

ENGINE

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ENGINE 2.5L TURBO DIESEL

DESCRIPTION

DESCRIPTION - 2.5L COMMON RAIL DIESEL ENGINE

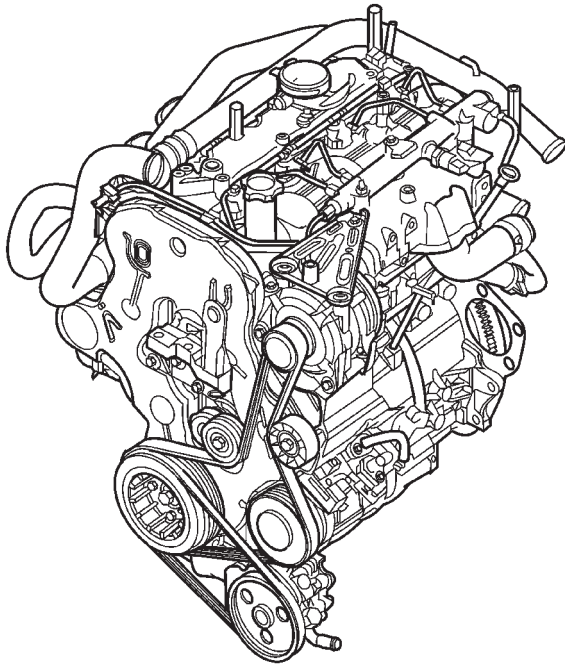
This 2.5 Liter (2500cc) four-cylinder “common rail” direct injection engine is an in-line overhead valve diesel engine. This engine utilizes a cast iron cylinder block and an aluminum cylinder head. The engine is turbocharged and intercooled. The engine also has four valves per cylinder and dual overhead camshafts (Fig. 1).

DESCRIPTION	SPECIFICATION
Displacement	2.5L (2499 cc)
Bore	92.00
Stroke	94.00
Compression Ratio	17.5:1
Vacuum at Idle	685.8 mm/Hg (27.0 In/Hg)
Belt Tension	Automatic Belt Tensioner

DESCRIPTION	SPECIFICATION
Thermostat Opening	80°C ± 2°C
Generator Rating	Denso 12V-95A
Cooling System Capacity	13.8 Liters W/O Auxiliary Heater 16.6 Liters With Auxiliary Heater
Engine Oil Capacity	6.0L W/Filter Change
Timing System	Belt Driven Camshafts In Cylinder Head Cover
Air Intake	Dry Filter
Fuel Feed	Vane Pump Incorporated In Injection Pump
Fuel System	Direct Fuel Injection
Combustion Cycle	4 Stroke
Cooling System	Water Cooling
Injection Pump	Rotary Pump and Electronically Managed
Lubrication	Pressure Lubricated By Rotary Pump
Engine Rotation	Clockwise Viewed From Front Cover

ENGINE 2.5L TURBO DIESEL (Continued)

DESCRIPTION - ENGINE COVER



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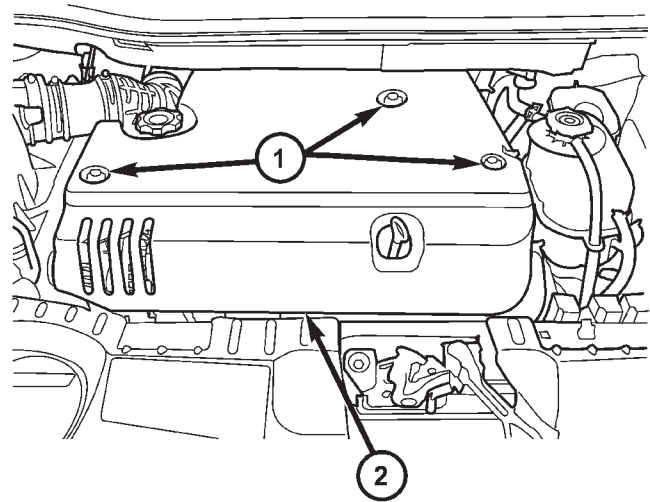
Fig. 1 2.5L COMMON RAIL DIESEL ENGINE

The engine cover is a black plastic cover used to cover the top of the engine (Fig. 10). It is used to isolate engine noises.

REMOVAL

REMOVAL - 2.5L DIESEL ENGINE

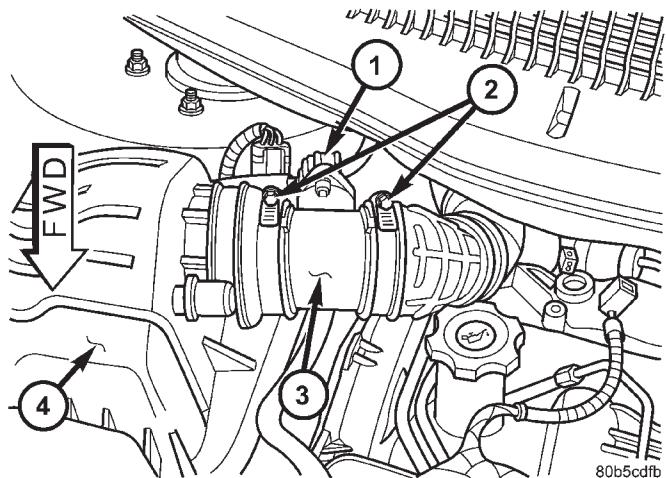
- (1) Disconnect negative battery cable.
- (2) Remove engine cover (Fig. 2). (Refer to 9 - ENGINE - REMOVAL)
- (3) Remove air cleaner housing, MAF sensor, and air intake tube assembly (Fig. 3).
- (4) Remove coolant pressure tank pressure cap.
- (5) Raise vehicle on hoist.
- (6) Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
- (7) Remove lower splash shield.
- (8) Remove splash shield side panels.



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Fig. 2 ENGINE COVER

- 1 - ENGINE COVER MOUNTING BOLTS
- 2 - ENGINE COVER



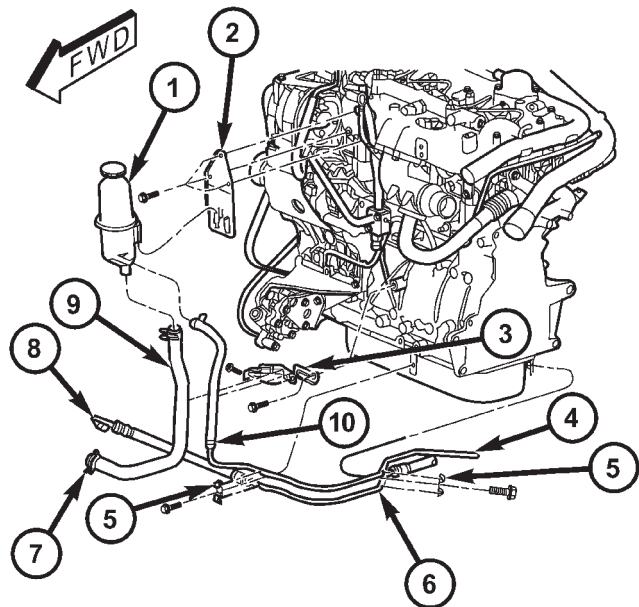
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Fig. 3 MASS AIR FLOW (MAF) SENSOR LOCATION

- 1 - MAF SENSOR ELECTRICAL CONNECTOR
- 2 - RETAINING CLAMPS
- 3 - MASS AIR FLOW (MAF) SENSOR
- 4 - AIR CLEANER HOUSING

ENGINE 2.5L TURBO DIESEL (Continued)

(9) Remove power steering reservoir hose from power steering pump and drain power steering fluid (Fig. 4).



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Fig. 4 RESERVOIR AND HOSES - 2.5L DIESEL

- 1 - POWER STEERING FLUID RESERVOIR
- 2 - RESERVOIR BRACKET
- 3 - SUPPLY HOSE BRACKET
- 4 - RETURN HOSE FROM GEAR
- 5 - ROUTING CLIP
- 6 - PRESSURE HOSE TO GEAR
- 7 - SUPPLY HOSE (PUMP END)
- 8 - PRESSURE HOSE (PUMP END)
- 9 - SUPPLY HOSE
- 10 - RETURN HOSE

(10) Disconnect high pressure line at pump (Fig. 4).

(11) Disconnect power steering pump return hose clamp (Fig. 4).

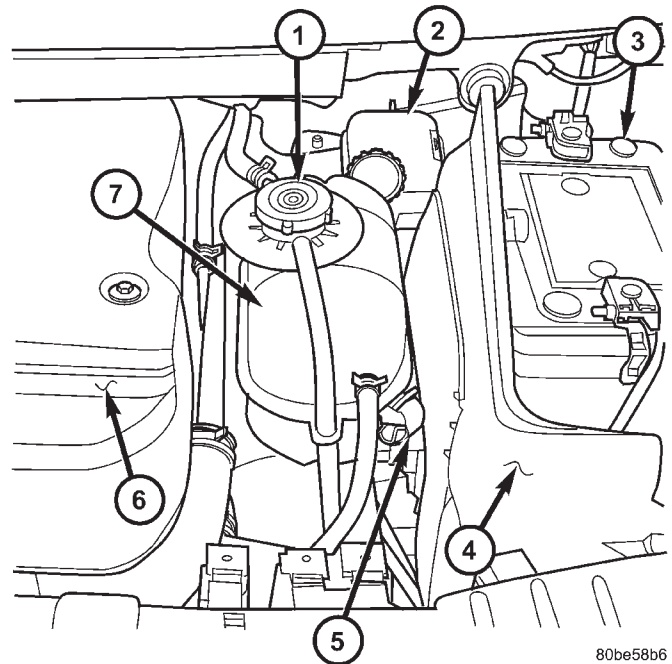
(12) Remove power steering return line retaining clamp (Fig. 4).

(13) Remove power steering line clamps from oil pan (Fig. 4).

(14) Remove power steering pump reservoir and bracket (Fig. 4).

(15) Drain coolant system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(16) Remove coolant pressure tank (Fig. 5).



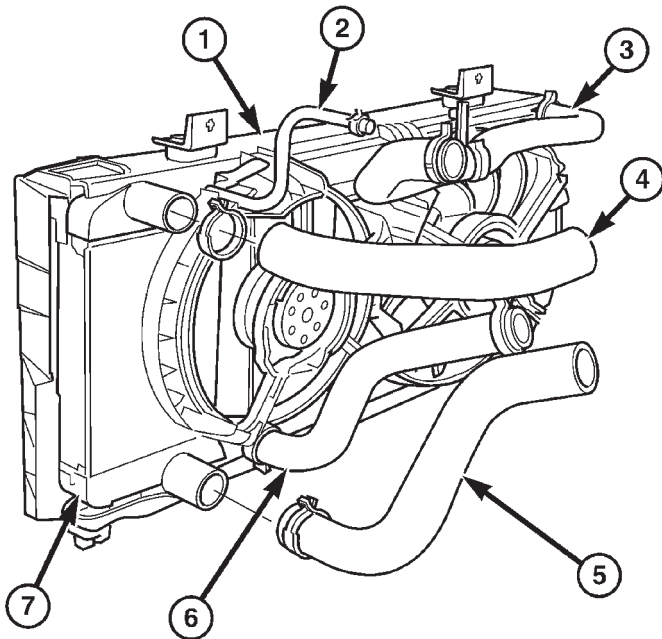
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Fig. 5 COOLANT RECOVERY PRESSURE CONTAINER LOCATION

- 1 - PRESSURE/VENT CAP
- 2 - BRAKE MASTER CYLINDER
- 3 - BATTERY
- 4 - BATTERY SHIELD
- 5 - COOLANT RECOVERY PRESSURE CONTAINER RETAINING CLIP
- 6 - ENGINE COVER
- 7 - COOLANT RECOVERY PRESSURE CONTAINER

ENGINE 2.5L TURBO DIESEL (Continued)

- (17) Remove battery shield.
- (18) Remove charge air cooler outlet hose.
- (19) Remove charge air cooler inlet hose (Fig. 6).

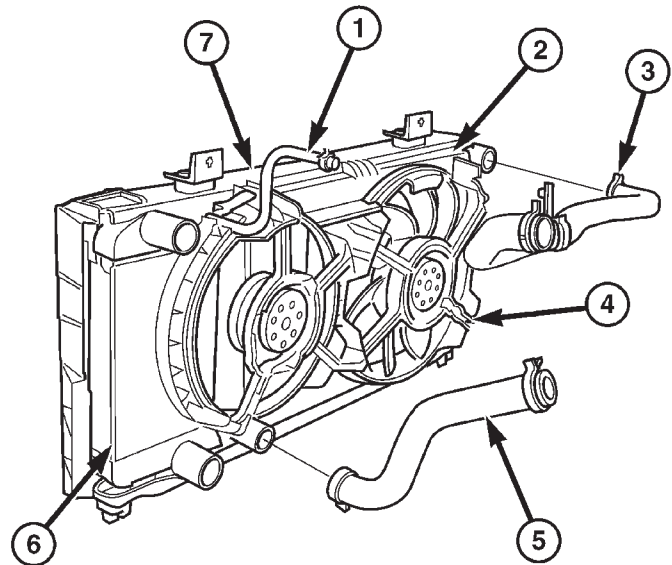


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Fig. 6 CHARGE AIR COOLER HOSES

- 1 - COOLING MODULE
- 2 - BYPASS HOSE
- 3 - UPPER RADIATOR HOSE
- 4 - CHARGE AIR COOLER OULET HOSE
- 5 - CHARGE AIR COOLER INLET HOSE
- 6 - LOWER RADIATOR HOSE
- 7 - CHARGE AIR COOLER

- (20) Disconnect upper radiator hose at engine (Fig. 7).
- (21) Disconnect lower radiator hose at engine (Fig. 7).
- (22) Disconnet brake booster vacuum supply hose.
- (23) Disconnect heater core return hose at engine.
- (24) Disconnect egr solenoid vacuum line at brake booster check valve.
- (25) Disconnect fuel injector, cam sensor, boost pressure/intake air temp sensor, fuel rail high pressure, and egr solenoid connectors (Fig. 8).
- (26) Disconnect generator electrical connectors.
- (27) Disconnect coolant temp sensor and glow plug electrical connectors.
- (28) Disconnect injection pump and A/C compressor electrical connectors.
- (29) Disconnect starter electrical connectors.
- (30) Disconnect ground wires at engine block.
- (31) Raise vehicle on hoist.
- (32) Disconnect oil temp sensor, oil pressure sensor, engine speed sensor, and vehicle speed sensor electrical connector (Fig. 9).



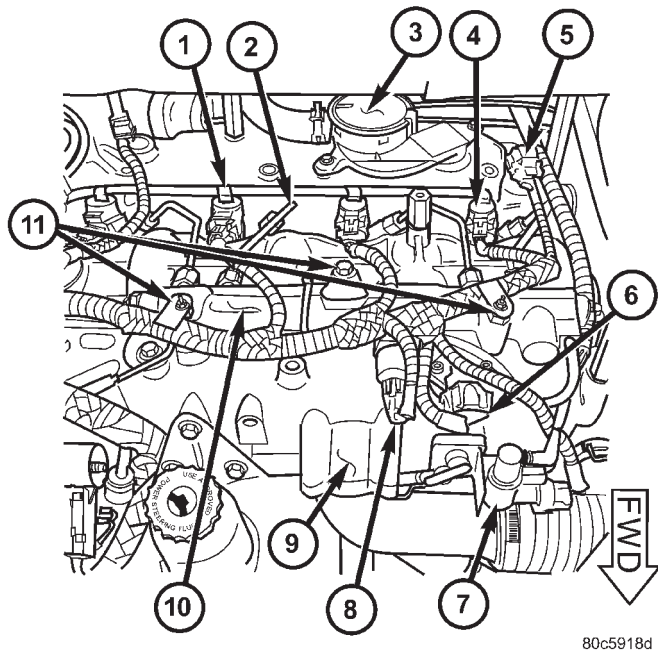
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Fig. 7 UPPER AND LOWER RADIATOR HOSES

- 1 - COOLANT BYPASS HOSE
- 2 - RADIATOR ASSEMBLY
- 3 - UPPER RADIATOR HOSE
- 4 - COOLING FAN
- 5 - LOWER RADIATOR HOSE
- 6 - CHARGE AIR COOLER
- 7 - RADIATOR BRACKET

- (33) Remove front wheels.
- (34) Remove the suspension cradle assembly (Refer to 13 - FRAME & BUMPERS/FRAME/ENGINE CRADLE CROSSMEMBER - REMOVAL).
- (35) Remove both axle shaft assemblies (Refer to 3 - DIFFERENTIAL & DRIVELINE/HALF SHAFT - REMOVAL).
- (36) Disconnect the clutch slave cylinder quick disconnect line (RHD only)(Refer to 6 - CLUTCH/SLAVE CYLINDER - REMOVAL).
- (37) Disconnect reverse lamp connector.
- (38) Disconnect shifter cables at the tranmission (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL/GEAR SHIFT CABLE - REMOVAL).
- (39) Disconnect exhaust pipe from the turbo-charger downpipe and reposition to right side of vehicle.
- (40) Disconnect cabin heater coolant line (Refer to 24 - HEATING & AIR CONDITIONING/CABIN HEATER/HEATER UNIT - REMOVAL).
- (41) Remove front engine mount bracket retaining bolts from lower radiator support
- (42) Lower vehicle. Evacuate the A/C system (Refer to 24 - HEATING & AIR CONDITIONING/

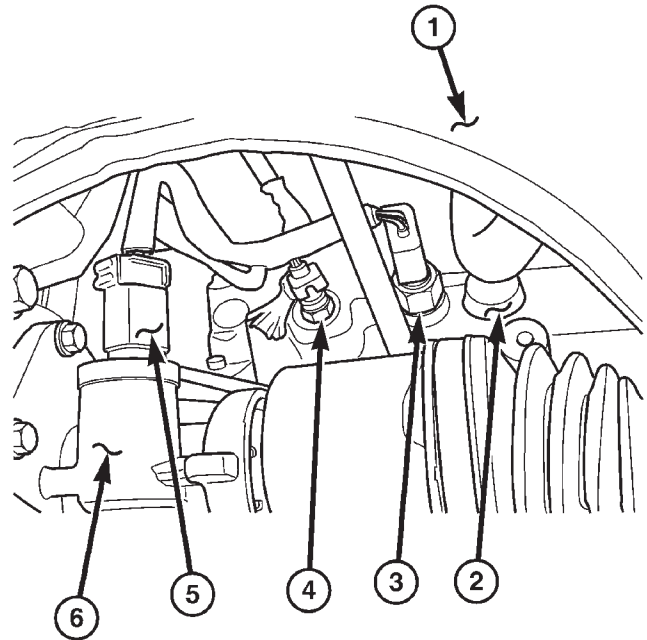
ENGINE 2.5L TURBO DIESEL (Continued)



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Fig. 8 ENGINE COMPONENT LOCATIONS

- 1 - FUEL INJECTOR RETURN LINE
- 2 - FUEL INJECTOR SUPPLY LINE
- 3 - OIL SEPARATOR
- 4 - FUEL INJECTOR
- 5 - CAMSHAFT POSITION SENSOR
- 6 - BOOST PRESSURE/INTAKE AIR TEMPERATURE SENSOR
- 7 - EGR SOLENOID
- 8 - FUEL PRESSURE SENSOR
- 9 - CYLINDER HEAD COVER/INTAKE MANIFOLD
- 10 - FUEL RAIL
- 11 - WIRING HARNESS RETAINING CLIPS



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Fig. 9 REAR ENGINE VIEW

- 1 - SUSPENSION CRADLE
- 2 - ENGINE BLOCK
- 3 - OIL PRESSURE SWITCH
- 4 - OIL TEMPERATURE SENSOR
- 5 - VEHICLE SPEED SENSOR
- 6 - TRANSMISSION

PLUMBING/REFRIGERANT - STANDARD PROCEDURE).

(43) Disconnect the A/C lines at the A/C compressor.

(44) Disconnect the fuel supply and return lines.

(45) Position engine cradle under engine and lower vehicle over cradle.

(46) Remove right engine mount bolts.

(47) Remove left engine mount through bolt.

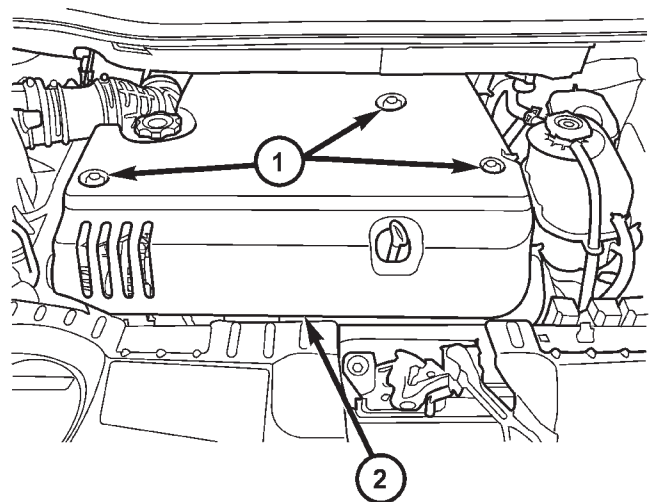
(48) Raise vehicle, leaving engine and transmission on engine cradle.

(49) Lift engine from engine cradle and disassemble as necessary.

REMOVAL - ENGINE COVER

(1) Remove engine cover retaining bolts.

(2) Remove engine cover from engine (Fig. 10).



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Fig. 10 ENGINE COVER

- 1 - ENGINE COVER MOUNTING BOLTS
- 2 - ENGINE COVER

ENGINE 2.5L TURBO DIESEL (Continued)

INSTALLATION

INSTALLATION - 2.5L TURBO DIESEL ENGINE

(1) Reassembly engine and transmission assembly and install on engine cradle.

(2) Position engine and cradle assembly under vehicle.

(3) Slowly lower the vehicle down over the engine and cradle assembly.

(4) Install right engine mount bolts. Torque to 54N·m (40 ft. lbs.)

(5) Install left engine mount through bolt. Torque to 75N·m (55 ft. lbs.)

(6) Raise vehicle and engine from engine cradle.

(7) Attach front engine mount bracket to lower radiator support. Torque to 54N·m (40 ft. lbs.)

(8) Connect cabin heater coolant hose.

(9) Connect exhaust pipe to the turbocharger downpipe flange. Torque to 28 N·m (250 in. lbs.)

(10) Connect reverse lamp electrical connector at transmission.

(11) Connect both shifter cables (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL/GEAR SHIFT CABLE - INSTALLATION).

(12) Connect the clutch slave cylinder quick disconnect connector (RHD only)(Refer to 6 - CLUTCH/SLAVE CYLINDER - INSTALLATION).

(13) Install engine harness into bracket on transmission.

(14) Lower vehicle.

(15) Connect fuel supply and return lines.

(16) Connect A/C lines to A/C compressor. Torque to 23N·m (17 ft. lbs.)

(17) Route engine wiring harness to proper location.

(18) Connect engine harness ground cables to engine block

(19) Connect starter solenoid electrical connector and battery feed wire to starter. Torque to 10N·m (90 in. lbs.)

(20) Connect A/C compressor, injection pump, glow plugs, and coolant temperature sensor electrical connectors.

(21) Connect generator electrical connector. Torque to 9N·m (75 in. lbs.)

(22) Connect the fuel injector, fuel pressure sensor, boost pressure/intake air temp sensor, cam sensor, and egr solenoid electrical connectors (Fig. 8).

(23) Connect egr solenoid vacuum supply line to brake boost vacuum supply line.

(24) Connect brake booster vacuum supply line.

(25) Connect heater core return hose to coolant pipe.

(26) Connect lower radiator hose to engine (Fig. 7).

(27) Install charger air cooler inlet hose (Fig. 6).

(28) Install charge air cooler outlet hose (Fig. 6).

(29) Connect upper radiator hose to engine (Fig. 7).

(30) Install battery shield.

(31) Install coolant reserve pressure container (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY PRESS CONTAINER - INSTALLATION).

(32) Install power steering reservoir and bracket (Fig. 4).

(33) Raise vehicle

(34) Connect oil pressure sensor, oil temperature sensor, engine speed sensor, and vehicle speed sensor electrical connector (Fig. 9).

(35) Install suspension cradle in vehicle (Refer to 13 - FRAME & BUMPERS/FRAME/ENGINE CRADLE CROSSMEMBER - INSTALLATION).

(36) Install both axle shaft assemblies (Refer to 3 - DIFFERENTIAL & DRIVELINE/HALF SHAFT - INSTALLATION).

(37) Connect the power steering supply, pressure, and return lines to power steering pump (Fig. 4).

(38) Install the power steering line brackets on oil pan (Fig. 4).

(39) Install lower splash shield and side panels.

(40) Install both front wheel and tire assemblies.

(41) Lower vehicle.

(42) Install air cleaner housing, MAF sensor, and air intake tube assembly (Fig. 3).

(43) Refill transmission to proper level (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL/FLUID - STANDARD PROCEDURE).

(44) Refill engine coolant (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(45) Recharge A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE) .

(46) Install engine cover (Refer to 9 - ENGINE - INSTALLATION) (Fig. 2).

(47) Connect negative battery cable.

INSTALLATION - ENGINE COVER

(1) Install engine cover on engine.

(2) Install the engine cover mounting bolts (Fig. 10).

ENGINE 2.5L TURBO DIESEL (Continued)

SPECIFICATIONS

**SPECIFICATIONS - 2.5L COMMON RAIL
DIESEL ENGINE***ENGINE SPECIFICATIONS*

DESCRIPTION	SPECIFICATION
Type	R2516C
Number of Cylinders	4
Bore	92 mm
Stroke	94 mm
Displacement	2499.5cc
Injection Order	1-3-4-2
Compression Ratio	17.5:1 (± 0.5)
Maximum Power	103kW (140 HP) @ 4000 RPM
Peak Torque	320Nm (32.6 kgm) @ 2000 RPM
CRANKSHAFT	
Front Journal Diameter	
Nominal	62.985-63.005 mm
-0.25	62.735-62.755 mm
Front Bearing Diameter	
Nominal	63.045-63.074 mm
-0.25	62.795-62.824 mm
Clearance Between Journal and Bearing	0.040-0.089 mm
Center Journal Diameter	
Nominal	63.005-63.020 mm
-0.25	62.755-62.770 mm
Center Bearing Diameter	
Nominal	63.005-63.020 mm
-0.25	62.755-62.770 mm
Clearance Between Journal and Bearing	0.008-0.051 mm
Rear Journal Diameter	
Nominal	89.980-90.000 mm
-0.25	89.730-99.750 mm
Rear Bearing Diameter	
Nominal	90.045-90.065 mm
-0.25	89.795-89.815 mm
Clearance Between Journal and Bearing	0.045-0.080 mm
Connecting Rod Journal	
Nominal	53.940-53.955 mm

DESCRIPTION	SPECIFICATION
-0.25	53.690-53.705 mm
Connecting Rod Bearing	
Nominal	53.977-54.016 mm
-0.25	53.727-53.766 mm
Clearance Between Journal and Bearing	0.022-0.076 mm
Crankshaft End Play	
End Play	0.080-0.280 mm
Adjustment	Thrust Washers
Thrust Washers Available	2.31-2.36 mm
	2.41-2.46 mm
	2.51-2.56 mm
Carrier with thrust washers installed	27.670-27.820 mm
MAIN BEARING CARRIERS	
Internal Diameter	
Front	67.025-67.050 mm
Center	66.670-66.690 mm
Rear	85.985-86.005 mm
LINERS	
Internal Diameter	91.997-92.015 mm
Protrusion	0.01-0.06 mm
Adjustment	Shims
Available Shims	0.15 mm
	0.17 mm
	0.20 mm
	0.23 mm
	0.25 mm
CYLINDER HEAD	
Minimum Thickness	89.95-90.05 mm
Gasket Thickness	1.32 mm ± 0.08, 0 notches
	1.42 mm ± 0.08, 1 notch
	1.52 mm ± 0.08, 2 notches
CONNECTING RODS	
Weight (without the crankbearing)	1129-1195 grams
Small End Bearing Internal Diameter	30.035-30.050 mm
Large End Internal Diameter	53.977-54.016 mm

ENGINE 2.5L TURBO DIESEL (Continued)

DESCRIPTION	SPECIFICATION
PISTONS	
Skirt Diameter (measured at approximately 10 mm above the bottom of the skirt)	91.912-91.928 mm
Piston Clearance	0.065-0.083 mm
Top of Piston to Cylinder Head	0.69-0.83 mm
Piston Potrusion	0.49-0.60 Fit Gasket Number (1.32), 0 notches or holes
	0.61-0.70 Fit Gasket Number (1.42), 1 notch or hole
	0.71-0.83 Fit Gasket Number (1.52), 2 notches or holes
PISTON PINS	
Type	Full Floating
Pin Diameter	29.992-29.996 mm
Clearance	0.004-0.012 mm
PISTON RINGS	
Clearance in Groove	
Top	0.078-0.137 mm
Second	0.070-0.110 mm
Oil Control	0.040-0.080 mm
Fitted Gap	
Top	0.30-0.45 mm
Second	0.30-0.45 mm
Oil Control	0.25-0.50 mm
CAMSHAFT	
Journal Diameter–Front	29.960-29.980 mm
Bearing Clearance	0.03-0.08 mm
Journal Diameter–Center	39.250-39.270 mm
Bearing Clearance	0.03-0.08 mm
Journal Diameter–Rear	39.250-39.270 mm
Bearing Clearance	0.03-0.08 mm
HYDRAULIC LIFTER	
Outside Diameter	11.994 ± 0.006 mm
VALVES	
Intake Valve	
Opens	16° B.T.D.C.
Closes	58° A.B.D.C.
Exhaust Valve	

DESCRIPTION	SPECIFICATION
Opens	65° B.B.D.C.
Closes	29° A.T.D.C.
Face Angle	
Intake	45° 25'-55° 35'
Exhaust	45° 25'-45° 35'
Head Diameter	
Intake	32.30-32.50 mm
Exhaust	30.80-31.00 mm
Head Stand Down	
Intake	1.08-1.34 mm
Exhaust	0.99-1.25 mm
Stem Diameter	
Intake	5.952-5.970 mm
Exhaust	5.942-5.960 mm
Clearance in Guide	
Intake	0.030-0.060 mm
Exhaust	0.040-0.070 mm
VALVE GUIDE	
Inside Diameter	6.00-6.012 mm
Fitted Height	
Intake	14.5-15.0 mm
Exhaust	16.5-17.0 mm
VALVE SPRINGS	
Free Length	45.26 mm
Fitted Length	38.00 mm
Load at Fitted Length	182 ± 5-10% Kg
Load at Top of Lift	395 ± 5% Kg
Number of Coils	8
LUBRICATION	
System Pressure at 4000 RPM	4.5-5.0 bar (oil at 90-100°C)
Pressure Relief Valve Opens	6.50 bar
Pressure Relief Valve Spring-Free Length	51.5 mm
OIL PUMP	
Outer Rotor End Float	0.060-0.160 mm
Inner Rotor End Float	0.060-0.160 mm
Outer Rotor to Body Diameter Clearance	0.130-0.240 mm
Rotor Body to Drive Gear Clearance (pump not fitted)	0.90-1.50 mm

