

ENGINE BLOCK

DESCRIPTION

DESCRIPTION

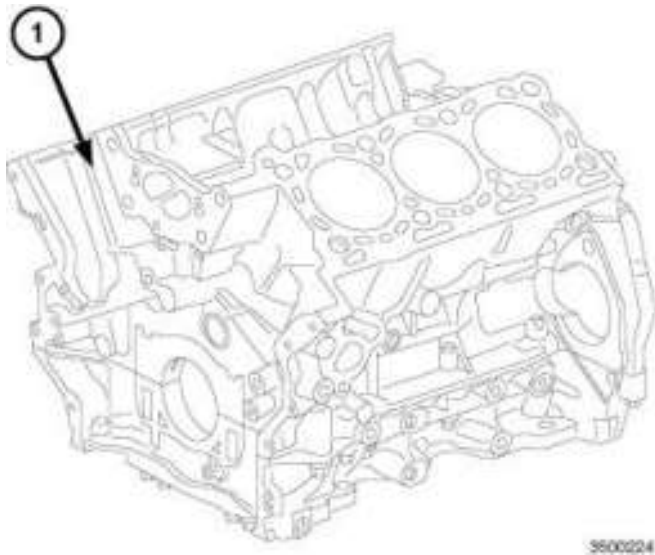


Fig. 159: 3.0L Engine Block
Courtesy of CHRYSLER GROUP, LLC

The 3.0L engine utilizes a cast Iron cylinder block (1) with a bedplate design. The cylinder angle is 60 degrees V block design. The cylinder block has increased rigidity that reduces structural flexing, plus a fractured connecting rod cap design that can not distort connecting rod cap fit.

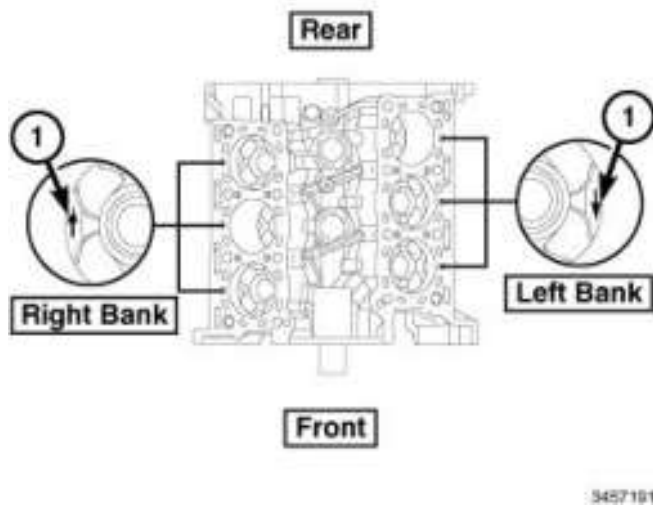


Fig. 160: Arrow Stamped On Piston Crown
Courtesy of CHRYSLER GROUP, LLC

Cylinders are numbered front to back, beginning with the right bank. The right bank cylinders are numbered 1, 2, 3. The left bank cylinders 4, 5, 6. The injection order of the engine is 1-4-2-5-3-6.

STANDARD PROCEDURE

STANDARD PROCEDURE - BEARING SELECTION CHARTS

CONNECTING ROD BEARINGS - LARGE END

Connecting Rod Journal Diameter - Connecting Rod Large End	Bearing Half	Connecting Rod Journal Diameter - Crankshaft		
		A	B	C
		67.500 - 67.494 mm	67.494 - 67.488 mm	67.488 - 67.482 mm
A 71.000 - 71.006 mm	Upper Bearing Shell	Red	Red	Blue
	Lower Bearing Shell	Red	Blue	Blue
B 71.006 - 71.012 mm	Upper Bearing Shell	Red	Blue	Blue
	Lower Bearing Shell	Blue	Blue	Yellow
C 71.012 - 71.018 mm	Upper Bearing Shell	Blue	Blue	Yellow
	Lower Bearing Shell	Blue	Yellow	Yellow

CRANKSHAFT BEARINGS

Cylinder Block Seat Diameter (Bed Plate)	Bearing Half	Crankshaft Main Journal Diameter		
		A	B	C
		73.958 - 73.952 mm	73.952 - 73.946 mm	73.946 - 73.940 mm
A 78.000 - 78.006 mm	Upper Bearing Shell	Red	Red	Blue
	Lower Bearing Shell	Red	Blue	Blue
B 78.006 - 78.012 mm	Upper Bearing Shell	Red	Blue	Blue
	Lower Bearing Shell	Blue	Blue	Yellow
C 78.012 - 78.018 mm	Upper Bearing Shell	Blue	Blue	Yellow
	Lower Bearing Shell	Blue	Yellow	Yellow

BEARING(S), CONNECTING ROD

REMOVAL

REMOVAL

1. Disconnect negative battery cable.
2. Remove the engine from vehicle. Refer to **REMOVAL** .
3. Remove the oil pump pickup tube. Refer to **PICK-UP, OIL PUMP, REMOVAL** .

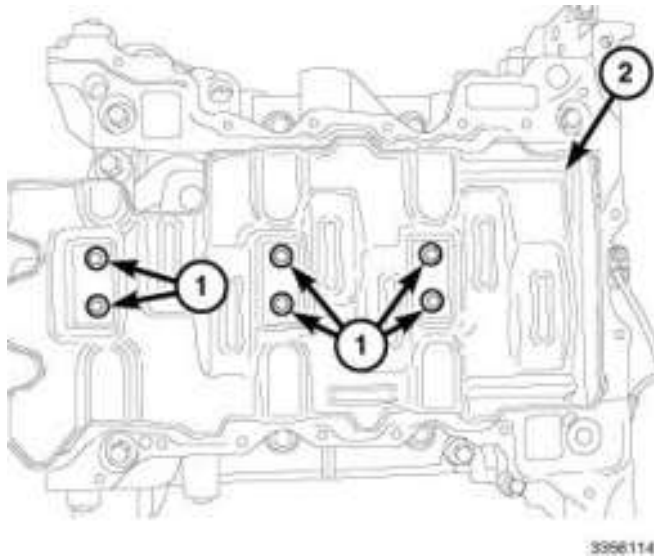


Fig. 161: Windage Tray & Bolts
Courtesy of CHRYSLER GROUP, LLC

4. Remove bolts (1) and the windage tray (2).

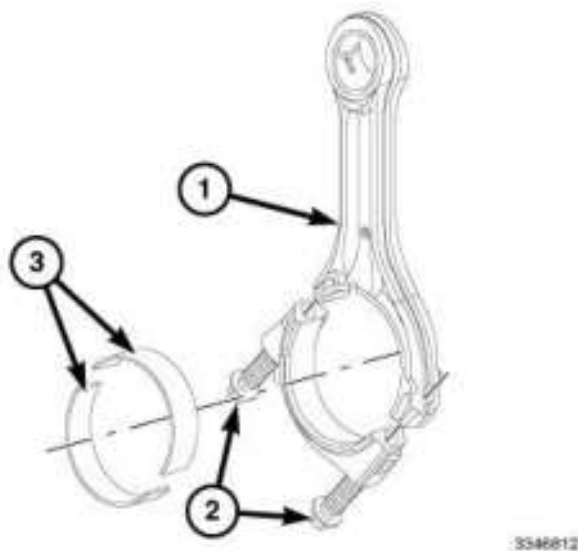
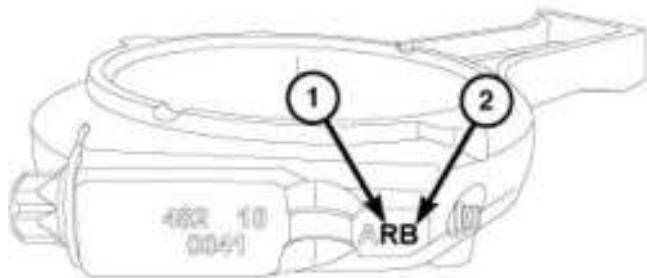


Fig. 162: Connecting Rod, Bearings & Bolts
Courtesy of CHRYSLER GROUP, LLC

5. Remove the connecting rod bearing caps one at a time and discard bolts (2).
6. Carefully remove the upper half and lower bearing half (3) from the connecting rod.

INSTALLATION

INSTALLATION



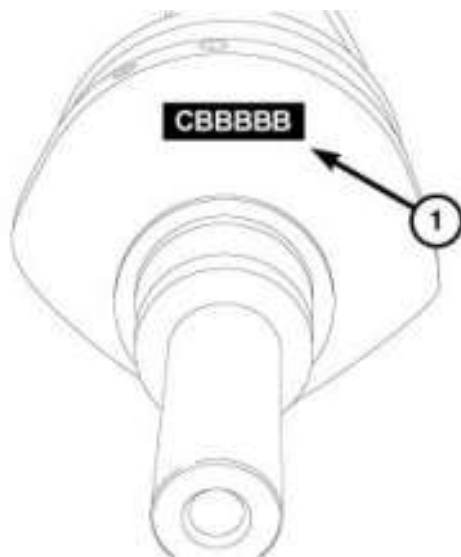
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Fig. 163: Connecting Rod Shaft & Class Identification Mark
 Courtesy of CHRYSLER GROUP, LLC

NOTE: If the connecting rod has to be replaced only use connecting rod of the same weight, recognizable by a letter stamped on connecting rod shaft (1).

NOTE: Connecting rods can only be replace in sets of six, not individually.

1. Each connecting rod has its own letter class identification mark (2) on connecting rod for bearing selection.



3346516

Fig. 164: Letters Stamped Into Crankshaft
 Courtesy of CHRYSLER GROUP, LLC

2. Letter class identification mark on crankshaft (1).

Cylinder No.	1	2	3	4	5	6
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Crankshaft Letter	C	B	B	B	B	B
Connecting Rod Letter	B	B	A	A	A	A

3. Choose the correct connecting rod bearings size from the above table. To determine the correct bearing size for each cylinder, each connecting rod "letter class" (letter stamped on each connecting rod) must be matched with crankshaft "letter class" (6 digits letters stamped on the first crankshaft counter weight). The letters stamped on the crankshaft are in the same orders as the cylinders. The first letter correspond to the first cylinder (timing system side), the second letter to the second one, etc. See bearing selection chart. Refer to **ENGINE BLOCK - STANDARD PROCEDURE** .

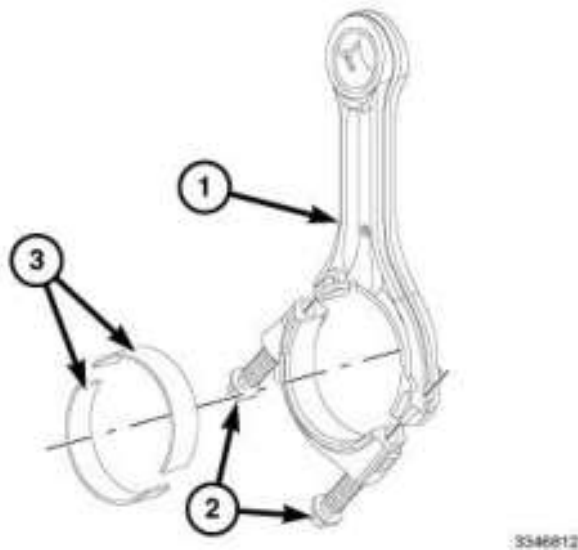


Fig. 165: Connecting Rod, Bearings & Bolts
 Courtesy of CHRYSLER GROUP, LLC

4. Assemble connecting rod bearings (3) and bearing caps to their respective connecting rods (2) ensuring that the serrations on the cap and reference marks are aligned.
5. Using new bolts, tighten the connecting rod cap bolts to:
- Step 1: Tighten to 10 N.m (88 in. lbs.).
 - Step 2: Tighten each bolt to 25 N.m (18 ft. lbs.).
 - Step 3: Tighten each bolt an additional 75 degrees turn.
 - Step 4: With the torque wrench set at 50 N.m (37 ft. lbs.) to check the tightening of each bolt.

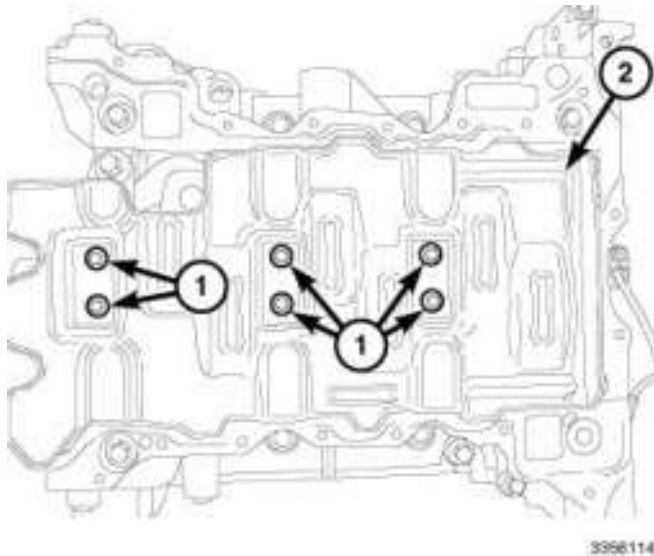


Fig. 166: Windage Tray & Bolts
 Courtesy of CHRYSLER GROUP, LLC

6. Install the windage tray (2). Tighten bolts (1) to 11 N.m (97 in. lbs.).
7. Install the oil pump pickup tube. Refer to **PICK-UP, OIL PUMP, INSTALLATION** .
8. Install the engine into vehicle. Refer to **INSTALLATION** .
9. Connect the negative battery cable.

BEARING(S), CRANKSHAFT, MAIN

DESCRIPTION

DESCRIPTION

The bottom of the cylinder block has provisions for mounting the bedplate and the oil jets. The bedplate houses the other half of the main bearing shell. The bedplate is made of cast iron and bolts to the cylinder block. There is twenty six M12 mounting bolts, and three M8 mounting bolts.

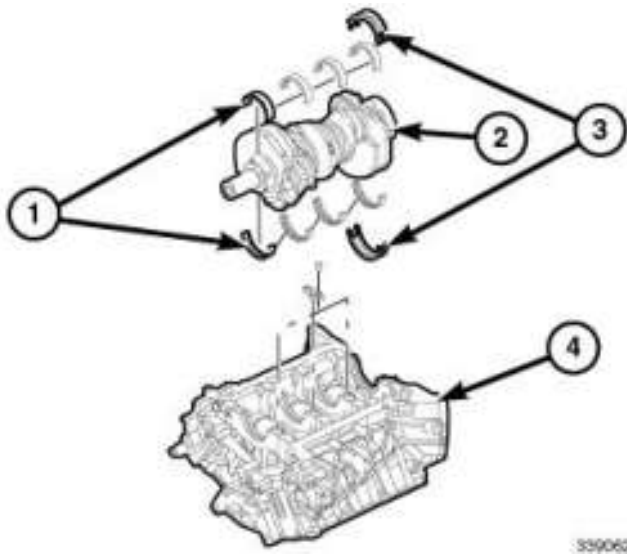
The number four main bearing serves as the thrust washer location.

The upper main bearings have a oil supply holes and center grooves for lubrication of the main journals. The lower main bearings provide strength where it is needed.

The upper main bearings are available in three different thicknesses bearings. A color coded mark on the side of the bearing is used to identify it's thickness. Each color coded bearing is matched to it's respective journal. The select fit is obtained by matching the color coded bearings to grade identification marks on the cylinder block and crankshaft. Letters marked on the cylinder block identify the color of each upper-half main bearing, while letters marked on the front end of the crankshaft indicate the color of each lower half main bearing.

