Jeep Truck Liberty 2004 2WD L4-2.4L

Timing Belt Change

Balance Shaft: Description and Operation

BALANCE SHAFT

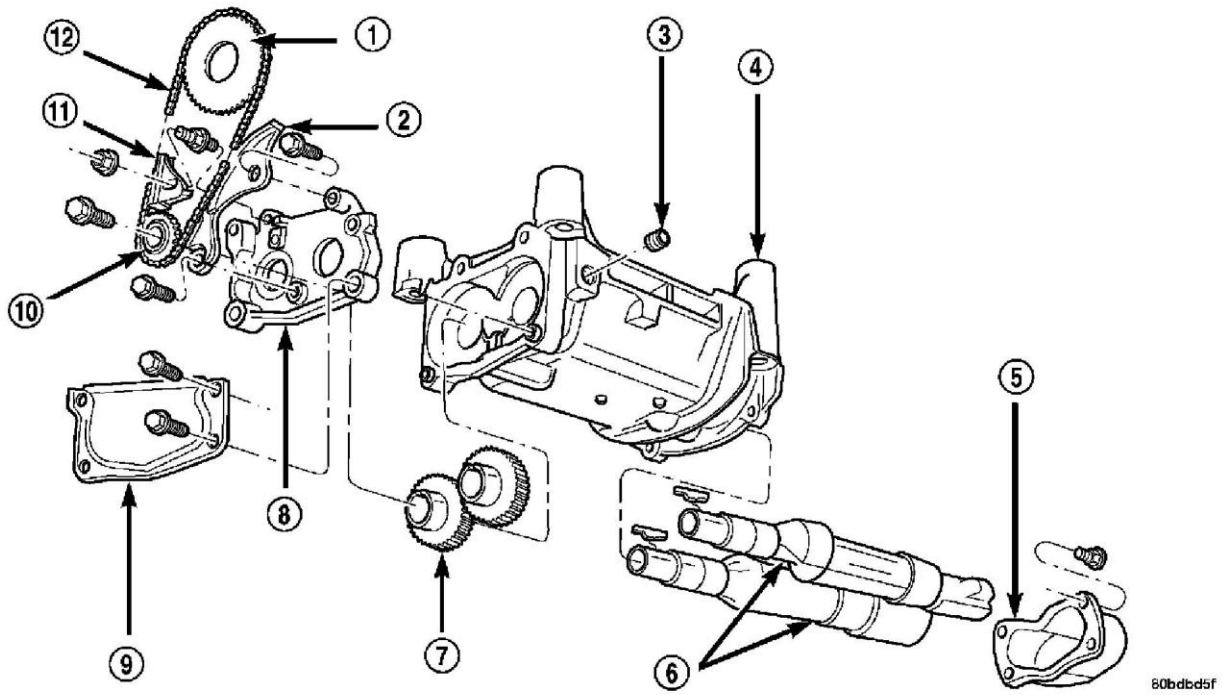

Fig. 108 Balance Shafts and Carrier Assembly

1 - SPROCKET
2 - TENSIONER
3 - PLUG
4 - CARRIER
5 - REAR COVER
6 - BALANCE SHAFTS
7 - GEARS
8 - GEAR COVER
9 - CHAIN COVER
10 - SPROCKET
11 - GUIDE
12 - CHAIN

Fig. 108 Balance Shafts And Carrier Assembly

DESCRIPTION

The 2.4L engine is equipped with two nodular cast iron balance shafts installed in a cast aluminum carrier attached to the lower cylinder block.

OPERATION

The balance shafts are driven by the crankshaft via a roller chain and sprockets. The balance shafts are connected by helical gears. The dual counter rotating shafts decrease second order vertical shaking forces caused by component movement.

Balance Shaft: Service and Repair

REMOVAL - BALANCE SHAFTS

1. Drain engine oil.

2. Remove the oil pan.

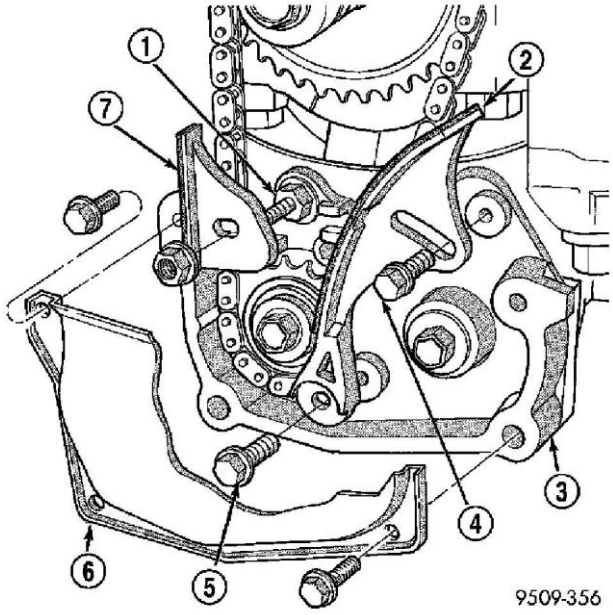

Fig. 109 Chain Cover, Guide and Tensioner

1 - STUD
2 - TENSIONER (ADJUSTER)
3 - GEAR COVER
4 - ADJUST SCREW
5 - PIVOT SCREW
6 - CHAIN COVER (CUTAWAY)
7 - GUIDE

Fig. 109 Chain Cover, Guide And Tensioner

3. Remove chain cover, guide and tensioner. Also see Carrier Assembly Removal for service procedures requiring only temporary relocation of assembly.
4. Remove gear cover retaining stud (double ended to also retain chain guide). Remove cover and balance shaft gears.

