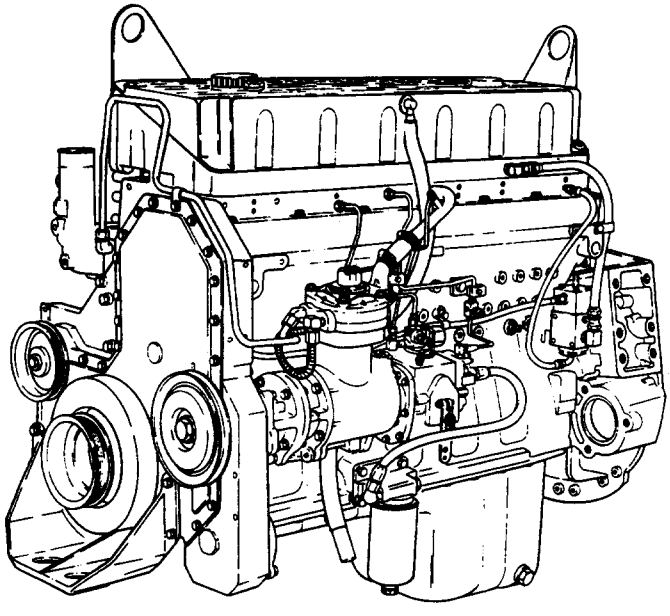
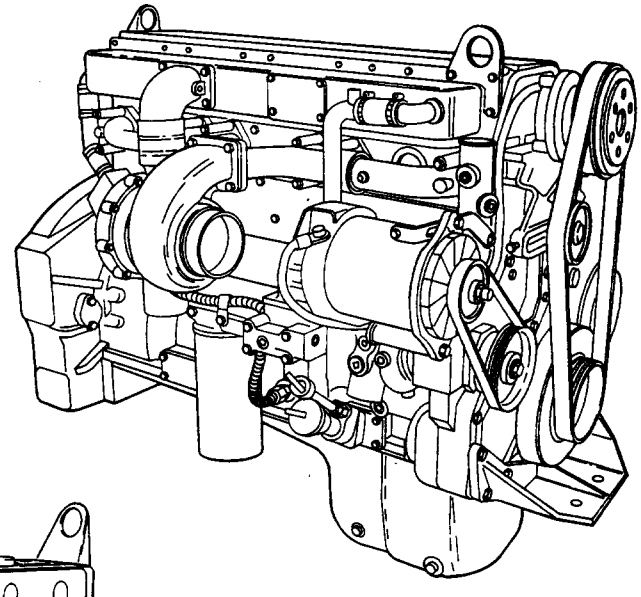
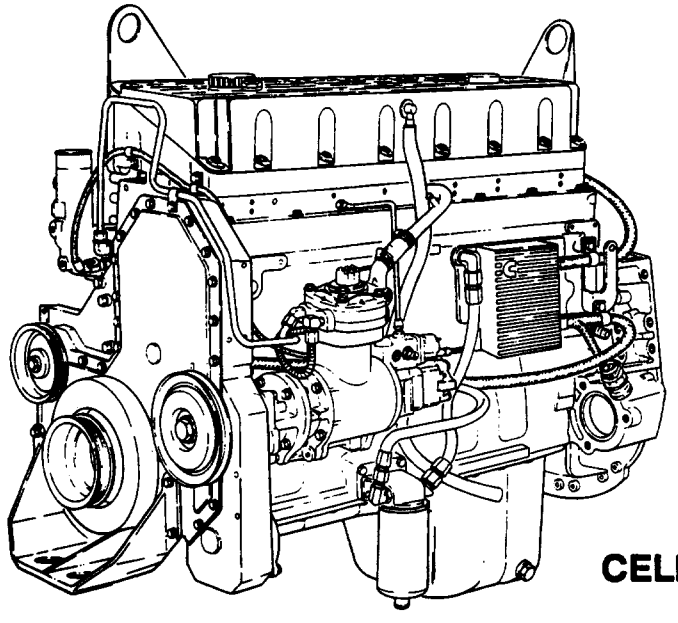
Specification Manual
L10 Series Engines
External Damper Models



STC



Fixed Time



CELECT

Bulletin No. 3810498-02
Printed 12/94

Foreword

This manual contains complete assembly and rebuild specifications for the external damper model L10 engine and all associated components manufactured by Cummins Engine Company, Inc. This manual is intended as a quick reference guide for an experienced technician who is familiar with our product. Various accessory and component suppliers can be contacted directly for any information **not** covered in this manual.

A series of specific service manuals (Troubleshooting and Repair, Shop, Alternative Repair, and so on) are available and can be ordered by filling out and mailing the Literature Order Form located at the end of this manual.

Reporting of errors, omissions, and recommendations for improving this publication by the user is encouraged. Please use the postage paid, self-addressed Literature Survey Form at the end of this manual for communicating your comments.

The specifications in this manual are based on the most current information at the time of publication. Cummins Engine Company, Inc. reserves the right to initiate any changes at any time without obligation. If differences are found between your engine and the information in this manual, contact a Cummins Authorized Repair Location, a Cummins Division Office, or the factory.

The latest technology and the highest quality components are used to manufacture the products of Cummins Engine Company, Inc. When replacement parts are needed, we recommend using only genuine Cummins or ReCon® exchange parts. These parts can be identified by the following trademarks:

Table of Contents

Page

Engine Identification

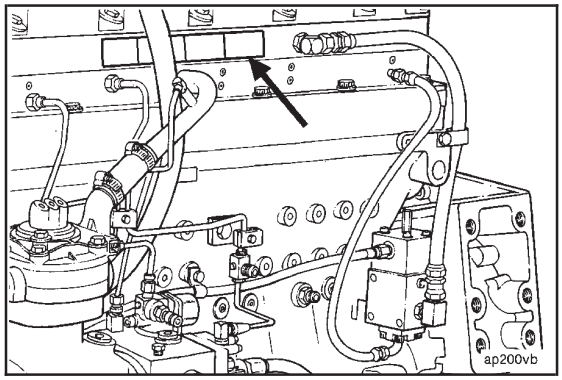
The model name provides the following data:

L 10–310 E

- L — Electronic Fuel System
- 310 — Brake Horsepower
- 10 — Displacement (Liters)
- L — Engine Model Designation

Engine Dataplate

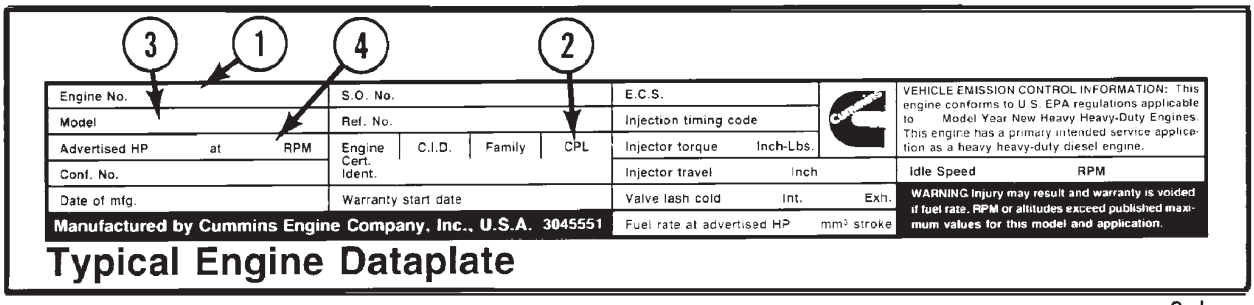
The engine dataplate is located on the fuel pump side of the rocker housing.



The engine dataplate provides model identification as well as other important information about the engine.

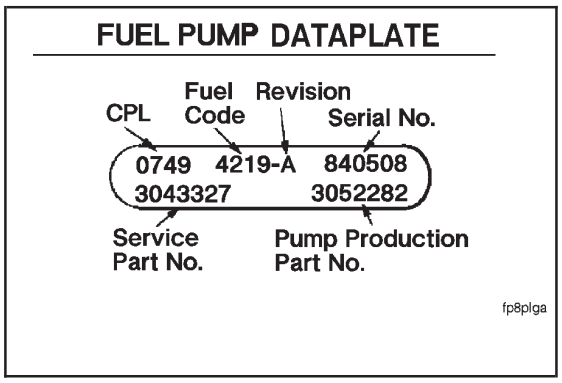
Have the following engine data available when communicating with a Cummins Authorized Repair Location. The information on the dataplate is **mandatory** when sourcing service parts.

1. Engine Serial Number (E.S.N.)
2. Control Parts List (CPL)
3. Model
4. Horsepower and RPM Rating



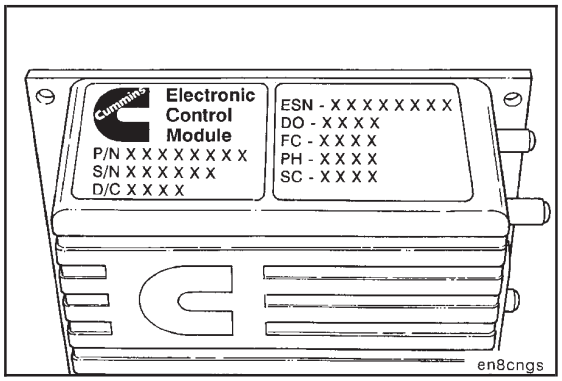
Typical Engine Dataplate

ap8plga



Fuel Pump Dataplate

On STC and Fixed Time engines, the fuel pump dataplate is located on the top of the fuel pump. It provides information for fuel pump calibration.



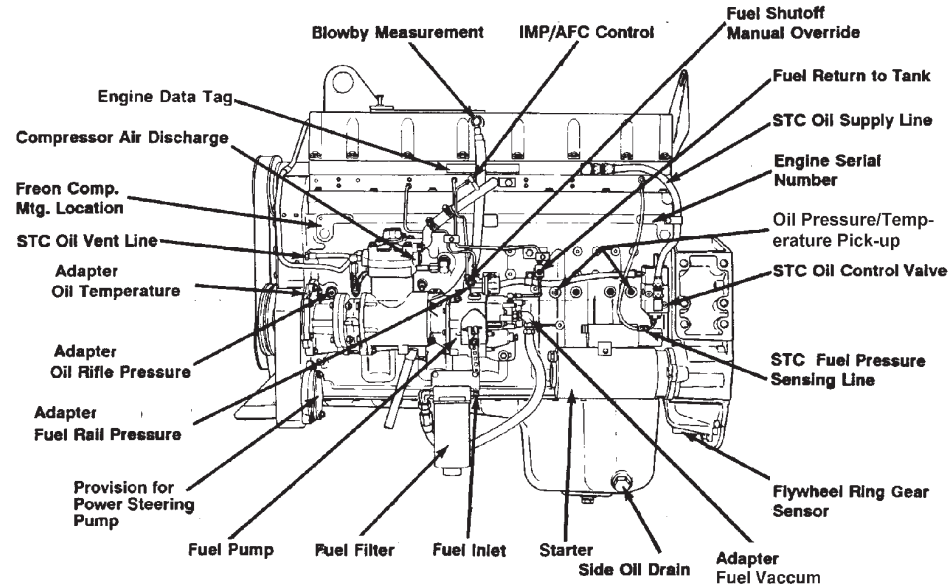
ECM Dataplate(s)

On CELECT™ engines, there are two dataplates on the top of the electronic control module (ECM). The dataplate on the left contains the part number (P/N), serial number (S/N) and the data code (D/C) of the ECM. The dataplate on the right contains the engine calibration information.

Engine Diagrams

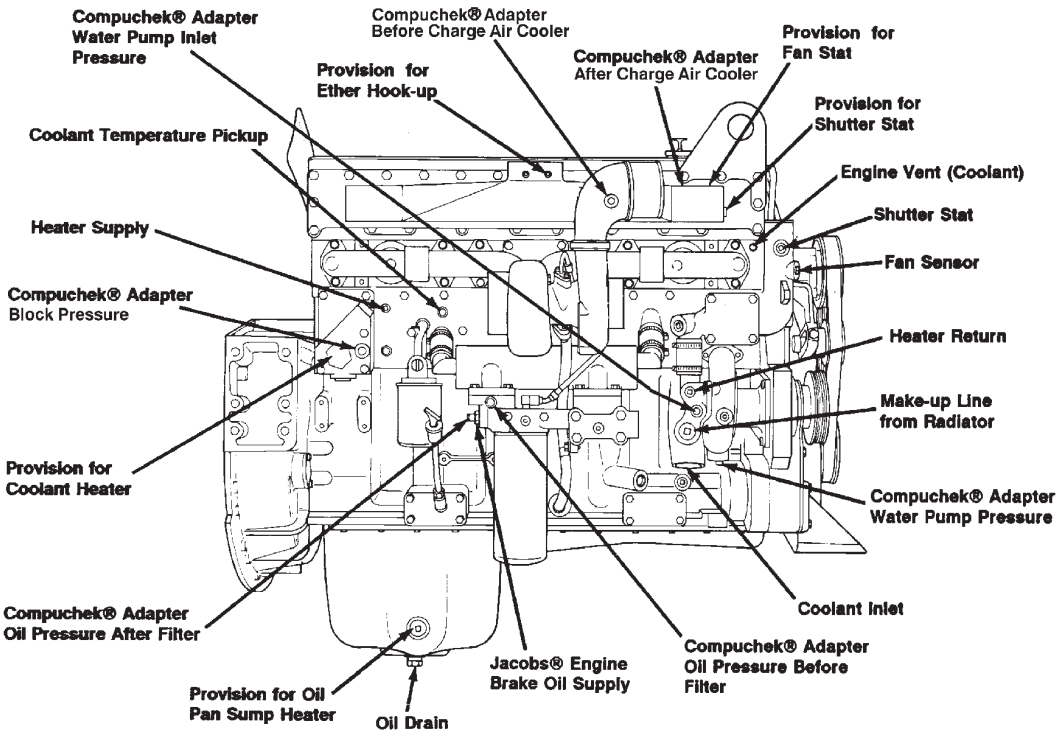
The following illustrations contain information about engine components, filter locations, drain points and access locations for instrumentation and engine controls:

The information and configuration of components shown in these drawings are of a general nature. Some component locations will vary depending on applications and installations.



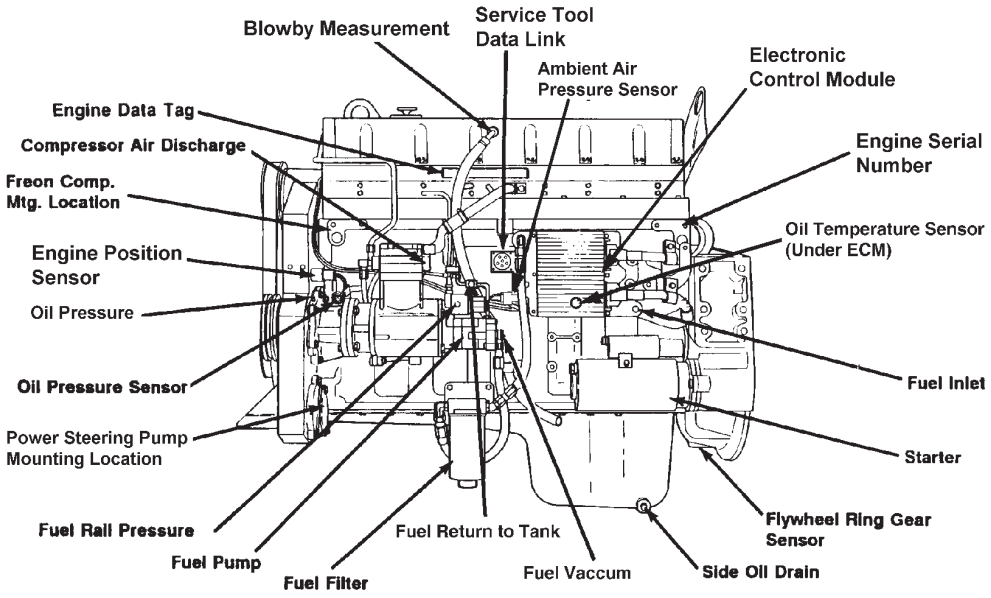
STC Fuel Pump Side

ew200gg

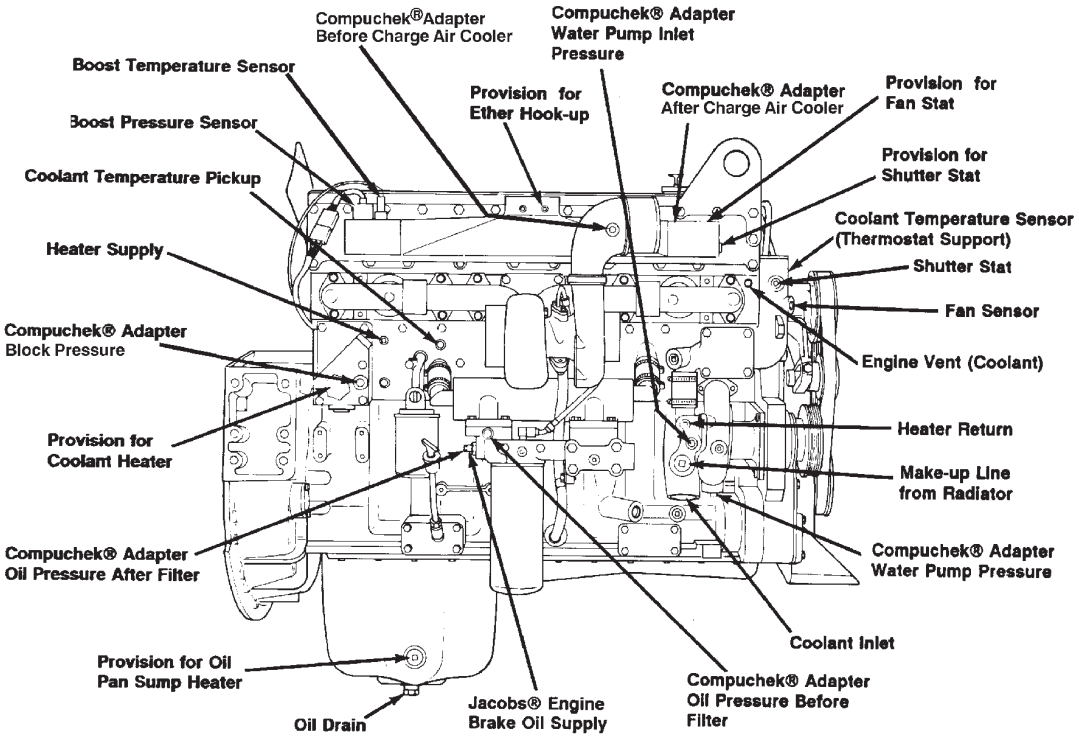


STC Exhaust Side

ew200gh



Fuel Pump Side ew200gi



CELECT™ Exhaust Side ew200gj

Specifications - General Information

The specifications in this manual are organized in the same sequence as the L10 Series Engine Shop Manual, External Damper Models, Bulletin No. 3810476. The **minimum** and **maximum** tolerance limit specifications are listed in both **metric** and **U.S. Customary** dimensions. The metric dimension is given first, followed by the U.S. Customary dimension in brackets; for example: 0.50 mm [0.020 inch]. The assembly and rebuild specifications and torque values are provided to be sure the parts are assembled correctly, fit properly, and are secured with the correct torque value.

Most of the capscrews used to assemble the L10 engine are metric. Some components, such as the air compressor and the fuel pump, are installed using U.S. Customary capscrews. Capscrew torque values are listed in newton metres and foot pounds, unless otherwise specified. If a torque value is **not** listed, use the standard torque value for the capscrew. Refer to the Table of Contents, Capscrew Markings and Torque Values, in this manual.

General Engine Specifications

Metric [U.S. Customary]

General Engine Data

Horsepower (Refer to the engine dataplate)

Engine speed @ Maximum Output:

- Industrial Rating (RPM) 2100
- Standard Rating (RPM) 1800
- Cruise Rating (RPM) 1600

Bore and Stroke ..... 125 mm [4.921 in] X 136 mm [5.354 in]

Displacement ..... 10 liters [611 C.I.D.]

