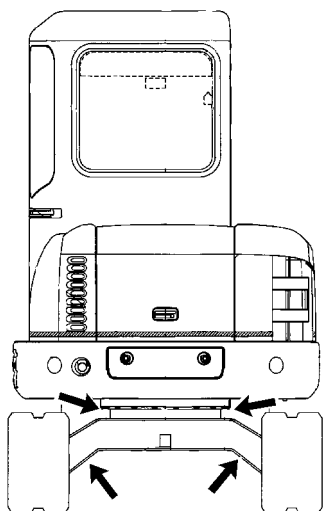


Illustration 170

g01425287

Check the weld joints in the lower structure. Check for loose hardware or missing hardware. Check the ring of bolts that secure the swing gear.

Boom Swing Cylinder Pins - Lubricate

SMCS Code: 5105-086

1. Lower all work tools to the ground.
2. Wipe all grease fittings before you lubricate the grease fittings.

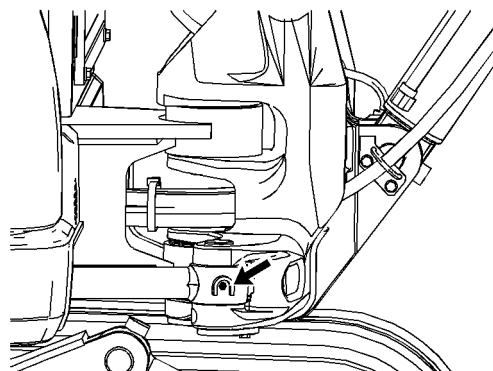


Illustration 171

g01191058

3. Apply lubricant to the grease fitting for the rod end of the boom swing cylinder.

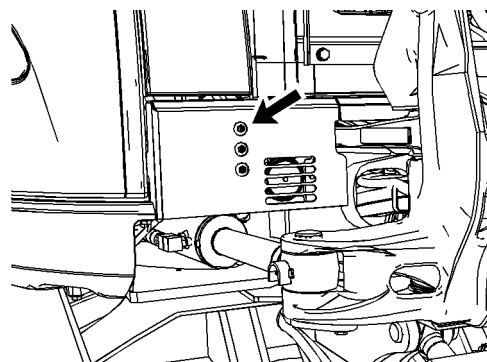


Illustration 172

g02162814

303.5D CR and 304D CR

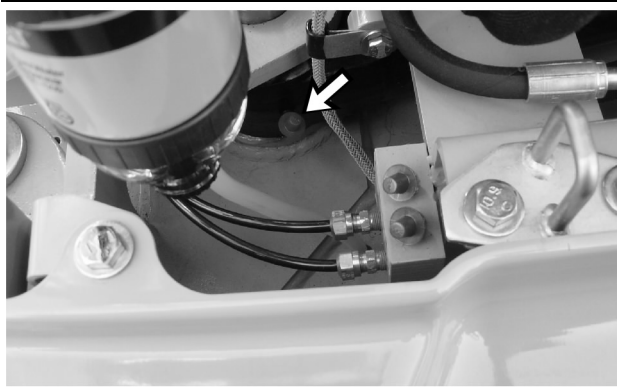


Illustration 173

g01249957

305D CR and 305.5D CR

4. Apply lubricant to the grease fitting for the head end of the boom swing cylinder.

i02386794

Bucket Linkage - Lubricate

SMCS Code: 6513-086

Note: Caterpillar recommends the use of 5% molybdenum grease for lubricating the bucket linkage. Refer to Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations" for more information on molybdenum grease.

Apply lubricant through all fittings after operation under water.

Wipe all fittings before you apply lubricant.

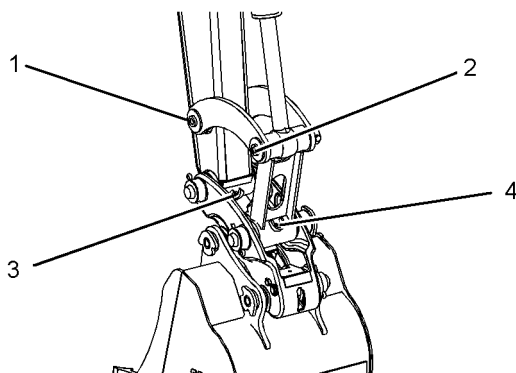


Illustration 174

g01190973

Note: Completely fill all cavities of the bucket control linkage with grease when you initially install a bucket.

1. Apply lubricant through fittings for the linkages (1) and (2).

2. Apply lubricant through fittings for the bucket (3) and (4).

Note: Service the above fittings after you operate the bucket under water.

i02869831

Bucket Tips - Inspect/Replace

SMCS Code: 6805-040; 6805-510

WARNING

Personal injury or death can result from bucket falling.

Block the bucket before changing bucket tips or side cutters.

Bucket Tips

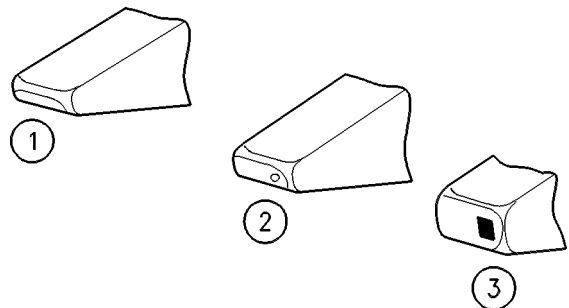


Illustration 175

g00101352

- (1) Usable
- (2) Replace this bucket tip.
- (3) Overworn

Check the bucket tips for wear. If the bucket tip has a hole, replace the bucket tip.

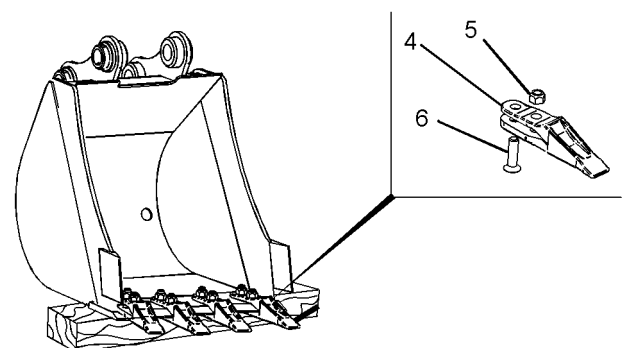


Illustration 176

g01429324

1. Block the bucket.
2. Remove mounting bolts (6) and nuts (5). Remove bucket tip (4).
3. Clean the mounting surfaces.
4. Install the new bucket tip onto the adapter.

i02798352

Bucket Tips - Inspect/Replace (J200 Tips)

SMCS Code: 6805-040; 6805-510

WARNING

Block the bucket before changing the bucket teeth.

To prevent possible injury to the eyes, wear a protective face shield when striking the pin.

The pin, when struck, can fly out and cause injury to nearby personnel.

Bucket Tips

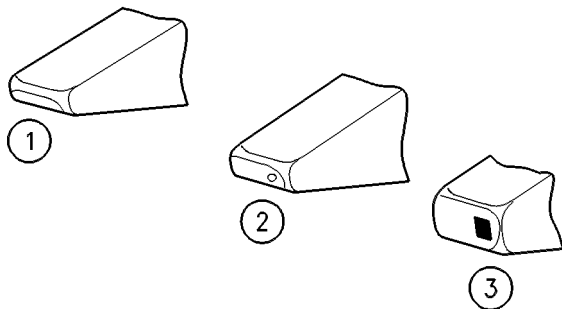


Illustration 177

g00101352

- (1) Usable
- (2) Replace this bucket tip.
- (3) Overworn

Check the bucket tips for wear. If the bucket tip has a hole, replace the bucket tip.

1. Remove the pin from the bucket tip. The pin can be removed by one of the following methods.
 - Use a hammer and a punch from the retainer side of the bucket to drive out the pin.
 - Use a Pin-Master. Follow Step 1.a through Step 1.c for the procedure.

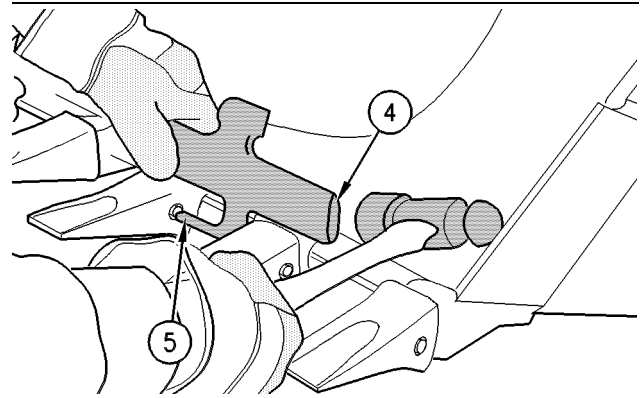


Illustration 178

g00590670

- (4) Back of Pin-Master
- (5) Extractor

- a. Place the Pin-Master on the bucket tip.
- b. Align extractor (5) with the pin.
- c. Strike the Pin-Master at the back of the tool (4) and remove the pin.

Note: Discard the old pin and the retainer assembly. When you change tips, use a new pin and a new retainer assembly. Refer to the appropriate parts manual for your machine.

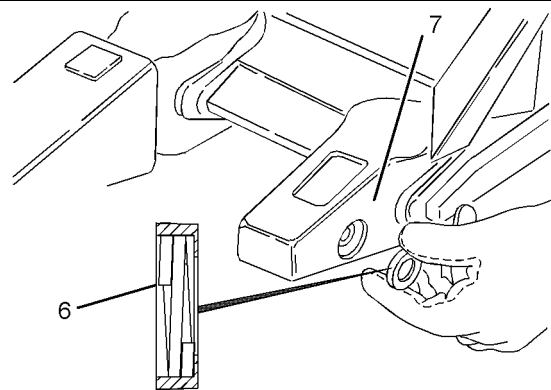


Illustration 179

g01194448

- (6) Retainer assembly
- (7) Adapter

2. Clean the adapter and the pin.
3. Fit retainer assembly (6) into the counterbore that is in the side of adapter (7). Make sure that the face of the retainer assembly with the marking "OUTSIDE" is visible.

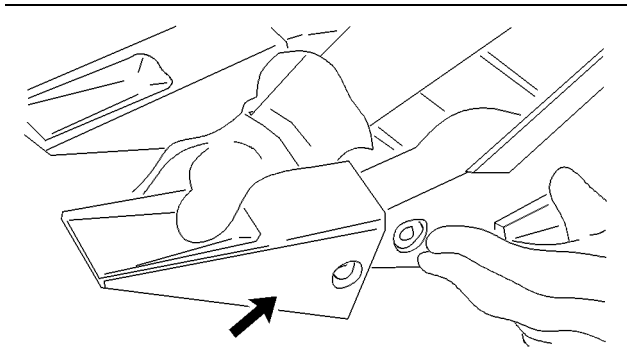


Illustration 180

g00101359

4. Install the new bucket tip onto the adapter.

Note: The bucket tips can be rotated by 180 degrees in order to allow the tip to wear evenly. You may also move the tips from the outside teeth to the inside teeth. Check the tips often. If wear is present on the tips, rotate the tips. The outside teeth generate the most wear.

5. Drive the pin through the bucket tip. The pin can be installed by using one of the following methods:

- From the same side of the retainer, drive the pin through the bucket tip, the retainer assembly, and the adapter.
- Use a Pin-Master. Follow Step 5.a through Step 5.e for the procedure.

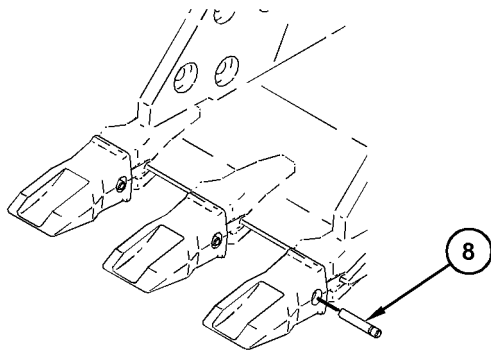


Illustration 181

g01209166

(8) Pin

a. Insert pin (8) through the bucket tip.

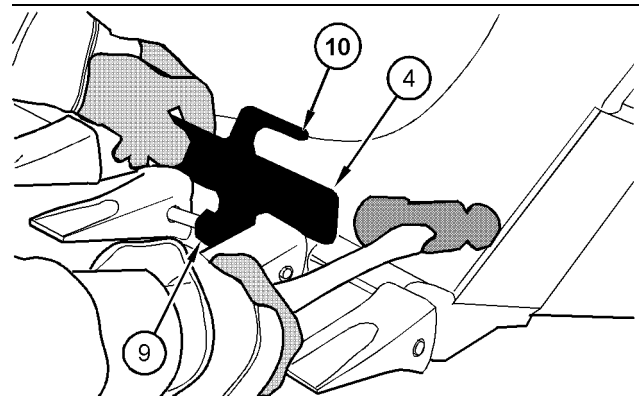


Illustration 182

g01209140

(4) Back of Pin-Master

(9) Pin holder

(10) Pin setter

- Place the Pin-Master over the bucket tips so that the pin will fit into the counterbore of the pin holder (9).
- Strike the Pin-Master with a hammer at the back of the tool (4) in order to insert the pin.
- Slide pin holder (9) away from the pin and rotate the tool slightly in order to align pin setter (10) with the pin.

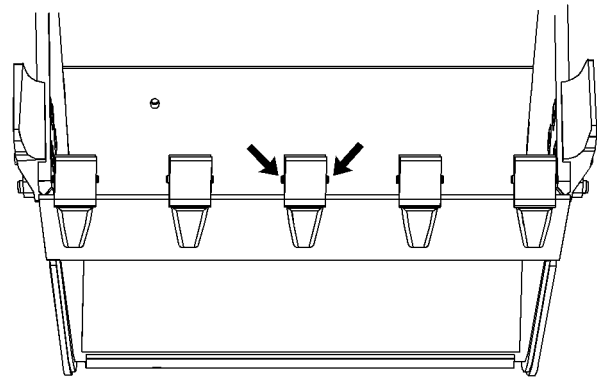


Illustration 183

g01209159

Final assembly of pin into bucket tip.

- Strike the end of the tool until the pin is fully inserted.

