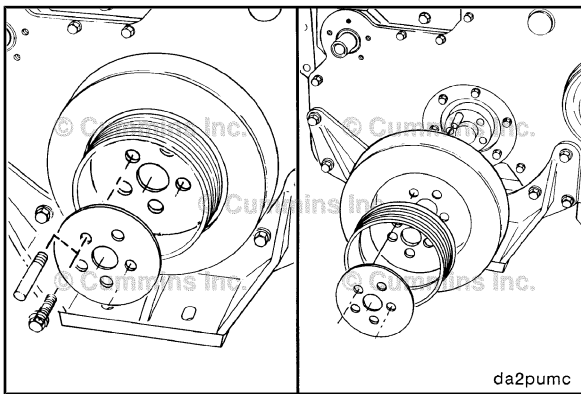


Crankshaft Pulley (001-022)

Remove



Remove the fan drive belt. Refer to Procedure 008-002.



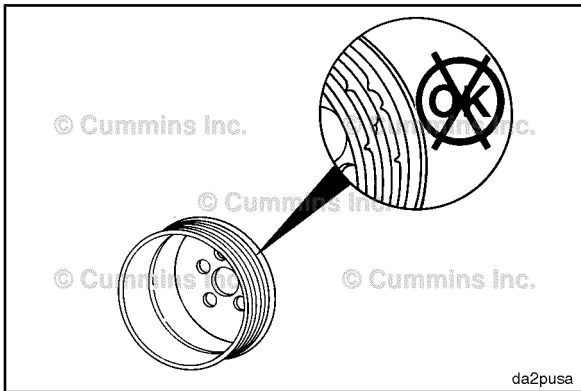
CAUTION

Do not use a hammer or a screwdriver to remove the viscous damper. These tools can damage the damper.

Remove two of the vibration damper and crankshaft pulley retaining capscrews.

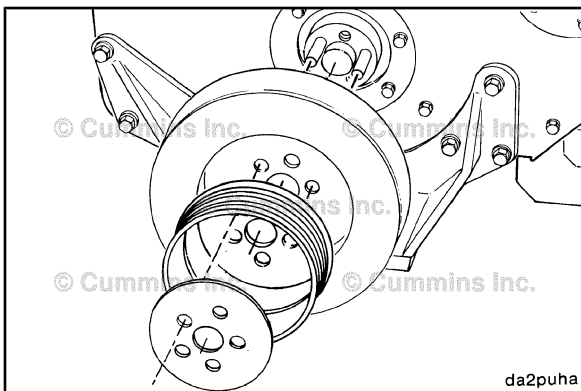
Install two guide studs, Part Number 3376696, in the holes.

Remove the remaining three capscrews, clamping plate, pulley, and damper.



Inspect for Reuse

Inspect the pulley for cracks, excessive wear in the belt grooves, or other damage.



Install

Make sure the mounting surfaces of the crankshaft nose, the vibration damper, and the pulley are clean, dry, and free of burrs.

Install two guide studs, Part Number 3376696, in the crankshaft nose.

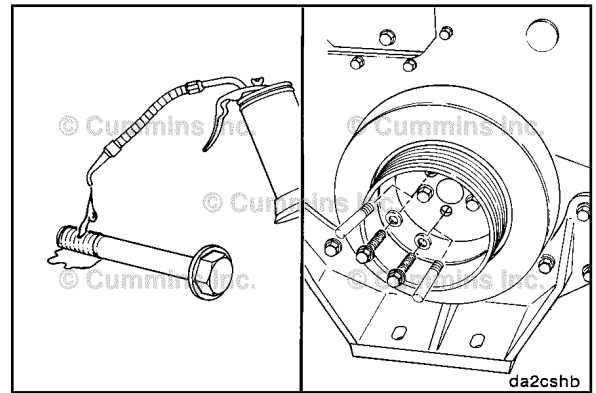
Install the vibration damper, pulley, and clamping plate on the guide studs.

Use clean 15W-40 oil to lubricate the capscrew threads.
Install three of the five capscrews.

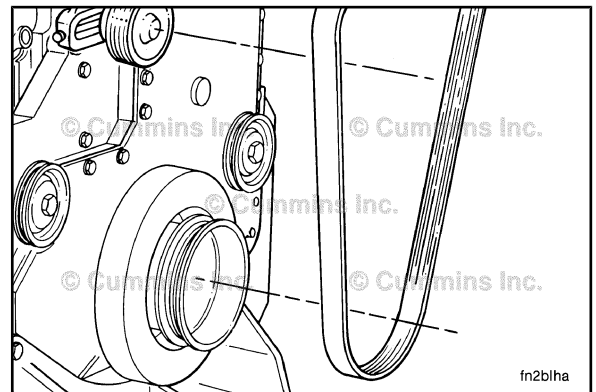
Remove the two guide studs, and install the two remaining capscrews.

Tighten the capscrews in a star pattern.

