

2012 ENGINE**4.7L - Service Information - Ram Pickup****DIAGNOSIS AND TESTING****INTRODUCTION**

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either performance (e.g., engine idles rough and stalls) or mechanical (e.g., a strange noise).

Refer to **PERFORMANCE** and **MECHANICAL** for possible causes and corrections of malfunctions.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that can not be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following diagnosis:

- Cylinder Compression Pressure Test. Refer to **CYLINDER COMPRESSION PRESSURE LEAKAGE**.
- Cylinder Combustion Pressure Leakage Test. Refer to **CYLINDER COMBUSTION PRESSURE LEAKAGE**.
- Engine Cylinder Head Gasket Failure Diagnosis. Refer to **DIAGNOSIS AND TESTING - CYLINDER HEAD GASKET**.
- Intake Manifold Leakage Diagnosis. Refer to **DIAGNOSIS AND TESTING - INTAKE MANIFOLD LEAKAGE**.

PERFORMANCE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery	1. Charge or replace as necessary.
	2. Corroded or loose battery connections.	2. Clean and tighten battery connections. Apply a coat of light mineral grease to the terminals.
	3. Faulty starter.	3. Refer to <u>DIAGNOSIS AND TESTING</u> .
	4. Faulty coil or control unit.	4. Refer to <u>COIL, IGNITION, REMOVAL</u> .
	5. Incorrect spark plug gap.	5. Correct as necessary.
	6. Dirt or water in fuel system.	6. Clean system and replace fuel filter.
	7. Faulty fuel pump, relay or wiring.	7. Repair or replace as necessary.

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ENGINE STALLS OR ROUGH IDLE	1. Dirty or incorrectly gapped spark plugs.	1. Correct as necessary.
	2. Idle mixture too lean or too rich.	2. Refer to appropriate Engine Performance (Powertrain Diagnosis) Information.
	3. Vacuum leak.	3. Inspect intake manifold and vacuum hoses, repair or replace as necessary.
	4. Faulty coil.	4. Refer to <u>COIL, IGNITION, REMOVAL</u> .
	5. Incorrect engine timing.	5. Refer to <u>Engine/Valve Timing - Standard Procedure</u> .
ENGINE LOSS OF POWER	1. Dirty or incorrectly gapped spark plugs.	1. Correct as necessary.
	2. Dirt or water in fuel system.	2. Clean system and replace fuel filter.
	3. Faulty fuel pump.	3. Refer to the Appropriate Diagnostic Information
	4. Blown cylinder head gasket.	4. Replace cylinder head gasket.
	5. Low compression.	5. Refer to <u>CYLINDER COMPRESSION PRESSURE LEAKAGE</u> .
	6. Burned, warped or pitted valves.	6. Replace as necessary.
	7. Plugged or restricted exhaust system.	7. Inspect and replace as necessary.
	8. Faulty coil.	8. Refer to <u>COIL, IGNITION, REMOVAL</u> .
ENGINE MISSES ON ACCELERATION	1. Spark plugs dirty or incorrectly gapped.	1. Correct as necessary.
	2. Dirt in fuel system.	2. Clean fuel system.
	3. Burned, warped or pitted valves.	3. Replace as necessary.
	4. Faulty coil.	4. Refer to <u>COIL, IGNITION, REMOVAL</u> .
ENGINE MISSES AT HIGH SPEED	1. Spark plugs dirty or incorrectly gapped.	1. Correct as necessary.
	2. Faulty coil.	2. Refer to <u>COIL, IGNITION, REMOVAL</u> .
	3. Dirt or water in fuel system.	3. Clean system and replace fuel filter.

MECHANICAL

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CONDITION	POSSIBLE CAUSES	CORRECTIONS
NOISY VALVES	1. High or low oil level in crankcase.	1. Refer to <u>CAPACITIES AND RECOMMENDED FLUIDS, SPECIFICATIONS</u> .
	2. Thin or diluted oil.	2. Change oil and filter.
	3. Low oil pressure.	3. Check oil pump, if OK, check rod and main bearings for excessive wear.
	4. Dirt in lash adjusters.	4. Replace as necessary.
	5. Worn rocker arms.	5. Replace as necessary.
	6. Worn lash adjusters	6. Replace as necessary.
	7. Worn valve guides.	7. Inspect the valve guides for wear, cracks or looseness. If either condition exists, replace the cylinder head. Refer to <u>CYLINDER HEAD, REMOVAL, 4.7L</u> .
	8. Excessive runout of valve seats on valve faces.	8. Refer to <u>VALVES, INTAKE AND EXHAUST</u> .
CONNECTING ROD NOISE	1. Insufficient oil supply.	1. Refer to <u>CAPACITIES AND RECOMMENDED FLUIDS, SPECIFICATIONS</u> .
	2. Low oil pressure.	2. Check oil pump, if OK, check rod and main bearings for excessive wear.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Connecting rod journal out-of-round.	5. Service or replace crankshaft.
	6. Misaligned connecting rods.	6. Replace bent connecting rods.
MAIN BEARING NOISE	1. Insufficient oil supply.	1. Refer to <u>CAPACITIES AND RECOMMENDED FLUIDS, SPECIFICATIONS</u> .
	2. Low oil pressure.	2. Check oil pump, if OK, check rod and main bearings for excessive wear.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Excessive end play.	5. Check thrust washers for wear.
	6. Crankshaft journal out-of-round.	6. Service or replace crankshaft.
	7. Loose flywheel or torque converter.	7. Tighten to correct torque

CYLINDER COMPRESSION PRESSURE LEAKAGE

NOTE: The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

NOTE: Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

1. Clean the spark plug recesses with compressed air.
2. Remove the spark plugs and record the cylinder number of each spark plug for future reference.
3. Inspect the spark plug electrodes for abnormal firing indicators such as fouled, hot, oily, etc.
4. Disable the fuel system and perform the fuel system pressure release procedure. Refer to **FUEL SYSTEM PRESSURE RELEASE**.
5. Insert a compression pressure gauge and rotate the engine with the engine starter motor for three revolutions.
6. Record the compression pressure on the 3rd revolution. Continue the test for the remaining cylinders.

NOTE: The recommended compression pressures are to be used only as a guide to diagnosing engine problems. An engine should not be disassembled to determine the cause of low compression unless some malfunction is present.

7. Compression should not be less than 689 kPa (100 psi) and not vary more than 25 percent from cylinder to cylinder.
8. If one or more cylinders have abnormally low compression pressures, repeat the compression test.

NOTE: If the same cylinder or cylinders repeat an abnormally low reading on the second compression test, it could indicate the existence of a problem in the cylinder in question.

9. If one or more cylinders continue to have abnormally low compression pressures, perform the cylinder combustion pressure leakage test. Refer to **CYLINDER COMBUSTION PRESSURE LEAKAGE**.

CYLINDER COMBUSTION PRESSURE LEAKAGE

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss.

1. Check the coolant level and fill as required. DO NOT install the radiator cap.
2. Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.

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3. Remove the spark plugs.
4. Remove the oil filler cap.
5. Remove the air cleaner hose.
6. Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum and 552 kPa (80 psi) recommended.
7. Perform the test procedures on each cylinder according to the tester manufacturer's instructions. Set piston of cylinder to be tested at TDC compression. While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the radiator coolant.

All gauge pressure indications should be equal, with no more than 25% leakage.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

Refer to **CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART**.

CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
AIR ESCAPES THROUGH THROTTLE BODY	Intake valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as necessary.
AIR ESCAPES THROUGH TAILPIPE	Exhaust valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as necessary.
AIR ESCAPES THROUGH RADIATOR	Head gasket leaking or cracked cylinder head or block	Remove cylinder head and inspect. Replace defective part
MORE THAN 50% LEAKAGE FROM ADJACENT CYLINDERS	Head gasket leaking or crack in cylinder head or block between adjacent cylinders	Remove cylinder head and inspect. Replace gasket, head, or block as necessary
MORE THAN 25% LEAKAGE AND AIR ESCAPES THROUGH OIL FILLER CAP OPENING ONLY	Stuck or broken piston rings; cracked piston; worn rings and/or cylinder wall	Inspect for broken rings or piston. Measure ring gap and cylinder diameter, taper and out-of-round. Replace defective part as necessary

OIL CONSUMPTION TEST AND DIAGNOSIS

Diagnostic Procedure

The following diagnostic procedures are used to determine the source of excessive internal oil Consumption, these procedures and tests apply to vehicles with 50,000 miles or less.

NOTE: Engine oil consumption may be greater than normal during engine break-in.

Repairs should be delayed until vehicle has been driven at least 7, 500 miles.

Severe service (high ambient temperature, short trips, heavy loading, trailer towing, taxi, off-road, or law enforcement use) may result in greater oil consumption than normal.

Sustained high speed driving and high engine RPM operation may result in increased oil consumption.

Failure to comply with the recommended oil type and viscosity rating, as outlined in the owner's manual, may impact oil economy as well as fuel economy.

Oil consumption may increase with vehicle age and mileage due to normal engine wear.

NOTE: Because a few drops of external oil leakage per mile can quickly account for the loss of one quart of oil in a few hundred miles, ensure no external engine oil leaks are present.

- **Oil leakage is not the same as oil consumption and all external leakage must be eliminated before any action can be taken to verify and/or correct oil consumption complaints.**
- **Verify that the engine has the correct oil level dipstick and dipstick tube installed.**
- **Verify that the engine is not being run in an overfilled condition. Check the oil level 15 minutes after a hot shutdown with the vehicle parked on a level surface. In no case should the level be above MAX or the FULL mark on the dipstick.**

OIL CONSUMPTION TEST

1. Check the oil level at least 15 minutes after a hot shutdown.
2. If the oil level is low, top off with the proper viscosity and API service level engine oil. Add one bottle of MOPAR® 4-In-1 Leak Detection Dye into the engine oil.
3. Tamper proof the oil pan drain plug, oil filter, dipstick and oil fill cap.
4. Record the vehicle mileage.
5. Instruct the customer to drive the vehicle as usual.
6. Ask the customer to return to the servicing dealer after accumulating 500 miles, Check the oil level at least 15 minutes after a hot shutdown. If the oil level is half way between the "FULL" and "ADD" mark continue with the next step.
7. Using a black light, re-check for any external engine oil leaks, repair as necessary, if no external engine oil leaks are present, continue with oil consumption diagnosis.

OIL CONSUMPTION DIAGNOSIS

1. Check the Positive Crankcase Ventilation (PCV) system. Make sure the system is not restricted and the PCV valve has the correct part number and correct vacuum source (18-20 in. Hg at idle below 3000 ft. above sea level is considered normal).
2. Perform a **CYLINDER COMPRESSION PRESSURE LEAKAGE** and **CYLINDER-TO-CYLINDER LEAKAGE TEST** using the standard leak down gauge following manufacturers suggested best practices.

NOTE: **Verify the spark plugs are not oil saturated. If the spark plugs are oil saturated and compression is good it can be assumed the valve seals or valve guides are at fault.**

3. If one or more cylinders have more than 15% leak down further engine tear down and inspection will be required.

TOP 19 REASONS THAT MAY LEAD TO ENGINE OIL CONSUMPTION

1. Tapered and Out-of-Round Cylinders

The increased piston clearances permit the pistons to rock in the worn cylinders. While tilted momentarily, an abnormally large volume of oil is permitted to enter on one side of the piston. The rings, also tilted in the cylinder, permit oil to enter on one side. Upon reversal of the piston on each stroke, some of this oil is passed into the combustion chamber.

2. Distorted Cylinders

This may be caused by unequal heat distribution or unequal tightening of cylinder head bolts. This condition presents a surface which the rings may not be able to follow completely. In this case, there may be areas where the rings will not remove all of the excess oil. When combustion takes place, this oil will be burned and cause high oil consumption.

3. Improper operation of "PCV "system

The main purpose of the Positive Crankcase Ventilation (PCV) valve is to recirculate blow-by gases back from the crankcase area through the engine to consume unburned hydrocarbons. The PCV system usually has a one way check valve and a make up air source. The system uses rubber hoses that route crankcase blow by gases to the intake manifold. Vacuum within the engine intake manifold pulls the blow by gases out of the crankcase into the combustion chamber along with the regular intake air and fuel mixture.

The PCV system can become clogged with sludge and varnish deposits and trap blow by gases in the crankcase. This degrades the oil, promoting additional formation of deposit material. If left uncorrected, the result is plugged oil rings, oil consumption, rapid ring wear due to sludge buildup, ruptured gaskets and seals due to crankcase pressurization.

4. Worn Piston Ring Grooves

For piston rings to form a good seal, the sides of the ring grooves must be true and flat - not flared or shouldered. Piston rings in tapered or irregular grooves will not seal properly and, consequently, oil will pass around behind the rings into the combustion chamber.

5. Worn, Broken or Stuck Piston Rings

When piston rings are broken, worn or stuck to such an extent that the correct tension and clearances are not maintained, this will allow oil to be drawn into the combustion chamber on the intake stroke and hot gases of combustion to be blown down the cylinder past the piston on the power stroke. All of these

conditions will result in burning and carbon build up of the oil on the cylinders, pistons and rings.

6. Cracked or Broken Ring Lands

Cracked or broken ring lands prevent the rings from seating completely on their sides and cause oil pumping. This condition will lead to serious damage to the cylinders as well as complete destruction of the pistons and rings. Cracked or broken ring lands cannot be corrected by any means other than piston replacement.

7. Worn Valve Stems and Guides

When wear has taken place on valve stems and valve guides, the vacuum in the intake manifold will draw oil and oil vapor between the intake valve stems and guides into the intake manifold and then into the cylinder where it will be burned.

8. Bent or Misaligned Connecting Rods

Bent or misaligned connecting rods will not allow the pistons to ride straight in the cylinders. This will prevent the pistons and rings from forming a proper seal with the cylinder walls and promote oil consumption. In addition, it is possible that a bearing in a bent connect rod will not have uniform clearance on the connecting rod wrist pin. Under these conditions, the bearing will wear rapidly and throw off an excessive amount of oil into the cylinder.

9. Fuel Dilution

If raw fuel is allowed to enter the lubrication system, the oil will become thinner and more volatile and will result in higher oil consumption. The following conditions will lead to higher oil consumption;

- Excess fuel can enter and mix with the oil via a leaking fuel injector
- Gasoline contaminated with diesel fuel
- Restricted air intake
- Excessive idling

10. Contaminated Cooling Systems

Corrosion, rust, scale, sediment or other formations in the water jacket and radiator will prevent a cooling system from extracting heat efficiently. This is likely to cause cylinder distortion thus leading to higher oil consumption.

11. Oil Viscosity

The use of oil with a viscosity that is too light may result in high oil consumption. Refer to the vehicle owner's manual for the proper oil viscosity to be used under specific driving conditions and/or ambient temperatures.

12. Dirty Engine Oil

Failure to change the oil and filter at proper intervals may cause the oil to be so dirty that it will promote accumulation of sludge and varnish and restrict oil passages in the piston rings and pistons. This will increase oil consumption; dirty oil by nature is also consumed at a higher rate than clean oil.

13. Crankcase Overfull

Due to an error in inserting the oil dip stick so that it does not come to a seat on its shoulder, a low reading may be obtained. Additional oil may be added to make the reading appear normal with the stick in this incorrect position which will actually make the oil level too high. If the oil level is so high that the lower ends of the connecting rods touch the oil in the oil pan excessive quantities of oil will be thrown on the cylinder walls and some of it will work its way up into the combustion chamber.

14. Excessively High Oil Pressure

A faulty oil pressure relief valve may cause the oil pressure to be too high. The result will be that the engine will be flooded with an abnormally large amount of oil in a manner similar to that which occurs with worn bearings. This condition may also cause the oil filter to burst.

15. Aftermarket Performance Chips and Modification

Increasing performance through the use of performance/power enhancement products to a stock or factory engine will increase the chance of excessive oil consumption.

16. Lugging Engine

Lugging is running the engine at a lower RPM in a condition where a higher RPM (more power/torque) should be implemented. Especially susceptible on vehicles equipped with a manual transmission. This driving habit causes more stress loading on the piston and can lead to increases in engine oil consumption.

17. Turbocharged Engines

There is a possibility for PCV "push-over" due to higher crankcase pressure (as compared to naturally aspirated engines) which is normal for turbocharged engines. This condition causes varying amounts of engine oil to enter the intake manifold, charge air cooler and associated plumbing to and from the charge air cooler, also a leaking turbocharger seal will draw oil into the combustion chamber where it will burn (blue smoke from tail pipe may be present) and form carbon deposits which contribute to further oil consumption as they interfere with proper engine function.

18. Restricted Air Intake

Excessive restriction in the air intake system will increase engine vacuum and can increase oil consumption, an extremely dirty air filter would be one example of this situation.

19. Intake Manifold port seals

Engines that have a "V" configuration and a "wet valley" could draw oil into the intake ports due to improper sealing between the intake manifold ports and cylinder head. Causes may include improper

torque of intake manifold bolts, corrosion (aluminum intake manifold) and or warped sealing surface.

STANDARD PROCEDURE

DUST COVERS AND CAPS

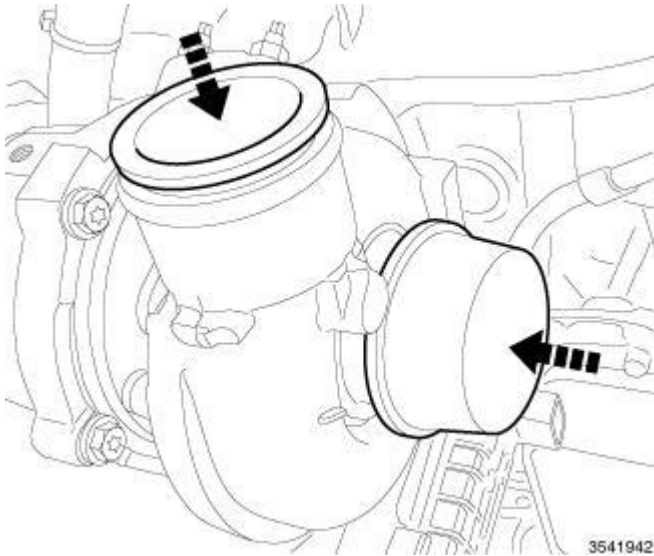


Fig. 1: Covers/Caps

Courtesy of CHRYSLER GROUP, LLC

Due to the high amounts of failures caused by dust, dirt, moisture and other foreign debris being introduced to the engine during service. Covers or caps are needed to reduce the possible damage that can be caused or created.

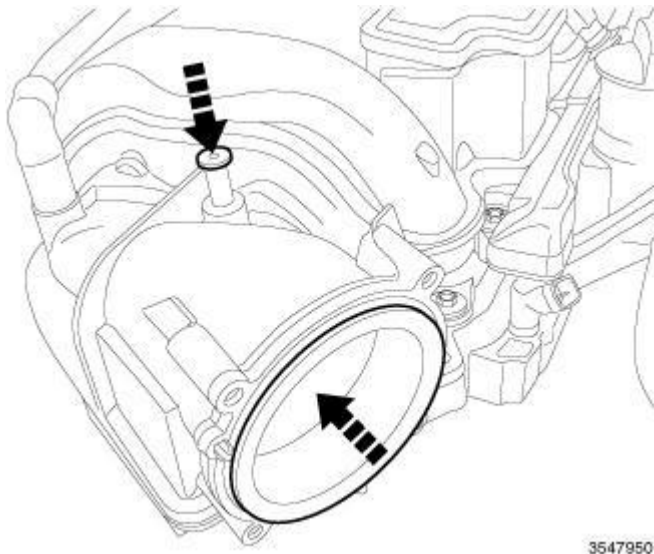


Fig. 2: Opening Cover

Courtesy of CHRYSLER GROUP, LLC

Covers over openings will reduce any possibilities for foreign materials to enter the engine systems. Using miller tool (special tool #10368, Set, Universal Protective Cap), Select the appropriated cover needed to the procedure.

ENGINE CORE AND OIL GALLERY PLUGS

Using a blunt tool such as a drift and a hammer, strike the bottom edge of the cup plug. With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug.

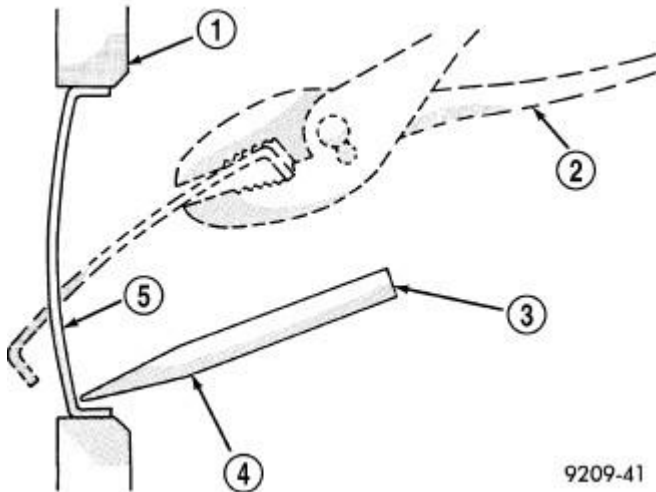


Fig. 3: Core Hole Plug Removal

Courtesy of CHRYSLER GROUP, LLC

CAUTION: Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.

Thoroughly clean inside of cup plug hole in cylinder block or head. Be sure to remove old sealer. Lightly coat inside of cup plug hole with Mopar® Stud and Bearing Mount. Make certain the new plug is cleaned of all oil or grease. Using proper drive plug, drive plug into hole so that the sharp edge of the plug is at least 0.5 mm (0.020 in.) inside the lead-in chamfer.

It is not necessary to wait for curing of the sealant. The cooling system can be refilled and the vehicle placed in service immediately.

REPAIR DAMAGED OR WORN THREADS

CAUTION: Be sure that the tapped holes maintain the original center line.

Damaged or worn threads can be repaired. Essentially, this repair consists of:

- Drilling out worn or damaged threads.

- Tapping the hole with a special Heli-Coil Tap, or equivalent.
- Installing an insert into the tapped hole to bring the hole back to its original thread size.

FORM-IN-PLACE GASKETS AND SEALERS

NOTE: All of the sealants mentioned below are not used on every engine, they are listed as general reference guide. See service information for specific sealer usage.

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets to assure obtaining the desired results. **Do not use form-in-place gasket material unless specified.** Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over which can break off and obstruct fluid feed lines. A continuous bead of the proper width is essential to obtain a leak-free gasket. All sealing surfaces that use form-in-place gaskets and sealers **must** free of grease or oil. Surfaces should be cleaned with Mopar® brake parts cleaner prior to sealer application. After the sealer is applied, the parts should be assembled in no more than 10 minutes.

There are numerous types of form-in-place gasket materials that are used in the engine area. Mopar® Engine RTV GEN II, Mopar® ATF-RTV, and Mopar® Gasket Maker gasket materials, each have different properties and can not be used in place of the other.

MOPAR® ENGINE RTV GEN II is used to seal components exposed to engine oil. This material is a specially designed black silicone rubber RTV that retains adhesion and sealing properties when exposed to engine oil. Moisture in the air causes the material to cure. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® ATF RTV is a specifically designed black silicone rubber RTV that retains adhesion and sealing properties to seal components exposed to automatic transmission fluid, engine coolants, and moisture. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® GASKET MAKER is an anaerobic type gasket material. The material cures in the absence of air when squeezed between two metallic surfaces. It will not cure if left in the uncovered tube. The anaerobic material is for use between two machined surfaces. Do not use on flexible metal flanges.

MOPAR® BED PLATE SEALANT is a unique (green-in-color) anaerobic type gasket material that is specially made to seal the area between the bed plate and cylinder block without disturbing the bearing clearance or alignment of these components. The material cures slowly in the absence of air when torqued between two metallic surfaces, and will rapidly cure when heat is applied.

MOPAR® GASKET SEALANT is a slow drying, permanently soft sealer. This material is recommended for sealing threaded fittings and gaskets against leakage of oil and coolant. Can be used on threaded and machined parts under all temperatures. This material also will prevent corrosion. Mopar® Gasket Sealant is available in a 13 oz. aerosol can or 4 oz. / 16 oz. can w/applicator.

SEALER APPLICATION

Mopar® Gasket Maker material should be applied sparingly 1 mm (0.040 in.) diameter or less of sealant to one gasket surface. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Engine RTV GEN II or ATF RTV gasket material should be applied in a continuous bead approximately 3 mm (0.120 in.) in diameter. All mounting holes must be circled. For corner sealing and "T" joint locations, a 3.17 or 6.35 mm (1/8 or 1/4 in.) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The usage of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Gasket Sealant in an aerosol can should be applied using a thin, even coat sprayed completely over both surfaces to be joined, and both sides of a gasket. Then proceed with assembly. Material in a can w/applicator can be brushed on evenly over the sealing surfaces.

ENGINE GASKET SURFACE PREPARATION

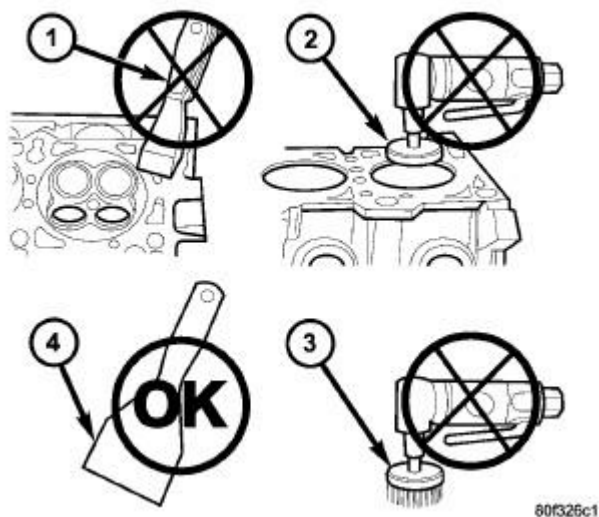


Fig. 4: Proper Tool Usage For Surface Preparation
Courtesy of CHRYSLER GROUP, LLC

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components and multi-layer steel cylinder head gaskets.

Never use the following to clean gasket surfaces:

- Metal scraper (1).
- Abrasive pad or paper to clean cylinder block and head

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- High speed power tool with an abrasive pad (2).
- High speed power tool with 3M Roloc™ Bristle Disc (white or yellow) or a wire brush (3).

NOTE: Multi-Layer Steel (MLS) head gaskets require a scratch free sealing surface.

CAUTION: The use of unapproved cleaning methods can cause severe engine damage.

Only use the following for cleaning gasket surfaces:

- Solvent or a commercially available gasket remover.
- Plastic or wood scraper (4).

SPECIFICATIONS

SPECIFICATIONS

ENGINE - GENERAL

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Displacement	4.7 Liters / 4701 cc	287 Cubic Inches
Bore	93.0 mm	3.66 in.
Stroke	86.5 mm	3.40 in.
Engine Type	90° SOHC V-8 16-Valve	
Compression Ratio	9.6:1	
Max. Variation Between Cylinders	25%	
Horsepower	303 BHP @ 5650 RPM	
Torque	330 LB-FT @ 3950 RPM	
Lead Cylinder	#1 Left Bank	
Firing Order	1-8-4-3-6-5-7-2	

CYLINDER BLOCK

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bore Diameter	93.010 ± 0.0075 mm	3.6619 ± 0.0003 in.
Out of Round (MAX)	0.076 mm	0.003 in.
Taper (MAX)	0.051 mm	0.002 in.

PISTONS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Diameter	92.975 mm	3.6605 in.

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Weight	366 grams	12.9 oz.
No. 1 Ring Groove Diameter	83.37 - 83.13 mm	3.282 - 3.273 in.
No. 2 Ring Groove Diameter	82.833 - 83.033 mm	3.261 - 3.310 in.
No. 3 Ring Groove Diameter	83.88 - 84.08 mm	3.302 - 3.310 in.

PISTON PINS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance In Piston	0.010 - 0.019 mm	0.0004 - 0.0008 in.
Diameter	24.013 - 24.016 mm	0.9454 - 0.9455 in.

PISTON RINGS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Top Compression Ring Gap	0.20 - 0.36 mm	0.0079 - 0.0142 in.
Second Compression Ring Gap	0.37 - 0.63 mm	0.0146 - 0.0249 in.
Oil Control (Steel Rails) Ring Gap	0.25 - 0.76 mm	0.0099 - 0.30 in.
Top Compression Ring Side Clearance	.051 -.094 mm	0.0020 - 0.0037 in.
Second Compression Ring Side Clearance	0.040 - 0.080 mm	0.0016 - 0.0031 in.
Oil Ring (Steel Ring) Ring Side Clearance	.019 -.229 mm	.0007 -.0091 in.
Top Compression Ring Width	1.472 - 1.490 mm	0.057 - 0.058 in.
Second Compression Ring Width	1.472 - 1.490 mm	0.057 - 0.058 in.
Oil Ring (Steel Rails) Ring Width	0.445 - 0.470 mm	0.017 - 0.018 in.

CONNECTING RODS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bearing Clearance	0.015 - 0.055 mm	0.0006 - 0.0022 in.
Side Clearance	0.10 - 0.35 mm	0.004 - 0.0138 in.
Piston Pin Bore Diameter (Interference Fit)	.025 -.048 mm	0.001 - 0.0019 in.
Bearing Bore Out of Round (MAX)	0.004 mm	0.0002 in.
Total Weight (Less Bearing)	555 grams	19.5771 oz.

CRANKSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Main Bearing Journal Diameter	63.488 - 63.512 mm	2.4996 - 2.5005 in.
Bearing Clearance	0.004 - 0.034 mm	0.0002 - 0.0013 in.

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Out of Round (MAX)	0.005 mm	0.0004 in.
Taper (MAX)	0.008 mm	0.0004 in.
End Play	0.052 - 0.282 mm	0.0021 - 0.0112 in.
End Play (MAX)	0.282 mm	0.0112 in.
Connecting Rod Journal Diameter	50.992 - 51.008 mm	2.0076 - 2.0082 in.
Bearing Clearance	0.010 - 0.048	0.0004 - 0.0019 in.
Out of Round (MAX)	0.005 mm	0.0002 in.
Taper (MAX)	0.008 mm	0.0004 in.

CAMSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bore Diameter	26.02 - 26.04 mm	1.0245 - 1.0252 in.
Bearing Journal Diameter	25.973 - 25.995 mm	1.0227 - 1.0235 in.
Bearing Clearance	0.025 - 0.065 mm	0.001 - 0.0026 in.
Bearing Clearance (MAX)	0.065 mm	0.0026 in.
End Play	.075 - .200 mm	0.003 - 0.0079 in.
End Play (MAX)	.200 mm	0.0079 in.

VALVE TIMING

DESCRIPTION	LOCATION	SPECIFICATION
Intake Valve Open	BTDC	4.4°
Intake Valve Closed	ATDC	239.1°
Exhaust Valve Open	BTDC	240.5°
Exhaust Valve Closed	ATDC	13.2°
Intake Valve Duration	243.5°	
Exhaust Valve Duration	253.70°	
Valve Overlap	17.6°	

VALVES

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Intake Head Diameter	48.52 - 48.78 mm	1.9103 - 1.9205 in.
Exhaust Head Diameter	36.87 - 37.13 mm	1.4516 - 1.4618 in.
Intake Length (Overall)	113.45 - 114.21 mm	4.4666 - 4.4965
Exhaust Length (Overall)	114.92 - 115.68 mm	4.5244 - 4.5543 in.
Intake Stem Diameter	6.931 - 6.957 mm	0.2729 - 0.2739 in.
Exhaust Stem Diameter	6.902 - 6.928 mm	0.2717 - 0.2728 in.
Intake Stem-to-Guide Clearance	0.018 - 0.069 mm	0.0008 - 0.0028 in.
Exhaust Stem-to-Guide	0.047 - 0.098 mm	0.0019 - 0.0039 in.
Intake Maximum Stem-to-Guide Clearance (Rocking Method)	0.069 mm	0.0028 in.

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Exhaust Maximum Stem-to-Guide Clearance (Rocking Method)	0.098 mm	0.0039 in.
Intake Valve Lift (Zero Lash)	11.25 mm	0.443 in.
Exhaust Valve Lift (Zero Lash)	10.90 mm	0.4292 in.
Face Angle	45° - 45.5°	

VALVE SPRING

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Intake Free Length (Approx)	49.0 mm	1.9291 in.
Exhaust Free Length (Approx)	49.0 mm	1.9291 in.
Intake and Exhaust Spring Force (Valve Closed)	313.0 - 354.0 N @ 40.12 mm	70.365 - 79.582 lbs. @ 1.5795 in.
Intake and Exhaust Spring Force (Valve Open)	776.0 - 870.0 N @ 28.88 mm	174.451 - 195.583 lbs. @ 1.137 in.
Intake and Exhaust Spring Wire Diameter	4.6 X 3.67 mm	0.1811 - 0.1445 in.
Intake and Exhaust Spring Nominal Installed Height (Spring Seat to Bottom of Retainer)	40.12 mm	1.579 in.
Intake and Exhaust Spring Number of Coils	7.3	

CYLINDER HEAD

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Gasket Thickness (Compressed)	0.7 mm	0.0276 in.
Valve Seat Runout (MAX)	0.051 mm	0.002 in.
Intake Valve Seat Width	1.75 - 2.36 mm	0.0698 - 0.0928 in.
Exhaust Valve Seat Width	1.71 - 2.32 mm	(0.0673 - 0.0911 in.)
Guide Bore Diameter (Std.)	6.975 - 7.00 mm	(0.2747 - 0.2756 in.)
Cylinder Head Warpage (Flatness)	0.0508 mm	(0.002 in.)
Valve Seat Angle	44.5° - 45.0°	

OIL PUMP

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance Over Rotors/End Face (MAX)	0.095 mm	0.0038 in.
Cover Out - of - Flat (MAX)	0.025 mm	0.001 in.
Inner and Outer Rotor Thickness	12.02 mm	0.4731 in.
Outer Rotor to pocket (Diametral) clearance (MAX)	0.235 mm	0.0093 in.

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Outer Rotor Diameter (MIN.)	85.925 mm	0.400 in.
Tip Clearance Between Rotors (MAX)	0.150 mm	0.006 in.

OIL PRESSURE

DESCRIPTION	SPECIFICATION	
	Metric	Standard
At Curb Idle Speed (MIN.)*	48 kPa	(7 psi)
@ 3000 rpm	240 - 725 kPa	(35 - 105 psi)
* CAUTION: If pressure is zero at curb idle, DO NOT run engine at 3000 rpm.		

TORQUE SPECIFICATIONS

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.
Camshaft Position Sensor Bolt	12	9	-
Camshaft Sprocket Bolt	122	90	-
Camshaft Bearing Cap Bolts	11	8	-
Timing Chain Cover Bolts	58	43	-
Connecting Rod Cap Bolts	27 + 90°	20 + 90°	-
Bed Plate Bolts	Refer to <u>CRANKSHAFT, INSTALLATION, 4.7L</u> Procedure.		
Cylinder Head Bolts	Refer to <u>CYLINDER HEAD, INSTALLATION, 4.7L</u> Procedure.		
Crankshaft Damper Bolt	175	130	-
Cylinder Head Cover Bolts	12	9	-
Exhaust Manifold Bolts	25	18	-
Exhaust Manifold Heat Shield Nuts	8 - 45°	-	72 - 45°
Flexplate Bolts	60	45	-
Engine Mount Bracket to Block Bolts	61	45	-
Rear Mount to Transmission Bolts	46	34	-
Generator Mounting Bolts	M10 Bolts	54	40
	M8 Bolts	28	21
Intake Manifold Bolts	12	9	-
Oil Pan Bolts	15	11	-
Oil Pan Drain Plug	34	25	-
Oil Pump Bolts	28	21	-
Oil Pump Cover Bolts	12	-	105
Oil Pickup Tube Bolt and Nut	28	-	250
Block Bolt	15	-	130
Oil Fill Tube Bolts	12	9	-
Timing Chain Guide Bolts	28	21	-

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Timing Chain Tensioner Arm	28	21	-
Hydraulic Tensioner Bolts	28	21	-
Timing Chain Primary Tensioner Bolts	28	21	-
Timing Drive Idler Sprocket Bolt	34	25	-
Thermostat Housing Bolts	13	10	-
Water Pump Bolts	58	43	-

REMOVAL

REMOVAL

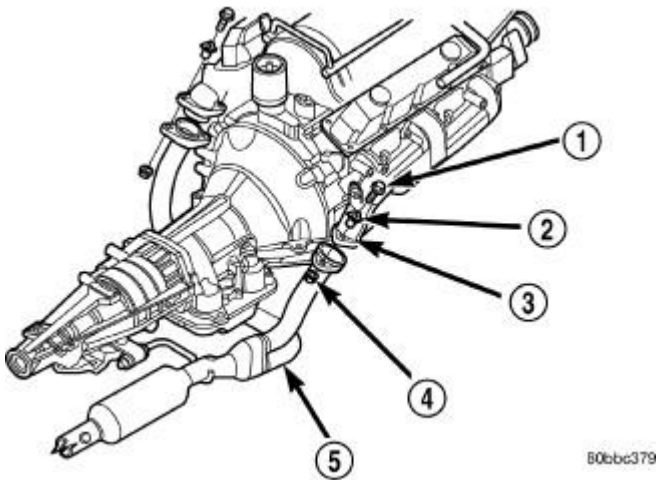
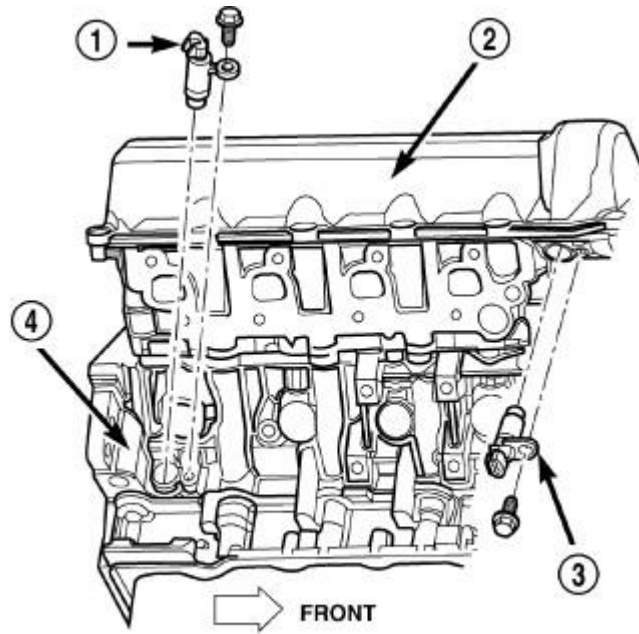


Fig. 5: Exhaust Pipe To Manifold Connection

Courtesy of CHRYSLER GROUP, LLC

NOTE: This procedure applies to both the 4X2 and 4X4 vehicles, steps that apply to the 4X4 vehicle only, are identified.

1. Release fuel rail pressure then disconnect the fuel supply quick connect fitting at the fuel rail. Refer to **FUEL SYSTEM PRESSURE RELEASE** and **STANDARD PROCEDURE - QUICK-CONNECT FITTINGS**.
2. Disconnect the battery negative and positive cables.
3. Raise vehicle on hoist.
4. Remove exhaust crossover pipe (5) from exhaust manifolds.
5. **4X4 vehicles** Disconnect axle vent tube from left side engine mount.



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Fig. 6: Crankshaft Position Sensor, Camshaft Position Sensor, Engine Cover & Bolts
 Courtesy of CHRYSLER GROUP, LLC

6. Remove the through bolt retaining nut and bolt from both the left and right side engine mounts.
7. **4X4 vehicles** Remove locknut from left and right side engine mount brackets.
8. Disconnect two ground straps from the lower left hand side and one ground strap from the lower right hand side of the engine.
9. Disconnect crankshaft position sensor (1).

NOTE: The following step applies to 4X4 vehicles equipped with automatic transmission only.

10. **4X4 vehicles** Remove the axle isolator bracket from the engine, transmission and the axle.

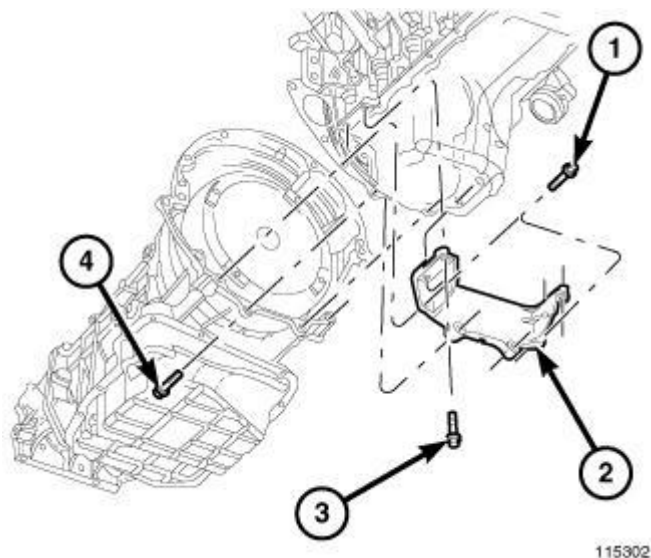


Fig. 7: Structural Cover & Bolts
Courtesy of CHRYSLER GROUP, LLC

11. Remove structural cover. Refer to COVER, STRUCTURAL DUST, REMOVAL, 4.7L.

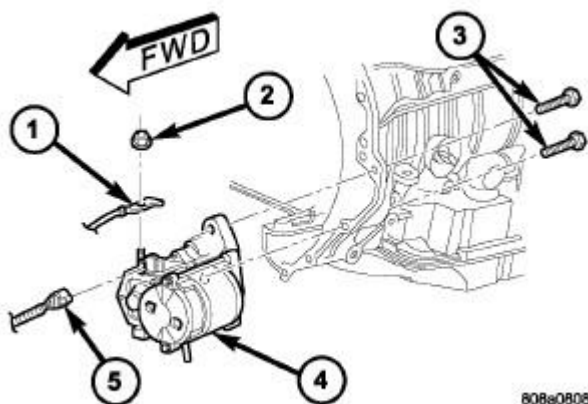


Fig. 8: Remove/Install Starter Motor
Courtesy of CHRYSLER GROUP, LLC

12. Remove starter (4). Refer to STARTER, REMOVAL.
13. Drain cooling system. Refer to STANDARD PROCEDURE.
14. Remove torque converter bolts (Automatic Transmission Only).
15. Remove transmission to engine mounting bolts.
16. Disconnect the engine block heater power cable from the block heater, if equipped.
17. Lower vehicle.
18. Remove throttle body resonator assembly and air inlet hose.
19. Disconnect throttle and speed control cables.

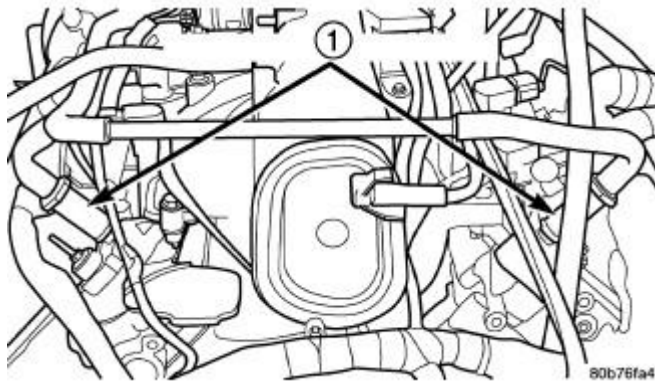


Fig. 9: Crankcase Breather Connection Points
Courtesy of CHRYSLER GROUP, LLC

20. Disconnect tube from both the left and right side crankcase breathers (1). Remove breathers.

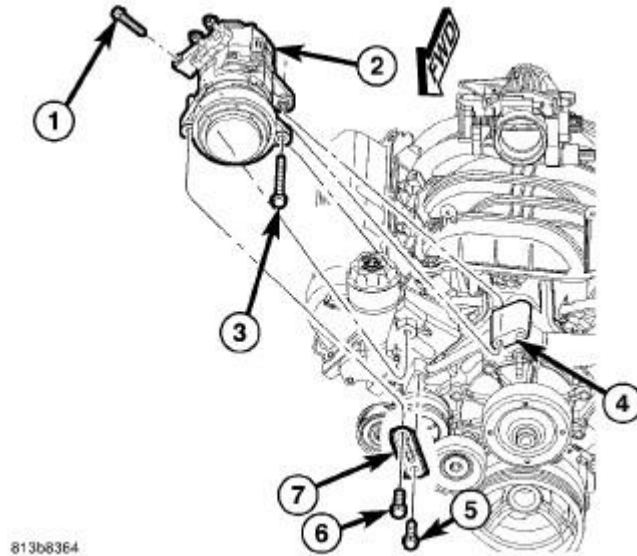


Fig. 10: A/C Compressor Removal/Installation
Courtesy of CHRYSLER GROUP, LLC

21. Discharge A/C system. Refer to **PLUMBING, STANDARD PROCEDURE** .
22. Remove A/C compressor (2). Refer to **COMPRESSOR, A/C, REMOVAL** .
23. Remove shroud, fan assembly and accessory drive belt.
24. Disconnect transmission oil cooler lines at the radiator.
25. Disconnect radiator upper and lower hoses.
26. Remove radiator, A/C condenser and transmission oil cooler. Refer to **RADIATOR, ENGINE COOLING, REMOVAL** . Refer to **CONDENSER, A/C, REMOVAL** .

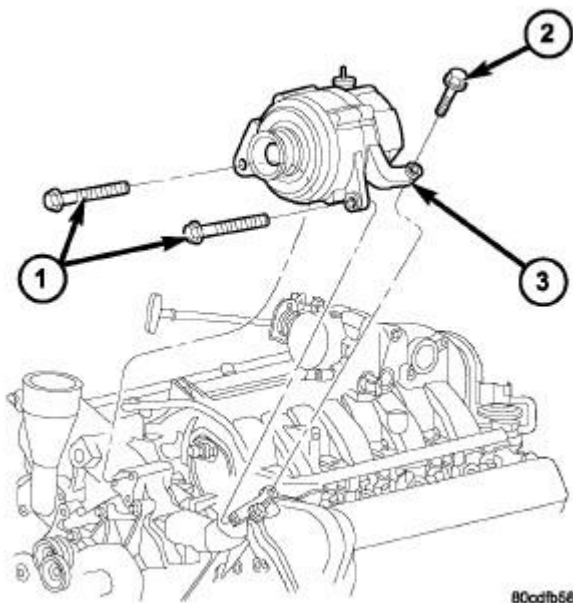


Fig. 11: Generator Removal/Installation
Courtesy of CHRYSLER GROUP, LLC

27. Remove generator (3). Refer to **GENERATOR, REMOVAL**.

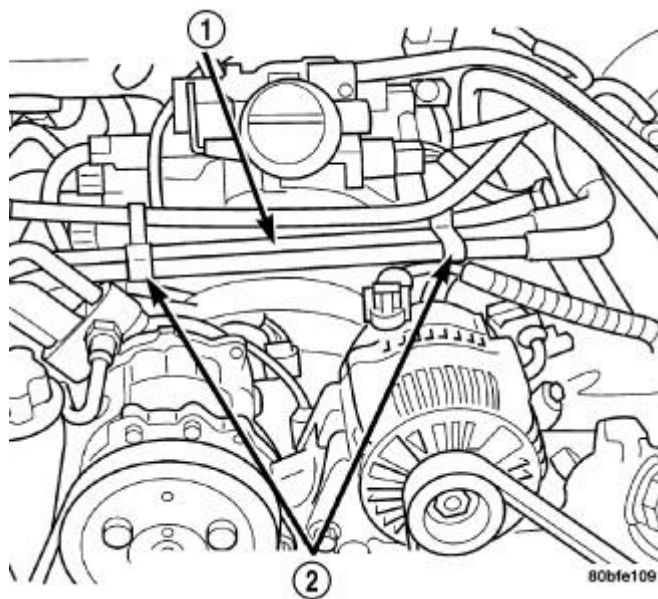


Fig. 12: Heater Hoses & Clips
Courtesy of CHRYSLER GROUP, LLC

28. Disconnect the two heater hoses from the timing chain cover and heater core.
29. Unclip (2) and remove heater hoses (1) and tubes from the intake manifold.

30. Remove power steering pump and position out of the way.
31. Remove intake manifold.

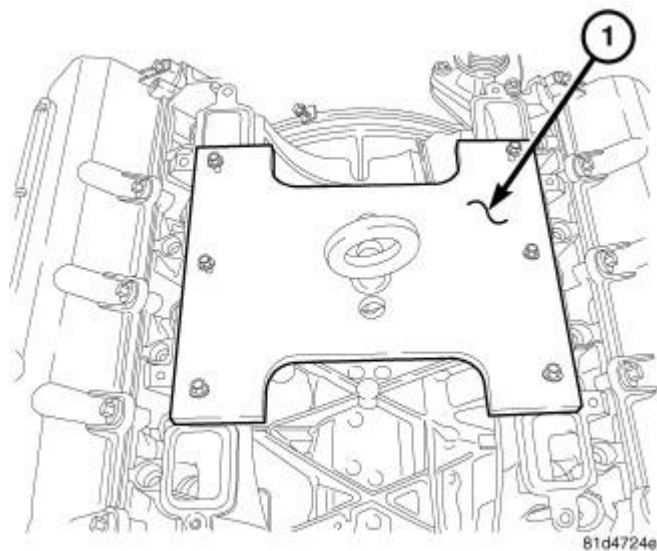


Fig. 13: Engine Lifting Fixture
Courtesy of CHRYSLER GROUP, LLC

32. Install Engine Lifting Fixture (special tool #10101, Fixture, Engine Lifting).

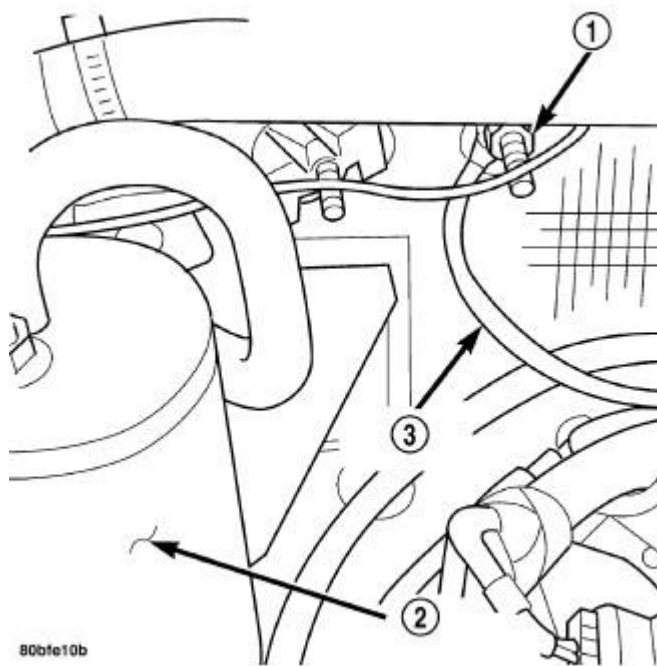


Fig. 14: Removal/Installation Body Ground Strap-Right Side
Courtesy of CHRYSLER GROUP, LLC

33. Disconnect body ground strap (1) at the right side cowl.

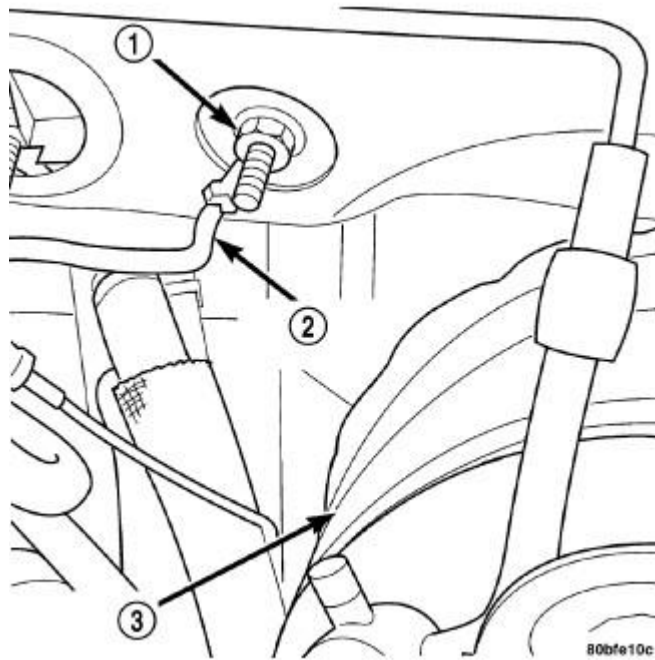


Fig. 15: Removal/Installation Body Ground Strap-Left Side
Courtesy of CHRYSLER GROUP, LLC

34. Disconnect ground strap (1) at the left side cowl.

NOTE: It will be necessary to support the transmission in order to remove the engine.

35. Position a suitable jack under the transmission.
36. Remove engine from the vehicle.

INSTALLATION

INSTALLATION

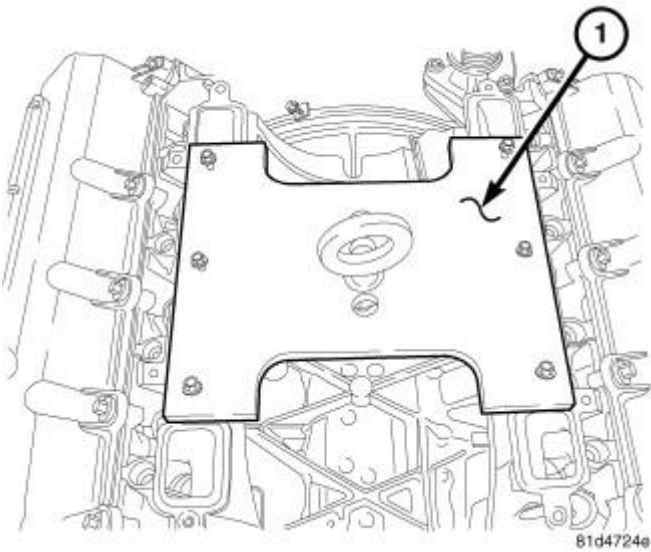


Fig. 16: Engine Lifting Fixture
Courtesy of CHRYSLER GROUP, LLC

1. Position engine in the vehicle.
2. Position both the left and right side engine mount brackets and install the through bolts and nuts. Tighten nuts to **4X2 vehicles** 95 N.m (70 ft. lbs.). **4X4 vehicles** 102 N.m (75 ft. lbs.).
3. **4X4 vehicles** Install locknuts onto the engine mount brackets. Tighten locknuts to 41 N.m (30 ft. lbs.).
4. Remove jack from under the transmission.
5. Remove Engine Lifting Fixture (special tool #10101, Fixture, Engine Lifting) (1).

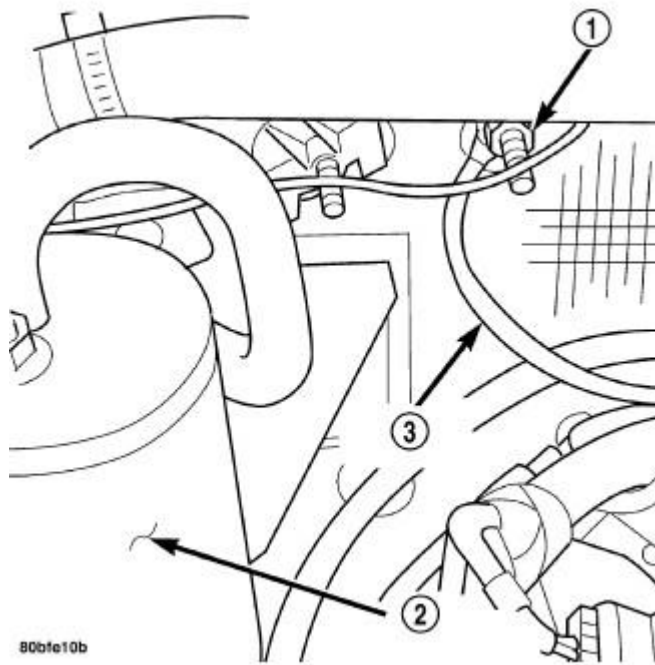


Fig. 17: Removal/Installation Body Ground Strap-Right Side

Courtesy of CHRYSLER GROUP, LLC

6. Connect right (1) side ground straps.

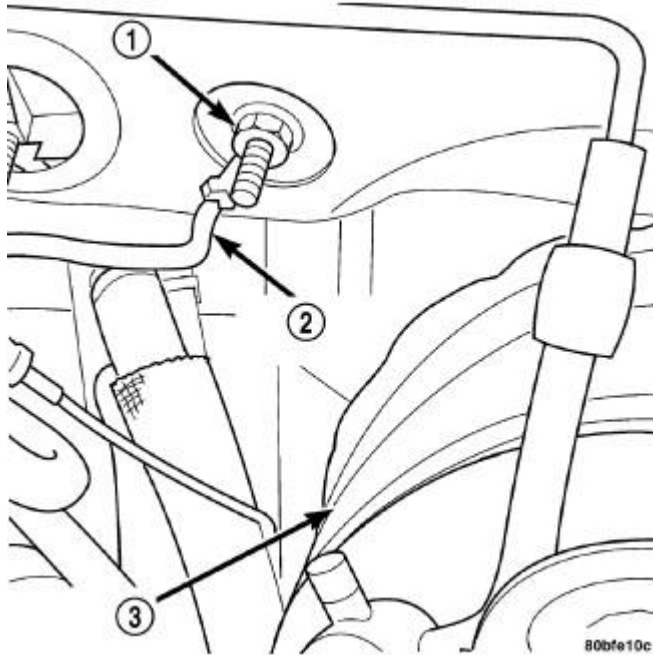


Fig. 18: Removal/Installation Body Ground Strap-Left Side
Courtesy of CHRYSLER GROUP, LLC

7. Connect left (1) side ground straps.
8. Install intake manifold.
9. Position generator wiring behind the oil dipstick tube, then install the oil dipstick tube upper mounting bolt.
10. Install power steering pump.
11. Connect fuel supply line quick connect fitting. Refer to **STANDARD PROCEDURE - QUICK-CONNECT FITTINGS** .

