

SECTION 7 ENGINE

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ENGINE MAINTENANCE 7.1

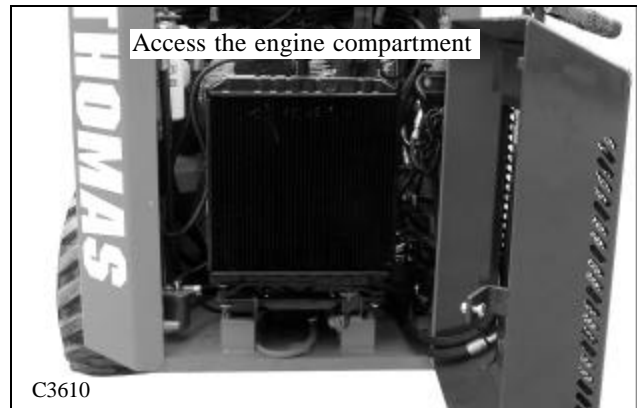
Lubrication System

Engine Oil and Filter:

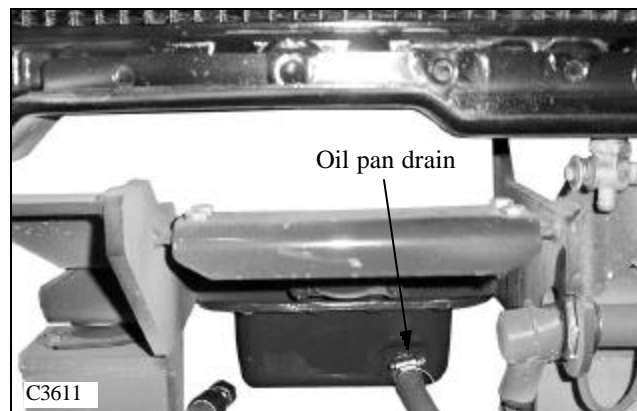
Engine oil and filter changes should be made with the engine warm. Change the engine oil every 75 hours and the oil filter every 150 hours of operation.

Park the loader on a level surface, lower the boom arms, engage the parking brake and shut off the engine.

1 Access the engine compartment by opening the rear door and lifting the engine cover. (fig. C3610)

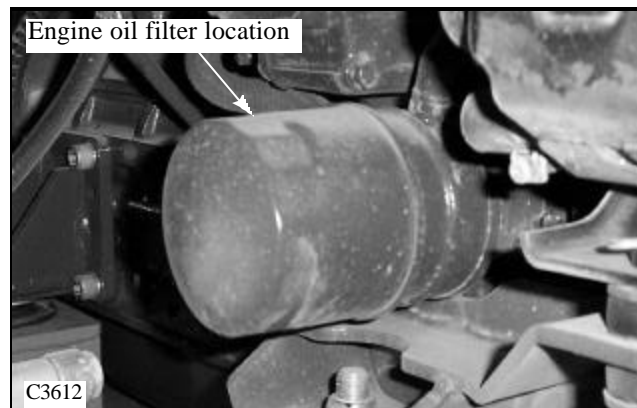


2 Remove the oil pan drain plug located at the bottom of the engine oil pan to drain the oil. Have a catch container ready to contain approximately 8 liters (8.5 qts) of fluid. (fig. C3611)



3 Remove the oil filter using an appropriate filter wrench. If the oil filter area is excessively dirty, clean around the filter area before removing the oil filter to prevent contaminant's reaching the engine lubricating system. (fig. C3612)

4 Check the oil filter mounting adapter area after removing the oil filter and check for dirt on the sealing surface and to make sure the oil filter O-ring seal has not stuck to the oil filter adapter.



5 Lubricate the new oil filter O-ring seal with engine oil and install to the engine hand tightened.

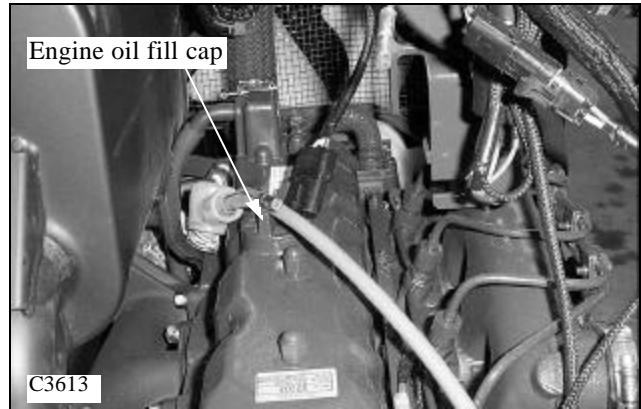
6 Replace the oil pan drain plug. Make sure the seal is still in place and in good condition. Tighten the oil pan drain plug not exceeding 25 ft/lbs (34 Nm.)

7

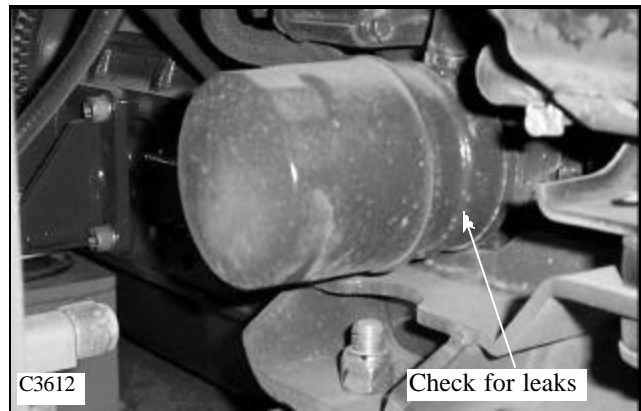
ENGINE MAINTENANCE 7.1

Lubrication System (cont'd)

7 Remove the oil fill cap located in the engine rocker arm cover. (fig. C3613) Add 7.5 liters (8qts) of 10W30 API classification SE / CD engine oil. Replace the fill cap in the rocker arm cover.



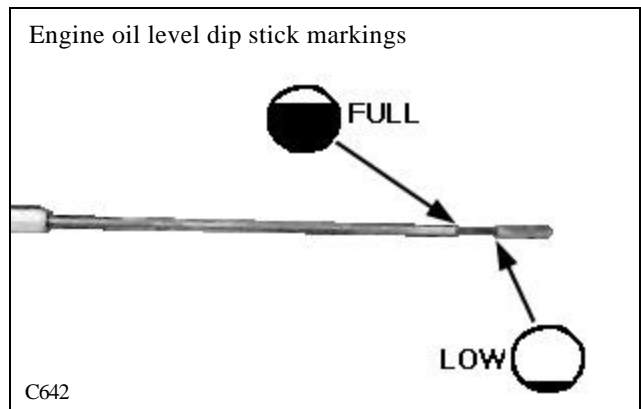
8 Start the engine and check for leaks around the oil filter and oil pan drain plug. (fig. C3612) Allow the engine to operate for approximately 5 minutes and then shut it off.



9 Check the level of the engine oil. (fig. C3614) Add oil as required to bring the oil to the top mark of the engine oil dip stick. (fig. C642) Do not over fill.



Change the engine oil every 75 hours and the engine oil filter every 150 hours.



ENGINE MAINTENANCE 7.1

Fuel System

Fuel Filter:

The fuel filter is a spin on type on the inner side of the oil tank attached to a bracket and is located in the engine compartment on the engine mounting bracket. Change the fuel filter every 400 operating hours.

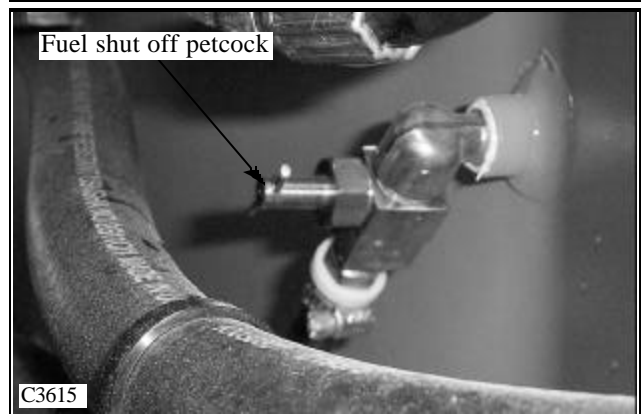
Loader S / N's LE008500 ~ 8799 have the filter mounted to the left hand side of the engine. S / N's LE008800 onward are mounted to the right hand side of the engine.

To change the fuel filter: Park the loader on a level surface, lower the boom arms, engage the parking brake and shut off the engine.

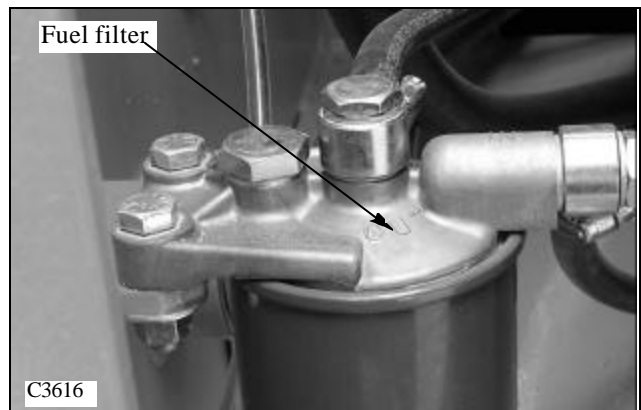
- 1 Access the engine compartment by opening the rear door and lifting the engine cover. (fig. C3610)
- 2 Close the fuel line shut off petcock located on the lower right hand side of the fuel tank. (fig. C3615) This will prevent fuel loss due to siphoning.
- 3 Remove the fuel filter using a filter wrench. (fig. C3616) Check to make sure the fuel filter O-ring seal has not stuck to the filter adapter mount.
- 4 Lubricate the new fuel filter O-ring seal with light oil. Tighten the filter to the adapter mount hand tight.
- 5 Open the fuel line shut off petcock.



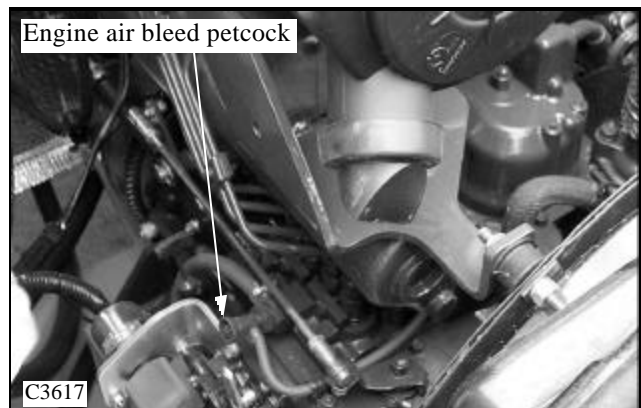
C3610



C3615




C3616



C3617

- 6 Open the engine fuel line / air bleed petcock located just to the left of the fuel injection pump. (fig. C3617) Start the engine and allow to idle for 5 minutes. Close the fuel line / air bleed petcock.

If the engine fails to continue operating, it may be necessary to bleed the fuel system of air after changing the fuel filter or running out of fuel. See Bleeding the Fuel System, next page.