Torque Value: 203 N•m [150 ft-lb]



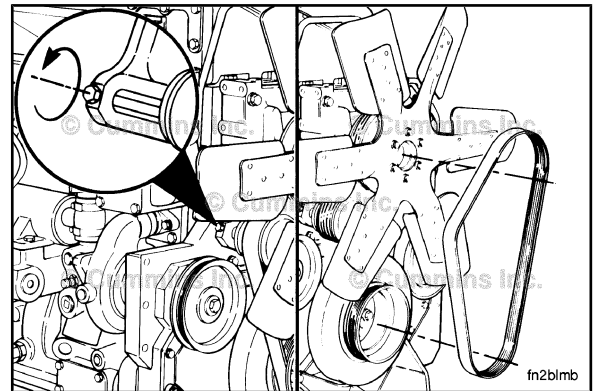
Install and adjust the fan drive belt. Refer to Procedure 008-002.



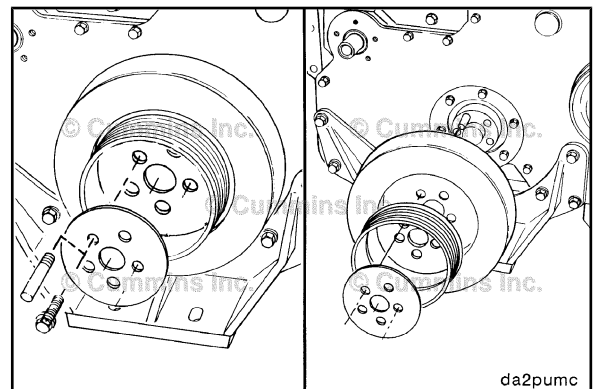
Crankshaft Seal, Front (001-023)

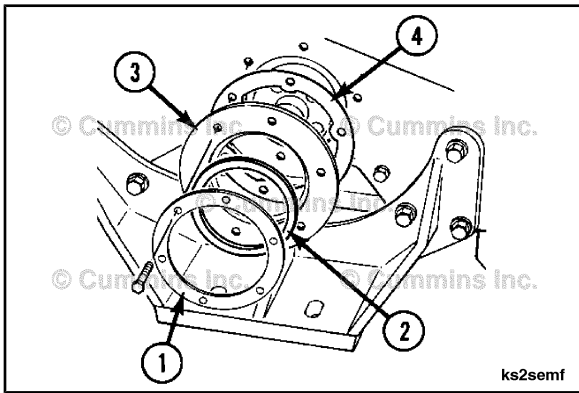
Remove

Remove the fan drive belt. Refer to Procedure 008-002.



Remove the clamping plate, crankshaft pulley, and vibration damper. Refer to Procedure 001-022.

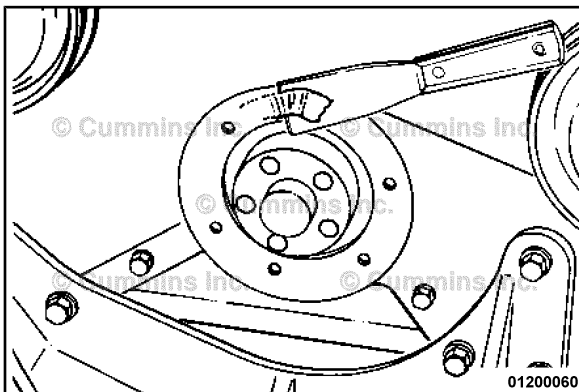




Remove the six capscrews, the clamping ring (1), the oil seal (3), and dust seal (2) together.

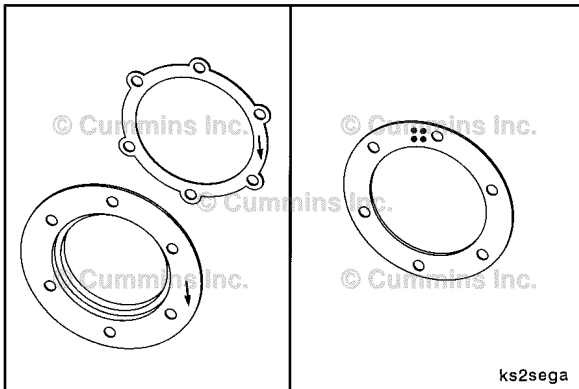


Remove the gasket (4).



Clean

Clean the front crankshaft oil seal gasket surface of the gear cover.

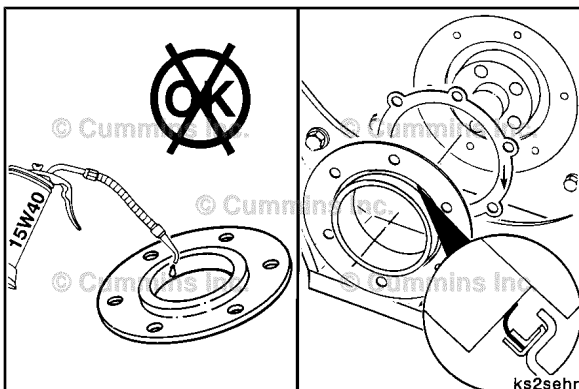


Install

The capscrew hole spacing on the oil seal is **not** symmetrical.

The gear cover, oil seal, and carrier gasket are each marked with an arrow located at approximately the three-o'clock location.

The clamping ring is marked with four punch marks, which can be found at approximately the eleven-thirty location.



Do **not** use any kind of lubricant to install the seal. The oil seal **must** be installed with the lip of the seal and the crankshaft clean and dry.