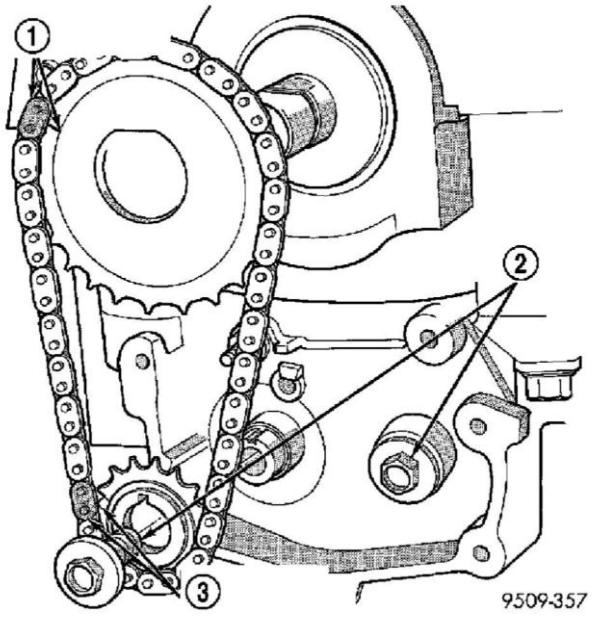

Fig. 110 Drive Chain and Sprockets

1 - NICKEL PLATED LINK AND MARK
2 - GEAR/SPROCKET SCREWS
3 - NICKEL PLATED LINK AND DOT

Fig. 110 Drive Chain And Sprockets

5. Remove balance shaft gear, chain sprocket retaining screws, and crankshaft chain sprocket. Remove chain and sprocket assembly. Using two wide pry bars, work the sprocket back and forth until it is off the shaft.

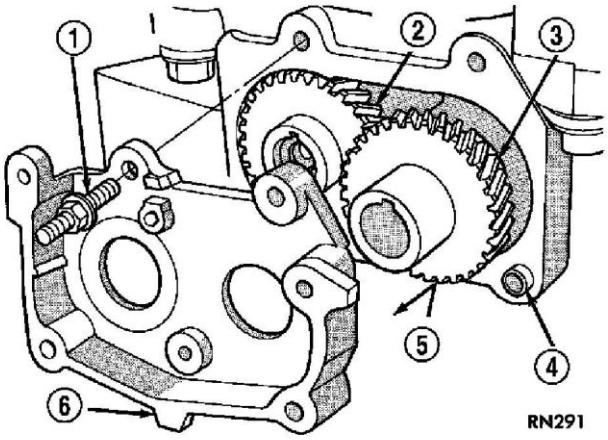

Fig. 111 Gear Cover and Gears

1 - STUD (DOUBLE ENDED)
2 - DRIVE GEAR
3 - DRIVEN GEAR
4 - CARRIER DOWEL
5 - GEAR(S)
6 - GEAR COVER

Fig. 111 Gear Cover And Gears

6. Remove carrier gear cover and balance shafts.
7. Remove four carrier to crankcase attaching bolts to separate carrier from engine bedplate.

REMOVAL - BALANCE SHAFT CARRIER

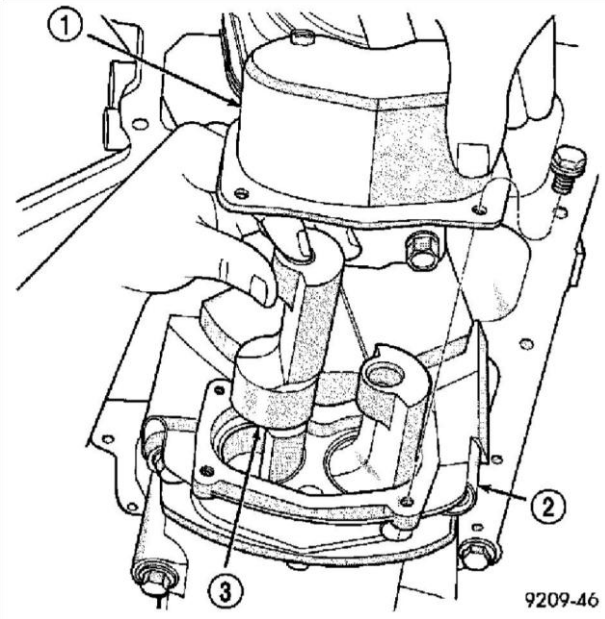

Fig. 112 Balance Shaft - Removal/Installation

1 - REAR COVER
2 - CARRIER
3 - BALANCE SHAFT

Fig. 112 Balance Shaft Removal/Installation

The following components will remain intact during carrier removal. Gear cover, gears, balance shafts and the rear cover.

1. Remove chain cover and driven balance shaft chain sprocket screw.
2. Loosen tensioner pivot and adjusting screws, move driven balance shaft inboard through driven chain sprocket. Sprocket will hang in lower chain loop.
3. Remove carrier to crankcase attaching bolts to remove carrier.

INSTALLATION - BALANCE SHAFT

Balance shaft and carrier assembly installation is the reverse of the removal procedure. During installation crankshaft-to-balance shaft timing must be established. Refer to Timing procedure in this section.

1. With balance shafts installed in carrier position carrier on crankcase and install four attaching bolts and tighten to 54 Nm (40 ft. lbs.).

