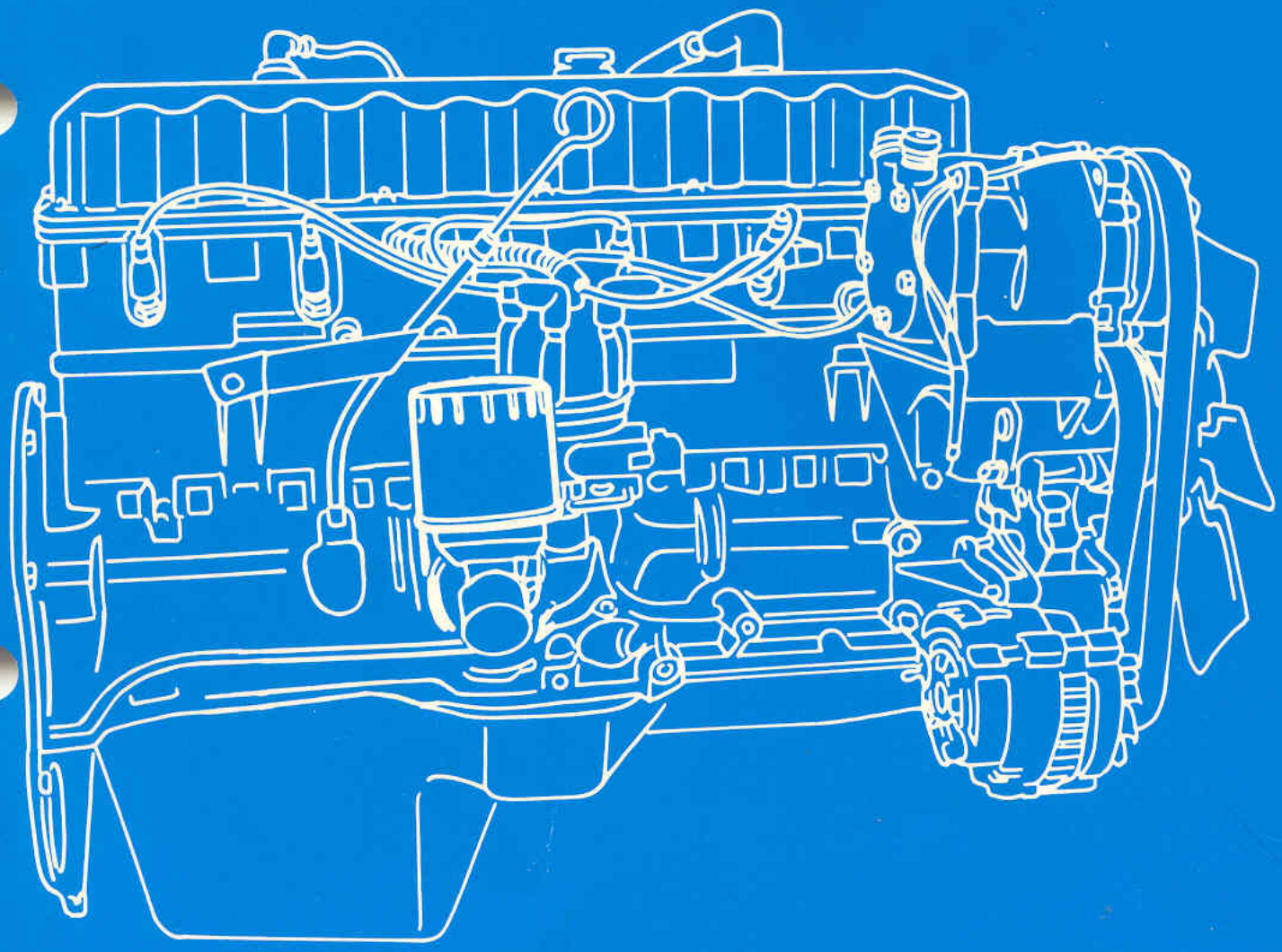
MOT. I-6

8980 010 422 U.S.A./CANADA EDITION

Includes I.S. Note 1E



AMC | Jeep®

Component Service Manual

4.0/4.2L SIX-CYLINDER ENGINE

Application

Cherokee/Wagoneer/Comanche
YJ/Wrangler/CJ-7/Scrambler
Grand Wagoneer/Truck/Eagle

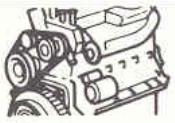
REVISED AUGUST, 1986 U.S.A./Canada Edition

8980 010 422

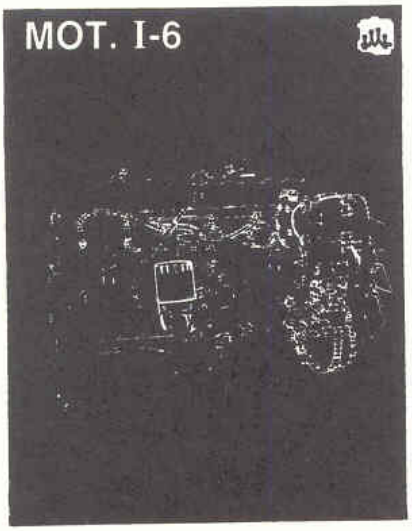
All information and specifications in this manual are based on the latest data available at the time of publication. American Motors Corporation and Jeep Corporation reserve the right to discontinue designs or change specifications without notice or incurring obligation.

4.0L/4.2L ENGINE OVERHAUL

CONTENTS



SEE I.S. NOTES



I.S.
INFORMATIONS SERVICE
SERVICE INFORMATION
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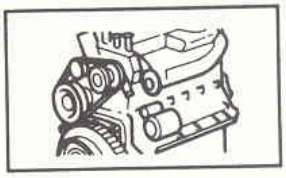
1E

REVISED EDITION

NOVEMBER 1986
ENGLISH EDITION

ALL 1987 CHEROKEE/ WAGONEER/COMANCHE VEHICLES WITH 4.0L ENGINES



ENGINES

Attention: Workshop

THIS I.S. NOTE HAS BEEN REVISED AS INDICATED BY THE REVISION BAR:

SERVICE MANUAL UPDATE – SPECIFICATION ADDITIONS AND/OR CHANGES

The following specification additions and/or changes should be noted in the MOT. I-6 Component Service Manual, P/N 8980 010 422.

CYLINDER HEAD BOLT TORQUE SPECIFICATION ADDITIONS

There are new cylinder head bolt torque specifications for 1987 Cherokee/Wagoneer/ Comanche vehicles.

The cylinder head bolt (capscrew) torque specifications on page 12 should read:

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Re-Check Torque
Cylinder Head Bolt No. 11 (in torque sequence)	135 N•m (100 ft-lbs)	129-142 N•m (95-105 ft-lbs)
All Other Cylinder Head Bolts	149 N•m (110 ft-lbs)	142-156 N•m (105-115 ft-lbs)

CYLINDER HEAD INSTALLATION

Add a notation to page 57, referring this I.S. Note, giving the following instructions regarding the cylinder head bolt tightening sequence:

NOTE: Coat the threads of the stud bolt in the No. 11 position with Loctite 592 sealant, or equivalent, before installation.

1. Tighten all cylinder head bolts to 29 N·m (22 ft-lbs) torque using the torque sequence.

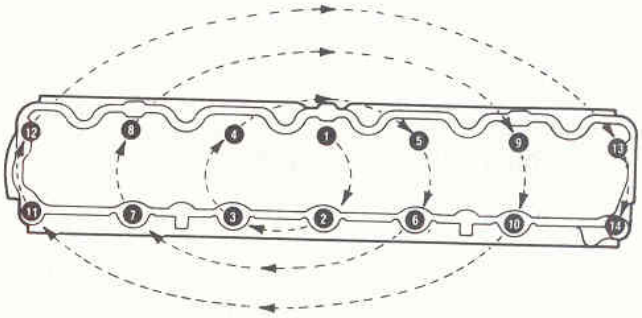
2. Tighten all cylinder head bolts to 61 N·m (45 ft-lbs) torque using the torque sequence.

3. Recheck all cylinder head bolts at 61 N·m (45 ft-lbs) torque using the torque sequence.

4. Tighten all the cylinder head bolts, except No. 11 in the torque sequence, to 149 N·m (110 ft-lbs) torque using the torque sequence.

5. Tighten cylinder head bolt No. 11 in the torque sequence to 135 N·m (100 ft-lbs).

NOTE: Clean and mark each bolt with a dab of paint after tightening. Should you encounter a set of bolts which were painted during an earlier servicing operation, replace them.



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FILING INFORMATION

Record this I.S. Note on the pages noted in the MOT. I-6 and in the following manuals and charts:

Manual	Pages
• M.R. 244	B-3, B-6, B-19
• M.R. 277	B-3, B-6, B-19

- Jeep Wagoneer, Cherokee 1987 Models Maintenance Specifications Chart
- Jeep Comanche 1987 Models Maintenance Specifications Chart

Discard the original edition.

Replace it with this revised edition.

File it in the MOT. I-6 Component Service Manual.

I. S. NOTES

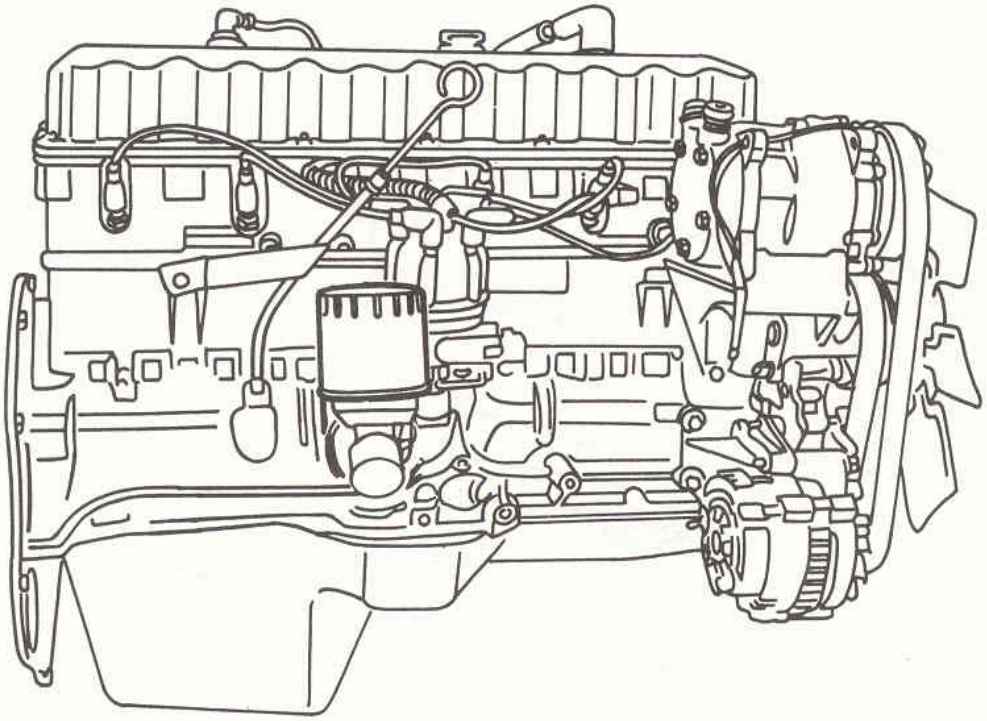
NUMBER	SECTION	SUBJECT
1E	ENGINES	Cylinder Head Bolt Torque Specifications

GENERAL DESCRIPTION

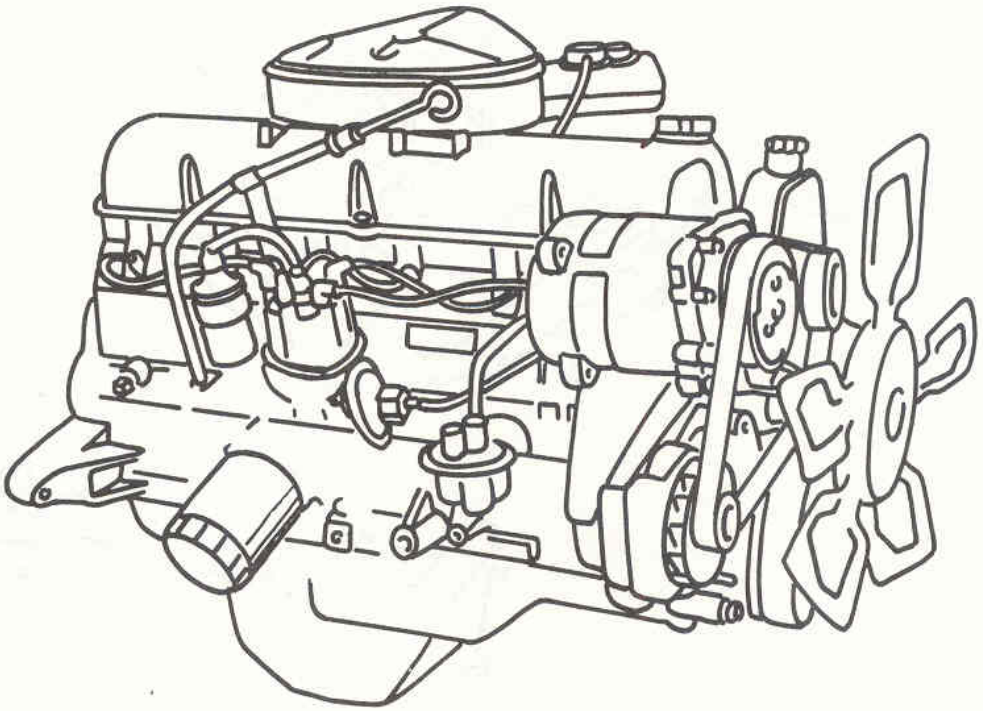
ENGINE IDENTIFICATION INFORMATION

SEE I.S. NOTES

4.0L (243 CID)



4.2L (258 CID)



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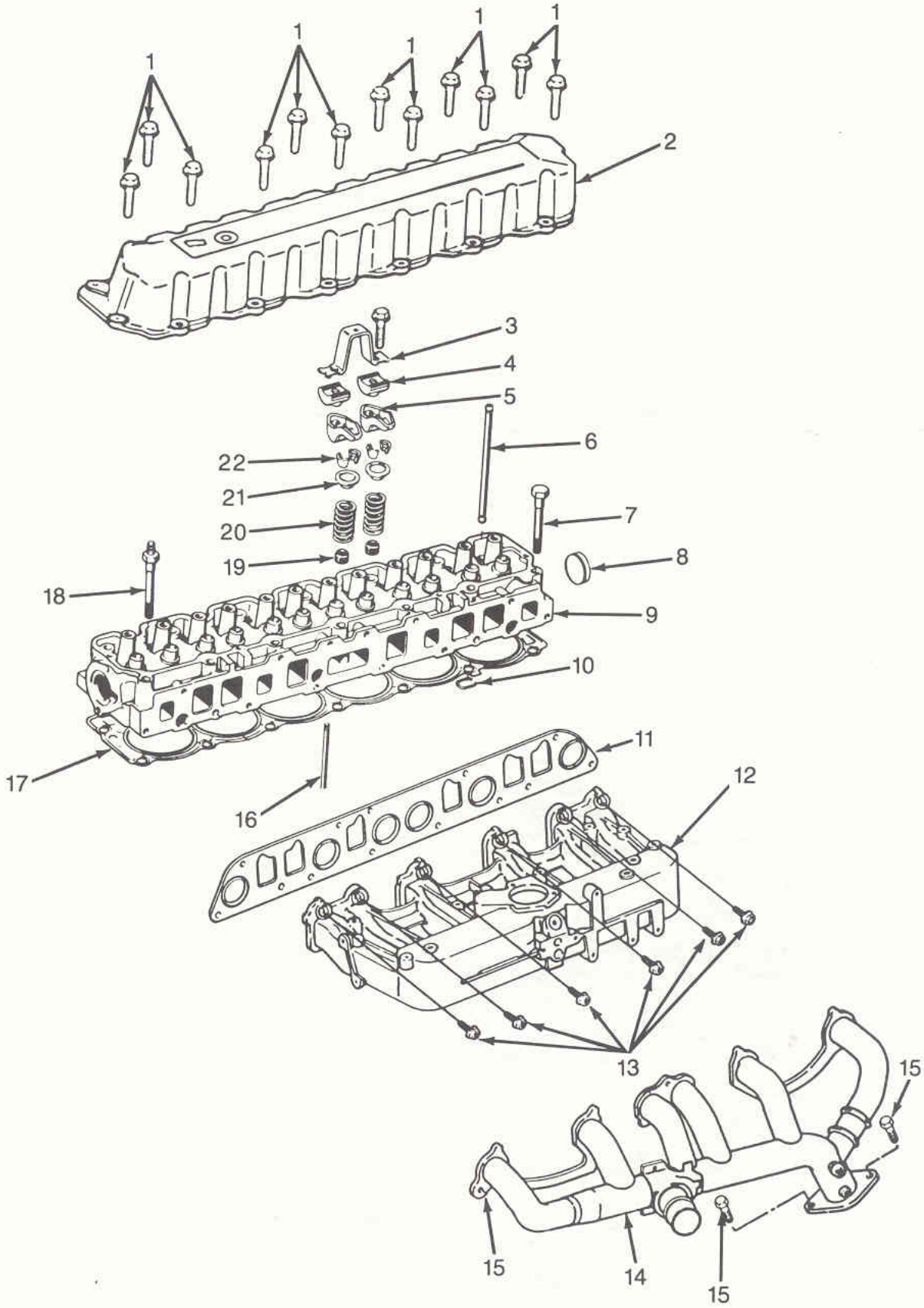
CYLINDER HEAD ASSEMBLY COMPONENTS – 4.0L

SEE I.S. NOTES



861

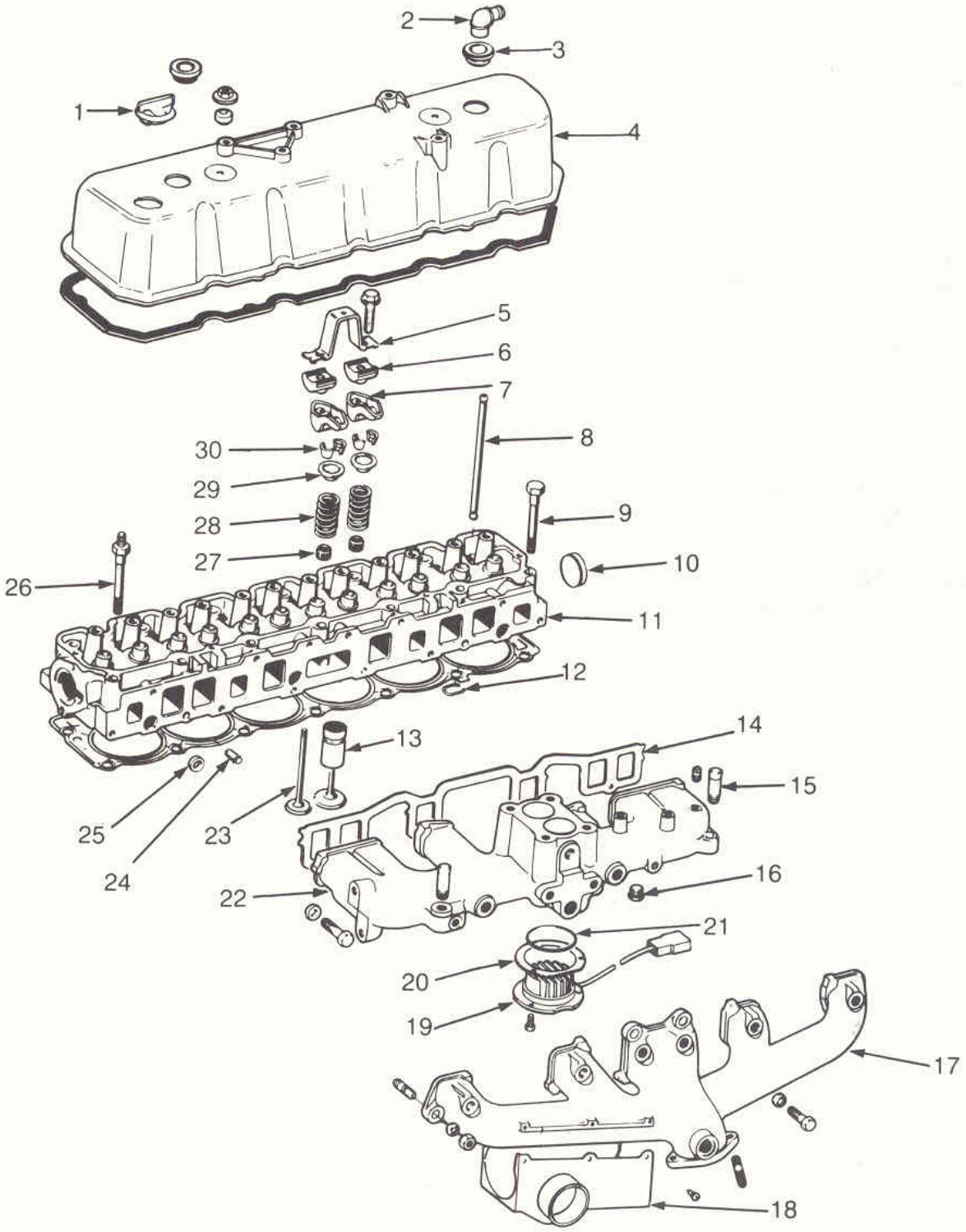
CYLINDER HEAD COMPONENTS - 4.0L

1. Cylinder Head Cover Bolts
2. Cylinder Head Cover
3. Bridge
4. Pivot
5. Rocker Arm
6. Push Rod
7. Cylinder Head Bolt
8. Cylinder Head Core Plug
9. Cylinder Head
10. Snap Ring
11. Intake Manifold Gasket
12. Intake Manifold
13. Intake Manifold Bolts
14. Exhaust Manifold
15. Exhaust Manifold Bolts
16. Hydraulic Valve Tappet
17. Gasket
18. Cylinder Head Stud
19. Oil Deflector
20. Valve Spring
21. Valve Retainer
22. Valve Lock (Keeper)