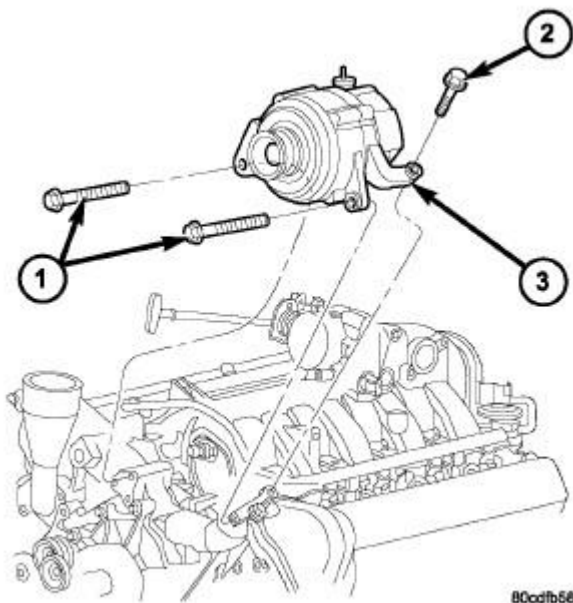


Fig. 19: Generator Removal/Installation
Courtesy of CHRYSLER GROUP, LLC

12. Install generator. Refer to **GENERATOR, INSTALLATION** .
13. Install A/C condenser. Refer to **CONDENSER, A/C, INSTALLATION** .
14. Install radiator and transmission oil cooler. Refer to **RADIATOR, ENGINE COOLING, INSTALLATION** .
15. Connect radiator upper and lower hoses.
16. Connect the transmission oil cooler lines to the radiator.
17. Install accessory drive belt, fan assembly and shroud.

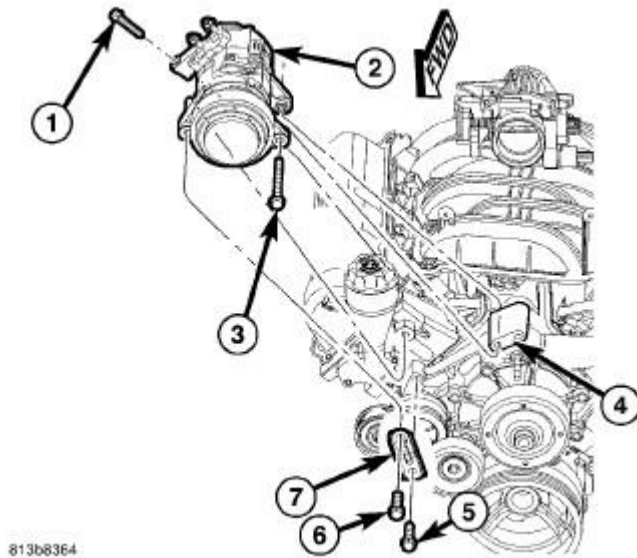


Fig. 20: A/C Compressor Removal/Installation
Courtesy of CHRYSLER GROUP, LLC

18. Install A/C compressor (2). Refer to **COMPRESSOR, A/C, INSTALLATION** .
19. Install throttle body resonator assembly and air inlet hose. Tighten clamps 4 N.m (35 in. lbs.).
20. Raise vehicle.

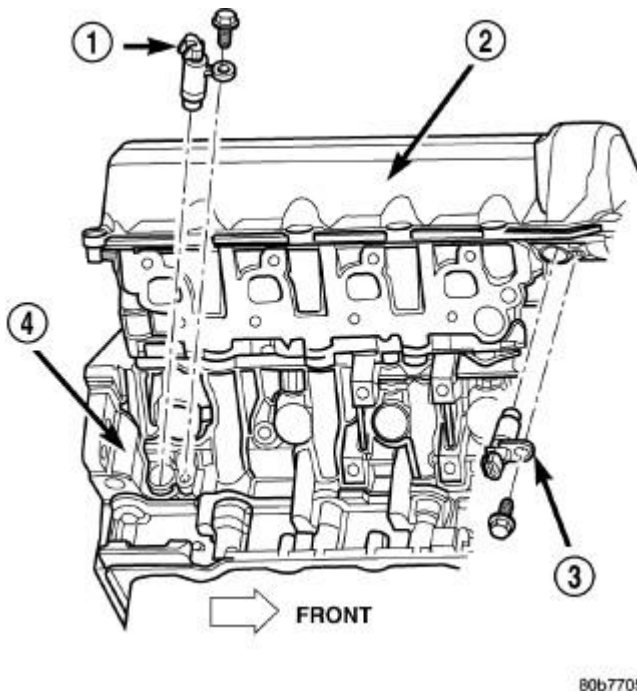


Fig. 21: Crankshaft Position Sensor, Camshaft Position Sensor, Engine Cover & Bolts
Courtesy of CHRYSLER GROUP, LLC

21. Install transmission to engine mounting bolts. Tighten the bolts to 41 N.m (30 ft. lbs.).

22. Install torque converter bolts (Automatic Transmission Only).
23. Connect crankshaft position sensor (1).

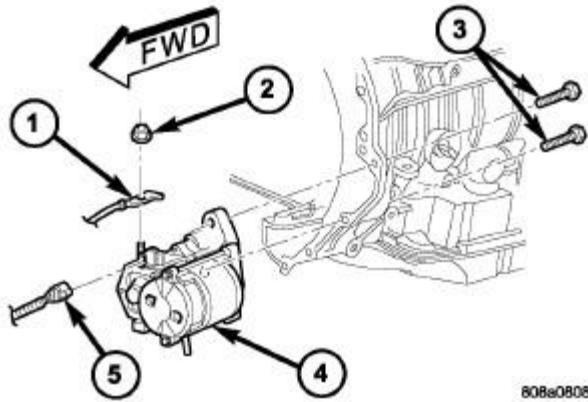


Fig. 22: Remove/Install Starter Motor
Courtesy of CHRYSLER GROUP, LLC

24. **4X4 vehicles** Position and install the axle isolator bracket onto the axle, transmission and engine block. Tighten bolts to specification. Refer to **Engine - Specifications**.
25. Install starter (4). Refer to **STARTER, INSTALLATION**.

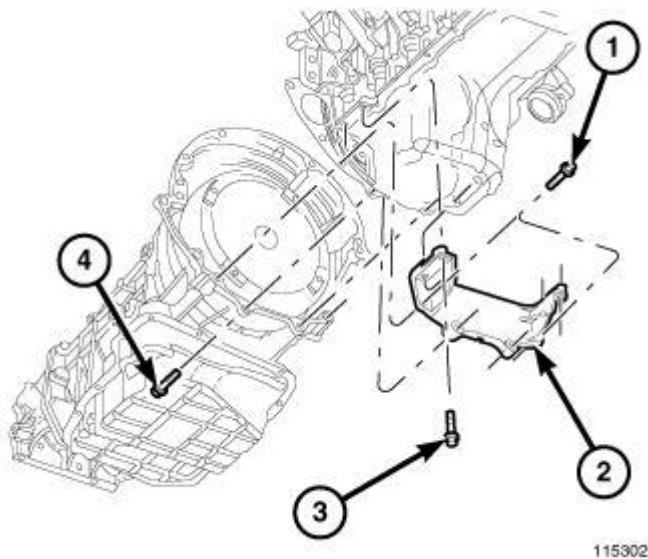


Fig. 23: Structural Cover & Bolts
Courtesy of CHRYSLER GROUP, LLC

CAUTION: The structural cover requires a specific torque sequence. Failure to follow this sequence may cause severe damage to the cover.

26. Install structural cover. Refer to **COVER, STRUCTURAL DUST, INSTALLATION, 4.7L**.

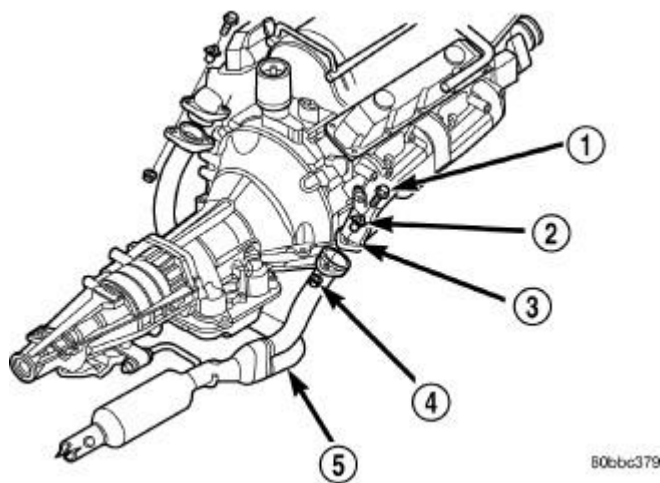


Fig. 24: Exhaust Pipe To Manifold Connection
Courtesy of CHRYSLER GROUP, LLC

27. Install exhaust crossover pipe (5).
28. Install engine block heater power cable, If equipped.
29. **4X4 vehicles** Connect axle vent tube to left side engine mount.
30. Lower vehicle.
31. Fill engine with clean oil.
32. Recharge the A/C system. Refer to **PLUMBING, STANDARD PROCEDURE** .
33. Refill the engine cooling system. Refer to **STANDARD PROCEDURE** .
34. Connect the battery positive and negative cables.
35. Start the engine and check for leaks.

SPECIAL TOOLS

SPECIAL TOOLS

10101 - Fixture, Engine Lifting
(Originally Shipped In Kit Number(s) 10100, 10109.)
10102 - Remover/Installer, Valve Spring
(Originally Shipped In Kit Number(s) 10100, 10109.)
1023 - Puller
(Originally Shipped In Kit Number(s) 8678.)
10368 - Set, Universal Protective Cap
6871 - Installer, A/C Hub
(Originally Shipped In Kit Number(s) 6896.)
6958 - Wrench, Spanner
(Originally Shipped In Kit Number(s) 6947, 6949, 6966, 8204, 8204CC, 8667.)

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7700 - Tester, Cooling System
(Originally Shipped In Kit Number(s) 7700-A.)

8346 - Pins, Adapter
(Originally Shipped In Kit Number(s) 8503, 8510, 8520, 8520CC.)

8348 - Installer, Seal
(Originally Shipped In Kit Number(s) 8283, 8283CC, 8527, 8527CC, 8575, 8575CC, 9975.)

8349 - Installer, Crankshaft Rear Oil Seal
(Originally Shipped In Kit Number(s) 8283, 8283CC, 8527, 8527CC, 8575, 8575CC.)

8349-2 - Guide Crank Seal
(Originally Shipped In Kit Number(s) 8283, 8283CC, 8527, 8527CC, 8575, 8575CC.)

8428A - Holder, Camshaft
(Originally Shipped In Kit Number(s) 10134, 10134, 9975.)

8429 - Holder, Secondary Camshaft Chain
(Originally Shipped In Kit Number(s) 8703, 8703CC, 8712, 9975.)

8454 - 3-Jaw Puller
(Originally Shipped In Kit Number(s) 8673, 8675, 8676, 8709, 8709CC.)

8506 - Remover, Seal
(Originally Shipped In Kit Number(s) 8283, 8283CC, 8527, 8527CC, 8575, 8575CC.)

8507 - Guides, Connecting Rod
(Originally Shipped In Kit Number(s) 8283, 8283CC, 8527, 8527CC, 8575, 8575CC.)

8511 - Remover, Seal
(Originally Shipped In Kit Number(s) 8283, 8283CC, 8527, 8527CC, 8575, 8575CC, 9975.)

8512A - Installer, Damper
(Originally Shipped In Kit Number(s) 8283, 8527, 8575, 8575CC, 8660, 8661.)

8513A - Insert, Crankshaft
(Originally Shipped In Kit Number(s) 8283, 8527, 8575, 8999, 8999CC.)

8514 - Pins, Tensioner
(Originally Shipped In Kit Number(s) 8283, 8283CC, 8527, 8527CC, 8575, 8575CC, 9975.)

8516A - Remover/Installer
(Originally Shipped In Kit Number(s) 8283, 8527, 8534B, 8575, 9090, 9300, 9975.)

8517 - Remover
(Originally Shipped In Kit Number(s) 8283, 8283CC, 8527, 8527CC, 8575, 8575CC, 9975.)

8519 - Adapters, Valve Spring
(Originally Shipped In Kit Number(s) 8283, 8283CC, 8527, 8527CC, 8575, 8575CC, 9975.)

8534B - Fixture, Driveline Support
(Originally Shipped In Kit Number(s) 8534, 8534B, 8849, 9565.)

9867 - Wedge, Locking
(Originally Shipped In Kit Number(s) 9998, 9999.)

C-119 - Cylinder Indicator

C-3292A - Gauge, Pressure

C-3339A - Set, Dial Indicator
(Originally Shipped In Kit Number(s) 9202.)

C-3422-D - Compressor, Valve Spring

C-3501 - Hone W/Oil, AMMCO Cylinder

C-3501-3810 - Stones, 220 Grit Honing

C-3501-3880 - Oil, Honing

C-3685-A - Bloc-Chek Kit

C-4171 - Driver Handle, Universal

(Originally Shipped In Kit Number(s) 9202, 9202A-CAN, 9202CC, 9299, 9299CC, 9299CC, 9300A-CAN.)

C-823 - Hone, Cylinder

AIR INTAKE SYSTEM

AIR CLEANER

REMOVAL

REMOVAL

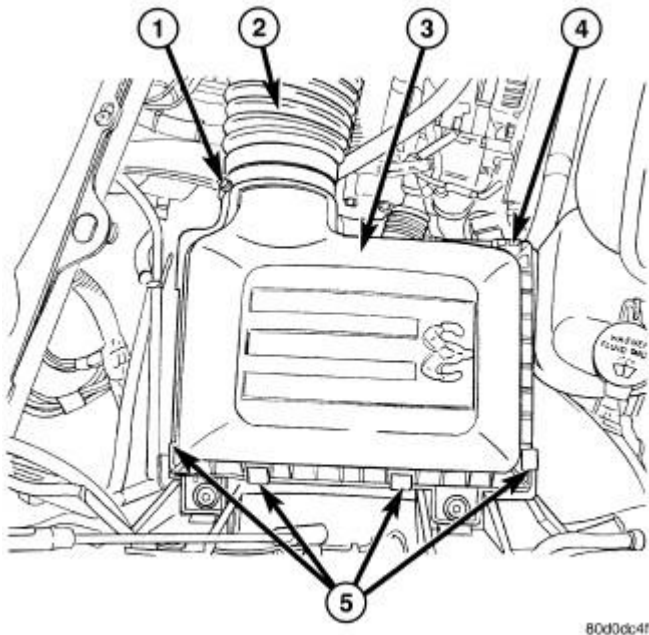


Fig. 25: Air Cleaner Housing Cover, Air Duct & Fasteners
Courtesy of CHRYSLER GROUP, LLC

1. Loosen clamp (1) and disconnect air duct (2) at air cleaner cover (3).
2. Pry over 4 spring clips (5) from housing cover (3).
3. Release housing cover (3) from locating tabs on housing and remove cover.
4. Remove air cleaner element (filter) from housing.
5. Clean inside of housing before replacing element.

INSTALLATION

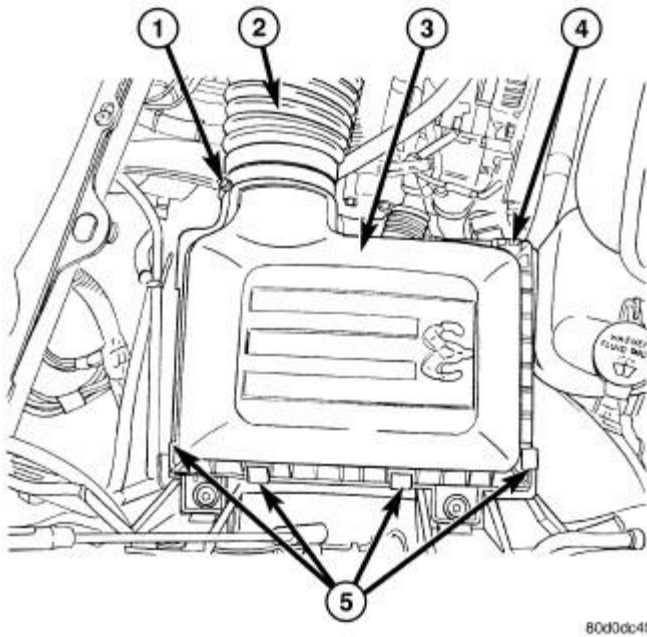
INSTALLATION

Fig. 26: Air Cleaner Housing Cover, Air Duct & Fasteners
Courtesy of CHRYSLER GROUP, LLC

1. Install filter element into housing.
2. Position housing cover (3) into housing locating tabs.
3. Pry up 4 spring clips (5) and lock cover to housing.
4. Install air duct (2) to air cleaner cover (3) and tighten hose clamp (1) to 3 N.m (30 in. lbs.).

BODY, AIR CLEANER**REMOVAL****REMOVAL**

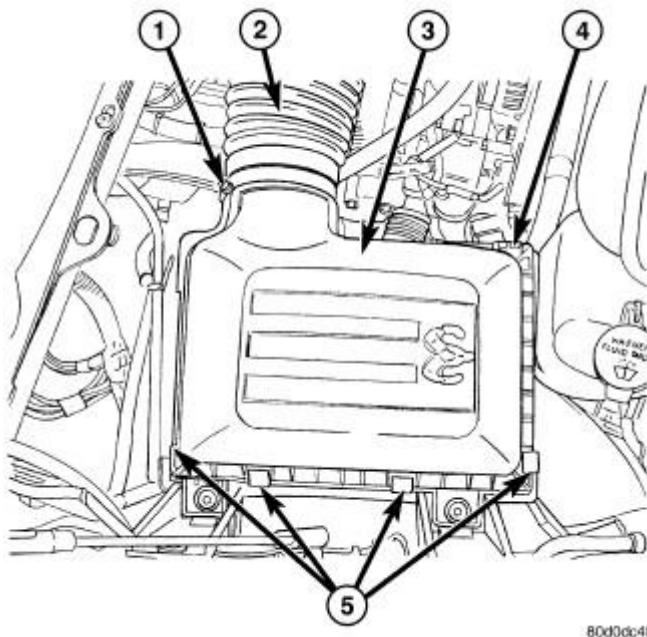


Fig. 27: Air Cleaner Housing Cover, Air Duct & Fasteners
 Courtesy of CHRYSLER GROUP, LLC

1. Loosen clamp (1) and disconnect air duct (2) at air cleaner cover (3).

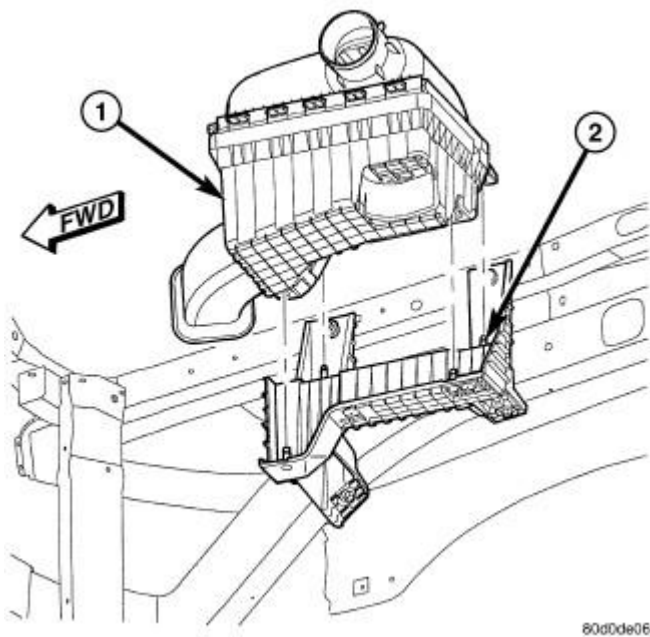


Fig. 28: Air Cleaner Housing Assembly
 Courtesy of CHRYSLER GROUP, LLC

2. Lift entire housing (1) assembly from 4 locating pins (2).

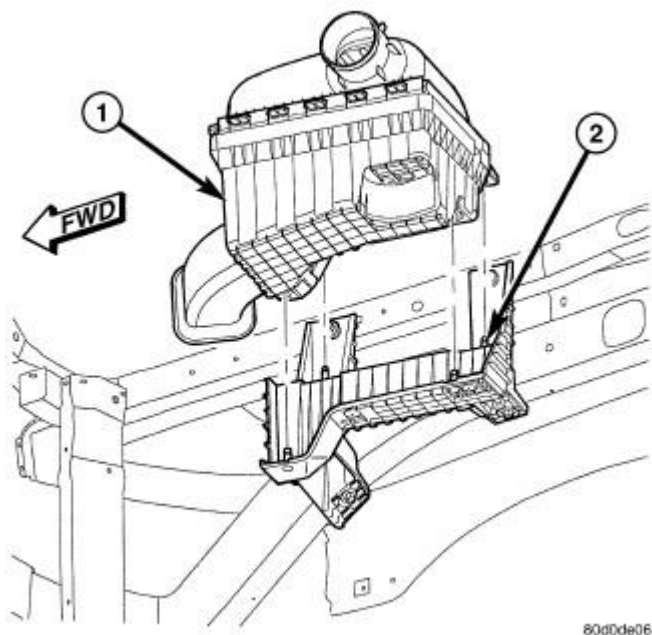
INSTALLATION**INSTALLATION**

Fig. 29: Air Cleaner Housing Assembly
Courtesy of CHRYSLER GROUP, LLC

1. Position housing assembly (1) into 4 locating pins (2).

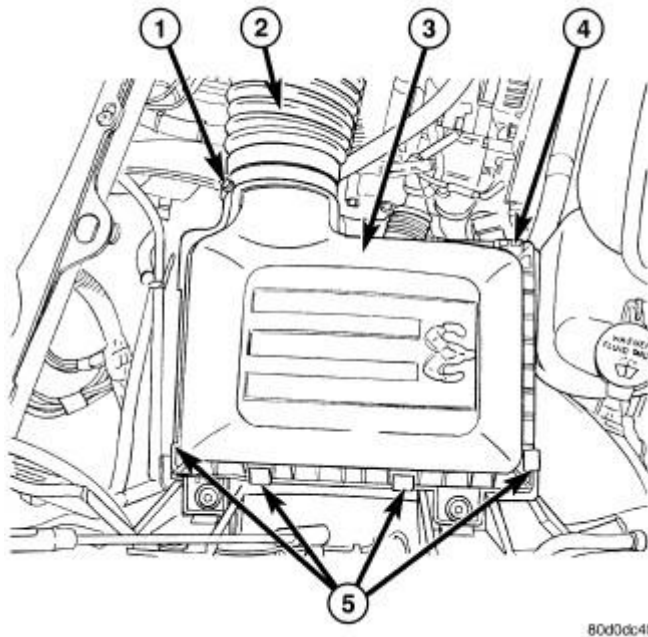


Fig. 30: Air Cleaner Housing Cover, Air Duct & Fasteners
Courtesy of CHRYSLER GROUP, LLC

2. Connect air duct (2) at air cleaner cover (3) and tighten clamp (1).

CYLINDER HEAD

DESCRIPTION

CYLINDER HEAD

The cylinder heads are made of an aluminum alloy. The cylinder head features two valves per cylinder with pressed in powdered metal valve guides. The cylinder heads also provide enclosures for the timing chain drain, necessitating unique left and right cylinder heads.

VALVE GUIDES

The valve guides are made of powdered metal and are pressed into the cylinder head. The guides are not replaceable or serviceable, and valve guide reaming is not recommended. If the guides are worn beyond acceptable limits, replace the cylinder heads.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - CYLINDER HEAD GASKET

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

Possible indications of the cylinder head gasket leaking between adjacent cylinders are:

- Loss of engine power
- Engine misfiring
- Poor fuel economy

Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:

- Engine overheating
- Loss of coolant
- Excessive steam (white smoke) emitting from exhaust
- Coolant foaming

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test. Refer to **CYLINDER COMPRESSION PRESSURE LEAKAGE**. An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50 - 70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.

VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

COOLING SYSTEM TESTER METHOD

WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

Install Cooling System Tester (special tool #7700, Tester, Cooling System) or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

CHEMICAL TEST METHOD

Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit (special tool #C-3685-A,

Bloc-Chek Kit) or equivalent. Perform test following the procedures supplied with the tool kit.

REMOVAL

LEFT CYLINDER HEAD

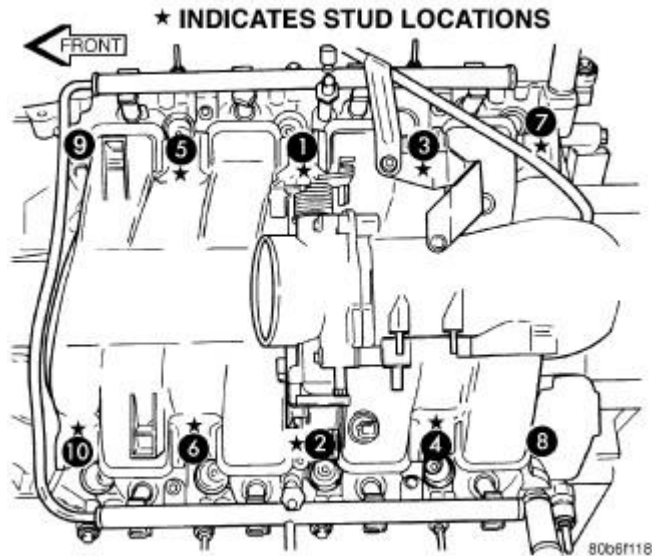


Fig. 31: Intake Manifold Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect the negative cable from the battery.
2. Raise the vehicle on a hoist.
3. Disconnect the exhaust pipe at the left side exhaust manifold.
4. Drain the engine coolant. Refer to **STANDARD PROCEDURE** .
5. Lower the vehicle.
6. Remove the intake manifold. Refer to **MANIFOLD, INTAKE, REMOVAL, 4.7L.**

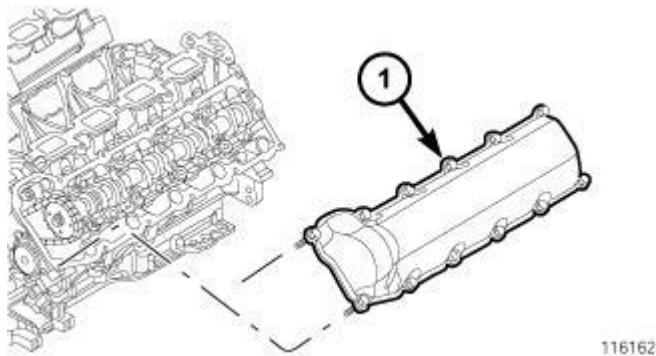


Fig. 32: Cylinder Head Cover - Left
Courtesy of CHRYSLER GROUP, LLC

7. Remove the master cylinder and booster assembly. Refer to **BOOSTER, POWER BRAKE, REMOVAL** and **BOOSTER, POWER BRAKE, HYDRO-BOOST, REMOVAL**.
8. Remove the cylinder head cover (1). Refer to **COVER(S), CYLINDER HEAD, REMOVAL, 4.7L**.

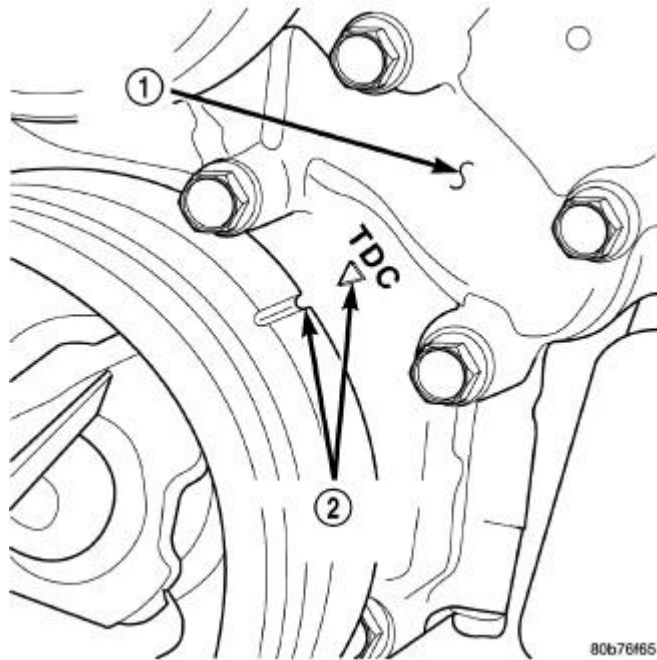


Fig. 33: TDC Indicator Marks

Courtesy of CHRYSLER GROUP, LLC

- | |
|---|
| 1 - TIMING CHAIN COVER
2 - CRANKSHAFT TIMING MARKS |
|---|

9. Remove the fan shroud and fan blade assembly. Refer to **FAN, COOLING, ELECTRIC, REMOVAL** and **FAN, COOLING, VISCOUS, REMOVAL**.
10. Remove accessory drive belt.
11. Remove the power steering pump and set aside.
12. Rotate the crankshaft until the damper timing marks are aligned (2).

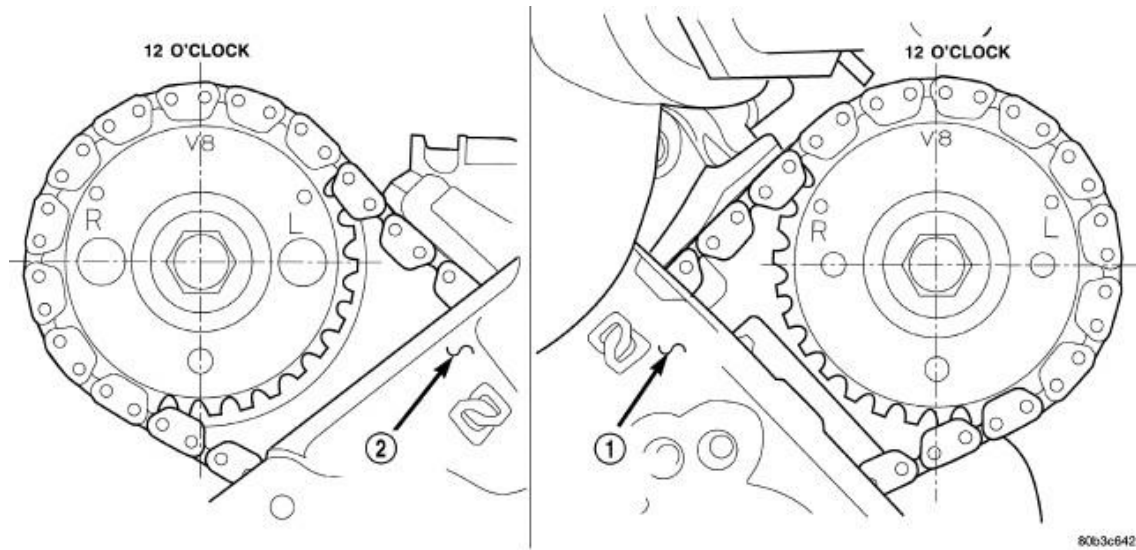
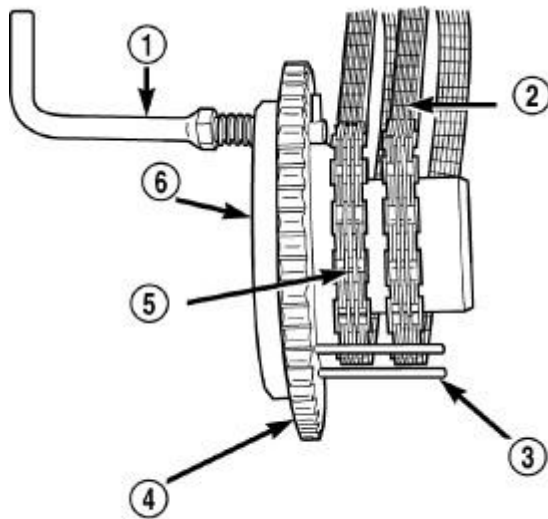


Fig. 34: V8 Timing Mark On Camshaft Sprocket
Courtesy of CHRYSLER GROUP, LLC

1 - LEFT CYLINDER HEAD
2 - RIGHT CYLINDER HEAD

13. Verify the V8 mark on the camshaft sprocket is at the 12 o'clock position. Rotate the crankshaft one turn if necessary.
14. Remove the crankshaft damper. Refer to **DAMPER, VIBRATION, REMOVAL, 4.7L.**
15. Remove the timing chain cover. Refer to **COVER(S), ENGINE TIMING, REMOVAL, 4.7L.**



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Fig. 35: Secondary Timing Chains Locked
Courtesy of CHRYSLER GROUP, LLC

16. Lock the secondary timing chains to the idler sprocket using secondary camshaft chain holder (special

tool #8429, Holder, Secondary Camshaft Chain) (6).

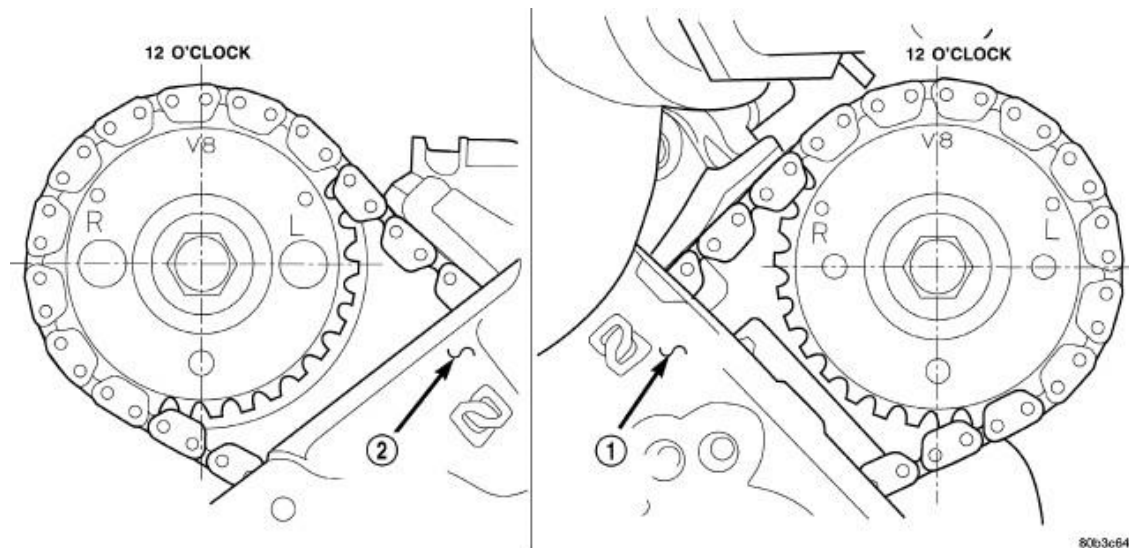


Fig. 36: V8 Timing Mark On Camshaft Sprocket
Courtesy of CHRYSLER GROUP, LLC

- | |
|-------------------------|
| 1 - LEFT CYLINDER HEAD |
| 2 - RIGHT CYLINDER HEAD |

NOTE: Mark the secondary timing chain prior to removal to aid in installation.

17. Mark the secondary timing chain, one link on each side of the V8 mark on the camshaft drive gear.
18. Remove the left side secondary chain tensioner. Refer to **CHAIN AND SPROCKETS, TIMING, REMOVAL, 4.7L**.

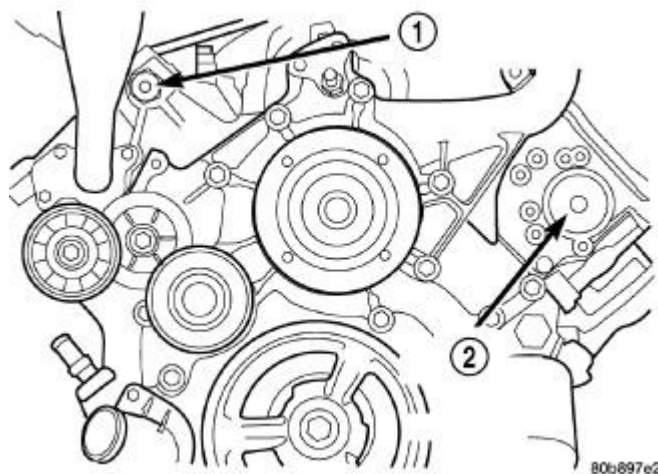


Fig. 37: Access Plugs From Left And Right Cylinder Heads
Courtesy of CHRYSLER GROUP, LLC

- 1 - RIGHT CYLINDER HEAD ACCESS PLUG
- 2 - LEFT CYLINDER HEAD ACCESS PLUG

CAUTION: Do not allow the engine to rotate. Severe damage to the valve train can occur.

19. Remove the cylinder head access plug (2).
20. Remove the left side secondary chain guide. Refer to CHAIN AND SPROCKETS, TIMING, REMOVAL, 4.7L.
21. Remove the retaining bolt and the camshaft drive gear.

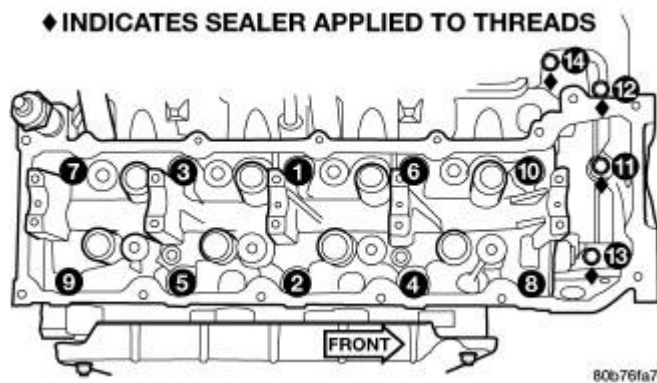


Fig. 38: Cylinder Head Bolts Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.

NOTE: The cylinder head is attached to the cylinder block with fourteen bolts.

22. Remove the cylinder head retaining bolts using the sequence provided.

CAUTION: Do not lay the cylinder head on its gasket sealing surface, due to the design of the cylinder head gasket, any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.

23. Remove the cylinder head and gasket. Discard the gasket.

RIGHT CYLINDER HEAD

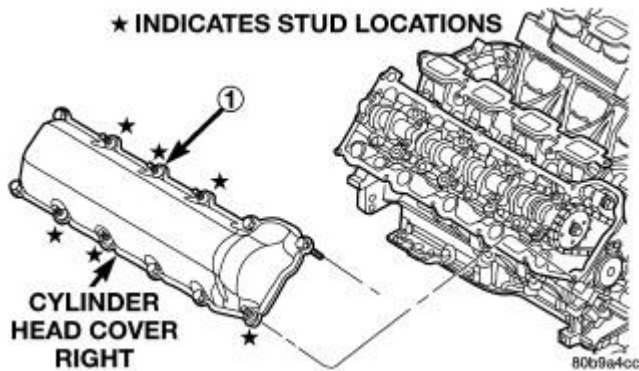


Fig. 39: Cylinder Head Cover - Right
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect battery negative cable.
2. Raise the vehicle on a hoist.
3. Disconnect the exhaust pipe at the right side exhaust manifold.
4. Drain the engine coolant. Refer to **STANDARD PROCEDURE** .
5. Lower the vehicle.
6. Remove the intake manifold. Refer to **MANIFOLD, INTAKE, REMOVAL, 4.7L**.
7. Remove the cylinder head cover (1). Refer to **COVER(S), CYLINDER HEAD, REMOVAL, 4.7L**.

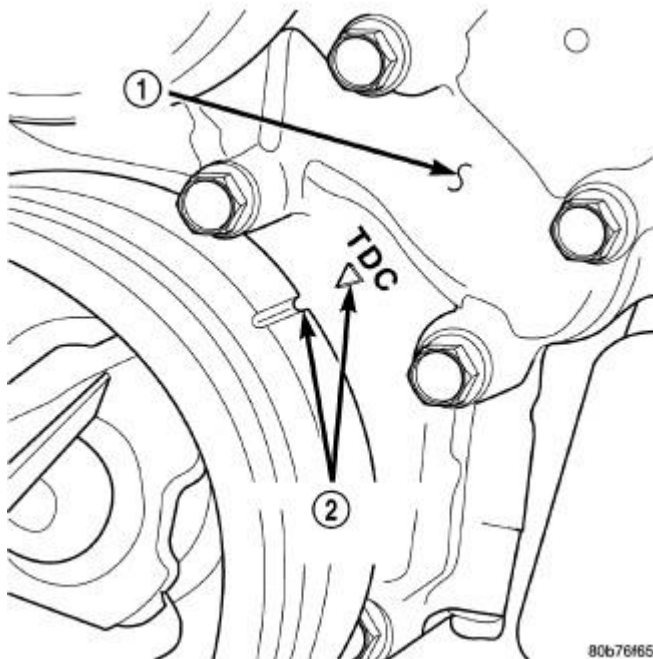


Fig. 40: TDC Indicator Marks
Courtesy of CHRYSLER GROUP, LLC

1 - TIMING CHAIN COVER

2 - CRANKSHAFT TIMING MARKS

8. Remove the fan shroud. Refer to **Fig. 188**.
9. Remove oil fill housing from cylinder head.
10. Remove accessory drive belt.
11. Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark (2).

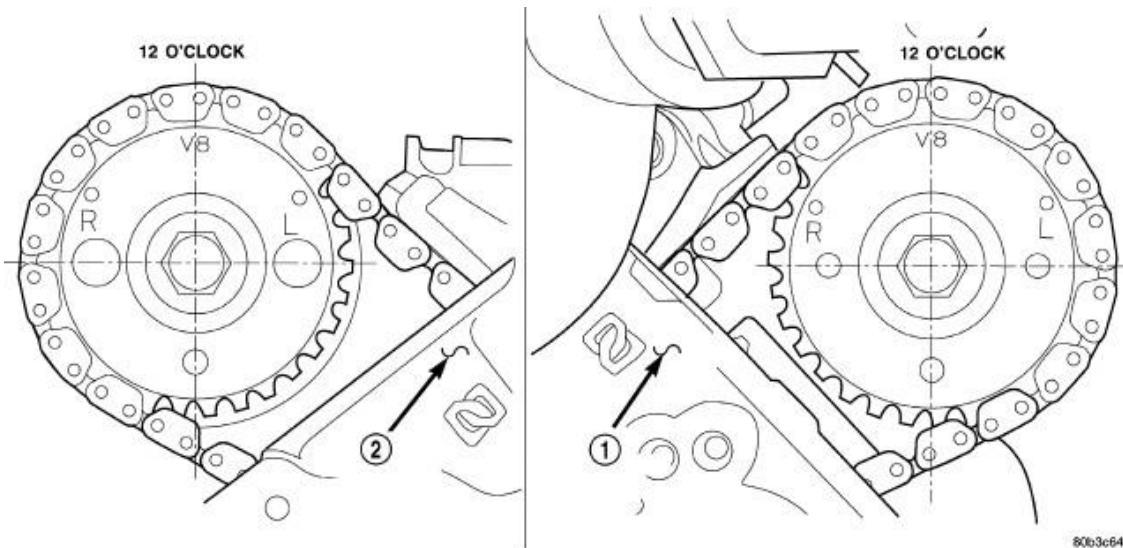
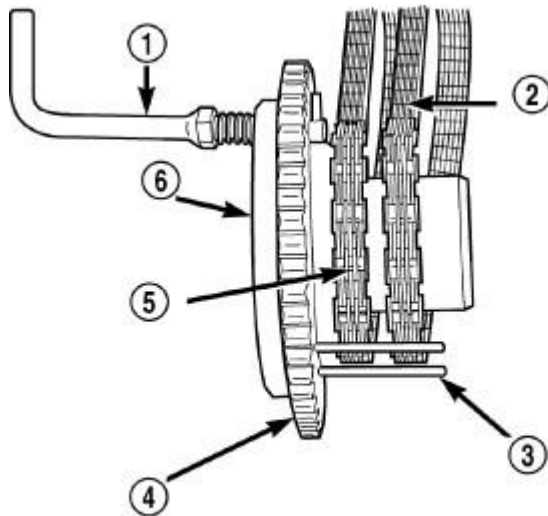


Fig. 41: V8 Timing Mark On Camshaft Sprocket
Courtesy of CHRYSLER GROUP, LLC

1 - LEFT CYLINDER HEAD
2 - RIGHT CYLINDER HEAD

12. Verify the V8 mark on the camshaft sprocket is at the 12 o'clock position (2). Rotate the crankshaft one turn if necessary.
13. Remove the crankshaft damper. Refer to **DAMPER, VIBRATION, REMOVAL, 4.7L**.
14. Remove the timing chain cover. Refer to **CHAIN AND SPROCKETS, TIMING, REMOVAL, 4.7L**.



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Fig. 42: Secondary Timing Chains Locked
Courtesy of CHRYSLER GROUP, LLC

- | |
|---|
| <p>1 - LOCK ARM
 2 - RIGHT CAMSHAFT CHAIN
 3 - SECONDARY CHAINS RETAINING PINS (4)
 4 - IDLER SPROCKET
 5 - LEFT CAMSHAFT CHAIN
 6 - SECONDARY CAMSHAFT CHAIN HOLDER 8429</p> |
|---|

15. Lock the secondary timing chains to the idler sprocket using Secondary Camshaft Chain Holder (special tool #8429, Holder, Secondary Camshaft Chain) (6).

NOTE: Mark the secondary timing chain prior to removal to aid in installation.

16. Mark the secondary timing chain, one link on each side of the V8 mark on the camshaft drive gear.
17. Remove the right side secondary chain tensioner. Refer to **CHAIN AND SPROCKETS, TIMING, REMOVAL, 4.7L**.

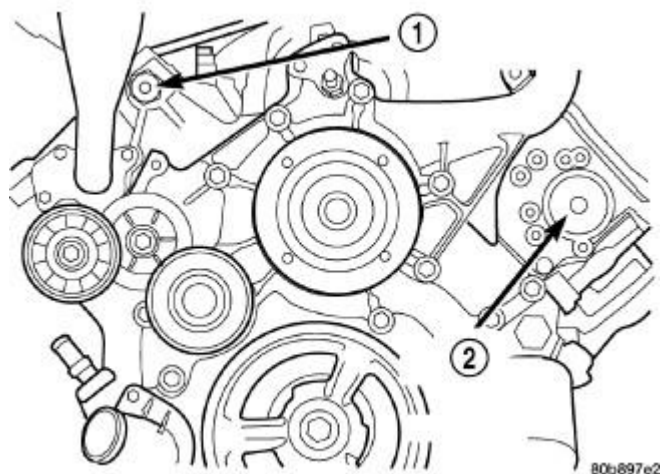


Fig. 43: Access Plugs From Left And Right Cylinder Heads
Courtesy of CHRYSLER GROUP, LLC

- | |
|-------------------------------------|
| 1 - RIGHT CYLINDER HEAD ACCESS PLUG |
| 2 - LEFT CYLINDER HEAD ACCESS PLUG |

18. Remove the cylinder head access plug (1).
19. Remove the right side secondary chain guide. Refer to **CHAIN AND SPROCKETS, TIMING, REMOVAL, 4.7L**.
20. Remove the retaining bolt and the camshaft drive gear.

CAUTION: Do not allow the engine to rotate. severe damage to the valve train can occur.

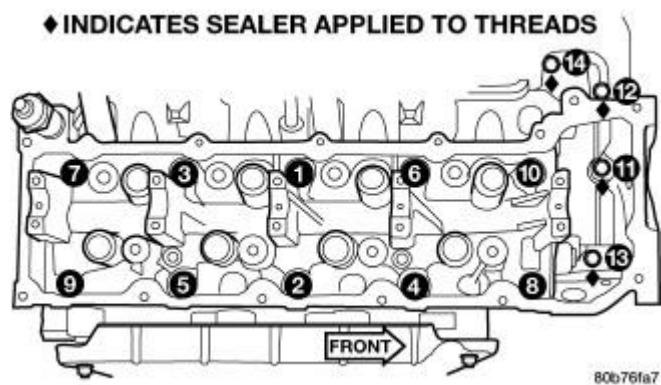


Fig. 44: Cylinder Head Bolts Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.

CAUTION: Do not hold or pry on the camshaft target wheel for any reason. A damaged target wheel can result in a vehicle no start condition.

NOTE: The cylinder head is attached to the cylinder block with fourteen bolts.

21. Remove the cylinder head retaining bolts using the sequence provided.

CAUTION: Do not lay the cylinder head on its gasket sealing surface, do to the design of the cylinder head gasket any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.

22. Remove the cylinder head and gasket. Discard the gasket.

CLEANING

CLEANING

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components. Refer to **Engine - Standard Procedure**.

INSPECTION

INSPECTION

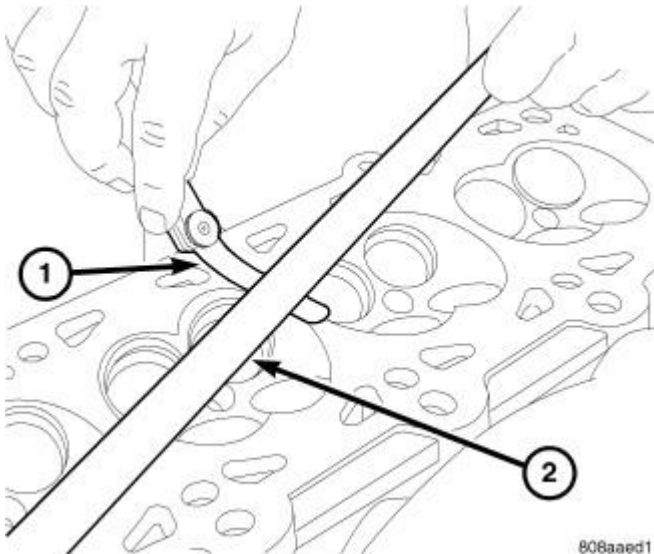


Fig. 45: Checking Cylinder Head Flatness
Courtesy of CHRYSLER GROUP, LLC

1. Inspect the cylinder head for out-of-flatness, using a straightedge (2) and a feeler gauge (1). Check Cylinder head in several locations. If tolerances exceed 0.0508 mm (0.002 in.) replace the cylinder head.

2. Inspect the valve seats for damage. Service the valve seats as necessary.
3. Inspect the valve guides for wear, cracks or looseness. If either condition exist, replace the cylinder head.

INSTALLATION

LEFT CYLINDER HEAD

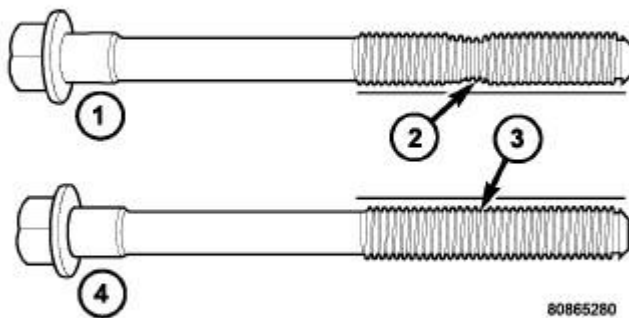
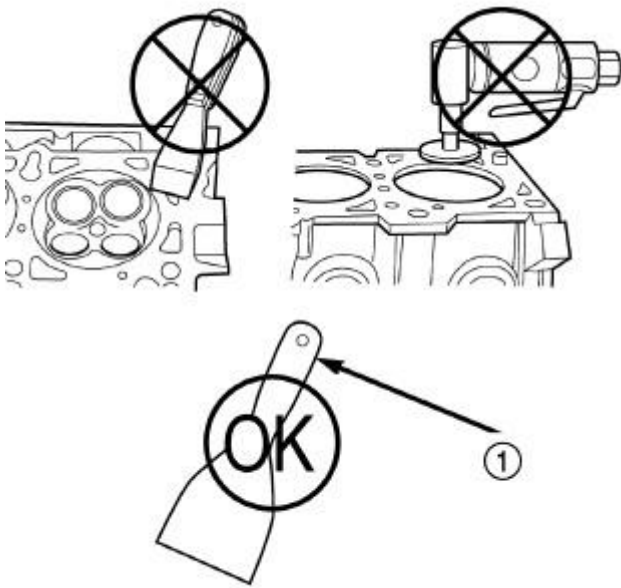


Fig. 46: Checking Cylinder Head Bolts For Stretching (Necking)

Courtesy of CHRYSLER GROUP, LLC

NOTE: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined **BEFORE** reuse. If the threads are necked down (2) the bolts should be replaced.

Necking can be checked by holding a straight edge against the threads. If all the threads do not contact the scale, the bolt should be replaced.



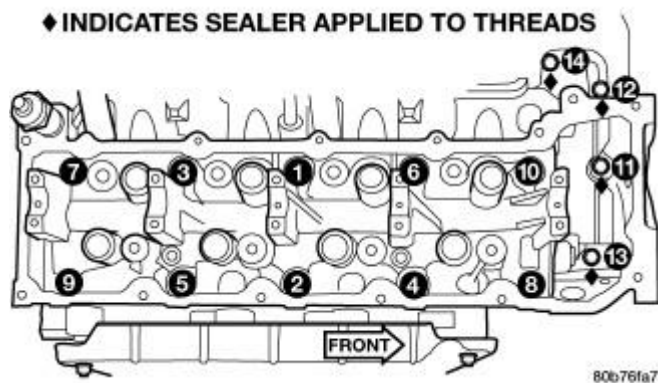
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Fig. 47: Proper Tool Usage For Surface Preparation
Courtesy of CHRYSLER GROUP, LLC

1 - PLASTIC/WOOD SCRAPER

CAUTION: When cleaning cylinder head and cylinder block surfaces, **DO NOT** use a metal scraper (1), high speed scotch brite (2) or rolock tool (3) because the surfaces could be cut or ground. Use only a wooden or plastic scraper (4).

1. Clean the cylinder head and cylinder block mating surfaces.



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Fig. 48: Cylinder Head Bolts Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

2. Position the new cylinder head gasket on the locating dowels.

CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.

3. Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

NOTE: The four M8 cylinder head mounting bolts (11 - 14) require sealant to be added to them before installing. Failure to do so may cause leaks.

4. Lubricate the cylinder head bolt threads with clean engine oil and install the ten M11 bolts.
5. Coat the four M8 cylinder head bolts with **Mopar® Thread Sealant with PTFE** then install the bolts.

NOTE: The cylinder head bolts are tightened using an torque angle procedure.

6. Tighten the bolts in sequence using the following steps and torque values:
 1. Tighten bolts 1 - 10 to 27 N.m (20 ft. lbs.).
 2. Verify that bolts 1 - 10 have all reached 27 N.m (20 ft. lbs.), by repeating step 1 without loosening the bolts.
 3. Tighten bolts 11 - 14 to 14 N.m (89 in. lbs.).
 4. Rotate bolts 1 - 10 an additional 90°.
 5. Rotate bolts 1 - 10 an additional 90° again.
 6. Tighten bolts 11 - 14 to 26 N.m (19 ft. lbs.).