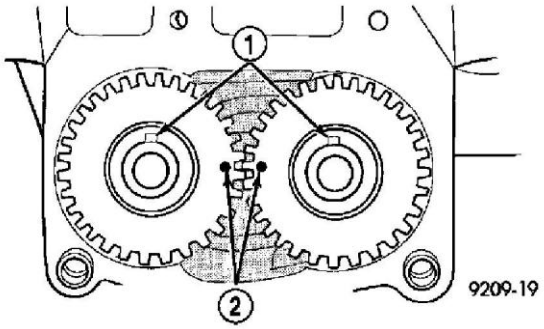

Fig. 113 Gear Timing

1 - KEY WAYS UP
2 - GEAR ALIGNMENT DOTS

Fig. 113 Gear Timing

2. Turn balance shafts until both shaft key ways are up, parallel to vertical centerline of engine. Install short hub drive gear on sprocket driven shaft and long hub gear on gear driven shaft. After installation gear and balance shaft keyways must be up with gear timing marks meshed as shown.
3. Install gear cover and tighten double ended stud/washer fastener to 12 Nm (105 in. lbs.).

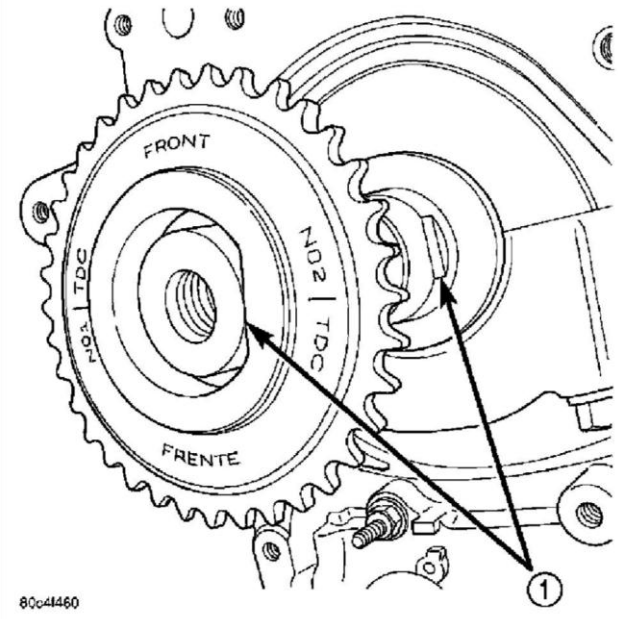

Fig. 114 Balance Shaft Sprocket Alignment to Crankshaft

1 - ALIGN FLATS

Fig. 114 Balance Shaft Sprocket Alignment To

Crankshaft 4. Align flat on balance shaft drive sprocket to the flat on crankshaft.

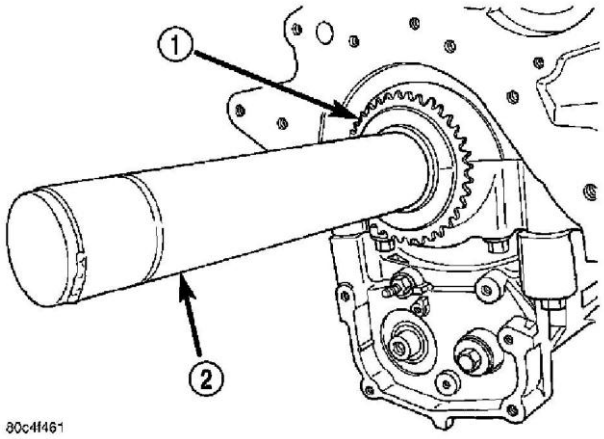

Fig. 115 Balance Shaft Drive

1 - SPROCKET
2 - SPECIAL TOOL 6052

Fig. 115 Balance Shaft Drive

5. Install balance shaft drive sprocket on crankshaft using Special Tool 6052.

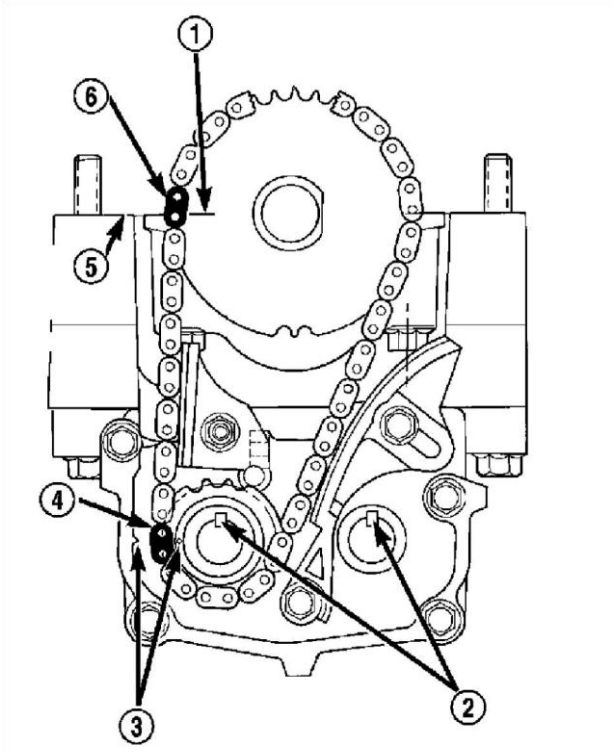

Fig. 116 Balance Shaft Timing

1 - MARK ON SPROCKET
2 - KEYWAYS UP
3 - ALIGN MARKS
4 - PLATED LINK
5 - PARTING LINE (BEDPLATE TO BLOCK)
6 - PLATED LINK

Fig. 116 Balance Shaft Timing

6. Turn crankshaft until number 1 cylinder is at top dead center (TDC). The timing marks on the chain sprocket should line up with the parting line on the left side of number one main bearing cap.

