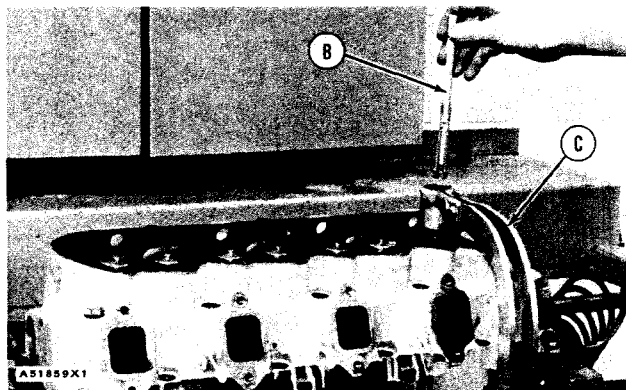
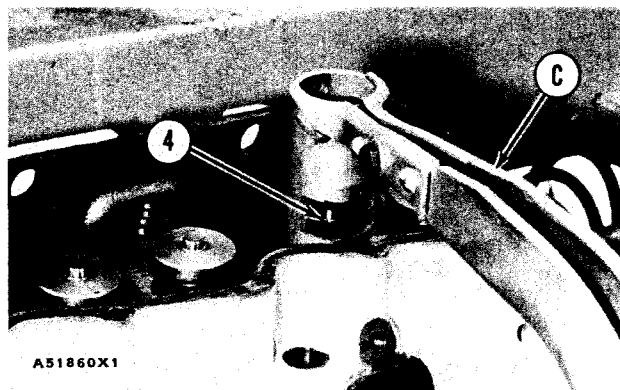


Cylinder Heads



5. Put the valve springs under compression with tool (C).

6. Install the locks on the valve stem with tool (B).



WARNING

Locks (4) can be thrown from the valve when tool (C) is released if not in their correct position. To prevent possible personal injury, release tool (C) slowly, and stay as far away as possible.

7. Remove tool (C), and hit the valve with a rubber hammer to be sure the locks are in their correct position.

8. Do Steps 4 through 7 for the remainder of the valves.

END BY:

a. install cylinder heads

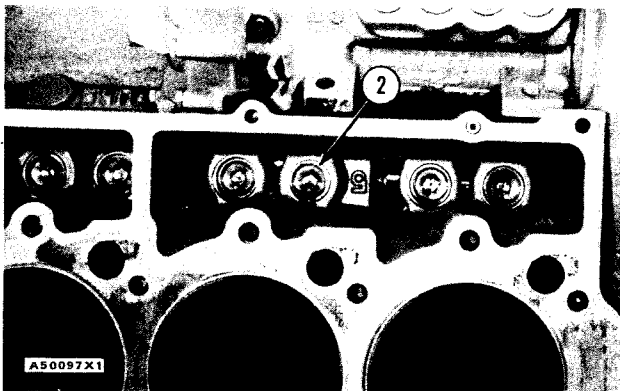
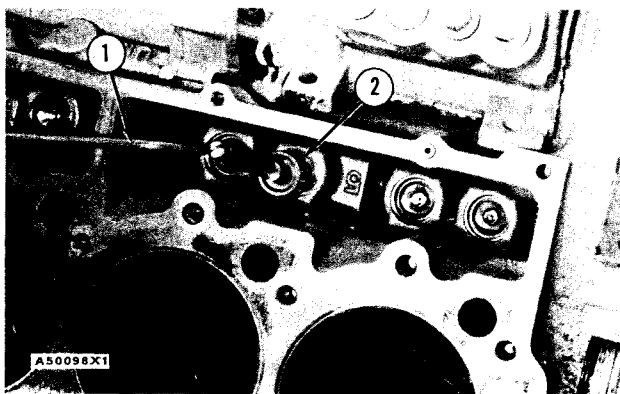
Valve Lifters

Remove And Install Valve Lifters 1209-010

START BY:

a. remove cylinder heads

1. Remove valve lifters (2) with magnet (1).
2. Put identification on each lifter as to its location in the engine for installation purposes.



NOTE: The following steps are for installation of the valve lifters.

3. Put 2P2506 Thread Lubricant on valve lifters and camshaft lobes.
4. Install the valve lifters (2) in their original positions in the cylinder block.

END BY:

a. install cylinder heads

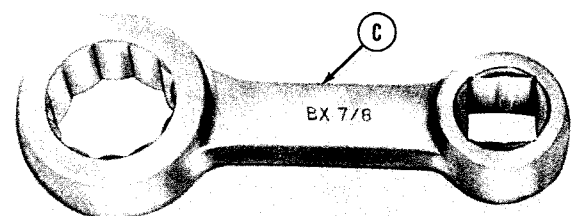
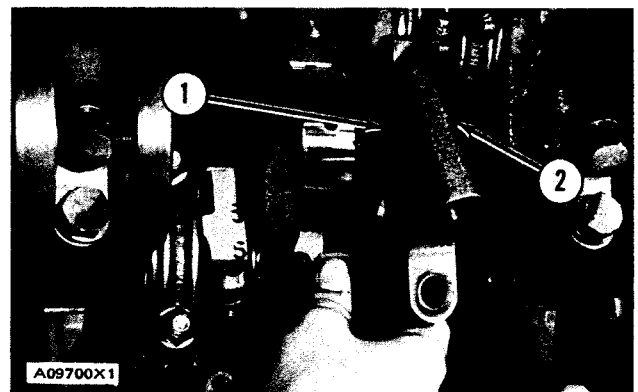
Crankshaft Main Bearings

Remove And Install Crankshaft Main Bearings 1203-010

Tools Needed		A	B	C	D
2P5518	Bearing Tool	1			
	Plastigage		•		
8S5131	Adapter			1	
8S2328	Dial Indicator Test Group				1

START BY:

a. remove oil pan

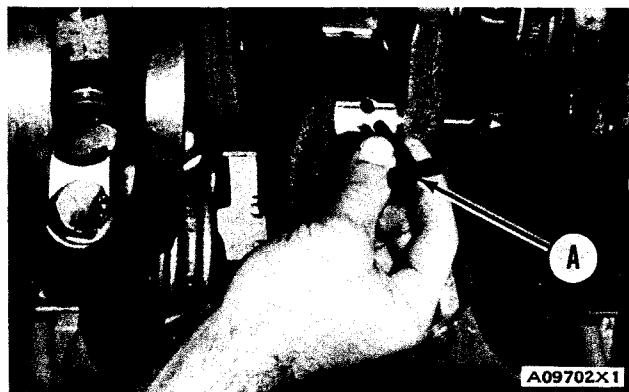


1. Check each main bearing cap for its location on the engine. Each cap has a number which gives the location of that cap. Make a note that the number on each cap is toward the front of the cylinder block.

2. Remove the bolts and washers that hold main bearing cap (2) in place. Remove the bearing cap and the lower half of the main bearing. Use tool (C) to remove the bolts that hold the No. 1 main bearing cap in position.

3. Remove bearing (1) from the bearing cap.

Crankshaft Main Bearings



NOTICE

If the crankshaft is turned in the wrong direction, the tab of the bearing will be pushed between the crankshaft and the cylinder block. This will cause damage to the crankshaft and block.

4. Turn the crankshaft until tool (A) can be installed in the oil hole in the crankshaft in the direction which will push the upper main bearing out, tab end first.

NOTE: Install the bearings dry when the clearance checks are made. Put clean engine oil on the bearings for final assembly.

NOTICE

When bearing caps are installed, make sure the number on the side of the cap is next to and respective with the number on the engine block.

5. Install the lower bearing in the bearing caps. Install upper bearings (bearing with the oil hole) in the cylinder block with tool (A).

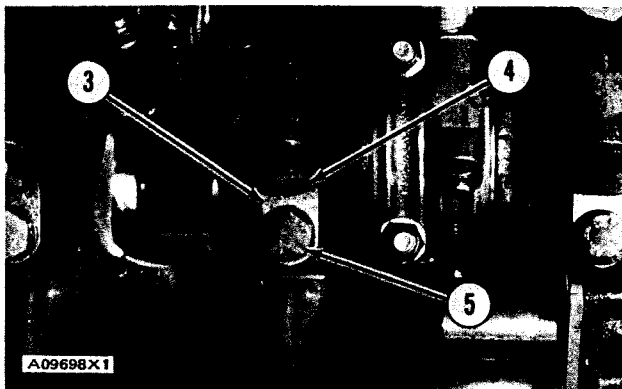
If the serviceman wants to measure the bearing clearances, Plastigage is recommended. Lead wire, shim stock or use of a dial bore gauge can damage the bearing surface.

The serviceman must be very careful to use Plastigage correctly. The following points must be remembered:

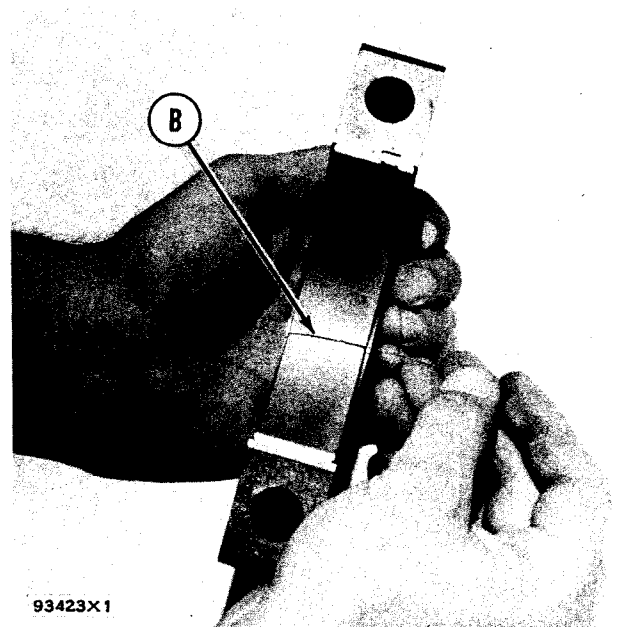
- ... Make sure that the backs of the bearings and the bores are clean and dry.
- ... Make sure that the bearing locking tabs are properly seated in their slots.
- ... The crankshaft must be free of oil where the Plastigage touches it.
- ... If the main bearing clearances are checked with the engine upright or on its side, the crankshaft must be supported. Use a jack under an adjacent crankshaft counterweight and hold the crankshaft against the crown of the bearing. If the crankshaft is not supported, the weight of the crankshaft will cause incorrect readings.
- ... Put a piece of Plastigage on the crown of the bearing half that is in the cap. Do not allow the Plastigage to extend over the edge of the bearing.
- ... Install the bearing cap using the correct torque-turn specifications. Do not use an impact wrench. Be careful not to dislodge the bearing when the cap is installed.
- ... Do not turn the crankshaft with the Plastigage installed.
- ... Carefully remove the cap, but do not remove the Plastigage. Measure the width of the Plastigage while it is in the bearing cap or on the crankshaft journal. Do this by using the correct scale on the package. Record the measurements.
- ... Remove the Plastigage before reinstalling the cap.

When using Plastigage, the readings can sometimes be unclear. For example, all parts of the Plastigage are not the same width. Measure the major widths to make sure that they are within the specification range. Also, experience has shown that when checking clearances tighter than 0.10 mm (.004") the readings may be low by 0.013 to 0.025 mm (.0005 to .0010"). Out-of-round journals can give faulty readings. Also, journal taper may be indicated when one end of the Plastigage is wider than the other.

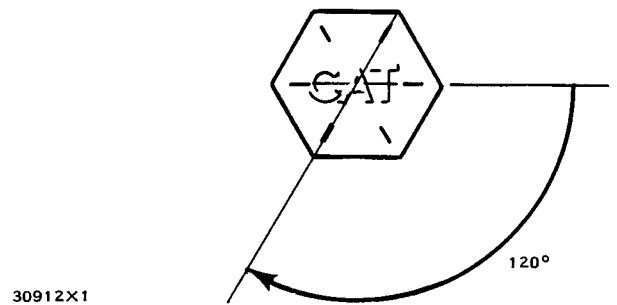
For complete details concerning measuring bearing clearances, see Engine Bearings And Crankshafts, Form No. SEBD0531.



6. Check the bearing clearance with tool (B) as follows: Put cap (3) in position, and install the bolts. Tighten bolt (5) to a torque of $40 \pm 4 \text{ N}\cdot\text{m}$ ($30 \pm 3 \text{ lb}\cdot\text{ft}$). Tighten bolt (4) to a torque of $40 \pm 4 \text{ N}\cdot\text{m}$ ($30 \pm 3 \text{ lb}\cdot\text{ft}$). Put a mark on both bolt heads and the bearing cap. Tighten bolt (4) $120^\circ \pm 5^\circ$ more. Tighten bolt (5) $120^\circ \pm 5^\circ$ more.



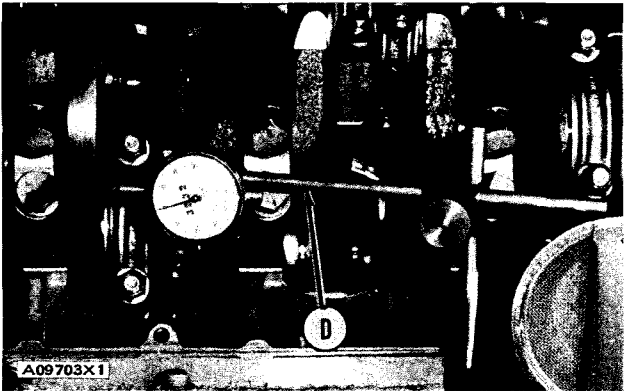
7. Remove the bearing cap, and measure the thickness of the Plastigage. The main bearing clearance must be 0.076 to 0.168 mm (.0030 to .0066 in.). The maximum permissible clearance is 0.18 mm (.007 in.).



8. Put 2P2506 Thread Lubricant on the bolt threads and washer faces. Put clean engine oil on the lower half of the main bearing. Put the bearing cap and lower half of the main bearing in position on the engine. Install the bolts. Tighten bolt (5) to a torque of $40 \pm 4 \text{ N}\cdot\text{m}$ ($30 \pm 3 \text{ lb}\cdot\text{ft}$). Tighten bolt (4) to a torque of $40 \pm 4 \text{ N}\cdot\text{m}$ ($30 \pm 3 \text{ lb}\cdot\text{ft}$). Put a mark on both heads and the cap. Tighten bolt (4) $120^\circ \pm 5^\circ$ more. Tighten bolt (5) $120^\circ \pm 5^\circ$ more.

9. Do Steps 1 through 8 for the remainder of the bearings.

Crankshaft Main Bearings



10. Check the crankshaft end play with tooling (D). The end play is controlled by the thrust bearing on No. 4 main bearing. The end play with new bearings must be 0.08 to 0.25 mm (.003 to .010 in.). The maximum permissible end play with used bearings is 0.36 mm (.014 in.).

END BY:

- a. install oil pan

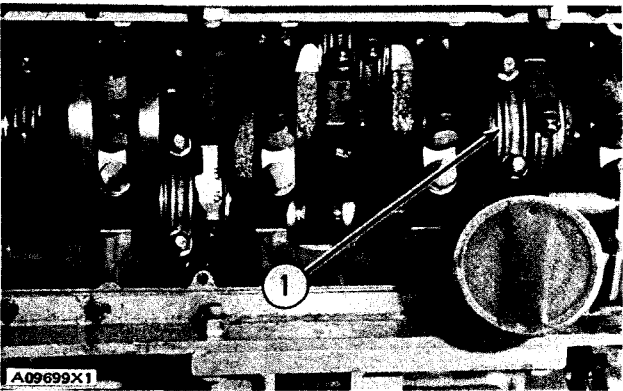
Connecting Rod Bearings

Remove And Install Connecting Rod Bearings 1219-010

Tools Needed	A
Plastigage	•

START BY:

- a. remove oil pan



- 1.** Turn the crankshaft until two pistons are at bottom center. Remove connecting rod caps (1) from the two connecting rods. Remove the lower half of the bearings from the caps.
- 2.** Push the connecting rods away from the crankshaft, and remove the upper half of the bearings.

NOTICE

Be careful not to damage the crankshaft journals. Do not turn the crankshaft while any of the connecting rod caps are removed.

NOTE: Install the bearings dry when the clearance checks are made. Put clean engine oil on the bearings for final assembly.

3. Clean the surfaces where the bearings fit. Install the upper half of the bearing in the connecting rod. Pull the connecting rod slowly on to the crankshaft.

4. Install lower half of the bearing in the cap.

NOTICE

When the connecting rod caps are installed, make sure that the numbers on the side of the caps are next to and respective with the number on the side of the connecting rods.

The serviceman must be very careful to use Plastigage correctly. The following points must be remembered:

... Make sure that the backs of the bearings and the bores are clean and dry.

... Make sure that the bearing locking tabs are properly seated in their slots.

... The crankshaft must be free of oil where the Plastigage touches it.

... Put a piece of Plastigage on the crown of the bearing half that is in the cap. Do not allow the Plastigage to extend over the edge of the bearing.

... Install the bearing cap using the correct torque-turn specifications. Do not use an impact wrench. Be careful not to dislodge the bearing when the cap is installed.

... Do not turn the crankshaft with the Plastigage installed.

... Carefully remove the cap, but do not remove the Plastigage. Measure the width of the Plastigage while it is in the bearing cap or on the crankshaft journal. Do this by using the correct scale on the package. Record the measurements.

... Remove the Plastigage before reinstalling the cap.

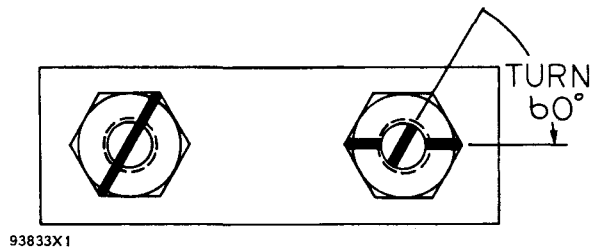
When using Plastigage, the readings can sometimes be unclear. For example, all parts of the Plastigage are not the same width. Measure the major widths to make sure that they are within the specification range. Also, experience has shown that when checking clearances tighter than 0.10 mm (.004") the readings may be low by 0.013 to 0.025 mm (.0005 to .0010"). Out-of-round journals can give faulty readings. Also, journal taper may be indicated when one end of the Plastigage is wider than the other.