Firing Order 1-5-3-6-2-4

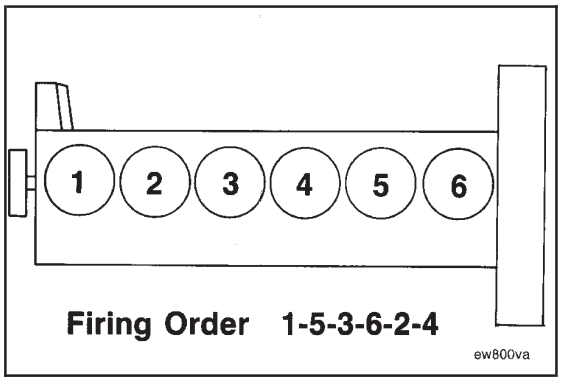
Engine Weight (with Standard Accessories):

Fixed Time
- Dry Weight ..... 884.5 kg [1950 lb]
- Wet Weight ..... 929.8 kg [2050 lb]

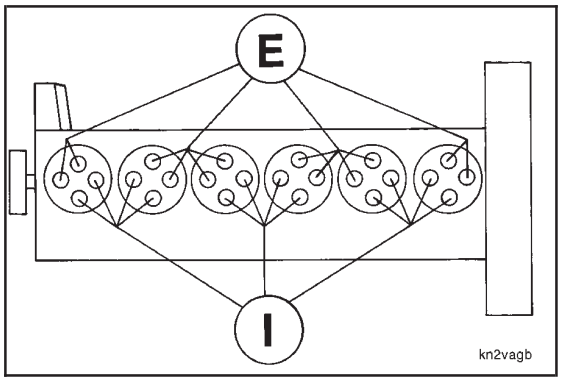
STC
- Dry Weight ..... 891.3 kg [1965 lb]
- Wet Weight ..... 936.6 kg [2065 lb]

CELECT™
- Dry Weight ..... 902.6 Kg [1990 lb]
- Wet Weight ..... 948.0 Kg [2090 lb]

Crankshaft Rotation - (viewed from the front of the engine).....Clockwise



Cylinder Location and Firing Order



Intake and **Exhaust** Valve Locations

Engine Specifications (Continued)

Metric [U.S. Customary]

Air Induction System

Maximum Allowable Intake Restriction with Clean Air Filter Element:

- Heavy Duty Dry Type Cleaner ..... 38 cm H_20 [15 in. H_20]

Maximum Allowable Intake Restriction with Dirty Air Filter Element ..... 64 cm H_20 [25 in. H_20]

Lubricating Oil System

Oil Pressure - Low Idle (Minimum Allowable) ..... 70 kPa [10 psi]

- At 1200 RPM - or Torque Peak (Miminum Allowable) ..... 207 kPa [30 psi]

Oil Capacity of Standard Engine:

- Combination Filter ..... 2.6 liters [0.7 U.S. gallon]
- Oil Pan
  - Automotive (High-Low) ..... 34 to 26.5 liters [9 to 7 U.S. gallon]
  - Industrial (High-Low) ..... 34 to 30.3 liters [9 to 8 U.S. gallon]

Total System Capacity including filter .....38 liters [10 U.S. gallon]

Cooling System

Coolant Capacity (Engine Only) ..... 9.5 liters [10 U.S. quarts]

Standard Modulating Thermostat Range: ..... 82 to 93°C [180 to 200°F]

Minimum Coolant Cylinder Block Pressure (Pressure Cap Removed):

Closed Thermostat - 1800 RPM - No load .....138 kPa [20 psi]

Maximum Coolant Cylinder Block Pressure (Pressure Cap Removed):

Closed Thermostat ..... 275 kPa [40 psi]

Maximum Allowable Operating Temperature ..... 100°C [212°F]

Minimum Recommended Operating Temperature ..... 70°C [158°F]

Minimum Recommended Pressure Cap ..... 50 kPa [7 psi]

Engine Specifications (Continued)

Metric [U.S. Customary]

Exhaust System

Maximum Allowable Back Pressure Created by Piping and Silencer:

- Hg ..... 75 mm [3 inch]
- H_20 ..... 1016 mm [40 inch]

Exhaust Pipe Size (Normally Acceptable Inside Diameter) ..... 102 mm [4 inch]
Fuel System

NOTE: For performance and fuel rate values, refer to the engine data sheet, or the fuel pump code for the particular model involved.

Maximum Allowable Restriction to Pump:

CELECT™
- With **Clean** Filter .....152 mm Hg [6 in Hg]
- With **Dirty** Filter .....254 mm Hg [10 in Hg]

STC and Fixed Time
- With **Clean** Filter ..... 102 mm Hg [4 in Hg]
- With **Dirty** Filter ..... 203 mm Hg [8 in Hg]

Maximum Allowable Return Line Restriction ..... 64 mm Hg [2.5 in Hg]

Maximum Allowable Return Line Restriction with Check Valves and/or Overhead Tanks . 165 mm Hg [6.5 in Hg]

Electrical System

Minimum Recommended Battery Capacity

System Voltage	Ambient Temperatures			
	-18°C [0°F]		0°C [32°F]	
	Cold Cranking Amperes	Reserve Capacity * Amperes	Cold Cranking Amperes	Reserve Capacity Amperes
12 Volt	1800	640	1280	480
24 Volt **	900	320	640	240

* The number of plates within a given battery size determines reserve capacity. Reserve capacity determines the length of time which sustained cranking can occur.

** CCA ratings are based on two, 12 volt batteries in series.

A minimum of 6.5 volts at the three pin connector is required to power up to the ECM on CELECT™ engines.

Batteries (Specific Gravity)

Specific Gravity at 27°C [80°F]	State of Charge
1.260 to 1.280	100%
1.230 to 1.250	75%
1.200 to 1.220	50%
1.170 to 1.190	25%
1.110 to 1.130	Discharged

Valve and Injector Adjustments*

Valves

Intake ..... 0.35 mm [0.014 in]
Exhaust ..... 0.68 mm [0.027 in]

Recheck Limits
Intake ..... 0.10 to 0.41 mm [0.004 to 0.016 in]
Exhaust ..... 0.46 to 0.76 mm [0.018 to 0.030 in]

Adjusting Screw Locknut Torque (Valves and Injectors):
With Part No.ST-669 ..... 47 N•m [35 ft-lb]
Without Part No. ST-669 ..... 60 N•m [45 ft-lb]

Injector Preload (Top Stop)

STC and Fixed Time ..... 0.6 to 0.7 N•m [5.00 to 6.00 in-lb]

CELECT™ (Injector Lash Recheck Limits)
MIN ..... 0.51 mm [0.020 in]
MAX ..... 2.04 mm [0.080 in]

Jacobs® Engine Brake

Slave Piston Adjustment ..... 0.38 mm [0.015 in]

Adjusting Screw Locknut Torque:
With Part No. ST-669 ..... 47 N•m [35 ft-lb]
Without Part No.ST-669 ..... 50 N•m [40 ft-lb]

* Adjustments **must** be made when the engine is cold (any stabalized coolant temperature at 60°C [140°F] or below).

Valve and Injector Adjustment Sequence

STC/Fixed Time Engines

Injector and Valve Adjustment Sequence

Bar Engine in Direction of Rotation	Pulley Position	Set Cylinder Injector	Set Cylinder Valve
Start	A	3	5
Advance to	B	6	3
Advance to	C	2	6
Advance to	A	4	2
Advance to	B	1	4
Advance to	C	5	1

Firing Order: 1-5-3-6-2-4

oi100vd

CELECT™ Engines

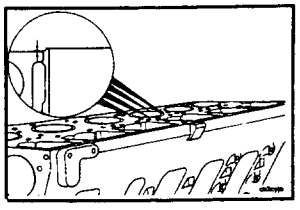
CELECT™ Injector and Valve Measurement Sequence

Bar Engine in Direction of Rotation	Pulley Position	Set Cylinder Injector	Set Cylinder Valve
Start	A	1	1
Advance to	B	5	5
Advance to	C	3	3
Advance to	A	6	6
Advance to	B	2	2
Advance to	C	4	4

Firing Order: 1-5-3-6-2-4

oi200vh

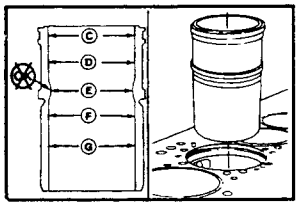
Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.

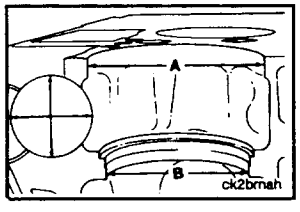


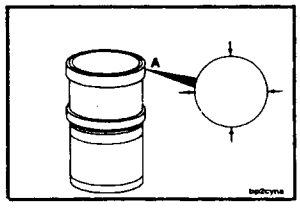
Component Specifications and Torque Values

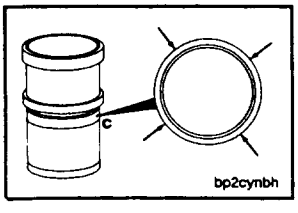
Engine Assembly - Specifications

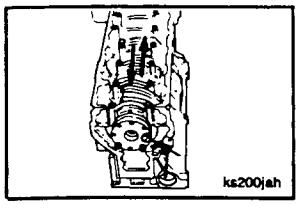
Cylinder Liner Protrusion		0.00 mm 0.13 mm	MIN MAX	0.000 in 0.005 in
Note: Liner protrusion is measured with Part No. 3823495 Cyliner Liner Clamp Set installed.				
Cylinder Liner to Block Clearance		0.25 mm	MIN	0.010 in
Cylinder Liner Out of Round		0.10 mm	MAX	0.004 in
Cylinder Block Upper Liner Bore I.D.	A	145.900 mm 146.027 mm	MIN MAX	5.7441 in 5.7491 in
Cylinder Block Liner Seal Seat Bore I.D.	B	138.063 mm 138.113 mm	MIN MAX	5.4355 in 5.4375 in
Cylinder Liner Top Press Fit O.D.	A	145.938 mm 145.976 mm	MIN MAX	5.7456 in 5.7471 in
Cylinder Liner Seal Seat Bore Fit O.D.	C	137.937 mm 138.013 mm	MIN MAX	5.4306 in 5.4336 in
Crankshaft End Clearance		0.10 mm 0.56 mm	MIN MAX	0.004 in 0.022 in

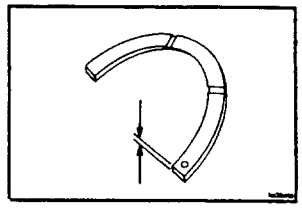
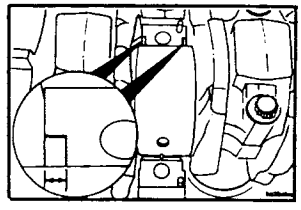
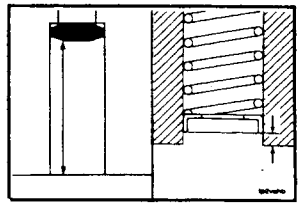
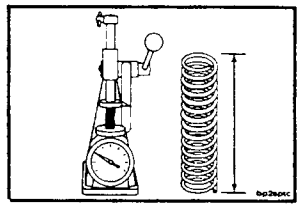
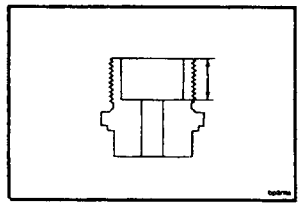
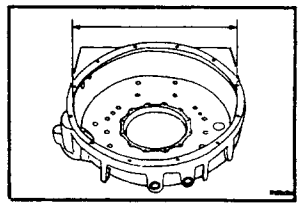
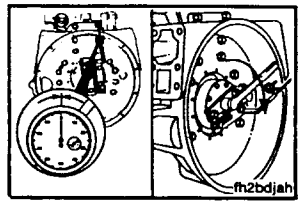


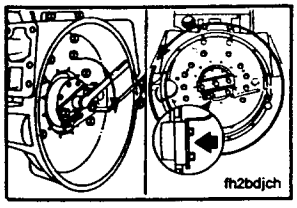
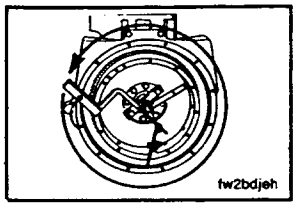
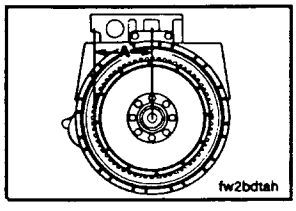


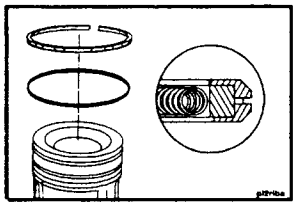






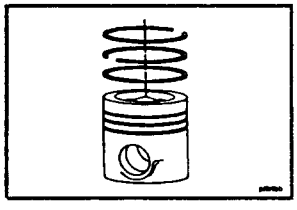
Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.	
Crankshaft Thrust Bearing Thickness		4.83 mm 4.89 mm	MIN MAX	0.192 in 0.195 in	
Crankshaft Thrust Bearing Surface Width		49.975 mm 50.100 mm	MIN MAX	1.9675 in 1.9724 in	
High Oil Pressure Regulator Retainer Plug **Installed Depth @ 63.12 ± 0.50 mm [2.485 ± 0.020 in]**		8.03 mm 8.53 mm	MIN MAX	0.316 in 0.336 in	
Installed Depth @ 68.12 ± 0.50 mm [2.682 ± 0.020 in]		13.03 mm 13.52 mm	MIN MAX	0.513 in 0.533 in	
Main Oil Pressure Regulator Spring Free Length		84.1 mm		3.31 in	
Spring Load at 48.3 mm [1.90 in]		91.1 N 94.7 N	MIN MAX	20.50 lbf 21.30 lbf	
Main Oil Pressure Regulator Retainer Plug		11.1 mm 13.4 mm	MIN MAX	0.44 in 0.53 in	
Flywheel Housing Bore I.D.	SAE No. 00 0 1/2 1 2 3	 787.7 mm 648.0 mm 584.4 mm 511.3 mm 447.8 mm 409.7 mm	 MAX MAX MAX MAX MAX MAX	 31.01 in 25.51 in 23.01 in 20.13 in 17.63 in 16.13 in	
Flywheel Housing Bore Alignment TIR	SAE No. 00 0 1/2 1 2 3	 0.31 mm 0.25 mm 0.25 mm 0.20 mm 0.20 mm 0.20 mm	 MAX MAX MAX MAX MAX MAX	 0.012 in 0.010 in 0.010 in 0.008 in 0.008 in 0.008 in	

Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.
 fh2bdjch				
Flywheel Housing Face Alignment TIR	SAE No.			
	00	0.31 mm	MAX	0.012 in
	0	0.25 mm	MAX	0.010 in
	1/2	0.25 mm	MAX	0.010 in
	1	0.20 mm	MAX	0.008 in
	2	0.20 mm	MAX	0.008 in
	3	0.20 mm	MAX	0.008 in
 fw2bdjeh				
Flywheel Bore Runout TIR		0.127 mm	MAX	0.0050 in
 fw2bdtah	Radius (A) mm / in			
Flywheel Face Runout TIR	203 / 8	0.203 mm	MAX	0.008 in
	254 / 10	0.254 mm	MAX	0.010 in
	305 / 12	0.305 mm	MAX	0.012 in
	356 / 14	0.356 mm	MAX	0.014 in
	406 / 16	0.406 mm	MAX	0.016 in



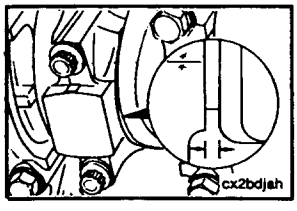
Oil Control Ring End Gap

The two-piece oil ring **must** be installed with the expander gap 180 degrees from the oil ring gap.



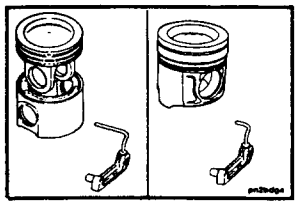
Piston Ring End Gap

The ring gaps **must not** be aligned with the piston pin bore. Rotate the rings to position the gaps as shown.

 cx2bdjah

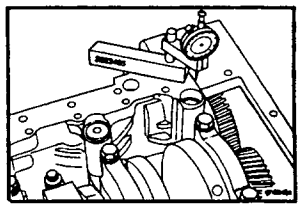
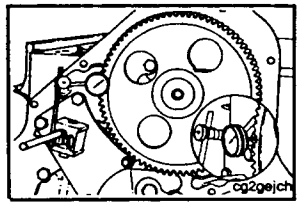
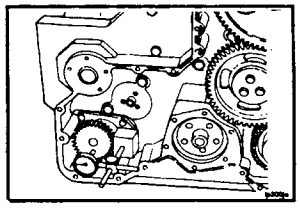
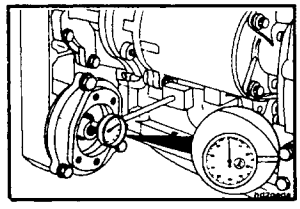
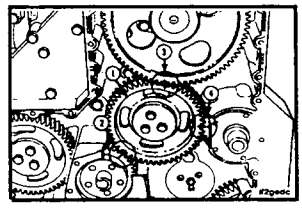
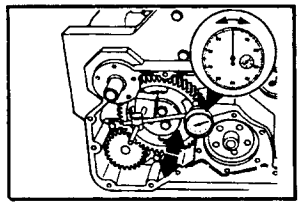
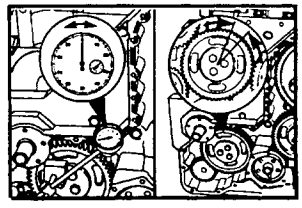
Connecting Rod Side Clearance	0.10 mm	MIN	0.004 in
	0.30 mm	MAX	0.012 in

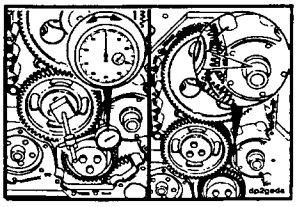
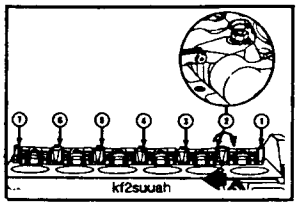
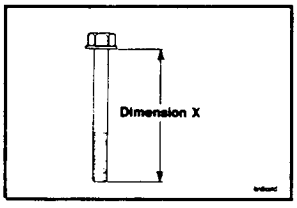
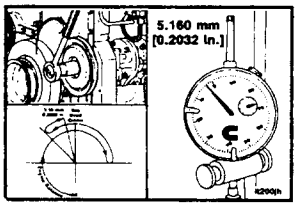
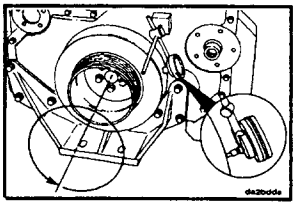
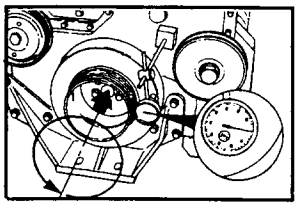
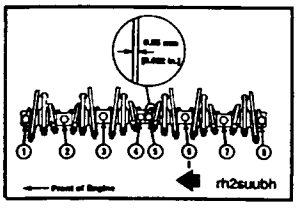
Note: The rod **must** move freely from side-to-side.