SEE I.S. NOTES

CYLINDER HEAD ASSEMBLY COMPONENTS – 4.2L

SEE I.S. NOTES



86157B

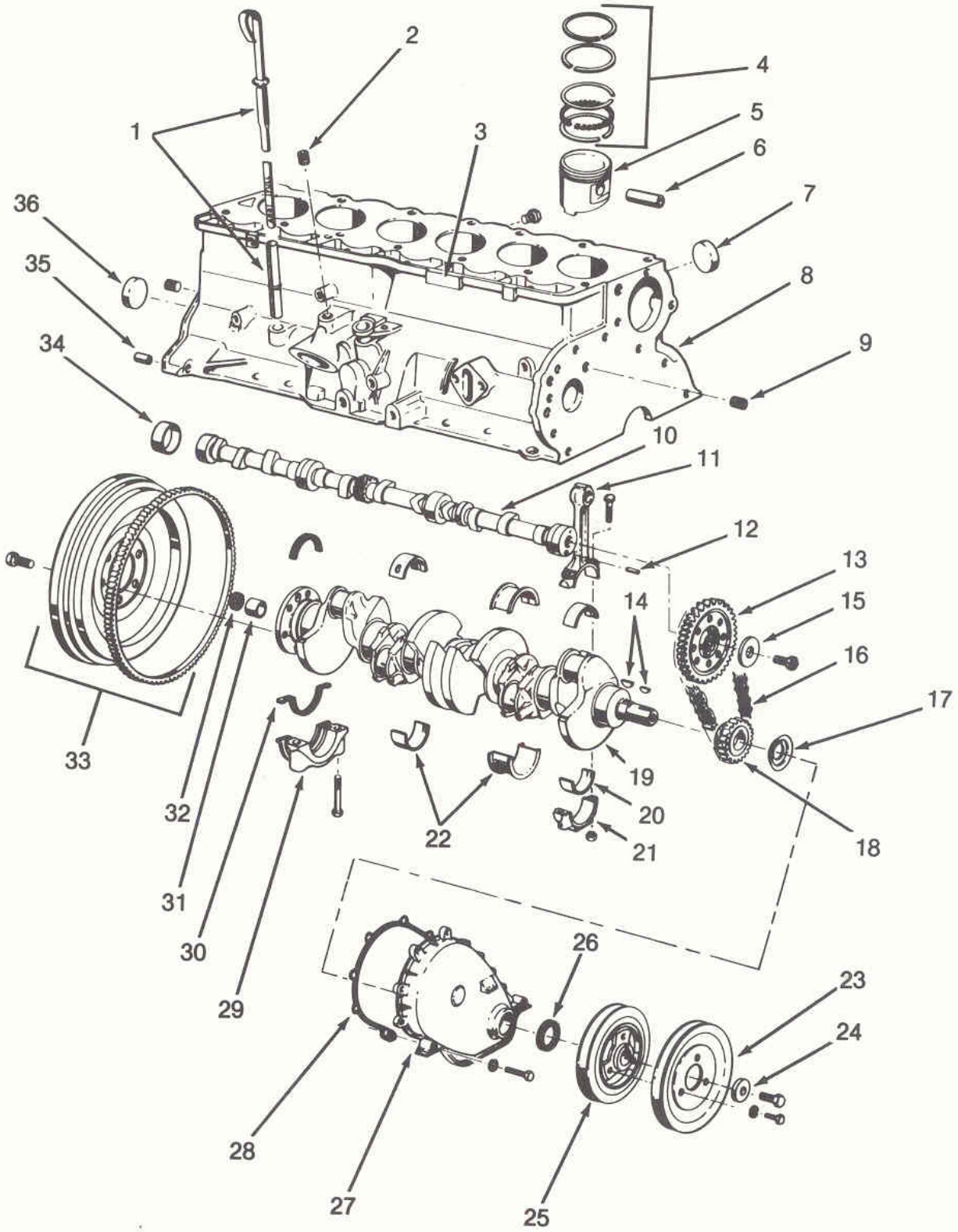
CYLINDER HEAD COMPONENTS – 4.2L

1. Oil Filler Cap
2. Ventilation Valve
3. Grommet
4. Cylinder Head (Rocker) Cover
5. Bridge
6. Pivot
7. Rocker Arm
8. Push Rod
9. Cylinder Head Bolt
10. Cylinder Head Core Plug
11. Cylinder Head
12. Snap Ring
13. Tappet
14. Intake Manifold Gasket
15. Hose Fitting
16. Plug
17. Exhaust Manifold
18. Heat Stove
19. Intake Manifold Heater
20. Gasket
21. O-Ring
22. Intake Manifold
23. Valve
24. Dowel Pin
25. Plug
26. Cylinder Head Stud
27. Oil Deflector
28. Valve Spring
29. Valve Retainer
30. Valve Lock (Keeper)

SEE I.S. NOTES

CYLINDER BLOCK COMPONENTS – 4.0L/4.2L

SEE I.S. NOTES



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CYLINDER BLOCK COMPONENTS – 4.0L / 4.2L

1. Oil Level Gauge (Dipstick) and Tube
2. Oil Filter By-Pass Plug
3. Build Date Code Location
4. Ring Set
5. Piston
6. Pin Set
7. Plug
8. Cylinder Block
9. Oil Channel Plug
10. Camshaft
11. Connecting Rod
12. Pin
13. Camshaft Sprocket
14. Keys
15. Washer
16. Timing Chain
17. Oil Shedder (Slinger)
18. Crankshaft Sprocket
19. Crankshaft
20. Connecting Rod Bearing
21. Connecting Rod Bearing Cap
22. Main Bearings
23. Vibration Damper Pulley
24. Washer
25. Vibration Damper
26. Seal
27. Timing Case Cover
28. Gasket
29. Main Bearing Cap (Rear)
30. Main Bearing Cap Seal Kit (Rear)
31. Pilot Bushing (with Manual Transmission)
32. Bushing Oil Wick (with Manual Transmission)
33. Flywheel and Ring Gear (with Manual Transmission)
34. Bearing Set
35. Dowel
36. Plug

SEE I.S. NOTES

GENERAL INFORMATION

SEE I.S. NOTES

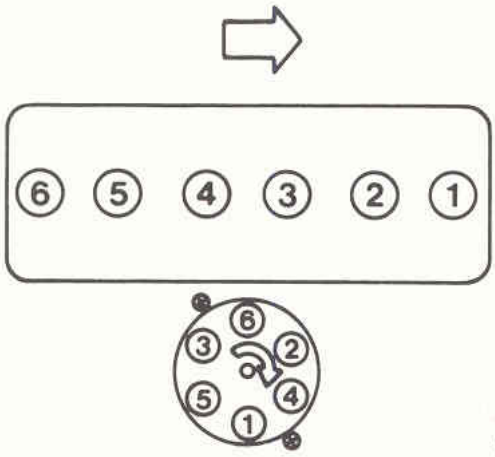
Both the 4.0L (243 CID) and the 4.2L (258 CID) six-cylinder engines are in-line, lightweight, overhead valve engines.

These engines are designed to burn unleaded gasoline.

The cylinders are numbered 1 through 6 from front to rear.

The firing order is

1–5–3–6–2–4



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The crankshaft rotation is clockwise, viewed from the front. The crankshaft rotates within seven main bearings. The camshaft rotates within four line bored bearings.

The engine features a quench-type combustion chamber, which creates turbulence and fast burning of the air/fuel mixture for good fuel economy.

ENGINE IDENTIFICATION

Build Date Code

The engine Build Date Code is located on a machined surface on the right side of the cylinder block between the No. 2 and No. 3 cylinders.

The numbers of the code identify the year, month and day that the engine was built.

Letter Code	C.I.D.	Carburetor	Compression Ratio
C	258/4.2L	2V	9.2:1
M	243/4.0L	MPI	9.2:1

1st Character (Year)	2nd and 3rd Characters (Month)	4th Character (Engine Type)	5th and 6th Characters (Day)
6 = 1986 7 = 1987	01 – 12	C M	01 – 31

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Code Letter Explanation

The code letter identifies the cubic inch displacement, carburetor type and compression ratio.

EXAMPLE: **6 10 C 11**

The example code identifies the 258 CID (4.2 liter) engine with a 2 V carburetor and an 9.2:1 compression ratio built on October 11, 1986.

NOTE: Engines built for sale in Georgia and Tennessee have an additional, nonrepeating number, located on the right side of the engine below the build date code.

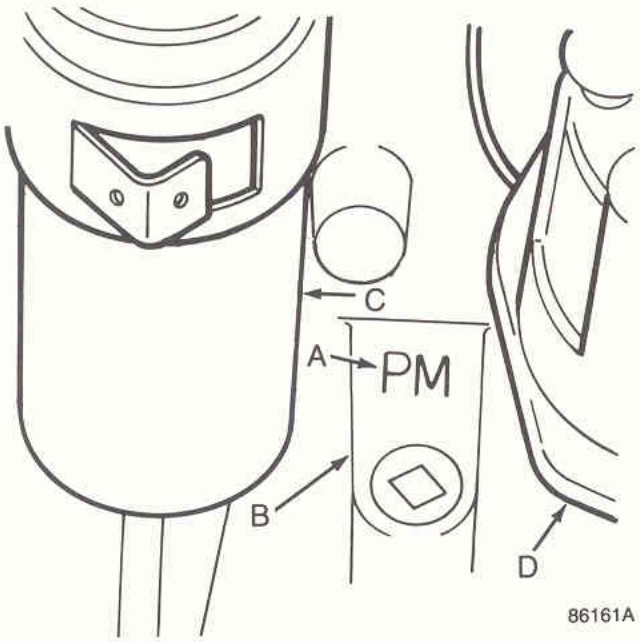
Example:
Kenosha-Built
E-1197277 or *W-1207177*

Oversize or Undersize Components

Some engines may be built with oversize or undersize components such as:

- Oversize cylinder bores
- Undersize crankshaft main bearing journals
- Undersize connecting rod journals
- Oversize camshaft bearing bores

These engines are identified by a letter code (A) stamped on a boss (B) between the ignition coil (C) and distributor (D).



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Oversize or Undersize Code Component Letter Explanation

The letters are decoded as follows:

Code Letter	Definition	
B	All cylinder bores	0.010-inch (0.254 mm) oversize
M	All crankshaft main bearing journals	0.010-inch (0.254 mm) undersize
P	All connecting rod bearing journals	0.010-inch (0.254 mm) undersize
C	All camshaft bearing bores	0.010-inch (0.254 mm) oversize

EXAMPLE: The code letters PM mean that the crankshaft main bearing journals and connecting rod journals are 0.010-inch undersize.

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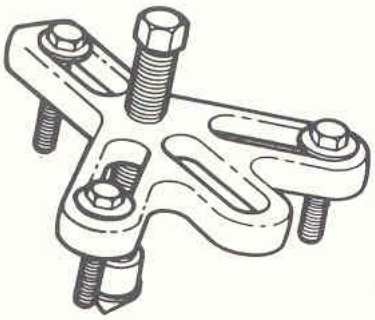
SEE I.S. NOTES

SPECIAL TOOLS

Tool Ref.	Description	SEE I.S. NOTES
J-5268	Hydraulic Valve Tappet Test Oil	
J-5601	Piston Ring Compressor	
J-5790	Hydraulic Valve Tappet Tester	
J-5959-4	C-Clamp and Rod Extension	
J-6042-1,4,5	Valve Guide Reamer Set	
J-8056	Valve Spring Tester	
J-8062	Valve Spring Compressor Tool	
J-8520	Dial Indicator Set	
J-21872-1,2,3	Piston Pin Remover and Installer	
J-21882	Oil Pump Inlet Tube Installer	
J-21884	Hydraulic Valve Tappet Removal and Installation Tool	
J-22248	Timing Case Cover Alignment Tool and Seal Installer Tool	
J-24420-B	Vibration Damper Remover	

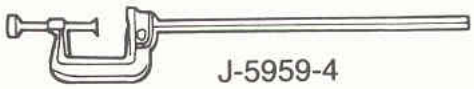


J-24420-B

J-22248

J-21882

J-21884



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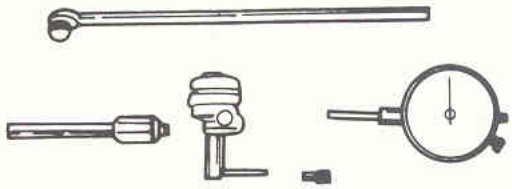
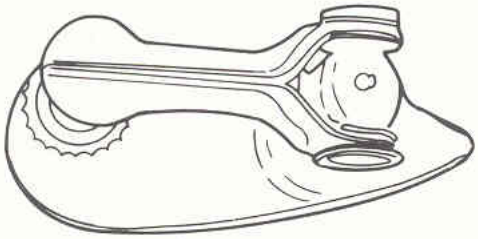


J-8520



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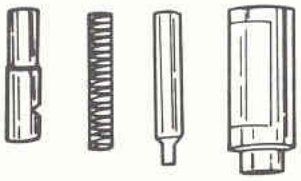

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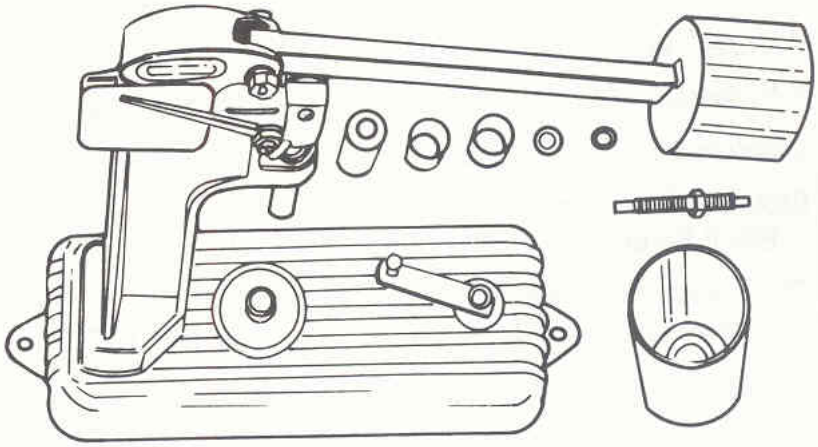

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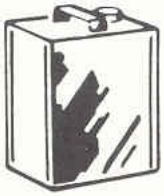

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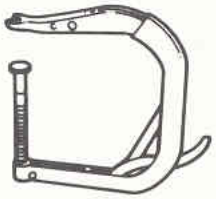

J-8062

J-5601

J-6042-1,4,5

86223A

SEE I.S. NOTES

TORQUE SPECIFICATIONS

SEE I.S. NOTES

Component	Service Set-To Torque	Service Recheck Torque
Air Injection Tube-to-Manifold	27 N·m (20 ft-lbs)	20-27 N·m (15-20 ft-lbs)
Air Pump-to-Bracket	27 N·m (20 ft-lbs)	20-30 N·m (15-22 ft-lbs)
Air Pump Brackets-to-Engine (A.C. Compressor or Pedestals)	34 N·m (25 ft-lbs)	24-38 N·m (18-28 ft-lbs)
Air Pump Adjusting Strap-to-Pump	27 N·m (20 ft-lbs)	20-30 N·m (15-22 ft-lbs)
Alternator Pivot Bolt or Nut	38 N·m (28 ft-lbs)	27-47 N·m (20-35 ft-lbs)
Alternator Adjusting Bolt	24 N·m (18 ft-lbs)	20-27 N·m (15-20 ft-lbs)
Alternator Mounting Bracket-to-Engine	38 N·m (28 ft-lbs)	31-41 N·m (23-30 ft-lbs)
Alternator Pivot Mounting Bolt-to-Head	45 N·m (33 ft-lbs)	41-47 N·m (30-35 ft-lbs)
Block Heater Nut	2 N·m (20 in-lbs)	2-3 N·m (17-25 in-lbs)
Camshaft Sprocket Screw	68 N·m (50 ft-lbs)	61-75 N·m (45-55 ft-lbs)
Carburetor Hold-Down Nuts	19 N·m (14 ft-lbs)	16-27 N·m (12-20 ft-lbs)
Coil Bracket-to-Cylinder Head Bolt	19 N·m (14 ft-lbs)	14-24 N·m (10-18 ft-lbs)
Connecting Rod Bolt Nuts	45 N·m (33 ft-lbs)	41-47 N·m (30-35 ft-lbs)
Cylinder Head Capscrews	115 N·m (85 ft-lbs)	108-122 N·m (80-90 ft-lbs)
Cylinder Head Cover Nuts	3.2 N·m (28 in-lbs)	2.8-3.5 N·m (25-31 in-lbs)
Crankshaft Pulley-to-Damper	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Clutch Housing Spacer-to-Block Screws	16 N·m (12 ft-lbs)	12-20 N·m (9-15 ft-lbs)
Clutch Housing-to-Block Screws (top)	37 N·m (27 ft-lbs)	30-41 N·m (22-30 ft-lbs)
Clutch Housing-to-Block Screws (bottom)	58 N·m (43 ft-lbs)	50-64 N·m (37-47 ft-lbs)
Differential Housing-to-Left Engine Mounting Bolt	54 N·m (40 ft-lbs)	47-68 N·m (35-50 ft-lbs)
Distributor Clamp Bracket Screw	18 N·m (13 ft-lbs)	14-24 N·m (10-18 ft-lbs)
Drive Plate-to-Converter Bolt	30 N·m (22 ft-lbs)	27-34 N·m (20-25 ft-lbs)

TORQUE SPECIFICATIONS (Cont'd)

Component	Service Set-To Torque	Service Recheck Torque
EGR Valve Tube Nuts	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
EGR Valve	18 N·m (13 ft-lbs)	12-24 N·m (9-18 ft-lbs)
Exhaust Manifold Bolts	31 N·m (23 ft-lbs)	24-38 N·m (18-28 ft-lbs)
Exhaust Pipe-to-Manifold	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Fan and Hub Assembly Bolts	24 N·m (18 ft-lbs)	16-34 N·m (12-25 ft-lbs)
Flywheel or Drive Plate-to-Crankshaft	142 N·m (105 ft-lbs)	129-156 N·m (95-115 ft-lbs)
Front Crossmember-to-Sill	88 N·m (65 ft-lbs)	75 min (55 min)
Front Support Bracket-to-Block	47 N·m (35 ft-lbs)	34-54 N·m (25-40 ft-lbs)
Front Support Bracket-to-Block (Eagle)	47 N·m (35 ft-lbs)	34-54 N·m (40-50 ft-lbs)
Front Support Cushion-to-Bracket	45 N·m (33 ft-lbs)	36-52 N·m (27-38 ft-lbs)
Front Support Cushion-to-Crossmember	50 N·m (37 ft-lbs)	41-61 N·m (30-45 ft-lbs)
Fuel Pump Screws	22 N·m (16 ft-lbs)	18-26 N·m (13-19 ft-lbs)
Idler Arm Bracket-to-Sill	68 N·m (50 ft-lbs)	47-81 N·m (35-60 ft-lbs)
Idler Pulley Bracket-to-Front Cover Nut	9 N·m (7 ft-lbs)	5-12 N·m (4-9 ft-lbs)
Idler Pulley Bearing Shaft-to-Bracket Nut	45 N·m (33 ft-lbs)	38-52 N·m (28-38 ft-lbs)
Intake Manifold Coolant Fittings	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Intake Manifold Heater Screws	9 N·m (7 ft-lbs)	7-12 N·m (5-9 ft-lbs)
Intake Manifold Screws	31 N·m (23 ft-lbs)	24-38 N·m (18-28 ft-lbs)
Main Bearing Capscrews	108 N·m (80 ft-lbs)	101-115 N·m (75-85 ft-lbs)
Oil Filter Adapter	65 N·m (48 ft-lbs)	57-75 N·m (42-55 ft-lbs)
Oil Pan Drain Plug	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Oil Pan Screws – 1/4 inch – 20	9 N·m (7 ft-lbs)	7-12 N·m (5-9 ft-lbs)
Oil Pan Screws – 5/16 inch – 18	15 N·m (11 ft-lbs)	12-18 N·m (9-13 ft-lbs)
Oil Pump Cover Screws	8 N·m (70 in-lbs)	7-9 N·m (60-80 in-lbs)

SEE I.S. NOTES

TORQUE SPECIFICATIONS (Cont'd)

SEE I.S. NOTES

Component	Service Set-To Torque	Service Recheck Torque
Oil Pump Attaching Screws (Short)	14 N·m (10 ft-lbs)	11-18 N·m (8-13 ft-lbs)
Oil Pump Attaching Screws (Long)	23 N·m (17 ft-lbs)	16-27 N·m (12-20 ft-lbs)
Oxygen Sensor	48 N·m (35 ft-lbs)	43-52 N·m (32-38 ft-lbs)
Power Steering Pump Adapter Screw	31 N·m (23 ft-lbs)	24-38 N·m (18-28 ft-lbs)
Power Steering Pump Bracket Screw	58 N·m (43 ft-lbs)	50-64 N·m (37-47 ft-lbs)
Power Steering Pump Mounting Screw	38 N·m (28 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Power Steering Pump Pressure Hose Nut	52 N·m (38 ft-lbs)	41-61 N·m (30-45 ft-lbs)
Power Steering Pump Pulley Nut	79 N·m (58 ft-lbs)	54-88 N·m (40-65 ft-lbs)
Rear Crossmember-to-Side Sill Nut	41 N·m (30 ft-lbs)	27-47 N·m (20-35 ft-lbs)
Rear Support Bracket-to-Transmission	45 N·m (33 ft-lbs)	37-52 N·m (27-38 ft-lbs)
Rear Support Cushion-to-Bracket	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Rear Support Cushion-to-Crossmember	24 N·m (18 ft-lbs)	16-34 N·m (12-25 ft-lbs)
Rocker Arm Assembly-to-Cylinder Head	26 N·m (19 ft-lbs)	22-35 N·m (16-26 ft-lbs)
Spark Plug	15 N·m (11 ft-lbs)	10-20 N·m (7-15 ft-lbs)
Starter Motor-to-Converter Housing Bolt	24 N·m (18 ft-lbs)	18-34 N·m (13-25 ft-lbs)

TORQUE SPECIFICATIONS (Cont'd)

Component	Service Set-To Torque	Service Recheck Torque
Timing Case Cover-to-Block Screws	7 N·m (5 ft-lbs)	5-11 N·m (4-8 ft-lbs)
Timing Case Cover-to-Block Studs	22 N·m (16 ft-lbs)	18-26 N·m (13-19 ft-lbs)
Thermostat Housing Bolt	18 N·m (13 ft-lbs)	14-24 N·m (10-18 ft-lbs)
Vibration Damper Bolt (Lubricated)	108 N·m (80 ft-lbs)	95-122 N·m (70-90 ft-lbs)
Water Pump Bolt	18 N·m (13 ft-lbs)	12-24 N·m (9-18 ft-lbs)

SEE I.S. NOTES

SEE I.S. NOTES

ENGINE SPECIFICATIONS – 4.0L

GENERAL	USA Inches*	METRIC Millimeters*
Type	In Line, OHV, Six-cylinder	
Bore	3.88	98.4
Stroke	3.44	87.4
Displacement	243 cubic inches	4.0 liter
Compression Ratio	9.2:1	
Compression Pressure	120-150 psi	827-1034 kPa
Maximum Variation Between Cylinders	30 psi	206 kPa
Firing Order	1-5-3-6-2-4	
Taxable Horsepower	36.13 Bhp	26.85 kW
Fuel	unleaded	