For complete details concerning measuring bearing clearances, see Engine Bearings And Crankshafts, Form No. SEBD0531.

5. Check the bearing clearance with Plastigage (A). Put Plastigage (A) on the bearing.

6. Put 2P2506 Thread Lubricant on the threads of the rod bolts and seat surfaces of the nuts.

Connecting Rod Bearings



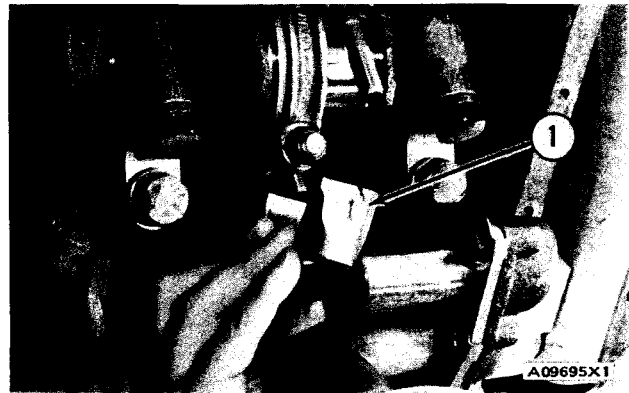
NOTICE

Do not use an impact wrench to tighten the nuts the additional $60 \pm 5^\circ$.

NOTE: Do not turn the crankshaft when Plastigage (A) is in position.

7. Put caps (1) in position on the connecting rods, and install the nuts. Tighten the nuts to a torque of $40 \pm 4 \text{ N}\cdot\text{m}$ ($30 \pm 3 \text{ lb}\cdot\text{ft.}$). Put a mark on each nut and the end of each bolt. Tighten the nuts $60^\circ \pm 5^\circ$ more.

8. Remove the caps. Measure the thickness of Plastigage (A). The rod bearing clearance must be 0.053 to 0.140 mm (.0021 to .0055 in.). The maximum permissible clearance is 0.15 mm (.006 in.).



9. Put the caps in position on the connecting rods, and install the nuts. Tighten the nuts to a torque of $40 \pm 4 \text{ N}\cdot\text{m}$ ($30 \pm 3 \text{ lb}\cdot\text{ft.}$). Put a mark on each nut and the end of each bolt. Tighten the nuts $60^\circ \pm 5^\circ$ more.

10. Do Steps 1 through 9 again for other bearings.

END BY:

a. install oil pan

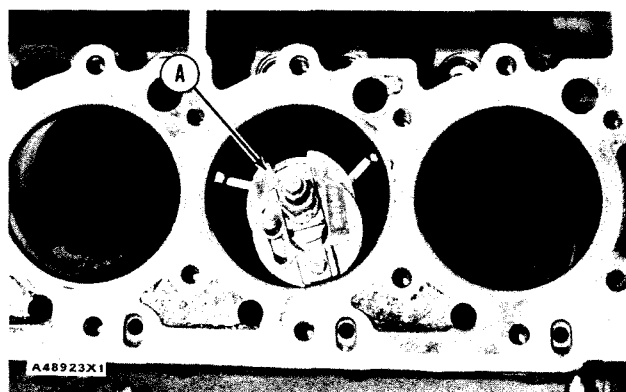
Pistons And Connecting Rod Assemblies

Remove Pistons And Connecting Rod Assemblies 1225-011

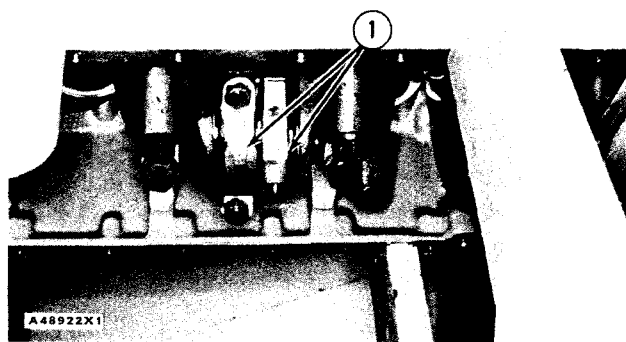
Tools Needed		A
8S2269	Ridge Reamer	1

START BY:

- a. remove cylinder heads
- b. remove oil pan

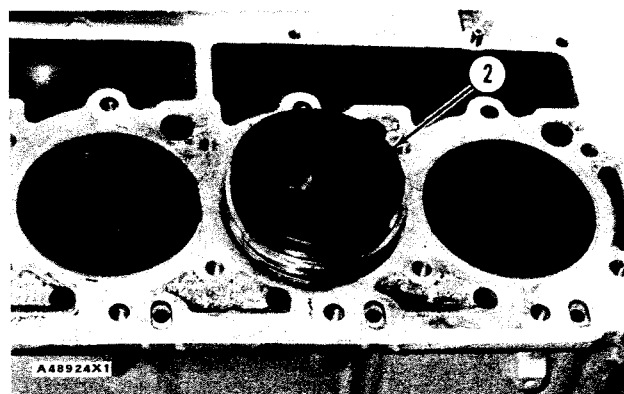


1. Remove the carbon from the top inside surface of the cylinders with tool (A).



2. Turn the crankshaft until two pistons are at bottom center.
3. Remove connecting rod caps (1) from the two connecting rods. Put pieces of rubber hose or tape on the threads of the connecting rod bolts as protection for the crankshaft.

4. Push the pistons and connecting rods away from the crankshaft until the piston rings are above the cylinder block.



5. Remove the two pistons (2) and the connecting rods. Keep each connecting rod cap with its respective connecting rod and piston. Put identification on each connecting rod as to its location for use at installation.

NOTICE

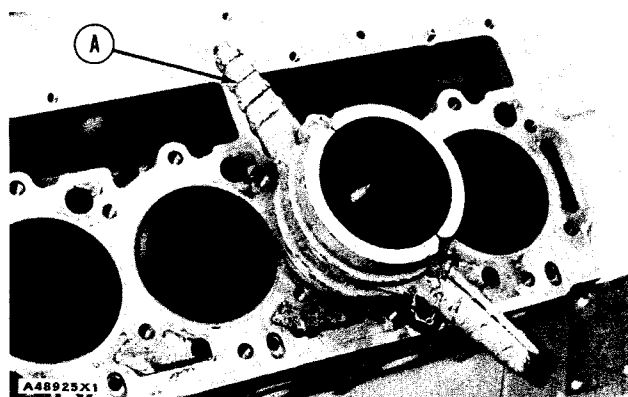
Do not turn the crankshaft while any of the connecting rods are in the engine without the caps installed.

6. Do Steps 2 through 5 for the remainder of the pistons.

Pistons And Connecting Rod Assemblies

Install Pistons And Connecting Rod Assemblies 1225-012

Tools Needed		A	B
5P3524	Ring Compressor	1	
	Plastigage		*



1. Put clean engine oil on the piston rings, connecting rod bearings, cylinder walls and crankshaft bearing journals.

2. Turn the crankshaft until the bearing journal for the pistons to be installed is at bottom center.

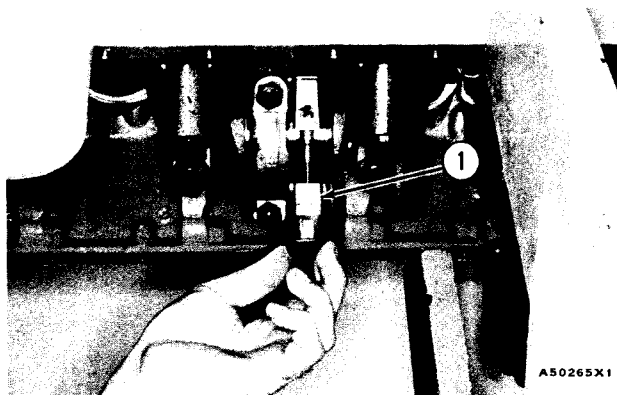
3. Make sure the piston ring gaps are at least 120° apart on the piston.

4. Use tool (A), and install the piston in position in the same cylinder bore from which it was removed. The hole (crater) in the top of the piston must be toward (nearest) the center of the engine.

NOTE: For more detail about the installation of connecting rod bearings, see Remove And Install Connecting Rod Bearings.

5. Check the bearing clearances with tool (B).

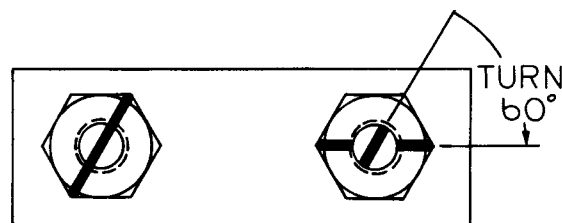
6. Put 2P2506 Thread Lubricant on the threads of the bolts and contact surfaces of the nuts for the connecting rod caps.



NOTICE

When the connecting rod caps are installed, make sure that the number on the side of the cap is next to and respective with the number on the side of the connecting rod.

7. Put the cap (1) in position on the connecting rod, and install the nuts. Tighten the nuts to a torque of $40 \pm 4 \text{ N}\cdot\text{m}$ ($30 \pm 3 \text{ lb}\cdot\text{ft.}$). Put a mark on each nut and the end of each bolt. Tighten the nuts $60 \pm 5^\circ$ more.



93833X1

8. Check the side clearance between the connecting rods on the same crankshaft journal. Clearance must be 0.08 mm (.003 in.) for new rods.

9. Do Steps 1 through 8 for the remainder of the pistons.

END BY:

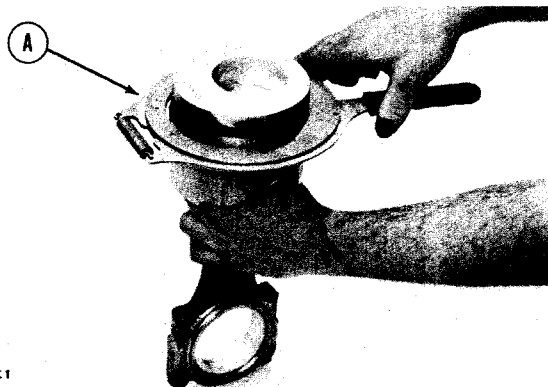
- install cylinder heads
- install oil pan

Disassemble Pistons And Connecting Rod Assemblies 1225-015

Tools Needed		A	B
5F9059	Ring Expander	1	
5P8639	Press Group		1
8F24	Hose Assembly		1
1P2375	Coupler Assembly		1
1P2376	Coupler Assembly		1
2D2825	Hand Pump		1
5P8652	Tool Group		1

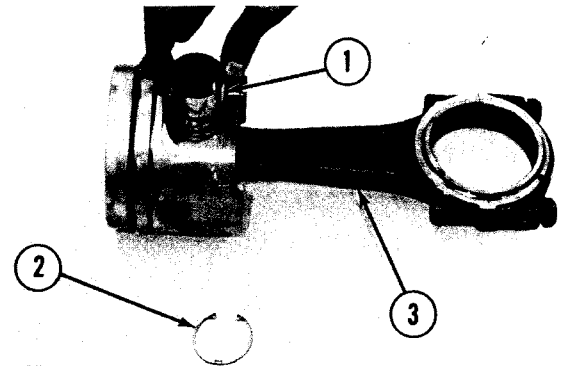
START BY:

- a. remove pistons and connecting rod assemblies



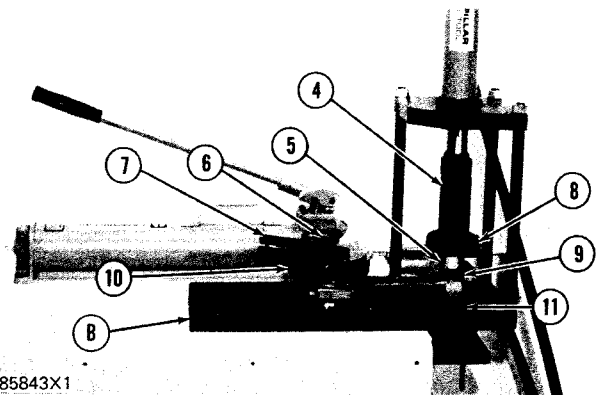
81080X1

1. Remove the rings from the piston with tool (A).



92636X1

2. Remove the bearings from the connecting rod and connecting rod cap.
3. Remove snap rings (2), pin (1) and connecting rod (3) from the piston.
4. See Use Of Piston Pin Bearing Removal And Installation Tools, Special Instructions, Form No. SMHS7295, for more information of removal and installation of piston pin bearings.



A85843X1

5. Heat the connecting rod to a temperature of 176 to 260°C (350 to 500°F). Put 5P8654 Spacer (11) in the base plate. Put the connecting rod on the base plate of tooling (B).
6. Put the connecting rod piston pin bearing end in the center of the port assembly of tooling (B). Install pin (7) in the center of the bore for the connecting rod bearings.
7. Install 5P9653 Adapter (9). Put the hole in the adapter in alignment with the hole in the base plate of tooling (B).

Pistons And Connecting Rod Assemblies

8. Install clamp bar (10) and clamp pin (6).

9. Install new piston pin bearing (5) on adapter (9).

NOTE: The old bearing is pushed out by tooling (B) as the new bearing is installed.

10. Put 5P8645 Adapter (8) in position as shown with the taper side down. The piston pin bearing joint must be in alignment with the hole in adapter (9) and the base plate of tooling (B).

11. Put pusher (4) on adapter (8).

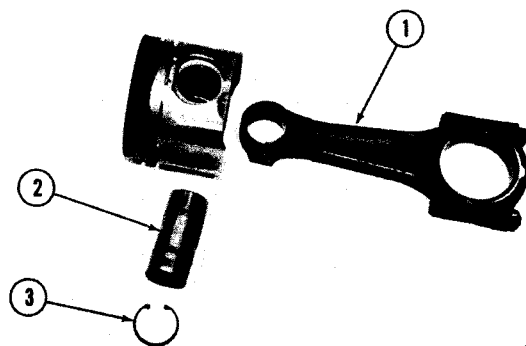
12. Use tooling (B) to push the new piston pin bearing into the connecting rod until adapter (8) of tooling (B) makes full contact with the connecting rod surface.

13. Remove the connecting rod and the old piston pin bearing from tooling (B).

14. Check the piston pin bearing bore diameter after the bearing is installed. The correct dimension is 38.125 ± 0.008 mm ($1.5010 \pm .0003$ in.).

Assemble Pistons And Connecting Rod Assemblies 1225-016

Tools Needed		A
5F9059	Ring Expander	1



A92225X2

1. Install connecting rod (1) in the piston with the boss on small end of connecting rod on the same side as the hole (crater) in top of the piston.

2. Install piston pin (2) and snap ring (3).

3. When old pistons are to be used, clean the piston grooves with an acceptable ring groove cleaner.

4. Install the spring for the oil ring. Install the oil ring with tool (A). The gap in the ring must be approximately 180° from the oil ring spring connections.

Crankshaft Pulley

5. Install the compression ring with tool (B). The side of the ring that has the identification "TOP" must be toward the top of the piston. The gaps in the rings must be approximately 120° apart.

NOTE: Compression rings that do not have identification must be installed with the edge that has the bevel toward the top of the piston.

6. Install connecting rod bearings.

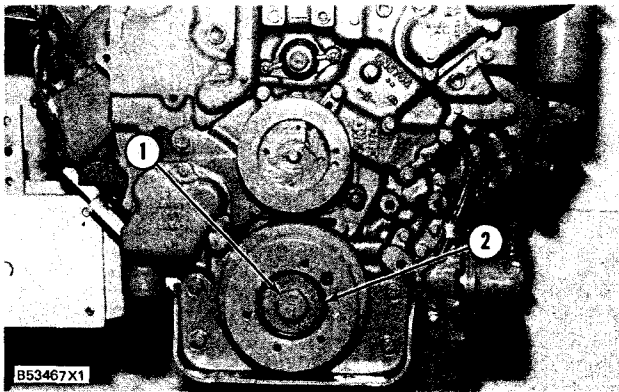
END BY:

- a. install pistons and connecting rod assemblies

Remove Crankshaft Pulley 1205-011

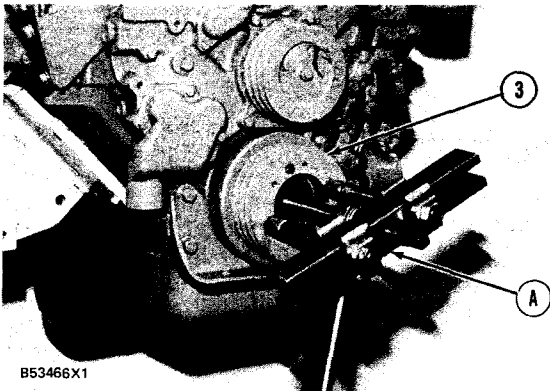
Tools Needed		A
8B7548	Push-Puller	1
8B7557	Adapter	2
8H684	Ratchet Wrench	1
8B7561	Step Plate	1

1. Remove fan. See Remove Fan And Fan Drive.



2. Loosen the tension on the V-belts, and disconnect the V-belts from the crankshaft pulley.

3. Remove bolt (1) and washer (2) from the crankshaft.

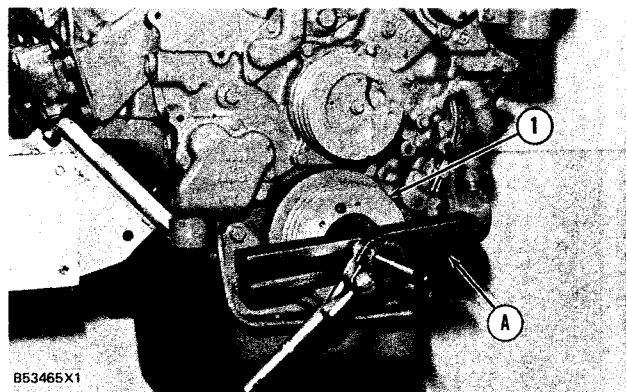


4. Use tooling (A) to pull crankshaft pulley (3) from the crankshaft.

Crankshaft Pulley

Install Crankshaft Pulley 1205-012

Tools Needed		A
8B7548	Push-Puller (without legs)	1
8H684	Ratchet Wrench	1



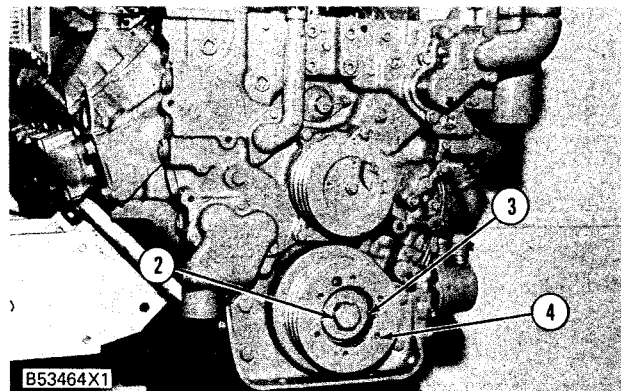
1. Put clean engine oil on the lip of the front crankshaft seal and seal surface of the crankshaft pulley.