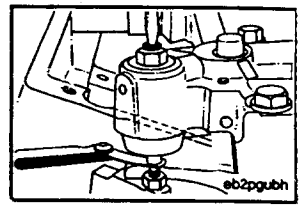
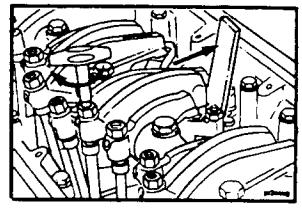
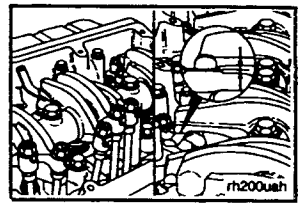
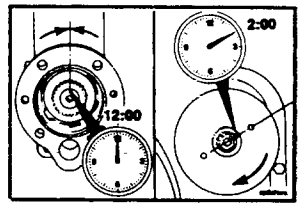
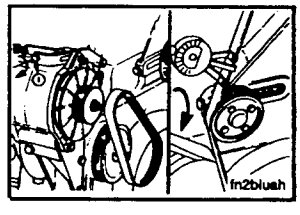


Piston Cooling Nozzle Length

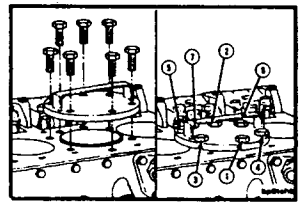
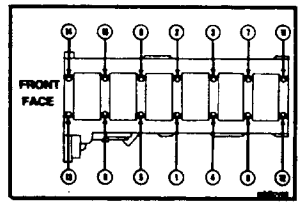
Articulated Pistons	44.5 mm	1.752 in
Aluminum Pistons	15.9 mm	0.626 in

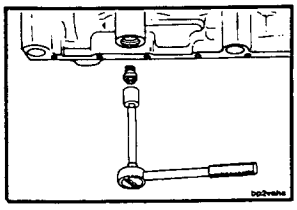
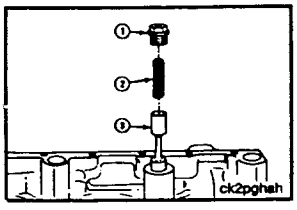
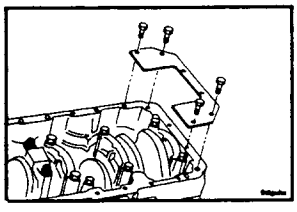
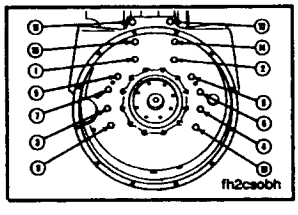
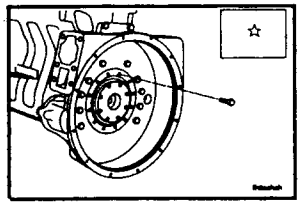
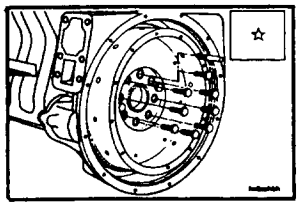
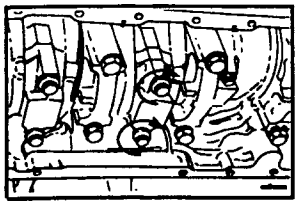
Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.	
Gear Housing Protrusion (below the cylinder block oil pan rail)		0.15 mm	MAX	0.006 in	
Camshaft End Clearance		0.13 mm 0.33 mm	MIN MAX	0.005 in 0.013 in	
Lubricating Oil Pump Gear End Clearance		0.064 mm 0.270 mm	MIN MAX	0.0025 in 0.0106 in	
Hydraulic Pump Drive Shaft End Clearance		0.076 mm 0.635 mm	MIN MAX	0.0030 in 0.0250 in	
Engine Timing **Note:** The timing marks on the camshaft idler gear **must** align with the timing marks on the accessory drive, crankshaft and camshaft gears to make sure the engine timing is set correctly.					
Idler Gear End Clearance		0.30 mm 0.53 mm	MIN MAX	0.012 in 0.021 in	
Idler Gear Backlash **Note:** Do **not** allow the mating gears to move while measuring the backlash.		0.08 mm 0.38 mm	MIN MAX	0.003 in 0.015 in	

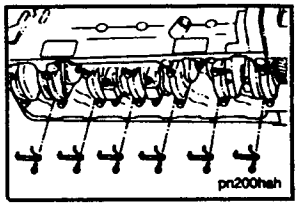
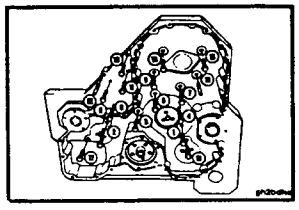
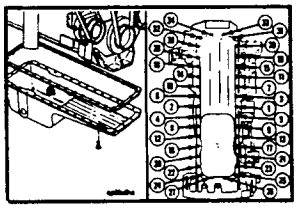
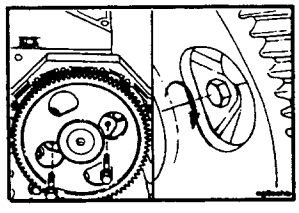
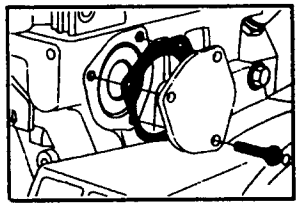
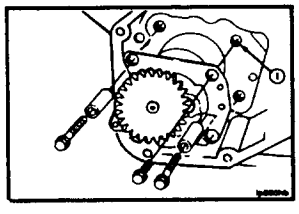
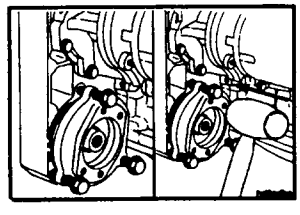
Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.
 **Accessory Drive Gear Backlash**		0.08 mm 0.41 mm	MIN MAX	0.003 in 0.016 in
 **Cam Follower Side Clearance Between Supports**		0.76 mm	MIN	0.030 in
 **Cylinder Head Capscrew Free Length** Part No. 3045849 Part No. 3045850		 74.5 mm 139.5 mm	 MAX MAX	 2.933 in 5.492 in
 **Injection Timing** To verify the correct injection timing for a particular engine refer to the engine dataplate. Refer to Group 00, Engine Assembly, Injection Timing for complete instructions.				
 **Vibration Damper Eccentricity TIR**		0.28 mm	MAX	0.011 in
 **Vibration Damper Face Alignment ("Wobble") TIR**		0.28 mm	MAX	0.011 in
 **Rocker Lever Side Clearance**		0.55 mm	MIN	0.022 in

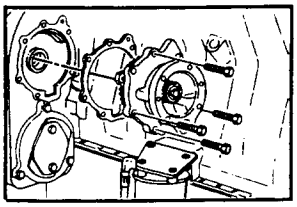
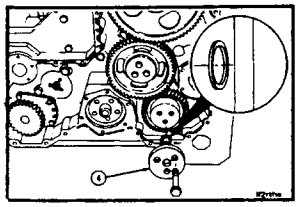
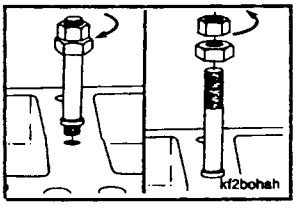
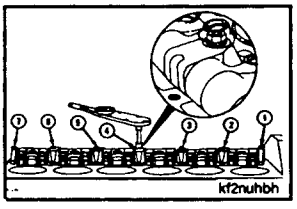
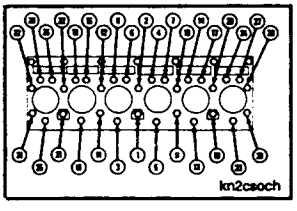
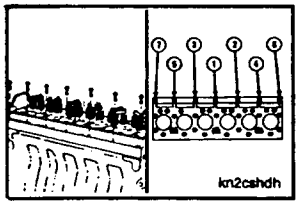
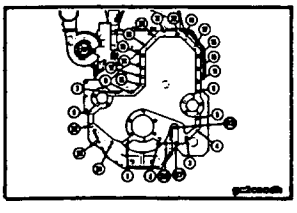
Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.	
Jacobs® Brake Slave Piston Clearance		0.38 mm	MIN	0.015 in	
Top-Stop Injector Adjustment Refer to Top Stop Injector Shop Manual, Bulletin No. 3810344.					
Intake Valve Clearance **Exhaust Valve Clearance**		0.36 mm 0.69 mm	MIN MIN	0.014 in 0.027 in	
Air Compressor to Accessory Drive Timing Position the air compressor crankshaft timing mark at the 12:00 o'clock position. Position the accessory drive shaft dowel pin at the 2:00 o'clock position.					
Alternator Belt Tension Refer to the belt tension chart in this section.		445 N 490 N	MIN MAX	100 lbf 110 lbf	
Fan Belt Tension Refer to the belt tension chart in this section.		890 N	MIN	200 lbf	

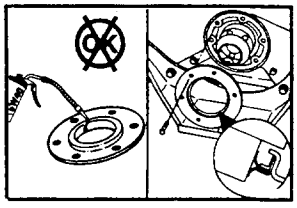
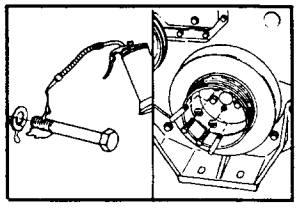
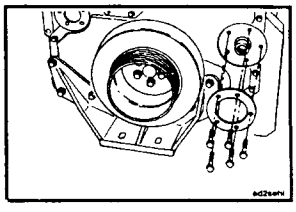
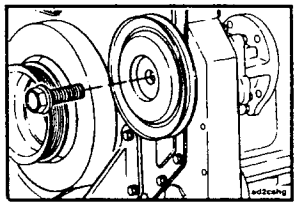
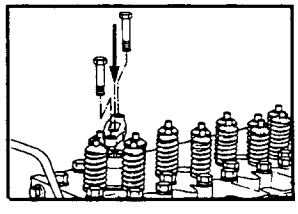
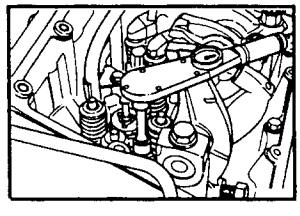
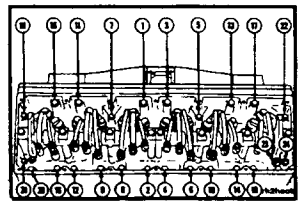
Engine Assembly - Capscrew Torque Values

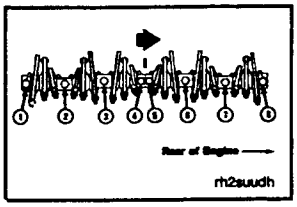
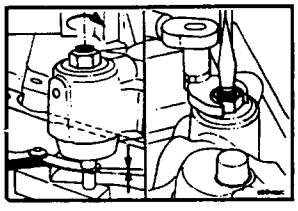
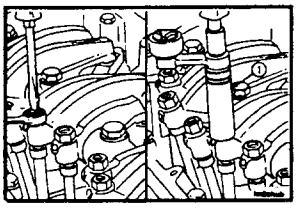
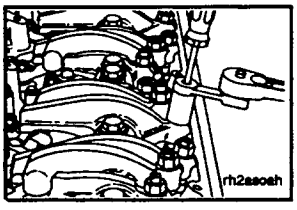
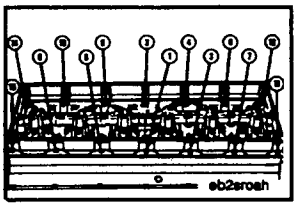
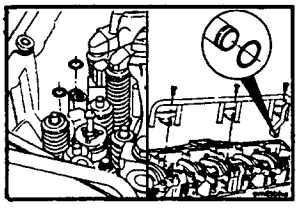
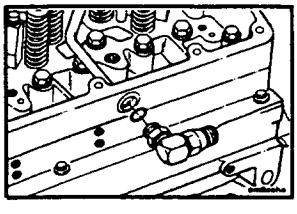
Cylinder Liner Clamping Plate		36 N•m		105 ft-lb	
Main Bearing **Note:** Tighten the capscrews in the sequence shown.	1 2 3 4 5 6 7	68 N•m 142 N•m 210 N•m Loosen All 68 N•m 142 N•m 210 N•m		50 ft-lb 105 ft-lb 155 ft-lb 50 ft-lb 105 ft-lb 155 ft-lb	

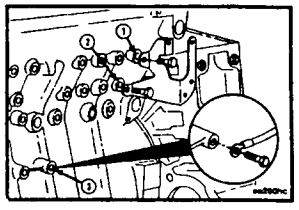
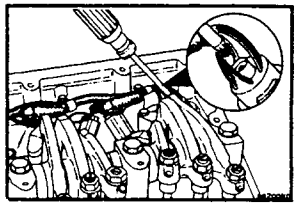
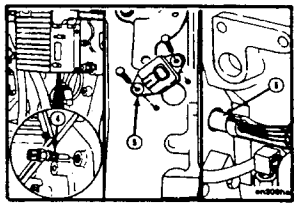
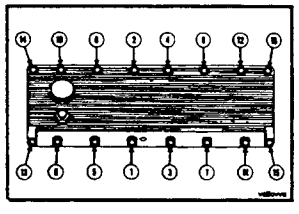
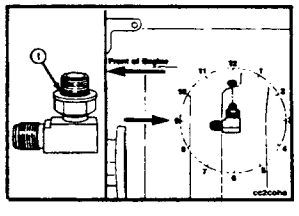
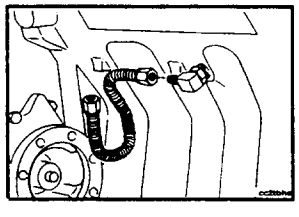
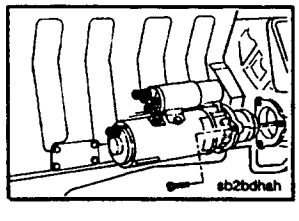
	Component or Assembly (Procedure)	Ref.No./Steps	Metric	U.S.
	**Viscosity Sensor**		24 N•m	18 ft-lb
	**Main Oil Pressure Regulator Retainer Plug (1)**		75 N•m	55 ft-lb
	**Flywheel Housing Alignment Plate**		47 N•m	35 ft-lb
	**Flywheel Housing** **Note:** Tighten the capscrews in the sequence shown.	1 2 3	68 N•m 129 N•m 197 N•m	50 ft-lb 95 ft-lb 145 ft-lb
	**Crankshaft Rear Oil Seal** **Note:** Tighten in a star pattern.	1 2	7 N•m 19 N•m	60 in-lb 170 in-lb
	**Flywheel** **Note:** Tighten the capscrews in a star pattern.		183 N•m	135 ft-lb
	**Connecting Rod**	1 2 3 4 5 6 7	68 N•m 142 N•m 210 N•m Loosen All 68 N•m 142 N•m 210 N•m	50 ft-lb 105 ft-lb 155 ft-lb 50 ft-lb 105 ft-lb 155 ft-lb

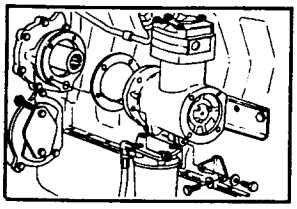
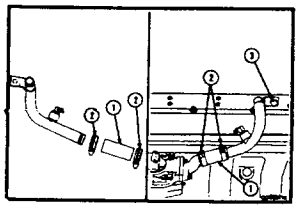
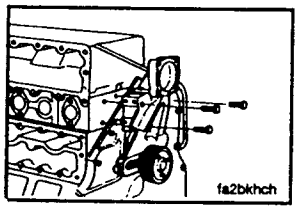
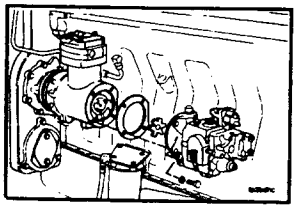
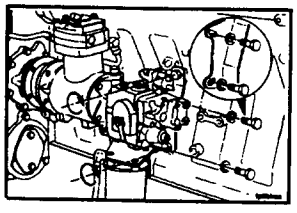
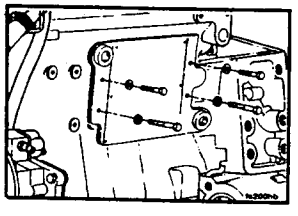
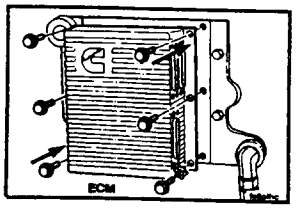
Component or Assembly (Procedure)	Ref.No./Steps	Metric	U.S.	
Piston Cooling Nozzle		27 N•m	18 ft-lb	
Gear Housing **Note:** Tighten the capscrews in sequence shown	1 2	20 N•m 68 N•m	15 ft-lb 50 ft-lb	
Lubricating Oil Pan **Note:** Tighten the capscrews in the sequence shown.		47 N•m	35 ft-lb	
Camshaft Thrust Plate		47 N•m	35 ft-lb	
Camshaft Rear Cover Plate		47 N•m	35 ft-lb	
Lubricating Oil Pump (Grade 10.9 Capscrews) Spot Faced Pump Casting As Cast Pump Casting **Note:** Use sealant, Part No. 3824038 or 3375068, or equivalent to coat the threads of the capscrews.		41 N•m 34 N•m	30 ft-lb 25 ft-lb	
Hydraulic Drive Adapter **Hydraulic Drive Cover Plate**		47 N•m 27 N•m	35 ft-lb 20 ft-lb	

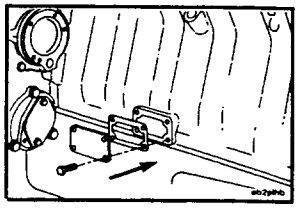
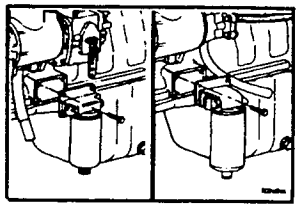
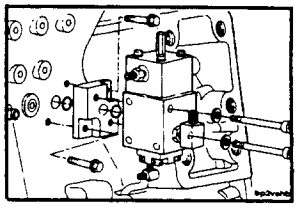
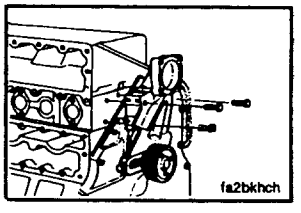
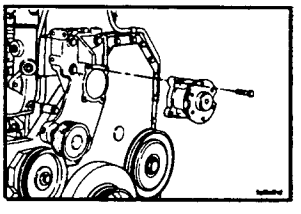
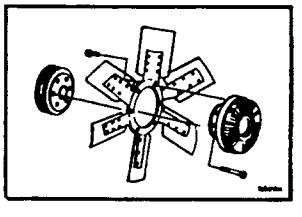
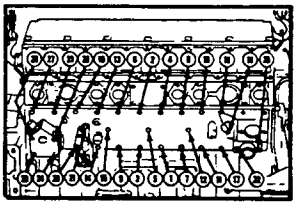
	Component or Assembly (Procedure)	Ref.No./Steps	Metric	U.S.
	**Accessory Drive Assembly**		47 N•m	35 ft-lb
	**Idler Gear Cover Plate:**		61* N•m	45* ft-lb * Plus 60 degrees
	**Cam Follower Support Studs** **Note:** Install the cam follower support studs with two (M10X1.5) nuts tightened together. Remove the nuts after the studs are tightened.		34 N•m	25 ft-lb
	**Cam Follower Support Nuts**		47 N•m	35 ft-lb
	**Cylinder Head** **Note:** Tighten the cylinder head capscrews in the sequence shown. **Note:** Rotate at least one flat, but not more than two.	1 2 3	136 N•m 217 N•m	100 ft-lb 160 ft-lb Rotate 90 Degrees
	**Cylinder Head (Fuel Pump Side)** Tighten the capscrews in the sequence shown.		47 N•m	35 ft-lb
	**Gear Cover** Capscrews 1 through 22 Capscrews 23 through 28 **Note:** Tighten the capscrews in the sequence shown.		20 N•m 68 N•m	15 ft-lb 50 ft-lb