CAMSHAFT

Tappet Clearance	Zero Lash (Hydraulic tappets)	
End Play	Zero (engine operating)	
Bearing Clearance	0.001-0.003	0.025-0.076
Bearing Journal Diameter		
No. 1	2.029-2.030	51.54-51.56
No. 2	2.019-2.020	51.28-51.31
No. 3	2.009-2.010	51.03-51.05
No. 4	1.999-2.000	50.78-50.80
Base Circle Runout	0.001 (max)	0.03 (max)
Cam Lobe Lift	0.253	6.43
Valve Lift	0.424	10.76
Intake Valve Timing		
Opens	15° BTDC	
Closes	75° ABDC	
Exhaust Valve Timing		
Opens	59° BBDC	
Closes	31° ATDC	
Valve Overlap	46°	
Intake Duration	270°	
Exhaust Duration	270°	

*Unless Otherwise Specified

CONNECTING RODS	USA Inches*	METRIC Millimeters*
Total Weight (less bearings)	657-665 grams	
Total Length (center-to-center)	6.123-6.127	155.52-155.62
Piston Pin Bore Diameter	0.9288-0.9298	23.59-23.62
Connecting Rod Bore (less bearings)	2.2085-2.2080	56.09-56.08
Bearing Clearance	0.001-0.003 (0.0015-0.002 preferred)	0.03-0.08 (0.044-.05 preferred)
Side Clearance	0.010-0.019	0.25-0.48
Maximum Twist	0.001 per inch	0.025 per 25.4 mm
Maximum Bend	0.0005 per inch	0.0127 per 25.4 mm

CRANKSHAFT

End Play	0.0015-0.0065	0.038-0.165
Main Bearing Journal Diameter	2.4996-2.5001	63.489-63.502
Main Bearing Journal Width		
No. 1	1.086-1.098	27.58-27.89
No. 3	1.271-1.273	32.28-32.33
No. 2-4-5-6-7	1.182-1.188	30.02-30.18
Main Bearing Clearance	0.001-0.0025 (0.002 preferred)	0.03-0.06 (0.051 preferred)
Connecting Rod Journal Diameter	2.0934-2.0955	53.17-53.23
Connecting Rod Journal Width	1.070-1.076	27.18-27.33
Maximum Out-of-Round (All Journals)	0.0005	0.013
Maximum Taper (All Journals)	0.0005	0.013

CYLINDER BLOCK

Deck Height	9.429-9.435	239.49-239.64
Deck Clearance	0.0215 (below block)	0.546 (below block)
Cylinder Bore Diameter (standard)	3.8751-3.8775	98.42-98.48
Maximum Taper	0.001	0.025
Maximum Out-of-Round	0.001	0.025
Tappet Bore Diameter	0.9055-0.9065	23.000-23.025
Cylinder Block Flatness	0.001/1-0.002/6 (0.008 max)	0.03/25-0.05/152 (0.20 max)

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ENGINE SPECIFICATIONS – 4.0L (Continued)

CYLINDER HEAD	USA Inches*	METRIC Millimeters*
Combustion Chamber Volume	64.45-67.45cc	
Valve Arrangement	EI-IE-IE-EI-EI-IE	
Valve Guide ID (Integral)	3.12	7.9
Valve Stem-to-Guide Clearance	0.001-0.003	0.03-0.08
Intake Valve Seat Angle	44.5°	
Exhaust Valve Seat Angle	44.5°	
Valve Seat Width	0.040-0.060	1.02-1.52
Valve Seat Runout	0.0025	0.064
Cylinder Head Flatness	0.001/1-0.002/6 (0.008 max)	0.03/25-0.05/152 (0.20 max)

LUBRICATION SYSTEM		
Engine Oil Capacity	5 quarts (Add ½ quart with filter change)	4.7 liters (Add .45 liter with filter change)
Normal Operating Pressure	13 psi at 600 rpm; 37-75 psi (max) at 1600+ rpm	89.6 kPa at 600 rpm; 255.1-517.1 kPa (max) at 1600+ rpm
Oil Pressure Relief	75 psi (max)	517.1 kPa (max)
Gear-to-Body Clearance (Radial)	0.002-0.004 (.002 preferred)	0.051-0.102 (.051 preferred)
Gear End Clearance, Plastigage	0.002-0.006 (0.002 preferred)	0.051-0.152 (0.051 preferred)
Gear End Clearance, Feeler Gauge	0.004-0.008 (0.007 preferred)	0.1016-0.2032 (0.1778 preferred)

PISTONS		
Weight (less pin)	510-514 grams	
Piston Pin Bore Centerline-to-Piston Top	1.651-1.655	41.94-42.04
Piston-to-Bore Clearance	0.0009-0.0017 (0.0012-0.0013 preferred)	0.023-0.043 (0.030-0.033 preferred)
Piston Ring Gap Clearance – Compression (both)	0.010-0.020	0.25-0.51
Piston Ring Gap Clearance – Oil Control Steel Rails	0.010-0.025	0.25-0.64
Piston Ring Side Clearance No. 1 Compression	0.0017-0.0032 (0.0017 preferred)	0.043-0.081 (0.043 preferred)
No. 2 Compression	0.0017-0.0032 (0.0017 preferred)	0.043-0.081 (0.043 preferred)
Oil Control	0.001-0.008 (0.003 preferred)	0.03-0.20 (0.08 preferred)
Piston Ring Groove Height Compression (both)	0.0795-0.0805	2.019-2.045
Oil Control	0.188-0.1895	4.78-4.80
Piston Ring Groove Diameter No. 1 and No. 2	3.476-3.486	88.30-88.55
Oil Control	3.557-3.566	90.35-90.60
Piston Pin Bore Diameter	0.9308-0.9313	23.642-23.655
Piston Pin Diameter	0.9304-0.9309	23.632-23.645
Piston-to-Pin Clearance	0.0003-0.0005 loose (0.0005 preferred)	0.008-0.013 loose (0.013 preferred)
Piston-to-Pin Connecting Rod	2000 lbf press-fit	8.9kN press-fit

ROCKER ARMS, PUSH RODS AND TAPPETS	USA Inches*	METRIC Millimeters*
Rocker Arm Ratio	1.6:1	
Rush Rod Length	9.640-9.660	244.856-245.364
Push Rod Diameter	0.312-0.315	7.92-8.00
Hydraulic Tappet Diameter	0.904-0.9045	22.962-22.974
Tappet-to-Bore Clearance	0.001-0.0025	0.03-0.05

VALVES		
Valve Length (Tip-to-Gauge Dim. Line)		
(Intake)	4.822-4.837	122.4-122.8
(Exhaust)	4.837-4.852	122.8-123.2
Valve Stem Diameter	3.12	7.9
Stem-to-Guide Clearance	0.001-0.003	0.03-0.08
Intake Valve Head Diameter	1.91	48.5
Intake Valve Face Angle	45°	
Exhaust Valve Head Diameter	1.50	38
Exhaust Valve Face Angle	45°	
Maximum Allowable Removed for Tip Refinishing	0.010	0.25

VALVE SPRINGS		
Free Length	1.82 approx.	46.22 approx.
Spring Tension Valve Closed	66-74 lbf at 1.625	293-329 N at 41.2
Valve Open	205-220 lbf at 1.200	911-978 N at 30.4
Inside Diameter	0.948-0.968	24.08-24.59

*Unless Otherwise Specified

SEE I.S. NOTES

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ENGINE SPECIFICATIONS – 4.2L

SEE I.S. NOTES

GENERAL	USA Inches*	METRIC Millimeters*
Type	In Line, OHV, Six-cylinder	
Bore	3.75	95.25
Stroke	3.895	98.93
Displacement	258 cubic inches	4.2 liter
Compression Ratio	9.2:1	
Compression Pressure	120-150 psi	827-1034 kPa
Maximum Variation Between Cylinders	30 psi	206 kPa
Firing Order	1-5-3-6-2-4	
Taxable Horsepower	33.75 Bhp	25.2 kW
Fuel	unleaded	

CAMSHAFT		
Fuel Pump Eccentric Diameter	1.615-1.625	41.02-41.28
Tappet Clearance	Zero Lash (Hydraulic tappets)	
End Play	Zero (engine operating)	
Bearing Clearance	0.001-0.003	0.025-0.076
Bearing Journal Diameter		
No. 1	2.029-2.030	51.54-51.56
No. 2	2.019-2.020	51.28-51.31
No. 3	2.009-2.010	51.03-51.05
No. 4	1.999-2.000	50.78-50.80
Base Circle Runout	0.001 (max)	0.03 (max)
Cam Lobe Lift	0.253	6.43
Valve Lift	0.405	10.29
Intake Valve Timing		
Opens	9° BTDC	
Closes	73° ABDC	
Exhaust Valve Timing		
Opens	57° BBDC	
Closes	25° ATDC	
Valve Overlap	34°	
Intake Duration	262°	
Exhaust Duration	262°	

*Unless Otherwise Specified

CONNECTING RODS	USA Inches*	METRIC Millimeters*
Total Weight (less bearings)	695-703 grams	
Total Length (center-to-center)	5.873-5.877	149.17-149.28
Piston Pin Bore Diameter	0.9288-0.9298	23.59-23.62
Connecting Rod Bore (less bearings)	2.2085-2.2080	56.09-56.08
Bearing Clearance	0.001-0.003 (0.0015-0.002 preferred)	0.03-0.08 (0.044-.05 preferred)
Side Clearance	0.010-0.019	0.25-0.48
Maximum Twist	0.001 per inch	0.025 per 25.4 mm
Maximum Bend	0.0005 per inch	0.0127 per 25.4 mm

CRANKSHAFT		
End Play	0.0015-0.0065	0.038-0.165
Main Bearing Journal Diameter	2.4996-2.5001	63.489-63.502
Main Bearing Journal Width		
No. 1	1.086-1.098	27.58-27.89
No. 3	1.271-1.273	32.28-32.33
No. 2-4-5-6-7	1.182-1.188	30.02-30.18
Main Bearing Clearance	0.001-0.0025 (0.002 preferred)	0.03-0.06 (0.051 preferred)
Connecting Rod Journal Diameter	2.0934-2.0955	53.17-53.23
Connecting Rod Journal Width	1.070-1.076	27.18-27.33
Maximum Out-of-Round (All Journals)	0.0005	0.013
Maximum Taper (All Journals)	0.0005	0.013

CYLINDER BLOCK		
Deck Height	9.487-9.493	240.97-241.12
Deck Clearance	0.0148 (below block)	0.376 (below block)
Cylinder Bore Diameter (standard)	3.7501-3.7533	95.253-95.334
Maximum Taper	0.001	0.025
Maximum Out-of-Round	0.001	0.025
Tappet Bore Diameter	0.9055-0.9065	23.000-23.025
Cylinder Block Flatness	0.001/1-0.002/6 (0.008 max)	0.03/25-0.05/152 (0.20 max)

86218B

ENGINE SPECIFICATIONS – 4.2L (Continued)

CYLINDER HEAD

	USA Inches*	METRIC Millimeters*
Combustion Chamber Volume	64.45-67.45cc	
Valve Arrangement	EI-IE-IE-EI-EI-IE	
Valve Guide ID (Integral)	0.3735-0.3745	9.487-9.512
Valve Stem-to-Guide Clearance	0.001-0.003	0.03-0.08
Intake Valve Seat Angle	30°	
Exhaust Valve Seat Angle	44.5°	
Valve Seat Width	0.040-0.060	1.02-1.52
Valve Seat Runout	0.0025	0.064
Cylinder Head Flatness	0.001/1-0.002/6 (0.008 max)	0.03/25-0.05/152 (0.20 max)

LUBRICATION SYSTEM

Engine Oil Capacity	4 quarts (Add 1 quart with filter change)	3.8 liters (Add 0.9 liter with filter change)
Normal Operating Pressure	13 psi at 600 rpm; 37-75 psi (max) at 1600+ rpm	89.6 kPa at 600 rpm; 255.1-517.1 kPa (max) at 1600+ rpm
Oil Pressure Relief	75 psi (max)	517.1 kPa (max)
Gear-to-Body Clearance (Radial)	0.002-0.004 (.002 preferred)	0.051-0.102 (.051 preferred)
Gear End Clearance, Plastigage	0.002-0.006 (0.002 preferred)	0.051-0.152 (0.051 preferred)
Gear End Clearance, Feeler Gauge	0.004-0.008 (0.007 preferred)	0.1016-0.2032 (0.1778 preferred)

PISTONS

Weight (less pin)	510-514 grams	
Piston Pin Bore	1.651-1.655	41.94-42.04
Centerline-to-Piston Top	0.0009-0.0017	0.023-0.043
Piston-to-Bore Clearance	(0.0012-0.0013 preferred)	(0.030-0.033 preferred)
Piston Ring Gap Clearance – Compression (both)	0.010-0.020	0.25-0.51
Piston Ring Gap Clearance – Oil Control Steel Rails	0.010-0.025	0.25-0.64
Piston Ring Side Clearance		
No. 1 Compression	0.0017-0.0032 (0.0017 preferred)	0.043-0.081 (0.043 preferred)
No. 2 Compression	0.0017-0.0032 (0.0017 preferred)	0.043-0.081 (0.043 preferred)
Oil Control	0.001-0.008 (0.003 preferred)	0.03-0.20 (0.08 preferred)
Piston Ring Groove Height		
Compression (both)	0.0795-0.0805	2.019-2.045
Oil Control	0.188-0.1895	4.78-4.80
Piston Ring Groove Diameter		
No. 1 and No. 2	3.324-3.329	84.43-84.56
Oil Control	3.329-3.339	84.56-84.81
Piston Pin Bore Diameter	0.9308-0.9313	23.642-23.655
Piston Pin Diameter	0.9304-0.9309	23.632-23.645
Piston-to-Pin Clearance	0.0003-0.0005 loose (0.0005 preferred)	0.008-0.013 loose (0.013 preferred)
Piston-to-Pin Connecting Rod	2000 lbf press-fit	8.9kN press-fit

ROCKER ARMS, PUSH RODS AND TAPPETS

	USA Inches*	METRIC Millimeters*
Rocker Arm Ratio	1.6:1	
Rush Rod Length	9.710-9.730	246.63-247.14
Push Rod Diameter	0.312-0.315	7.92-8.00
Hydraulic Tappet Diameter	0.904-0.9045	22.962-22.974
Tappet-to-Bore Clearance	0.001-0.0025	0.03-0.05

VALVES

Valve Length (Tip-to-Gauge Dim. Line)	4.7895-4.8045	121.653-122.034
Valve Stem Diameter	0.3715-0.3725	9.436-9.462
Stem-to-Guide Clearance	0.001-0.003	0.03-0.08
Intake Valve Head Diameter	1.782-1.792	45.26-45.52
Intake Valve Face Angle	29°	
Exhaust Valve Head Diameter	1.401-1.411	35.59-35.84
Exhaust Valve Face Angle	44°	
Maximum Allowable Removed for Tip Refinishing	0.010	0.25

VALVE SPRINGS

Free Length	1.99 approx.	50.55 approx.
Spring Tension		
Valve Closed	64-72 lbf at 1.786	285-320 N at 45.4
Valve Open	188-202 lbf at 1.411	836-898 N at 35.84
Inside Diameter	0.948-0.968	24.08-24.59

*Unless Otherwise Specified

SEE I.S. NOTES

86219B

SEE I.S. NOTES

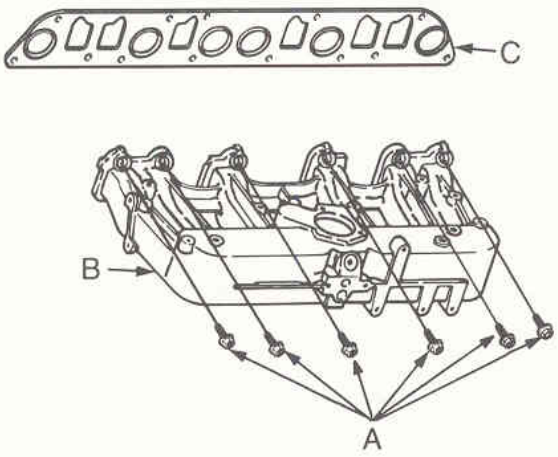
INTAKE MANIFOLD REMOVAL

Remove the intake manifold retaining bolts (A).

Remove the intake manifold (B).

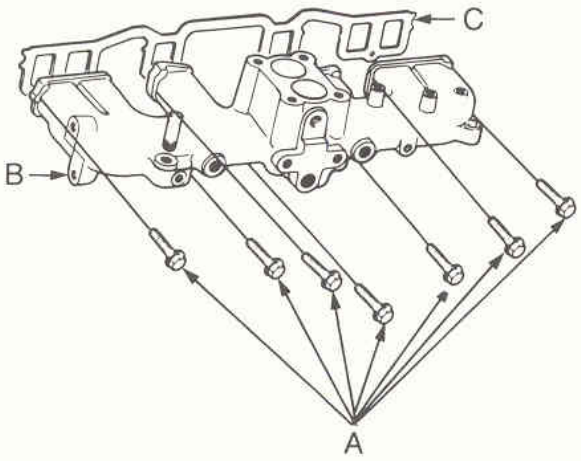
Discard the intake manifold gasket (C).

4.0L



101935A

4.2L



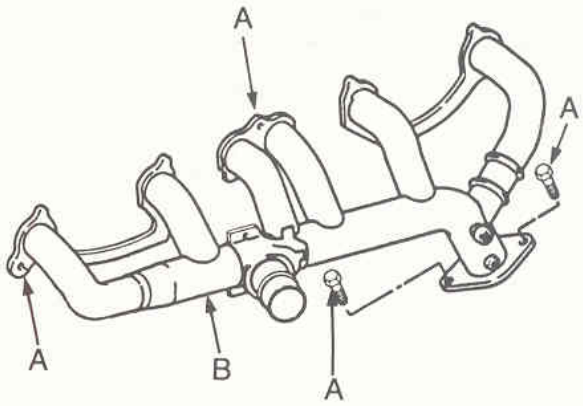
101935B

EXHAUST MANIFOLD REMOVAL

Remove the exhaust manifold retaining bolts (A).

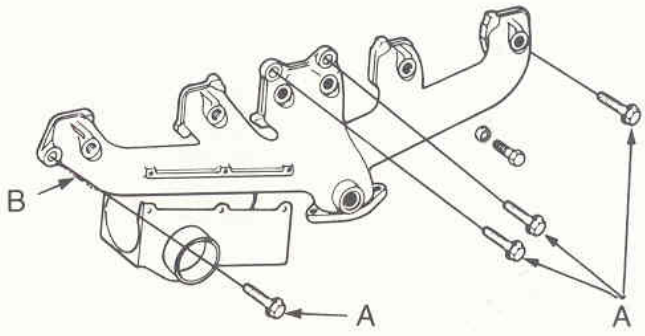
Remove the exhaust manifold (B).

4.0L



101935D

4.2L



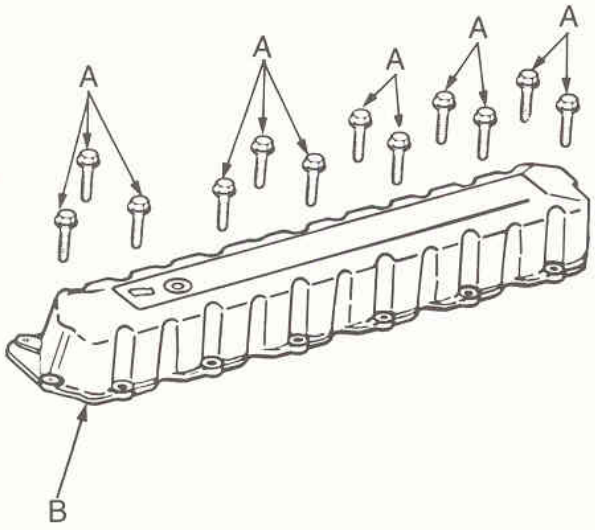
101935C

CYLINDER HEAD COVER REMOVAL

Remove the cylinder head cover retaining nuts/bolts (A).

Detach the cover from the cylinder head (B) by breaking the RTV sealant with a putty knife or razor blade.

4.0L



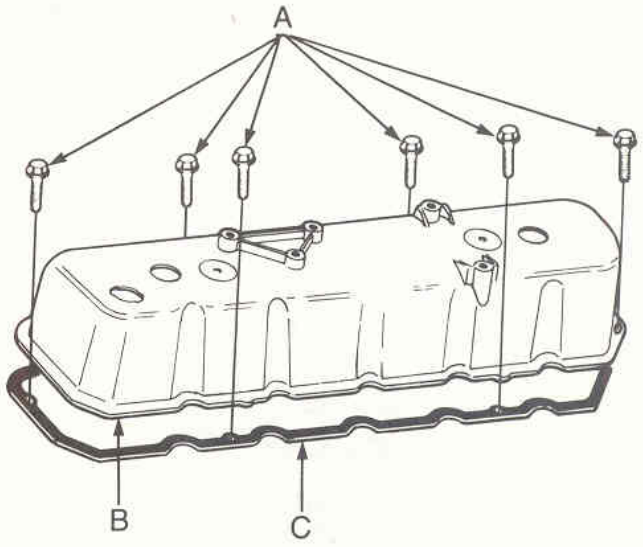
102303A

NOTE: Do not pry the cover upward until the seal has been completely broken.

NOTE: Some 1986 4.2L engines and all 4.0L engines use a new cylinder head cover with a pre-cured RTV sealer. DO NOT use a putty knife, razor blade, or similar tool, to remove the cover.

Remove the gasket (C).

4.2L



102303B

SEE I.S. NOTES

CYLINDER HEAD REMOVAL

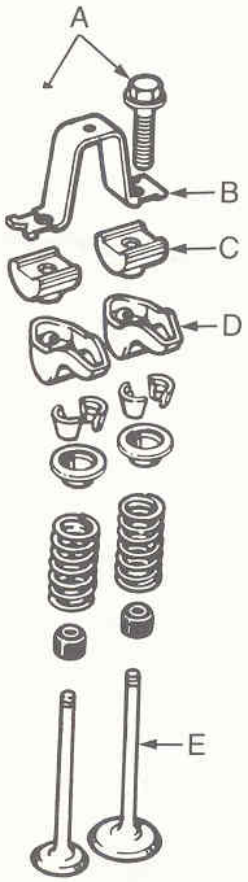
SEE I.S. NOTES

Remove the two capscrews (A) at each bridge (B) and pivot (C) assembly. Alternately loosen the capscrews one turn at a time to avoid damaging the bridge.

Remove the bridges, pivots and corresponding pairs of rocker arms (D). Place these components on the bench in the order in which they were removed.