The yellow dust lip of the seal **must** be facing out.

Align the arrow markings on the seal and gasket to the arrow markings on the gear cover.

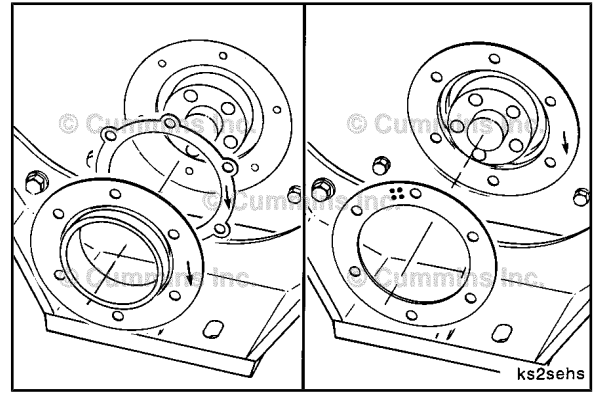
Use the installation sleeve provided with the new seal kit to install the new seal and gasket.

Orientate the four punch marks on the clamping ring at the 11:30 o'clock location.

Apply a coating of thread sealant, Part Number 3823494, to the six mounting capscrews.

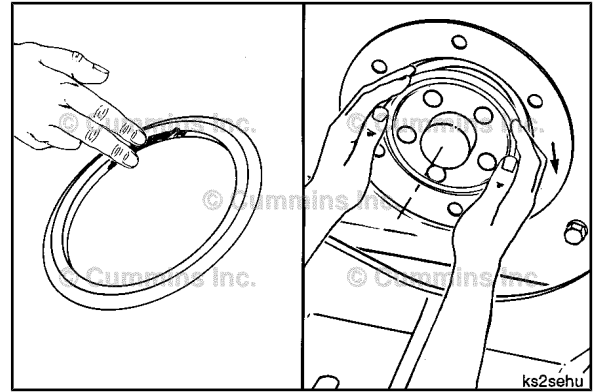
Install the six seal capscrews (M8-1.25 x 20) and washers. Tighten the capscrews in a star pattern in two steps.

| | | |
|----------------------------|--------|---------------|
| Torque Value: Step1 | 7 N•m | [60 in-lb] |
| Step2 | 20 N•m | [180 in-lb] |



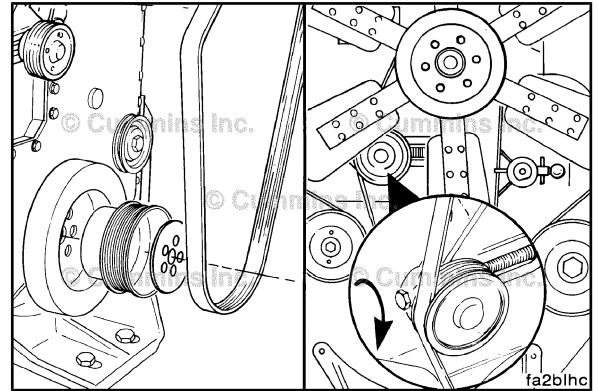
Place a light film of oil or antifreeze on the inside diameter of a new dust seal.

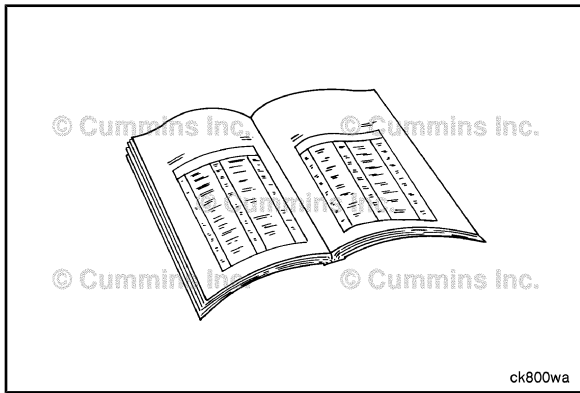
Install the dust seal with the larger outside diameter facing toward the engine. Push the dust seal back on the shaft until the entire seal contacts the oil seal case.



Install the vibration damper, crankshaft pulley, and clamping plate. Refer to Procedure 001-022.

Install and adjust the fan drive belt. Refer to Procedure 008-002.





Crankshaft Seal, Rear (001-024)

Preparatory Steps

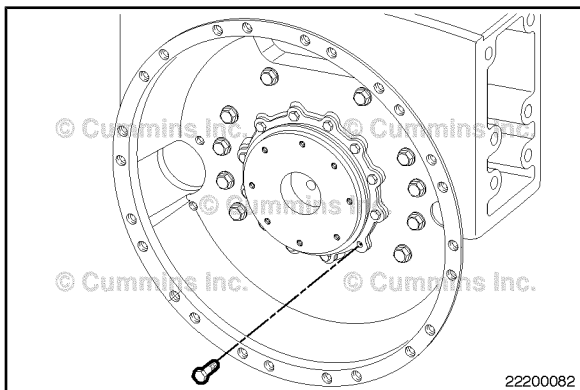


WARNING
This component weighs 23kg [50lb] or more. To reduce the possibility of personal injury, use a hoist or get assistance to lift this component.