7. Place chain over crankshaft sprocket so that the plated link of the chain is over the number 1 cylinder timing mark on the balance shaft crankshaft sprocket.
8. Place balance shaft sprocket into the timing chain and align the timing mark on the sprocket (dot) with the (lower) plated link on the chain.

NOTE: The lower plated link is 8 links from the upper link.

9. With balance shaft keyways pointing up (12 o'clock) slide the balance shaft sprocket onto the nose of the balance shaft. The balance shaft may have to be pushed in slightly to allow for clearance

NOTE: THE TIMING MARK ON THE SPROCKET, THE (LOWER) NICKEL PLATED LINK, AND THE ARROW ON THE SIDE OF THE GEAR COVER SHOULD LINE UP WHEN THE BALANCE SHAFTS ARE TIMED CORRECTLY.

10. If the sprockets are timed correctly, install the balance shaft bolts and tighten to 28 Nm (250 in. lbs.). A wood block placed between crankcase and crankshaft counterbalance will prevent crankshaft and gear rotation.
11. CHAIN TENSIONING:
    a. Install chain tensioner loosely assembled.
    b. Position guide on double ended stud making sure tab on the guide fits into slot on the gear cover. Install and tighten nut/washer assembly to 12 Nm (105 in. lbs.).
    c. Place a shim 1 mm (0.039 in.) thick x 70 mm (2.75 in.) long or between tensioner and chain. Push tensioner and shim up against the chain.

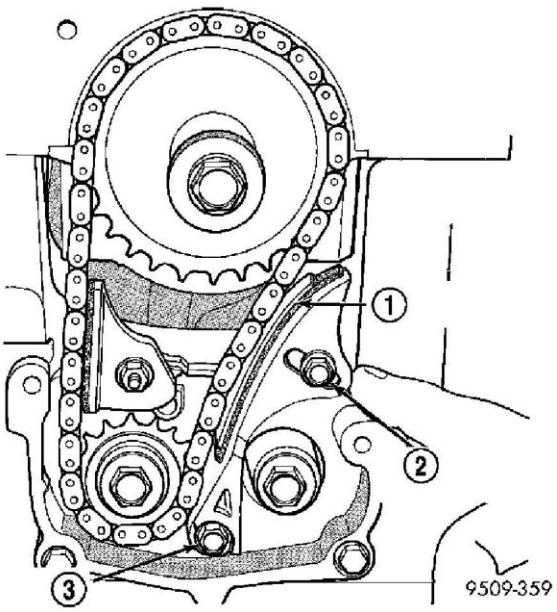

Fig. 117 Chain Tension Adjustment

1 - 1MM (0.039 IN.) SHIM
2 - TENSIONER (ADJUSTER) BOLT
3 - PIVOT BOLT

Fig. 117 Chain Tension Adjustment

Apply firm pressure 2.5 - 3 Kg (5.5 - 6.6 lbs.) directly behind the adjustment slot to take up all slack. Chain must have shoe radius contact as shown.

    d. With the load applied, tighten top tensioner bolt first, then bottom pivot bolt. Tighten bolts to 12 Nm (105 in. lbs.). Remove shim. e. Install carrier covers and tighten screws to 12 Nm (105 in. lbs.).

12. Install pick-up tube and oil pan.
13. Fill engine crankcase with proper oil to correct level.

Timing Belt: Service and Repair

TIMING BELT AND SPROCKET(S)

REMOVAL - TIMING BELT

1. Remove air cleaner upper cover, housing, and clean air tube.
2. Raise vehicle on hoist.
3. Remove accessory drive belts.
4. Remove crankshaft vibration damper.
5. Remove air conditioner/generator belt tensioner and pulley assembly.
6. Remove timing belt lower front cover bolts and remove cover.
7. Lower vehicle.
8. Remove bolts attaching timing belt upper front cover and remove cover.

CAUTION: When aligning crankshaft and camshaft timing marks always rotate engine from crankshaft. Camshaft should not be rotated after timing belt is removed. Damage to valve components may occur. Always align timing marks before removing timing belt.