 **WARNING**

When servicing the fuel system, stay away from open flame and sparks. No smoking

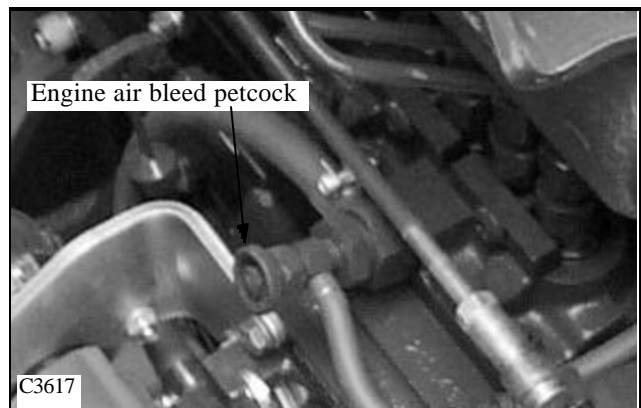
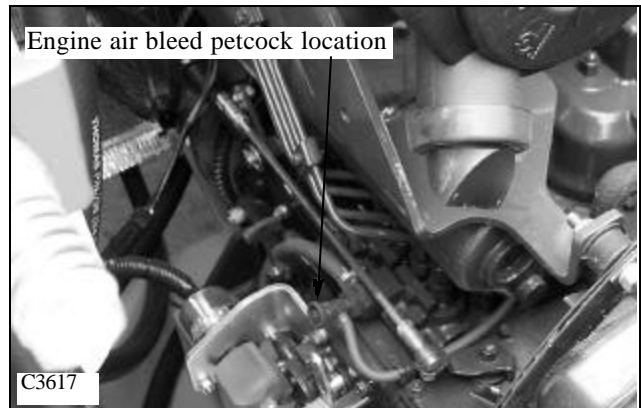
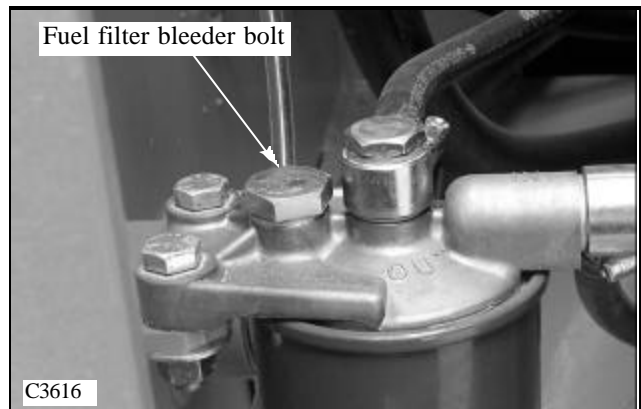
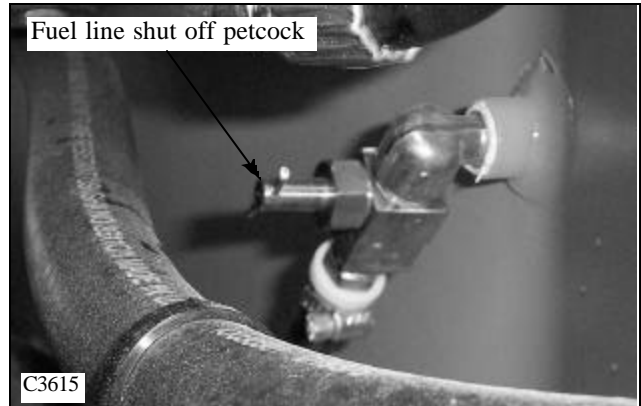
ENGINE MAINTENANCE 7.1

Fuel System (cont'd)

Bleeding the Fuel System:

If the loader has been run dry of fuel, or the fuel filter has been changed, it may be necessary to bleed the air from the fuel lines.

- 1 Replenish the fuel reservoir (tank) with a minimum of 10 gallons (45 £) of fuel.
- 2 Make sure the fuel line shut off petcock is fully open. (fig. C3615)
- 3 Loosen the fuel filter bleeder bolt and allow the fuel to siphon through the fuel line and filter. (fig. C3616) Tighten the fuel filter bleeder bolt.
- 4 Loosen the air bleed petcock located to the left of the fuel injection pump. (fig. C3617)
- 5 Turn the engine over with the starter until the engine starts to smoke. Do not engage the starter for more than 15 second intervals. Allow the starter to cool between starting attempts for 1 (one) minute.
- 6 Pre-heat and start engine. Allow to operate at idle speed for 5 minutes. Shut off the engine.
- 7 Close the air bleed petcock.



ENGINE MAINTENANCE 7.1

Air Filter

The loader is equipped with dual dry cartridge, radial seal type filter elements. The larger outside element is called a primary and the one inside of the primary is referred to as a safety element. (fig. C653)

The loader is equipped with an air restriction indicator that functions while the engine is operating. When the air filter elements require servicing the indicator light on the dash panel will illuminate.

Over servicing the air filters can damage the seals and pleated filter material. When the air restriction indicator light illuminates in the dash panel, replace the primary air filter element with a new one. On average, the safety air filter element will be replaced once for every three (3) primary air filter element changes, if the primary filter hasn't been damaged due to over servicing.

To service the air filters, park the loader on a level surface, lower the boom arms, engage the parking brake and shut off the engine.

Daily Checks

Checking the Restriction Sensor:

1 The air filter restriction sender wires should be visually checked daily for breaks and proper connection. (fig. C3618)

2 With the engine operating, place your hand over the air intake inlet to restrict air flow to the engine. The indicator light on the dash panel should illuminate promptly. Do not hold your hand over the air intake excessively, just long enough for the indicator light to illuminate then quickly release your hand from the intake.

NOTE: If the indicator light fails to function replace the restriction sender or check for shorts in the wiring circuit.

3 Air cleaner hoses and clamps should be inspected daily for proper tightness and verify air inlet hose integrity. Replace any worn or cracked inlet hoses immediately.

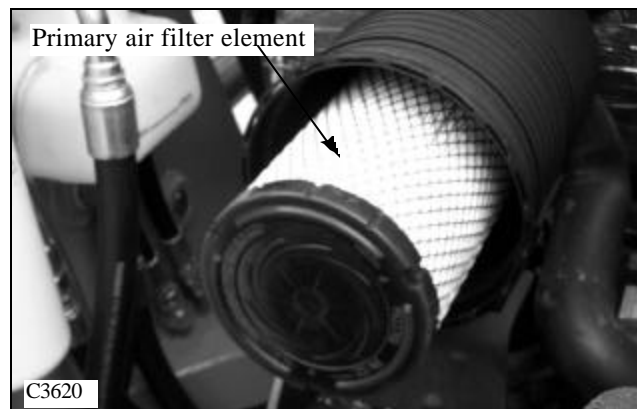
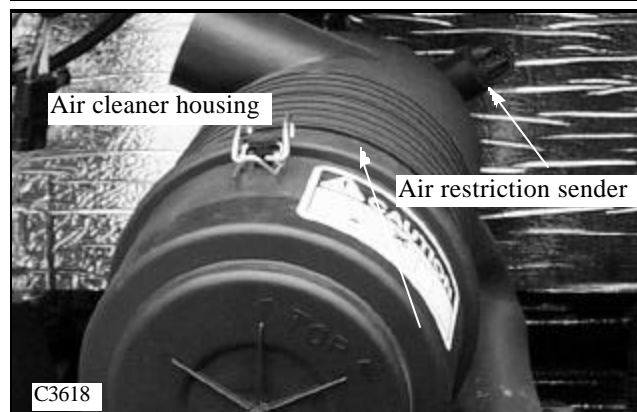
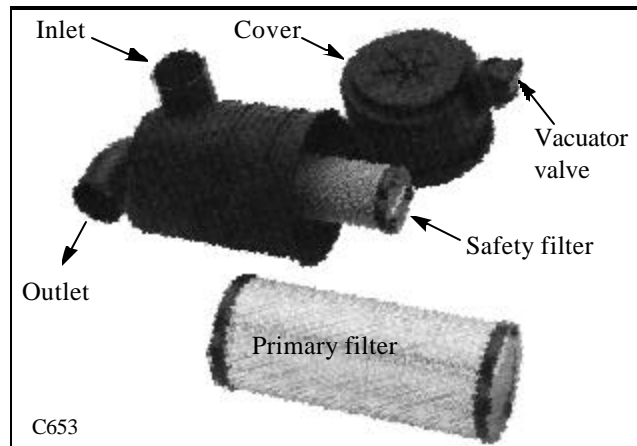
IMPORTANT

Air filter service recommended only when the service indicator light illuminates.

Servicing the Air Filter Elements:

1 Release the latches holding the air cleaner cover to the canister body. (fig. C3619)

2 Pull straight out on the primary element to remove from the air cleaner housing. (fig. C3620) Do not twist or force the filter. This may damage the sealing area around the end of the air filter element.



ENGINE MAINTENANCE 7.1

Air Filter (cont'd)

3 If required, remove the safety air filter element by pulling straight out of the air cleaner housing. (fig. C3621)

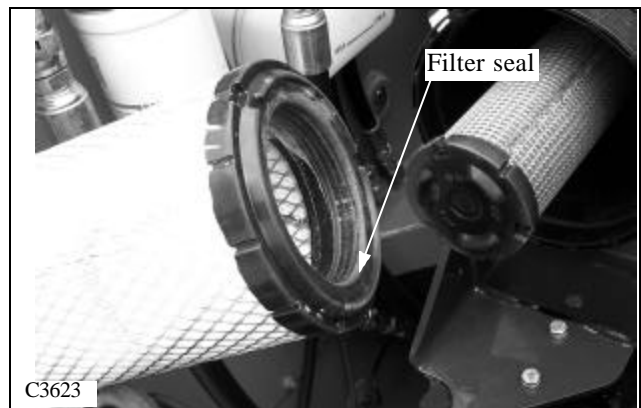
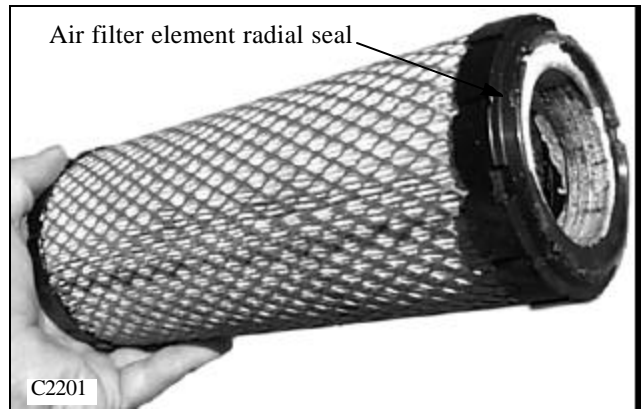
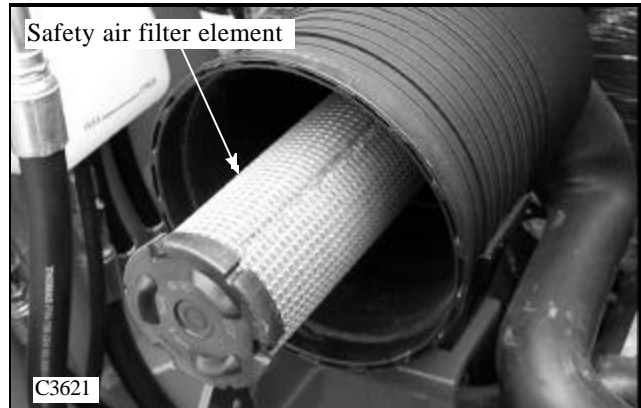
4 After removing the air filter elements, carefully wipe out any excess dirt from the air cleaner housing. (fig. C3622)

5 Check the air filter element seal before installing to the air cleaner housing. (fig. C2201) Be sure the seal is not damaged, torn or gouged. Do not use a filter with a damaged seal.

6 When installing the air filter elements to the air cleaner housing, support the back of housing with one hand and push the air filter element into position as gently as possible. (fig. C3623)

7 Install the air cleaner cover onto the housing. Be sure to align the latch hooks with the notches in the air cleaner housing.

Do not use the latches to push the air filter elements into position.