Disconnect the driveline and remove the transmission and clutch. Refer to the manufacturer's instructions.

Remove the flywheel, if equipped.

- For L10 engines, refer to Procedure 7-32 in the Troubleshooting and Repair Manual L10 COMMAND STC and CELECT™ Models, Bulletin 3810439.
- For M11 engines, refer to Procedure 016-005 in the Troubleshooting and Repair M11 Series Engines (STC, CELECT™, CELECT™ Plus Models), Manual, Bulletin 3666139.
- For L10G engines, refer to Procedure 016-005 in the Troubleshooting and Repair L10 (Natural Gas) Engines, Manual, Bulletin 3666207.
- For ISM, ISMe, and QSM11 engines, refer to Procedure 016-005 in the Troubleshooting and Repair ISM, ISMe, and QSM11 Engines, Manual, Bulletin 3666322.



Remove

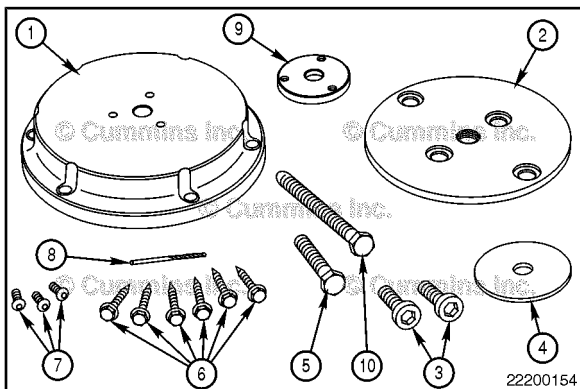
Non-REPTO Dry Lip Seal

NOTE: Only the unitized seal can be used as the service replacement for Non-REPTO Dry Seal application.

Remove the 12 mounting capscrews from the rear crankshaft oil seal.

The lip style seal can be easily removed by hand or light prying bars.

Discard the oil seal.



Non-REPTO Dry Unitized Seal

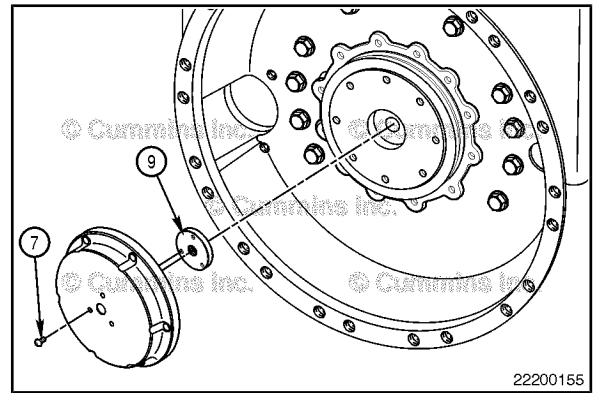
The unitized seal requires the rear crankshaft seal replacer kit, Part Number 3164302, for the removal process.

1. Installer plate
2. Crankshaft seal guide
3. Guide screw
4. Washer
5. Installer screw
6. Sheet metal screw
7. Button head socket screw
8. Drill bit
9. Remover screw adapter
10. Remover screw.

Place the remover screw adapter (9) on the back side of the installer plate.

Install the three button head socket screws (7) through the installer plate, into the adapter, and hand tighten.

Position the installer plate on the rear crankshaft oil seal.



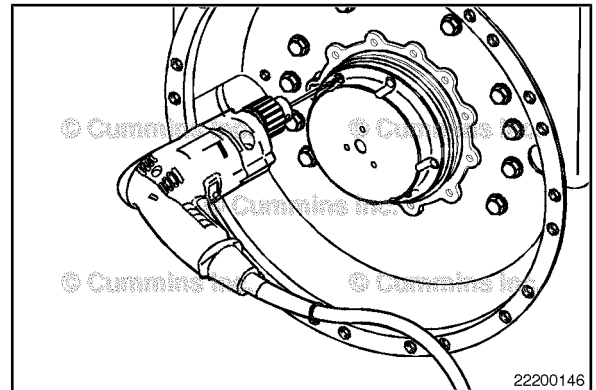
Apply grease to the drill to catch the chips.

Drill one hole through the oil seal casing, using the installer plate as a location guide.

Install a sheet metal screw and hand tighten.

Repeat the process of drilling and installing the sheet metal screws.

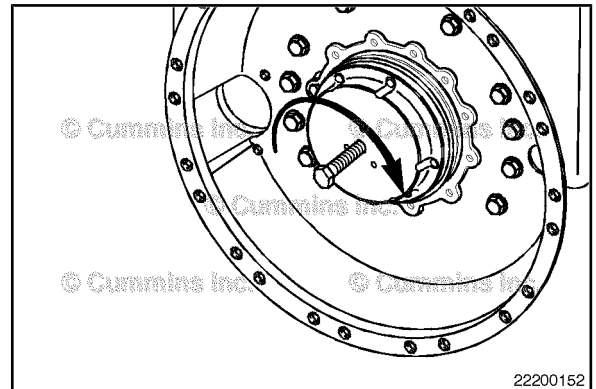
At least three sheet metal screws equally spaced, **must** be used. It can be necessary to use more sheet metal screws on some engines.