ENGINE 2.5L TURBO DIESEL (Continued)

SPECIFICATIONS - TORQUE

2.5L DIESEL TORQUE SPECIFICATIONS

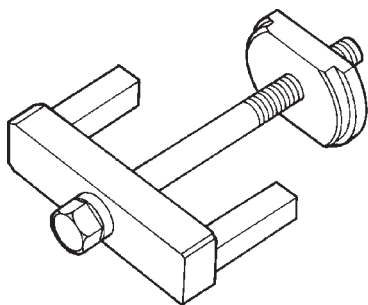
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Oil Pump Bolts	10.8	8	96
Vacuum Pump Bolts	10.8	8	96
Crankshaft Gear Bolts	10.8	8	96
Crankshaft Position Sensor Bolts	10.8	8	96
Flywheel Bolts - Refer to the Service Procedure			
Cylinder Head Bolts - Refer to the Service Procedure			
Reluctor Wheel Bolts	14.6	11	130
Rear Main Bearing Support Bolts	27.5	21	240
Oil Cooler to Engine Block Bolt	47.1	35	—
Oil Cooler Mounting Stud	50	37	—
Water Pump Housing Nuts	24.4	18	212
Connecting Rod Bolts - Refer to the Service Procedure			
Balance Shaft Bolts	32.4	24	—
Oil Jet Bolts	10.8	8	96
Oil Pan Bolts	11.8	8	96
Crankshaft Hub Bolt	304	225	—
Front Engine Cover Bolts	11.8	8	96
Transmission to Engine Bolts	83.4	62	—
Cylinder Head Cover / Intake Manifold Bolts	27.5	20	—
Camshaft Access Plugs	80	59	—
Oil Separator Bolts	10.8	8	96
Camshaft Position Sensor Bolt	10.8	8	96
Boost Pressure / Intake Air Temp. Sensor Bolts	5.4	—	48
Accessory Drive Bracket Bolts	47.1	35	—
Vacuum Line Fitting Bolt	56.9	42	—
Fuel Pump Nuts	27.5	21	—
Fuel Line Fittings at Pump	27.5	21	—
Inner Timing Belt Cover Bolts			

ENGINE 2.5L TURBO DIESEL (Continued)

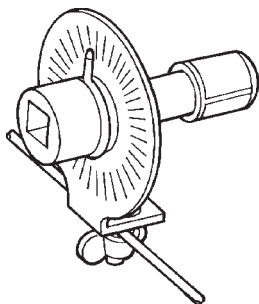
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
8mm	10.8	8	96
10mm	47.1	35	—
Outer Timing Belt Cover Bolts			
3mm	6	—	54
8mm	10.8	8	96
Engine Mount Bracket to Cylinder Head Bolts	47.1	35	—
Intake Inlet Tube Bolts	10.1	8	89
Camshaft Sprocket Bolts	108	80	—
Timing Belt Idler Pulley Bolt	47.1	35	—
Timing Belt Tensioner Bolt	34.7	26	—
Fuel Pump Nut	88.3	65	—
Engine Lift Hook Bolts	32.4	24	—
Thermostat Housing Bolts	27.5	21	—
Turbocharger Oil Feed Line Fitting	24.5	18	217
Exhaust Manifold Nuts	32.4	24	—
Exhaust Manifold Heatshield Bolts	27.5	21	—
EGR Valve Nuts	32.4	24	—
EGR Cooler to EGR Bolts	32.4	24	—
Turbocharger Downpipe Nuts	32.4	24	—
Turbocharger Bracket Bolts	47.1	35	—
Vibration Damper to Crankshaft Hub Bolts	27.5	21	—
Crankshaft Support Bolts	44.1	33	—
Turbocharger to Exhaust Manifold Nuts	32.4	24	—

ENGINE 2.5L TURBO DIESEL (Continued)

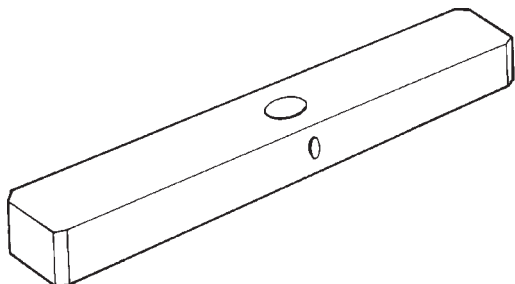
SPECIAL TOOLS



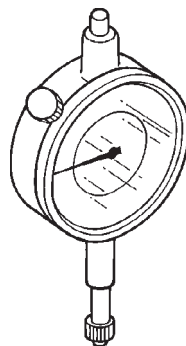
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VM.1001 CYLINDER LINER PULLER

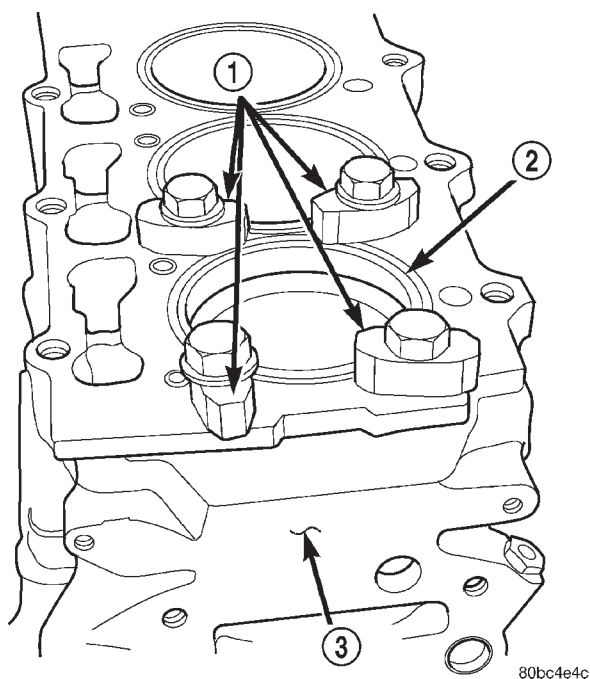
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VM.1005 TORQUE ANGLE GAUGE

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VM.1010 CYLINDER LINER PROTRUSION TOOL

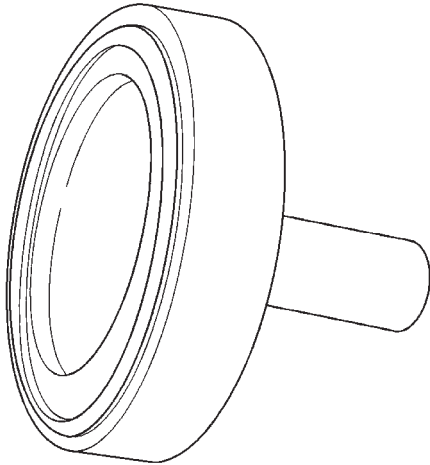
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VM.1013 DIAL INDICATOR

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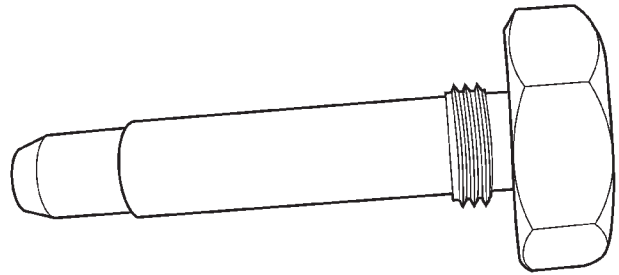
VM.1016 CYLINDER RETAINER

ENGINE 2.5L TURBO DIESEL (Continued)



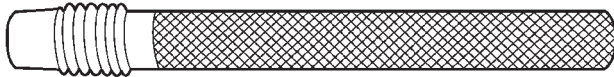
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VM.1050 CRANKSHAFT REAR SEAL INSTALLER



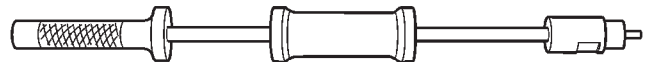
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VM.1053 EXHAUST CAMSHAFT ALIGNMENT PIN



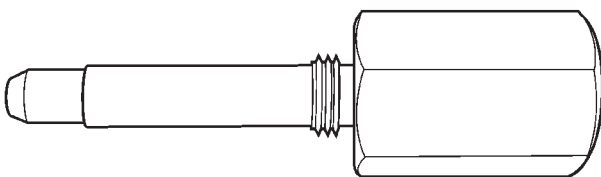
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VM.1051 TDC ALIGNMENT PIN



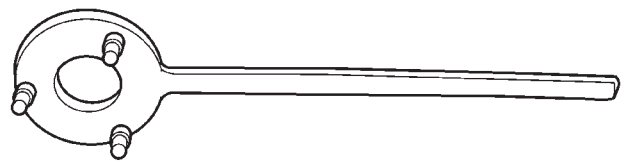
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**VM.1054 RELIEF VALVE REMOVER/CENTRAL
CARRIER PIN REMOVER/INSTALLER**



80c143ba

VM.1052 INTAKE CAMSHAFT ALIGNMENT PIN



80c13cec

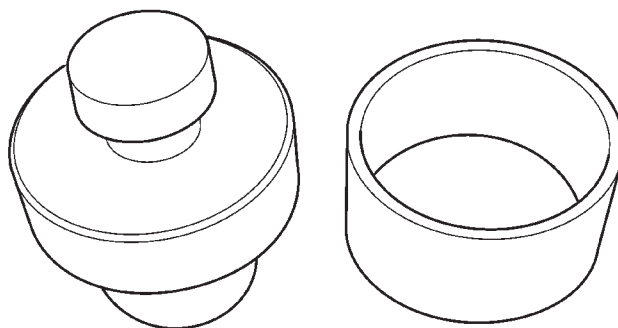
**VM.1055 CAMSHAFT/INJECTION PUMP GEAR
HOLDER**

ENGINE 2.5L TURBO DIESEL (Continued)



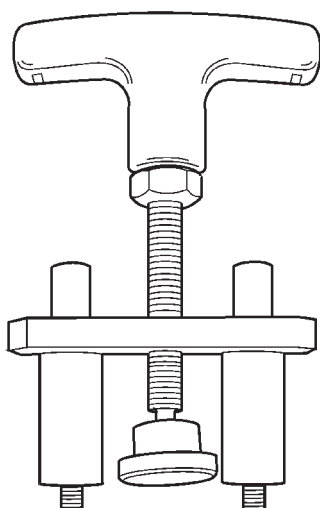
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VM.1056 BALANCE SHAFT LOCKING PIN

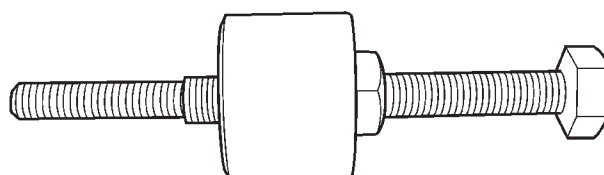


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VM.1061 FRONT OIL SEAL INSTALLER



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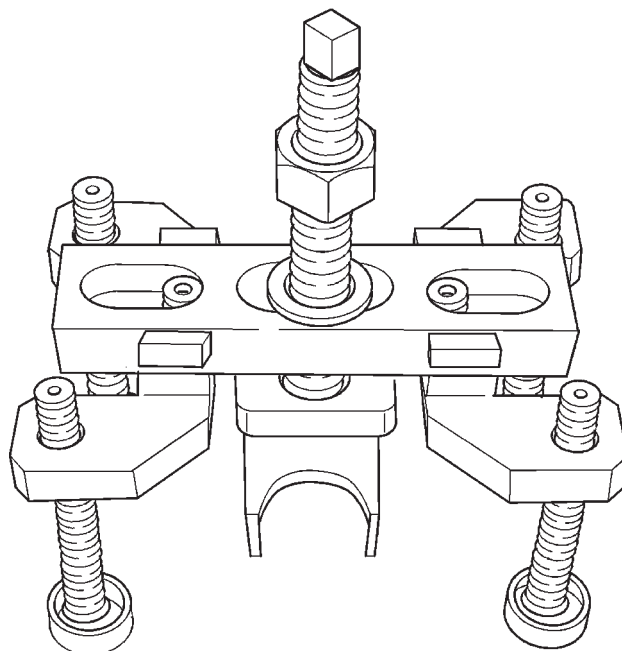
VM.1062 POWER STEERING PUMP INSTALLER

VM.1059 OIL PRESSURE RELIEF VALVE INSTALLER



80c17f19

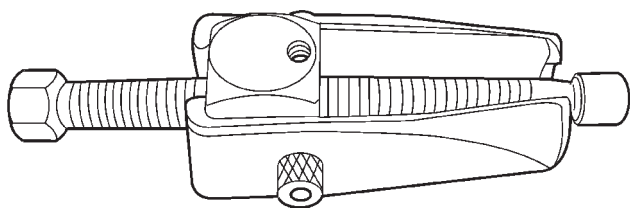
VM.1060 OIL JET REMOVER /INSTALLER



80c499a4

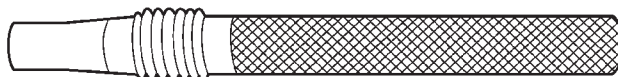
VM.1063 FUEL INJECTOR REMOVER

ENGINE 2.5L TURBO DIESEL (Continued)



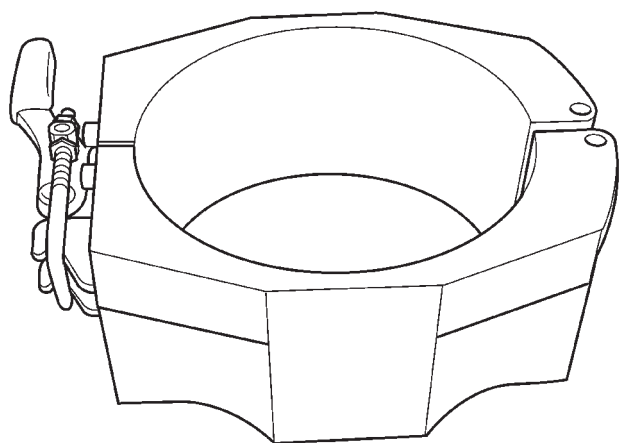
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**VM.1064 POWER STEERING PUMP GEAR
REMOVER**



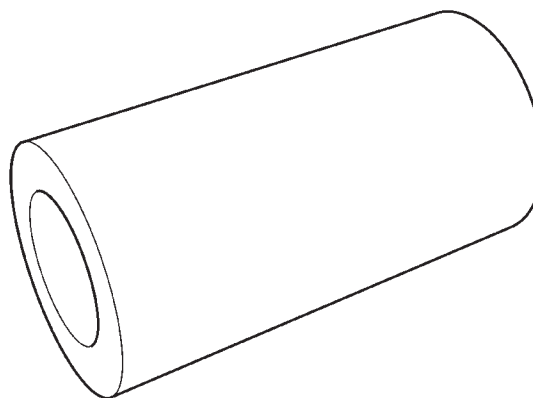
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VM.1068 90 DEGREES AFTER TDC ALIGNMENT PIN



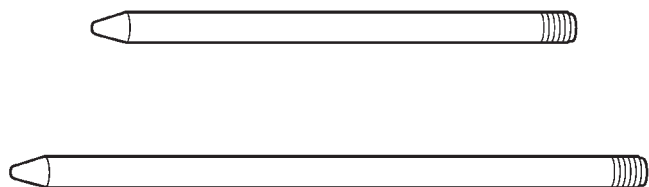
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VM.1065 PISTON RING COMPRESSOR



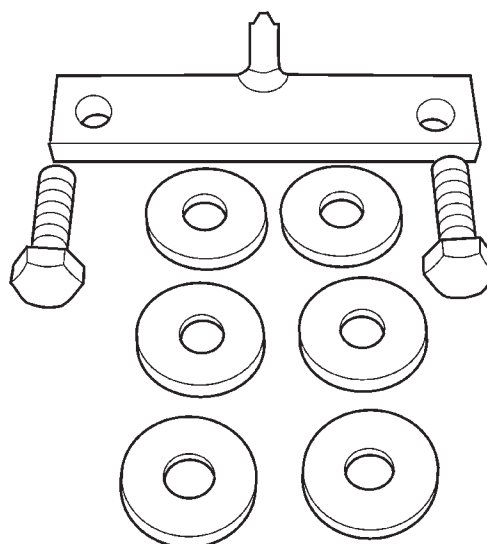
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VM.1069 CRANKSHAFT REM/INSTALL SLEEVE



80c177d0

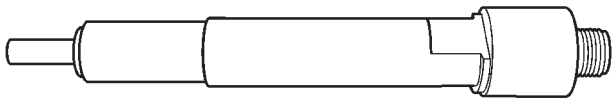
**VM.1066 CYLINDER HEAD COVER ALIGNMENT
PINS**



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VM.1070 FLYWHEEL LOCKING TOOL

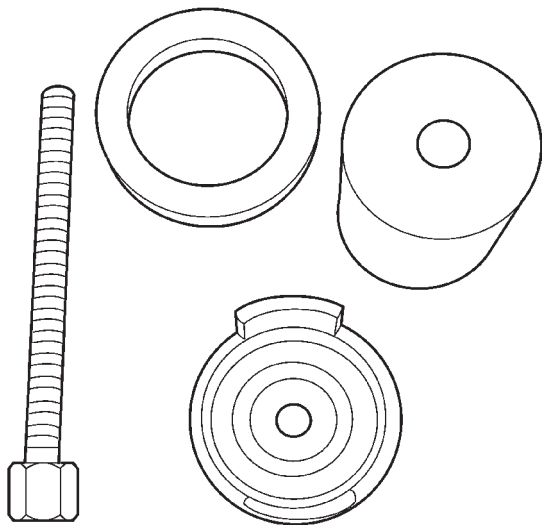
ENGINE 2.5L TURBO DIESEL (Continued)



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VM.1072 COMPRESSION TESTER ADAPTER

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VM.1075 FLYWHEEL ALIGNMENT PINS

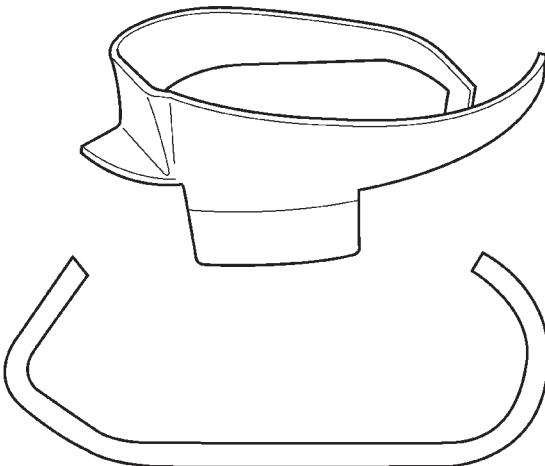
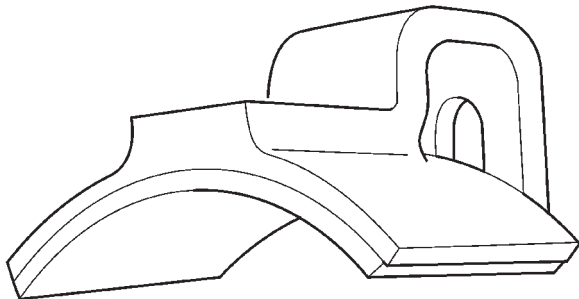


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VM.1073 CRANKSHAFT FRONT BEARING
REMOVER/INSTALLER

VM.1077 POWER STEERING BELT REMOVER



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VM.1074 TIMING BELT RETAINER

VM.1078 POWER STEERING BELT INSTALLER

CYLINDER HEAD

STANDARD PROCEDURE

STANDARD PROCEDURE - VALVE SERVICE

This procedure is done with the engine cylinder head removed from the block.

DISASSEMBLY

(1) Remove the engine cylinder head from the cylinder block. Refer to cylinder head removal and installation in this section.

(2) Use Valve Spring Compressor Tool and compress each valve spring.

(3) Remove the valve locks, retainers, and springs.

(4) Use an Arkansas smooth stone or a jewelers file to remove any burrs on the top of the valve stem, especially around the groove for the locks.

(5) Remove the valves, and place them in a rack in the same order as removed.

VALVE CLEANING

(1) Clean all carbon deposits from the combustion chambers, valve ports, valve stems, valve stem guides and head.

(2) Clean all grime and gasket material from the engine cylinder head machined gasket surface.

INSPECTION

(1) Inspect for cracks in the combustion chambers and valve ports.

(2) Inspect for cracks on the exhaust seat.

(3) Inspect for cracks in the gasket surface at each coolant passage.

(4) Inspect valves for burned, cracked or warped heads.

(5) Inspect for scuffed or bent valve stems.

(6) Replace valves displaying any damage.

(7) Check valve spring height (Fig. 11).

VALVE REFACING

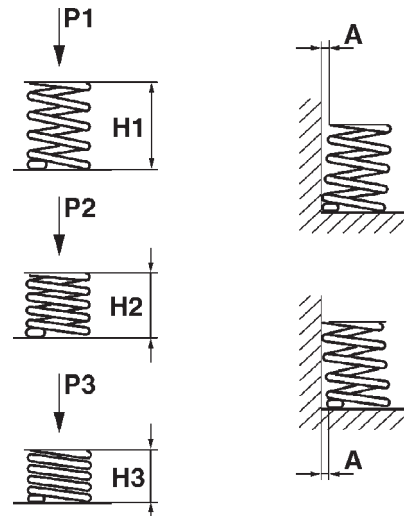
(1) Use a valve refacing machine to reface the intake and exhaust valves to the specified angle.

(2) After refacing, a margin of at least 4.52-4.49 mm (.178-.177 inch) must remain (Fig. 12). If the margin is less than 4.49 mm (.177 inch), the valve must be replaced.

VALVE SEAT REFACING

(1) Install a pilot of the correct size in the valve guide bore. Reface the valve seat to the specified angle with a good dressing stone. Remove only enough metal to provide a smooth finish.

(2) Use tapered stones to obtain the specified seat width when required.



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Fig. 11 VALVE SPRING CHART

	LOAD Kg		HEIGHT mm	STATE
P1	0.00	H1	45.26	FREE LENGTH
P2	182-5 +10%	H2	38.00	VALVE CLOSED
P3	395±5%	H3	28.20	VALVE OPEN

VALVE STAND DOWN

Valve stand down is to maintain the adequate compression ratio.

(1) Invert cylinder head.

(2) Fit each valve to its respective valve guide.

(3) Using a straight edge and feeler gauge, check valve head stand down: Inlet valve head stand down 1.08 to 1.34 mm (.042 to .052 ins.) and exhaust valve stand down .99 to 1.25 mm (.035 to .049 ins.).

(4) If valve head stand down is not in accordance with above, discard original valves, check stand down with new valves and recut valve seat inserts to obtain correct stand down.

VALVE GUIDES

(1) Valve Guides height requirement.

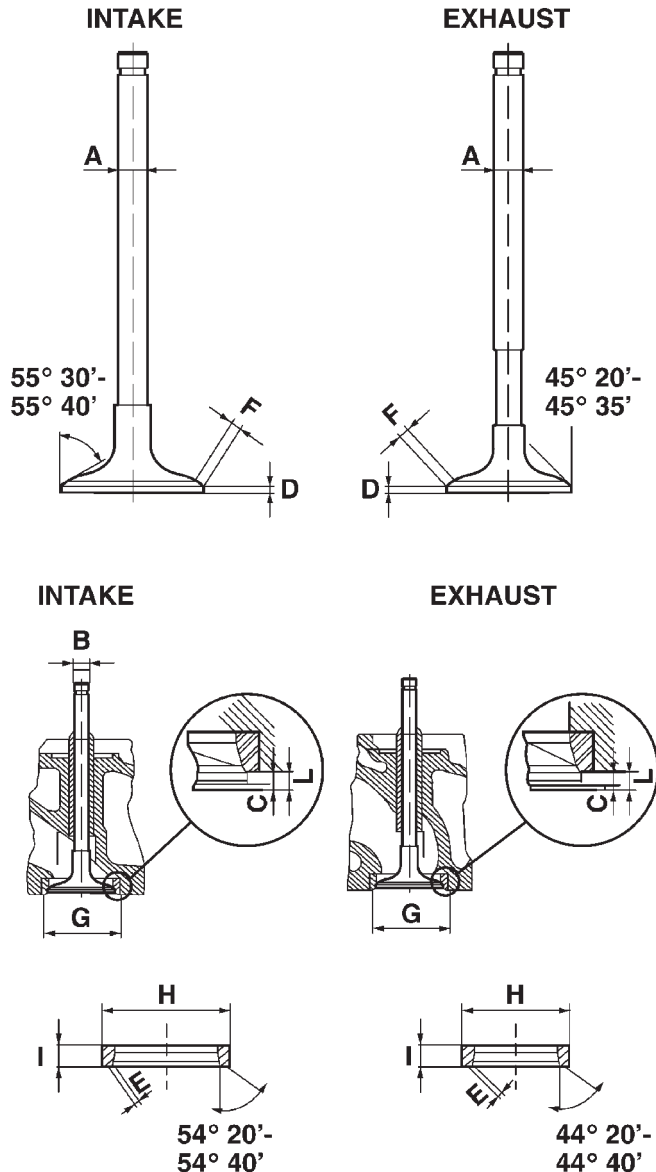
(2) Measurement A (Fig. 13): 16.50 - 17.00 mm.
Measurement B : 14.50 - 15.00 mm.

VALVE STEM-TO-GUIDE CLEARANCE MEASUREMENT

(1) Measure and record internal diameter of valve guides. Valve guide internal diameter is 8.0 to 8.015 mm (.3149 to .3155 ins.).

(2) Measure valve stems and record diameters. Intake valve stem diameter 7.94 to 7.96 mm (.3125 to

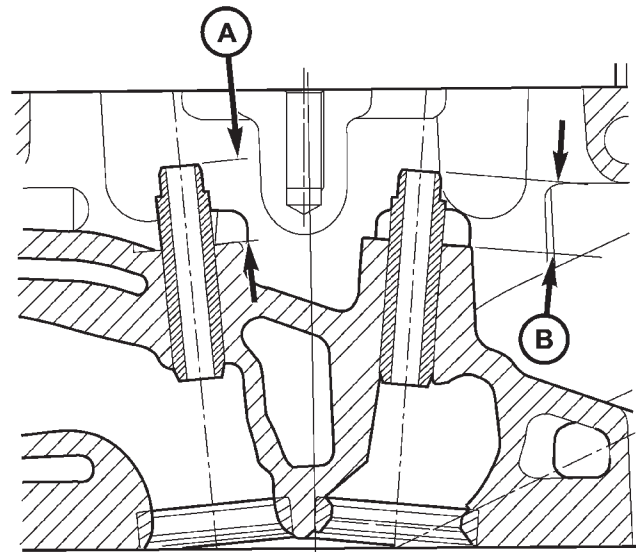
CYLINDER HEAD (Continued)



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Fig. 12 VALVE SPECS.

MEASUREMENT	INTAKE	EXHAUST
A	7.940-7.960	7.922-7.940
B	8.00-8.015	8.000-8.015
C	1.08-1.34	0.990-1.250 +0.07
D	2.2 ± 0.08	2.09 -0.09
E	1.80-2.20	1.65-2.05
F	2.73-3.44	2.45-3.02
G	41.962-41.985	35.964-35.987
H	42.070-42.086	36.050-36.066
I	7.14-7.19	7.00-7.05
L	3.11-3.26	3.10-3.25



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Fig. 13 VALVE GUIDE HEIGHT

.3133 in). Exhaust valve stem diameter 7.92 to 7.94 mm (.3118 to .31215 in).

(3) Subtract diameter of valve stem from internal diameter of its respective valve guide to obtain valve stem clearance in valve guide. Clearance of inlet valve stem in valve guide is .040 to .075 mm (.0015 to .0029 in). Clearance of exhaust valve stem in valve guide is .060 to .093 mm (.0023 to .0036 in).

(4) If valve stem clearance in valve guide exceeds tolerances, new valve guides must be installed.

STANDARD PROCEDURE - MEASURING PISTON PROTRUSION

(1) Use special tool VM.1010 with dial indicator special tool VM.1013 (Fig. 14).

(2) Bring the piston of cylinder no. 1 exactly to top dead center.

(3) Zero the dial indicator on the cylinder block mating surface.

(4) Setup the dial indicator on the piston crown (above the center of the piston pin) 5mm (1/8 in.) from the edge of the piston and note the measurement.

(5) Repeat the procedure with the rest of the cylinders.

(6) Establish the thickness of the steel gasket by averaging the four piston protrusion readings.

CYLINDER HEAD (Continued)

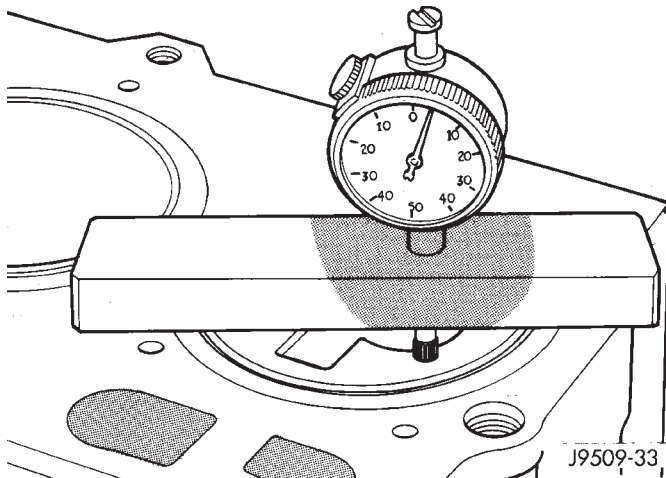


Fig. 14 MEASURING PISTON PROTRUSION

Measure Dimension (mm)	0.49-0.60
Cylinder Head Gasket Thickness (mm)	1.32 No Holes or Notches
Piston Clearance (mm)	0.72-0.83
Measure Dimension (mm)	0.61-0.70
Cylinder Head Gasket Thickness (mm)	1.42 1 Hole or Notch
Piston Clearance (mm)	0.72-0.84
Measure Dimension (mm)	0.71-0.83
Cylinder Head Gasket Thickness (mm)	1.52 2 Holes or Notches
Piston Clearance (mm)	0.68-0.81

REMOVAL

- (1) Disconnect negative battery cable.
- (2) Remove front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - REMOVAL).
- (3) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
- (4) Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
- (5) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (6) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (7) Remove generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - REMOVAL).