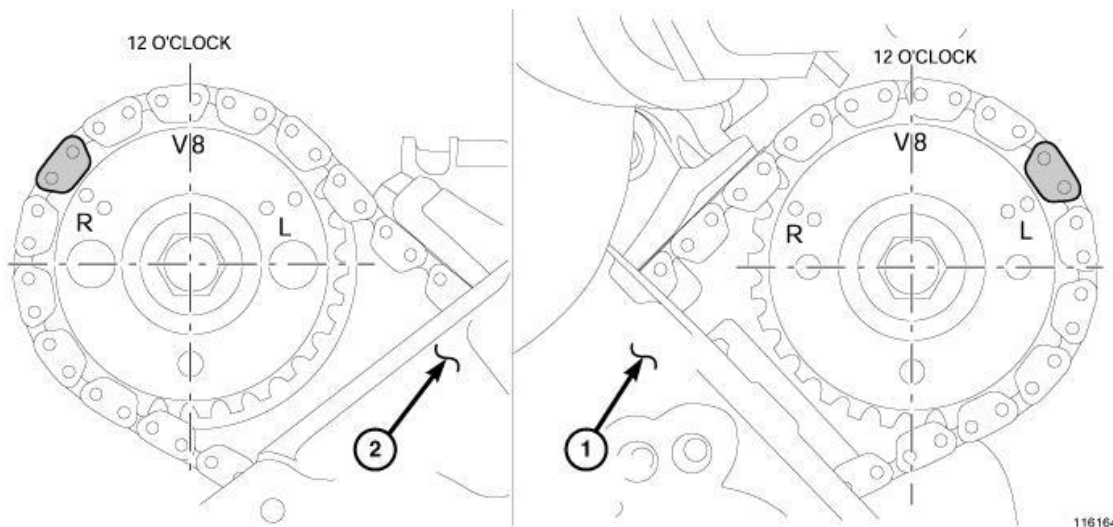


Fig. 49: V8 Timing Mark On Camshaft Sprocket
Courtesy of CHRYSLER GROUP, LLC

1 - LEFT CYLINDER HEAD
2 - RIGHT CYLINDER HEAD

7. Position the secondary chain onto the camshaft drive gear, making sure one marked chain link is on either side of the V8 mark on the gear and position the gear onto the camshaft.
8. Install the camshaft drive gear retaining bolt.
9. Install the left side secondary chain guide. Refer to **CHAIN AND SPROCKETS, TIMING, INSTALLATION, 4.7L.**

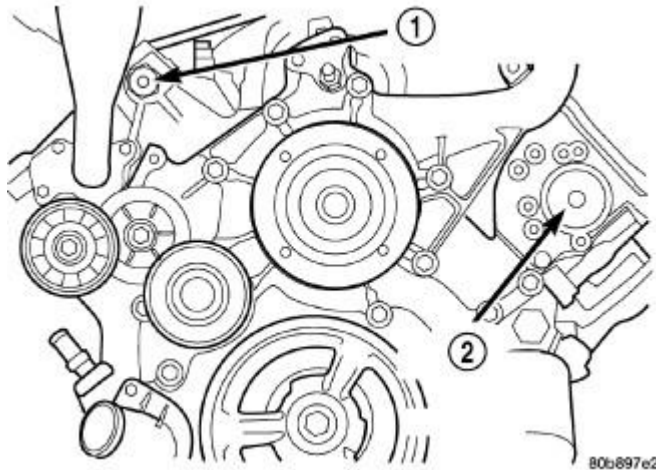
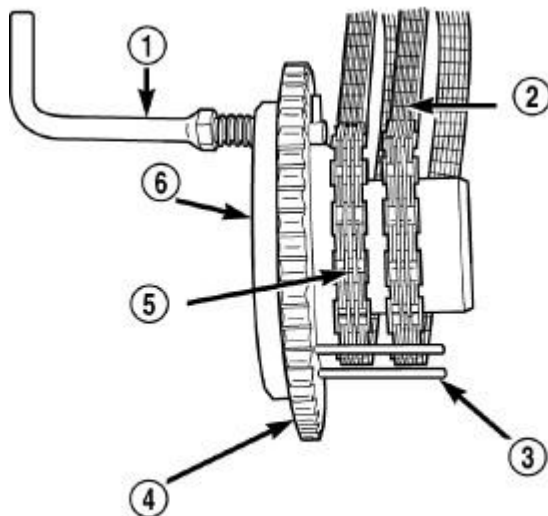


Fig. 50: Access Plugs From Left And Right Cylinder Heads
 Courtesy of CHRYSLER GROUP, LLC

- | |
|---|
| 1 - RIGHT CYLINDER HEAD ACCESS PLUG
2 - LEFT CYLINDER HEAD ACCESS PLUG |
|---|

10. Install the cylinder head access plug (2).
11. Re-set and Install the left side secondary chain tensioner. Refer to **CHAIN AND SPROCKETS, TIMING, INSTALLATION, 4.7L.**



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Fig. 51: Secondary Timing Chains Locked
Courtesy of CHRYSLER GROUP, LLC

- 1 - LOCK ARM
- 2 - RIGHT CAMSHAFT CHAIN
- 3 - SECONDARY CHAINS RETAINING PINS (4)
- 4 - IDLER SPROCKET
- 5 - LEFT CAMSHAFT CHAIN
- 6 - SECONDARY CAMSHAFT CHAIN HOLDER 8429

- 12. Remove Secondary Camshaft Chain Holder (special tool #8429, Holder, Secondary Camshaft Chain) (6).
- 13. Install the timing chain cover. Refer to **COVER(S), ENGINE TIMING, INSTALLATION, 4.7L.**
- 14. Install the crankshaft damper. Refer to **DAMPER, VIBRATION, INSTALLATION, 4.7L.**
- 15. Install the power steering pump.
- 16. Install the fan blade assembly and fan shroud.

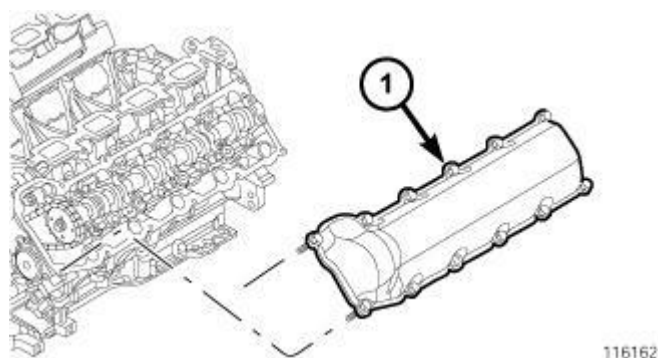


Fig. 52: Cylinder Head Cover - Left
Courtesy of CHRYSLER GROUP, LLC

- 17. Install the cylinder head cover. Refer to **COVER(S), CYLINDER HEAD, INSTALLATION, 4.7L.**
- 18. Reinstall the master cylinder and booster assembly. Refer to **BOOSTER, POWER BRAKE, INSTALLATION** and **BOOSTER, POWER BRAKE, HYDRO-BOOST, INSTALLATION**.
- 19. Install the intake manifold. Refer to **MANIFOLD, INTAKE, INSTALLATION, 4.7L.**
- 20. Fill the cooling system. Refer to **STANDARD PROCEDURE**.
- 21. Raise the vehicle.
- 22. Install the exhaust pipe onto the left exhaust manifold.
- 23. Drain oil.
- 24. Lower the vehicle.
- 25. Fill with oil.
- 26. Connect the negative cable to the battery.
- 27. Start the engine and check for leaks.

RIGHT CYLINDER HEAD

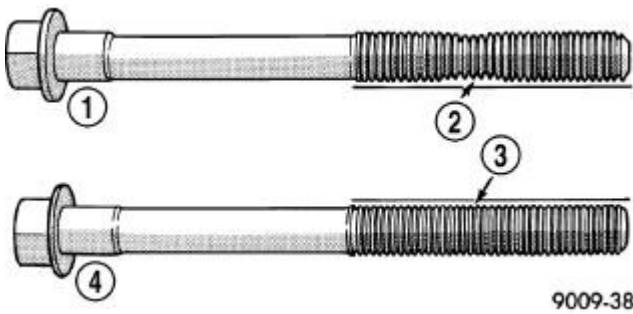
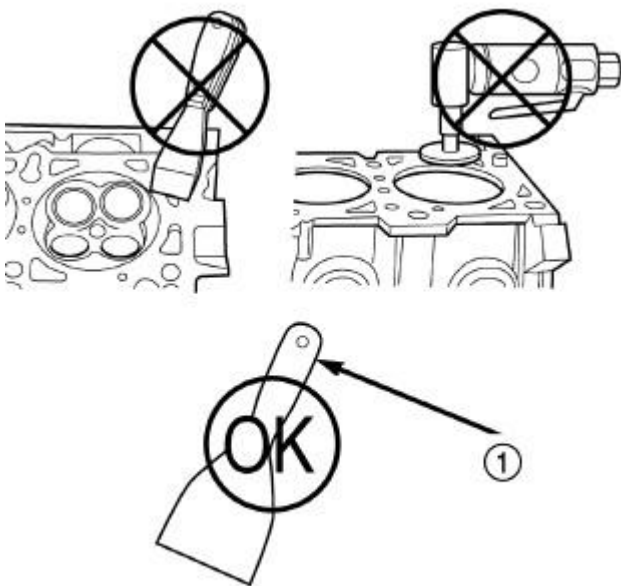


Fig. 53: Checking Cylinder Head Bolts For Stretching (Necking)

Courtesy of CHRYSLER GROUP, LLC

NOTE: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined **BEFORE** reuse. If the threads are necked down (2) the bolts should be replaced.

Necking (2) can be checked by holding a straight edge against the threads. If all the threads do not contact the scale (2), the bolt should be replaced.



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Fig. 54: Proper Tool Usage For Surface Preparation

Courtesy of CHRYSLER GROUP, LLC

1 - PLASTIC/WOOD SCRAPER

CAUTION: When cleaning cylinder head and cylinder block surfaces, **DO NOT** use a metal scraper (1), high speed scotch brite (2) or rolock tool (3) because the surfaces could be cut or ground. Use only a wooden or plastic scraper (4).

1. Clean the cylinder head and cylinder block mating surfaces.

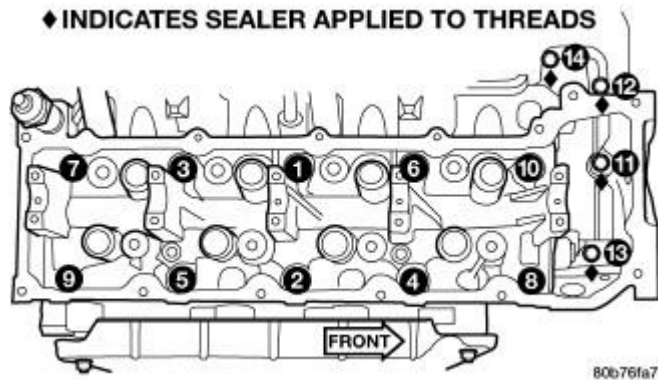


Fig. 55: Cylinder Head Bolts Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

2. Position the new cylinder head gasket on the locating dowels.

CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.

3. Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

NOTE: The four M8 cylinder head mounting bolts (11 - 14) require sealant to be added to them before installing. Failure to do so may cause leaks.

4. Lubricate the cylinder head bolt threads with clean engine oil and install the ten M10 bolts.
5. Coat the four M8 cylinder head bolts with **Mopar® Thread Sealant with PTFE** then install the bolts.

NOTE: The cylinder head bolts are tightened using an angle torque procedure.

6. Tighten the bolts in sequence using the following steps and torque values:
 1. Tighten bolts 1 - 10 to 27 N.m (20 ft. lbs.).
 2. Verify that bolts 1 - 10 have all reached 27 N.m (20 ft. lbs.), by repeating step 1 without loosening the bolts.
 3. Tighten bolts 11 - 14 to 14 N.m (89 in. lbs.).
 4. Rotate bolts 1 - 10 an additional 90°.
 5. Rotate bolts 1 - 10 an additional 90° again.
 6. Tighten bolts 11 - 14 to 26 N.m (19 ft. lbs.).

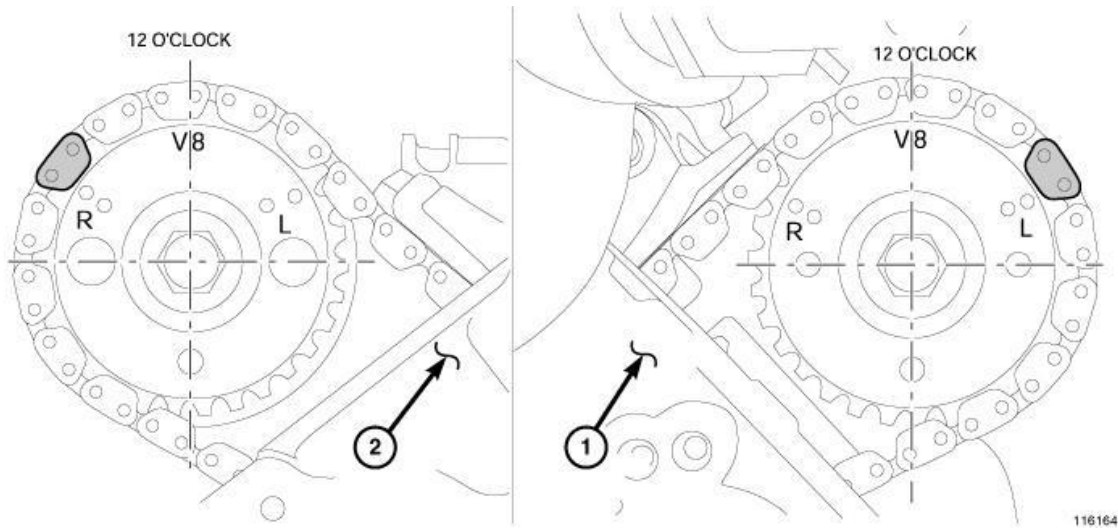


Fig. 56: V8 Timing Mark On Camshaft Sprocket
Courtesy of CHRYSLER GROUP, LLC

- | |
|-------------------------|
| 1 - LEFT CYLINDER HEAD |
| 2 - RIGHT CYLINDER HEAD |

- Position the secondary chain onto the camshaft drive gear, making sure one marked chain link is on either side of the V8 mark on the gear (2) and position the gear onto the camshaft.
- Install the camshaft drive gear retaining bolt.
- Install the right side secondary chain guide. Refer to **CHAIN AND SPROCKETS, TIMING, INSTALLATION, 4.7L.**

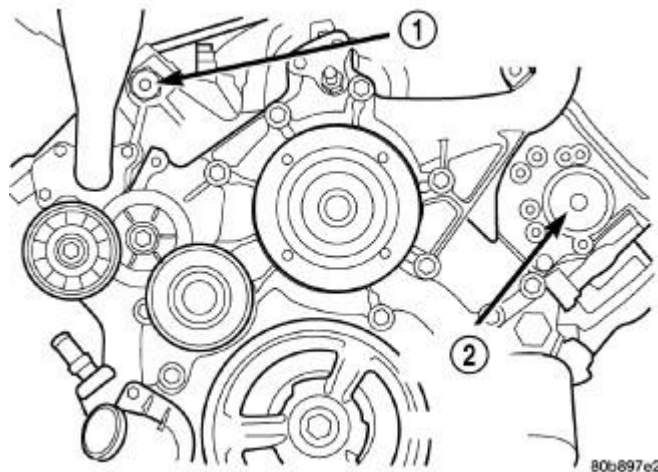
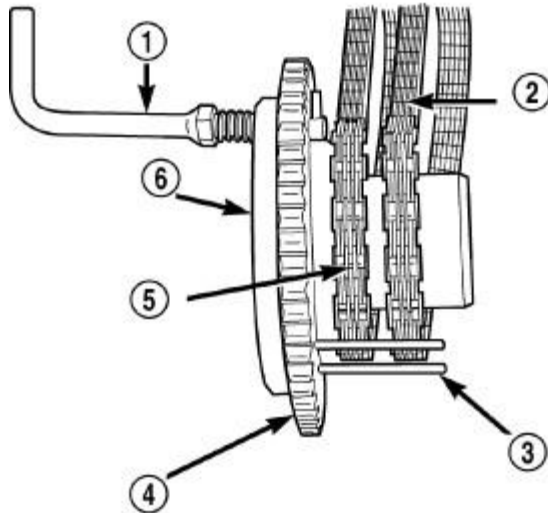


Fig. 57: Access Plugs From Left And Right Cylinder Heads
Courtesy of CHRYSLER GROUP, LLC

- | |
|-------------------------------------|
| 1 - RIGHT CYLINDER HEAD ACCESS PLUG |
| 2 - LEFT CYLINDER HEAD ACCESS PLUG |

10. Install the right side cylinder head access plug (1).
11. Re-set and install the right side secondary chain tensioner.



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Fig. 58: Secondary Timing Chains Locked
Courtesy of CHRYSLER GROUP, LLC

1 - LOCK ARM
2 - RIGHT CAMSHAFT CHAIN
3 - SECONDARY CHAINS RETAINING PINS (4)
4 - IDLER SPROCKET
5 - LEFT CAMSHAFT CHAIN
6 - SECONDARY CAMSHAFT CHAIN HOLDER 8429

12. Remove Secondary Camshaft Chain Holder (special tool #8429, Holder, Secondary Camshaft Chain) (6).
13. Install the timing chain cover. Refer to **COVER(S), ENGINE TIMING, INSTALLATION, 4.7L**.
14. Install the crankshaft damper. Refer to **DAMPER, VIBRATION, INSTALLATION, 4.7L**.
15. Install accessory drive belt.
16. Install the fan shroud.

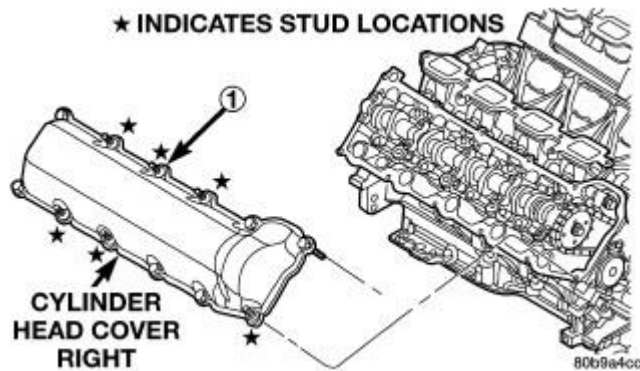


Fig. 59: Cylinder Head Cover - Right
Courtesy of CHRYSLER GROUP, LLC

17. Install the cylinder head cover (1). Refer to COVER(S), CYLINDER HEAD, INSTALLATION, 4.7L.

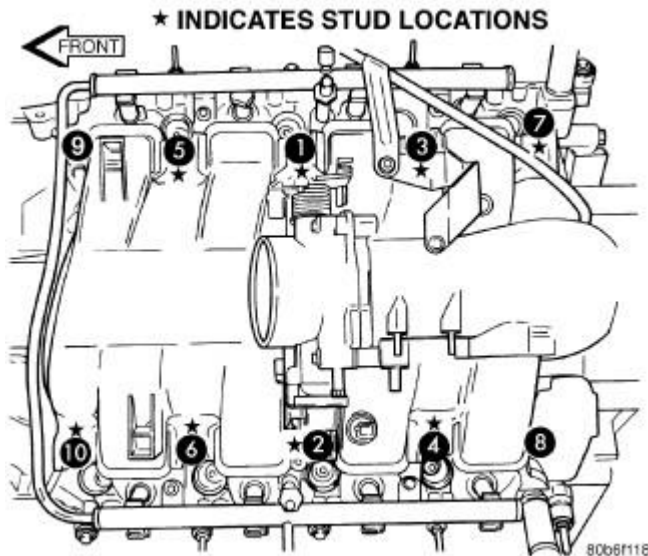


Fig. 60: Intake Manifold Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

18. Install the intake manifold. Refer to MANIFOLD, INTAKE, INSTALLATION, 4.7L.
19. Install oil fill housing onto cylinder head.
20. Refill the cooling system. Refer to STANDARD PROCEDURE.
21. Raise the vehicle.
22. Drain oil.
23. Install the exhaust pipe onto the right exhaust manifold.
24. Lower the vehicle.
25. Fill with new engine oil.
26. Reconnect battery negative cable.

27. Start the engine and check for leaks.

CAMSHAFT, ENGINE

DESCRIPTION

DESCRIPTION

The camshafts consist of powdered metal steel lobes which are sinter-bonded to a steel tube. A steel post or nose piece is friction-welded to the steel camshaft tube. Five bearing journals are machined into the camshaft, four on the steel tube and one on the steel nose piece. Camshaft end play is controlled by two thrust walls that border the nose piece journal. Engine oil enters the hollow camshafts at the third journal and lubricates every intake lobe rocker through a drilled passage in the intake lobe.

STANDARD PROCEDURE

STANDARD PROCEDURE - CAMSHAFT END PLAY

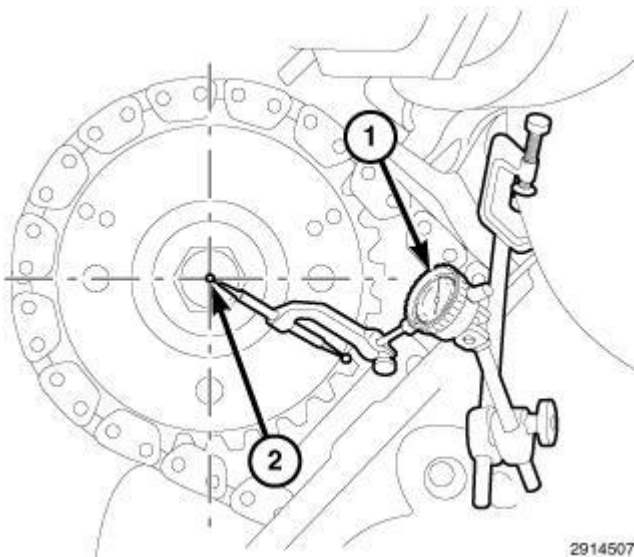


Fig. 61: Positioning Dial Indicator Tip Against Camshaft
Courtesy of CHRYSLER GROUP, LLC

1. Remove the cylinder head cover. Refer to **COVER(S), CYLINDER HEAD, REMOVAL, 4.7L**.
2. Mount Dial Indicator Set (special tool #C-3339A, Set, Dial Indicator) (1) to a stationary point at the front of the engine.
3. Position the dial indicator tip against the camshaft (2).
4. Push the camshaft toward rear of engine and adjust the dial indicator to zero.
5. Move the camshaft forward and note reading.
6. Camshaft end play must be within specification, if end play is not within specification replace defective part as necessary. Refer to **Engine - Specifications**.

REMOVAL

REMOVAL - RIGHT CAMSHAFT

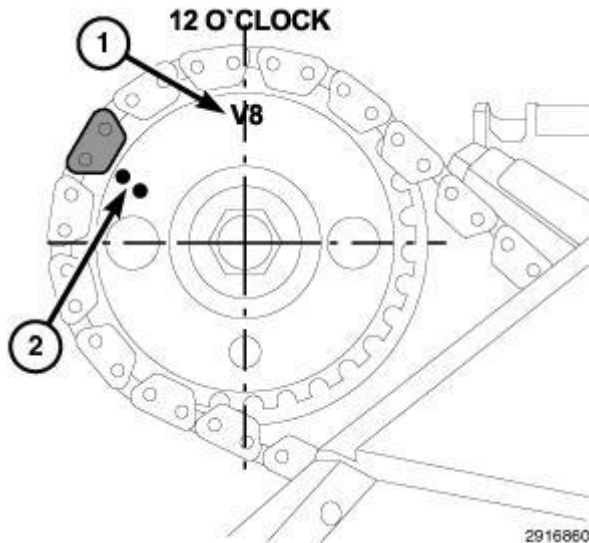


Fig. 62: Aligning Camshaft Sprocket V8 Mark & Identifying 2 Dots
Courtesy of CHRYSLER GROUP, LLC

1. Remove the cylinder head cover(s) (1). Refer to COVER(S), CYLINDER HEAD, REMOVAL, 4.7L.

CAUTION: When the timing chain is removed and the cylinder heads are still installed, Do not forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.

2. Set #1 cylinder to TDC and align the camshaft sprocket V8 mark (1) to the 12 o'clock position.
3. Mark the link on the secondary timing chain that is aligned with the two dots (2) on the camshaft sprocket as shown in illustration to aid in installation.

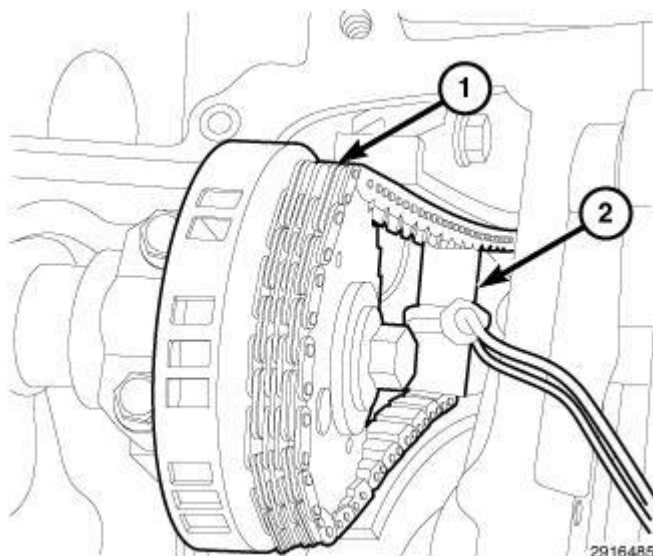


Fig. 63: Positioning Locking Wedge Between Timing Chain

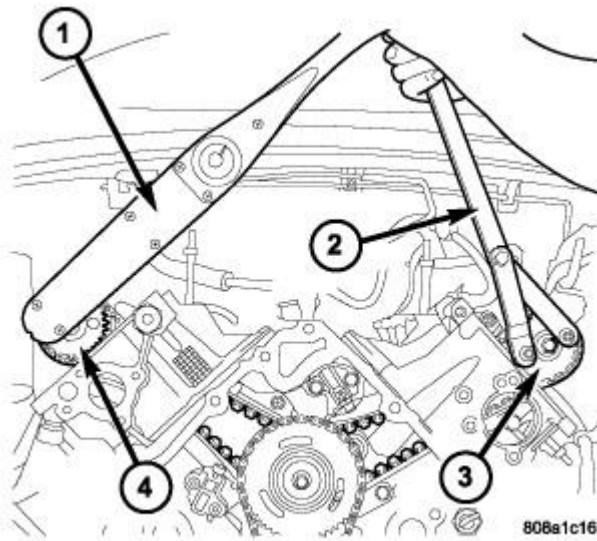
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Do not hold or pry on the camshaft target wheel for any reason, severe damage will occur to the target wheel resulting in a vehicle no start condition.

CAUTION: When removing the camshaft sprocket, timing chains or camshaft, the timing chain tensioner must be secured, failure to use Locking Wedge (special tool #9867, Wedge, Locking) will result in hydraulic tensioner ratchet over extension, requiring timing chain cover removal to reset the tensioner ratchet.

CAUTION: Do not force Locking Wedge (special tool #9867, Wedge, Locking) past the narrowest point between the chain strands. Damage to the tensioners may occur.

4. Position Locking Wedge (special tool #9867, Wedge, Locking) (2) between the timing chain strands (1), gently tap the wedge into position and secure the timing chain against the tensioner arm and guide.

**Fig. 64: Tightening Right Side Camshaft Sprocket Bolt**

Courtesy of CHRYSLER GROUP, LLC

5. Using Spanner Wrench (special tool #6958, Wrench, Spanner) (2) with Adapter Pins (special tool #8346, Pins, Adapter), secure the camshaft sprocket (3) and remove the camshaft sprocket bolt.

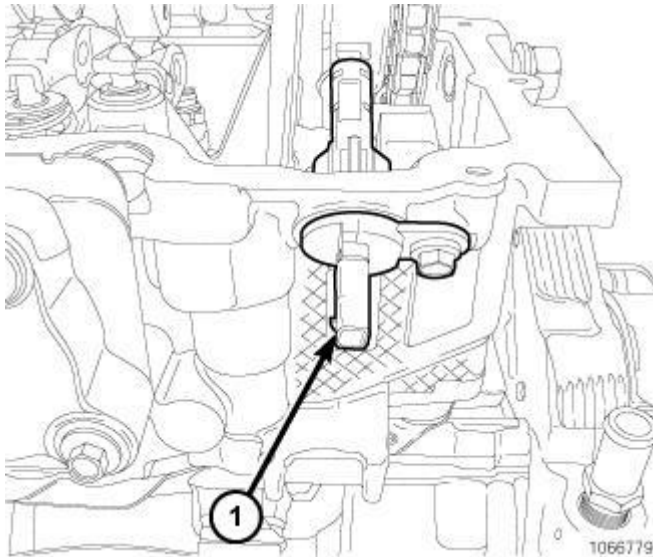


Fig. 65: Camshaft Position Sensor
Courtesy of CHRYSLER GROUP, LLC

6. Disconnect the electrical connector to the Camshaft Position Sensor (CMP).
7. Remove the CMP sensor retaining bolt
8. Using a slight rocking motion, carefully remove the CMP sensor (1).
9. Check the condition of the CMP sensor O-ring, replace as necessary.

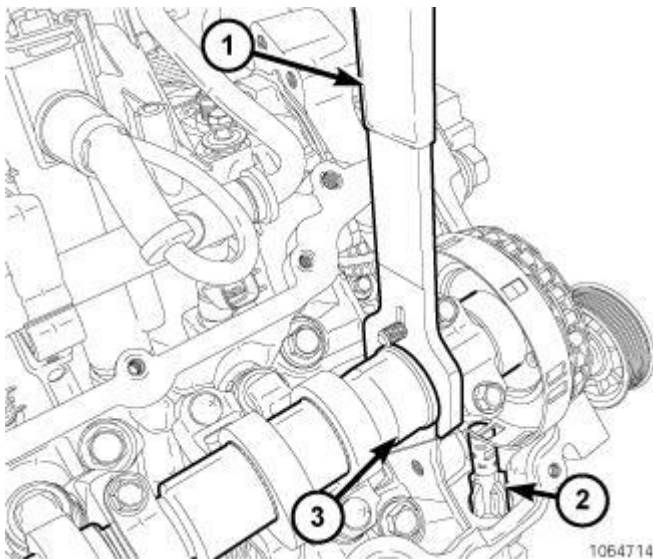


Fig. 66: Removing/Installing Cam Sensor & Camshaft Sprocket Bolt Using Spanner Wrench
Courtesy of CHRYSLER GROUP, LLC

10. Position Camshaft Holder (special tool #8428A, Holder, Camshaft) (1) onto the camshaft (3).

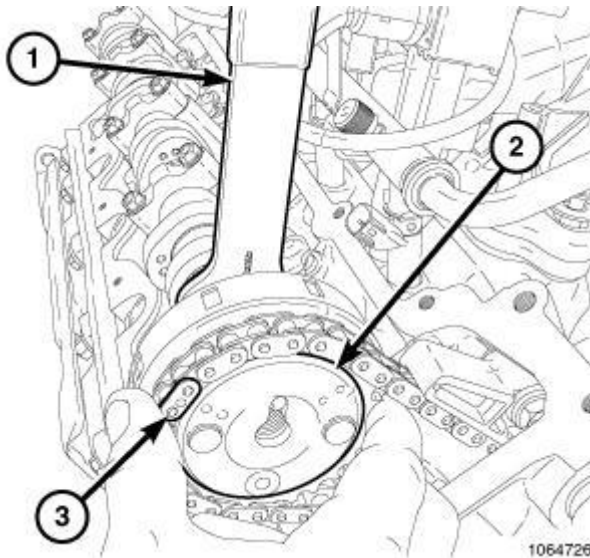


Fig. 67: Camshaft Holder On Camshaft Sprocket
Courtesy of CHRYSLER GROUP, LLC

11. Using Camshaft Holder (special tool #8428A, Holder, Camshaft) (1), hold the camshaft while removing the camshaft sprocket (2).
12. Using Camshaft Holder (special tool #8428A, Holder, Camshaft) (1), gently allow the camshaft to rotate 45° counterclockwise until the camshaft is in the neutral position (no valve load).

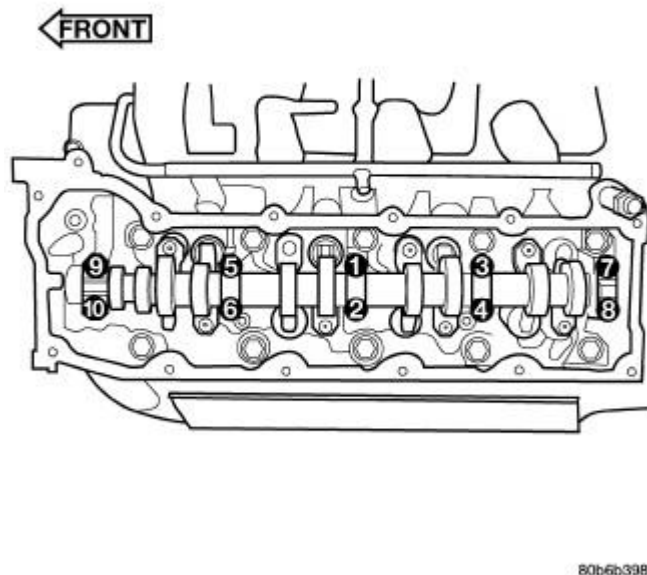


Fig. 68: Removal/Installation Sequence Of Camshaft Bearing Cap Retaining Bolts
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Do not stamp or strike the camshaft bearing caps or severe engine

damage may result.

NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.

13. Using the sequence shown in illustration, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time until all load is off the bearing caps and remove bolts.
14. Remove the camshaft bearing caps and the camshaft.

REMOVAL - LEFT CAMSHAFT

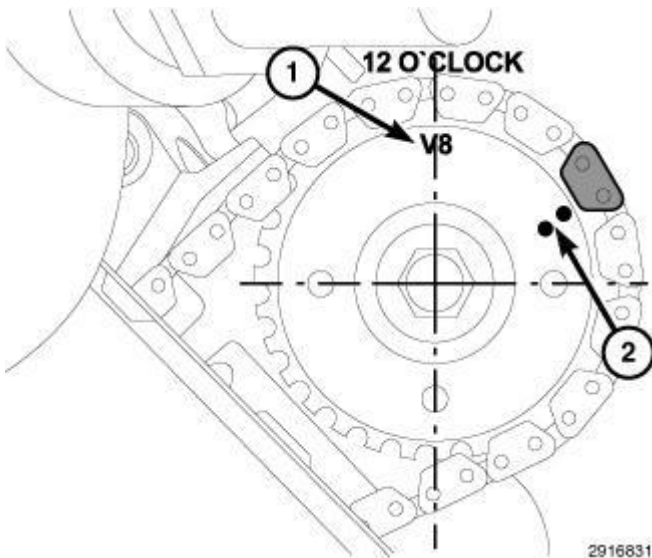


Fig. 69: Aligning Camshaft Sprocket V8 Mark & Identifying 2 Dots
Courtesy of CHRYSLER GROUP, LLC

1. Remove the cylinder head cover. Refer to COVER(S), CYLINDER HEAD, REMOVAL, 4.7L.

CAUTION: When the timing chain is removed and the cylinder heads are still installed, Do not forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.

2. Set #1 cylinder to TDC and align the camshaft sprocket V8 mark (1) to the 12 o'clock position.
3. Mark the link on the secondary timing chain that is aligned with the two dots (2) on the camshaft sprocket as shown in illustration to aid in installation.

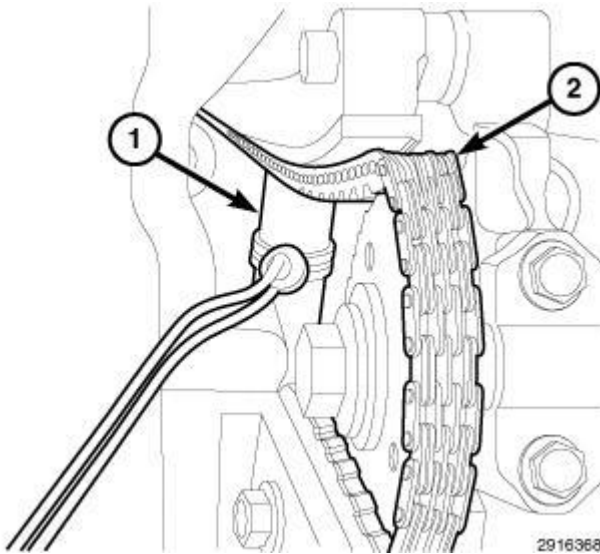


Fig. 70: Positioning Locking Wedge Between Timing Chain Strands
Courtesy of CHRYSLER GROUP, LLC

CAUTION: When removing the camshaft sprocket, timing chains or camshaft, the timing chain tensioner must be secured, failure to use Locking Wedge (special tool #9867, Wedge, Locking) will result in hydraulic tensioner ratchet over extension, requiring timing chain cover removal to reset the tensioner ratchet.

CAUTION: Do not force Locking Wedge (special tool #9867, Wedge, Locking) past the narrowest point between the chain strands. Damage to the tensioners may occur.

4. Position Locking Wedge (special tool #9867, Wedge, Locking) (1) between the timing chain strands (2), gently tap the wedge into position and secure the timing chain against the tensioner arm and guide.

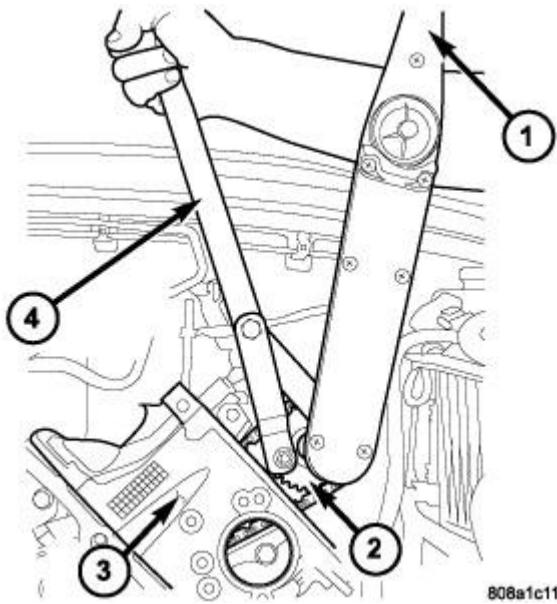


Fig. 71: Removing/Installing Left Side Camshaft Sprocket Bolt
Courtesy of CHRYSLER GROUP, LLC

5. Using Spanner Wrench (special tool #6958, Wrench, Spanner) (4) with Adapter Pins (special tool #8346, Pins, Adapter), secure the camshaft sprocket (2) and remove the camshaft sprocket bolt.

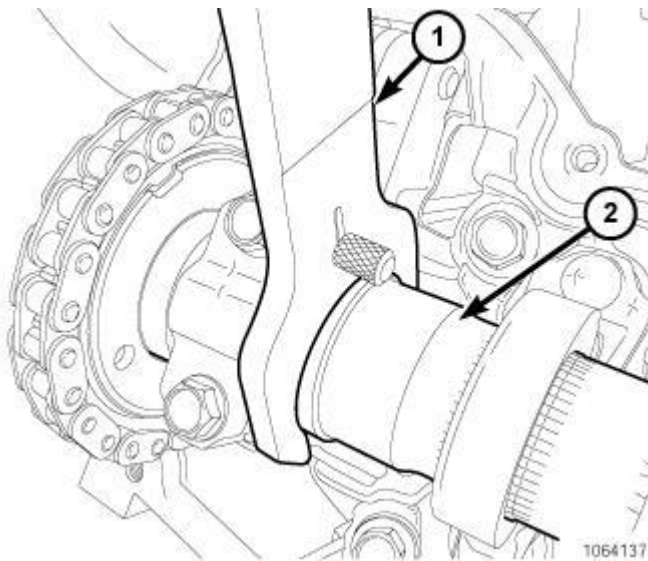


Fig. 72: Removing/Installing Camshaft Sprocket Bolt Using Spanner Wrench
Courtesy of CHRYSLER GROUP, LLC

6. Position Camshaft Holder (special tool #8428A, Holder, Camshaft) (1) onto the camshaft (2).

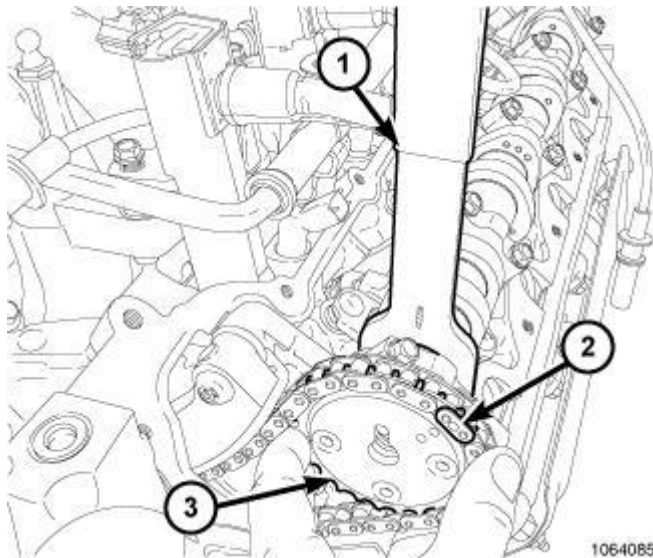


Fig. 73: Removing/Installing Camshaft Sprocket Using Camshaft Holder
 Courtesy of CHRYSLER GROUP, LLC

7. Using Camshaft Holder (special tool #8428A, Holder, Camshaft) (1), hold the camshaft while removing the camshaft sprocket (3).
8. Using Camshaft Holder (special tool #8428A, Holder, Camshaft) (1), gently allow the camshaft to rotate 15° clockwise until the camshaft is in the neutral position (no valve load).

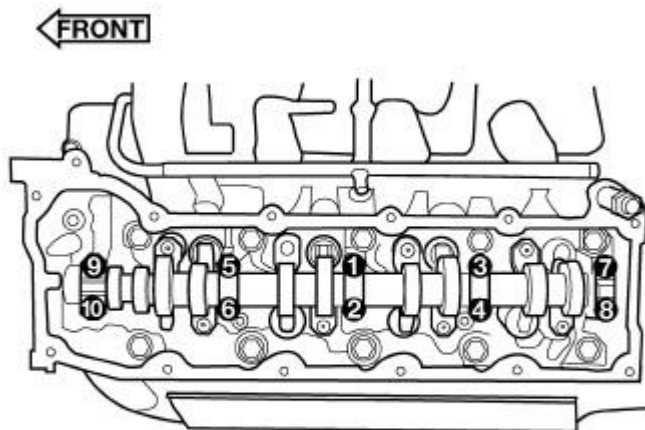


Fig. 74: Removal/Installation Sequence Of Camshaft Bearing Cap Retaining Bolts
 Courtesy of CHRYSLER GROUP, LLC

CAUTION: Do not stamp or strike the camshaft bearing caps or severe engine

damage may result.

NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.

9. Using the sequence shown in illustration, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time until all load is off the bearing caps and remove bolts.
10. Remove the camshaft bearing caps and the camshaft.

INSTALLATION

INSTALLATION - RIGHT CAMSHAFT

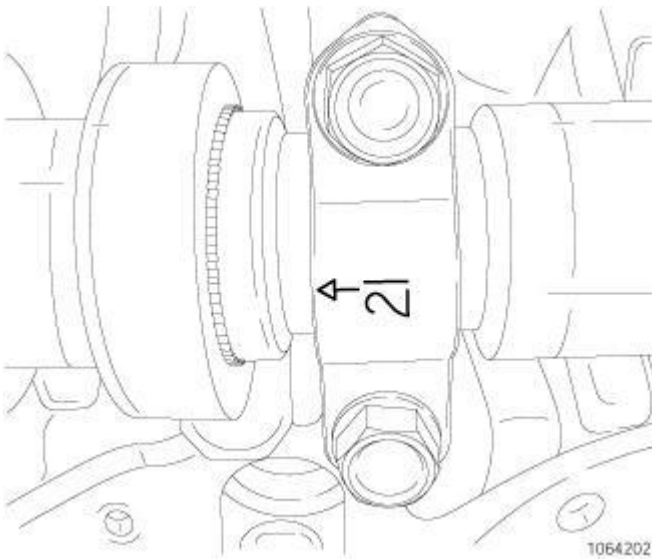


Fig. 75: Positioning Camshaft Cap Arrow Toward Front Of Engine
Courtesy of CHRYSLER GROUP, LLC

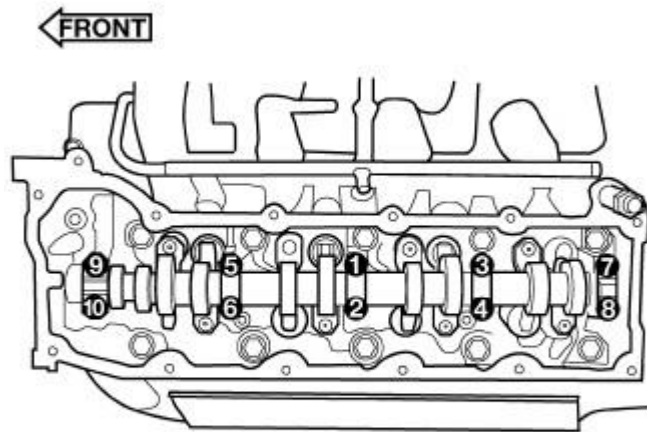
1. Lubricate the camshaft journals with clean engine oil.

NOTE: Position the right side camshaft so that the camshaft sprocket dowel is near the 10 o'clock position, this will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.

2. Install the camshaft into the cylinder head while aligning the camshaft sprocket dowel near the 10 o'clock position.

NOTE: The camshaft caps are marked for location. The arrow must point to the front of the engine.

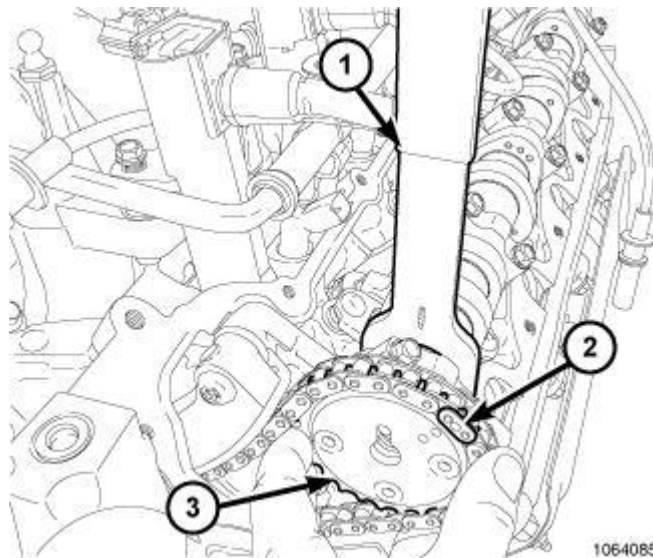
3. Install the camshaft bearing caps in the same position as noted during removal.
4. Install the camshaft bearing cap retaining bolts hand tight.



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Fig. 76: Removal/Installation Sequence Of Camshaft Bearing Cap Retaining Bolts
 Courtesy of CHRYSLER GROUP, LLC

5. Using the sequence shown in illustration, working in 1/2 turn increments, tighten the bearing cap retaining bolts to 11 N.m (8 ft. lbs.).
6. Check the camshaft end play. Refer to **CAMSHAFT, ENGINE, STANDARD PROCEDURE, 4.7L.**



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Fig. 77: Removing/Installing Camshaft Sprocket Using Camshaft Holder
 Courtesy of CHRYSLER GROUP, LLC

7. Position the camshaft drive gear into the timing chain while aligning the two dots on the camshaft sprocket with the chain link (2) marked during removal.

8. Using Camshaft Holder (special tool #8428A, Holder, Camshaft) (1), rotate the camshaft until the camshaft sprocket dowel is aligned with the slot in the camshaft sprocket.
9. Position the sprocket onto the camshaft.

CAUTION: Remove excess oil from the camshaft sprocket retaining bolt, failure to do so can cause bolt over-torque resulting in bolt failure.

10. Remove excess oil from the camshaft sprocket retaining bolt.
11. Install the camshaft sprocket retaining bolt hand tight.

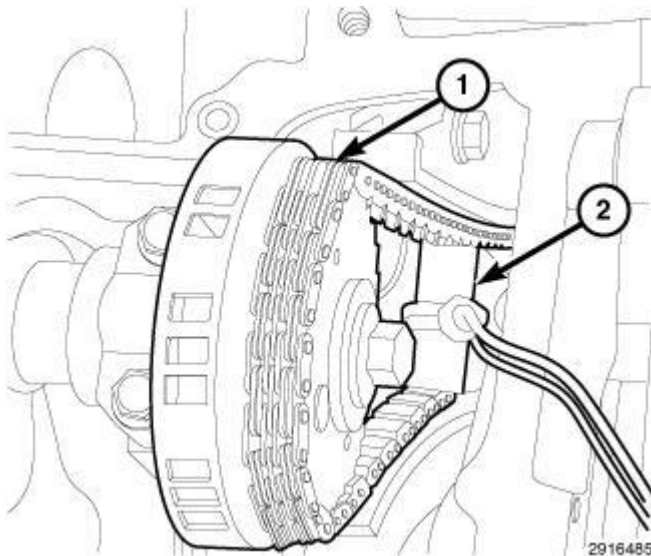


Fig. 78: Positioning Locking Wedge Between Timing Chain

Courtesy of CHRYSLER GROUP, LLC

12. Remove the timing chain (1) Locking Wedge (special tool #9867, Wedge, Locking) (2).

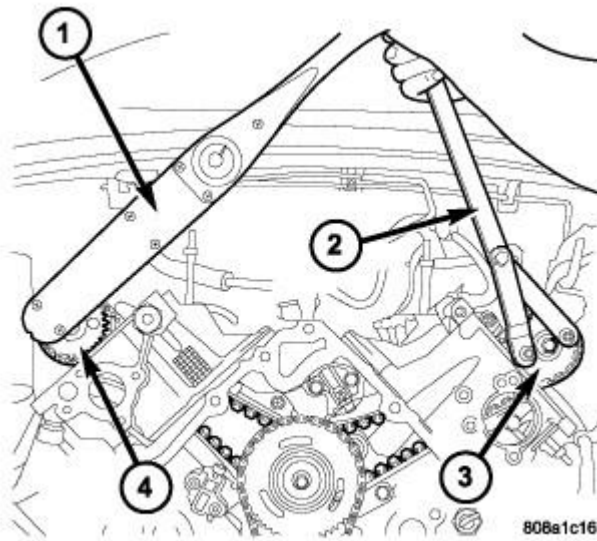


Fig. 79: Tightening Right Side Camshaft Sprocket Bolt
 Courtesy of CHRYSLER GROUP, LLC

13. Using Spanner Wrench (special tool #6958, Wrench, Spanner) (2) with Adapter Pins (special tool #8346, Pins, Adapter), secure the camshaft sprocket (3) and tighten the retaining bolt (1) to 122 N.m (90 ft. lbs.).

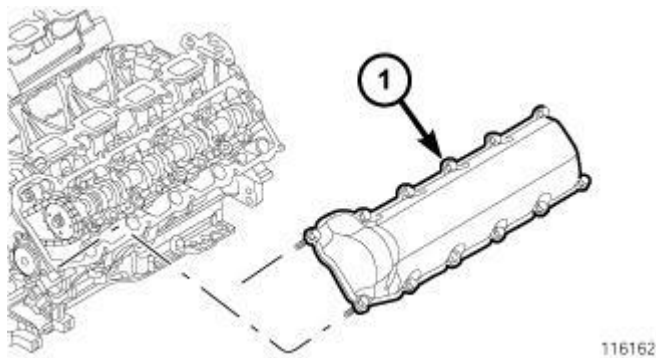


Fig. 80: Cylinder Head Cover - Left
 Courtesy of CHRYSLER GROUP, LLC

14. Install the cylinder head cover (1). Refer to **COVER(S), CYLINDER HEAD, INSTALLATION, 4.7L.**

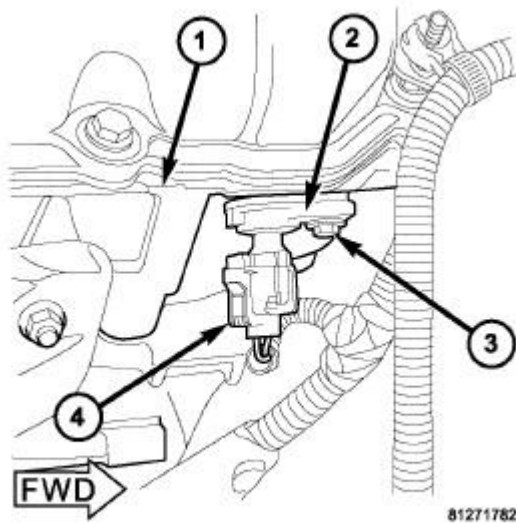


Fig. 81: Cylinder Head, CMP Sensor, Retaining Bolt & Connector
Courtesy of CHRYSLER GROUP, LLC

NOTE: Before installing the CMP sensor into the cylinder head, the machined hole must be clean of any dirt or debris.

15. Clean machined hole in the cylinder head (1).
16. Apply a small amount of engine oil to CMP sensor O-ring.
17. Install the CMP sensor (2) into the cylinder head with a slight rocking motion. Do not twist sensor into position as damage to O-ring may result.

CAUTION: Before tightening sensor mounting bolt, be sure sensor is completely flush to cylinder head. If sensor is not flush, damage to sensor mounting tang may result.

18. Install the retaining bolt (3) and tighten to 12 N.m (9 ft. lbs.).
19. Connect the electrical connector (4) to the CMP sensor.

INSTALLATION - LEFT CAMSHAFT

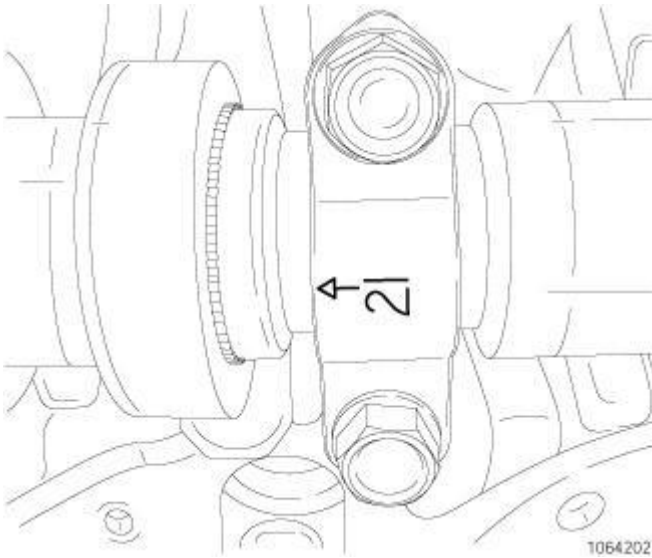


Fig. 82: Positioning Camshaft Cap Arrow Toward Front Of Engine
Courtesy of CHRYSLER GROUP, LLC

1. Lubricate the camshaft journals with clean engine oil.

NOTE: Position the left side camshaft so that the camshaft sprocket dowel is near the 1 o'clock position, this will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.

2. Install the camshaft into the cylinder head while aligning the camshaft sprocket dowel near the 1 o'clock position.

NOTE: The camshaft caps are marked for location. The arrow must point to the front of the engine.

3. Install the camshaft bearing caps in the same position as noted during removal.
4. Install the camshaft bearing cap retaining bolts hand tight.

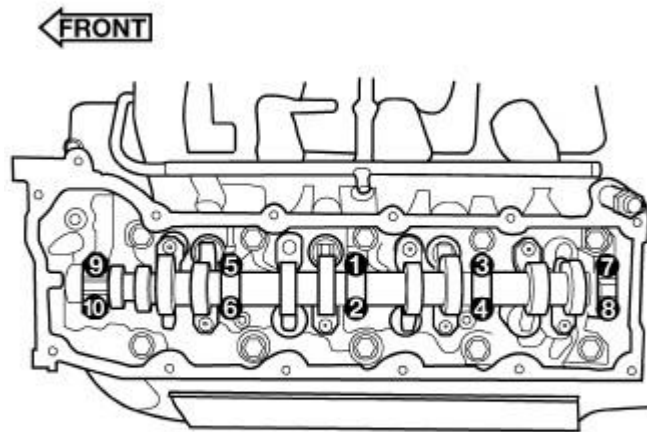


Fig. 83: Removal/Installation Sequence Of Camshaft Bearing Cap Retaining Bolts
 Courtesy of CHRYSLER GROUP, LLC

5. Using the sequence shown in illustration, working in 1/2 turn increments, tighten the bearing cap retaining bolts to 11 N.m (8 ft. lbs.).
6. Check the camshaft end play. Refer to **CAMSHAFT, ENGINE, STANDARD PROCEDURE, 4.7L.**

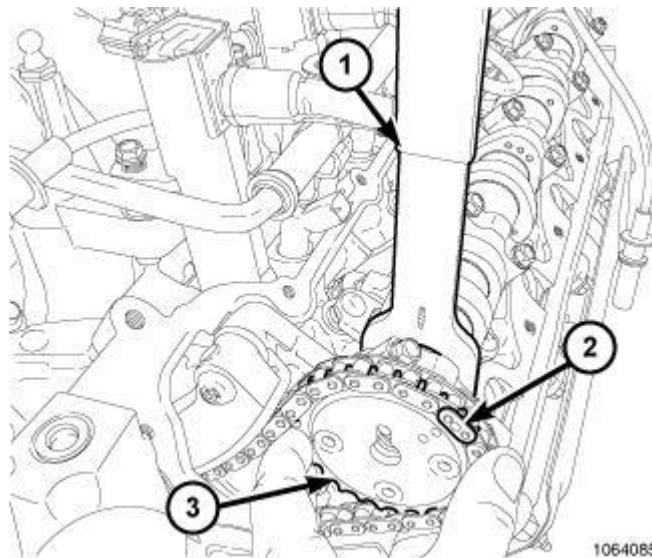


Fig. 84: Removing/Installing Camshaft Sprocket Using Camshaft Holder
 Courtesy of CHRYSLER GROUP, LLC

7. Position the camshaft drive gear into the timing chain while aligning the two dots on the camshaft sprocket with the chain link (2) marked during removal.