ENGINE MAINTENANCE 7.1

Cooling System

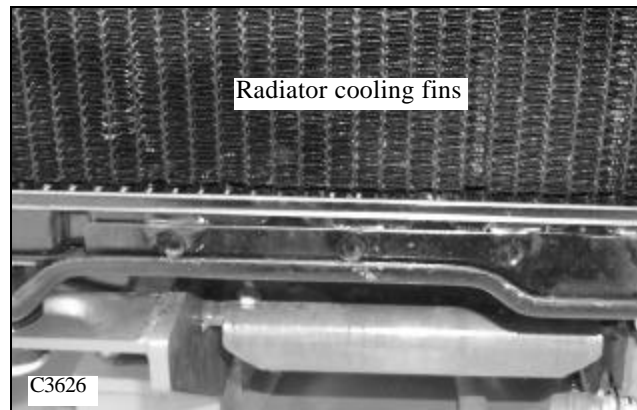
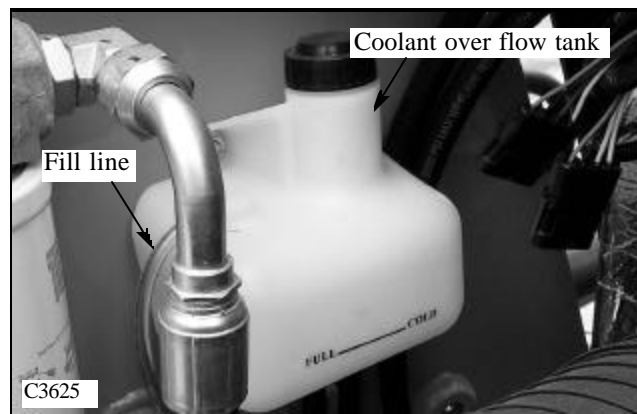
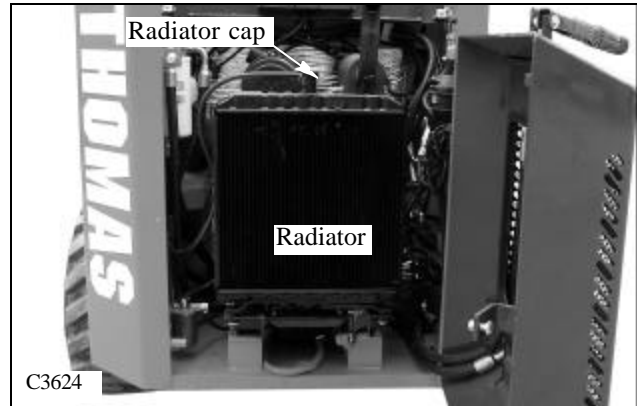
Daily Checks:

The loader is equipped with a liquid cooled diesel engine that requires daily coolant level checks and radiator service if necessary.

The cooling system should always be checked when the engine is cool.

Park the loader on a level surface, lower the boom arms, engage the parking brake and shut off the engine.

- 1 Access the engine compartment by opening the rear door and lifting the engine compartment cover.
- 2 Visually inspect the radiator cooling fins for dirt or debris build up that may be blocking air flow through the radiator. (fig. C3626) Blow any dirt or debris out with compressed air and / or water. Do not exceed 40 psi (2.7 Kg / cm²) Any bent cooling fins should be carefully straightened to prevent core damage.
- 3 Visually inspect the coolant overflow tank for the proper coolant level marked on the tank. (fig. C3625)



WARNING
To prevent eye injury, wear safety goggles when cleaning with compressed air

CAUTION
To prevent radiator fin damage, do not use air pressure higher than 40 psi (2.7 kg / cm²)

WARNING
Do not remove the radiator cap when the engine is hot.

7

Add a 50 / 50 mixture of ethylene glycol and water as required.

- 4 Remove the radiator cap to verify the coolant level in the radiator. If the coolant level is below the upper part of the radiator tank, and the coolant bottle is still full, then either the radiator cap is defective or there is a coolant leak in the cooling system. Perform a pressure test of the cooling system.

Testing the Cooling System:

- 1 Ensure the radiator is full of coolant.
- 2 Start the engine operate until warm, **NOT HOT!**
- 3 Shut off the engine and carefully remove the radiator cap. Use extreme caution.

WARNING
Always use a pre - mixed or diluted coolant to prevent engine over heating, freezing and proper water pump lubrication

ENGINE MAINTENANCE 7.1

Cooling System (cont'd)

4 Attach a radiator tester and increase the pressure to 0.9 kg / cm² (12.8 psi). (fig. C172) Inspect the radiator, hoses and engine block for external leaks. Repair as required.

5 Attach a radiator tester to the radiator cap. (fig. C173) Apply 0.9 kg / cm² (12.8 psi) pressure to the radiator cap. The pressure should not drop more than 0.3 kg / cm² (4.3 psi) in 10 seconds. Replace the radiator cap if required.

If no external leaks are found, and the radiator cap tests good, there may be an internal problem with the engine such as a gasket, cylinder head or block defect. Consult a Kubota Repair Manual P / N 40916 (Kubota P / N 97897-0109-5) to assist in engine disassembly and inspection.



WARNING

Do not remove the radiator cap when the engine is hot.

Coolant Replacement:

The engine coolant should be changed every 1000 hours of operation. To change the coolant:

Park the loader on a level surface, lower the boom arms, engage the parking brake and shut off the engine.

1 Make sure the engine is not hot to touch. Remove the radiator cap.

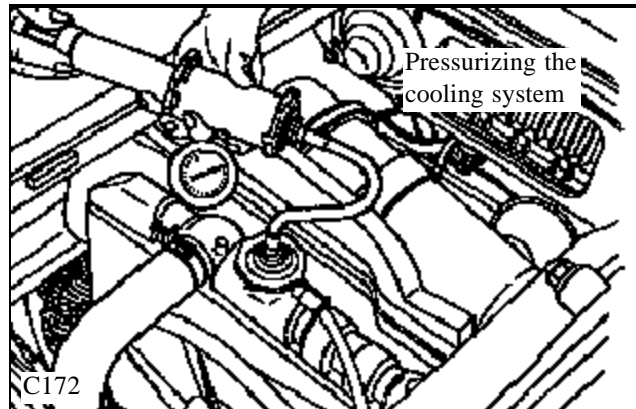
2 Remove the radiator drain plug located lower left corner of radiator. (fig. C3626) Be prepared to contain 7 liters (1.8 gal) of fluid.

3 Open the engine drain petcock located next to the engine fuel pump, just below the engine solenoid shut off. Close the drain petcock after the engine is completely drained.

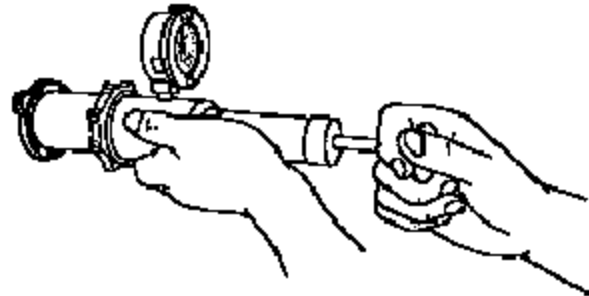
Note: Attaching a piece of 5 / 16" (8mm) hose to the drain petcock and routing to a container lessens waste fluid clean up. Please dispose of waste fluid in an environmentally friendly manner.

4 Replace the radiator drain plug using teflon tape or equivalent on the threads. Be sure to tighten the drain plug so it does not protrude past the radiator's lower mount. This will prevent interference with the hydraulic oil cooler.

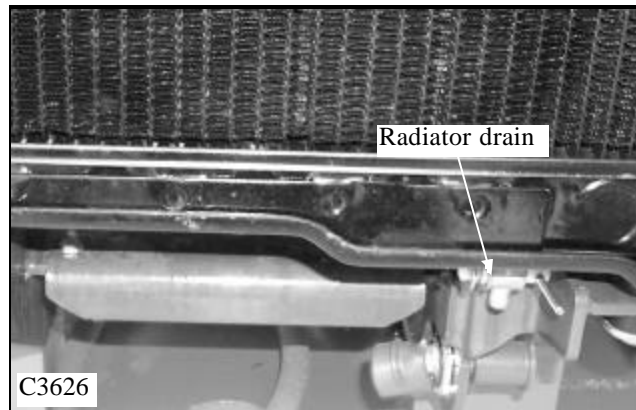
5 Pre - mix the engine coolant, ethylene glycol, to equal parts of water. (50 / 50 ratio) Add the mixed coolant to the engine radiator. The cooling system will hold approximately 7 liters (1.8 gal) of coolant. Never use coolant undiluted. Pure coolant does not absorb and pass heat efficiently. It will also gel in cold weather.



Radiator cap test



C173



MAINTENANCE 7.7

Fan Belt Adjustment

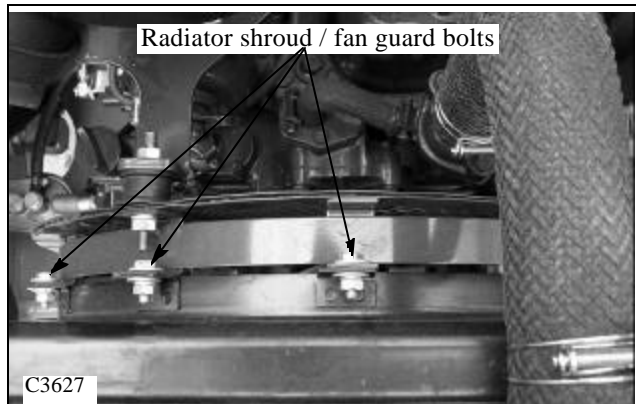
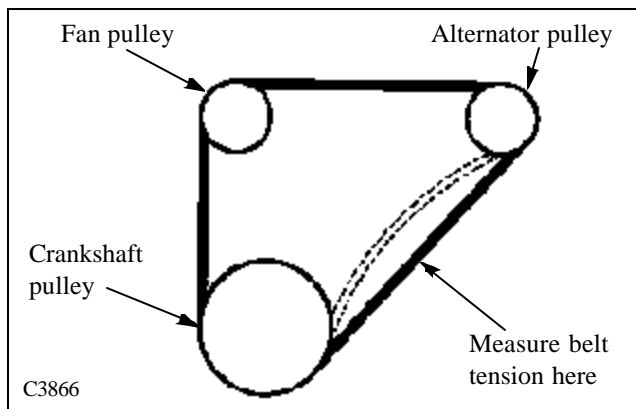
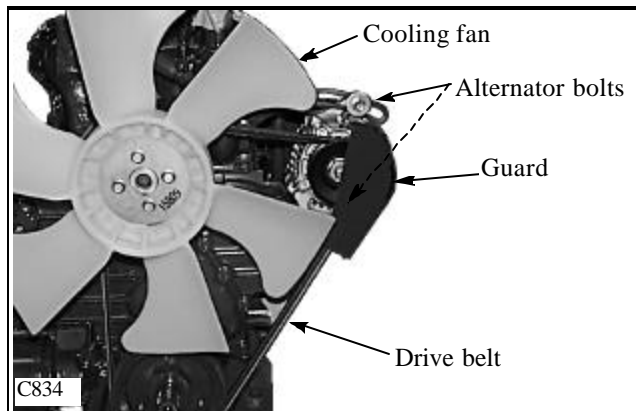
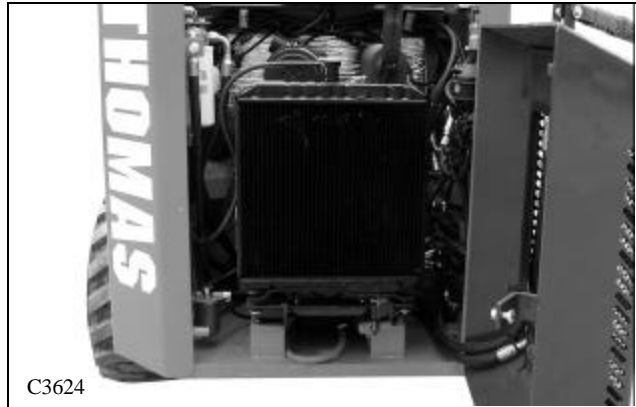
The fan (alternator) drive belt should be checked daily for tension and wear. The drive belt should be replaced promptly when fraying of the belt cords or cracks in the rubber are observed. Failure to replace the drive belt could lead to slippage or complete failure, causing the engine to over heat and lead to extensive repairs.