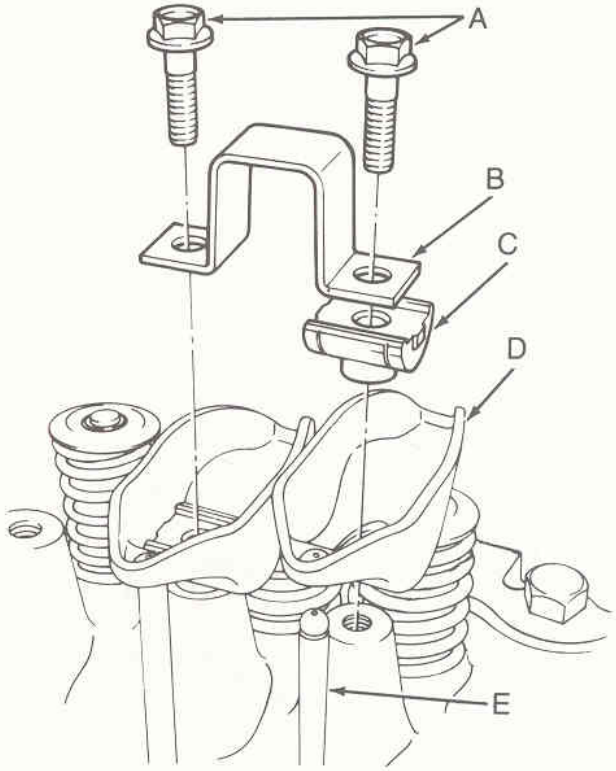
Remove the push rods (E) and place them on the bench in the order in which they were removed.

4.0L



101302A

4.2L



101302B

Remove the spark plugs.

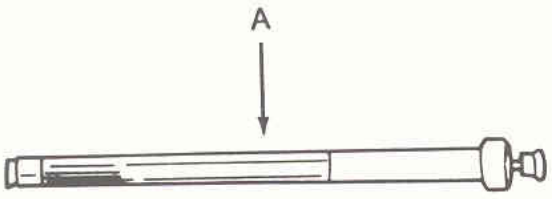
Remove the cylinder head bolts.

Remove the cylinder head.

Remove the cylinder head gasket.

HYDRAULIC VALVE TAPPET REMOVAL

Remove the valve tappets through the push rod openings in the cylinder block. Use Hydraulic Valve Tappet Removal and Installation Tool J-21884, or equivalent (A).



102304A

NOTE: Be sure to keep the valve tappets in the same order in which they are removed to help later when installing them in their original positions.

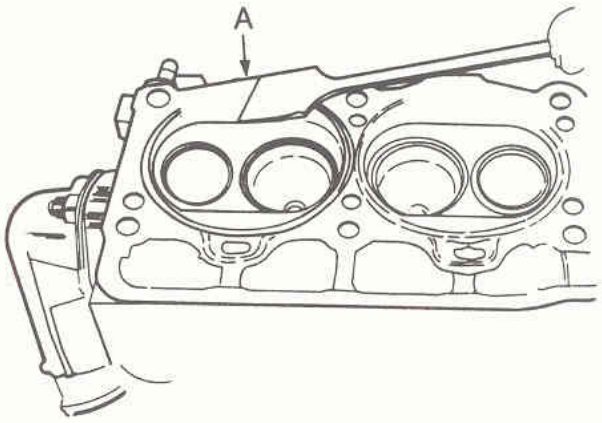
CLEANING AND INSPECTION

Thoroughly clean the machined surfaces of the cylinder head and block.

Remove all gasket material and cement (A).

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

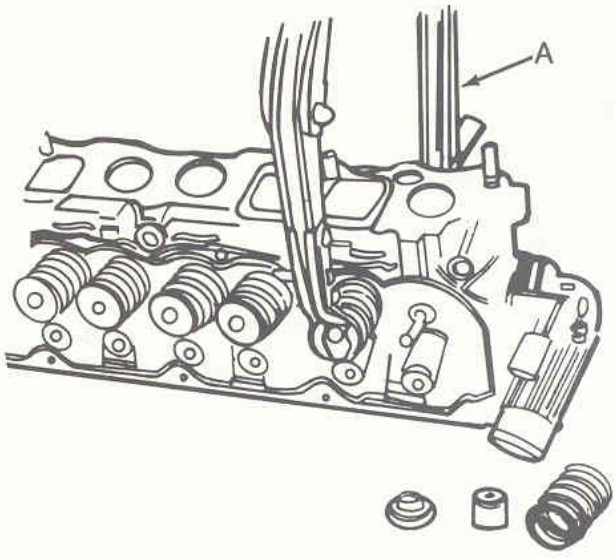
Use a straightedge and a feeler gauge to check the flatness of the cylinder head and block mating surfaces. Refer to the Specifications.



86163

VALVE REMOVAL

Compress each valve spring. Use the Valve Compressor Tool J-8062 (A), or equivalent.



86164

Remove the valve locks.

Remove the valve retainers.

Remove the valve springs.

Remove the valve stem oil deflectors.

Discard the deflectors.

Remove the valves, and place them in a rack in the order in which they are removed.

SEE I.S. NOTES

CLEANING AND INSPECTION

SEE I.S. NOTES

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

Clean all grime and gasket cement from the cylinder head machined gasket surface.

Inspect for cracks in the combustion chambers and valve ports.

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

Inspect the valves for burned, cracked or warped heads.

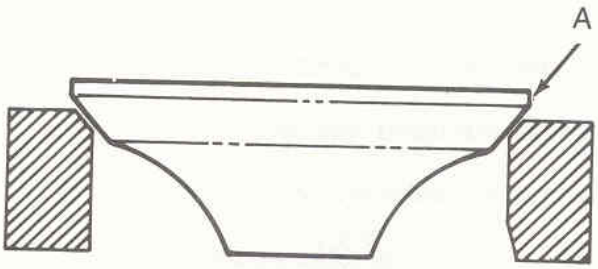
Inspect for scuffed or bent valve stems.

Replace valves displaying any damage.

VALVE REFACING

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

After refacing, a margin of at least 0.787 mm (A) (0.031 in.) must remain.



86165A

If the margin is less than 0.787 mm (B) (0.031 in.), the valve must be replaced.

86165B

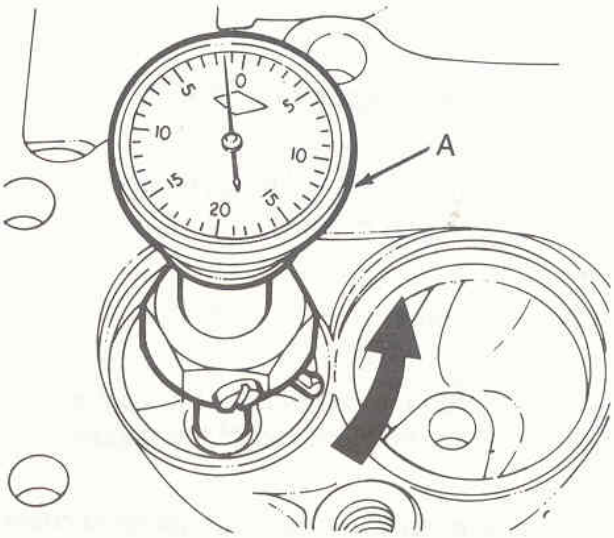
VALVE SEAT REFACING

Install a pilot of the correct size in the valve guide bore and reface the valve seat to the specified angle with a good dressing stone.

Remove only enough metal to provide a smooth finish.

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

Control seat runout to a maximum of 0.0635 mm (0.0025 in.), using a dial indicator (A).



86166A

VALVE STEM OIL DEFLECTOR REPLACEMENT

Nylon valve stem oil deflectors are installed on each valve stem to prevent rocker arm lubricating oil from entering the combustion chamber through the valve guide bores.

Replace the oil deflectors whenever valve service is performed or if the deflectors have deteriorated.

VALVE GUIDE REPLACEMENT

Valve guides are an integral part of the cylinder head. VALVE GUIDES ARE NOT REPLACEABLE.

When the stem-to-guide clearance is excessive, the valve guide bores must be reamed to accommodate the next larger oversize valve stem.

Oversize stem service valves are available in 0.076 mm (0.003 in.), 0.381 mm (0.015 in.), and 0.762 mm (0.030 in.) stem sizes.

Valve Guide Reamer Size – 4.0L

Reamer Tool Number	Size
J-26590-L	0.076 mm (0.003 in.) [Oversize]

Valve Guide Reamer Size – 4.2L

Reamer Tool Number	Size
J-6042-1	0.076 mm (0.003 in.)
J-6042-5	0.381 mm (0.015 in.)
J-6042-4	0.762 mm (0.030 in.)

86167

NOTE: Ream valve guide bores in steps, starting with the 0.0762 mm (0.003 in.) oversize reamer and progress to the size required.

VALVE STEM-TO-GUIDE CLEARANCE MEASUREMENT

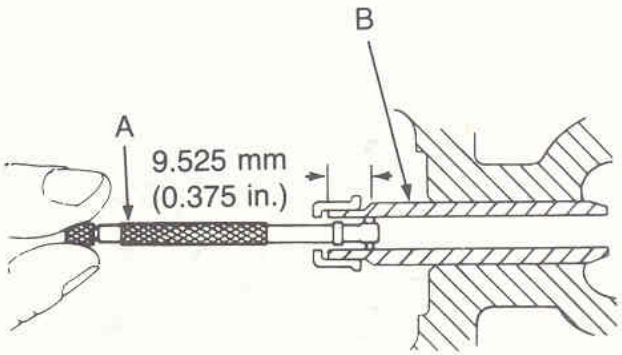
Valve stem-to-guide clearance may be measured by either of the following two methods.

Preferred Method

Remove the valve from the head. Refer to Valve Removal for the procedure.

Clean the valve stem guide bore with solvent and a bristle brush.

Insert the telescoping gauge (A) into the bore of the valve stem guide (B) approximately 9.525 mm (.375 in.) from the valve spring side of the head with contacts crosswise to the cylinder head.



86168A

SEE I.S. NOTES

SEE I.S. NOTES

Remove and measure the telescoping gauge with a micrometer.

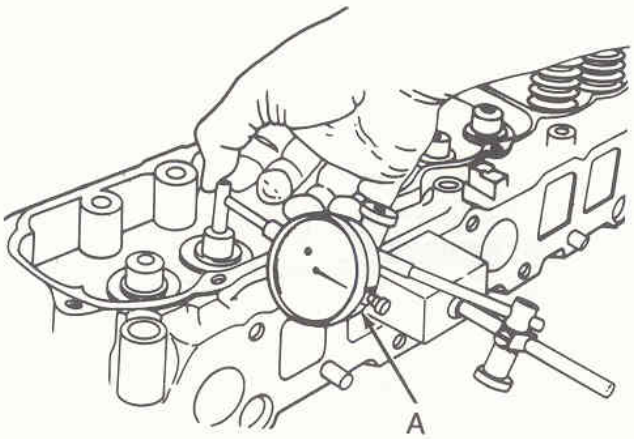
Repeat the measurement with contacts lengthwise to the cylinder head.

Compare the crosswise to lengthwise measurements to determine out-of-roundness. If the measurements differ by more than 0.0635 mm (0.0025 in.), ream the guide bore to accommodate the oversize valve stem.

Compare the measured valve guide bore diameter with the diameter listed in the Specifications. If the measurement differs from the specification by more than 0.0762 mm (0.003 in.), ream the guide bore to accommodate the oversize valve stem.

Alternate Method

Use Dial Indicator Tool J-8520 (A), or equivalent, and a C-Clamp and Rod Extension Tool J-5959-4, or equivalent, to measure the lateral movement of the valve stem (stem-to-guide clearance) with the valve installed in its guide and just off the valve seat.

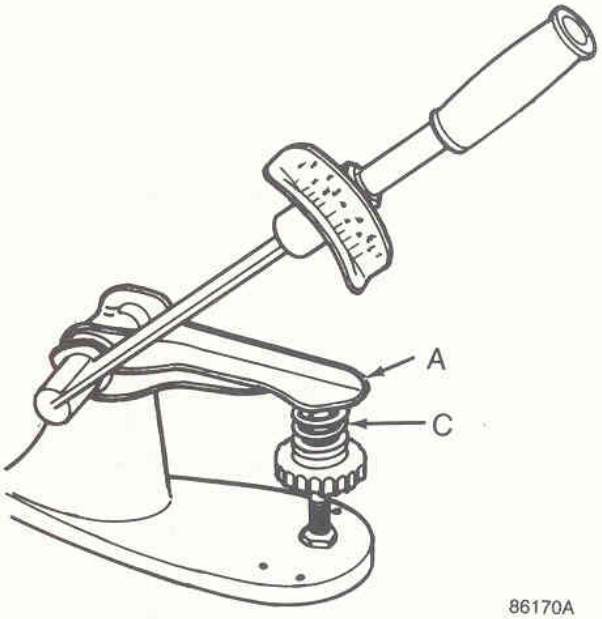


86169A

The correct clearance is 0.0025 – 0.0762 mm (0.001 – 0.003 in.). If the indicated movement exceeds the specification, ream the guide bore to accommodate an oversize valve stem.

VALVE SPRING TENSION TEST

Use the Valve Spring Tester Tool J-8056, or equivalent and torque wrench (A) to test each valve spring (B) for the specified tension value.



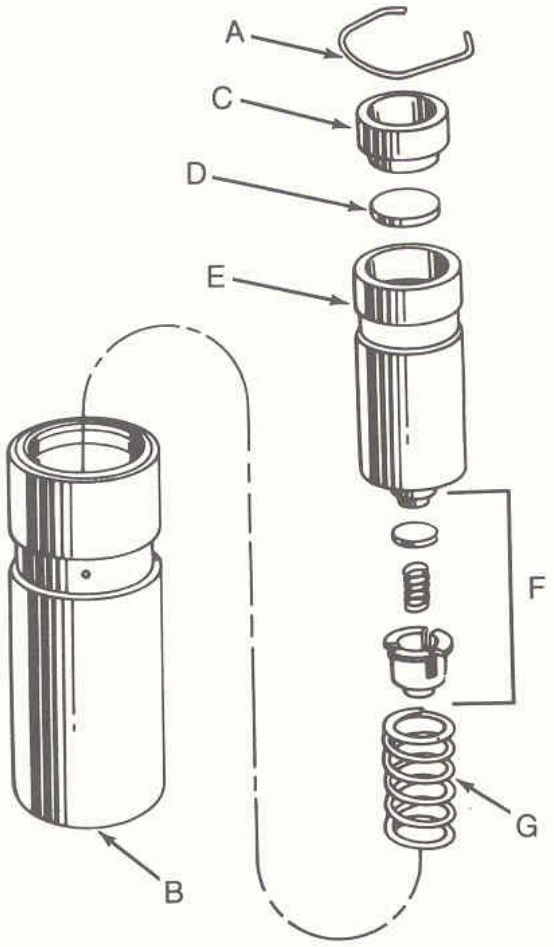
86170A

Replace the valve springs that are not within specifications.

HYDRAULIC VALVE TAPPET DISASSEMBLY

NOTE: Be sure to place the components of each valve tappet in a separate location. This will greatly assist in the installation operation.

Release the snap ring (A).



86172A

Remove the following components from the tappet body (B):

- Plunger cap (C)
- Metering valve (D)
- Plunger (E)
- Check valve assembly (F)
- Plunger return spring (G)

CLEANING AND INSPECTION

Clean the components of each tappet assembly in cleaning solvent to remove all varnish, gum and sludge deposits.

Inspect for indications of scuffing on the side and base of each tappet body.

Inspect each tappet base for concave wear with a straightedge positioned across the base.

If the base is concave, the corresponding lobe on the camshaft is also worn. Replace the camshaft and tappets.

HYDRAULIC VALVE TAPPET ASSEMBLY

Refer to hydraulic valve tapper assembly in the **CYLINDER BLOCK ASSEMBLY** section, page 55.

SEE I.S. NOTES

WATER PUMP REMOVAL

Remove the water pump from the cylinder block.

SEE I.S. NOTES

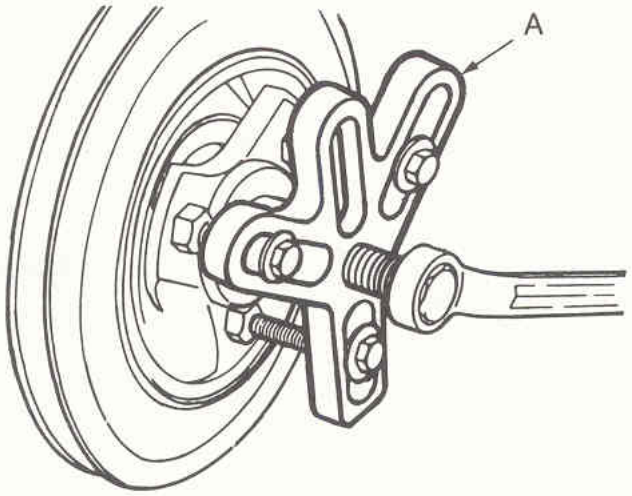
FUEL PUMP

Remove the fuel pump from the cylinder block (4.2L ONLY).

VIBRATION DAMPER REMOVAL

Remove the vibration damper.

Use Vibration Damper Tool J-24420-B (A), or equivalent.

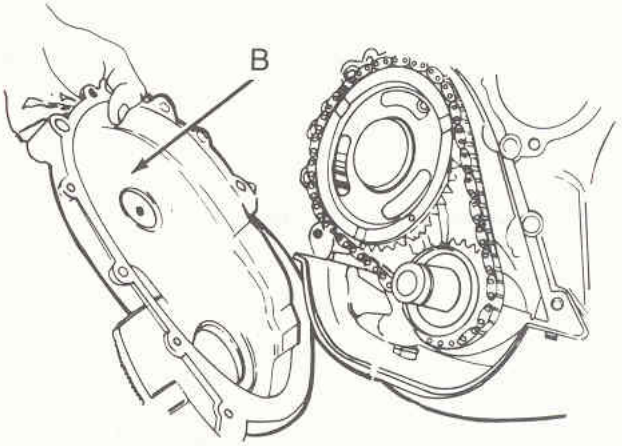


86174A

TIMING CASE COVER REMOVAL

Remove the timing case cover seal using a screwdriver or suitable tool (A).

Remove the timing case cover.



86176A

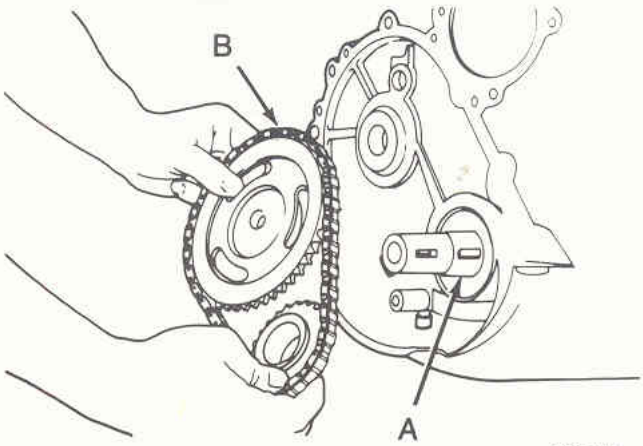
CAMSHAFT REMOVAL

Remove the oil slinger (A) from the crankshaft.

Remove the camshaft retaining bolt.

Remove the sprockets and chain (B) as an assembly.

Remove the camshaft.



86177A

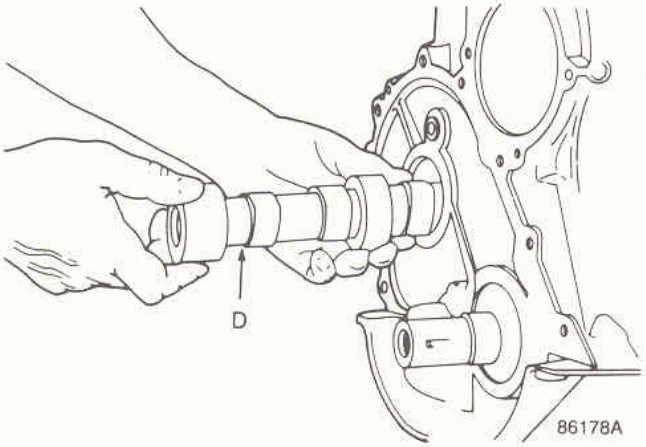
Inspect the cam lobes for wear.

Inspect the bearing journals for uneven wear pattern or finish.

Inspect the bearings for wear.

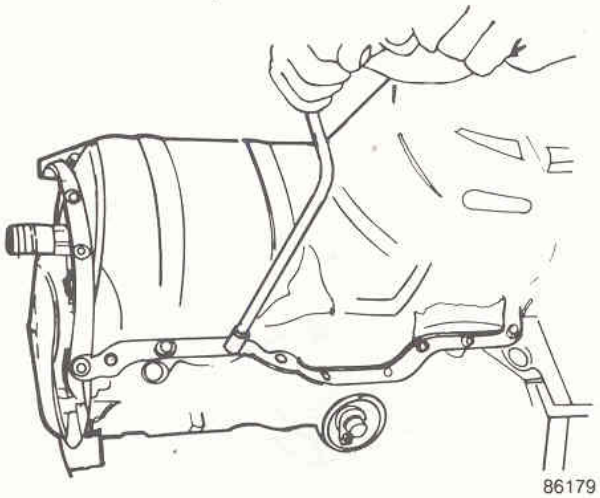
Inspect the distributor drive gear for wear.

NOTE: If the camshaft (D) appears to have been rubbing against the timing case cover, examine the oil pressure relief holes in the rear cam journal to ensure that they are free of debris.



OIL PAN REMOVAL

Remove the oil pan.



Remove the gaskets.

Remove the seals.

Thoroughly clean the pan and engine block gasket surfaces.

SEE I.S. NOTES

OIL PUMP REMOVAL

The positive-displacement, gear-type oil pump is driven by the distributor shaft, which is driven by a gear on the camshaft.

Oil is siphoned into the pump through an inlet tube and strainer assembly that is pressed into the pump body.

The pump incorporates a non-adjustable pressure relief valve to limit maximum pressure to 75 psi (517 kPa).

In the relief position, the valve permits oil to bypass through a passage in the pump body to the inlet side of the pump.

NOTE: Replacement or removal of the oil pump will not affect the distributor timing because the distributor drive gear remains in mesh with the camshaft gear.