REMOVAL

REMOVAL



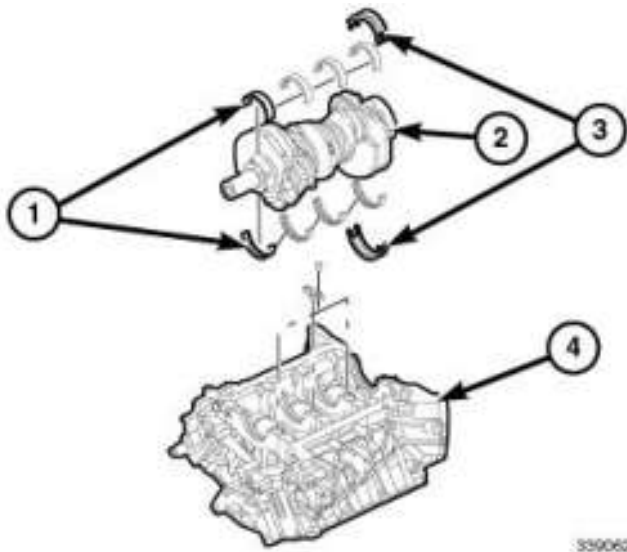
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Fig. 167: Crankshaft, Bearings, Thrust Bearing & Engine Block
 Courtesy of CHRYSLER GROUP, LLC

1. Remove the crankshaft (2). Refer to CRANKSHAFT, REMOVAL .

INSTALLATION

INSTALLATION



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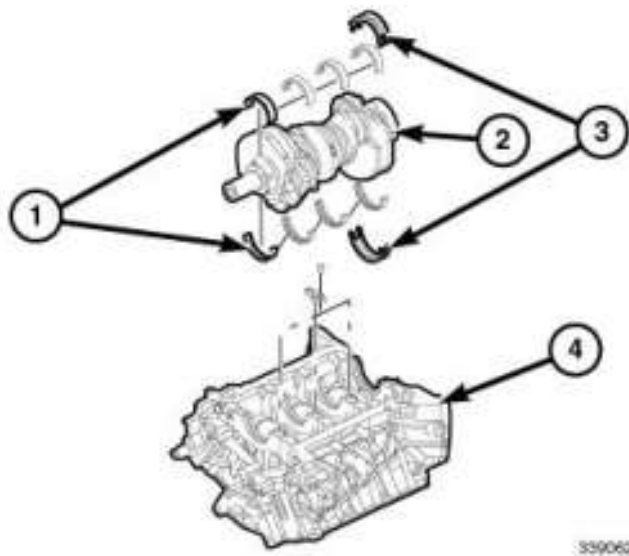
Fig. 168: Crankshaft, Bearings, Thrust Bearing & Engine Block
 Courtesy of CHRYSLER GROUP, LLC

1. Install the crankshaft (2). Refer to CRANKSHAFT, INSTALLATION .

CRANKSHAFT

DESCRIPTION

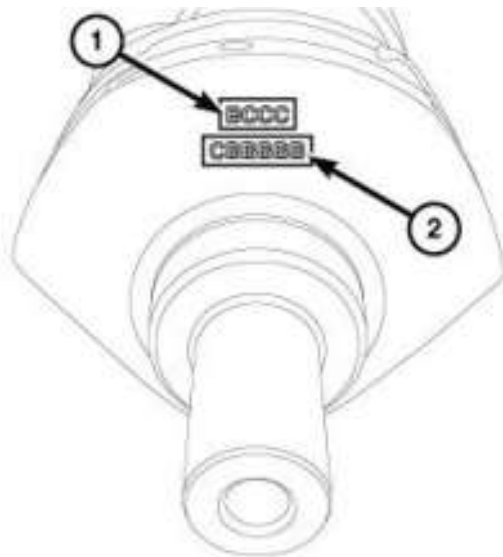
DESCRIPTION



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Fig. 169: Crankshaft, Bearings, Thrust Bearing & Engine Block
 Courtesy of CHRYSLER GROUP, LLC

The crankshaft (1) for the 3.0L is a forged steel type design with four main bearing journals. The fourth crankshaft support controls crankshaft thrust.



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Fig. 170: Bearing Identification & Letters Stamped Into Crankshaft
 Courtesy of CHRYSLER GROUP, LLC

The bearing identification for the upper crankshaft main journals is etched into the lower right side of engine block and the proper lower bearing selection can be found etched in the front of the crankshaft (1).

OPERATION

OPERATION

The crankshaft transfers force generated by combustion within the cylinder bores to the flexibility. The crankshaft has six separate throws arranged at different angles (splayed) to reduce second order free movements of inertia. Following the injection order 1-4-2-5-3-6, the crankshaft throw angles alternate between 48° and 192°.

In the injection order, together with the splayed throws and the 72° V-block, produce injection intervals of 120° (even fire). After ignition TDC of cylinder number 1, the crankshaft turns 120° to reach TDC of cylinder number 4. The 120° angle (even fire) is the result of the 48° throw angle plus the 72° cylinder block angle.

STANDARD PROCEDURE

MEASURE CRANKSHAFT AND BLOCK JOURNALS

NOTE: **After any bearing damage occurred, remove all debris which is present in the main oil gallery, connecting rod bores, and in the crankshaft and oil galleries.**

1. Remove crankshaft.
2. Clean all engine parts thoroughly.
3. Inspect crankshaft, replace as necessary.
4. Inspect crankcase for damage.
5. Inspect crankshaft main bearing bedplate for damage.
6. Install the crankshaft main bearing caps and check for out of round. Replace as necessary.
7. Remove the main bearing caps and install the crankshaft with the correct selected bearings.

NOTE: **Radial mounting of the main bearings of standard size crankshaft is possible by assigning the color-coded bearing shells. The upper main bearings can be identified by the four digit mark etched on the engine block below the high pressure pump. The lower main bearings can be identified by the code etched on the front of the crankshaft hub.**

8. Select the correct bearing shells based upon the crankcase and crankshaft identification marks.
9. Mount crankshaft axially using the thinnest thrust washer.
10. Inspect crankshaft end play. If the crankshaft end play is out of specification, remove the crankshaft and install the larger thrust shim. repeat the procedure until crankshaft end play is within specification.
11. Mount the crankshaft axially again and check each main bearing oil clearance with plasti-gauge. For bearing clearance specifications. Refer to **ENGINE SPECIFICATIONS** .

ASSIGNING CRANKSHAFT MAIN BEARING SHELLS

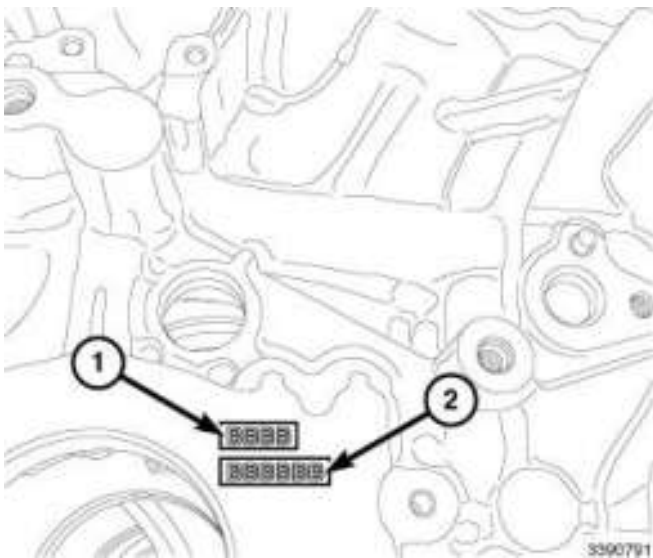


Fig. 171: Upper Main Bearing Identification
 Courtesy of CHRYSLER GROUP, LLC

The upper main bearings can be identified by the four digit mark etched in the block (1) next to the oil pump.

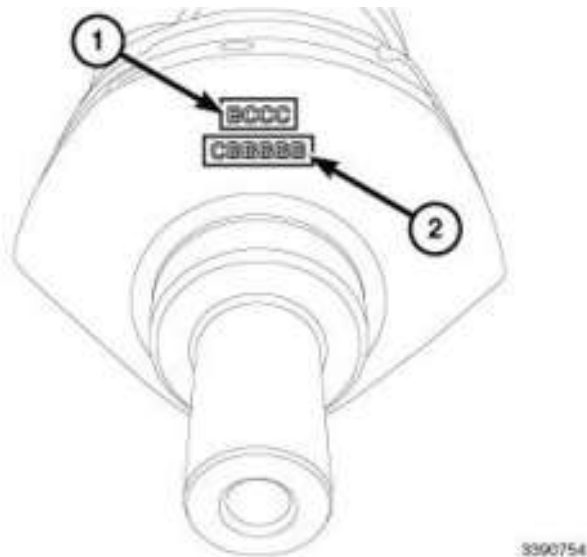


Fig. 172: Bearing Identification & Letters Stamped Into Crankshaft
 Courtesy of CHRYSLER GROUP, LLC

The lower main bearings can be identified by the code etched on the front of the crankshaft counter weight (1). This color code indicates which bearing shell halves are to be used.

CHECKING CRANKSHAFT END PLAY

1. Mount a dial indicator to a stationary point at rear of engine. Locate the probe perpendicular against the rear of the crankshaft.
2. Move the crankshaft all the way to the front of its travel.
3. Zero the dial indicator.
4. Move the crankshaft all the way to the rear of it's travel and record the reading on the dial indicator. For crankshaft end play clearances refer to the engine specification chart. Refer to **ENGINE**

SPECIFICATIONS .

REMOVAL

REMOVAL

1. Remove the engine from the vehicle. Refer to REMOVAL .
2. Mount the engine to a suitable engine stand.
3. Remove both cylinder heads. Refer to CYLINDER HEAD, REMOVAL .
4. Remove the flywheel. Refer to FLEXPLATE, REMOVAL .
5. Check the crankshaft end play. Refer to CRANKSHAFT - STANDARD PROCEDURE .
6. Remove the oil pump. Refer to PUMP, ENGINE OIL, REMOVAL .

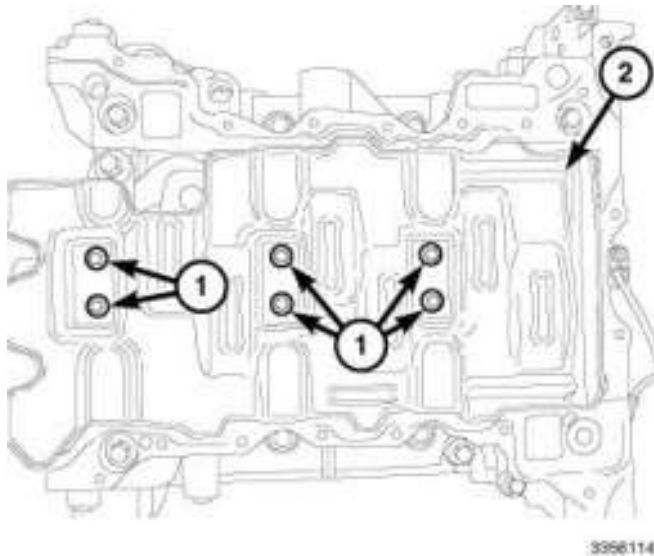


Fig. 173: Windage Tray & Bolts
Courtesy of CHRYSLER GROUP, LLC

7. Remove bolts (1) and the windage tray (2).

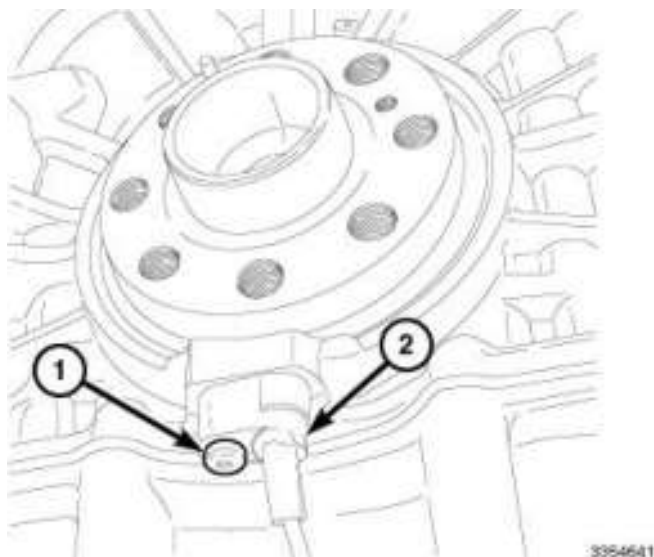
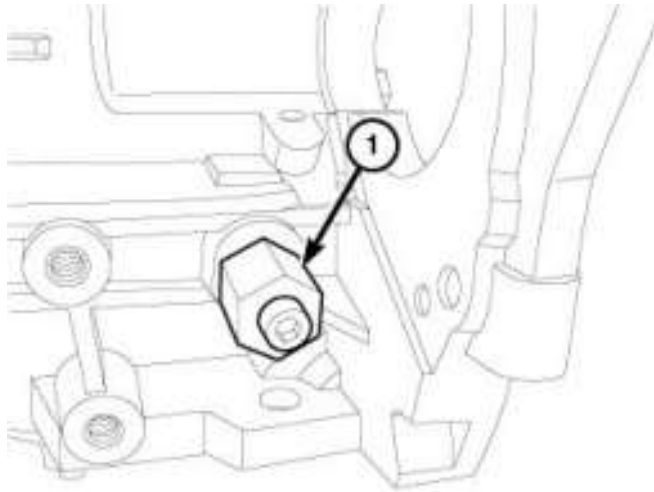


Fig. 174: Crankshaft Position Sensor & Bolt

Courtesy of CHRYSLER GROUP, LLC

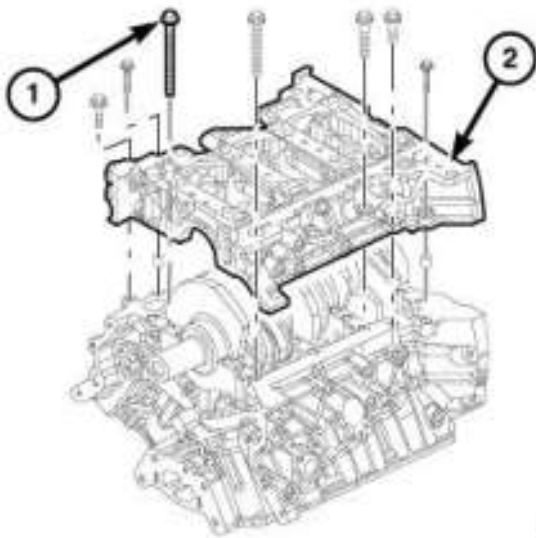
8. Remove bolt (1) and the Crankshaft Position Sensor (CKP) (2).



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Fig. 175: Crankshaft Timing Tool
Courtesy of CHRYSLER GROUP, LLC

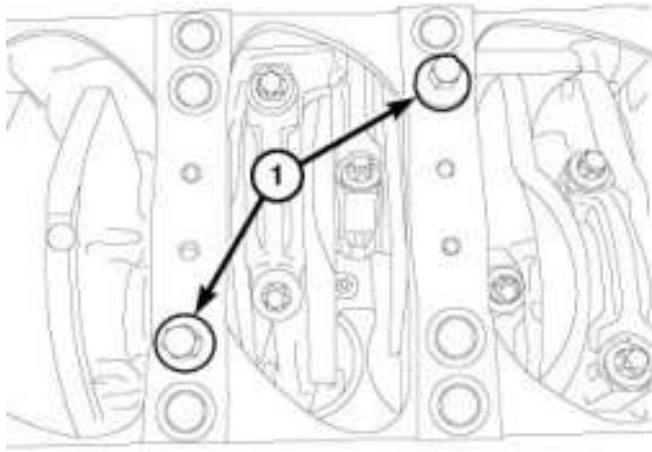
9. Remove the (special tool #VM.10339, Tool, Crankshaft Timing) (1).



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Fig. 176: Bed Plate & Bolts
Courtesy of CHRYSLER GROUP, LLC

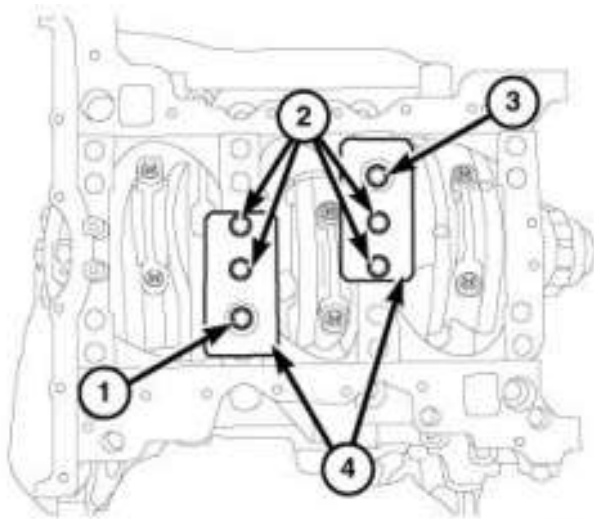
10. Remove bolts (1) securing the bed plate (2) to engine block.



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Fig. 177: Bed Plate Bolts
 Courtesy of CHRYSLER GROUP, LLC

11. Install two bed plate bolts (1) finger tight.



3645060

Fig. 178: Bedplate Removal Tools & Bolts
 Courtesy of CHRYSLER GROUP, LLC

12. Install the (special tool #VM.10362A, Tool, Bedplate Removal) (4) and securely tighten bolts (2).
13. Loosen bolts (1 and 3) in half turn increments until seal is broken.
14. Removal bolts (2) and the (special tool #VM.10362A, Tool, Bedplate Removal) (4).
15. Remove bolts (1 and 3) and the bed plate.