To Adjust the Fan Belt:

- 1 Park the loader on a level surface, lower the boom arms, engage the parking brake and shut off the engine.
- 2 Access the engine compartment by opening the rear door and lifting the engine cover. (fig. C3624)
- 3 Locate the drive belt. Fig. C834 shows the drive belt without the radiator obstructing the view.
- 4 Check the drive belt tension midway between the alternator and crankshaft drive pulley. (fig. C3866)
Correct tension is 10 ~ 12mm deflection @ 98 newtons force. (3 / 8 ~ 1 / 2" deflection @ 22 lbs force).

Fan Belt Replacement:

- 1 Loosen the 2 bolts on the alternator and allow the belt tension to loosen off. (fig. C834)
- 2 Remove the bolts retaining the fan guard to the radiator shroud. (fig.C3627)
- 3 Pull the drive belt off the alternator pulley, crankshaft pulley and remove from around the fan.
- 4 Replace in reverse order and adjust belt tension as described above.



ENGINE MAINTENANCE 7.1

Universal Joint

The engine drive universal is located and accessed by removing the operators seat, and removing the service access cover. The universal joint should be serviced every 50 hours. Check the universal joint for wear and lubricate with a standard grade of multi purpose grease.



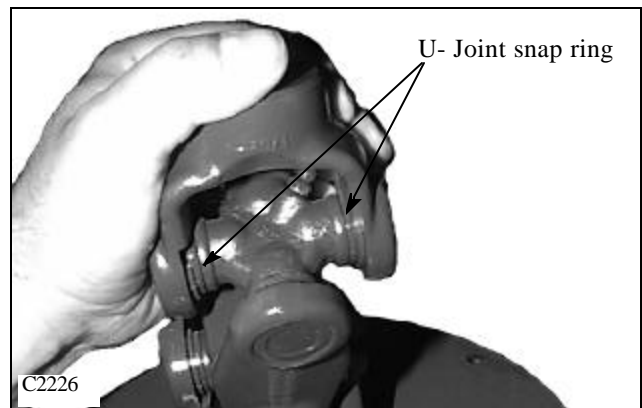
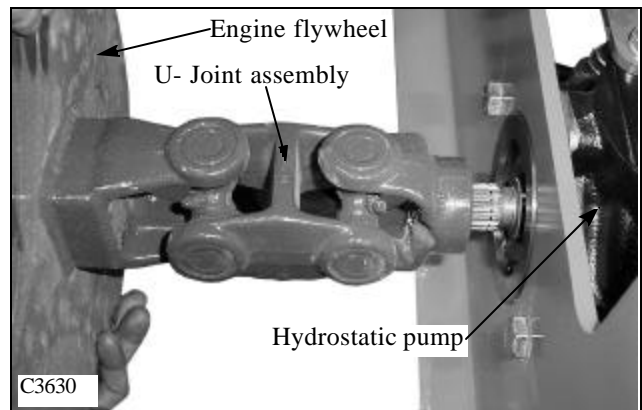
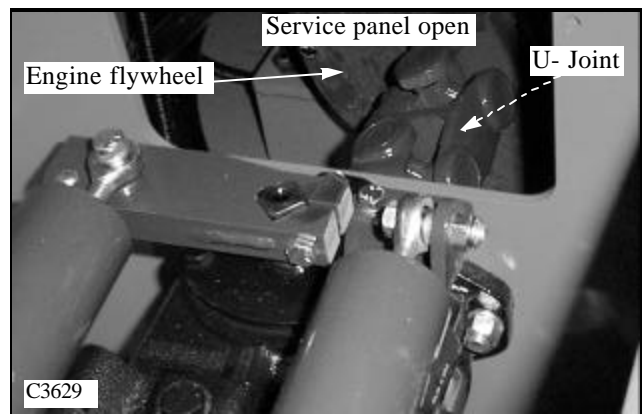
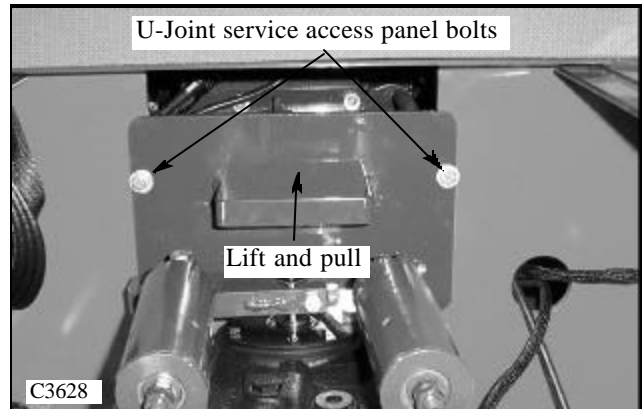
WARNING

Never work under the boom arms without the boom supports engaged

To Service the U- Joint:

- 1 Remove any attachment, raise the boom arms, engage the boom supports, engage the parking brake and shut off the engine. Remove the ignition key.
- 2 Remove the seat assembly. Be sure to disconnect the electrical plug on the seat switch, left hand side.
- 3 Remove the service access panel, located below the battery compartment cover, by removing the 2 bolts and lifting and pulling forward from the top. (fig. C3628)
- 4 Grasp the U- Joint assembly with your hands and rotate the joint left and right, forward and back to check U- Joint wear.
- 5 Check the condition of the splined yoke and spline on the hydrostatic pump input shaft.
- 4 Rotate the U- Joint if necessary to locate the grease fittings on the U- Joint crosses. Apply 2 ~ 3 pumps of multi purpose grease to each U- Joint cross.

NOTE: Remove the U- Joint assembly from the loader to replace worn U- Joints. (fig. C2226) The U- Joints are retained by internal snap ring clips. Loosen the engine mounting isolators to move the engine rearward enough to allow the engine U-joint to come off the hydraulic tandem pump splined shaft.



CYLINDER HEAD 7.2

Valve Adjustment

The engine used in this application uses a solid lifter (tappet) design that requires periodic maintenance of the rocker arm to valve clearance. (Valve lash)

Valve clearance should be checked every 500 hours of operation. Always check the valve clearance while the engine is cold. **Correct valve clearance is 0.18 ~ 0.22mm (0.0071 ~ 0.0087in).**

Procedure to Check / Adjust the Valve Clearance:

- 1 Park the loader on a level surface, lower the boom arms, engage the parking brake and shut off the engine. Remove the ignition key for safety.
- 2 Allow the engine to cool to room temperature.



WARNING

Do not adjust the valve clearance while the engine is hot. Clearances provided are for cold engine adjustment only.

3 Access the engine compartment by opening the rear door and lifting the engine compartment cover.

4 Remove the 4 nuts and washers retaining the valve cover to the engine cylinder head and remove the cover. (fig. C3613)

NOTE: The crankshaft pairs pistons # 1 and # 4, and pistons # 2 and # 3 to rise and fall at the same time. The camshaft valve timing though, has the cylinder pairs on different cycles of operation.

Example: If both pistons on # 1 and # 4 were at top dead center (TDC), one of the cylinders would be on the compression stroke (both valves closed) the other cylinder would be starting the intake stroke. (Intake valve starting to open).

5 Turn the engine over until the intake valve is just starting to open on number 1 (one) cylinder. (Cylinder closest to radiator) This valve action means that cylinder number 4 (next to flywheel) is on the compression stroke, with both valves closed. This is the proper point to check and / or adjust the intake and exhaust valves on cylinder number 4.

6 Insert a feeler gauge between the rocker arm and the intake or exhaust valve on cylinder number 4. (fig. C551) If necessary, loosen the jam nut on top of the rocker arm and turn the adjustment screw to acquire correct valve clearance. **Correct valve clearance is 0.18 ~ 0.22mm (0.0071 ~ 0.0087in).**

7 Rotate the engine after checking / setting cylinder number 4 valves, until cylinder number 4 intake valve start to open. This position means that cylinder number 1 (one) is on the compression stroke and can have the intake and exhaust valves checked and / or adjusted.

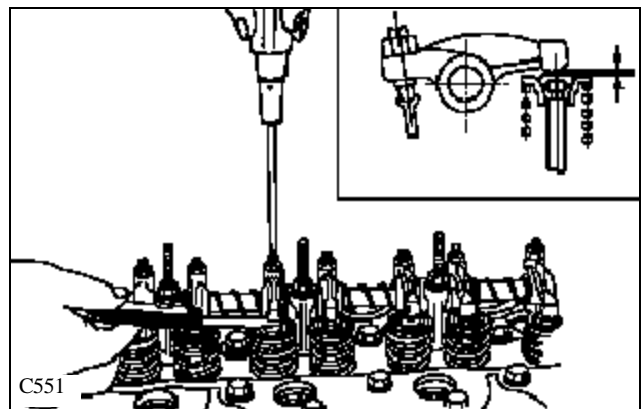
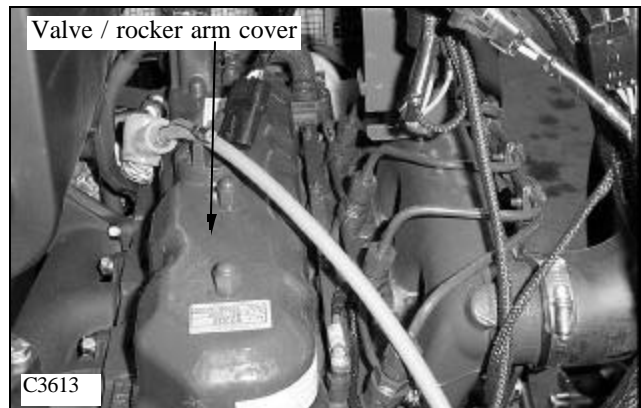
Correct valve clearance is 0.18 ~ 0.22mm (0.0071 ~ 0.0087in).

8 Repeat the procedure for cylinder pairs 2 and 3. As one of the cylinders intake valves are just starting to open the opposite cylinder is on the compression stroke and can have it's valves adjusted.

Correct valve clearance is 0.18 ~ 0.22mm (0.0071 ~ 0.0087in).

9 Rotate the engine 2 ~ 3 complete revolutions and recheck the valve clearances by repeating the procedure above.

10 Replace the valve cover. Tighten the mounting nuts to 6.9 ~ 8.8 Nm (5.1 ~ 6.6 ft / lbs).



7

CYLINDER HEAD 7.2

Compression Testing

Testing the engine for compression is not a normal part of a scheduled maintenance procedure, but is important when trying to diagnose engine power or unusual performance related problems with the engine.