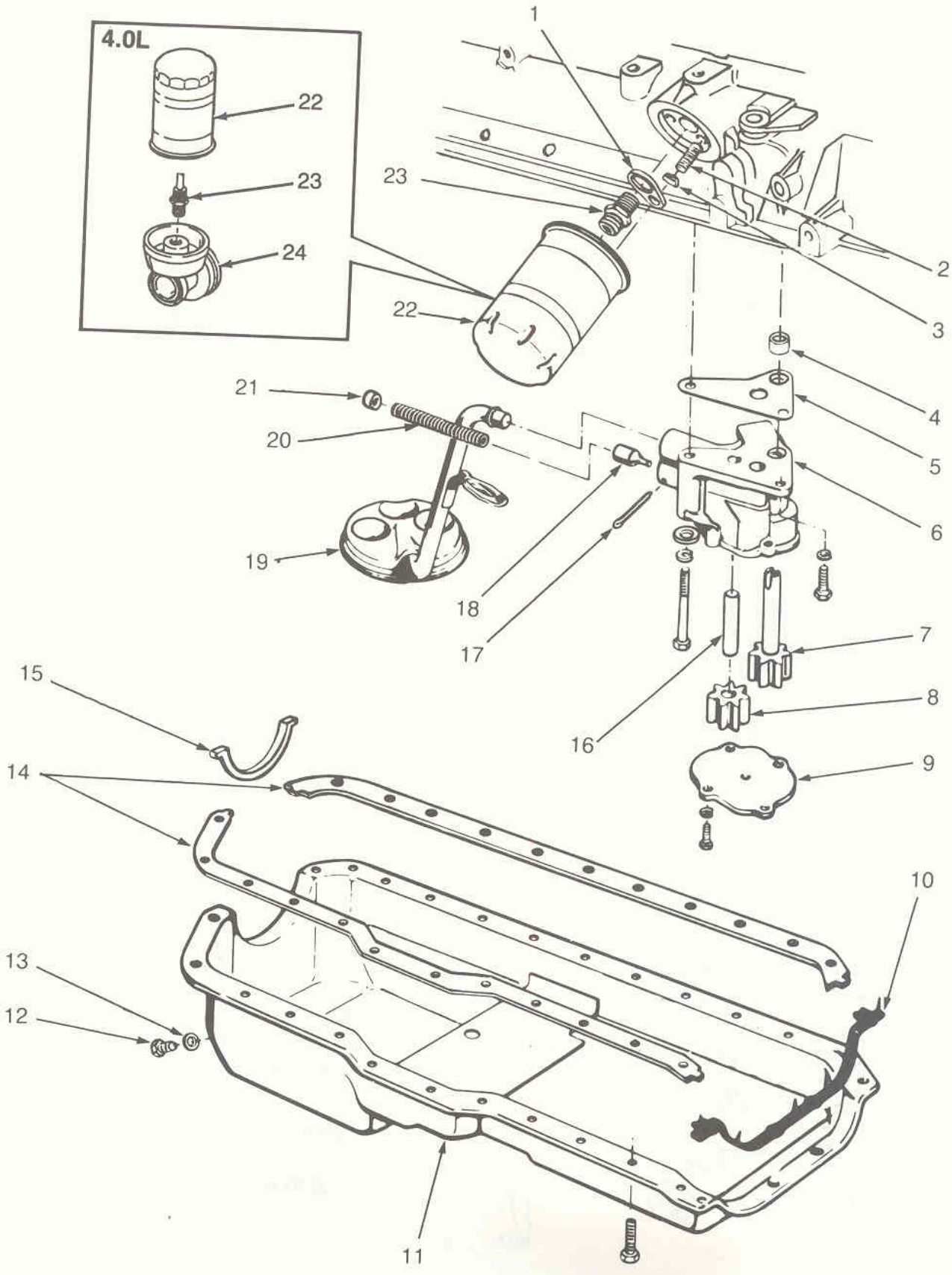
Remove the oil pump assembly and gasket from the cylinder block.

CAUTION: If the oil pump is not to be serviced, do not disturb the position of the oil inlet tube and strainer assembly in the pump body.

If the tube is moved within the pump body, a replacement tube and strainer assembly must be installed to ensure an airtight seal.

LUBRICATION SYSTEM COMPONENTS – 4.0L/4.2L

SEE I.S. NOTES



LUBRICATION SYSTEM COMPONENTS – 4.0L/4.2L

1. Oil Filter By-Pass Valve Retainer[1]
2. Oil Filter By-Pass Valve Spring[1]
3. Oil Filter By-Pass Valve[1]
4. Dowel Pin
5. Oil Pump-to-Cylinder-Block Gasket
6. Oil Pump Body
7. Oil Pump Drive Shaft and Gear
8. Oil Pump Idler Gear
9. Oil Pump Cover
10. Oil Pan Timing Case Cover Seal
11. Oil Pan
12. Oil Pan Drain Plug
13. Oil Pan Drain Plug Gasket
14. Oil Pan Gasket Set
15. Oil Pan-to-Bearing Cap Seal
16. Oil Pump Idler Gear Shaft
17. Cotter Pin
18. Release Valve Plunger
19. Oil Pump Strainer and Inlet Tube Assembly
20. Oil Pump Release Valve Spring
21. Valve Spring Release Cap
22. Oil Filter Element
23. Oil Filter By-Pass Connector
24. Oil Filter Adapter

[1] – Not on 1987 engines

SEE I.S. NOTES

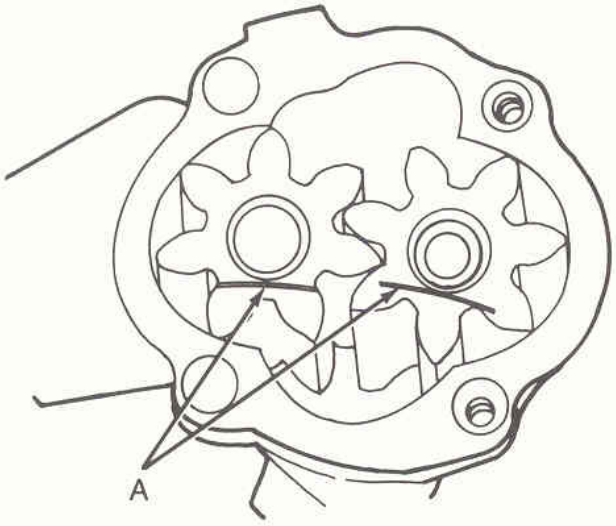
OIL PUMP GEAR END CLEARANCE MEASUREMENT

Remove the cover retaining screws and cover from the pump body.

SEE I.S. NOTES

Preferred Method

Place a strip of Plastigage (A) across the full width of each gear.



86181A

Install the pump cover and tighten the screws to 8 N·m (70 in-lbs) torque.

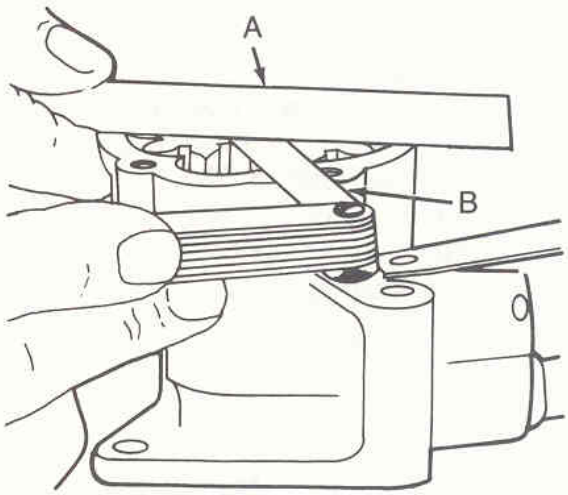
Remove the pump cover and determine the amount of clearance by measuring the width of compressed Plastigage with the scale on the Plastigage envelope.

The correct clearance by this method is 0.051 – 0.152 mm (0.002 – 0.006 in.). The preferred measurement is 0.051 mm (0.002 in.).

Alternate Method

Place a straightedge (A) across the ends of the gears and the pump body.

Select a feeler gauge (B) that fits snugly but freely between the straightedge and the pump gears.



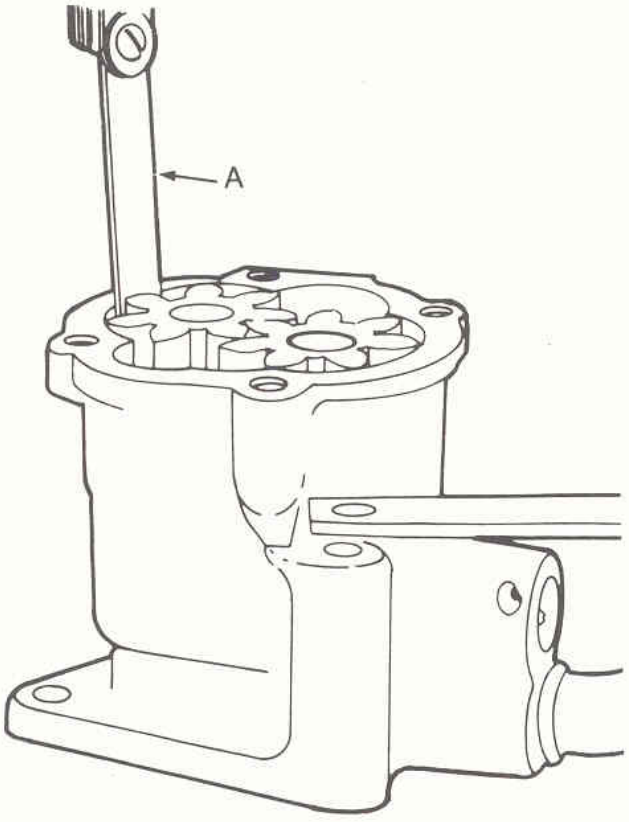
86182A

Using this method the correct clearance is 0.051 – 0.152 mm (0.002 – 0.006 in.), with the preferred measurement being 0.051 mm (0.002 in.).

If the gear end clearance is excessive, replace the oil pump assembly.

OIL PUMP GEAR-TO-BODY CLEARANCE MEASUREMENT

Measure the gear-to-body clearance by inserting a feeler gauge (A) between the gear tooth and the pump body inner wall directly opposite the point of the gear mesh.



86183A

NOTE: Select a feeler gauge which fits snugly but freely.

Rotate the gears to measure each tooth-to-body clearance in this manner.

The correct clearance is 0.051 – 0.102 mm (0.002 – 0.004 in.). The preferred clearance is 0.051 mm (0.002 in.).

If the gear-to-body clearance is more than specified, replace the idler gear, the idler shaft and the drive gear assembly.

Remove the cotter pin and slide the spring retainer, spring and oil pressure relief valve plunger out of the pump body.

Inspect for binding condition during disassembly.

Clean or replace, as necessary.

NOTE: The oil inlet tube and strainer assembly must be moved to allow removal of the relief valve. Install a replacement inlet tube and strainer assembly.

OIL PUMP ASSEMBLY

Refer to **CYLINDER BLOCK ASSEMBLY** section, page 50.

SEE I.S. NOTES

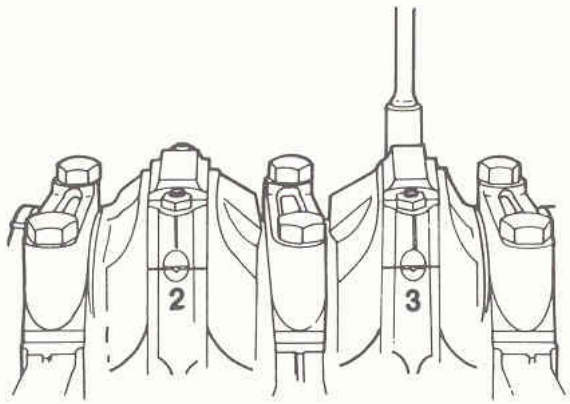
CONNECTING ROD AND PISTON REMOVAL

Remove the connecting rod bearing caps and inserts.

SEE I.S. NOTES

Keep them in the same order in which they were removed to facilitate installation in the original location.

NOTE: The connecting rods and caps are stamped with the corresponding cylinder number.



86185

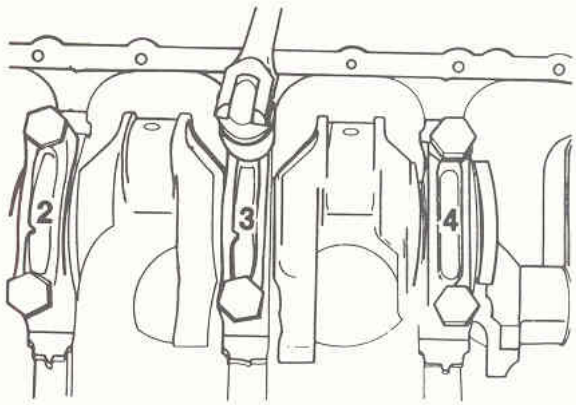
Remove the connecting rod and piston assemblies through the top of the cylinder bores.

NOTE: Be sure that the connecting rod bolts do not scratch the crankshaft journals or cylinder walls. Short pieces of rubber hose slipped over the connecting rod bolts will provide protection during removal.

CRANKSHAFT REMOVAL

Remove the main bearing caps and bearings.

NOTE: The bearing caps are numbered front to rear.



86186

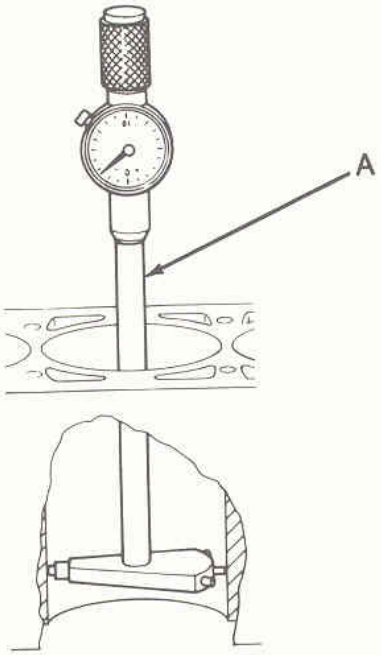
Remove the rear main bearing oil seal.

Remove the crankshaft and upper bearing inserts.

Inspect the crankshaft for scoring.

CYLINDER BORE MEASUREMENT

Use a bore gauge (A) to measure each cylinder bore diameter. If a bore gauge is not available, use an inside micrometer.



86187

Measure the cylinder bore diameter crosswise to the cylinder block near the top of the bore. Repeat the measurement at the bottom of the bore.

Determine the taper by subtracting the smaller diameter from the larger diameter.

Rotate the measuring device 120 degrees and repeat the previous steps.

Lastly, rotate the device another 120 degrees and repeat the measurements.

Determine out-of-roundness by comparing the difference between each 120 degree measurement.

If the cylinder bore taper does not exceed 0.025 mm (0.001 in.) and the out-of-roundness does not exceed 0.025 mm (0.001 in.) the cylinder bore can be trued by honing.

If the cylinder bore taper or out-of-round condition exceeds these maximum limits, the cylinder must be bored and then honed to accept an oversize piston.

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

CYLINDER BORE RESURFACING

CAUTION: Do not use rigid type hones to remove cylinder wall glaze.

Use an expanding type hone to true the cylinder bore and to remove the glaze for faster piston ring seating.

Move the hone down and up (stroke) at sufficient speed to produce a uniform 60 degree angle crosshatch pattern on the cylinder walls. Do not use more than ten strokes per cylinder (one stroke is one down-and-up movement).

Clean the cylinder bores by scrubbing clean with a solution of hot water and detergent.

Immediately apply light engine oil to the cylinder walls. Wipe with a clean, lint-free cloth.

SEE I.S. NOTES

PISTON PIN REMOVAL

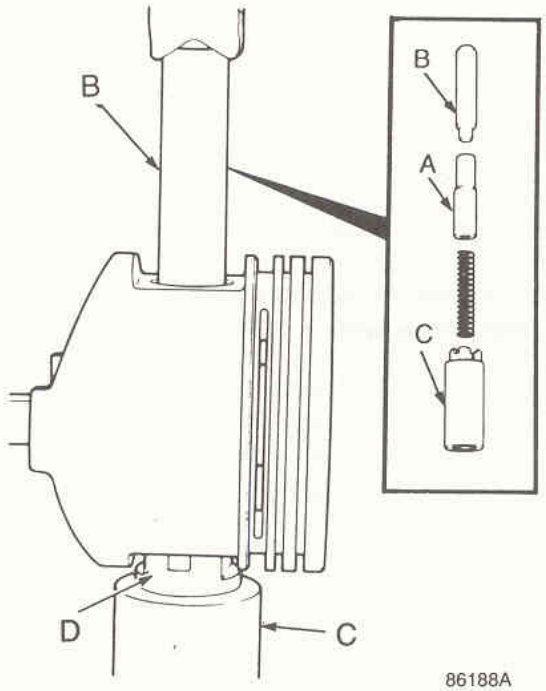
Piston pins are press-fitted into the connecting rods and require no locking device.

SEE I.S. NOTES

Position the following components in place on an arbor press:

- Piston Pin Pilot Tool J-21872-2 (A), or equivalent
- Piloted Driver Tool J-21872-3 (B), or equivalent
- Removal Support Tool J-21872-1 (C), or equivalent
- Piston and connecting rod assembly

Apply force to the piloted driver to press the pin completely out of the connecting rod and piston. Note the position of the pin through the gauge window (D) of the Removal Support Tool J-21872-1, or equivalent.



PISTON PIN INSPECTION

Inspect the piston pin and pin bore in the connecting rod.

NOTE: Never re-use the piston pin after it has been installed in, and removed from, a connecting rod.

With the pin removed from the piston and connecting rod, clean and dry the piston pin bores and the replacement piston pin.

Position the piston so that the pin bore is in the vertical position.

Insert the pin in the bore. At room temperature, the replacement pin should slide completely through the pin bore in the piston by the force of gravity.

Replace the piston if the pin jams in the pin bore.

PISTON PIN INSTALLATION

Insert the Pin Pilot Tool J-21872-2, or equivalent, through the piston and connecting rod pin bores.

Position the pin pilot, piston and connecting rod on the Support Tool J-21872-1, or equivalent.

Insert the piston pin through the upper piston pin bore and into the connecting rod pin bore.

Position the Piloted Driver Tool J-21872-3, or equivalent, inside the piston pin.

Using an arbor press, press the piston pin through the connecting rod and piston bores until the pin pilot indexes with the mark on the support.

NOTE: The piston pin requires an 8.9 kN (2 000 pounds-force) press fit. If little effort is required to install a piston pin in a connecting rod, or if the rod moves laterally on the pin, the connecting rod must be replaced.

Remove the piston and connecting rod assembly from the press. The pin should be centered in the rod ± 0.792 mm (0.0312 in.).

PISTON FITTING – MICROMETER METHOD

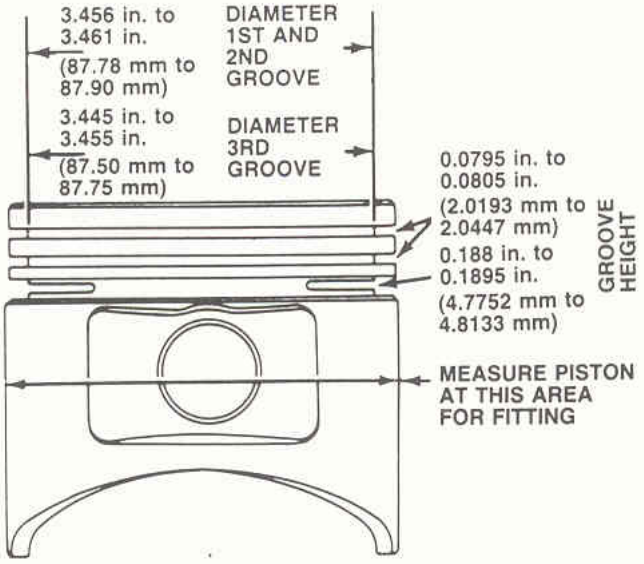
Measure the inside diameter of the cylinder bore at a point 58.725 mm (2.3125 in.) below the top of the bore.

Measure the outside diameter of the piston.

NOTE: Because pistons are cam ground, measure at a right angle to the piston pin at the centerline of the pin.

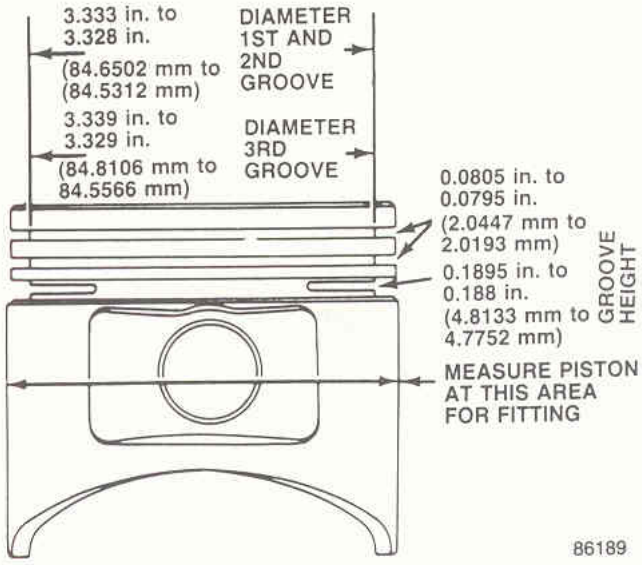
The difference between the cylinder bore diameter and the piston diameter is the piston-to-bore clearance.

4.0L



41909A

4.2L



86189

PISTON FITTING – FEELER GAUGE METHOD

Remove the rings from the piston.

Insert the long 0.025 mm (0.001 in.) feeler gauge into the cylinder bore.

Insert the piston, top first, into the cylinder bore alongside the feeler gauge.

With the entire piston inserted in the cylinder bore, the piston should not bind against the feeler gauge.

Repeat these steps with a long 0.051 mm (0.002 in.) feeler gauge. The piston should bind.

If the piston binds on the 0.025 mm (0.001 in.) feeler gauge, the piston is too large or the cylinder bore is too small.

If the piston does not bind on the 0.051 mm (0.002 in.) feeler gauge, the piston is too small for the cylinder bore. The piston may be enlarged by knurling or shot-peening. Replace pistons that are at least 0.102 mm (0.004 in.) undersize.

SEE I.S. NOTES

PISTON RING FITTING

SEE I.S. NOTES

NOTE: The two compression rings are made of cast iron. The oil control ring is a three-piece steel design.