Lubricate the threads and tip of the remover screw with Lubriplate™ multi-purpose lubricant, Part Number 3163086, Part Number 3163087, or a suitable grease.

Install and turn the remover screw **clockwise** until the rear crankshaft oil seal is removed.

Discard the rear crankshaft oil seal.



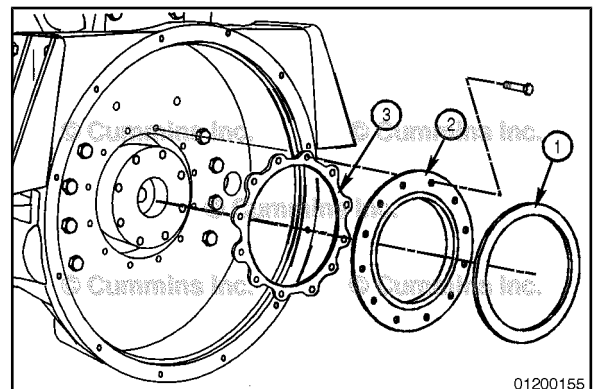
REPTO Dry Seal

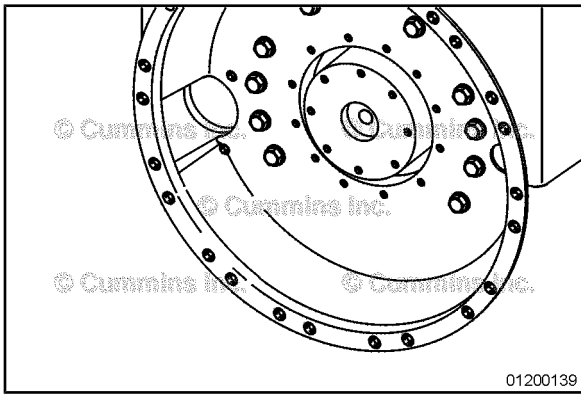
Remove the crankshaft gear mounting capscrews.

Remove the 12 capscrews fastening the oil seal to the flywheel housing.

Use a heel bar to remove the oil seal (2) and dust seal (1) together.

Remove the gasket (3) and discard.





Clean and Inspect for Reuse



WARNING
When using solvents, acids, or alkaline materials for cleaning, follow the manufacturer's recommendations for use. Wear goggles and protective clothing to avoid personal injury.



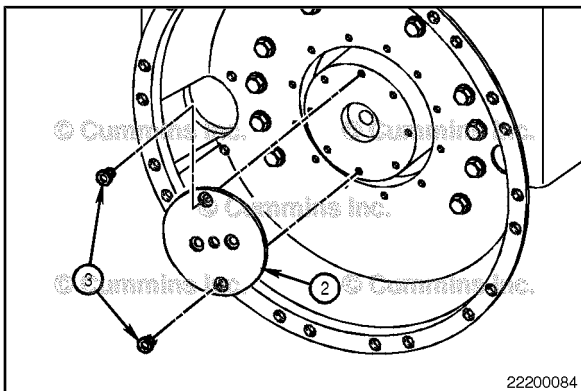
WARNING
Some solvents are flammable and toxic. Read the manufacturer's instructions before using.

Clean and inspect the crankshaft sealing surface area and flywheel housing sealing surface. Use a crocus cloth to remove any rust or deposits on the crankshaft sealing surface.

Use a lint-free cloth to remove oil from the crankshaft sealing surface and flywheel housing sealing surface.

Check the crankshaft sealing surface and flywheel housing sealing surface for nicks, burrs, or grooves.

If nicks, burrs, or grooves are present, refer to the Alternative Repair Manual, L10 and M11 Series Engines, Bulletin 3810310.



Install

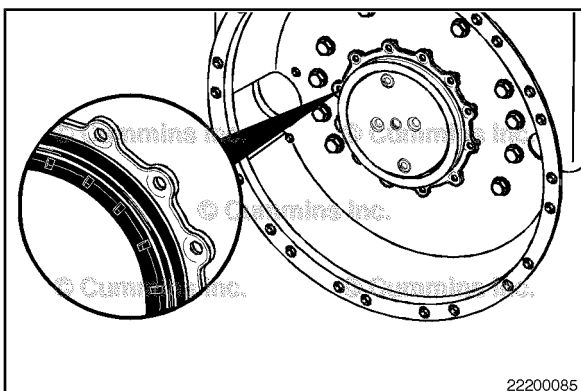
Non-REPTO Dry Unitized Seal

Place the crankshaft seal guide (2) with the counterbore holes facing outward, away from the crankshaft.

Install the two guide screws (3) in opposite counterbore holes and finger tighten.

Tighten the guide screws (3).

Torque Value: 7 N•m [62 in-lb]

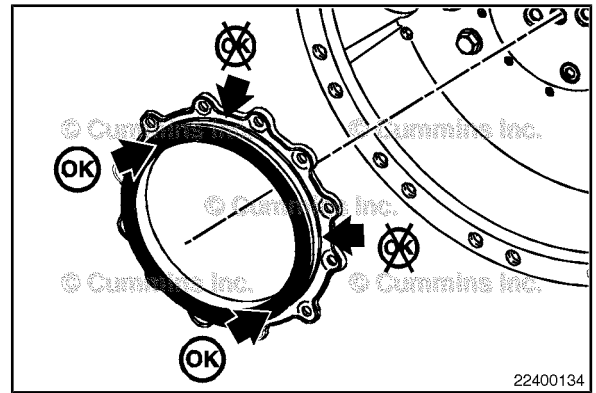


Do **not** separate the two parts of the oil seal assembly.

