7.3 Liter Engine Specifications

Engine Specifications	English			Metric		
Engine Models	A-130, A-155 and A-170					
Number of Cylinders	8					
Configuration	Vee					
Bore	4.11 inch			104.39 mm		
Stroke	4.180 inch			106.20 mm		
Displacement	444 cu. in.			7.3 Liters		
Compression Ratio	21.5:1					
Firing Order	1-2-7-3-4-5-6-8					
Engine Rating	A-130	A-155	A-170	A-130	A-155	A-170
Brake Power @ 2700 RPM	130 BHP					
Brake Power @ 3000 RPM		155 BHP	170 BHP	97 KW	115.6 KW	126.7 KW
Peak Torque @ 1600 RPM	272 lb.ft.	304 lb.ft.	332 lb.ft.	368 N•m	412 N•m	450 N•m
Low Idle (No Load)#	675 RPM					
Governor Speed (No Load)	2950 3170 RPM	3250 - 3470 RPM				
Governor Speed (Full Load Rated)	2700 RPM	3000 RPM				
Timing (Static)	Align Marks @ 10:00 position					
Valve Tappet Clearance	0 (Valve Lash)					
Engine Lube Oil Pressure (Engine at Operating Temperature) Low Idle, Minimum High Idle	 10 psi 40 - 70 psi			 69 kPa 276 - 482 kPa		
Maximum Exhaust Restriction	41 inches H_2O			10.1 kPa		
Maximum Intake Restriction	25 inches H_2O			6.0 kPa		
Crankcase Capacity (without Filter)	15 quarts			14.2 Liters		
Crankcase Capacity (with Filter)	16 quarts			15.1 Liters		
Thermostat Opening Temperature	192° F			89° C		

Manual transmission in Neutral position.
Automatic transmission in Drive position.

SERVICE MANUAL
COMPONENT SPECIFICATIONS

EXHAUST VALVES:

Stem Diameter ..... 0.37165–0.37235 in. (9.4399–9.4577 mm)
Stem to Guide Clearance (Max. Allowable Before Replacement) ..... 0.0055 in. (0.140 mm)
Face to Stem Run–Out (T.I.R. Max.) ..... 0.0015 in. (0.0381 mm)
Valve Face Angle ..... 37.5°
Valve Face Margin (Min.) ..... 0.053" (1.35 mm)

INTAKE VALVES:

Stem Diameter ..... 0.37165–0.37235 in. (9.4399–9.4577 mm)
Stem to Guide Clearance (Max. Allowable Before Replacement) ..... 0.0055 in. (0.140 mm)
Face to Stem Run–Out (T.I.R. Max.) ..... 0.0015 in. (0.0381 mm)
Valve Face Angle ..... 30°
Valve Face Margin (Min.) ..... 0.112 in. (2.84 mm)

CYLINDER HEADS:

Bore Diameter in Cylinder Head
Valve Guide Insert (Service) ..... 0.6234–0.6244 in. (15.834–15.859 mm)
Valve Guide O.D. (Service) ..... 0.6248–0.6252 in. (15.87–15.88 mm)
Inside Diameter of Valve Guide Inserts (Service) ..... 0.3736–0.3746 in. (9.489–9.514 mm)
Valve Guide Bore Finish (Micro inches) 63–93
Valve Guide Bore Run–Out ..... 0.002 in. (0.05 mm)
Valve Guide Taper (Max.) ..... 0.005 in. (0.127 mm)
Valve Guide Length (Service) ..... 2.600 in. (66.04 mm)
Valve Seat Width (Int. & Exh.) ..... 0.065–0.095 in. (1.651–2.413 mm)
Valve Seat Angle (Int.) ..... 30°
Valve Seat Angle (Exh.) ..... 37.5°
Valve Seat Run–Out (T.I.R. Max.) ..... 0.002 in. (0.05 mm)
Valve Seat Insert O.D. (Exhaust Only) ..... 1.6671–1.6681 in. (42.34–42.37 mm)
Valve Seat Insert I.D. (Exhaust Only) ..... 1.366–1.376 in. (34.696–34.950 mm)
Valve Seat Insert Counterbore Diameter – Cylinder Head ... 1.6645–1.6655 in. (42.28–42.30 mm)
Gasket Surface Flatness ... 0.003 in. (0.0762 mm) in 6 inches; 0.006 inches (0.1524 mm) overall
Gasket Surface Finish (Micro inches) 63–125
Deck to Deck Dimension (Head Thickness Overall) ..... 4.795–4.805 in. (121.793–122.047 mm)
Pre–Combustion Chamber Insert
Recession/Protrusion ..... –0.0025 in./+0.0025 in. (–0.064 mm/+0.064 mm)