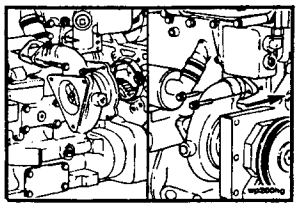
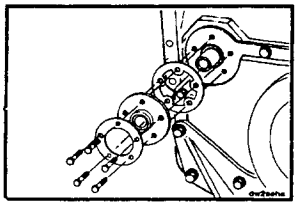
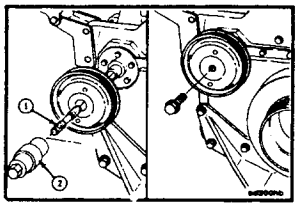
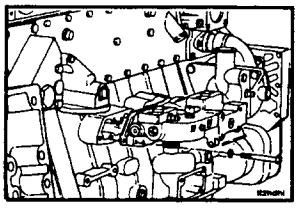
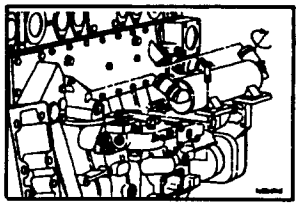
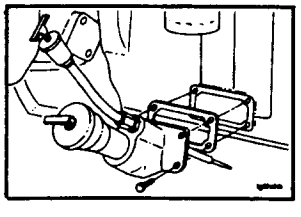
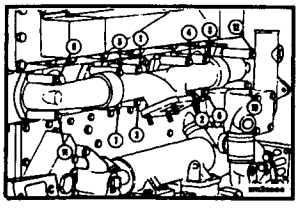
Component or Assembly (Procedure)	Ref.No./Steps	Metric	U.S.	
Front Crankshaft Oil Seal	1 2	7 N•m 19 N•m	60 in-lb 170 in-lb	
Vibration Damper and Crankshaft Pulley **Note:** Tighten the capscrews in a star pattern.		203 N•m	150 ft-lb	
Accessory Drive Oil Seal	1 2	7 N•m 19 N•m	60 in-lb 170 in-lb	
Accessory Drive Pulley		542 N•m	400 ft-lb	
Injector Hold-Down Clamp **Fixed Time Engines**	1 2 3	6 N•m 12 N•m 19 N•m	55 in-lb 110 in-lb 165 in-lb	
Injector Hold Down Clamp **STC and CELECT™ Engines**		75 N•m	55 ft-lb	
Rocker Lever Housing **Note:** Tighten the capscrews in the sequence shown.		47 N•m	35 ft-lb	

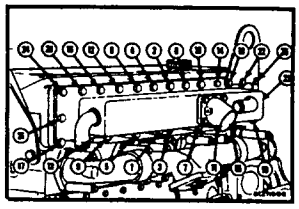
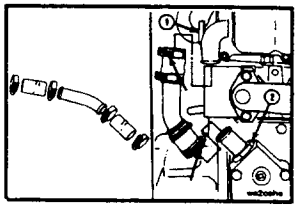
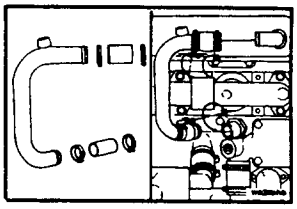
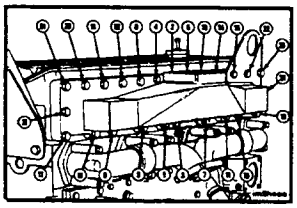
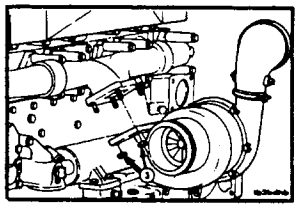
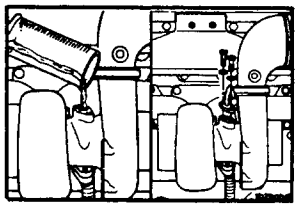
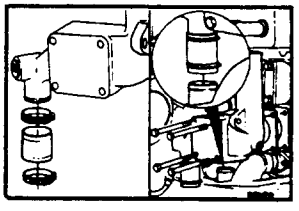
Component or Assembly (Procedure)	Ref.No./Steps	Metric	U.S.
	**Rocker Lever Assembly** **Note:** This torque value applies to engines with or without Jacobs® Brakes.	122 N•m	90 ft-lb
	**Jacobs® Brake Slave Piston Adjusting Srew Locknut:** • (Without Torque Wrench Adapter) • (With ST-669 Torque Wrench Adapter)	 34 N•m 30 N•m	 25 ft-lb 22 ft-lb
	**Top-Stop Injector Lever Adjusting Screw Locknut:** • (Without Torque Wrench Adapter) • (With ST-669 Torque Wrench Adapter)	 61 N•m 47 N•m	 45 ft-lb 35 ft-lb
	**Valve Rocker Lever Adjusting Screw Locknut:** • (Without Torque Wrench Adapter) • (With ST-669 Torque Wrench Adapter)	 61 N•m 47 N•m	 45 ft-lb 35 ft-lb
	**Jacobs® Brake Housing Spacer** **Note:** Tighten the capscrews in the sequence shown.	25 N•m	18 ft-lb
	**STC Oil Manifold**	24 N•m	18 ft-lb
	**STC Oil Supply Connection** Locknut on elbow in rocker housing	34 N•m	25 ft-lb

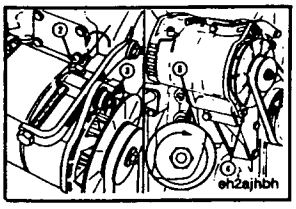
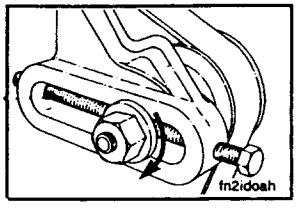
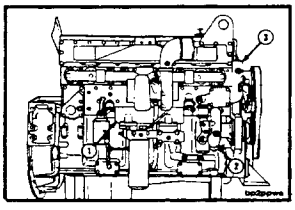
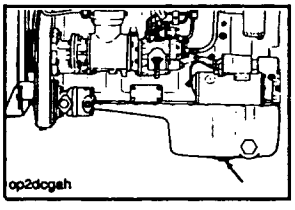
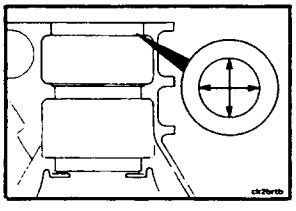
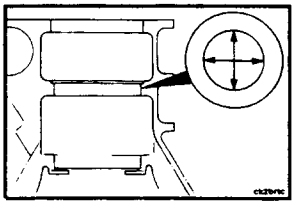
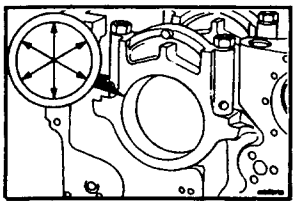
Component or Assembly (Procedure)	Ref.No./Steps	Metric	U.S.	
CELECT™ Wiring Harness Bracket		41 N•m	30 ft-lb	
Internal/External Actuator Harness Connector		1 N•m	11 in-lb	
CELECT™ Sensors				
Oil Temperature		34 N•m	25 ft-lb	
Oil Pressure		30 N•m	22 ft-lb	
Engine Position		34 N•m	25 ft-lb	
Boost Pressure		27 N•m	20 ft-lb	
Intake Manifold Temperature		27 N•m	20 ft-lb	
Rocker Lever Cover **Note:** Tighten the capscrews in the sequence shown.		15 N•m	130 in-lb	
Air Compressor Coolant Inlet Tube Fitting Locknut		47 N•m	35 ft-lb	
Air Compressor Coolant Inlet Tube		40 N•m	30 ft-lb	
Starting Motor Mounting		190 N•m	140 ft-lb	

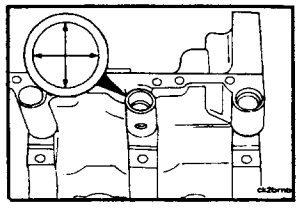
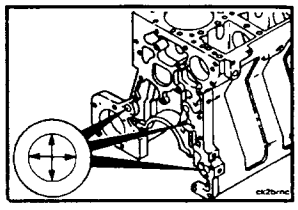
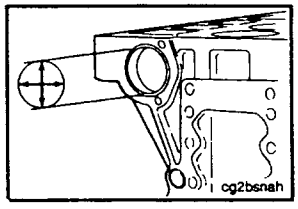
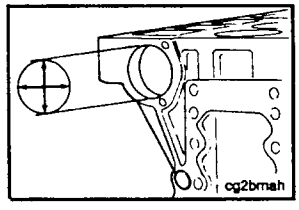
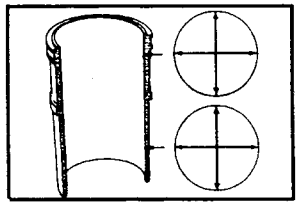
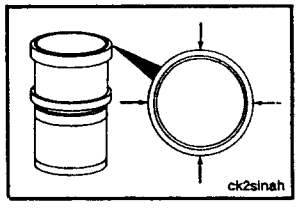
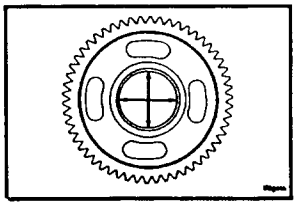
Component or Assembly (Procedure)	Ref.No./Steps	Metric	U.S.
 **Air Compressor Mounting**		65 N•m	50 ft-lb
 **Air Compressor Air Supply Tube**		47 N•m	35 ft-lb
Air Compressor Air Tube Hose Clamps		5 N•m	40 in-lb
 **Fan Hub Support**		75 N•m	55 ft-lb
 **Fuel Pump Mounting**		47 N•m	35 ft-lb
 **Fuel Pump Support Bracket**			
Fuel pump housing mounting		11 N•m	95 in-lb
Cylinder block mounting		47 N•m	35 ft-lb
 **Electronic Control Cooling Plate**		40 N•m	30 ft-lb
 **Electronic Control Module**		7 N•m	62 in-lb

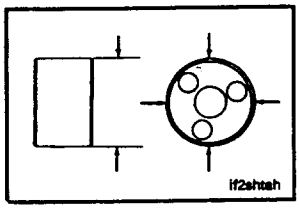
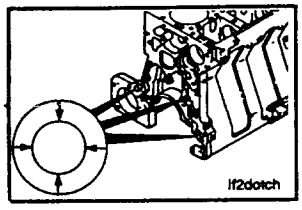
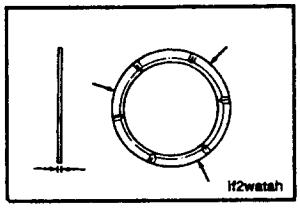
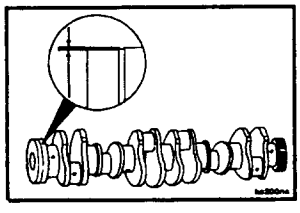
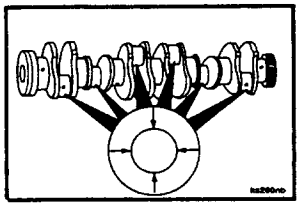
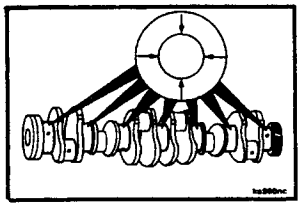
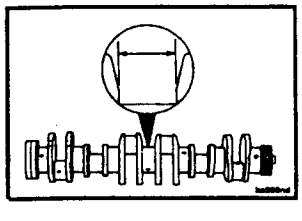
Component or Assembly (Procedure)	Ref.No./Steps	Metric	U.S.	
Hand Hole Cover		47 N•m	35 ft-lb	
Fuel Filter Head		47 N•m	35 ft-lb	
STC Control Valve				
Adapter Block		27 N•m	20 ft-lb	
Valve		47 N•m	35 ft-lb	
Fan Hub Support		75 N•m	55 ft-lb	
Fan Hub		47 N•m	35 ft-lb	
Fan Pulley and Fan		47 N•m	35 ft-lb	
Water Header Plate **Note:** Tighten the capscrews in the sequence shown.		55 N•m	40 ft-lb	

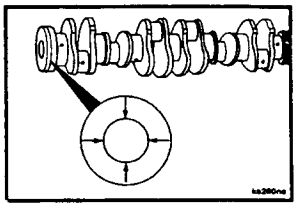
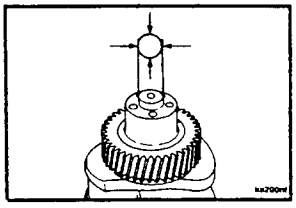
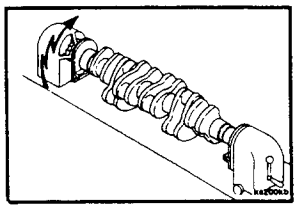
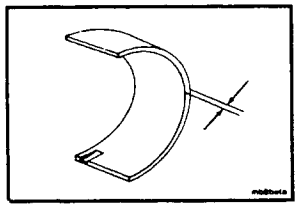
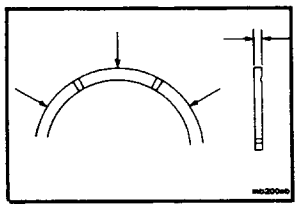
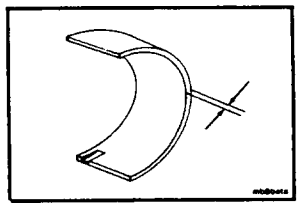
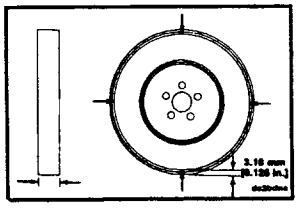
Component or Assembly (Procedure)	Ref.No./Steps	Metric	U.S.
 **Water Pump Mounting**		47 N•m	35 ft-lb
Water Transfer Connection		25 N•m	20 ft-lb
 **Water Pump Oil Seal**	1	7 N•m	60 in-lb
Note: Tighten the capscrews in a star pattern	2	19 N•m	170 in-lb
 **Alternator Drive Pulley**		75 N•m	55 ft-lb
 **Lubricating Oil Filter Head**		47 N•m	35 ft-lb
 **Lubricating Oil Cooler Mounting**		47 N•m	35 ft-lb
Hose Clamps		3 N•m	30 in-lb
 **Dipstick Tube and Housing**		47 N•m	35 ft-lb
 **Exhaust Manifold**	1	27 N•m	20 ft-lb
Note: Tighten the capscrews in the sequence shown.	2	47 N•m	35 ft-lb

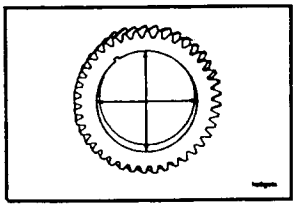
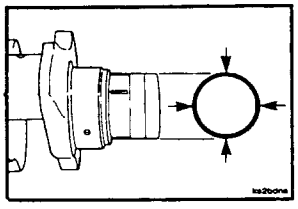
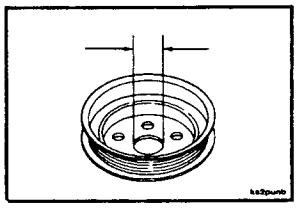
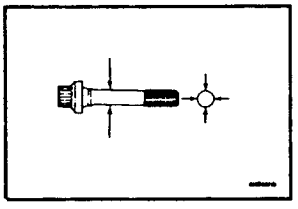
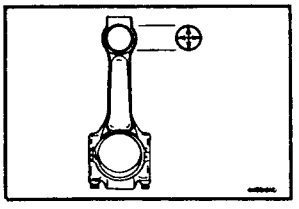
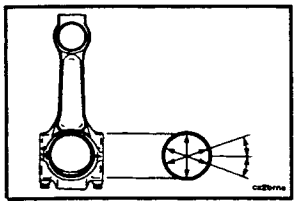
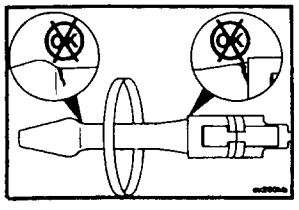
Component or Assembly (Procedure)	Ref.No./Steps	Metric	U.S.	
Aftercooler Housing **Note:** Tighten the capscrews in the sequence shown.		47 N•m	35 ft-lb	
Aftercooler Inlet Tube Hose Clamps		3 N•m	30 in-lb	
Aftercooler Outlet Tube Hose Clamps		3 N•m	30 in-lb	
Air Intake Manifold **Note:** Tighten the capscrews in the sequence shown.		47 N•m	35 ft-lb	
Turbocharger - "T-bolt" Clamps **Turbocharger - Mounting Nuts**		8 N•m 60 N•m	72 in-lb 45 ft-lb	
Turbocharger Oil Supply **Turbochager Oil Drain**		20 N•m 27 N•m	15 ft-lb 20 ft-lb	
Thermostat Housing Hose Clamps		47 N•m 3 N•m	35 ft-lb 30 in-lb	

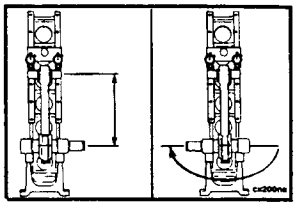
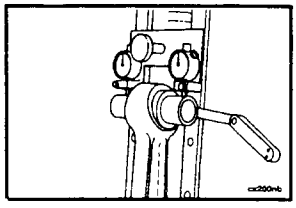
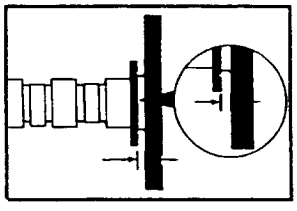
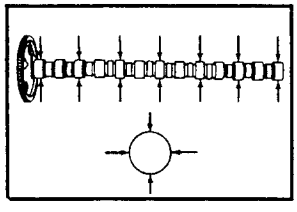
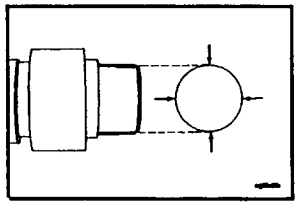
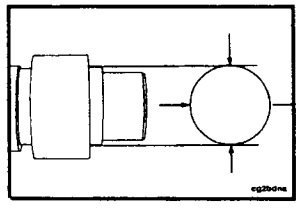
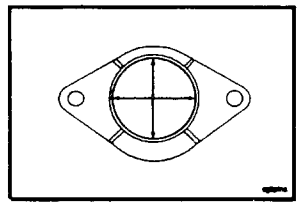
Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.
 **Alternator Adjusting Screw Locknuts (2 and 3)**		80 N•m		60 ft-lb
Alternator Mounting Bracket (4) and nut (5)		47 N•m		35 ft-lb
 **Idler Pulley Shaft Locknut**		190 N•m		140 ft-lb
 **Drain Plugs (Coolant)** Refer to Engine Diagrams, Pages i-13 and i-14 for the location of the coolant drain plugs.		20 N•m		15 ft-lb
 **Drain Plug (Lubricating Oil Pan)**		90 N•m		65 ft-lb
 **Cylinder Block - Rebuild Specifications**				
Cylinder Block Upper Liner Bore I.D.		145.900 mm 146.027 mm	MIN MAX	5.7441 in 5.7491 in
 **Cylinder Block Liner Seal Seat Bore I.D.**		138.063 mm 138.113 mm	MIN MAX	5.4355 in 5.4375 in
 **Main Bearing Bore I.D.**		121.990 mm 122.015 mm	MIN MAX	4.8028 in 4.8037 in