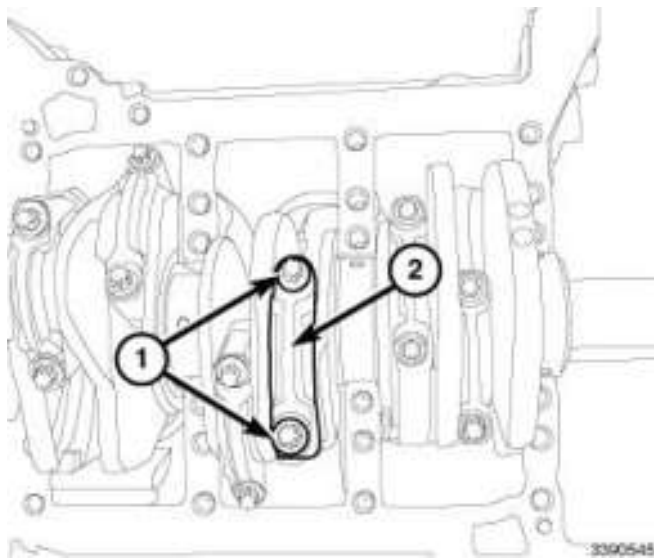


Fig. 179: Connecting Rods Bearing Cap & Bolts
 Courtesy of CHRYSLER GROUP, LLC

CAUTION: Do not allow the connecting rods to nick or score the crankshaft during assembly or disassembly.

CAUTION: Do not allow the connecting rod to bend or dent the oil jet. Serious engine damage may result from a misaligned oil jet.

16. Remove bolts (1) and the connecting rods bearing cap (2).

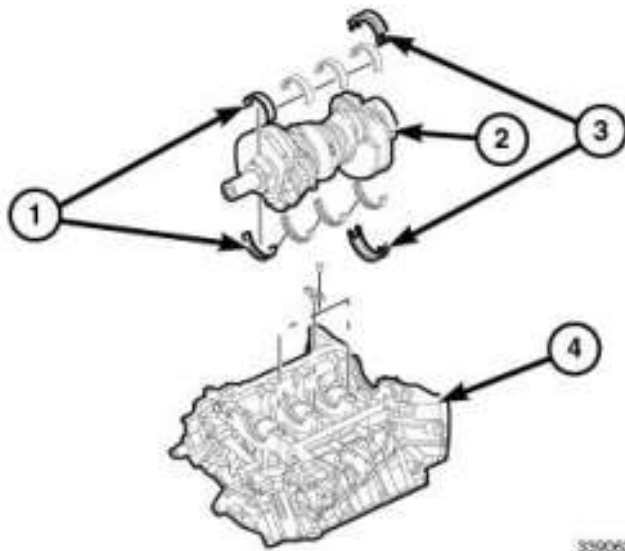
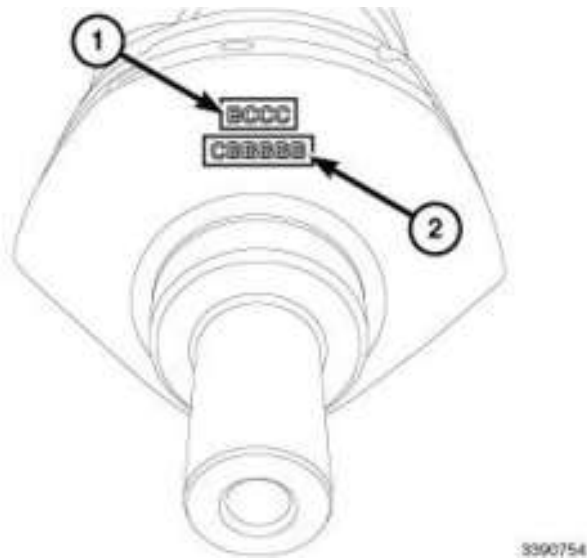


Fig. 180: Crankshaft, Bearings, Thrust Bearing & Engine Block
 Courtesy of CHRYSLER GROUP, LLC

17. Remove the crankshaft (2).
18. Remove the thrust washer (3).
19. Remove the crankshaft bearings (1).

INSTALLATION

INSTALLATION



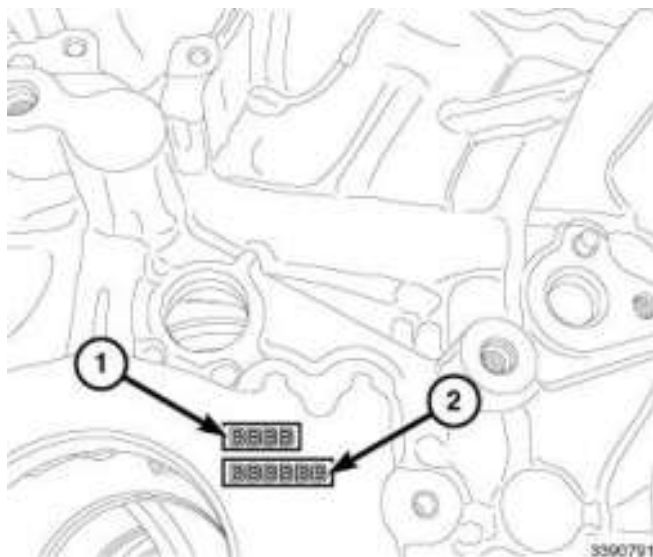
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Fig. 181: Bearing Identification & Letters Stamped Into Crankshaft
Courtesy of CHRYSLER GROUP, LLC

1. Clean all sealing and mating surfaces. Be sure that the sealing and mating surfaces are free of oil and debris. Refer to **ENGINE GASKET SURFACE PREPARATION**.

NOTE: If any bearing damage has occurred, remove all debris from the connecting rod bores, crankshaft, and oil galleries. Remove the steel ball from the main oil gallery before cleaning.

2. Clean and inspect the crankshaft and bearings journals. Replace the bearings as necessary.
3. Locate the crankshaft journal letter class (1) stamp on the crankshaft weight.



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Fig. 182: Upper Main Bearing Identification
Courtesy of CHRYSLER GROUP, LLC

4. Locate the engine block crankshaft journal letter class stamp on the engine block (1).

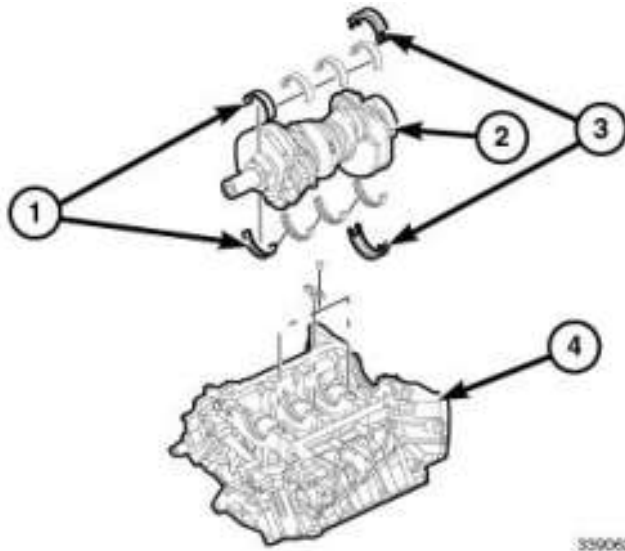


Fig. 183: Crankshaft, Bearings, Thrust Bearing & Engine Block
Courtesy of CHRYSLER GROUP, LLC

5. To determine the correct crankshaft journal letter class, each cylinder block seat diameter letter class must be matched with the crankshaft main journal diameter letter class. Both letter classes stamped on the cylinder block as well as on the crankshaft weight are in a progressive order starting from the front of the engine. The first letter corresponds to the first cylinder, the second to the second, etc. Use the crankshaft bearing selection chart to determine the half shell color. Refer to **CRANKSHAFT - STANDARD PROCEDURE** .
6. Select the correct and install top half of the crankshaft bearings (1) and the top half of the crankshaft thrust bearing (3) into engine block (4).
7. Using the bearing selection chart from step five, select the correct bearing and install lower half of the crankshaft bearings (1) and the lower half of the crankshaft thrust bearing (3) into bed plate.

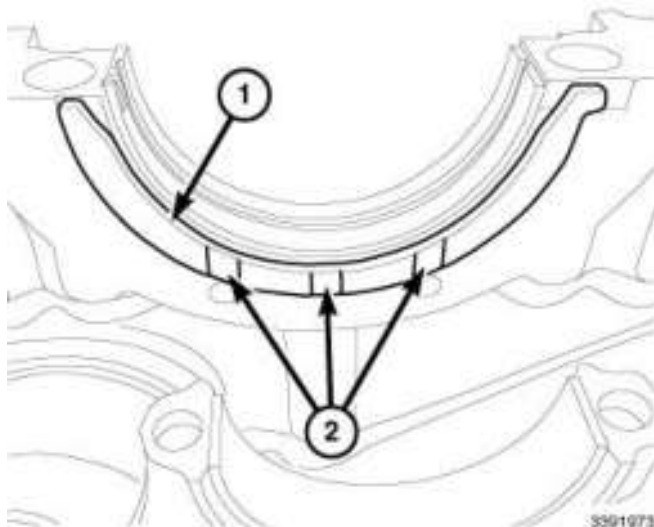


Fig. 184: Thrust Bearings & Oil Discharge Grooves
Courtesy of CHRYSLER GROUP, LLC

8. When installing the thrust bearings (1) in the engine block and bed plate, make sure the oil discharge grooves (2) face towards the crankshaft.

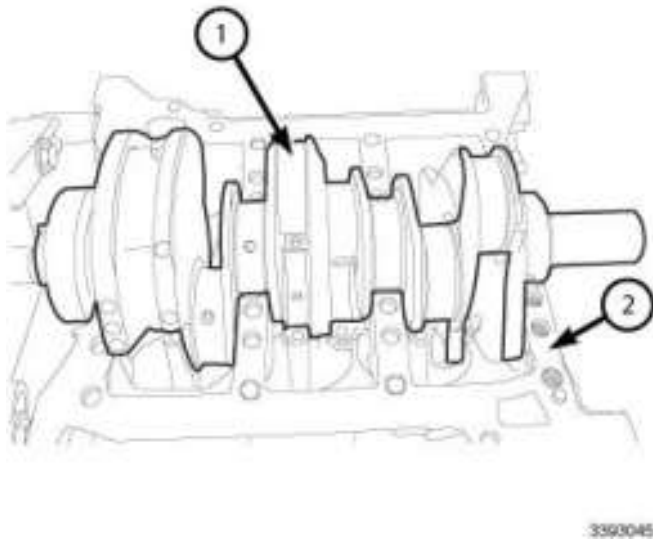


Fig. 185: Crankshaft & Engine Block
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Do not allow the connecting rods to nick or score the crankshaft during assembly or disassembly.

9. Set the crankshaft (2) into the engine block.

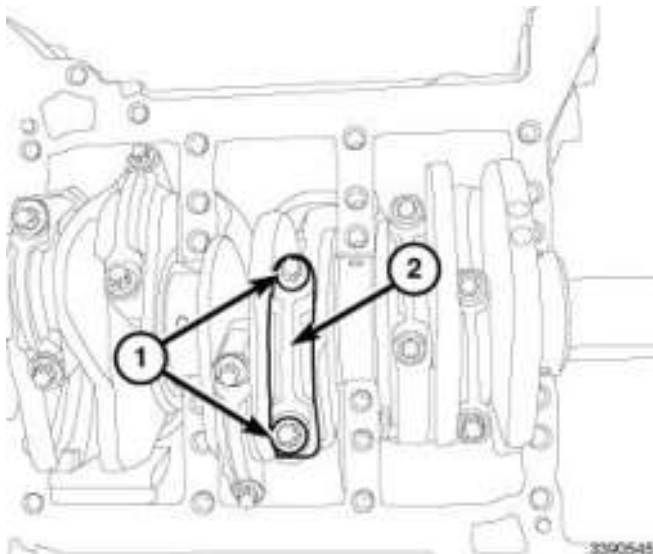


Fig. 186: Connecting Rods Bearing Cap & Bolts
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Do not allow the connecting rod to bend or dent the oil jet. Serious engine damage may result from a misaligned oil jet.

10. Using new connecting rod bearings and bolts (1), install the connecting rod bearing caps (2). Refer to

BEARING(S), CONNECTING ROD, INSTALLATION.

11. Install the lower half of the crankshaft bearings and the lower half of the crankshaft thrust bearing into bed plate.

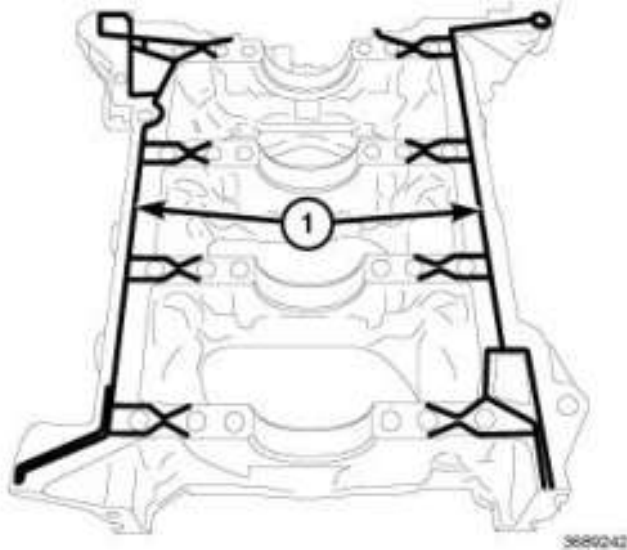


Fig. 187: RTV Sealant Compound On Bed Plate
Courtesy of CHRYSLER GROUP, LLC

12. Clean the gasket sealing surfaces. Refer to **ENGINE GASKET SURFACE PREPARATION** .

NOTE: Do not let the bed plate sit for longer than 10 minutes after applying sealing compound.

13. Using Mopar® Threebond Engine RTV Sealant, apply a 1.5 mm thick bead of sealing compound to bed plate as illustrated (1) and **DO NOT** spread the sealing bead.

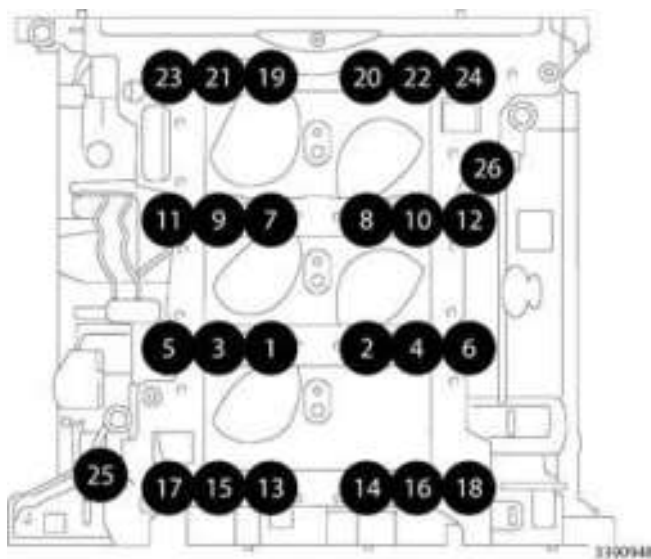


Fig. 188: Bed Plate Onto Engine Block Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

14. Install the bed plate onto the engine block.

15. Using new bolts, install the twenty six M12 bolts (1 - 26) and the three M8 bolts finger tight.
16. Using the tightening shown in illustration, tighten all M12 bolts to 45 N.m (33 ft. lbs.).

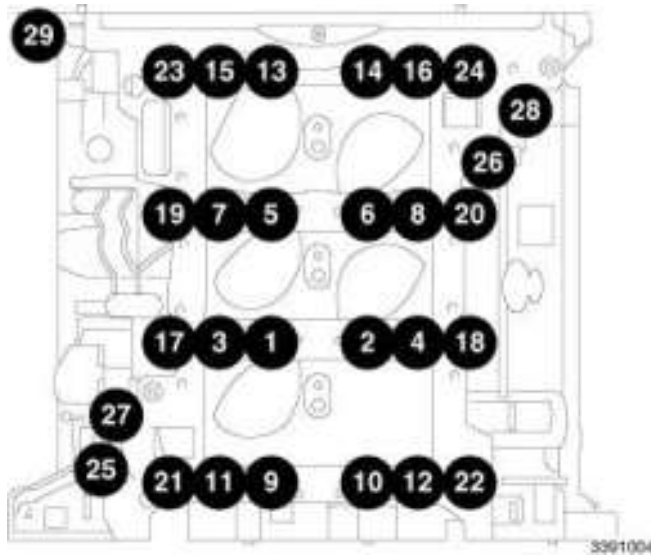


Fig. 189: Bed Plate Tightening Sequence
 Courtesy of CHRYSLER GROUP, LLC

17. Using the tightening sequence shown in illustration to the following torque values:
 - Step 1: Using a torque angle gauge, tight the internal bed plate bolts (1 - 16) an additional 110 degrees turn.
 - Step 2: Tight the external bed plate bolts (17 - 26) to 120 N.m (89 ft. lbs.).
 - Step 3: Tighten the three M8 bolts (27 - 29) to 30 N.m 22 ft. lbs.).
 - Step 4: Check the torque of the M12 bolts (1 - 26) in a counterclockwise direction with the torque wrench set at 115 N.m (85 ft. lbs.).
18. The crankshaft should turn freely. If the crankshaft does not turn freely loosen and re-torque the bearing caps.