8. Using Camshaft Holder (special tool #8428A, Holder, Camshaft) (1), rotate the camshaft until the camshaft sprocket dowel is aligned with the slot in the camshaft sprocket.
9. Position the sprocket onto the camshaft.

CAUTION: Remove excess oil from the camshaft sprocket retaining bolt, failure to do so can cause bolt over-torque resulting in bolt failure.

10. Remove excess oil from the camshaft sprocket retaining bolt.
11. Install the camshaft sprocket retaining bolt hand tight.

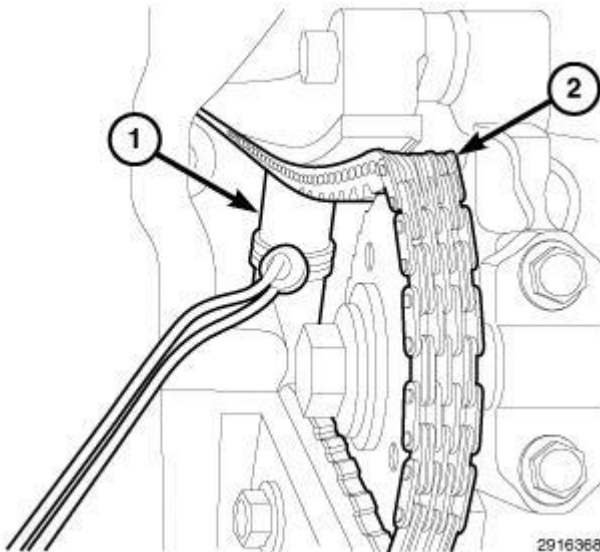


Fig. 85: Positioning Locking Wedge Between Timing Chain Strands

Courtesy of CHRYSLER GROUP, LLC

12. Remove the timing chain (2) Locking Wedge (special tool #9867, Wedge, Locking) (1).

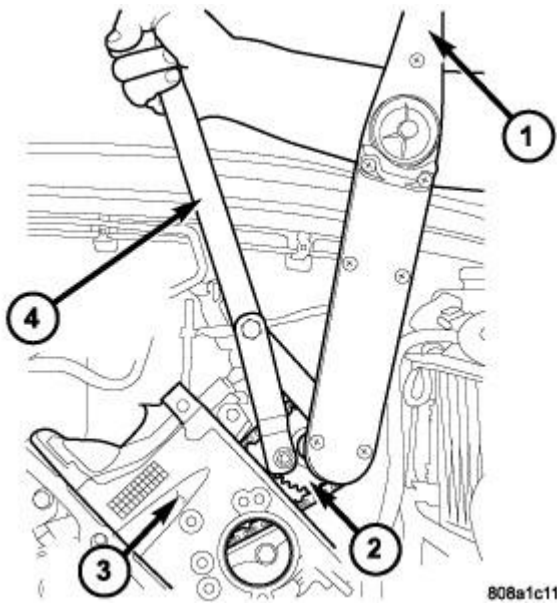


Fig. 86: Removing/Installing Left Side Camshaft Sprocket Bolt
Courtesy of CHRYSLER GROUP, LLC

13. Using Spanner Wrench (special tool #6958, Wrench, Spanner) (4) with Adapter Pins (special tool #8346, Pins, Adapter), secure the camshaft sprocket (2) and tighten the retaining bolt (1) to 122 N.m (90 ft. lbs.).

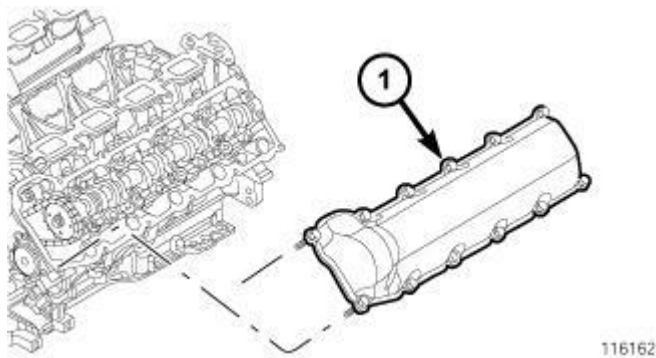


Fig. 87: Cylinder Head Cover - Left
Courtesy of CHRYSLER GROUP, LLC

14. Install the cylinder head cover (1). Refer to **COVER(S), CYLINDER HEAD, INSTALLATION, 4.7L.**

COVER(S), CYLINDER HEAD

DESCRIPTION

DESCRIPTION

The cylinder head covers are made of injection molded thermo-set plastic, and are not interchangeable from side-to-side. It is imperative that nothing rest on the cylinder head covers. Prolonged contact with other items may wear a hole in the cylinder head cover.

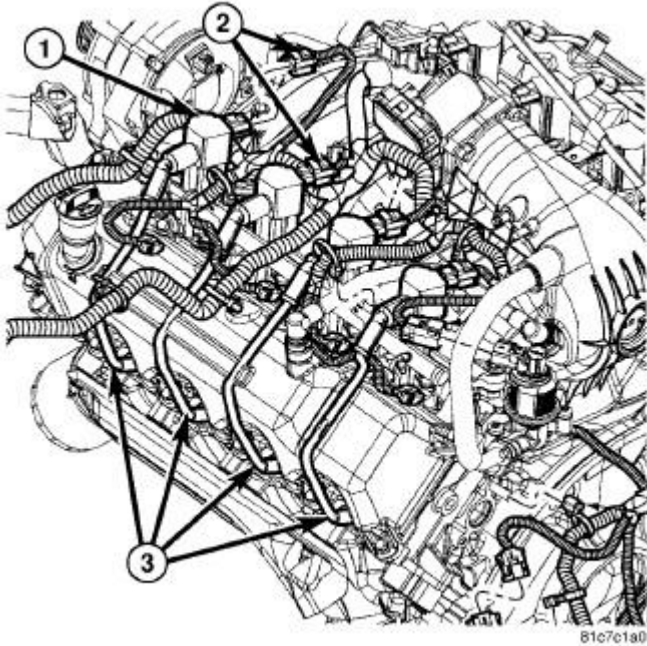
REMOVAL**RIGHT SIDE**

Fig. 88: Ignition Coils & Spark Plug Wires
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect battery negative cable.
2. Remove air cleaner assembly, resonator assembly and air inlet hose.
3. Drain cooling system. Refer to **STANDARD PROCEDURE** .
4. Remove accessory drive belt. Refer to **BELT, SERPENTINE, REMOVAL** .
5. Remove air conditioning compressor retaining bolts and move compressor to the left.
6. Remove heater hoses.
7. Disconnect and remove positive crankcase ventilation (PCV) hose.
8. Remove oil fill tube.
9. Remove spark plug wires (3).
10. Remove right rear breather tube and filter assembly.
11. Remove cylinder head cover retaining bolts.
12. Remove cylinder head cover.

NOTE: **The gasket may be used again, provided no cuts, tears, or deformation has occurred.**

LEFT SIDE

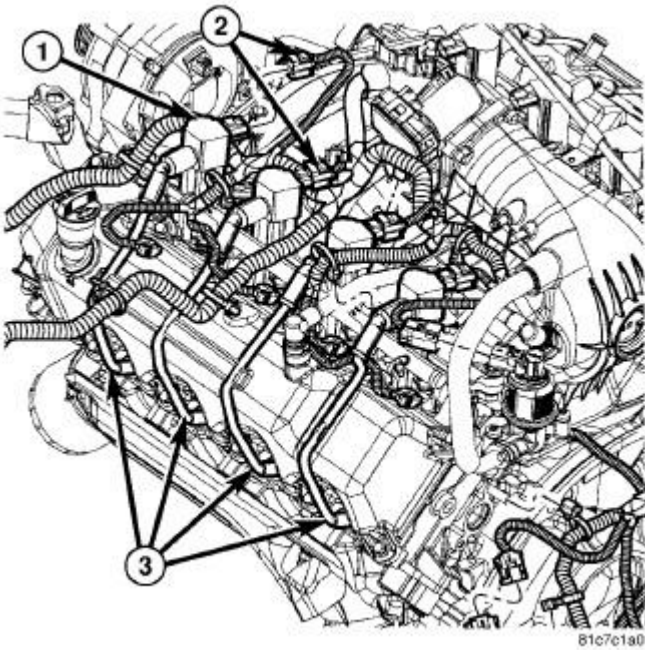


Fig. 89: Ignition Coils & Spark Plug Wires
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect negative cable from battery.
2. Remove the resonator assembly and air inlet hose.
3. Remove the spark plug wires (3).
4. Route injector harness in front of cylinder head cover.
5. Disconnect the left side breather tube and remove the breather tube.
6. Remove the cylinder head cover mounting bolts.
7. Remove cylinder head cover and gasket.

NOTE: **The gasket may be used again, provided no cuts, tears, or deformation has occurred.**

CLEANING

CLEANING

Clean cylinder head cover gasket surface.

Clean head rail, if necessary.

INSTALLATION

RIGHT SIDE

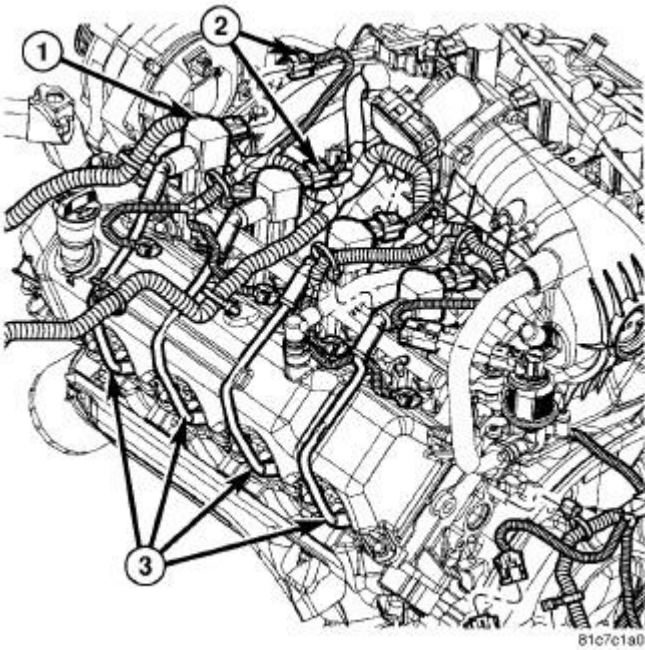


Fig. 90: Ignition Coils & Spark Plug Wires
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.

1. Clean cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.
2. Install cylinder head cover and hand start all fasteners.
3. Tighten cylinder head cover bolts and double ended studs to 12 N.m (105 in. lbs).
4. Install right rear breather tube and filter assembly.
5. Install spark plug wires (3).
6. Install the oil fill tube.
7. Install PCV hose.
8. Install heater hoses.
9. Install air conditioning compressor retaining bolts.
10. Install accessory drive belt. Refer to **BELT, SERPENTINE, INSTALLATION** .
11. Fill Cooling system. Refer to **STANDARD PROCEDURE** .
12. Install air cleaner assembly, resonator assembly and air inlet hose.
13. Connect battery negative cable.

LEFT SIDE

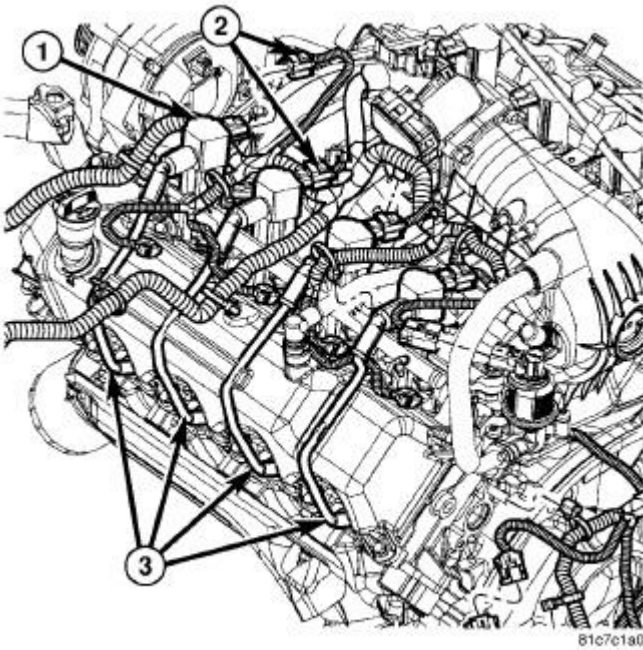


Fig. 91: Ignition Coils & Spark Plug Wires
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.

1. Clean cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.
2. Install cylinder head cover and hand start all fasteners. Verify that all studs are in the correct location as shown in illustration.
3. Tighten cylinder head cover bolts and double ended studs to 12 N.m (105 in. lbs.).
4. Install left side breather and connect breather tube.
5. Install the spark plug wires (3).
6. Install the resonator and air inlet hose.
7. Connect negative cable to battery.

ROCKER ARM, VALVE

DESCRIPTION

DESCRIPTION

The rocker arms are steel stampings with an integral roller bearing. The rocker arms incorporate an 0.5 mm (0.019 inch) oil hole in the ball socket for roller and camshaft lubrication.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - HYDRAULIC LASH ADJUSTER

A tappet-like noise may be produced from several items. Check the following items.

1. Engine oil level too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.
2. Insufficient running time after rebuilding cylinder head. Low speed running up to 1 hour may be required.
3. Turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.
4. Low oil pressure.
5. The oil restrictor in cylinder head gasket or the oil passage to the cylinder head is plugged with debris.
6. Air ingested into oil due to broken or cracked oil pump pick up.
7. Worn valve guides.
8. Rocker arm ears contacting valve spring retainer.
9. Rocker arm loose, adjuster stuck or at maximum extension and still leaves lash in the system.
10. Oil leak or excessive cam bore wear in cylinder head.
11. Faulty lash adjuster.
 - a. Check lash adjusters for sponginess while installed in cylinder head and cam on camshaft at base circle. Depress part of rocker arm over adjuster. Normal adjusters should feel very firm. Spongy adjusters can be bottomed out easily.
 - b. Remove suspected lash adjusters, and replace.
 - c. Before installation, make sure adjusters are at least partially full of oil. This can be verified by little or no plunger travel when lash adjuster is depressed.

REMOVAL**REMOVAL**

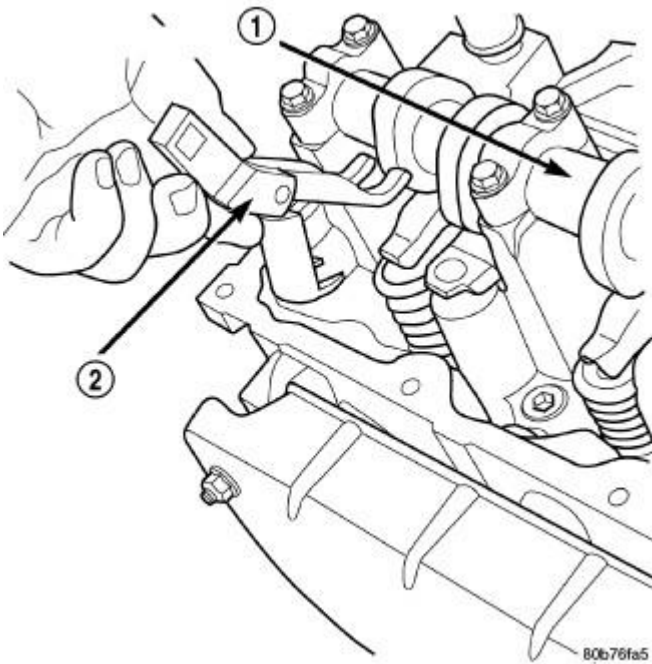


Fig. 92: Rocker Arm Removal/Installation
Courtesy of CHRYSLER GROUP, LLC

- | |
|-----------------------------------|
| 1 - CAMSHAFT |
| 2 - VALVE SPRING COMPRESSOR 10102 |

NOTE: Disconnect the battery negative cable to prevent accidental starter engagement.

1. Remove the cylinder head cover. Refer to COVER(S), CYLINDER HEAD, REMOVAL, 4.7L.
2. For rocker arm removal on cylinders 3 and 5 Rotate the crankshaft until cylinder #1 is at TDC exhaust stroke.
3. For rocker arm removal on cylinders 2 and 8 Rotate the crankshaft until cylinder #1 is at TDC compression stroke.
4. For rocker arm removal on cylinders 4 and 6 Rotate the crankshaft until cylinder #3 is at TDC compression stroke.
5. For rocker arm removal on cylinders 1 and 7 Rotate the crankshaft until cylinder #2 is at TDC compression stroke.
6. Using special tool (special tool #8516A, Remover/Installer) Rocker Arm Remover (2), press downward on the valve spring, remove rocker arm.

INSTALLATION

INSTALLATION

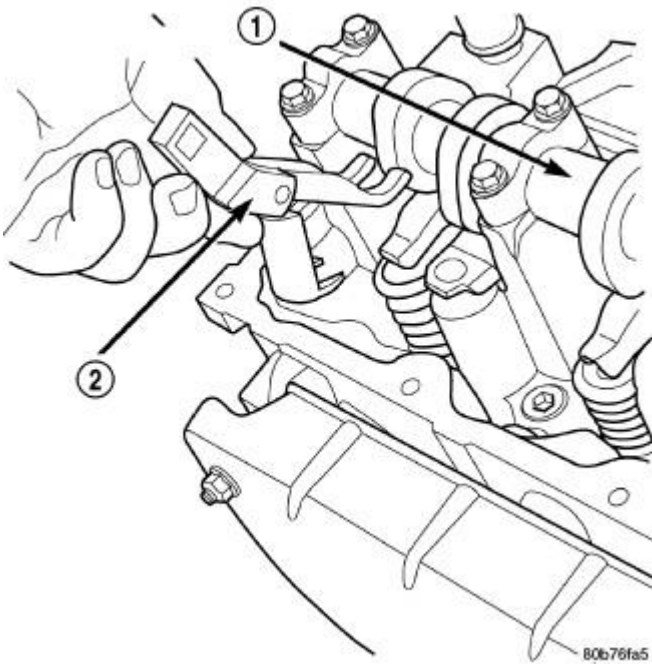


Fig. 93: Rocker Arm Removal/Installation
Courtesy of CHRYSLER GROUP, LLC

- | |
|-----------------------------------|
| 1 - CAMSHAFT |
| 2 - VALVE SPRING COMPRESSOR 10102 |

CAUTION: Make sure the rocker arms are installed with the concave pocket over the lash adjusters. Failure to do so may cause severe damage to the rocker arms and/or lash adjusters.

NOTE: Coat the rocker arms with clean engine oil prior to installation.

1. For rocker arm installation on cylinders 3 and 5 Rotate the crankshaft until cylinder #1 is at TDC exhaust stroke.
2. For rocker arm installation on cylinders 2 and 8 Rotate the crankshaft until cylinder #1 is at TDC compression stroke.
3. For rocker arm installation on cylinders 4 and 6 Rotate the crankshaft until cylinder #3 is at TDC compression stroke.
4. For rocker arm installation on cylinders 1 and 7 Rotate the crankshaft until cylinder #2 is at TDC compression stroke.
5. Using valve spring compressor (special tool #10102, Remover/Installer, Valve Spring) press downward on the valve spring, install rocker arm.
6. Install the cylinder head cover. Refer to **COVER(S), CYLINDER HEAD, INSTALLATION, 4.7L.**

SEAL(S), VALVE GUIDE

DESCRIPTION**DESCRIPTION**

The valve stem seals are made of rubber and incorporate an integral steel valve spring seat. The integral garter spring maintains consistent lubrication control to the valve stems.

REMOVAL**REMOVAL**

The valve stem seal is integral with the valve spring seat, for removal. Refer to **SPRING(S), VALVE, REMOVAL, 4.7L**.

INSTALLATION**INSTALLATION**

The valve stem seal is integral with the valve spring seat, for installation. Refer to **SPRING(S), VALVE, INSTALLATION, 4.7L**.

SPRING(S), VALVE**DESCRIPTION****DESCRIPTION**

The valve springs are made from high strength chrome silicon steel. The springs are common for intake and exhaust applications. The valve spring seat is integral with the valve stem seal, which is a positive type seal to control lubrication.

REMOVAL**REMOVAL**

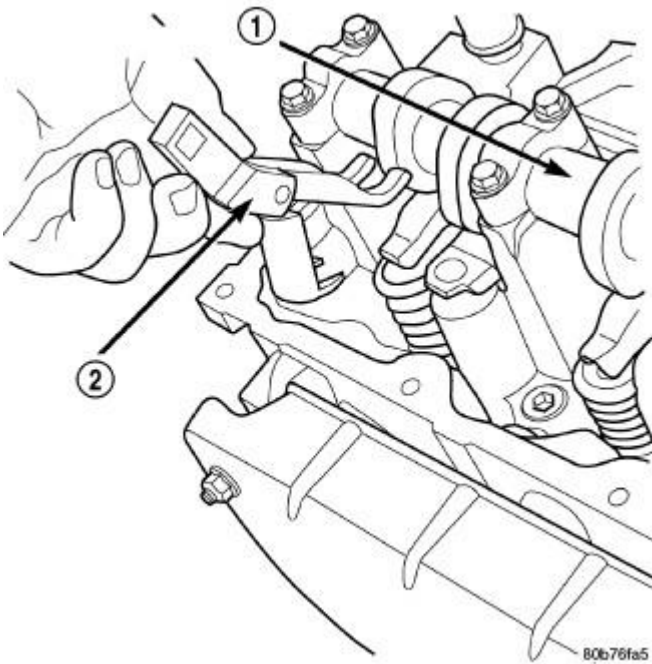


Fig. 94: Rocker Arm Removal/Installation
Courtesy of CHRYSLER GROUP, LLC

- | |
|-----------------------------------|
| 1 - CAMSHAFT |
| 2 - VALVE SPRING COMPRESSOR 10102 |

1. Remove the cylinder head cover. Refer to **COVER(S), CYLINDER HEAD, REMOVAL, 4.7L.**
2. Using Valve Spring Compressor (special tool #10102, Remover/Installer, Valve Spring) (2), remove the rocker arms and the hydraulic lash adjusters.
3. Remove the spark plug for the cylinder the valve spring and seal are to be removed from.
4. Apply shop air to the cylinder to hold the valves in place when the spring is removed

NOTE: All eight valve springs and seals are removed in the same manner; this procedure only covers one valve seal and valve spring.

5. Using Valve Spring Compressor (special tool #10102, Remover/Installer, Valve Spring), compress the valve spring.

NOTE: It may be necessary to tap the top of the valve spring to loosen the spring retainers locks enough to be removed.

6. Remove the two spring retainer lock halves.

NOTE: the valve spring is under tension use care when releasing the valve spring compressor.

7. Remove the valve spring compressor.
8. Remove the spring retainer, and the spring.
9. Remove the valve stem seal.

INSTALLATION

INSTALLATION

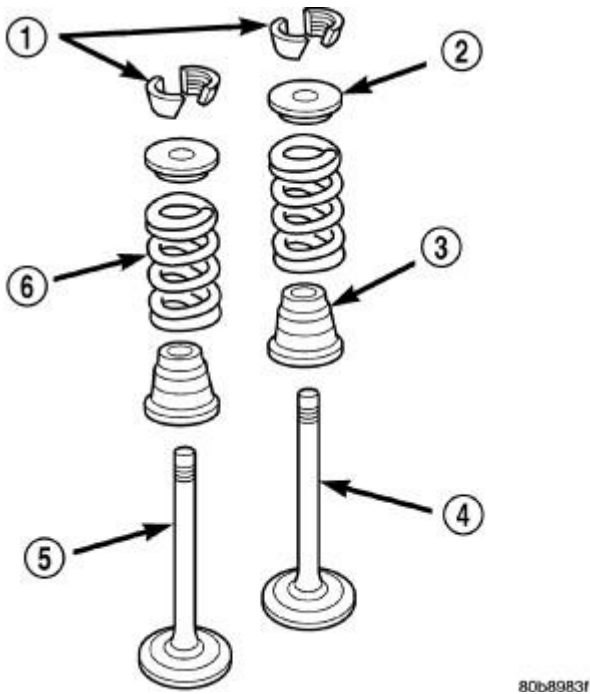


Fig. 95: Valve Assembly Configuration
Courtesy of CHRYSLER GROUP, LLC

- | |
|--------------------------|
| 1 - VALVE LOCKS (3-BEAD) |
| 2 - RETAINER |
| 3 - VALVE STEM OIL SEAL |
| 4 - INTAKE VALVE |
| 5 - EXHAUST VALVE |
| 6 - VALVE SPRING |

1. Coat the valve stem with clean engine oil and install the valve stem seal. Make sure the seal is fully seated and that the garter spring at the top of the seal is intact.
2. Install the spring (6) and the spring retainer (2).
3. Using Valve Spring Compressor (special tool #10102, Remover/Installer, Valve Spring), compress the spring and install the two valve spring retainer halves.
4. Release the valve spring compressor and make sure the two spring retainer halves and the spring retainer are fully seated.
5. Position the hydraulic lash adjusters and rocker arms.

6. Install the cylinder head cover. Refer to **COVER(S), CYLINDER HEAD, INSTALLATION, 4.7L**.
7. Install spark plugs and plug wires.

VALVES, INTAKE AND EXHAUST

DESCRIPTION

DESCRIPTION

The valves are made of heat resistant steel and have chrome plated stems to prevent scuffing. Each valve is actuated by a roller rocker arm which pivots on a stationary lash adjuster. All valves use three bead lock keepers to retain the springs and promote valve rotation.

REMOVAL

REMOVAL

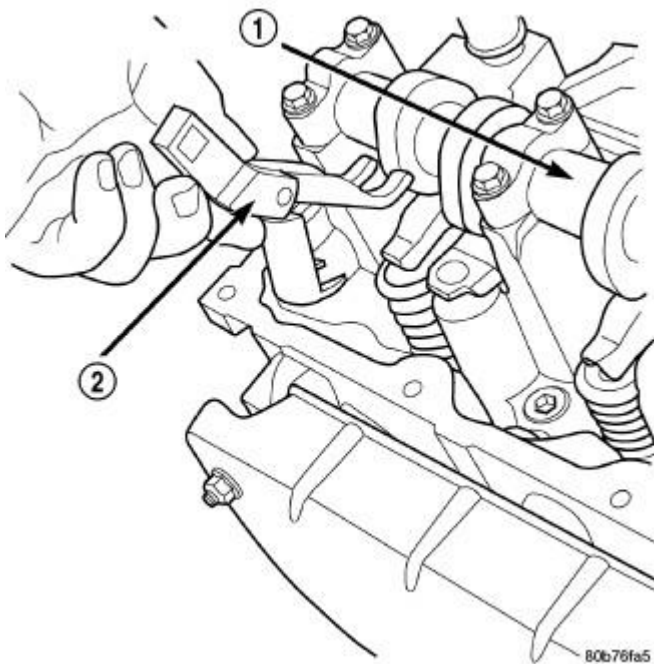


Fig. 96: Rocker Arm Removal/Installation
Courtesy of CHRYSLER GROUP, LLC

NOTE: The cylinder head(s) must be removed in order to perform this procedure.

1. Remove and isolate the negative battery cable.
2. Remove the cylinder head covers. Refer to **COVER(S), CYLINDER HEAD, REMOVAL, 4.7L**.
3. Remove the rocker arms and lash adjusters. Refer to **ROCKER ARM, VALVE, REMOVAL, 4.7L**.
4. Remove the camshaft bearing caps and the camshaft. Refer to **CAMSHAFT, ENGINE, REMOVAL,**

4.7L.

5. Remove the cylinder head(s). Refer to **CYLINDER HEAD, REMOVAL, 4.7L.**

NOTE: All valve springs and valves are removed in the same manner; this procedure only covers one valve and valve spring.

6. Using Valve Spring Compressor (special tool #C-3422-D, Compressor, Valve Spring) and Adapter (special tool #8519, Adapters, Valve Spring), compress the valve spring.

NOTE: It may be necessary to tap the top of the valve spring to loosen the spring retainers locks enough to be removed.

7. Remove the two spring retainer lock halves.

NOTE: The valve spring is under tension, use care when releasing the valve spring compressor.

8. Remove the valve spring compressor.

9. Remove the spring retainer, and the spring.

NOTE: Check for sharp edges on the keeper grooves. Remove any burrs from the valve stem before removing the valve from the cylinder head.

10. Remove the valve from the cylinder head.

NOTE: The valve stem seals are common between intake and exhaust.

11. Remove the valve stem seal. Mark the valve for proper installation.

TESTING VALVE SPRINGS

NOTE: Whenever the valves are removed from the cylinder head it is recommended that the valve springs be inspected and tested for reuse.

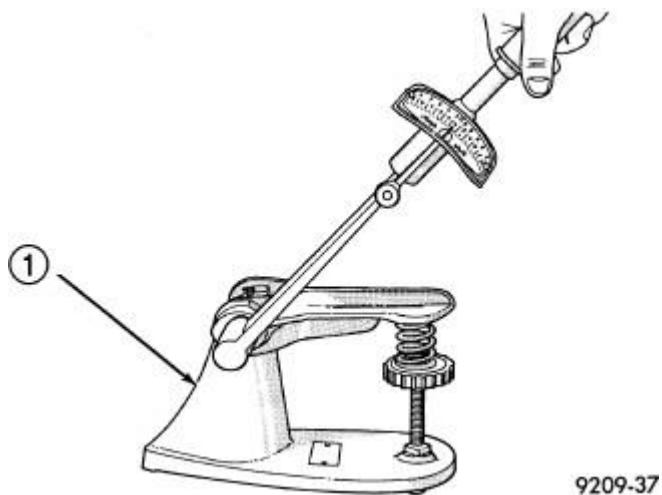


Fig. 97: Testing Valve Springs

Courtesy of CHRYSLER GROUP, LLC

Inspect the valve springs for physical signs of wear or damage. Using a suitable valve spring tester (1), test the following;

- Specified Spring Height
- Specified Spring Force (Valve Open)
- Specified Spring Force (Valve Closed)

Replace any springs that do not meet specifications. Refer to **Engine - Specifications**.

INSTALLATION

INSTALLATION

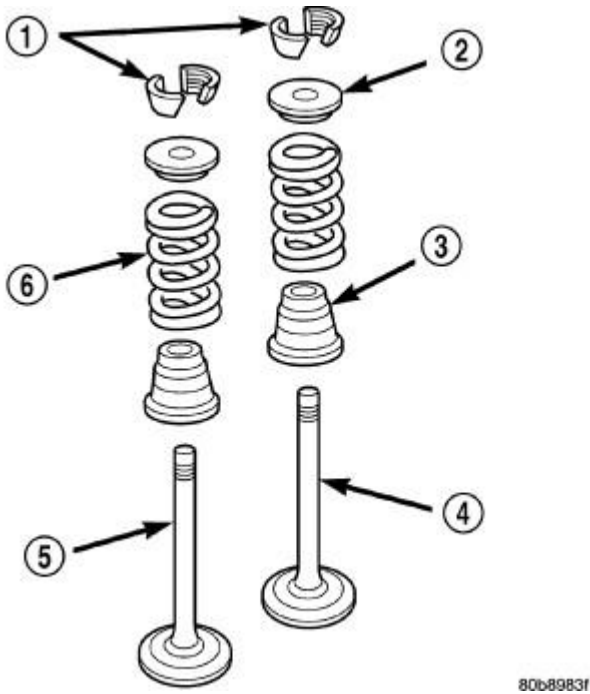
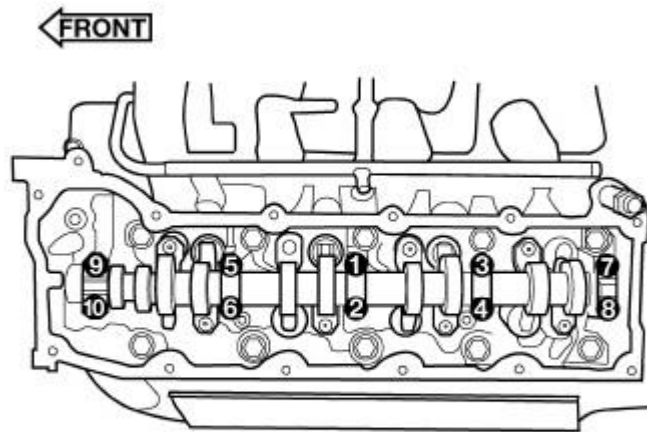


Fig. 98: Valve Assembly Configuration
 Courtesy of CHRYSLER GROUP, LLC

1 - VALVE LOCKS (3-BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING

1. Coat the valve stem (4, 5) with clean engine oil and insert it into the cylinder head.
2. Install the valve stem seal (3). Make sure the seal is fully seated and that the garter spring at the top of the seal is intact.
3. Install the spring (6) and the spring retainer (2).
4. Using the valve spring compressor, compress the spring (6) and install the two valve locks (1).
5. Release the valve spring compressor and make sure the two valve locks and the spring retainer are fully seated.



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Fig. 99: Removal/Installation Sequence Of Camshaft Bearing Cap Retaining Bolts
 Courtesy of CHRYSLER GROUP, LLC

6. lubricate the camshaft journal with clean engine oil then Position the camshaft (with the sprocket dowel on the left camshaft at 11 o'clock and the right camshaft at 12 o'clock), then position the camshaft bearing caps.
7. Install the camshaft bearing cap retaining bolts. Tighten the bolts 9 - 13 N.m (100 in. lbs.) in 1/2 turn increments in the sequence shown in illustration.
8. Position the hydraulic lash adjusters and rocker arms.

ENGINE BLOCK

DESCRIPTION

DESCRIPTION

The cylinder block is made of cast iron. The block is a closed deck design with the left bank forward. To provide high rigidity and improved NVH an enhanced compacted graphite bedplate is bolted to the block. The block design allows coolant flow between the cylinders bores, and an internal coolant bypass to a single poppet inlet thermostat is included in the cast aluminum front cover.

STANDARD PROCEDURE

STANDARD PROCEDURE - CYLINDER BORE HONING

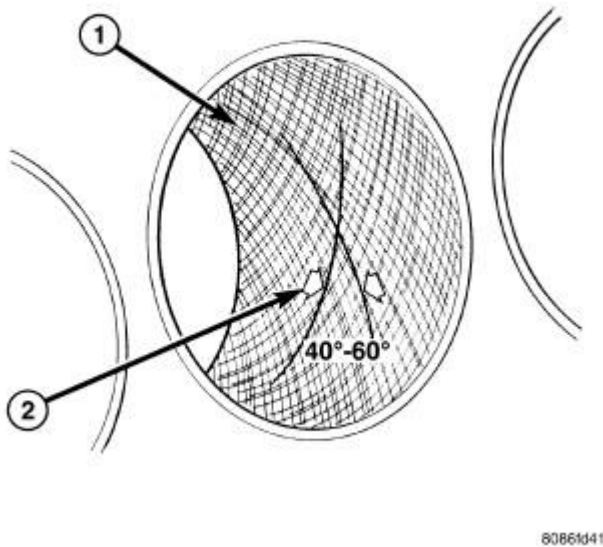


Fig. 100: Cylinder Bore Crosshatch Pattern
Courtesy of CHRYSLER GROUP, LLC

1 - CROSSHATCH PATTERN

2 - INTERSECT ANGLE

Before honing, stuff plenty of clean shop towels under the bores and over the crankshaft to keep abrasive materials from entering the crankshaft area.

1. Used carefully, the Cylinder Bore Sizing Hone (special tool #C-823, Hone, Cylinder), equipped with 220 grit stones, is the best tool for this job. In addition to deglazing, it will reduce taper and out-of-round, as well as removing light scuffing, scoring and scratches. Usually, a few strokes will clean up a bore and maintain the required limits.

CAUTION: DO NOT use rigid type hones to remove cylinder wall glaze.

2. Deglazing of the cylinder walls may be done if the cylinder bore is straight and round. Use a cylinder surfacing hone, Honing Tool (special tool #C-3501, Hone W/Oil, AMMCO Cylinder), equipped with 280 grit stones (special tool #C-3501-3810, Stones, 220 Grit Honing). about 20-60 strokes, depending on the bore condition, will be sufficient to provide a satisfactory surface. Using honing oil (special tool #C-3501-3880, Oil, Honing), or a light honing oil, available from major oil distributors.

CAUTION: DO NOT use engine or transmission oil, mineral spirits, or kerosene.

3. Honing should be done by moving the hone up and down fast enough to get a crosshatch pattern (1). The hone marks should INTERSECT at 50° to 60° for proper seating of rings (2).
4. A controlled hone motor speed between 200 and 300 RPM is necessary to obtain the proper crosshatch angle. The number of up and down strokes per minute can be regulated to get the desired 50° to 60° angle. Faster up and down strokes increase the crosshatch angle.
5. After honing, it is necessary that the block be cleaned to remove all traces of abrasive. Use a brush to wash parts with a solution of hot water and detergent. Dry parts thoroughly. Use a clean, white, lint-free cloth to check that the bore is clean. Oil the bores after cleaning to prevent rusting.

CLEANING

CLEANING

Thoroughly clean the oil pan and engine block gasket surfaces.

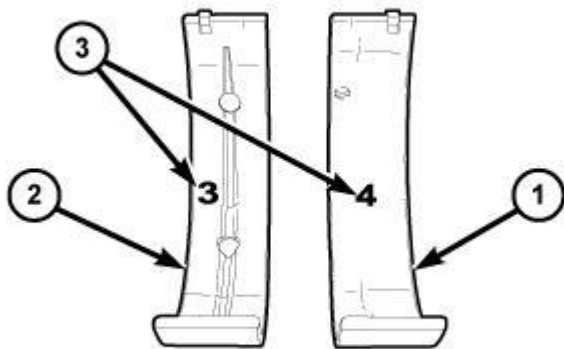
Use compressed air to clean out:

- The galley at the oil filter adaptor hole.
- The front and rear oil galley holes.
- The feed holes for the crankshaft main bearings.

Once the block has been completely cleaned, apply Loctite PST pipe sealant with Teflon 592 to the threads of the front and rear oil galley plugs. Tighten the 1/4 inch NPT plugs to 20 N.m (177 in. lbs.) torque. Tighten the 3/8 inch NPT plugs to 27 N.m (240 in. lbs.) torque.

INSPECTION

INSPECTION



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Fig. 101: Main Bearing Inserts

Courtesy of CHRYSLER GROUP, LLC

1. Wipe the main bearing inserts (1, 2) clean.
2. Inspect the inserts for abnormal wear patterns, scoring, grooving, fatigue, pitting and for metal or other foreign material imbedded in the lining.
3. Inspect the back of the inserts for fractures, scrapes or irregular wear patterns.
4. Inspect the insert locking tabs for damage.
5. Inspect the crankshaft thrust washers for scoring, scratches, wear or blueing.
6. Replace any bearing that shows abnormal wear.
7. Inspect the main bearing bores for signs of scoring, nicks and burrs.
8. If the cylinder block main bearing bores show damage, replace the engine block.

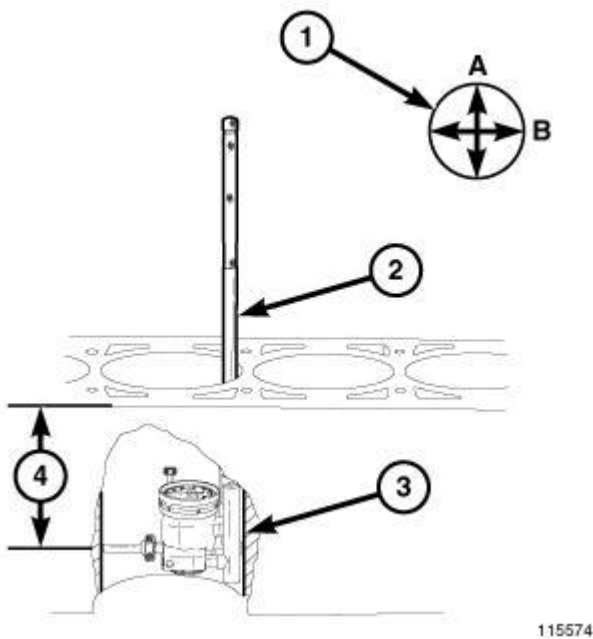


Fig. 102: Measuring Cylinder Bore Diameter
 Courtesy of CHRYSLER GROUP, LLC

9. Use Cylinder Indicator (special tool #C-119, Cylinder Indicator) (2) to correctly measure the inside diameter of the cylinder bore (3). A cylinder bore gauge capable of reading in 0.003 mm (0.0001 in.) Increments is required. If a bore gauge is not available, do not use an inside micrometer.
10. Measure the inside diameter of the cylinder bore at three levels below the top of the bore (4). Start at the top of the bore, perpendicular (across or at 90°) to the axis of the crankshaft at point A (1).
11. Repeat the measurement near the middle of the bore then repeat the measurement near the bottom of the bore.
12. Determine the taper by subtracting the smaller diameter from the larger diameter.
13. Rotate the measuring device 90° to point B (1) and repeat the three measurements. Verify that the maximum taper is within specifications.
14. Determine out-of-roundness by comparing the difference between each measurement.
15. If the cylinder bore taper does not exceed 0.025 mm (0.001 inch) and out-of-roundness does not exceed 0.015 mm (0.0006 inch) then the cylinder bore can be honed. If the cylinder bore taper or out- of-round

condition exceeds the maximum limits, replace the cylinder block.

NOTE: A slight amount of taper always exists in the cylinder bore after the engine has been in use for a period of time.

BEARING(S), CONNECTING ROD

STANDARD PROCEDURE

STANDARD PROCEDURE - CONNECTING ROD BEARING FITTING

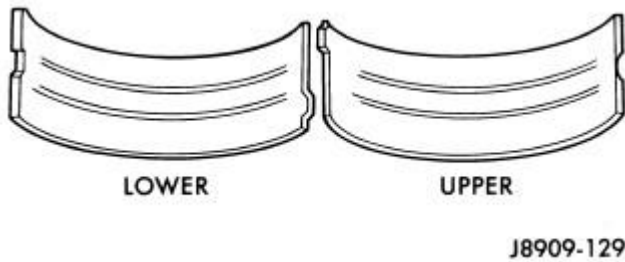


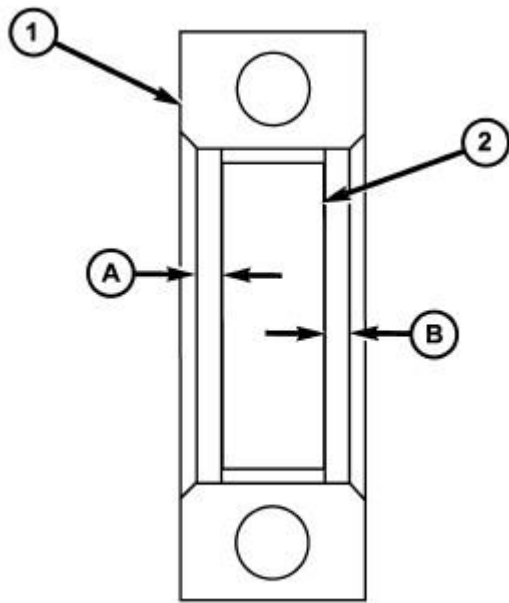
Fig. 103: Inspecting Connecting Rod Bearing
Courtesy of CHRYSLER GROUP, LLC

Inspect the connecting rod bearings for scoring. Check the bearings for normal wear patterns, scoring, grooving, fatigue and pitting. Replace any bearing that shows abnormal wear.

Inspect the connecting rod journals for signs of scoring, nicks and burrs.

Misaligned or bent connecting rods can cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearings and crankshaft connecting rod journals. If wear patterns or damage to any of these components indicate the probability of a misaligned connecting rod, inspect it for correct rod alignment. Replace misaligned, bent or twisted connecting rods.

1. Wipe the oil from the connecting rod journal.



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Fig. 104: Bearing Insert Location
Courtesy of CHRYSLER GROUP, LLC

1 - Connecting Rod
2 - Bearing Insert
- A, B less than 0.50 mm (.0196 in.)

2. Lubricate the upper bearing insert (2) and install in connecting rod (1). **Center bearing insert (2) in connecting rod.**

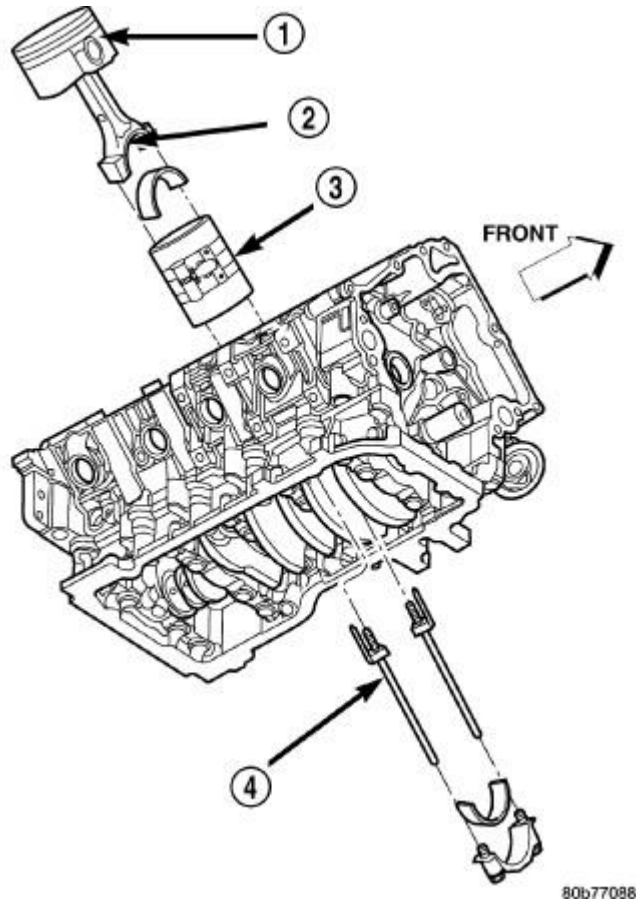
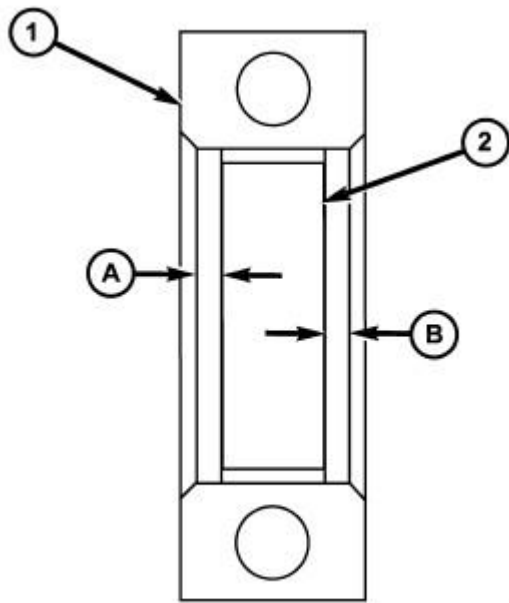


Fig. 105: Piston, Oil Slinger Slot, Ring Compressor & Special Tool
Courtesy of CHRYSLER GROUP, LLC

1 - "F" TOWARD FRONT OF ENGINE
2 - OIL SLINGER SLOT
3 - RING COMPRESSOR
4 - SPECIAL TOOL 8507

3. Use piston ring compressor (3) and Guide Pins Special Tool (special tool #8507, Guides, Connecting Rod) (4) to install the rod and piston assemblies. The oil slinger slots in the rods must face front of the engine. The "F"s near the piston wrist pin bore should point to the front of the engine.

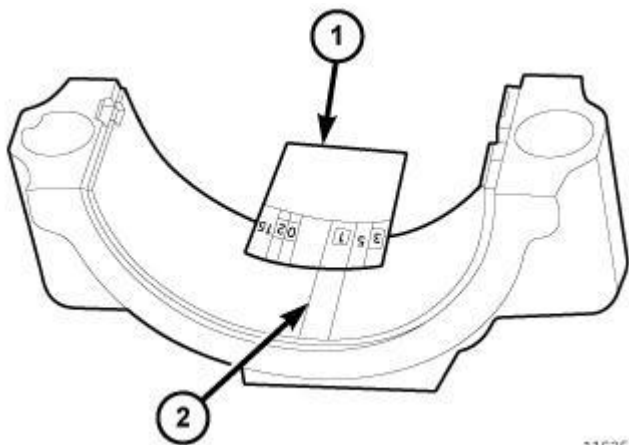


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Fig. 106: Bearing Insert Location
 Courtesy of CHRYSLER GROUP, LLC

1 - Connecting Rod
2 - Bearing Insert
- A, B less than 0.50 mm (.0196 in.)

4. Install the lower bearing insert in the bearing cap **Center bearing insert (2) in connecting rod (1)**. . The lower insert must be dry. Place strip of Plastigage across full width of the lower insert at the center of bearing cap. Plastigage must not crumble in use. If brittle, obtain fresh stock.



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Fig. 107: Measuring Bearing Clearance With Plastigage
 Courtesy of CHRYSLER GROUP, LLC

5. Install bearing cap and connecting rod on the journal and tighten bolts to 27 N.m (20 ft. lbs.) plus a 90° turn. DO NOT rotate crankshaft. Plastigage will smear, resulting in inaccurate indication.
6. Remove the bearing cap and determine amount of bearing-to-journal clearance by measuring the width of compressed Plastigage (2). Refer to **Engine - Specifications** for the proper clearance. **Plastigage should indicate the same clearance across the entire width of the insert. If the clearance varies, it may be caused by either a tapered journal, bent connecting rod or foreign material trapped between the insert and cap or rod.**
7. If the correct clearance is indicated, replacement of the bearing inserts is not necessary. Remove the Plastigage (2) from crankshaft journal and bearing insert. Proceed with installation.

Bearing Mark	SIZE	USED WITH JOURNAL SIZE
.025 US	.025 mm (.001 in.)	50.983-50.967 mm (2.0073-2.0066 in.)
Std.	STANDARD	50.992-51.008 mm (2.0076-2.0082 in.)
.250 US	.250 mm (.010 in.)	50.758-50.742 mm (1.9984-1.9978 in.)

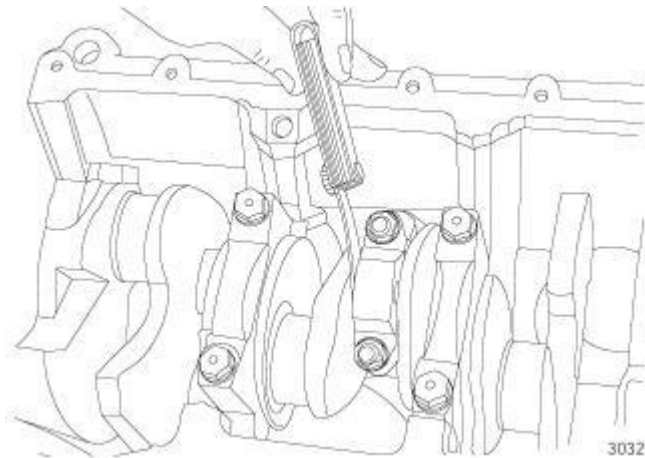


Fig. 108: Checking Connecting Rod Side Clearance
Courtesy of CHRYSLER GROUP, LLC

8. If bearing-to-journal clearance exceeds the specification, determine which service bearing set to use, using the chart above.

CAUTION: Connecting Rod Bolts are Torque to Yield Bolts and Must Not Be Reused. Always replace the Rod Bolts whenever they are loosened or removed.

9. Repeat the Plastigage measurement to verify your bearing selection prior to final assembly.
10. Once you have selected the proper insert, install the insert and cap. Tighten the connecting rod bolts to 27 N.m (20 ft. lbs.) plus a 90° turn.

Slide snug-fitting feeler gauge between the connecting rod and crankshaft journal flange. Refer to **Engine - Specifications** for the proper clearance. Replace the connecting rod if the side clearance is not within specification.

BEARING(S), CRANKSHAFT, MAIN

STANDARD PROCEDURE

STANDARD PROCEDURE - CRANKSHAFT MAIN BEARING - FITTING

MAIN BEARING JOURNAL DIAMETER (CRANKSHAFT REMOVED)

Crankshaft removed from the cylinder block.

Clean the oil off the main bearing journal.

Determine the maximum diameter of the journal with a micrometer. Measure at two locations 90° apart at each end of the journal.

The maximum allowable taper is 0.008 mm (0.0004 inch.) and maximum out of round is 0.005 mm (0.002 inch). Compare the measured diameter with the journal diameter specification (Main Bearing Fitting Chart). Select inserts required to obtain the specified bearing-to-journal clearance.

CRANKSHAFT MAIN BEARING SELECTION

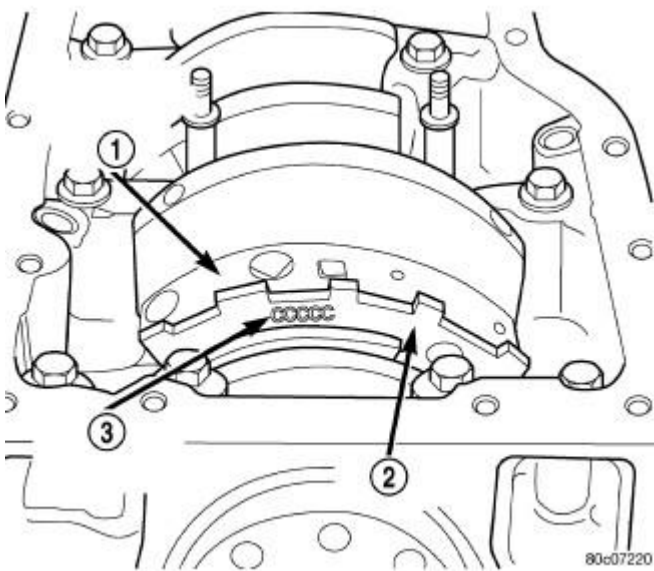


Fig. 109: Main Bearing Markings On Target Wheel
Courtesy of CHRYSLER GROUP, LLC

- | |
|--|
| 1 - REARMOST CRANKSHAFT COUNTER WEIGHT |
| 2 - TARGET WHEEL |
| 3 - MAIN BEARING SELECT FIT MARKINGS |

The main bearings are "select fit" to achieve proper oil clearances. For main bearing selection, the crankshaft position sensor target wheel has grade identification marks stamped into it (3). These marks are read from left to right, corresponding with journal number 1, 2, 3, 4 and 5. The crankshaft position sensor target wheel (2) is mounted to the number 8 counter weight (1) on the crankshaft.

NOTE: Service main bearings are coded. These codes identify what size (grade) the bearing is.

MAIN BEARING SELECTION CHART - 4.7L		
GRADE MARKING	SIZE mm (in.) JOURNAL SIZE	FOR USE WITH
A	0.008 mm U/S (0.0004 in.) U/S	63.488-63.496 mm (2.4996-2.4999 in.)
B	NOMINAL	63.496-63.504 mm (2.4999-2.5002 in.)
C	0.008 mm O/S (0.0004 in.) O/S	63.504-63.512 mm (2.5002-2.5005 in.)