Make certain the raised section of the rear crankshaft oil seal cap screw flange is facing outward, away from the flywheel housing, and the gray rubber sealing bead is facing toward the flywheel housing, as illustrated.

Do **not** push on the oil seal capscrew flange.

Push on the black inside oil seal area while placing the oil seal assembly onto the crankshaft seal guide.



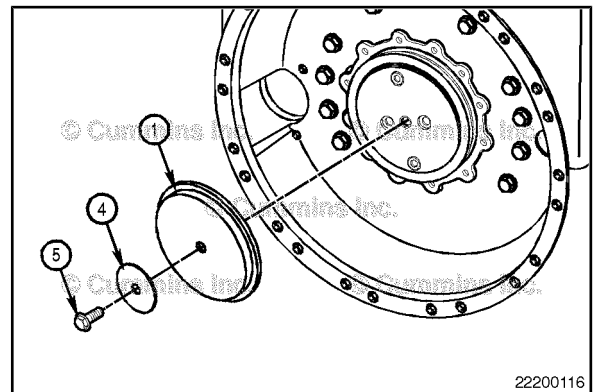
Make certain that the remover screw adapter is removed before the installation process.

Lubricate the threads of the installer screw (5) with Lubriplate™ multi-purpose lubricant, Part Number 3163086, Part Number 3163087, or a suitable grease.

Position the installer plate (1) onto the rear crankshaft oil seal and the crankshaft seal guide.

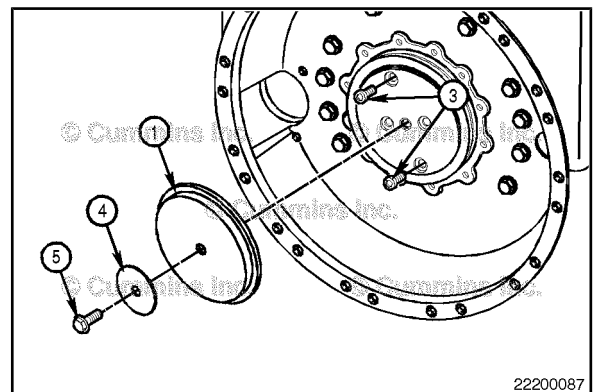
Install the installer screw (5) through the washer (4) and the installer plate (1). Turn the installer screw **clockwise** until the installer plate (1) positions the rear crankshaft oil seal against the flywheel housing. Tighten the installer screw.

Torque Value: 34 N•m [25 ft-lb]



Remove the installer screw (5), washer (4), and the installer plate (1).

Remove the two guide screws (3) and the crankshaft seal guide.



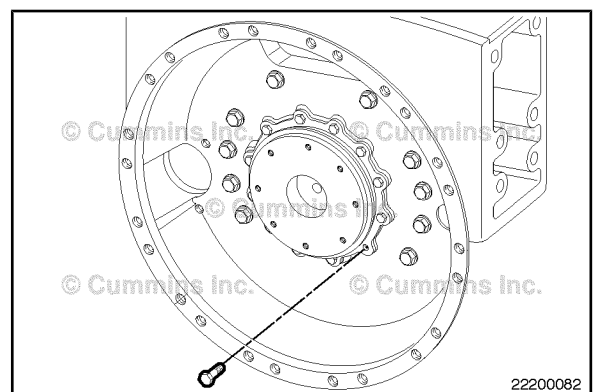
Rotate the oil seal capscrew flange to align the bolt holes and install the 12 capscrews.

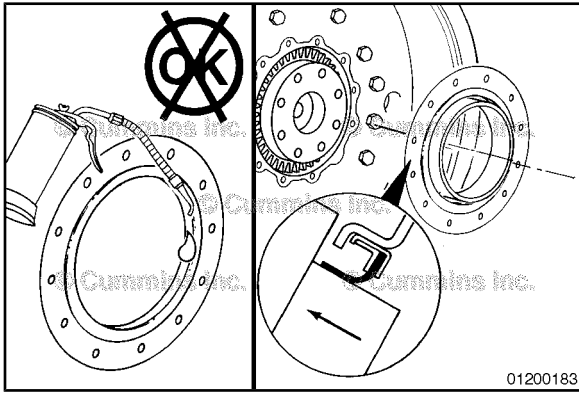
Tighten three capscrews 120 degrees apart.

Torque Value: 6 N•m [50 in-lb]

Tighten all capscrews, starting with the three previously tightened, in a crisscrossing pattern.

Torque Value: 34 N•m [25 ft-lb]





REPTO Dry Seal

Do **not** use any kind of lubricant to install the seal. The oil seal **must** be installed with the lip of the seal and the crankshaft gear clean and dry.

Use the installation sleeve provided with the new oil seal to install the oil seal on the crankshaft gear.