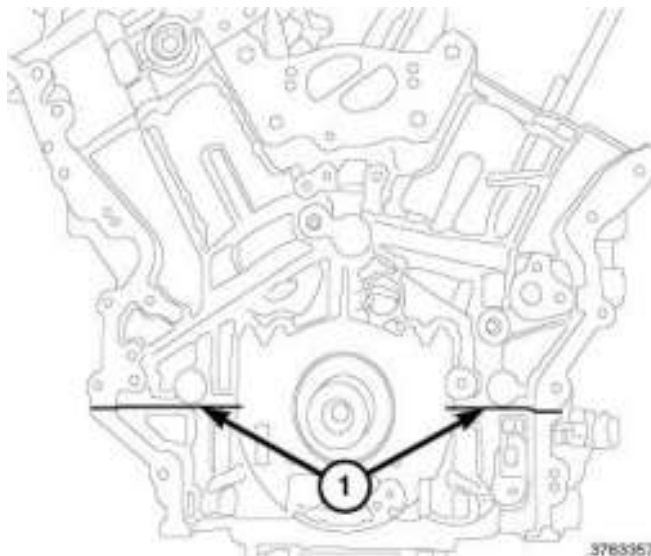


Fig. 190: RTV Sealant Excess Locations
 Courtesy of CHRYSLER GROUP, LLC

19. Remove any excess Mopar® Threebond Engine RTV Sealant (1) that may have squeezed out in the front of engine.

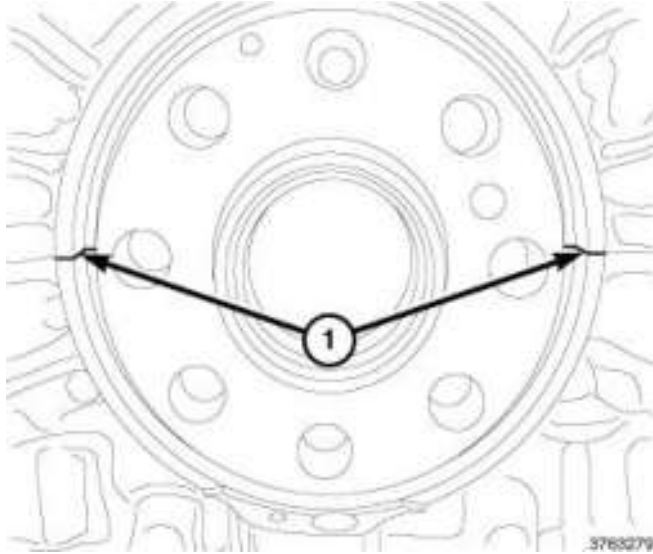


Fig. 191: Rear Oil Seal Excess RTV Sealant Locations
Courtesy of CHRYSLER GROUP, LLC

20. Remove any excess Mopar® Threebond Engine RTV Sealant (1) that may have squeezed out in rear oil seal bay.
21. Check the crankshaft end play. Refer to **CRANKSHAFT - STANDARD PROCEDURE** .

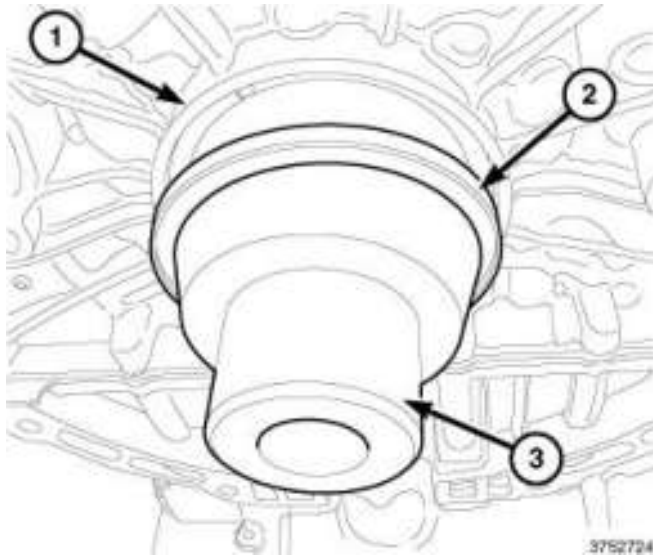


Fig. 192: Rear Seal Guide, Rear Oil Seal & Crankshaft
Courtesy of CHRYSLER GROUP, LLC

22. Install the (special tool #VM.10341-1, Guide, Rear Seal) (3) and slide the rear oil seal (2) onto the crankshaft.
23. Remove the (special tool #VM.10341-1, Guide, Rear Seal).

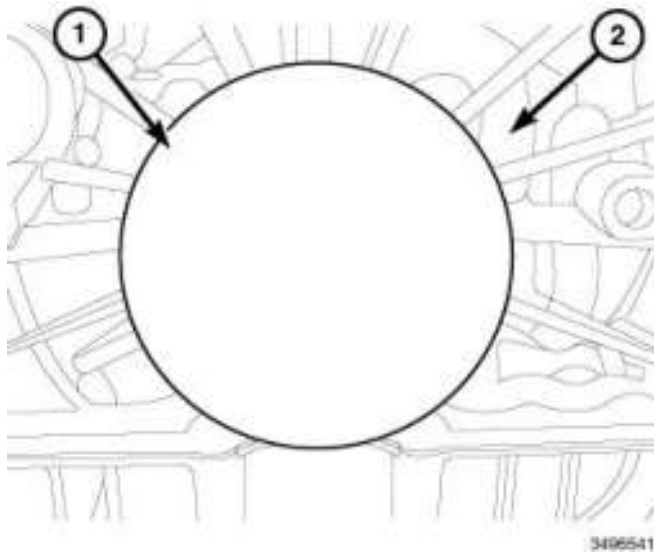


Fig. 193: Rear Seal Installer & Crankshaft Position Sensor (CKP) Boss
Courtesy of CHRYSLER GROUP, LLC

NOTE: Position the flat portion of the Rear Seal Installer should be facing down giving you clearance by the Crankshaft Position Sensor (CKP) boss.

24. Using the (special tool #VM.10341-2, Installer Tool, Rear Seal) (1) install the rear main oil seal into the engine block.

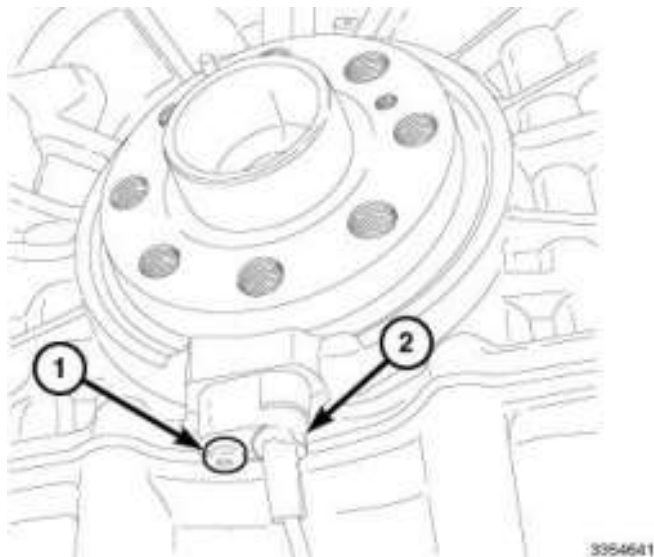


Fig. 194: Crankshaft Position Sensor & Bolt
Courtesy of CHRYSLER GROUP, LLC

25. Install the Crankshaft Position Sensor (CKP) (2). Tighten bolt (1) to 6 N.m (53 in. lbs.).

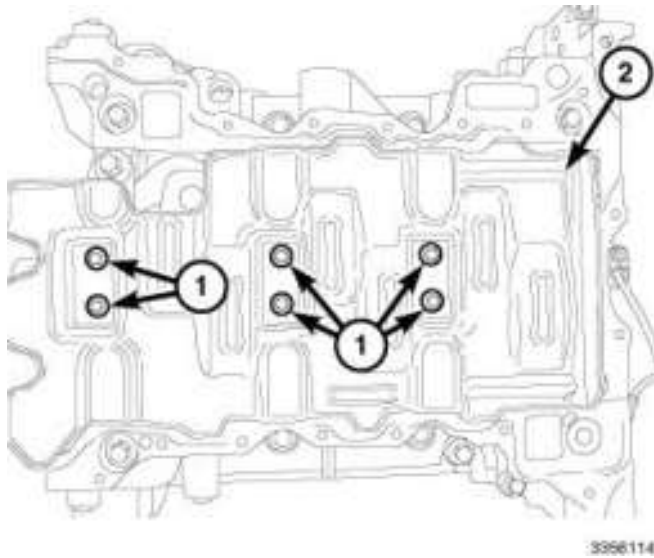


Fig. 195: Windage Tray & Bolts
 Courtesy of CHRYSLER GROUP, LLC

26. Install the windage tray (2). Tighten bolts (1) to 11 N.m (97 in. lbs.).
27. Install the oil pump. Refer to **PUMP, ENGINE OIL, INSTALLATION** .

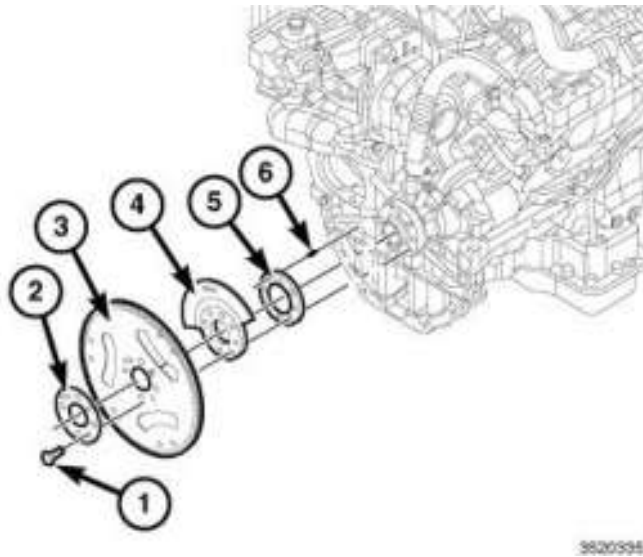


Fig. 196: Flex Plate, Counter Weight, Tone Wheel & Bolts
 Courtesy of CHRYSLER GROUP, LLC

28. Install the tone wheel (5), counter weight (4), and the flex plate (3). Refer to **FLEXPLATE, INSTALLATION** .
29. Install both cylinder heads. Refer to- **CYLINDER HEAD, INSTALLATION** .
30. Install the engine into vehicle. Refer to **INSTALLATION** .

DAMPER, VIBRATION

REMOVAL

REMOVAL

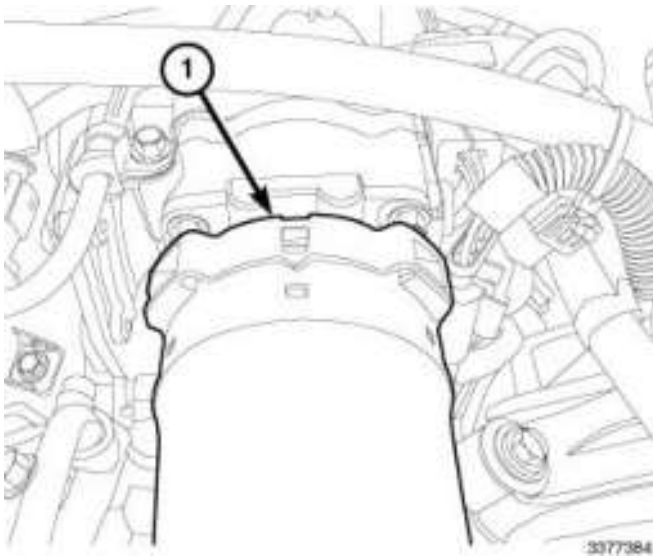


Fig. 197: Charge Air Cooler Hose
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect negative battery cable.
2. Disconnect the CAC hose (1) from the EGR air flow control valve and position aside.

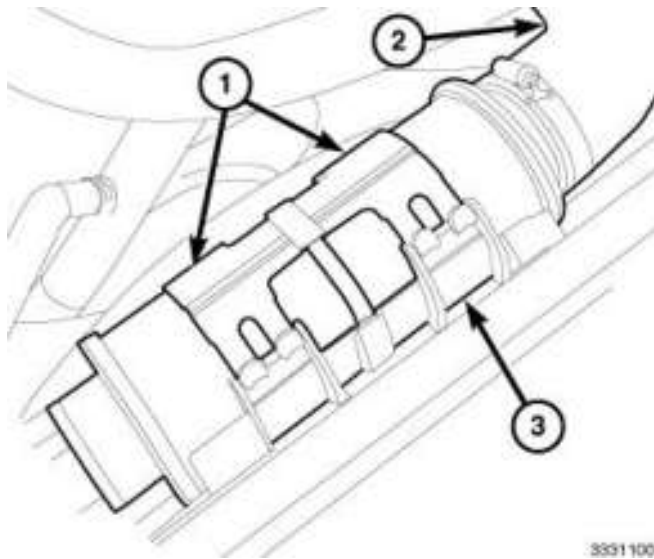


Fig. 198: Charge Air Hose, Clamps & Resonator
Courtesy of CHRYSLER GROUP, LLC

3. Disconnect the Charge Air Cooler (CAC) hose at resonator (3).
4. Release clips (1) and remove the charge air resonator (3) and position aside.

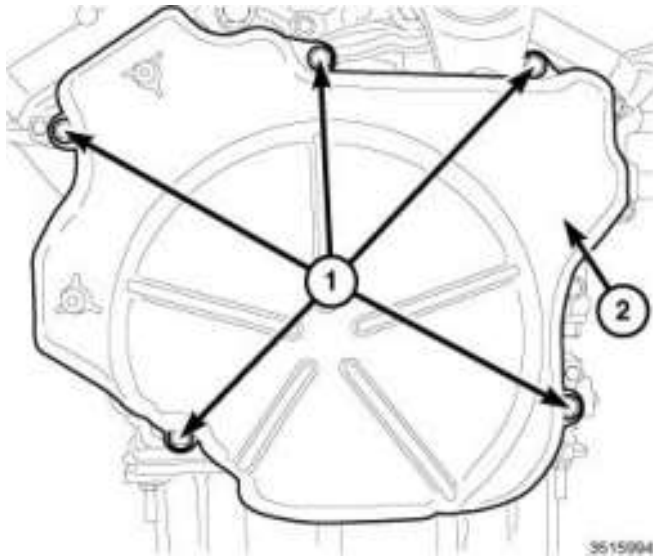


Fig. 199: Vibration Damper Cover & Bolts
 Courtesy of CHRYSLER GROUP, LLC

5. Remove bolts (1) and the vibration damper cover (2).

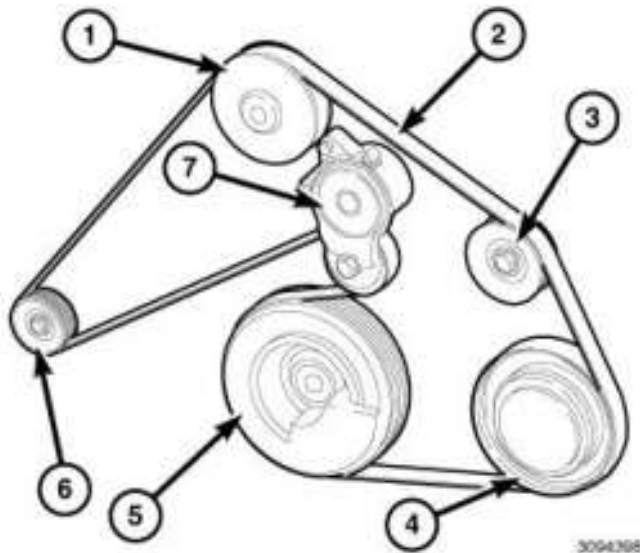


Fig. 200: Pulleys, Tensioner & Drive Belt Routing 3.0L
 Courtesy of CHRYSLER GROUP, LLC

6. Remove the accessory drive belt. Refer to **BELT, SERPENTINE, REMOVAL** .
7. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
8. Remove the front skid plate. Refer to **PLATE, SKID, FRONT, REMOVAL** .
9. Remove the front suspension skid plate. Refer to **PLATE, SKID, FRONT SUSPENSION, REMOVAL** .
10. Lock the engine 30 degrees ATDC. Refer to **VALVE TIMING - STANDARD PROCEDURE** .

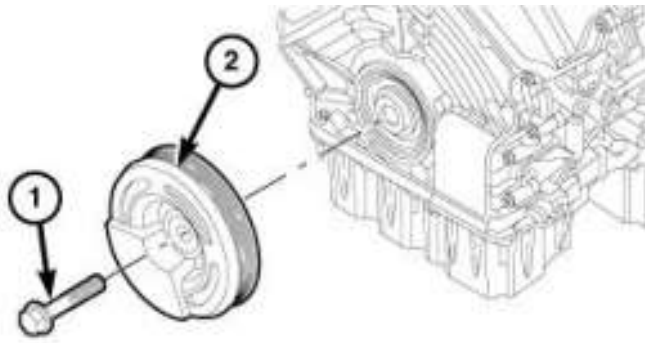


Fig. 201: Vibration Damper & Bolt
Courtesy of CHRYSLER GROUP, LLC

11. Lower the vehicle.

NOTE: The crankshaft damper bolt is a left hand thread.