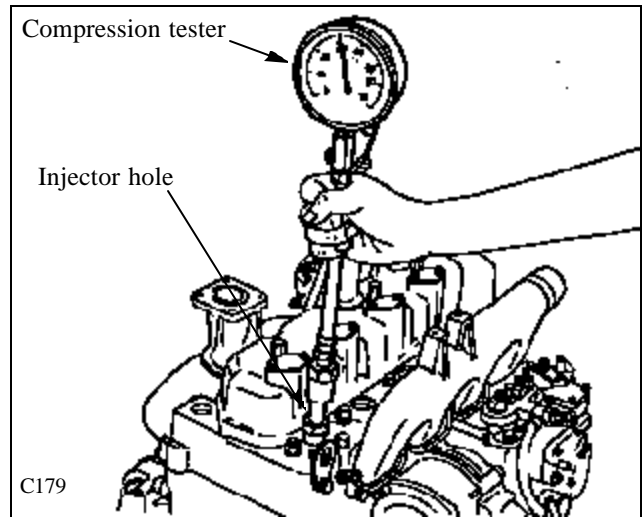
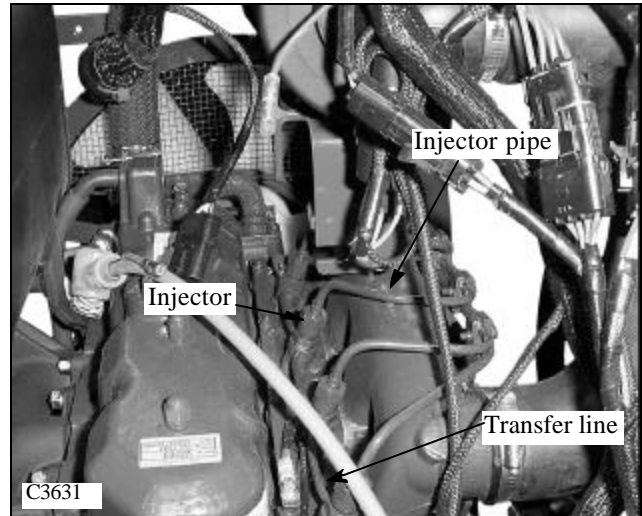
Before performing a compression test, be sure the battery is fully charged and valve clearances are correctly adjusted. See page 7-12. Be sure the air cleaner and exhaust systems are free of obstructions, to prevent a false or low reading

The engine should be warmed up for approximately 5 minutes prior to compression testing.

To Perform Compression Test:

- 1 Move the loader to a level surface, lower the boom arms, engage the parking brake and shut off the engine. Remove the ignition key for safety.
- 2 Access the engine by opening the rear door and raising the engine compartment cover.
- 3 Disconnect the wiring plug connection on the engine stop solenoid. This will prevent fuel flowing to the engine when the engine is turning over.
- 4 Clean dirt from the top of the engine area to prevent contaminants entering the engine.
- 5 Remove the fuel injection pipes from the fuel injectors. (fig. C3631) If the injector pipes are corroded or the pipes twist with the nut when loosening, replace the injection pipe before putting the loader back into service. Cap the open lines and injectors to prevent contamination entering the fuel injection system.
- 6 Remove the fuel transfer lines from the injectors.
- 7 Remove the fuel injectors from each cylinder. Use caution. Do not damage the injector while removing from the cylinder head.
- 8 Connect a compression tester (see Special Tools in Section 8) to the cylinder to be tested. (fig. C179) Be sure to use the correct thread on the adapter screwed into the injector hole.
- 9 Rotate the engine with the starter (200 ~ 300 RPM) 2 ~ 3 complete revolutions. Note the compression reading on the gauge. Repeat the process again to verify the first test reading.
- 10 Continue the compression test on the remaining cylinders keeping written notes of all the registered test readings.
- 11 Compare the compression test readings with the specifications given in Section 7.4, pg. 7-24, Engine Specifications.

continued...

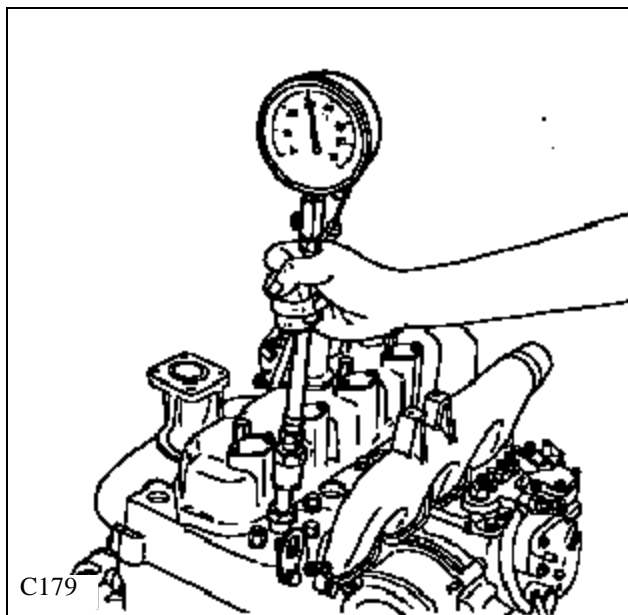


CYLINDER HEAD 7.2

Compression Testing (cont'd)

If the compression test reading are low, add a small amount of oil, through the injector hole, to the affected cylinder (s). Recheck the compression test readings. If the readings improve from the first test then the piston rings or cylinder bores are likely worn.

If the compression reading does not improve the problem is likely a cylinder head related problem such as valve train, cylinder head gasket, or a bad piston. The cylinder head should be removed for further inspection. See the Kubota Service / Repair Manual P / N 97897-109-5 or Thomas P / N 40916.



Cylinder Head

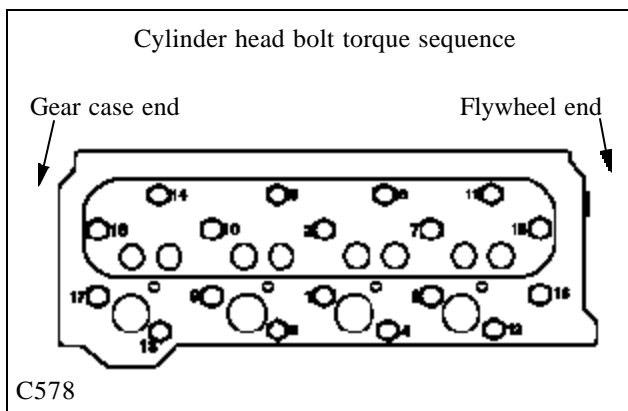
After replacement of the engine cylinder head, the proper bolt torquing sequence must be followed. (fig. C578)

Torque the bolts in 3 separate steps, increasing tightness to the specified 93.1 ~ 98 Nm (68.7 ~ 72.3 ft / lbs)

Apply oil to the threads of the bolt and to the heads of the bolt where they contact the cylinder head casting.

Always install a new head gasket and oil gallery O- ring when replacing the cylinder head.

After installation, operate the engine for half an hour to bring to full operating temperature. Allow the engine to fully cool and retorque the cylinder head bolts.



ENGINE REPLACEMENT 7.3

Removal

1 Move the loader to a level surface. Raise the boom arms, engage the boom supports, apply the parking brake, shut off the engine and remove the ignition key.

2 Remove the seat, hydrostatic shield and U- Joint service access panel. (fig. C3453)

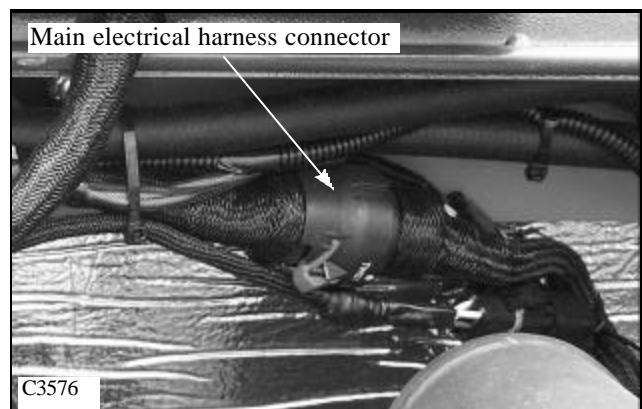
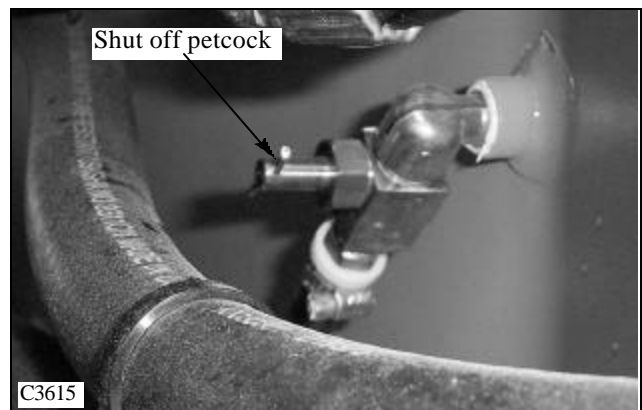
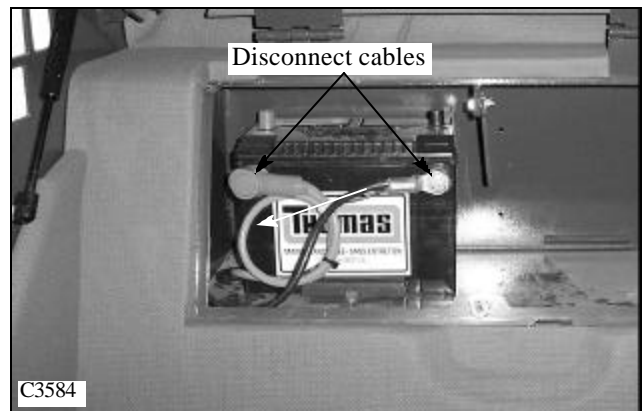
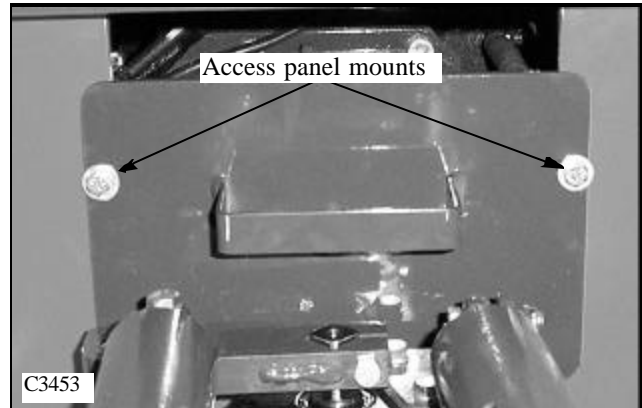
3 Access the battery compartment and disconnect the battery cables from the battery terminals. (fig. C3584)
Ground cable first.