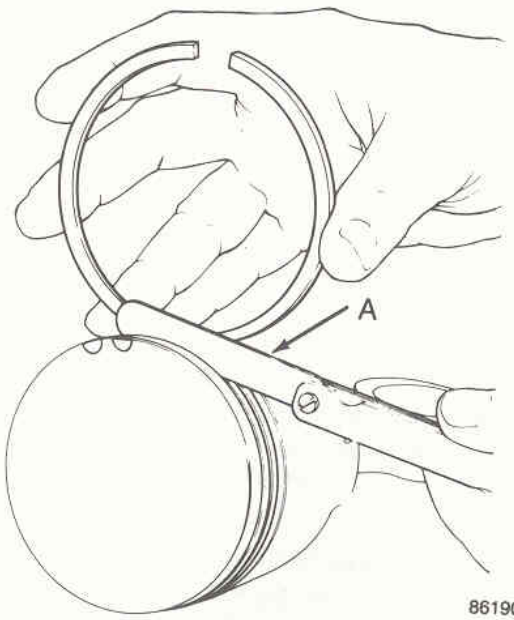
Carefully clean the carbon from all ring grooves.

The oil drain openings in the oil ring grooves and pin boss must be clear.

CAUTION: Do not remove metal from the grooves or lands. This will change the ring-to-groove clearances and will damage the ring-to-land seating.

Measure the ring side clearance with a feeler gauge (A) fitted snugly between the ring land and ring.

Rotate the ring in the groove. It must move freely around the circumference of the groove.



86190A

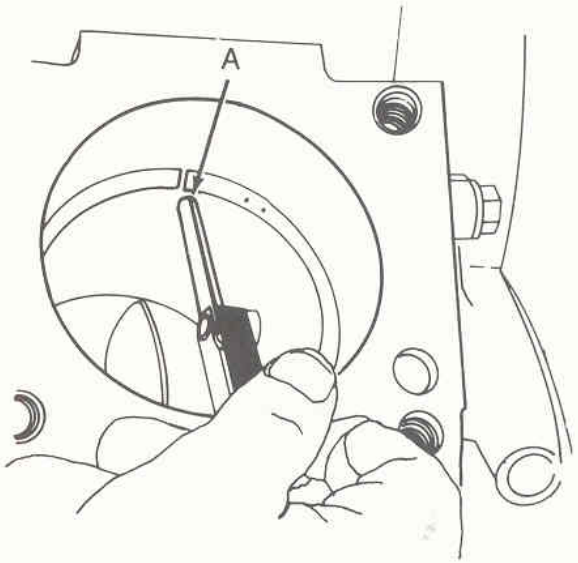
PISTON RING SIDE CLEARANCE MEASUREMENTS

	Millimeters	Inches
No. 1. Compression	0.043-0.081 (0.043 Preferred)	0.0017-0.0032 (0.0017 Preferred)
No. 2 Compression	0.043-0.081 (0.043 Preferred)	0.0017-0.0032 (0.0017 Preferred)
Oil Control	0.03-0.020 (0.08 Preferred)	0.001-0.008 (0.003 Preferred)

86287A

Place the ring in the cylinder bore and push down with the inverted piston to position near the lower end of the ring travel.

Measure the ring gap with a feeler gauge (A) fitting snugly between the ring ends.



86191A

PISTON RING INSTALLATION

Refer to the figure for the position of the ring gaps when installing the piston rings.

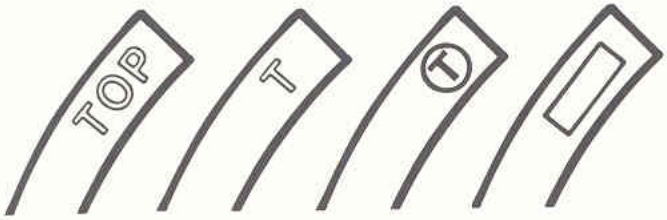
Install the oil control rings according to the instructions in the package. It is not necessary to use a tool to install the upper and lower rails.

Insert the expander ring first, and then the side rails.

Install the lower compression ring using the ring installer to expand the ring around the piston.

NOTE: Be sure that the upper and lower compression rings are installed with the markings that indicate the top side of the ring facing up.

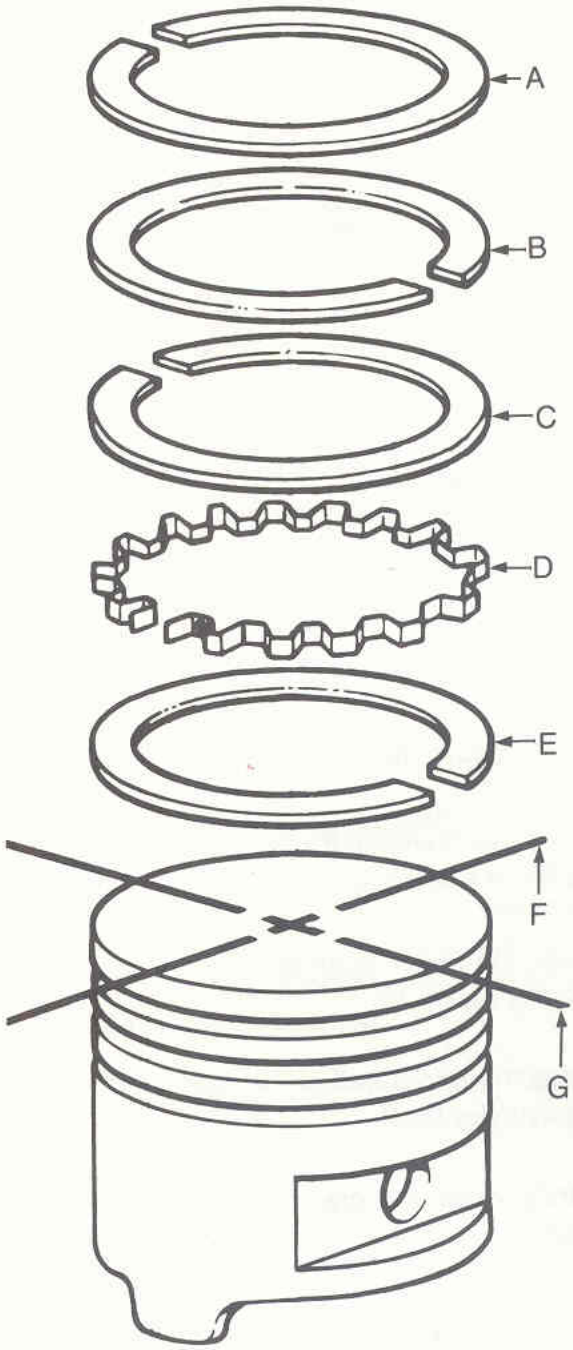
Typical piston ring markings are as follows:



86192A

NOTE: The ring gap position may vary ± 20° from the position illustrated.

The ring gap position is as follows:



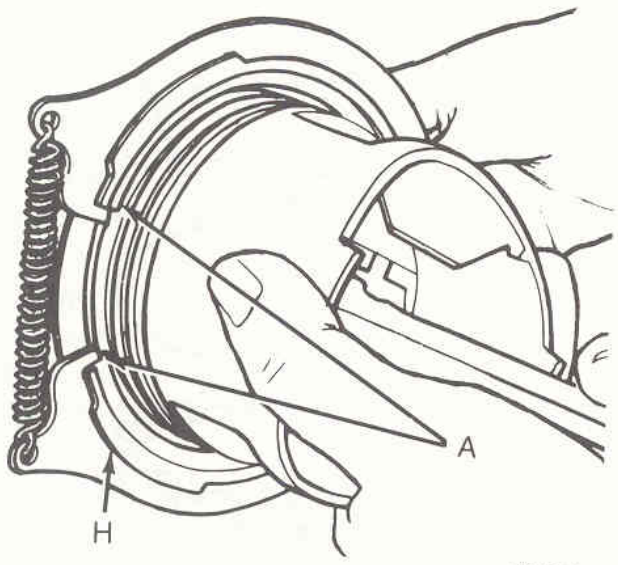
A. Top Compression Ring
B. Bottom Compression Ring
C. Top Oil Control Rail
D. Oil Rail Expander
E. Bottom Oil Control Rail
F. Imaginary Line Through Center of Piston Skirt
G. Imaginary Line Parallel to Piston Pin

86193A

SEE I.S. NOTES

SEE I.S. NOTES

Install the upper compression ring (A) using the ring installer to expand the ring around the piston. A ring expander (H) is recommended.



86194A

CRANKSHAFT INSTALLATION

Install the crankshaft upper bearing inserts to the block assembly.

Install the lower bearing inserts into the main bearing caps.

Install the upper half of the rear main seal into the cylinder block.

Gently lower the crankshaft into the cylinder block.

Install the lower half of the rear main oil seal into the rear main bearing cap.

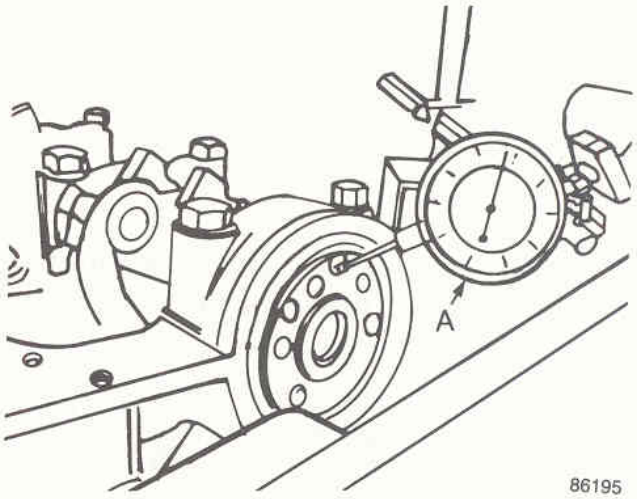
Install the main bearing caps (with the new inserts) in their original positions.

Tighten the bolts to 108 N·m (80 ft-lbs) torque.

NOTE: The bearing caps are numbered front to rear.

CRANKSHAFT END PLAY MEASUREMENT

The crankshaft end play is controlled at the No. 3 main bearing, which is flanged for this purpose.



86195

Attach a dial indicator (A) to the cylinder block adjacent to the end of the crankshaft to check end play.

Pry the shaft forward.

Position the dial indicator push rod on the face of the crankshaft.

Set the dial pointer at zero.

Pry the shaft fore and aft. Note the dial indicator pointer.

End play is the difference between the high and low measurements. The correct crankshaft end play is 0.038 – 0.165 mm (0.0015 – 0.0065 in.). The desired end play is 0.051 – 0.064 mm (0.002 – 0.0025 in.).

If the end play is not within specifications, inspect the crankshaft thrust faces for wear.

If no wear is apparent, replace the thrust bearing and remeasure the end play.

If the end play is still not within specifications, replace the crankshaft.

NOTE: When replacing the thrust bearing, pry the crankshaft fore and aft to align the faces of the thrust bearing before the final tightening.

MAIN BEARING DESCRIPTION

The main crankshaft bearings are the steel-backed, micro-babbitt, two-piece precision type.

The main bearing caps, numbered (front to rear) from 1 through 7, have an arrow to indicate the forward position.

The upper main bearing inserts are grooved to provide oil channels. The lower inserts are smooth.

Each bearing insert pair is selectively fitted to its respective journal to obtain the specified operating clearance.

In production, the select fit is obtained by using various-sized, color-coded bearing insert pairs as listed in the **MAIN BEARING FITTING CHART**. The bearing color code appears on the edge of the insert.

NOTE: The size is not stamped on inserts used for engine production.

The main bearing journal size (diameter) is identified in production by a color-coded paint mark on the adjacent cheek toward the flanged (rear) end of the crankshaft, except for the rear main journal, which is on the crankshaft rear flange.

When required, the upper and lower bearing inserts of different sizes may be used as a pair. A standard size insert is sometimes used in combination with a 0.025 mm (0.001 in.) undersize insert to reduce the clearance by 0.013 mm (0.0005 in.).

Example:

BEARING INSERT PAIRS

Insert	Correct	Incorrect
Upper	Standard	Standard
Lower	0.025 mm (0.001 in.) undersize	0.051 mm (0.002 in.) undersize

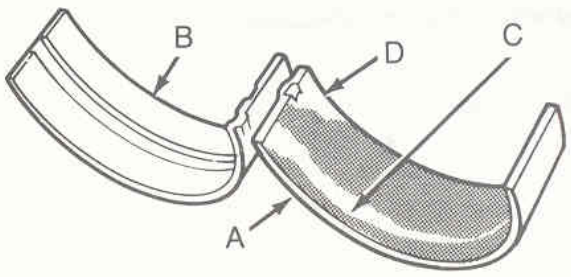
86196

CAUTION: Never use a pair of bearing inserts with greater than a 0.025 mm (0.001 in.) difference in size.

CAUTION: When replacing the inserts, the odd size inserts must be either all on the top (in the cylinder block) or all on the bottom (in the main bearing cap).

MAIN BEARING-TO-JOURNAL CLEARANCE MEASUREMENT
[Using Plastigage With Crankshaft Installed]

A heavier wear pattern is seen on the lower bearing (A) than on the upper bearing (B). A low area in the lower bearing lining is illustrated at (C). No wear is shown at (D).



86198A

SEE I.S. NOTES

Plastigage should indicate the same clearance across the entire width of the insert. If clearance varies, it may indicate a tapered journal or foreign material trapped behind the insert.

SEE I.S. NOTES

NOTE: Do not rotate the crankshaft. This will cause the Plastigage to shift, resulting in an inaccurate indication. Plastigage must not be permitted to crumble. If brittle, obtain fresh stock.

If the specified clearance is indicated, replacement bearing fitting is not necessary. Remove the Plastigage from the crankshaft and bearing insert and proceed to installation.

If the clearance exceeds specifications, install a pair of 0.025 mm (0.001 in.) undersize bearing inserts and remeasure the clearance as described in the previous steps.

The clearance indicated with the 0.025 mm (0.001 in.) undersize insert pair installed will determine if this insert size or some other combination will provide the specified clearance.

For example, if the clearance was 0.089 mm (0.0035 in.) originally, a pair of 0.025 mm (0.001 in.) undersize inserts would reduce the clearance by 0.025 mm (0.001 in.). The clearance would then be 0.063 mm (0.0025 in.) and within the specification.

A 0.051 mm (0.002 in.) undersize bearing insert and a 0.025 mm (0.001 in.) undersize insert would reduce the original clearance an additional 0.013 mm (0.005 in.) and the clearance would then be 0.051 mm (0.002 in.).

CAUTION: Never use a pair of inserts that differ more than one bearing size as a pair. For example, do not use a standard size upper insert and a 0.051 mm (0.002 in.) undersize lower insert.

If the clearance exceeds the specifications using a pair of 0.051 mm (0.002 in.) undersize bearing inserts, measure the crankshaft journal diameter with a micrometer. If the journal diameter is correct, the crankshaft bore in the cylinder block may be misaligned, which requires cylinder block replacement or machining to true bore.

If the diameter for journals 1 through 5 is less than 63.4517 mm (2.4981 in.), replace the crankshaft or grind down to accept the appropriate undersize bearing inserts.

MAIN BEARING JOURNAL DIAMETER MEASUREMENT

[Using a Micrometer With Crankshaft Removed]

Clean the main bearing journal of oil.

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

Compare the measured diameter with the journal diameter specification listed in the Main Bearing Fitting Chart, and select inserts required to obtain the specified bearing-to-journal clearance.

MAIN BEARING FITTING CHART

Crankshaft No. 1 Main Bearing Journal Color Code and Diameter	Cylinder Block No. 1 Main Bearing Bore Color Code and Size	Bearing Insert Color Code	
		Upper Insert Size	Lower Insert Size
Yellow – 63.5025-63.4898 mm (2.5001-2.4996 in.) (Standard)	Yellow – 68.3514-68.3641 mm (2.6910-2.6915 in.) Black – 68.3641-68.3768 mm (2.6915-2.6920 in.)	Yellow – Standard Yellow – Standard	Yellow – Standard Black – 0.025 mm Undersize (0.001 in.)
Orange – 63.4898-63.4771 mm (2.4996-2.4991 in.) (0.0005 Undersize)	Yellow – 68.3514-68.3641 mm (2.6910-2.6915 in.) Black – 68.3641-68.3768 mm (2.6915-2.6920 in.)	Yellow – Standard Black – 0.025 mm Undersize (0.001 in.)	Black – 0.025 mm Undersize (0.001 in.) Black – 0.025 mm Undersize (0.001 in.)
Black – 63.4771-63.4644 mm (2.4991-2.4986 in.) (0.001 Undersize)	Yellow – 68.3514-68.3641 mm (2.6910-2.6915 in.) Black – 68.3641-68.3768 mm (2.6915-2.6920 in.)	Black – 0.025 mm Undersize (0.001 in.) Black – 0.025 mm Undersize (0.001 in.)	Black – 0.025 mm Undersize (0.001 in.) Green – 0.051 mm Undersize (0.002 in.)
Green – 63.4644-63.4517 mm (2.4986-2.4981 in.) (0.0015 Undersize)	Yellow – 68.3514-68.3641 mm (2.6910-2.6915 in.)	Black – 0.025 mm Undersize (0.001 in.)	Green – 0.051 mm Undersize (0.002 in.)
Red – 63.2485-63.2358 mm (2.4901-2.4986 in.) (0.010 Undersize)	Yellow – 68.3514-68.3641 mm (2.6910-2.6915 in.)	Red – 0.254 mm Undersize (0.010 in.)	Red – 0.254 mm Undersize (0.010 in.)

NOTE: With Green and Red Coded Crankshaft Journals, Use Yellow Coded Cylinder Block Bores Only.

Crankshaft Main Bearing Journals 2-6 Color Code and Diameter (Journal Size)	Bearing Insert Color Code	
	Upper Insert Size	Lower Insert Size
Yellow – 63.5025-63.4898 mm (2.5001-2.4996 in.) (Standard)	Yellow – Standard	Yellow – Standard
Orange – 63.4898-63.4771 mm (2.4996-2.4991 in.) (0.0005 Undersize)	Yellow – Standard	Black – 0.025 mm Undersize (0.001 in.)
Black – 63.4771-63.4644 mm (2.4991-2.4986 in.) (0.001 Undersize)	Black – 0.025 mm Undersize (0.001 in.)	Black – 0.025 mm Undersize (0.001 in.)
Green – 63.4644-63.4517 mm (2.4986-2.4981 in.) (0.0015 Undersize)	Black – 0.025 mm Undersize (0.001 in.)	Green – 0.051 mm Undersize (0.002 in.)
Red – 63.2485-63.2358 mm (2.4901-2.4966 in.) (0.010 Undersize)	Red – 0.054 mm Undersize (0.010 in.)	Red – 0.254 mm Undersize (0.010 in.)

Crankshaft Main Bearing Journal 7 Color Code and Diameter (Journal Size)	Bearing Insert Color Code	
	Upper Insert Size	Lower Insert Size
Yellow – 63.4873-63.4746 mm (2.4995-2.4990 in.) (Standard)	Yellow – Standard	Yellow – Standard
Orange – 63.4746-63.4619 mm (2.4990-2.4985 in.) (0.0005 Undersize)	Yellow – Standard	Black – 0.025 mm Undersize (0.001 in.)
Black – 63.4619-63.4492 mm (2.4985-2.4980 in.) (0.001 Undersize)	Black – 0.025 mm Undersize (0.001 in.)	Black – 0.025 mm Undersize (0.001 in.)
Green – 63.4492-63.4365 mm (2.4980-2.4975 in.) (0.0015 Undersize)	Black – 0.025 mm Undersize (0.001 in.)	Green – 0.051 mm Undersize (0.002 in.)
Red – 63.2333-63.2206 mm (2.4895-2.4890 in.) (0.010 Undersize)	Red – 0.254 mm Undersize (0.010 in.)	Red – 0.254 mm Undersize (0.010 in.)

SEE I.S. NOTES

REAR MAIN BEARING OIL SEAL INSTALLATION

SEE I.S. NOTES

NOTE: The crankshaft rear main bearing oil seal consists of two half pieces of neoprene with a single lip that effectively seals the rear of the crankshaft. Replace the upper and lower seal halves as a unit to ensure leak-free operation.

Remove the rear main bearing cap.

Wipe the seal surface area of the crankshaft until it is clean.

Apply a thin coat of engine oil.

Coat the lip of the seal with engine oil (A).

Position the upper seal into the cylinder block.

NOTE: The lip of the seal faces toward the front of the engine.

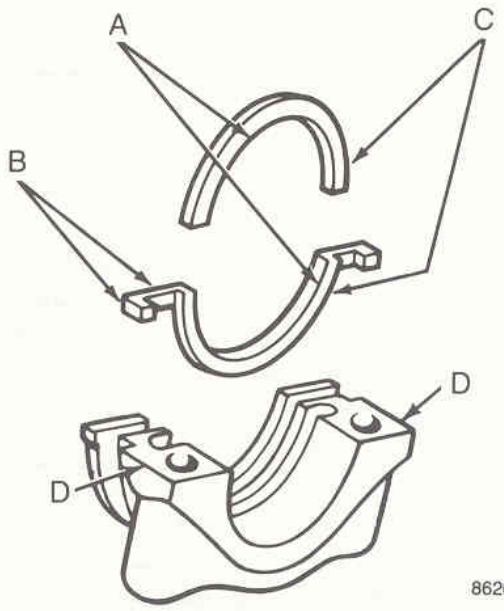
Coat both sides of the lower seal end tabs with RTV sealant (B) (AMC Gasket-in-a-Tube, or equivalent). Do not apply sealant to the lip of the seal.

Coat the outer curved surface of the lower seal with soap (C) and the lip of the seal with engine oil.

Position the lower seal into the bearing cap recess and seat it firmly.

Coat both chamfered edges of the rear main bearing cap with RTV sealant (D).

CAUTION: Do not apply sealant to the cylinder block mating surfaces of the rear main bearing cap because the bearing-to-journal clearance would be altered.



86200A

Install the rear main bearing cap.

Tighten all main bearing bolts to 108 N·m (80 ft-lbs) torque.

CONNECTING ROD INSTALLATION

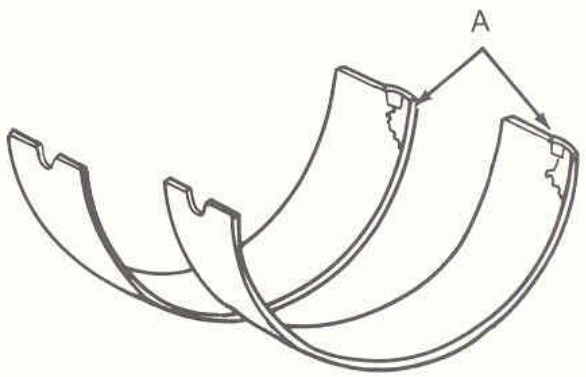
The connecting rods are made of malleable iron and are balanced assemblies with bearing inserts at the crankshaft journal end. The piston pin is 8.9 kN (2 000 pounds-force) press-fitted into the rod.

A squirt hole in the crankshaft end of the connecting rod provides lubrication for the camshaft lobes, distributor drive gear, cylinder walls and piston pins. The squirt hole faces the camshaft when the connecting rod is installed correctly.