12. Remove bolt (1) and the vibration damper (2).

INSTALLATION

INSTALLATION

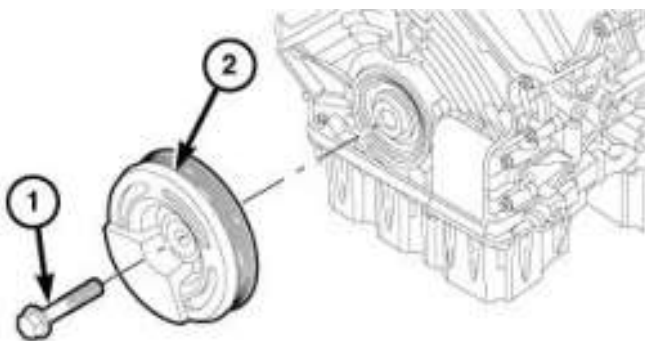
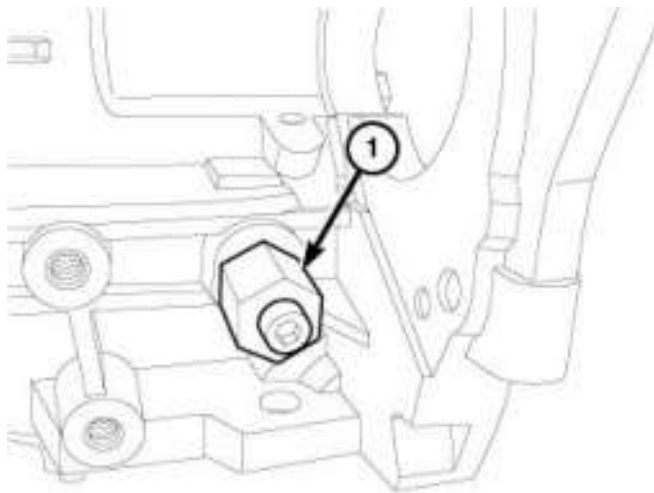


Fig. 202: Vibration Damper & Bolt
Courtesy of CHRYSLER GROUP, LLC

NOTE: The crankshaft damper bolt is a left hand thread.

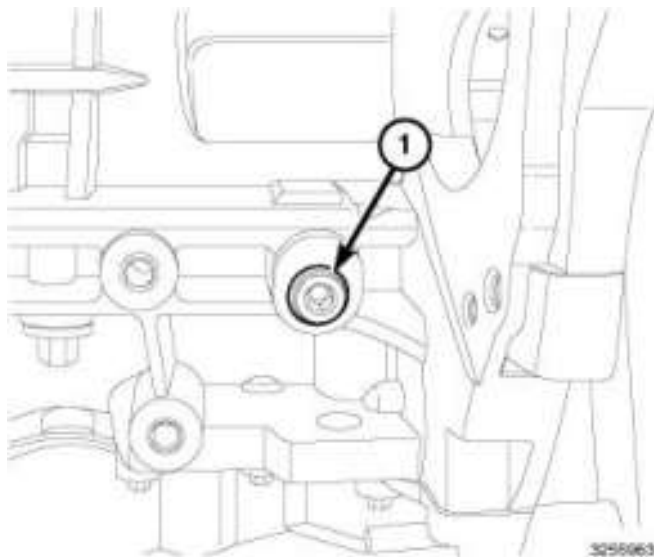
1. Install the vibration damper (2). Tighten bolt (1) to 100 N.m (74 ft. lbs.) plus an additional 125 degrees turn.



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Fig. 203: Crankshaft Timing Tool
 Courtesy of CHRYSLER GROUP, LLC

2. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
3. Remove Crankshaft Locking Tool (special tool #VM.10339, Tool, Crankshaft Timing) (1).



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Fig. 204: Engine Block Plug
 Courtesy of CHRYSLER GROUP, LLC

4. Install engine block plug (1). Tighten 30 N.m (22 ft. lbs.).
5. Install the front suspension skid plate. Refer to **PLATE, SKID, FRONT SUSPENSION, INSTALLATION** .

Install the front skid plate. Refer to **PLATE, SKID, FRONT, INSTALLATION** .

6. Lower the vehicle.

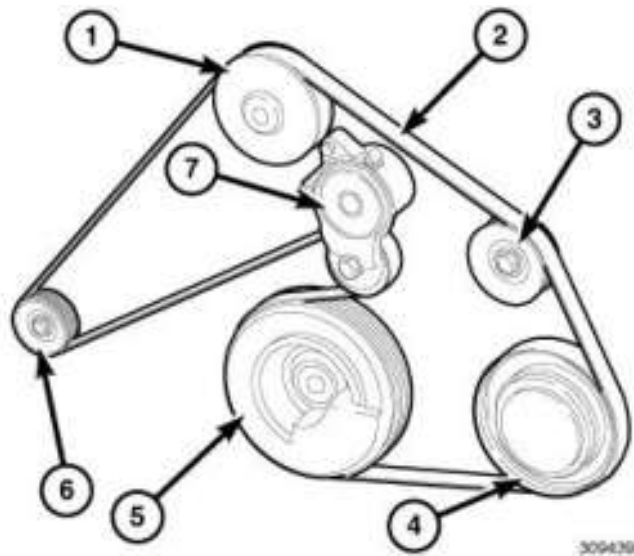


Fig. 205: Pulleys, Tensioner & Drive Belt Routing 3.0L
 Courtesy of CHRYSLER GROUP, LLC

7. Installed the accessory drive belt. Refer to **BELT, SERPENTINE, INSTALLATION** .

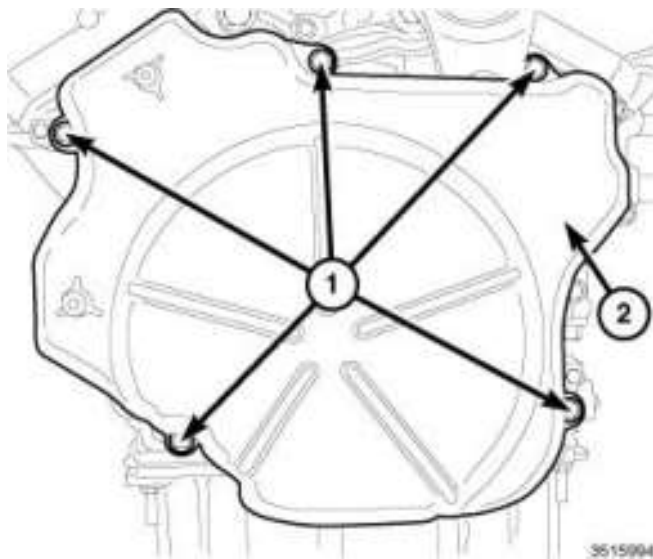


Fig. 206: Vibration Damper Cover & Bolts
 Courtesy of CHRYSLER GROUP, LLC

8. Install the vibration damper cover (2). Tighten bolts (1) to 11 N.m (97 in. lbs.).

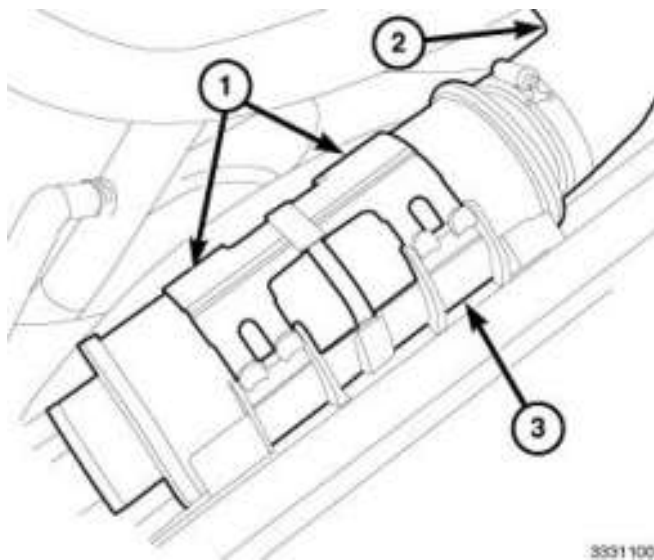


Fig. 207: Charge Air Hose, Clamps & Resonator
Courtesy of CHRYSLER GROUP, LLC

9. Install the charge air resonator (3) and attach the clips (1).
10. Connect the CAC hose to resonator (3).

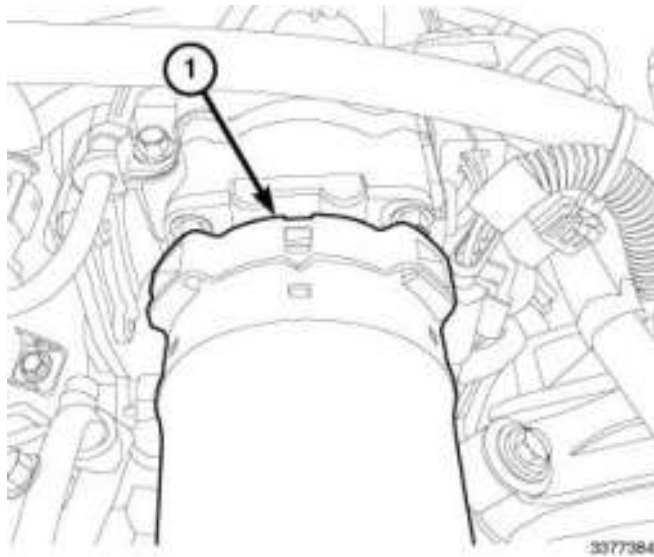


Fig. 208: Charge Air Cooler Hose
Courtesy of CHRYSLER GROUP, LLC

11. Connect the Charge Air Cooler (CAC) hose (1) to the EGR air flow control valve.
12. Connect negative battery cable.

FLEXPLATE

DESCRIPTION

DESCRIPTION

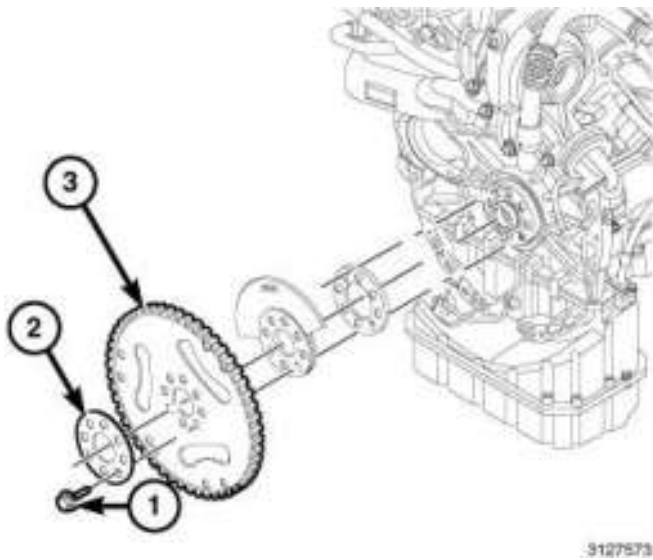


Fig. 209: Flex Plate, Counter Weight, Tone Wheel & Bolts
 Courtesy of CHRYSLER GROUP, LLC

The flex plate is fastened to the crankshaft and can only be installed one way. The crankshaft has a dowel locating pin that is used to align the magnetic tone wheel and the counter weight. The stamped-steel flex plate has a segment ring to provide engine speed and crankshaft position information to the Power Control Module (PCM). The crankshaft position sensor is mounted next to the segment ring and sends electrical pulses to the PCM.

REMOVAL

REMOVAL

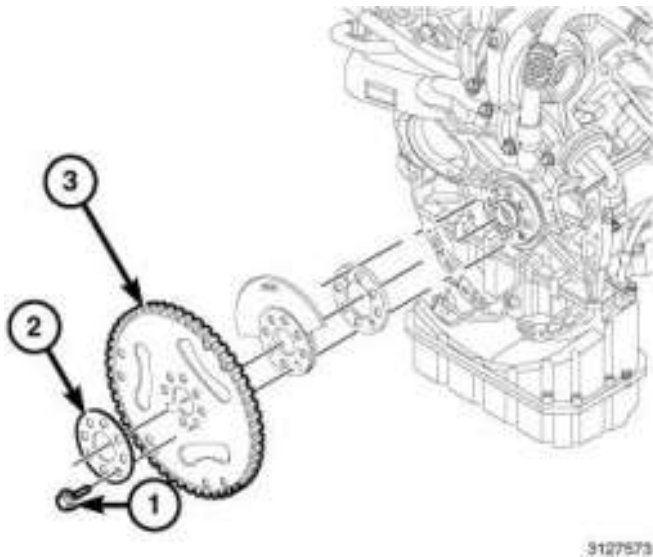


Fig. 210: Flex Plate, Counter Weight, Tone Wheel & Bolts
 Courtesy of CHRYSLER GROUP, LLC

1. Remove the transmission. Refer to **REMOVAL** .
2. Paint mark the flex plate hub to flex plate relation.
3. Remove bolts (1) and flex plate (3).
4. If necessary, remove the counter weight (4) and tone wheel (5).

5. Inspect flex plate for damage.

INSTALLATION

INSTALLATION

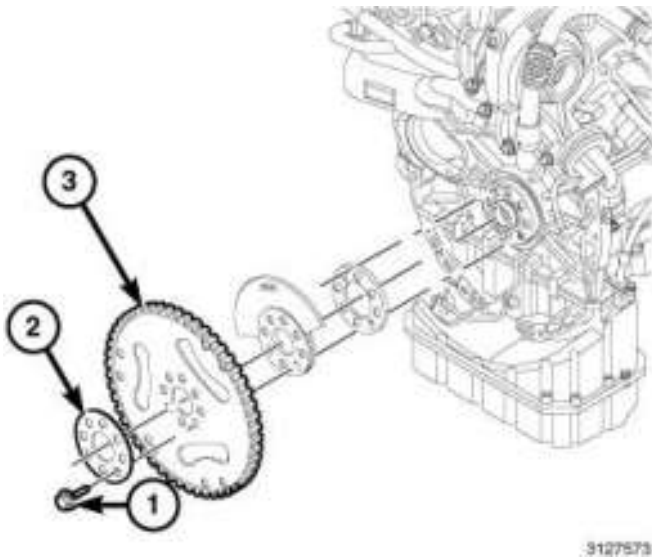


Fig. 211: Flex Plate, Counter Weight, Tone Wheel & Bolts
Courtesy of CHRYSLER GROUP, LLC

NOTE: Do Not lubricate new bolts as they are already coated with an anti-scuff treatment.

Align the flex plate to hub paint marks, where applicable.

NOTE: Always use new flex plate bolts when ever the existing bolts have been removed

1. If removed, install the tone wheel (5) and counter weight (4).
2. Install the flex plate (3).

NOTE: With clean engine oil, lubricate the bolt side of backing plate (2).

3. Lubricate and install the backing plate (2) and tighten bolts (1) finger tight.



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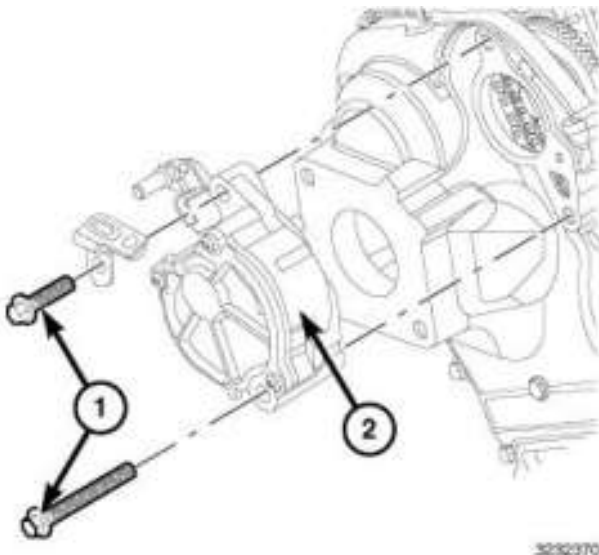
Fig. 212: Flex Plate Tightening Sequence
 Courtesy of CHRYSLER GROUP, LLC

4. Using the tightening sequence shown in illustration, Tighten bolts to:
 - Tighten bolts 50 N.m (37 ft. lbs.).
 - Loosen one bolt at a time and retighten bolt in a clockwise cross pattern to 125 N.m (92 ft. lbs.).
 - Using a torque angle gauge, tighten each bolt an additional 30 degrees in a clockwise cross pattern.
5. Install the transmission. Refer to **INSTALLATION** .