4 Shut off the fuel petcock located at the bottom of the right hand fuel tank, inside the engine compartment. (fig. C3615)

5 Loosen the fuel line clamp and disconnect the fuel line.

6 Disconnect the fuel return line from behind the rear fuel injector. Disconnect the main Engine harness / ROPS harness plug connector. (fig. C3576)

7 Drain the engine oil and coolant. See Section 7.1 Lubrication system and Cooling System.



ENGINE REPLACEMENT 7.3

Removal (cont'd)

8 Disconnect the air filter restrictor sensor wires located at the rear of the air cleaner canister.

9 Remove the exhaust system from the loader. Cover or plug any open exhaust ports to the engine.

10 Remove the air cleaner canister assembly. (fig. C3632). Plug or cover any open air lines to prevent contamination.

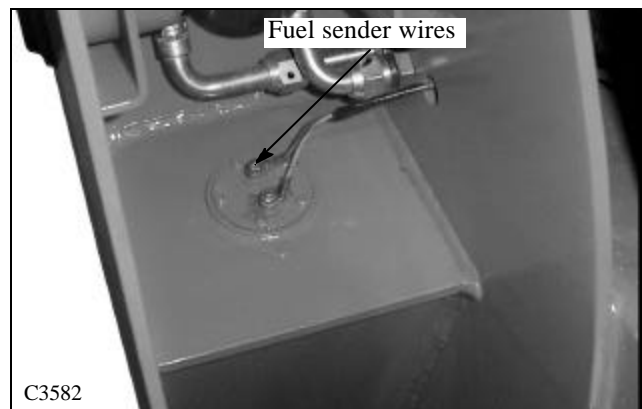


11 Disconnect the hoses going to the coolant over flow tank, or remove the bolts holding the tank to the loader frame. (fig. C3625)



12 Remove the ground wires from the chassis ground bolt. Disconnect the wires going to the fuel level sender in the fuel tank. (fig. C3582)

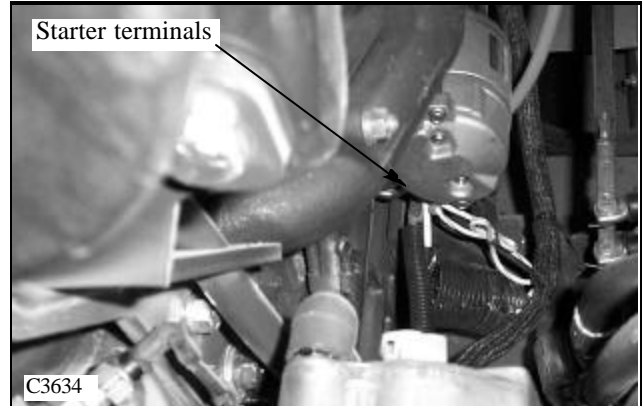
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ENGINE REPLACEMENT 7.3

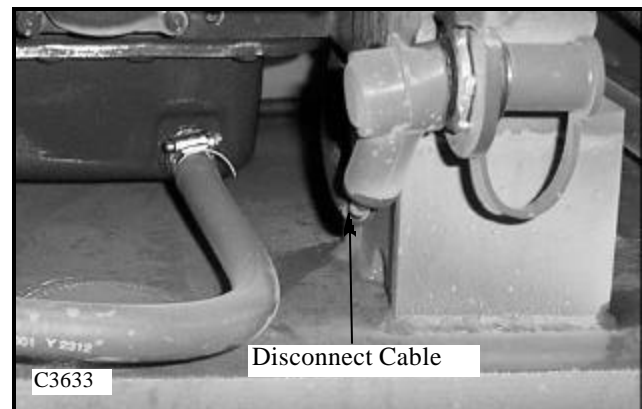
Removal (cont'd)

13 Disconnect the ground straps (cables) mounted from the engine to the loader frame.

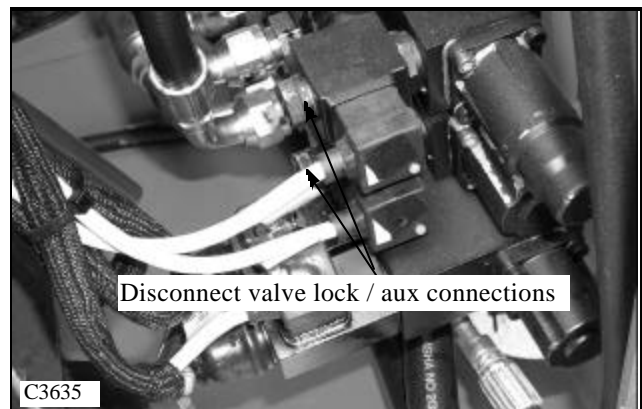


14 Disconnect the engine starter cable coming from the positive terminal of the battery. (fig. C3634)

15 Disconnect the electrical cable from the boosting lug terminal. (fig. C3633)



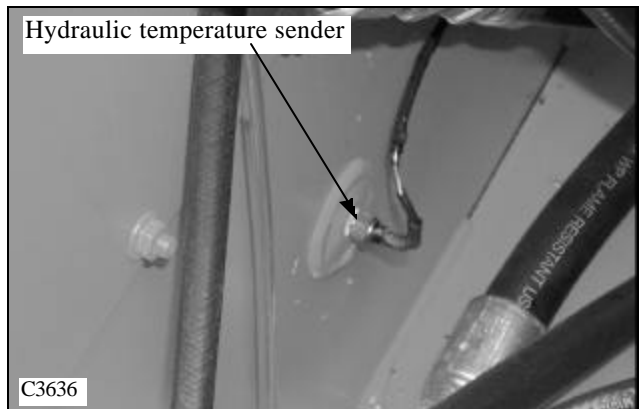
16 Disconnect the hydraulic control valve electrical connections. (fig. C3635) Tag the connections for location to prevent mixing up upon engine replacement.



ENGINE REPLACEMENT 7.3

Removal (cont'd)

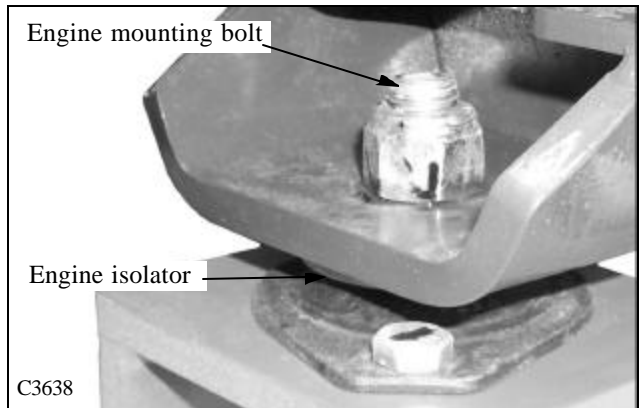
17 Disconnect the hydraulic oil temperature sender located on the left hand oil tank, inside the engine compartment. (fig. C3636)



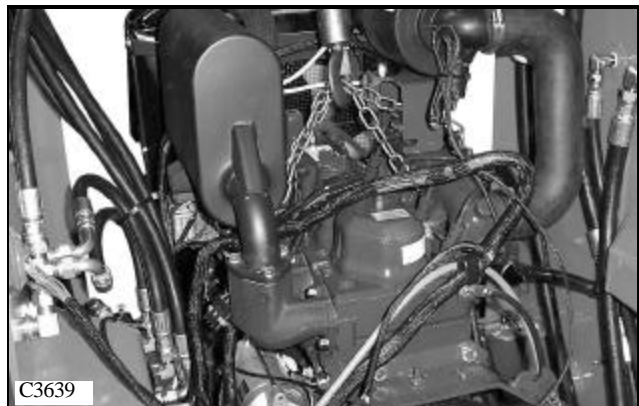
18 Disconnect the throttle linkage. (fig. C3637)



19 Remove the 4 bolts retaining the engine to its rubber composite mounting isolators. (fig. C3638)



20 Using a suitable lift point, raise the engine slightly and pull rearward slowly. (fig. C3639) Check frequently for wires or hoses that may still be connected or tied to the engine and frame. Remove the engine.



CAUTION

Use a chain size of 3/8" grade 40 minimum when replacing the engine

ENGINE REPLACEMENT 7.3

Installation

If the engine is being replaced with a new assembly, the engine will require some preparation.

1 Remove the protective rust preventative coating from the flywheel. (fig. C3641) Use a solvent to remove. The flywheel must be cleaned to the surface metal.

2 Install the engine U- Joint adapter. (fig. C3640) There are 6 bolts holding the adapter to the engine flywheel. Note that 2 of the bolts are longer than the rest. These 2 bolts must be used in the counter sunk holes in the engine flywheel. Torque the adapter bolts 20 ft / lbs. (27.2 Nm)

3 Install the flywheel shield to the rear of the engine block. (fig. C3640)

4 Paint must be removed from the engine block where the ground strap is attach to the front of the engine. This will provide proper grounding of the engine with the loader chassis. (fig. C4190)

5 Install the engine mounts. Apply Loctite 242 (blue) to the threads of the mounting bolts. Torque the mounting bolts to 80 ft / lbs. (108.8 Nm).

6 Install the engine temperature sender.

7 Install the engine shut off solenoid. See Section 7.3 for special installation instructions of the engine stop solenoid.

8 Install the engine wire harness.

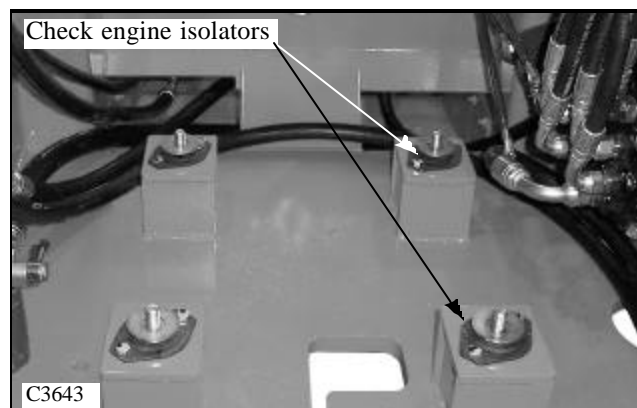
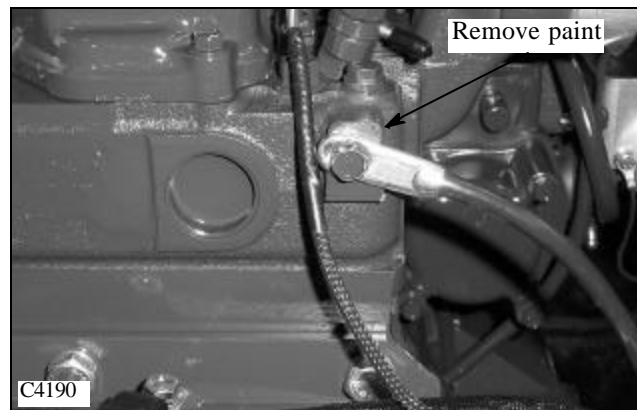
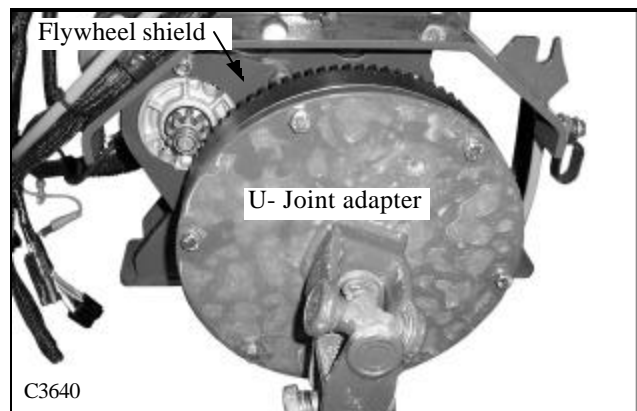
9 Install the radiator to the engine mounts and install the radiator hoses.

10 Install the fan guard to the radiator shroud.

11 Install the upper radiator mounting bracket.

12 Add engine oil and coolant.

13 Check the engine mounting isolators in the loader frame. (fig. C3643) Make sure the isolators are not separating or the rubber is deteriorated in any way. Replace engine isolators as required.