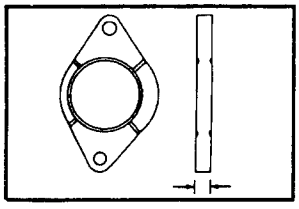
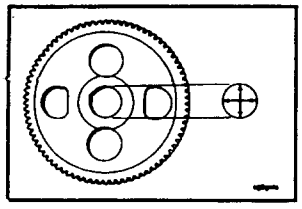
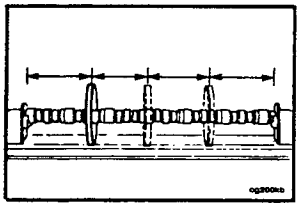
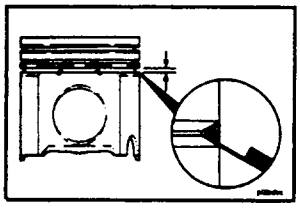
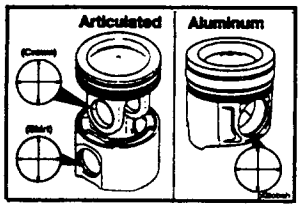
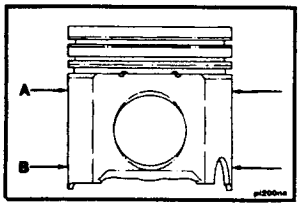
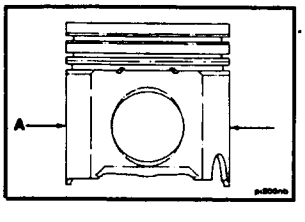
Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.	
Main Oil Pressure Regulator Valve Bore I.D.		22.226 mm 22.301 mm	MIN MAX	0.8750 in 0.8780 in	
Idler Gear Ring Dowel Bore I.D.		19.175 mm 19.215 mm	MIN MAX	0.7549 in 0.7565 in	
Camshaft Bushing I.D. (Installed) **Note:** If one of the bushings exceeds the specifications, all of the bushings **must** be replaced.		72.078 mm 72.142 mm	MIN MAX	2.8377 in 2.8402 in	
Cylinder Block Camshaft Bore I.D.		76.987 mm 77.040 mm	MIN MAX	3.0310 in 3.0331 in	
Cylinder Liner I.D.		125.000 mm 125.095 mm	MIN MAX	4.9213 in 4.9250 in	
Cylinder Liner Top Press Fit O.D.		145.938 mm 145.976 mm	MIN Max	5.7456 in 5.7471 in	
Idler Gear Bushing Bore I.D.		60.045 mm 60.100 mm	MIN MAX	2.3640 in 2.3661 in	

Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.
 **Idler Gear Shaft O.D.**		59.975 mm 60.008 mm	MIN MAX	2.3612 in 2.3625 in
 **Idler Gear Ring Dowel O.D.**		19.217 mm 19.243 mm	MIN MAX	0.7566 in 0.7576 in
 **Idler Gear Thrust Washer Thickness**		2.400 mm 2.470 mm	MIN MAX	0.0945 in 0.0972 in
 **Crankshaft Rear Oil Seal Wear Groove**		0.25 mm	MAX	0.0098 in
 **Crankshaft Connecting Rod Journal O.D.**		78.950 mm 79.013 mm	MIN MAX	3.1083 in 3.1107 in
 **Crankshaft Main Bearing Journal O.D.**		114.015 mm 114.055 mm	MIN MAX	4.4888 in 4.4903 in
 **Crankshaft Thrust Face Width**		49.975 mm 50.100 mm	MIN MAX	1.9675 in 1.9724 in

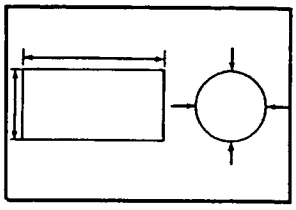
Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.	
Crankshaft Rear Oil Seal Flange O.D.		164.965 mm 165.035 mm	MIN MAX	6.4947 in 6.4974 in	
Crankshaft Damper Pilot O.D.		32.01 mm 32.04 mm	MIN MAX	1.2602 in 1.2614 in	
Note: The instructions for performing a magnetic crack inspection and the limits of acceptance for open and subsurface indications are provided in Cylinder Block - Group 01. Refer to Crankshaft - Magnetic Crack Inspection (1-07).					
Main Bearing Shell Thickness (Standard)		3.895 mm 3.944 mm	MIN MAX	0.1533 in 0.1553 in	
Note: For visual inspection criteria, refer to the Parts Reuse Guidelines, Bulletin No. 3810303.					
Crankshaft Thrust Bearing Thickness		4.75 mm 4.89 mm	MIN MAX	0.1870 in 0.1925 in	
Connecting Rod Bearing Thickness (Standard)		2.430 mm 2.473 mm	MIN MAX	0.0957 in 0.0974 in	
Note: For visual inspection criteria, refer to the Parts Reuse Guidelines, Bulletin No. 3810303.					
Vibration Damper Thickness Measure the thickness in four places 90 degrees apart approximately 3.18 mm [0.125 inch] from the outside diameter. The difference between any two of the four measurements **must** not exceed 0.25 mm [0.010 inch].					

	Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.
	Crankshaft Gear Bore I.D.		85.910 mm 85.935 mm	MIN MAX	3.3823 in 3.3833 in
	Crankshaft Gear Journal O.D.		85.975 mm 86.000 mm	MIN MAX	3.3848 in 3.3858 in
	Crankshaft Pulley Crankshaft Pilot Bore I.D.		49.250 mm 50.750 mm	MIN MAX	1.9390 in 1.9980 in
	Connecting Rod Capscrew O.D.		12.600 mm 12.800 mm	MIN MAX	0.4961 in 0.5039 in
	Connecting Rod Piston Pin Bushing I.D. (Installed)		54.054 mm 54.099 mm	MIN MAX	2.1281 in 2.1299 in
	Connecting Rod Bearing Bore I.D.		83.975 mm 84.025 mm	MIN MAX	3.3061 in 3.3080 in
	The instructions for performing a magnetic crack inspection of the connecting rod are provided in Group 01. Refer to Connecting Rods - Magnetic Crack Inspection (1-14).				

Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.	
Connecting Rod - Length		217.975 mm 218.025 mm	MIN MAX	8.5817 in 8.5836 in	
Connecting Rod - Alignment: • (Without Bushing) • (With Bushing)		 0.25 mm 0.10 mm	 MAX MAX	 0.010 in 0.004 in	
Connecting Rod - Twist: • (Without Bushing) • (With Bushing)		 0.50 mm 0.25 mm	 MAX MAX	 0.020 in 0.010 in	
Camshaft Thrust Plate Clearance		0.180 mm 0.330 mm	MIN MAX	0.0070 in 0.0130 in	
Camshaft Bushing Journal O.D.		71.987 mm 72.013 mm	MIN MAX	2.8341 in 2.8352 in	
Camshaft Gear Mounting Surface O.D.		46.987 mm 47.013 mm	MIN MAX	1.8499 in 1.8509 in	
Camshaft Thrust Bearing Journal O.D.		54.800 mm 55.200 mm	MIN MAX	2.1575 in 2.1732 in	
Camshaft Thrust Plate I.D.		55.60 mm 56.61 mm	MIN MAX	2.1890 in 2.2287 in	

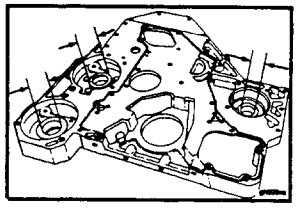
Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.
 **Camshaft Thrust Plate Thickness**		8.960 mm 9.040 mm	MIN MAX	0.3528 in 0.3559 in
 **Camshaft Gear Bore I.D.**		46.912 mm 46.938 mm	MIN MAX	1.8469 in 1.8479 in
 The instructions for performing a magnetic crack inspection of the camshaft and camshaft gear is provided in Group 01. Refer to Camshaft - Magnetic Crack Inspection (1-18) and Camshaft or Idler Gear - Magnetic Crack Inspection (1-19).				
 **Piston Ring Groove Width** Use a new ring and a 0.152 mm [0.006 inch] feeler gauge. If the feeler gauge enters the groove without resistance the piston **must** be replaced.				
 **Piston Pin Bore I.D.**				
• Articulated Crown		54.040 mm 54.055 mm	MIN MAX	2.1276 in 2.1281 in
• Articulated Skirt		54.007 mm 54.015 mm	MIN MAX	2.1263 in 2.1266 in
• Aluminum		54.007 mm 54.015 mm	MIN MAX	2.1263 in 2.1266 in
 **Piston Skirt O.D. (Aluminum)** Temperature: 21°C [70°F]	A	124.675 mm 124.719 mm	MIN MAX	4.9085 in 4.9102 in
	B	124.807 mm 124.846 mm	MIN MAX	4.9137 in 4.9152 in
 **Piston Skirt O.D. (Articulated)** Temperature: 21°C [70°F]	A	124.939 mm 124.983 mm	MIN MAX	4.9189 in 4.9206 in

Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.
Piston Pin Length		101.700 mm	MIN	4.0039 in
		102.000 mm	MAX	4.0157 in
Piston Pin O.D.		53.997 mm	MIN	2.1259 in
		54.003 mm	MAX	2.1261 in



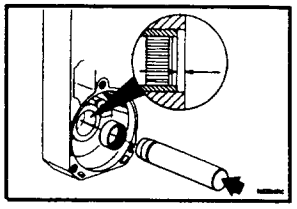
Gear Housing

Bearing Bore I.D. (Hydraulic Drive)		41.967 mm	MIN	1.6522 in
		41.992 mm	MAX	1.6532 in
Bearing Bore I.D. (Water Pump Drive)		36.967 mm	MIN	1.4553 in
		36.992 mm	MAX	1.4564 in
Bearing Bore I.D. (Accessory Drive)		45.100 mm	MIN	1.7756 in
		45.125 mm	MAX	1.7766 in



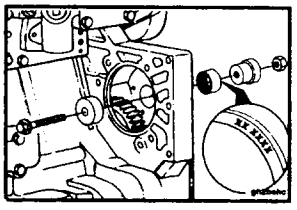
Hydraulic Pump Needle Bearing Installed Depth

The bearing **must** be 0.25 to 0.76 mm [0.010 to 0.030 inch] below the edge of the housing.



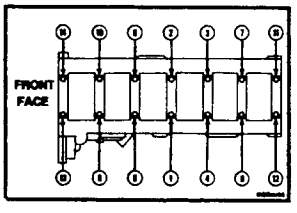
Water Pump Needle Bearing Installed Depth

The bearing **must** be installed with the part number side of the bearing against the installation tool to prevent bearing damage during installation. Use bearing driver kit, Part No. 3824117, to install to the correct specification.

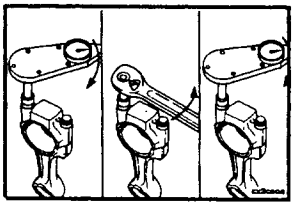


Cylinder Block - Torque Values

Main Bearing Capscrews	1	68 N•m	50 ft-lb
Note: Tighten the main bearing capscrews	2	142 N•m	105 ft-lb
in the sequence shown.	3	210 N•m	155 ft-lb
	4	Loosen All	
	5	68 N•m	50 ft-lb
	6	142 N•m	105 ft-lb
	7	210 N•m	155 ft-lb

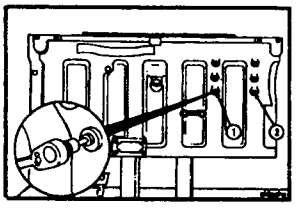


Connecting Rod Capscrews	1	68 N•m	50 ft-lb
	2	142 N•m	105 ft-lb
	3	210 N•m	155 ft-lb
	4	Loosen All	
	5	68 N•m	50 ft-lb
	6	142 N•m	105 ft-lb
	7	210 N•m	155 ft-lb

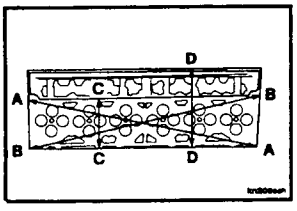


Cylinder Block Pipe Plugs

Refer to "Pipe Plug Torque Value Table" at the rear of this section for torque value of various plug sizes.



Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.

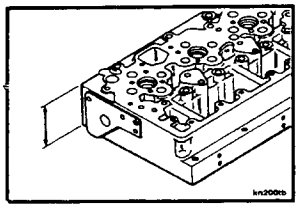


Cylinder Head - Rebuild Specifications

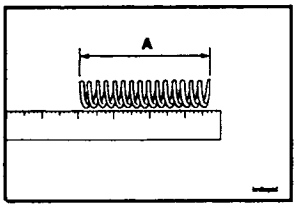
Cylinder Head Flatness

AA and BB (Corner to Corner)	0.200	MAX	0.008
CC (Across Combustion Face)	0.076	MAX	0.003
DD (Across Entire Head Surface)	0.127	MAX	0.005

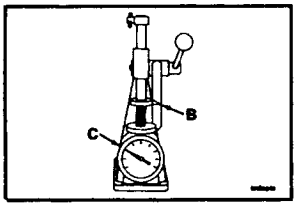
Note: Dimensions CC and DD must be checked from front to rear of head.



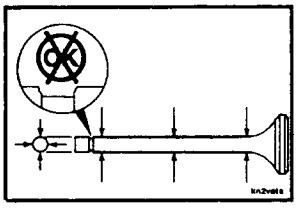
Cylinder Head Thickness		99.24 mm	MIN	3.907 in
		100.25 mm	MAX	3.947 in



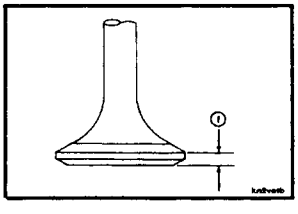
Valve Spring Free Height:	A	103.300 mm	Nominal	4.0669 in



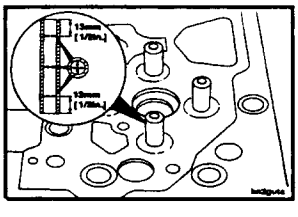
Valve Spring Working Height:	B	71.48 mm	Nominal	2.8142 in
Load for Working Height:	C	1252 N	MIN	281 lbf
		1584 N	MAX	356 lbf



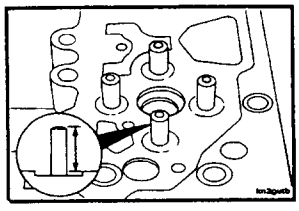
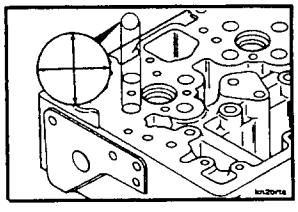
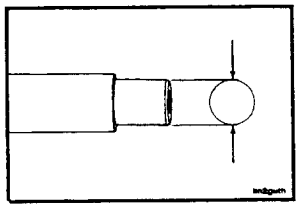
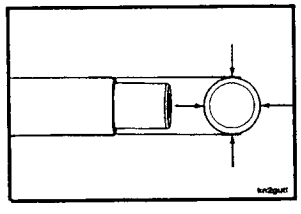
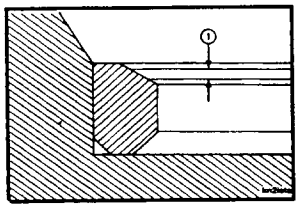
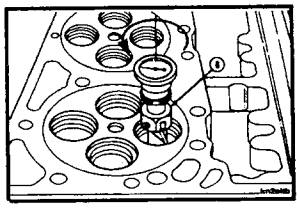
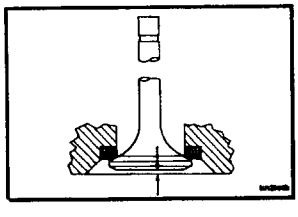
Valve Stem O.D.		9.580 mm	MIN	0.3772 in
		9.633 mm	MAX	0.3793 in

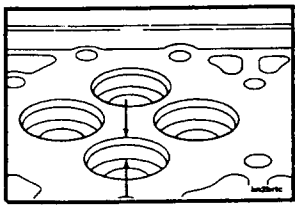
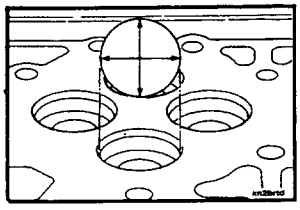
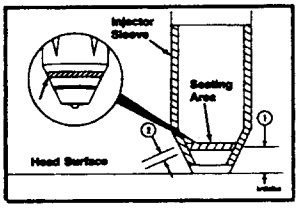
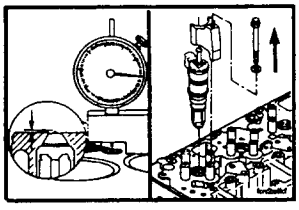
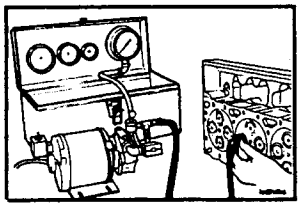
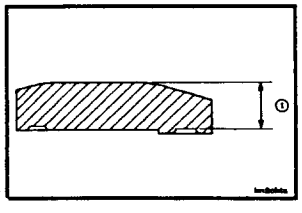


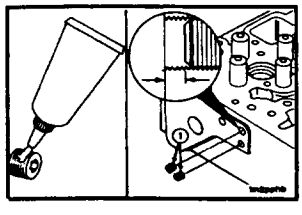
Valve Head Thickness at O.D.	1	3.15 mm	MIN	0.124 in
		3.62 mm	MAX	0.143 in



Valve Guide I.D. (Installed)			
Used	9.670 mm	MIN	0.3807 in
	9.730 mm	MAX	0.3831 in
New/Rebuilt	9.670 mm	MIN	0.3807 in
	9.695 mm	MAX	0.3817 in

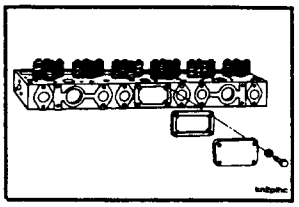
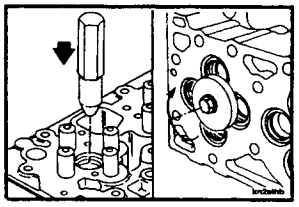
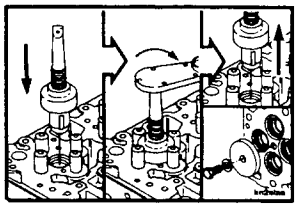
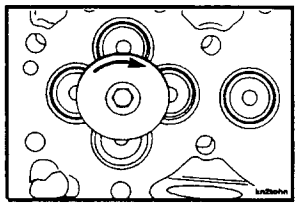
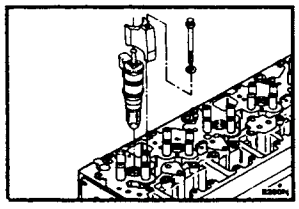
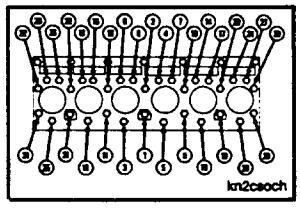
Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.	
Valve Guide Height (Installed)		27.15 mm 27.65 mm	MIN MAX	1.069 in 1.089 in	
Note: Only valve seal compatible guides can be used.					
Valve Guide Bore I.D.		16.480 mm 16.500 mm	MIN MAX	0.6488 in 0.6496 in	
Valve Guide O.D. (Seal Area)		14.25 mm 14.37 mm	MIN MAX	0.561 in 0.566 in	
Valve Guide O.D. (Base)		16.513 mm 16.526 mm	MIN MAX	0.6501 in 0.6506 in	
Valve Seat Area Width	1	1.63 mm 2.69 mm	MIN MAX	0.064 in 0.106 in	
Valve Seat to Valve Guide Concentricity (Per 360 Degrees)		0.05 mm	MAX	0.002 in	
Valve Recess in Cylinder Head	1	0.76 mm 1.17 mm	MIN MAX	0.030 in 0.046 in	

Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.
 **Valve Insert Bore Depth (Standard Insert)**		9.40 mm 9.50 mm	MIN MAX	0.370 in 0.374 in
 **Valve Insert Bore I.D. (Standard Insert)**		45.920 mm 45.935 mm	MIN MAX	1.8073 in 1.8085 in
Note: Refer to Cylinder Head - Oversize Valve Seat Installation (2-05) for oversize valve insert dimensions.				
 **Injector to Injector Sleeve Seat Pattern:**				
• Distance from Cylinder Head Surface	1	13.0 mm	Approx.	0.50 in
• Pattern Width	2	1.52 mm	MIN	0.060 in
 **Injector Tip Protrusion:**				
• (Used Injector Sleeve)		2.28 mm 2.65 mm	MIN MAX	0.090 in 0.104 in
• (New Injector Sleeve)		2.28 mm 2.54 mm	MIN MAX	0.090 in 0.100 in
 **Valve Seat Leakage**		508 mm-Hg 685 mm-Hg	MIN MAX	20 in-Hg 25 in-Hg
Note: Refer to Cylinder Head - Vacuum Test Valve Seating (2-09). Vacuum test applicable to new or rebuilt head only. For used heads, refer to Procedure 7-07 in the Troubleshooting and Repair Manual, Bulletin No. 3810439-01.				
 **Crosshead Stem Pocket to Pad Face**		12.05 mm 12.55 mm	MIN MAX	0.474 in 0.494 in