PUMP, VACUUM

DESCRIPTION

DESCRIPTION



3232170

Fig. 213: Vacuum Pump & Bolts
 Courtesy of CHRYSLER GROUP, LLC

The vacuum pump is a constant displacement, vane-type pump. Vacuum is generated by vanes mounted in the pump rotor. The rotor is located in the pump housing and is pressed onto the pump shaft.

The vacuum pump operates by a slotted extension attached to the vacuum pump shaft. The vacuum pump shaft slotted extension fits into, and is driven by, the intake camshaft gear.

The vacuum pump rotating components are internally lubricated and the vacuum pump has no serviceable parts. Do not disassemble or attempt to repair the pump.

OPERATION

OPERATION

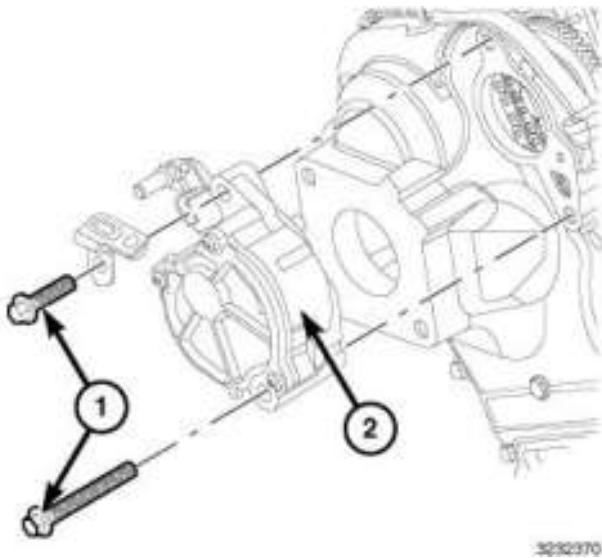


Fig. 214: Vacuum Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

Vacuum pump output is transmitted to the EGR vacuum bypass solenoid and brake vacuum booster, systems through a supply hose. The hose is connected to an outlet port on the pump housing and uses an in-line check valve to retain system vacuum when vehicle is not running.

Pump output ranges from a minimum of 8.5 to 25 inches vacuum.

The pump rotor and vanes are rotated by the slotted pump drive gear which fits into the camshaft drive gear.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - VACUUM PUMP

1. Connect a vacuum gauge to the booster check valve with a short length of hose and T-fitting.
2. Start the engine allowing the engine to run for 30 seconds. Vacuum should be 18 inches HG (609 millibars). Verify the vacuum line is not leaking. If no leak is present replace vacuum pump. Refer to **PUMP, VACUUM, REMOVAL** and **PUMP, VACUUM, INSTALLATION**.

REMOVAL

REMOVAL

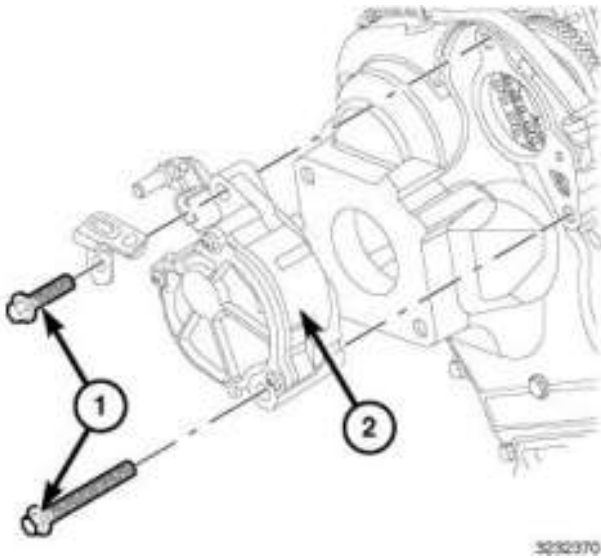


Fig. 215: Vacuum Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect negative battery cable.
2. Remove the vacuum line at vacuum pump.

NOTE: Observe position of driver on rear of pump upon removal.

3. Remove bolts (1) and the vacuum pump (2).

INSTALLATION

INSTALLATION

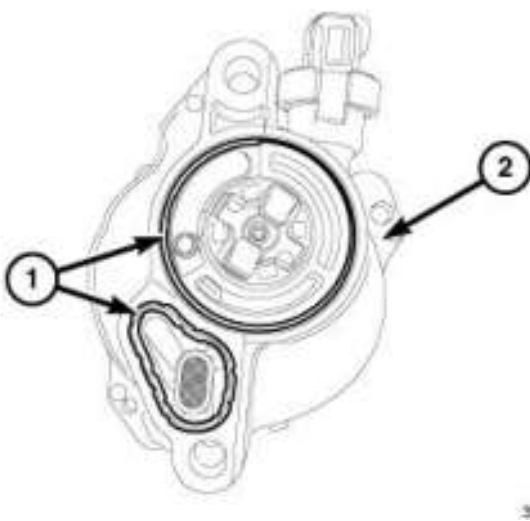


Fig. 216: Vacuum Pump & O-Ring Seals
Courtesy of CHRYSLER GROUP, LLC

1. Clean all sealing surfaces.
2. Install new O-ring seals (1) onto the vacuum pump (2).

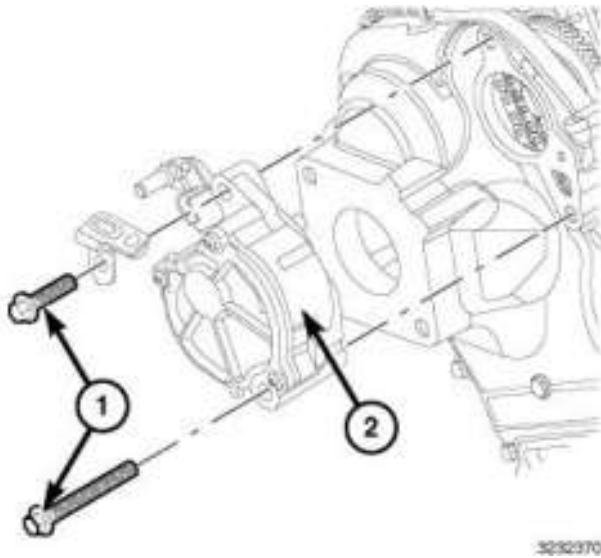


Fig. 217: Vacuum Pump & Bolts
 Courtesy of CHRYSLER GROUP, LLC

3. Position driver on rear of pump and install vacuum pump (2). Tighten bolts (1) to 30 N.m (22 ft. lbs.).
4. Install vacuum line onto the vacuum pump.
5. Connect the negative battery cable.
6. Start the engine and inspect for leaks.

ROD, PISTON AND CONNECTING

DESCRIPTION

DESCRIPTION

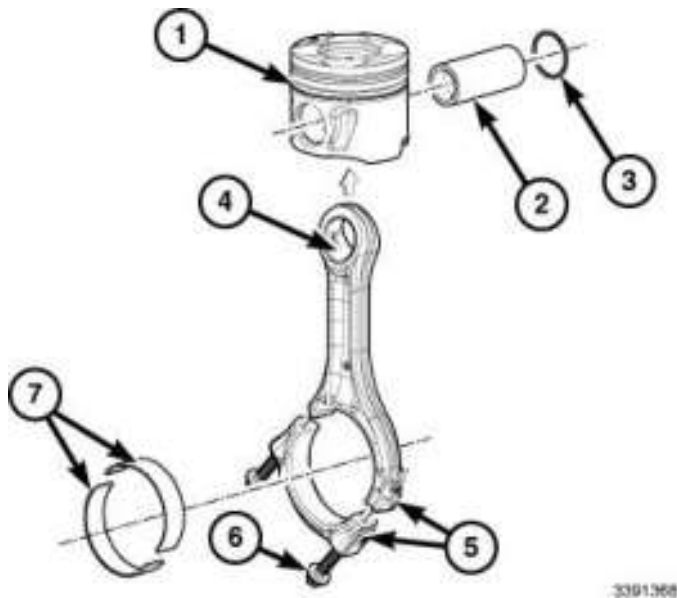


Fig. 218: Piston & Connecting Rod Components
 Courtesy of CHRYSLER GROUP, LLC

NOTE: The connecting rod bolts are a one time use, and must be replaced every

time they are loosened or removed.

The pistons (1) are made of a high strength Aluminum Alloy B2+Phosphate and Graphite Coating. Conventional Cooling Gallery. Insert Ring + Parallel Type Groove. The piston crown consists of a combustion bowl and four recesses machined for the valves. Circlips (3) secure a full floating piston pin (2). The pistons have a phosphate surface treatment and the piston skirts have a graphite treatment for scuff resistance. The piston skirts have notches to provide the necessary clearance for the oil jets when the pistons are at BDC. The connecting rod (5) that are forged steel I-shaped with a diagonal slit and a tapered faced small end. The connecting rod (5) is a fracture split type rod.

REMOVAL

REMOVAL

1. Disconnect the negative battery cable.
2. Remove the engine from the vehicle. Refer to REMOVAL .
3. Remove both cylinder heads. Refer to CYLINDER HEAD, REMOVAL .

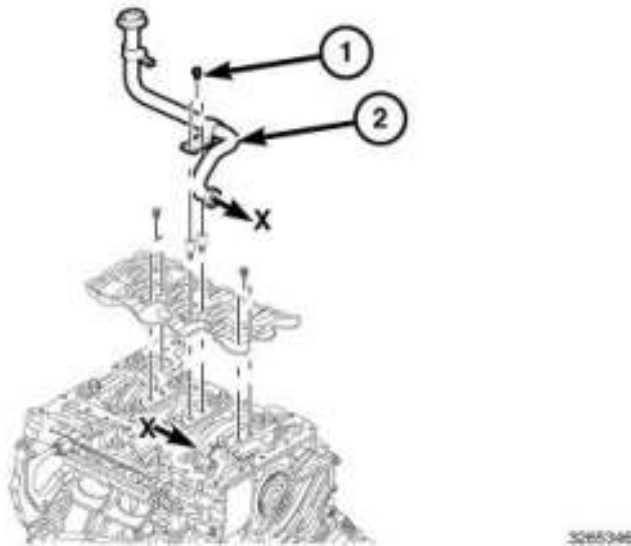


Fig. 219: Oil Pump Pickup Tube & Bolts
Courtesy of CHRYSLER GROUP, LLC

4. Remove the oil pump and pickup tube (2). Refer to PUMP, ENGINE OIL, REMOVAL .

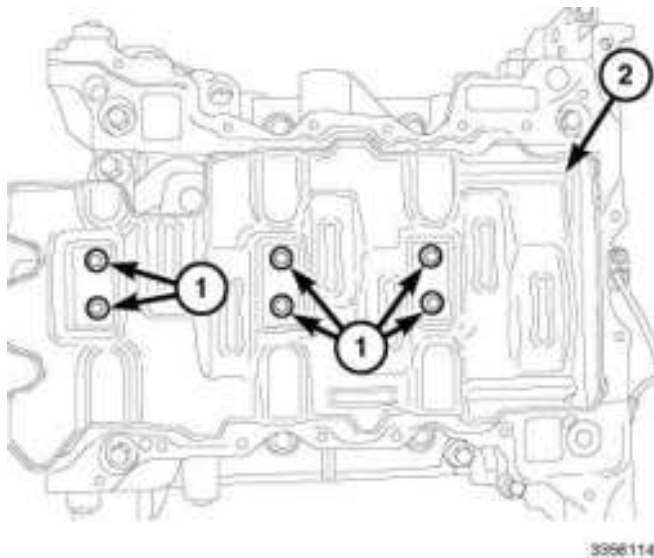


Fig. 220: Windage Tray & Bolts
 Courtesy of CHRYSLER GROUP, LLC

5. Remove bolts (1) and the windage tray (2).

CAUTION: To prevent damage to the oil jets, remove the oil jets before removing the pistons.

CAUTION: Use caution when removing and installing oil jets. Damage to oil jet nozzle could cause severe engine damage. Care must be taken not to damage the crankshaft tone ring when removing cylinder number four oil jet.

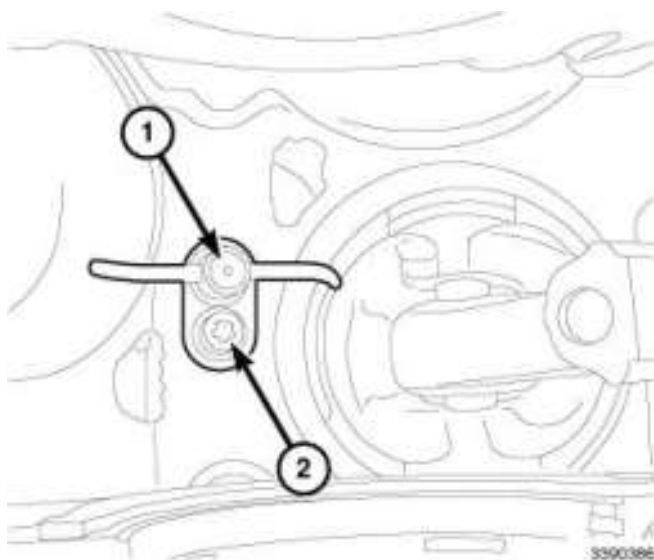


Fig. 221: Oil Jet & Retaining Bolt
 Courtesy of CHRYSLER GROUP, LLC

6. Remove the appropriate oil jet retaining bolt (2) and remove oil jet (1) from the engine block.

NOTE: The piston and connecting rod assembly must be removed through the

top of cylinder block.

7. Remove the ridge from the top of the cylinder bores with a ridge reamer before removing pistons from cylinder block. **Be sure to keep the top of pistons covered during this operation.**
8. Rotate the crankshaft so the connecting rod is centered in the cylinder bore.
9. Remove the connecting rod cap bolts and remove the fracture-split rod cap.

NOTE: Use care not to nick or scratch the crankshaft journal or cylinder bore during removal.

10. Carefully remove the piston and connecting rod assembly out through the top of the cylinder block.
11. Mark the pistons with the matching cylinder number after removal.
12. Repeat this procedure for the remaining pistons and connecting rod assemblies.

PISTON PIN

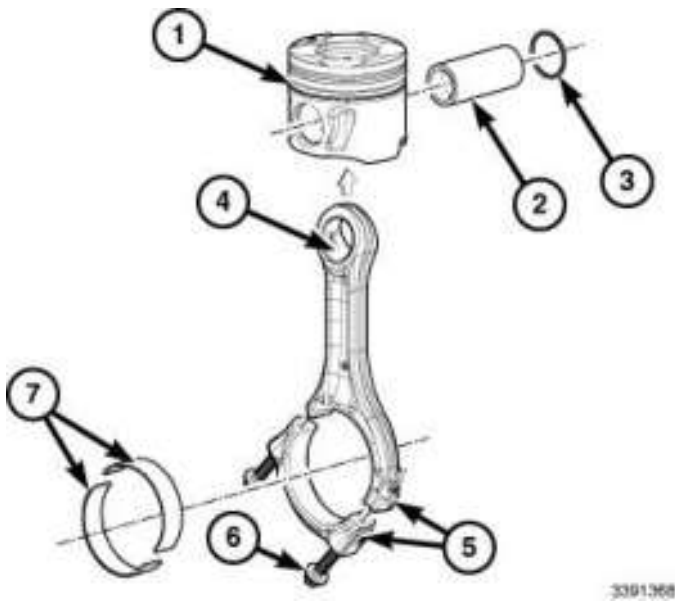


Fig. 222: Piston & Connecting Rod Components

Courtesy of CHRYSLER GROUP, LLC

1. Secure the connecting rod (5) in a soft jawed vice.
2. Remove the two snap rings (3) securing the piston pin (2).
3. Push the piston pin (2) out of the piston (1) and the connecting rod (5).
4. Remove the piston (1) from the connecting rod (5).
5. Measure the diameter of the piston pin in the center and on both ends. Refer to **ENGINE SPECIFICATIONS**.
6. Repeat this procedure for the remaining pistons and connecting rod assemblies.

PISTON RING

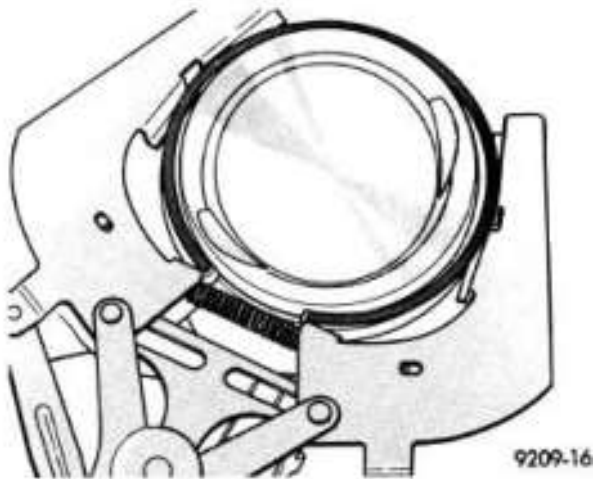


Fig. 223: Piston Rings - Removal/Installation
Courtesy of CHRYSLER GROUP, LLC

1. The ID mark on the face of the top and second piston rings must point toward the piston crown.
2. Using a suitable ring expander, remove the top and second piston rings.
3. Remove the upper oil ring side rail, lower oil ring side rail and then the oil expander from the piston.
4. Carefully clean carbon from the piston crowns, skirts and ring grooves ensuring the 4 oil holes in the oil control ring groove are clear.
5. Repeat this procedure for the remaining pistons and connecting rod assemblies.