Valve Head Recession Relative to Deck (Head Gasket) Surface on Cylinder Head:

Intake ..... 0.042–0.054 in. (1.06–1.37 mm)
Exhaust ..... 0.051–0.063 in. (1.29–1.60 mm)

Valve Springs: [Serviced only as an assembly (P/N 317 365 C11)]
Valve Spring w/Damper
Free Length ..... 2.075"±.150" (52.705 mm ±3.8 mm)
Test Length ..... 1.397" (35.48 mm)
Test Load ..... 200 lbs. ± 8 lbs.

CAMSHAFT

Bearing Journal Diameter (All Journals) ..... 2.0900"–2.1000" (53.31–53.34 mm)
Bearing (Bushing) Diameter ..... 2.1015"–2.1025" (53.37–53.40 mm)
Journal/Bushing Running Clearance ..... 0.0015"–0.0035" (0.038–0.089 mm)
Shaft End Play ..... 0.002"–0.009" (0.025–0.228 mm)
Timing Gear Backlash ..... 0.0015"–0.013" (0.038–0.330 mm)
Lobe Surface Finish ..... 12 RMS
Maximum Permissible Cam Lobe Wear ..... 0.020" (0.51 mm)
Journal Surface Finish ..... 16 RMS
Lobe Taper ..... .0002" (0.005 mm)
Camshaft Thrust Flange Thickness ..... 0.4305"–0.4355" (10.93–11.06 mm)
Camshaft Lift
  Intake ..... 0.2535" (6.44 mm) Max.
  Exhaust ..... 0.25308" (6.43 mm) Max.
Valve Timing No. 1 Cylinder (Top of Ramp)
  Intake Open ..... 17.2° BTDC
    Closed ..... 42.8° ABDC
  Exhaust Open ..... 51.2° BBDC
    Closed ..... 20.8° ATDC

HYDRAULIC VALVE LIFTERS

Diameter ..... 0.9209"–0.9217" (23.391–23.411 mm)
Bore Diameter in Block ..... 0.9228"–0.9243" (23.439–23/477 mm)
Clearance in Bore ..... 0.0011"–0.0034" (0.027–0.086 mm)
Bleed-down Rate ..... 20–110 Sec. for 0.125" Travel*

*Time required for plunger to move 0.125" under 50 lbs load with **test fluid at room temperature.**

Type ..... Roller Follower

PUSH ROD

Run Out (Max. TIR) ..... 0.015" Max.

CONNECTING RODS:

Material ..... I–Beam Section – Steel Forging
Rod Length Center to Center ..... 7.128"–7,132" (181.05–181.15 mm)
Bushing Bore Diameter (Pin End) ..... 1.235"–1.236" (31.37–31.39 mm)
Bushing Bore Finish ..... 63–125 RMS
Piston Pin Bushing I.D ..... 1.1105"–1.1108" (28.20–28.21 mm)
Bearing Bore Diameter (Crankshaft End) ..... 2.6905"–2.6915" (68.34–68.36 mm)
  Maximum Out of Round ..... 0.0005" (0.0127 mm)
  Maximum Taper/Inch ..... 0.0005" (0.0127 mm)
Connecting Rod Bearing I.D ..... 2.5001"–2.5016" (63.50–63.54 mm)
Connecting Rod Bearing Running Clearance ..... 0.0011"–0.0036" (0.0280–0.091 mm)
Connecting Rod Side Clearance ..... 0.012"–0.024" (0.30–0.060 mm)
Connecting Rod Alignment (Max. Total Difference)
  Twist ..... 0.002"/in.(0.0508 mm/in.)
  Bend ..... 0.001"/in. (0.0254 mm/in.)
Weight – Complete rod without Bearing ..... 1140–1156g.
Weight – at pin end (Non–Service Spec.) ..... 328–336g.
Weight – at journal end (Non–Service Spec.) ..... 812–820g.
Surface Finish – Bearing Bore (Crankshaft End) ..... 50–90 RMS
Surface Finish – Installed Bushing (Pin End) ..... 16 RMS