2. Put crankshaft pulley (1) in position on end of the crankshaft.

NOTICE

The bolt (2) and washer (3) must not be used to install pulley (1) on the crankshaft.

3. Install the screw of tooling (A) in the end of the crankshaft. Put crossbar of tooling (A) on screw and against the pulley. Use tooling (A) to push the pulley on to crankshaft until it makes contact with the crankshaft gear inside timing gear housing. Remove tooling (A).



4. Install washer (3) and bolt (2) in the end of the crankshaft. Tighten the bolt to a torque of $624 \pm 80 \text{ N}\cdot\text{m}$ ($460 \pm 60 \text{ lb}\cdot\text{ft.}$).

5. Make sure surface (4) of pulley (1) is clean prior to installation of the alternator drive pulley.

6. Install the V-belts, and make an adjustment to the belt tension. See the V-Belt Tension Chart in the Specifications.

7. Install fan. See Install Fan And Fan Drive.

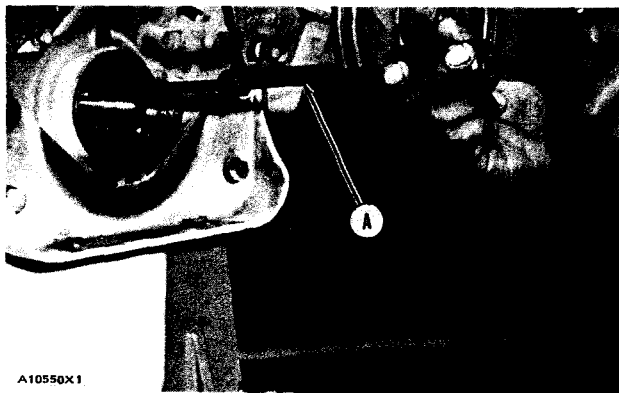
Crankshaft Front Seal

Remove Crankshaft Front Seal 1160-011

Tools Needed		A
1P3075	Puller Group	1

START BY:

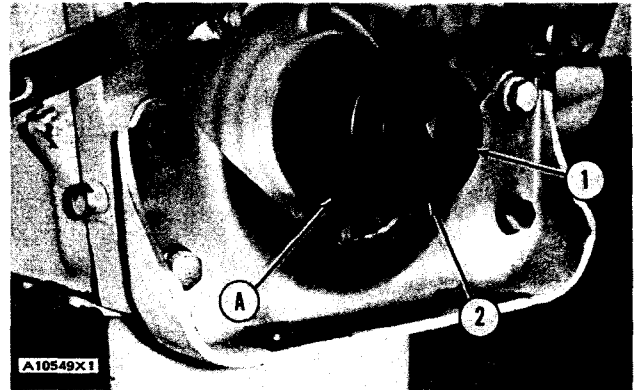
- a. remove crankshaft pulley



1. Remove the front seal with tool group (A).

Install Crankshaft Front Seal 1160-012

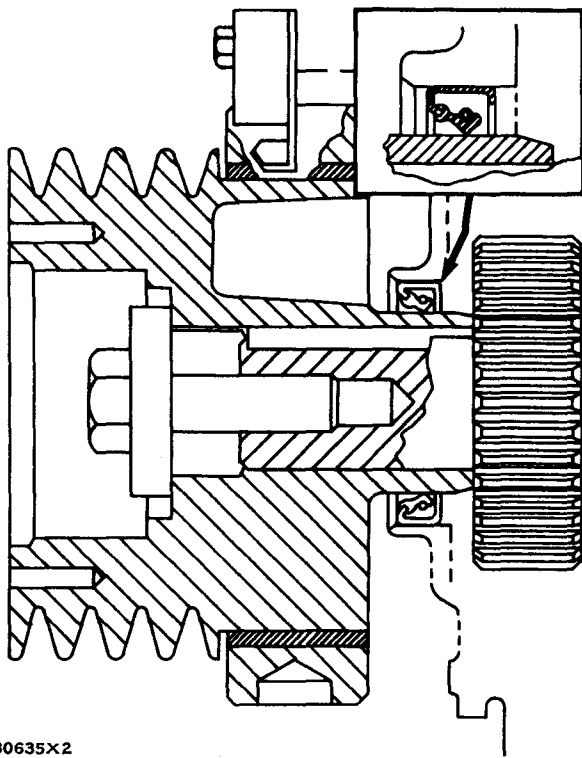
Tools Needed		A
5P4194	Installer Assembly	1
2H3745	Bolt (1"-14 NF x 2 3/4 in. long)	1



1. Put 7F2770 Cement on the outer metal surface of the front seal. Put the seal in position on the short end of the installer assembly (A). The lip of the seal must be toward the inside of the engine.

NOTE: If a new wear surface for the front seal is needed, put the spacer from tooling (A) between the seal and flange of the installer assembly.

Crankshaft Front Seal



30635X2

2. Put the seal and installer assembly in position on the end of the crankshaft. Install washer (1) that is used to hold the crankshaft pulley and the 2H3745 Bolt. Tighten the bolt until the installer assembly makes contact with the crankshaft gear. Remove tooling (A) and washer (1).

END BY:

- a. install crankshaft pulley

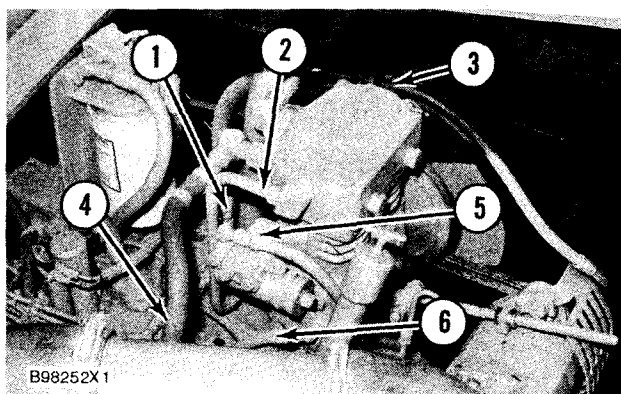
Air Compressor

Remove And Install Air Compressor 1065-010

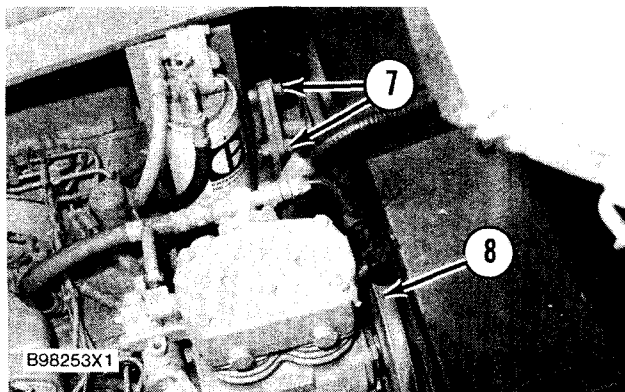
WARNING

Do not disconnect the air lines until the air pressure in the system is zero. Disconnecting lines under pressure can cause personal injury.

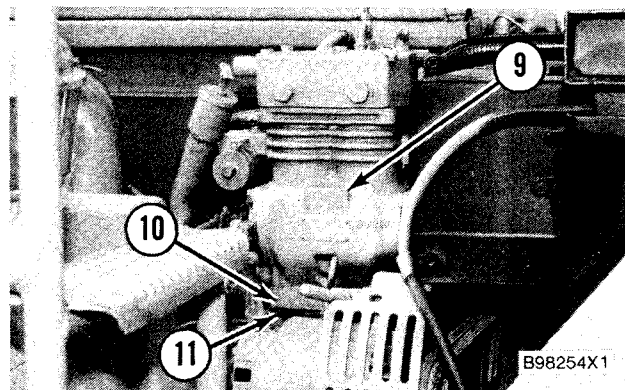
- 1.** Remove air pressure from the air reservoirs.
- 2.** Drain the coolant from the cooling system.



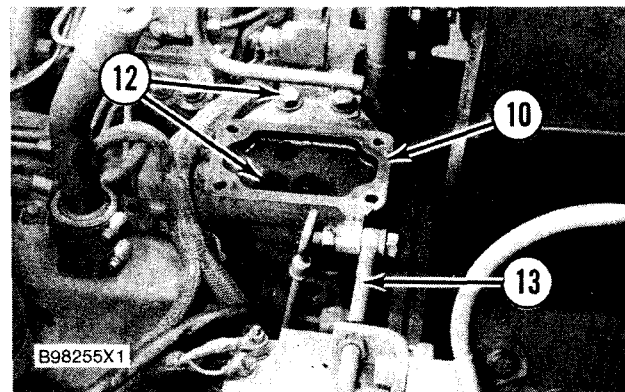
- 3.** Put identification marks on air compressor tubes and hoses for installation purposes.
- 4.** Disconnect hose assemblies (1), (3), (5), (6) and tube assembly (2) from the air compressor. Hose assembly (4) is disconnected from the inlet manifold.



5. Loosen two bolts (7), and remove belt (8) from the air compressor.



6. Remove four bolts (11) that fasten air compressor (9) to air compressor adapter (10). Remove air compressor (9).



7. Disconnect alternator adjustment rod (13), and remove four bolts (12) that fasten adapter (10) to the timing gear housing. Remove the adapter and gasket.

NOTE: For more information and to disassemble and assemble the air compressor, see Air Compressors, Form No. REGO0914-3.

8. Clean the gasket surface of the adapter and the timing gear cover.

9. Install the gasket, adapter (10) and alternator adjustment rod (13).

10. Install air compressor (9) on its adapter.

11. Install V-belt. See V-belt Tension Chart in Specifications for correct adjustment.

12. Install hose assemblies (1), (3), (4), (5), (6) and tube assembly (2).

13. Fill the cooling system. See the Maintenance Guide.

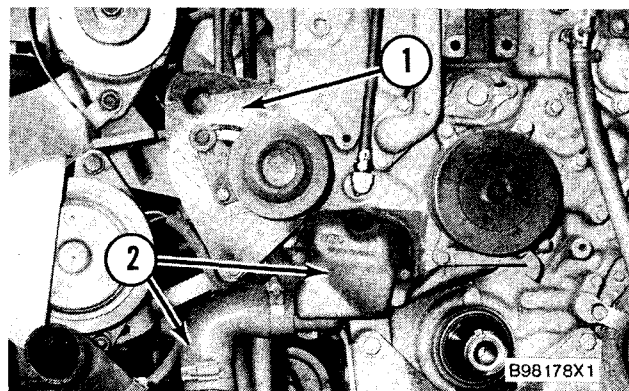
Timing Gear Cover And Oil Pump

Remove Timing Gear Cover And Oil Pump 1166 & 1304-011

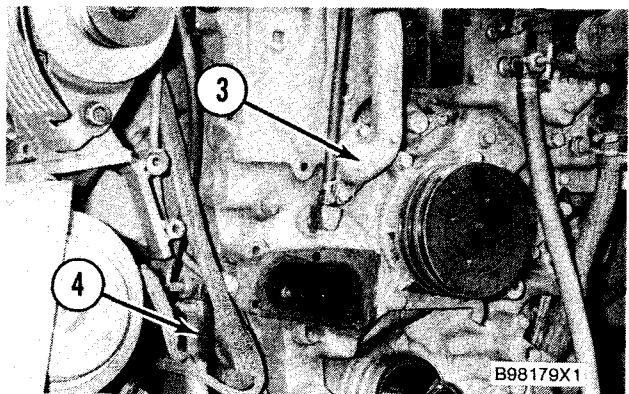
Tools Needed		A	B	C
6V116	Water Sleeve Removal Tool	1		
FT1321	Support Beam		1	
5P9736	Link Brackets			2

START BY:

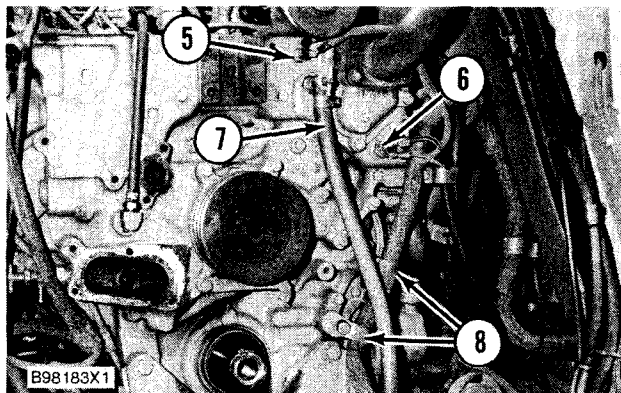
- a. remove oil pan
- b. remove crankshaft pulley
- c. remove air compressor
- d. remove fan and fan drive



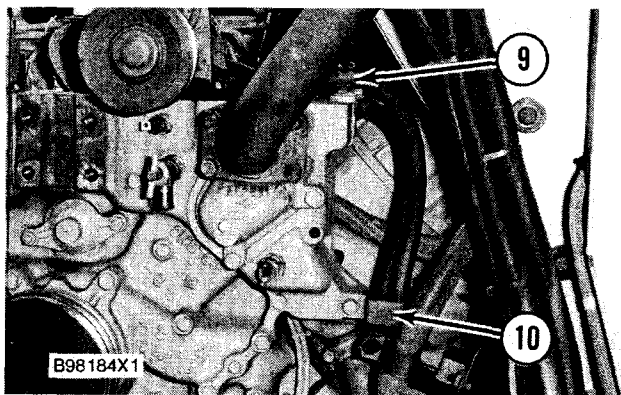
1. Remove idler pulley plate (1) and elbow and hose assembly (2) from the timing gear cover.



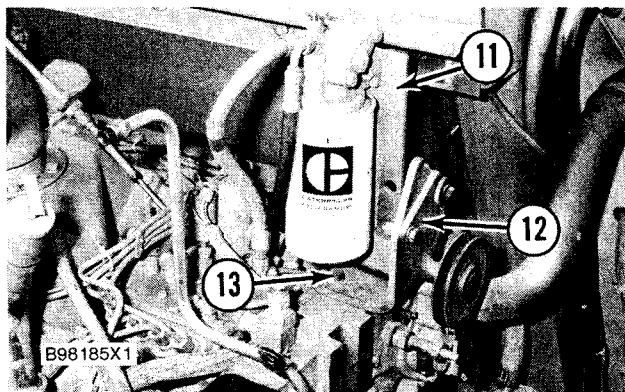
2. Remove connector (3), and disconnect hose assembly (4).



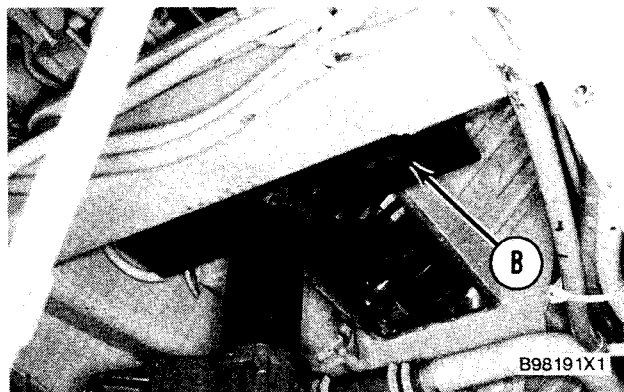
3. Disconnect wiring harnesses from switches (5) and (6).
4. Remove wiring harness clips (8) from the timing gear cover.
5. Loosen the clamp, and disconnect hose (7).



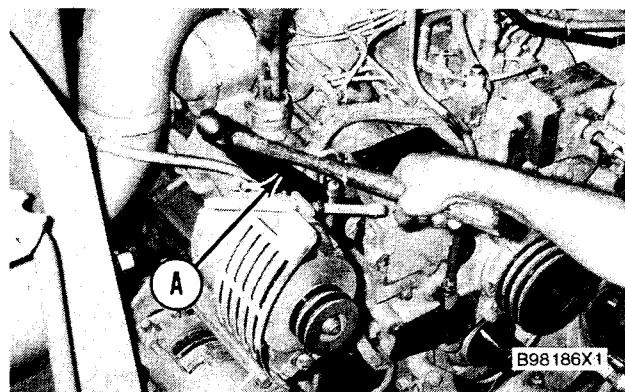
6. Disconnect hose clips (9) and (10).



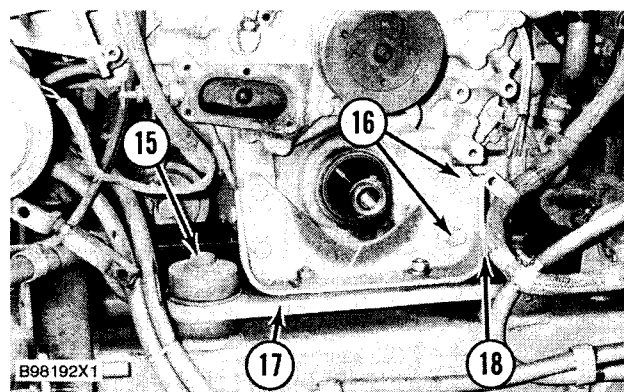
7. Remove four bolts (13) and pulley bracket (12). Move the fuel filter base bracket (11) from the top of the timing gear cover.