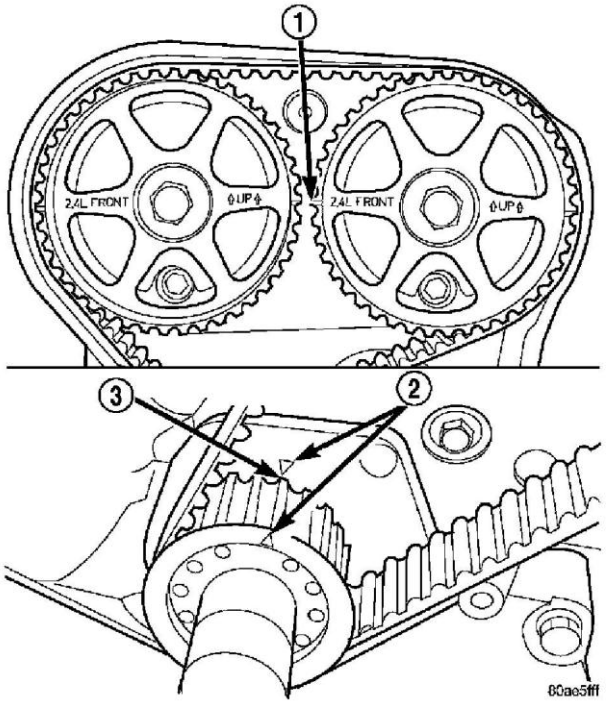

Fig. 98 Crankshaft and Camshaft Timing

1 - CAMSHAFT TIMING MARKS
2 - CRANKSHAFT TDC MARKS
3 - TRAILING EDGE OF SPROCKET TOOTH

Fig. 98 Crankshaft And Camshaft Timing

9. Before the removal of the timing belt, rotate crankshaft until the TDC mark on oil pump housing aligns with the TDC mark on crankshaft sprocket (trailing edge of sprocket tooth).

NOTE: The crankshaft sprocket TDC mark is located on the trailing edge of the sprocket tooth. Failure to align trailing edge of sprocket tooth to TDC mark on oil pump housing will cause the camshaft timing marks to be misaligned.

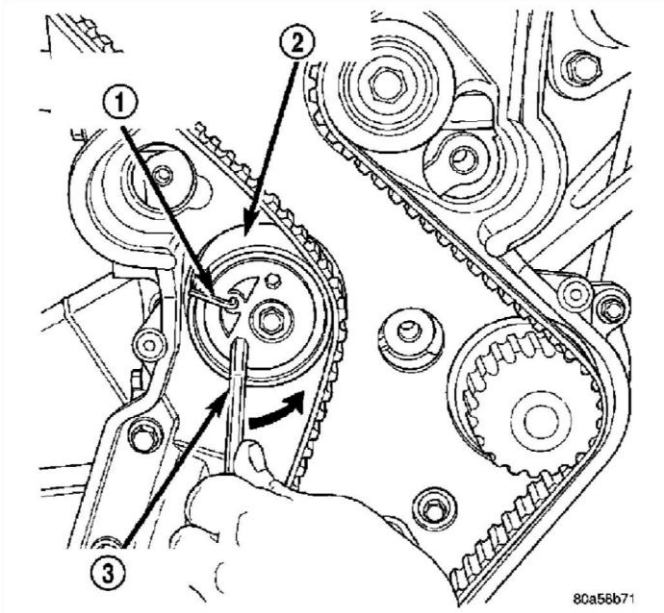

Fig. 99 Locking Timing Tensioner

1 - 1/8 OR 3mm ALLEN WRENCH
2 - BELT TENSIONER
3 - 6mm ALLEN WRENCH

Fig. 99 Locking Timing Tensioner

10. Install 6 mm Allen wrench into belt tensioner. Before rotating the tensioner, insert the long end of a 1/8" or 3 mm Allen wrench into the pin hole on the front of the tensioner. While rotating the tensioner counterclockwise, push in lightly on the 1/8" or 3 mm Allen wrench, until it slides into the locking hole.
11. Remove timing belt.

REMOVAL - CRANKSHAFT SPROCKET

1. Disconnect negative battery cable.
2. Remove timing belt.

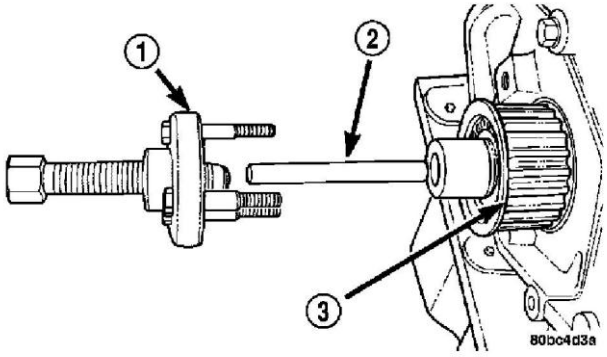

Fig. 100 Crankshaft Sprocket - Removal

1 - SPECIAL TOOL 6793
2 - SPECIAL TOOL C-4685–C2
3 - CRANKSHAFT SPROCKET

Fig. 100 Crankshaft Sprocket Removal

3. Remove crankshaft sprocket using Special Tools 6793 and insert C-4685-C2.

CLEANING

1. Do Not attempt to clean a timing belt. If contamination from oil, grease, or coolants have occurred, the timing belt should be replaced.

2. Clean all sprockets using a suitable solvent. Clean all sprocket grooves of any debris.

INSTALLATION - CRANKSHAFT SPROCKET

CAUTION: The crankshaft sprocket is set to a predetermined depth from the factory for correct timing belt tracking. If removed, use of Special Tool 6792 is required to set the sprocket to original installation depth. An incorrectly installed sprocket will result in timing belt and engine damage.

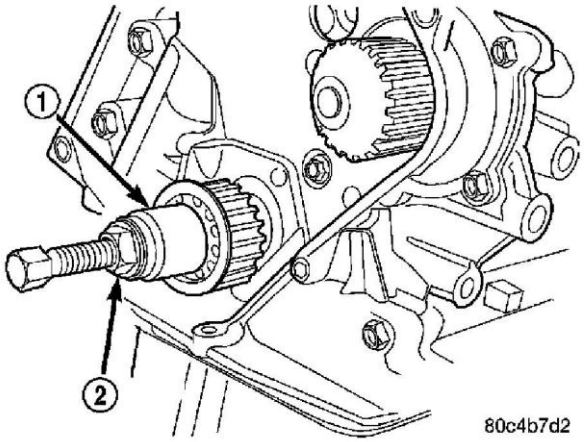

Fig. 101 Crankshaft Sprocket - Installation

1 - SPECIAL TOOL 6792
2 - TIGHTEN NUT TO INSTALL

Fig. 101 Crankshaft Sprocket Installation

1. Install crankshaft sprocket using Special Tool 6792 .
2. Install timing belt.

INSTALLATION - TIMING BELT

CAUTION: The crankshaft sprocket is set to a predetermined depth from the factory for correct timing belt tracking. If removed, use of Special Tool 6792 is required to set the sprocket to original installation depth. An incorrectly installed sprocket will result in timing belt and engine damage.