Side Cutters

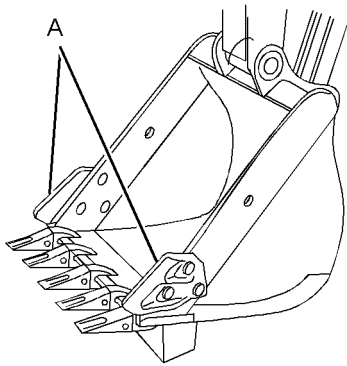


Illustration 184

g01092808

Bucket With Side Cutters

(A) Side cutters

1. Remove the mounting bolts and the side cutters.
2. Clean the mounting surface of the side plate on the bucket and of the side cutter. Remove any burrs or protrusions on the mating surfaces.

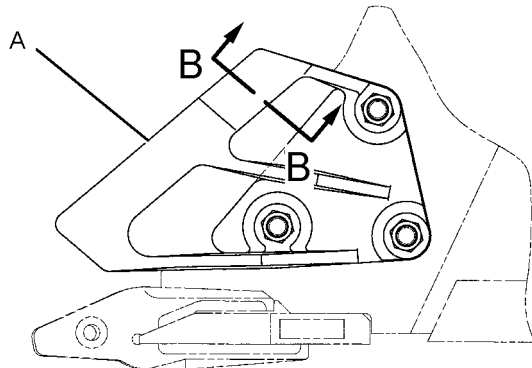


Illustration 185

g01092810

(A) Side cutter

Note: Some side cutters may be rotated for additional wear.

3. Install the side cutter.

Note: Certain bolts may require thread compound.

4. Hand tighten the bolts.

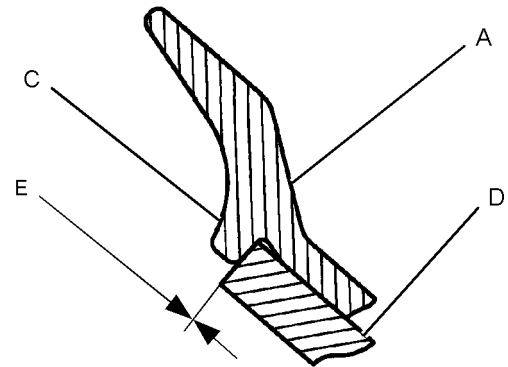


Illustration 186

g01092812

Section B-B From Illustration 185

(A) Side cutter
(C) Shear ledge on a side cutter
(D) Side plate on a bucket
(E) 0.0 mm (0.0 inch)

5. Make sure that there is not a gap between the side plate on the bucket and the shear ledge on the side cutter.
6. Torque the mounting bolts to the correct specification.

i02873799

Bucket Tips - Inspect/Replace (Vertical Retention System for a Round Hole Tip)

SMCS Code: 6805-040; 6805-510

WARNING

Personal injury or death can result from bucket falling.

Block the bucket before changing bucket tips or side cutters.

Bucket Tips

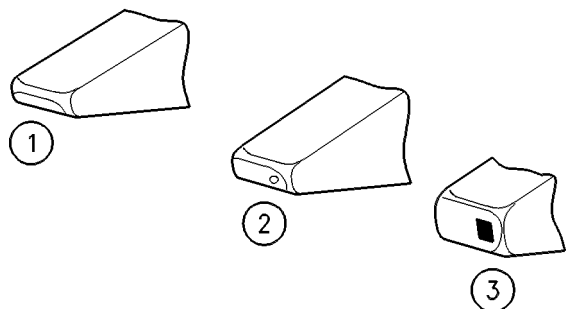


Illustration 187

g00101352

- (1) Usable
- (2) Replace this bucket tip.
- (3) Overworn

Check the bucket tips for wear. If the bucket tip has a hole, replace the bucket tip.

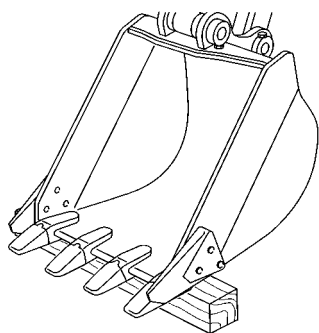


Illustration 188

g00823856

1. Block the bucket.

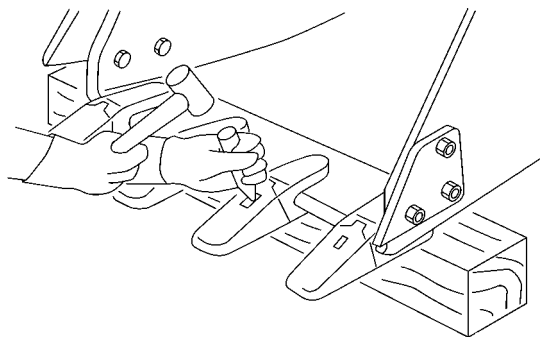


Illustration 189

g00823857

2. Remove the pin from the bucket tip. Use a hammer and a punch in order to drive the pin from the bucket tip.

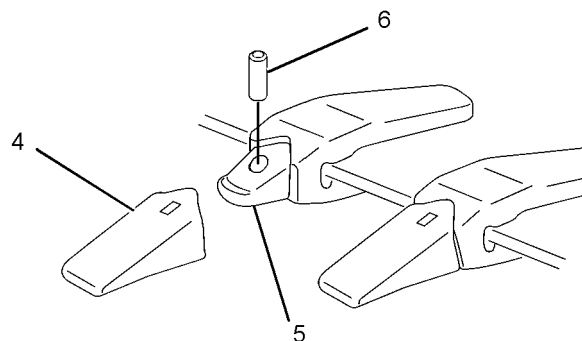


Illustration 190

g01198006

- (4) Tip
- (5) Adapter
- (6) Pin

3. Clean the adapter and the pin. When you replace tip (4), also replace pin (6).

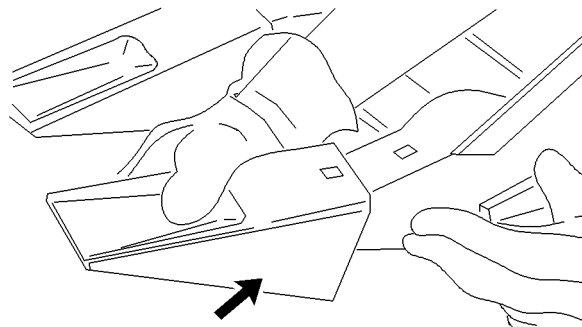


Illustration 191

g00823892

4. Install the new bucket tip onto the adapter.

Note: The bucket tip can be rotated by 180 degrees in order to allow greater penetration or less penetration.

5. Drive pin (6) through tip (4).
6. After you drive pin (6), make sure that the pin fits snugly into the groove.

Side Cutters

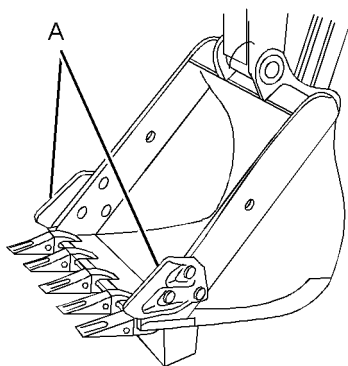


Illustration 192

g01092808

Bucket With Side Cutters

(A) Side cutters

1. Remove the mounting bolts and the side cutters.
2. Clean the mounting surface of the side plate on the bucket and of the side cutter. Remove any burrs or protrusions on the mating surfaces.

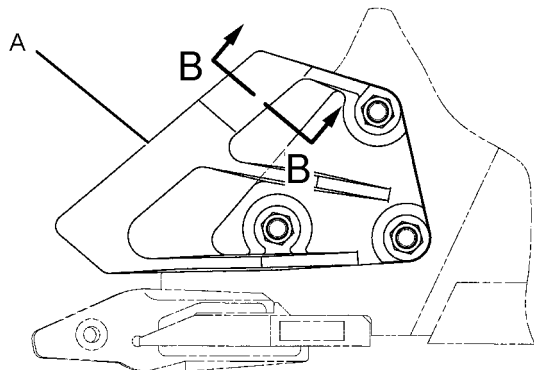


Illustration 193

g01092810

(A) Side cutter

Note: Some side cutters may be rotated for additional wear.

3. Install the side cutter.

Note: Certain bolts may require thread compound.

4. Hand tighten the bolts.

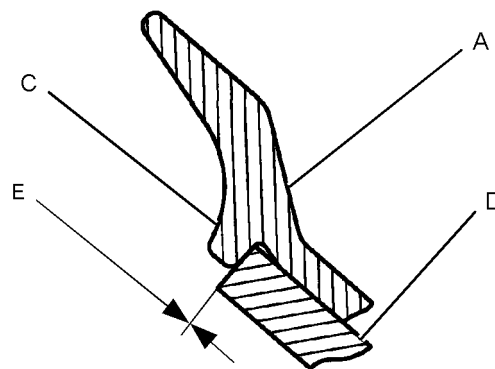


Illustration 194

g01092812

Section B-B From Illustration 193

(A) Side cutter
(C) Shear ledge on a side cutter
(D) Side plate on a bucket
(E) 0.0 mm (0.0 inch)

5. Make sure that there is not a gap between the side plate on the bucket and the shear ledge on the side cutter.
6. Torque the mounting bolts to the correct specification.

i02399962

Condenser (Refrigerant) - Clean

SMCS Code: 1805-070

NOTICE

If excessively dirty, clean condenser with a brush. To prevent damage or bending of the fins, do not use a stiff brush.

Repair the fins if found defective.

1. Open the access cover on the right side of the machine.

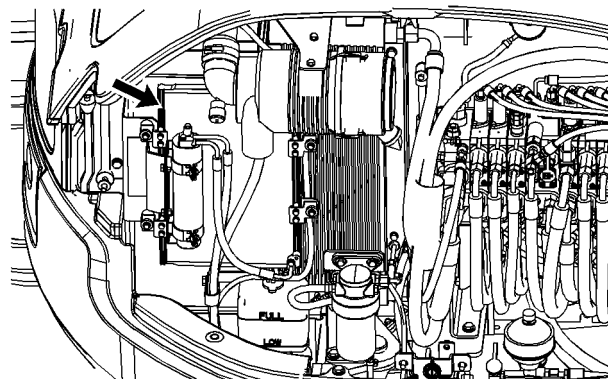


Illustration 195

g01198735

2. Inspect the condenser for debris. Clean the condenser, if necessary.
3. You can use compressed air, high pressure water, or steam to remove dust and other debris from the condenser. However, the use of compressed air is preferred.
4. Close the access cover on the right side of the machine.

i02379208

Cooling System Coolant (ELC) - Change

SMCS Code: 1350-044

NOTICE

Do not change the coolant until you read and understand the cooling system information in Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations".

Failure to do so could result in damage to the cooling system components.

NOTICE

Mixing ELC with other products will reduce the effectiveness of the coolant.

This could result in damage to cooling system components.

If Caterpillar products are not available and commercial products must be used, make sure they have passed the Caterpillar EC-1 specification for pre-mixed or concentrate coolants and Caterpillar Extender.

Note: This machine was filled at the factory with Caterpillar Extended Life Coolant.

If the coolant in the machine is changed to Extended Life Coolant from another type of coolant, see Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations".

1. Open the right side access door.

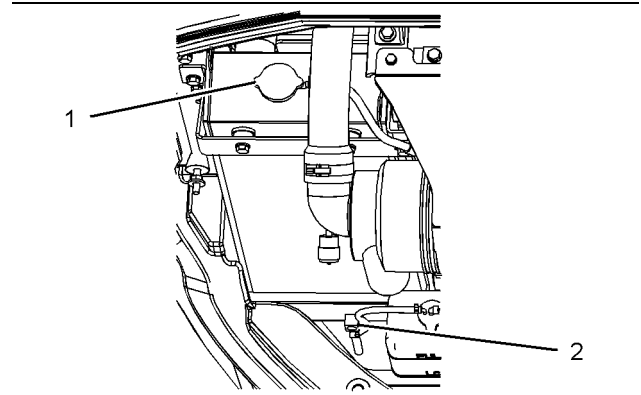


Illustration 196

g01187906

2. Slowly loosen the cooling system pressure cap (1) in order to relieve cooling system pressure. Remove the pressure cap.
- Note:** Refer to Operation and Maintenance Manual, "General Hazard Information" for information on Containing Fluid Spillage.
3. Open the drain valve (2) that is under the radiator. Allow the coolant to drain into a suitable container.
 4. Close the drain valve. Fill the system with a solution that consists of clean water and of cooling system cleaner.
 5. Start the engine. Run the engine for approximately ten minutes in order to raise the coolant temperature.
 6. Stop the engine. Open the drain valve and allow the cleaning solution to drain into a suitable container.
 7. Flush the cooling system with water until the draining water is transparent.
 8. Close the drain valve.
 9. Add the Extended Life Coolant. Refer to the following topics:
 - Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations"
 - Operation and Maintenance Manual, "Capacities (Refill)"
 10. Start the engine. Leave the cooling system pressure cap off. Run the engine in order to expel any air from the system.
 11. Maintain the coolant level within 13 mm (0.5 inch) of the bottom of the filler pipe.

12. Install the cooling system pressure cap after the thermostat and the coolant level stabilizes.
13. Stop the engine.

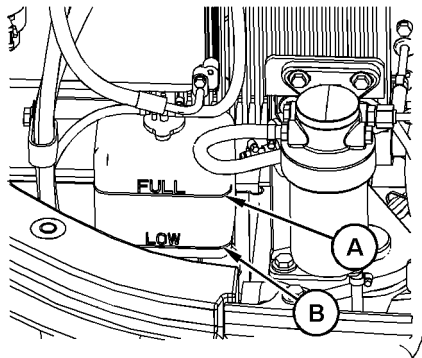


Illustration 197

g01187910

14. Check the coolant level of the coolant reservoir. Maintain the coolant level between the "FULL" mark and the "LOW" mark.
15. If additional coolant is necessary, remove the reservoir cap and add the appropriate coolant solution.
16. Install the reservoir cap.
17. Close the right side access door.

Note: Drained fluids should always be disposed of according to local regulations.

i03967772

Cooling System Coolant Extender (ELC) - Add

SMCS Code: 1352; 1353; 1395

WARNING

Pressurized system: Hot coolant can cause serious burn. To open cap, stop engine, wait until radiator is cool. Then loose the cap slowly to relieve the pressure.

When a Caterpillar Extended Life Coolant is used, an extender must be added to the cooling system. See the Operation and Maintenance Manual, "Maintenance Interval Schedule" for the proper service interval. The amount of extender is determined by the cooling system capacity.