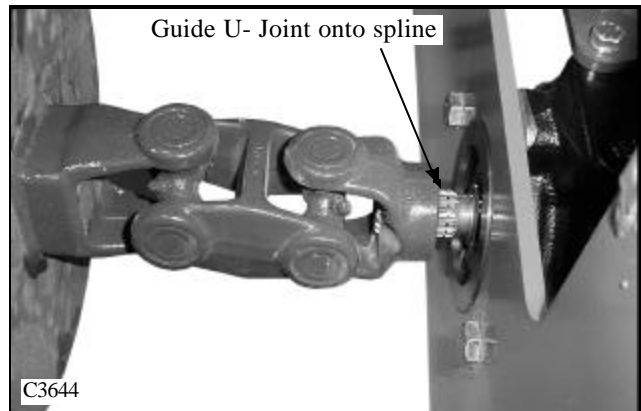
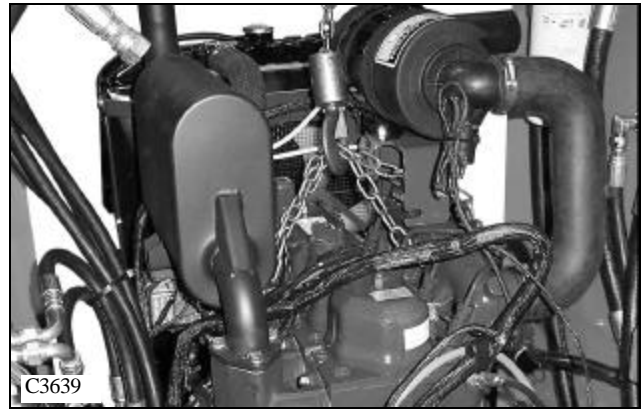
IMPORTANT

The engine shut off solenoid requires proper adjustment. Improper adjustment will lead to premature solenoid failure.

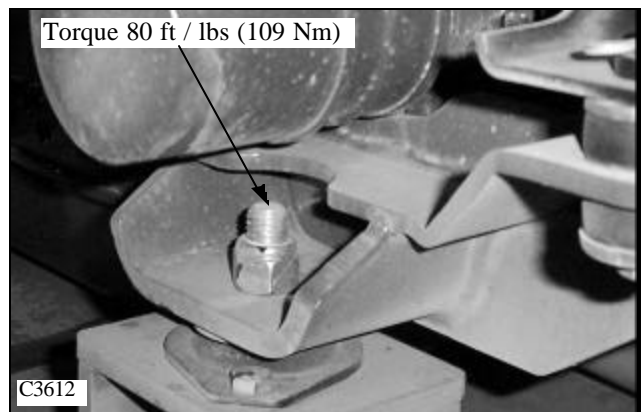
ENGINE REPLACEMENT 7.3

Installation

14 Install the engine to the loader. (fig. C3639) Have a helper inside the cab to line up the engine U- Joint to the hydrostatic pump input shaft. (fig. C3644) Align the engine U-Joint in a straight line with the hydrostatic pump. Failure to align the U- Joint properly will cause premature U- Joint failure.



- 15 Install the engine mounting bolts to the isolators. Torque the bolts to 80 ft / lbs. (109 Nm).(fig. C3612)
- 16 Connect the various electrical connections, routing wires carefully to prevent chaffing. Tie the wires with Zip ties as required. Be sure all ground point are clean.
- 17 Install the intake and exhaust systems.



- 18 Install the coolant over flow tank and hoses. (fig. C3625)
- 19 Connect the fuel supply and turn on the fuel tank petcock.
- 20 Bleed the air from the fuel lines.
- 20 Check the engine oil and coolant level.
- 21 Check again for any loose wires that may be dangling free.
- 22 Test fire the engine.



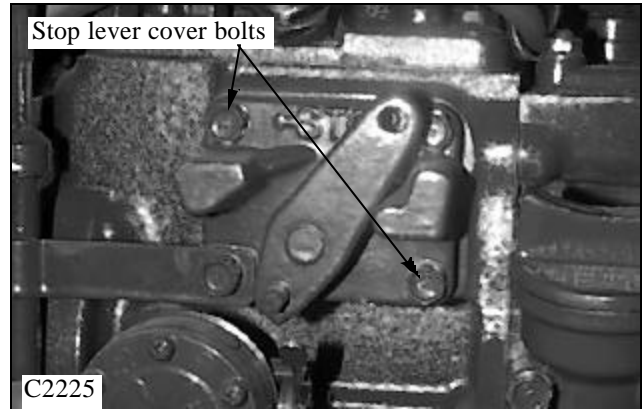
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ENGINE REPLACEMENT 7.3

Stop Solenoid

The engine stop solenoid requires special attention when replacing. If not properly adjusted, the stop solenoid will fail prematurely.

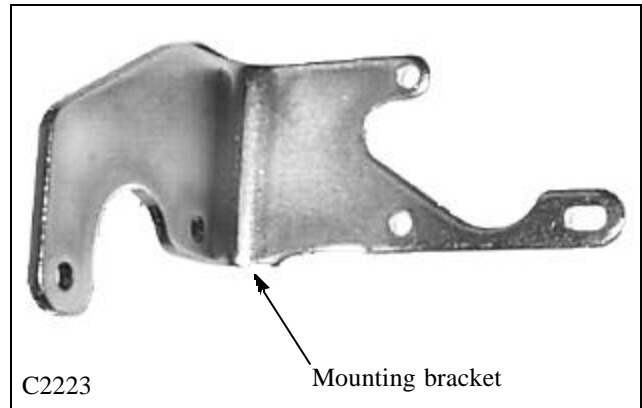
- 1 Remove the 4 bolts retaining the engine stop cover and lever assembly. (fig. C2225) Remove the cover.
- 2 Knock out the roll pin retaining the stop lever to the stop cover.
- 3 Replace the stop lever with the new stop lever and roll pin provided in the stop solenoid kit. (fig. C2275) Attach the stop lever so the end with the protruding pin is on the bottom of the stop cover as installed to the engine.
- 4 Replace the stop cover to the engine using the new gasket provided in the stop solenoid kit.



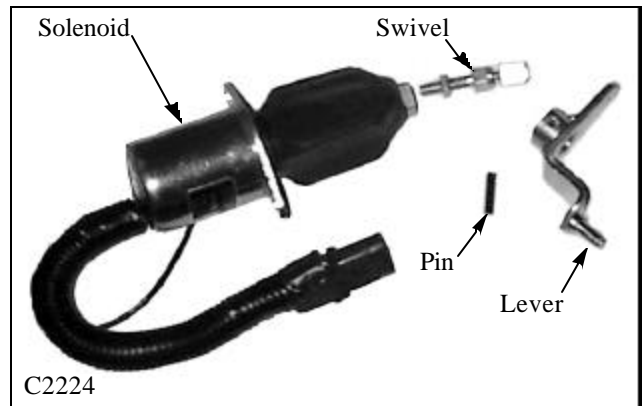
Install new stop lever and roll pin



- 5 Using the washers and bolts provided in the kit, attach the solenoid mounting bracket and stop cover to the engine. (fig. C2223, C2276) Flat washers are provided to space the solenoid mounting bracket away from the stop cover and provide a "square" and level point for the stop solenoid to mount. Do not bend the mounting bracket to fit.



- 6 Install the jam nut and lock washer to the swivel, and screw the swivel into the solenoid. (fig. C2224)



ENGINE REPLACEMENT 7.3

Stop Solenoid (cont'd)

7 Attach the stop solenoid to the shut off lever making sure the cable tie around the solenoid dust boot is facing down, away from the mounting bracket. (fig. C2277) Failure to do so may cause the solenoid to bind and fail prematurely. Use the cotter pin provided to secure the solenoid to the stop lever.

8 Bolt the stop solenoid to the mounting bracket. (fig. C2220)

IMPORTANT

The boot cable tie clamp must face away from the mounting bracket to prevent binding

9 Pull the stop lever and solenoid by hand to initially adjust the clearance between the stop lever and the stop cover lever limiter. (fig. C2221) Adjust stop lever clearance to 1 / 16 in. (1.5mm) by turning the swivel.

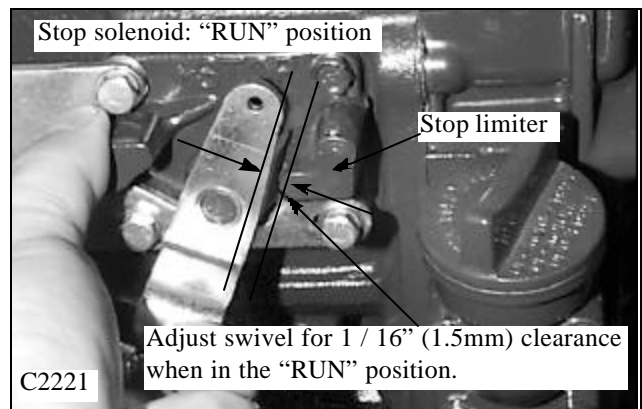
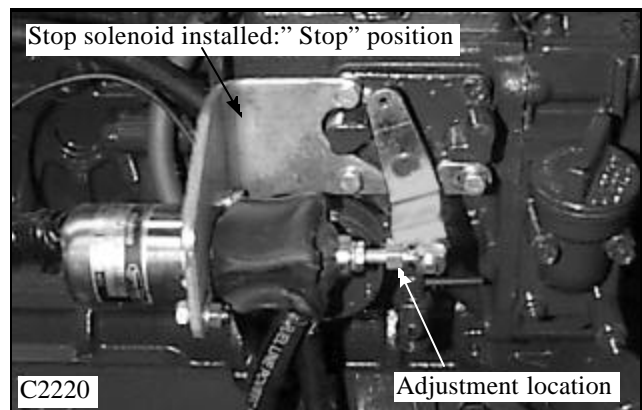
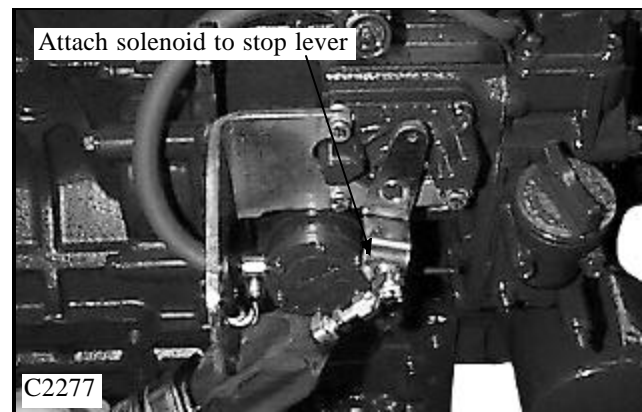
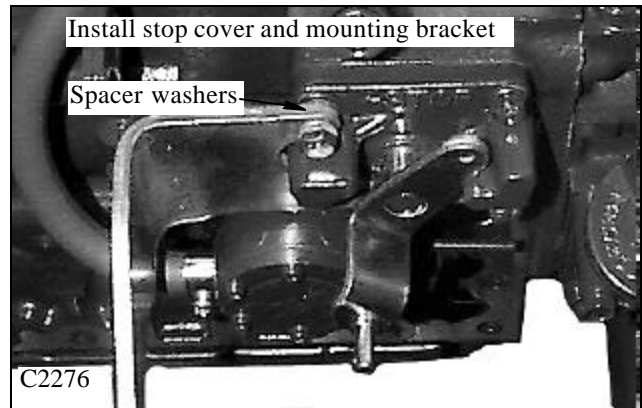
10 Plug in the solenoid connector to the engine electrical harness.

11 Turn on the ignition key but do not start the engine.

12 Manually push the stop solenoid to the run position. Check for smooth engagement, no binding should occur. The solenoid must remain in the "RUN" position now, without holding by hand.

13 Check the stop lever clearance again as the solenoid is engaged. Adjust to 1 / 16 in. (1.5mm).

14 Apply Loctite 242 (blue) to the swivel and jam nut and turn the jam nut against the end of the solenoid plunger. Be sure to support the solenoid as the jam nut is tightened.