1. Set crankshaft sprocket to TDC by aligning the sprocket with the arrow on the oil pump housing.

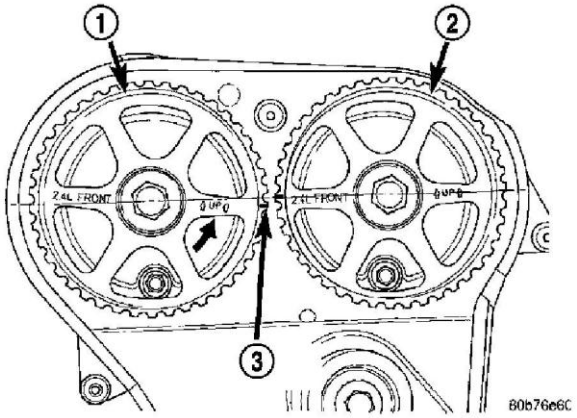

Fig. 102 Camshaft Sprocket Alignment

1 - CAMSHAFT SPROCKET-EXHAUST
2 - CAMSHAFT SPROCKET-INTAKE
3 - 1/2 NOTCH LOCATION

Fig. 102 Camshaft Sprocket Alignment

2. Set camshafts timing marks so that the exhaust camshaft sprocket is a 1/2 notch below the intake camshaft sprocket.

CAUTION: Ensure that the arrows on both camshaft sprockets are facing up.

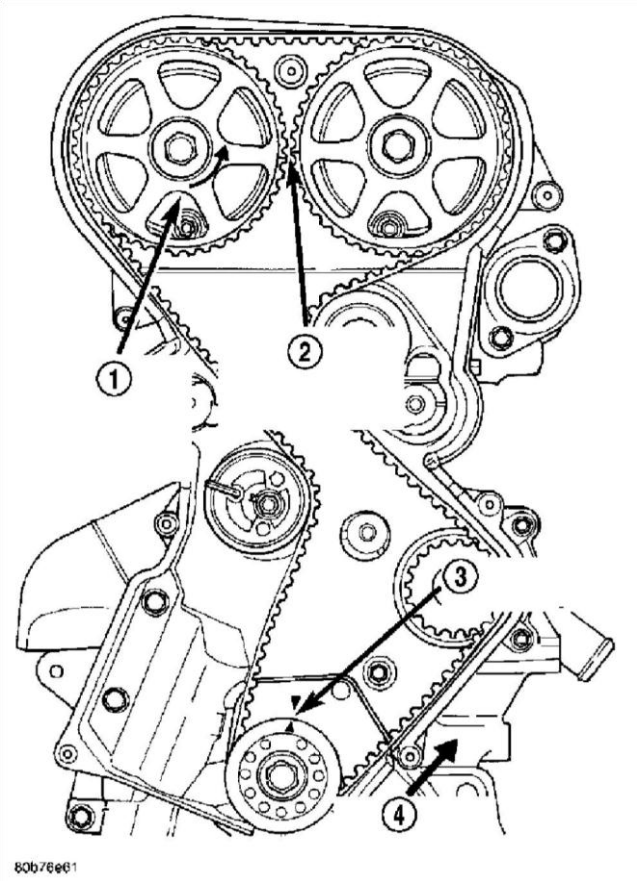

Fig. 103 Timing Belt - Installation - Typical

1 - ROTATE CAMSHAFT SPROCKET TO TAKE UP BELT SLACK
2 - CAMSHAFT TIMING MARKS 1/2 NOTCH LOCATION
3 - CRANKSHAFT AT TDC
4 - INSTALL BELT IN THIS DIRECTION

Fig. 103 Timing Belt Installation - Typical

3. Install timing belt. Starting at the crankshaft, go around the water pump sprocket, idler pulley, camshaft sprockets and then around the tensioner.
4. Move the exhaust camshaft sprocket counterclockwise to align marks and take up belt slack.

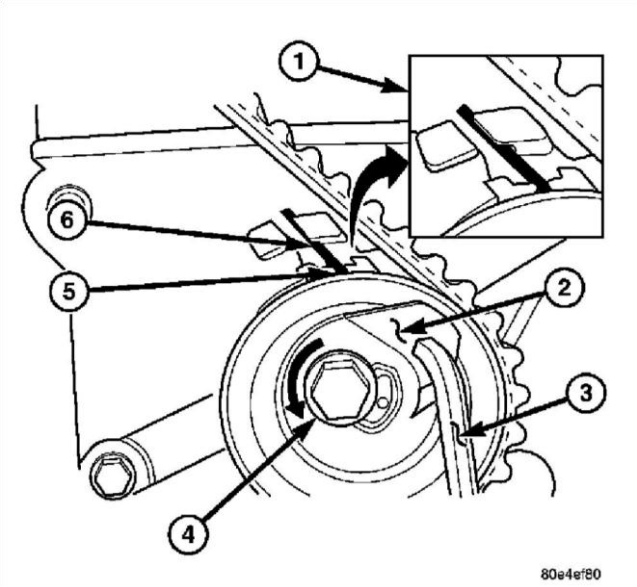

Fig. 104 Timing Belt Tension Adjustment

1 - ALIGN SETTING NOTCH WITH SPRING TANG
2 - TOP PLATE
3 - 6mm ALLEN WRENCH
4 - LOCK NUT
5 - SETTING NOTCH
6 - SPRING TANG