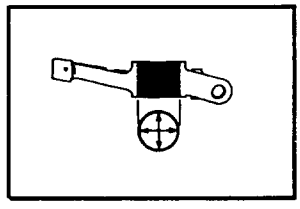


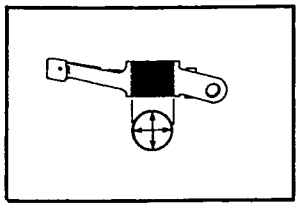
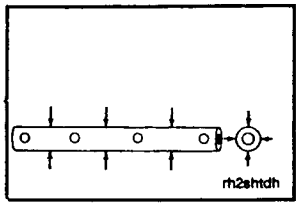
Cylinder Head - Torque Values

Cylinder Head Pipe Plugs **Note:** The pipe plugs (1) located in the front of the cylinder head **must** be installed below the surface of the cylinder head.		10 N•m	8 ft-lb

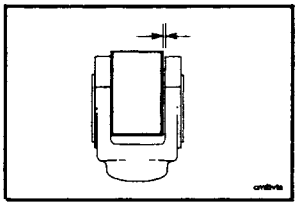
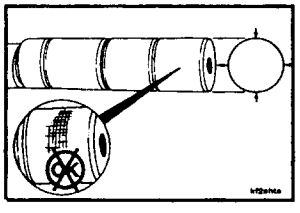
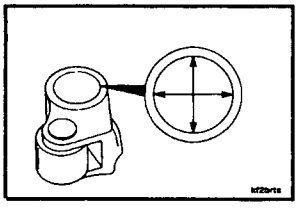
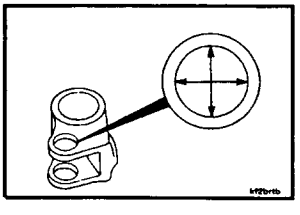
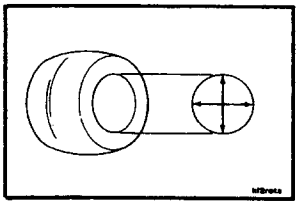
Component or Assembly (Procedure)	Ref.No./Steps	Metric	U.S.	
Water Cover Plate		68 N•m	50 ft-lb	
Injector Sleeve Holding Tool Capscrew **Note:** This torque value is for installing new injector sleeves. Refer to Cylinder Head - Replace Injector Sleeves (2-08).		50 N•m	38 ft-lb	
Injector Sleeve Expander Mandrel		8.9 N•m	75 in-lb	
Injector Sleeve Holding Tool Capscrew **Note:** This torque value is for pressure testing the cylinder head. Refer to Cylinder Head-Pressure Test for Reuse (2-08).	1 2 3	5 N•m 10 N•m 15 N•m	45 in-lb 90 in-lb 130 in-lb	
Injector Hold-Down Clamp Capscrews (Fixed Time Engines) **(STC and CELECT™)**	1 2 3	6 N•m 12 N•m 19 N•m 75 N•m	55 in-lb 110 in-lb 165 in-lb 55 ft-lb	
Cylinder Head Capscrew Torque Refer to Engine Assembly Torque Values.				

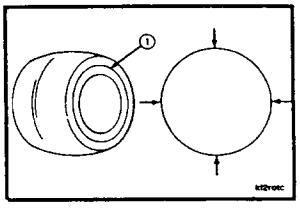
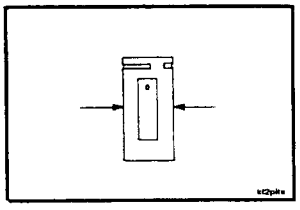
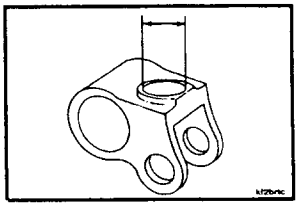
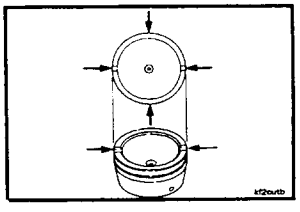
Rocker Lever Assembly - Rebuild Specifications

Rocker Lever Bushing Bore I.D.	34.900 mm 34.976 mm	MIN MAX	1.3740 in 1.3770 in	

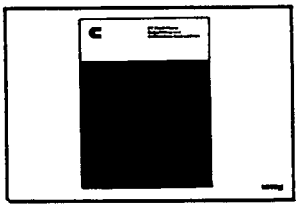
Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.
 **Rocker Lever Bore I.D.**		36.474 mm 36.499 mm	MIN MAX	1.4359 in 1.4370 in
 **Rocker Lever Shaft O.D.**		34.837 mm 34.863 mm	MIN MAX	1.3715 in 1.3726 in

Cam Follower Assembly - Rebuild Specifications

 **Cam Follower Roller Side Clearance**		0.19 mm 0.65 mm	MIN MAX	0.007 in 0.026 in
 **Cam Follower Shaft Journal O.D.**		33.991 mm 34.009 mm	MIN MAX	1.3382 in 1.3389 in
 **Cam Follower Lever Shaft Bore I.D.**		34.086 mm 34.116 mm	MIN MAX	1.3420 in 1.3431 in
 **Cam Follower Lever Roller Pin Bore I.D.**		19.043 mm 19.055 mm	MIN MAX	0.7497 in 0.7502 in
 **Cam Follower Lever Roller Bore I.D.**		19.151 mm 19.177 mm	MIN MAX	0.7540 in 0.7550 in

Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.	
Cam Follower Crowned Roller O.D.		41.237 mm 41.287 mm	MIN MAX	1.6235 in 1.6255 in	
Cam Follower Roller Pin (New) O.D.		19.065 mm 19.073 mm	MIN MAX	0.7506 in 0.7509 in	
Cam Follower Lever Socket Bore I.D.		19.024 mm 19.050 mm	MIN MAX	0.7490 in 0.7500 in	
Cam Follower Lever Socket (New) O.D.		19.062 mm 19.088 mm	MIN MAX	0.7505 in 0.7515 in	

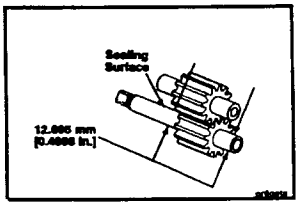
Fuel Pump - Rebuild Specifications

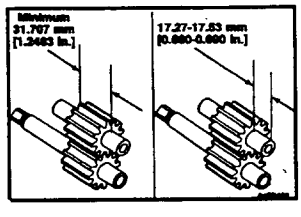


STC and Fixed Time Engines

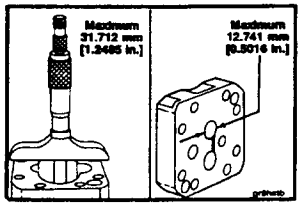
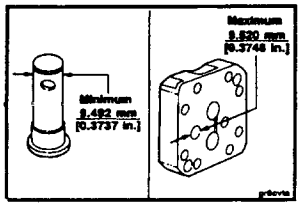
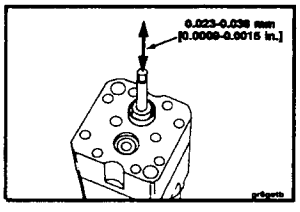
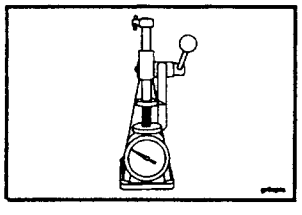
The disassembly, inspection, repair, assembly and calibration procedures for the fuel pump are covered in PT Fuel Pump Rebuilding and Calibration Instructions, Bulletin No. 3379084.

CELECT™ Engines **Gear Pump Shaft Bearing Surface**		12.695 mm	MIN	0.4998 in
Gear Width		31.707 mm	MIN	1.2483 in
Gear Installed Depth		17.270 mm 17.533 mm	MIN MAX	0.6799 in 0.6903 in



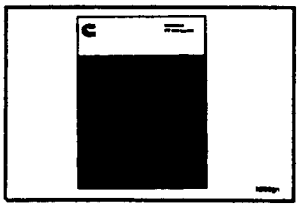


Note: Measure from the body end of the shaft.

Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.
	**Body Gear Hole Depth**	31.704 mm 31.712 mm	MIN MAX	1.2482 in 1.2485 in
	Body Shaft Bore I.D.	12.733 mm 12.741 mm	MIN MAX	0.5013 in 0.5016 in
	**Body Regulator Bore I.D.**	9.510 mm 9.520 mm	MIN MAX	0.3744 in 0.3748 in
	**Shaft End Clearance**	0.023 mm 0.038 mm	MIN MAX	0.0009 in 0.0015 in
				

Regulator Spring Specifications

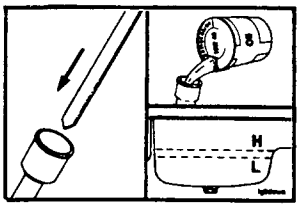
Part No.	Wire Dia. mm [inch]	No. Coils	Load Kg [lb]	Length mm [inch]	Free Length mm [inch]
3068424	1.52 [.060]	5.25	4.0 [8.9]	16.0 [.631]	21.16 [.8337]



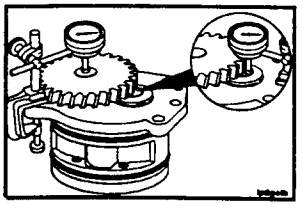
Injectors - Rebuild Specifications

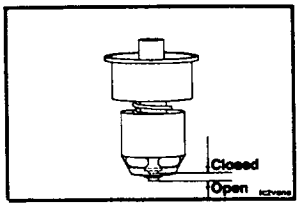
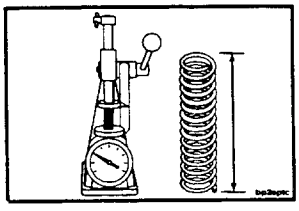
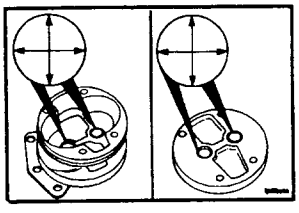
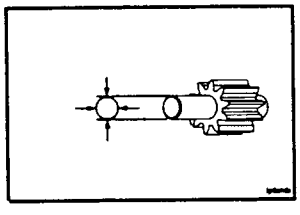
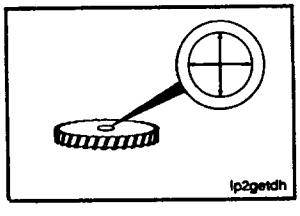
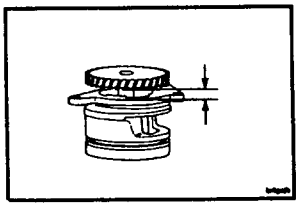
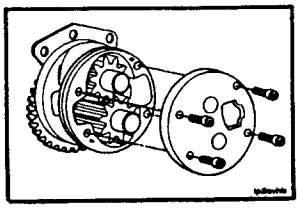
The disassembly, inspection, repair and calibration procedure for STC and fixed time injectors are covered in Cummins PT Injectors (all types), Bulletin Nos. 3810344 and 3810313.

Note: CELECT™ injectors **cannot** presently be rebuilt.

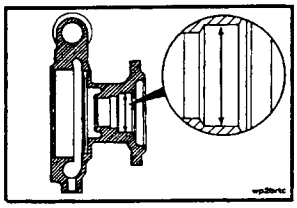
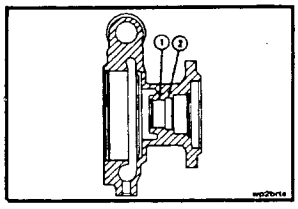
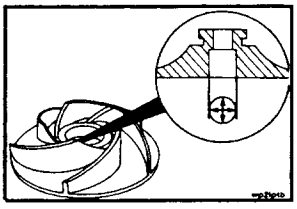
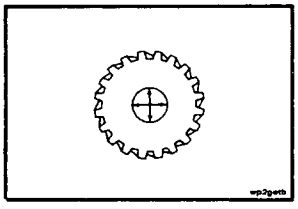
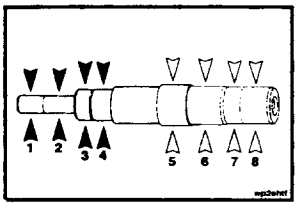
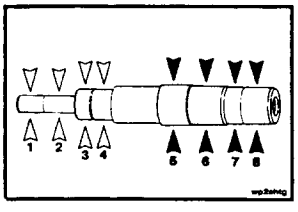
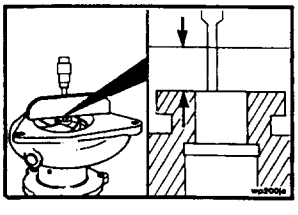


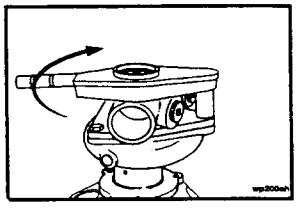
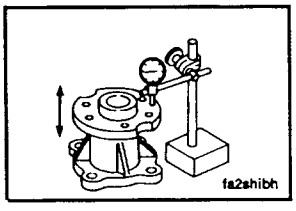
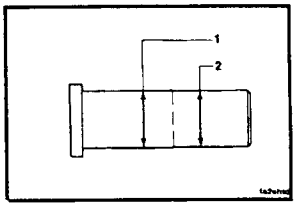
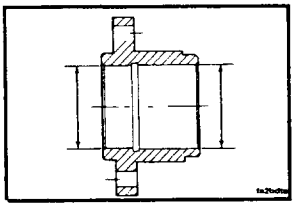
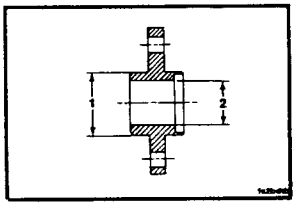
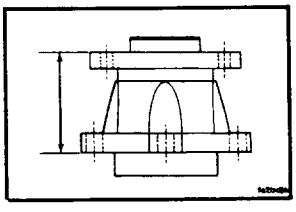
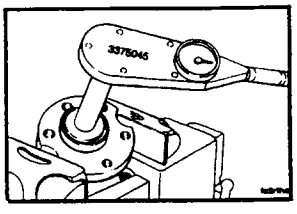
Lubricating Oil System - Specifications

Oil Pan Capacity:			
• Automotive	26.5 litres 34.0 litres	Low High	7.0 gal. 9.0 gal.
• Industrial	30.3 litres 34.0 litres	Low High	8.0 gal. 9.0 gal.
			
Lubricating Oil Pump Shaft End Clearance	0.064 mm 0.269 mm	MIN MAX	0.0025 in 0.0106 in

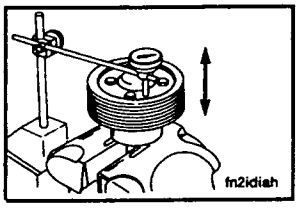
Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.	
Lubricating Oil Thermostat					
• Initial Opening Temperature		106°C 108°C	MIN MAX	223°F 227°F	
• Fully Open Temperature		115°C	MAX	240°F	
• Maximum Opening Distance		6.35 mm	MAX	0.250 in	
Lubricating Oil Filter Head Bypass Valve Spring:					
• Free Length		37.68 mm 38.52 mm	MIN MAX	1.483 in 1.517 in	
• Load at 29.65 mm [1.167 inch]		110.1 N 121.7 N	MIN MAX	24.751 lbf 27.359 lbf	
Lubricating Oil Pump Body and Cover Shaft Bore I.D.		18.720 mm 18.746 mm	MIN MAX	0.7370 in 0.7380 in	
Lubricating Oil Pump Gear Shaft O.D.		18.669 mm 18.681 mm	MIN MAX	0.7350 in 0.7355 in	
Lubricating Oil Pump Drive Gear Bore I.D.		18.600 mm 18.625 mm	MIN MAX	0.7323 in 0.7333 in	
Lubricating Oil Pump Gear to Body Clearance		9.500 mm 12.000 mm	MIN MAX	0.3740 in 0.4724 in	
Lubricating Oil System - Torque Values					
Rear Cover Plate		20 N•m		18 ft-lb	

Water Pump Assembly - Rebuild Specifications

Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.
 **Water Pump Body Bearing Bore I.D.**		51.996 mm 52.011 mm	MIN MAX	2.0471 in 2.0477 in
 **Water and Oil Seal Bore I.D.:**				
• Water Seal Bore	1	36.450 mm 36.475 mm	MIN MAX	1.4350 in 1.4360 in
• Oil Seal Bore	2	40.975 mm 41.025 mm	MIN MAX	1.6132 in 1.6152 in
 **Water Pump Impeller Bore I.D.**		15.339 mm 15.365 mm	MIN MAX	0.6039 in 0.6049 in
 **Water Pump Drive Gear Bore I.D.**		33.900 mm 33.925 mm	MIN MAX	1.3346 in 1.3356 in
 **Water Pump Shaft Journals O.D.**	1	15.389 mm 15.402 mm	MIN MAX	0.6059 in 0.6064 in
	2	15.897 mm 15.910 mm	MIN MAX	0.6259 in 0.6264 in
	3	24.999 mm 25.009 mm	MIN MAX	0.9842 in 0.9846 in
	4	24.999 mm 25.009 mm	MIN MAX	0.9842 in 0.9846 in
 **Water Pump Shaft Journals O.D. (Cont'd.)**	5	33.951 mm 33.976 mm	MIN MAX	1.3366 in 1.3376 in
	6	29.987 mm 30.000 mm	MIN MAX	1.1806 in 1.1811 in
	7	27.975 mm 28.025 mm	MIN MAX	1.1014 in 1.1033 in
	8	27.887 mm 27.900 mm	MIN MAX	1.0979 in 1.0984 in
 **Water Pump Impeller Hub To Body Surface Distance**		13.52 mm 13.72 mm	MIN MAX	0.532 in 0.540 in

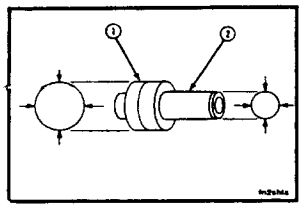
Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.	
Water Pump Assembly - Torque Values					
Water Pump Cover		47 N•m		35 ft-lb	
Fan Hub - Inspection Specifications					
Fan Hub Shaft End Clearance		0.076 mm 0.406 mm	MIN MAX	0.0030 in 0.0160 in	
Fan Hub Shaft O.D.	1	34.590 mm 34.963 mm	MIN MAX	1.3760 in 1.3765 in	
	2	34.912 mm 34.925 mm	MIN MAX	1.3745 in 1.3750 in	
Hub Bearing Bore I.D.		65.038 mm 65.076 mm	MIN MAX	2.5605 in 2.5620 in	
Flange O.D. and I.D.	1	48.975 mm 49.000 mm	MIN MAX	1.9281 in 1.9291 in	
	2	34.849 mm 34.875 mm	MIN MAX	1.3720 in 1.3730 in	
Face to Face Distance		73.4 mm 74.0 mm	MIN MAX	2.890 in 2.913 in	
Fan Hub - Torque Values					
Retaining Capscrew		61 N•m		45 ft-lb	

Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.

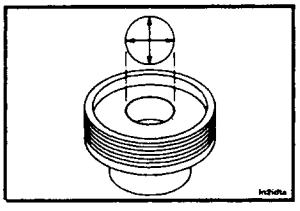


Fan Idler Pulley - Rebuild Specifications

Idler Pulley End Clearance		0.05 mm 0.25 mm	MIN MAX	0.002 in 0.010 in

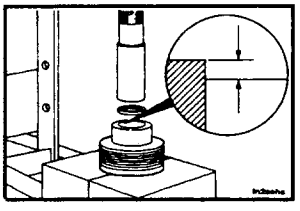


Idler Pulley Shaft O.D.:				
• Oil Seal Surface	1	32.975 mm 33.000 mm	MIN MAX	1.2982 in 1.2992 in
• Bearing Surface	2	19.037 mm 19.050 mm	MIN MAX	0.7495 in 0.7500 in



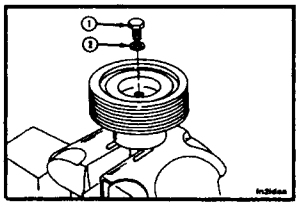
Idler Pulley Bearing Bore I.D.		45.199 mm 45.224 mm	MIN MAX	1.7795 in 1.7805 in

Note: The front and rear bearing bores are the same inside diameter.