10. Install tooling (B) and a suitable hydraulic jack beneath the cylinder block.

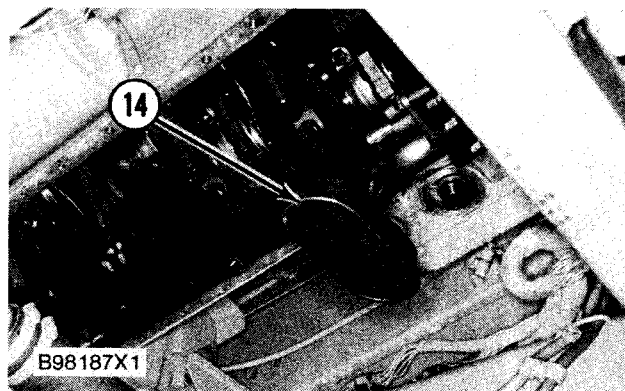


8. Remove the clips from the water sleeve, and install tool (A) on the water sleeve, and push it into the timing gear cover.

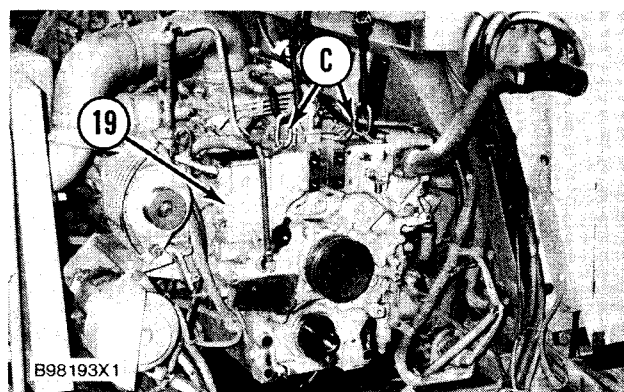


11. Remove four bolts (16) that fasten the engine support (18) to the cylinder block.

12. Remove two bolts (15) and support (17) from the frame.



9. Remove suction bell assembly (14) from the oil pump.



13. Install tooling (C) and a hoist on the front timing gear cover.

Timing Gear Cover And Oil Pump

14. Remove all the bolts that hold timing gear cover (19) to the cylinder block. Remove timing gear cover (19) and the oil pump. The weight of the timing gear cover and oil pump is 62 kg (136 lb.).

NOTICE

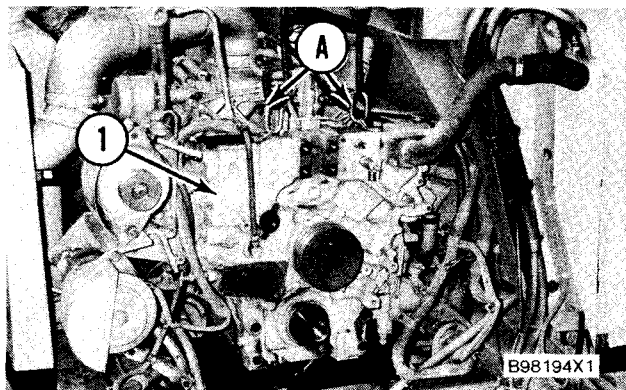
Be extra careful not to cause damage to the crankshaft front seal during removal and installation of the timing gear cover.

Install Timing Gear Cover And Oil Pump 1166 & 1304-012

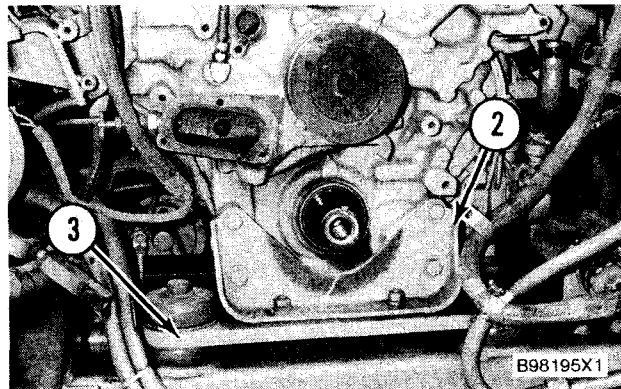
Tools Needed		A	B	C
5P9736	Link Brackets	2		
FT1321	Support Beam		1	
6V116	Water Sleeve Removal Tool			1

1. Clean the contact surfaces of the cylinder block and timing gear cover. Install the timing gear cover gasket on the cylinder block.

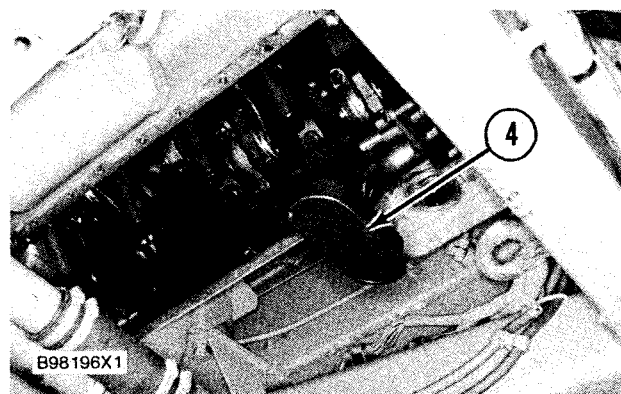
NOTE: Make sure the water sleeves are installed in the timing gear cover. Put oil on the seals of the water pump sleeves.



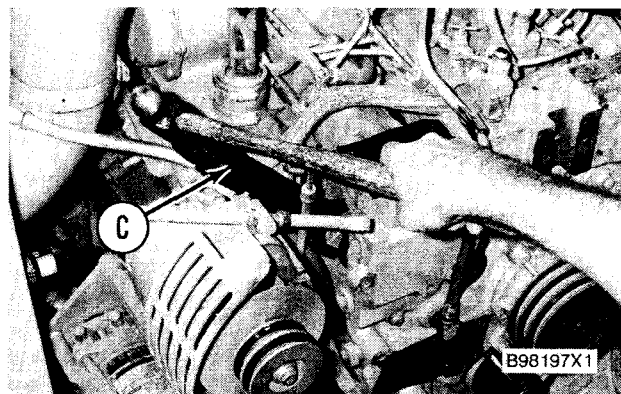
2. Install tooling (A) on timing gear cover (1). Install the timing gear cover and oil pump on the cylinder block.



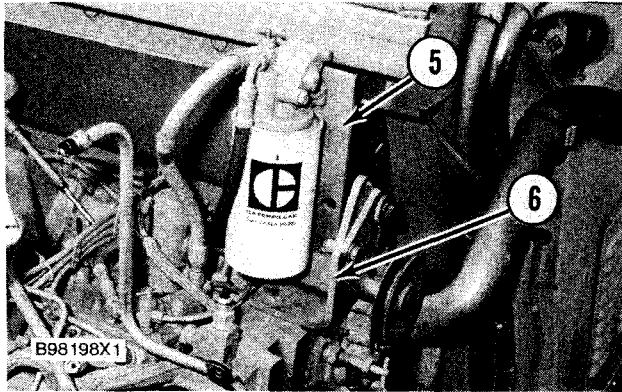
3. Install supports (2) and (3) to the cylinder block and frame.



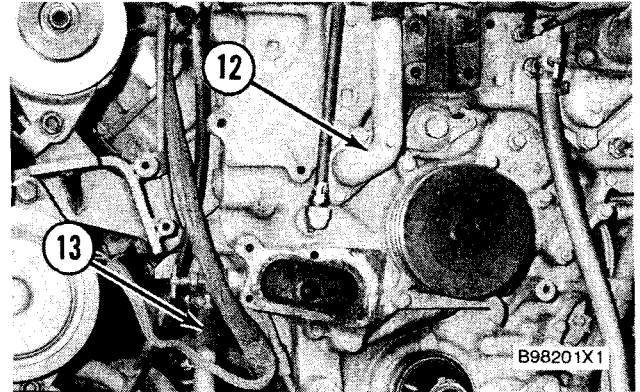
4. Remove tooling (B), and install suction bell (4) on the oil pump.



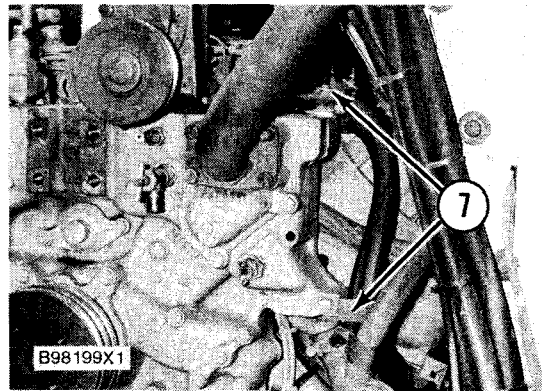
5. Install tool (C) on the water sleeve, and push water sleeve into the cylinder block.



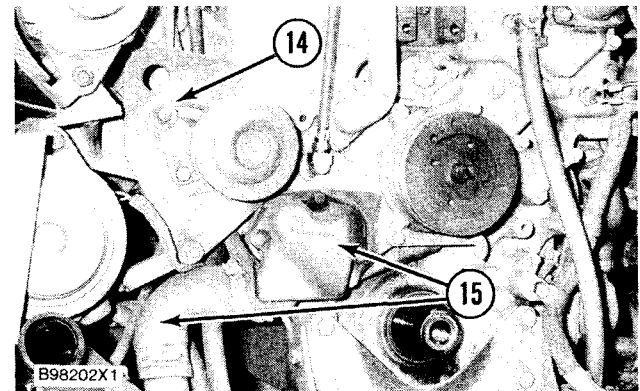
6. Install fuel filter base bracket (5) and pulley bracket (6) in position.



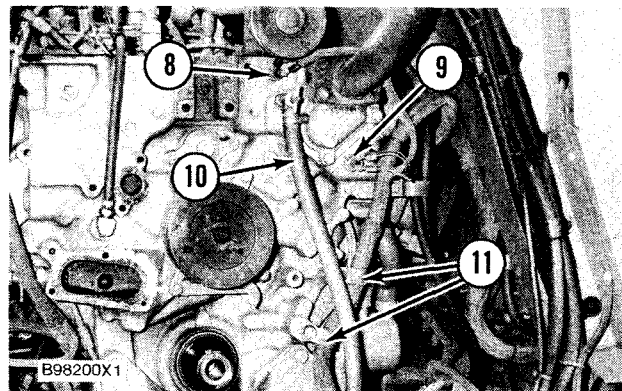
9. Install connector (12) on the timing gear cover and hose assembly (13) to the valve.



7. Install water hose clips (7) on the timing gear cover.



10. Install hose and elbow (15) on the timing gear cover. Install idler pulley plate (14).



8. Connect water hose (10), and install wiring harness clips (11). Connect the wiring harness to switches (8) and (9).

END BY:

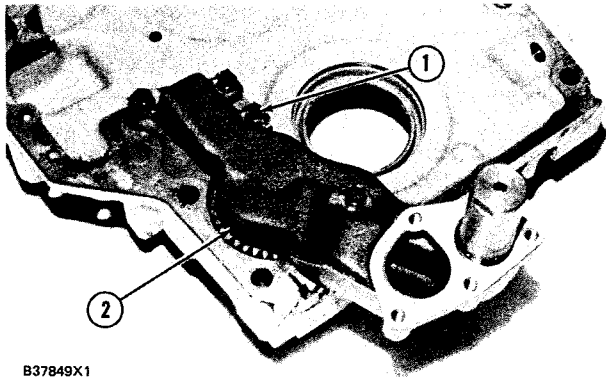
- a. install fan and fan drive
- b. install air compressor
- c. install crankshaft pulley
- d. install oil pan

Oil Pump And Relief Valve

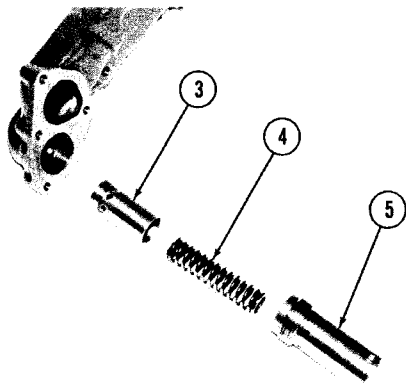
Remove Oil Pump And Relief Valve 1304 & 1315-011

START BY:

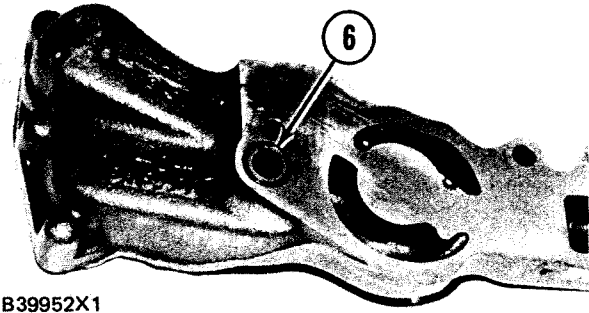
- a. remove timing gear cover and oil pump



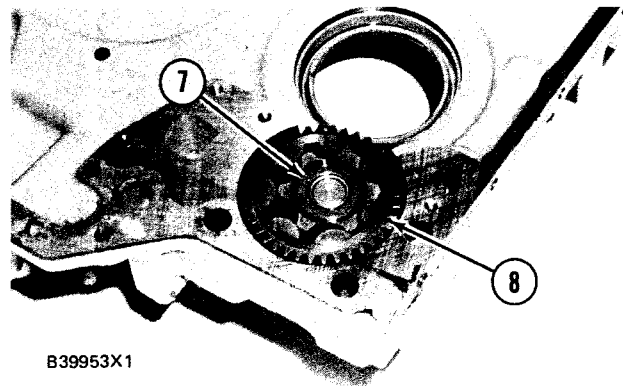
1. Bend the locks away from bolts (1), and remove the bolts. Remove cover (2) from the timing gear cover.



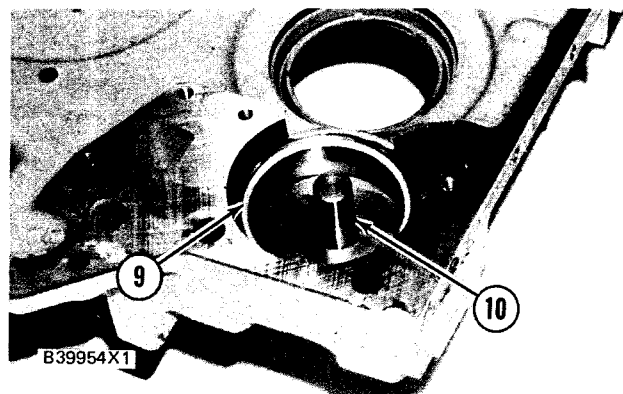
2. Remove guide (5), spring (4) and plunger (3) from the cover.



3. Remove O-ring seal (6) from the back of the cover.



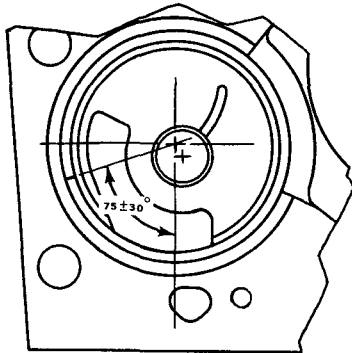
4. Remove inner rotor (7) and outer rotor (8) from the timing gear cover.



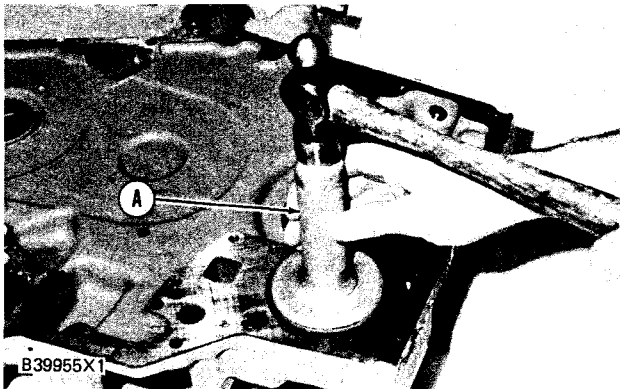
5. Measure the inside diameter of bearing (9). The inside diameter must be 71.224 ± 0.056 mm ($2.8041 \pm .0022$ in.). Remove bearing (9) only if a replacement is necessary. Remove shaft (10) if a replacement is necessary.

Install Oil Pump And Relief Valve 1304 & 1315-012

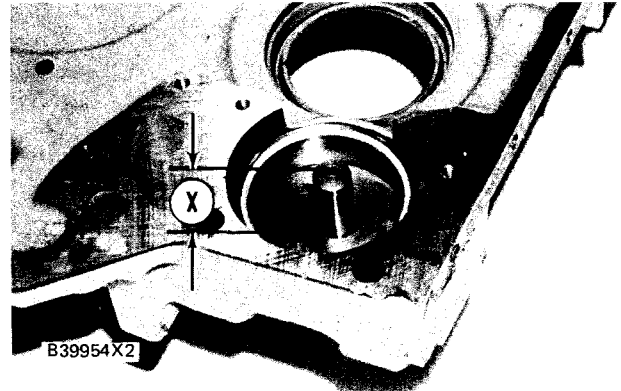
Tools Needed		A
8S2285	Driver Assembly	1



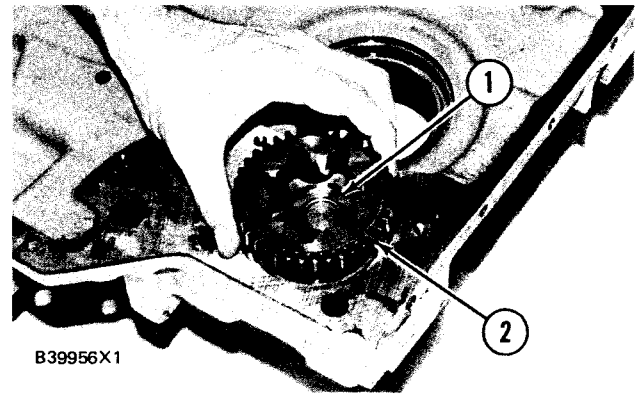
A51104X2



1. Thoroughly clean all of the parts. Put oil on all of the pump parts.
2. If the bearing was removed from the timing gear cover, install a new bearing with tool (A). Make sure the bearing is installed with the joint in the position shown in the illustration.