(8) Support engine and remove right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - REMOVAL).

CAUTION: Before removing the cylinder head cover/intake manifold or timing belt the engine must put at 90° after TDC. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)

(9) Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(10) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(11) Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(12) Remove cylinder head cover/intake manifold (Fig. 15)(Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

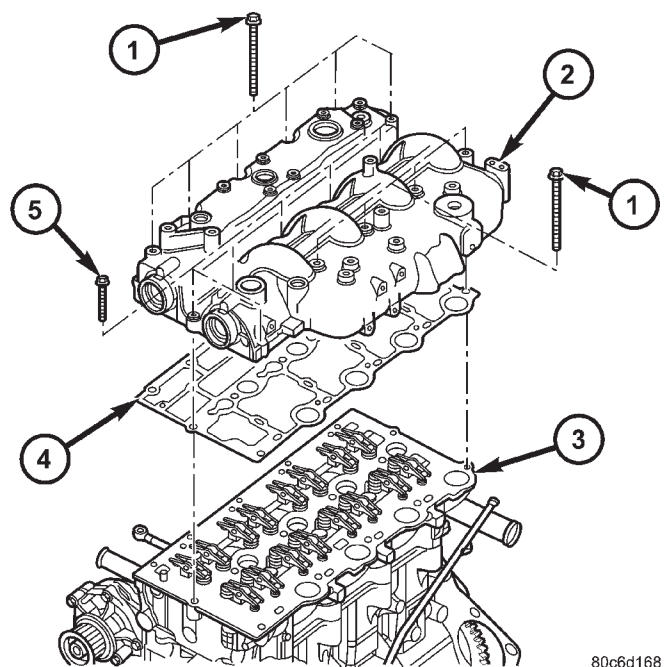


Fig. 15 CYLINDER HEAD COVER/INTAKE MANIFOLD ASSEMBLY

- 1 - CYLINDER HEAD COVER/INTAKE MANIFOLD BOLTS(LONG)
- 2 - CYLINDER HEAD COVER/INTAKE MANIFOLD
- 3 - CYLINDER HEAD
- 4 - CYLINDER HEAD COVER/INTAKE MANIFOLD GASKET
- 5 - CYLINDER HEAD COVER/INTAKE MANIFOLD BOLTS(SHORT)

CYLINDER HEAD (Continued)

(13) Remove rocker arm and lifter assemblies from cylinder head.

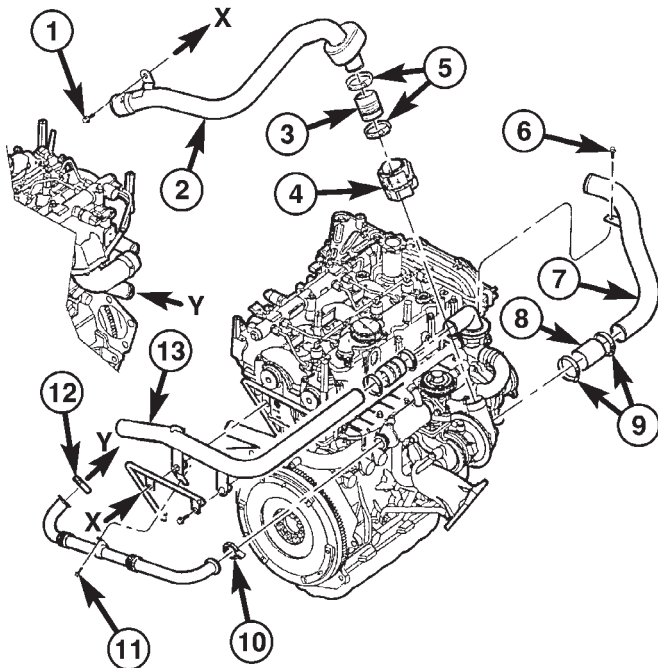
(14) Remove cylinder head cover/intake manifold gasket from cylinder head.

(15) Disconnect glow plug and engine coolant temperature electrical connectors.

(16) Remove coolant recovery pressure container (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY PRESS CONTAINER - REMOVAL).

(17) Remove thermostat housing to upper radiator hose pipe (Fig. 16).

(18) Remove turbocharger outlet to charge air cooler pipe (Fig. 16).

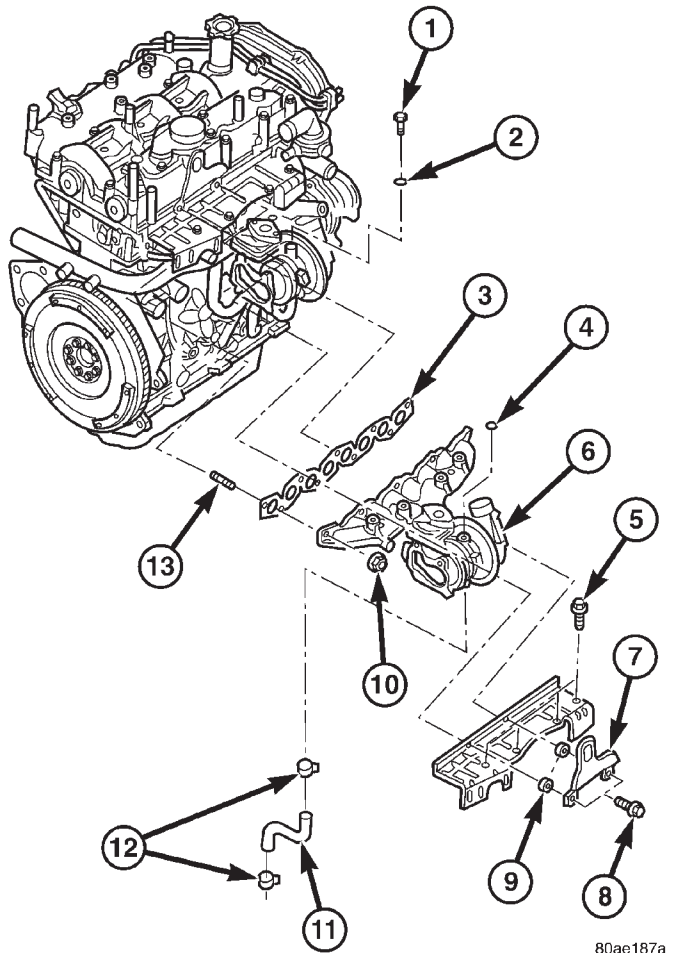


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Fig. 16 TURBOCHARGER AND COOLANT PIPES

- 1 - TURBOCHARGER OUTLET PIPE RETAINING BOLT
- 2 - TURBOCHARGER OUTLET PIPE
- 3 - ADAPTER HOSE
- 4 - HEAT SHIELD
- 5 - HOSE CLAMPS
- 6 - TURBOCHARGER INLET PIPE RETAINING BOLT
- 7 - TURBOCHARGER INLET PIPE
- 8 - ADAPTER HOSE
- 9 - HOSE CLAMPS
- 10 - CLAMP
- 11 - EGR VALVE TO INTAKE AIR INLET PIPE
- 12 - CLAMP
- 13 - THERMOSTAT HOUSING TO UPPER RADIATOR HOSE PIPE

(19) Remove exhaust manifold heat shield (Fig. 17).



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Fig. 17 EXHAUST MANIFOLD AND TURBOCHARGER

- 1 - TURBOCHARGER OIL SUPPLY BANJO BOLT
- 2 - COPPER WASHER
- 3 - EXHAUST MANIFOLD GASKET
- 4 - COPPER WASHER
- 5 - EXHAUST MANIFOLD HEAT SHIELD RETAINING BOLT
- 6 - TURBOCHARGER
- 7 - ENGINE LIFT HOOK
- 8 - ENGINE LIFT HOOK RETAINING BOLT
- 9 - SPACER
- 10 - EXHAUST MANIFOLD RETAINING NUT
- 11 - TURBOCHARGER OIL RETURN HOSE
- 12 - HOSE CLAMPS
- 13 - EXHAUST MANIFOLD STUDS

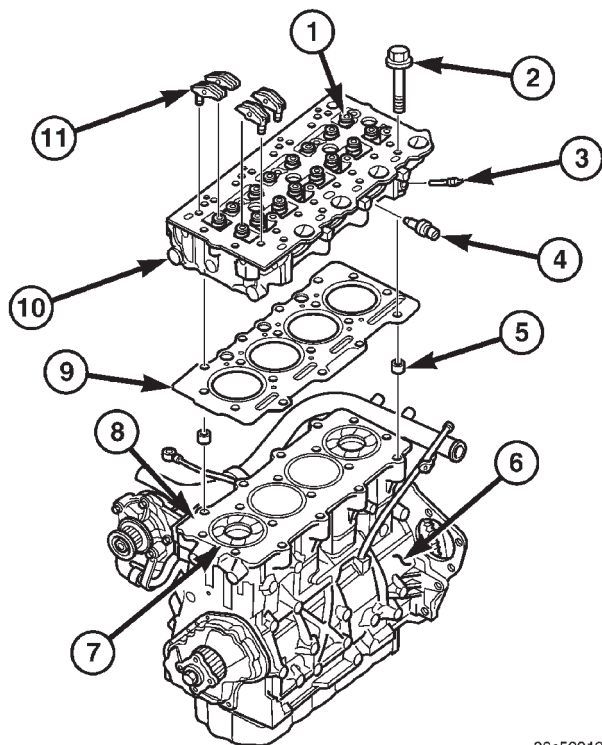
(20) Remove exhaust manifold retaining nuts (Fig. 17).

(21) Slide exhaust manifold and turbocharger off of exhaust manifold studs (Fig. 17).

(22) Remove cylinder head bolts.

CYLINDER HEAD (Continued)

(23) Remove cylinder head assembly from engine block (Fig. 18).



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Fig. 18 CYLINDER HEAD ASSEMBLY

- 1 - VALVE SPRING
- 2 - CYLINDER HEAD BOLT
- 3 - GLOW PLUG
- 4 - COOLANT TEMPERATURE SENSOR
- 5 - CYLINDER HEAD ALIGNMENT DOWEL
- 6 - CYLINDER BLOCK
- 7 - CYLINDER LINER
- 8 - ENGINE BLOCK DECK
- 9 - CYLINDER HEAD GASKET
- 10 - CYLINDER HEAD
- 11 - ROCKER ARM AND LIFTER ASSEMBLY

CLEANING

Thoroughly clean the engine cylinder head and cylinder block mating surfaces. Clean the intake and exhaust manifold and engine cylinder head mating surfaces. Remove all gasket material and carbon.

Check to ensure that no coolant or foreign material has fallen into the tappet bore area.

Remove the carbon deposits from the combustion chambers and top of the pistons.

INSPECTION

Use a straightedge and feeler gauge to check the flatness of the engine cylinder head and block mating surfaces.

The minimum cylinder head thickness is 89.95mm (3.541 in.).

INSTALLATION

CAUTION: Piston protrusion must be measured to determine cylinder head gasket thickness if one or more cylinder liners have been replaced (Refer to 9 - ENGINE/CYLINDER HEAD - STANDARD PROCEDURE).

NOTE: If cylinder liner(s) have not been removed, the same thickness head gasket that was removed can be used.

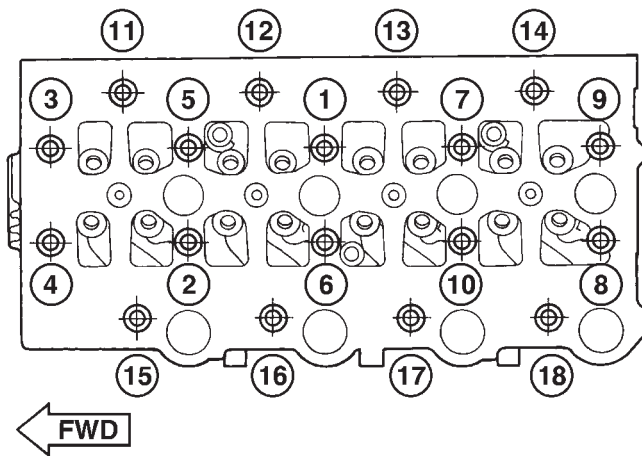
- (1) Clean and inspect gasket mating surfaces.
- (2) Position correct head gasket on engine block.
- (3) Place cylinder head on engine block (Fig. 18).

CAUTION: New cylinder head bolts must be used.

(4) Tighten cylinder head bolts following procedure below.

Cylinder Head Bolt Torquing Procedure

- (1) Lubricate cylinder head bolts with engine oil.
- (2) Torque bolts to 30N·m in numerical starting with bolt #1 (Fig. 19).
- (3) Tighten all bolts an additional 75°, starting with bolt #4 then 5-6-7-8-9-10-1-2-3 (Fig. 19).
- (4) Tighten all bolts an additional 50° in numerical order starting with bolt #11 then 12-13-14-15-16-17-18 (Fig. 19).
- (5) Without loosening any bolts tighten all bolts an additional 75° in the following sequence: 4-5-6-7-8-9-10-1-2-3-11-12-13-14-15-16-17-18.



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Fig. 19 CYLINDER HEAD TORQUE SEQUENCE

CYLINDER HEAD (Continued)

(5) Slide exhaust manifold and turbocharger on exhaust manifold studs (Fig. 17).

(6) Install exhaust manifold retaining nuts. Torque nuts to 32.4N·m.

(7) Install exhaust manifold heat shield (Fig. 17). Torque bolts to 27.5N·m.

(8) Install turbocharger outlet to charge air cooler pipe (Fig. 16).

(9) Install thermostat housing to upper radiator hose pipe (Fig. 16). Install retaining bolt and torque to 47.1N·m.

(10) Install coolant recovery pressure container (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY PRESS CONTAINER - INSTALLATION).

(11) Connect glow plug and coolant temperature sensor electrical connectors.

(12) Install new cylinder head cover/intake manifold gasket.

(13) Install rocker arm and lifter assemblies. **Be sure to put rocker arm and lifter assemblies in same location as removed.**

(14) Install cylinder head cover/intake manifold (Fig. 15)(Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(15) Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(16) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(17) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(18) **Remove crankshaft and both camshaft locking pins at this time** (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).

(19) Install generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).

(20) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(21) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(22) Install right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - INSTALLATION).

(23) Install air cleaner housing assembly.

(24) Refill cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(25) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

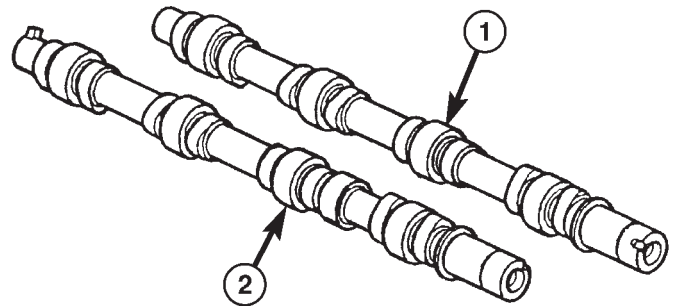
(26) Install front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - INSTALLATION).

(27) Connect negative battery cable.

CAMSHAFT(S)

DESCRIPTION

The camshafts are made of gray cast iron with eight machined lobes and four bearing journals (Fig. 20).



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Fig. 20 CAMSHAFTS

- 1 - INTAKE CAMSHAFT
- 2 - EXHAUST CAMSHAFT

OPERATION

When the camshaft rotates the lobes actuate the hydraulic lifters and rocker arms, forcing downward on the rocker arms which opens the valves.

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - REMOVAL).

(3) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(4) Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(5) Remove air cleaner housing.

(6) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(7) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(8) Remove generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - REMOVAL).

(9) Support engine and remove right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - REMOVAL).

CAMSHAFT(S) (Continued)

CAUTION: Before removing the cylinder head cover/intake manifold or timing belt the engine must put at 90° after TDC. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)

(10) Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(11) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(12) Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(13) Remove cylinder head cover/intake manifold (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(14) With cylinder head cover/intake manifold on work bench, remove plugs at rear of cylinder head cover/intake manifold.

(15) Remove camshaft oil seals (Fig. 21).

(16) Remove snapping and thrust washer from camshaft (Fig. 21).

(17) Slide camshaft through access hole at rear of cylinder head cover/intake manifold.

INSTALLATION

(1) Lubricate the camshafts with Mopar® Engine Oil Supplement, or equivalent.

(2) Carefully install camshafts into access holes in rear of cylinder head cover/intake manifold.

(3) Install thrust washer, snapping, and camshaft oil seal (Fig. 21).

CHECKING CAMSHAFT ENDPLAY

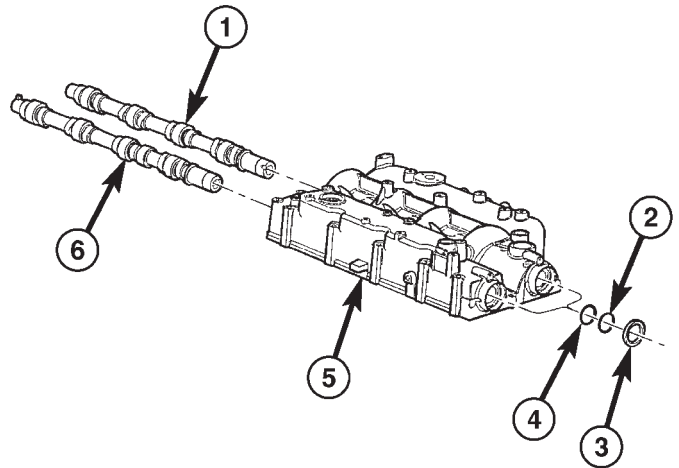
(1) After camshafts are properly installed in cylinder head cover check end play of camshafts with a dial indicator. The end play should be between .10 mm – .30 mm.

NOTE: If the camshaft endplay is not within specification, measure thickness of the camshaft spacer. Camshaft spacer thickness should be $2.8 \pm .02\text{mm}$.

(4) Install access hole plugs and gaskets at rear of cylinder head cover/intake manifold. Torque plugs to 80N·m.

(5) Install cylinder head cover/intake manifold on engine block (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(6) Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).



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Fig. 21 CAMSHAFT ASSEMBLY

- 1 - INTAKE CAMSHAFT
- 2 - SNAPRING
- 3 - CAMSHAFT OIL SEAL
- 4 - THRUST WASHER
- 5 - CYLINDER HEAD COVER/INTAKE MANIFOLD
- 6 - EXHAUST CAMSHAFT

(7) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION) .

(8) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(9) Install right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - INSTALLATION).

(10) Install generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).

(11) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(12) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(13) Install air cleaner housing.

(14) Refill cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

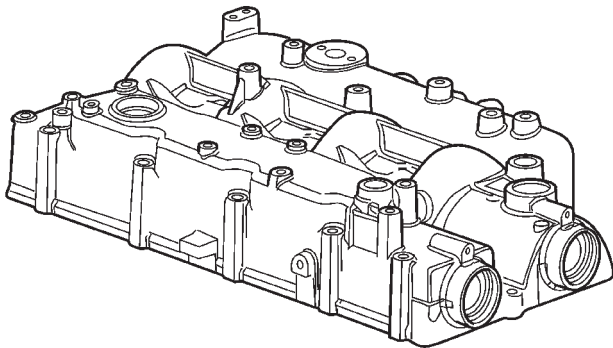
(15) Install front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - INSTALLATION).

(16) Connect negative battery cable.

CYLINDER HEAD COVER(S)

DESCRIPTION

The cylinder head cover is made of cast aluminum and is also the intake manifold on this engine (Fig. 22).



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Fig. 22 CYLINDER HEAD COVER/INTAKE MANIFOLD

REMOVAL

CAUTION: Before removing the cylinder head cover/intake manifold the engine must put at 90° after TDC. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)

- (1) Disconnect negative battery cable.
- (2) Remove front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - REMOVAL).
- (3) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
- (4) Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
- (5) Rotate engine until 90° after TDC is reached. Install both camshaft locking pins and the crankshaft locking pin. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)
- (6) Remove air cleaner housing assembly.
- (7) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(8) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(9) Remove generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - REMOVAL).

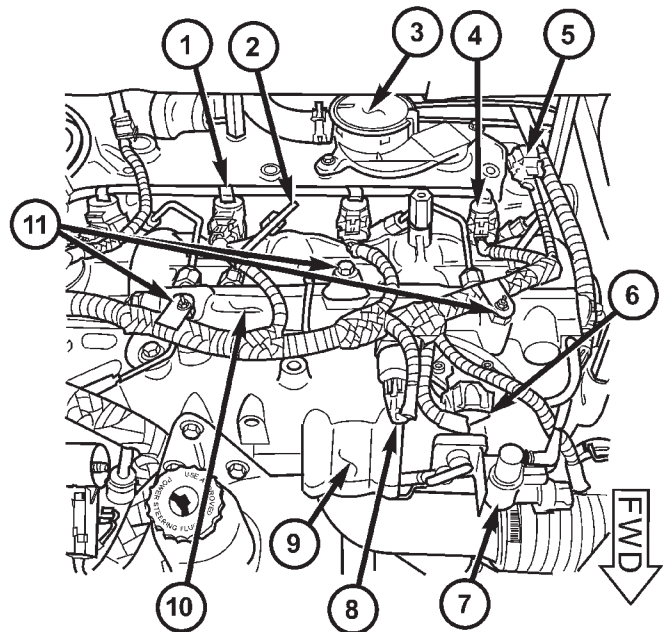
(10) Support engine and remove right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - REMOVAL).

(11) Remove outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(12) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(13) Remove inner timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(14) Disconnect camshaft position sensor, boost pressure/intake air temperature sensor, EGR solenoid, and fuel pressure sensor electrical connectors (Fig. 23).



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Fig. 23 ENGINE COMPONENT LOCATIONS

- 1 - FUEL INJECTOR RETURN LINE
- 2 - FUEL INJECTOR SUPPLY LINE
- 3 - OIL SEPARATOR
- 4 - FUEL INJECTOR
- 5 - CAMSHAFT POSITION SENSOR
- 6 - BOOST PRESSURE/INTAKE AIR TEMPERATURE SENSOR
- 7 - EGR SOLENOID
- 8 - FUEL PRESSURE SENSOR
- 9 - CYLINDER HEAD COVER/INTAKE MANIFOL
- 10 - FUEL RAIL
- 11 - WIRING HARNESS RETAINING CLIPS

CYLINDER HEAD COVER(S) (Continued)

- (15) Disconnect vacuum lines at EGR solenoid.
- (16) Position electrical harness out of way.
- (17) Remove fuel injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).
- (18) Remove fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL RAIL - REMOVAL).
- (19) Remove power steering pump reservoir from bracket.
- (20) Remove oil dipstick tube retaining bolt at intake manifold inlet.
- (21) Disconnect oil separator outlet hose at separator.
- (22) Remove turbo inlet tube retaining bolt at intake manifold.
- (23) Disconnect EGR tube at intake manifold inlet tube.
- (24) Remove cylinder head cover/intake manifold retaining bolts (Fig. 24).
- (25) Lift cylinder head cover/intake manifold from cylinder head (Fig. 24).

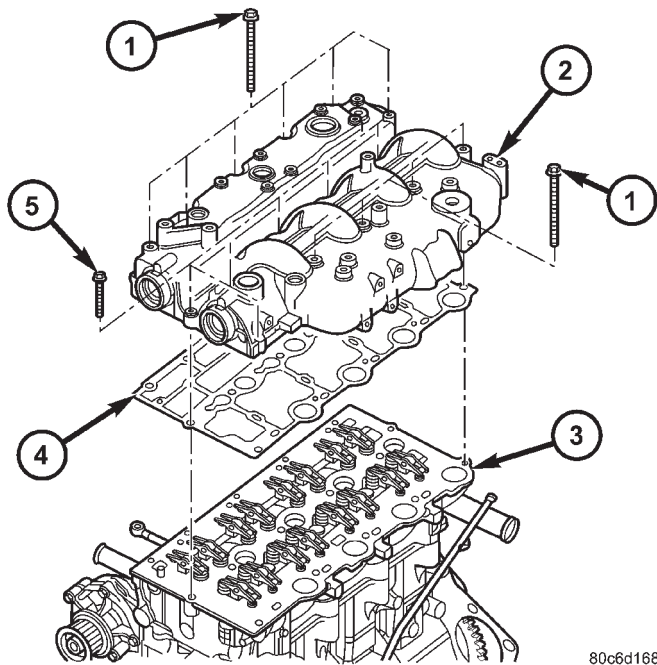


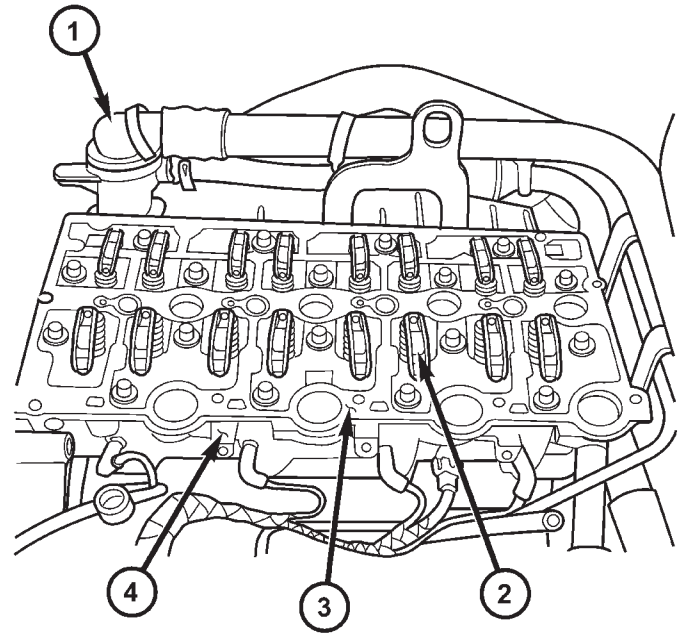
Fig. 24 CYLINDER HEAD COVER/INTAKE MANIFOLD ASSEMBLY

- 1 - CYLINDER HEAD COVER/INTAKE MANIFOLD BOLTS(LONG)
- 2 - CYLINDER HEAD COVER/INTAKE MANIFOLD
- 3 - CYLINDER HEAD
- 4 - CYLINDER HEAD COVER/INTAKE MANIFOLD GASKET
- 5 - CYLINDER HEAD COVER/INTAKE MANIFOLD BOLTS(SHORT)

NOTE: When removing rocker arm and lifter assemblies, be sure to keep them in order as they were removed from the cylinder head. Always keep lifters

in an upright position when removed from cylinder head.

- (26) Remove rocker arm and lifter assemblies from cylinder head (Fig. 25).



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Fig. 25 CYLINDER HEAD COVER/INTAKE MANIFOLD GASKET LOCATION

- 1 - THERMOSTAT HOUSING
- 2 - ROCKER ARM AND LIFTER ASSEMBLY
- 3 - CYLINDER HEAD COVER/INTAKE MANIFOLD
- 4 - CYLINDER HEAD

- (27) Remove cylinder head cover/intake manifold gasket from cylinder head.

INSTALLATION

- (1) Clean and inspect sealing surfaces.
- (2) Install new gasket on cylinder head.

NOTE: Apply a small amount of grease on each valve stem. This will help hold the rocker arm in position during the cylinder head cover installation.

- (3) Install rocker arm and lifter assemblies in cylinder head (Fig. 25). **Be sure to put rocker arm and lifter assemblies in same location as removed.**

- (4) Install cylinder head cover/intake manifold alignment studs in cylinder head (Fig. 26).

- (5) Install cylinder head cover/intake manifold over alignment stud.

CYLINDER HEAD COVER(S) (Continued)

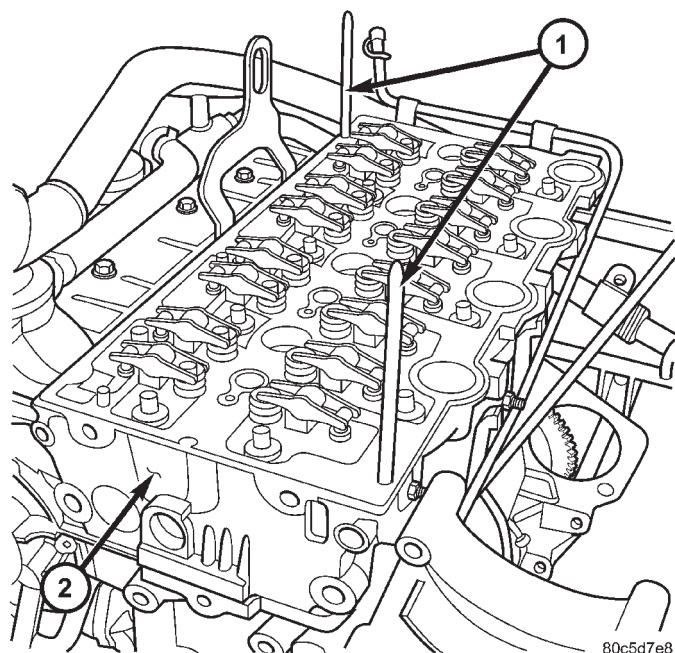


Fig. 26 CYLINDER HEAD COVER/INTAKE MANIFOLD ALIGNMENT STUDS VM.1066

1 - CYLINDER HEAD COVER/INTAKE MANIFOLD ALIGNMENT STUDS VM.1066

2 - CYLINDER HEAD

NOTE: Be sure to lubricate cylinder head cover/intake manifold retaining bolts with engine oil before assembly. If new bolts are being installed, **DO NOT** lubricate before assembly.

(6) Install two cylinder head cover/intake manifold retaining bolts and tighten finger tight.

(7) Remove alignment studs and install remaining retaining bolts (Fig. 24). Tighten retaining bolts finger tight.

(8) Torque cylinder head cover/intake manifold retaining bolts following procedure below.

CYLINDER HEAD COVER/INTAKE MANIFOLD TIGHTENING PROCEDURE

(1) Coat all bolts being reused with clean engine oil.

(2) Install the M8x35 bolts into holes 1,2,3,4,5, and 12. Install the M8x85 bolts into holes 6,7,8,9,10,11,13,14,15, and 16. Tighten all bolt **hand tight**.

(3) Alternate between bolts #11 and #16 to seat cylinder head cover/intake manifold on cylinder head (Fig. 27). Torque bolts to 7 N·m.

(4) Torque all cylinder head cover/intake manifold retaining bolts to 25 N·m in numerical order starting with #1 and ending with #16 (Fig. 27).