SERVICE MANUAL
COMPONENT SPECIFICATIONS

PISTONS:

Material ..... Aluminum Alloy

Skirt Diameter (Measured 1.23" below oil groove at 90° to the piston pin). Measure only at room temperature 68° F. (20° C)

● Production Piston (See Note)

Class U	4.10325" ± 0.00025" (104.223 mm ± 0.006 mm)
Class B	4.10375" ± 0.00025" (104.235 mm ± 0.006 mm)
Class A	4.10425" ± 0.00025" (104.248 mm ± 0.006 mm)
Class C	4.10475" ± 0.00025" (104.261 mm ± 0.006 mm)
Class D	4.10525" ± 0.00025" (104.273 mm ± 0.006 mm)

● Service Piston

Standard Size	4.10425" ± 0.00025" (104.247 mm ± 0.006 mm)
.010" Oversize	4.11425" ± 0.0005" (104.502 mm ± 0.013 mm)
.020" Oversize	4.12425" ± 0.0005" (104.756 mm ± 0.013 mm)
.030" Oversize	4.13425" ± 0.0005" (105.010 mm ± 0.013 mm)

NOTE: For corresponding bore diameters and class fit, refer to Section 6, SPECIFICATIONS

Clearance in Cylinder Bore

Cylinder No. 1 thru 6	0.0055"–0.0085" (0.0380–0.216 mm)
Cylinder No. 7 and 8	0.0060"–0.0085" (0.152–0.216 mm)

PISTONS PINS:

Length	2.692"–2.702" (68.38–68.63 mm)
Diameter	1.1099"–1.1101" (28.19–28.20 mm)

Pin Fit @ Room Temperature 20°C (68°F)

● Clearance in Rod	0.0004"–0.0009" (0.010–0.022 mm)
● Clearance in Piston	0.0003"–0.0007" (0.007–0.018 mm)

PISTON RINGS:

Ring Diameter (Standard)

Top	4.11" (104.39 mm)
2nd	4.11" (104.39 mm)
Oil Control	4.11" (104.39 mm)

Fit in Groove (Side Clearance) [Engine S/N 598753 and Below]

Top	0.002"–0.004" (0.05–0.10 mm)
2nd	0.002"–0.004" (0.05–0.10 mm)
Oil Control	0.001"–0.003" (0.02–0.07 mm)

Fit in Groove (Side Clearance) [Engine S/N 598754 and Above]

Top	0.002"–0.004" (0.05–0.10 mm)
2nd	0.003"–0.005" (0.07–0.12 mm)
Oil Control	0.001"–0.003" (0.02–0.07 mm)

Ring Gap in Bore [Engine S/N 598753 and Below]

Top	0.013"–0.045" (0.33–1.14 mm)
2nd	0.060"–0.085" (1.52–2.16 mm)
Oil Control	0.008"–0.030" (0.20–0.76 mm)

Ring Gap in Bore [Engine S/N 598754 and Above]

Top	0.013"–0.023" (0.33–0.58 mm)
2nd	0.062"–0.072" (1.57–1.83 mm)
Oil Control	0.010"–0.020" (0.25–0.51 mm)

CRANKSHAFT:

Type	Steel Forging, Induction Hardened, Grindable
Main Bearing Journal Diameter	
• Standard Size	3.1228"–3.1236" (79.319–79.340 mm)
• .010" Undersize	3.1128"–3.1136" (79.065–79.085 mm)
• .020" Undersize	3.1028"–3.1036" (78.811–78.831 mm)
• .030" Undersize	3.0928"–3.0936" (78.557–78.577 mm)
Main Bearing Journal Max. Out–of–Round	0.0002" (0.005 mm)
Main Bearing Thrust Face Runout (TIR Max.)	0.001" (0.03 mm)
Main Bearing Journal Taper (Max./In.)	0.0005" (0.013 mm)
Main Journal Fillet Radius	0.121"–0.127" (3.07–3.22 mm)
Rod Journal Fillet Radius	0.120" (3.048 mm)
Oil Seal Journal Runout (Max.)	0.002" (0.05 mm)
Damper Mounting Area Runout (Max.)	0.001" (0.03 mm)
Flywheel Mounting Surface Runout (Max.)	0.002" (0.05 mm)
Number of Main Bearings	5
Thrust Taken By	Intermediate
Thrust Bearing Journal Length	1.1325"–1.1355" (28.766–28.841 mm)
Main Bearing I.D. (Installed)	3.1254"–3.1274" (79.385–79.436 mm)
Main Bearing to Crankshaft Clearance	0.0018"–0.0046" (0.046–0.117 mm)
Main and Rod Bearing Journal Finish	5–20 RMS
Main Bearing Thrust Face Finish	5–20 RMS
Connecting Rod Journal Diameter	
• Standard Size	2.498"–2.499" (63.45–63.47 mm)
• .010" Undersize	2.488"–2.489" (63.20–63.22 mm)
• .020" Undersize	2.478"–2.479" (62.94–62.96 mm)
• .030" Undersize	2.468"–2.469" (62.69–62.71 mm)
Connecting Rod Journal Max. Out–of–Round	0.0003" (0.008 mm)
Connecting Rod Journal Taper (Max./In.)	0.0005" (0.013 mm)
Connecting Rod Bearing to Crankshaft Running Clearance	0.0011"–0.0036" (0.028–0.091 mm)
Crankshaft Flange O.D.	3.748"–3.752" (95.199–95.300 mm)
Crankshaft End Play	0.0025"–0.0085" (0.063–0.215 mm)
Crankshaft End Play Max. Wear Limit	0.012" (0.304 mm)
Rod to Crankshaft Side Clearance	0.012"–0.024" (0.304–0.609 mm)
Crankshaft Straightness	0.002" (0.051 mm)
Crankshaft Gear Backlash	0.0015"–0.012" (0.038–0.30 mm)
Flywheel Runout	0.008" (0.20 mm)
Flywheel Concentricity	0.008" (0.20 mm)

CRANKCASE:

Crankcase Deck Flatness	0.003" (0.076 mm) Overall
Crankcase Deck Finish (Micro Inches)	63–125
Crankcase Main Bearing Bore Diameter	3.3152"–3.3162" (84.21–84.23 mm)
Crankcase Cam Bearing Bore Diameter	2.2305"–2.2320" (56.65–56.69 mm)
Valve Lifter Bore Diameter	0.9228"–0.9243" (23.44–23.48 mm)
Valve Lifter O.D.	0.9209"–0.9217" (23.39–23.41 mm)
Oil Jet Tube Bore Diameter (Spray Hole Dia.)	0.052" (1.37 mm)
Cylinder Bore Diameter	
• Cylinder 1 thru 6	4.1095"–4.1115" (104.38–104.43 mm)
• Cylinder 7 and 8 Only	4.1100"–4.1120" (104.39–104.44 mm)
Cylinder Bore Taper (Top to Bottom)	0.003" Max.
Cylinder Bore Maximum Out–of–Round	0.002"
Cylinder Bore Surface Finish	15–30 RMS
Centerline of Main Bearing Bore to Head Deck	11.137"–11.141" (282.88–282.98 mm)

SERVICE MANUAL
COMPONENT SPECIFICATIONS

CRANKCASE: – Continued

Oil Seals (Front and Rear Seal Face Runout)
(with Plates Installed on Engine) ..... 0.015" T.I.R. Max. (0.381 mm)

Main Bearings
Type ..... Precision Replaceable
Material ..... Steel Backed Copper/Lead
Thrust Taken By ..... No. 3 Main
Cap Attachment ..... 4 Bolts per Cap

Rear Plate Seal Bore Concentricity (T.I.R.) ..... 0.020" (0.05 mm)

THERMOSTAT
Type ..... Poppet Valve, Pellet operated

	Start to Open Temp. (Deg. F)	Full Open Temp. (Deg. F)
Operating Temperature Range	192° $^{+0°}_{-7°}$	212°