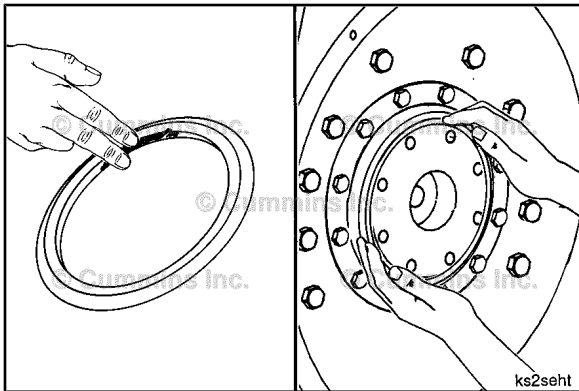
Install the captive washer capscrews and tighten.

Tighten three capscrews in a crisscrossing pattern.

Torque Value: 6 N•m [50 in-lb]

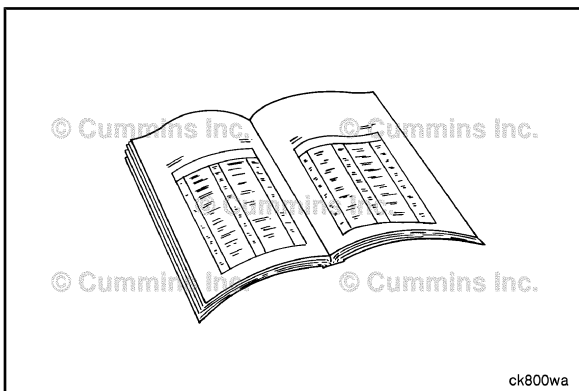
Tighten all capscrews, starting with the three previously tightened, in a crisscrossing pattern.

Torque Value: 34 N•m [25 ft-lb]



Place a light film of oil or antifreeze on the inside diameter of the dust seal.

Install the dust seal on the crankshaft gear with the larger outside diameter facing toward the engine. Push the dust seal back by hand on the crankshaft gear until the entire dust seal contacts the oil seal case.



Finishing Steps



⚠ WARNING ⚠

This component weighs 23kg [50lb] or more. To reduce the possibility of personal injury, use a hoist or get assistance to lift this component.

Install the flywheel, if equipped.

- For L10 engines, refer to Procedure 7-32 in the Troubleshooting and Repair Manual L10 COMMAND STC and CELECT™ Models, Bulletin 3810439.
- For M11 engines, refer to Procedure 016-005 in the Troubleshooting and Repair M11 Series Engines (STC, CELECT™, CELECT™ Plus Models), Manual, Bulletin 3666139.
- For L10G engines, refer to Procedure 016-005 in the Troubleshooting and Repair L10 (Natural Gas) Engines, Manual, Bulletin 3666207.
- For ISM, ISMe, and QSM11 engines, refer to Procedure 016-005 in the Troubleshooting and Repair ISM, ISMe, and QSM11 Engines, Manual, Bulletin 3666322.

Install the clutch, transmission, and driveline. Refer to the manufacturer's instructions.

Operate the engine and check for leaks.

Cylinder Block (001-026)

Basic Description

Fretting, typically occurs on main bearing caps number 2 and number 6. However, main bearing caps numbers 3, 4, and 5 are also at risk of fretting; therefore, inspection of main bearing caps number 2 through number 6 can be necessary. An inspection is conducted to determine which main bearing cap requires the Plastigage® procedure.

Side-to-side press fit of a main bearing cap is the fit between the block joint and the main cap sides. The intent of machining a press fit into the joint is to establish the correct position of the lower main bearing for assembly. During disassembly, it is possible to encounter a main cap with a slip fit. This is acceptable and the main cap can be reused.

Some engines have been previously inspected for main bearing cap fretting. These engines were upfitted with a stiffener plate or Service Block Kit and returned to service. These main caps **must** also be inspected prior to main bearing replacement or overhaul.

To determine if a stiffener plate has previously been installed, inspect the joint between the oil pan and the engine block. The stiffener plate is approximately 6.35 mm [0.25 in] thick and will be visible between the oil pan and engine block. Removal of the oil pan is **not** necessary to determine if a stiffener plate has been installed.

Service Block Kit incorporates the Torque-To-Yield block. These blocks were introduced into production June 28, 2000. Engine serial number (ESN) first is 35011095. These blocks require a higher main cap capscrew torque procedure than earlier production blocks.

To determine if a Service Block Kit has been previously installed, inspect the engine case history. If the engine case history is **not** available, inspect the rear engine serial number stamp pad located on the camshaft side of the block. If the block had previously been replaced with a Torque-To-Yield Block, the letters TTY will be stamped in the rear engine serial number stamp pad.

NOTE: Do not destroy evidence-go slowly and observe all conditions.

Inspect for Reuse



⚠ CAUTION ⚠

Make sure the proper main cap capscrew torque procedure is used when tightening the main bearings on M11 and ISM engines. Using the incorrect torque procedure will damage the engine.

⚠ CAUTION ⚠

Two evenly spaced main bearing caps must be left in place to support the engine crankshaft. This prevents the crankshaft from dropping.

⚠ CAUTION ⚠

Do not mark the backside of the bearing shell. Marking on the backside of the bearing shell can give a false Plastigage® reading.

The block type **must** be identified to determine which main cap capscrew torque method **must** be used.