INSPECTION

INSPECTION

PISTONS

1. Check piston pin bores in piston for roundness. Make 3 checks at 120° intervals. Maximum out of roundness .020 mm (.0008 in.).
2. The piston diameter should be measured approximately 10 mm (.394 in.) up from the base.
3. Skirt wear should not exceed 0.1 mm (.00039 in.).

PISTON PINS

1. Measure the diameter of piston pin in the center and both ends. Refer to the engine specification chart. Refer to **ENGINE SPECIFICATIONS** .

CONNECTING RODS

NOTE: Connecting rod bolts are a one time use, and must be replaced every time they are loosened or removed. All six must have the same weight and the same number. Replacement connecting rods will only be supplied in sets of six. When assembling the connecting rod, be sure to paint mark or scribe mark each of the connecting rods and caps before installation, for alignment purposes later.

NOTE: Do Not lubricate the new connecting rod bolts. They are already coated with

a anti scuff treatment.

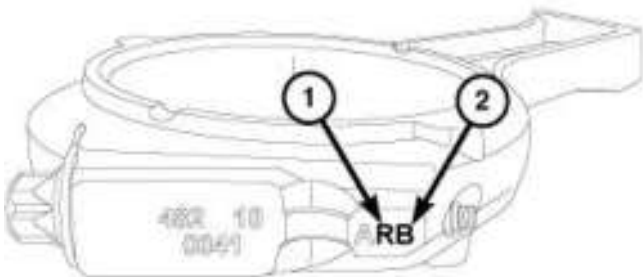
Connecting rods are supplied in sets of six since they all must be of the same weight category.

1. Assemble bearing shells and bearing caps to their respective connecting rods ensuring that the serrations on the cap and reference marks are aligned.
2. Using new bolts, tighten the connecting rod cap bolts to:
 - Step 1: Tighten to 10 N.m (88 in. lbs.).
 - Step 2: Tighten each bolt to 25 N.m (18 ft. lbs.).
 - Step 3: Tighten each bolt an additional 75 degrees turn.
 - Step 4: With the torque wrench set at 50 N.m (37 ft. lbs.) to check the tightening of each bolt.

INSTALLATION

INSTALLATION

NOTE: All six connecting rods must have the same weight and letter classification. The connecting rod bolts are a one time use, and must be replaced every time they are loosened or removed.



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Fig. 224: Connecting Rod Shaft & Class Identification Mark
Courtesy of CHRYSLER GROUP, LLC

Each connecting rod has its own letter weight class identification mark (1) on connecting rod. Only use connecting rods that are of the same weight class. (R = Rosso, V = Verde)

Connecting rods can only be replace in sets of six, not individually.

PISTON PIN

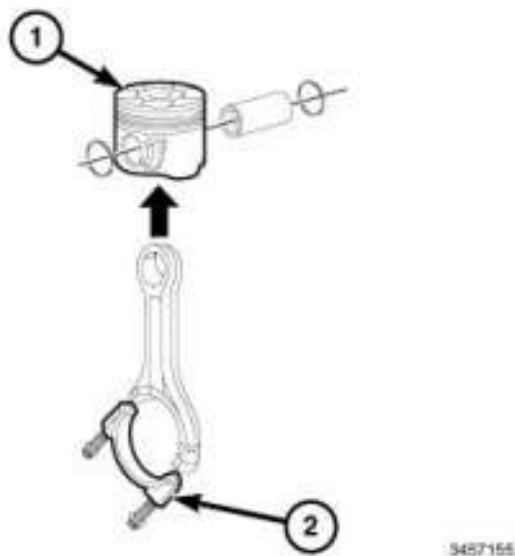


Fig. 225: Piston Crown & Connecting Rod Cap
 Courtesy of CHRYSLER GROUP, LLC

NOTE: During piston assembly with the conrod pay attention concerning the arrow position on the piston crown (1) and the stamping on the connecting rod cap (2): the arrow and the stamping must oppose one another and cannot be on the same side.

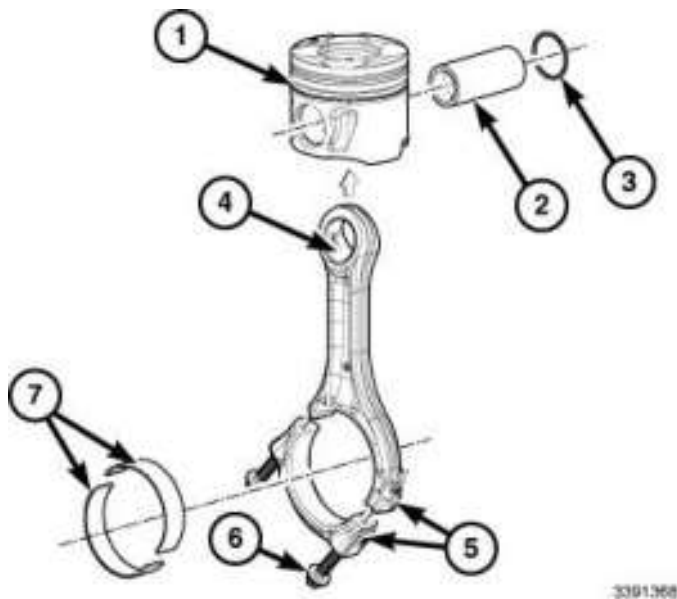


Fig. 226: Piston & Connecting Rod Components
 Courtesy of CHRYSLER GROUP, LLC

1. Secure connecting rod (5) in soft jawed vice.
2. Lubricate piston pin (2) and piston (1) with clean engine oil.
3. Position piston (1) on connecting rod (5).
4. Install piston pin (2).
5. Install snap ring (3) in piston (1) to retain piston pin (2).
6. Remove connecting rod (5) from vice.

PISTON RINGS

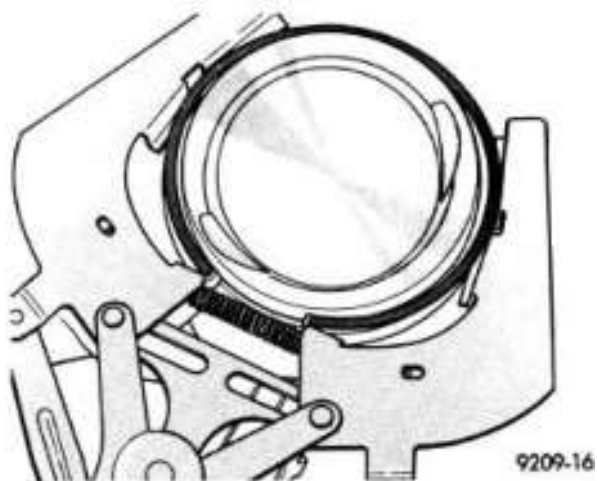


Fig. 227: Piston Rings - Removal/Installation
Courtesy of CHRYSLER GROUP, LLC

1. Install rings on the pistons using a suitable ring expander.

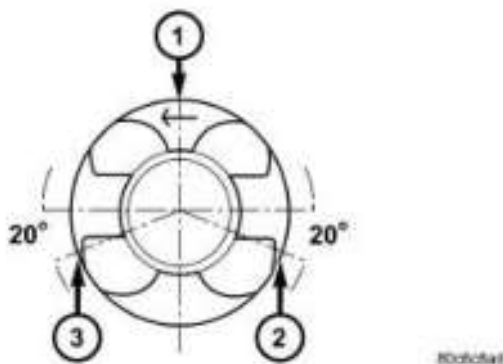


Fig. 228: Piston Ring Gap Location
Courtesy of CHRYSLER GROUP, LLC

- | |
|--|
| 1 - SECOND COMPRESSION RING GAP POSITION
2 - OIL CONTROL RING GAP POSITION
3 - TOP COMPRESSION RING GAP POSITION |
|--|

2. Top compression ring is tapered and chromium plated. The second ring is of the scraper type and must be installed with scraping edge facing bottom of the piston. The third is an oil control ring. Ring gaps must be positioned, before inserting piston into the liners, as follows.
3. Top ring gap must be positioned at the No. 3 position (looking at the piston crown from above).
4. Second piston ring gap should be positioned at the No. 1 position.
5. Oil control ring gap should be positioned at the No. 2 position.

PISTON

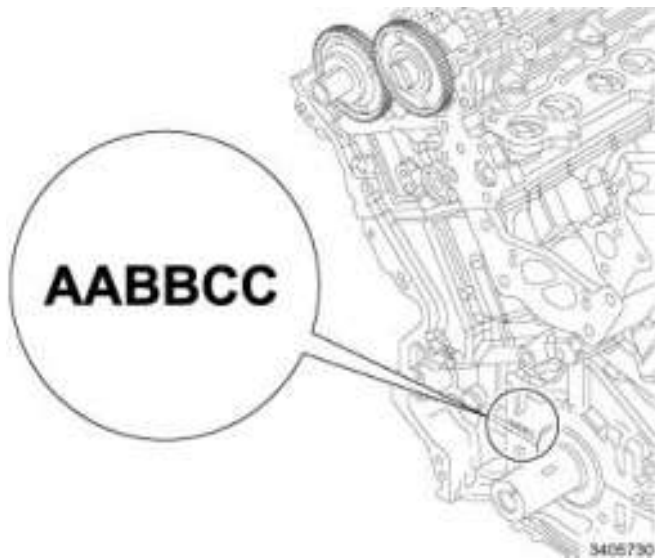
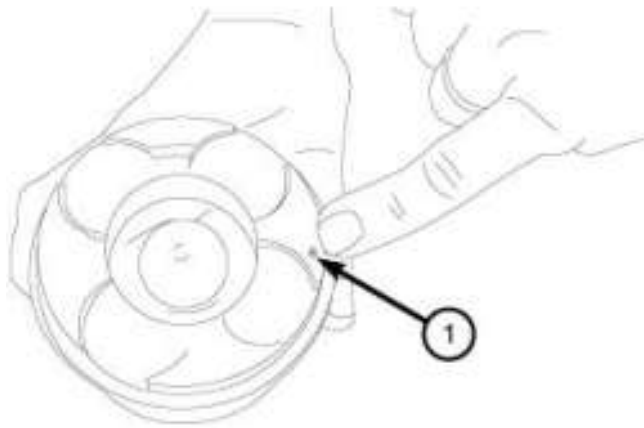


Fig. 229: Cylinder Location Identification
 Courtesy of CHRYSLER GROUP, LLC

1. Identify the correct piston to cylinder location on left front of engine block.



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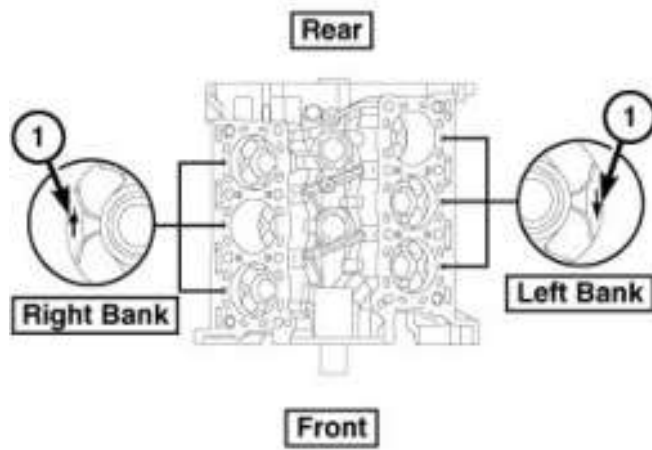
Fig. 230: Piston Lettering Identification
 Courtesy of CHRYSLER GROUP, LLC

2. Identify the piston by the lettering shown in illustration on piston crown.
3. Using the reference table below select the correct piston to location.

NOTE: The first letter correspond to the first cylinder, the second letter to the second one etc.

Piston Letter On Crown	A	A	B	B	C	C
Cylinder Piston Location	1	2	3	4	5	6

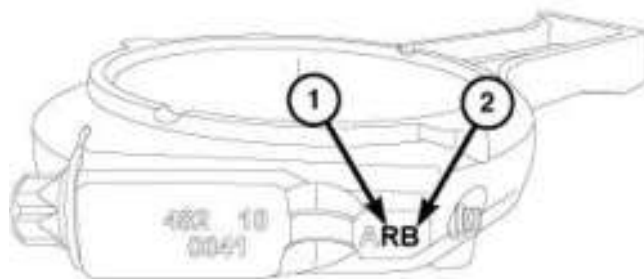
4. Before installing the Piston Installer, make sure the oil ring expander ends are butted together.
5. Immerse the piston head and rings in clean engine oil, slide the piston installer over the piston and tighten. **Ensure position of rings does not change during this operation .**



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Fig. 231: Arrow Stamped On Piston Crown
 Courtesy of CHRYSLER GROUP, LLC

6. When installing the pistons and connecting rod assembly, making sure that the arrow stamped on the piston crown (1) is turned toward the back side of the engine (flywheel side) for the right bank pistons 1 2 3 and toward the front side of the engine (timing chain side) for the left bank pistons 4 5 6.



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Fig. 232: Connecting Rod Shaft & Class Identification Mark
 Courtesy of CHRYSLER GROUP, LLC

7. Each connecting rod has its own letter class identification mark (2) on connecting rod for bearing selection.

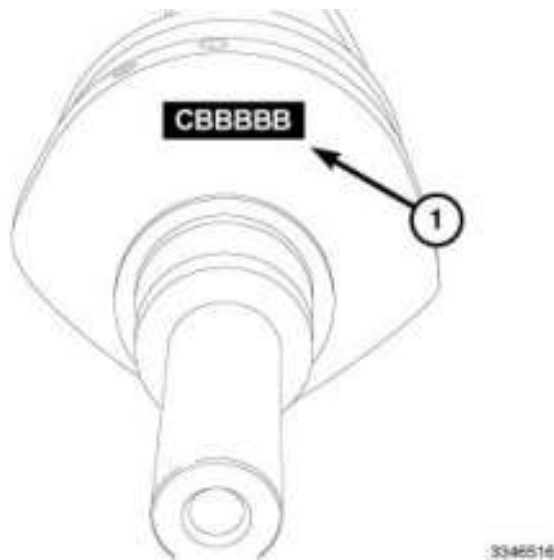


Fig. 233: Letters Stamped Into Crankshaft
 Courtesy of CHRYSLER GROUP, LLC

8. To determine the correct bearing size for each cylinder. Each connecting rod letter class must be matched with the crankshaft letter class (1) with the bearing selection chart to determine the correct bearing color for each cylinder. The letters stamped into the crankshaft (1) are in the same order as the cylinders. The first letter corresponds to the first cylinder, the second to the second, etc. See bearing selection chart. Refer to **ENGINE BLOCK - STANDARD PROCEDURE** .

CAUTION: Care must be taken not to nick the crankshaft journal or cylinder bore when installing the pistons.

9. Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert rod and piston into cylinder bore and guide rod over the crankshaft journal.
10. Guide the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on connecting rod journal.

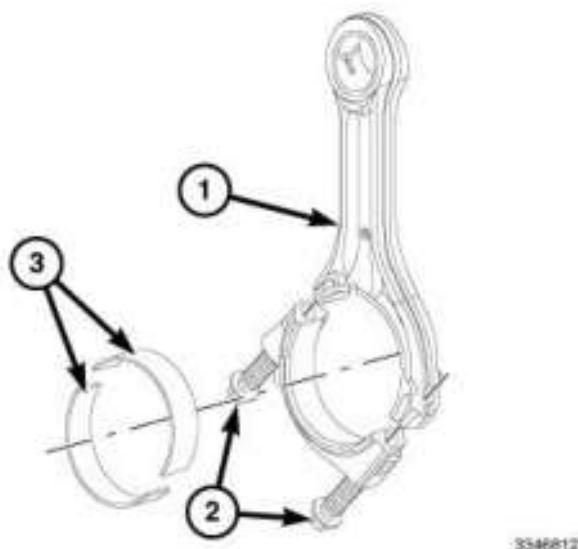


Fig. 234: Connecting Rod, Bearings & Bolts
 Courtesy of CHRYSLER GROUP, LLC

11. Assemble connecting rod bearings (3) and bearing caps to their respective connecting rods (2) ensuring that the serrations on the cap and reference marks are aligned.

NOTE: The connecting rod bolts must be replaced every time they are loosened or removed.

12. Using new bolts, tighten the connecting rod cap bolts to:
 - Step 1: Tighten to 10 N.m (88 in. lbs.).
 - Step 2: Tighten each bolt to 25 N.m (18 ft. lbs.).
 - Step 3: Tighten each bolt an additional 75 degrees turn.
 - Step 4: With the torque wrench set at 50 N.m (37 ft. lbs.) to check the tightening of each bolt.