Fig. 104 Timing Belt Tension Adjustment

5. Insert a 6 mm Allen wrench into the hexagon opening located on the top plate of the belt tensioner pulley Rotate the top plate COUNTERCLOCKWISE . The tensioner pulley will move against the belt and the tensioner setting notch will eventually start to move clockwise. Watching the movement of the setting notch, continue rotating the top plate counterclockwise until the setting notch is aligned with the spring tang. Using the allen wrench to prevent the top plate from moving, torque the tensioner lock nut to 30 Nm (22 ft. lbs.). Setting notch and spring tang should remain aligned after lock nut is torqued.
6. Remove allen wrench and torque wrench.

NOTE: Repositioning the crankshaft to the TDC position must be done only during the CLOCKWISE rotation movement. If TDC is missed, rotate a further two revolutions until TDC is achieved. DO NOT rotate crankshaft counterclockwise as this will make verification of proper tensioner setting impossible.

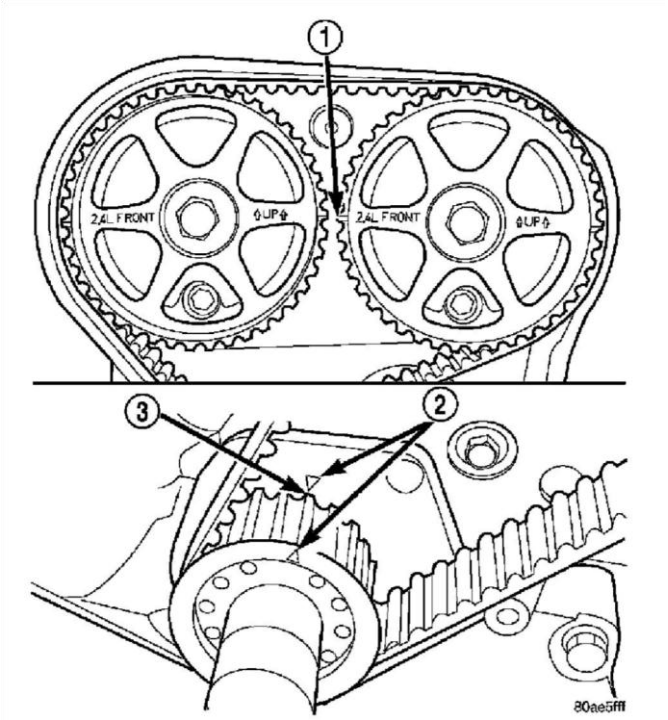

Fig. 105 Crankshaft and Camshaft Timing

1 - CAMSHAFT TIMING MARKS
2 - CRANKSHAFT TDC MARKS
3 - TRAILING EDGE OF SPROCKET TOOTH

Fig. 105 Crankshaft And Camshaft Timing

7. Once the timing belt has been installed and tensioner adjusted, rotate the crankshaft CLOCKWISE two complete revolutions manually for seating of the belt, until the crankshaft is repositioned at the TDC position. Verify that the camshaft and crankshaft timing marks are in proper position.

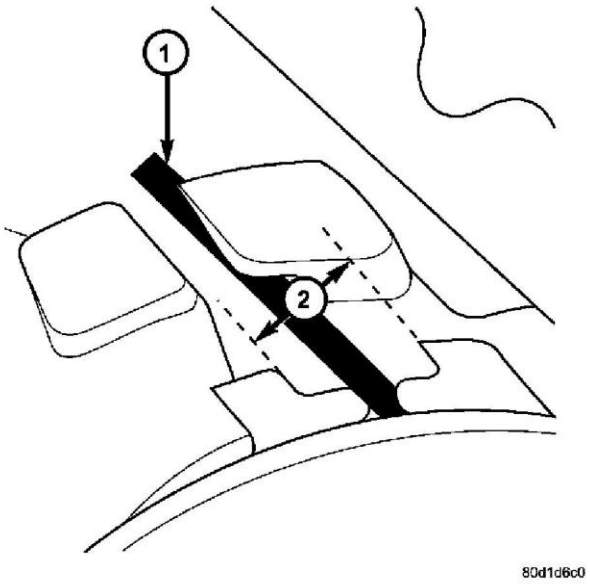

Fig. 106 Timing Belt Tension Verification

1 - SPRING TANG
2 - TOLERANCE WINDOW

Fig. 106 Timing Belt Tension Verification

8. Check if the spring tang is within the tolerance window. If the spring tang is within the tolerance window, the installation process is complete and nothing further is required. If the spring tang is not within the tolerance window, repeat Steps 5 through 7.

9. Install timing belt front covers and bolts.
10. Install air conditioning/generator belt tensioner and pulley
11. Install crankshaft vibration damper.
12. Install accessoiy drive belts.
13. Install drive belt splash shield.
14. Install air cleaner housing, upper cover, and clean air tube.