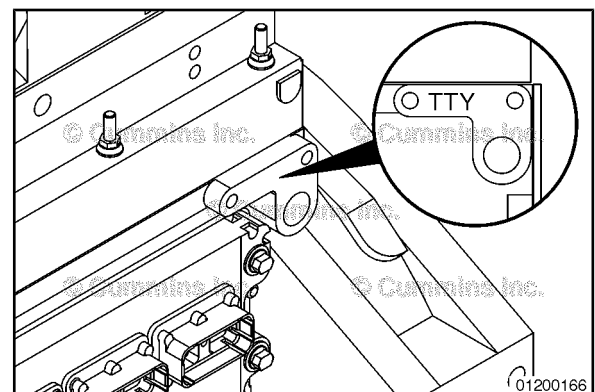
Torque-to-yield block

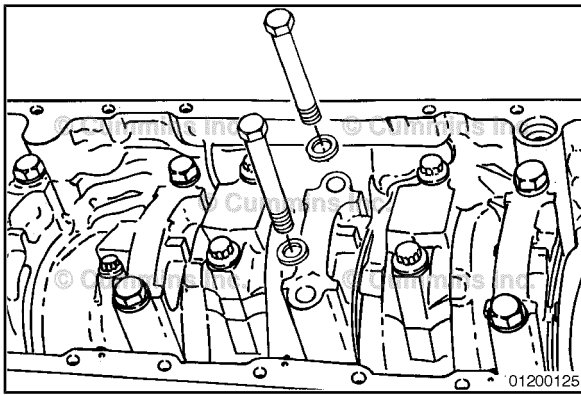
The torque-to-yield block was introduced into production June 28, 2000. ESN first is 35011095.

To determine if an older block has been replaced with a torque-to-yield block perform the following:

Review the engine case history.

Inspect the rear ESN stamp pad. A torque-to-yield service block will have the letters TTY stamped in the rear serial number stamp pad on the camshaft side of the block.



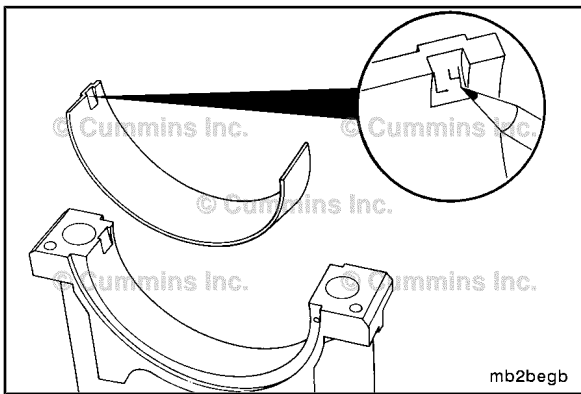


Remove main caps 2 through 6 and arrange all parts as they are located in the engine.



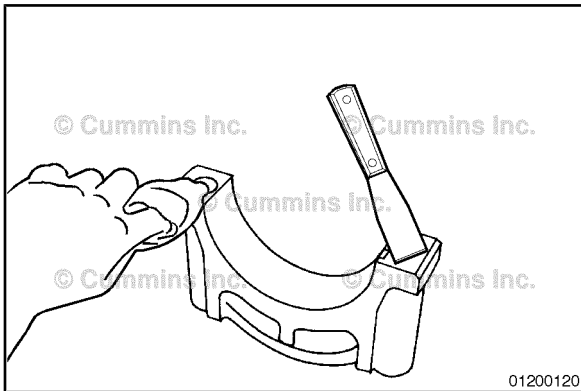
Use main bearing cap puller, Part Number ST-1178, to remove the caps. The main bearing cap puller **must** be centered on the cap. Pull straight down to remove the cap.

Observe respective part conditions-amount and condition of lubricant present, burrs, cuts or particles in evidence, condition of journals, fillets, and so forth.



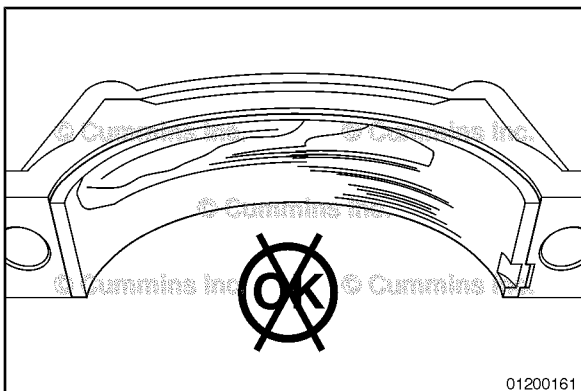
Remove the lower main bearing shell from the cap.

Mark the bearing shell with the letter L (lower) and the journal number from which it was removed.



Wipe oil from all main bearing cap mounting surfaces on the cylinder block with a clean, lint-free cloth.

The main bearing cap surfaces **must** be free of grease and oily residue to perform a proper inspection.



Inspect the lower bearing shells for type and extent of damage, unusual wear patterns, uneven wear, or copper exposure.

An uneven wear pattern on the lower bearing shell is an indication of fretting.

If a lower bearing shell exhibits an uneven wear pattern or copper exposure, as shown here, the bearing **must** be Plastigaged®.