Table 50

RECOMMENDED AMOUNT OF EXTENDER BY COOLING SYSTEM CAPACITY	
Cooling System Capacity	Recommended Amount of Extender
6 to 11 L (1.6 to 3 US gal)	.2 L (0.21 qt)

For additional information on the addition of extender, see Operation and Maintenance Manual, SEBU6250, "Caterpillar Coolant Recommendations" or consult your Caterpillar dealer.

i02379547

Cooling System Coolant Level - Check

SMCS Code: 1350-040; 1350-535-FLV; 1395-535-FLV

WARNING

Pressurized system: Hot coolant can cause serious burn. To open cap, stop engine, wait until radiator is cool. Then loosen cap slowly to relieve the pressure.

1. Open the right side access door.

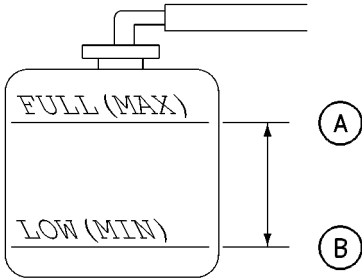


Illustration 198

g00824033

2. Maintain the coolant level between "FULL" mark (A) on the coolant reservoir and "LOW" mark (B) on the coolant reservoir.

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information on containing fluid spillage.

3. If additional coolant is necessary, remove the filler cap for the coolant reservoir and add the appropriate coolant mixture. Install the filler cap.

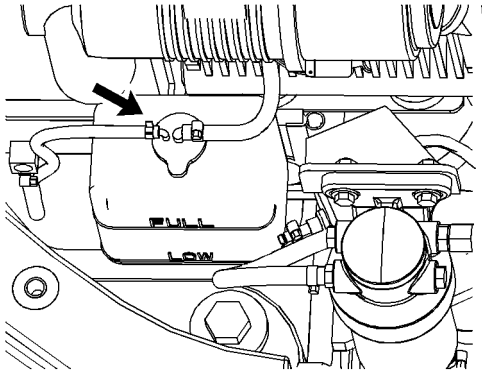


Illustration 199

g01188129

4. If the coolant reservoir is empty, remove the cooling system pressure cap slowly in order to relieve pressure. Add coolant to the radiator.

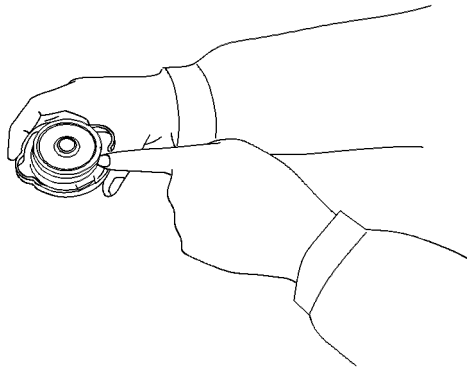


Illustration 200

g00102170

5. Inspect the condition of the cap gasket. If necessary, replace the cap.
6. Install the cooling system pressure cap.
7. Close the right side access door.

i02425978

Cooling System Coolant Sample (Level 1) - Obtain

SMCS Code: 1395-008; 1395-554; 7542

Note: It is not necessary to obtain a Coolant Sample (Level 1) if the cooling system is filled with Cat ELC (Extended Life Coolant). Cooling systems that are filled with Cat ELC should have a Coolant Sample (Level 2) that is obtained at the recommended interval that is stated in the Maintenance Interval Schedule.

Note: Obtain a Coolant Sample (Level 1) if the cooling system is filled with any other coolant instead of Cat ELC. This includes the following types of coolants.

- Commercial long life coolants that meet the Caterpillar Engine Coolant Specification -1 (Caterpillar EC-1)
- Cat Diesel Engine Antifreeze/Coolant (DEAC)
- Commercial heavy-duty antifreeze/coolant solution

NOTICE

Always use a designated pump for oil sampling, and use a separate designated pump for coolant sampling. Using the same pump for both types of samples may contaminate the samples that are being drawn. This contaminate may cause a false analysis and an incorrect interpretation that could lead to concerns by both dealers and customers.

Note: Level 1 results may indicate a need for Level 2 Analysis.

NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Refer to Special Publication, NENG2500, "Caterpillar Dealer Service Tool Catalog" for tools and supplies suitable to collect and contain fluids on Caterpillar products.

Dispose of all fluids according to local regulations and mandates.

Obtain the sample of the coolant as close as possible to the recommended sampling interval. The recommended sampling interval for Level 1 Coolant Analysis is every 250 service hours. In order to receive the full effect of S·O·S analysis, you must establish a consistent trend of data. In order to establish a pertinent history of data, perform consistent samplings that are evenly spaced. Supplies for collecting samples can be obtained from your Caterpillar dealer.

Use the following guidelines for proper sampling of the coolant:

- Complete the information on the label for the sampling bottle before you begin to take the samples.

- Keep the unused sampling bottles stored in plastic bags.
- Keep the lids on empty sampling bottles until you are ready to collect the sample.
- Place the sample in the mailing tube immediately after obtaining the sample in order to avoid contamination.
- Never collect samples from expansion bottles.
- Never collect samples from the drain for a system.

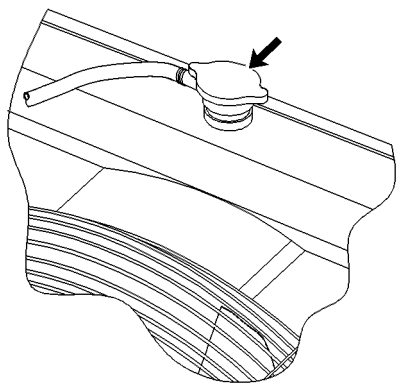


Illustration 201

g00544510

WARNING

Pressurized System: Hot coolant can cause serious burns. To open the cooling system filler cap, stop the engine and wait until the cooling system components are cool. Loosen the cooling system pressure cap slowly in order to relieve the pressure.

1. The machine needs to be operated in order to circulate the coolant. Collect the sample after a normal workday. Collect the samples from one to two hours after the engine has been shut off.
2. Start the engine momentarily in order to circulate the coolant again.
3. Shut off the engine.
4. Carefully remove the radiator cap.
5. Use a vacuum pump and draw the sample. Do not allow dirt or other contaminants to enter the sampling bottle. Fill the sampling bottle three-fourths from the top. Do not fill the bottle completely.
6. Place the sampling bottle with the completed label into the mailing tube.
7. Install the radiator cap.

i02049802

Cooling System Coolant Sample (Level 2) - Obtain

SMCS Code: 1395-008; 1395-554; 7542

Reference: Refer to Operation and Maintenance Manual, "Cooling System Coolant Sample (Level 1) - Obtain" for the guidelines for proper sampling of the coolant.

Obtain the sample of the coolant as close as possible to the recommended sampling interval. Supplies for collecting samples can be obtained from your Caterpillar dealer.

Submit the sample for Level 2 analysis.

Reference: For additional information about coolant analysis, refer to Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations" or consult your Caterpillar dealer.

i02379557

Engine Air Filter Primary Element - Clean/Replace

SMCS Code: 1054-070; 1054-510

Cleaning Primary Air Filter Elements

NOTICE

Caterpillar recommends certified air filter cleaning services available at participating Caterpillar dealers. The Caterpillar cleaning process uses proven procedures to assure consistent quality and sufficient filter life.

Observe the following guidelines if you attempt to clean the filter element:

Do not tap or strike the filter element in order to remove dust.

Do not wash the filter element.

Use low pressure compressed air in order to remove the dust from the filter element. Air pressure must not exceed 207 kPa (30 psi). Direct the air flow up the pleats and down the pleats from the inside of the filter element. Take extreme care in order to avoid damage to the pleats.

Do not use air filters with damaged pleats, gaskets, or seals. Dirt entering the engine will cause damage to engine components.

The primary air filter element can be used up to six times if the element is properly cleaned and if the element is properly inspected. When the primary air filter element is cleaned, check for rips or tears in the filter material. The primary air filter element should be replaced at least one time per year. This replacement should be performed regardless of the number of cleanings.

NOTICE

Do not clean the air filter elements by bumping or tapping. This could damage the seals. Do not use elements with damaged pleats, gaskets, or seals. Damaged elements will allow dirt to pass through. Engine damage could result.

Visually inspect the primary air filter elements before cleaning. Inspect the air filter elements for damage to the seal, the gaskets, and the outer cover. Discard any damaged air filter elements.

There are two common methods that are used to clean primary air filter elements:

- Pressurized air
- Vacuum cleaning

Pressurized Air

Pressurized air can be used to clean primary air filter elements that have not been cleaned more than two times. Pressurized air will not remove deposits of carbon and oil. Use filtered, dry air with a maximum pressure of 207 kPa (30 psi).

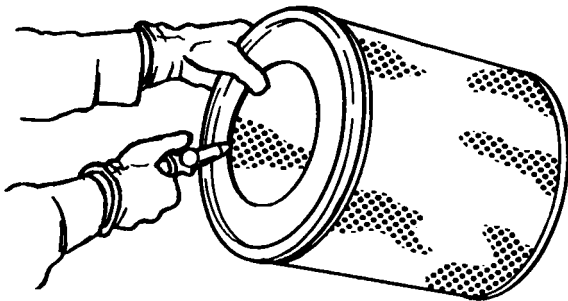


Illustration 202

g00281692

Note: When the primary air filter elements are cleaned, always begin with the clean side (inside) in order to force dirt particles toward the dirty side (outside).

Aim the hose so that the air flows inside the element along the length of the filter in order to help prevent damage to the paper pleats. Do not aim the stream of air directly at the primary air filter element. Dirt could be forced further into the pleats.

Vacuum Cleaning

Vacuum cleaning is another method for cleaning primary air filter elements which require daily cleaning because of a dry, dusty environment. Cleaning with pressurized air is recommended prior to vacuum cleaning. Vacuum cleaning will not remove deposits of carbon and oil.

Inspecting the Primary Air Filter Elements

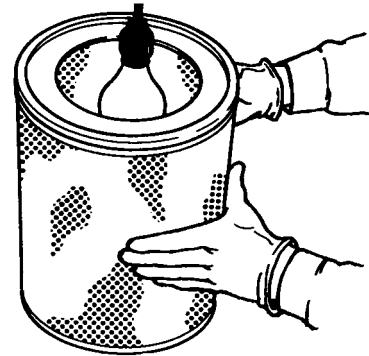


Illustration 203

g00281693

Inspect the clean, dry primary air filter element. Use a 60 watt blue light in a dark room or in a similar facility. Place the blue light in the primary air filter element. Rotate the primary air filter element. Inspect the primary air filter element for tears and/or holes. Inspect the primary air filter element for light that may show through the filter material. If it is necessary in order to confirm the result, compare the primary air filter element to a new primary air filter element that has the same part number.

Do not use a primary air filter element that has any tears and/or holes in the filter material. Do not use a primary air filter element with damaged pleats, gaskets or seals. Discard damaged primary air filter elements.

Storing Primary Air Filter Elements

If a primary air filter element that passes inspection will not be used, the primary air filter element can be stored for future use.

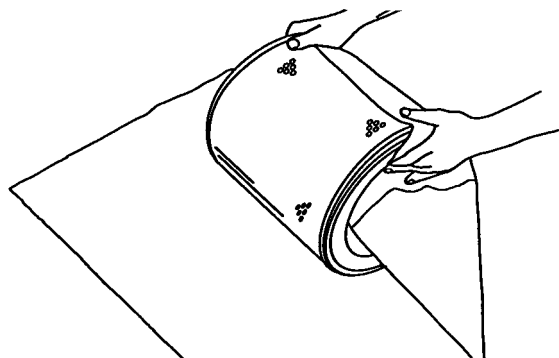


Illustration 204

g00281694

Do not use paint, a waterproof cover, or plastic as a protective covering for storage. An airflow restriction may result. To protect against dirt and damage, wrap the primary air filter elements in volatile corrosion inhibitor (VCI) paper.

Place the primary air filter element into a box for storage. For identification, mark the outside of the box and mark the primary air filter element. Include the following information:

- Date of cleaning
- Number of cleanings

Store the box in a dry location.

Replacing the Air Filter Element

The air filter element should be replaced immediately if the element is damaged.

1. Open the right side access door.

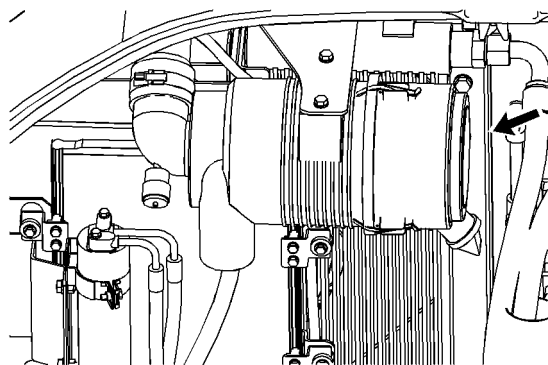


Illustration 205

g01188133

2. Unclamp the access cover and remove the access cover to the air cleaner.

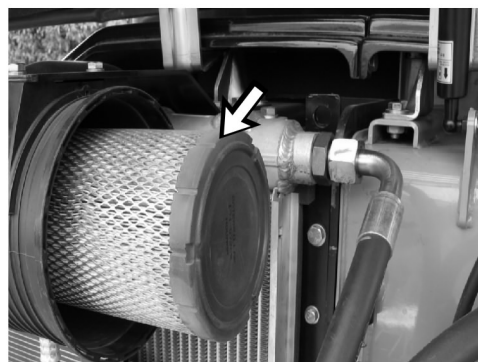


Illustration 206

g01188134

3. Remove the primary filter element from the air cleaner housing.
4. Inspect the filter element. If the pleats, the gaskets or the seals are damaged, discard the filter element. Replace damaged filter elements with new filter elements.
5. Wipe dust from the interior of the air cleaner housing. Remove the cover from the air inlet port. Leave the secondary filter element in place while you clean the air cleaner housing.
6. Put the clean air filter element into the air cleaner housing and push the air filter element into position.
7. Install the access cover.
8. Close the right side access door.

i02015686

Engine Air Filter Secondary Element - Replace

SMCS Code: 1054-510

NOTICE

Always replace the secondary filter element. Never attempt to reuse the element by cleaning.