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

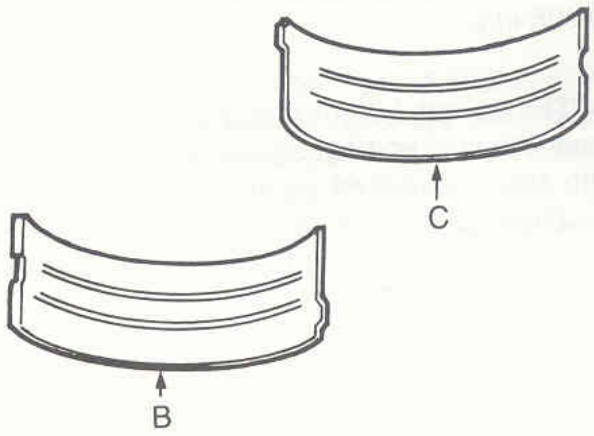
Replace misaligned or bent rods. Refer to Side Clearance Measurement.

Example of abnormal contact areas (A) caused by locking tabs that have not been fully seated or are bent:



86202A

Example of scoring on the lower (B) and upper (C) bearing surfaces:



86203A

SEE I.S. NOTES

CONNECTING ROD BEARINGS

The connecting rod bearings are two-piece, steel backed, lead-aluminum alloy units.

SEE I.S. NOTES

Each bearing insert is selectively fitted to its respective journal to obtain the specified operating clearance between the bearing and the journal. In production, the select fit is obtained by using various-sized, color-coded bearing inserts as listed in the bearing fitting chart. The color code appears on the edge of the bearing insert.

NOTE: The size is not stamped on inserts used for the production of engines.

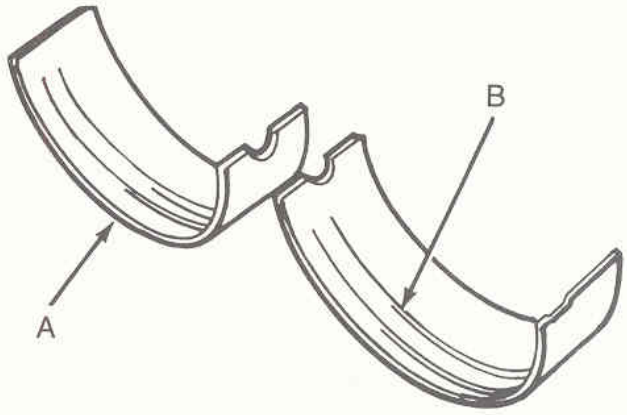
The rod journal is identified during the engine production by a color-coded paint mark on the adjacent cheek or counterweight toward the flanged (rear) end of the crankshaft. The color codes used to indicate journal sizes are listed in the bearing fitting chart.

When required, upper and lower bearing inserts of different sizes may be used as a pair. A standard size insert is sometimes used in combination with a 0.025 mm (0.001 in.) undersize insert to reduce clearance 0.013 mm (0.005 in.).

NOTE: Do not intermix bearing caps. Each connecting rod and its bearing cap are stamped with the associated cylinder number on a machined surface adjacent to the oil squirt hole that faces the camshaft side of the cylinder block.

CONNECTING ROD BEARING INSPECTION

The wear pattern is always greater on the upper bearing (A). Grooves (B) may be caused by the rod bolts scratching the journal during installation.



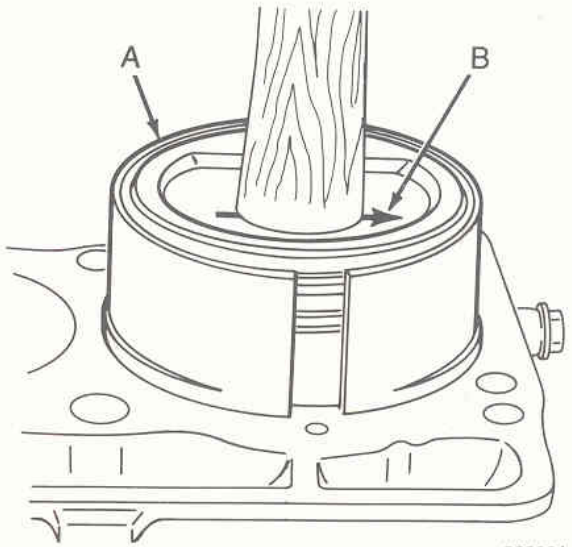
86204

CONNECTING ROD BEARING INSTALLATION

Wipe the journal clean of oil.

Lubricate the upper bearing insert and install in the connecting rod.

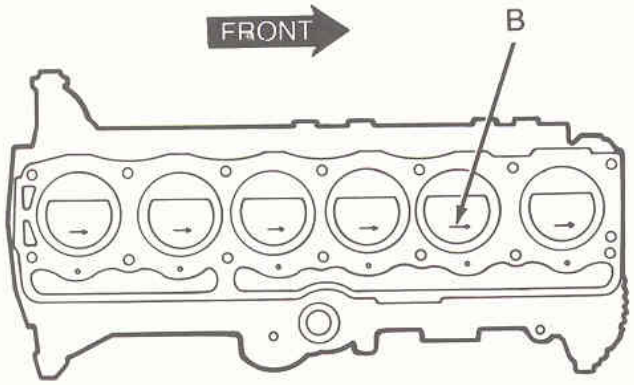
Use the Ring Compressor Tool J-5601 (A), or equivalent, to install the rod and piston assemblies.



86206A

Use short rubber hose sections over the rod bolts during installation.

NOTE: Verify that the oil squirt holes in the rods face the camshaft and that the arrows on the pistons face the front of the engine (B).



86205A

Install the lower bearing insert in the bearing cap. The lower insert must be dry.

CONNECTING ROD BEARING-TO-JOURNAL CLEARANCE MEASUREMENT [Using Plastigage]

Place a strip of Plastigage across the full width of the lower insert at the center of the bearing cap.

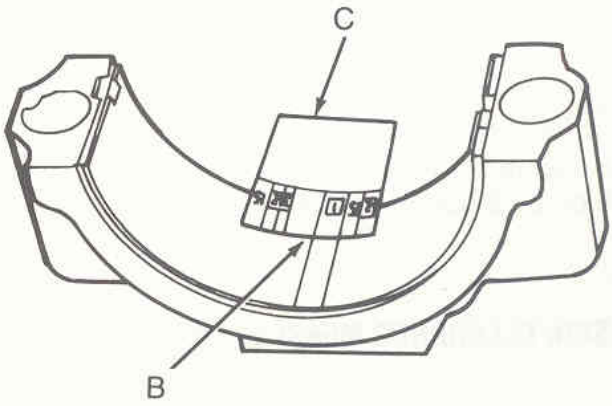
Install the bearing cap and connecting rod on the journal and tighten the nuts to 45 N·m (33 ft-lbs) torque.

NOTE: Do not rotate the crankshaft. The Plastigage will shift, resulting in an inaccurate indication.

NOTE: The Plastigage must not crumble in use. If brittle, obtain fresh stock.

Remove the bearing cap and determine the amount of bearing-to-journal clearance by measuring the width of the compressed Plastigage (B) with the scale (C) on the Plastigage envelope.

The correct clearance is 0.025 – 0.076 mm (0.001 – 0.003 in.).



86207A

NOTE: The Plastigage should indicate the same clearance across the entire width of the insert. If the clearance varies, it may be caused by either a tapered journal, bent connecting rod, or foreign material trapped between the insert and cap or rod.

If the correct clearance is indicated, replacement bearing fitting is not necessary.

Remove the Plastigage from the crankshaft journal and bearing insert and proceed with installation.

SEE I.S. NOTES

If bearing-to-journal clearance exceeds the specification, install a pair of 0.025 mm (0.001 in.) undersize bearing inserts and measure the clearance as described in the previous steps.

SEE I.S. NOTES

The clearance measured with a pair of 0.025 mm (0.001 in.) undersize bearing inserts will determine if two 0.025 mm (0.001 in.) undersize inserts or another combination is needed to provide the correct clearance.

For example, if the initial clearance was 0.076 mm (0.003 in.), 0.025 mm (0.001 in.) undersize inserts would reduce the clearance by 0.025 mm (0.001 in.). The clearance would be 0.051 mm (0.002 in.), and within specification. A 0.051 mm (0.002 in.) undersize insert and a 0.025 mm (0.001 in.) undersize insert would reduce the initial clearance an additional 0.013 mm (0.0005 in.). The clearance would then be 0.038 mm (0.0015 in.).

SIDE CLEARANCE MEASUREMENT

Slide a snug-fitting feeler gauge between the connecting rod and the crankshaft journal flange.

The correct clearance is 0.254 – 0.482 mm (0.010 – 0.019 in.).

Replace the connecting rod if the side clearance is not within specifications.

NOTE: Never use a pair of bearing inserts with more than a 0.025 mm (0.001 in.) difference in size.

Example:

BEARING INSERT PAIRS

Insert	Correct	Incorrect
Upper	Standard	Standard
Lower	0.025 mm (0.001 in.) undersize	0.051 mm (0.002 in.) undersize

86224

When replacing bearing inserts, all the odd size inserts must be on the bottom.

The sizes of the service replacement bearing inserts are stamped on back of the inserts.

Repeat the Plastigage measurement to verify bearing selection prior to final assembly.

Once the proper insert has been selected, install the insert and cap and tighten the screws to 45 N·m (33 ft-lbs) torque.

CONNECTING ROD BEARING FITTING CHART

Connecting Rod Bearing Journal Color Code and Diameter (Journal Size)	Bearing Insert Color Code	
	Upper Insert Size	Lower Insert Size
Yellow – 53.2257 - 53.2079 mm (2.0955 - 2.0948 in.) (Standard)	Yellow – Standard	Yellow – Standard
Orange – 53.2079 - 53.1901 mm (2.0948 - 2.0941 in.) (0.0007 Undersize)	Yellow – Standard	Black – 0.025 mm (0.001 in.) Undersize
Black – 53.1901 - 53.1723 mm (2.0941 - 2.0943 in.) (0.0014 Undersize)	Black – 0.025 mm (0.001 in.) Undersize	Black – 0.025 mm (0.001 in.) Undersize
Red – 53.9717 - 53.9539 mm (2.0855 - 2.0848 in.) (0.010 Undersize)	Red – 0.254 mm (0.010 in.) Undersize	Red – 0.245 mm (0.010 in.) Undersize

86208

SEE I.S. NOTES

OIL PUMP ASSEMBLY

SEE I.S. NOTES

NOTE: Two relief valve plunger sizes (standard and oversize) are available. When replacing the valve, assure that the correct replacement valve, standard size or 0.254 mm (0.010 in.) oversize plunger diameter, is obtained and installed.

Install the oil pressure relief valve plunger.

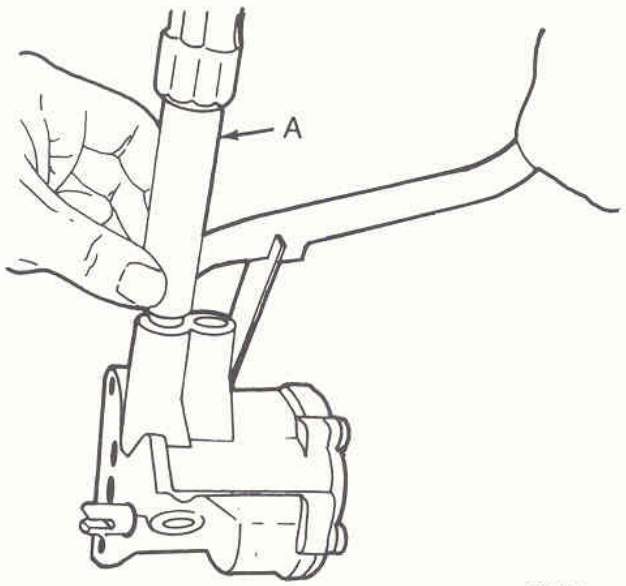
Install the spring.

Install the retainer.

Install the cotter pin.

If the position of the inlet tube in the pump body has been disturbed, install a replacement inlet tube and strainer assembly. Apply a light film of Permatex No. 2 sealant, or equivalent, around the end of the tube.

Use the Oil Pump Inlet Tube Installer Tool J-21882 (A), to drive the tube into the body. Ensure that the support bracket is properly aligned.



86184A

Install the idler gear.

Install the drive gear assembly.

NOTE: To ensure self-priming of the oil pump, fill the pump with petroleum jelly before installing the oil pump cover. Do not use grease.

Apply a bead of Loctite 515, or equivalent, and install the pump cover.

Tighten the cover screws to 8 N·m (70 in-lbs) torque.

NOTE: Inspect the gears to ensure that a binding condition does not exist before installing the oil pump.

OIL PUMP INSTALLATION

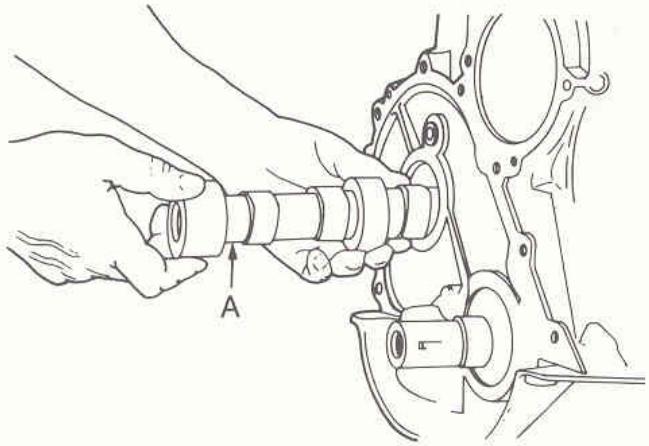
Install the oil pump with a new gasket.

Tighten the short bolts to 14 N·m (10 ft-lbs) torque.

Tighten the long bolts to 23 N·m (17 ft-lbs) torque.

CAMSHAFT BEARING DESCRIPTION

The camshaft (A) rotates within four steel-shelled, babbitt-lined bearings that are pressed into the cylinder block and then line reamed.



86209A

The camshaft bearing bores are step-bored (larger at the front bearing than at the rear) to permit easier removal and installation of the camshaft. The camshaft bearings are pressure lubricated.

NOTE: It is not advisable to attempt to replace the camshaft bearings unless special removal and installation tools are available.

Camshaft end play is maintained by the load placed on the camshaft by the oil pump and distributor drive gear.

The helical cut of the gear holds the camshaft sprocket thrust face against the cylinder block face. Camshaft end play is zero during engine operation.

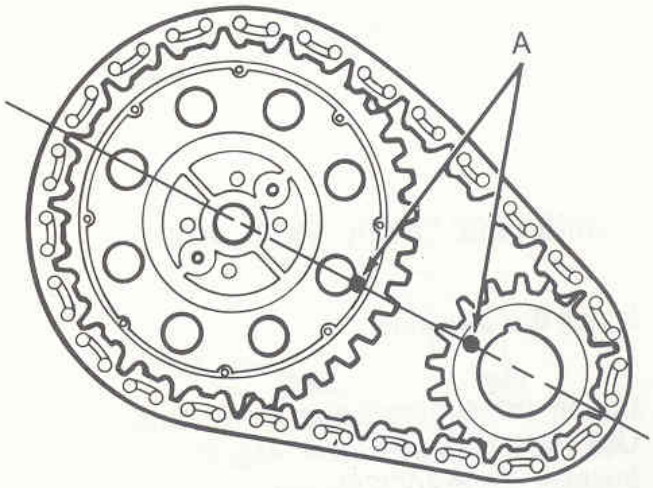
CAMSHAFT INSTALLATION

Lubricate the camshaft with AMC/Jeep Engine Oil Supplement, or equivalent, prior to installing the camshaft.

Install the camshaft sprockets.

Install the timing chain.

NOTE: Be sure the timing marks (A) on the sprockets are properly aligned.



86210A

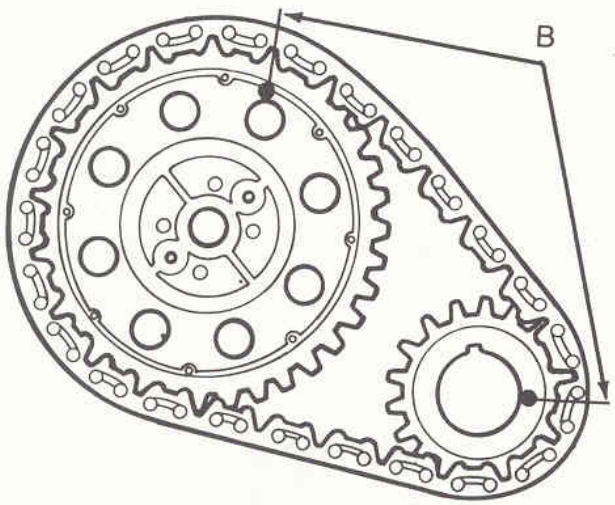
Install the camshaft sprocket retaining bolt and washer and tighten the bolt to 108 N·m (80 ft-lbs) torque.

NOTE: To verify the correct installation of the timing chain, turn the crankshaft to locate the camshaft sprocket timing mark at approximately the one o'clock position. This positions the crankshaft sprocket timing mark where the adjacent tooth meshes with the chain at the three o'clock position.

SEE I.S. NOTES

Count the number of chain pins between the timing marks of both sprockets. There must be 15 pins (B).

SEE I.S. NOTES

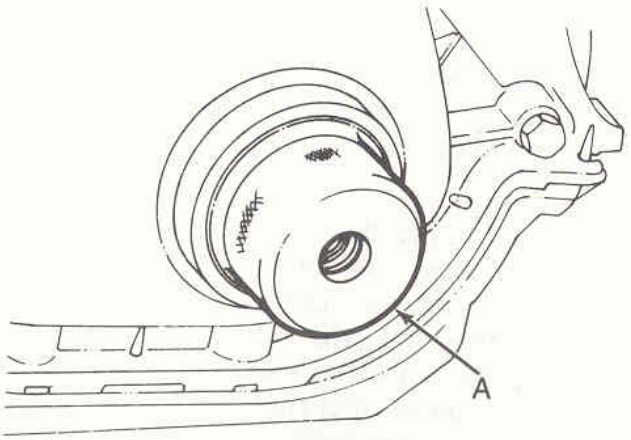


86211A

TIMING CASE COVER INSTALLATION

Install the oil slinger.

Install the timing case cover and gasket. Use Timing Case Cover Alignment and Seal Installer Tool J-22248 (A), or equivalent, for cover alignment.



86212

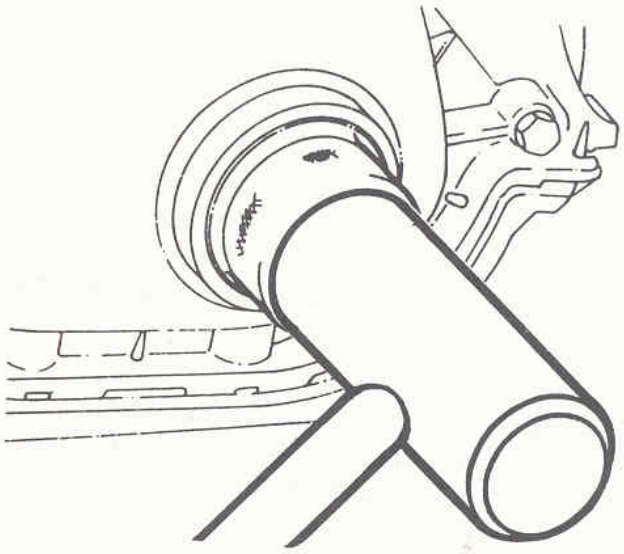
Tighten the cover bolts to 7 N·m (5 ft-lbs) torque, and the oil pan-to-cover bolts to 13 N·m (11 ft-lbs) torque.

Apply Perfect Seal, or equivalent, to the outside diameter of the timing cover seal.

Install the seal into position.

NOTE: The seal can be installed by gently tapping on Timing Case Cover Alignment and Seal Installer Tool J-22248 (A), or equivalent, with a plastic or rubber mallet until the tool comes into contact with the cover.

Apply a light film of engine oil to the seal lip on the inside diameter of the timing cover seal.



86212A

Remove the tool.

OIL PAN INSTALLATION

NOTE: Inspect to be sure that the oil pan and engine block gasket mating surfaces are thoroughly clean and free of debris.

Install the front oil pan seal (A) to the timing case cover.

Install the rear oil pan seal (G) to the rear main bearing cap.

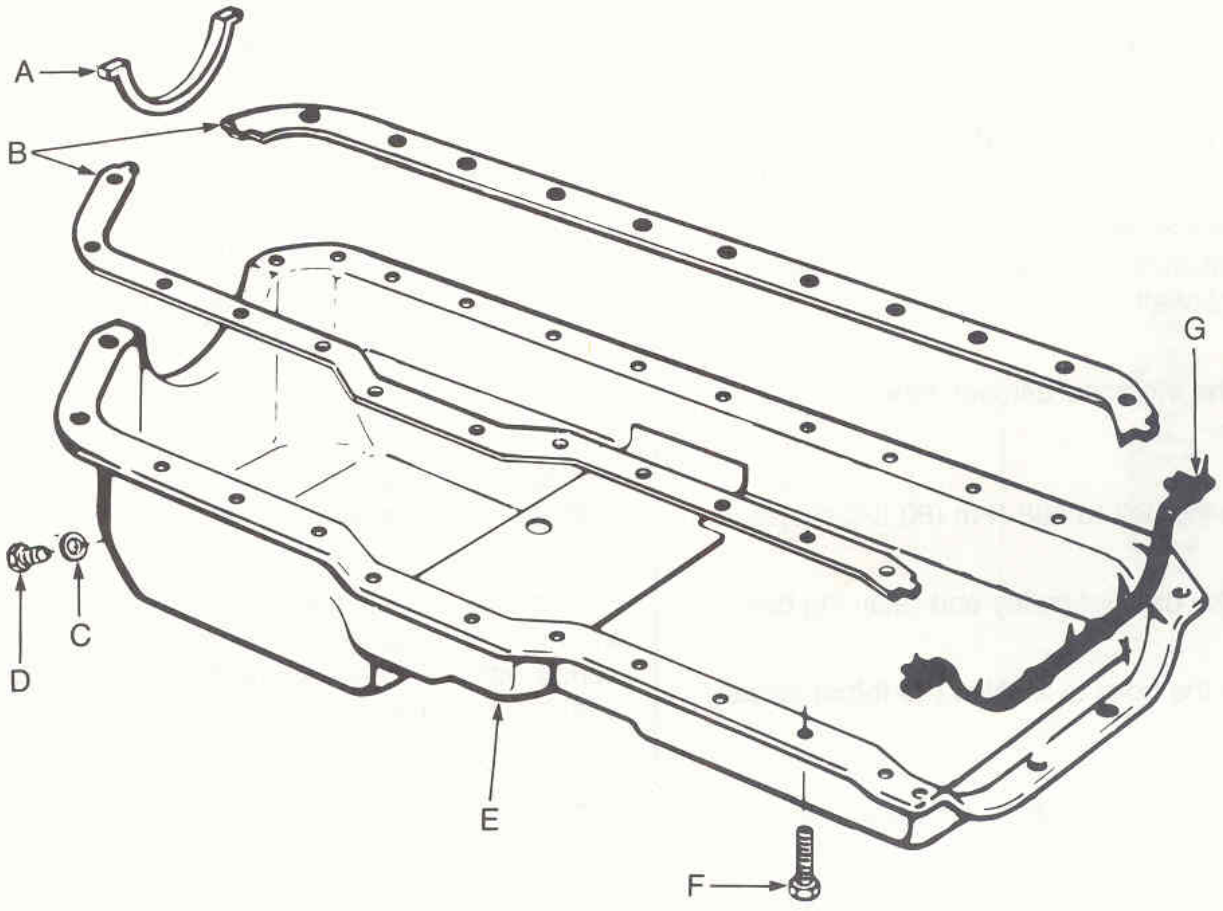
Install the oil pan side gaskets (B) in position on the engine block.