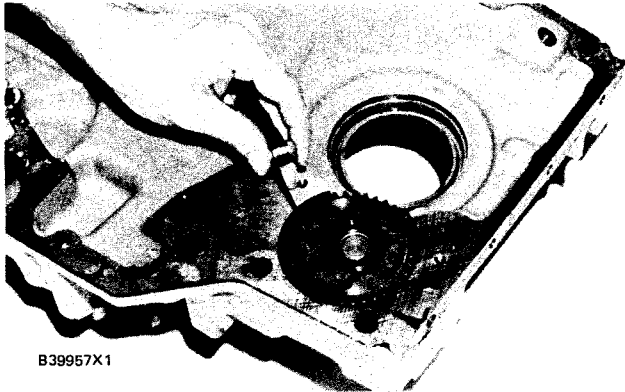


3. If the shaft was removed from the timing gear cover, install the new shaft so dimension "X" from the top of the shaft to the counterbore in the cover is 36.14 ± 0.25 mm ($1.423 \pm .010$ in.).



4. Install inner rotor (1) and outer rotor (2) in the timing gear cover.

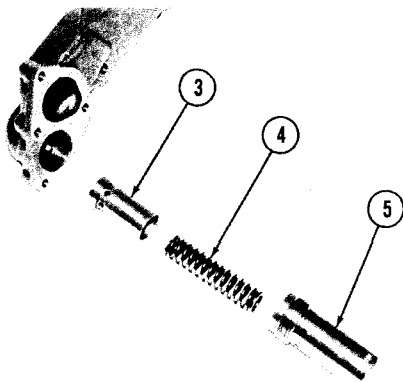
Oil Pump And Relief Valve



B39957X1

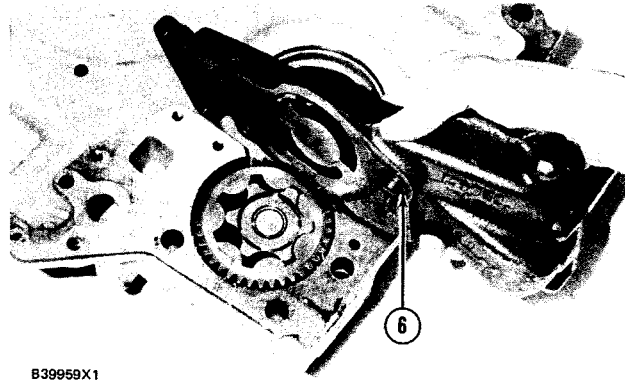
5. Measure the clearance between the rotors with a feeler gauge. The clearance must be 0.05 to 0.20 mm (.002 to .008 in.). The maximum permissible clearance is 0.28 mm (.011 in.).

NOTE: Make a replacement of BOTH rotors if the clearance is not correct. The rotors can not be ordered separately.



B39958X1

6. Put plunger (3), spring (4) and guide (5) in the cover. Use a 1-1/8 in. crowfoot wrench and torque wrench to tighten guide (5) to a torque of 40 ± 7 N•m (30 ± 5 lb.ft.). A slide rule type torque computer, Form No. SEHS7150, is available to find the torque wrench dial reading for different extensions.



B39959X1

7. Install O-ring seal (6) on the cover, and put the cover in position on the timing gear cover. Install the locks and bolts that hold the cover in place.



B39960X1

8. Check the oil pump and clearance with a feeler gauge. The end clearance must be 0.069 to 0.135 mm (.0027 to .0053 in.).

NOTE: If the clearance is not correct, make a replacement of BOTH rotors or the cover.

END BY:

a. install timing gear cover and oil pump

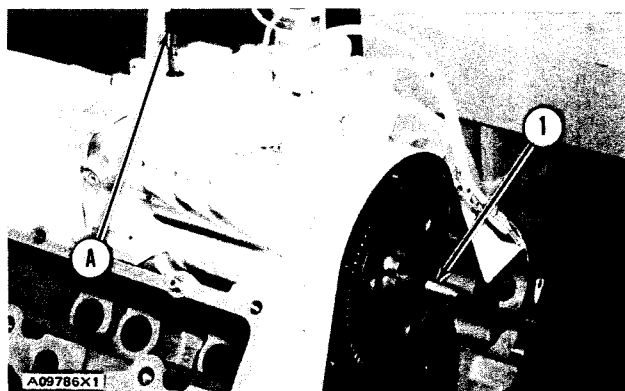
Camshaft And Gears

Remove Camshaft And Gears 1210 & 1212-011

Tools Needed		A	B
3P1544	Timing Pin	1	
5P2371	Puller Plate		1
	Bolt (1/4"-20 NC x 1" long)		2
	Flat Washer		2

START BY:

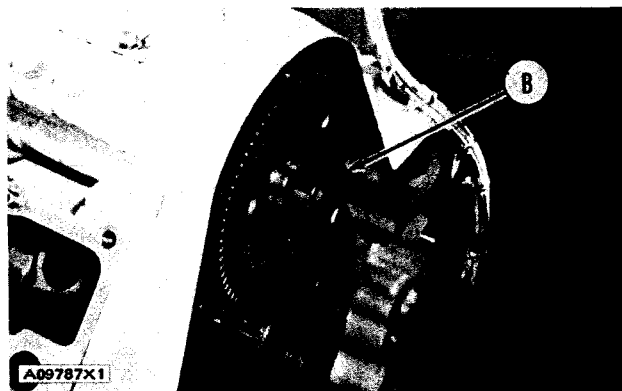
- a. remove timing gear cover and oil pump
- b. remove valve lifters
- c. remove turbocharger



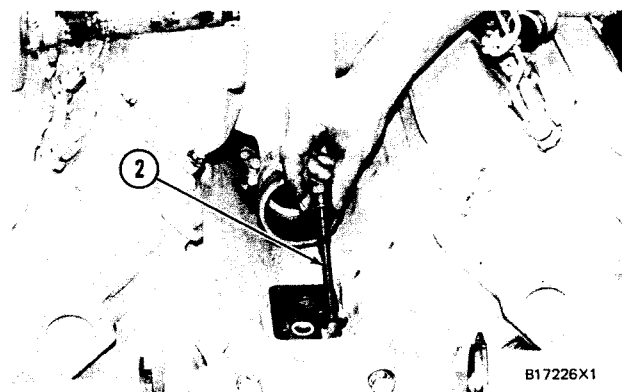
1. Remove the plug from the fuel injection pump housing, and install timing pin (A).

2. While the crankshaft is turned clockwise (as seen from the front of the engine), push on tool (A) until it slides into the groove (slot) in the fuel injection pump camshaft.

3. Remove the tachometer drive adapter shaft (1).

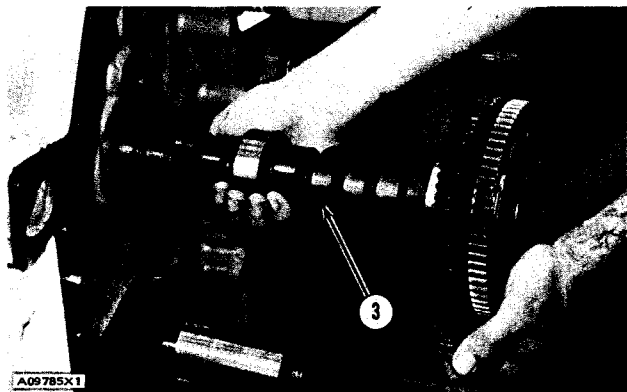


4. Install tooling (B) into the camshaft drive gear for the fuel injection pump. Turn both bolts evenly until the drive gear is free of the shaft. Remove tooling (B).



5. Remove thrust pin (2) that holds the camshaft in place from the rear of the cylinder block.

Camshaft And Gears

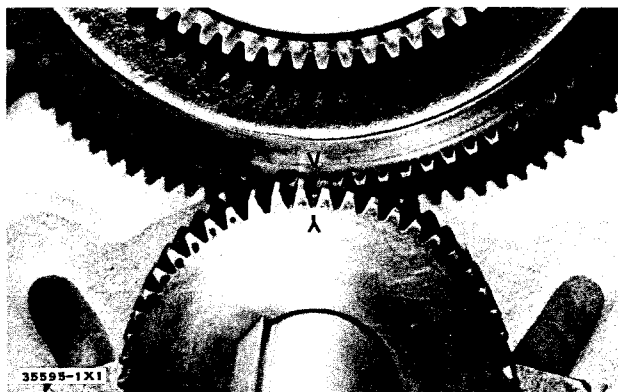


6. Remove the camshaft (3) and gears from the cylinder block as a unit. Be careful not to cause damage to the camshaft bearing or journals.

NOTE: The camshaft gear can be removed from the camshaft if a replacement is necessary.

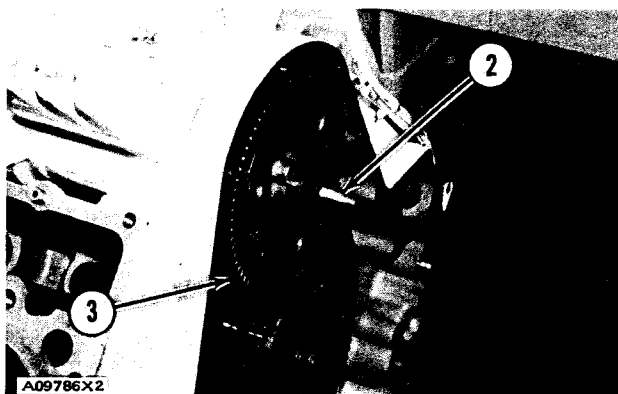
Install Camshaft And Gears 1210 & 1212-012

Tools Needed		A
3P1544	Timing Pin	1



1. Install the camshaft gear on the camshaft if it was removed. Heat the gear to a maximum temperature of 315°C (600°F). Put the gear in position on the camshaft. Put 2P2506 Thread Lubricant on the camshaft lobes. Install camshaft (1) and the gears as a unit. Make sure the timing marks on the crankshaft gear and camshaft gear are in alignment.

2. Install the thrust pin. Tighten the pin to a torque of $45 \pm 7 \text{ N}\cdot\text{m}$ ($35 \pm 5 \text{ lb}\cdot\text{ft.}$).

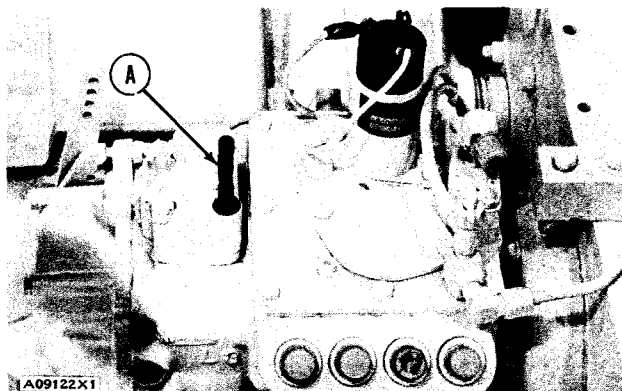


3. Put gear (3) in position, and install tachometer drive adapter shaft (2). Tighten the shaft to a torque of $149 \pm 14 \text{ N}\cdot\text{m}$ ($110 \pm 10 \text{ lb}\cdot\text{ft.}$).



4. After valve lifters and timing gear cover have been installed, check the timing as follows:

- a. Remove timing pin (A).
- b. Turn the crankshaft clockwise as seen from the front of the engine approximately 1/2 turn. Install timing pin (A) again.
- c. While turning the crankshaft clockwise, push on timing pin (A) until it slides into the groove (slot) in the fuel injection pump camshaft.
- d. Remove the plug from the timing hole in the front cover, and install a 5/16"-18 NC bolt (4) 2 1/2 in. long. The cover bolt from hole (5) can be used. Check to make sure bolt (4) can be installed into the timing gear and is in the center of the timing hole. The camshaft for the fuel injection pump is now in correct time with the engine.
- e. Remove the bolt, and install the plug. Remove timing pin (A), and install the plug.



NOTE: If the bolt can not be installed in the hole of camshaft gear, the timing must be corrected as follows:

- a. With timing pin (A) installed, remove the tachometer drive adapter housing and shaft.
- b. Loosen the gear from the fuel injection pump camshaft. Turn the crankshaft clockwise approximately two full turns until bolt (4) can be installed. Install the bolt.
- c. Install tachometer drive adapter shaft, and tighten it to a torque of $149 \pm 14 \text{ N}\cdot\text{m}$ ($110 \pm 10 \text{ lb}\cdot\text{ft.}$). Install adapter housing. Remove the bolt and timing pin, and install the plugs.

END BY:

- a. install valve lifters
- b. install timing gear cover and oil pump
- c. install turbocharger

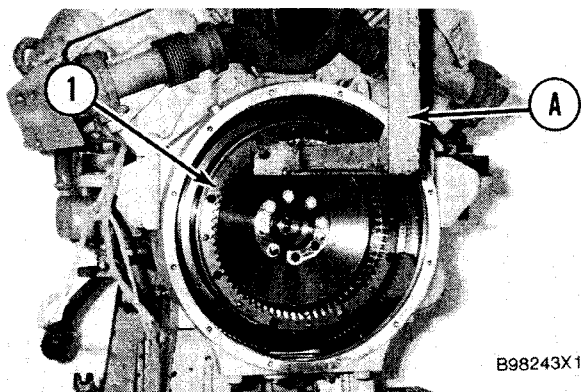
Flywheel

Remove Flywheel 1156-011

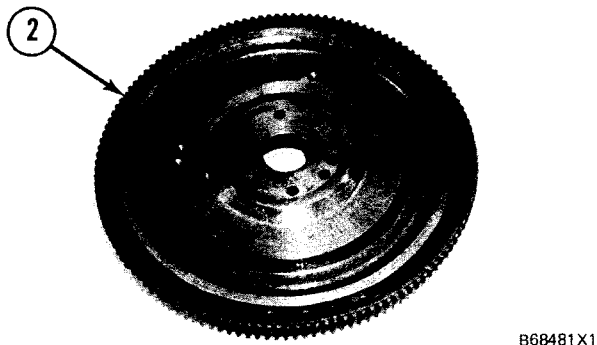
Tools Needed		A
FT120	Lifting Bracket	1

START BY:

- a. remove engine



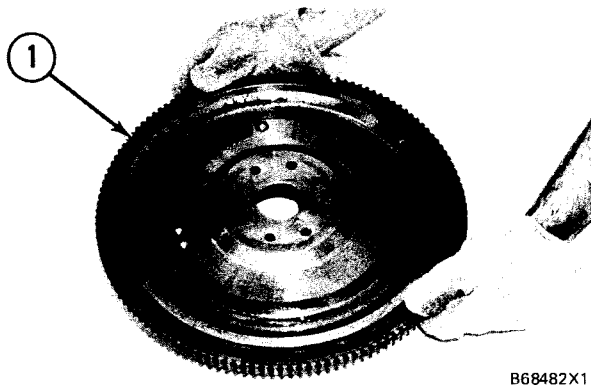
1. Fasten a hoist to flywheel (1) with tool (A).
2. Remove the bolts, and remove flywheel (1) from the end of the crankshaft and the flywheel housing. The weight of the flywheel is 28 kg (62 lb.).



3. If necessary, remove ring gear (2) from the flywheel.

Install Flywheel 1156-012

Tools Needed		A
FT120	Lifting Bracket	1



1. If necessary, heat ring gear (1) to a maximum temperature of 204°C (400°F), and install it on the flywheel. Make sure the ring gear is against the shoulder of the flywheel and the part number is toward the engine.

NOTE: Make sure the correct sealant is put on the bolt threads. The holes for the bolts in the crankshaft flange are drilled through so the holes are open to the oil in the engine. Leakage along the bolt threads can be the result if the correct sealant is not used.

NOTICE

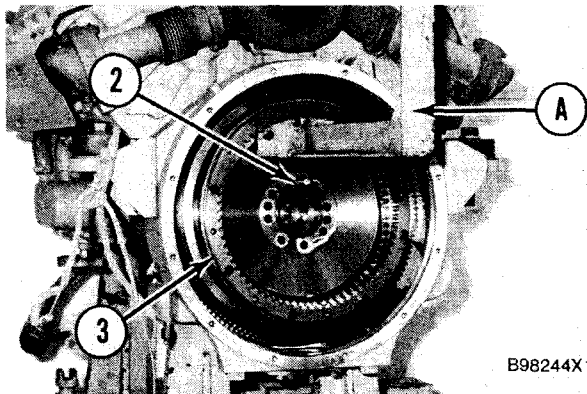
When a new flywheel is installed, check the thickness of the new flywheel at the bolt holes in relation to the thickness of the old flywheel. Install the correct length bolts so they will be fully engaged in the crankshaft flange. Bolts that are too long will make contact with the block on the back side of the crankshaft flange, and pull the crankshaft back. This will cause the crankshaft thrust bearing to fail.

Flywheel Housing

Remove And Install Flywheel Housing 1157-010

START BY:

- a. remove electric starter motor
- b. remove engine
- c. remove flywheel



2. Install a 5/8"-18 NF guide bolt (2) in the end of the crankshaft.

3. Fasten a hoist to flywheel (3) with tool (A). Make sure the dash mark on the flywheel and the dash mark on the crankshaft are in alignment. Put flywheel (3) in position on the guide bolts and the end of the crankshaft. Put 5P3413 Sealant on the threads of the flywheel bolts. Install the flywheel bolts, and remove the guide bolt. Install the last flywheel bolt, and tighten all the bolts to a torque of $75 \pm 7 \text{ N}\cdot\text{m}$ ($55 \pm 5 \text{ lb}\cdot\text{ft.}$).

END BY:

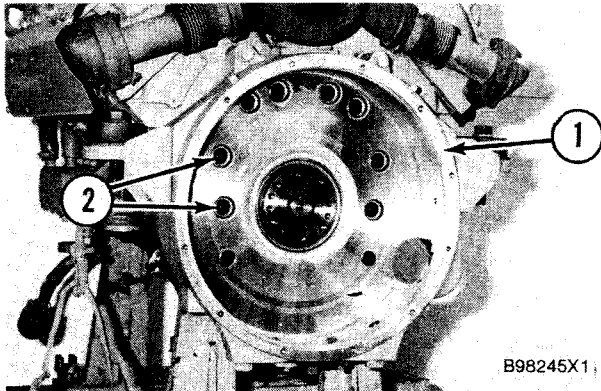
- a. install engine

NOTICE

Any time the rear crankshaft seal is removed from the wear sleeve, the seal and sleeve become scrap. A new seal and sleeve must be installed as a unit for replacement purposes.

- 1.** See Specifications, Form No. SENR2763, to check the flywheel housing bore to determine if the housing is acceptable for use.