INSPECTION

INSPECTION

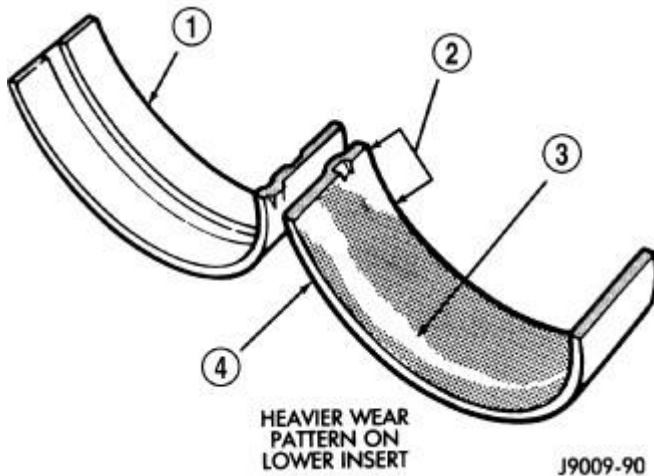


Fig. 110: Main Bearing Wear Patterns
Courtesy of CHRYSLER GROUP, LLC

1 - UPPER INSERT
2 - NO WEAR IN THIS AREA
3 - LOW AREA IN BEARING LINING
4 - LOWER INSERT

Wipe the inserts clean and inspect for abnormal wear patterns and for metal or other foreign material imbedded

in the lining. Normal main bearing insert wear patterns are illustrated.

NOTE: If any of the crankshaft journals are scored, the crankshaft must be repaired or replaced.

Inspect the back of the inserts for fractures, scrapings or irregular wear patterns.

Inspect the upper insert locking tabs for damage.

Replace all damaged or worn bearing inserts.

COVER, STRUCTURAL DUST

DESCRIPTION

DESCRIPTION

The structural dust cover is made of die cast aluminum and joins the lower half of the transmission bell housing to the engine bedplate.

OPERATION

OPERATION

The structural cover provides additional powertrain stiffness and reduces noise and vibration.

REMOVAL

REMOVAL

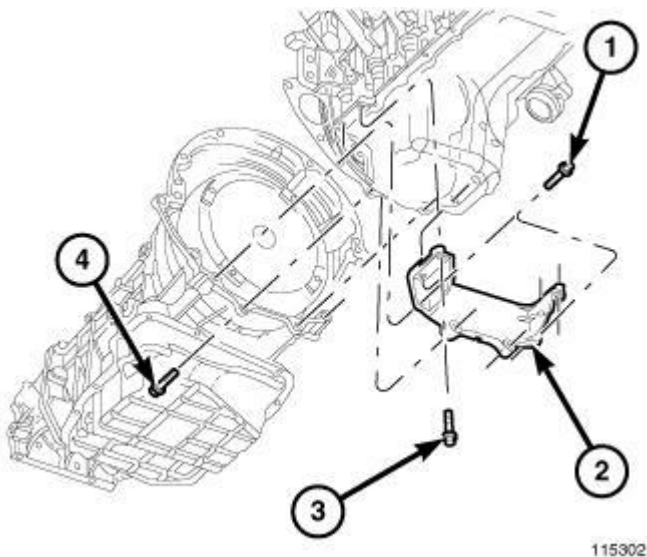


Fig. 111: Structural Cover & Bolts
Courtesy of CHRYSLER GROUP, LLC

1. Raise vehicle on hoist.
2. Remove the left hand exhaust pipe from exhaust manifold.
3. Loosen the right hand exhaust manifold-to-exhaust pipe retaining bolts.
4. Remove the eight bolts (1, 2, 3) retaining structural cover in the sequence shown in illustration.
5. Pivot the exhaust pipe downward and remove the structural cover.

INSTALLATION

INSTALLATION

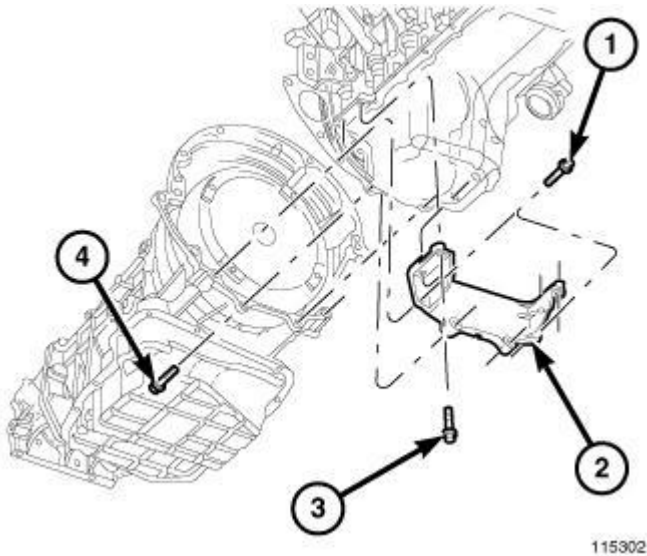


Fig. 112: Structural Cover & Bolts
Courtesy of CHRYSLER GROUP, LLC

CAUTION: The structural dust cover must be installed as described in the following steps. Failure to do so may cause severe damage to the cover.

1. Position the structural cover in the vehicle.
2. Install all four bolts (1, 2, 3) retaining the cover-to-engine. Refer to **Fig. 112**. DO NOT tighten the bolts at this time.
3. Install the four cover-to-transmission bolts (1, 2, 3). Do NOT tighten at this time.

CAUTION: The structural dust cover must be held tightly against both the engine and the transmission bell housing during the tightening sequence. Failure to do so may cause severe damage to the cover.

4. Starting with the two rear cover-to-engine bolts, tighten bolts (1) to 54 N.m (40 ft. lbs.), then tighten bolts (2) and (3) to 54 N.m (40 ft. lbs.) in the sequence shown in illustration.
5. Install the exhaust pipe on left hand exhaust manifold.
6. Tighten exhaust manifold-to-exhaust pipe retaining bolts to 20-26 N.m (15-20 ft. lbs.).

CRANKSHAFT

DESCRIPTION

DESCRIPTION

The crankshaft is constructed of nodular cast iron. The crankshaft is a crossshaped four throw design with eight counterweights for balancing purposes. The crankshaft is supported by five select fit main bearings with the number three serving as the thrust washer location. The main journals of the crankshaft are cross drilled to improve rod bearing lubrication. The number eight counterweight has provisions for crankshaft position sensor target wheel mounting. The select fit main bearing markings are located on the rear side of the target wheel. The crankshaft oil seals are one piece design. The front oil seal is retained in the timing chain cover, and the rear seal is pressed in to a bore formed by the cylinder block and the bedplate assembly.

REMOVAL

REMOVAL

NOTE: To remove the crankshaft from the engine, the engine must be removed from the vehicle.

1. Remove the engine. Refer to REMOVAL, 4.7L.
2. Remove the engine oil pump. Refer to PUMP, ENGINE OIL, REMOVAL, 4.7L.

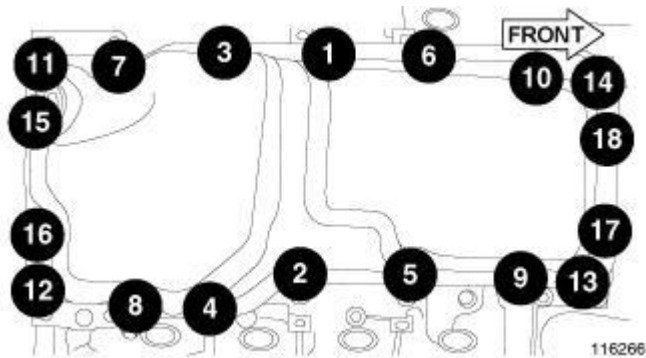


Fig. 113: Oil Pan Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

CAUTION: DO NOT pry on the oil pan gasket when removing the oil pan, The oil pan gasket is mounted to the cylinder block in three locations and will remain attached to block when removing oil pan. Gasket can not be removed with oil pan.

3. Remove oil pan. Refer to PAN, OIL, REMOVAL, 4.7L.
4. Remove the oil pump pickup tube and oil pan gasket / windage tray.
5. Remove the bedplate mounting bolts. Note the location of the three stud bolts for installation.
6. Remove the connecting rods from the crankshaft.

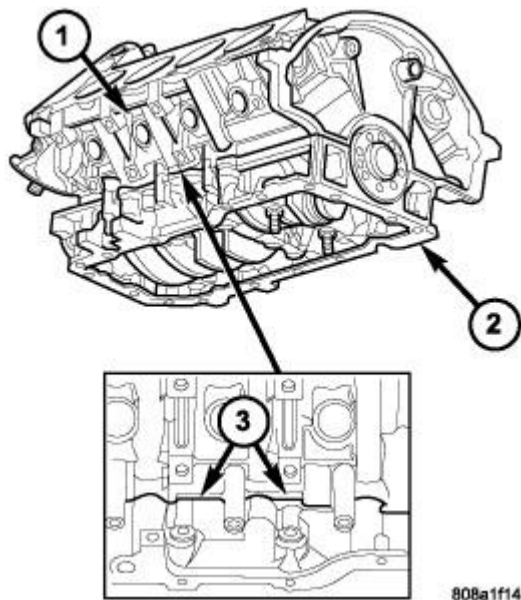


Fig. 114: Bedplate Pry Point Location
Courtesy of CHRYSLER GROUP, LLC

CAUTION: The bedplate to cylinder block mating surface is a critical sealing surface. Do not pry on or damage this surface in any way.

NOTE: The bedplate contains the lower main bearing halves. Use care when handling bedplate as not to drop or damage bearing halves. Installing main bearing halves in the wrong position will cause severe damage to the crankshaft.

NOTE: The bedplate has pry points cast into it. Use these points only. The pry points are on both the left and right sides, only the left side is shown in illustration.

7. Carefully pry on the pry points (3) to loosen the bedplate (2) then remove the bedplate.

CAUTION: When removing the crankshaft, use care not to damage bearing surfaces on the crankshaft.

8. Remove the crankshaft.

INSPECTION

INSPECTION

NOTE: Thoroughly inspect the connecting rod bearing bores and main bearing bores for scoring, blueing or severe scratches. Further disassembly may be required.

If connecting rod bearing bores show damage, the cylinder heads must be removed to service the piston and rod assemblies. If the bedplate or the cylinder block main bearing bores show damage the engine must be replaced.

1. If required, remove the main bearing halves from the cylinder block and bedplate.
2. Thoroughly clean the bedplate to cylinder block sealing surfaces and main bearing bores. Remove all oil and sealant residue.
3. Inspect the bedplate main bearing bores for cracks, scoring or severe blueing. If either condition exists the engine must be replaced.
4. Inspect the crankshaft thrust washers for scoring, scratches, wear or blueing. If either condition exist replace the thrust washer.
5. Inspect the oil pan gasket/windage tray for splits, tears or cracks in the gasket sealing surfaces. Replace gasket as necessary.

INSTALLATION

INSTALLATION

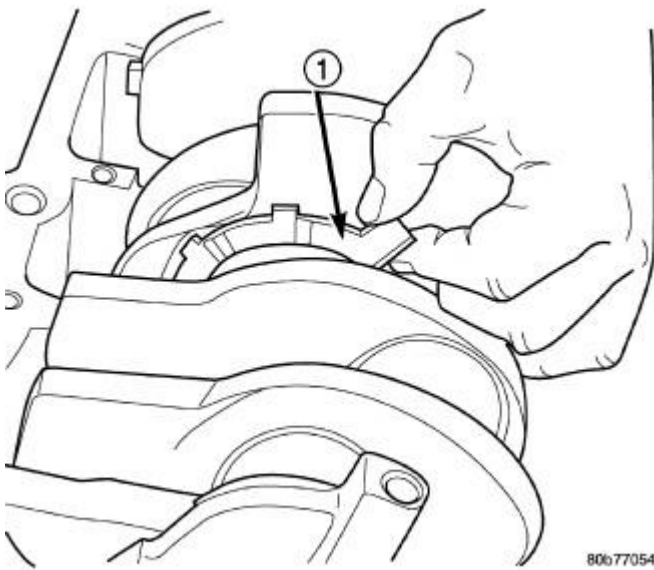


Fig. 115: Crankshaft Thrust Washer Installation
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Main bearings are select fit. for proper bearing selections. Refer to Engine/Engine Block/BEARING(S), Crankshaft - Standard Procedure.

1. Lubricate upper main bearing halves with clean engine oil.

CAUTION: When installing the crankshaft, use care not to damage bearing surfaces on the crankshaft.

2. Position crankshaft in cylinder block.
3. Install the thrust washers (1).

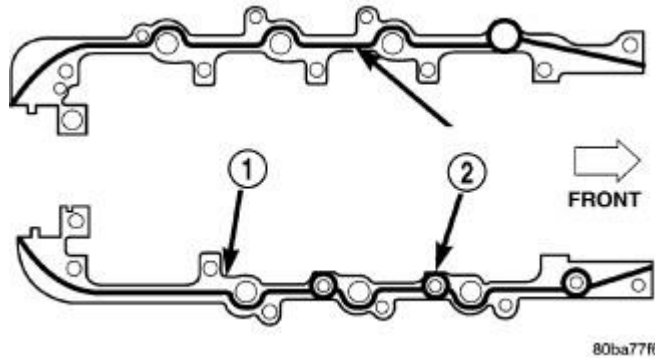


Fig. 116: Cylinder Block-To-Bed-Plate Sealant Bead Location
Courtesy of CHRYSLER GROUP, LLC

CAUTION: The bedplate to cylinder block mating surface must be coated with sealant prior to installation. Failure to do so will cause severe oil leaks.

NOTE: The parts must assembled and tightened within 10 after applying sealer.

NOTE: Make sure that the bedplate and cylinder block sealing surfaces are clean and free of oil or other contaminants. Contaminants on the sealing surfaces may cause main bearing distortion and/or oil leaks.

4. Apply a 2.5 mm (0.100 inch) bead of Mopar® Silicone Rubber RTV (2) to the cylinder block-to-bedplate mating surface (1) as shown in illustration.
5. Coat the crankshaft main bearing journals with clean engine oil and position the bedplate onto the cylinder block.

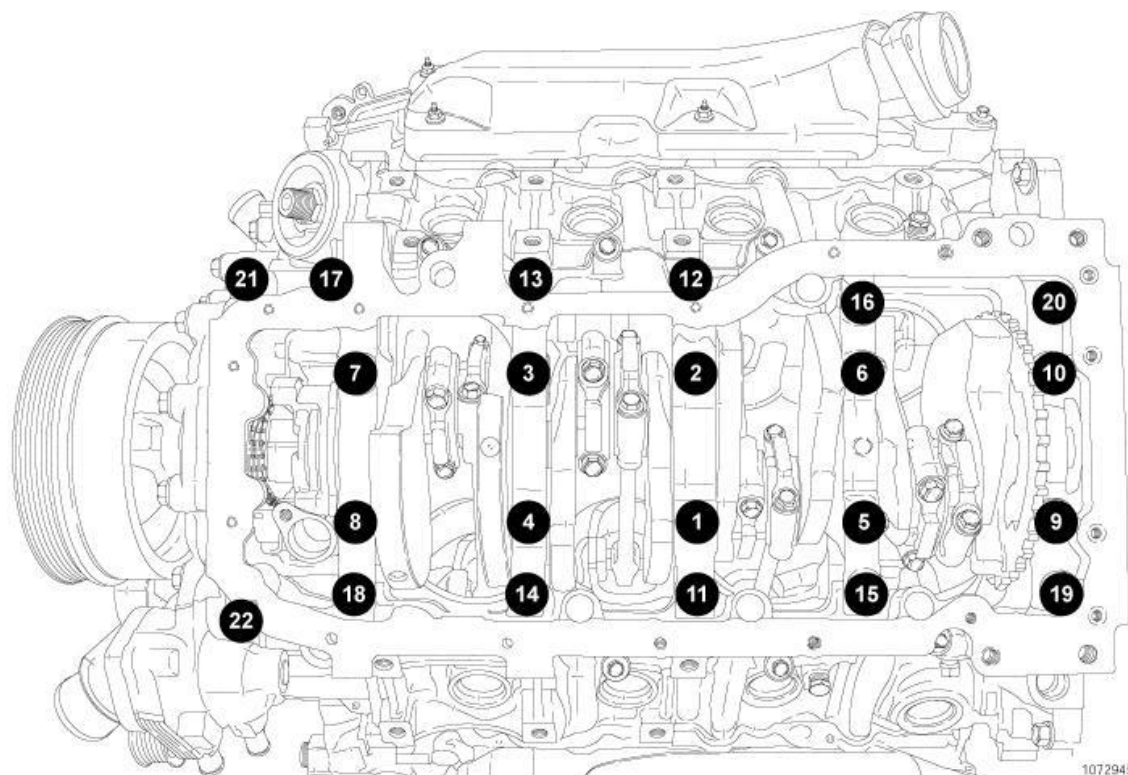


Fig. 117: Tightening Bedplate Bolts (1 Of 4)

Courtesy of CHRYSLER GROUP, LLC

NOTE: Lubricate the bedplate retaining bolts with clean engine oil prior to installation.

NOTE: Install the studs in locations three, five, and six.

6. Install the bedplate retaining bolts.
7. Tighten bolts to 3 N.m (26 in. lbs.) in the sequence shown in illustration.

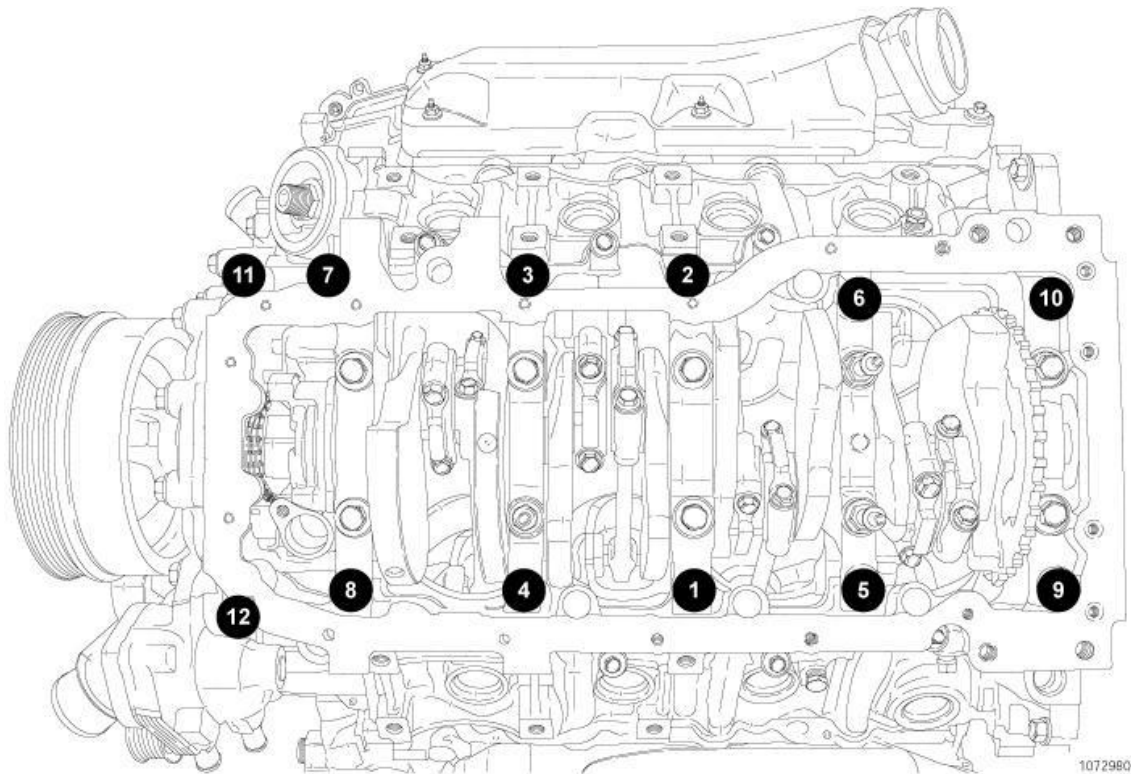


Fig. 118: Tightening Bedplate Bolts (2 Of 4)
Courtesy of CHRYSLER GROUP, LLC

8. Tighten bolts to 54 N.m (40 ft. lbs.) in the sequence shown in illustration.

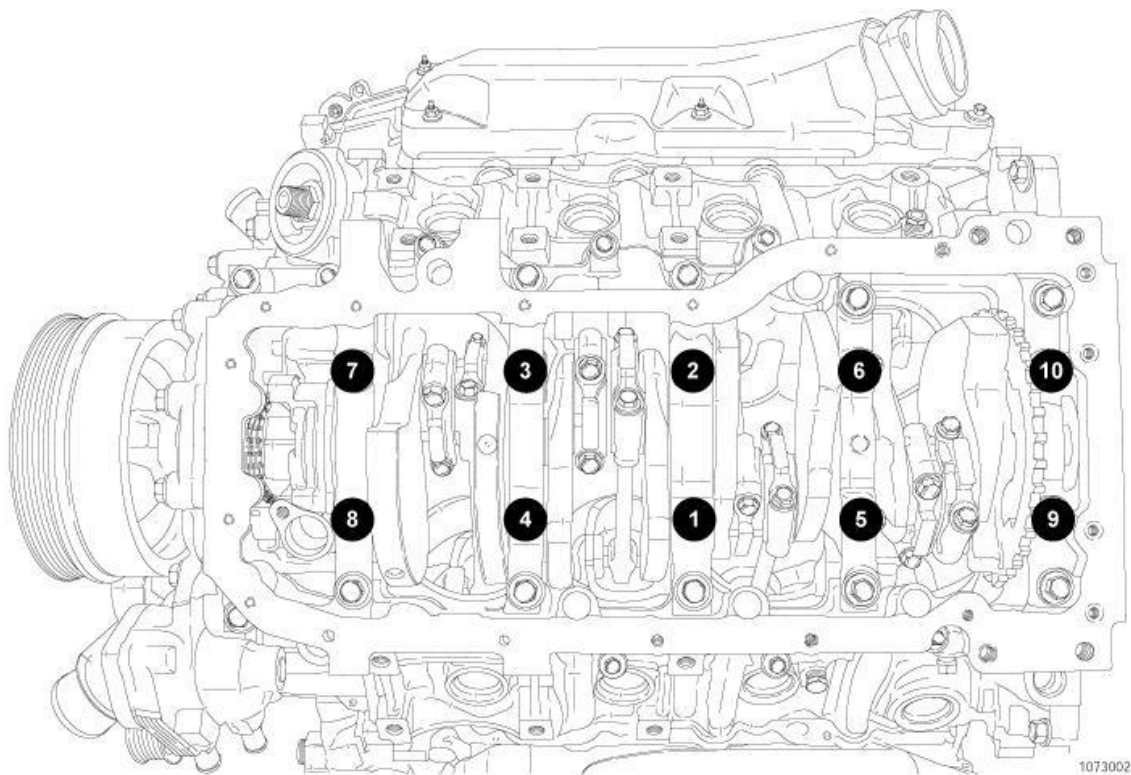


Fig. 119: Tightening Bedplate Bolts (3 Of 4)

Courtesy of CHRYSLER GROUP, LLC

9. Rotate bolts 90° in the sequence shown in illustration.

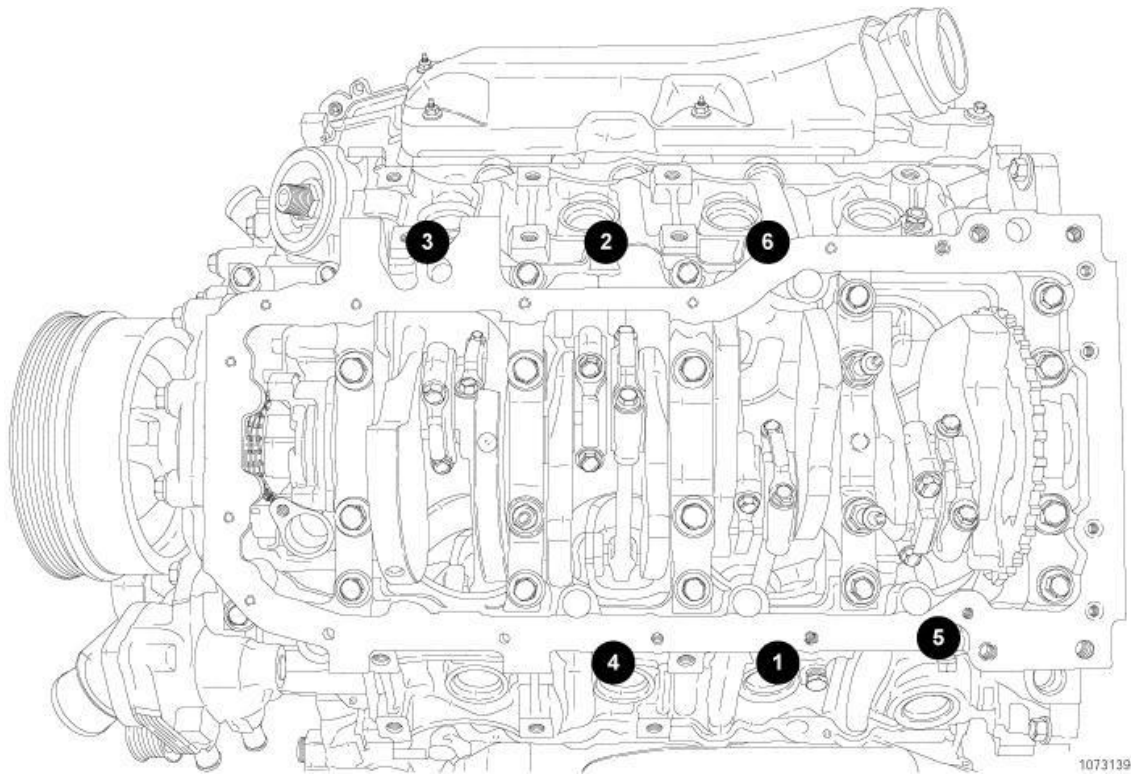


Fig. 120: Tightening Bedplate Bolts (4 Of 4)

Courtesy of CHRYSLER GROUP, LLC

10. Tighten bolts to 23 N.m (20 ft. lbs.) in the sequence shown in illustration.
11. Measure crankshaft end play. Refer to **Engine - Specifications**.
12. Install the connecting rods and measure side clearance. Refer to **Engine/Engine Block/BEARING(S), Connecting Rod - Standard Procedure**.

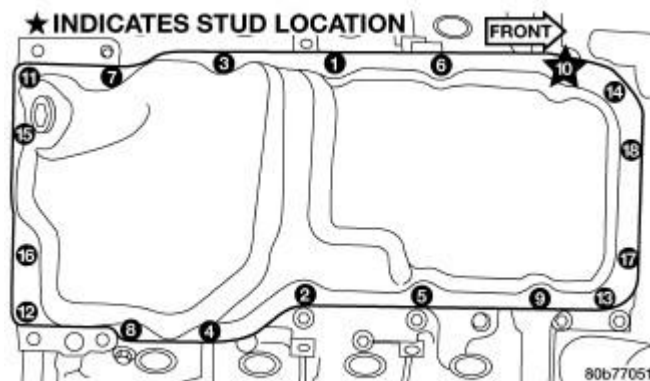


Fig. 121: Oil Pan Removal/Tightening Sequence

Courtesy of CHRYSLER GROUP, LLC

NOTE: Install the stud in location 10.

13. Position the oil pan gasket/windage tray.
14. Install the oil pickup tube with a new O-ring and tighten the fasteners to 28 N.m (20 ft. lbs.).
15. Position oil pan in place and install bolts.
16. Tighten the oil pan bolts to 15 N.m (11 ft. lbs.) in the sequence shown in illustration.
17. Install the engine. Refer to **INSTALLATION, 4.7L**.

DAMPER, VIBRATION

REMOVAL

REMOVAL

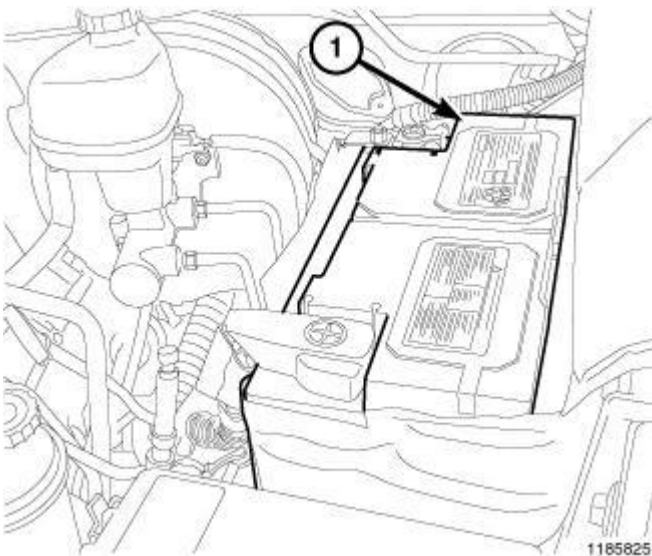


Fig. 122: Negative Battery Cable

Courtesy of CHRYSLER GROUP, LLC

1. Disconnect and isolate the negative battery cable (1).

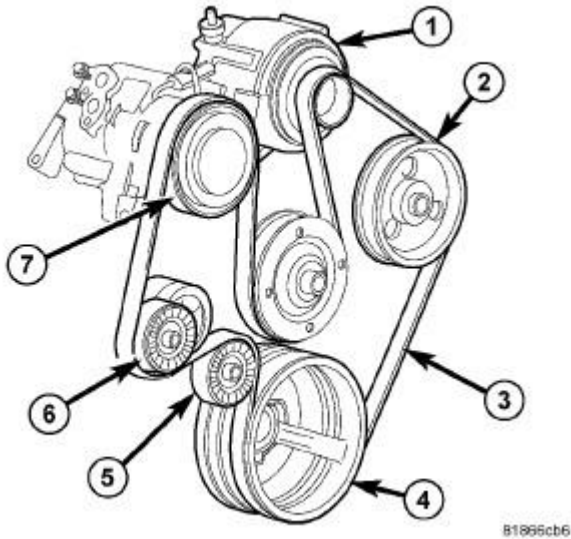


Fig. 123: Accessory Drive Belt Routing, Tensioner & Pulleys
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Do not let the tensioner arm snap back to the freearm position, severe damage may occur to the tensioner.

2. Rotate the belt tensioner (6) until it contacts its stop and remove the belt (3), then slowly rotate the tensioner (6) into the freearm position.
3. Raise and support the vehicle.

WARNING: Do not remove the radiator pressure cap, cylinder block drain plugs or loosen the radiator draincock with the system hot and under pressure. Serious burns from coolant can occur.

4. Drain the cooling system. Refer to STANDARD PROCEDURE .
5. Lower the vehicle.
6. Remove the upper radiator hose.

NOTE: The thermal viscous fan drive/fan blade assembly is attached (threaded) to the water pump hub shaft.

NOTE: The transmission cooler line snaps onto the lower right hand corner of the fan shroud.

CAUTION: After removing fan blade/viscous fan drive assembly, do not place viscous fan drive in horizontal position. If stored horizontally, silicone fluid in the viscous fan drive could drain into the bearing assembly and contaminate the bearing lubricant.

7. Remove the fan shroud and fan blade/viscous fan drive assembly as a complete unit from the vehicle. Refer to **FAN, COOLING, ELECTRIC, REMOVAL** and **FAN, COOLING, VISCOUS, REMOVAL**.

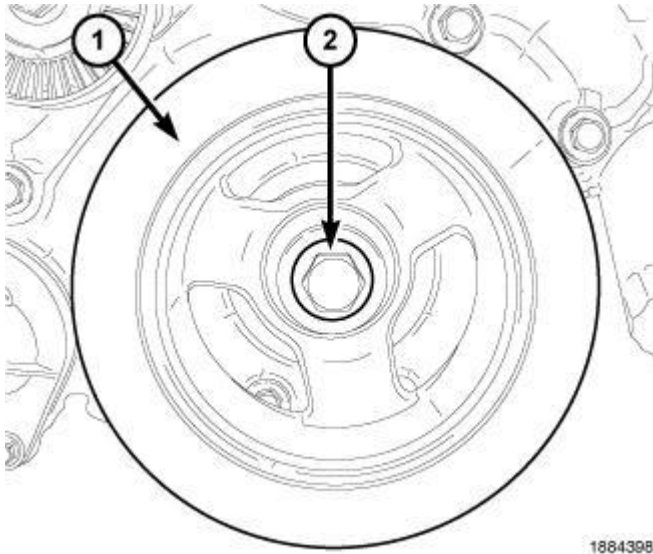


Fig. 124: Vibration Damper & Retaining Bolt
Courtesy of CHRYSLER GROUP, LLC

8. Remove the vibration damper (1) retaining bolt (2).

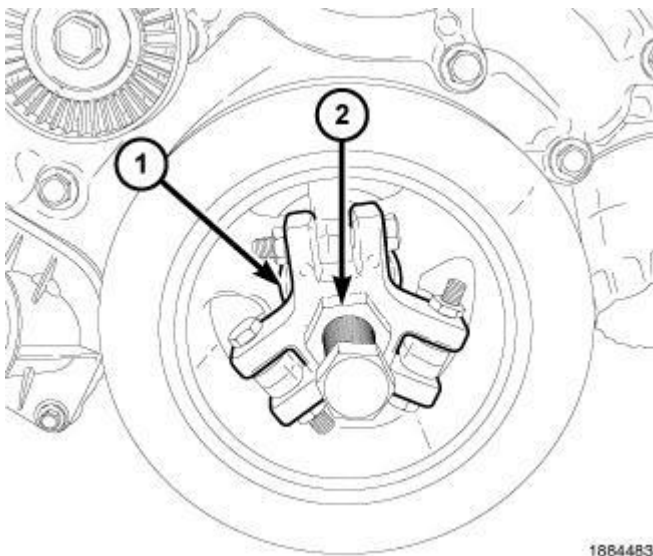
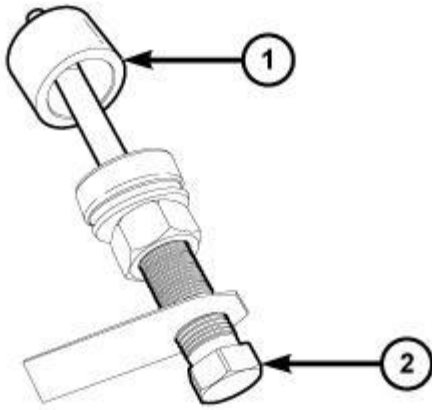


Fig. 125: Removing Crankshaft Damper
Courtesy of CHRYSLER GROUP, LLC

9. Using the crankshaft insert (special tool #8513A, Insert, Crankshaft) (1) and the three jaw puller (special tool #8454, 3-Jaw Puller) (2) remove the crankshaft damper.

INSTALLATION

INSTALLATION

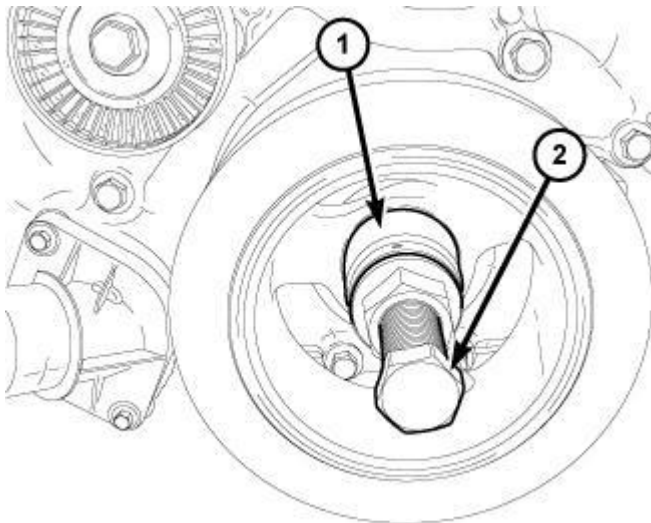


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Fig. 126: Damper Installer & A/C Hub Installer Cup
Courtesy of CHRYSLER GROUP, LLC

CAUTION: To prevent severe damage to the crankshaft, damper, and damper installer (special tool #8512A, Installer, Damper), thoroughly clean the damper bore and the crankshaft nose before installing damper.

1. Position the damper onto the crankshaft.
2. Assemble the damper installer (special tool #8512A, Installer, Damper) (2) and the A/C hub installer cup (special tool #6871, Installer, A/C Hub) (1).



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Fig. 127: Pressing Damper Onto Crankshaft
Courtesy of CHRYSLER GROUP, LLC

3. Using the damper installer (special tool #8512A, Installer, Damper) (2) and the A/C hub installer cup (special tool #6871, Installer, A/C Hub) (1), press the damper onto the crankshaft.
4. Coat the vibration damper bolt threads with Mopar ® Nickel Anti-Seize or equivalent, install and tighten the bolt to 175 N.m (130 ft. lbs.).
5. Install the cooling fan assembly. Refer to **FAN, COOLING, ELECTRIC, INSTALLATION** and **FAN, COOLING, VISCOUS, INSTALLATION** .
6. Install the radiator upper shroud and tighten fasteners to 11 N.m (95 in. lbs.).
7. Install the radiator upper hose.
8. Install the accessory drive belt. Refer to **BELT, SERPENTINE, INSTALLATION** .
9. Refill the cooling system. Refer to **STANDARD PROCEDURE** .
10. Connect the negative battery cable.

FLEXPLATE

REMOVAL

REMOVAL

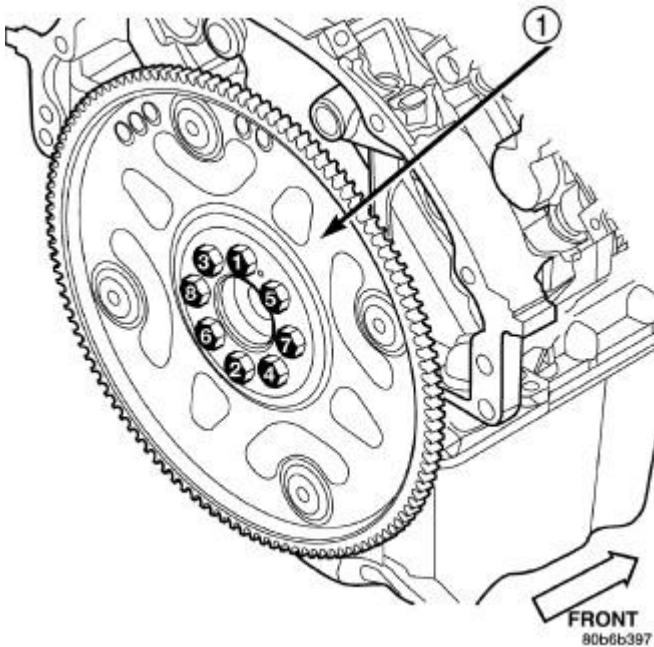


Fig. 128: Flexplate Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

1 - FLEXPLATE

1. Remove the transmission. Refer to **REMOVAL** .
2. Remove the bolts and flexplate (1).

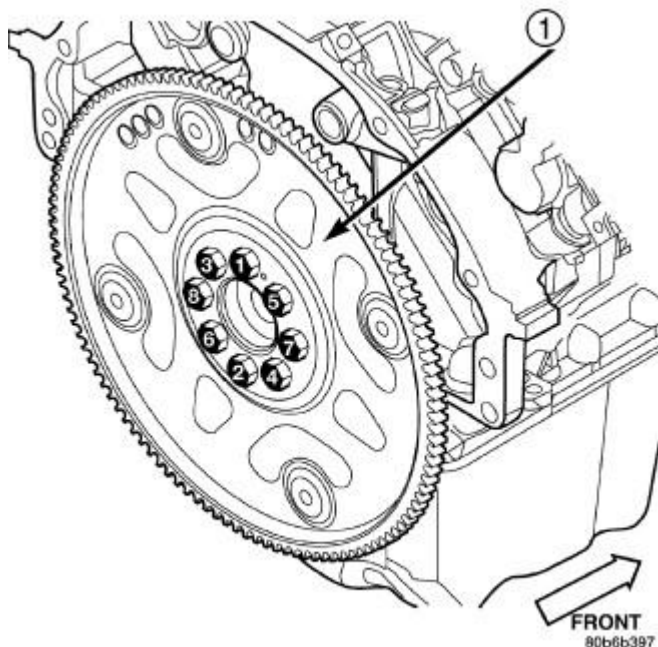
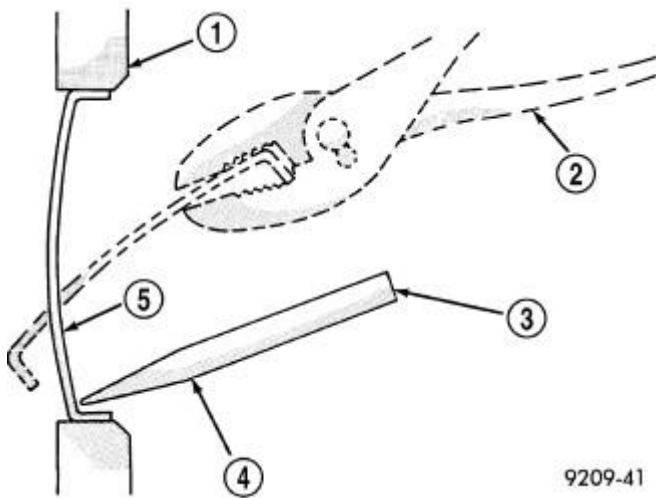
INSTALLATION**INSTALLATION**

Fig. 129: Flexplate Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

1 - FLEXPLATE

1. Position the flexplate onto the crankshaft and install the bolts hand tight.
2. Tighten the flexplate retaining bolts to 60 N.m (45 ft. lbs.) in the sequence shown in illustration.
3. Install the transmission. Refer to **INSTALLATION** .

PLUG, CORE**REMOVAL****REMOVAL**

**Fig. 130: Core Hole Plug Removal**

Courtesy of CHRYSLER GROUP, LLC

1 - CYLINDER BLOCK

2 - REMOVE PLUG WITH PLIERS

3 - STRIKE HERE WITH HAMMER

4 - DRIFT PUNCH

5 - CUP PLUG

1. Drain the cooling system. Refer to **STANDARD PROCEDURE** .
2. Using a blunt tool such as a drift or a screw driver and a hammer, strike the bottom edge of the cup plug (5).
3. Using a suitable pair of pliers, grasp the core plug (5) and remove.

INSTALLATION**INSTALLATION****NOTE:** Thoroughly clean core plug bore, remove all of the old sealer.

1. Coat the edges of the engine core plug and the core plug bore with Mopar Gasket Maker, or equivalent.

NOTE: It is not necessary to wait for the sealant to cure on the core plugs. The cooling system can be filled and the vehicle returned to service immediately.

2. Using proper plug driver, drive core plug into the core plug bore. The sharp edge of the core plug should be at least 0.50 mm (0.020 in.) inside the lead in chamfer.
3. Refill the cooling system. Refer to **STANDARD PROCEDURE** .

RING(S), PISTON

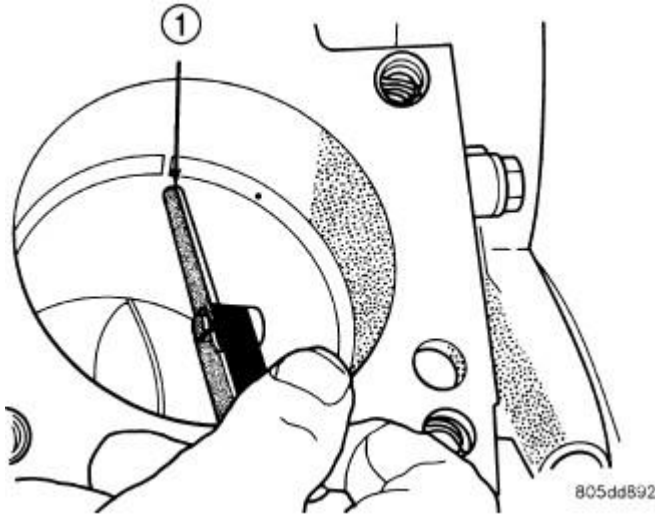
STANDARD PROCEDURE**STANDARD PROCEDURE - PISTON RING FITTING**

Fig. 131: Ring End Gap Measurement
Courtesy of CHRYSLER GROUP, LLC

1 - FEELER GAUGE

Before reinstalling used rings or installing new rings, the ring clearances must be checked.

1. Wipe the cylinder bore clean.
2. Insert the ring in the cylinder bore.

NOTE: The ring gap measurement must be made with the ring positioned at least 12 mm (0.50 inch.) from bottom of cylinder bore.

3. Using a piston, to ensure that the ring is squared in the cylinder bore, slide the ring downward into the cylinder.
4. Using a feeler gauge (1) check the ring end gap. Replace any rings not within specification.

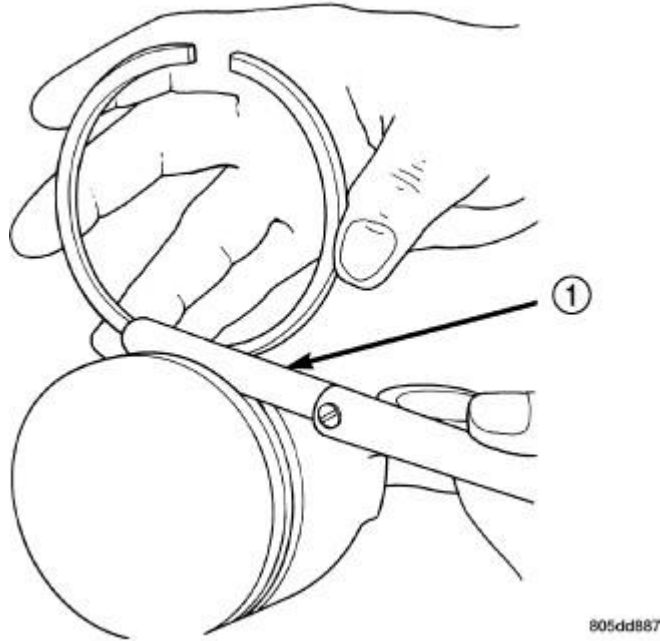


Fig. 132: Measuring Piston Ring Side Clearance
 Courtesy of CHRYSLER GROUP, LLC

1 - FEELER GAUGE

PISTON RING SIDE CLEARANCE

NOTE: Make sure the piston ring grooves are clean and free of nicks and burrs.

5. Measure the ring side clearance as shown in illustration make sure the feeler gauge (1) fits snugly between the ring land and the ring. Replace any ring not within specification.
6. Rotate the ring around the piston, the ring must rotate in the groove with out binding.

PISTON RING SPECIFICATION CHART

Ring Position	Groove Clearance	Maximum Clearance
Upper Ring	0.051 - 0.094 mm (0.0020 - 0.0037 in.)	0.11 mm (0.004 in.)
Intermediate Ring	0.04 - 0.08 mm (0.0016 - 0.0031 in.)	0.10 mm (0.004 in.)
Oil Control Ring (Steel Rails)	0.019 - 0.229 mm (0.0007-.0090 in.)	0.25 mm (0.010 in.)

Ring Position	Ring Gap	Wear Limit
---------------	----------	------------

Upper Ring	0.20 - 0.36 mm (0.0079 - 0.0142 in.)	0.43 mm (0.0017 in.)
Intermediate Ring	0.37 - 0.63 mm (0.0146 - 0.0249 in.)	0.74 mm (0.029 in.)
Oil Control Ring (Steel Rail)	0.025 - 0.76 mm (0.0099 - 0.03 in.)	1.55 mm (0.061 in.)



Fig. 133: Removing/Installing Piston Ring Side Rail
Courtesy of CHRYSLER GROUP, LLC

1 - SIDE RAIL END

- The No. 1 and No. 2 piston rings have a different cross section. Ensure No. 2 ring is installed with manufacturers I.D. mark (Dot) facing up, towards top of the piston.

NOTE: Piston rings are installed in the following order:

- Oil ring expander.
- Upper oil ring side rail.
- Lower oil ring side rail.
- No. 2 Intermediate piston ring.
- No. 1 Upper piston ring.

- Install the oil ring expander.
- Install upper side rail (1) by placing one end between the piston ring groove and the expander ring. Hold end firmly and press down the portion to be installed until side rail is in position. Repeat this step for the lower side rail.

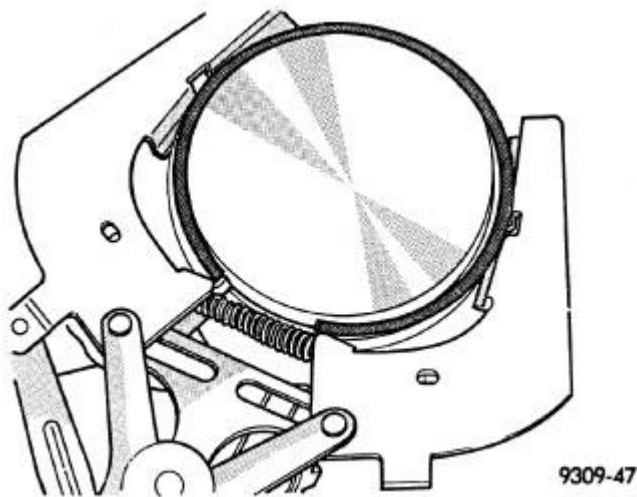


Fig. 134: Removing/Installing Upper & Intermediate Rings
 Courtesy of CHRYSLER GROUP, LLC

10. Install No. 2 intermediate piston ring using a piston ring installer.
11. Install No. 1 upper piston ring using a piston ring installer.

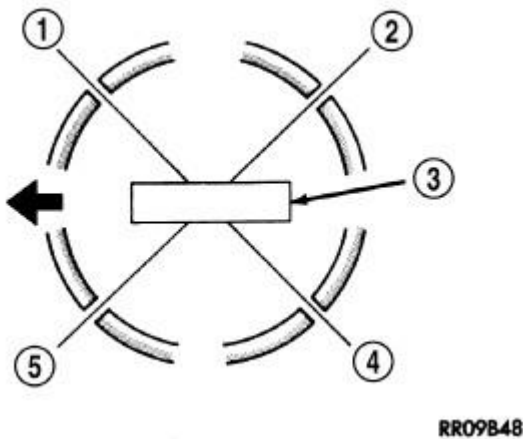


Fig. 135: Piston Ring End Gap Position
 Courtesy of CHRYSLER GROUP, LLC

1 - SIDE RAIL UPPER
2 - NO. 1 RING GAP
3 - PISTON PIN
4 - SIDE RAIL LOWER
5 - NO. 2 RING GAP AND SPACER EXPANDER GAP

12. Position piston ring end gaps as shown in illustration. It is important that expander ring gap (5) is at least 45° from the side rail gaps, but not on the piston pin center or on the thrust direction.

ROD, PISTON AND CONNECTING

DESCRIPTION

DESCRIPTION

CAUTION: Do not use a metal stamp to mark connecting rods as damage may result, instead use ink or a scratch awl.

The pistons are made of a high strength aluminum alloy. The anodized top ring groove and crown has been replaced with a coated top ring that is blue in color on the bottom surface. Piston skirts are coated with a solid lubricant (Molykote) to reduce friction and provide scuff resistance. The connecting rods are made of forged powdered metal, with a "fractured cap" design. A pressed fit piston pin is used to attach the piston and connecting rod.

STANDARD PROCEDURE

PISTON FITTING

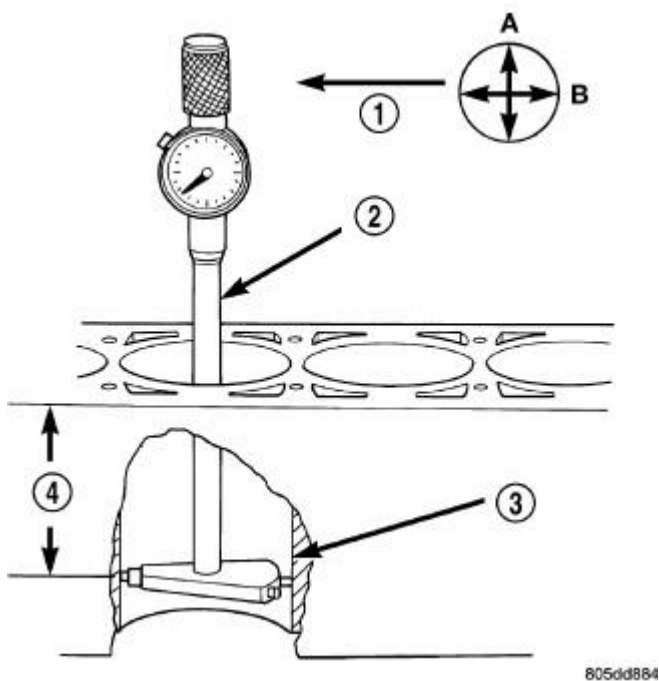


Fig. 136: Measuring Cylinder Bore Diameter

Courtesy of CHRYSLER GROUP, LLC

1 - FRONT
2 - BORE GAUGE
3 - CYLINDER BORE
4 - 38 MM (1.5 in)

1. To correctly select the proper size piston, a cylinder bore gauge (2), capable of reading in 0.003 mm

(.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer. Refer to **Fig. 136**.

- Measure the inside diameter of the cylinder bore (3) at a point 38.0 mm (1.5 inches) below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft at point A and then take an additional bore reading 90 degrees to that at point B.

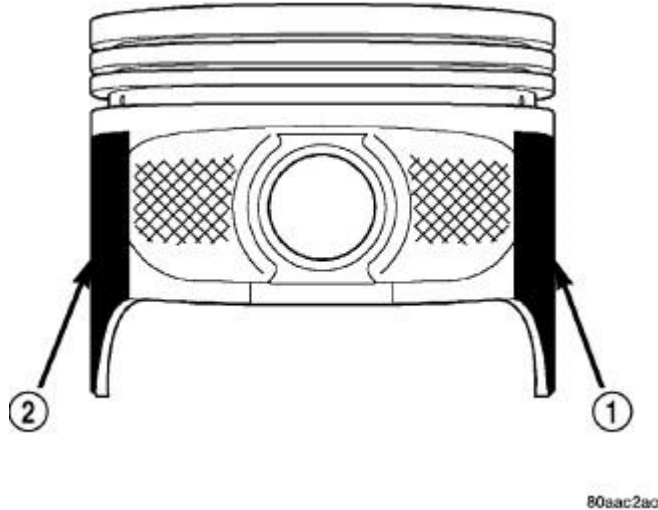


Fig. 137: Moly Coated Piston
 Courtesy of CHRYSLER GROUP, LLC

1 - MOLY COATED
2 - MOLY COATED

- The coated pistons (1, 2) will be serviced with the piston pin and connecting rod pre-assembled. Refer to **Fig. 137**.
- The coating material is applied to the piston after the final piston machining process. Measuring the outside diameter of a coated piston (1, 2) will not provide accurate results. Therefore measuring the inside diameter of the cylinder bore with a dial Bore Gauge is **MANDATORY**. To correctly select the proper size piston, a cylinder bore gauge capable of reading in 0.003 mm (.0001 in.) increments is required.
- Piston installation into the cylinder bore requires slightly more pressure than that required for non-coated pistons. The bonded coating on the piston will give the appearance of a line-to-line fit with the cylinder bore.

REMOVAL

REMOVAL

- Disconnect negative cable from battery.
- Remove the following components:
 - Oil pan and gasket/windage tray. Refer to **PAN, OIL, REMOVAL, 4.7L**.
 - Cylinder head covers. Refer to **COVER(S), CYLINDER HEAD, REMOVAL, 4.7L**.
 - Timing chain cover. Refer to **COVER(S), ENGINE TIMING, REMOVAL, 4.7L**.

- Cylinder head(s). Refer to **CYLINDER HEAD, REMOVAL, 4.7L**.
3. If necessary, remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation.** Pistons and connecting rods must be removed from top of cylinder block. When removing piston and connecting rod assemblies from the engine, rotate crankshaft so the each connecting rod is centered in cylinder bore.

CAUTION: DO NOT use a number stamp or a punch to mark connecting rods or caps, as damage to connecting rods could occur

NOTE: Connecting rods and bearing caps are not interchangeable and should be marked before removing to ensure correct reassembly.

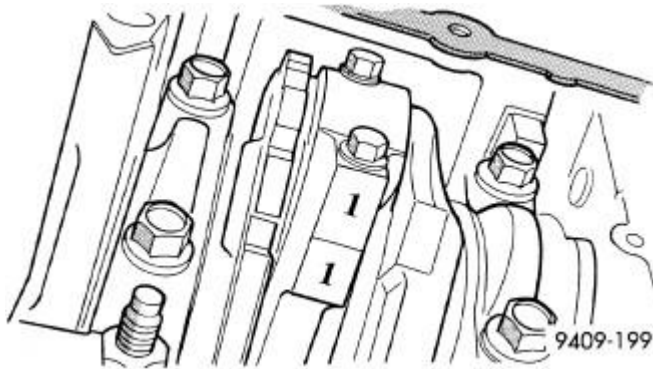


Fig. 138: Mark On Connecting Rod And Bearing Cap
Courtesy of CHRYSLER GROUP, LLC

4. Mark connecting rod and bearing cap positions using a permanent ink marker or scribe tool. Refer to **Fig. 138**.

CAUTION: Care must be taken not to damage the fractured rod and cap joint face surfaces, as engine damage may occur.