Apply a generous amount of AMC Gasket-in-a-Tube, or equivalent to the side gasket contacting surface of the seal end tabs.

Install the oil pan (E).

Tighten the oil pan bolts (F) to 9 N·m (7 ft-lbs) torque.

SEE I.S. NOTES



A. Oil Pan-To-Bearing Cap Seal
B. Oil Pan Gasket Set
C. Oil Pan Drain Plug Gasket
D. Oil Pan Drain Plug
E. Oil Pan
F. Bolt(s)
G. Oil Pan Timing Case Cover Seal

10240

WATER PUMP INSTALLATION

Install the water pump and gasket.

Tighten the bolts to 18 N·m (13 ft-lbs) torque.

Install the oil filter to the engine.

SEE I.S. NOTES

FUEL PUMP INSTALLATION

Install the fuel pump and gasket.

Tighten the bolts to 22 N·m (16 ft-lbs) torque.

VIBRATION DAMPER INSTALLATION

Align the key slot on the vibration damper with the crankshaft key and tap the damper onto the crankshaft.

Install the vibration damper retaining bolt and washer.

Tighten the bolt to 108 N·m (80 ft-lbs) torque.

Install the damper pulley and retaining bolts.

Tighten the bolts to 27 N·m (20 ft-lbs) torque.

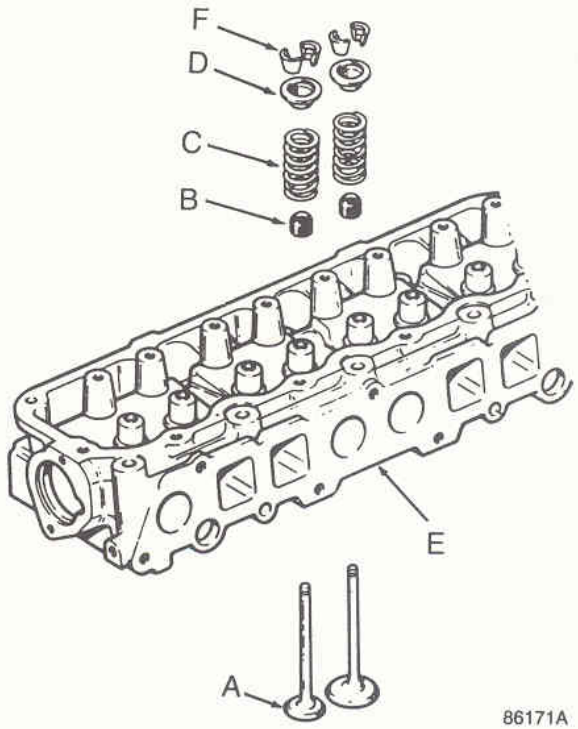
VALVE INSTALLATION

Thoroughly clean the valve stems and the valve guide bores.

Lubricate the stem lightly.

Install the valve (A) in the original valve guide bore from where it was removed.

Install the replacement valve stem oil deflector (B) on the valve stem.



NOTE: If the oversize valve stems are used, oversize oil deflectors are required.

Position the valve spring (C) and retainer (D) on the cylinder head (E) and compress the valve spring with the Valve Spring Compressor Tool J-8062, or equivalent.

Install the valve locks (6) and release the tool.

Tap the valve spring from side to side with a hammer to ensure that the spring is properly seated at the cylinder head.

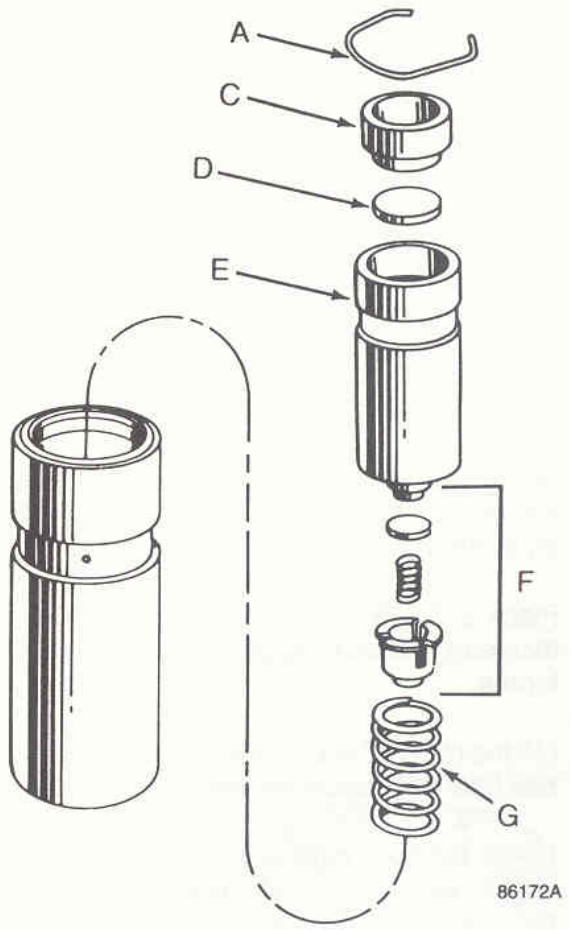
HYDRAULIC VALVE TAPPET ASSEMBLY

Install the following components in the tappet body:

- Plunger return spring (G)
- Check valve assembly (F)
- Plunger (E)
- Metering valve (D)
- Plunger cap (C)

Compress the plunger assembly by exerting force on the plunger cap with the push rod.

Install the snap ring (A).



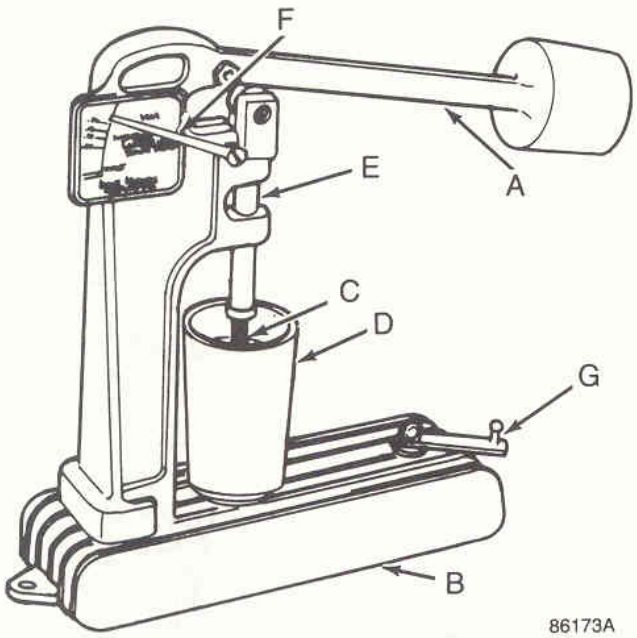
SEE I.S. NOTES

HYDRAULIC VALVE TAPPET LEAK-DOWN TEST

After cleaning, inspection and assembly, test each tappet for the specified leak-down rate tolerance to ensure zero-lash operation.

NOTE: A timing device is required to test the leak-down rate.

SEE I.S. NOTES



Swing the weighted arm (A) of the Hydraulic Valve Tappet Tester Tool J-5790 (B), or equivalent, away from the ram of the tester.

Place a 7.925 - 7.950 mm (0.312 - 0.313 in.) diameter ball bearing on the plunger cap of the tappet.

Lift the ram (C) and position the tappet (with the ball bearing) inside the tester cup (D).

Lower the ram, then adjust the nose of the ram until it contacts the ball bearing. Do not tighten the hex nut on the ram.

Fill the tester cup with Hydraulic Valve Tappet Test Oil J-5268, or equivalent, until the tappet is completely submerged.

Swing the weighted arm onto the push rod (E).

Pump the tappet plunger up and down to remove air.

When the air bubbles cease, swing the weighted arm away and allow the plunger to rise to the normal position.

Adjust the nose of the ram to align the pointer (F) with the SET mark on the scale of the tester and tighten the hex nut.

Slowly swing the weighted arm onto the push rod.

Rotate the cup by turning the handle (G) at the base of the tester clockwise one revolution every two seconds.

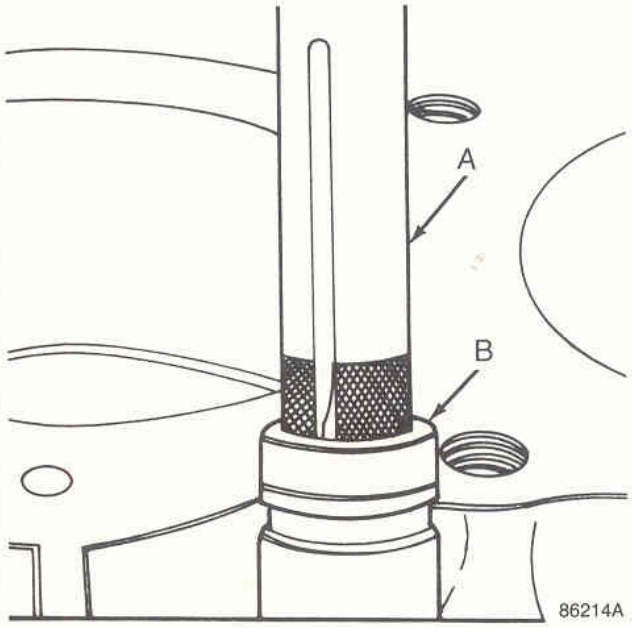
Observe the leak-down time interval from the instant the pointer aligns with the START mark on the scale until the pointer aligns with the 0.125 mark.

A normally functioning tappet will require 20 - 110 seconds to leak-down. Discard the tappets with leak-down time intervals which are not within this specification.

HYDRAULIC VALVE TAPPET INSTALLATION

Dip each tappet assembly in AMC Engine Oil Supplement, or equivalent.

Use Hydraulic Valve Tappet Removal/Installation Tool J-21884 (A), or equivalent, to install each tappet (B) in the original bore.



CYLINDER HEAD INSTALLATION

Apply an even coat of Perfect Seal compound, or equivalent, to both sides of the new head gasket.

Install the head gasket with the work "top" up.

Install the cylinder head.

Tighten the cylinder head bolts to 115 N·m (85 ft-lbs) torque following the proper tightening sequence.

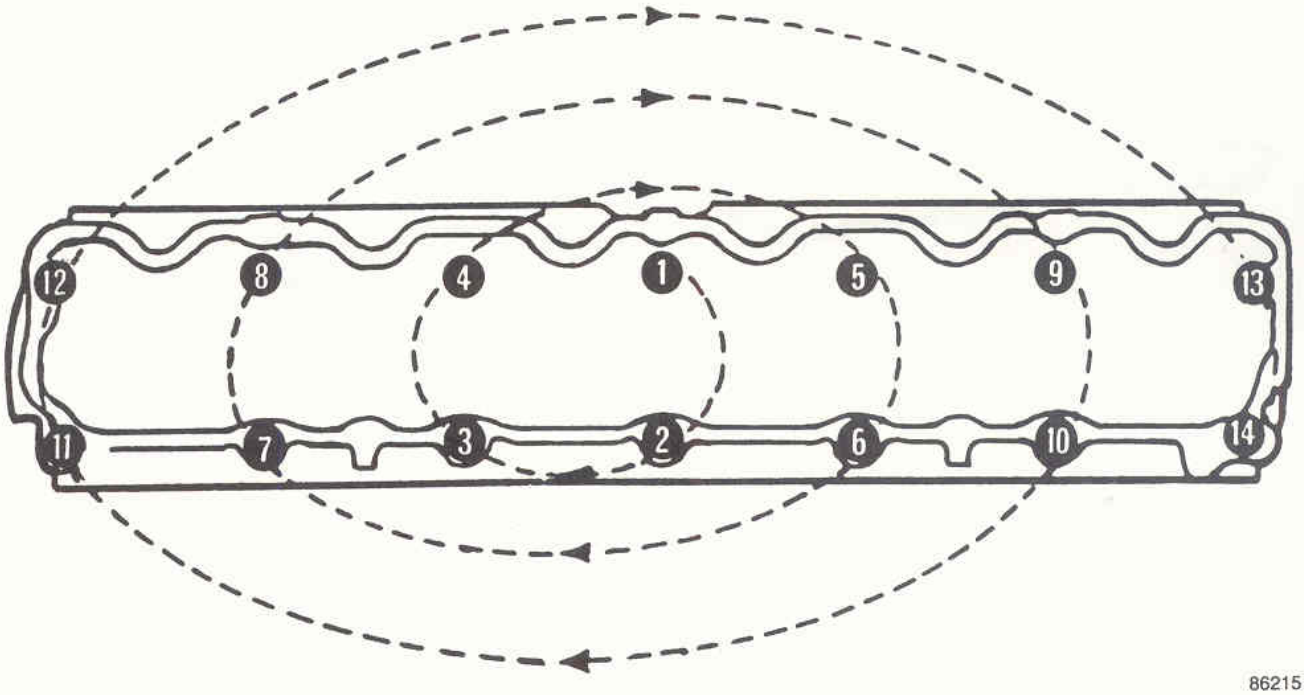
NOTE: Coat the threads of the stud bolt in the number 11 sequence position with Loctite 592 sealer, or equivalent, and tighten to 102 N·m (75 ft-lbs) torque.

Install the spark plugs.

Tighten to 38 N·m (28 ft-lbs) torque.

SEE I.S. NOTES

Cylinder Head Bolt Tightening Sequence



86215

Install the push rods (A) in the original holes.

Be sure the bottom end of each push rod is centered in the tappet plunger cap seat.

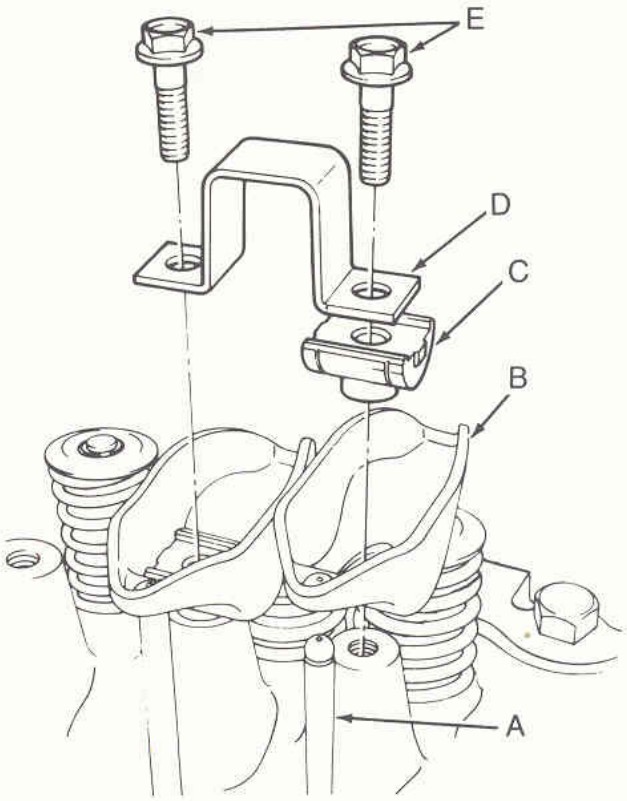
SEE I.S. NOTES

Install the rocker arms (B), pivots (C) and bridge (D) above each cylinder from where they were originally removed.

Loosely install the capscrews (E) through each bridge.

At each bridge, tighten the capscrews alternately, one turn at a time, to avoid damaging the bridge.

Tighten to 26 N·m (19 ft-lbs) torque.



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CYLINDER HEAD COVER INSTALLATION

A room temperature, vulcanizing (RTV) silicone rubber sealant is required for this procedure. Use AMC Gasket-in-a-Tube, or equivalent.

Remove the sealant (or gasket and adhesive) from the sealing surface area of the cylinder head and cover.

Thoroughly clean the sealing surface of the cylinder head and cover.

Apply a 3 mm (.125 in.) bead of RTV sealant along the entire length of the cylinder head sealing surface.

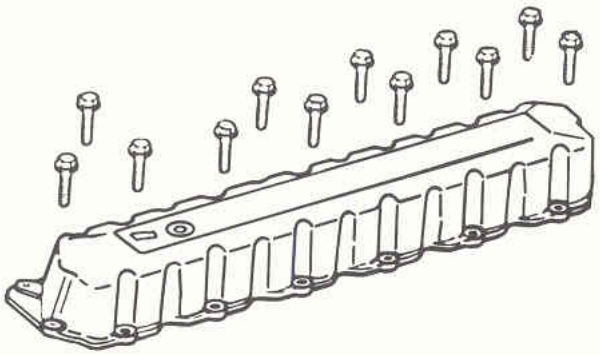
Before the sealant begins to cure, install the cover on the cylinder head. Do not allow the sealant to come into contact with the rocker arms or other valve assembly components.

Install the cylinder head cover retaining nuts and tighten the nuts to 3.2 N·m (28 in-lbs) torque.

NOTE: Some 1986 4.2L and all 4.0L engines utilize a valve cover that has a pre-cured sealer on the cover. Install the valve cover onto the cylinder head and torque retaining bolts to 50 - 70 in-lbs.

SEE I.S. NOTES

4.0L



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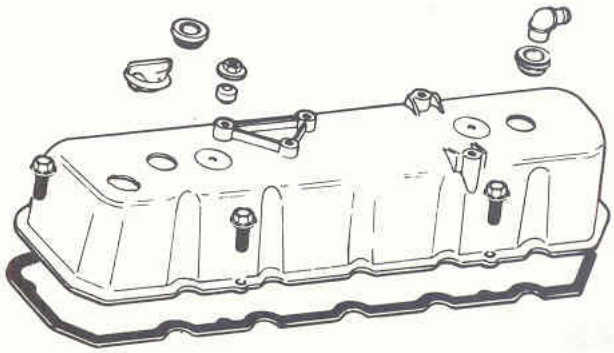
4.2L



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SEE I.S. NOTES

INTAKE MANIFOLD INSTALLATION

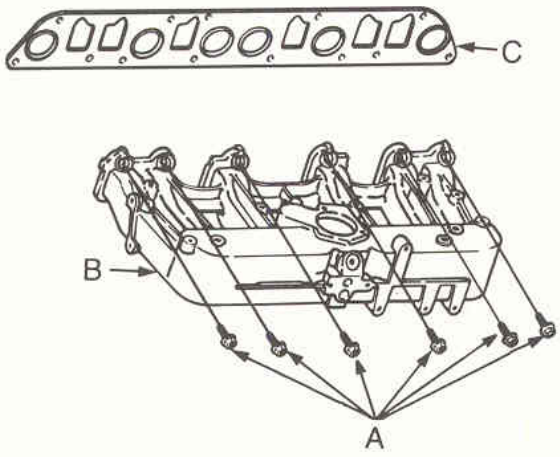
Attach a new intake manifold gasket (C).

Install the intake manifold (B).

Tighten the intake and exhaust manifold bolts in proper sequence to 31 N·m (23 ft-lbs) torque.

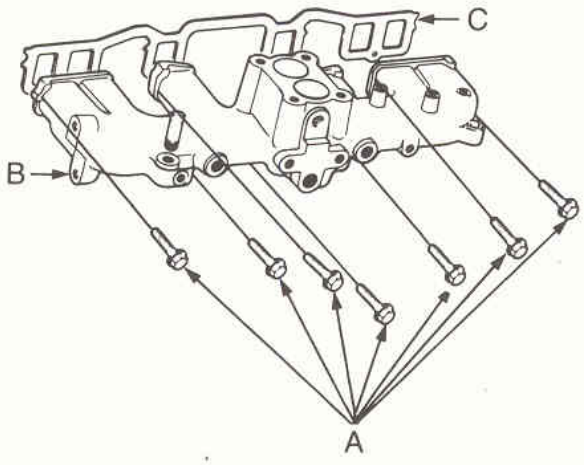
Connect EGR tube.

4.0L



101935A

4.2L

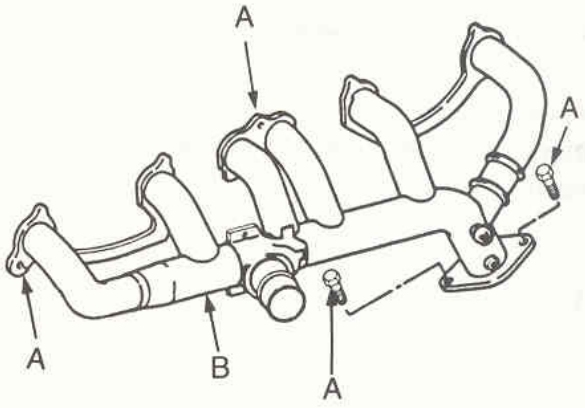


101935B

EXHAUST MANIFOLD INSTALLATION

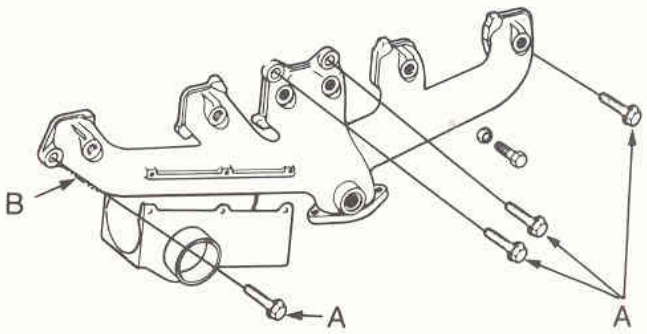
Install the exhaust manifold (A) and finger-tighten the center retaining bolts (B).

4.0L



101935D

4.2L



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