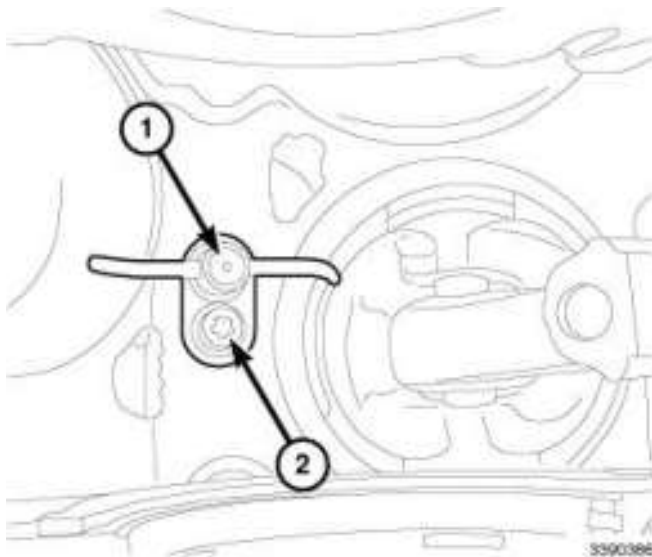


Fig. 235: Oil Jet & Retaining Bolt
Courtesy of CHRYSLER GROUP, LLC

13. Install the oil jets. Refer to **JET, PISTON OIL COOLER, INSTALLATION** .

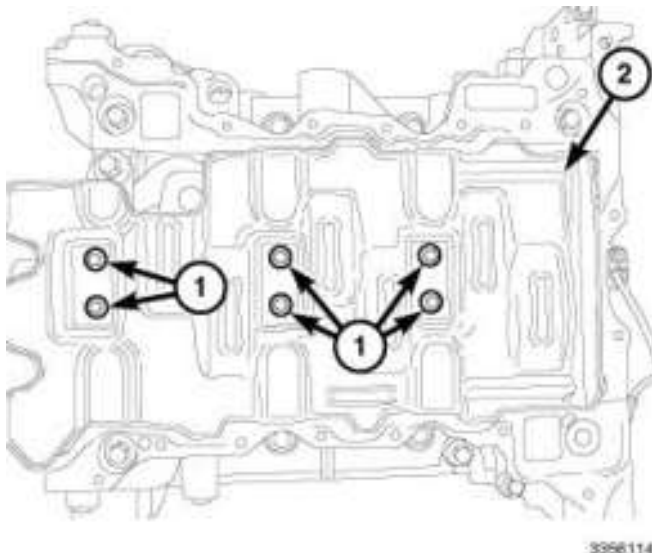
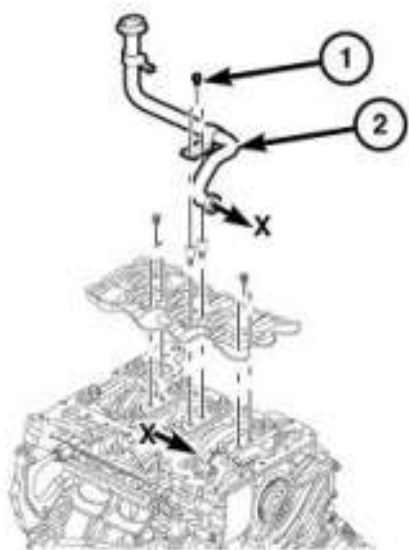


Fig. 236: Windage Tray & Bolts

Courtesy of CHRYSLER GROUP, LLC

14. Install the windage tray (2). Tighten bolts (1) to 11 N.m (97 in. lbs.).



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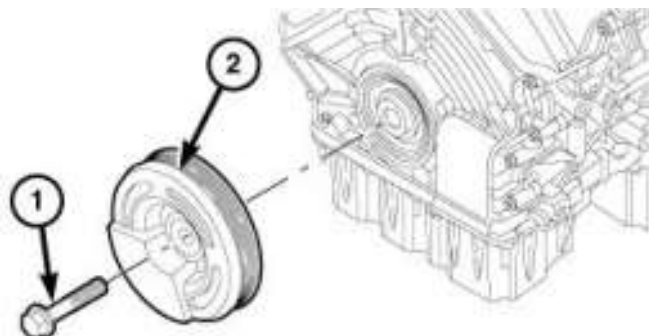
Fig. 237: Oil Pump Pickup Tube & Bolts
Courtesy of CHRYSLER GROUP, LLC

15. Install the oil pump pickup tube. Refer to PICK-UP, OIL PUMP, INSTALLATION .
16. Install both cylinder head. Refer to CYLINDER HEAD, INSTALLATION .
17. Connect negative battery cable.

SEAL, CRANKSHAFT OIL, FRONT

REMOVAL

REMOVAL



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Fig. 238: Vibration Damper & Bolt
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect the negative battery cable.
2. Remove the vibration damper. Refer to **DAMPER, VIBRATION, REMOVAL** .

CAUTION: Care must be taken when removing the crankshaft seal. DO NOT damage or gouge the timing chain cover.

3. Using suitable seal puller, remove the front crankshaft seal.

INSTALLATION

INSTALLATION

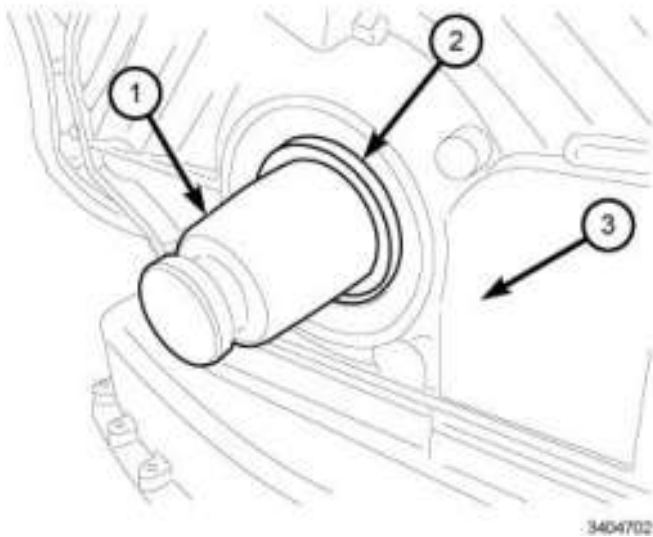


Fig. 239: Front Seal Guide & Oil Seal
Courtesy of CHRYSLER GROUP, LLC

1. Clean timing chain cover seal surface.

NOTE: Install the front oil seal so the lip of seal face away from the engine.

2. Install the (special tool #VM.10340-1, Guide, Front Seal) (1) and position the front seal (2) in place.
3. Remove the (special tool #VM.10340-1, Guide, Front Seal) (1).

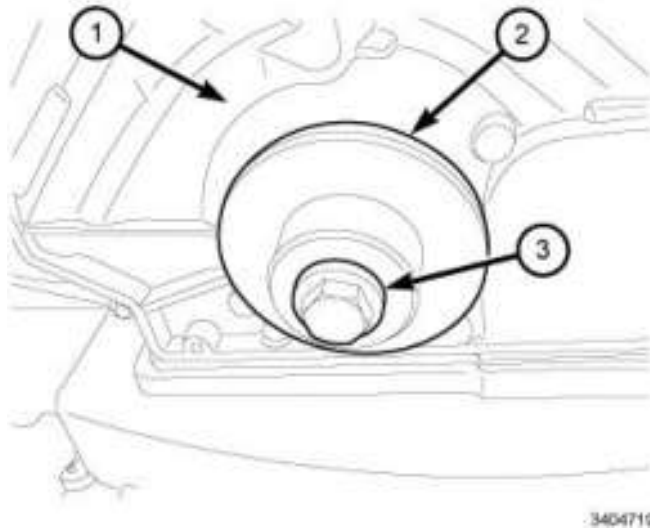


Fig. 240: Front Seal Installer Tool & Vibration Damper Bolt
 Courtesy of CHRYSLER GROUP, LLC

4. Using the (special tool #VM.10340-2, Installer Tool, Front Seal) (2), install the front crankshaft oil seal using the vibration damper bolt (3) to draw the seal in place.
5. Remove bolt (3) and the (special tool #VM.10340-2, Installer Tool, Front Seal) (2).

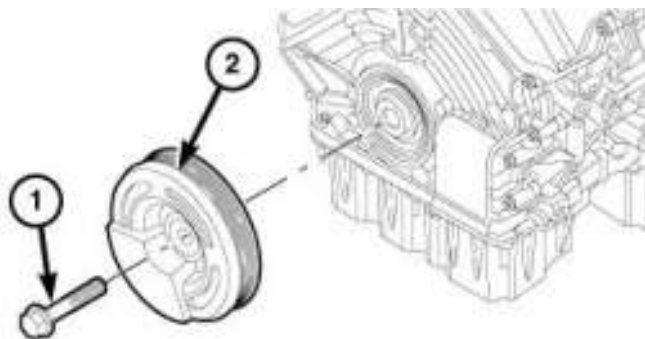


Fig. 241: Vibration Damper & Bolt
 Courtesy of CHRYSLER GROUP, LLC

6. Install the vibration damper. Refer to **DAMPER, VIBRATION, INSTALLATION** .
7. Connect the negative battery cable.

SEAL, CRANKSHAFT OIL, REAR

REMOVAL

REMOVAL

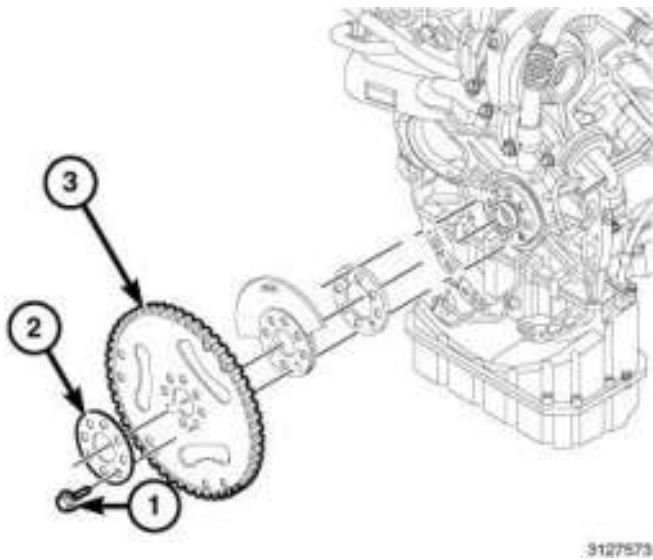


Fig. 242: Flex Plate, Counter Weight, Tone Wheel & Bolts
 Courtesy of CHRYSLER GROUP, LLC

1. Remove the flex plate (3), counter weight, and tone wheel. Refer to **FLEXPLATE, REMOVAL** .

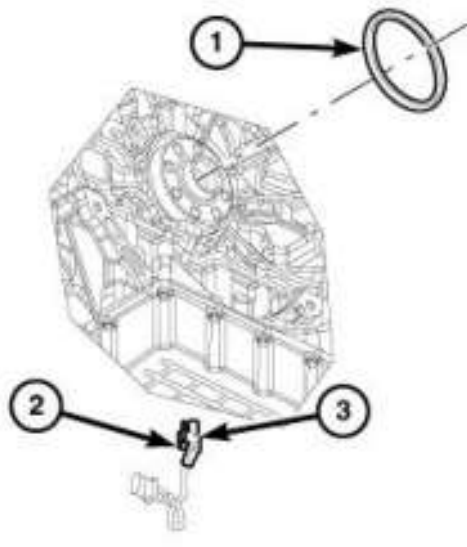


Fig. 243: Rear Main Oil Seal, Crankshaft Position Sensor (CKP) & Bolt
 Courtesy of CHRYSLER GROUP, LLC

2. Remove bolt (2) and the Crankshaft Position Sensor (CKP) (3).

NOTE: Use care not to damage the rear main oil seal sealing surface.

3. Using suitable seal puller, remove the rear main oil seal (1).

INSTALLATION

INSTALLATION

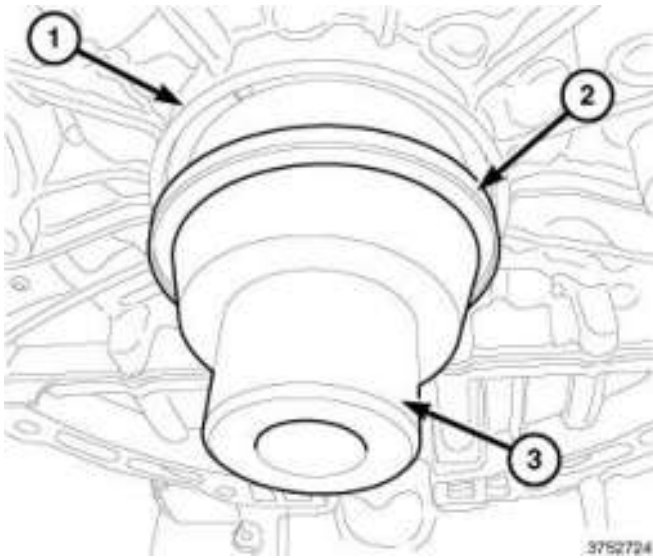


Fig. 244: Rear Seal Guide, Rear Oil Seal & Crankshaft
Courtesy of CHRYSLER GROUP, LLC

1. Clean around seal surface area.

NOTE: Install the rear oil seal so that the lip of seal faces away from the engine.

2. Install the (special tool #VM.10341-1, Guide, Rear Seal) (3) and slide the rear oil seal (2) onto the crankshaft.
3. Remove the (special tool #VM.10341-1, Guide, Rear Seal) (3).



Fig. 245: Rear Seal Installer
Courtesy of CHRYSLER GROUP, LLC

NOTE: Position the flat portion of the Rear Seal Installer should be facing down giving you clearance by the Crankshaft Position Sensor (CKP) boss.

- Using the (special tool #VM.10341-2, Installer Tool, Rear Seal) (1) install the rear main oil seal into the engine block.

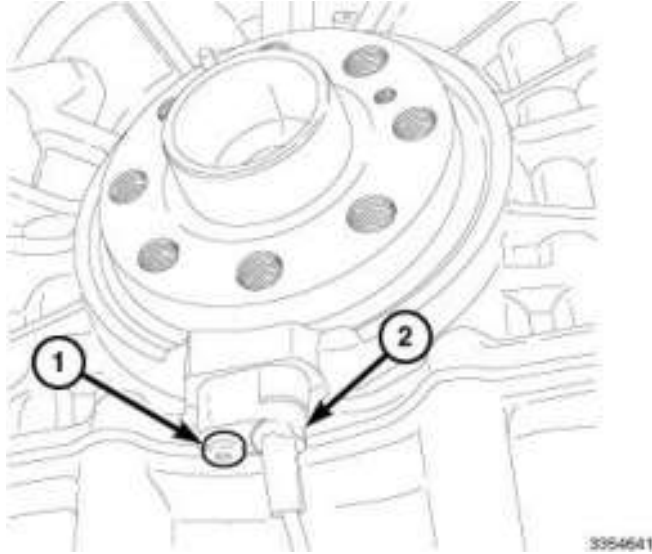


Fig. 246: Crankshaft Position Sensor & Bolt
Courtesy of CHRYSLER GROUP, LLC

- Clean the area and bore around CKP.
- Install the CKP (2). Tighten bolt (1) to 6 N.m (53 in. lbs.).

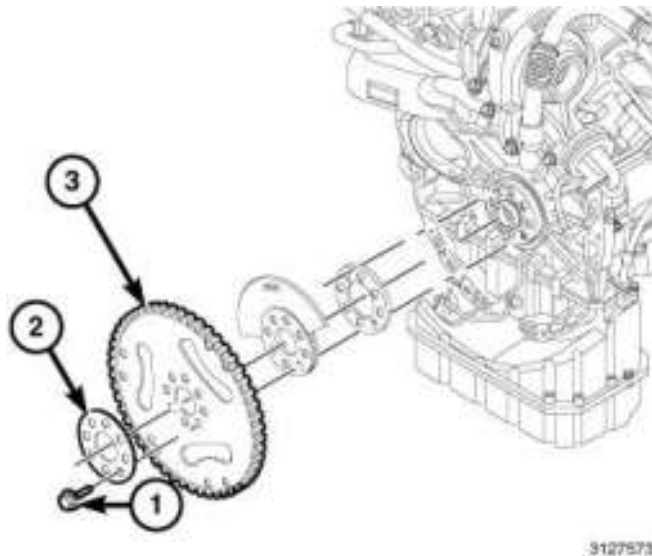


Fig. 247: Flex Plate, Counter Weight, Tone Wheel & Bolts
Courtesy of CHRYSLER GROUP, LLC

- Install the tone wheel (3), counter weight, and flex plate. Refer to **FLEXPLATE, INSTALLATION**.