Flywheel Housing



2. Remove bolts (2) and flywheel housing (1) from the cylinder block.

3. Remove the flywheel housing gasket, and clean the flywheel housing to cylinder block contact surfaces.

4. Install two 3/8"-16 NC guide bolts with a minimum length of 101.6 mm (4.00 in.).

5. Put flywheel housing (1) in position over the guide bolts. Install bolts (2) to hold the flywheel housing, and remove the guide bolts. Install the last two bolts, and tighten all the bolts to their standard torques.

END BY:

- a. install flywheel
- b. install engine
- c. install electric starter motor

Crankshaft Rear Seal And Wear Sleeve

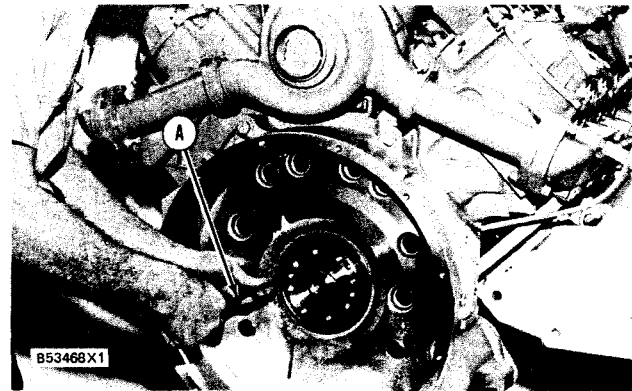
Remove Crankshaft Rear Seal And Wear Sleeve 1161-011

Tools Needed		A	B	C
1P3075	Puller Assembly	1		
5P7312	Distorter		1	
5P7338	Ring			1

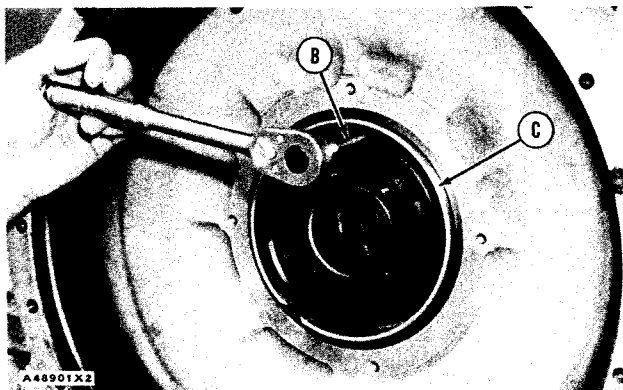
START BY:

- a. remove flywheel

NOTE: Any time the crankshaft seal is removed from the wear sleeve, a new sleeve and seal must be installed as a unit. If the seal is put back on the sleeve, the seal will be damaged.



- 1.** Remove the crankshaft rear seal from the flywheel housing with tooling (A).



2. Install tool (C) in the rear seal bore.

3. Install tool (B) between tool (C) and the wear sleeve. Turn tool (B) until the edge of the tool makes a flat place (crease) in the wear sleeve. Do this in two or more places until the wear sleeve is loose.

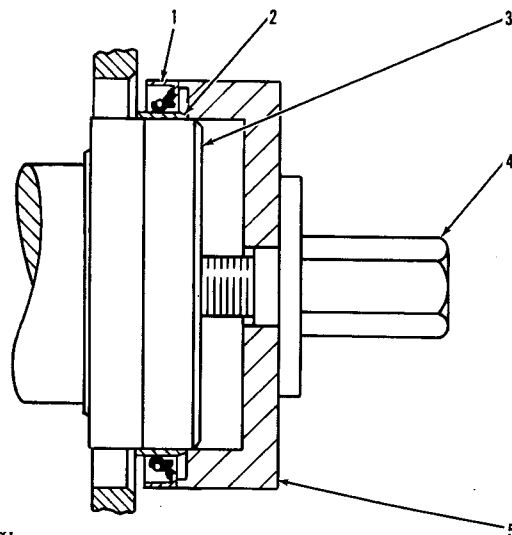
4. Remove tool (C) and the wear sleeve by hand.

Install Crankshaft Rear Seal And Wear Sleeve 1161-012

Tools Needed		A
5P7293	Installer	1
5P290	Locator	1
1P5515	Bolt	2
9S8858	Nut	1

NOTICE

If the crankshaft seal and wear sleeve come apart during installation, the seal and sleeve become scrap and a new seal and sleeve must be installed as a unit.



1. Install the crankshaft rear seal and wear sleeve with tooling (A) as follows:

- Clean and make a preparation of the crankshaft outside diameter with 6V1541 Quick Cure Primer. Make an application of 9S3265 Retaining Compound to crankshaft outside diameter.
- Install locator (3) and the bolts on the rear of the crankshaft.
- Put wear sleeve (2) and seal (1) as a unit on locator (3) with the lip of the seal toward the front of the engine.
- Put installer (5) in position on the locator.
- Put clean engine oil on the face of nut (4), and install it on the locator. Tighten the nut until installer (5) is at bottom.
- Remove tooling (A), and check the wear sleeve and seal for the correct position after installation.

END BY:

- install flywheel

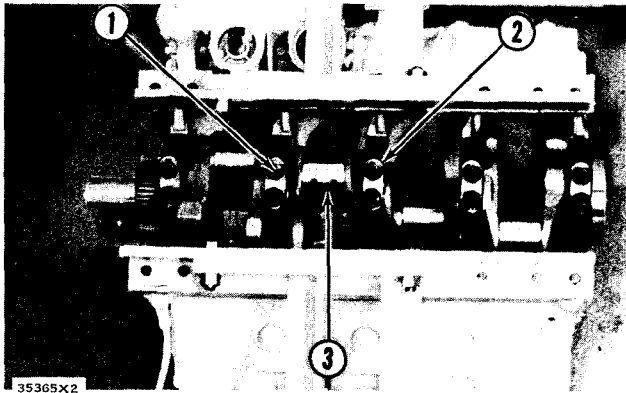
Crankshaft And Gear

Remove Crankshaft And Gear 1202 & 1204-011

Tools Needed		A	B
OTC Model 1730-A Engine Stand		1	
8B7551	Bearing Puller Attachment		1
1P820	Puller Group		1
8B7549	Leg		2
8B7561	Step Plate		1
3H465	Plate		4
1B4207	Nut		2
6V9061	Pump Group		1

START BY:

- a. remove flywheel housing
- b. remove valve lifters
- c. remove pistons
- d. remove timing gear cover and oil pump

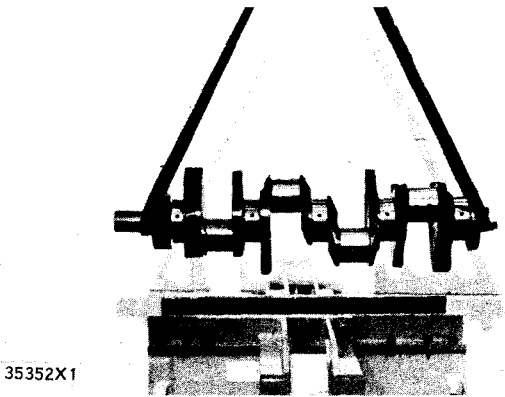


1. Fasten a hoist, and put the engine in position on tool (A).
2. Turn the crankshaft until the timing mark on the crankshaft gear is in alignment with the timing mark on the camshaft gear.

NOTE: For more detail about removal of main bearings, see Remove And Install Crankshaft Main Bearings.

3. Remove bolts (1) and main bearing caps (2). Remove the lower halves of the main bearings from the caps.

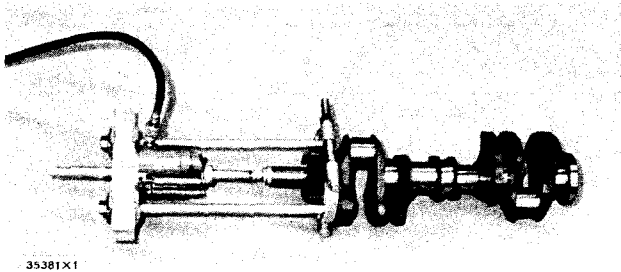
4. Install two of the bolts that hold the flywheel in place in the end of crankshaft.



NOTICE

Be careful not to cause damage to the crankshaft journals when the crankshaft is removed.

5. Fasten a hoist, and remove crankshaft (3) from the engine. Weight of the crankshaft is 54 kg (120 lb.).
6. Remove the upper halves of the main bearings from the cylinder block.



7. Install tooling (B), and remove the gear from the crankshaft.

Install Crankshaft And Gear 1202 & 1204-012

Tools Needed		A	B
8S2328	Dial Indicator Test Group	1	
	Plastigage		*

1. Install the key for the crankshaft gear so it is even with the end of the crankshaft.

2. Heat the crankshaft gear to a maximum temperature of 260°C (500°F). Install the gear on the crankshaft with the timing mark on the gear toward the pulley end of the crankshaft.

3. Install the thrust bearing for the No. 4 main.

NOTE: Install the bearings dry when the clearance checks are made. Put clean engine oil on the bearings for final assembly.

4. Install the upper main bearings (the bearings with oil hole) into the engine block.

5. Install two of the bolts that hold the flywheel in place in the end of the crankshaft. Fasten a hoist, and put the crankshaft in position in the block. Make sure the timing mark on the crankshaft gear is in alignment with the timing mark on the camshaft gear.

NOTE: For more detail about installation of main bearings, see Remove And Install Crankshaft Main Bearings.

NOTICE

When the bearing caps are installed, make sure the number on the side of the cap is next to and respective with the number on the engine block.

If the crankshaft journals and bores for the block and rods were measured at disassembly and found to be within specifications, no

further checks are necessary. However, if the serviceman still wants to measure the bearing clearances, Plastigage is recommended. Lead wire, shim stock or use of a dial bore gauge can damage the bearing surface.

The serviceman must be very careful to use Plastigage correctly. The following points must be remembered:

... Make sure that the backs of the bearings and the bores are clean and dry.

... Make sure that the bearing locking tabs are properly seated in their slots.

... The crankshaft must be free of oil where the Plastigage touches it.

... If the main bearing clearances are checked with the engine upright or on its side, the crankshaft must be supported. Use a jack under an adjacent crankshaft counterweight and hold the crankshaft against the crown of the bearing. If the crankshaft is not supported, the weight of the crankshaft will cause incorrect readings.

... Put a piece of Plastigage on the crown of the bearing half that is in the cap. Do not allow the Plastigage to extend over the edge of the bearing.

... Install the bearing cap using the correct torque-turn specifications. Do not use an impact wrench. Be careful not to dislodge the bearing when the cap is installed.

... Do not turn the crankshaft with the Plastigage installed.

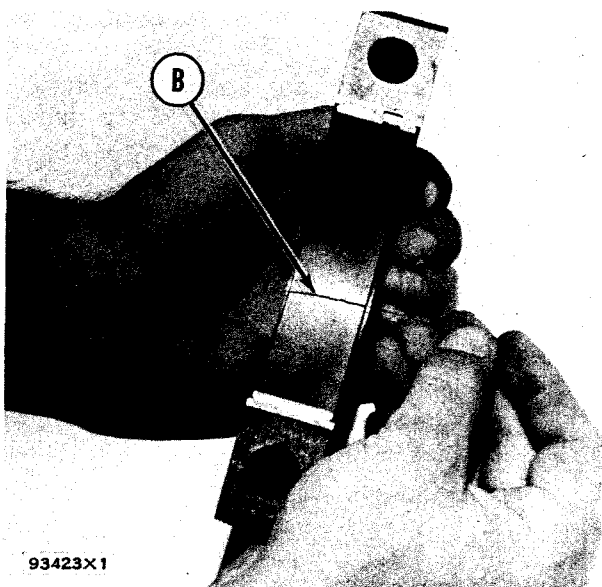
... Carefully remove the cap, but do not remove the Plastigage. Measure the width of the Plastigage while it is in the bearing cap or on the crankshaft journal. Do this by using the correct scale on the package. Record the measurements.

... Remove the Plastigage before reinstalling the cap.

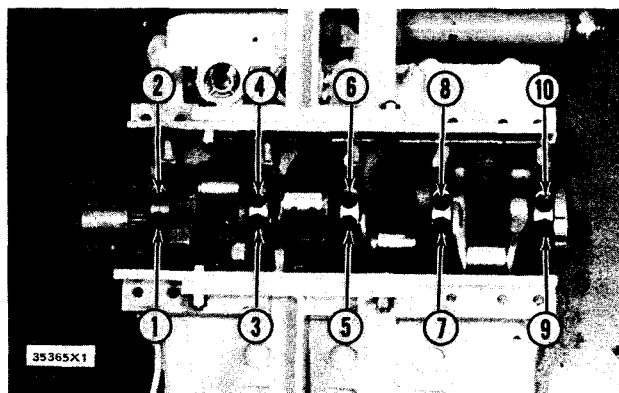
Crankshaft And Gear

When using Plastigage, the readings can sometimes be unclear. For example, all parts of the Plastigage are not the same width. Measure the major widths to make sure that they are within the specification range. Also, experience has shown that when checking clearances tighter than 0.10 mm (.004") the readings may be low by 0.013 to 0.025 mm (.0005 to .0010"). Out-of-round journals can give faulty readings. Also, journal taper may be indicated when one end of the Plastigage is wider than the other.

NOTE: When the bearing clearance is checked and the engine is in a vertical position, the crankshaft will have to be lifted up with a force equal to the weight of the crankshaft and held against the upper halves of the main bearings to get a correct measurement with Plastigage. The Plastigage will not hold the weight of the crankshaft and give a correct indication. If the engine is in a horizontal position, such as on an engine stand, it is not necessary to hold the crankshaft up. Do not turn crankshaft when Plastigage is in position to check clearance.



93423X1



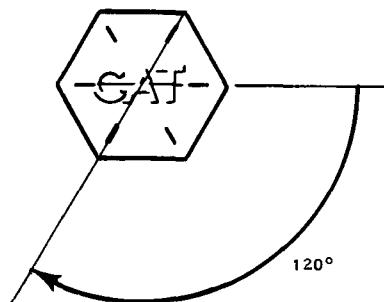
6. Check the bearing clearance with Plastigage (B). Put the lower main bearings into the caps. Put the caps in position, and install the bolts. Tighten the bolts in number sequence as follows:

a. Tighten bolts 1 through 10 to a torque of $40 \pm 4 \text{ N}\cdot\text{m}$ ($30 \pm 3 \text{ lb}\cdot\text{ft}$).

NOTICE

Do not use an impact wrench to tighten the nuts that additional $120 \pm 5^\circ$.

b. Put a mark on each bolt head and bearing cap. Tighten bolts 1 through 10 $120^\circ \pm 5^\circ$ more.



30912X1

7. Remove the bearing caps, and measure the thickness of Plastigage. The main bearing clearance must be 0.076 to 0.168 mm (.0030 to .0066 in.). The maximum permissible clearance is 0.18 mm (.007 in.).

Camshaft Bearings

8. Put 2P2506 Thread Lubricant on the bolt threads and washer faces. Put clean engine oil on the main bearings. Put the bearing caps in position, and install the bolts. Tighten the bolts in number sequence as follows:

- a. Tighten bolts 1 through 10 to a torque of $40 \pm 4 \text{ N}\cdot\text{m}$ ($30 \pm 3 \text{ lb}\cdot\text{ft.}$).
- b. Put a mark on each bolt head and bearing cap. Tighten bolts 1 through 10 $120^\circ \pm 5^\circ$ more.

9. Install indicator group (A), and check the end play of the crankshaft. The end play is controlled by the thrust bearing on No. 4 main bearing. The end play with new bearings must be $0.08 \pm 0.25 \text{ mm}$ (.003 to .010 in.). The maximum permissible end play with used bearing is 0.36 mm (.014 in.).

END BY:

- a. install timing gear cover and oil pump
- b. install pistons
- c. install valve lifters
- d. install flywheel housing

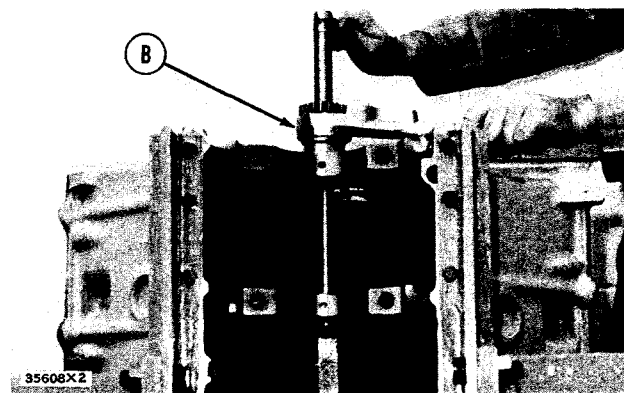
Remove Camshaft Bearings 1211-011

Tools Needed		A	B
1P5545	Adaper Group	1	
8S2241	Camshaft Bearing Installation And Removal Group		1
8H684	Ratchet Wrench		1

START BY:

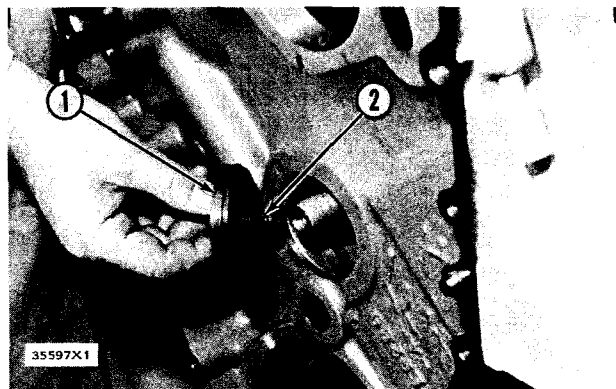
- a. remove crankshaft and gear
- b. remove camshaft and gears

NOTE: The crankshaft does not have to be removed for removal and installation of the camshaft bearings, but must be removed to correctly clean the oil passages in the cylinder block.



- 1.** Install tooling (B) through the flywheel housing end of the cylinder block.