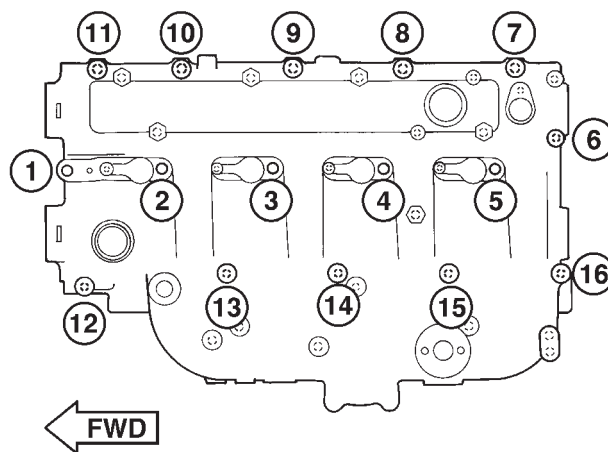


Fig. 27 CYLINDER HEAD COVER/INTAKE MANIFOLD TIGHTENING SEQUENCE

(9) Connect EGR tube at intake manifold inlet tube. Torque clamp to 10.8 N·m.

(10) Install turbo inlet tube retaining bolt at intake manifold. Torque bolt to 27.5 N·m.

(11) Connect oil separator outlet hose at separator.

(12) Install oil dipstick tube retaining bolt at intake manifold inlet. Torque bolt to 10 N·m.

(13) Install power steering pump reservoir in bracket.

(14) Install fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL RAIL - INSTALLATION).

(15) Install fuel injectors and fuel injector supply lines (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).

(16) Connect vacuum lines at EGR solenoid.

(17) Clip wiring harness retainers on studs on fuel rail (Fig. 23).

(18) Connect camshaft position sensor, boost pressure/intake air temperature sensor, EGR solenoid, and fuel pressure sensor electrical connectors (Fig. 23).

(19) Install inner timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(20) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(21) Install outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

CYLINDER HEAD COVER(S) (Continued)

(22) Install right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - INSTALLATION).

(23) Install generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).

(24) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(25) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(26) Install air cleaner housing assembly.

(27) Remove crankshaft and both camshaft locking pins (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).

(28) Refill cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(29) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(30) Install front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - INSTALLATION).

(31) Connect negative battery cable.

CAMSHAFT OIL SEAL(S)

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove air cleaner housing assembly.

(3) Support engine and remove right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - REMOVAL).

(4) Remove outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

WARNING: Before removing the timing belt the engine must put at 90° after TDC. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)

(5) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(6) Using VM.1055, remove both camshaft gears (Fig. 28).

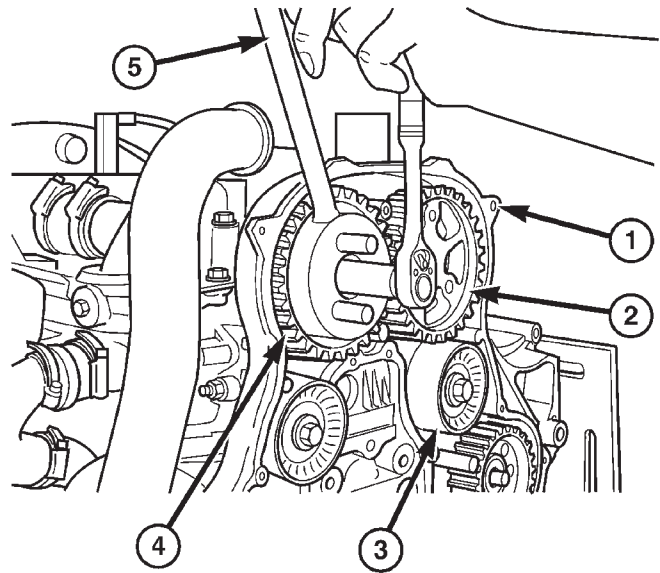
(7) Remove both camshaft oil seals.

INSTALLATION

(1) Install new camshaft oil seal using VM.1057.

(2) Install camshaft sprockets and tighten retaining bolts finger tight.

(3) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION) .



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Fig. 28 CAMSHAFT GEAR REMOVAL/INSTALLATION

- 1 - TIMING BELT INNER COVER
- 2 - CAMSHAFT SPROCKET
- 3 - IDLER PULLEYS
- 4 - CAMSHAFT SPROCKET
- 5 - VM.1055

(4) Torque camshaft sprockets to 108 N·m using VM.1055 (Fig. 28).

(5) Install outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(6) Install right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - INSTALLATION).

(7) Install air cleaner housing assembly.

(8) Connect negative battery cable.

ROCKER ARMS

DESCRIPTION

The rocker arms are made of stamped steel (Fig. 29).

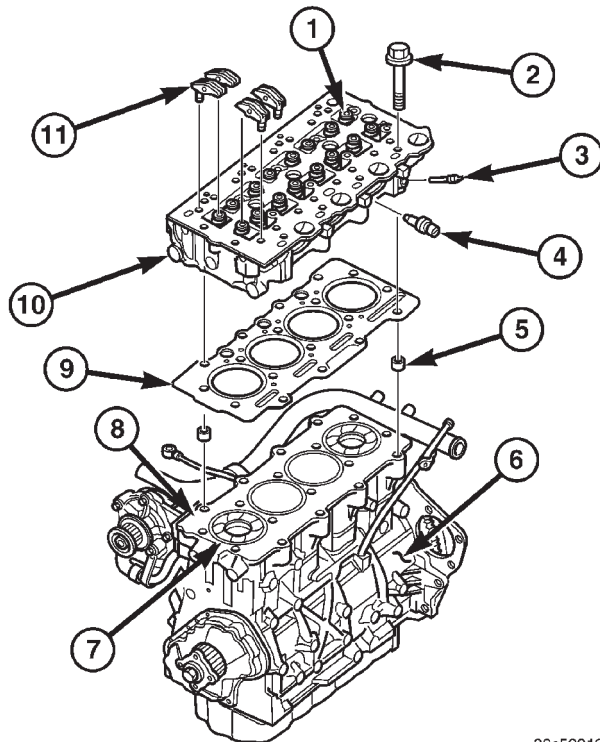
OPERATION

The rocker arms are used as a link between the camshaft and valves. As the camshaft rotates the lobes of the camshafts apply downward pressure on the rocker arms. This pressure is then transmitted to the valves which causes the valves to open.

REMOVAL

(1) Disconnect negative battery cable.

ROCKER ARMS (Continued)



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Fig. 29 CYLINDER HEAD ASSEMBLY

- 1 - VALVE SPRING
- 2 - CYLINDER HEAD BOLT
- 3 - GLOW PLUG
- 4 - COOLANT TEMPERATURE SENSOR
- 5 - CYLINDER HEAD ALIGNMENT DOWEL
- 6 - CYLINDER BLOCK
- 7 - CYLINDER LINER
- 8 - ENGINE BLOCK DECK
- 9 - CYLINDER HEAD GASKET
- 10 - CYLINDER HEAD
- 11 - ROCKER ARM AND LIFTER ASSEMBLY

(2) Remove front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - REMOVAL).

(3) Remove air cleaner housing assembly.

(4) Support engine and remove right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - REMOVAL).

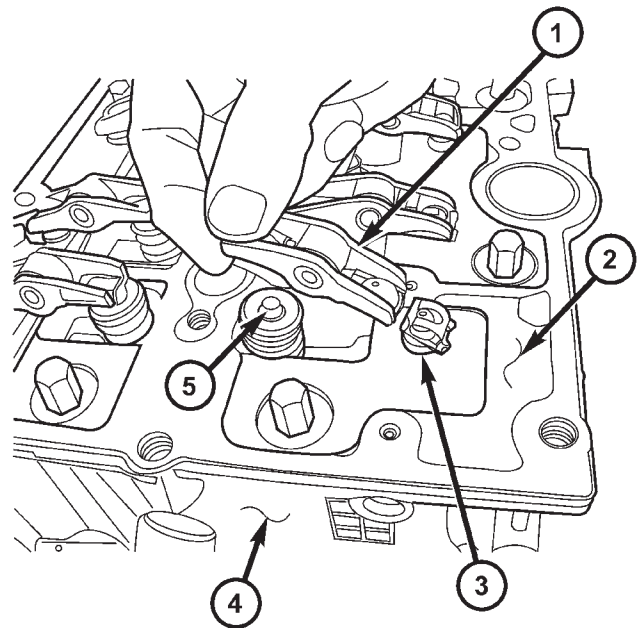
(5) Remove outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(6) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(7) Remove inner timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(8) Remove cylinder head cover/intake manifold (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(9) Remove rocker arm from lifter (Fig. 30).



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Fig. 30 ROCKER ARM ASSEMBLY

- 1 - ROCKER ARM ASSEMBLY
- 2 - CYLINDER HEAD COVER/INTAKE MANIFOLD
- 3 - HYDRAULIC LIFTER
- 4 - CYLINDER HEAD
- 5 - VALVE

INSTALLATION

(1) Clean and inspect gasket sealing surfaces.

(2) Install new gasket on cylinder head.

(3) Lubricate lifter ball end of lifter(s), valve(s), and rocker arm roller(s) with Mopar® Engine Oil Supplement or equivalent.

(4) Connect rocker arm(s) to lifter and reposition on valve(s) (Fig. 30).

(5) Install cylinder head cover/intake manifold (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(6) Install inner timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(7) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(8) Install outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(9) Install right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - INSTALLATION).

(10) Install air cleaner housing assembly.

ROCKER ARMS (Continued)

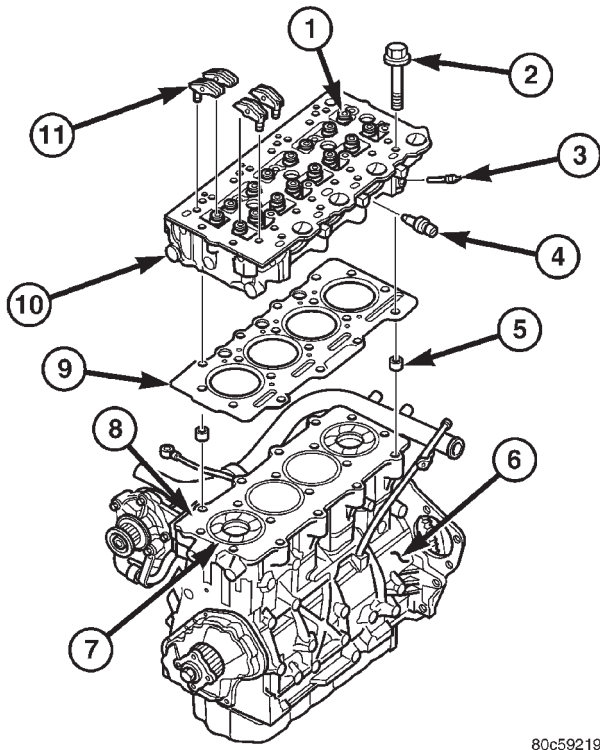
(11) Install front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - INSTALLATION).

(12) Connect negative battery cable.

HYDRAULIC LIFTERS

DESCRIPTION

Valve lash is controlled by hydraulic tappets located inside the cylinder head, in tappet bores below the camshafts (Fig. 31).



80c59219

Fig. 31 CYLINDER HEAD ASSEMBLY

- 1 - VALVE SPRING
- 2 - CYLINDER HEAD BOLT
- 3 - GLOW PLUG
- 4 - COOLANT TEMPERATURE SENSOR
- 5 - CYLINDER HEAD ALIGNMENT DOWEL
- 6 - CYLINDER BLOCK
- 7 - CYLINDER LINER
- 8 - ENGINE BLOCK DECK
- 9 - CYLINDER HEAD GASKET
- 10 - CYLINDER HEAD
- 11 - ROCKER ARM AND LIFTER ASSEMBLY

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - REMOVAL).

(3) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(4) Support engine and remove right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - REMOVAL).

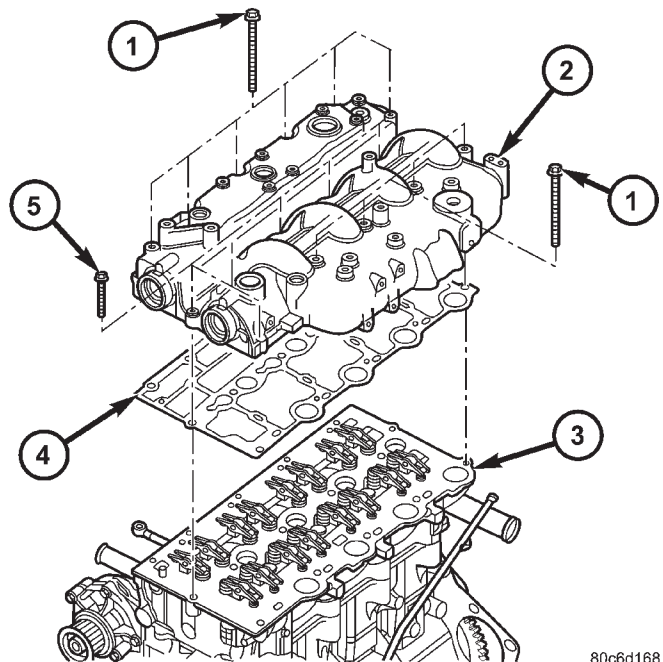
(5) Remove outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

CAUTION: Before removing the cylinder head cover/intake manifold or the timing belt the engine must put at 90° after TDC. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)

(6) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(7) Remove inner timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(8) Remove cylinder head cover/intake manifold (Fig. 32)(Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).



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Fig. 32 CYLINDER HEAD COVER/INTAKE MANIFOLD

- 1 - CYLINDER HEAD COVER/INTAKE MANIFOLD BOLTS(LONG)
- 2 - CYLINDER HEAD COVER/INTAKE MANIFOLD
- 3 - CYLINDER HEAD
- 4 - CYLINDER HEAD COVER/INTAKE MANIFOLD GASKET
- 5 - CYLINDER HEAD COVER/INTAKE MANIFOLD BOLTS(SHORT)

HYDRAULIC LIFTERS (Continued)

(9) Remove rocker arm and lifter assemblies from lifter bores.

INSPECTION

Clean each lifter assembly in cleaning solvent to remove all varnish and sludge deposits. Inspect for indications of scuffing on the side and base of each lifter body.

INSTALLATION

(1) Install rocker arm and lifter assemblies in lifter bores.

(2) Install cylinder head cover/intake manifold (Fig. 32) (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(3) Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(4) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION) .

(5) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(6) Install right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - INSTALLATION).

(7) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(8) Install front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - INSTALLATION).

(9) Connect negative battery cable.

ENGINE BLOCK**DESCRIPTION**

The 2.5L CRD Diesel engine uses a cast iron engine block with wet cast iron cylinder liners (Fig. 33).

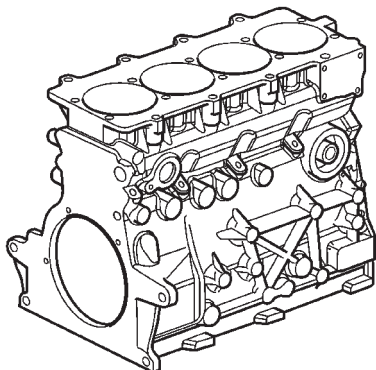
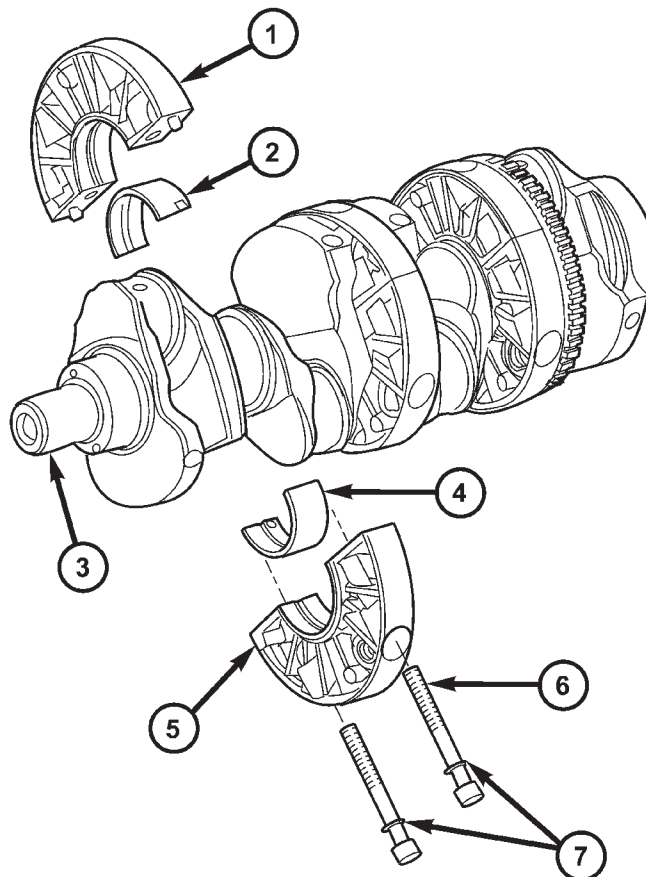


Fig. 33 ENGINE BLOCK

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CRANKSHAFT**DESCRIPTION**

The crankshaft is a forged steel type design with five main bearing journals. The crankshaft is located at the bottom of the engine block and is held in place with three main bearing supports (Fig. 34).



80adf230

Fig. 34 CRANKSHAFT ASSEMBLY

- 1 - CRANKSHAFT SUPPORT HALVE
- 2 - MAIN BEARING HALVE
- 3 - CRANKSHAFT
- 4 - MAIN BEARING HALVE
- 5 - CRANKSHAFT SUPPORT HALVE
- 6 - MAIN BEARING SUPPORT BOLTS
- 7 - WASHERS

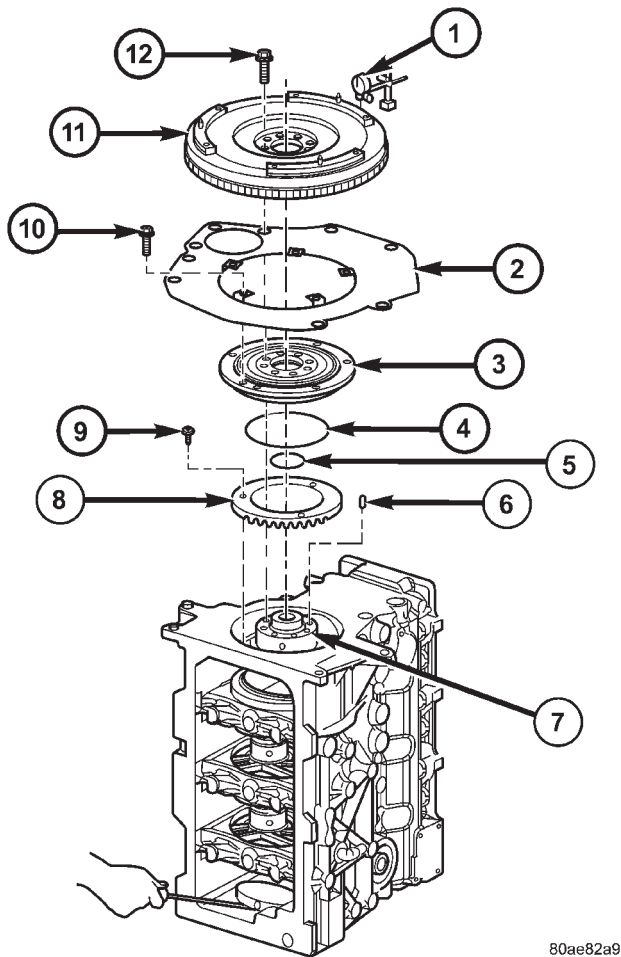
OPERATION

The crankshaft transfers force generated by combustion within the cylinder bores to the flywheel or flexplate.

CRANKSHAFT (Continued)

STANDARD PROCEDURE - CHECKING CRANKSHAFT END PLAY

- (1) Mount a dial indicator to a stationary point at rear of engine. Locate the probe perpendicular against the flywheel (Fig. 35).
- (2) Move the crankshaft all the way to the front of its travel.
- (3) Zero the dial indicator.
- (4) Move the crankshaft all the way to the rear and read dial indicator. For crankshaft end play clearances (Refer to 9 - ENGINE - SPECIFICATIONS).



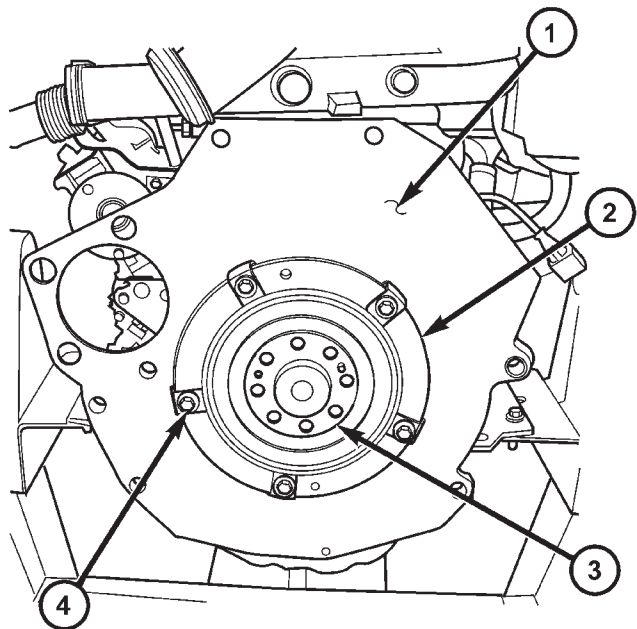
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Fig. 35 CHECKING CRANKSHAFT END PLAY

- 1 - DIAL INDICATOR
- 2 - ADAPTER PLATE
- 3 - REAR MAIN BEARING SUPPORT
- 4 - SEALING RING
- 5 - SEALING RING
- 6 - ALIGNMENT PIN
- 7 - CRANKSHAFT
- 8 - RELUCTOR WHEEL
- 9 - RELUCTOR WHEEL RETAINING BOLT
- 10 - REAR MAIN BEARING SUPPORT RETAINING BOLTS
- 11 - FLYWHEEL
- 12 - FLYWHEEL BOLTS

REMOVAL

- (1) Remove engine from vehicle (Refer to 9 - ENGINE - REMOVAL).
- (2) Mount engine on an engine stand.
- (3) Drain engine oil and remove oil filter.
- (4) Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
- (5) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
- (6) Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
- (7) Remove cylinder head cover/intake manifold (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
- (8) Remove cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
- (9) Remove flywheel.
- (10) Remove rear main bearing support/adapter plate retaining bolts and remove adapter plate (Fig. 36).



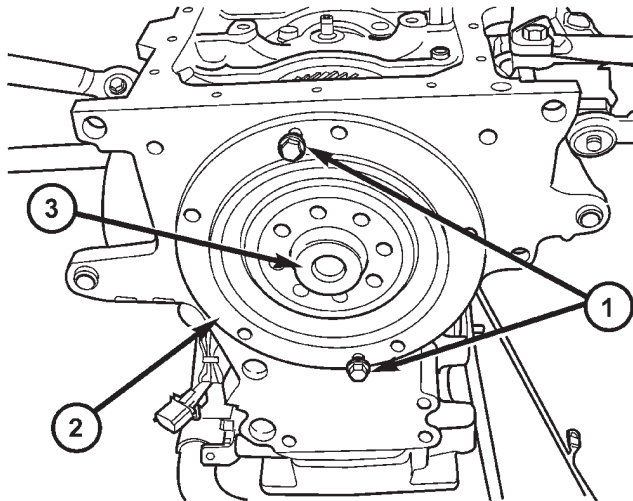
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Fig. 36 REAR MAIN BEARING SUPPORT

- 1 - ADAPTER PLATE
- 2 - REAR MAIN BEARING SUPPORT
- 3 - CRANKSHAFT
- 4 - REAR MAIN BEARING SUPPORT RETAINING BOLTS

CRANKSHAFT (Continued)

(11) Remove rear main bearing support by threading two retaining bolts in holes provided. Tighten bolts equally to push main bearing support out of block (Fig. 37).



80c6ea3e

Fig. 37 REAR MAIN BEARING SUPPORT REMOVAL

- 1 - BOLTS
- 2 - REAR MAIN BEARING SUPPORT
- 3 - CRANKSHAFT

(12) Remove front engine cover (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - REMOVAL).

(13) Remove crankshaft sprocket.

(14) Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

(15) Remove oil pump pickup tube (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).

(16) Remove balance shaft assembly (Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - REMOVAL).

(17) Remove oil jets (Refer to 9 - ENGINE/LUBRICATION/OIL JET - REMOVAL).

(18) Remove piston and connecting rod assemblies (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - REMOVAL).

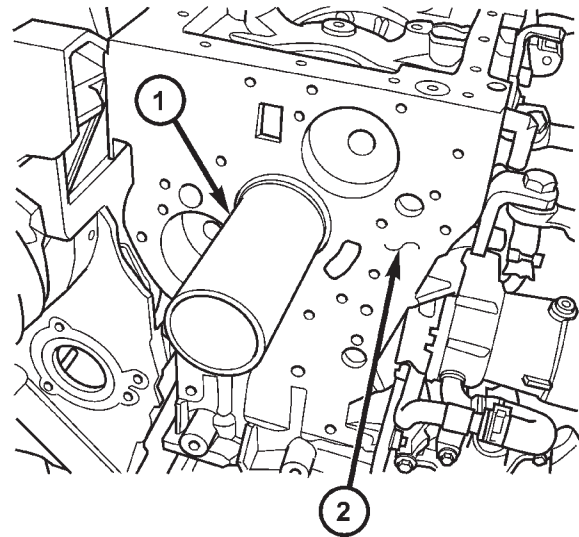
(19) Slide special tool VM.1069 on crankshaft (Fig. 38).

(20) Using special tool VM.1054, remove crankshaft support retainers (Fig. 39).

(21) Slide crankshaft out rear of engine block.

INSTALLATION

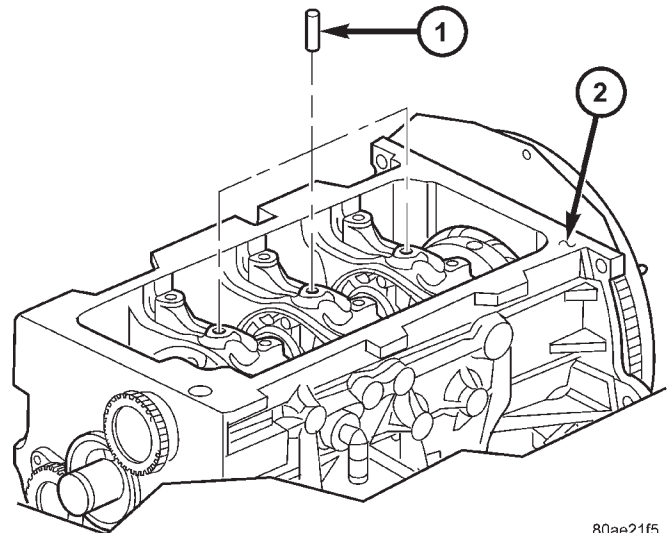
NOTE: Before installing crankshaft in engine block, be sure the notches in the crankshaft supports are facing towards the front of the engine.



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Fig. 38 CRANKSHAFT SLEEVE VM.1069

- 1 - CRANKSHAFT SLEEVE VM.1069
- 2 - ENGINE BLOCK



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Fig. 39 CRANKSHAFT SUPPORT RETAINERS/BALANCE SHAFT OIL FEED

- 1 - CRANKSHAFT SUPPORT RETAINERS/BALANCE SHAFT OIL FEED
- 2 - ENGINE BLOCK

(1) Install crankshaft in engine block. **Be sure to align oil holes in crankshaft supports and engine block.**

(2) Install crankshaft support retainers (Fig. 39).

(3) Remove special tool VM.1069 from crankshaft (Fig. 38).

(4) Install crankshaft sprocket.

CRANKSHAFT (Continued)

(5) Install front engine cover (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - INSTALLATION).

(6) Install rear main bearing support in engine block. **Be sure to align oil hole in rear main bearing support with hole in block.**

(7) Install adapter plate and retaining bolts (Fig. 36). Torque bolts to 27.5N·m.

(8) Install flywheel.

(9) Install piston and connecting rod assemblies (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - INSTALLATION).

(10) Install oil jets (Refer to 9 - ENGINE/LUBRICATION/OIL JET - INSTALLATION).

(11) Install balance shaft assembly (Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - INSTALLATION).

(12) Install oil pump pickup tube (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).

(13) Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

(14) Install cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

(15) Install cylinder head cover/intake manifold (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(16) Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(17) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(18) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(19) Install engine in vehicle.

(20) Fill engine oil with proper oil to correct level.

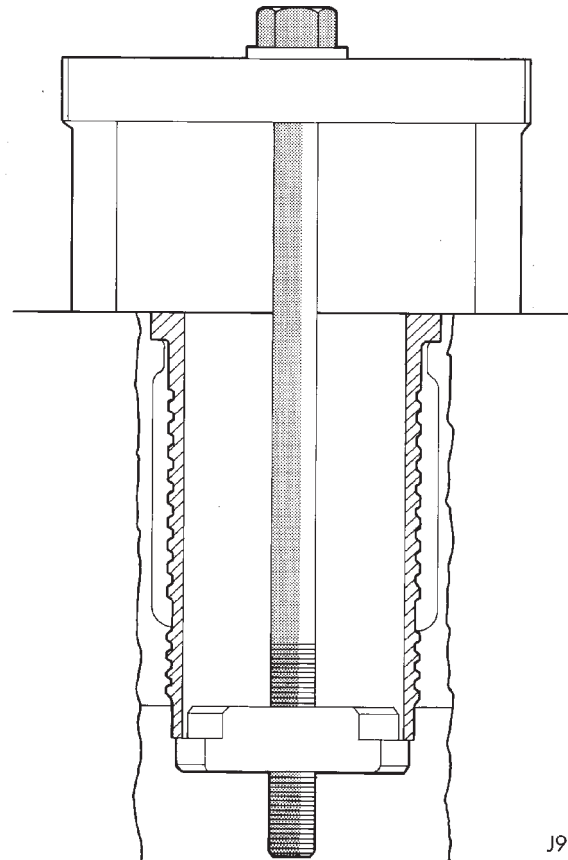
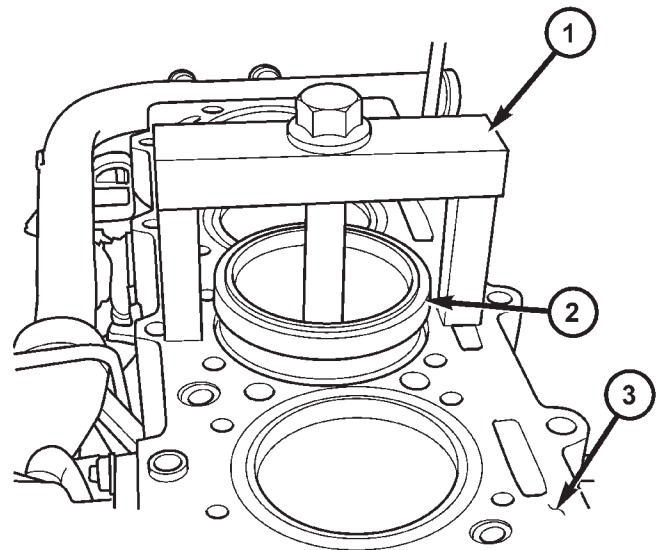


Fig. 40 CYLINDER LINER REMOVER



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Fig. 41 CYLINDER LINER REMOVAL

- 1 - SPECIAL TOOL VM.1001
- 2 - CYLINDER LINER
- 3 - ENGINE BLOCK

CYLINDER LINERS

DESCRIPTION

The cylinder wall liner used on this engine is of the wet design. O-rings are used to seal the liner to the engine block.