The secondary filter element should be replaced at the time the primary element is serviced for the third time.

NOTICE

The filter should be kept in service for no longer than one year.

NOTICE

Always leave the secondary filter element in place while you clean the air cleaner housing.

1. Open the engine access door.
2. Remove the air cleaner housing cover.
3. Remove the primary filter element. Refer to Operation and Maintenance Manual, "Engine Air Filter Primary Element - Clean/Replace".

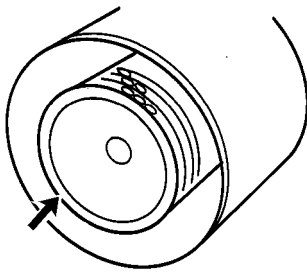


Illustration 207

g00470240

4. Remove the secondary filter element. Pull out in order to remove the element.
5. Cover the air inlet opening. Clean the inside of the air cleaner housing.
6. Install a new secondary filter element. Push the element firmly in order to properly seat the element. Write the date on the element.
7. Install the primary filter element and the air cleaner housing cover.
8. Close the engine access door.

i02379569

Engine Air Filter Service Indicator - Inspect

SMCS Code: 7452-040-DJ

NOTICE

Service the air cleaner only with the engine stopped. Engine damage could result if the air cleaner is serviced while the engine is running.

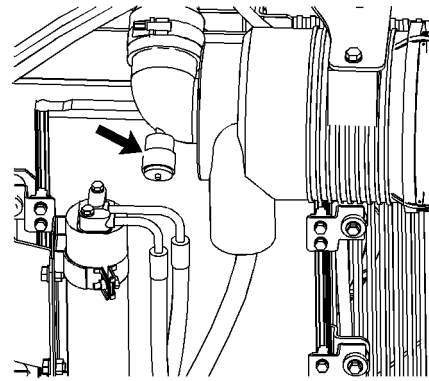


Illustration 208

g01188149

1. Open the right side access door.
2. Start the engine.
3. Run the engine at high idle.
4. If the piston in the engine air filter service indicator enters the red zone, service the air cleaner.
5. Stop the engine.

Note: See the Operation and Maintenance Manual, "Engine Air Filter Element - Clean/Replace".

6. Close the right side access door.

i02379576

Engine Oil Level - Check

SMCS Code: 1000-535

NOTICE

Do not overfill the crankcase. Engine damage can result.

1. Open the engine access door and lock the door open.

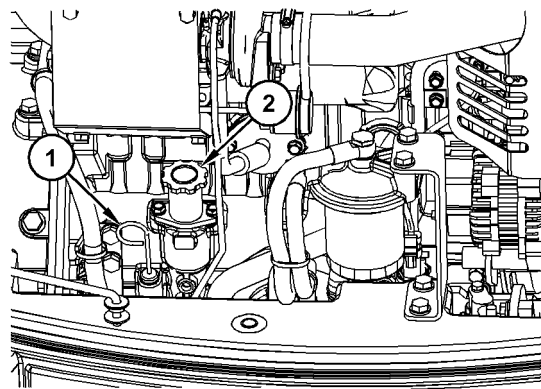


Illustration 209

g01188158

2. Remove the dipstick (1). Wipe the oil off the dipstick and reinsert the dipstick.

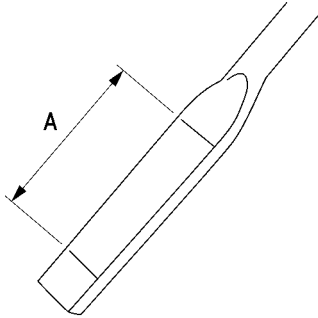


Illustration 210

g00824454

3. Remove the dipstick and check the dipstick. Maintain the oil level in area (A) on the dipstick.
4. If necessary, remove the oil filler cap (2) and add oil. Allow the oil to drain into the crankcase before you check the oil level.
5. Clean the oil filler cap and install the oil filler cap.
6. Close the engine access door.

i03998610

Engine Oil Sample - Obtain

SMCS Code: 1000-008; 1000; 1348-008; 1348-554-SM; 7542-008; 7542-554-OC, SM

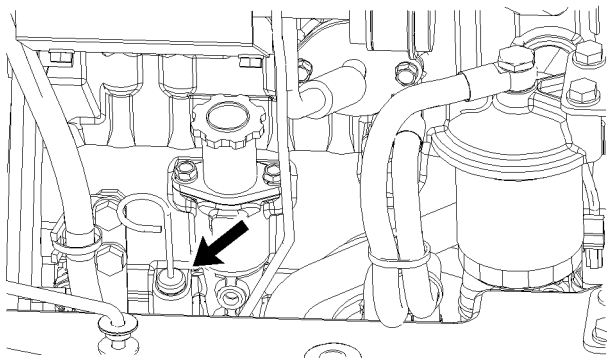


Illustration 211

g01188166

Obtain the oil sample of the engine oil through the opening for the dipstick.

Refer to Special Publication, SEBU6250, "S-O-S Oil Analysis" for information that pertains to obtaining a sample of the engine oil. Refer to Special Publication, PEGJ0047, "How To Take A Good Oil Sample" for more information about obtaining a sample of the engine oil.

i02379585

Engine Oil and Filter - Change

SMCS Code: 1318-510

Note: If the sulfur content in the fuel is greater than 1.5% by weight, use an oil that has a TBN of 30 and reduce the oil change interval by one-half.

Drain the crankcase while the oil is warm.

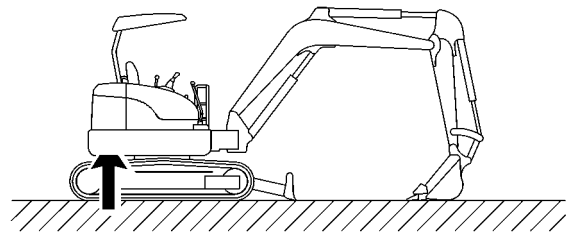


Illustration 212

g00824782

1. Open the crankcase access cover that is under the rear of the machine. Remove the bolts that secure the access cover.

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information on Containing Fluid Spillage.

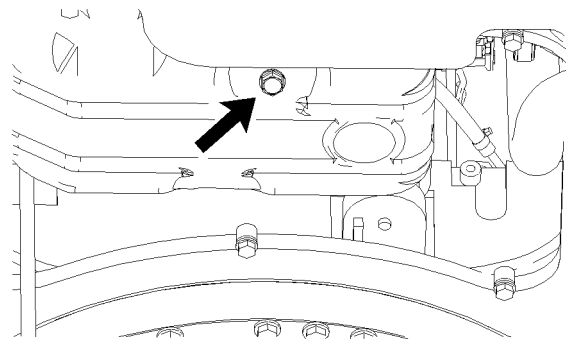


Illustration 213

g01188174

2. Remove the crankcase drain plug. Allow the oil to drain into a suitable container.

Note: Discard any drained fluids according to local regulations.

3. Clean the drain plug and install the drain plug.
4. Install the crankcase access cover.
5. Open the access door.

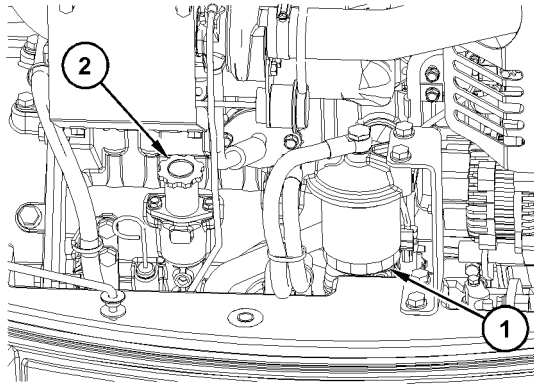


Illustration 214

g01188175

6. Remove the oil filter (1) with a filter wrench. Discard the used oil filter properly.
7. Clean the filter housing base. Make sure that all of the former filter gasket is removed.

Note: Always discard used filters according to local regulations.

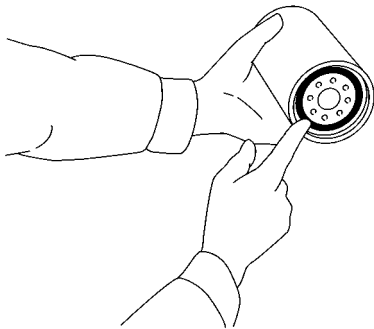


Illustration 215

g00824766

8. Apply a thin coat of clean engine oil to the gasket of the new filter.
9. Install the new oil filter by hand. When the gasket contacts the filter base, tighten the filter for an additional three quarters of a turn.
10. Remove the oil filler cap (2).

11. Fill the crankcase with new oil. Refer to Operation and Maintenance Manual, "Capacities (Refill)" and Operation and Maintenance Manual, "Lubricant Viscosities".

12. Clean the oil filler cap and install the oil filler cap.

13. Start the engine and operate the engine at low idle for several minutes. While the engine is running, check the filter base for oil leaks.

14. Stop the engine. Wait for thirty minutes in order to allow the oil to drain back into the crankcase.

15. Remove the dipstick and wipe off the oil.

16. Reinsert the dipstick.

17. Remove the dipstick and check the oil level on the dipstick.

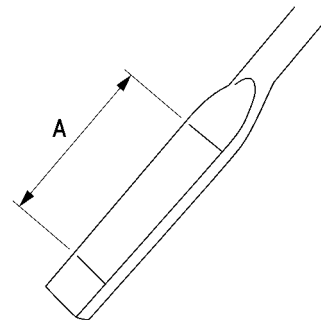


Illustration 216

g00824779

18. Maintain the oil within area (A) on the dipstick.

19. Close the engine access door.

i02865346

Engine Valve Lash - Check

SMCS Code: 1102-082; 1102-535; 1102; 1105-025; 1105-535; 1121-535; 1209-082; 1209-535; 1209; 7527

WARNING

Ensure that the engine can not be started while this maintenance is being performed. To help prevent possible injury, do not use the starting motor to turn the flywheel.

Hot engine components can cause burns. Allow additional time for the engine to cool before measuring/adjusting valve lash clearance.

NOTICE

Only qualified service personnel should perform this maintenance. Refer to the Systems Operation/Testing and Adjusting Manual, "Valve Lash and Valve Bridge Adjustment" article or consult your Caterpillar dealer for the complete valve lash adjustment procedure.

Operation of Caterpillar engines with improper valve adjustments can reduce engine efficiency. This reduced efficiency could result in excessive fuel usage and/or shortened engine component life.

For the serial number BXT1-up and DMY1-up, refer to Service Manual, RENR9640, "Mitsubishi Diesel Engines S3Q, S3Q2-T" in order to perform the complete procedure for the valve lash adjustment.

For the serial number FPK1-up and HWJ1-up, refer to Service Manual, RENR9620, "Mitsubishi Diesel Engines S4Q, S4Q2" in order to perform the complete procedure for the valve lash adjustment.

i03997106

Film (Product Identification) - Clean

SMCS Code: 7405-070; 7557-070

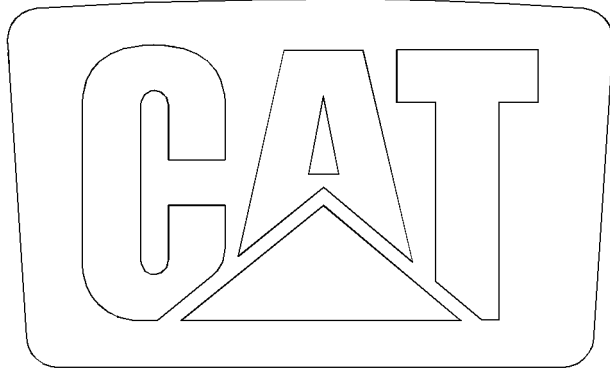


Illustration 217

g02174985

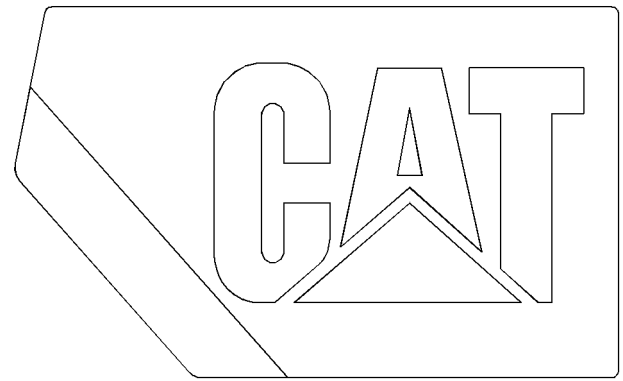


Illustration 218

g02175297

Typical example of the Product Identification Films.

Cleaning of the Films

Make sure that all of the product identification films are legible. Make sure that the recommended procedures are used in order to clean the product identification films. Ensure that all the product identification films are not damaged or missing. Clean the product identification films or replace the films.

Hand Washing

Use a wet solution with no abrasive material that contains no solvents and no alcohol. Use a wet solution with a "pH" value between 3 and 11. Use a soft brush, a rag, or a sponge in order to clean the product identification films. Avoid wearing down the surface of the product identification films with unnecessary scrubbing. Ensure that the surface of the product identification films is flushed with clean water and allow the product identification films to air dry.

Power Washing

Power washing or washing with pressure may be used in order to clean product identification films. However, aggressive washing can damage the product identification films.

Excessive pressure during power washing can damage the product identification films by forcing water underneath the product identification films. Water lessens the adhesion of the product identification film to the product, allowing the product identification film to lift or curl. These problems are magnified by wind. These problems are critical for the perforated film on windows.

To avoid lifting of the edge or other damage to the product identification films, follow these important steps:

- Use a spray nozzle with a wide spray pattern.