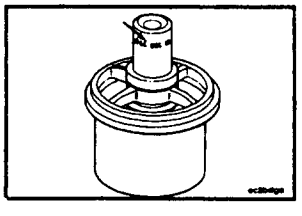
Idler Pulley Bore Oil Seal Installed Depth		0.00 mm 0.25 mm	MIN MAX	0.000 in 0.010 in

Note: Measure depth from the mounting flange surface, as shown.



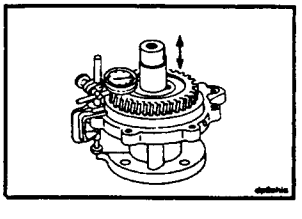
Fan Idler Pulley - Torque Values

Assembly Retaining Capscrew		47 N•m		35 ft-lb



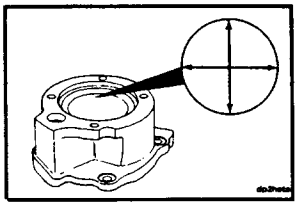
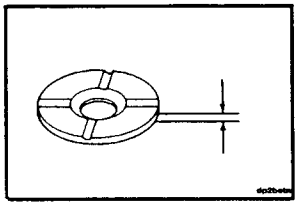
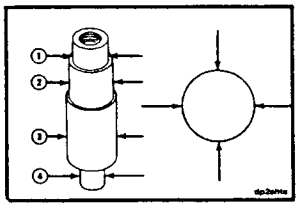
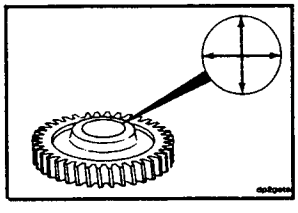
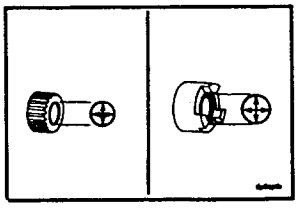
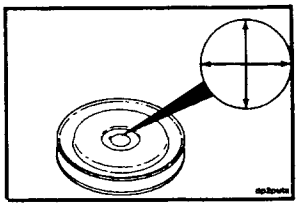
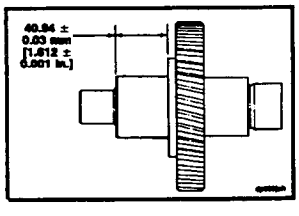
Thermostat, Coolant - Operating Temperature

• Initial Opening Temperature		81°C 83°C	MIN MAX	178°F 182°F
• Fully Open Temperature		93°C	MAX	200°F
• Maximum Opening Distance		9.52 mm	MAX	0.375 in

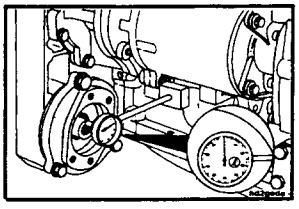


Fuel Pump and Compressor Drive - Rebuild Specifications

Drive Shaft End Clearance		0.10 mm 0.30 mm	MIN MAX	0.004 in 0.012 in

Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.	
Drive Housing Bearing Bore I.D.		47.676 mm 47.775 mm	MIN MAX	1.8770 in 1.8809 in	
Thrust Bearing Thickness		6.084 mm 6.312 mm	MIN MAX	0.2395 in 0.2485 in	
Drive Shaft Journal O.D.	1	34.984 mm 35.000 mm	MIN MAX	1.3773 in 1.3779 in	
	2	44.975 mm 45.000 mm	MIN MAX	1.7706 in 1.7716 in	
	3	47.554 mm 47.570 mm	MIN MAX	1.8722 in 1.8728 in	
	4	25.476 mm 25.489 mm	MIN MAX	1.0030 in 1.0035 in	
Drive Gear Bore I.D.		47.484 mm 47.509 mm	MIN MAX	1.8694 in 1.8704 in	
Splined Coupling I.D.		25.400 mm 25.425 mm	MIN MAX	1.0000 in 1.0010 in	
Hub Coupling I.D.		25.425 mm 25.438 mm	MIN MAX	1.0010 in 1.0015 in	
Drive Pulley Bore I.D.:		35.060 mm 35.098 mm	MIN MAX	1.3803 in 1.3818 in	
Drive Shaft Installed Height In the Drive Gear		40.91 mm 40.97 mm	MIN MAX	1.611 in 1.613 in	

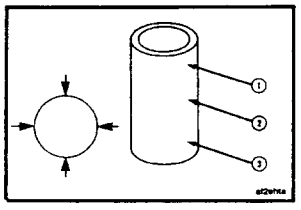
Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.



Hydraulic Pump Drive - Rebuild Specifications

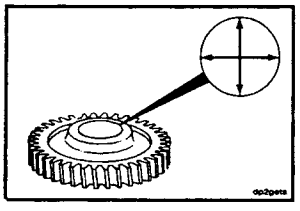
Drive Shaft End Clearance	0.076 mm	MIN	0.0030 in
	0.635 mm	MAX	0.0250 in

Note: The hydraulic pump drive **must** be mounted to the engine to check the drive shaft end clearance.

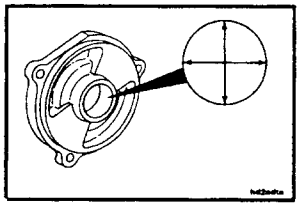


Drive Shaft O.D.	34.984 mm	MIN	1.3773 in
	35.000 mm	MAX	1.3780 in

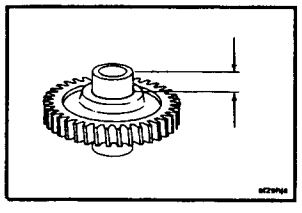
Note: Measure the drive shaft outside diameter in two positions 90 degrees apart at points (1, 2 and 3).



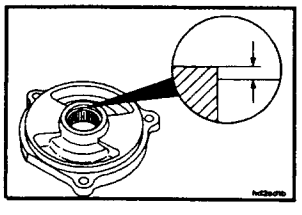
Drive Gear Bore I.D.	34.925 mm	MIN	1.3750 in
	34.950 mm	MAX	1.3760 in



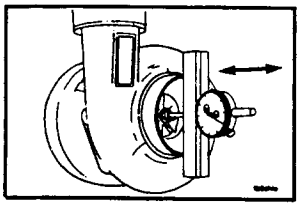
Rear Adapter Bore I.D.	41.967 mm	MIN	1.6522 in
	41.992 mm	MAX	1.6532 in



Drive Shaft Installed Height in the Drive Gear	18.50 mm	MIN	0.728 in
	19.50 mm	MAX	0.768 in

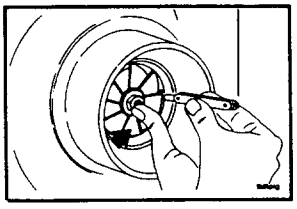


Rear Adapter Bore Bearing Depth	0.254 mm	MIN	0.0100 in
	0.762 mm	MAX	0.0300 in

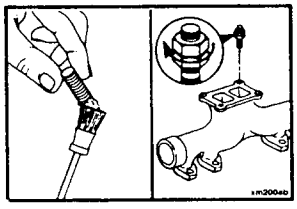


Turbocharger - Inspection Specifications

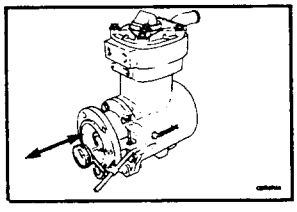
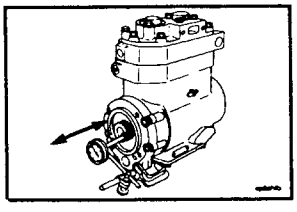
Turbocharger Shaft End Clearance	0.038 mm	MIN	0.0015 in
	0.089 mm	MAX	0.0035 in

Component or Assembly (Procedure)	Ref.No./Steps	Metric		U.S.	
Turbocharger Turbine Wheel Radial Clearance **Note:** Specifications and instructions for rebuilding the turbocharger are provided in the Turbocharger Component Shop Manual, Bulletin No. 3379461.		0.15 mm 0.64 mm	MIN MAX	0.006 in 0.025 in	

Exhaust Manifold - Torque Values

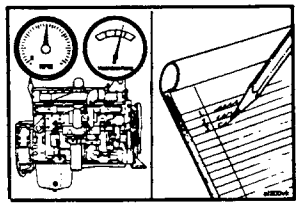
Exhaust Manifold Flange To Turbocharger Mounting Stud Torque **Note:** Apply a coat of anti-seize compound to the threads. Use two mounting nuts locked together to tighten the studs.		65 N•m		50 ft-lb	

Air Compressor - Inspection Specifications

Single Cylinder Air Compressor Crankshaft End Clearance **Note:** Specifications and instructions for rebuilding the single cylinder air compressor are provided in the Air Equipment Rebuild Manual, Bulletin No. 3810457.		0.05 mm 0.15 mm	MIN MAX	0.002 in 0.006 in	
Two Cylinder Air Compressor Crankshaft End Clearance **Note:** Specifications and instructions for rebuilding the two cylinder air compressor are provided in the Air Equipment Rebuild Manual, Bulletin No. 3810347.		0.05 mm 0.19 mm	MIN MAX	0.002 in 0.008 in	

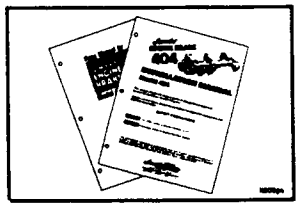
Engine Testing - Test Specifications

Note: The specifications and instructions for testing the engine are provided in this manual. Refer to Engine Testing - Group 14, Page 14-1.



Vehicle Braking - Rebuild Specifications

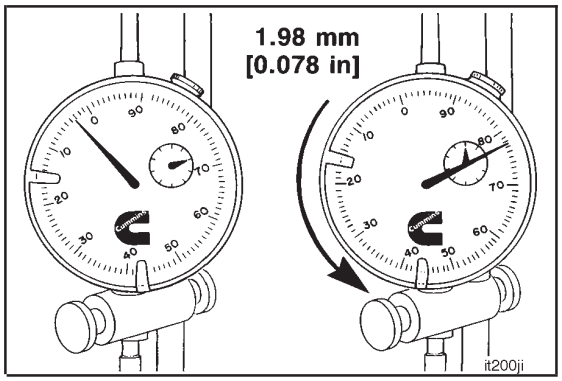
Note: The specifications and instructions for rebuilding the Jacobs® Brake are provided in the Jacobs® Brake Installation Manual. Refer to Vehicle Braking - Group 20, Page 20-1.



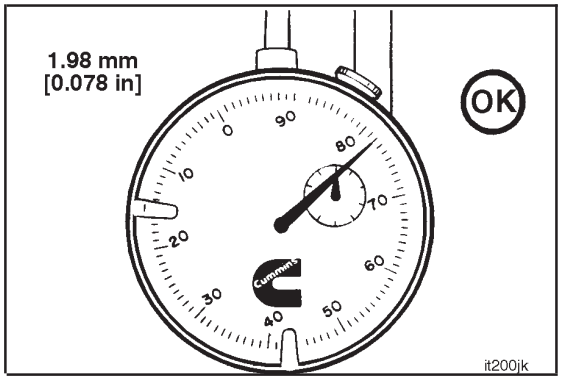
Injection Timing Codes

Note: Injection timing is measured at 5.161 mm [0.2032 inch] BTDC piston travel.

Timing Code	Push Rod Travel Range mm	Push Rod Travel Range in	Reference Camshaft Key Part No.	Key Configuration	Amount of Offset mm [in]
CELECT™					
HM	-5.00 to -5.16	-0.197 to -0.201	3009953	Straight Key	0.000 [0.0000]
STC					
HN	-3.66 to -3.76	-0.144 to -0.148	3009953	Straight Key	0.000 [0.0000]
Fixed Time					
FS	-2.24 to -2.34	-0.088 to -0.092	3030894	Arrow Out	0.330 [0.0130]
FC	-2.11 to -2.21	-0.083 to -0.087	3030894	Arrow In	0.330 [0.0130]
CY	-1.85 to -1.96	-0.073 to -0.077	3030894	Arrow Out	0.330 [0.0130]



Read the push rod travel gauge **counterclockwise** from ‘‘0’’. This travel represents the injection timing value. In the example shown, the value is 1.98 mm [0.078 inch].



Injection timing can be changed by removing the camshaft gear and installing an offset key.

Drive Belt Tension

SAE Belt Size	Belt Tension Gauge Part No.		Belt Tension New		Belt Tension Range Used*	
	Click-type	Burroughs	N	lbf	N	lbf
.380 in.	3822524		620	140	270 to 490	60-110
.440 in.	3822524		620	140	270 to 490	60-110
1/2 in.	3822524	ST-1138	620	140	270 to 490	60-110
11/16 in.	3822524	ST-1138	620	140	270 to 490	60-110
3/4 in.	3822524	ST-1138	620	140	270 to 490	60-110
7/8 in.	3822524	ST-1138	620	140	270 to 490	60-110
4 rib	3822524	ST-1138	620	140	270 to 490	60-110
5 rib	3822524	ST-1138	670	150	270 to 530	60-120
6 rib	3822525	ST-1293	710	160	290 to 580	65-130
8 rib	3822525	ST-1293	890	200	360 to 710	80-160
10 rib	3822525	3823138	1110	250	440 to 890	100-200
12 rib	3822525	3823138	1330	300	530 to 1070	120-240

* A belt is considered used if it has been in service for ten minutes or longer.

* If used belt tension is less than the minimum value, tighten the belt to the maximum used belt value.

* Bus and coach high amperage alternator 12 rib K section used belt tension is 890 to 1070 N [200 to 240 lbf].

- This chart does **not** apply to automatic belt tensioners.

FRACTION, DECIMAL, MILLIMETER CONVERSIONS

8 THS.	16 THS.	32 NDS.	64 THS.	INCHES	MM	8 THS.	16 THS.	32 NDS.	64 THS.	INCHES	MM
			1	0.0156	0.397				33	0.5156	13.097
		1		0.0313	0.794			17		0.5313	13.494
			3	0.0469	1.191				35	0.5469	13.891
	1			0.0625	1.588		9			0.5625	14.288
			5	0.0781	1.984				37	0.5781	14.684
		3		0.0938	2.381			19		0.5938	15.081
			7	0.1094	2.778				39	0.6094	15.478
1				0.1250	3.175	5				0.6250	15.875
			9	0.1406	3.572				41	0.6406	16.272
		5		0.1563	3.969			21		0.6563	16.669
			11	0.1719	4.366				43	0.6719	17.066
	3			0.1875	4.763		11			0.6875	17.463
			13	0.2031	5.159				45	0.7031	17.859
		7		0.2188	5.556			23		0.7188	18.256
			15	0.2344	5.953				47	0.7344	18.653
1/4				0.2500	6.350	3/4				0.7500	19.050
			17	0.2656	6.747				49	0.7656	19.447
		9		0.2813	7.144			25		0.7813	19.844
			19	0.2969	7.541				51	0.7969	20.241
	5			0.3125	7.938		13			0.8125	20.638
			21	0.3281	8.334				53	0.8281	21.034
		11		0.3438	8.731			27		0.8438	21.431
			23	0.3594	9.128				55	0.8594	21.828
3				0.3750	9.525	7				0.8750	22.225
			25	0.3906	9.922				57	0.8906	22.622
		13		0.4063	10.319			29		0.9063	23.019
			27	0.4219	10.716				59	0.9219	23.416
	7			0.4375	11.113		15			0.9375	23.813
			29	0.4531	11.509				61	0.9531	24.209
		15		0.4688	11.906			31		0.9688	24.606
			31	0.4844	12.303				63	0.9844	25.003
1/2				0.5000	12.700	1 IN.				1.0000	25.400

CONVERSION FACTOR: 1 INCH = 25.4MM

Weight and Measures - Conversion Factors

QUANTITY	U.S. CUSTOMARY		METRIC		FROM U.S. CUSTOMARY TO METRIC MULTIPLY BY	FROM METRIC TO U.S. CUSTOMARY MULTIPLY BY
	Unit Name	Abbr.	Unit Name	Abbr.		
Area	sq. inch	in^2	sq. millimeters	mm^2	645.16	0.001550
			sq. centimeters	cm^2	6.452	0.155
	sq. foot	ft^2	sq. meter	m^2	0.0929	10.764
Fuel Consumption	pounds per horsepower hour	lb/hp-hr	grams per kilowatt hour	g/kw-hr	608.277	0.001645
Fuel Performance	miles per gallon	mpg	kilometers per liter	km/l	0.4251	2.352
	gallons per mile	gpm	liters per kilometer	l/km	2.3527	0.4251
Force	pounds force	lbf	Newton	N	4.4482	0.224809
Length	inch	in	millimeters	mm	25.40	0.039370
	foot	ft	millimeters	mm	304.801	0.00328
Power	horsepower	hp	kilowatt	kw	0.746	1.341
Pressure	pounds force per sq. inch	psi	kilopascal	kPa	6.8948	0.145037
	inches of mercury	in Hg	kilopascal	kPa	3.3769	0.29613
	inches of water	in H_2O	kilopascal	kPa	0.2488	4.019299
	inches of mercury	in Hg	millimeters of mercury	mm Hg	25.40	0.039370
	inches of water	in H_2O	millimeters of water	mm H_2O	25.40	0.039370
	bars	bars	kilopascals	kPa	100.001	0.00999
	bars	bars	millimeters of mercury	mm Hg	750.06	0.001333
Temperature	fahrenheit	°F	centigrade	°C	(°F-32) ÷1.8	(1.8 x °C) +32
Torque	pound force per foot	ft lb	Newton-meter	N•m	1.35582	0.737562
	pound force per inch	in lb	Newton-meter	N•m	0.113	8.850756
Velocity	miles/hour	mph	kilometers/hour	kph	1.6093	0.6214
Volume: liquid displacement	gallon (U.S.)	gal.	liter	l	3.7853	0.264179
	gallon (Imp*)	gal.	liter	l	4.546	0.219976
	cubic inch	in^3	liter	l	0.01639	61.02545
	cubic inch	in^3	cubic centimeter	cm^3	16.387	0.06102
Weight (mass)	pounds (avoir.)	lb	kilograms	kg	0.4536	2.204623
Work	British Thermal Unit	BTU	joules	j	1054.5	0.000948
	British Thermal Unit	BTU	kilowatt-hour	kw-hr	0.000293	3414
	horsepower hours	hp-hr	kilowatt-hour	kw-hr	0.746	1.341

Newton-Meter to Foot-Pound Conversion Chart

N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1	8.850756 in-lb	55	41	155	114
5	44 in-lb	60	44	160	118
6	53 in-lb	65	48	165	122
7	62 in-lb	70	52	170	125
8	71 in-lb	75	55	175	129
9	80 in-lb	80	59	180	133
10	89 in-lb	85	63	185	136
1	0.737562 ft-lb	90	66	190	140
12	9	95	70	195	144
14	10	100	74	200	148
15	11	105	77	205	151
16	12	110	81	210	155
18	13	115	85	215	159
20	15	120	89	220	162
25	18	125	92	225	165
30	22	130	96	230	170
35	26	135	100	235	173
40	30	140	103	240	177
45	33	145	107	245	180
50	37	150	111	250	184

NOTE: To convert from Newton-Meters to Kilogram-Meters divide Newton-Meters by 9.803.

Capscrew Markings and Torque Values

Caution: When replacing capscrews, always use a capscrew of the same measurement and strength as the capscrew being replaced. Using the wrong capscrews can result in engine damage.

Metric capscrews and nuts are identified by the grade number stamped on the head of the capscrew or on the surface of the nuts. U.S. Customary capscrews are identified by radial lines stamped on the head of the capscrew.