REMOVAL

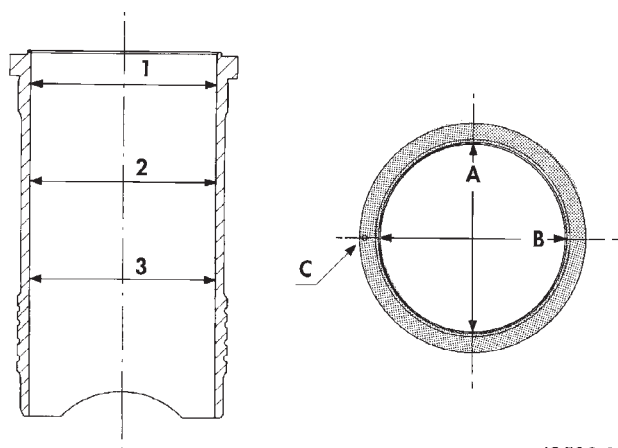
- (1) Remove engine from vehicle.
- (2) With engine completely disassembled, use special tool VM.1001 to remove liner assembly (Fig. 40).
- (3) Tighten bolt on VM.1001 to remove liner from block (Fig. 41).
- (4) Remove shims from cylinder liner or cylinder block recess. Keep shims with each cylinder liner.

CYLINDER LINERS (Continued)

INSPECTION

The cylinder walls should be checked for out-of-round and taper with a dial bore gauge. The cylinder bore out-of-round is 0.100 mm (.0039 in.) maximum and cylinder bore taper is 0.100 mm (.0039 in.) maximum. If the cylinder walls are badly scuffed or scored, new liners should be installed and honed, and new pistons and rings fitted.

Measure the cylinder bore at three levels in directions A and B (Fig. 42). Top measurement should be 10 mm (3/8 in.) down and bottom measurement should be 10 mm (3/8 in.) up from the bottom bore.



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Fig. 42 LINER INSPECTION

INSTALLATION

(1) Carefully clean liner and engine block, and degrease the engine block where it comes into contact with the liners. Install the liners in the engine block as shown, rotating them back and forth by 45° in order to guarantee correct positioning (Fig. 43).

(2) Measure the liner recess relative to block deck with a dial indicator mounted on a special tool VM-1010 A. **All the measurements must be taken on high pressure pump side of engine block..** Zero dial gauge on block deck.

(3) Move dial gauge to cylinder liner record reading on dial gauge.

(4) Remove liner and special tool.

(5) Then select the correct shim thickness to give proper protrusion (0.01 - 0.06 mm).

(6) Fit the shim and the O-rings onto the liner.

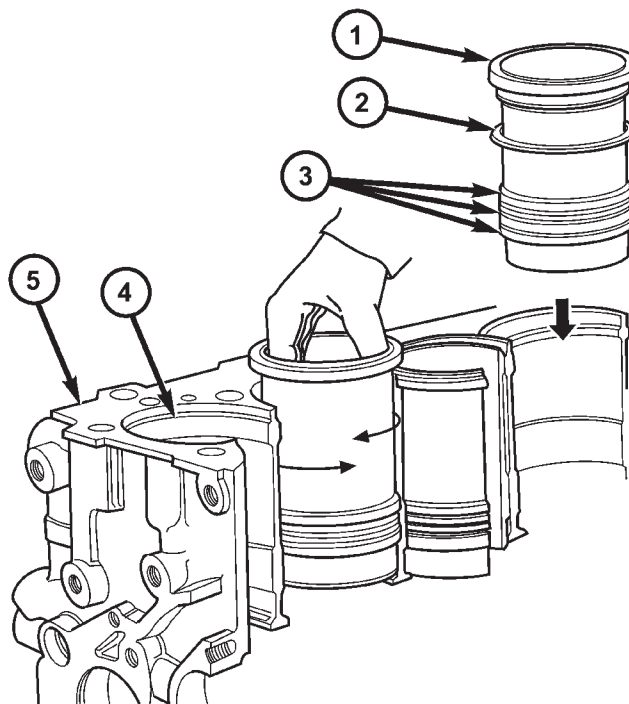
(7) Lubricate the lower liner location in the block.

(8) Fit the liners in the crankcase making sure that the shim is positioned correctly in the seat. Lock the liners in position using special tool (VM.1076) and bolts (Fig. 44). Clean the residual LOCTITE on the upper surface of the block deck.

(9) Recheck the liner protrusion. It should be 0.01 - 0.06 mm.

(10) Reassemble engine.

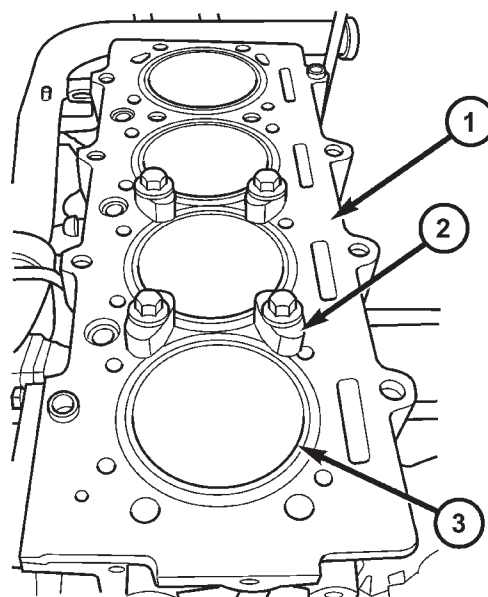
(11) Install engine in vehicle.



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Fig. 43 LINER INSTALLATION

- 1 - CYLINDER LINER
- 2 - SHIMS
- 3 - O-RINGS
- 4 - BLOCK LEDGE
- 5 - ENGINE BLOCK



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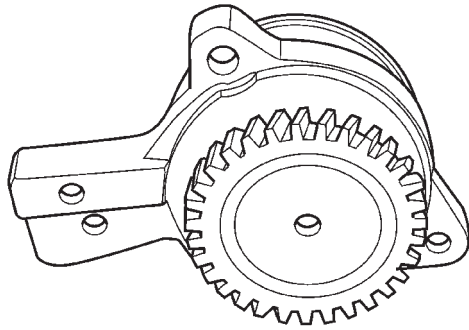
Fig. 44 LINER CLAMP LOCATION

- 1 - ENGINE BLOCK
- 2 - LINER RETAINER VM.1076
- 3 - CYLINDER LINER

INTERNAL VACUUM PUMP

DESCRIPTION

The diesel engine uses a internal vacuum pump. This vacuum pump is mounted in the front of the engine block under the engine front cover (Fig. 45). The vacuum pump is driven by a sprocket on the crankshaft.



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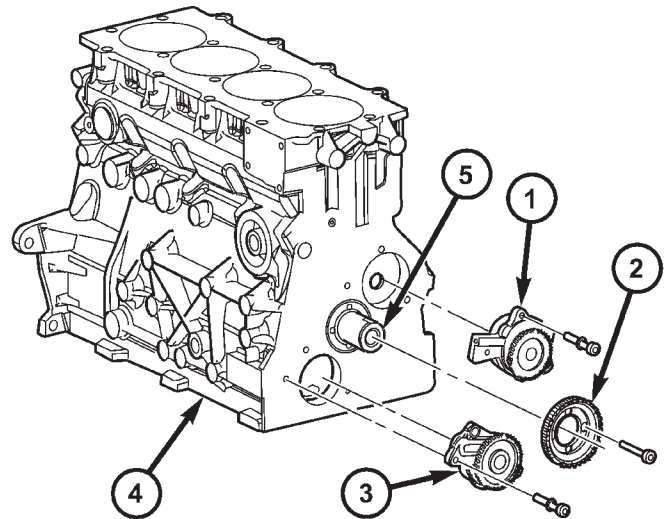
Fig. 45 VACUUM PUMP

REMOVAL

- (1) Disconnect negative battery cable.
- (2) Remove air cleaner housing.
- (3) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (4) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (5) Support engine and remove right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - REMOVAL).
- (6) Remove vibration damper/crankshaft pulley (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
- (7) Remove outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
- (8) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
- (9) Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

NOTE: Crankshaft hub has LHD thread.

- (10) Remove crankshaft hub.
- (11) Remove front engine cover (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - REMOVAL).
- (12) Remove crankshaft sprocket (Fig. 46).
- (13) Remove vacuum pump (Fig. 46).



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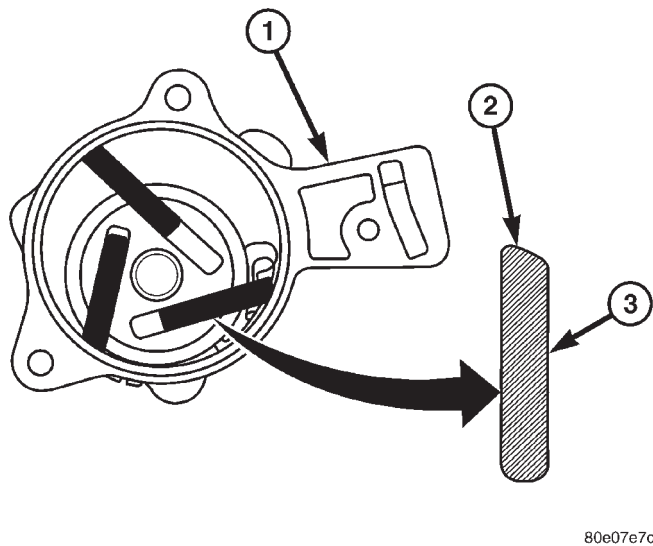
Fig. 46 OIL PUMP AND VACUUM PUMP

- 1 - VACUUM PUMP
- 2 - CRANKSHAFT SPROCKET
- 3 - OIL PUMP
- 4 - ENGINE BLOCK
- 5 - CRANKSHAFT

INSTALLATION

- (1) Lubricate vacuum pump blades and install in vacuum pump body as shown (Fig. 47).
- (2) Install vacuum pump in engine block (Fig. 46). Torque bolts to 10.8N·m.
- (3) Install crankshaft sprocket (Fig. 46). Torque bolts to 10.8N·m.
- (4) Install front engine cover (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - INSTALLATION).
- (5) Install front crankshaft hub. Torque bolt to 304N·m.
- (6) Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
- (7) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
- (8) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
- (9) Install vibration damper/crankshaft pulley.

INTERNAL VACUUM PUMP (Continued)

**Fig. 47 VACUUM PUMP COMPONENTS**

- 1 - VACUUM PUMP BODY
- 2 - VACUUM PUMP BLADE TAPERED EDGE
- 3 - VACUUM PUMP BLADE

(10) Install right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - INSTALLATION).

(11) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(12) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(13) Install air cleaner housing.

(14) Connect negative battery cable.

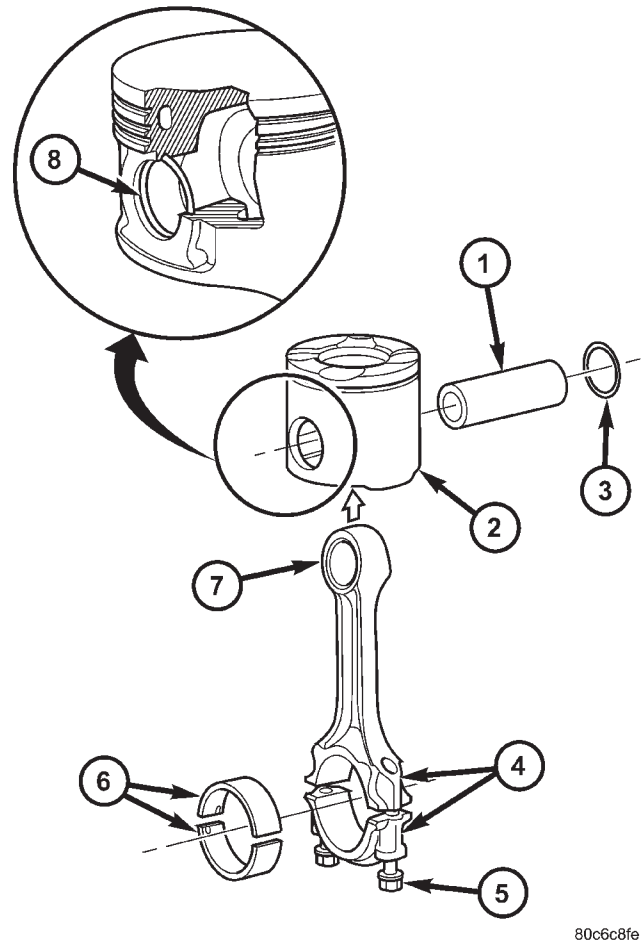
PISTON & CONNECTING ROD

DESCRIPTION

The pistons are of a free floating design. Oil jets in the engine block lubricate and cool the piston and pin assembly. The connecting rods have a pressed in place wrist pin bushing which is lubricated by the oil jets (Fig. 48).

STANDARD PROCEDURE - PISTON RING FITTING

(1) Wipe cylinder bore clean. Insert ring and push down with piston to ensure it is square in bore. The ring gap measurement must be made with the ring positioning at least 12 mm (0.50 in.) from bottom of cylinder bore (Fig. 49). Check gap with feeler gauge. Top compression ring gap .30 to .45mm (.0118 to .0177 in.). Second compression ring gap .30 to .45mm

**Fig. 48 PISTON AND CONNECTING ROD ASSEMBLY**

- 1 - PISTON PIN
- 2 - PISTON
- 3 - SNAP RING
- 4 - CONNECTING ROD ALIGNMENT NUMBERS
- 5 - CONNECTING ROD BOLT
- 6 - CONNECTING ROD BEARING
- 7 - CONNECTING ROD
- 8 - SNAP RING

(.0118 to .0177 in.). Oil control ring gap .25 to .50mm (.0098 to .0196 in.).

(2) If ring gaps exceed dimension given, new rings or cylinder liners must be fitted. Keep piston rings in piston sets.

(3) Check piston ring to groove clearance (Fig. 50). Top compression ring gap .080 to .130mm (.0031 to .0051 in.). Second compression ring gap .070 to .110mm (.0027 to .0043 in.). Oil control ring gap .040 to .080mm (.0015 to .0031 in.).

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

PISTON & CONNECTING ROD (Continued)

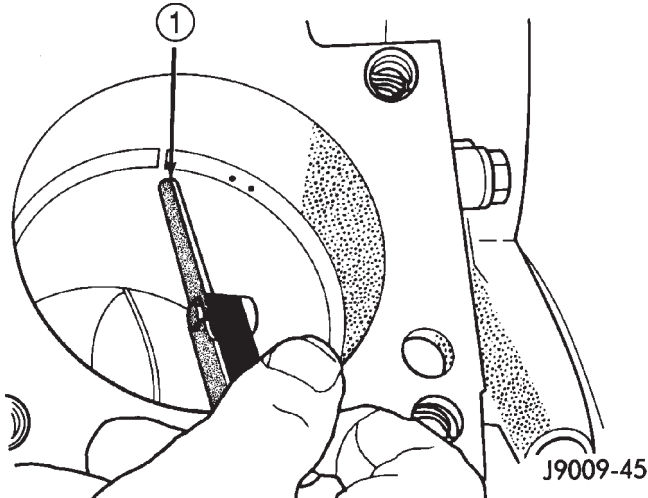


Fig. 49 RING END GAP MEASUREMENT

1 - FEELER GAUGE

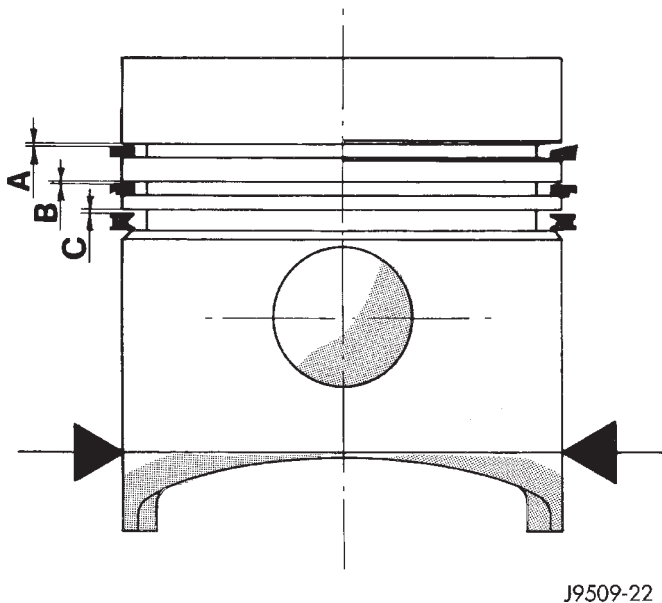


Fig. 50 PISTON RING TO GROOVE CLEARANCE

- (3) Raise vehicle on hoist.
- (4) Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
- (5) Remove oil pump pickup tube.(Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL)
- (6) Remove balance shaft assembly (Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - REMOVAL).
- (7) Remove top ridge of cylinder bores with a ridge reamer before removing pistons from cylinder block. **Be sure to keep top of pistons covered during this operation.**
- (8) Piston and connecting rods must be removed from top of cylinder block. Rotate crankshaft so that each connecting rod is centered in cylinder bore.

NOTE: Be careful not to nick or scratch crankshaft journals

- (9) After removal, install bearing cap on the mating rod and mark pistons with matching cylinder number when removed from engine block.

PISTON PIN - REMOVAL

- (1) Secure connecting rods in a soft jawed vice.
- (2) Remove 2 snap rings securing piston pin (Fig. 51).
- (3) Push piston pin out of piston and connecting rod (Fig. 51).

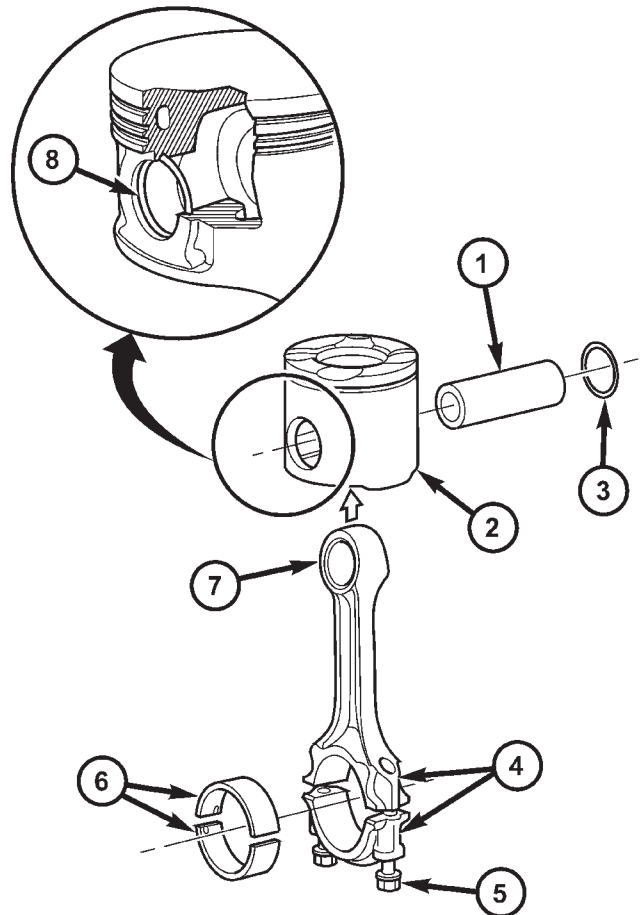


Fig. 51 PISTON AND CONNECTING ROD ASSEMBLY

- 1 - PISTON PIN
- 2 - PISTON
- 3 - SNAP RING
- 4 - CONNECTING ROD ALIGNMENT NUMBERS
- 5 - CONNECTING ROD BOLT
- 6 - CONNECTING ROD BEARING
- 7 - CONNECTING ROD
- 8 - SNAP RING

PISTON & CONNECTING ROD (Continued)

PISTON RING - REMOVAL

(1) ID mark on face of top and second piston rings must point toward piston crown.

(2) Using a suitable ring expander, remove top and second piston rings (Fig. 52).

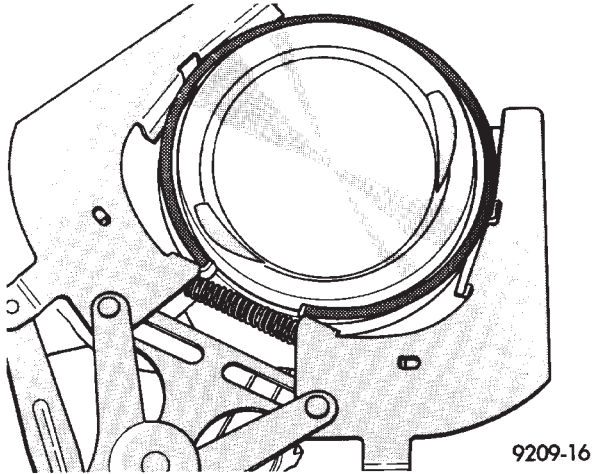


Fig. 52 PISTON RINGS - REMOVAL/INSTALLATION

(3) Remove upper oil ring side rail, lower oil ring side rail and then the oil expander from piston.

(4) Carefully clean carbon from piston crowns, skirts and ring grooves ensuring the 4 oil holes in the oil control ring groove are clear.

INSPECTION**PISTONS**

(1) Piston Diameter: Size: 91.912-91.928mm (3.6185-3.6192 in.) Maximum wear limit .05mm (.0019 in.).

(2) Check piston pin bores in piston for roundness. Make 3 checks at 120° intervals. Maximum out of roundness .05mm (.0019 in.).

(3) The piston diameter should be measured approximately 15 mm (.590 in.) up from the base.

(4) Skirt wear should not exceed 0.1 mm (.00039 in.).

(5) The clearance between the cylinder liner and piston should not exceed 0.065-0.083 mm (.0025-.0032 in.).

(6) Make sure the weight of the pistons does not differ by more than 5 g.

CONNECTING RODS

(1) Assemble bearing shells and bearing caps to their respective connecting rods ensuring that the serrations on the cap and reference marks are aligned.

(2) Tighten connecting cap bolts to 29 N·m (21 ft. lbs.) plus 60°.

(3) Without loosening connecting rod bolts, tighten all bolts to 88N·m.

(4) Check and record internal diameter of crank end of connecting rod.

NOTE: When changing connecting rods, all four must have the same weight and be stamped with the same number. Replacement connecting rods will only be supplied in sets of four.

Connecting rods are supplied in sets of four since they all must be of the same weight category. Max allowable weight difference is 5 gr.

NOTE: On one side of the big end of the con-rod there is a two-digit number which refers to the weight category. On the other side of the big end there is a four digit number on both the rod and the cap. These numbers must both face the injection pump side of the block (Fig. 53). Lightly heat the piston in oven. Insert piston pin in position and secure it with provided snap rings.

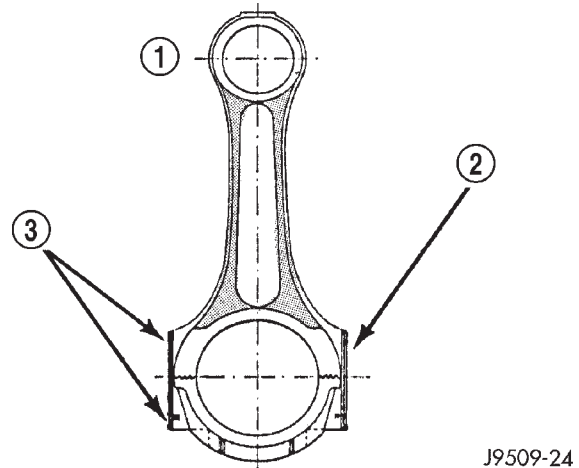


Fig. 53 CONNECTING ROD IDENTIFICATION

- 1 - SMALL END OF CONNECTING ROD
- 2 - 2 DIGIT NUMBER LOCATION
- 3 - 4 DIGIT NUMBER LOCATION

The Four digit numbers marked on con rod big end and rod cap must be on the same side as the injection pump (Fig. 53). After having coated threads with Molyguard, tighten con rod bolts to 29 N·m (21 ft. lbs.) plus 60°.

PISTON PINS

(1) Measure the diameter of piston pin in the center and both ends.

(2) Piston pin diameter is 29.992 to 29.996mm (1.1807 to 1.1809 in.).

PISTON & CONNECTING ROD (Continued)

INSTALLATION

PISTON PIN INSTALLATION

- (1) Secure connecting rod in soft jawed vice.
- (2) Lubricate piston pin and piston with clean engine oil.
- (3) Position piston on connecting rod (Fig. 54).

CAUTION: Ensure arrow on piston crown and the bearing cap numbers on the connecting rod are on the opposite side.

- (4) Install piston pin (Fig. 54).
- (5) Install clips in piston to retain piston pin (Fig. 54).

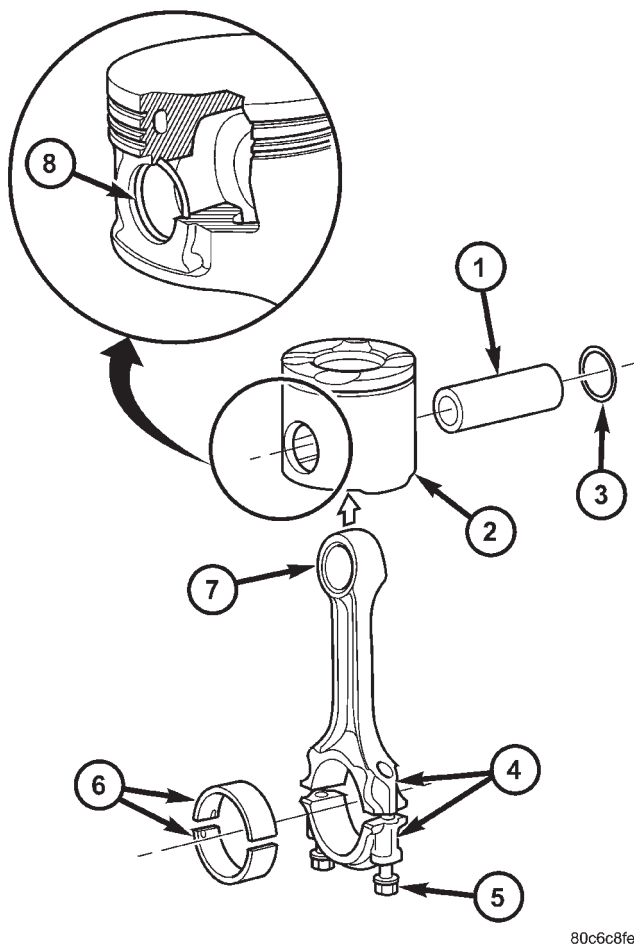


Fig. 54 PISTON AND CONNECTING ROD ASSEMBLY

- 1 - PISTON PIN
- 2 - PISTON
- 3 - SNAP RING
- 4 - CONNECTING ROD ALIGNMENT NUMBERS
- 5 - CONNECTING ROD BOLT
- 6 - CONNECTING ROD BEARING
- 7 - CONNECTING ROD
- 8 - SNAP RING

- (6) Remove connecting rod from vice.

PISTON RINGS - INSTALLATION

- (1) Install rings on the pistons using a suitable ring expander (Fig. 55).

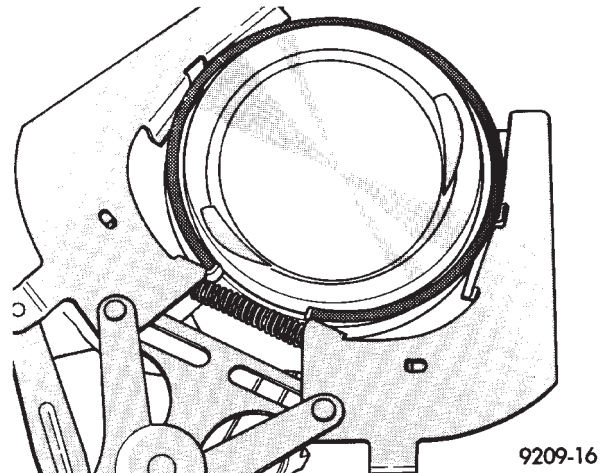


Fig. 55 PISTON RINGS-INSTALLATION

- (2) Top compression ring is tapered and chromium plated. The second ring is of the scraper type and must be installed with scraping edge facing bottom of the piston. The third is an oil control ring. Ring gaps must be positioned, before inserting piston into the liners, as follows.

- (3) Top ring gap must be positioned at the #3 position (looking at the piston crown from above) (Fig. 56).

- (4) Second piston ring gap should be positioned at the #1 position (Fig. 56).

- (5) Oil control ring gap should be positioned at the #2 position (Fig. 56).

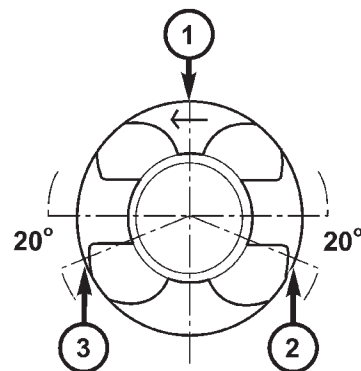


Fig. 56 PISTON RING GAP LOCATION

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

- (6) When assembling pistons check that components are installed in the same position as before dis-

PISTON & CONNECTING ROD (Continued)

assembly, determined by the numbers stamped on the crown of individual pistons. Engine cylinders are numbered starting from gear train end of the engine. **Face arrow on top of piston toward front of engine.** Therefore, the numbers stamped on connecting rod big end should face toward the injection pump side of engine. To insert piston into cylinder use a ring compressor (VM.1065) as shown in (Fig. 57).

INSTALLATION

(1) Before installing pistons, and connecting rod assemblies into the bore, be sure that compression ring gaps are staggered so that neither is in line with oil ring rail gap (Fig. 56).