WATER PUMP

Type ..... Centrifugal, Prelubricated
Drive/Ratio V–Belt/1.08:1
Bearing No–Type ..... 1– Sealed, Unitized
Capacity (gpm @ engine rpm) ..... 70 @ 3000

LUBRICATING OIL PUMP:
Type ..... Gear Pump, Gear Driven
Location ..... Inside Oil Pan
Capacity (gpm @ rpm) ..... 18.2 @ 3000
Gear Drive Ratio 1.06:1
Gear Backlash ..... 0.0056–0.010" (0.142–0.254 mm)
End Play ..... 0.0025"–0.0065" (0.0635–0. 1651 mm)
Engine Lube Oil Pressure
(Engine at Operating Temperature) ..... 10 psi (69 kPa) min. @ 700 RPM
40–70 psi (276–482 kPa) @ Governor Speed RPM (No Load)

ENGINE OIL CAPACITY:
(Without Filter) ..... 15 Qts. (14.2 L)
(With Filter) ..... 16 Qts. (15.1 L)

OIL COOLER:
Type ..... Full–Flow, Cylinderical Tube and Fin Bundle
Location ..... Left Side of Engine

OIL FILTER:
Type ..... Spin–On, Full Flow – Disposable
Location ..... Left Side, Oil Cooler Mounted
Fiiter By–Pass Location ..... In Oil Filter Header

BY-PASS VALVE SPRING: (NOT SERVICED)

Free Length	1.767 in. (44.88 mm)
Test Length	0.820 in. (20.83 mm)
Test Load	3.93 lbs. (17.5N)

PRESSURE REGULATING VALVE SPRING: (NOT SERVICED)

Free Length	1.547" (39.29 mm)
Test Length	0.915" (23.24 mm)
Test Load	5.82 ±.29 lbs (25.89 ±1.29 mm)

PRESSURE REGULATING VALVE: (NOT SERVICED)

Location	Oil Filter Header (After the oil cooler and before the oil filter)
Setting	50 psi (344.7 kPa)

INJECTION PUMPS

Model	Stanadyne DB-2
Drive	Gear - Steel Forging
Static Timing	Marks Aligned
Minimum Voltage to Pump	9 Volts

NOZZLES

Type	Pintle
Size	17 mm
Actuation	High Pressure Fuel from Fuel Injection Pump
Pintle Hole:	
Number	1
Hole Diameter	0.039 in. (1.0 mm)
Valve Seat Angle	60°
Valve Opening Pressure (VOP)	
New	1875±75 psi (12,928±517 kPa)
Min. VOP before Replacement	1425 psi (9825 kPa)

FUEL SUPPLY PUMP

Type	Mechanical Diaphragm

FUEL FILTER

Type	Spin-On

GLOW PLUGS

Location	Cylinder Head
Quantity	8
Thread Size	M10 X 1 (SAE J5480)

SERVICE MANUAL
ENGINE ACCESSORIES

ACCESSORIES

Your engine may be equipped with the following accessories that must be removed prior to mounting the engine on the overhaul stand.

FREON COMPRESSOR
ALTERNATOR
POWER STEERING PUMP
AIR COMPRESSOR

When reinstalling any accessory, provide special attention to the alignment and tension of the drive belt. Correct installation will prevent vehicle downtime and promote customer satisfaction.

New drive belts as well as reinstalled belts experience a break-in period. This break-in period causes a loss in tension during "groove-seating". Allow a newly installed belt to run 5 minutes (this is the break-in period). After 5 minutes running time, check belt tension as illustrated in **Figure 1** using a scale and straightedge.

Approximately 1/2"-3/4" (13 to 19 mm) deflection should be measured. The deflection measurement should be made between the longest belt span.

Belt and Pulley Replacement

Replace belts if they are:

a. Worn
b. Cracked
c. Grease Soaked
d. Oil Soaked

Replace pulleys if worn. Clean if still suitable for service.

FAN AND ALTERNATOR BELT ADJUSTMENT

Fan and Alternator Belt Adjustment:

1. Loosen alternator lock bolt and move alternator to increase or decrease belt tension.
2. After adjustment, tighten lock bolt and recheck belt tension.