- A maximum pressure of 83 bar (1200 psi)
- A maximum water temperature of 50° C (120° F)
- Hold the nozzle perpendicular to the product identification film at a minimum distance of 305 mm (12 inch).
- Do not direct a stream of water at a sharp angle to the edge of the product identification film.

i03149045

Final Drive Oil - Change

SMCS Code: 4050-044-FLV

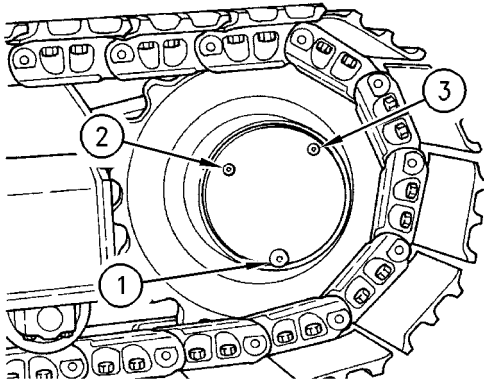


Illustration 219

g00740859

Type 1

- (1) Oil drain plug
- (2) Oil level plug
- (3) Oil filler plug

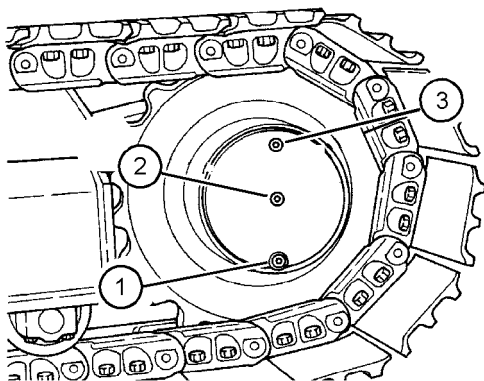


Illustration 220

g01619618

Type 2

- (1) Oil drain plug
- (2) Oil level plug
- (3) Oil filler plug

Note: Your machine may be equipped with a "Type 1" final drive or your machine may be equipped with a "Type 2" final drive.

1. Position one final drive so that oil drain plug (1) is at the bottom.

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information on containing fluid spillage.

2. Remove oil drain plug (1), level plug (2) and filler plug (3). Allow the oil to drain into a suitable container.
3. Clean the plugs and inspect the plugs. Replace a worn plug or a damaged plug.
4. Apply pipe sealant to oil drain plug (1), level plug (2) and filler plug (3).
5. Install drain plug (1).
6. Add oil through the opening of filler plug (3).
7. Fill the final drive to the bottom of the opening for level plug (2). Refer to Operation and Maintenance Manual, "Lubricant Viscosities" and Operation and Maintenance Manual, "Capacities (Refill)".
8. Install level plug (2) and filler plug (3).
9. Perform Step 1 to Step 8 on the other final drive. Do not combine the oil for the final drives in the same container. The oil from the final drives must be kept separate for the check that is performed in Step 15.
10. Completely remove any oil that has spilled.
11. Start the engine and allow the final drives to operate through several cycles.
12. Stop the engine.
13. Check the oil level.
14. Maintain the oil level to the bottom of the opening for level plug (2).
15. Check the drained oil for metal chips or for particles. If there are any chips or particles, consult your Caterpillar dealer.

Note: Dispose of drained fluids according to local regulations.

i01407687

Final Drive Oil Level - Check

SMCS Code: 4050-535-FLV

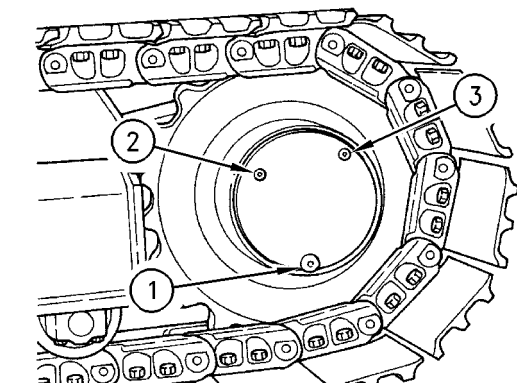


Illustration 221

g00740859

- (1) Oil drain plug
- (2) Oil level plug
- (3) Oil filler plug

1. Position one final drive so that oil drain plug (1) is at the bottom.

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information on Containing Fluid Spillage.

2. Remove oil level plug (2).
3. Check the oil level. The oil should be near the bottom of the opening of level plug (2).
4. Add oil through the opening of filler plug (3), if necessary.

Note: Overfilling the final drive will cause the seals on the travel motor to allow hydraulic oil or water to enter the final drive. This may contaminate the final drive.

5. Clean oil level plug (2) and filler plug (3).
6. Apply pipe sealant to oil level plug (2) and filler plug (3).
7. Install oil level plug (2).
8. Install oil filler plug (3).
9. Repeat the procedure for the other final drive.

i03998611

Final Drive Oil Sample - Obtain

SMCS Code: 4011-008; 4050-008; 4050-SM;
7542-008

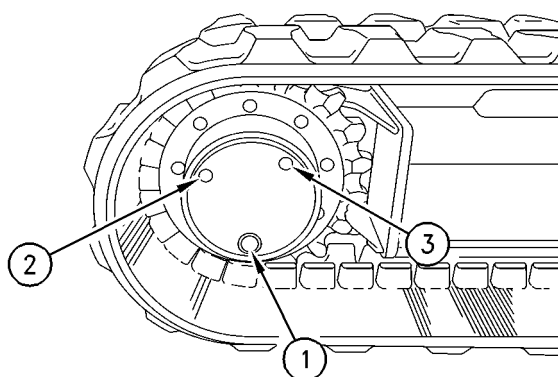


Illustration 222

g00823119

- (1) Oil drain plug
- (2) Oil level plug
- (3) Oil filler plug

Remove oil level plug (2) for the final drive. Obtain a sample of the final drive oil by pulling a sample through the opening for oil level plug (2).

Refer to Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations", "S-O-S Oil Analysis" for information that pertains to obtaining a sample of the final drive oil. Refer to Special Publication, PEGJ0047, "How To Take A Good Oil Sample" for more information about obtaining a sample of the final drive oil.

i02166043

Fuel System - Prime

SMCS Code: 1250-548

NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Refer to Special Publication, NENG2500, "Caterpillar Tools and Shop Products Guide" for tools and supplies suitable to collect and contain fluids on Caterpillar products.

Dispose of all fluids according to local regulations and mandates.

i02897671

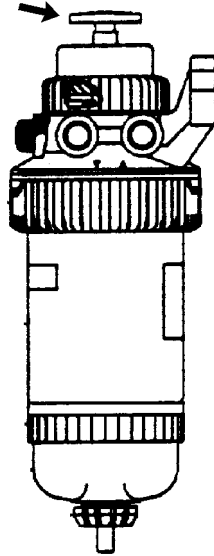


Illustration 223

g01098216

1. Operate the fuel priming pump plunger in order to fill the new filter element with fuel. Continue to pump until a resistance is felt. This resistance will indicate that the filter element is full of fuel.
2. Start the engine. If the engine will not start, further priming is necessary. If the engine starts but the engine continues to misfire, further priming is necessary. If the engine starts but the engine continues to emit smoke, further priming is necessary.
3. If the engine starts but the engine runs rough, continue to run the engine at low idle. Continue to run the engine at low idle until the engine runs smoothly.

Fuel System Primary Filter (Water Separator) Element - Replace

SMCS Code: 1263-510-FQ

WARNING

Personal injury or death may result from failure to adhere to the following procedures.

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

Clean up all leaked or spilled fuel. Do not smoke while working on the fuel system.

Turn the disconnect switch OFF or disconnect the battery when changing fuel filters.

NOTICE

Do not fill the fuel filters with fuel before installing the fuel filters. The fuel will not be filtered and could be contaminated. Contaminated fuel will cause accelerated wear to fuel system parts.

1. Open the access door on the right side of the machine.

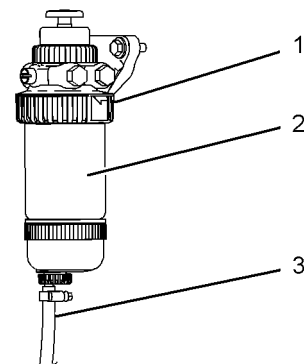


Illustration 224

g01442846

- (1) Locking Ring
- (2) Water Separator Bowl
- (3) Drain Hose

2. Open the drain on the water separator bowl (1). Allow the water and fuel to drain into a suitable container.
3. Support the water separator element and rotate the locking ring (2) counterclockwise. Remove the locking ring.

4. Remove the water separator bowl from the bottom of the fuel filter/water separator element.

Note: The water separator bowl is reusable. Do not discard the water separator bowl.

5. Inspect the O-ring seal of the water separator bowl for damage. Replace the O-ring seal, if necessary.
6. Lubricate the O-ring seal with clean diesel fuel or lubricate the O-ring seal with motor oil. Place the seal in the water separator bowl.
7. Spin the water separator bowl onto the new filter element by hand until the fuel filter/water separator is snug. Do not use tools to tighten the fuel filter/water separator element to the bowl.
8. Clean the filter mounting base.
9. Install the new element. Rotate the locking ring clockwise in order to fasten the filter to the mounting base.
10. Prime the fuel system. See Operation and Maintenance Manual, "Fuel System - Prime" for instructions.
11. Close the access door.

i02897701

Fuel System Water Separator - Drain

SMCS Code: 1263

1. Open the access door on the right side of the machine.

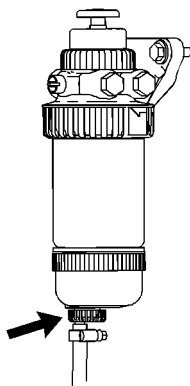


Illustration 225

g01442862

2. Turn the drain valve counterclockwise in order to open the drain valve.

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information on containing fluid spillage.

3. Drain the water and drain the sediment into a suitable container.

Note: Dispose of drained fluids according to local regulations.

4. Close the drain valve.
5. Close the access door.

i02379771

Fuel Tank Cap and Strainer - Clean

SMCS Code: 1273-070-STR

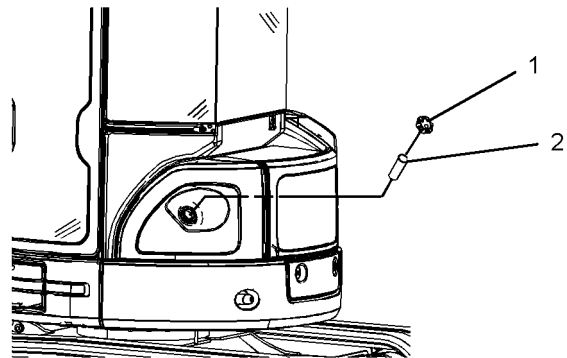


Illustration 226

g01188331

1. Remove the fuel cap (1) and the fuel fill screen (2).

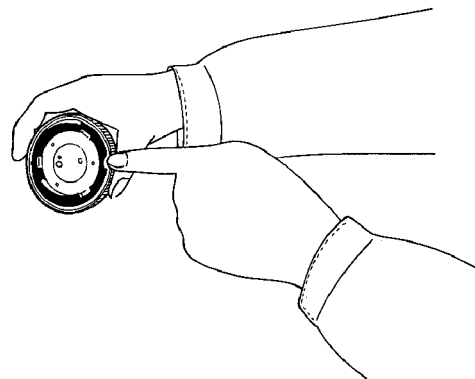


Illustration 227

g00104238

2. Inspect the cap. Replace the cap if the cap is damaged.

i03968089

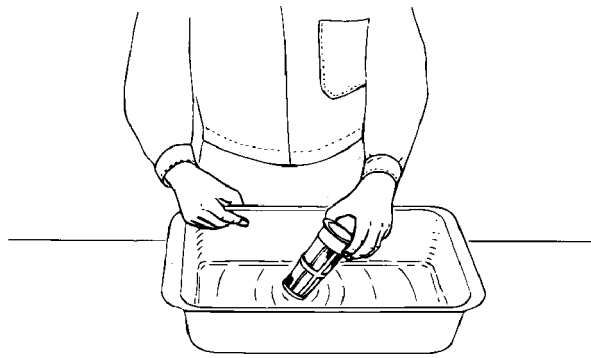


Illustration 228

g00104239

3. Wash the fuel fill screen in a clean, nonflammable solvent and dry the fuel fill screen.
4. Install the fuel fill screen.
5. Put a light coating of fuel oil on the cap gasket.
6. Install the fuel cap.

Fuel Tank Water and Sediment - Drain

i02386891

SMCS Code: 1273-543

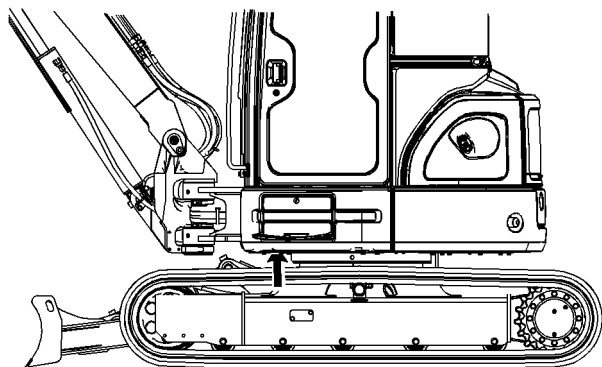


Illustration 229

g01191079

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information on Containing Fluid Spillage.

1. Open the drain valve that is located under the fuel tank. Allow the water and the sediment to drain into a suitable container.

Note: Discard the drained fluids according to local regulations.

2. Close the drain valve.

Fuses - Replace

SMCS Code: 1417-510

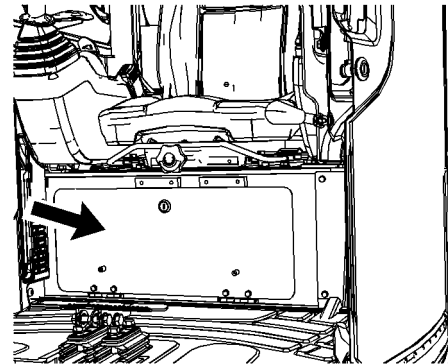


Illustration 230

g02161886

The fuse panel is located inside the access cover below the operators seat. Open the access cover for fuse access.



Fuses – Fuses protect the electrical system from damage that is caused by overloaded circuits. Change a fuse if the element separates. If the element of a new fuse separates, check the circuit and/or repair the circuit.

NOTICE

Always replace fuses with the same type and capacity fuse that was removed. Otherwise, electrical damage could result.

NOTICE

If it is necessary to replace fuses frequently, an electrical problem may exist.

Contact your Caterpillar dealer.

To replace a fuse, use a puller that is stored in the fuse panel. The following spare fuses are contained in the fuse panel:

- 5 Amp
- 10 Amp
- 15 Amp
- 20 Amp
- 30 Amp

The following list identifies the circuits that are protected by each fuse. The amperage for each fuse is included with each circuit.