Camshaft Bearings

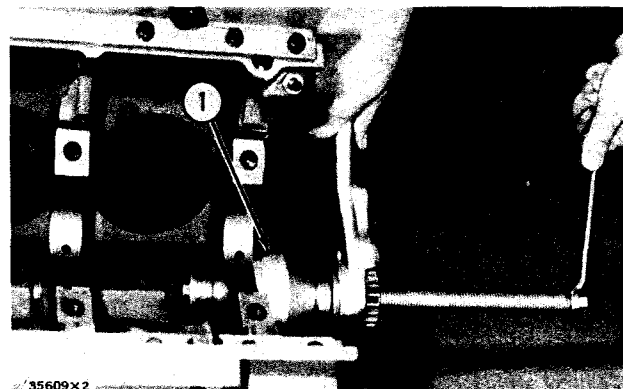


2. Install washer (1) and bolt (2) from tool group (A) in the end of the shaft of tooling (B). Remove the bearings from the cylinder block. Start with the front bearing.

3. Thoroughly clean the oil passages and surfaces where the camshaft and bearings fit.

Install Camshaft Bearings 1211-012

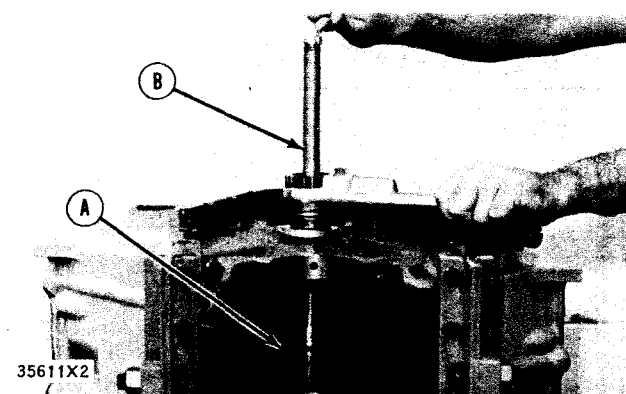
Tools Needed		A	B
1P5545	Adapter Group	1	
8S2241	Camshaft Bearing Installation And Removal Group		1
8H684	Ratchet Wrench		1



2. To install the front camshaft bearing, put tube (1) from tool group (B) in position shown with the tube over the boss on the front of the cylinder block, and pull the bearing into place. Make sure the oil holes in the bearings are in alignment with the oil holes in the cylinder block.

END BY:

- install camshaft and gears
- install crankshaft and gear

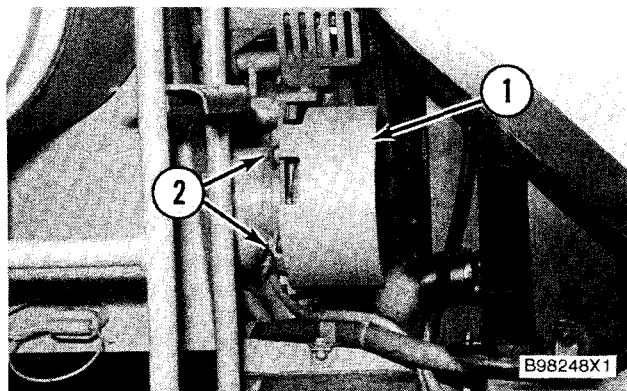


1. Start with the rear camshaft bearing, and install the bearings in the cylinder block with tooling (A) and (B). Make sure the oil holes in the bearing are in alignment with the oil holes in the cylinder block.

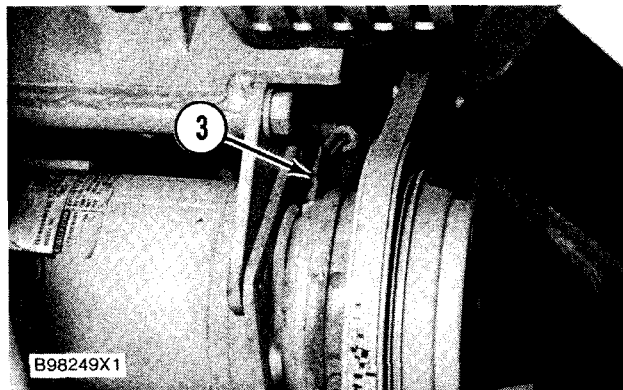
Air Conditioner Compressor

Remove And Install Air Conditioner Compressor 1802-010

1. Raise the hood for the engine compartment.



2. Remove two bolts (2) and belt guard (1).

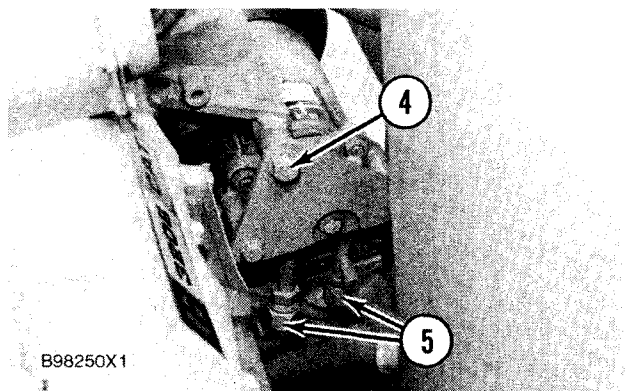


3. Disconnect two wires (3) from the compressor.

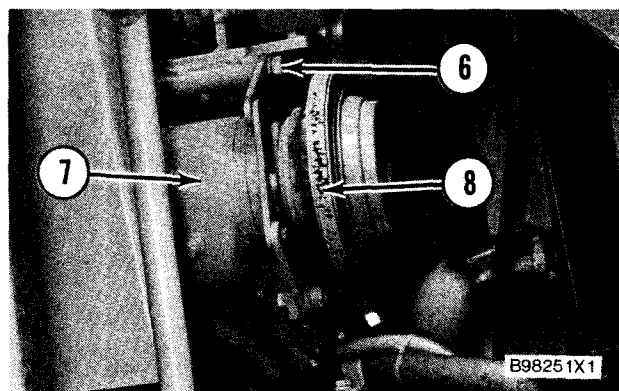
WARNING

Always wear goggles when the air conditioning system is opened. This system is charged with Freon-12 (CCL₂F₂ Dichlorodifluoromethane) which is not toxic or flammable. But there is a reason for caution. When Freon-12 makes contact with a flame, lethal phosgene gas is made. **INHALING FREON THROUGH A LIGHTED CIGARETTE CAN CAUSE VIOLENT ILLNESS.** This system is under pressure at all times, engine running or not. **HEAT MUST NEVER BE PUT ON A CHARGED SYSTEM.** See Air Conditioning And Heating Service Manual Form No. SENR7454 for more information on procedures and safety requirements on removal and installation of lines and refrigerant from the system.

Air Conditioner Compressor



4. Disconnect refrigerant lines (5) from the rear of the compressor. Remove bolt (4).



5. Remove bolt (6), V-belt (8) and compressor (7) from the engine compartment.

NOTE: The following steps are for the installation of the air conditioner compressor.

6. Put compressor (7) in position, and install bolts (6) and (4).

7. Install refrigerant lines (5).

8. Install electrical wires (3) and V-belt (8). See V-belt Tension Chart in Specifications for correct adjustment.

9. Install guard (1).

10. See Air Conditioning And Heating Service Manual, Form No. SENR7454, for correct procedure for evacuating and charging the system.

11. Close the hood for the engine compartment.

Engine

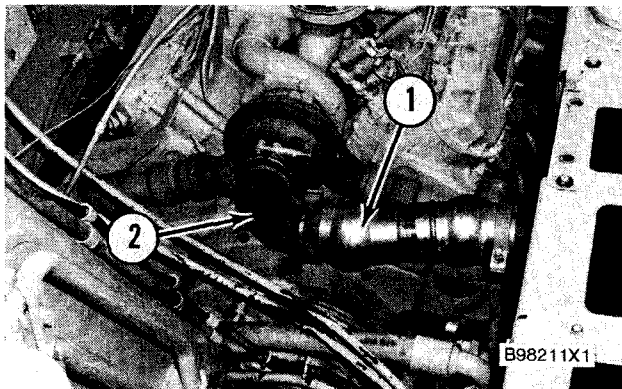
Remove Engine 1000-011

Tools Needed		A	B
6V6146	Load Leveler	1	
8S9906	Ratchet Puller	1	
5P9736	Link Bracket	1	
8S7620	Base Assembly		1
8S7650	Cylinder		1
8S7615	Pin		1
6V9061	Hand Pump Group		1

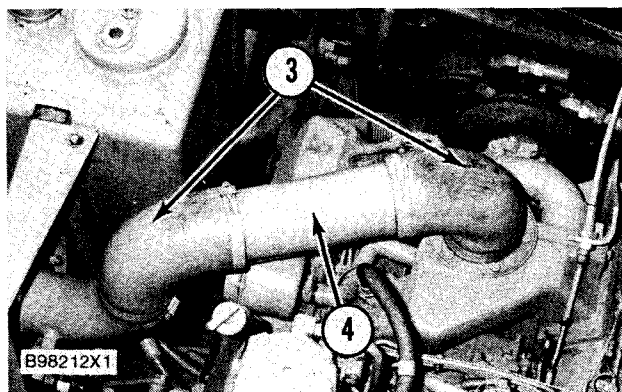
START BY:

- a. tilt cab*
- b. remove fan and fan drive
- c. remove oil pan

*See 615, 613C Operator Station, Disassembly And Assembly.



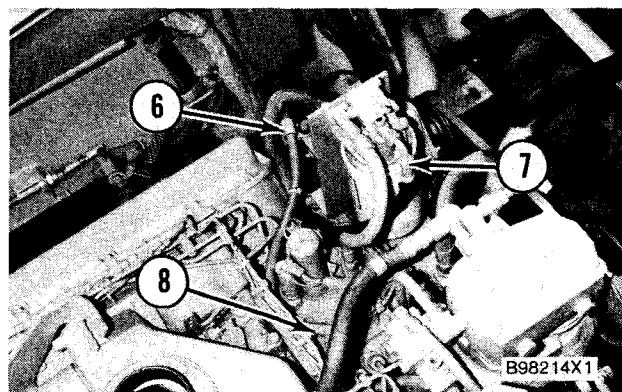
1. Loosen the clamps, and remove swivel assembly (1) and elbow (2).



2. Remove air inlet hoses (3) and tube (4) from the air cleaner and turbocharger.

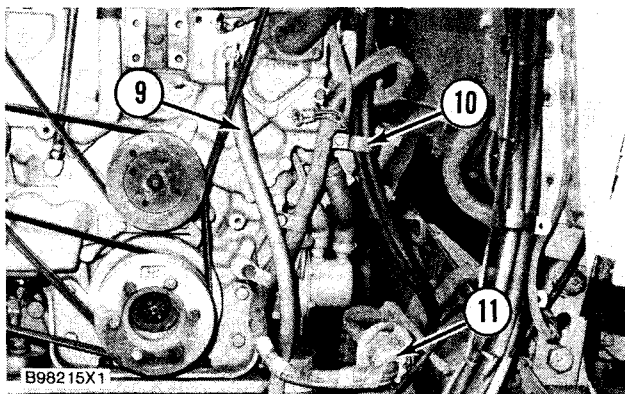


3. Disconnect governor control cable (5).

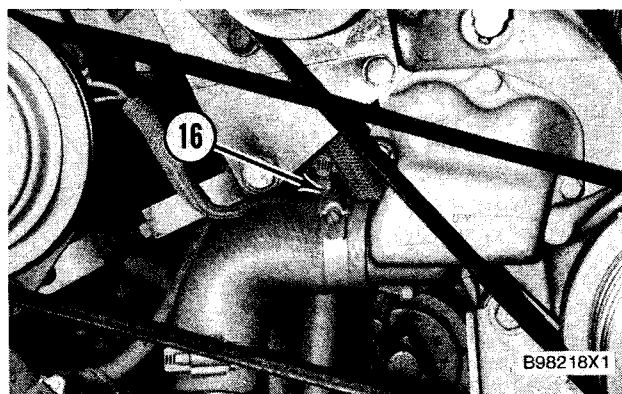


4. Disconnect fuel line (7) from the fuel filter base. Remove hose clip (6), and disconnect fuel line (8) from the fuel injection pump.

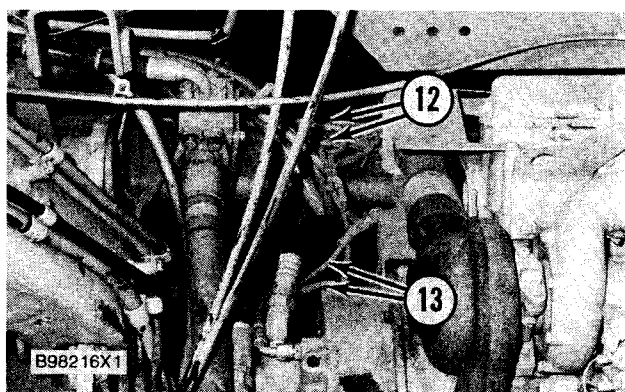
Engine



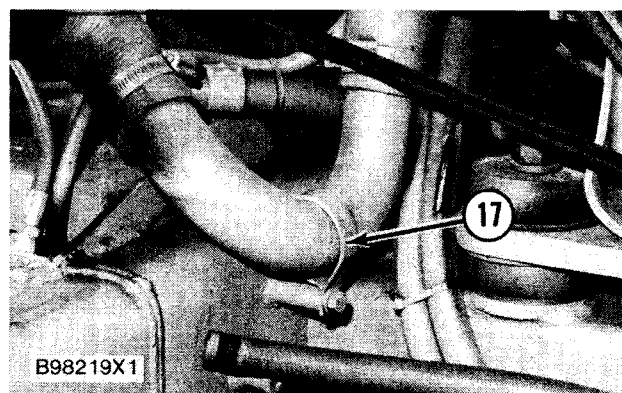
5. Disconnect hose assembly (9) and unplug wiring harness (11). Remove clip (10) from the timing gear cover.



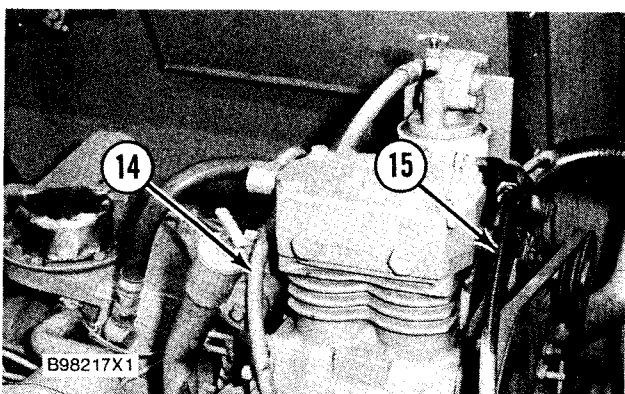
8. Disconnect hose assembly (16).



6. Disconnect two wires (13) from the torque converter. Disconnect two plugs (12) for the EMS.



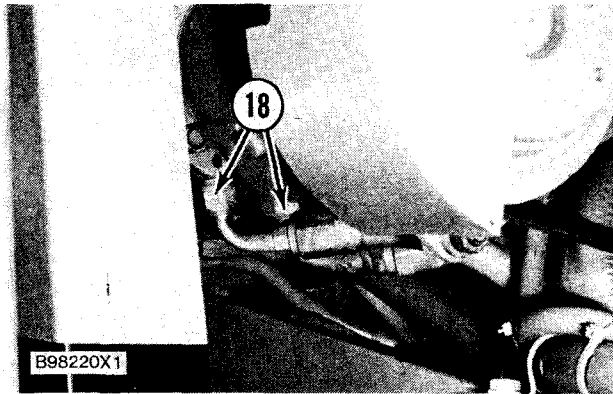
9. Disconnect hose clip (17) from the frame.



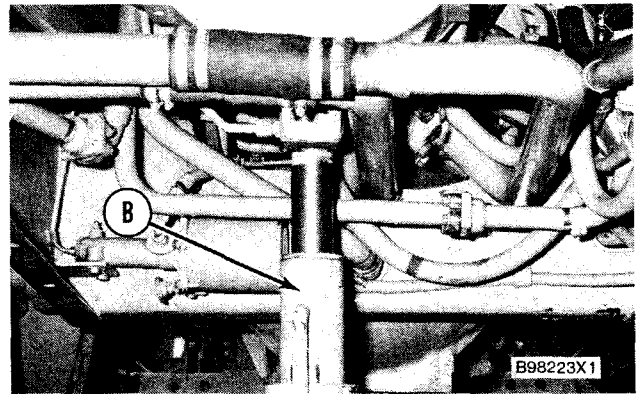
7. Disconnect hoses (14) and (15) from the air compressor.

WARNING

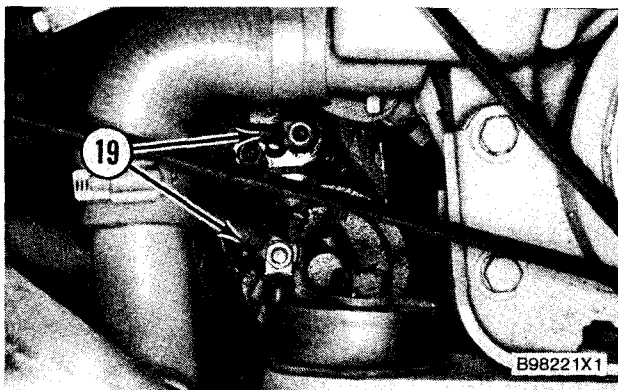
Always wear goggles when the air conditioning system is opened. This system is charged with Freon-12 (CCL₂F₂ Dichlorodifluoromethane) which is not toxic or flammable. But there is a reason for caution. When Freon-12 makes contact with a flame, lethal phosgene gas is made. **INHALING FREON THROUGH A LIGHTED CIGARETTE CAN CAUSE VIOLENT ILLNESS.** This system is under pressure at all times, engine running or not. **HEAT MUST NEVER BE PUT ON A CHARGED SYSTEM.** See Air Conditioning And Heating Service Manual Form No. SENR7454 for more information on procedures and safety requirements on removal and installation of lines and refrigerant from the system.