To prevent premature failure of the engine stop solenoid, follow the recommended starting procedure. Maximum energizing of the pull coil must not exceed three 30 second cranking attempts with 2 minutes rest between each attempt. After the third 30 second cranking attempt, the stop solenoid must be allowed to cool to ambient 25 ° C (77 ° F) before further cranking attempts.

ENGINE SPECIFICATIONS T175 7.3

| | |
|---|--|
| Make and model | Kubota V2003-T-B |
| Type..... | Vertical , In Line, 4 Cycle |
| Number of cylinders..... | 4 |
| Displacement | 19.99 cu. in.(122.12cc) |
| Cylinder bore..... | 83 mm (3.27 inches) |
| Allowable limit: 80 ~ 80.034mm. (3.1496 ~ 3.1563 inches) | |
| Stroke..... | 92.4 mm (3.64 inches) |
| Bearing clearance.....Main journals: 0.04 ~ 0.118mm (0.0006 ~ 0.0015 in) < 0.2 mm (0.0079 in) allowable limit >Rod journals: 0.025 ~ 0.087 mm (0.0009 ~ 0.0034 in)< 0.2 mm (0.0079 in) allowable limit >Thrust bearing end play: 0.15 ~ 0.31 mm (0.0059 ~ 0.0122 in) < 0.5 mm (0.0197 in) allowable limit > | |
| Maximum engine speed (no load) | 2950 RPM |
| Low idle setting..... | 1000 RPM |
| Cooling system | Liquid |
| Cold starting aid..... | Glow plug in combustion chamber |
| Horsepower (Gross)..... | 60.5 @ 2800 RPM |
| Power (ISO 9249 Net Power)..... | 41.8Kw (56 hp) @ 2800 RPM |
| Torque (ISO 9249 Net Power)..... | 165 N.m. (122 lbs / ft.) @ 1600 RPM |
| Compression ratio | 22.0: 1 |
| Engine compression..... | 36 - 38 kgf / cm ² (512 - 540 psi) |
|Service limit: 24.5 kgf / cm ³ (355 psi) 10 % variance among cylinders | |
| Firing order (viewed from gear case end)..... | 1 - 3 - 4 - 2 |
| Fuel injection pump | Bosch type mini pump (PFR 4M) |
| Fuel injection timing | 18° BTDC (0.314 Rad) |
| Injector working pressure..... | 140 - 150 kgf / cm ² (1990 - 2133 psi) |
| Direction of rotation (viewed from flywheel end) | Counter - clockwise |
| Location of timing marks | N / A |
| Valve clearance, (cold) | 0.18 - 0.22 mm (0.0071 - 0.0087 in) |
| Valve seat angle | Intake 1.047 Rad (60°) |
| ..... | Exhaust 0.785 Rad (45°) |
| Valve seat width..... | Intake 2.12mm (0.0835 in) |
| ..... | Exhaust 2.12mm (0.0835 in) |
| Valve face angle | Intake 1.047 Rad (60°) |
| ..... | Exhaust 0.785 Rad (45°) |
| Valve recessing..... | Protrusion 0.05mm (0.0020 in) |
| ..... | Recess 0.15mm (0.0059 in) |
| Fuel type | Diesel No. 2 |
| Fuel filter..... | Single spin on type |
| Air cleaner | Dual dry cartridge elements (primary and secondary) with restriction indicator |
| Oil filter..... | Single spin on type |
| Engine oil pressure | @ Idle speed 98 Kpa (14 psi) minimum |
| ..... | @ Rated speed 245 Kpa (36 psi) minimum |
| Oil pressure switch..... | Closes @ 49 Kpa (7 psi) |
| Engine oil capacity with filter | 7.9. (8. 3 qts) |
| Oil type | 10W30API CF |
| Cooling system capacity | 7 l (1.8 gal.) |
| Radiator cap pressure setting | 88 KPa (12. 8 psi) |
| Thermostat rating..... | Fully open 85°C (185°F) |

**For complete engine service repair manual:
Order P / N 97897-01670 from your nearest Kubota dealer.**



— ENGINE SPECIFICATIONS PT1700 7.4 —

| | |
|---|---|
| Make and model | Kubota V2203 |
| Type | Vertical , In Line, 4 Cycle |
| Number of cylinders..... | 4 |
| Displacement | 134.08 cu. in.(2197cc) |
| Cylinder bore..... | 87 mm (3.43 inches) |
| Allowable limit: 80 ~ 80.034mm. (3.1496 ~ 3.1563 inches) | |
| Stroke..... | 92.4 mm (3.64 inches) |
| <i>Maximum engine speed (no load)</i> | <i>2950 RPM</i> |
| <i>Low idle setting</i> | <i>1000 RPM</i> |
| Cooling system | Liquid |
| Cold starting aid | Glow plug in combustion chamber |
| Horsepower (Gross)..... | 51 @ 2800 RPM |
| Power (ISO 9249 Net Power) | 34.3Kw (46 hp) @ 2800 RPM |
| Torque (ISO 9249 Net Power)..... | 155 N.m. (115 lbs / ft.) @ 1600 RPM |
| Compression ratio | 23.0: 1 |
| Engine compression..... | 30 - 33 kgf / cm ² (427 - 469 psi) |
| ..... | Service limit: 26 kgf / cm ³ (355 psi) 10 % variance among cylinders |
| Firing order (viewed from gear case end)..... | 1 - 3 - 4 - 2 |
| Fuel injection pump..... | Bosch type mini pump (PFR 4M) |
| Fuel injection timing | 18° BTDC (0.314 Rad) |
| Injector working pressure | 140 - 150 kgf / cm ³ (1990 - 2133 psi) |
| Direction of rotation (viewed from flywheel end)..... | Counter - clockwise |
| Location of timing marks | N / A |
| Valve clearance, (cold) | 0.18 - 0.22 mm (0.0071 - 0.0087 in) |
| Valve seat angle..... | Intake 1.047 Rad (60°) |
| ..... | Exhaust 0.785 Rad (45°) |
| Valve seat width..... | Intake 2.12mm (0.0835 in) |
| ..... | Exhaust 2.12mm (0.0835 in) |
| Valve face angle | Intake 1.047 Rad (60°) |
| ..... | Exhaust 0.785 Rad (45°) |
| Valve recessing..... | Protrusion 0.05mm (0.0020 in) |
| ..... | Recess 0.15mm (0.0059 in) |
| Fuel type | Diesel No. 2 |
| Fuel filter | Single spin on type |
| Air cleaner | Dual dry cartridge elements (primary and secondary) with restriction indicator |
| Oil filter | Single spin on type |
| Engine oil pressure..... | @ Idle speed 98 Kpa (14 psi) minimum |
| ..... | @ Rated speed 245 Kpa (36 psi) minimum |
| Oil pressure switch..... | Closes @ 49 Kpa (7 psi) |
| Engine oil capacity with filter..... | 8 l. (8. 5 qts) |
| Oil type | 10W30API CF |
| Cooling system capacity | 14.5 l (3.2 gal.) |
| Radiator cap pressure setting | 88 KPa (12. 8 psi) |
| Thermostat rating..... | Fully open 85°C (185°F) |



ENGINE TROUBLE SHOOTING 7.5

| Symptom | Cause | Remedy |
|---|---|--|
| Engine does not start | No fuel | Replenish fuel |
| | Air in the fuel | Vent air |
| | Water in the fuel | Change fuel and repair or replace fuel system |
| | Fuel pipe clogged | Clean |
| | Fuel filter clogged | Clean or change |
| | Excessively high viscosity of fuel or engine oil at low temperature | Use the specified fuel or engine oil |
| | Fuel with low octane number | Use the specified fuel |
| | Fuel leak due to loose injection pipe retaining nut | Tighten nut |
| | Incorrect injection timing | Adjust |
| | Fuel cam shaft worn | Replace |
| | Injection nozzle clogged | Clean |
| | Injection pump malfunctioning | Repair or replace |
| | Seizure of crankshaft, camshaft, piston, cylinder liner or bearing | Repair or replace |
| | Compression leak from cylinder | Replace head gasket, tighten cylinder head bolt, glow plug and nozzle holder |
| | Improper valve timing | Correct or replace timing gear |
| Piston ring and liner worn | Replace | |
| Excessive valve clearance | Adjust | |
| Starter does not run | Battery discharged | Charge |
| | Starter malfunctioning | Repair or replace |
| | Key switch malfunctioning | Repair or replace |
| | Wiring disconnected | Connect |
| Engine revolution is not smooth | Fuel filter clogged or dirty | Clean or change |
| | Air cleaner clogged | Clean or change |
| | Fuel leak due to loose injection pipe retaining nut | Tighten nut |
| | Injection pump malfunctioning | Repair or replace |
| | Incorrect nozzle opening pressure | Adjust |
| | Injection nozzle stuck or clogged | Repair or replace |
| | Fuel overflow pipe clogged | Clean |
| | Governor malfunctioning | Repair |
| Either white or blue exhaust gas is observed | Excessive engine oil | Reduce to the specified level |
| | Low grade fuel used | Used the specified fuel |
| | Fuel filter clogged | Adjust |
| | Air cleaner clogged | Adjust top clearance |
| Either black or dark gray exhaust gas is observed | Overload | Lessen the load |
| | Low grade fuel used | Use the specified fuel |
| | Fuel filter clogged | Clean or change |
| | Air cleaner clogged | Clean or change |



ENGINE TROUBLE SHOOTING 7.5

| SYMPTOM | PROBABLE CAUSE | SOLUTION |
|-------------------------------------|---|--|
| Excessive lubricant oil consumption | Piston rings gap facing the same direction | Shift gap direction |
| | Oil ring worn or stuck | Replace |
| | Piston ring groove worn | Replace |
| | Valve stem and guide worn | Replace |
| | Crankshaft bearing and crank pin bearing worn | Replace |
| Fuel mixed into lubricant oil | Injection pump's plunger worn | Replace pump element or pump |
| | Injection pump broken | Replace |
| Water mixed into lubricant oil | Head gasket defective | Replace |
| | Cylinder block or cylinder head flawed | Replace |
| Low oil pressure | Engine oil insufficient | Replenish |
| | Oil strainer clogged | Clean |
| | Relief valve stuck with dirt | Clean |
| | Relief valve spring weakened or broken | Replace |
| | Excessive oil clearance of crankshaft bearing | Replace |
| | Excessive oil clearance of crank pin bearing | Replace |
| | Excessive oil clearance of rocker arm bearing | Replace |
| | Oil passage clogged | Clean |
| | Oil pump defective | Replace |
| | Different type of oil | Use the specified oil type |
| High oil pressure | Relief valve defective | Replace |
| | Engine oil insufficient | Replenish |
| Engine overheated | Fan belt broken or elongated | Change or adjust |
| | Cooling water insufficient | Replenish |
| | Radiator net and radiator fin clogged with dust | Clean |
| | Inside of radiator corroded | Clean or replace |
| | Cooling water flow route corroded | Clean or replace |
| | Radiator cap defective | Replace |
| | Overload running | Loosen the load |
| | Head gasket defective | Replace |
| | Incorrect injection timing | Adjust |
| Deficient output | Unsuitable fuel used | Use the specified fuel |
| | Incorrect injection timing | Adjust |
| | Engine's moving parts seem to be seizing | Repair or replace |
| | Uneven fuel injection | Repair or replace injection pump |
| | Deficient nozzle injection | Repair or replace nozzle |
| | Compression leak | Replace head gasket, tighten cylinder head bolt, glow plug and nozzle holder |
| Battery quickly discharges | Battery electrolyte insufficient | Replenish distilled water |
| | Fan belt slips | Adjust belt tension or change |
| | Wiring disconnected | Connect |
| | Rectifier defective | Replace |
| | Alternator defective | Replace |
| | Battery defective | Change |

7