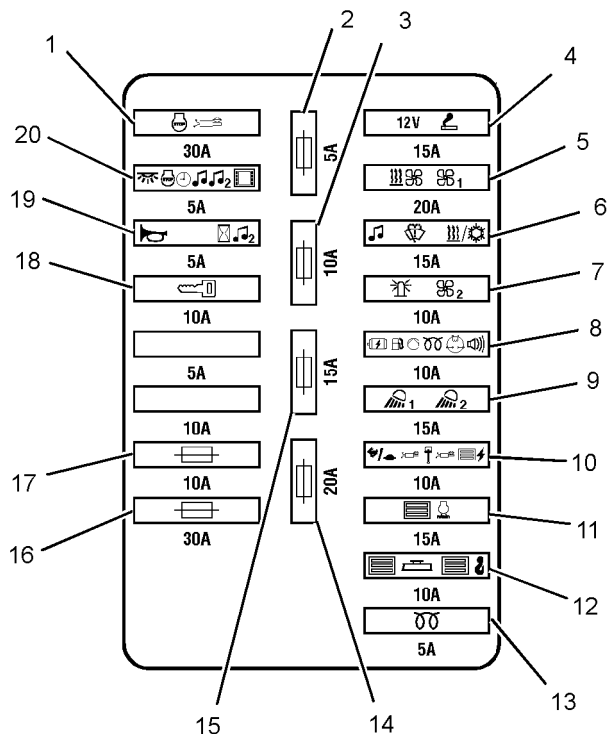


Illustration 231

g02161881

- (1) Engine Stop Solenoid – 30 Amp
- (2) Spare – 5 Amp
- (3) Spare – 10 Amp
- (4) Cigar Lighter – 15 Amp
- (5) Heater and Air Conditioner Blower – 20 Amp
- (6) Radio, Window Wiper, Window Washer, and Air Conditioner – 15 Amp
- (7) Beacon and Cab Fan – 10 Amp
- (8) Alternator, Fuel Pump, Glow Plug, and Travel Alarm – 10 Amp
- (9) Work Lights – 15 Amp
- (10) Travel Speed, Boom Swing, and Auxiliary Controller – 10 Amp
- (11) Engine Speed – 15 Amp
- (12) PAT Controller and Crane Controller – 10 Amp
- (13) Glow Indicator – 5 Amp
- (14) Spare – 20 Amp

- (15) Spare – 15 Amp
- (16) Spare – 30 Amp
- (17) Spare – 10 Amp
- (18) Engine Start Switch – 10 Amp
- (19) Horn and Service Hour Meter – 5 Amp
- (20) Dome Lamp, Engine Shutoff Timer, Radio Memory, and Monitor – 5Amp

i03968530

Hydraulic System Oil - Change

SMCS Code: 5056-044

Cat HYDO Advanced 10 Oil Change Interval

The standard Cat HYDO Advanced 10 oil change interval is every 3000 service hours or 18 months.

A maintenance interval of 6000 service hours or 3 years for changing the hydraulic oil is available. The extended interval requires S·O·S monitoring of the hydraulic oil. The interval for S·O·S monitoring is every 500 hours. The maintenance interval for the hydraulic oil filter is not changed.

Machines with hammers are not included in the maintenance interval of 6000 service hours or 3 years. Machines with hammers must use the intervals that are listed in the Maintenance Interval Schedule. Machines that are used in severe conditions are not included in the maintenance interval of 6000 service hours or 3 years. Machines that are used in severe conditions must use the interval in the Maintenance Interval Schedule.

Procedure to Change the Hydraulic Oil

WARNING

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

1. Park the machine on level ground.

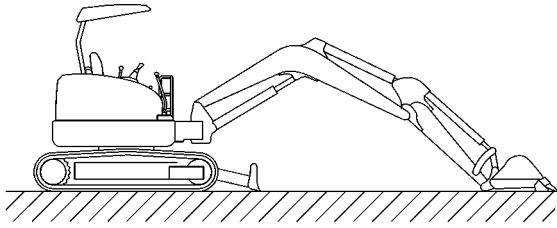


Illustration 232

g00825578

2. Extend the stick and the bucket fully. Lower the boom so that the bucket is rested on the ground. Lower the blade to the ground.
3. The hydraulic tank is located under the access cover on the right side of the machine. Open the access cover for the hydraulic tank. Clean the area around the hydraulic oil filler cap in order to prevent dirt from entering the hydraulic tank.
4. Relieve the internal pressure from the hydraulic tank by loosening the hydraulic oil filler cap. After the pressure is relieved, remove the hydraulic oil filler cap.

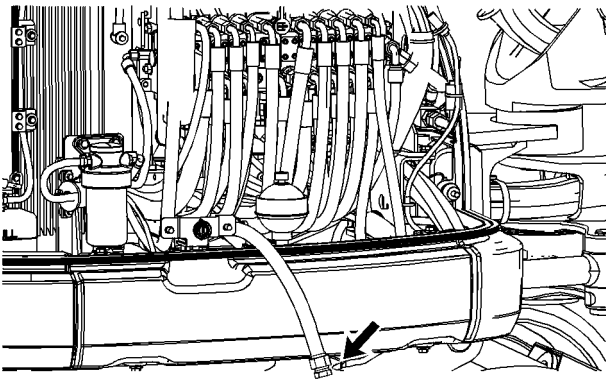


Illustration 233

g01188740

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information on Containing Fluid Spillage.

5. Remove the hydraulic oil drain plug. Allow the oil to drain into a suitable container.
6. Clean the drain plug and inspect the drain plug. Replace the drain plug if the drain plug is damaged or worn. Reinstall the plug.

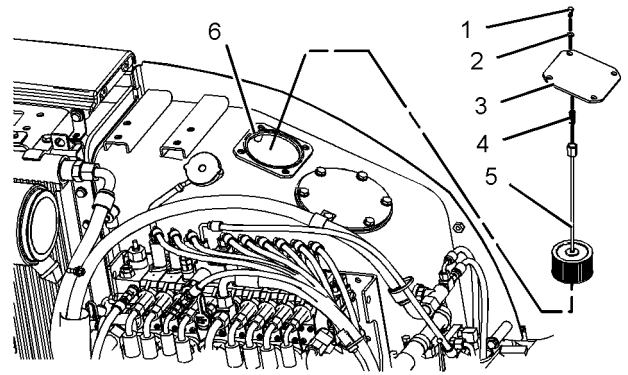


Illustration 234

g01188745

7. Remove bolt (1), washer (2), and left cover (3).
8. Remove spring (4) and screen (5).

Note: Do not allow spring (4) to fall into the hydraulic tank.

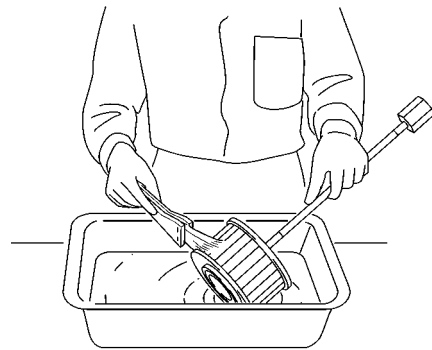


Illustration 235

g00825626

9. Clean screen (5) and inspect screen (5). Replace the screen if the screen is damaged or badly contaminated.
10. Inspect O-ring seal (6). Replace the O-ring seal if necessary.
11. Install the screen by reversing step 7 and step 8.

Note: Make sure that the O-ring seal and the spring are properly positioned during installation.

12. Fill the hydraulic system oil tank. Refer to Operation and Maintenance Manual, "Capacities (Refill)".

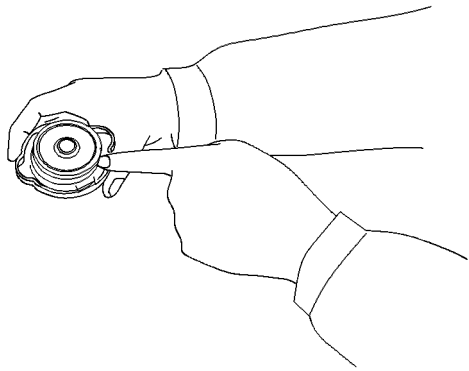


Illustration 236

g00101462

13. Inspect the pressure cap. Clean the pressure cap. Replace the pressure cap if damage is evident.
14. Install the pressure cap.
15. Start the engine and run the engine for a few minutes. Slowly operate the control levers in order to cause the hydraulic oil to flow through the circuits.

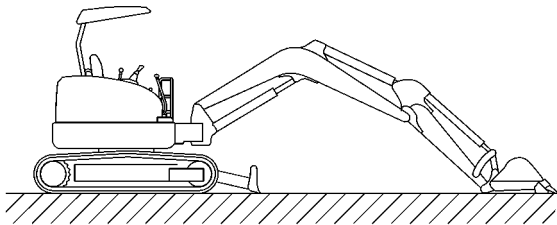


Illustration 237

g00825578

16. Extend the stick and the bucket fully. Lower the boom so that the bucket is rested on the ground. Lower the blade to the ground.

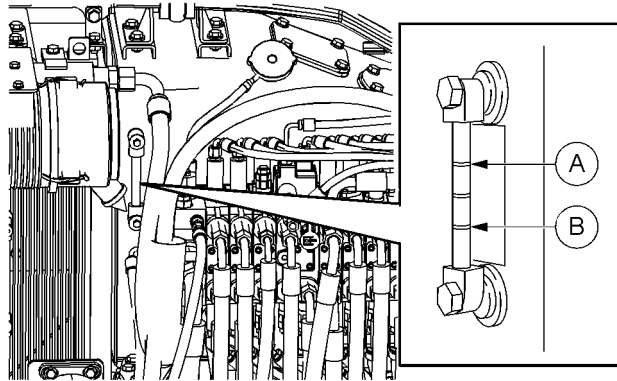


Illustration 238

g01188773

17. Maintain the hydraulic oil level between mark (A) and mark (B) of the sight gauge.

18. Close the right side access door.

i02385140

Hydraulic System Oil Filter (Return) - Replace

SMCS Code: 5068-510-RJ

NOTICE

Hot oil can cause personal injury. Remove the hydraulic oil filler cap only when the engine is stopped. Allow time for the hydraulic system to cool. Remove hydraulic oil filler cap slowly in order to relieve pressure.

The hydraulic oil tank is located under the access cover on the right side of the machine.

1. Open the right side access cover.
2. Clean the area thoroughly in order to prevent dirt from entering the hydraulic oil tank.
3. Slowly loosen the hydraulic oil filler cap in order to relieve the pressure in the hydraulic oil tank.

i02384736

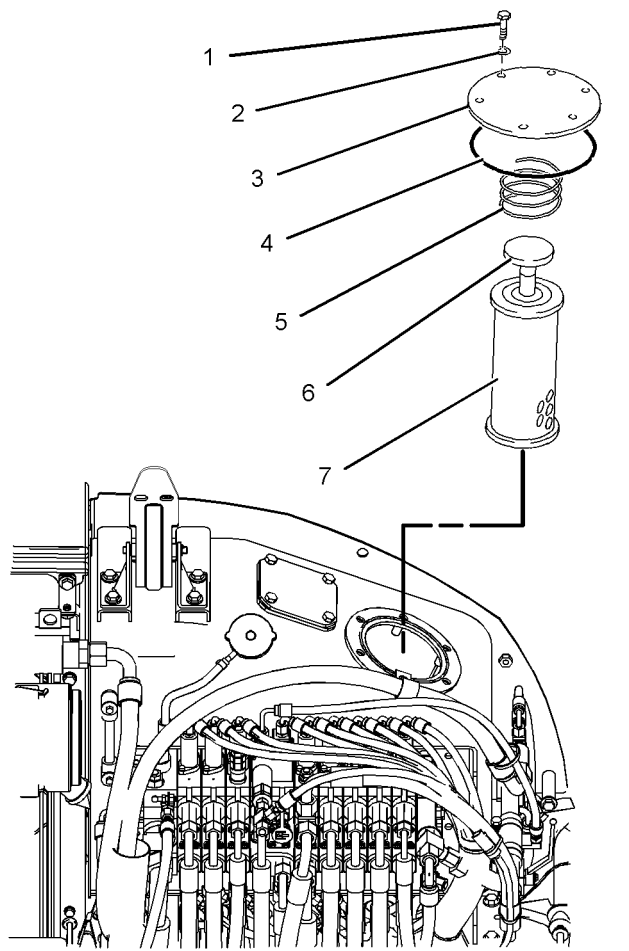


Illustration 239

g01189656

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information on Containing Fluid Spillage.

4. Remove bolt (1), washer (2), and right cover (3).
5. Remove spring (5), valve (6), and element (7) from the case.
6. Inspect O-ring (4). Replace the O-ring if the O-ring is worn or damaged.
7. Reverse steps 4 and 5 in order to install the new element.
8. Tighten the hydraulic oil filler cap.
9. Close the right side access cover.

Hydraulic System Oil Level - Check

SMCS Code: 5050-535

Note: Check the hydraulic system oil level with the machine on a level surface.

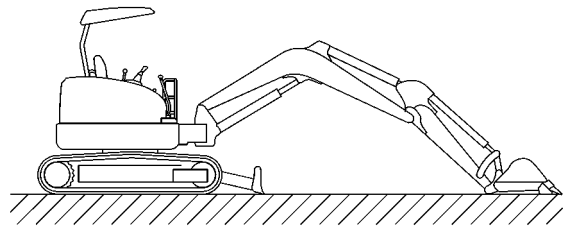


Illustration 240

g00825529

1. Extend the stick and the bucket fully. Lower the boom so that the bucket is rested on the ground. Lower the blade to the ground.

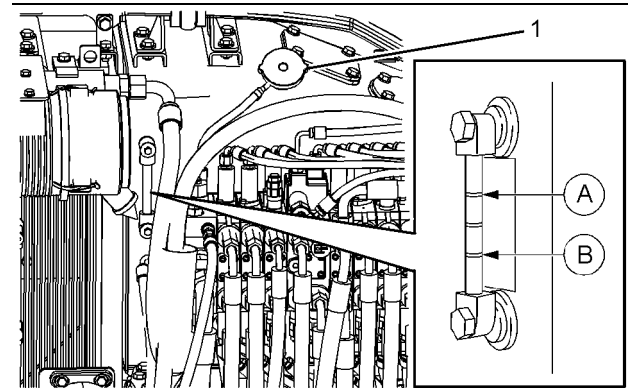


Illustration 241

g01189326

2. The sight gauge is located on the side of the hydraulic tank.
3. Maintain the hydraulic system oil level between top mark (A) and bottom mark (B) on the sight gauge.
4. If additional hydraulic oil is needed, the hydraulic oil filler cap is located on top of the hydraulic tank under the access door on the right side of the machine.