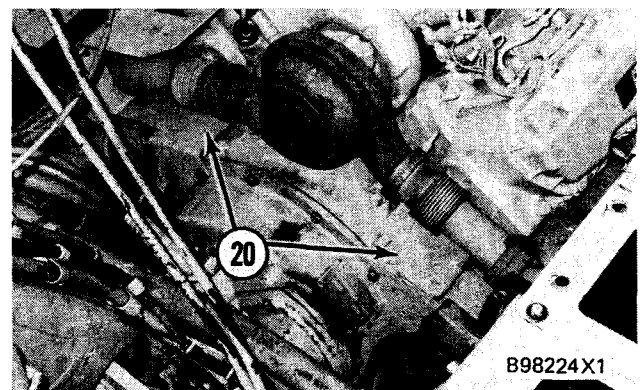
10. Disconnect two hose assemblies (18) from the air conditioning compressor.



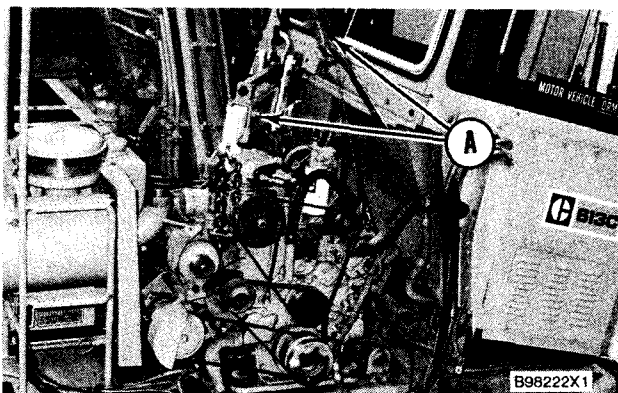
13. Install tooling (B) as shown to support the torque converter.



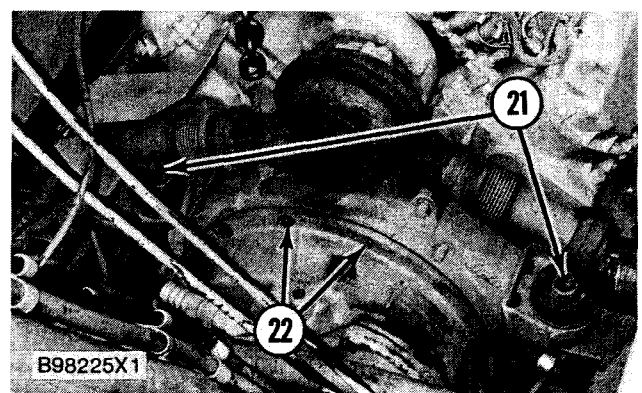
11. Put identification marks on the starter and solenoid wires (19), and disconnect them.



14. Remove heat shields (20) from the flywheel housing.

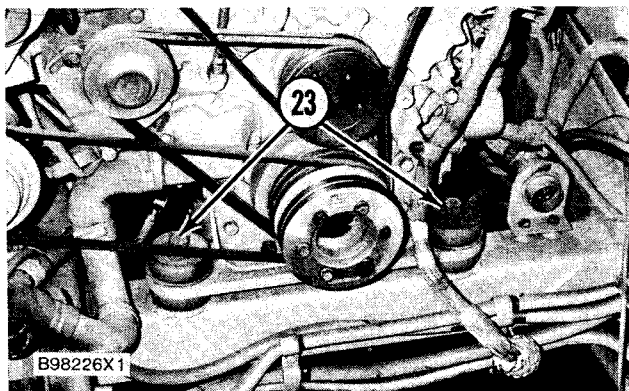


12. Attach tooling (A) to the engine as shown.

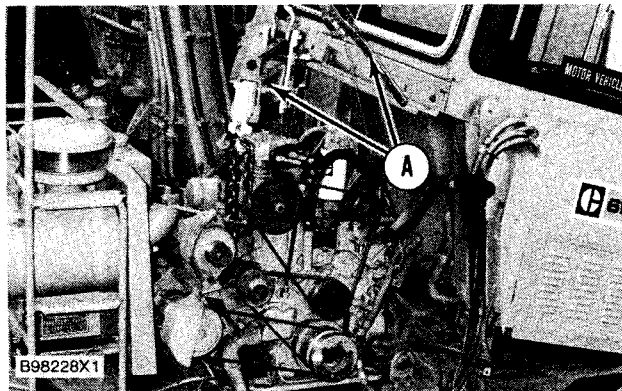


15. Remove the remainder of the torque converter to flywheel housing mounting bolts (22) and the two rear engine support mounting bolts (21).

Engine



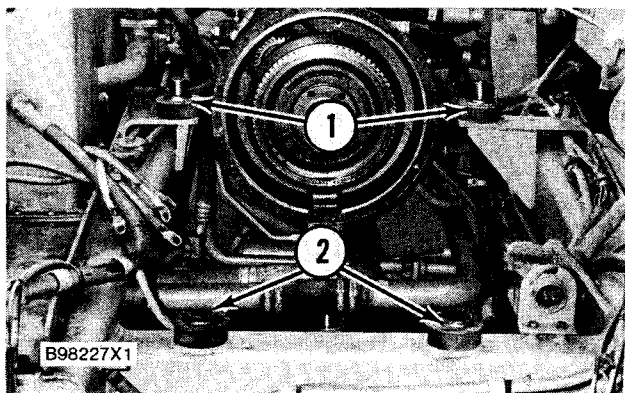
16. Remove front mounting bolts (23). Remove the engine from the machine. The weight of the engine is approximately 850 kg (1875 lb.).



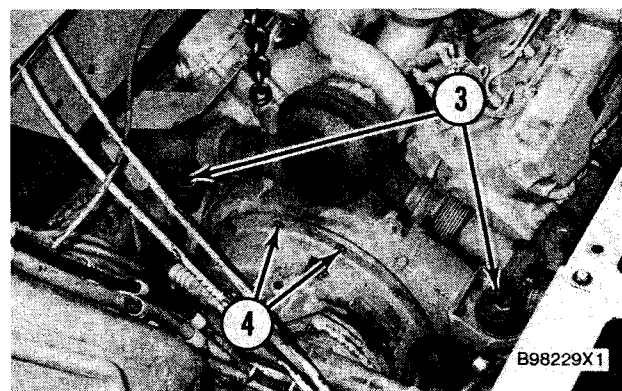
2. With tooling (A) and a hoist, put the engine in position in the machine.

Install Engine 1000-012

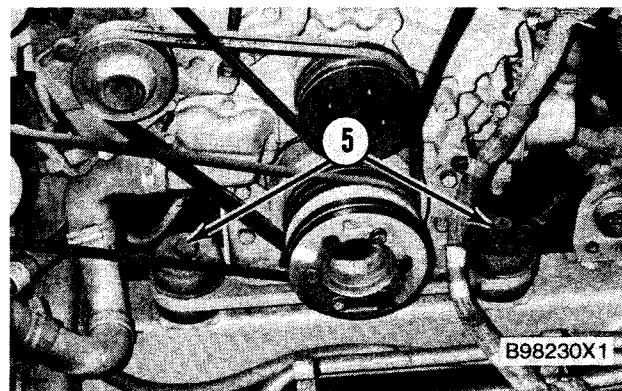
Tools Needed		A
6V6146	Load Leveler	1
8S9906	Ratchet Puller	1
5P9736	Link Bracket	1



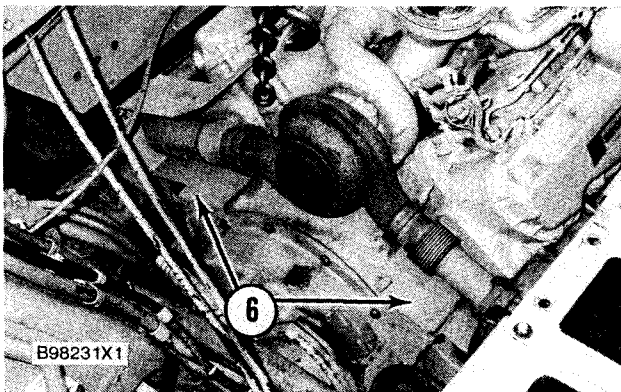
1. Put front and rear engine mounts (2) and (1) in position on the frame.



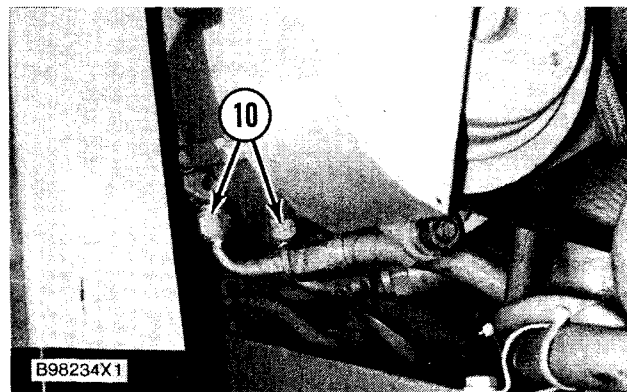
3. Install torque converter to flywheel mounting bolts (4) and rear engine mounting bolts (3).



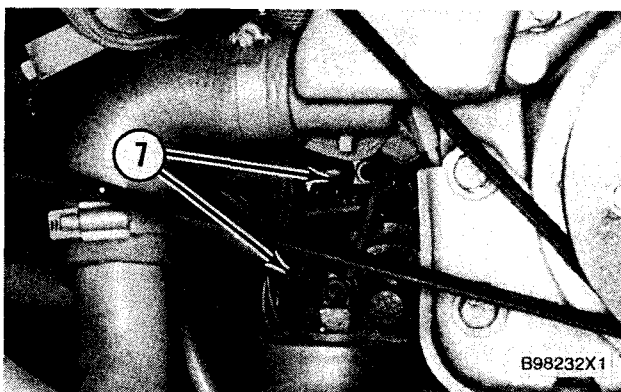
4. Install front engine mounting bolts (5).



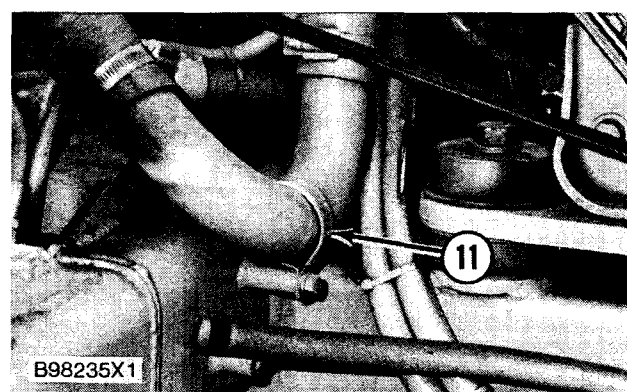
5. Install heat shields (6) on the flywheel housing.



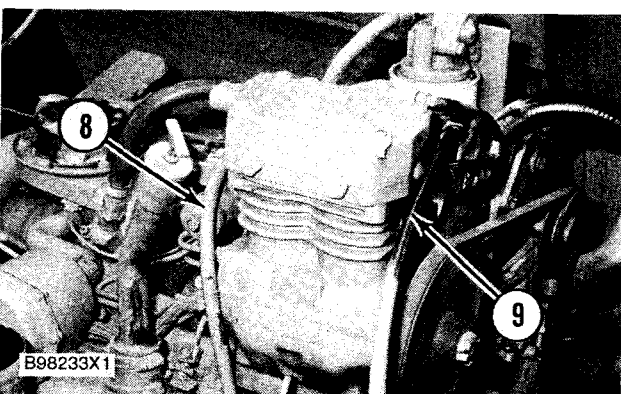
8. Connect hose assemblies (10) to the air conditioning compressor.



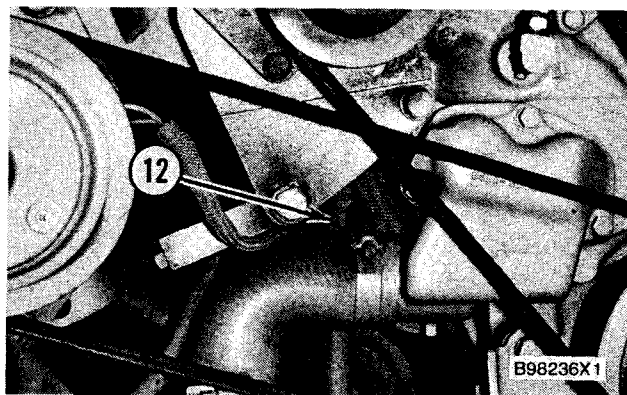
6. Connect wires (7) to the solenoid and starter.



9. Install hose clip (11) to the frame.

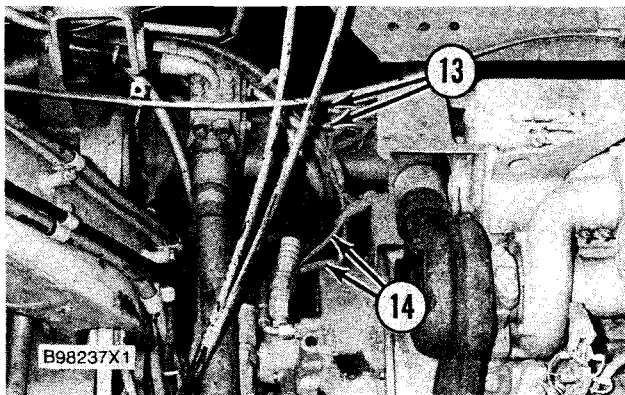


7. Connect hose assemblies (8) and (9) to the air compressor.

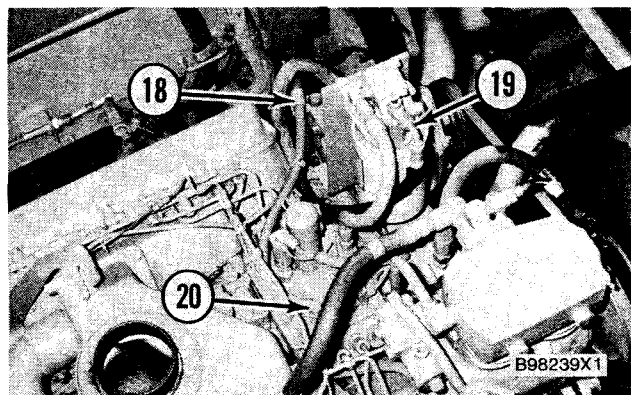


10. Install hose assembly (12).

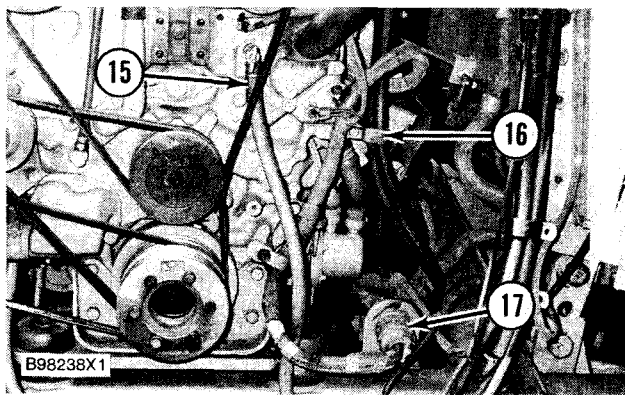
Engine



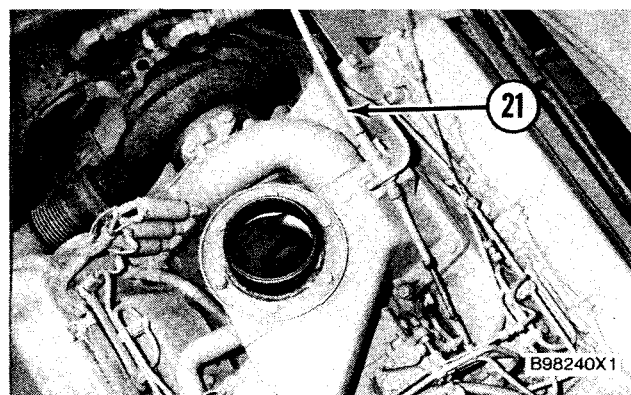
11. Install two wires (14) to the torque converter. Connect two plugs (13) for the EMS.



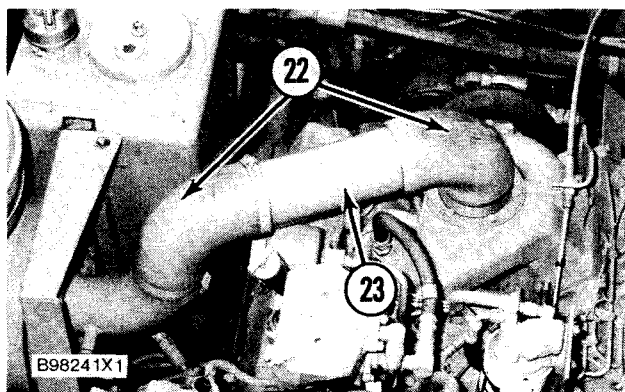
13. Connect two fuel hoses (19) and (20). Install fuel hose clip (18).



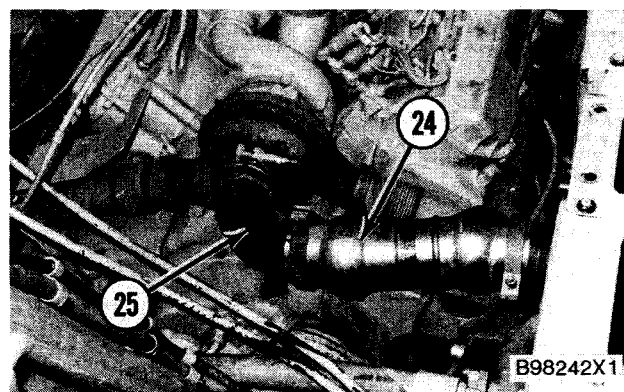
12. Connect wiring harness (17) and hose assembly (15). Install hose clip (16) to the timing gear cover.



14. Connect governor control cable (21).



15. Install two hoses (22) and tube (23) between the air cleaner and the turbocharger.



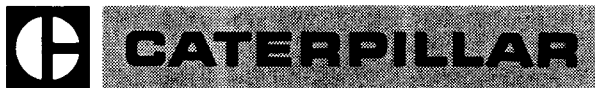
16. Install swivel (24) and elbow (25).

17. See Air Conditioning And Heating Service Manual, Form No. SENR7454, for correct procedure for evacuating and charging the system.

END BY:

- a. install oil pan
- b. install fan and fan drive
- c. lower cab*

*See 615, 613C Operator's Station, Disassembly And Assembly.



CATERPILLAR, CAT and  are trademarks of Caterpillar Inc.