WARNING

DO NOT PLACE HEAD, BODY, FEET, FINGERS OR HANDS NEAR A ROTATING FAN, BELT OR POWER DRIVEN PART. DO NOT CHECK OR ADJUST BELTS WHEN ENGINE IS RUNNING.

Figure 1. Checking Tension by Deflection Method

Belt Replacement Guidelines

1. During belt assembly, do not force belt(s) into pulley grooves by prying with a screwdriver, pry bar, etc. This will damage belt side cords which will cause belt(s) to turn over in pulley grooves and result in complete destruction of belt(s) during operation.
2. Do not use belt dressing on belt(s).
3. Always check condition of remaining belt(s).
4. In a dual-belt drive, always replace with a matched set of belts.
5. When replacing belt(s) and pulley, pulley alignment must be checked under tensioned condition (brackets securely clamped). A misalignment that can be detected by visual inspection is detrimental to belt(s) performance.
6. If belt(s) is disturbed for any reason, it must be tensioned to the correct tension.

IMPORTANT

OPERATING ENGINE WITH BELOW MINIMUM TENSION WILL RESULT IN BELT AND GROOVE DETERIORATION, BELT ROLL OR BELT ESCAPE.

GENERAL TORQUE GUIDELINES

Many conditions affect torque and the results of torque applications. The major purpose in tightening a fastener to a specified torque is to obtain tension in the fastener (i.e., bolt, nut, etc.), which in turn develops a clamping load which exceeds any possible loading imposed on parts due to engine RPM or vibration.

Tension Values for Standard Fasteners

The "Standard Nut and Bolt Torque Chart" provides tightening torque for general purpose applications using original equipment standard hardware as listed in the Parts Catalog for the application involved. **DO NOT SUBSTITUTE.** Original equipment standard hardware is defined as Type 8, coarse thread bolts and nuts and thru hardened flat washers (Rockwell "C" 38–45), all phosphate coated and assembled without supplemental lubrication (as received condition). **NOTE: Phosphate coating is a dry lubricant.**

Fastener Thread Condition

Threads that are dry, excessively rough, battered or filled with dirt require considerable effort just to rotate. Then when the clamping load is developed or the bolt tension is applied, the torque reading mounts rapidly (due to thread friction) to the specified torque value. However, the desired bolt tension and maximum clamping effect is not achieved. This condition can lead to failure of the fastener to maintain component integrity. The proper bolt tension and clamping effect can never be attained if the fastener is dry. The fastener threads must have a film of clean lubricant (engine oil) to be considered lubricated.

STANDARD NUT AND BOLT TORQUE CHART

Nominal Thread Diameter	Standard Torque± 10%	
	lbf-ft	N•m
1/4	7	10
5/16	14	19
3/8	24	32
7/16	38	51
1/2	60	80
9/16	80	110
5/8	115	155
3/4	200	270
7/8	320	440
1	480	650
1-1/8	590	800
1-1/4	830	1100
1-3/8	1100	1500
1-1/2	1400	1900
1-3/4	2300	3100
2	3400	4600

SERVICE MANUAL
TORQUE DATA

SPECIAL NUT AND BOLT TORQUE DATA*

	lbf-ft.	N•m
Air Cleaner Stud Adapter (See Note 1)	45	61
Camshaft Screw	15	20
Connecting Rod Nut (See Note 2)	51	69
Crankshaft Vibration Damper Bolt	90	122
Cylinder Head Bolt (See Note 3)	100	135
Exhaust Manifold bolt (with Metal Prevailing Torque 8olt) (See Note 4)	35	47
Flywheel Mounting Bolt	47	64
Front Engine Mounting Bolt	70	95
Fuel Filter Assembly – Threaded Insert	50	68
Fuel Filter Assembly Vent/Valve Assembly	3–5 lbf–in.	0.5
Glow Plug	12	16
Injection Line Pressure Sensor	28	38
Injection Nozzle	35	47
Injection Nozzle Cap Nut	33	45
Injection Pump Gear Cover Bolt (See Note 1)	14	19
Injection Pump Gear Mounting Bolt	25	34
Intake Manifold Bolt (See Note 5)	24	33
Intake Manifold Gasket Drain Plug	40	54
Main Bearing Cap Bolt (See Note 6)	95	129
Nut, Injection Pipe	22	30
Oil Pan Drain Plug	28	37
Valve Cover Bolt (See Note 7)	6	8
Valve Lever Post Bolt (See Note 8)	20	27
Water Outlet Elbow Mounting Bolt	20	27
Water Pump Mounting Bolts (See Note 9)	14	19

*Unless otherwise specified, torque values are with threads and washer faces coated with clean engine oil.