NOTICE

Never remove the hydraulic tank filler cap from the hydraulic tank if the oil is hot. Hot oil can cause burns.

Air can enter the system. Air in the system can cause pump damage.

5. Remove the hydraulic tank filler cap (1) slowly in order to relieve any pressure. Add hydraulic oil, if necessary.
6. Inspect the gasket on the hydraulic tank filler cap. If the gasket is damaged replace the hydraulic tank filler cap.
7. Install the hydraulic tank filler cap.

i03998619

Hydraulic System Oil Sample - Obtain

SMCS Code: 5050-008-OC; 5095-008; 5095-SM; 7542-008; 7542

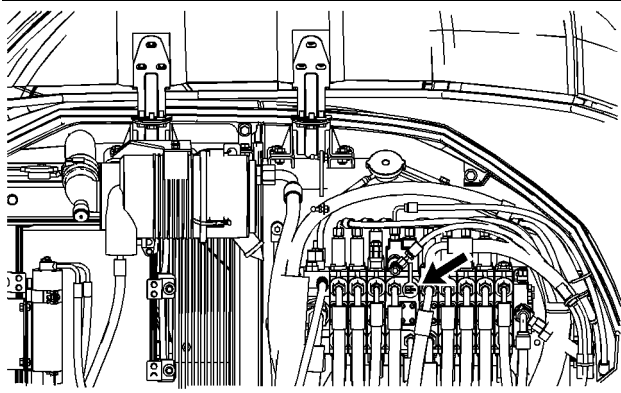


Illustration 242

g01189323

Park the machine on level ground. Lower the bucket to the ground with the stick in the vertical position.

Obtain a sample of the hydraulic oil through the sampling valve. The sampling valve for the hydraulic oil is located on the main control valve.

Refer to Special Publication, SEBU6250, "S-O-S Oil Analysis" for information that pertains to obtaining a sample of the hydraulic oil. Refer to Special Publication, PEGJ0047, "How To Take A Good Oil Sample" for more information about obtaining a sample of the hydraulic oil.

i02106227

Oil Filter - Inspect

SMCS Code: 1308-507; 5068-507

Inspect a Used Filter for Debris

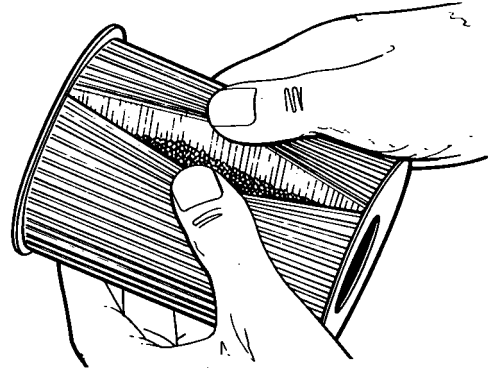


Illustration 243

g00100013

The element is shown with debris.

Use a filter cutter to cut the filter element open. Spread apart the pleats and inspect the element for metal and for other debris. An excessive amount of debris in the filter element can indicate a possible failure.

If metals are found in the filter element, a magnet can be used to differentiate between ferrous metals and nonferrous metals.

Ferrous metals can indicate wear on steel parts and on cast iron parts.

Nonferrous metals can indicate wear on the aluminum parts of the engine such as main bearings, rod bearings, or turbocharger bearings.

Small amounts of debris may be found in the filter element. This could be caused by friction and by normal wear. Consult your Caterpillar dealer in order to arrange for further analysis if an excessive amount of debris is found.

Using an oil filter element that is not recommended by Caterpillar can result in severe engine damage to engine bearings, to the crankshaft, and to other parts. This can result in larger particles in unfiltered oil. The particles could enter the lubricating system and the particles could cause damage.

i02973191

i03981729

Quick Coupler - Clean

SMCS Code: 6129-070

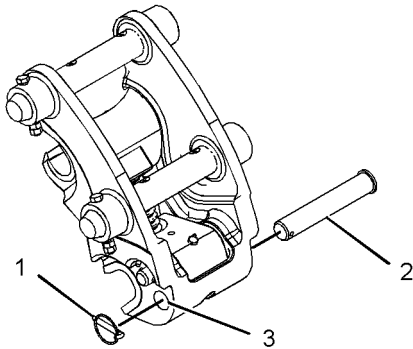


Illustration 244

g01155173

Typical example

1. Remove pin (1).
 2. Remove safety pin (2) from the quick coupler. The pin may be located on the right side or located on the rear of the quick coupler.
 3. Clean safety pin (2).
 4. Clean out bore (3) on either side of the coupler.
 5. Remove any trash or buildup from the quick coupler.
 6. Apply grease to safety pin (2).
- Refer to Special Publication, SEBU6250, "Caterpillar Machine Fluid Recommendations" for more information about the selection of grease.
7. Insert safety pin (2) into bore (3) on the right side.
 8. Insert pin (1) into safety pin (2) on the left side of the quick coupler.

Quick Coupler - Lubricate (Mechanical Pin Grabber Quick Coupler (If Equipped))

SMCS Code: 6129-086

1. Release the work tool from the quick coupler. Ensure that the work tool is in a stable and safe storage position on the ground. Refer to Operation and Maintenance Manual, "Quick Coupler Operation - Mechanical Pin Grabber Quick Coupler" for the proper procedure.

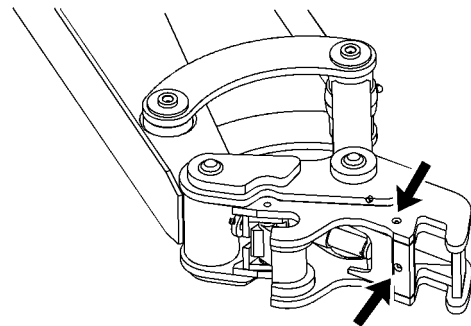


Illustration 245

g02165233

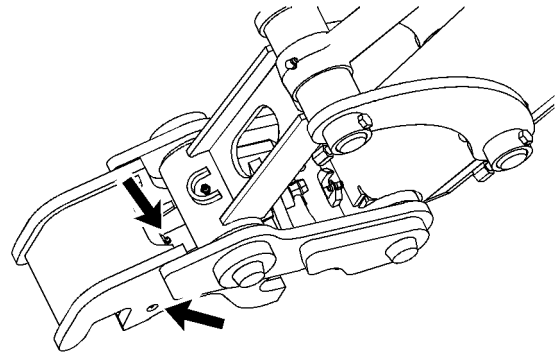


Illustration 246

g02165253

2. Wipe off the fittings before you lubricate the fitting.
3. Apply grease to the fittings of the quick coupler.
4. Check that all pin retainers are in place and that all bolts and nuts are tight.
5. Check the full operation of all the moving parts within the quick coupler. Repair or replace immediately if required.

6. Check that there is no material buildup around the rear locking mechanism, threaded actuator, or wedge plate. Check that there is no material buildup around the front locking mechanism.
7. Check the quick coupler for cracks, bent components, or wear.

i03972249

Quick Coupler - Lubricate (Hydraulic Pin Grabber Quick Coupler (If Equipped))

SMCS Code: 6129-086

1. Uncouple the work tool from the quick coupler. Ensure that the work tool is in a stable and safe storage position on the ground. Refer to Operation and Maintenance Manual, "Quick Coupler Operation - Hydraulic Pin Grabber Quick Coupler" for the proper procedure.

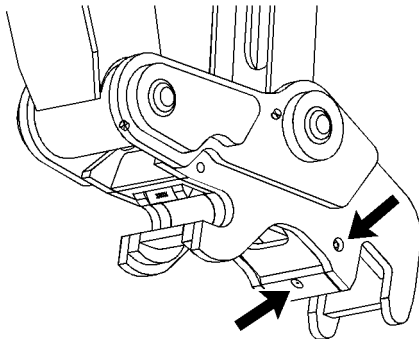


Illustration 247

g02162896

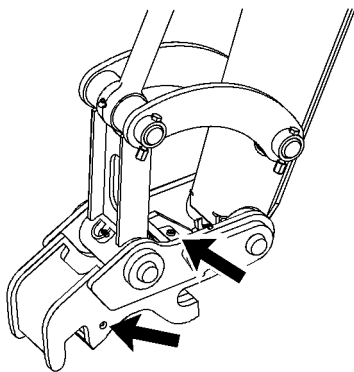


Illustration 248

g02162897

2. Wipe off the fittings before you lubricate the fitting.
3. Apply grease to the fittings of the quick coupler.

4. Check that all pin retainers are in place and that all bolts and nuts are tight, including the hydraulic cylinder mounting bolts.
5. Check the hydraulic hoses and fittings for any leaks, damage, or wear. Replace immediately if required.
6. Check the full operation of all the moving parts within the quick coupler. Repair or replace immediately if required.
7. Check that there is no material buildup around the rear locking mechanism, cylinder, or wedge plate. Check that there is no material buildup around the front locking mechanism.
8. Check the quick coupler for cracks, bent components, or wear.

i02973110

Quick Coupler - Lubricate (If Equipped)

SMCS Code: 6129-086

1. Lower all work tools to the ground.
2. Wipe off the fittings before you lubricate the fitting.

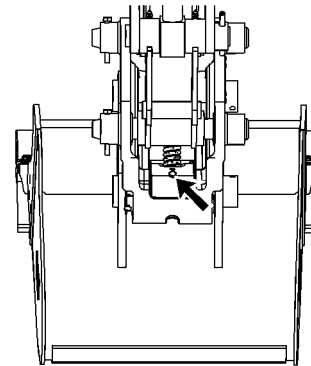


Illustration 249

g01167510

Typical example

3. Apply grease to the fittings of the quick coupler.

i02723802

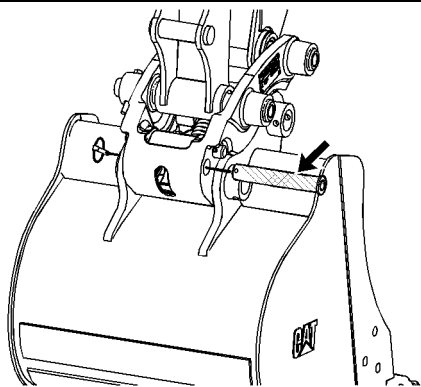


Illustration 250

g01167518

Typical example

4. Apply grease to the external surface of the pin in the lock assembly.

Note: The lock assembly may be located on the side of the coupler or located on the rear of the coupler.

5. Check the overall condition of the quick coupler. Look for the following conditions: loose bolts, worn parts, broken parts, missing parts, and damaged parts. Make any necessary repairs.

i02384754

Radiator Core - Clean

SMCS Code: 1353-070

1. Open the right side access cover.

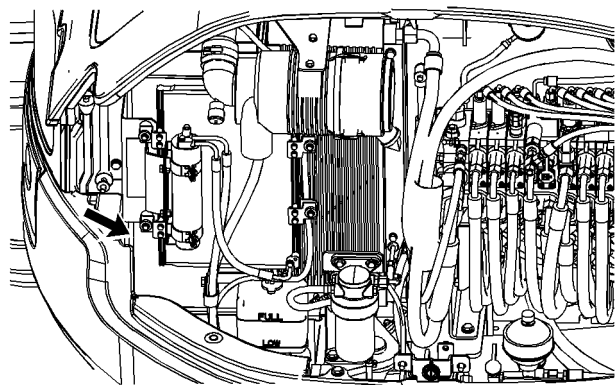


Illustration 251

g01189335

2. Inspect the radiator core for dust or debris.
3. You can use compressed air, high pressure water, or steam to remove dust and other debris from the radiator fins. However, the use of compressed air is preferred.
4. Close the right side access cover.

Receiver Dryer (Refrigerant) - Replace

SMCS Code: 7322-510; 7322-710

WARNING

Personal injury can result from contact with refrigerant.

Contact with refrigerant can cause frost bite. Keep face and hands away to help prevent injury.

Protective goggles must always be worn when refrigerant lines are opened, even if the gauges indicate the system is empty of refrigerant.

Always use precaution when a fitting is removed. Slowly loosen the fitting. If the system is still under pressure, release it slowly in a well ventilated area.

Personal injury or death can result from inhaling refrigerant through a lit cigarette.

Inhaling air conditioner refrigerant gas through a lit cigarette or other smoking method or inhaling fumes released from a flame contacting air conditioner refrigerant gas, can cause bodily harm or death.

Do not smoke when servicing air conditioners or wherever refrigerant gas may be present.

Use a certified recovery and recycling cart to properly remove the refrigerant from the air conditioning system.

NOTICE

If the refrigerant system has been open to the outside air (without being plugged) for more than 30 minutes, the receiver-dryer must be replaced. Moisture will enter an open refrigerant system and cause corrosion which will lead to component failure.

Refer to Service Manual, SENR5664, "Air Conditioning and Heating System with R-134a Refrigerant for All Caterpillar Machines" for the proper procedure to change the receiver-dryer assembly and for the procedure to reclaim the refrigerant gas.

i02429589

i02429594

Seat Belt - Inspect

SMCS Code: 7327-040

Always check the condition of the seat belt and the condition of the seat belt mounting hardware before you operate the machine. Replace any parts that are damaged or worn before you operate the machine.

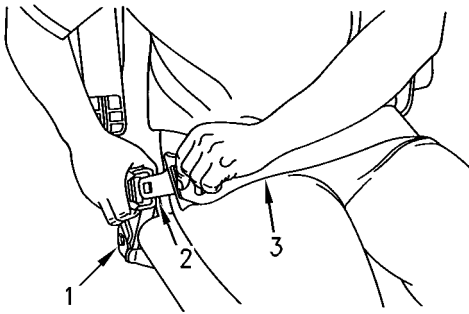


Illustration 252

g00932801

Typical example

Check the seat belt mounting hardware (1) for wear or for damage. Replace any mounting hardware that is worn or damaged. Make sure that the mounting bolts are tight.

Check buckle (2) for wear or for damage. If the buckle is worn or damaged, replace the seat belt.

Inspect the seat belt (3) for webbing that is worn or frayed. Replace the seat belt if the seat belt is worn or frayed.

Consult your Caterpillar dealer for the replacement of the seat belt and the mounting hardware.