5. Remove connecting rod cap. Install Special Tool (special tool #8507, Guides, Connecting Rod) Connecting Rod Guides into the connecting rod being removed. Remove piston from cylinder bore. Repeat this procedure for each piston being removed.

CAUTION: Care must be taken not to nick crankshaft journals, as engine damage may occur.

6. Immediately after piston and connecting rod removal, install bearing cap on the mating connecting rod to prevent damage to the fractured cap and rod surfaces.
7. Carefully remove piston rings from piston(s), starting from the top ring down.

CLEANING

CLEANING

CAUTION: DO NOT use a wire wheel or other abrasive cleaning devise to clean the pistons or connecting rods. The pistons have a Moly coating, this coating must not be damaged.

1. Using a suitable cleaning solvent clean the pistons in warm water and towel dry.
2. Use a wood or plastic scraper to clean the ring land grooves.

CAUTION: Do not remove the piston pin from the piston and connecting rod assembly.

INSPECTION**INSPECTION**

Check the connecting rod journal for excessive wear, taper and scoring. Refer to **Engine/Engine Block/BEARING(S), Connecting Rod - Standard Procedure.**

Check the connecting rod for signs of twist or bending.

Check the piston for taper and elliptical shape before it is fitted into the cylinder bore. Refer to **Engine/Engine Block/ROD, Piston and Connecting - Standard Procedure.**

Check the piston for scoring, or scraping marks in the piston skirts. Check the ring lands for cracks and/or deterioration.

INSTALLATION**INSTALLATION**

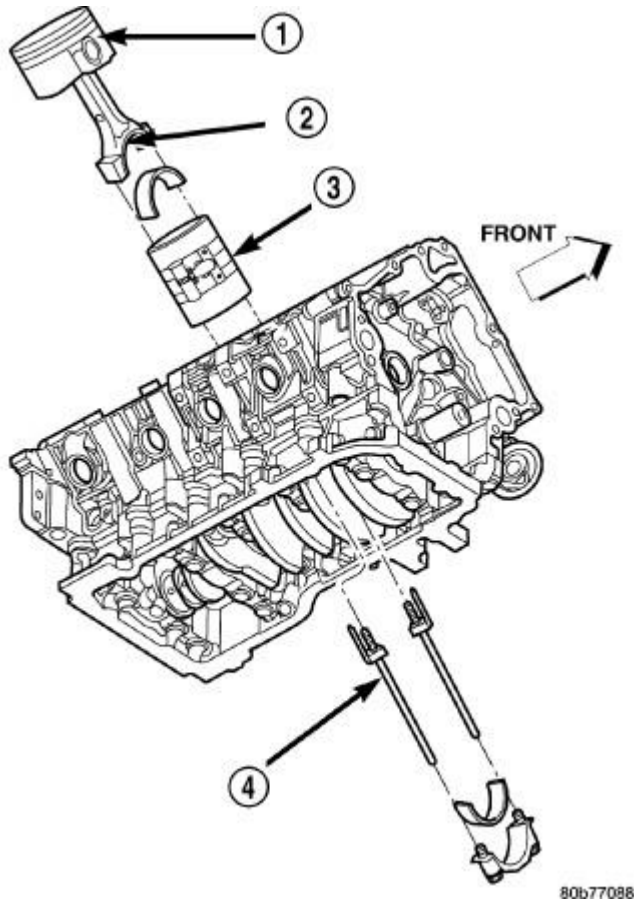


Fig. 139: Piston, Oil Slinger Slot, Ring Compressor & Special Tool
Courtesy of CHRYSLER GROUP, LLC

1 - "F" TOWARD FRONT OF ENGINE
2 - OIL SLINGER SLOT
3 - RING COMPRESSOR
4 - SPECIAL TOOL 8507

1. Before installing piston and connecting rod assemblies into the bore, install the piston rings.
2. Immerse the piston head and rings in clean engine oil. Position a ring compressor (3) over the piston and rings. Tighten ring compressor. **Ensure position of rings do not change during this operation.**
3. Position bearing onto connecting rod. Ensure that hole in bearing shell aligns with hole in connecting rod. Lubricate bearing surface with clean engine oil.
4. Install Special Tool (special tool #8507, Guides, Connecting Rod) Connecting Rod Guides (4) into connecting rod bolt threads.

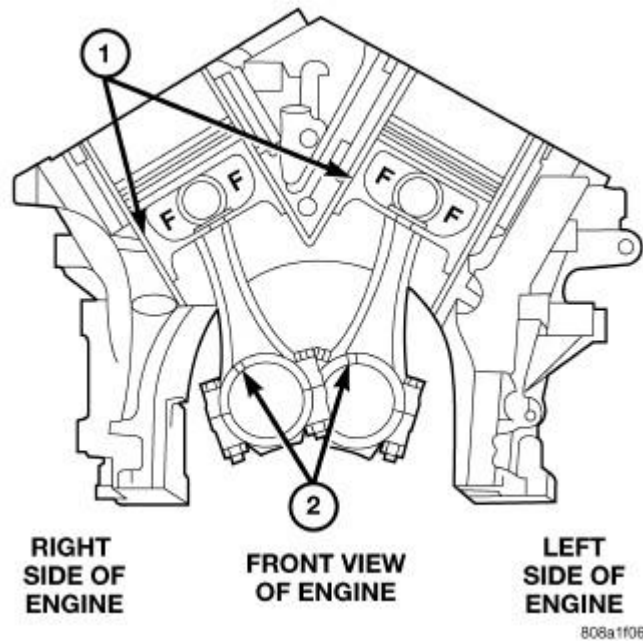


Fig. 140: Proper Connecting Rod Installation
 Courtesy of CHRYSLER GROUP, LLC

- | |
|---------------------------------|
| 1 - MAJOR THRUST SIDE OF PISTON |
| 2 - OIL SLINGER SLOT |

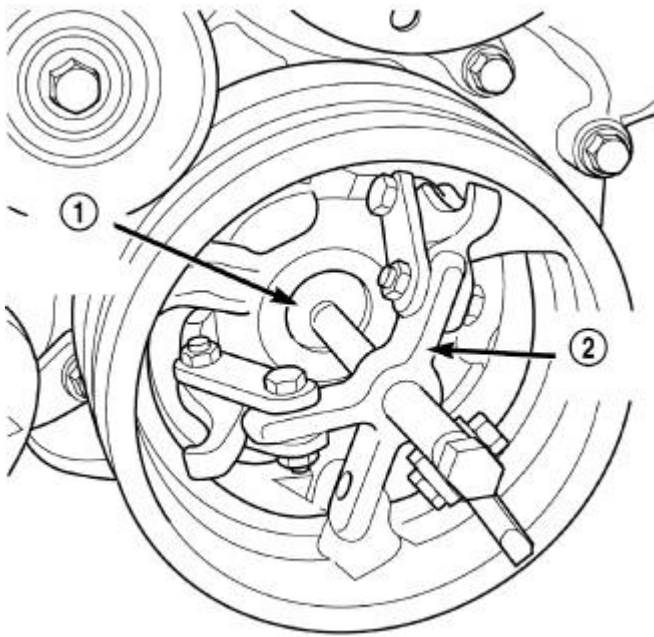
5. The pistons are marked on the piston pin bore surface with an raised "F" indicating installation position (1). This mark must be pointing toward the front of engine on both cylinder banks. The connecting rod oil slinger slot faces the front of the engine.
6. Wipe cylinder bore clean and lubricate with engine oil.
7. Rotate crankshaft until connecting rod journal is on the center of cylinder bore. Insert rod and piston into cylinder bore and carefully position connecting rod guides over crankshaft journal.
8. Tap piston down in cylinder bore using a hammer handle. While at the same time, guide connecting rod into position on rod journal.

CAUTION: Connecting Rod Bolts are Torque to Yield Bolts and Must Not Be Reused. Always replace the Rod Bolts whenever they are loosened or removed.

9. Lubricate rod bolts and bearing surfaces with engine oil. Install connecting rod cap and bearing. Tighten bolts to 27 N.m (20 ft. lbs.) plus 90°.
10. Install the following components:
 - Cylinder head(s). Refer to **CYLINDER HEAD, INSTALLATION, 4.7L.**
 - Timing chain and cover. Refer to **COVER(S), ENGINE TIMING, INSTALLATION, 4.7L.**
 - Cylinder head covers. Refer to **COVER(S), CYLINDER HEAD, INSTALLATION, 4.7L.**

- Oil pan and gasket/windage tray. Refer to **PAN, OIL, INSTALLATION, 4.7L**.

11. Fill crankcase with proper engine oil to correct level.
12. Connect negative cable to battery.

SEAL, CRANKSHAFT OIL, FRONT**REMOVAL****REMOVAL**

80b6b292

Fig. 141: Removing Crankshaft Damper
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect negative cable from battery.
2. Remove accessory drive belt. Refer to **BELT, SERPENTINE, REMOVAL**.
3. Remove A/C compressor mounting fasteners and set compressor aside.
4. Drain cooling system. Refer to **STANDARD PROCEDURE**.
5. Remove upper radiator hose.
6. Disconnect electrical connector for fan mounted inside radiator shroud.
7. Remove radiator shroud attaching fasteners.

NOTE: Transmission cooler line snaps into shroud lower right hand corner.

8. Remove radiator cooling fan and shroud. Refer to **FAN, COOLING, ELECTRIC, REMOVAL** and **FAN, COOLING, VISCOUS, REMOVAL**.

9. Remove crankshaft damper bolt.
10. Remove damper using Crankshaft Insert (special tool #8513A, Insert, Crankshaft) (1) and (special tool #1023, Puller) Three Jaw Puller (2).

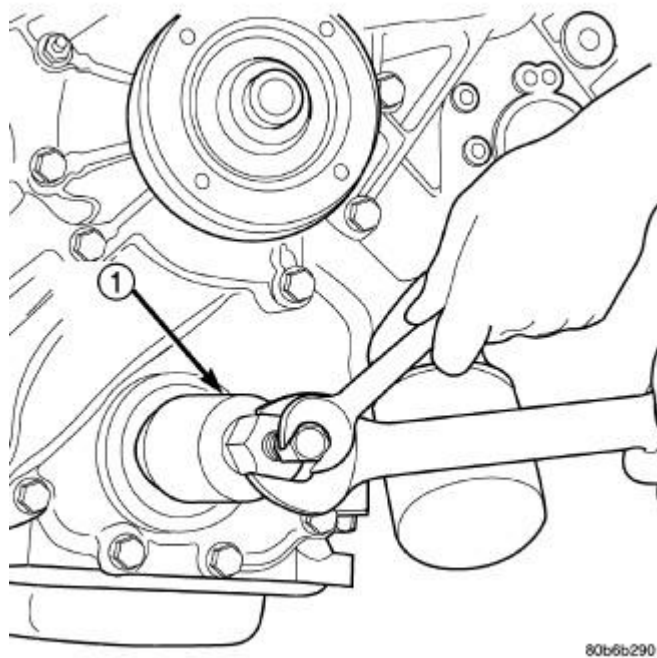


Fig. 142: Removing Crankshaft Front Oil Seal
Courtesy of CHRYSLER GROUP, LLC

11. Using Crankshaft Front Seal Remover (special tool #8511, Remover, Seal) (1), remove crankshaft front seal.

INSTALLATION

INSTALLATION

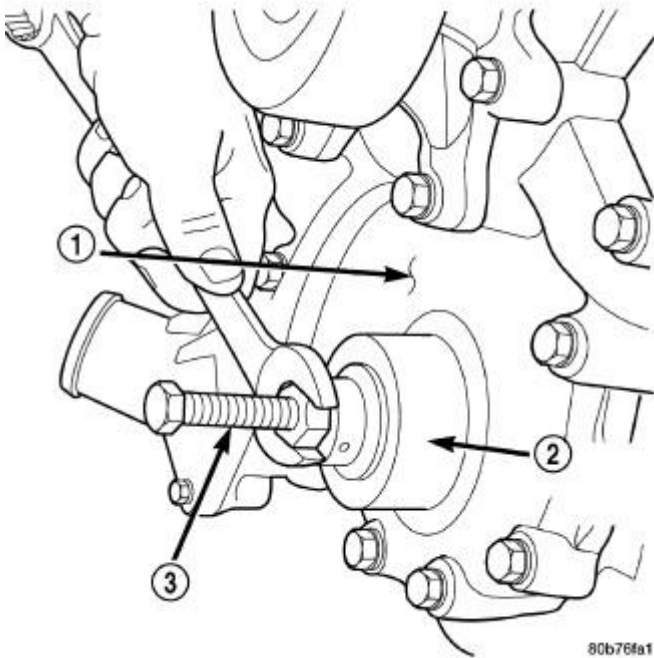


Fig. 143: Installing Crankshaft Front Oil Seal
Courtesy of CHRYSLER GROUP, LLC

CAUTION: To prevent severe damage to the Crankshaft, Damper or Special Tool (special tool #8512A, Installer, Damper), thoroughly clean the damper bore and the crankshaft nose before installing Damper.

1. Using Seal Installer (special tool #8348, Installer, Seal) and Damper Installer (special tool #8512A, Installer, Damper) (2, 3), install crankshaft front seal.
2. Install vibration damper. Refer to **DAMPER, VIBRATION, INSTALLATION, 4.7L**.
3. Install radiator cooling fan and shroud. Refer to **FAN, COOLING, ELECTRIC, INSTALLATION** and **FAN, COOLING, VISCOUS, INSTALLATION**.
4. Install upper radiator hose.
5. Install A/C compressor and tighten fasteners to 54 N.m (40 ft. lbs.).
6. Install accessory drive belt refer. Refer to **BELT, SERPENTINE, INSTALLATION**.
7. Refill cooling system. Refer to **STANDARD PROCEDURE**.
8. Connect negative cable to battery.

SEAL, CRANKSHAFT OIL, REAR

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
 1. Circular spray pattern generally indicates seal leakage or crankshaft damage.
 2. Where leakage tends to run straight down, possible causes are a porous block, oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces. See appropriate Engine information, for proper repair procedures of these items.
4. If no leaks are detected, pressurized the crankcase as outlined in the information, **OIL CONSUMPTION TEST AND DIAGNOSIS**.

CAUTION: Do not exceed 20.6 kPa (3 psi).

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks or scratches. The crankshaft seal flange is specially machined to complement the function of the rear oil seal.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled. Refer to **ENGINE OIL LEAK** for components inspections on possible causes and corrections.
7. After the oil leak root cause and appropriate corrective action have been identified. Refer to **SEAL, CRANKSHAFT OIL, REAR, REMOVAL, 4.7L**.

REMOVAL

REMOVAL

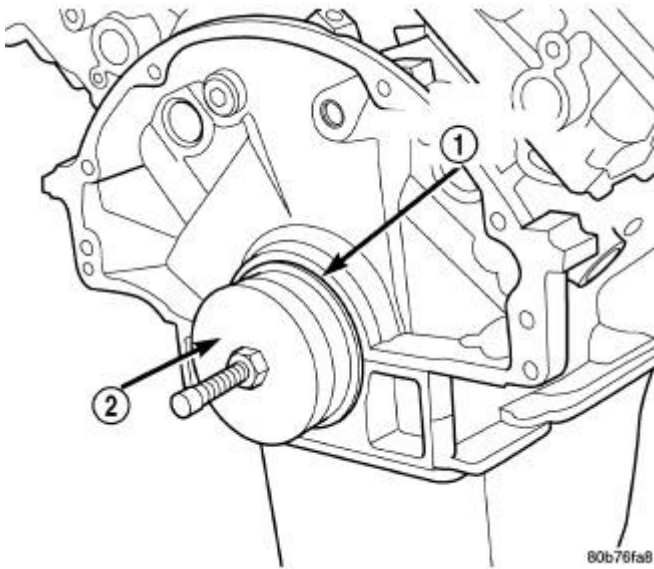


Fig. 144: Removing Crankshaft Rear Oil Seal Using Special Tool
 Courtesy of CHRYSLER GROUP, LLC

NOTE: This procedure can be performed in vehicle.

1. If being performed in vehicle, remove the transmission.
2. Remove the flexplate. Refer to **FLEXPLATE, REMOVAL, 4.7L**.

NOTE: The crankshaft oil seal **CAN NOT** be reused after removal.

NOTE: The crankshaft rear oil seal remover (special tool #8506, Remover, Seal) must be installed deeply into the seal. Continue to tighten the removal tool into the seal until the tool can not be turned farther. Failure to install tool correctly the first time will cause tool to pull free of seal without removing seal from engine.

3. Using Seal Remover (special tool #8506, Remover, Seal) (2), remove the crankshaft rear oil seal (1).

INSTALLATION

INSTALLATION

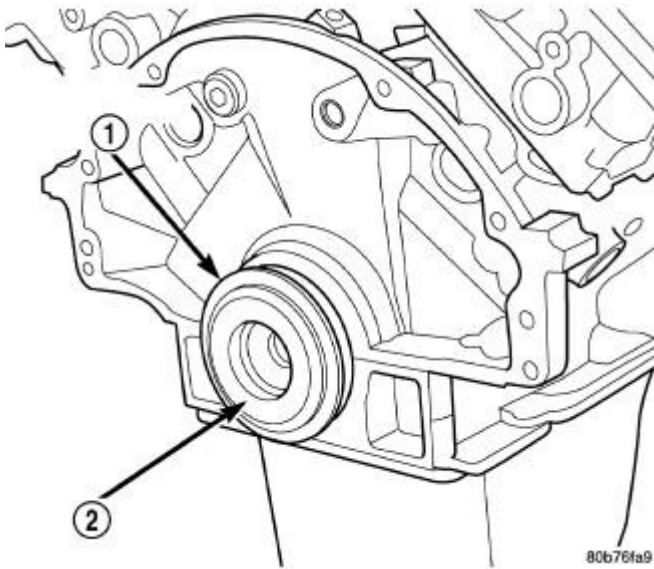


Fig. 145: Crankshaft Rear Oil Seal Guide Special Tool 8349-2 & Oil Seal
Courtesy of CHRYSLER GROUP, LLC

- | |
|-------------------------------|
| 1 - REAR CRANKSHAFT SEAL |
| 2 - SPECIAL TOOL 8349-2 GUIDE |

1. Lubricate the crankshaft flange with engine oil.
2. Position the magnetic seal guide (special tool #8349-2, Guide Crank Seal) onto the crankshaft rear face. Then position the crankshaft rear oil seal (1) onto the guide (2).

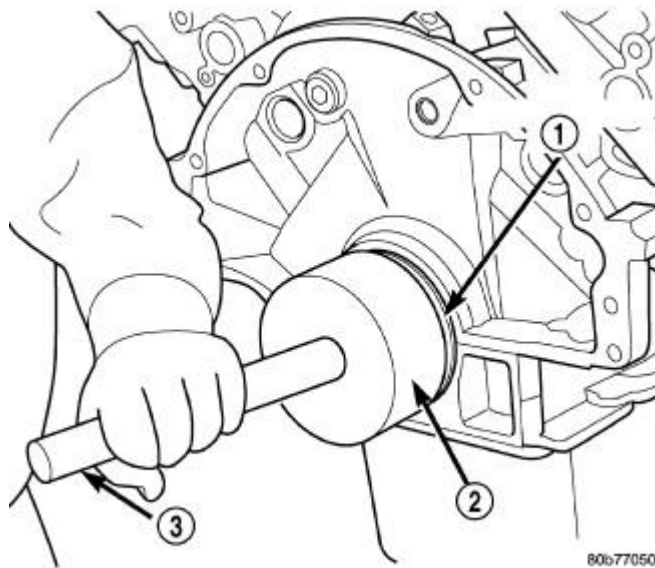


Fig. 146: Installing Crankshaft Rear Oil Seal
Courtesy of CHRYSLER GROUP, LLC

- | |
|-----------------------------------|
| 1 - REAR CRANKSHAFT SEAL |
| 2 - SPECIAL TOOL 8349-1 INSTALLER |
| 3 - SPECIAL TOOL C-4171 HANDLE |

3. Using Crankshaft Rear Oil Seal Installer (special tool #8349, Installer, Crankshaft Rear Oil Seal) (2) and Driver Handle (special tool #C-4171, Driver Handle, Universal) (3), with a hammer, tap the seal (1) into place. Continue to tap on the driver handle until the seal installer seats against the cylinder block crankshaft bore.
4. Install the flexplate.
5. Install the transmission.

ENGINE MOUNTING

INSULATOR, ENGINE MOUNT, REAR (TRANSMISSION)

REMOVAL

REMOVAL

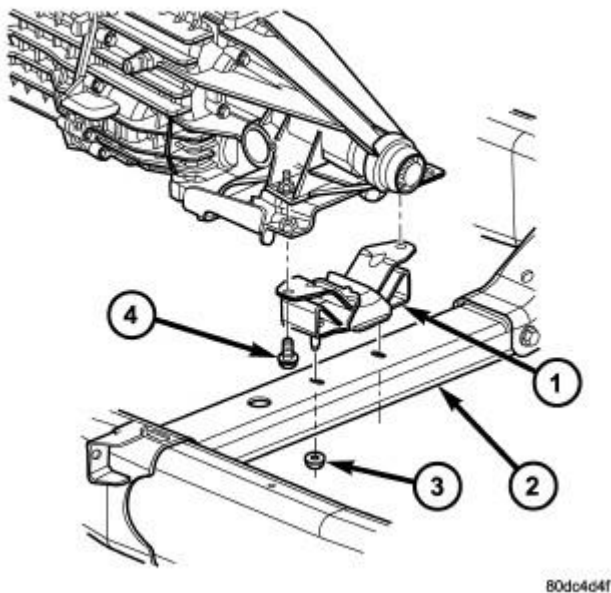


Fig. 147: Transmission Mount, Crossmember & Fasteners
 Courtesy of CHRYSLER GROUP, LLC

- | |
|-----------------|
| 1 - MOUNT |
| 2 - CROSSMEMBER |
| 3 - NUT |
| 4 - BOLT |

1. Raise the vehicle on a hoist.
2. Using a suitable jack, support transmission.
3. Remove the nuts from the transmission mount (1).
4. Remove the two bolts that attach the transmission mount to the engine bracket.
5. Raise the transmission enough to remove the mount from the crossmember (2). Refer to **Fig. 147**.
6. Remove the mount (1).

INSTALLATION**INSTALLATION**

NOTE: Threadlocking compound must be applied to the bolts before installation.

1. Install the two bolts that attach the transmission mount to the transmission bracket.
2. Torque the bolts to 61 N.m (45 ft.lbs.) torque.
3. Lower the transmission so the transmission mount rests on the crossmember, and the studs of the transmission mount are aligned in the slots in the crossmember.
4. Install the nuts onto the transmission mount studs through the crossmember access slot.
5. Torque the nuts to 54 N.m (40 ft. lbs.).

INSULATOR, ENGINE MOUNT, FRONT**REMOVAL****REMOVAL****2WD**

1. Disconnect the negative cable from the battery.

CAUTION: Remove the viscous fan before raising engine. Failure to do so may cause damage to the fan blade, fan clutch and fan shroud.

2. Remove the viscous fan.
3. Raise the vehicle.
4. Remove the engine oil filter.
5. Remove the oil drain trough.
6. Support the engine with a suitable jack and a block of wood across the full width of the engine oil pan.
7. Support the front axle with a suitable jack.
8. Remove the (4) bolts that attach the engine mounts to the front axle.
9. Remove the (3) bolts that attach the front axle to the left engine bracket.
10. Lower the front axle.

11. Remove the through bolts
12. Raise the engine far enough to be able to remove the left and right engine mounts.
13. Remove the (8) mount to engine attaching bolts
14. Remove the engine mounts.

4WD

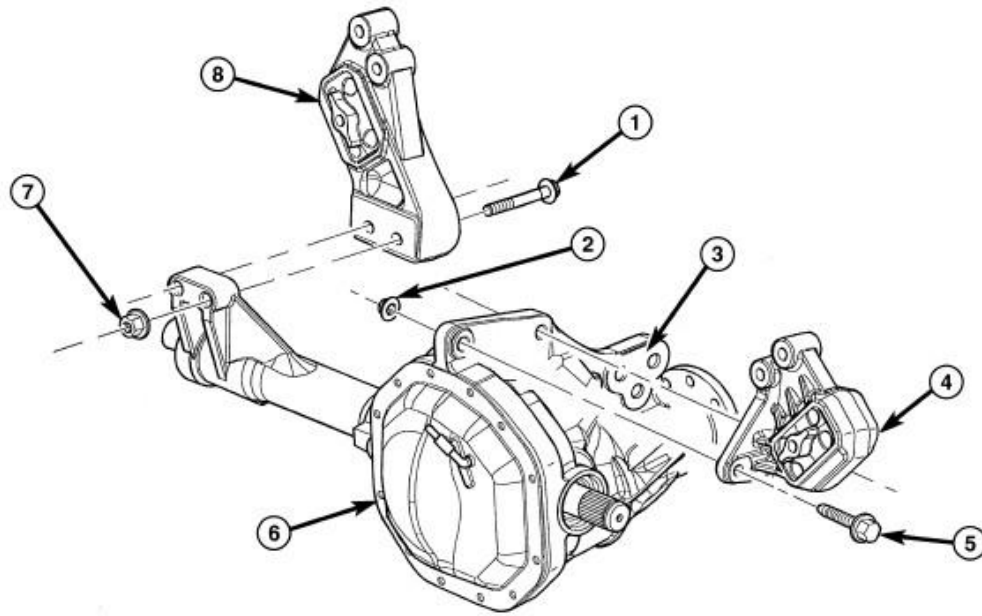
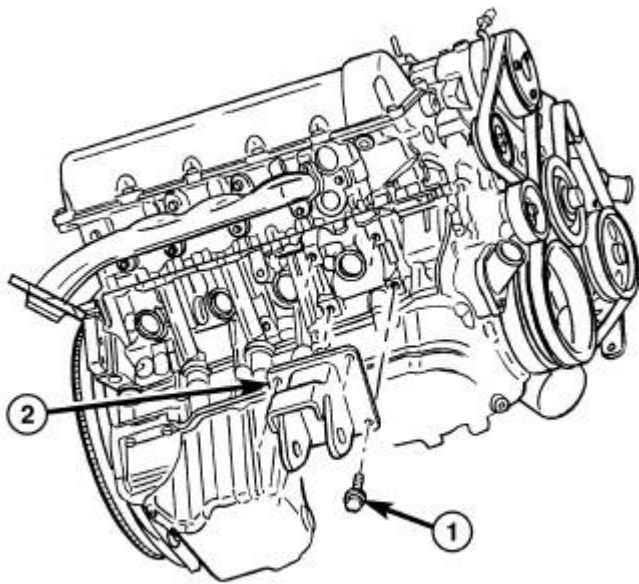


Fig. 148: Engine Insulator Mounts - 4x4
 Courtesy of CHRYSLER GROUP, LLC

1 - RH INSULATOR TO AXLE BOLT
2 - NUT
3 - PINION SUPPORT MOUNT
4 - LH INSULATOR MOUNT
5 - LH INSULATOR TO AXLE BOLT
6 - FRONT AXLE
7 - NUT
8 - RH INSULATOR MOUNT

1. Disconnect the negative cable from the battery.
2. Remove the viscous fan.
3. Raise the vehicle.
4. Remove the skid plate.
5. Remove the front crossmember.
6. Remove the engine oil filter.
7. Remove the oil drain trough.

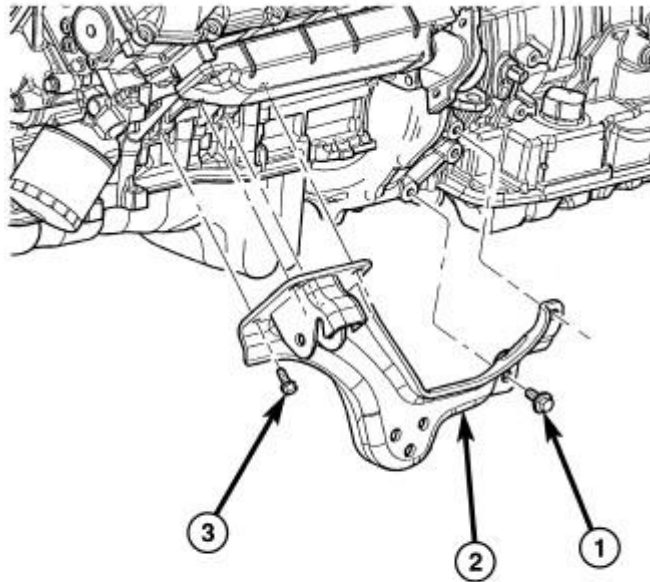
8. Support the engine with a suitable jack and a block of wood across the full width of the engine oil pan.
9. Support the front axle with a suitable jack.
10. Remove the 4 bolts that attach the engine mounts to the front axle (6).
11. Remove the 3 bolts (3) that attach the front axle to the left engine bracket.
12. Lower the front axle.
13. Remove the through bolts
14. Raise the engine far enough to be able to remove the left and right engine mounts.
15. Remove the engine mounts (4, 8).



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Fig. 149: Engine Mount Support Bracket
Courtesy of CHRYSLER GROUP, LLC

1 - BOLT
2 - ENGINE MOUNT SUPPORT BRACKET



80x82fc4

Fig. 150: Engine Mount Support Bracket
Courtesy of CHRYSLER GROUP, LLC

1 - BOLT
2 - ENGINE MOUNT SUPPORT BRACKET
3 - BOLT

16. Remove the engine mount brackets (2).

INSTALLATION

INSTALLATION

2WD

NOTE: For mount to engine block and left engine bracket to front axle bolts, apply Mopar® Lock and Seal Adhesive, Medium Strength Threadlocker.

1. Install the right and left side engine mounts to the engine block with (8) bolts. Torque bolts to 54 N.m (40 ft. lbs.).
2. Insert the (2) through bolts into the right and left side engine mounts and loose assemble the two nuts onto the through bolts.
3. Lower the engine until the through bolts rest onto the slots in the frame brackets.

4. Tighten the through bolt nuts to 94 N.m (70 ft. lbs.).
5. Install the oil drain trough.
6. Install the engine oil filter.
7. Lower the vehicle.
8. Install the viscous fan.
9. Reconnect the negative battery cable.

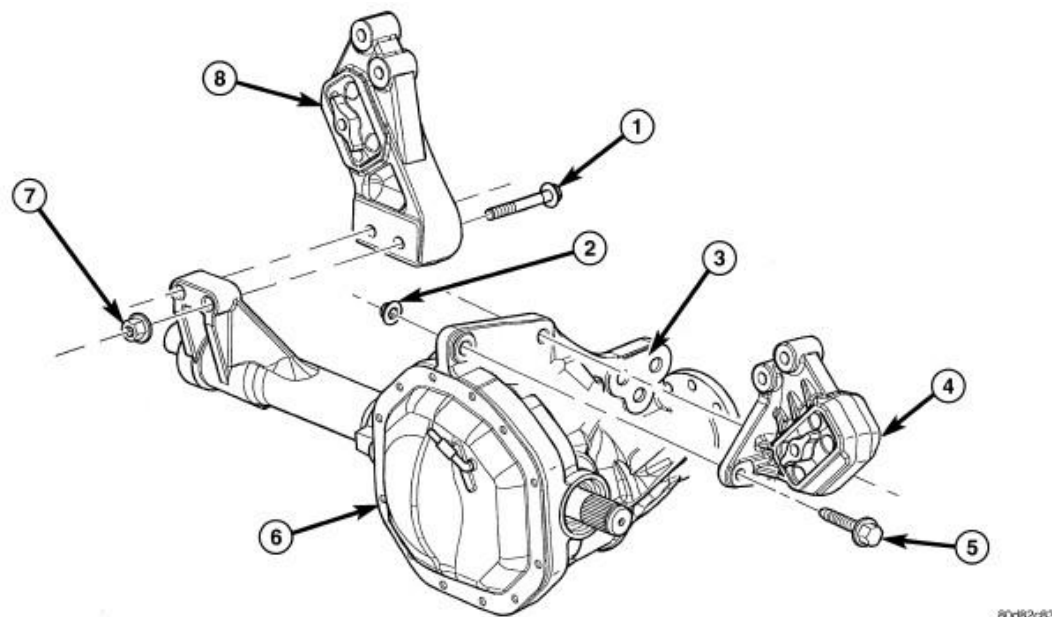
4WD

Fig. 151: Engine Insulator Mounts - 4x4
Courtesy of CHRYSLER GROUP, LLC

1 - RH INSULATOR TO AXLE BOLT
2 - NUT
3 - PINION SUPPORT MOUNT
4 - LH INSULATOR MOUNT
5 - LH INSULATOR TO AXLE BOLT
6 - FRONT AXLE
7 - NUT
8 - RH INSULATOR MOUNT

NOTE: For mount to engine block and left engine bracket to front axle bolts, apply Mopar® Lock and Seal Adhesive, Medium Strength Threadlocker.

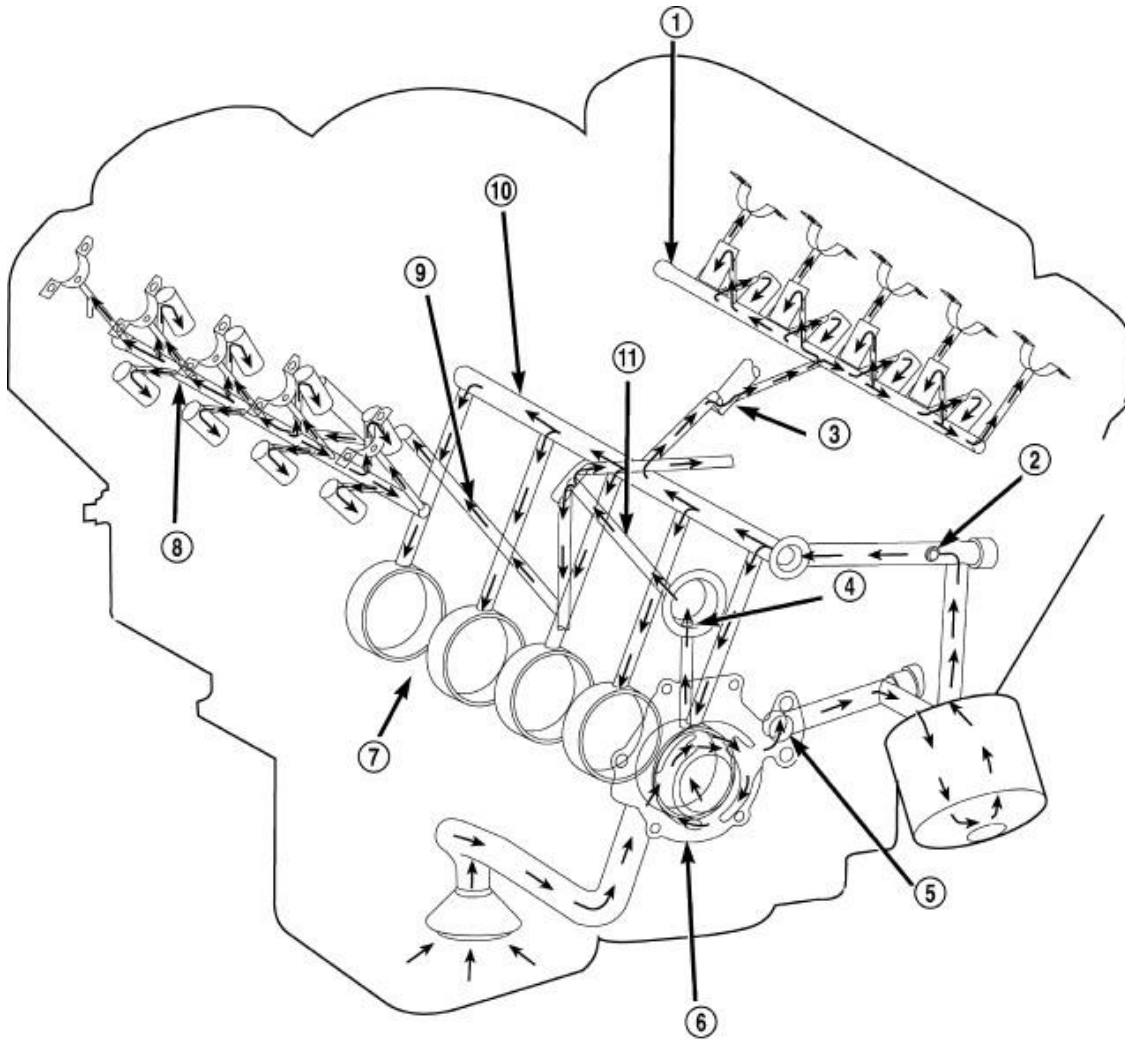
1. Install the right and left side engine mounts (4, 8) to the front axle (6). Torque nuts to 94 N.m (70 ft. lbs.).
2. Raise the front axle into the frame and install the left and right side through bolts. Torque nuts to 94 N.m (70 ft. lbs.).

3. Insert the two upper through bolts into the right and left side engine mounts and loose assemble the two nuts onto the through bolts.
4. Lower the engine until the left and right side engine brackets rest on the through bolts, and the lower engine bracket through holes align with the engine mounts, and the left engine bracket holes align with the front axle slots.
5. Loose assemble the (3) bolts that attach the front axle to the left engine bracket.
6. Loose assemble the lower through bolts.
7. Torque the nuts for the (4) through bolts to 101 N.m (75 ft. lbs.).
8. Torque the (3) bolts that attach the front axle to the left engine bracket to 101 N.m (75 ft. lbs.).
9. Install the oil drain trough.
10. Install the engine oil filter.
11. Install the front crossmember.
12. Install the skid plate.
13. Lower the vehicle.
14. Install the viscous fan.
15. Reconnect the negative battery cable.

LUBRICATION

DESCRIPTION

DESCRIPTION



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Fig. 152: Engine Oil Lubrication System
Courtesy of CHRYSLER GROUP, LLC

1 - LEFT CYLINDER HEAD OIL GALLERY
2 - OIL PRESSURE SENSOR LOCATION
3 - TO LEFT CYLINDER HEAD
4 - OIL FEED TO IDLER SHAFT
5 - OIL PUMP OUTLET TO BLOCK
6 - OIL PUMP
7 - TO CRANKSHAFT MAIN JOURNALS
8 - RIGHT CYLINDER HEAD OIL GALLERY
9 - TO RIGHT CYLINDER HEAD
10 - CYLINDER BLOCK MAIN GALLERY
11 - OIL FEED TO BOTH SECONDARY TENSIONERS

The lubrication system is a full flow filtration pressure feed type.

OPERATION

OPERATION

Oil from the oil pan is pumped by a gerotor type oil pump directly mounted to the crankshaft nose. Oil pressure is controlled by a relief valve mounted inside the oil pump housing.

The camshaft exhaust valve lobes and rocker arms are lubricated through a small hole in the rocker arm; oil flows through the lash adjuster then through the rocker arm and onto the camshaft lobe. Due to the orientation of the rocker arm, the camshaft intake lobes are not lubed in the same manner as the exhaust lobes. The intake lobes are lubed through internal passages in the camshaft. Oil flows through a bore in the number 3 camshaft bearing bore, and as the camshaft turns, a hole in the camshaft aligns with the hole in the camshaft bore allowing engine oil to enter the camshaft tube. The oil then exits through 1.6 mm (0.063 in.) holes drilled into the intake lobes, lubricating the lobes and the rocker arms.

ENGINE BLOCK LUBRICATION FLOW CHART : TABLE 1

FROM	TO
Oil Pickup Tube	Oil Pump
Oil Pump	Oil Filter
Oil Filter	Block Main Oil Gallery
Block Main Oil Gallery	1. Crankshaft Main Journal 2. Left Cylinder Head* 3. Right Cylinder Head*
Crankshaft Main Journals	Crankshaft Rod Journals
Crankshaft Number One Main Journal	1. Front Timing Chain Idler Shaft 2. Both Secondary Chain Tensioners
Left Cylinder Head	See Table 2 below
Right Cylinder Head	See Table 2 below
* The cylinder head gaskets have an oil restrictor to control oil flow to the cylinder heads.	

CYLINDER HEADS LUBRICATION FLOW CHART: TABLE 2

FROM	TO
Cylinder Head Oil Port (in bolt hole)	Diagonal Cross Drilling to Main Oil Gallery
Main Oil Gallery (drilled through head from rear to front)	1. Base of Camshaft Towers 2. Lash Adjuster Towers
Base of Camshaft Towers	Vertical Drilling Through Tower to Camshaft Bearings**
Lash Adjuster Towers	Diagonal Drillings to Hydraulic Lash Adjuster Pockets
** The number three camshaft bearing journal feeds oil into the hollow camshaft tubes. Oil is routed to the intake lobes, which have oil passages drilled into them to lubricate the rocker arms.	

DIAGNOSIS AND TESTING

CHECKING ENGINE OIL PRESSURE

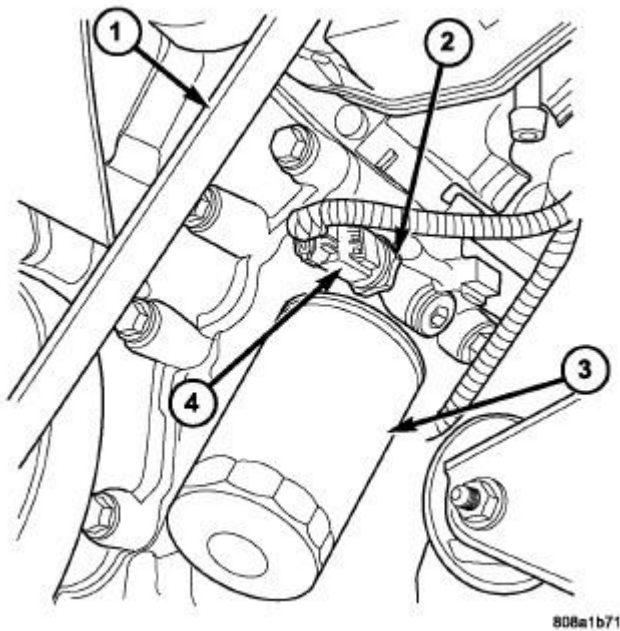


Fig. 153: Belt, Oil Pressure Sensor, Oil Filter & Connector
Courtesy of CHRYSLER GROUP, LLC

1 - BELT
2 - OIL PRESSURE SENSOR
3 - OIL FILTER
4 - ELEC. CONNECTOR

1. Remove oil pressure sending unit (2) and install gauge assembly (special tool #C-3292A, Gauge, Pressure). Refer to **Fig. 153**.
2. Run engine until thermostat opens.
3. Oil Pressure:
 - Curb Idle - 25 kPa (4 psi) minimum
 - 3000 rpm - 170 - 758 kPa (25 - 110 psi)
4. If oil pressure is 0 at idle, shut off engine. Check for a clogged oil pick-up screen or a pressure relief valve stuck open.

ENGINE OIL LEAK

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

1. Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.

2. Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.
3. Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair per service information instructions.
4. If dye is not observed, drive the vehicle at various speeds for approximately 24 km (15 miles), and repeat inspection.

If the oil leak source is not positively identified at this time, proceed with the AIR LEAK DETECTION TEST METHOD below.

AIR LEAK DETECTION TEST METHOD

1. Disconnect the breather cap to air cleaner hose at the breather cap end. Cap or plug breather cap nipple.
2. Remove the PCV valve from the cylinder head cover. Cap or plug the PCV valve grommet.
3. Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kPa (3 PSI) of test pressure.

4. Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provide the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service information procedures.
5. If the leakage occurs at the rear oil seal area, refer to the information, INSPECTION FOR REAR SEAL AREA LEAK below.
6. If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the PCV valve and breather cap hose.
7. Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
 1. Circular spray pattern generally indicates seal leakage or crankshaft damage.
 2. Where leakage tends to run straight down, possible causes are a porous block, oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces.

4. If no leaks are detected, pressurize the crankcase as outlined in the, **OIL CONSUMPTION TEST AND DIAGNOSIS**.

CAUTION: Do not exceed 20.6 kPa (3 psi).

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

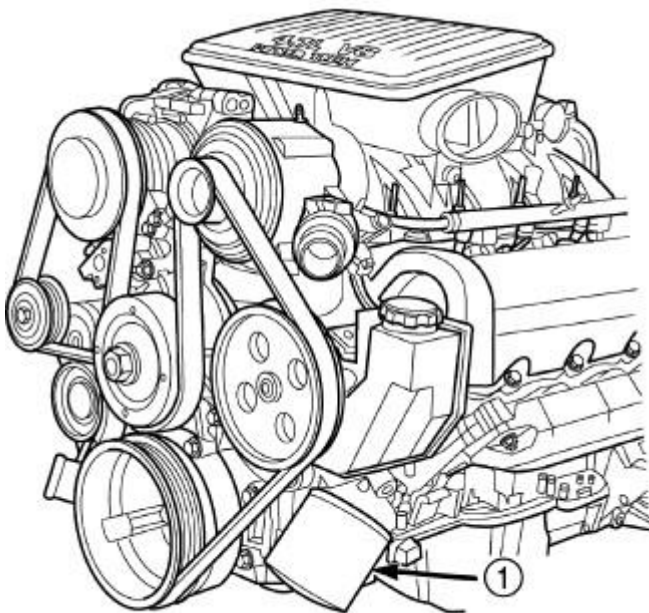
CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

FILTER, ENGINE OIL

REMOVAL

REMOVAL



80b76f61

Fig. 154: Oil Filter - 4.7L Engine
Courtesy of CHRYSLER GROUP, LLC

1 - ENGINE OIL FILTER

All engines are equipped with a high quality full-flow, disposable type oil filter. Chrysler Corporation recommends a Mopar® or equivalent oil filter be used.

1. Position a drain pan under the oil filter.
2. Using a suitable oil filter wrench loosen filter.
3. Rotate the oil filter counterclockwise to remove it from the cylinder block oil filter boss. Refer to **Fig. 154**.
4. When filter separates from cylinder block oil filter boss, tip gasket end upward to minimize oil spill. Remove filter from vehicle.

NOTE: Make sure filter gasket was removed with filter.

5. With a wiping cloth, clean the gasket sealing surface of oil and grime.

INSTALLATION

INSTALLATION

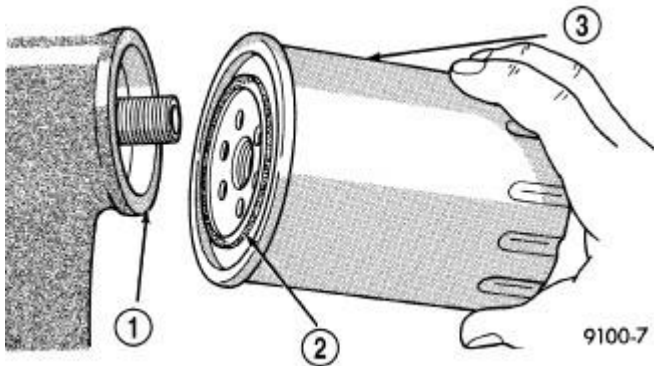


Fig. 155: Installing Engine Oil Filter
Courtesy of CHRYSLER GROUP, LLC

- | |
|---------------------|
| 1 - SEALING SURFACE |
| 2 - RUBBER GASKET |
| 3 - OIL FILTER |

1. Lightly lubricate oil filter gasket (2) with engine oil. Refer to **Fig. 155**.
2. Thread filter (3) onto adapter nipple. When gasket makes contact with sealing surface, hand tighten filter one full turn, do not over tighten.
3. Add oil, verify crankcase oil level and start engine. Inspect for oil leaks.

OIL

STANDARD PROCEDURE

STANDARD PROCEDURE - ENGINE OIL SERVICE

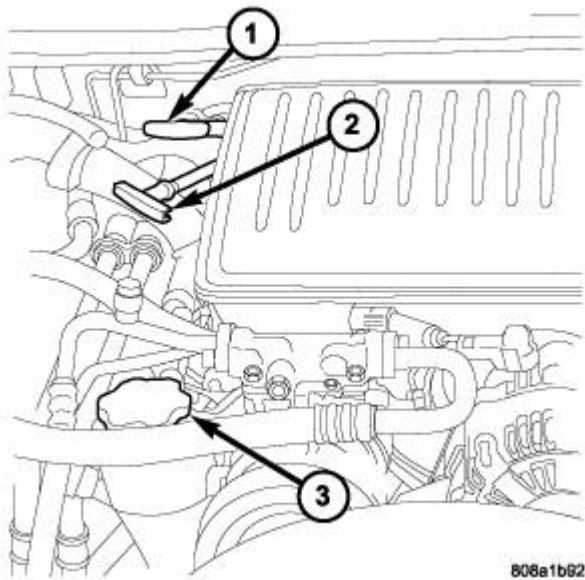


Fig. 156: Transmission And Engine Oil Dipsticks & Engine Oil Fill Cap
Courtesy of CHRYSLER GROUP, LLC

1 - TRANSMISSION DIPSTICK
2 - ENGINE OIL DIPSTICK
3 - ENGINE OIL FILL CAP

The engine oil level indicator (2) is located at the right rear of the engine on the 4.7L engines.

CRANKCASE OIL LEVEL INSPECTION

CAUTION: Do not overfill crankcase with engine oil, pressure loss or oil foaming can result.

Inspect engine oil level approximately every 800 kilometers (500 miles). Unless the engine has exhibited loss of oil pressure, run the engine for about five minutes before checking oil level. Checking engine oil level on a cold engine is not accurate.

To ensure proper lubrication of an engine, the engine oil must be maintained at an acceptable level. The acceptable levels are indicated between the ADD and SAFE marks on the engine oil dipstick.

1. Position vehicle on level surface.
2. With engine OFF, allow approximately ten minutes for oil to settle to bottom of crankcase, remove engine oil dipstick.
3. Wipe dipstick clean.
4. Install dipstick and verify it is seated in the tube.
5. Remove dipstick, with handle held above the tip, take oil level reading.
6. Add oil only if level is below the ADD mark on dipstick.

ENGINE OIL CHANGE

Change engine oil at mileage and time intervals described in Maintenance Schedules.

Run engine until achieving normal operating temperature.

1. Position the vehicle on a level surface and turn engine off.
2. Hoist and support vehicle on safety stands.
3. Remove oil fill cap.
4. Place a suitable drain pan under crankcase drain.
5. Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug if damaged.
6. Install drain plug in crankcase. Torque to 34 N.m (25 ft. lbs.).
7. Lower vehicle and fill crankcase with specified type and amount of engine oil described in this information.
8. Install oil fill cap.
9. Start engine and inspect for leaks.
10. Stop engine and inspect oil level.

NOTE: Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the **WARNING** at beginning of this service information.

PAN, OIL**REMOVAL****REMOVAL**

1. Disconnect the negative battery cable.
2. Install engine support fixture special tool (special tool #8534B, Fixture, Driveline Support). **Do not raise engine at this time.**
3. Loosen both left and right side engine mount through bolts. Do not remove bolts.
4. Remove the structural dust cover, if equipped.
5. Drain engine oil.
6. Disconnect transmission fluid cooler lines at radiator, transmission fittings and clips.

NOTE: When disconnecting the transmission oil cooler lines, it is necessary to replace the line clip that is located on the oil pan stud. The retention force of the clip is severely degraded upon removal.

7. Remove the front crossmember. Refer to **CROSSMEMBER, LOWER CONTROL ARM, REMOVAL** and **CROSSMEMBER, TRANSMISSION, REMOVAL**.

CAUTION: Only raise the engine enough to provide clearance for oil pan removal. Check for proper clearance at fan shroud to fan and cowl to intake manifold.

8. Raise engine using special tool (special tool #8534B, Fixture, Driveline Support) to provide clearance to remove oil pan.

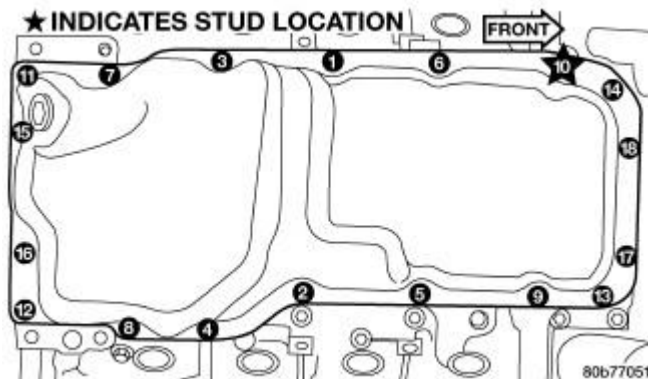


Fig. 157: Oil Pan Bolt Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

NOTE: Do not pry on oil pan or oil pan gasket. Gasket is integral to engine windage tray and does not come out with oil pan.

9. Remove the oil pan mounting bolts and oil pan.
10. Unbolt oil pump pickup tube and remove tube.
11. Inspect the integral windage tray and gasket and replace as needed.

INSTALLATION

INSTALLATION

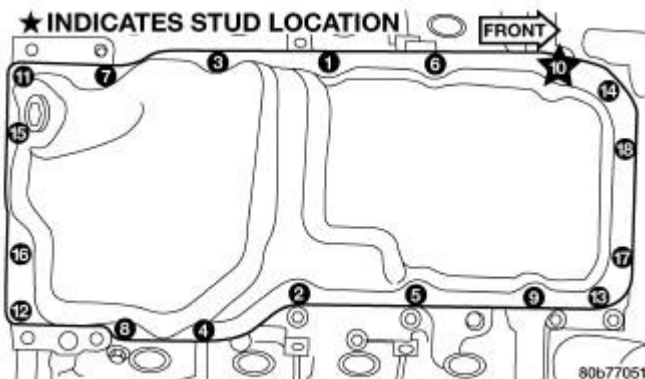


Fig. 158: Oil Pan Bolt Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

1. Clean the oil pan gasket mating surface of the bedplate and oil pan.
2. Position the oil pan gasket and pickup tube with new o-ring. Install the mounting bolt and nuts. Tighten bolt and nuts to 28 N.m (20 ft. lbs.).
3. Position the oil pan and install the mounting bolts. Tighten the mounting bolts to 15 N.m (11 ft. lbs.) in the sequence shown in illustration.
4. Lower the engine into mounts using special tool (special tool #8534B, Fixture, Driveline Support).
5. Install both the left and right side engine mount through bolts. Tighten the nuts to 68 N.m (50 ft. lbs.).
6. Remove special tool (special tool #8534B, Fixture, Driveline Support).
7. Connect cooler lines to radiator, transmission and clips.

NOTE: When connecting the transmission oil cooler lines, it is necessary to replace the line clip that is located on the oil pan stud. The retention force of the clip is severely degraded upon removal.

8. Install structural dust cover, if equipped.
9. Install the front crossmember. Refer to **CROSSMEMBER, LOWER CONTROL ARM, INSTALLATION** and **CROSSMEMBER, TRANSMISSION, INSTALLATION**.
10. Fill engine oil.
11. Reconnect the negative battery cable.
12. Start engine and check for leaks.

PUMP, ENGINE OIL

REMOVAL

REMOVAL

1. Remove the oil pan and pick-up tube. Refer to **PAN, OIL, REMOVAL, 4.7L**.
2. Remove the timing chain cover. Refer to **COVER(S), ENGINE TIMING, REMOVAL, 4.7L**.
3. Remove the timing chains and tensioners. Refer to **CHAIN AND SPROCKETS, TIMING, REMOVAL, 4.7L**.
4. Remove the four bolts, primary timing chain tensioner and the oil pump.

DISASSEMBLY

DISASSEMBLY

1. Remove oil pump cover screws and lift off cover plate.
2. Remove pump inner and outer rotors.

NOTE: Once the oil pressure relief valve, cup plug, and pin are removed, the pump assembly must be replaced.

3. If it is necessary to remove the pressure relief valve, drive the roll pin from pump housing and remove cup plug, spring and valve.

CLEANING**CLEANING**

1. Wash all parts in a suitable solvent.

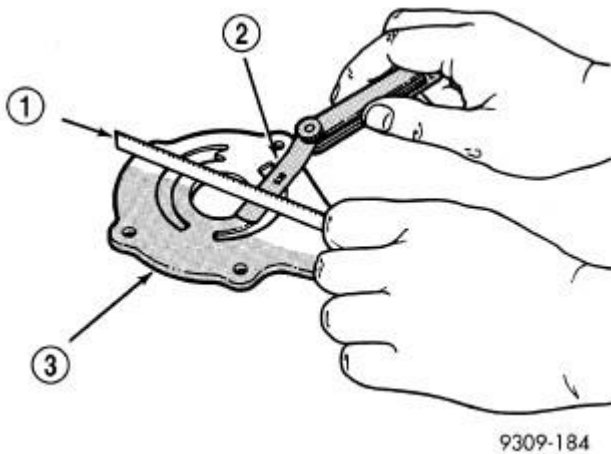
INSPECTION**INSPECTION**

Fig. 159: Checking Cover Surface

Courtesy of CHRYSLER GROUP, LLC

- | |
|--------------------|
| 1 - STRAIGHT EDGE |
| 2 - FEELER GAUGE |
| 3 - OIL PUMP COVER |

CAUTION: The oil pump pressure relief valve and spring should not be removed from the oil pump. If these components are disassembled and or removed from the pump the entire oil pump assembly must be replaced.