NOTE 1 – Apply general purpose Lock N' Seal™ (P/N 577 588 C1) to all threads of bolts prior to assembly.

NOTE 2 – Tighten both connecting rod nuts to 38 lbf–ft. (51 N•m) before final torque is applied.

NOTE 3 – Cylinder head bolts to be torqued in steps as specified in **Figure 2.**

NOTE 4 – Apply "Never Seez" compound (P/N 634 227 C1) to threads of bolts prior to assembly, then torque in steps as specified in **Figure 4.**

NOTE 5 – Intake manifold bolt to be torqued in steps as specified in **Figure 5.**

NOTE 6 – Tighten four main bearing cap bolts to 75 lbf–ft. (102 N•m) before final torque is applied.

NOTE 7 – Valve cover screws to be torqued in sequence as specified in **Figure 3.**

NOTE 8 – Rotate engine until timing mark (notch) on vibration damper is approximately 20° before vertical position as viewed from the front of the engine, approximately 11:00 so valves cannot contact the piston. Refer to **Figure 7.** Tighten each pair of bolts evenly. Refer to **Figure 8.**

NOTE 9 – Clean bolts thoroughly. Apply liquid gasket (P/N 446 839 C1) to designated bolts (refer to **Figure 6**) only.

SPECIAL NUT & BOLT TORQUE DATA:

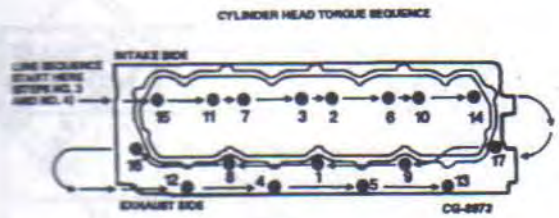

Figure 2. Cylinder Head Bolts

HEAD BOLTS

STEP 1. 65 lbf–ft. (88 N•m)*
STEP 2. 85 lbf–ft. (115 N•m)*
STEP 3. 100 lbf–ft. (135 N•m)**
STEP 4. Repeat Step 3.

*Tighten bolts in numbered sequence, **Figure 2.**
Tighten bolts in line sequence, **Figure 2.

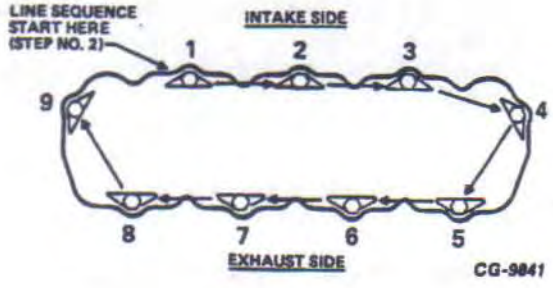

Figure 3. Valve Cover Torque Sequence

Install and tighten bolts to 6 lbf–ft. (8 N•m) in line sequence shown in **Figure 3.**

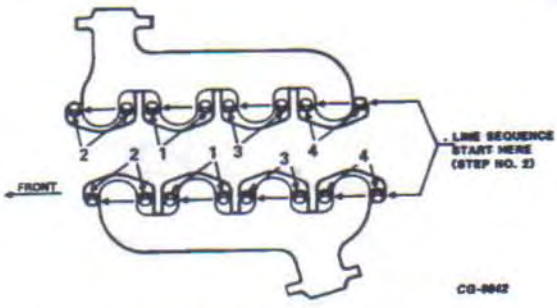

Figure 4. Exhaust Manifold Bolt Torque Sequence

STEP 1. Tighten bolts to 35 lbf–ft. (47 N•m) in numbered sequence (Figure 4).
STEP 2. Tighten bolts to 35 lbf–ft. (47 N•m) in line sequence (Figure 4).