Note: Within three years of the date of installation or within five years of the date of manufacture, replace the seat belt. Replace the seat belt at the date which occurs first. A date label for determining the age of the seat belt is attached to the seat belt, the seat belt buckle, and the seat belt retractor.

If your machine is equipped with a seat belt extension, also perform this inspection procedure for the seat belt extension.

Seat Belt - Replace

SMCS Code: 7327-510

Within three years of the date of installation or within five years of the date of manufacture, replace the seat belt. Replace the seat belt at the date which occurs first. A date label for determining the age of the seat belt is attached to the seat belt, the seat belt buckle, and the seat belt retractor.

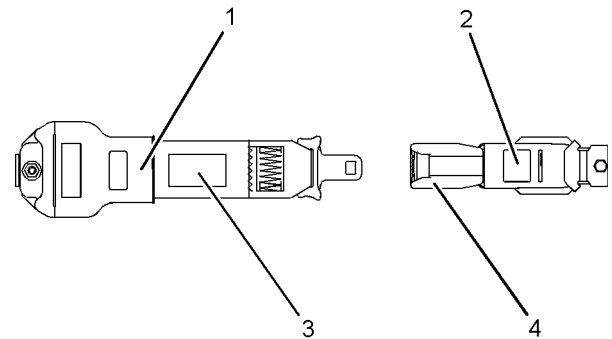


Illustration 253

g01152685

- (1) Date of installation (retractor)
- (2) Date of installation (buckle)
- (3) Date of manufacture (tag) (fully extended web)
- (4) Date of manufacture (underside) (buckle)

Consult your Caterpillar dealer for the replacement of the seat belt and the mounting hardware.

If your machine is equipped with a seat belt extension, also perform this replacement procedure for the seat belt extension.

i03997195

Swing Frame Pin - Lubricate

SMCS Code: 6506-086; 6507-086

1. Lower all work tools to the ground.
2. Wipe all grease fittings before you lubricate the grease fittings.

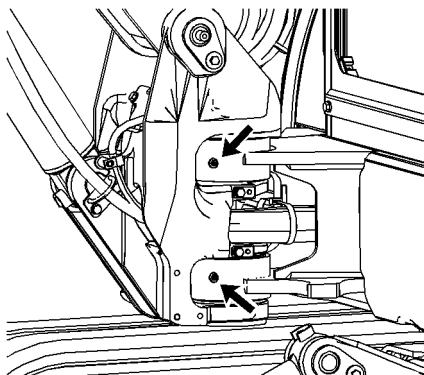


Illustration 254

g01190032

3. Apply lubricant to the grease fittings for the swing frame.

i03972129

Swing Gear and Bearing - Lubricate

SMCS Code: 7063-086

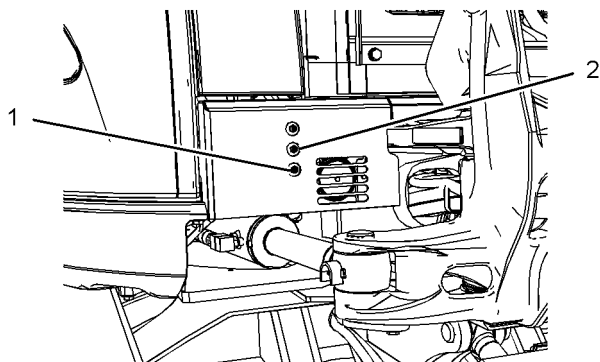


Illustration 255

g02162837

303.5D CR and 304D CR

- (1) Swing bearing
(2) Swing gear

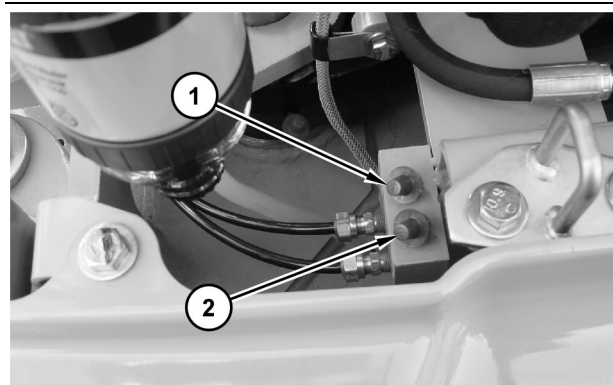


Illustration 256

g01249948

305D CR and 305.5D CR

- (1) Swing bearing
(2) Swing gear

The grease fittings for the swing gear and for the swing bearing are located on the right side of the machine.

1. Lower all work tools to the ground.
2. Open the right side access door.
3. Wipe all grease fittings before you lubricate the grease fittings.
4. Apply lubricant through fitting (1) until the old lubricant is pushed out from the seal surface.
5. Apply lubricant through fitting (2).
6. Rotate the upper structure for 90°.
7. Repeat Step 5 and Step 6 until the upper structure has rotated 360°.
8. Close the right side access door.

i03968551

Track Adjustment - Adjust

SMCS Code: 4170-025

WARNING

Personal injury or death can result from grease under pressure.

Grease coming out of the relief valve under pressure can penetrate the body causing injury or death.

Do not watch the relief valve to see if grease is escaping. Watch the track or track adjustment cylinder to see if the track is being loosened.

Loosen the relief valve one turn only.

If track does not loosen, close the relief valve and contact your Caterpillar dealer.

Tightening the Tracks

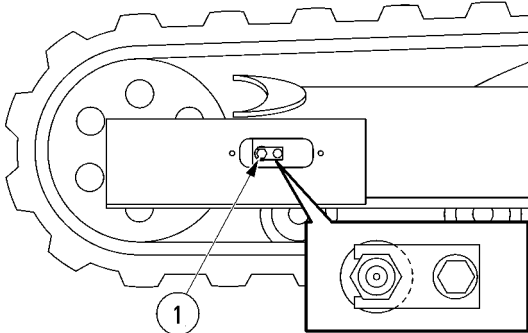


Illustration 257

g00825994

1. Wipe fitting (1) before you add grease.
2. Add grease through fitting (1) until the correct tension is reached.
3. Operate the track back and forth in order to equalize the pressure.
4. Check the amount of sag. Adjust the track, as needed.
5. Repeat the same procedure for the other track.

Loosening the Track

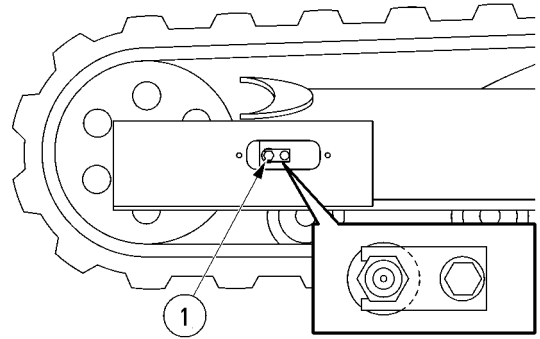


Illustration 258

g00825994

1. Loosen fitting (1) carefully until the track begins to loosen. One turn should be the maximum.
2. Tighten fitting (1) to 34 N·m (25 lb ft) when the desired track tension is reached.
3. Operate the track back and forth in order to equalize pressure.
4. Check the amount of sag in the track. Adjust the track, as needed.
5. Repeat the same procedure for the other track.

i02385623

Track Adjustment - Inspect

SMCS Code: 4170-040

Note: Keeping the track properly adjusted will increase the service life of the track components and the drive components.

Check the rubber tracks for the following conditions:

- Steel cords that are cut
- Core irons that are fractured
- Rubber flaking off to the point of showing steel cords or core irons
- Loss of traction or grousers are worn down to approximately 5 mm (0.2 inch) in height.

If any of the above conditions or a combination of the above conditions are observed, replace the belt.

Measuring Rubber Track Tension

1. Park the machine on a level surface.

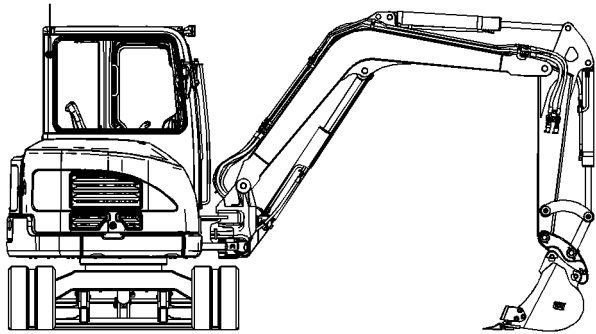


Illustration 259

g01190135

2. Position the upper frame over the tracks at a 90° angle.
3. Lower the bucket to the ground with the stick in a vertical position.
4. Chock the track that is not being lifted off the ground.
5. Apply boom down pressure until the track that is on the same side as the bucket has cleared the ground.
6. Chock the lower frame of the machine in this position.
7. Clean the track rollers and the area around the skid plate.

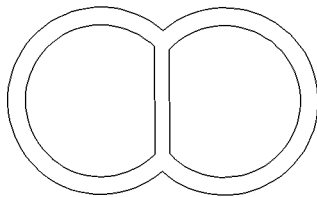


Illustration 260

g00484245

8. For a machine that is equipped with the rubber tracks, locate the "omega" mark on the inside flat of the track.
9. Locate the "omega" mark under the center track roller.

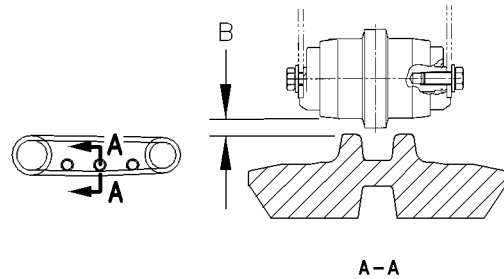


Illustration 261

g00522663

The distance (B) should be 10 to 15 mm (0.4 to 0.6 inch).

10. Measure the sag in the track. The sag is measured from the bottom of the roller to the surface on the top of the track. A properly adjusted track will have 10 to 15 mm (0.4 to 0.6 inch) of sag.

Measuring Steel Track Tension

Note: The track tension must be set according to the current operating conditions. Keep the track as slack as possible if the soil is heavy.

Follow the same procedures for measuring rubber track tension. There is not an "omega" mark on the steel tracks. You do not need to align the steel tracks. The proper amount of sag for steel tracks is 25 to 35 mm (1.0 to 1.4 inch).

If the correct adjustment cannot be achieved consult your Caterpillar dealer.

i02378200

Travel Alarm - Test (If Equipped)

SMCS Code: 7429-081

The travel alarm will sound when the machine is moved forward or backward. You must move the machine in order to test the travel alarm.

1. Start the engine. Move the hydraulic lockout control to the LOWERED position.
2. Raise the work tool. Make sure that there is adequate overhead clearance.

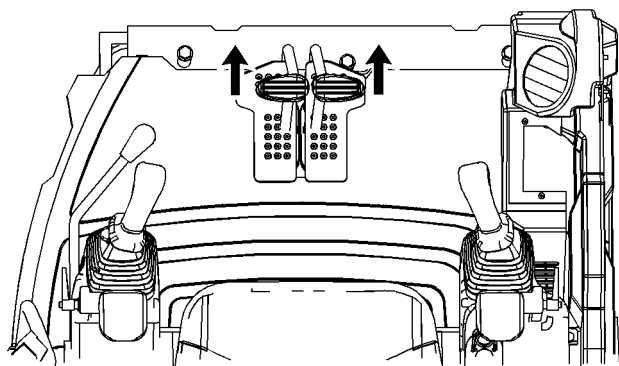


Illustration 262

g01187193

3. Use the travel levers to move the machine forward. The travel alarm should sound.
4. Release the travel levers in order to stop the machine.
5. Use the travel levers to move the machine backward. The travel alarm should sound.
6. Release the travel levers in order to stop the machine. Lower the work tool to the ground. Deactivate the hydraulic controls by placing the hydraulic lockout control in the RAISED position. Stop the engine.

i01722112

Undercarriage - Check

SMCS Code: 4150-535

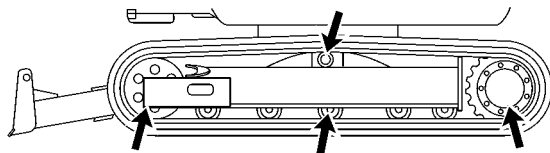


Illustration 263

g00885424

1. Check the carrier rollers, the track rollers, and the idler wheels for possible leakage.
2. Check the surface of the track, the carrier rollers, the track rollers, the idler wheels, the track shoes, and the drive sprockets. Look for signs of wear and loose mounting bolts.

3. Listen for any abnormal noises while you are moving slowly in an open area.
4. If abnormal wear exists or abnormal noises or leaks are found, consult your Caterpillar dealer.

i01021011

Window Washer Reservoir - Fill

SMCS Code: 7306-544-KE

NOTICE

When operating in freezing temperatures, use Caterpillar or any commercially available nonfreezing window washer solvent.

The washer fluid bottle is located in the engine compartment.

1. Open the engine access door.
2. Remove the filler cap.
3. Fill the washer fluid bottle with washer fluid through the filler opening.
4. Replace the filler cap.
5. Close the engine access door.

i01223970

Window Wiper - Inspect/Replace

SMCS Code: 7305-040; 7305-510

Inspect the wiper blade on the front window. Replace the wiper blade if the wiper blade is worn or damaged. Replace the wiper blade if the front window is streaked after use.

i01592019

Windows - Clean

SMCS Code: 7310-070; 7340-070

Use commercially available window cleaning solutions in order to clean the windows.

Note: When you are cleaning the window above the front window, you should use a soft cloth that is not abrasive. This window can be easily scratched.

 WARNING

Wash polycarbonate windows with a mild soap and water. Never use a cleaning solvent on polycarbonate windows.

Cleaning Methods

Aircraft Windshield Cleaner

Apply the cleaner with a soft cloth. Rub the window with moderate pressure until all the dirt is removed. Allow the cleaner to dry. Wipe off the cleaner with a clean soft cloth.

Soap and Water

Use a clean sponge or a soft cloth. Wash the windows with a mild soap or with a mild detergent. Also use plenty of lukewarm water. Rinse the windows thoroughly. Dry the windows with a moist chamois or with a moist cellulose sponge.

Stubborn Dirt and Grease

Wash the windows with a good grade of naphtha, or isopropyl alcohol, or of Butyl Cellosolve. Then, wash the windows with soap and with water.