1. Clean all parts thoroughly. Mating surface of the oil pump housing should be smooth. If the pump cover is scratched or grooved the oil pump assembly should be replaced.
2. Lay a straight edge across the pump cover surface (3). If a 0.025 mm (0.001 in.) feeler gauge (2) can be inserted between the cover and the straight edge the oil pump assembly should be replaced.

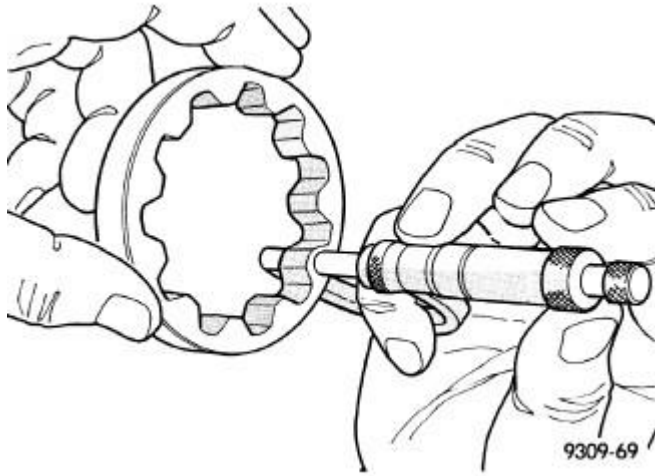


Fig. 160: Measuring Outer Rotor Thickness
Courtesy of CHRYSLER GROUP, LLC

3. Measure the thickness of the outer rotor. If the outer rotor thickness measures at 12.005 mm (0.472 in.) or less the oil pump assembly must be replaced.
4. Measure the diameter of the outer rotor. If the outer rotor diameter measures at 85.925 mm (3.382 in.) or less the oil pump assembly must be replaced.

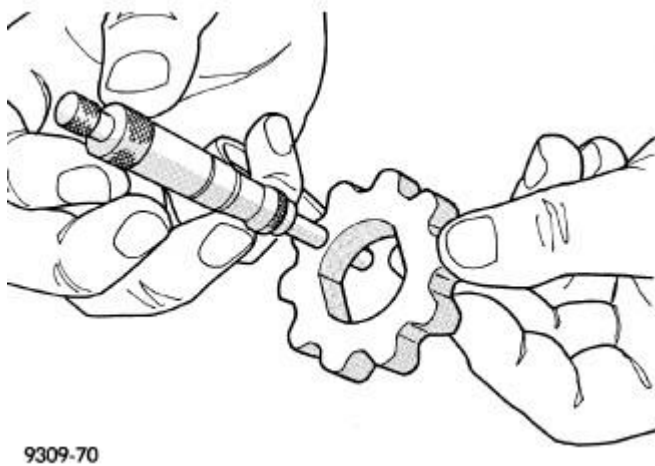
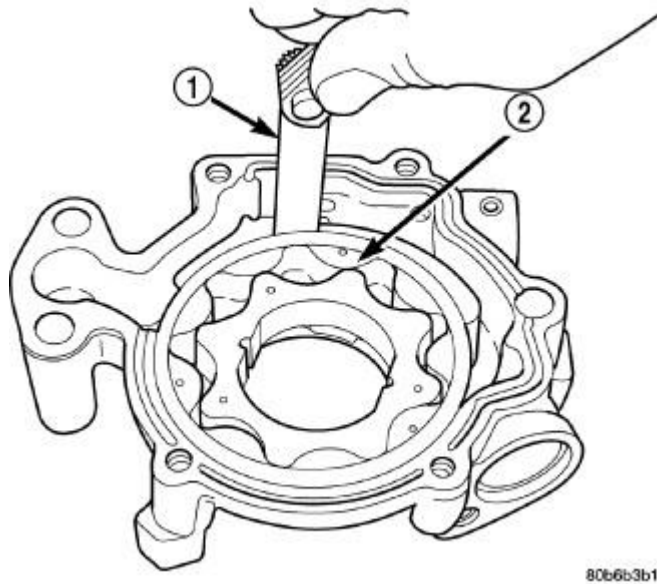


Fig. 161: Measuring Inner Rotor Thickness
Courtesy of CHRYSLER GROUP, LLC

5. Measure the thickness of the inner rotor. If the inner rotor thickness measures at 12.005 mm (0.472 in.) or less then the oil pump assembly must be replaced.



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Fig. 162: Measuring Clearance Between Outer Rotor & Body
Courtesy of CHRYSLER GROUP, LLC

1 - FEELER GAUGE
2 - OUTER ROTOR

6. Slide outer rotor (2) into the body of the oil pump. Press the outer rotor to one side of the oil pump body and measure clearance between the outer rotor and the body. If the measurement is 0.235 mm (0.009 in.) or more the oil pump assembly must be replaced.

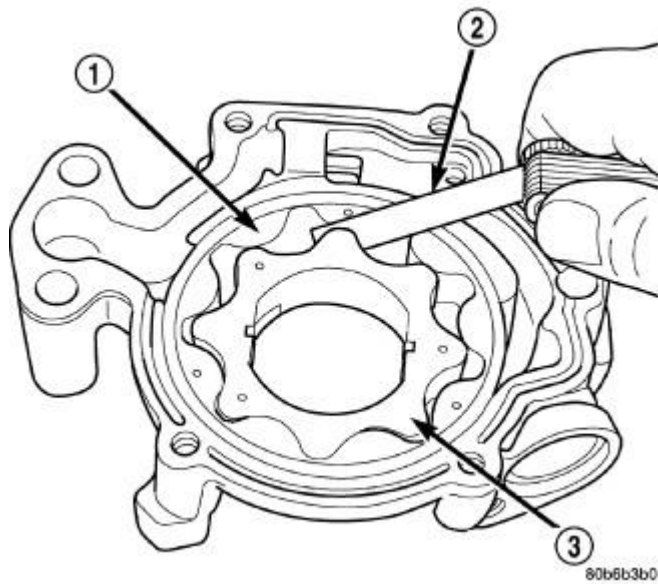


Fig. 163: Measuring Clearance Between Rotors
Courtesy of CHRYSLER GROUP, LLC

1 - OUTER ROTOR
2 - FEELER GAUGE
3 - INNER ROTOR

7. Install the inner rotor into the oil pump body. Measure the clearance between the inner (3) and outer (1) rotors. If the clearance between the rotors is 0.150 mm (0.006 in.) or more the oil pump assembly must be replaced.

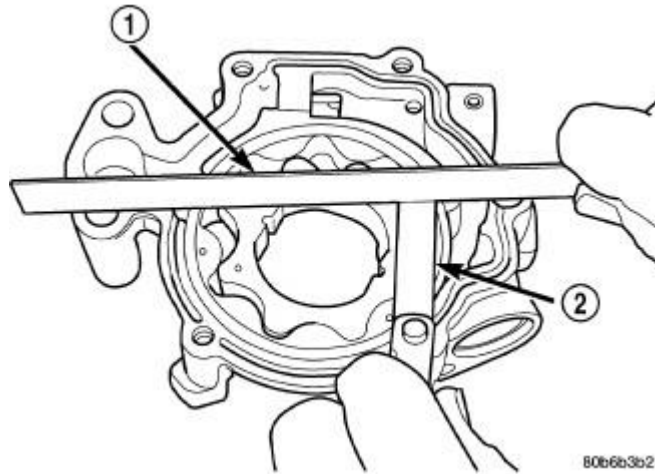


Fig. 164: Measuring Clearance Over Rotors
Courtesy of CHRYSLER GROUP, LLC

1 - STRAIGHT EDGE
2 - FEELER GAUGE

8. Place a straight edge (1) across the body of the oil pump (between the bolt holes), if a feeler gauge (2) of 0.095 mm (0.0038 in.) or greater can be inserted between the straightedge and the rotors, the pump must be replaced.

NOTE: The 3.7L/4.7L Oil pump is released as an assembly. There are no Chrysler part numbers for Sub-Assembly components. In the event the oil pump is not functioning or out of specification it must be replaced as an assembly.

ASSEMBLY

ASSEMBLY

1. Wash all parts in a suitable solvent and inspect carefully for damage or wear.
2. Install inner and outer rotors
3. Install oil pump cover plate and install cover bolts and tighten them to 12 N.m (105 in. lbs.).
4. Prime oil pump before installation by filling rotor cavity with engine oil.
5. If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other causes for oil pressure loss.

INSTALLATION

INSTALLATION

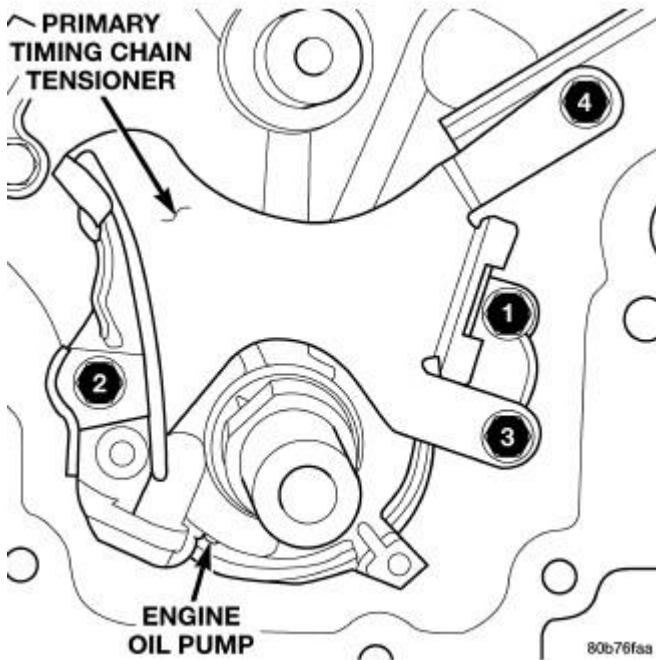


Fig. 165: Oil Pump & Primary Timing Chain Tensioner Tightening Sequence
 Courtesy of CHRYSLER GROUP, LLC

1. Position the oil pump onto the crankshaft and install one oil pump retaining bolt.
2. Position the primary timing chain tensioner and install three retaining bolts.
3. Tighten the oil pump and primary timing chain tensioner retaining bolts to 28 N.m (250 in. lbs.) in the sequence shown in illustration.
4. Install the secondary timing chain tensioners and timing chains. Refer to **CHAIN AND SPROCKETS, TIMING, INSTALLATION, 4.7L.**

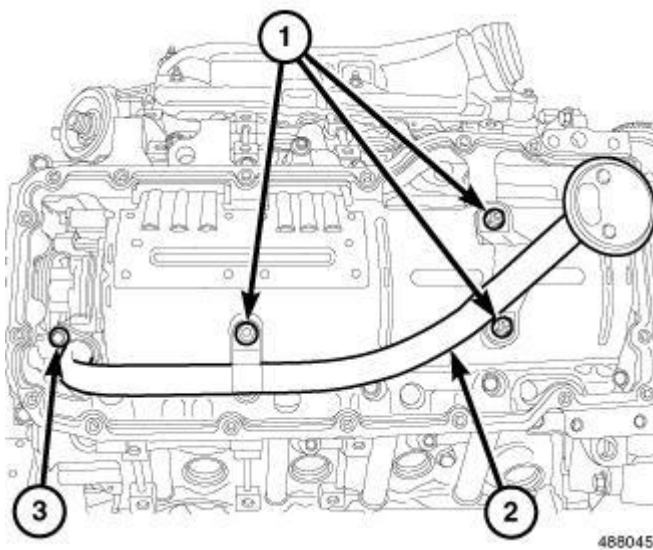


Fig. 166: Oil Pickup Tube & Fasteners
 Courtesy of CHRYSLER GROUP, LLC

5. Install the timing chain cover. Refer to **COVER(S), ENGINE TIMING, INSTALLATION, 4.7L.**
6. Install the pick-up tube and oil pan. Refer to **PAN, OIL, INSTALLATION, 4.7L.**

SWITCH, OIL PRESSURE

DESCRIPTION

DESCRIPTION

The oil pressure switch is a pressure sensitive switch that is activated by the engine's oil pressure (in the main oil gallery). The switch is a two terminal device (one terminal is provided to the wiring harness and the other terminal is the switch's metal housing that screws into the engine block).

OPERATION

OPERATION

The oil pressure switch is normally "Closed." The switch changes from a "Closed" circuit to an "Open" circuit, on increasing pressure of 7 psig. The oil pressure switch changes from an "Open" circuit to a "Closed" circuit, on decreasing pressure, between 2 psig and 4 psig.

REMOVAL

REMOVAL

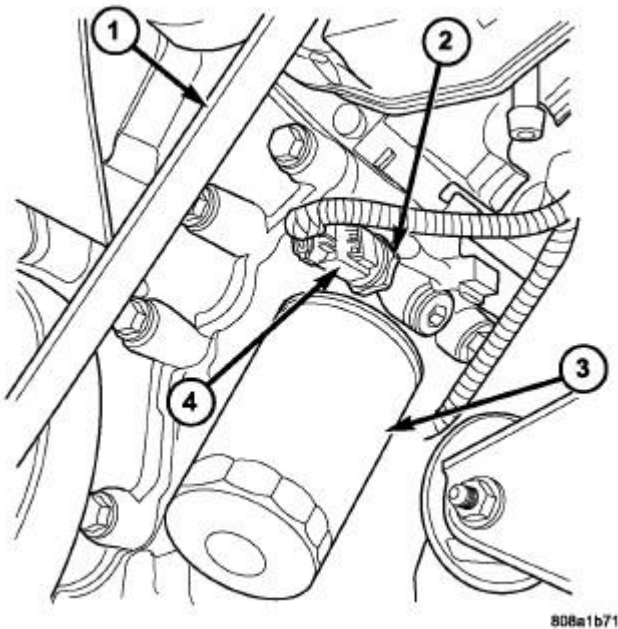


Fig. 167: Belt, Oil Pressure Sensor, Oil Filter & Connector
Courtesy of CHRYSLER GROUP, LLC

- | |
|-------------------------|
| 1 - BELT |
| 2 - OIL PRESSURE SENSOR |
| 3 - OIL FILTER |
| 4 - ELEC. CONNECTOR |

1. Disconnect the negative cable from the battery.
2. Raise vehicle on hoist.
3. Remove front splash shield.
4. Disconnect oil pressure sender wire (4).
5. Remove the pressure sender (2). Refer to **Fig. 167**.

INSTALLATION

INSTALLATION

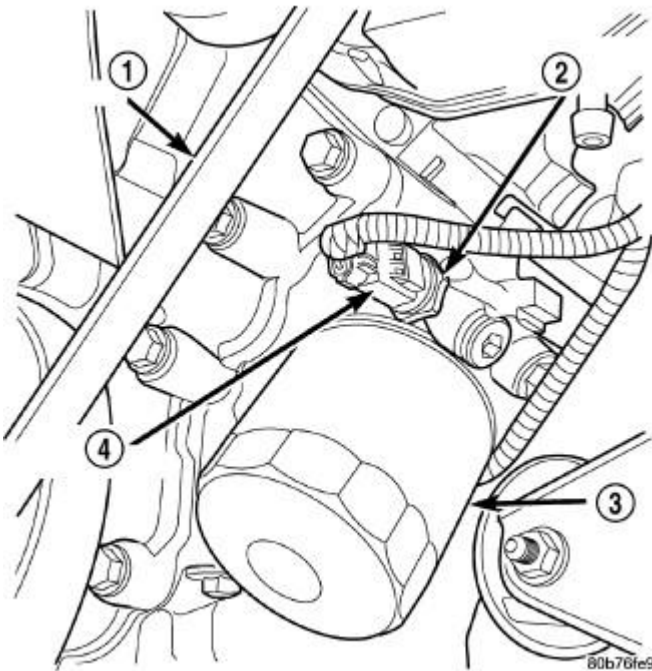


Fig. 168: Belt, Oil Pressure Sensor, Oil Filter & Connector
 Courtesy of CHRYSLER GROUP, LLC

1. Install oil pressure sender (2).
2. Connect oil pressure sender wire (4).
3. Install front splash shield.
4. Lower vehicle.
5. Connect the negative battery cable.

MANIFOLDS

MANIFOLD, EXHAUST

DESCRIPTION

DESCRIPTION

The exhaust manifolds are log style with a patented flow enhancing design to maximize performance. The exhaust manifolds are made of high silicon molybdenum cast iron. A perforated core graphite exhaust manifold gasket is used to improve sealing to the cylinder head. The exhaust manifolds are covered by a three layer laminated heat shield for thermal protection and noise reduction. The heat shields are fastened with a torque prevailing nut that is backed off slightly to allow for the thermal expansion of the exhaust manifold.

REMOVAL

REMOVAL

RIGHT EXHAUST MANIFOLD

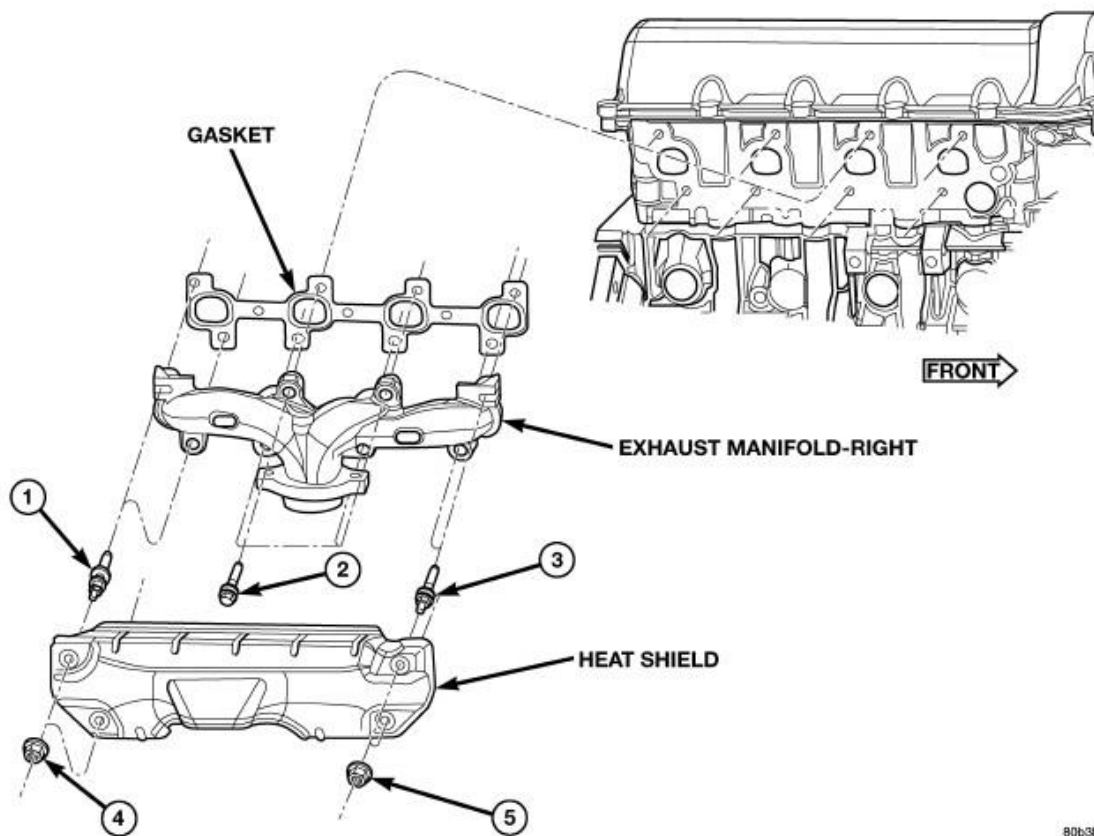


Fig. 169: Right Exhaust Manifold Assembly
Courtesy of CHRYSLER GROUP, LLC

ITEM	DESCRIPTION	TORQUE	ITEM	DESCRIPTION	TORQUE
1	Stud (Qty 2)		4	Nut (Qty 2)	8 N.m (72 in. lbs.), then

2012 RAM Pickup 2500

2012 ENGINE 4.7L - Service Information - Ram Pickup

2	Bolt (Qty 4)	25 N.m (18 ft. lbs.)	5	Nut (Qty 2)	loosen 45 degrees
3	Stud (Qty 2)				

1. Disconnect the negative battery cable.
2. Remove the air cleaner assembly. Refer to **BODY, AIR CLEANER, REMOVAL, 4.7L**.
3. Remove the accessory drive belt. Refer to **BELT, SERPENTINE, REMOVAL**.
4. Remove the A/C compressor. Refer to **COMPRESSOR, A/C, REMOVAL**.
5. Remove A/C accumulator support bracket fastener.
6. Drain the coolant below heater hose level. Refer to **STANDARD PROCEDURE**.
7. Remove the heater hoses at the engine.
8. Remove the exhaust manifold heat shield retaining nuts (4, 5) and remove the heat shield.
9. Remove the upper exhaust manifold retaining bolts (1, 2, 3).
10. Raise and support the vehicle.

CAUTION: When servicing or replacing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust to hang by the oxygen sensor wires will damage the harness and/or sensor.

11. Saturate the exhaust pipe/catalytic converter assembly flanged nuts at the exhaust manifold with heat valve lubricant, allow 5 minutes for penetration.

NOTE: If separating the exhaust pipe/catalytic converter at the exhaust manifold flange. New bolts will be required.

12. Separate the exhaust pipe/catalytic converter at the exhaust manifold flange. Discard the bolts.
13. Remove the starter. Refer to **STARTER, REMOVAL**.
14. Remove the lower exhaust manifold retaining bolts (1, 2, 3).

NOTE: The exhaust manifold is removed from below the engine compartment.

15. Remove the exhaust manifold and gasket.
16. Clean the mating surfaces.

LEFT EXHAUST MANIFOLD

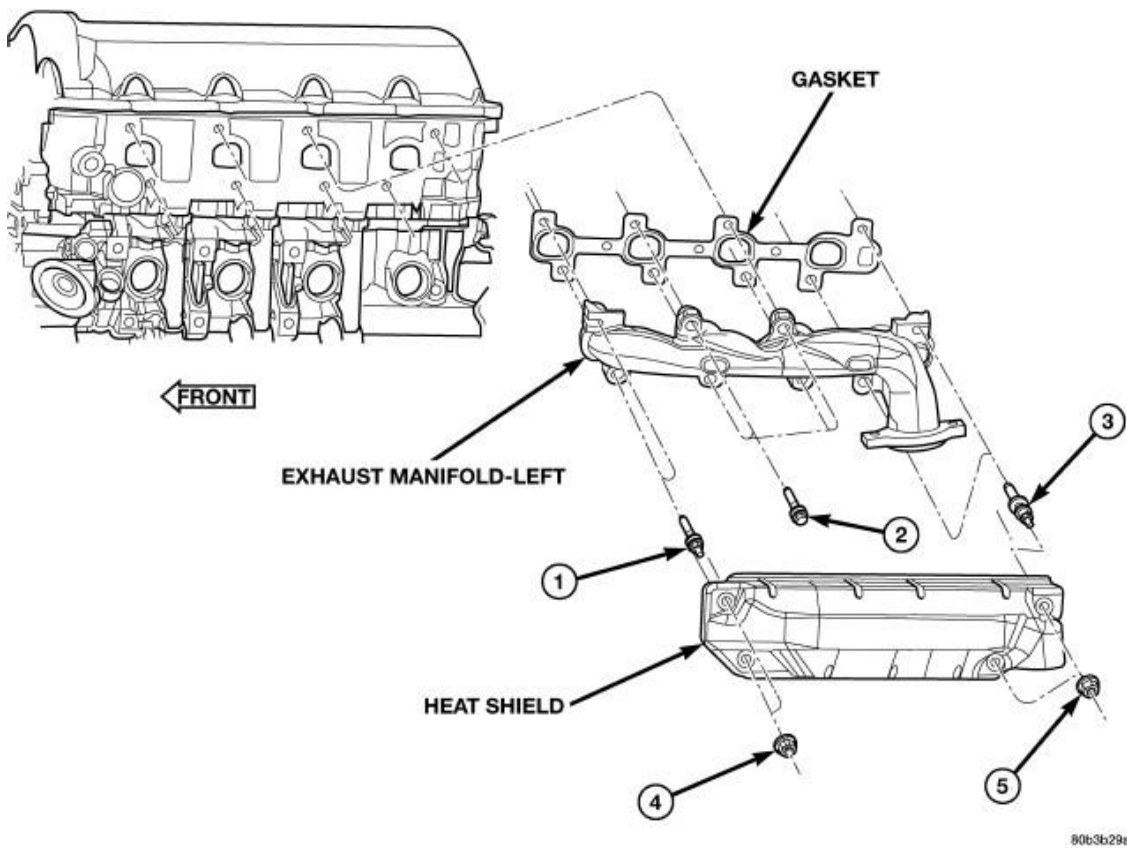


Fig. 170: Left Exhaust Manifold Assembly
Courtesy of CHRYSLER GROUP, LLC

ITEM	DESCRIPTION	TORQUE	ITEM	DESCRIPTION	TORQUE
1	Stud (Qty 2)	25 N.m (18 ft. lbs.)	4	Nut (Qty 2)	8 N.m (72 in. lbs.), then loosen 45 degrees
2	Bolt (Qty 4)		5	Nut (Qty 2)	
3	Stud (Qty 2)				

1. Disconnect the negative battery cable.
2. Remove the engine cover.
3. Remove the front two exhaust manifold heat shield retaining nuts (4).
4. Raise and support the vehicle.

CAUTION: When servicing or replacing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust to hang by the oxygen sensor wires will damage the harness and/or sensor.

5. Saturate the exhaust pipe/catalytic converter assembly flanged nuts at the exhaust manifold with heat valve lubricant, allow 5 minutes for penetration.

NOTE: If separating the exhaust pipe/catalytic converter at the exhaust manifold flange. New bolts will be required.

6. Separate the exhaust pipe/catalytic converter at the exhaust manifold flange. Discard the bolts.
7. Remove the rear heat shield (5) retaining nuts and remove the heat shield.
8. Lower the vehicle.
9. Remove the upper exhaust manifold retaining bolts (1, 2, 3).

NOTE: The exhaust manifold is removed from below the engine compartment.

10. Raise and support the vehicle.
11. Remove the lower exhaust manifold retaining bolts (1, 2, 3).
12. Remove the exhaust manifold and gasket.
13. Clean the mating surfaces.

CLEANING

CLEANING

1. Clean the exhaust manifold using a suitable cleaning solvent, then allow to air dry.
2. Clean all gasket residue from the manifold mating surface.

INSPECTION

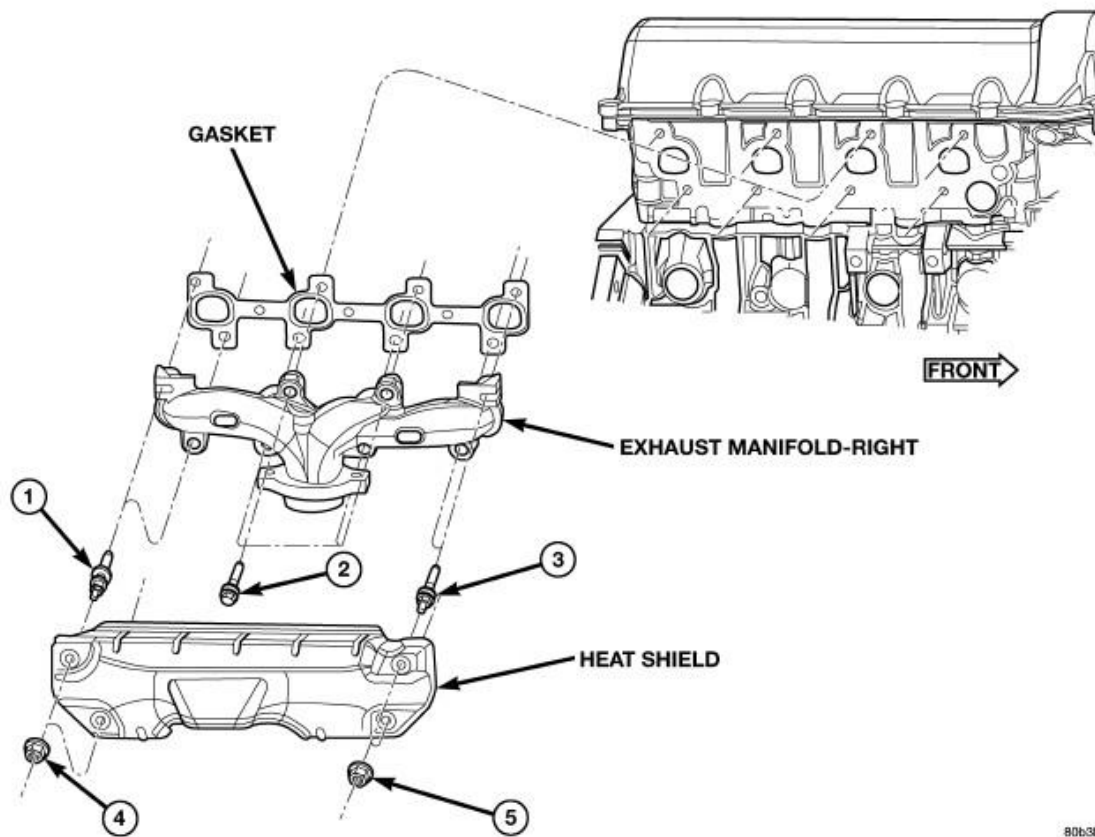
INSPECTION

1. Inspect the exhaust manifold for cracks in the mating surface and at every mounting bolt hole.
2. Using a straight edge and a feeler gauge, check the mating surface for warp and twist.
3. Inspect the manifold to exhaust pipe mating surface for cracks, gouges, or other damage that would prevent sealing.

INSTALLATION

INSTALLATION

RIGHT EXHAUST MANIFOLD



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Fig. 171: Right Exhaust Manifold Assembly
 Courtesy of CHRYSLER GROUP, LLC

ITEM	DESCRIPTION	TORQUE	ITEM	DESCRIPTION	TORQUE
1	Stud (Qty 2)	25 N.m (18 ft. lbs.)	4	Nut (Qty 2)	8 N.m (72 in. lbs.), then loosen 45 degrees
2	Bolt (Qty 4)		5	Nut (Qty 2)	
3	Stud (Qty 2)				

1. Prior to installation, make sure all gasket mating surfaces are clean and free of any debris.

NOTE: The exhaust manifold is installed from below the engine compartment.

2. Position the exhaust manifold and gasket.

NOTE: Do not tighten exhaust manifold retainers until all retainers are in place.

3. Install the lower exhaust manifold retaining bolts (1, 2, 3).
4. Install the starter. Refer to **STARTER, INSTALLATION**.
5. Lower the vehicle.

6. Install the upper exhaust manifold retaining bolts and tighten starting at center and working outward to 25 N.m (18 ft. lbs.).

CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.

7. Install the exhaust manifold heat shield and tighten retaining nuts (4, 5) to 8 N.m (72 in. lbs.), then loosen 45 degrees.
8. Connect the heater hoses at the engine.
9. Install the A/C accumulator support bracket retainers.
10. Install the A/C compressor. Refer to **COMPRESSOR, A/C, INSTALLATION** .
11. Install the accessory drive belt. Refer to **BELT, SERPENTINE, INSTALLATION** .
12. Raise and support the vehicle.

NOTE: If separating the exhaust pipe/catalytic converter at the exhaust manifold flange. New bolts will be required.

13. Position the exhaust pipe/catalytic converter to the exhaust manifold. Install new bolts.
14. Lower the vehicle.
15. Install air cleaner assembly. Refer to **BODY, AIR CLEANER, INSTALLATION, 4.7L**.
16. Connect the negative battery cable.
17. Fill the cooling system. Refer to **STANDARD PROCEDURE** .
18. Start the engine and check for leaks.

LEFT EXHAUST MANIFOLD

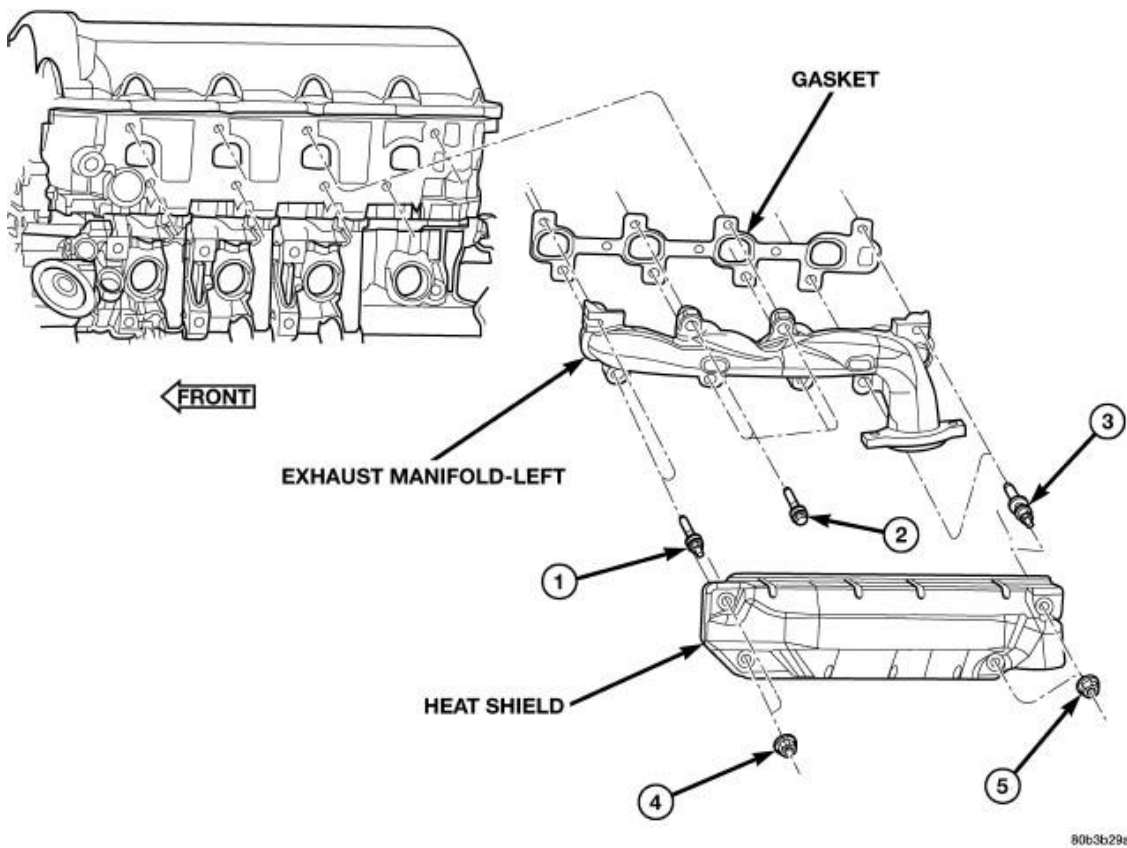


Fig. 172: Left Exhaust Manifold Assembly
Courtesy of CHRYSLER GROUP, LLC

ITEM	DESCRIPTION	TORQUE	ITEM	DESCRIPTION	TORQUE
1	Stud (Qty 2)	25 N.m (18 ft. lbs.)	4	Nut (Qty 2)	8 N.m (72 in. lbs.), then loosen 45 degrees
2	Bolt (Qty 4)		5	Nut (Qty 2)	
3	Stud (Qty 2)				

1. Prior to installation, make sure all gasket mating surfaces are clean and free of any debris.

NOTE: The exhaust manifold is installed from below the engine compartment.

2. Position the exhaust manifold and gasket.

NOTE: Do not tighten exhaust manifold retainers until all retainers are in place.

3. Install the lower exhaust manifold retaining bolts (1, 2, 3).
4. Lower the vehicle.
5. Install the upper exhaust manifold retaining bolts and tighten starting at center and working outward to 25 N.m (18 ft. lbs.).

CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.

6. Install the front two exhaust manifold heat shield retaining nuts (4).
7. Raise and support the vehicle.
8. Install the rear heat shield (5) retaining nuts and tighten all retaining nuts to 8 N.m (72 in. lbs.), then loosen 45 degrees.

NOTE: If separating the exhaust pipe/catalytic converter at the exhaust manifold flange. New bolts will be required.

9. Position the exhaust pipe/catalytic converter to the exhaust manifold. Install new bolts.
10. Lower the vehicle.
11. Install the engine cover.
12. Connect the negative battery cable.
13. Start the engine and check for leaks.

MANIFOLD, INTAKE

DESCRIPTION

DESCRIPTION

The intake manifold is made of a composite material and features long runners which maximizes low end torque. The intake manifold uses single plane sealing which consist of eight individual press in place port gaskets to prevent leaks.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - INTAKE MANIFOLD LEAKAGE

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or the fan. Do not wear loose clothing.

1. Start the engine.
2. Spray a small stream of water at the suspected leak area.
3. If a change in RPM is observed the area of the suspected leak has been found.
4. Repair as required.

REMOVAL

REMOVAL

1. Disconnect negative cable from battery.
2. Remove resonator assembly and air inlet hose.
3. Disconnect throttle and speed control cables.
4. Disconnect electrical connectors for the following components:
 - Manifold Absolute Pressure (MAP) Sensor
 - Intake Air Temperature (IAT) Sensor
 - Throttle Position (TPS) Sensor
 - Coolant Temperature (CTS) Sensor
 - Idle Air Control (IAC) Motor
5. Disconnect brake booster hose and positive crankcase ventilation (PCV) hose.
6. Disconnect generator electrical connections.
7. Disconnect air conditioning compressor electrical connections.
8. Disconnect left and right radio suppressor straps.
9. Disconnect and remove ignition coil towers.
10. Remove top oil dipstick tube retaining bolt and ground strap.
11. Bleed fuel system. Refer to **Fuel System/Fuel Delivery - Standard Procedure** .
12. Remove fuel rail. Refer to **RAIL, FUEL, REMOVAL** and **RAIL, FUEL, REMOVAL** .
13. Remove throttle body assembly and mounting bracket.
14. Drain cooling system below coolant temperature level. Refer to **STANDARD PROCEDURE** .

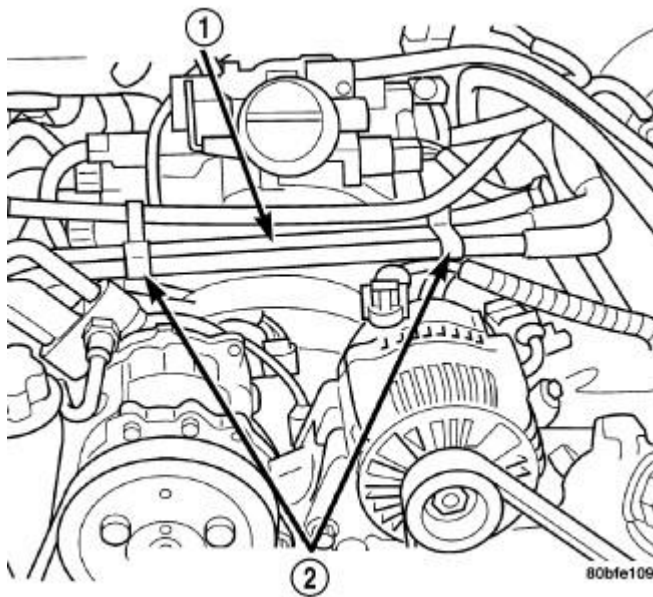


Fig. 173: Heater Hoses & Clips
 Courtesy of CHRYSLER GROUP, LLC

15. Remove the heater hoses (1) from the engine front cover and the heater core.
16. Unclip (2) and remove heater hoses and tubes from intake manifold.
17. Remove coolant temperature sensor.

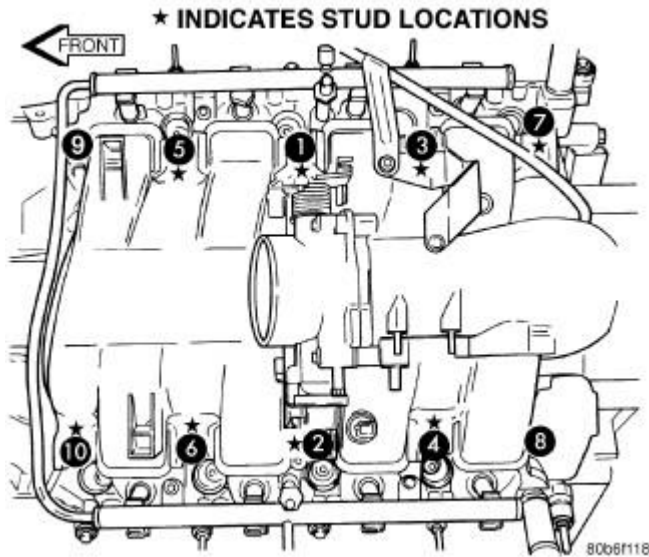


Fig. 174: Intake Manifold Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

18. Remove intake manifold retaining fasteners in reverse order of tightening sequence.
19. Remove intake manifold.

CLEANING

CLEANING

NOTE: There is NO approved repair procedure for the intake manifold. If severe damage is found during inspection, the intake manifold must be replaced.

Before installing the intake manifold thoroughly clean the mating surfaces. Use a suitable cleaning solvent, then air dry.

INSPECTION

INSPECTION

1. Inspect the intake sealing surface for cracks, nicks and distortion.
2. Inspect the intake manifold vacuum hose fittings for looseness or blockage.
3. Inspect the manifold to throttle body mating surface for cracks, nicks and distortion.

INSTALLATION

INSTALLATION

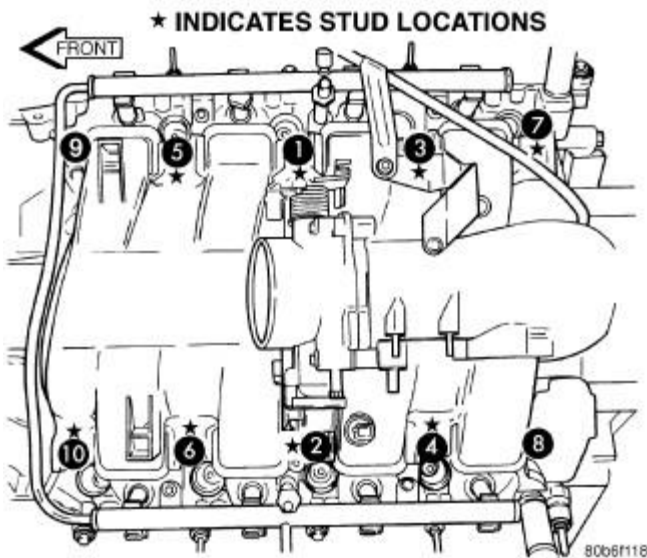


Fig. 175: Intake Manifold Removal/Tightening Sequence
 Courtesy of CHRYSLER GROUP, LLC

1. Install intake manifold gaskets.
2. Position intake manifold.
3. Install intake manifold retaining bolts and tighten in sequence shown in illustration in to 12 N.m (105 in. lbs.).
4. Install left and right radio suppressor straps.
5. Install throttle body assembly.
6. Install throttle cable bracket.
7. Connect throttle cable and speed control cable to throttle body.
8. Install fuel rail. Refer to **RAIL, FUEL, INSTALLATION** and **RAIL, FUEL, INSTALLATION**.
9. Install ignition coil towers.
10. Position and install heater hoses and tubes onto intake manifold.
11. Install the heater hoses to the heater core and engine front cover.
12. Connect electrical connectors for the following components:
 - Manifold Absolute Pressure (MAP) Sensor
 - Intake Air Temperature (IAT) Sensor
 - Throttle Position (TPS) Sensor
 - Coolant Temperature (CTS) Sensor
 - Idle Air Control (IAC) Motor
 - Ignition coil towers
 - Fuel injectors
13. Install top oil dipstick tube retaining bolt and ground strap.

2012 RAM Pickup 2500

2012 ENGINE 4.7L - Service Information - Ram Pickup

9 - CRANKSHAFT SPROCKET

10 - PRIMARY CHAIN TENSIONER

11 - TWO PLATED LINKS ON LEFT CAMSHAFT CHAIN

12 - SECONDARY TENSIONER ARM

The timing drive system has been designed to provide quiet performance and reliability to support a **non-free wheeling** engine. Specifically the intake valves are non-free wheeling and can be easily damaged with forceful engine rotation if camshaft-to-crankshaft timing is incorrect. The timing drive system consists of a primary chain and two secondary timing chain drives.

OPERATION

OPERATION

The primary timing chain is a single inverted tooth type. The primary chain drives the large fifty tooth idler sprocket directly from a 25 tooth crankshaft sprocket. Primary chain motion is controlled by a pivoting leaf spring tensioner arm and a fixed guide. The arm and the guide both use nylon plastic wear faces for low friction and long wear. The primary chain receives oil splash lubrication from the secondary chain drive and oil pump leakage. The idler sprocket assembly connects the primary and secondary chain drives. The idler sprocket assembly consists of two integral 26 tooth sprockets and a fifty tooth sprocket that is splined to the assembly. The spline joint is a non - serviceable press fit anti rattle type. The idler sprocket assembly spins on a stationary idler shaft. The idler shaft is press-fit into the cylinder block. A large washer on the idler shaft bolt and the rear flange of the idler shaft are used to control sprocket thrust movement. Pressurized oil is routed through the center of the idler shaft to provide lubrication for the two bushings used in the idler sprocket assembly.

There are two secondary drive chains, one to drive the camshaft in each SOHC cylinder head. There are no shaft speed changes in the secondary chain drive system. Each secondary chain drives a 26 tooth cam sprocket directly from the 26 tooth sprocket on the idler sprocket assembly. A fixed chain guide and a hydraulic oil damped tensioner are used to maintain tension in each secondary chain system. The hydraulic tensioners for the secondary chain systems are fed pressurized oil from oil reservoir pockets in the block. Each tensioner also has a mechanical ratchet system that limits chain slack if the tensioner piston bleeds down after engine shut down. The tensioner arms and guides also utilize nylon wear faces for low friction and long wear. The secondary timing chains receive lubrication from a small orifice in the tensioners. This orifice is protected from clogging by a fine mesh screen which is located on the back of the hydraulic tensioners.

STANDARD PROCEDURE

MEASURING TIMING CHAIN WEAR

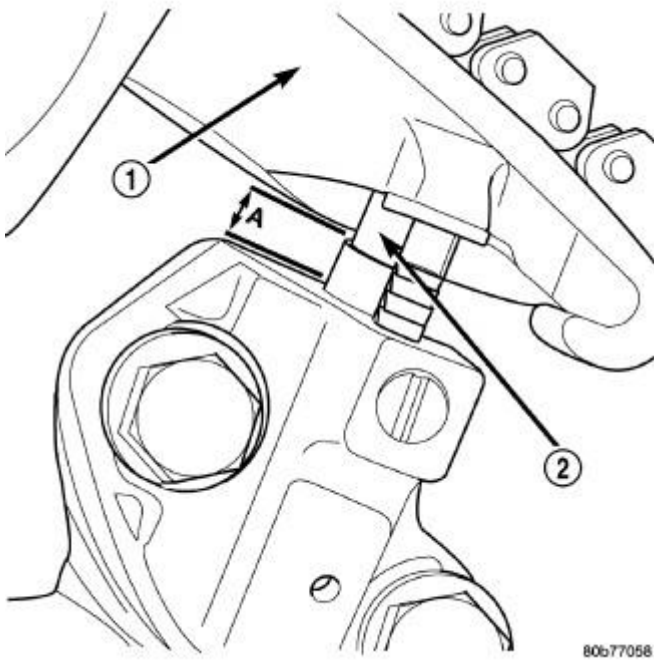


Fig. 177: Measuring Secondary Timing Chains For Wear
Courtesy of CHRYSLER GROUP, LLC

1 - SECONDARY TENSIONER ARM

2 - SECONDARY CHAIN TENSIONER PISTON

NOTE: This procedure must be performed with the timing chain cover removed.

1. Remove the timing chain cover. Refer to **COVER(S), ENGINE TIMING, REMOVAL, 4.7L**.
2. To determine if the secondary timing chains are worn, rotate the engine clockwise until maximum tensioner piston (2) extension is obtained. Measure the distance between the secondary timing chain tensioner housing and the step ledge on the piston. The measurement at point (A) must be less than 15 mm (0.5906 inches).
3. If the measurement exceeds the specification the secondary timing chains are worn and require replacement. Refer to **CHAIN AND SPROCKETS, TIMING, REMOVAL, 4.7L**.

NOTE: If the secondary chains are to be replaced the primary chain must also be replaced.

ENGINE TIMING VERIFICATION

CAUTION: The 4.7L is a non free-wheeling design engine. Therefore, correct engine timing is critical.

NOTE: Components referred to as left hand or right hand are as viewed from the

drivers position inside the vehicle.

NOTE: The blue link plates on the chains and the dots on the camshaft drive sprockets may not line up during the timing verification procedure. The blue link plates are lined up with the sprocket dots only when re-timing the complete timing drive. Once the timing drive is rotated blue link-to-dot alignment is no longer valid.

Engine base timing can be verified by the following procedure:

1. Remove the cylinder head covers. Refer to COVER(S), CYLINDER HEAD, REMOVAL, 4.7L.

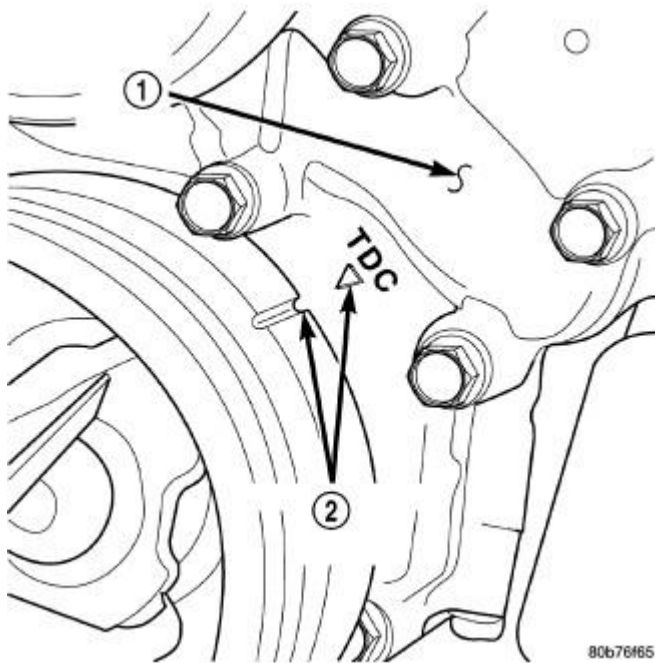


Fig. 178: TDC Indicator Marks

Courtesy of CHRYSLER GROUP, LLC

1 - TIMING CHAIN COVER
2 - CRANKSHAFT TIMING MARKS

2. Using a mirror, locate the TDC arrow on the front cover. Rotate the crankshaft until the mark on the crankshaft damper is aligned with the TDC arrow on the front cover. The engine is now at TDC.

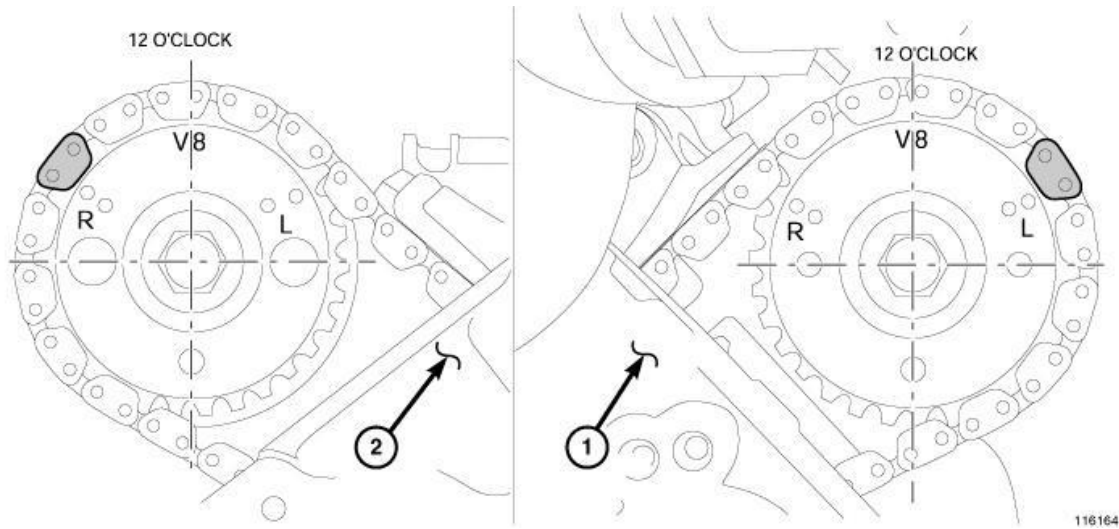


Fig. 179: V8 Timing Mark On Camshaft Sprocket
 Courtesy of CHRYSLER GROUP, LLC

- | |
|-------------------------|
| 1 - LEFT CYLINDER HEAD |
| 2 - RIGHT CYLINDER HEAD |

- Note the location of the V8 mark stamped into the camshaft drive gears. If the V8 mark on each camshaft drive gear is at the twelve o'clock position, the engine is at TDC (cylinder #1) on the exhaust stroke. If the V8 mark on each gear is at the six o'clock position, the engine is at TDC (cylinder #1) on the compression stroke.
- If both of the camshaft drive gears are off in the same or opposite directions, the primary chain or both secondary chains are at fault. Refer to **CHAIN AND SPROCKETS, TIMING** procedure in this service information.
- If only one of the camshaft drive gears is off and the other is correct, the problem is confined to one secondary chain. Refer to SINGLE CAMSHAFT TIMING below, in this procedure.
- If both camshaft drive gear V8 marks are at the twelve o'clock or the six o'clock position the engine base timing is correct. Reinstall the cylinder head covers.

SINGLE CAMSHAFT TIMING

NOTE: to adjust the timing on one camshaft, perform the following procedure.

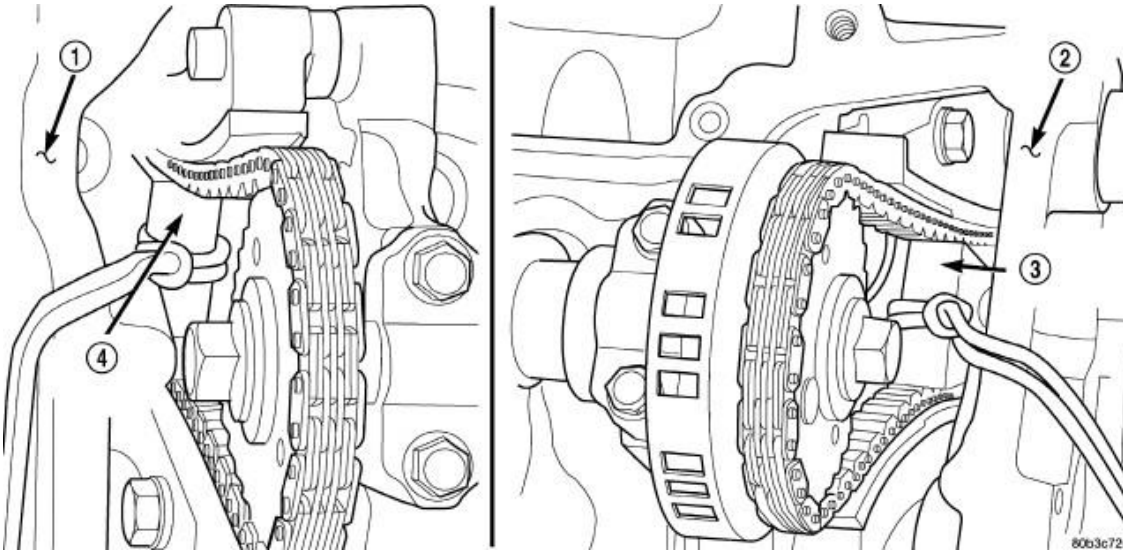


Fig. 180: Securing Timing Chain Tensioners Using Timing Chain Wedge
 Courtesy of CHRYSLER GROUP, LLC

- | |
|-----------------------------|
| 1 - LEFT CYLINDER HEAD |
| 2 - RIGHT CYLINDER HEAD |
| 3 - SPECIAL TOOL 9867 WEDGE |
| 4 - SPECIAL TOOL 9867 WEDGE |

1. Using Chain Tensioner Wedge, special tool (special tool #9867, Wedge, Locking) (3), stabilize the secondary chain drive. For reference purposes, mark the chain-to-sprocket position.
2. Remove the camshaft drive gear retaining bolt.
3. Carefully remove the camshaft drive gear from the camshaft.
4. Re-index the camshaft drive gear in the chain until the V8 mark is at the same position as the V8 mark on the opposite camshaft drive gear.