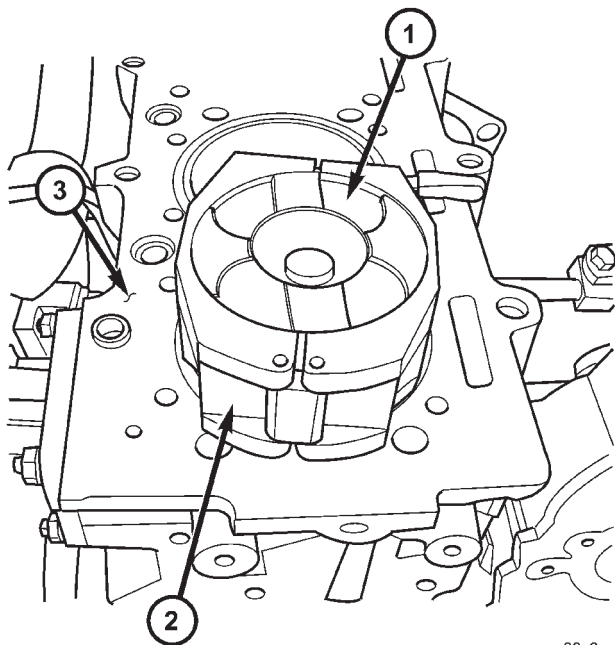
(2) Before installing the ring compressor, make sure the oil ring expander ends are butted together.

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor, over the piston and tighten (Fig. 57). **Ensure position of rings does not change during this operation.**

NOTE: Be sure arrow on top of piston faces towards front of engine.

NOTE: Be careful not to nick crankshaft journals.

(4) Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert rod and piston into cylinder bore and guide rod over the crankshaft journal.

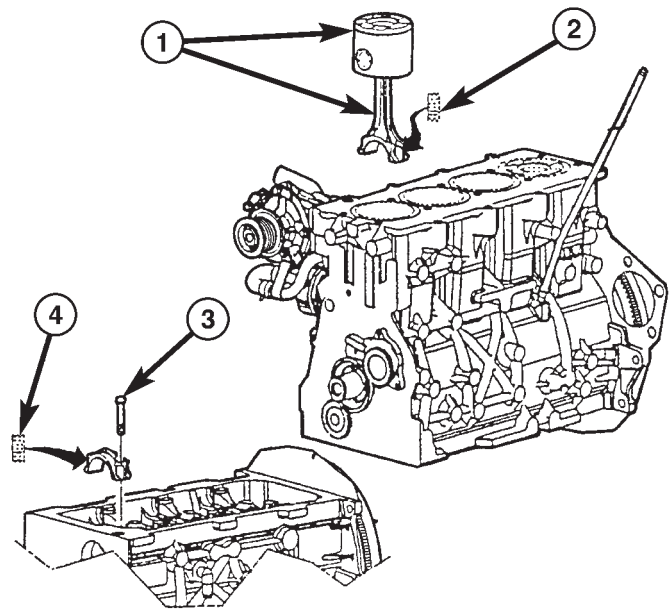


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Fig. 57 PISTON INSTALLATION USING VM.1065

(5) Tap the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on connecting rod journal.

(6) Install connecting rod caps (Fig. 58). Install rod bolts and tighten to 30N·m (22 ft.lb.) plus 60°. Then torque to 88N·m (65 ft.lb.).



80c6e51b

Fig. 58 PISTON AND CONNECTING ROD INSTALLATION

- 1 - PISTON AND CONNECTING ROD ASSEMBLY
- 2 - FOUR DIGIT NUMBER
- 3 - CONNECTING ROD BOLT
- 4 - FOUR DIGIT NUMBER

(7) Install cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

(8) Install balance shaft assembly (Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - INSTALLATION).

(9) Install oil pump pickup tube (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).

(10) Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

(11) Connect negative battery cable.

CRANKSHAFT OIL SEAL - FRONT

REMOVAL

- (1) Disconnect negative battery cable.
- (2) Remove air cleaner housing.
- (3) Support engine and remove right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - REMOVAL).
- (4) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (5) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (6) Remove vibration damper/crankshaft pulley (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
- (7) Remove outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
- (8) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
- (9) Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

NOTE: Crankshaft hub retaining bolt has LHD thread.

- (10) Remove crankshaft hub.
- (11) Remove front engine cover (Fig. 59) (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - REMOVAL).
- (12) With cover on work bench, pry out old seal.

INSTALLATION

- (1) Clean engine block and front engine cover sealing surfaces.
- (2) Install crankshaft oil seal on VM.1061 (Fig. 60).
- (3) Place sleeve for VM.1061 on workbench as shown (Fig. 60).

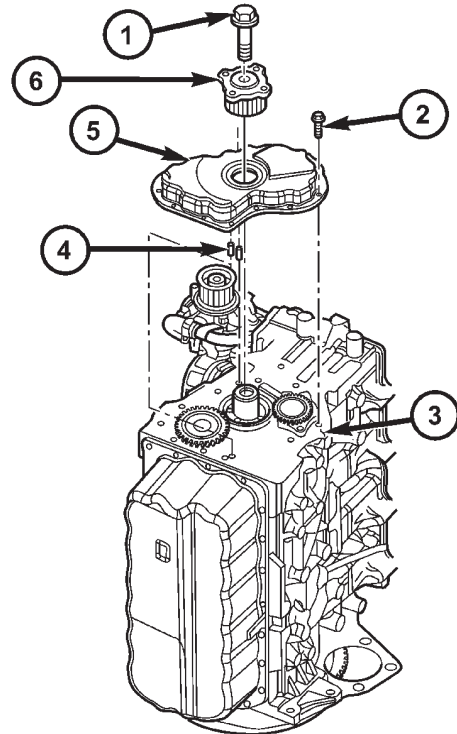


Fig. 59 ENGINE COVER - FRONT

- 1 - CRANKSHAFT HUB RETAINING BOLT
- 2 - FRONT ENGINE COVER RETAINING BOLTS
- 3 - ENGINE BLOCK
- 4 - FRONT ENGINE COVER ALIGNMENT DOWELS
- 5 - FRONT ENGINE COVER
- 6 - CRANKSHAFT HUB

80c6c8e1

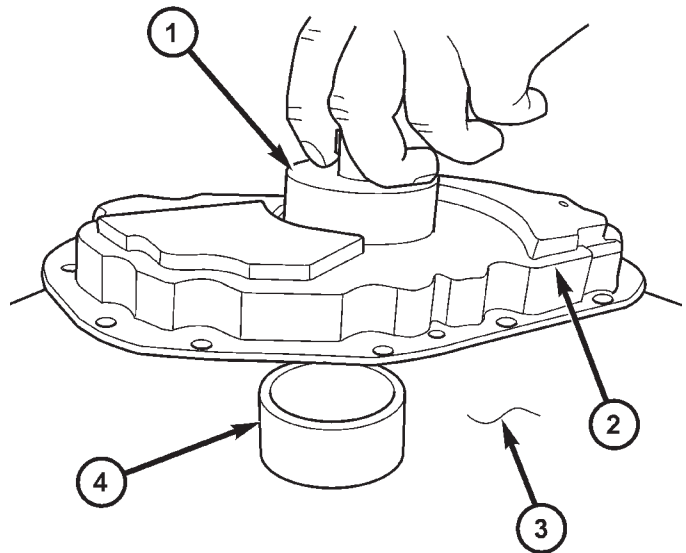


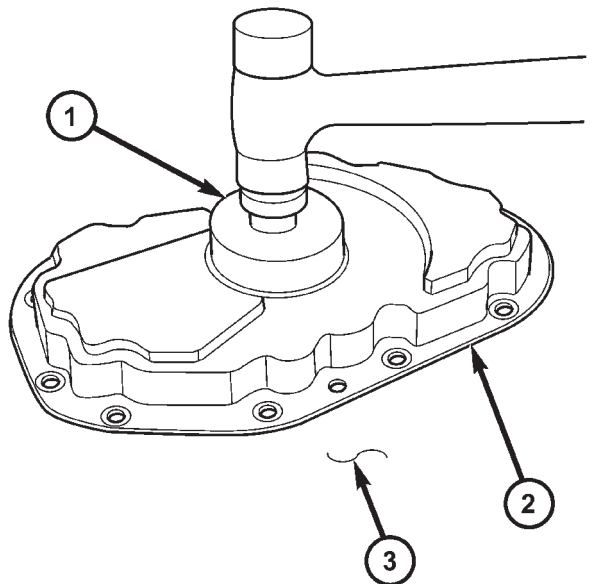
Fig. 60 VM.1061 PLACEMENT

- 1 - VM.1061
- 2 - FRONT ENGINE COVER
- 3 - WORK BENCH
- 4 - SLEEVE FROM VM.1061

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CRANKSHAFT OIL SEAL - FRONT (Continued)

(4) Using hammer, install new seal into front engine cover (Fig. 61).



80c6c150

Fig. 61 CRANKSHAFT OIL SEAL INSTALLATION WITH VM.1061

- 1 - VM.1061
- 2 - FRONT ENGINE COVER
- 3 - WORK BENCH

(5) Install front engine cover (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - INSTALLATION).

(6) Install crankshaft hub and retaining bolt. Torque bolt to 304N·m.

(7) Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(8) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(9) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(10) Install vibration damper/crankshaft pulley (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(11) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(12) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(13) Install right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - INSTALLATION).

(14) Install air cleaner housing.

(15) Connect negative battery cable.

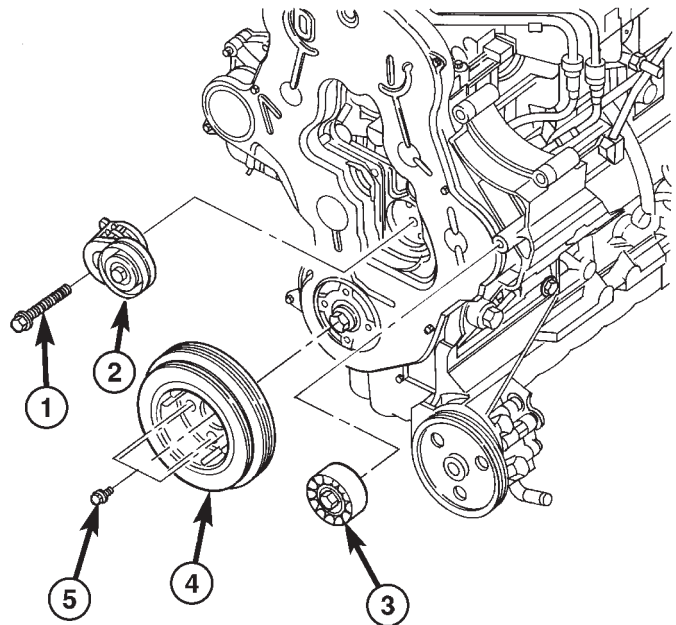
VIBRATION DAMPER

REMOVAL

(1) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(2) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(3) Remove vibration damper retaining bolts and damper (Fig. 62).



80bdce5e

Fig. 62 VIBRATION DAMPER

- 1 - BELT TENSIONER RETAINING BOLT
- 2 - BELT TENSIONER
- 3 - IDLER PULLEY
- 4 - VIBRATION DAMPER/CRANKSHAFT PULLEY
- 5 - VIBRATION DAMPER/CRANKSHAFT PULLEY RETAINING BOLTS

INSTALLATION

(1) Install vibration damper and retaining bolts (Fig. 62). Torque bolts to 27.5N·m.

(2) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(3) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

ENGINE COVER - FRONT

DESCRIPTION

The front engine cover on this engine is a stamped steel cover which covers the oil pump and vacuum pump.

REMOVAL

- (1) Disconnect negative battery cable.
- (2) Remove air cleaner housing.
- (3) Support engine and remove right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - REMOVAL).
- (4) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (5) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (6) Remove vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
- (7) Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

CAUTION: Before removing the cylinder head cover/intake manifold or timing belt the engine must put at 90° after TDC. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)

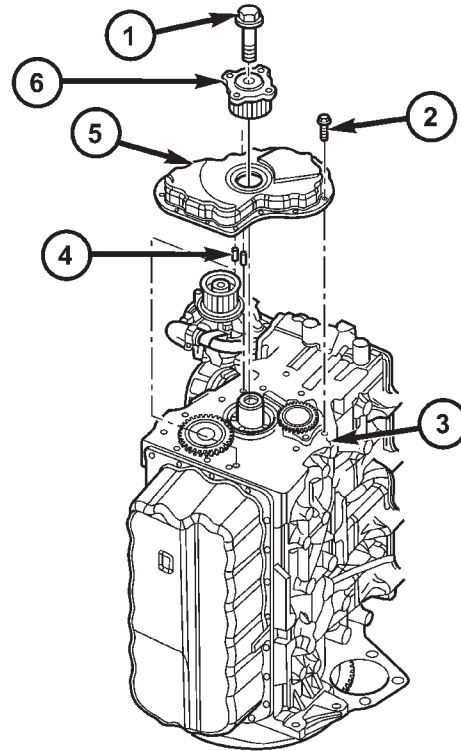
- (8) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
- (9) Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

NOTE: Crankshaft hub has LHD thread.

- (10) Remove crankshaft hub.
- (11) Remove front engine cover (Fig. 63).

INSTALLATION

- (1) Clean engine block and front engine cover sealing surfaces.
- (2) Apply a continuous 3mm bead of Silicone Sealer to cover, install within 10 minutes (Fig. 63). Torque bolts to 11.8N·m.
- (3) Install crankshaft hub (Fig. 63). Torque bolt to 304N·m.
- (4) Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).



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Fig. 63 ENGINE COVER - FRONT

- 1 - CRANKSHAFT HUB RETAINING BOLT
- 2 - FRONT ENGINE COVER RETAINING BOLTS
- 3 - ENGINE BLOCK
- 4 - FRONT ENGINE COVER ALIGNMENT DOWELS
- 5 - FRONT ENGINE COVER
- 6 - CRANKSHAFT HUB

- (5) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

- (6) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

- (7) Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

- (8) Install right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - INSTALLATION).

- (9) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

- (10) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

- (11) Install air cleaner housing.

- (12) Connect negative battery cable.

CRANKSHAFT MAIN BEARINGS

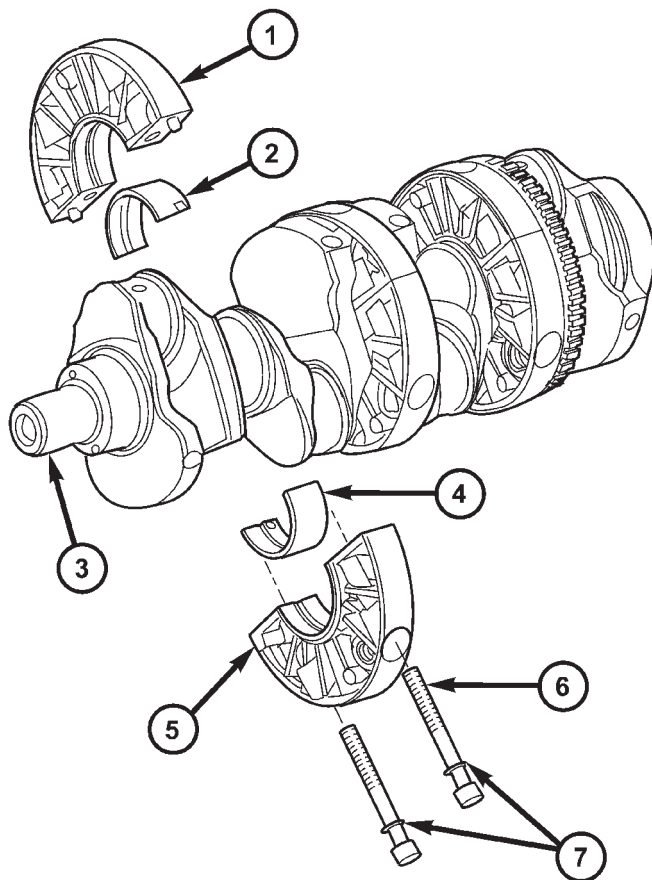
REMOVAL

The engine must be removed from vehicle and completely disassembled to replace the front main bearing.

CRANKSHAFT MAIN BEARINGS

(1) With crankshaft assembly removed from engine.

(2) Remove crankshaft supports from crankshaft and remove bearing halves from supports (Fig. 64).



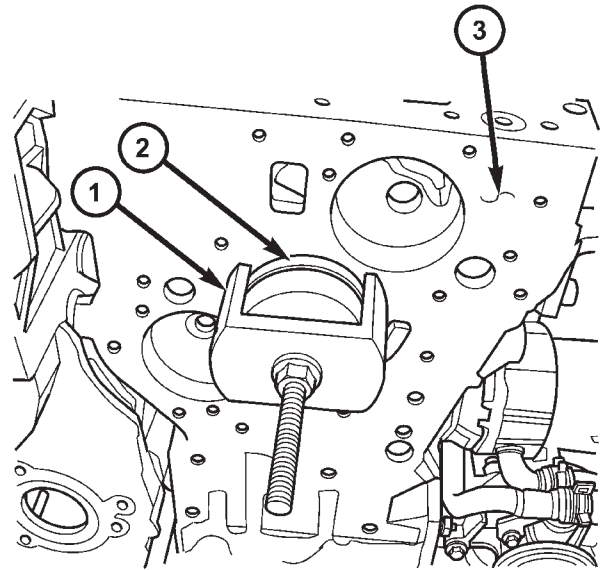
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Fig. 64 CRANKSHAFT ASSEMBLY

- 1 - CRANKSHAFT SUPPORT HALVE
- 2 - MAIN BEARING HALVE
- 3 - CRANKSHAFT
- 4 - MAIN BEARING HALVE
- 5 - CRANKSHAFT SUPPORT HALVE
- 6 - MAIN BEARING SUPPORT BOLTS
- 7 - WASHERS

CRANKSHAFT FRONT MAIN BEARING

(1) Using special tool VM.1073 push front main bearing out of front of engine block (Fig. 65).



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Fig. 65 FRONT MAIN BEARING REMOVAL

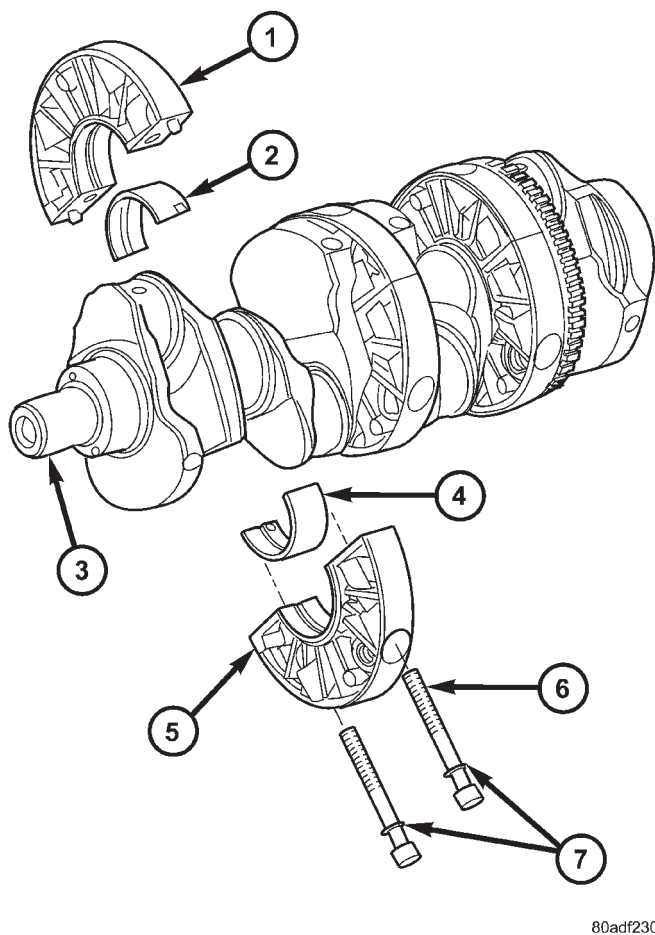
- 1 - VM.1073
- 2 - FRONT CRANKSHAFT MAIN BEARING
- 3 - ENGINE BLOCK

CRANKSHAFT MAIN BEARINGS (Continued)

INSTALLATION

CRANKSHAFT MAIN BEARINGS

- (1) Install bearing halves in crankshaft supports.
- (2) Lubricate crankshaft and main bearings with clean engine oil.
- (3) Install crankshaft supports on crankshaft (Fig. 66). Torque bolts to 44.1N·m.



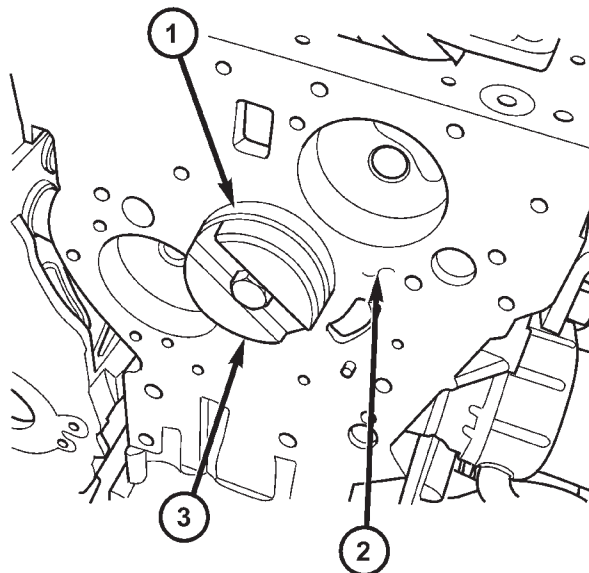
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Fig. 66 CRANKSHAFT ASSEMBLY

- 1 - CRANKSHAFT SUPPORT HALVE
- 2 - MAIN BEARING HALVE
- 3 - CRANKSHAFT
- 4 - MAIN BEARING HALVE
- 5 - CRANKSHAFT SUPPORT HALVE
- 6 - MAIN BEARING SUPPORT BOLTS
- 7 - WASHERS

FRONT CRANKSHAFT MAIN BEARING

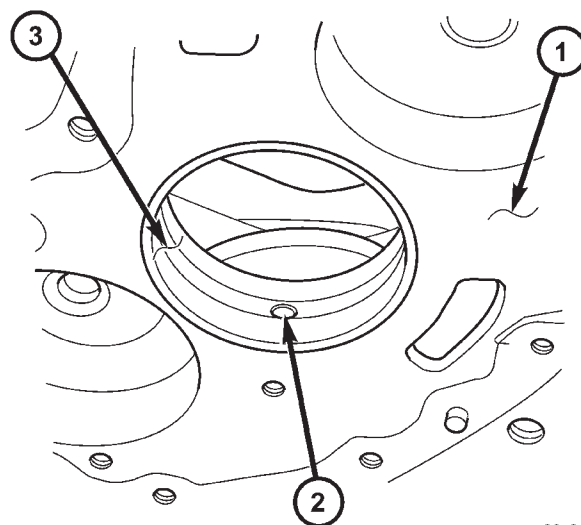
- (1) Using special tool VM.1073, push front crankshaft main bearing in engine block (Fig. 67).
- (2) Be sure oil hole in bearing lines up with oil gallery in engine block (Fig. 68).
- (3) Reassemble engine and install in vehicle.



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Fig. 67 FRONT MAIN BEARING INSTALLATION

- 1 - FRONT CRANKSHAFT MAIN BEARING
- 2 - ENGINE BLOCK
- 3 - SPECIAL TOOL VM.1073



80c6cad4

Fig. 68 FRONT MAIN BEARING ALIGNMENT

- 1 - ENGINE BLOCK
- 2 - OIL HOLE IN BEARING
- 3 - FRONT CRANKSHAFT MAIN BEARING

CRANKSHAFT OIL SEAL - REAR

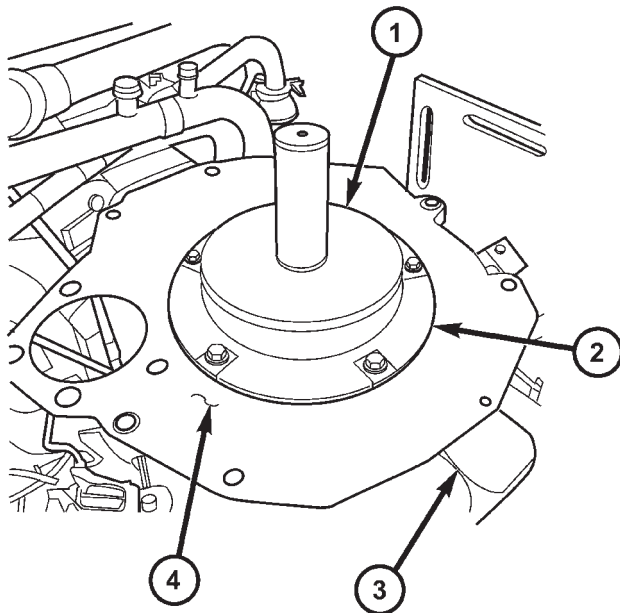
REMOVAL

This must be done with either the engine or transmission removed from vehicle.

- (1) Remove flywheel assembly.
- (2) Pry out old crankshaft oil seal.

INSTALLATION

- (1) Using special tool VM.1050, install rear crankshaft oil seal in rear main bearing support (Fig. 69).



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Fig. 69 REAR CRANKSHAFT OIL SEAL INSTALLATION USING VM.1050

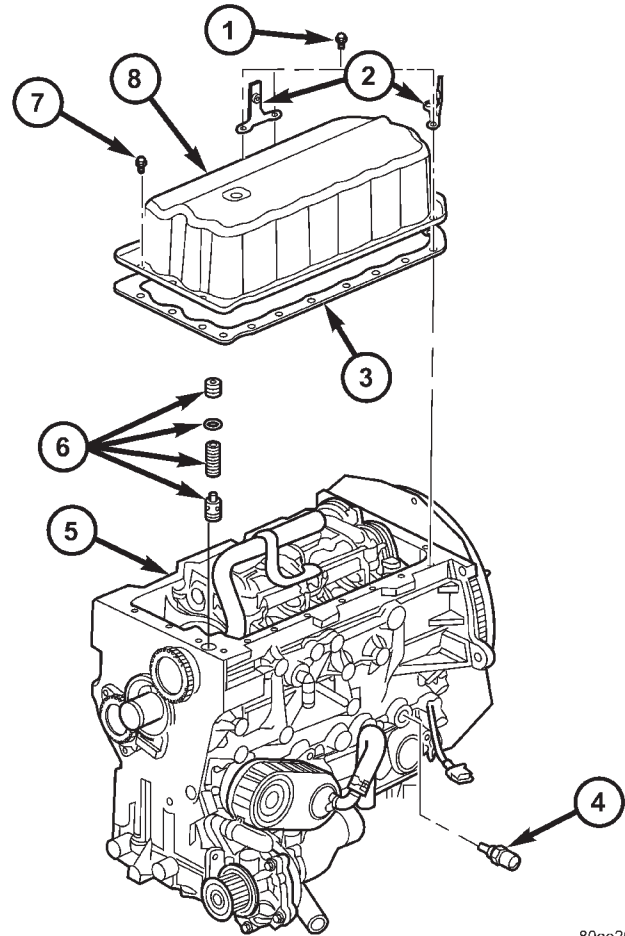
- 1 - SPECIAL TOOL VM.1050
- 2 - REAR MAIN BEARING SUPPORT
- 3 - OIL PAN
- 4 - ENGINE TO TRANSMISSION ADAPTER PLATE

- (2) Install engine or transmission in vehicle.

OIL PAN

REMOVAL

- (1) Disconnect negative battery cable.
- (2) Raise vehicle on hoist.
- (3) Drain engine oil from engine.
- (4) Remove all oil pan retaining bolts and oil pan (Fig. 70).



80ae2045

Fig. 70 OIL PAN AND PRESSURE RELIEF VALVE

- 1 - OIL PAN RETAINING BOLTS
- 2 - POWER STEERING LINE BRACKETS
- 3 - OIL PAN GASKET
- 4 - OIL PRESSURE SENSOR
- 5 - ENGINE BLOCK
- 6 - OIL PRESSURE RELIEF VALVE
- 7 - OIL PAN RETAINING BOLTS
- 8 - OIL PAN

INSTALLATION

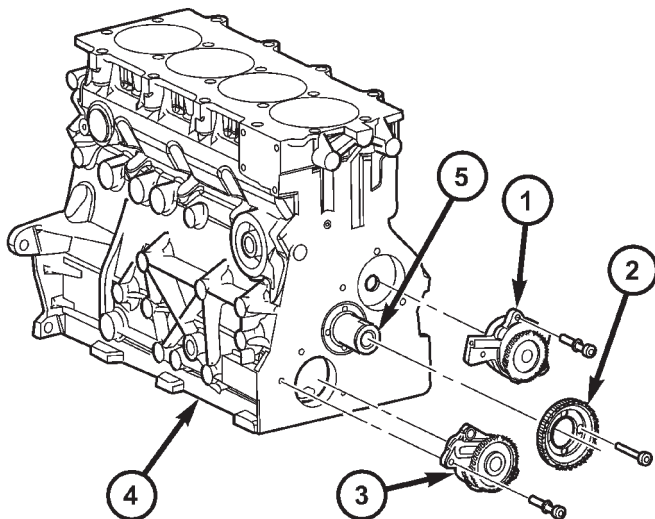
- (1) Clean oil pan and sealing surfaces. Inspect oil pan and engine block.
- (2) Install oil pan, gasket, and retaining bolts (Fig. 70).
- (3) Be sure power steering line brackets are in proper location (Fig. 70).
- (4) Torque oil pan bolts to 11.8N·m.
- (5) Lower vehicle.
- (6) Refill engine oil to proper level.
- (7) Connect negative battery cable.

OIL PUMP

REMOVAL

REMOVAL

- (1) Disconnect negative battery cable.
- (2) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (3) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (4) Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
- (5) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
- (6) Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
- (7) Remove front engine cover (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - REMOVAL).
- (8) Remove crankshaft sprocket (Fig. 71).
- (9) Remove oil pump retaining bolts and remove pump from engine block (Fig. 71).