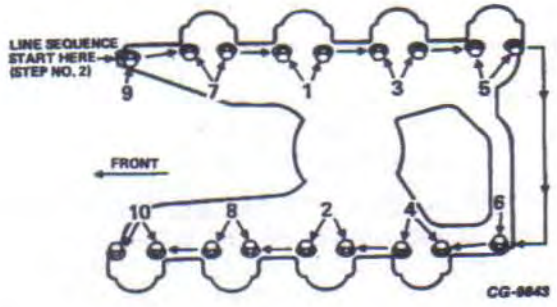

Figure 5. Intake Manifold Bolt Torque Sequence

NOTE: For ease of installation start corner bolts No. 9 and No. 6 by hand prior to performing Steps 1 and 2.

STEP 1. Tighten bolts to 24 lbf–ft. (33 N•m) in numbered sequence as shown in Figure 5.
STEP 2. Tighten bolts to 24 lbf.ft. (33 N•m) in line sequence as shown in Figure 5.

SPECIAL NUT & BOLT TOROUE DATA: –

Continued

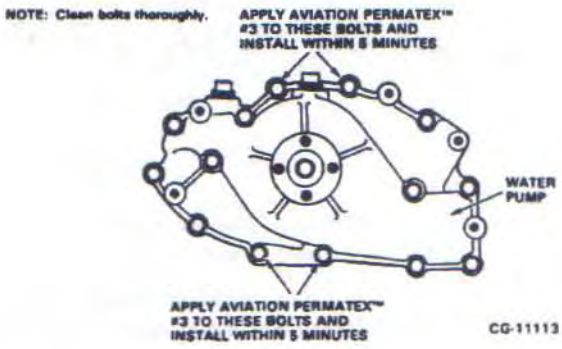

Figure 6. Water Pump Mounting Bolts

IMPORTANT
(Refer to Figure 7)

STEP 1 – ROTATE ENGINE UNTIL TIMING MARK (NOTCH) ON VIBRATION DAMPER IS AT 11:00 (20° BEFORE VERTICAL). THIS POSITIONS ALL PISTONS BELOW TDC SO THE VALVES DO NOT CONTACT THE PISTONS WHEN TIGHTENING THE VALVE LEVER ASSEMBLIES.

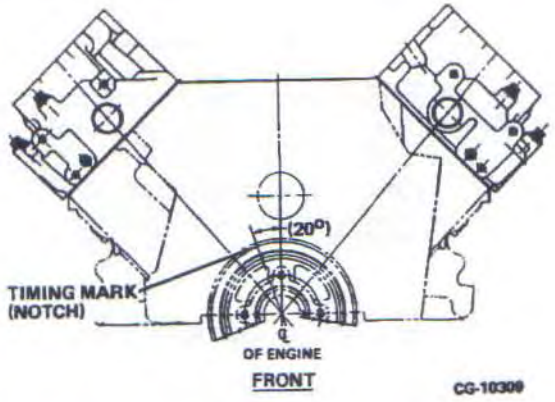

Figure 7. Engine Crankshaft Vibration Damper Timing Mark Positioned at 11:00 (20° from vertical) for Valve Lever Post Bolt Torque (Damper Behind Pulley)

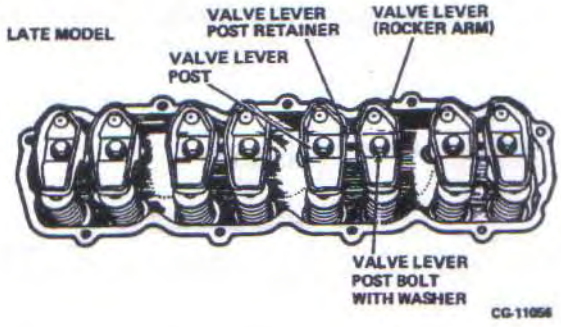

Figure 8. Valve Lever (Rocker Arm) Assembly

STEP 2. Tighten each pair of valve lever post bolts down evenly to 20 lbf-ft (27 N•m).