Timing Belt Tensioner: Service and Repair

TIMING BELT TENSIONER & PULLEY

REMOVAL

1. Remove the timing belt.
2. Remove timing belt idler pulley

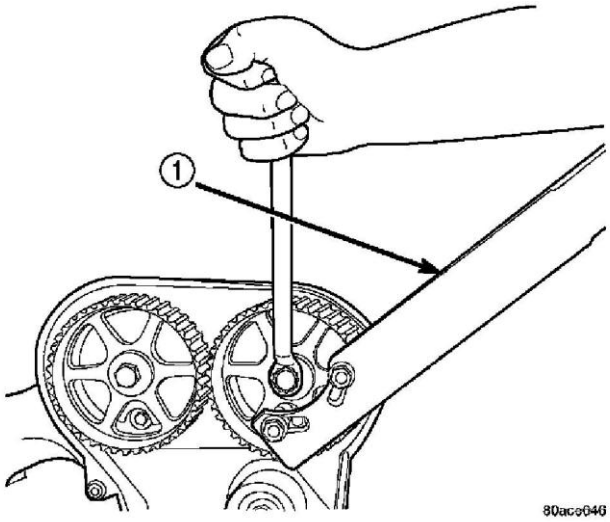

Fig. 107 Camshaft Sprocket - Removal/Installation

1 - SPECIAL TOOL 6847

Fig. 107 Camshaft Sprocket Removal/Installation

3. Hold camshaft sprocket with Special Tool 6847 while removing bolt. Remove both cam sprockets.
4. Remove rear timing belt cover fasteners and remove cover from engine.
5. Remove lower bolt attaching timing belt tensioner assembly to engine and remove tensioner as an assembly.

INSTALLATION

1. Align timing belt tensioner assembly to engine and install lower mounting bolt but do not tighten. To properly align tensioner assembly, install one of the engine bracket mounting bolts (M10) 5 to 7 turns into the tensioner's upper mounting location.
2. Torque the tensioner's lower mounting bolt to 61 Nm (45 ft. lbs.). Remove the upper bolt used for tensioner alignment.
3. Install rear timing belt cover and fasteners.
4. Install timing belt idler pulley and torque mounting bolt to 61 Nm (45 ft. lbs.).
5. Install camshaft sprockets. Use Special Tool 6847 to hold sprockets, torque bolts to 101 Nm (75 ft. lbs.).
6. Install the timing belt.

Timing Cover: Service and Repair

TIMING BELT COVERS

REMOVAL - FRONT COVER

1. Remove crankshaft vibration damper.
2. Remove generator drive belt tensioner assembly.
3. Remove timing belt front cover bolts, and remove covers.

REMOVAL - REAR COVER

1. Remove front covers.
2. Remove timing belt.
3. Hold camshaft sprocket with Special Tool 6847 while removing center bolt.
4. Remove timing belt idler pulley.
5. Remove rear cover fasteners and remove cover from engine.

INSTALLATION - REAR COVER

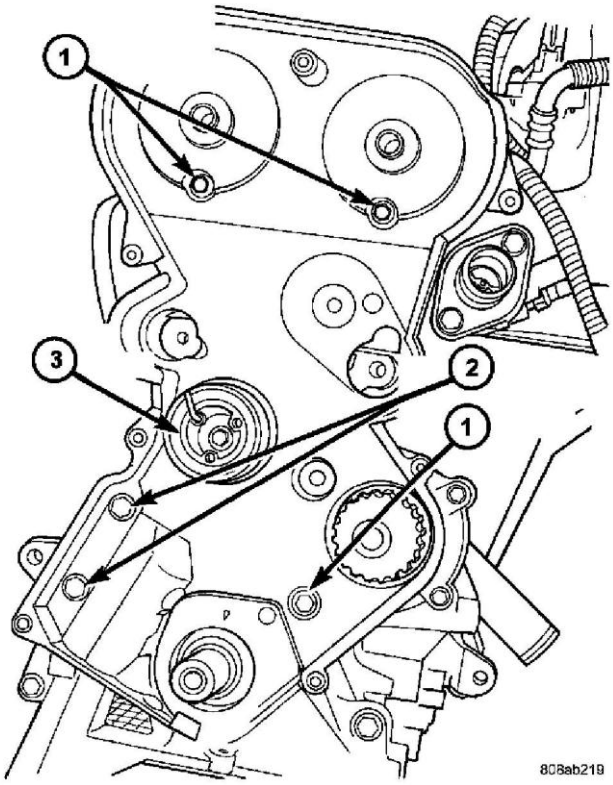

Fig. 97 Timing Belt Rear Cover

1 - REAR COVER TO CYLINDER HEAD FASTENERS
2 - REAR COVER TO ENGINE BLOCK FASTENERS
3 - BELT TENSIONER

Fig. 97 Timing Belt Rear Cover

1. Install timing belt rear cover and bolts.

   CAUTION: Do not use an impact wrench for tightening camshaft sprocket bolt. Damage to the timing locating pin can occur. Hand tighten using a wrench ONLY.

2. Install camshaft sprockets. Hold sprockets with Special Tool 6848 and tighten center bolt to 101 Nm (75 ft. lbs.).
3. Install timing belt idler pulley and tighten mounting bolt to 61 Nm (45 ft. lbs.).
4. Install timing belt.
5. Install front covers.

INSTALLATION - FRONT COVER

1. Install timing belt front covers. Tighten fasteners to 7 Nm (60 in. lbs.).
2. Install generator drive belt tensioner.
3. Install crankshaft vibration damper.