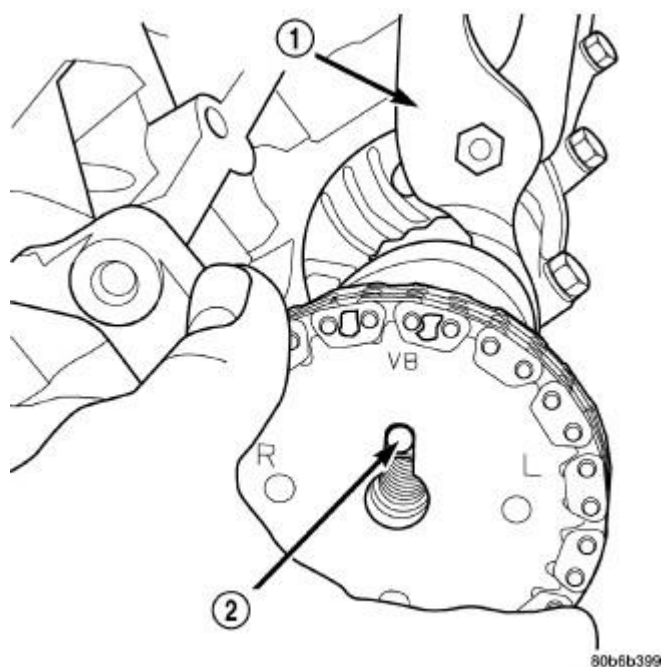


Fig. 181: Aligning Slot In Camshaft Sprocket
Courtesy of CHRYSLER GROUP, LLC

1 - ADJUSTABLE PLIERS
2 - CAMSHAFT DOWEL

NOTE: When gripping the camshaft, place the pliers on the tube portion of the camshaft only. Do not grip the lobes or the sprocket areas.

- Using a suitable pair of adjustable pliers (1), rotate the camshaft until the alignment dowel (2) on the camshaft is aligned with the slot in the camshaft drive gear.

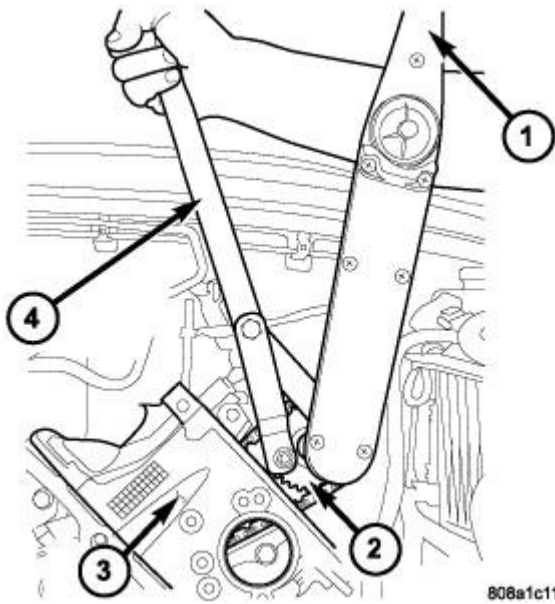


Fig. 182: Removing/Installing Left Side Camshaft Sprocket Bolt
Courtesy of CHRYSLER GROUP, LLC

- | |
|--|
| 1 - TORQUE WRENCH |
| 2 - CAMSHAFT SPROCKET |
| 3 - LEFT CYLINDER HEAD |
| 4 - SPECIAL TOOL 6958 SPANNER WITH ADAPTER PINS 8346 |

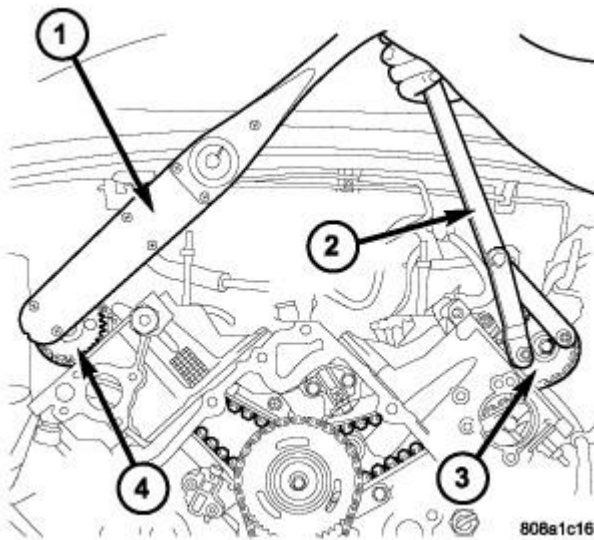


Fig. 183: Tightening Right Side Camshaft Sprocket Bolt
Courtesy of CHRYSLER GROUP, LLC

- | |
|-------------------|
| 1 - TORQUE WRENCH |
|-------------------|

- | |
|--|
| 2 - SPECIAL TOOL 6958 WITH ADAPTER PINS 8346 |
| 3 - LEFT CAMSHAFT SPROCKET |
| 4 - RIGHT CAMSHAFT SPROCKET |

CAUTION: Remove excess oil from camshaft sprocket retaining bolt before reinstalling bolt. Failure to do so may cause over-torquing of bolt resulting in bolt failure.

6. Position the camshaft drive gear onto the camshaft, remove oil from bolt then install the retaining bolt. Using Special Tools, Spanner Wrench (special tool #6958, Wrench, Spanner) with Adapter Pins (special tool #8346, Pins, Adapter) and a suitable torque wrench (1), Tighten retaining bolt to 122 N.m (90 ft. Lbs.).

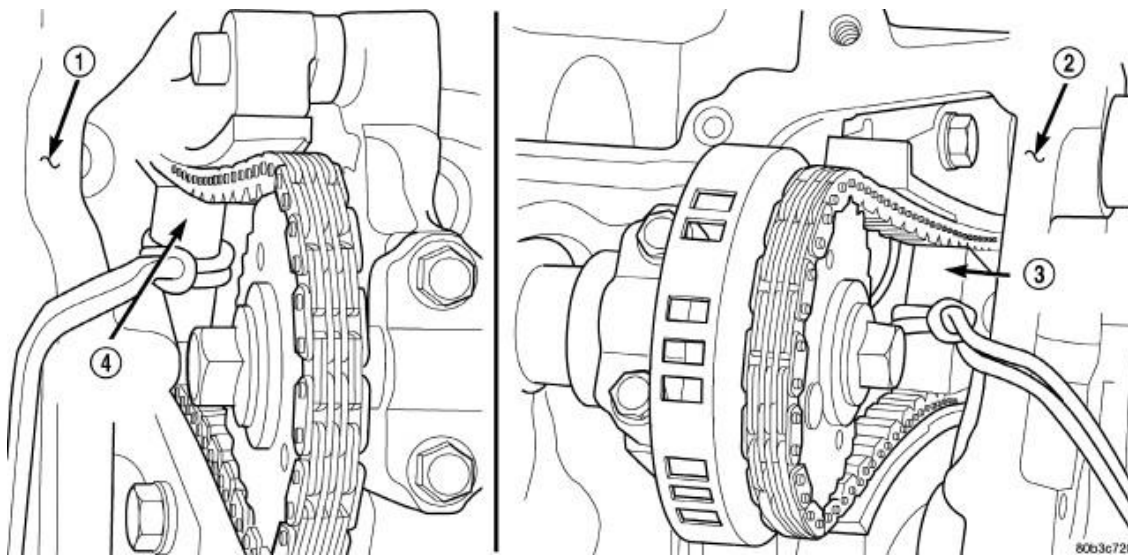


Fig. 184: Securing Timing Chain Tensioners Using Timing Chain Wedge
Courtesy of CHRYSLER GROUP, LLC

- | |
|--------------------------------------|
| 1 - LEFT
CYLINDER
HEAD |
| 2 - RIGHT
CYLINDER
HEAD |
| 3 -
SPECIAL
TOOL 9867
WEDGE |
| 4 -
SPECIAL
TOOL 9867
WEDGE |

7. Remove special tool (special tool #9867, Wedge, Locking) (3, 4).

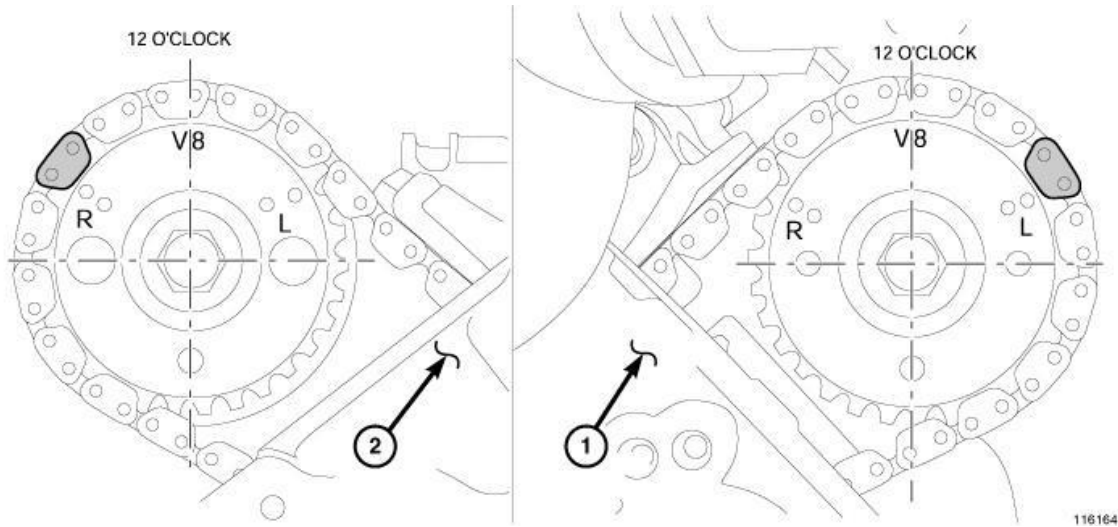


Fig. 185: V8 Timing Mark On Camshaft Sprocket
 Courtesy of CHRYSLER GROUP, LLC

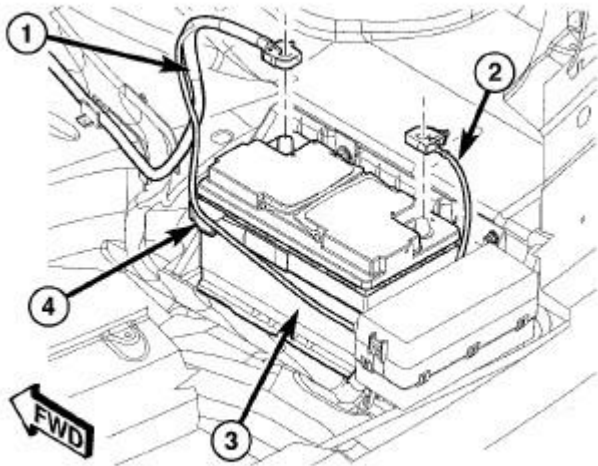
1 - LEFT CYLINDER HEAD
2 - RIGHT CYLINDER HEAD

8. Rotate the crankshaft two full revolutions, then reverify that the camshaft drive gear V8 marks are in fact aligned.
9. Install the cylinder head covers. Refer to **COVER(S), CYLINDER HEAD, INSTALLATION, 4.7L**.

CHAIN AND SPROCKETS, TIMING

REMOVAL

REMOVAL

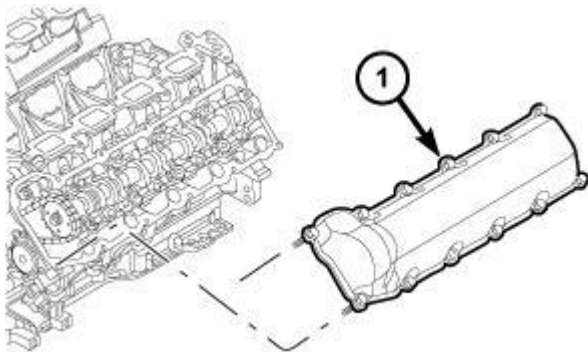


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Fig. 186: Battery & Cables

Courtesy of CHRYSLER GROUP, LLC

1. Disconnect and isolate the negative battery cable (2).
2. Drain the cooling system. Refer to **STANDARD PROCEDURE** .

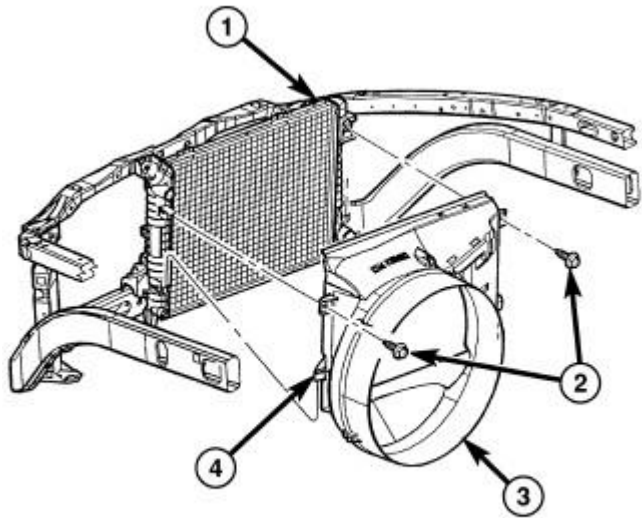


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Fig. 187: Cylinder Head Cover - Left

Courtesy of CHRYSLER GROUP, LLC

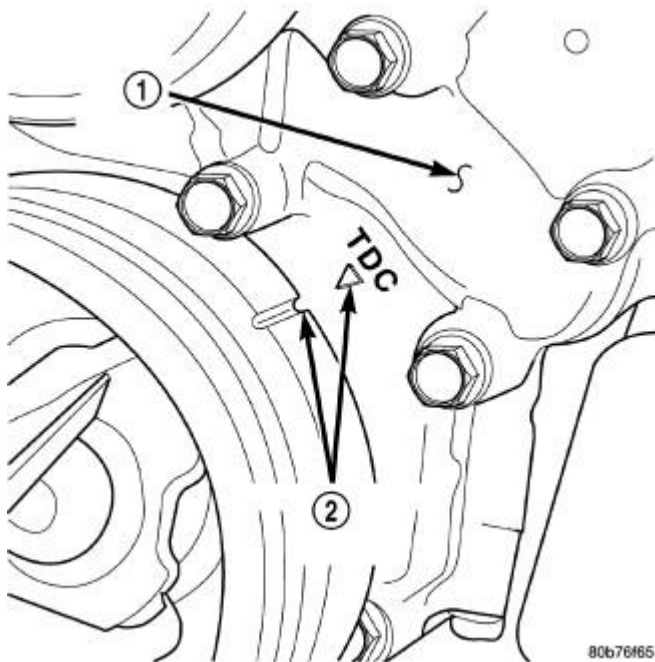
3. Remove both cylinder head covers (1). Refer to **COVER(S), CYLINDER HEAD, REMOVAL, 4.7L.**



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Fig. 188: Radiator & Fan Shroud
Courtesy of CHRYSLER GROUP, LLC

4. Remove the radiator fan shroud (3).



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Fig. 189: TDC Indicator Marks
Courtesy of CHRYSLER GROUP, LLC

5. Rotate the engine until the timing mark (2) on the crankshaft damper aligns with the TDC mark on timing chain cover (2) (#1 cylinder exhaust stroke).

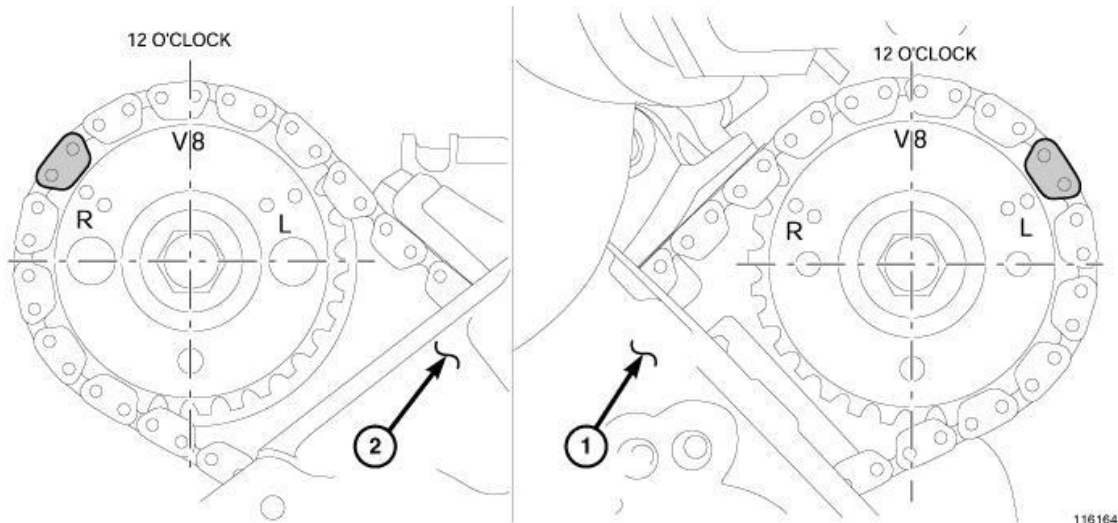


Fig. 190: V8 Timing Mark On Camshaft Sprocket
Courtesy of CHRYSLER GROUP, LLC

6. Verify the camshaft sprocket "V8" marks are at the 12 o'clock position (1, 2).

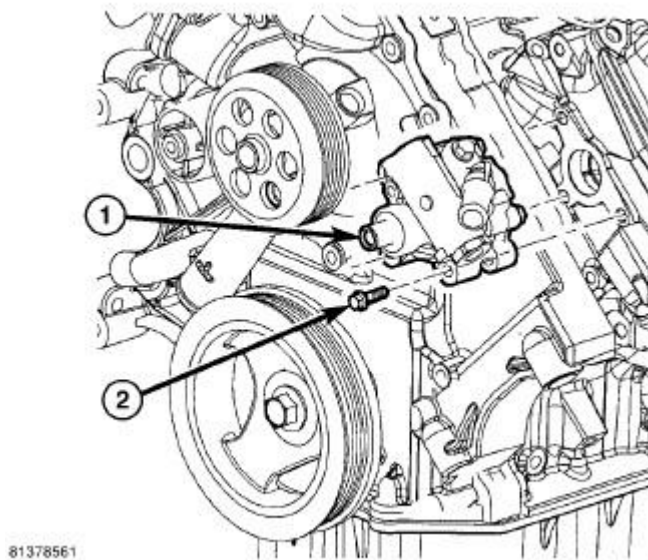


Fig. 191: Power Steering Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

NOTE: It is not necessary to disconnect the hoses from the power steering pump, for power steering pump removal.

7. Remove the three power steering pump (1) mounting bolts (2) through the access holes in the pulley and

secure out of the way.

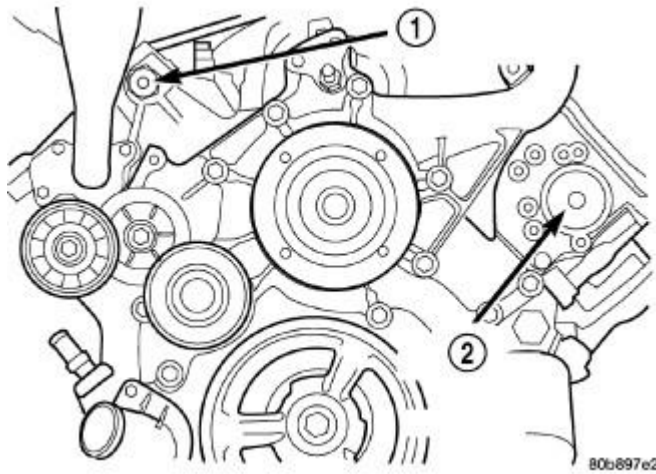


Fig. 192: Access Plugs From Left And Right Cylinder Heads
Courtesy of CHRYSLER GROUP, LLC

8. Remove the right (1) and left (2) access plug from the cylinder heads for access to chain guide fasteners.
9. Remove the oil fill housing to gain access to the right side tensioner arm fastener.

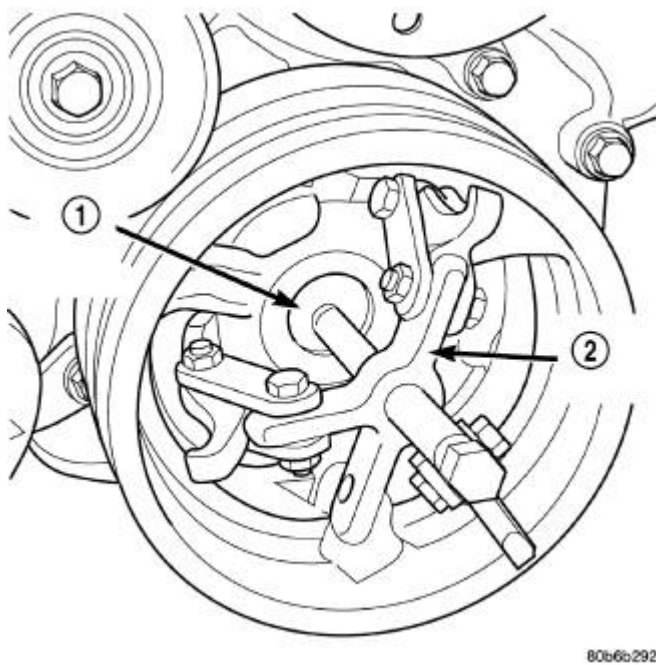


Fig. 193: Removing Crankshaft Damper
Courtesy of CHRYSLER GROUP, LLC

NOTE: Transmission cooler line snaps into shroud lower right hand corner.

10. Remove the vibration damper bolt.

11. Remove the vibration damper using Crankshaft Insert (special tool #8513A, Insert, Crankshaft) (1) and (special tool #1023, Puller) Three Jaw Puller (2).

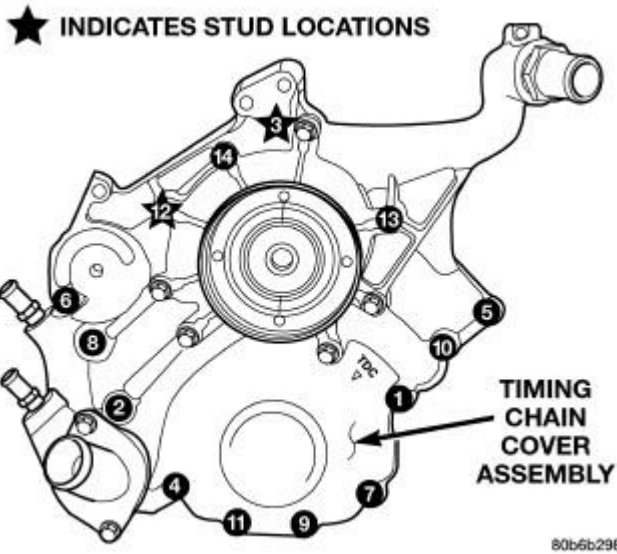


Fig. 194: Timing Chain Cover Fasteners Removal/Installation Sequence
 Courtesy of CHRYSLER GROUP, LLC

CAUTION: The 4.7L engine uses an RTV sealer instead of a gasket to seal the front cover to the engine block, from the factory. For service, Mopar® Grey Engine RTV sealant must be substituted.

NOTE: It is not necessary to remove the water pump for timing cover removal.

12. Remove the timing chain cover. Refer to COVER(S), ENGINE TIMING, REMOVAL, 4.7L.

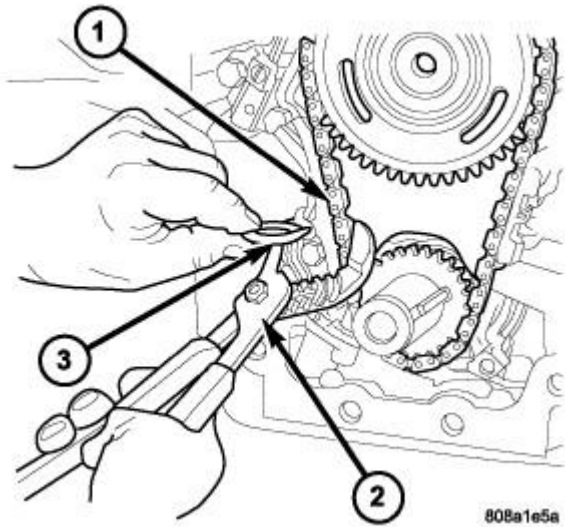


Fig. 195: Collapsing & Pinning Primary Chain Tensioner
Courtesy of CHRYSLER GROUP, LLC

13. Collapse and pin (3) the primary chain tensioner (1).

CAUTION: Plate behind left secondary chain tensioner could fall into oil pan.
Therefore, cover pan opening.

14. Remove the secondary chain tensioner.

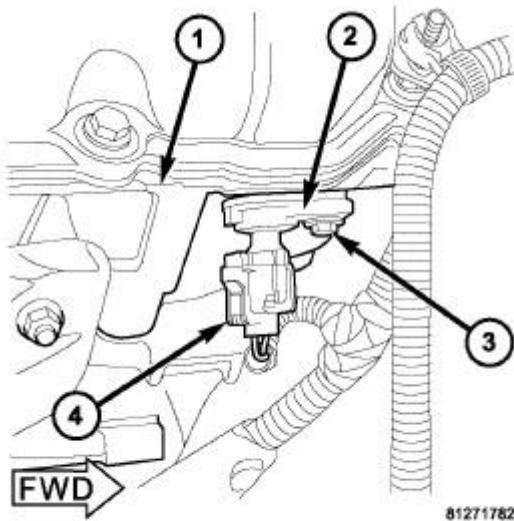


Fig. 196: Cylinder Head, CMP Sensor, Retaining Bolt & Connector
Courtesy of CHRYSLER GROUP, LLC

The Camshaft Position Sensor (CMP) (2) is bolted to the front/top of the right cylinder head (1).

15. Disconnect the electrical connector (4) at the CMP sensor.
16. Remove the sensor mounting bolt (3).
17. Carefully twist the sensor from the cylinder head.
18. Check the condition of the sensor O-ring.

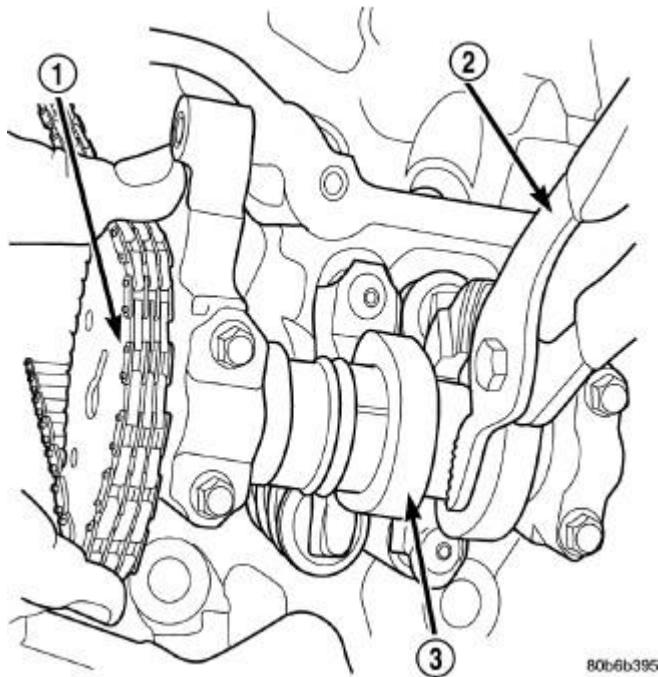


Fig. 197: Holding Camshaft With Adjustable Pliers
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Care should be taken not to damage the camshaft target wheel. Do not hold the target wheel while loosening or tightening the camshaft sprocket. Do not place the target wheel near a magnetic source of any kind. A damaged or magnetized target wheel could cause a vehicle no start condition.

CAUTION: Do not forcefully rotate the camshafts or crankshaft independently of each other. Damaging intake valve to piston contact will occur. Ensure the negative battery cable is disconnected and isolated to guard against accidental starter engagement.

19. Remove both camshaft sprocket bolts.

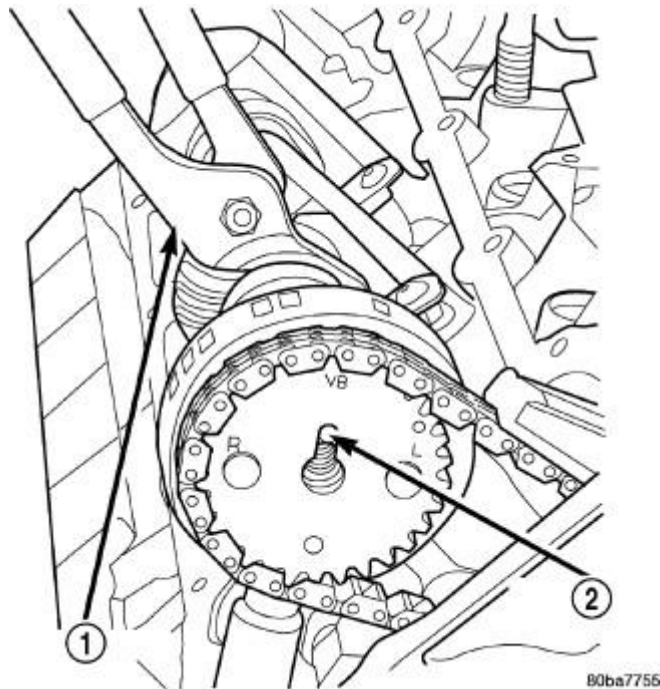
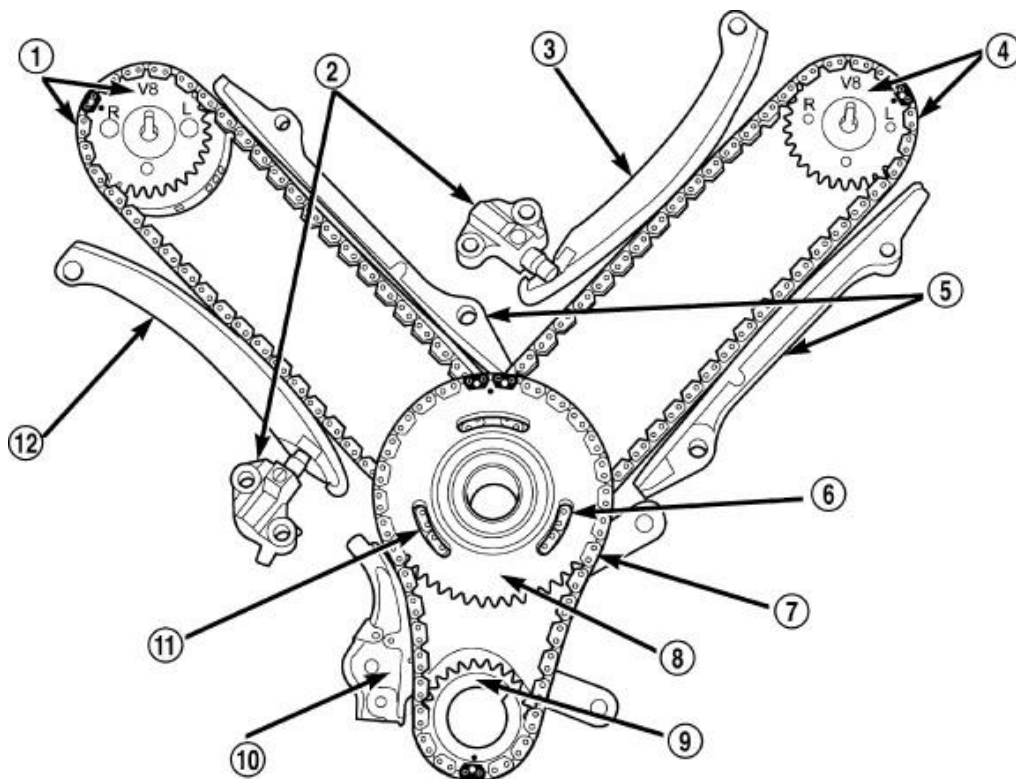


Fig. 198: Holding Right Camshaft With Pliers
 Courtesy of CHRYSLER GROUP, LLC

20. While holding the left camshaft steel tube with adjustable pliers (1), remove the left camshaft sprocket. Slowly rotate the camshaft approximately 15 degrees clockwise to a neutral position.
21. While holding the right camshaft steel tube with adjustable pliers (1), remove the right camshaft sprocket. Slowly rotate the camshaft approximately 45 degrees counterclockwise to a neutral position.
22. Remove the idler sprocket assembly bolt.
23. Slide the idler sprocket assembly and the crank sprocket forward simultaneously to remove the primary and secondary chains.
24. Remove both pivoting tensioner arms and chain guides.
25. Remove the chain tensioner.

INSPECTION

INSPECTION



in.) deep. If plastic face is severely grooved or melted, the tensioner lube jet may be clogged. The tensioner should be replaced.

- Secondary chain tensioner piston and ratcheting device. Inspect for evidence of heavy contact between tensioner piston and tensioner arm. If this condition exist the tensioner and tensioner arm should be replaced.
- Primary chain tensioner plastic faces. Replace as required.

INSTALLATION

INSTALLATION

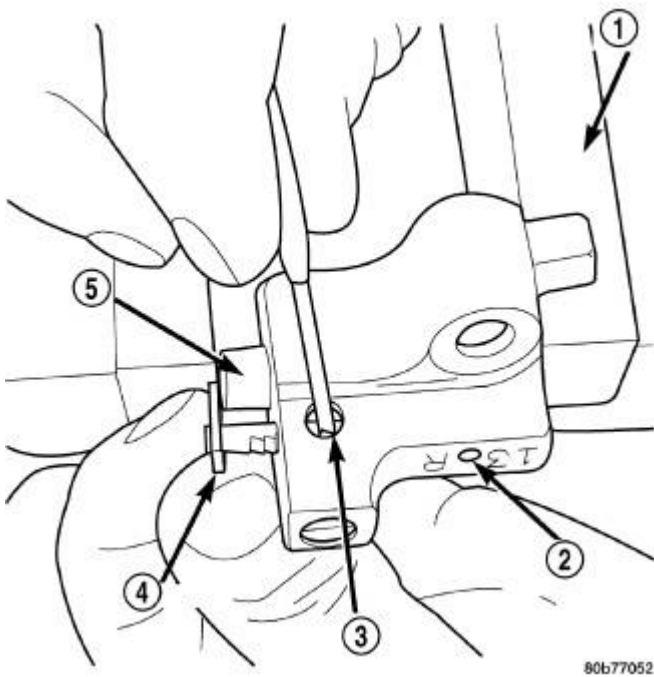


Fig. 200: Resetting Secondary Chain Tensioners
Courtesy of CHRYSLER GROUP, LLC

1 - VISE

2 - TENSIONER BODY

3 - INSERT LOCK PIN

4 - RATCHET

5 - PISTON

1. Using a vise, lightly compress the secondary chain tensioner piston until the piston step is flush with the tensioner body. Using a pin or suitable tool, release ratchet pawl by pulling pawl back against spring force through access hole on side of tensioner. While continuing to hold pawl back, Push ratchet device to approximately 2 mm from the tensioner body. Install Special Tool (special tool #8514, Pins, Tensioner) lock pin (3) into hole on front of tensioner (2). Slowly open vise to transfer piston spring force to lock pin.

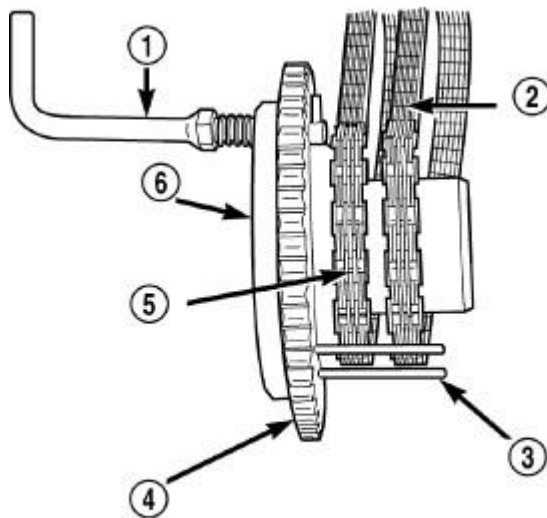
2. Position primary chain tensioner over oil pump and insert bolts into lower two holes on tensioner bracket. Tighten bolts to 28 N.m (250 in. lbs.).
3. Install right side chain tensioner arm. Apply Mopar® Lock N, Seal to torx® bolt, tighten bolt to 28 N.m (250 in. lbs.).

NOTE: The silver bolts retain the guides to the cylinder heads and the black bolts retain the guides to the engine block.

4. Install the left side chain guide. Tighten the bolts to 28 N.m (250 in. lbs.).

CAUTION: Overtightening the tensioner arm torx® bolt can cause severe damage to the cylinder head. Tighten torx® bolt to specified torque only.

5. Install left side chain tensioner arm. Apply Mopar® Lock N, Seal to torx® bolt, tighten bolt to 28 N.m (250 in. lbs.).
6. Install the right side chain guide. Tighten the bolts to 28 N.m (250 in. lbs.).



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Fig. 201: Secondary Timing Chains Locked
Courtesy of CHRYSLER GROUP, LLC

1 - LOCK ARM
2 - RIGHT CAMSHAFT CHAIN
3 - SECONDARY CHAINS RETAINING PINS (4)
4 - IDLER SPROCKET
5 - LEFT CAMSHAFT CHAIN
6 - SPECIAL TOOL 8429

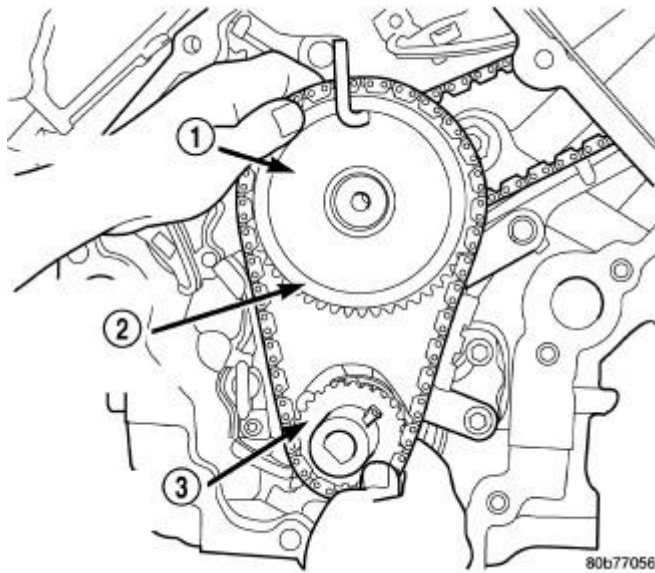


Fig. 202: Installing Idler Gear, Primary & Secondary Timing Chains
Courtesy of CHRYSLER GROUP, LLC

1 - SPECIAL TOOL 8429

2 - PRIMARY CHAIN IDLER SPROCKET

3 - CRANKSHAFT SPROCKET

7. Install both secondary chains onto the idler sprocket. Align two plated links on the secondary chains to be visible through the two lower openings on the idler sprocket (4 o'clock and 8 o'clock). Once the secondary timing chains are installed, position special tool (special tool #8429, Holder, Secondary Camshaft Chain) (6) to hold chains in place for installation.
8. Align primary chain double plated links with the timing mark at 12 o'clock (1) on the idler sprocket. Align the primary chain single plated link with the timing mark at 6 o'clock on the crankshaft sprocket (3).
9. Lubricate idler shaft and bushings with clean engine oil.
10. Install all chains, crankshaft sprocket, and idler sprocket as an assembly. After guiding both secondary chains through the block and cylinder head openings, affix chains with a elastic strap or the equivalent, This will maintain tension on chains to aid in installation.

NOTE: It will be necessary to slightly rotate camshafts for sprocket installation.

11. Align left camshaft sprocket "L" dot to plated link on chain.
12. Align right camshaft sprocket "R" dot to plated link on chain.

CAUTION: Remove excess oil from the camshaft sprocket bolt. Failure to do so can result in over-torque of bolt resulting in bolt failure.

13. Remove Special Tool (special tool #8429, Holder, Secondary Camshaft Chain), then attach both

sprockets to camshafts. Remove excess oil from bolts, then Install sprocket bolts, but do not tighten at this time.

14. Verify that all plated links are aligned with the marks on all sprockets and the "V8" marks on camshaft sprockets are at the 12 o'clock position .

CAUTION: Ensure the plate between the left secondary chain tensioner and block is correctly installed.

15. Install both secondary chain tensioners. Tighten bolts to 28 N.m (250 in. lbs.).

NOTE: Left and right secondary chain tensioners are not common.

16. Before installing idler sprocket bolt, lubricate washer with oil, and tighten idler sprocket assembly retaining bolt to 34 N.m (25 ft. lbs.).
17. Remove all locking pins from tensioners.

CAUTION: After pulling locking pins out of each tensioner, DO NOT manually extend the tensioner(s) ratchet. Doing so will over tension the chains, resulting in noise and/or high timing chain loads.

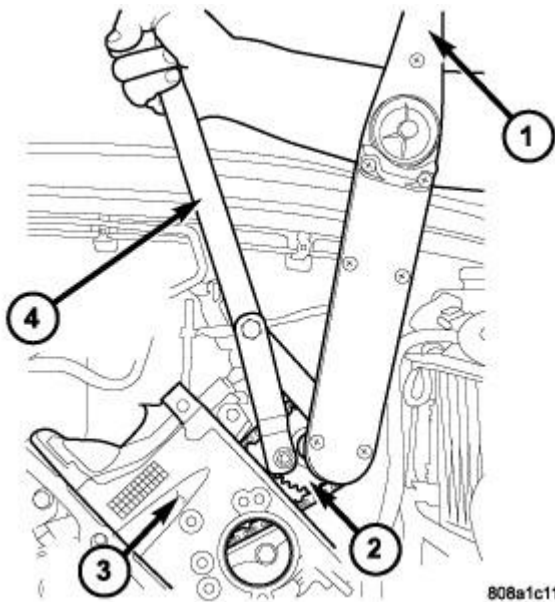


Fig. 203: Removing/Installing Left Side Camshaft Sprocket Bolt
 Courtesy of CHRYSLER GROUP, LLC

1 - TORQUE WRENCH
2 - CAMSHAFT SPROCKET
3 - LEFT CYLINDER HEAD
4 - SPECIAL TOOL 6958 SPANNER WITH ADAPTER PINS 8346

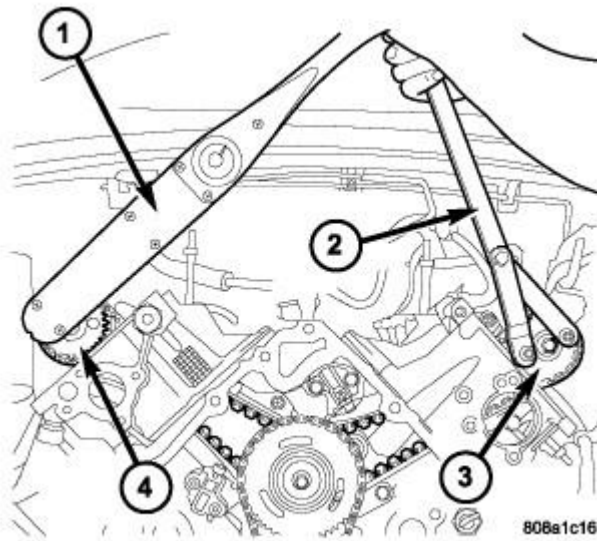


Fig. 204: Tightening Right Side Camshaft Sprocket Bolt
Courtesy of CHRYSLER GROUP, LLC

1 - TORQUE WRENCH
2 - SPECIAL TOOL 6958 WITH ADAPTER PINS 8346
3 - LEFT CAMSHAFT SPROCKET
4 - RIGHT CAMSHAFT SPROCKET

18. Using Special Tool (special tool #6958, Wrench, Spanner), Spanner with Adaptor Pins (special tool #8346, Pins, Adapter), tighten left (3) and right (4), camshaft sprocket bolts to 122 N.m (90 ft. lbs.).
19. Rotate engine two full revolutions. Verify timing marks are at the follow locations:
 - primary chain idler sprocket dot is at 12 o'clock
 - primary chain crankshaft sprocket dot is at 6 o'clock
 - secondary chain camshaft sprockets "V8" marks are at 12 o'clock
20. Lubricate all three chains with engine oil.

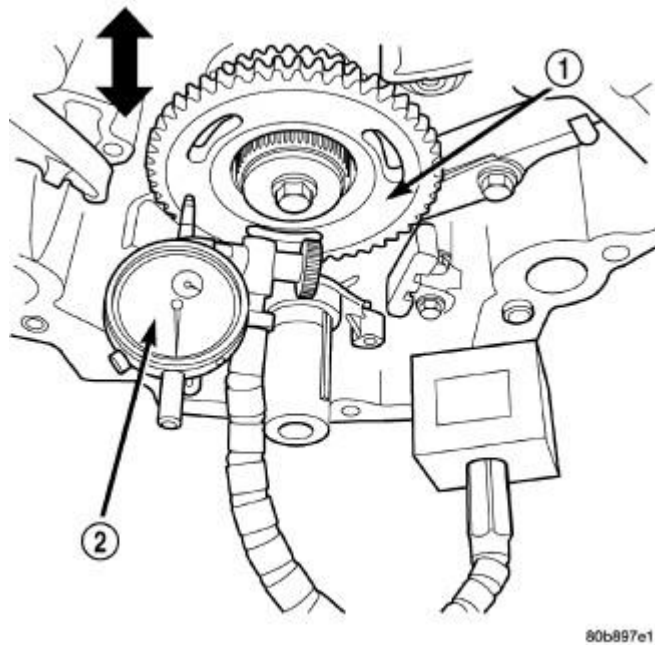


Fig. 205: Measuring Idler Gear End Play
 Courtesy of CHRYSLER GROUP, LLC

1 - IDLER SPROCKET ASSEMBLY
2 - DIAL INDICATOR

21. After installing all chains, it is recommended that the idler gear (1) end play be checked. The end play must be within 0.10-0.25 mm (0.004-0.010 in.). If not within specification, the idler gear must be replaced.
22. Install timing chain cover and crankshaft damper. Refer to **COVER(S), ENGINE TIMING, INSTALLATION, 4.7L**. Refer to **DAMPER, VIBRATION, INSTALLATION, 4.7L**.
23. Install cylinder head covers. Refer to **COVER(S), CYLINDER HEAD, INSTALLATION, 4.7L**.

NOTE: Before installing threaded plug in right cylinder head, the plug must be coated with sealant to prevent leaks.

24. Coat the large threaded access plug with **Mopar® Thread Sealant with Teflon** , then install into the right cylinder head and tighten to 81 N.m (60 ft. lbs.) .
25. Install the oil fill housing.
26. Install access plug in left cylinder head .
27. Install power steering pump. Refer to **PUMP, INSTALLATION** .
28. Install radiator fan shroud.
29. Fill cooling system. Refer to **STANDARD PROCEDURE** .
30. Connect negative cable to battery.

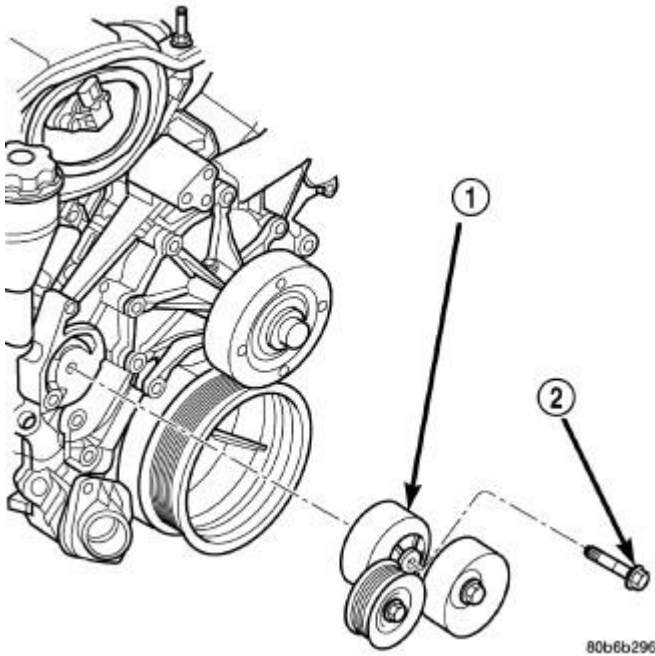
COVER(S), ENGINE TIMING**REMOVAL****REMOVAL**

Fig. 206: Accessory Drive Belt Tensioner
Courtesy of CHRYSLER GROUP, LLC

1 - TENSIONER ASSEMBLY
2 - FASTENER TENSIONER TO FRONT COVER

1. Disconnect the battery negative cable.
2. Drain cooling system. Refer to **STANDARD PROCEDURE** .
3. Disconnect both heater hoses at timing cover.
4. Disconnect lower radiator hose at engine.
5. Remove crankshaft damper. Refer to **DAMPER, VIBRATION, REMOVAL, 4.7L**.
6. Remove accessory drive belt tensioner assembly (1).
7. Remove the generator and A/C compressor.

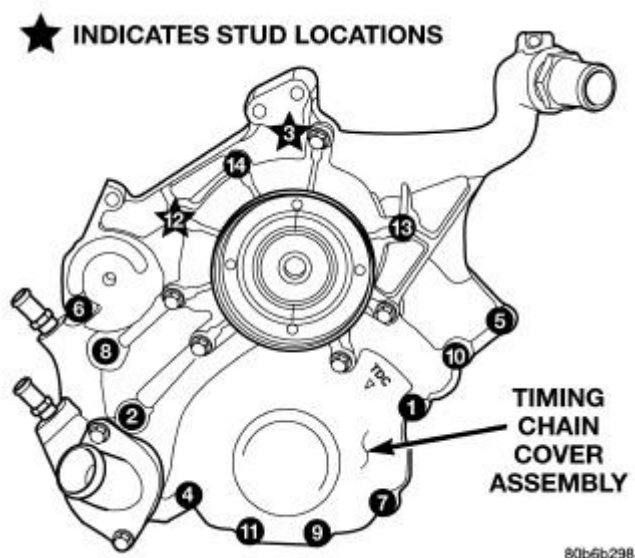


Fig. 207: Timing Chain Cover Fasteners Removal/Installation Sequence
 Courtesy of CHRYSLER GROUP, LLC

CAUTION: The 4.7L engine uses an RTV sealer instead of a gasket to seal the front cover to the engine block, from the factory. For service, Mopar® Grey Engine RTV sealant must be substituted.

NOTE: It is not necessary to remove the water pump for timing cover removal.

8. Remove the bolts holding the timing cover to engine block.
9. Remove cover.

INSTALLATION

INSTALLATION

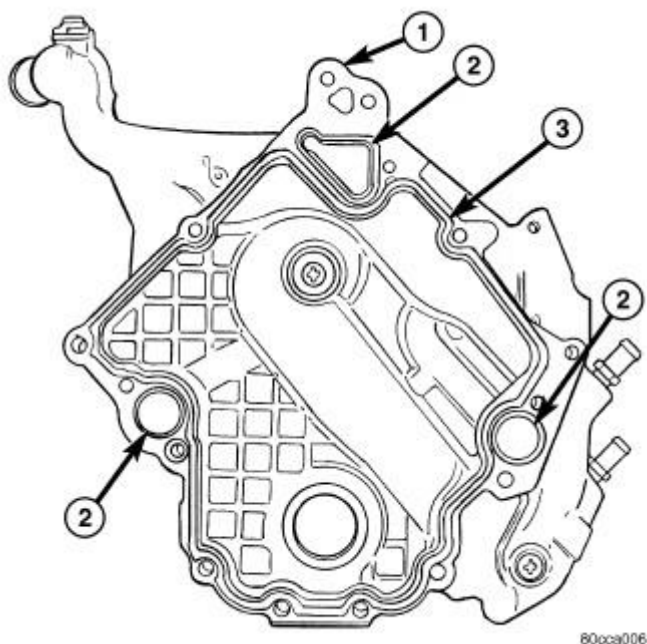


Fig. 208: Timing Chain Cover, Water Passage O-Ring & Engine RTV Sealer
Courtesy of CHRYSLER GROUP, LLC

- | |
|-----------------------------------|
| 1 - TIMING CHAIN COVER |
| 2 - WATER PASSAGE O-RING |
| 3 - MOPAR® GREY ENGINE RTV SEALER |

CAUTION: Do not use oil based liquids to clean timing cover or block surfaces. Use only rubbing alcohol, along with plastic or wooden scrapers. Use no wire brushes or abrasive wheels or metal scrapers, or damage to surfaces could result.

1. Clean timing chain cover and block surface using rubbing alcohol.

CAUTION: The 4.7L can use a special RTV sealer instead of a carrier gasket to seal the timing cover to the engine block, from the factory. For service repairs, Mopar® Grey Engine RTV must be used as a substitute, if RTV is present. If the front cover being used has no provisions for the water passage o-rings, then Mopar® Grey Engine RTV must be applied around the water passages.

2. Inspect the water passage o-rings, if equipped for any damage, and replace as necessary.
3. Apply Mopar® Grey Engine RTV sealer to the front cover following the path above, using a 3 to 4 mm thick bead.

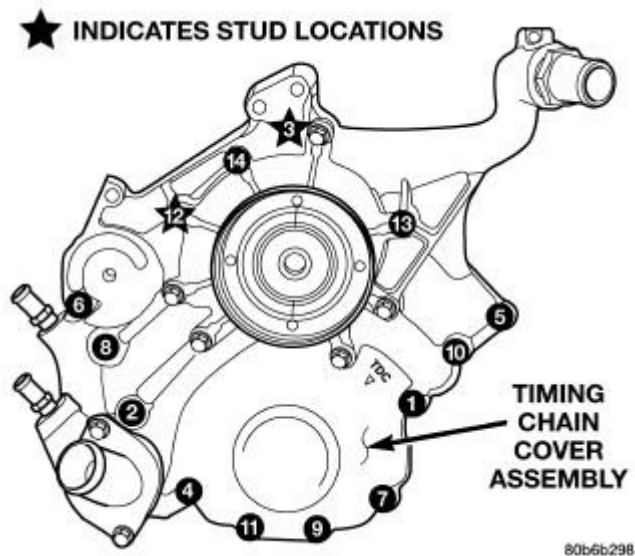


Fig. 209: Timing Chain Cover Fasteners Removal/Installation Sequence
Courtesy of CHRYSLER GROUP, LLC

4. Install cover. Tighten flange head fasteners in sequence as shown in illustration in to 58 N.m (43 ft. lbs.).
5. Install the A/C compressor and generator.
6. Install crankshaft damper. Refer to **DAMPER, VIBRATION, INSTALLATION, 4.7L**.
7. Install accessory drive belt tensioner assembly. Tighten fastener to 54 N.m (40 ft. lbs.).
8. Install lower radiator hose.
9. Install both heater hoses.
10. Fill cooling system. Refer to **STANDARD PROCEDURE**.
11. Connect the battery negative cable.

SHAFT, IDLER

REMOVAL

REMOVAL

1. Remove the primary and secondary timing chains and sprockets. Refer to **CHAIN AND SPROCKETS, TIMING, REMOVAL, 4.7L**.

NOTE: To remove the idler shaft, it is necessary to tap threads into the shaft, to install the removal tool.

2. Using a 12 mm X 1.75 tap, cut threads in the idler shaft center bore.
3. Cover the radiator core with a suitable cover.

CAUTION: Use care when removing the idler shaft, Do not strike the radiator

cooling fins with the slide hammer.

4. Using Special Tool (special tool #8517, Remover) Slide Hammer, remove the idler shaft.

INSTALLATION**INSTALLATION**

1. Thoroughly clean the idler shaft bore.
2. Position the idler shaft in the bore.

NOTE: **The two lubrication holes in the idler shaft do not require any special alignment.**

NOTE: **Before using the retaining bolt to install the idler shaft, coat the threads and the pilot on the idler shaft, with clean engine oil.**

3. Using the primary idler sprocket retaining bolt and washer, carefully draw the idler shaft into the bore until fully seated.
4. Coat the idler shaft with clean engine oil.
5. Install the timing chains and sprockets. Refer to **CHAIN AND SPROCKETS, TIMING, INSTALLATION, 4.7L.**