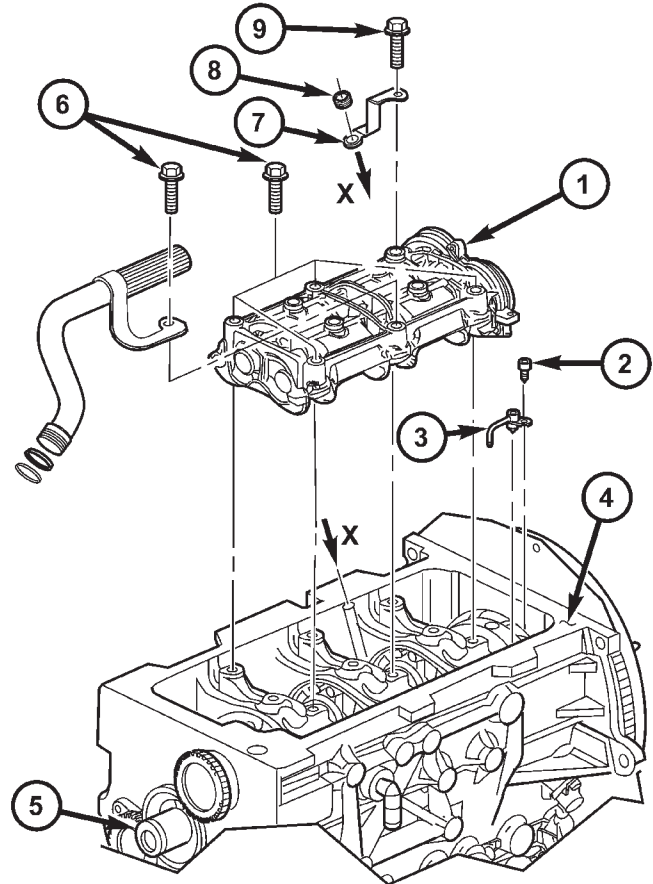
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Fig. 71 OIL PUMP AND VACUUM PUMP

- 1 - VACUUM PUMP
- 2 - CRANKSHAFT SPROCKET
- 3 - OIL PUMP
- 4 - ENGINE BLOCK
- 5 - CRANKSHAFT

REMOVAL

- (1) Disconnect negative battery cable.
- (2) Raise vehicle on hoist.
- (3) Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
- (4) Remove oil pump pickup tube retaining bolt and pull pickup tube from engine block (Fig. 72).



80ae3814

Fig. 72 OIL PUMP PICKUP TUBE ASSEMBLY

- 1 - BALANCE SHAFT
- 2 - OIL JET RETAINING BOLT
- 3 - OIL JET
- 4 - ENGINE BLOCK
- 5 - CRANKSHAFT
- 6 - BALANCE SHAFT RETAINING BOLTS
- 7 - OIL DIPSTICK TUBE RETAINER
- 8 - RUBBER BUSHING
- 9 - RETAINING BOLT

INSTALLATION

INSTALLATION

- (1) Lubricate oil pump rotor with engine oil.
- (2) Install oil pump in bore in engine block (Fig. 71).

OIL PUMP (Continued)

(3) Install oil pump retaining bolts (Fig. 71). Torque bolts to 10.8N·m.

(4) Install crankshaft sprocket (Fig. 71). Torque bolts to 10.8N·m.

(5) Install front engine cover (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - INSTALLATION).

(6) Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(7) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(8) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(9) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(10) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(11) Connect negative battery cable.

INSTALLATION

(1) Lubricate o-ring on oil pump pickup tube with engine oil.

(2) Install pickup tube in engine block and install retaining bolt (Fig. 72). Torque bolt to 32.4N·m.

(3) Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

(4) Refill engine oil to proper level.

(5) Connect negative battery cable.

OIL PRESSURE SENSOR/
SWITCH

DESCRIPTION

The oil pressure switch is located on the right side of the engine block. The switch screws into the engines main oil gallery (Fig. 73).

REMOVAL

(1) Disconnect negative battery cable.

(2) Raise vehicle on hoist.

(3) Disconnect oil pressure switch electrical connector (Fig. 73).

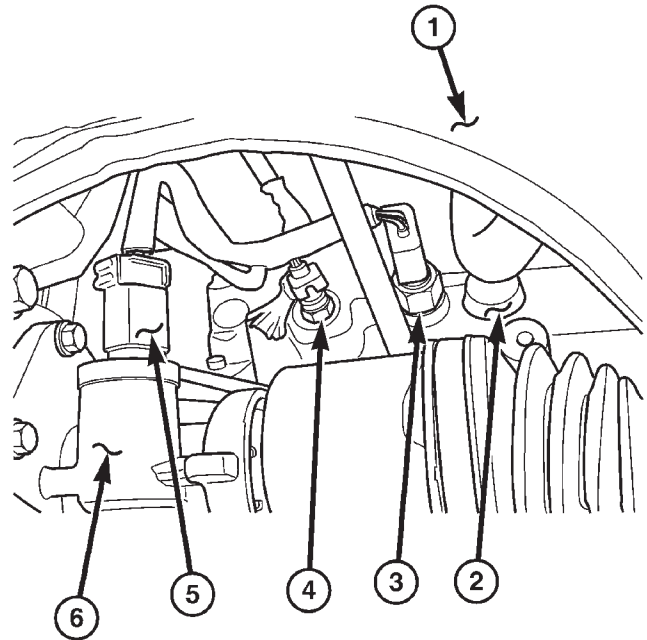
(4) Remove oil pressure switch from engine block.

INSTALLATION

(1) Apply Mopar® Thread Sealant to the switch threads.

(2) Install oil pressure switch in engine block.

(3) Connect oil pressure switch electrical connector (Fig. 73).



80c4714e

Fig. 73 REAR ENGINE VIEW

- 1 - SUSPENSION CRADLE
- 2 - ENGINE BLOCK
- 3 - OIL PRESSURE SWITCH
- 4 - OIL TEMPERATURE SENSOR
- 5 - VEHICLE SPEED SENSOR
- 6 - TRANSMISSION

(4) Lower vehicle.

(5) Start engine and check for leaks.

(6) Check and adjust oil level as necessary.

OIL TEMPERATURE SENSOR

DESCRIPTION

The oil temperature sensor is located on the right side of the engine block. The sensor screws into the engines main oil gallery (Fig. 74).

REMOVAL

(1) Disconnect negative battery cable.

(2) Raise vehicle on hoist.

(3) Disconnect oil temperature sensor electrical connector (Fig. 74).

(4) Remove oil temperature sensor from engine block.

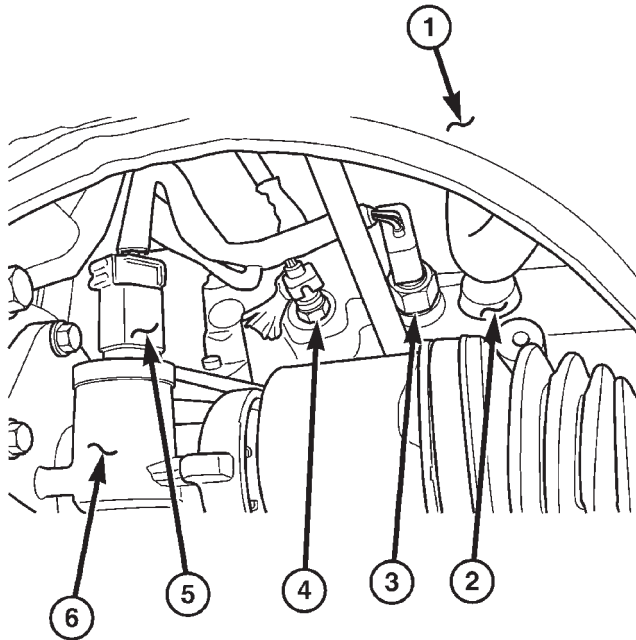
INSTALLATION

(1) Apply Mopar® Thread Sealant to the sensor threads.

(2) Install oil temperature sensor in engine block.

(3) Connect oil temperature sensor electrical connector (Fig. 74)

OIL TEMPERATURE SENSOR (Continued)



80c4714e

Fig. 74 REAR ENGINE VIEW

- 1 - SUSPENSION CRADLE
- 2 - ENGINE BLOCK
- 3 - OIL PRESSURE SWITCH
- 4 - OIL TEMPERATURE SENSOR
- 5 - VEHICLE SPEED SENSOR
- 6 - TRANSMISSION

- (4) Lower vehicle.
- (5) Start engine and check for leaks.
- (6) Check and adjust oil level as necessary.

OIL PRESSURE RELIEF VALVE

DESCRIPTION

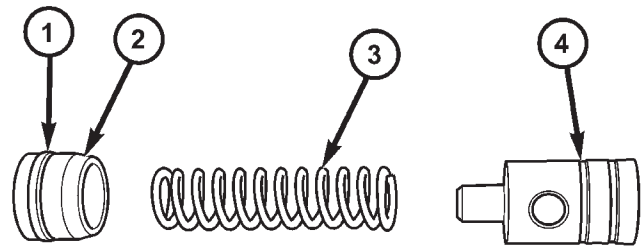
The oil pressure relief valve mounts in the front of the engine block and is used to control oil flow through the engines lubrication system (Fig. 75).

REMOVAL

- (1) Remove engine oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
- (2) Using special tool VM.1054, remove oil pressure relief valve from engine block (Fig. 76).

INSTALLATION

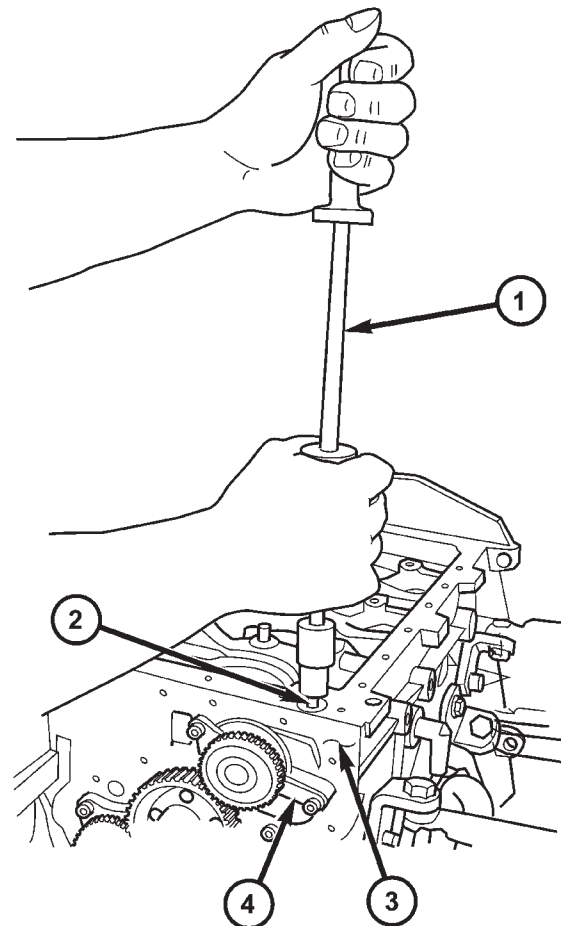
- (1) Thoroughly clean all components and relief valve pocket in cylinder block.
- (2) Lubricate all oil pressure relief valve components with engine oil.
- (3) Install oil pressure relief valve plunger, spring, and cap.



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Fig. 75 OIL PRESSURE RELIEF VALVE

- 1 - O-RING
- 2 - OIL PRESSURE RELIEF VALVE CAP
- 3 - OIL PRESSURE RELIEF VALVE SPRING
- 4 - OIL PRESSURE RELIEF VALVE PLUNGER



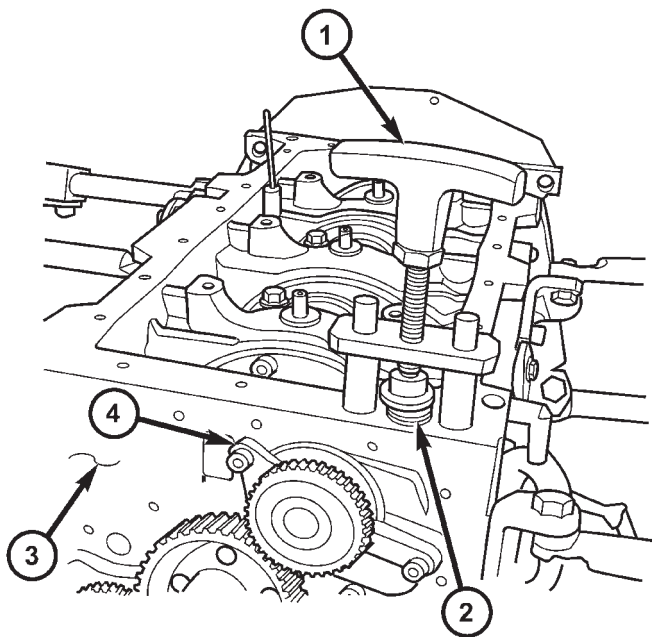
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Fig. 76 OIL PRESSURE RELIEF VALVE REMOVAL

- 1 - VM.1054
- 2 - OIL PRESSURE RELIEF VALVE
- 3 - ENGINE BLOCK
- 4 - OIL PUMP

OIL PRESSURE RELIEF VALVE (Continued)

(4) Using special tool VM.1059, push oil pressure relief valve cap in until flush with engine block (Fig. 77).



80c6cb13

Fig. 77 OIL PRESSURE RELIEF VALVE INSTALLATION

- 1 - VM.1059
- 2 - OIL PRESSURE RELIEF VALVE
- 3 - ENGINE BLOCK
- 4 - OIL PUMP

(5) Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

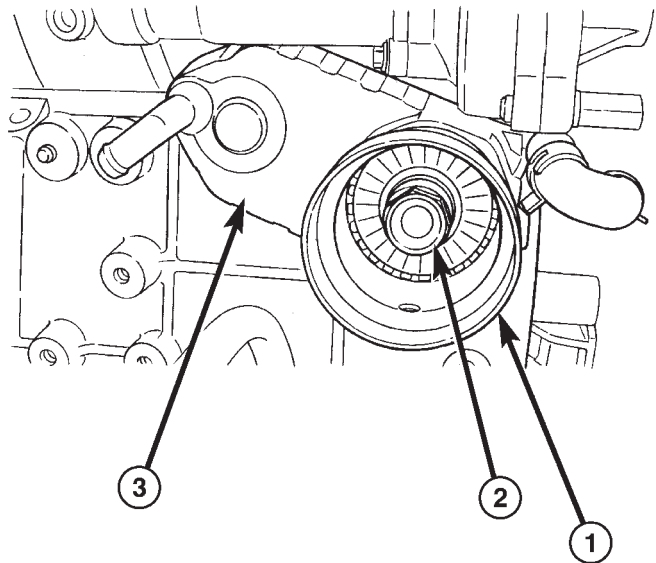
OIL COOLER & LINES

REMOVAL

- (1) Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
- (2) Raise vehicle on hoist.
- (3) Remove oil filter cap and filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - REMOVAL).
- (4) Remove oil filter housing retaining nut and housing (Fig. 78).
- (5) Disconnect coolant hoses at cooler (Fig. 79).
- (6) Remove oil cooler retaining bolt at engine block (Fig. 79).
- (7) Remove oil cooler retaining stud and remove oil cooler from engine block (Fig. 79).

INSTALLATION

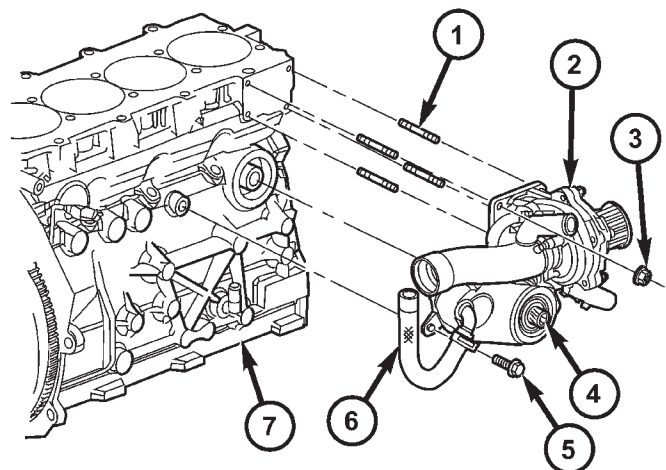
- (1) Clean oil cooler and engine block sealing surfaces.



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Fig. 78 OIL FILTER HOUSING RETAINING NUT

- 1 - OIL FILTER HOUSING
- 2 - OIL FILTER HOUSING RETAINING NUT
- 3 - OIL COOLER



80be2af9

Fig. 79 WATER PUMP AND OIL COOLER ASSEMBLIES

- 1 - WATER PUMP HOUSING STUDS
- 2 - WATER PUMP
- 3 - RETAINING NUTS
- 4 - OIL COOLER RETAINING STUD
- 5 - OIL COOLER TO ENGINE BLOCK RETAINING BOLT
- 6 - OIL COOLER COOLANT HOSE
- 7 - ENGINE BLOCK

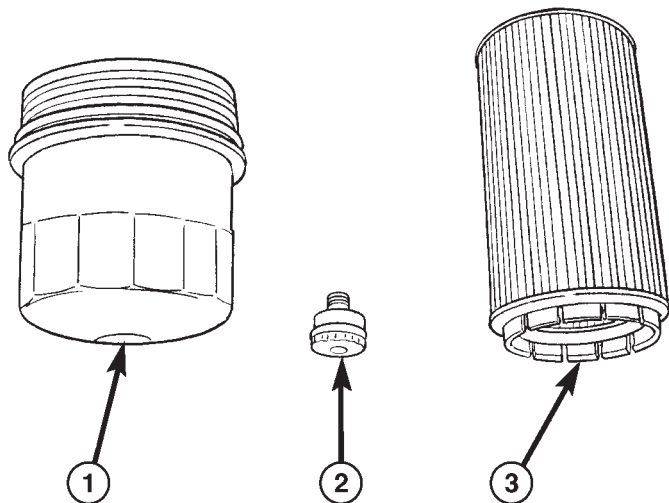
OIL COOLER & LINES (Continued)

- (2) Install oil cooler, retaining bolt, and stud (Fig. 79). Torque retaining bolt to 47.1N·m and stud to 50N·m.
- (3) Connect coolant hoses at cooler (Fig. 79).
- (4) Install oil filter housing and retaining nut (Fig. 78). Torque retaining nut to 3.5 Kg.
- (5) Install oil filter cartridge and oil filter cap (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - INSTALLATION).
- (6) Lower vehicle.
- (7) Refill cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
- (8) Start engine and check for leaks.
- (9) Check and adjust oil level as necessary.

OIL FILTER

DESCRIPTION

The oil filter used on this engine is a cartridge style filter (Fig. 80).



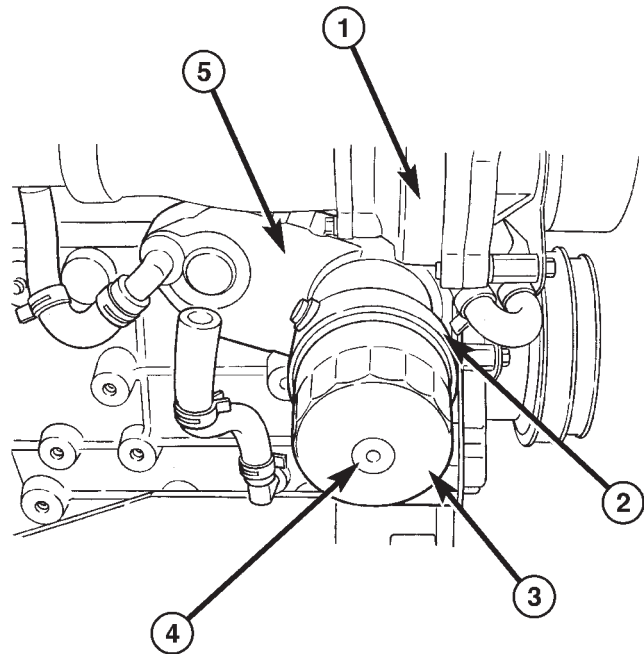
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Fig. 80 OIL FILTER ASSEMBLY

- 1 - OIL FILTER CAP
- 2 - DRAIN PLUG
- 3 - OIL FILTER CARTRIDGE

REMOVAL

- (1) Raise vehicle on hoist.
- (2) Remove oil filter cap drain plug and drain oil from oil filter housing (Fig. 81).
- (3) Remove oil filter cap with suitable oil filter wrench (Fig. 81).



80c6e277

Fig. 81 OIL COOLER AND FILTER ASSEMBLY

- 1 - WATER PUMP HOUSING
- 2 - OIL FILTER HOUSING
- 3 - OIL FILTER CAP
- 4 - OIL FILTER CAP DRAIN PLUG
- 5 - OIL COOLER

- (4) Remove oil filter cartridge from housing.

INSTALLATION

- (1) Clean oil filter cap and drain plug with suitable solvent.
- (2) Install new oil filter cartridge in oil filter housing.
- (3) Install oil filter cap and drain plug
- (4) Lower vehicle from hoist.
- (5) Start engine and check for leaks.
- (6) Check and adjust oil level as necessary.

OIL JET

DESCRIPTION

There are four oil jets installed in the engine block. These oil jets are used to cool and lubricate the piston assemblies (Fig. 82).

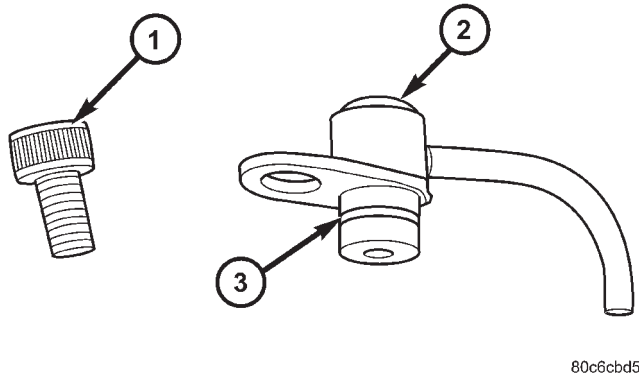


Fig. 82 OIL JET ASSEMBLY

- 1 - RETAINING BOLT
- 2 - OIL JET
- 3 - O-RING

REMOVAL

CAUTION: Use caution when removing and installing oil jets. Damage to oil jet nozzle could cause severe engine damage.

- (1) Disconnect negative battery cable.
- (2) Raise vehicle on hoist.
- (3) Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
- (4) Using special tool VM.1060 to hold oil jet. Remove oil jet retaining bolt and remove oil jet from engine block (Fig. 83).

INSTALLATION

CAUTION: Use caution when removing and installing oil jets. Damage to oil jet nozzle could cause severe engine damage.

- (1) Lubricate o-ring on oil jet.
- (2) Using special tool VM.1060, install oil jet in engine block (Fig. 83).
- (3) Install oil jet retaining bolt. Torque bolt to 10.8N·m.
- (4) Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
- (5) Refill engine oil to proper level.
- (6) Connect negative battery cable.

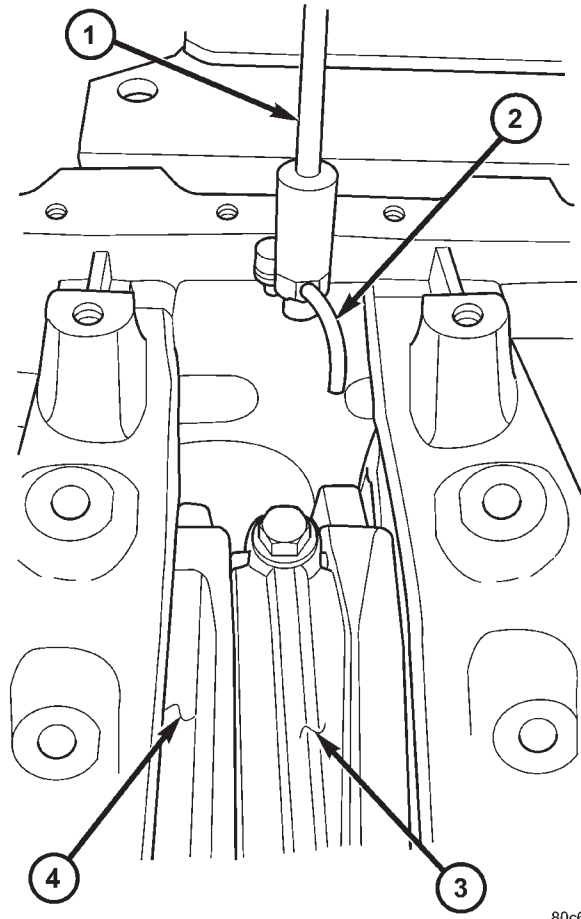


Fig. 83 OIL JET REMOVAL/INSTALLATION

- 1 - SPECIAL TOOL VM.1060
- 2 - OIL JET
- 3 - CONNECTING ROD
- 4 - CRANKSHAFT

INTAKE MANIFOLD

DESCRIPTION

(Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - DESCRIPTION)

REMOVAL

- (1) (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL)

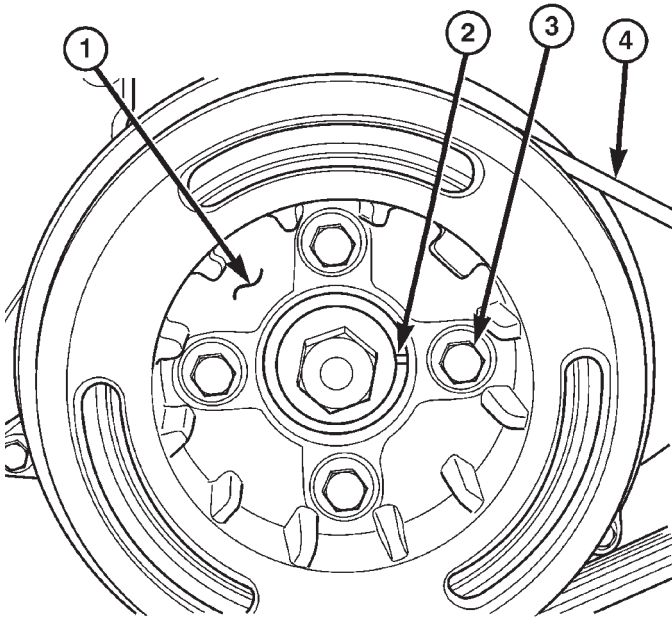
INSTALLATION

- (1) (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION)

VALVE TIMING

STANDARD PROCEDURE - LOCKING ENGINE 90° AFTER TDC

- (1) Disconnect negative battery cable.
- (2) Remove starter motor (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - REMOVAL).
- (3) Rotate engine until notch in hub is in the following position (Fig. 84).



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Fig. 84 CRANKSHAFT HUB ALIGNMENT

- 1 - VIBRATION DAMPER/CRANKSHAFT PULLEY
- 2 - CRANKSHAFT HUB NOTCH
- 3 - VIBRATION DAMPER/CRANKSHAFT PULLEY TO CRANKSHAFT HUB BOLTS

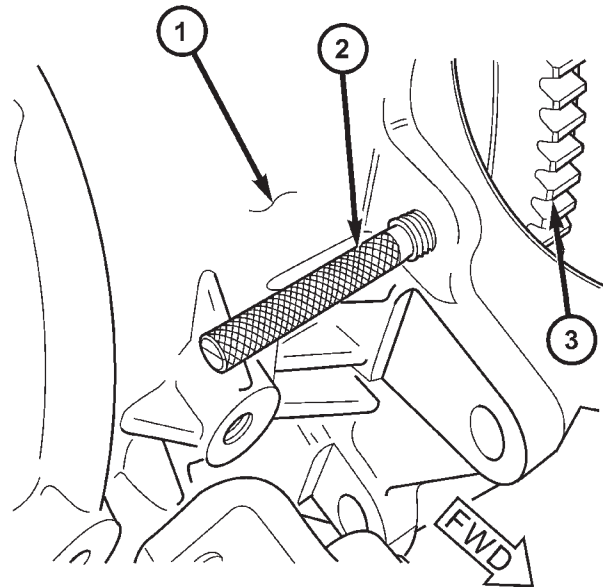
(4) Special tool VM.1068 can be install in engine block as shown at this time (Fig. 85). This will lock the engine at 90° after TDC.

(5) Remove front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - REMOVAL).

(6) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(7) Remove plug in cylinder head cover/intake manifold and insert VM.1053 to lock exhaust camshaft in position (Fig. 86).

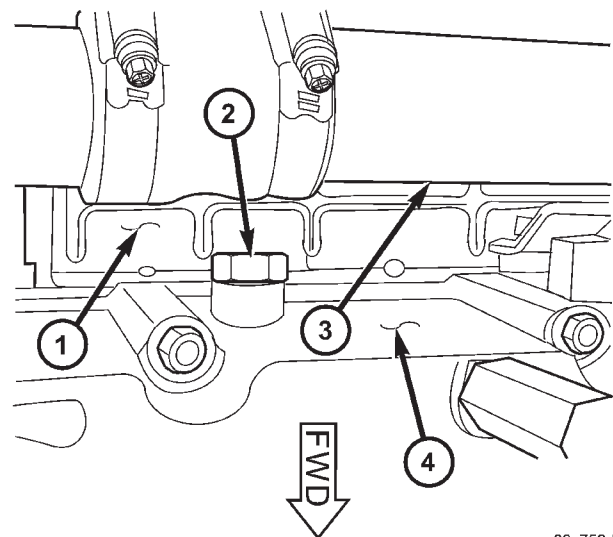
(8) Remove generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - REMOVAL).



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**Fig. 85 TDC AND 90 DEGREES AFTER TDC
ALIGNMENT PIN LOCATION**

- 1 - ENGINE BLOCK
- 2 - VM.1051 TDC PIN OR VM.1068 90 DEGREES ATDC PIN
- 3 - FLYWHEEL



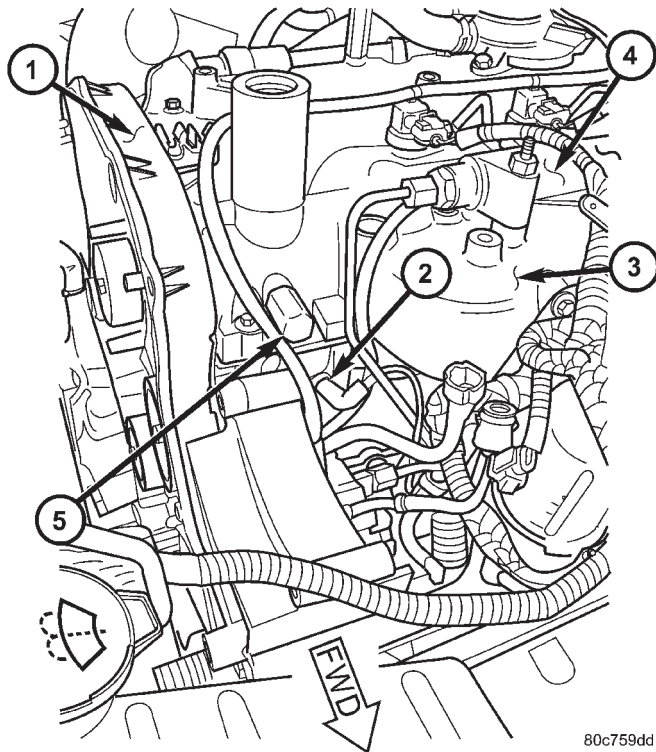
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**Fig. 86 EXHAUST CAMSHAFT LOCKING PIN
VM.1053**

- 1 - EXHAUST MANIFOLD HEAT SHIELD
- 2 - EXHAUST CAMSHAFT LOCKING PIN VM.1053
- 3 - COOLANT TUBE FROM THERMOSTAT HOUSING TO UPPER RADIATOR HOSE
- 4 - CYLINDER HEAD COVER/INTAKE MANIFOLD

VALVE TIMING (Continued)

(9) Remove plug in cylinder head cover/intake manifold and insert VM.1052 to lock intake camshaft in position (Fig. 87).



80c759dd

Fig. 87 INTAKE CAMSHAFT LOCKING PIN VM.1052

- 1 - TIMING BELT INNER COVER
- 2 - GLOW PLUG ELECTRICAL CONNECTOR
- 3 - CYLINDER HEAD COVER/INTAKE MANIFOLD
- 4 - FUEL RAIL
- 5 - INTAKE CAMSHAFT LOCKING PIN VM.1052

(10) At this point the timing belt can be removed for service.

(11) After engine service is completed and timing belt reinstalled, remove both camshaft locking pins from cylinder head cover/intake manifold.

(12) Install both camshaft access plugs.

(13) Remove 90° after TDC engine locking pin.

(14) Install starter motor (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - INSTALLATION).

(15) Install generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).

(16) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

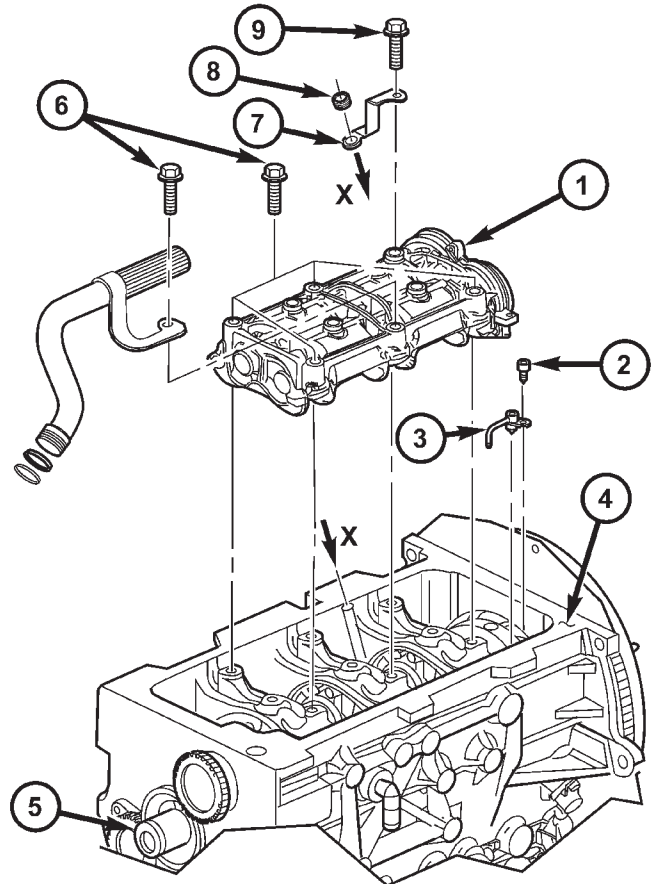
(17) Install front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - INSTALLATION).

(18) Connect negative battery cable.

BALANCE SHAFT

DESCRIPTION

The 2.5L Common Rail Diesel engine is equipped with two nodular cast iron balance shafts in a cast aluminum carrier. The balance shaft assembly is mounted to the engine block (Fig. 88).



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Fig. 88 BALANCE SHAFT ASSEMBLY

- 1 - BALANCE SHAFT
- 2 - OIL JET RETAINING BOLT
- 3 - OIL JET
- 4 - ENGINE BLOCK
- 5 - CRANKSHAFT
- 6 - BALANCE SHAFT RETAINING BOLTS
- 7 - OIL DIPSTICK TUBE RETAINER
- 8 - RUBBER BUSHING
- 9 - RETAINING BOLT

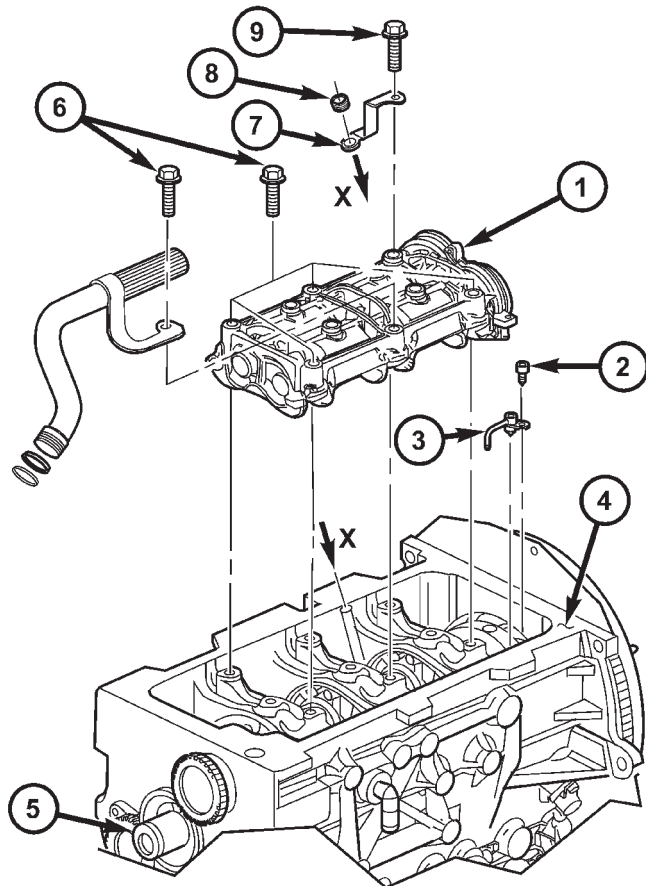
OPERATION

The balance shaft is driven by the crankshaft. 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 (Continued)

REMOVAL

- (1) Disconnect negative battery cable.
- (2) Raise vehicle on hoist.
- (3) Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
- (4) Remove balance shaft assembly (Fig. 89).



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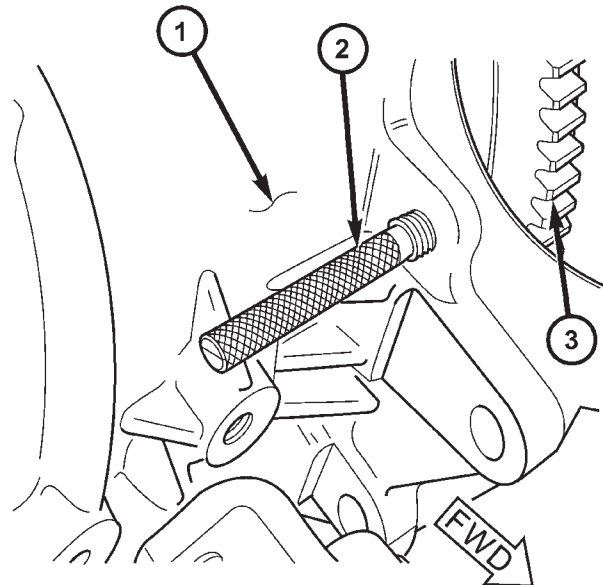
Fig. 89 BALANCE SHAFT ASSEMBLY

- 1 - BALANCE SHAFT
- 2 - OIL JET RETAINING BOLT
- 3 - OIL JET
- 4 - ENGINE BLOCK
- 5 - CRANKSHAFT
- 6 - BALANCE SHAFT RETAINING BOLTS
- 7 - OIL DIPSTICK TUBE RETAINER
- 8 - RUBBER BUSHING
- 9 - RETAINING BOLT

INSTALLATION

(1) Before installation of the balance shaft assembly, the # 1 cylinder must be brought to TDC. Using special tool VM.1051, roll engine over by hand until tool can be inserted into engine block locking flywheel from turning (Fig. 90). Once the # 1 cylinder is brought to TDC, the balance shaft assembly can be installed.

(2) With balance shaft assembly on work bench. Insert special tool VM.1056 into balance shaft assem-

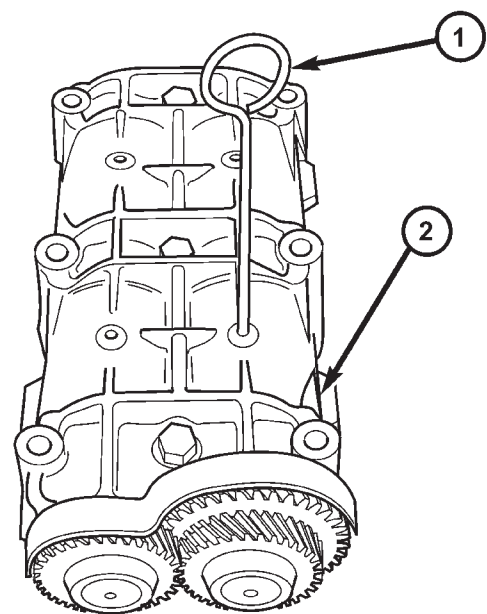


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Fig. 90 TDC AND 90 DEGREES AFTER TDC ALIGNMENT PIN LOCATION

- 1 - ENGINE BLOCK
- 2 - VM.1051 TDC PIN OR VM.1068 90 DEGREES ATDC PIN
- 3 - FLYWHEEL

bly (Fig. 91). This will ensure proper balance shaft and crankshaft timing after assembly.



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Fig. 91 BALANCE SHAFT ALIGNMENT PIN VM.1056

- 1 - VM.1056
- 2 - BALANCE SHAFT ASSEMBLY

BALANCE SHAFT (Continued)

- (3) Install balance shaft assembly and retaining bolts (Fig. 89). Torque bolts to 32.4N·m.
- (4) Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
- (5) Refill engine oil to proper level.
- (6) Connect negative battery cable.

TIMING BELT / CHAIN COVER(S)

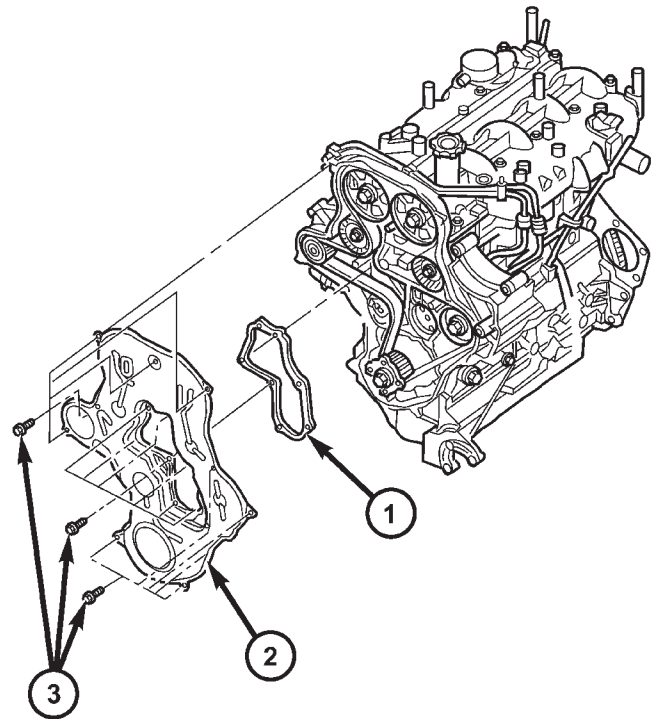
REMOVAL

REMOVAL - TIMING BELT OUTER COVER

- (1) Disconnect negative battery cable.
- (2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
- (3) Remove air cleaner housing.
- (4) Support engine and remove right engine mount and bracket.
- (5) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (6) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (7) Remove vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
- (8) Remove timing belt outer cover retaining bolts and remove cover (Fig. 92).

REMOVAL - TIMING BELT INNER COVER

- (1) Disconnect negative battery cable.
- (2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
- (3) Remove air cleaner housing.
- (4) Support engine and remove right engine mount and bracket.
- (5) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (6) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (7) Remove vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
- (8) Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
- (9) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).



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Fig. 92 TIMING BELT COVER (OUTER)

- 1 - SEAL
2 - TIMING BELT OUTER COVER
3 - RETAINING BOLTS

(10) Remove timing belt idler pulleys (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT IDLER PULLEY - REMOVAL).

(11) Using special tool VM.1055, remove camshaft sprockets (Fig. 93).

(12) Remove timing belt tensioner (Refer to 9 - ENGINE/VALVE TIMING/TMNG BELT/CHAIN TENSIONER&PULLEY - REMOVAL) .

(13) Remove injection pump sprocket (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - REMOVAL).

(14) Remove timing belt inner cover retaining bolts and remove cover (Fig. 94).

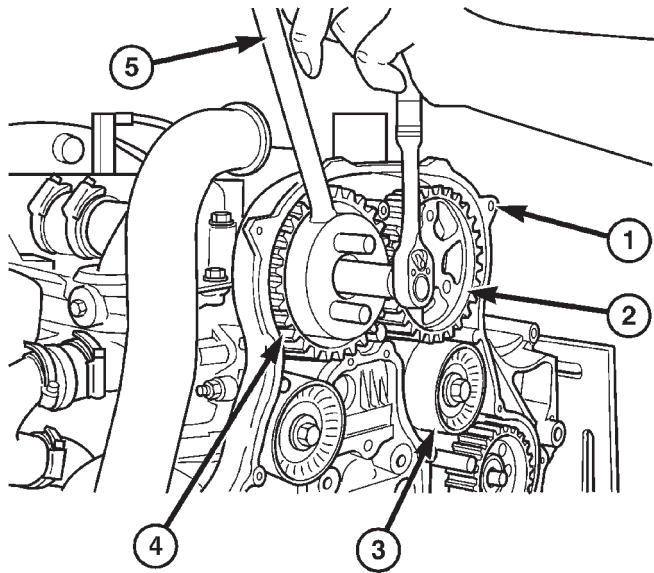
INSTALLATION

INSTALLATION - TIMING BELT OUTER COVER

(1) Install timing belt outer cover seal and cover (Fig. 92). Torque 3mm bolts to 10.8N·m and 8mm bolts to 10.8N·m.

(2) Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

TIMING BELT / CHAIN COVER(S) (Continued)



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Fig. 93 CAMSHAFT SPROCKET REMOVAL/ INSTALLATION

- 1 - TIMING BELT INNER COVER
- 2 - CAMSHAFT SPROCKET
- 3 - IDLER PULLEYS
- 4 - CAMSHAFT SPROCKET
- 5 - VM.1055

(3) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(4) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(5) Install right engine mount.

(6) Install air cleaner housing.

(7) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(8) Connect negative battery cable.

INSTALLATION - TIMING BELT INNER COVER

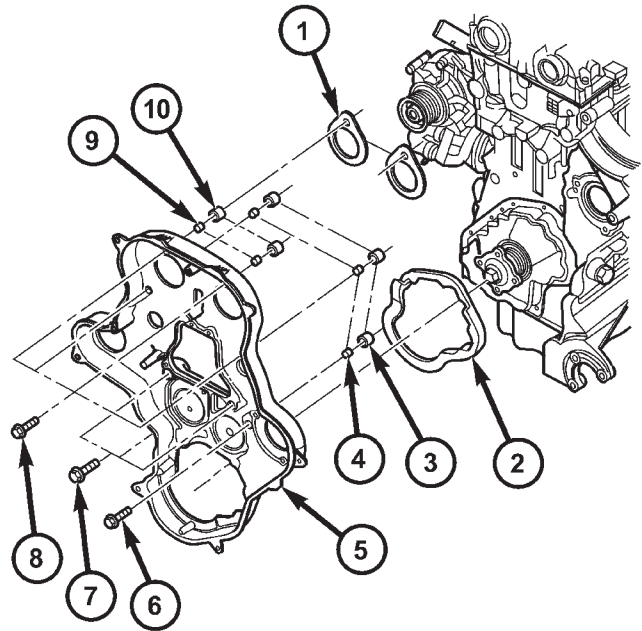
(1) Install timing belt inner cover to engine front cover seal (Fig. 94).

(2) Install timing belt inner cover to cylinder head cover gaskets (Fig. 94).

(3) Install timing belt inner cover and retaining bolts (Fig. 94). Torque 10mm bolts to 47.1N·m and 8mm bolts to 10.8N·m.

(4) Install injection pump sprocket (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - INSTALLATION).

(5) Install camshaft sprockets (Fig. 93). Torque bolts to 108N·m.



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Fig. 94 TIMING BELT COVER - INNER

- 1 - TIMING BELT COVER TO CYLINDER HEAD COVER GASKET
- 2 - TIMING BELT COVER TO FRONT ENGINE COVER SEAL
- 3 - RUBBER GROMMET
- 4 - BUSHING
- 5 - TIMING BELT COVER - INNER
- 6 - RETAINING BOLT
- 7 - RETAINING BOLT
- 8 - RETAINING BOLT
- 9 - BUSHING
- 10 - RUBBER GROMMET

(6) Install timing belt idler pulleys (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT IDLER PULLEY - INSTALLATION).

(7) Install timing belt and tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION) .

(8) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

TIMING BELT / CHAIN COVER(S) (Continued)

(9) Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(10) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(11) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(12) Install right engine mount assembly.

(13) Install air cleaner housing.

(14) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(15) Connect negative battery cable.

TIMING BELT IDLER PULLEY

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(3) Remove air cleaner housing.

(4) Support engine and remove right engine mount.

(5) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(6) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(7) Remove vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(8) Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(9) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

NOTE: Idler pulley retaining bolts are LHD thread.

(10) Remove timing belt idler pulleys (Fig. 95).

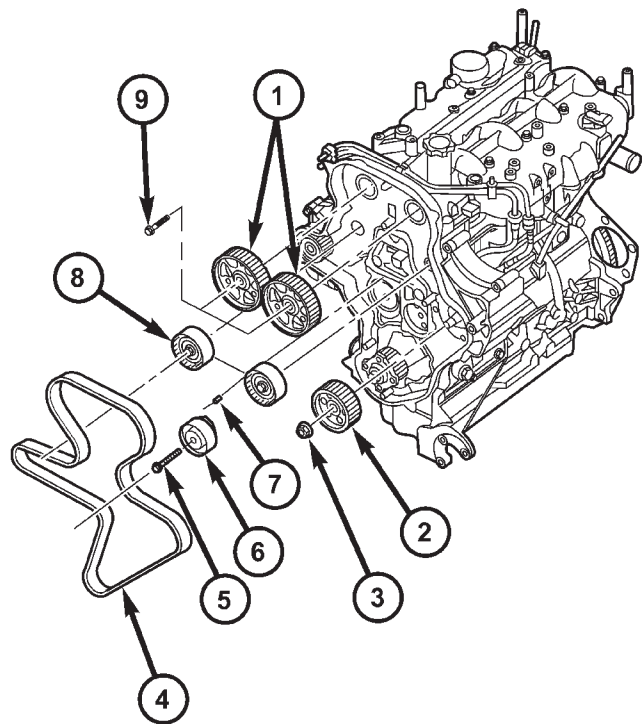
INSTALLATION

(1) Install timing belt idler pulleys (Fig. 95). Torque bolts to 47.1N·m.

(2) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(3) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(4) Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).



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Fig. 95 TIMING BELT AND SPROCKETS

- 1 - CAMSHAFT SPROCKETS
- 2 - INJECTION PUMP SPROCKET
- 3 - INJECTION PUMP SPROCKET RETAINING NUT
- 4 - TIMING BELT
- 5 - TIMING BELT TENSIONER RETAINING BOLT
- 6 - TIMING BELT TENSIONER
- 7 - TENSIONER ALIGNMENT PIN
- 8 - IDLER PULLEY
- 9 - CAMSHAFT SPROCKET RETAINING BOLT

(5) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(6) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(7) Install right engine mount.

(8) Install air cleaner housing.

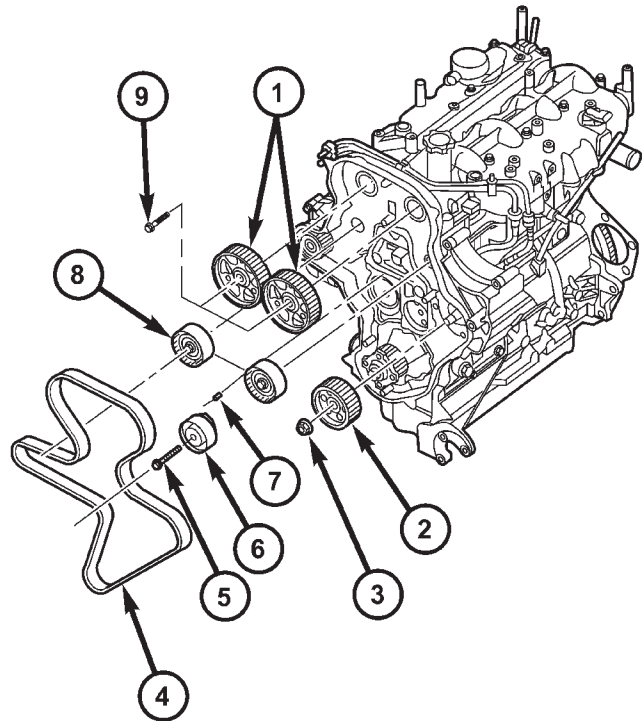
(9) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(10) Connect negative battery cable.

TMNG BELT/CHAIN TENSIONER

REMOVAL

- (1) Disconnect negative battery cable.
- (2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
- (3) Remove air cleaner housing.
- (4) Support engine and remove right engine mount.
- (5) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (6) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (7) Remove vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
- (8) Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
- (9) Loosen and remove timing belt tensioner (Fig. 96).



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INSTALLATION

- (1) Install timing belt tensioner and retaining bolt (Fig. 96).
- (2) Adjust timing belt tensioner (Refer to 9 - ENGINE/VALVE TIMING/TMNG BELT/CHAIN TENSIONER&PULLEY - ADJUSTMENTS) .
- (3) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
- (4) Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
- (5) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

Fig. 96 TIMING BELT AND SPROCKETS

- 1 - CAMSHAFT SPROCKETS
- 2 - INJECTION PUMP SPROCKET
- 3 - INJECTION PUMP SPROCKET RETAINING NUT
- 4 - TIMING BELT
- 5 - TIMING BELT TENSIONER RETAINING BOLT
- 6 - TIMING BELT TENSIONER
- 7 - TENSIONER ALIGNMENT PIN
- 8 - IDLER PULLEY
- 9 - CAMSHAFT SPROCKET RETAINING BOLT

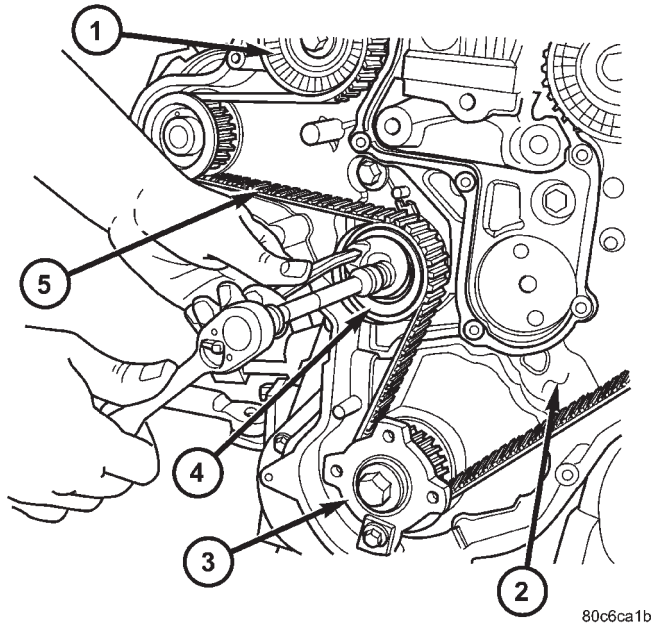
- (6) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
- (7) Install right engine mount.
- (8) Install air cleaner housing.
- (9) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).
- (10) Connect negative battery cable.

ADJUSTMENTS

ADJUSTMENT - TIMING BELT TENSIONER

(1) With timing belt outer cover removed and timing belt installed.

(2) Loosen timing belt tensioner (Fig. 97).



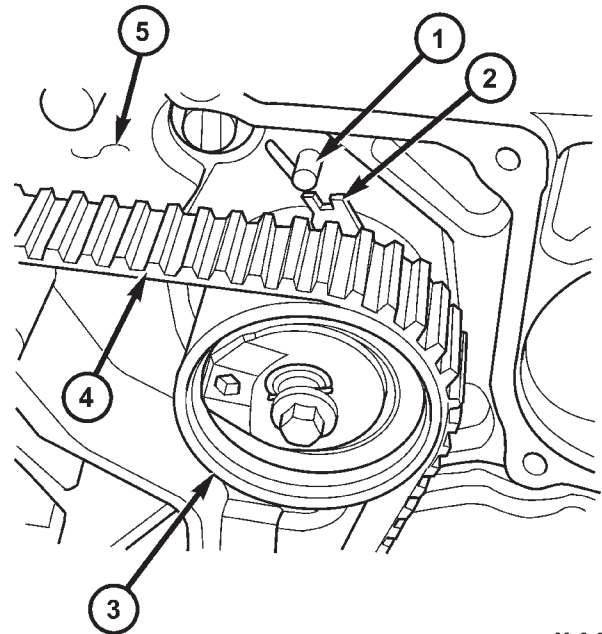
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Fig. 97 TIMING BELT TENSIONER ADJUSTMENT

- 1 - TIMING BELT IDLER PULLEY
- 2 - ENGINE FRONT COVER
- 3 - CRANKSHAFT HUB
- 4 - TIMING BELT TENSIONER
- 5 - TIMING BELT

(3) Align timing belt tensioner spring stop with tensioner as shown (Fig. 98) and torque timing belt tensioner retaining bolt to 34.7N·m.

(4) Rotate engine 2 complete revolution and then recheck tensioner alignment. Readjust tensioner alignment as necessary.



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Fig. 98 TIMING BELT TENSIONER ALIGNMENT

- 1 - TENSIONER SPRING STOP
- 2 - TIMING BELT TENSIONER
- 3 - TIMING BELT TENSIONER
- 4 - TIMING BELT
- 5 - TIMING BELT INNER COVER

TIMING BELT/CHAIN AND SPROCKETS

REMOVAL

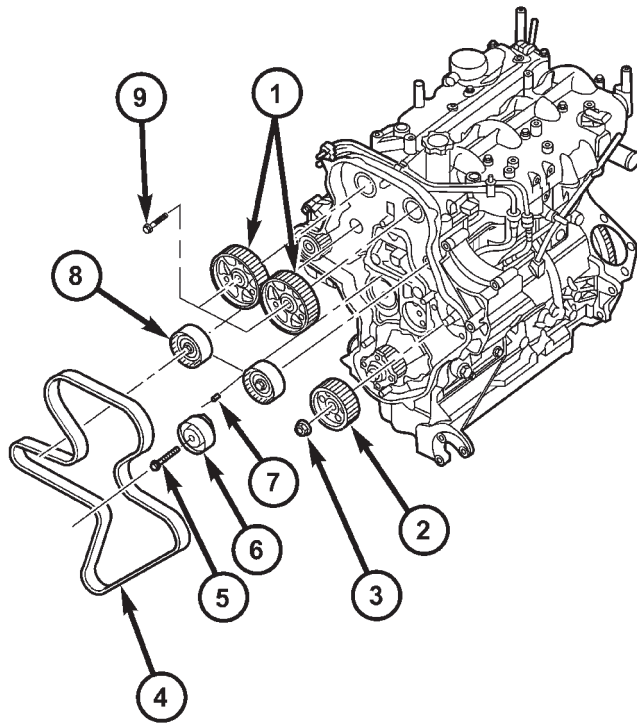
CAUTION: Before removing the timing belt, the engine must put at 90° after TDC. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)

- (1) Disconnect negative battery cable.
- (2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
- (3) Remove air cleaner housing assembly.
- (4) Support engine and remove right engine mount.
- (5) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (6) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (7) Remove vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

TIMING BELT/CHAIN AND SPROCKETS (Continued)

(8) Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(9) Loosen timing belt tensioner and remove timing belt (Fig. 99).



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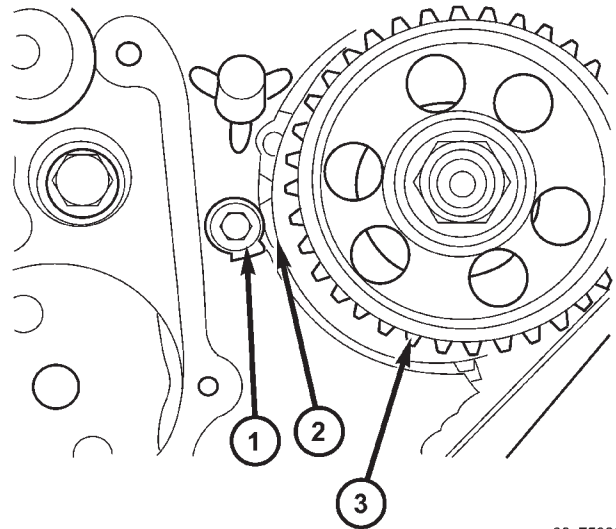
Fig. 99 TIMING BELT AND SPROCKETS

- 1 - CAMSHAFT SPROCKETS
- 2 - INJECTION PUMP SPROCKET
- 3 - INJECTION PUMP SPROCKET RETAINING NUT
- 4 - TIMING BELT
- 5 - TIMING BELT TENSIONER RETAINING BOLT
- 6 - TIMING BELT TENSIONER
- 7 - TENSIONER ALIGNMENT PIN
- 8 - IDLER PULLEY
- 9 - CAMSHAFT SPROCKET RETAINING BOLT

INSTALLATION

(1) With both camshaft alignment pins still installed and the engine locked at 90° after TDC.

(2) Align timing mark on injection pump sprocket with timing mark on timing belt (Fig. 100).



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Fig. 100 INJECTION PUMP GEAR TIMING MARKS

- 1 - TIMING MARK ON COVER
- 2 - TIMING MARK ON INJECTION PUMP SPROCKET
- 3 - INJECTION PUMP SPROCKET

(3) Install timing belt.

(4) Adjust the timing belt tensioner (Refer to 9 - ENGINE/VALVE TIMING/TMNG BELT/CHAIN TENSIONER&PULLEY - ADJUSTMENTS) .

(5) Remove both camshaft alignment pins from cylinder head cover/intake manifold and engine locking pin from engine block (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).

(6) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(7) Install vibration damper (Refer to 9 - ENGINE/ ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(8) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(9) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(10) Install right engine mount.

(11) Install air cleaner housing.

(12) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(13) Connect negative battery cable.