The following examples indicate how capscrews are identified:

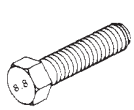
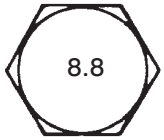
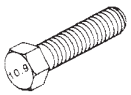
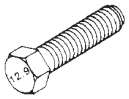
Metric - M8-1.25 X 25		
M8	**1.25**	**25**
Major Thread Diameter in Millimeters	Distance Between Threads in Millimeters	Length in Millimeters

U.S. Customary [5/16 X 18 X 1-1/2]		
5/16	**18**	**1-1/2**
Major Thread Diameter in Inches	Number Threads per Inch	Length in Inches

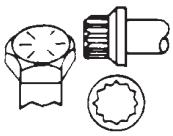
NOTES:

1. **Always** use the torque values listed in the following tables when specific torque values are **not** available.
2. Do **not** use the torque values in place of those specified in other sections of this manual.
3. The torque values in the table are based on the use of lubricated threads.
4. When the ft-lb value is less than 10, give consideration to converting the ft-lb value to in-lb to obtain a better torque with an in-lb torque wrench. Example: 6 ft-lb equals 72 in-lb.

Capscrew Markings and Torque Values - Metric

Commercial Steel Class	8.8				10.9				12.9			
Capscrew Head Markings	 				 				 			
Body Size	**Torque**				**Torque**				**Torque**			
Diam.	**Cast Iron**		**Aluminum**		**Cast Iron**		**Aluminum**		**Cast Iron**		**Aluminum**	
mm	**N•m**	**ft-lb**	**N•m**	**ft-lb**	**N•m**	**ft-lb**	**N•m**	**ft-lb**	**N•m**	**ft-lb**	**N•m**	**ft-lb**
6	9	5	7	4	12	9	7	4	14	9	7	4
7	14	9	11	7	18	14	11	7	23	18	11	7
8	25	18	18	14	33	25	18	14	40	29	18	14
10	45	33	30	25	60	45	30	25	70	50	30	25
12	80	60	55	40	105	75	55	40	125	95	55	40
14	125	90	90	65	165	122	90	65	195	145	90	65
16	180	130	140	100	240	175	140	100	290	210	140	100
18	230	170	180	135	320	240	180	135	400	290	180	135

Capscrew Markings and Torque Values - U.S. Customary

SAE Grade Number	5	8
Capscrew Head Markings		

These are all SAE Grade 5 (3) line

Capscrew Body Size	Capscrew Torque - Grade 5 Capscrew				Capscrew Torque - Grade 8 Capscrew			
	Cast Iron		Aluminum		Cast Iron		Aluminum	
	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1/4 - 20	9	7	8	6	15	11	8	6
- 28	12	9	9	7	18	13	9	7
5/16 - 18	20	15	16	12	30	22	16	12
- 24	23	17	19	14	33	24	19	14
3/8 - 16	40	30	25	20	55	40	25	20
- 24	40	30	35	25	60	45	35	25
7/16 - 14	60	45	45	35	90	65	45	35
- 20	65	50	55	40	95	70	55	40
1/2 - 13	95	70	75	55	130	95	75	55
- 20	100	75	80	60	150	110	80	60
9/16 - 12	135	100	110	80	190	140	110	80
- 18	150	110	115	85	210	155	115	85
5/8 - 11	180	135	150	110	255	190	150	110
- 18	210	155	160	120	290	215	160	120
3/4 - 10	325	240	255	190	460	340	255	190
- 16	365	270	285	210	515	380	285	210
7/8 - 9	490	360	380	280	745	550	380	280
- 14	530	390	420	310	825	610	420	310
1 - 8	720	530	570	420	1100	820	570	420
- 14	800	590	650	480	1200	890	650	480

Pipe Plug Torque Values

Size		Torque		Torque	
Thread	Actual Thread O.D.	In Aluminum Components		In Cast Iron or Steel Components	
in	in	N•m	ft-lb	N•m	ft-lb
1/16	0.32	5	45 in-lb	15	10
1/8	0.41	15	10	20	15
1/4	0.54	20	15	25	20
3/8	0.68	25	20	35	25
1/2	0.85	35	25	55	40
3/4	1.05	45	35	75	55
1	1.32	60	45	95	70
1-1/4	1.66	75	55	115	85
1-1/2	1.90	85	65	135	100

Tap-Drill Chart - U.S. Customary & Metric

NOTE ON SELECTING TAP-DRILL SIZES: The tap drill sizes shown on this card give the theoretical tap drill size for approximately 60% and 75% of full thread depth. Generally, it is recommended that drill sizes be selected in the 60% range as these sizes will provide about 90% of the potential holding power. Drill sizes in the 75% range are recommended for shallow hole tapping (less than 1 1/2 times the hole diameter) in soft metals and mild steel.

Tap Size		Drill
60%	75%	Size
		48
		1.95mm
		5/64
	3-48	47
		2.00mm
	M2.5x.45	2.05mm
		46
3-48	3056	45
		2.10mm
M2.5x.45	M2.6x.45	2.15mm
3-56	4-36	44
		2.20mm
M2.6x.45		2.25mm
4-36	4-40	43
		2.30mm
		2.35mm
4-40	4-48	42
		3/32
	M3x.6	2.40mm
4-48		41
		2.45mm
		40
M3x.6	M3x.5	2.50mm
		39
	5-40	38
M3x.5		2.60mm
5-40	5-44	37
		2.70mm
5-44	6-32	36
		2.75mm
		7/64
		35
		2.80mm
		34
6-32	6-40	33
	M3.5x6	2.90mm
		32
M3.5x6		3.00mm
6-40		31
		3.10mm
		1/8
		3.20mm
	M4x.75	3.25mm
		30
	M4x.7	3.30mm
M4x.75		3.40mm
M4x.7	8-32	29
		3.50mm
	8-36	28
8-32		9/64
		3.60mm
8-36		27
		3.70mm
		26
	M4.5x.75	3.75mm
	10-24	25
		3.80mm
		24
M4.5x.75		3.90mm
		23
		5/32
10-24		22
	M5x1	4.00mm
	10-32	21
		20
	M5x.9	4.10mm
M5x1	M5x.8	4.20mm
10-32		19
M5x.9		4.25mm
M5x.8		4.30mm
		18
		11/64
		17

Tap Size		Drill
60%	75%	Size
		4.40mm
	12-24	16
		4.50mm
		15
	M5.5x.9	4.60mm
12-24	12-28	14
		13
		4.70mm
M5.5x.9		4.75mm
12-28		3/16
		12
		4.80mm
		11
		4.90mm
		10
		9
	M6x1	5.00mm
		8
		5.10mm
	1/4-20	7
		13/64
		6
M6x1		5.20mm
		5
	M6x.75	5.25mm
		5.30mm
1/4-20		4
M6x.75		5.40mm
	1/4-28	3
		5.50mm
		7/32
		5.60mm
1/4-28		2
		5.70mm
		5.75mm
		1
		5.80mm
		5.90mm
		A
		15/64
	M7x1	6.00mm
		B
		6.10mm
		C
M7x1		6.20mm
		D
	M7x.75	6.25mm
		6.30mm
		E
		1/4
M7x.75		6.40mm
		6.50mm
	5/16-18	F
		6.60mm
		G
		6.70mm
		17/64
	M8x1.25	6.75mm
5/16-18		H
		6.80mm
		6.90mm
	5.16-24	I
M8x1.25	M8x1	7.00mm
		J
		7.10mm
5/16-24		K
		9/32
M8x1		7.20mm
		7.25mm
		7.30mm
		L
		7.40mm
		M

Tap Size		Drill
60%	75%	Size
		7.50mm
		19/64
		7.60mm
		N
		7.70mm
	M9x1.25	7.75mm
		7.80mm
		7.90mm
	3/8-16	5/16
M9x1.25	M9x1	8.00mm
		O
		8.10mm
M9x1		8.20mm
		P
		8.25mm
		8.30mm
3/8-16	1/8-27NPT	21/64
		8.40mm
	3/8-24	Q
	M10x1.5	8.50mm
		8.60mm
		R
3/8-24		8.70mm
1/8-27NPT		11/32
	M10x1.25	8.75mm
M10x1.5		8.80mm
		S
		8.90mm
M10x1.25	M10x1	9.00mm
		T
		9.10mm
		23/64
M10x1		9.20mm
		9.30mm
	7/16-14	U
		9.40mm
	M11x1.5	9.50mm
		3/8
		V
		9.60mm
		9.70mm
		9.75mm
M11x1.5		9.80mm
7/16-14		W
		9.90mm
	7/16-20	25/64
		10.00mm
7/16-20		X
	M12x1.75	10.20mm
		Y
		13/32
		Z
M12x1.75	M12x1.5	10.50mm
	1/2-13	27/64
M12x1.5	M12x1.25	10.75mm
M12x1.25		11.00mm
1/2-13		7/16
1/4-18NPT		
		11.25mm
		11.50mm
		29/64
		11.75mm
		11.50mm
	1/2-20	29/64
	9/16-12	15/32
	M14x2	12.00m
		12.25mm
9/16-12		31/64
M14x2	M14x1.5	12.50mm
	9/16-18	1/2
M14x1.5	M14x1.25	12.75mm
M14x1.25		13.00mm
9/16-18		33/64

Tap Size		Drill
60%	75%	Size
		13.25mm
	5/8-11	17/32
	M15x1.5	13.50mm
M15x1.5		13.75mm
5/8-11		35/64
	M16x2	14.00mm
		14.25mm
	5/8-18	9/16
M16x2	M16x1.5	14.50mm
5/8-18		37/64
		14.75mm
M16x1.5		15.00mm
		19.32
		15.25mm
		39/64
	M17x1.5	15.50mm
M17x1.5	M18x2.5	15.75mm
		5/8
M18x2.5	M18x2	16.00mm
M18x2		16.25mm
	3/4-10	41/64
	M18x1.5	16.50mm
3/4-10	M19x2.5	21/32
M18x1.5		16.75mm
M19x2.5		17.00mm
		43/64
		17.25mm
3/4-16	3/4-16	11/16
	M20x2.5	17.50mm
		17.75mm
		45/64
M20x2.5	M20x2	18.00mm
M20x2		18.25mm
		23/32
	M20x1.5	18.50mm
		47/64
M20x1.5		18.75mm
		19.00mm
		3/4
		19.25mm
	7/8-9	49/64
	M22x2.5	19.50mm
7/8-9		25/32
		19.75mm
M22x2.5	M22x2	20.00mm
	7/8-14	51/64
M22x2		20.25mm
	M22x1.5	20.50mm
7/8-14		13/16
		20.75mm
M22x1.5	M24x3	21.00mm
		53/64
		21/25mm
		27/32
M24x3		21.50mm
		21.75mm
		55/64
	M24x2	22.00mm
	1″-8	7/8
M24x2		22.25mm
	M24x1.5	22.50mm
1″-8		57/64
M24x1.5		22.75mm
	M25x2	23.00mm
	1″-12	29/32
M25x2		23.25mm
1″x12	1″-14	59/64
	M25x1.5	23.50mm
M20x1.5		23.75mm
1″-14		15/16

Component Manufacturers' Addresses

NOTE: The following list contains addresses and telephone numbers of suppliers of accessories used on Cummins engines. Suppliers may be contacted directly for any specifications **not** covered in this manual.

Air Compressors

Bendix Heavy Vehicles Systems
Div. of Allied Automotive
901 Cleveland Street
Elyria, OH 44036
Telephone: (216) 329-9000

Midland-Grau
Heavy Duty Systems
Heavy Duty Group Headquarters
10930 N. Pomona Avenue
Kansas City, MO 64153
Telephone: (816) 891-2470

Air Cylinders

Bendix Ltd.
Douglas Road
Kingswood
Bristol
England
Telephone: 0272-671881

Catching Engineering
2101 Roberts Drive
Broadview, IL 60153
Telephone: (312) 344-2334

Air Heaters

Fleetguard, Inc.
P.O. Box 6001
Cookeville, TN 38502
Telephone: (615) 526-9551

Kim Hotstart Co.
West 917 Broadway
Spokane, WA 99210
Telephone: (509) 534-6171

Air Starting Motors

Ingersoll Rand
Chorley New Road
Horwich
Bolton
Lancashire
England
BL6 6JN
Telephone: 0204-65544

Ingersoll-Rand Engine
Starting Systems
888 Industrial Drive
Elmhurst, IL 60126
Telephone: (312) 530-3800

StartMaster
Air Starting Systems
A Division of Sycon Corporation
P. O. Box 491
Marion, OH 43302
Telephone: (614) 382-5771

Alternators

Robert Bosch Ltd.
P.O. Box 98
Broadwater Park
North Orbital Road
Denham
Uxbridge
Middlesex UD9 5HG
England
Telephone: 0895-833633

Butec Electrics
Cleveland Road
Leyland
PR5 1XB
England
Telephone: 0744-21663

C.A.V. Electrical Equipment
P.O. Box 36
Warple Way
London
W3 7SS
England
Telephone: 01-743-3111

A.C. Delco Components Group
Civic Offices
Central Milton Keynes
MK9 3EL
England
Telephone: 0908-66001

C. E. Niehoff
2021 Lee Street
Evanston, IL 60202
Telephone: (708) 866-6030

Delco-Remy
P.O. Box 2439
Anderson, IN 46018
Telephone: (317) 646-7838

Leece-Neville Corp.
1374 E. 51st St.
Cleveland, OH 44013
Telephone: (216) 431-0740

Auxiliary Brakes

The Jacobs Manufacturing Company
Vehicle Equipment Division
22 East Dudley Town Road
Bloomfield, CT 06002
Telephone: (203) 243-1441

Belts

Dayco Rubber U.K.
Sheffield Street
Stockport
Cheshire
SK4 1RV
England
Telephone: 061-432-5163

T.B.A. Ind. Products
P.O. Box 77
Wigan
Lancashire
WN2 4XQ
England
Telephone: 0942-59221

Dayco Corp.
Belt Technical Center
P.O. Box 3258
Springfield, MO 65804
Telephone: (417) 881-7440

Gates Rubber Company
5610 Crawfordsville Road
Suite 2002
Speedway, IN 46224
Telephone: (317) 248-0386

Goodyear Tire and
Rubber Company
49 South Franklin Road
Indianapolis, IN 46219
Telephone: (317) 898-4170

Clutches

Twin Disc International S.A.
Chaussee de Namur
Nivelles
Belguim
Telephone: 067-224941

Twin Disc Clutch Co.
Racine, WI 53403
Telephone: (414) 634-1981

Coolant Heaters

Fleetguard, Inc.
P.O. Box 6001
Cookeville, TN 38502
Telephone: (615) 526-9551

Drive Plates

Detroit Diesel Allison
Division of General Motors
Corporation
P.O. Box 894
Indianapolis, IN 46206
Telephone: (317) 244-1511

Electric Starting Motors

Butec Electrics
Cleveland Road
Leyland
PR5 1XB
England
Telephone: 0744-21663

C.A.V. Electrical Equipment
P.O. Box 36
Warple Way
London
W3 7SS
England
Telephone: 01-743-3111

A.C. Delco Components Group
Civic Offices
Central Milton Keynes
MK9 3EL
England
Telephone: 0908-66001

Delco-Remy
P.O. Box 2439
Anderson, IN 46018
Telephone: (317) 646-7838

Leece-Neville Corp.
1374 E. 51st Street
Cleveland, OH 44013
Telephone: (216) 431-0740

Nippondenso Sales, Inc.
24777 Denso Drive
P.O. Box 5133
Southfield, MI 48086-5133
Telephone: (313) 350-7500

Engine Protection Controls

Teddington Industrial Equipment
Windmill Road
Sunburn on Thames
Middlesex
TW16 7HF
England
Telephone: 09327-85500

The Nason Company
10388 Enterprise Drive
Davisburg, MI 48019
Telephone: (313) 625-5381

Fan Clutches

Holset Engineering Co. Ltd.
P.O. Box 9
Turnbridge
Huddersfield
England
Telephone: 0484-22244

Horton Industries, Inc.
P.O. Box 9455
Minneapolis, MN 55440
Telephone: (612) 378-6410

Rockford Division
Borg-Warner Corporation
1200 Windsor Road
P.O. Box 7007
Rockford, IL 61125-7007
Telephone: (815) 633-7460

Transportation Components Group
Facet Enterprises, Inc.
Elmira, NY 14903
Telephone: (607) 737-8212

Fans

Truflo Ltd.
Westwood Road
Birmingham
B6 7JF
England
Telephone: 021-557-4101

Hayes-Albion
1999 Wildwood Avenue
Jackson, MI 49202
Telephone: (517) 782-9421

Engineering Cooling Systems
201 W. Carmel Drive
Carmel, IN 46032
Telephone: (317) 846-3438

Brookside
McCordsville, IN 46055
Telephone: (317) 873-5093

Aerovent
8777 Purdue Rd.
Indianapolis, IN 46268
Telephone: (317) 872-0030

Kysor
1100 Wright Street
Cadillac, MI 49601
Telephone: (616) 775-4681

Schwitzer
1125 Brookside Avenue
P.O. Box 80-B
Indianapolis, IN 46206
Telephone: (317) 269-3100

Filters

Fleetguard International Corp.
Cavalry Hill Industrial Park
Weedon
Northampton NN7 4TD
England
Telephone: 0327-41313

Fleetguard, Inc.
P.O. Box 6001
Cookeville, TN 38502
Telephone: (615) 526-9551

Flexplates

Corrugated Packing and Sheet Metal
Hamsterley
Newcastle Upon Tyne
Telephone: 0207-560-505

Detroit Diesel Allison
Division of General Motors Corporation
P.O. Box 894
Indianapolis, IN 46206
Telephone: (317) 244-1511

Detroit Diesel Allison
Division of General Motors
36501 Van Born Road
Romulus, MI 48174
Telephone: (313) 595-5711

Midwest Mfg. Co.
30161 Southfield Road
Southfield, MI 48076
Telephone: (313) 642-5355

Fuel Warmers

Fleetguard, Inc.
P.O. Box 6001
Cookeville, TN 38502
Telephone: (615) 526-9551

Gauges

A.I.S.
Dyffon Industrial Estate
Ystrad Mynach
Hengoed
Mid Glamorgan
CF8 7XD
England
Telephone: 0443-812791

Grasslin U.K. Ltd.
Vale Rise
Tonbridge
Kent
TN9 1TB
England
Telephone: 0732-359888

Icknield Instruments Ltd.
Jubilee Road
Letchworth
Herts
England
Telephone: 04626-5551

Superb Tool and Gauge Co.
21 Princip Street
Birmingham
B4 61E
England
Telephone: 021-359-4876

Kabi Electrical and Plastics
Cranborne Road
Potters Bar
Herts
EN6 3JP
England
Telephone: 0707-53444

Datcon Instrument Co.
P.O. Box 128
East Petersburg, PA 17520
Telephone: (717) 569-5713

Rochester Gauge of Texas
11637 Denton Drive
Dallas, TX 75229
Telephone: (214) 241-2161

Governors

Woodward Governors Ltd.
P.O. Box 15
663/664 Ajax Avenue
Slough
Bucks
SL1 4DD
England
Telephone: 0753-26835

Woodward Governor Co.
1000 E. Drake Road
Fort Collins, CO 80522
Telephone: (303) 482-5811

Barber Colman Co.
1300 Rock Street
Rockford, IL 61101
Telephone: (815) 877-0241

United Technologies
Diesel Systems
1000 Jorie Blvd.
Oak Brook, IL 60521
Telephone: (312) 325-2020

Hydraulic and Power Steering Pumps

Hobourn Eaton Ltd.
Priory Road
Strood
Rochester
Kent
ME2 2BD
Telephone: 0634-71773

Honeywell Control Systems Ltd.
Honeywell House
Charles Square
Bracknell
Berks RG12 1EB
Telephone: 0344-424555

Sundstrand Hydratec Ltd.
Cheney Manor Trading Estate
Swindon
Wiltshire
SN2 2PZ
England
Telephone: 0793-30101

Sperry Vickers
1401 Crooks Road
Troy, MI 48084
Telephone: (313) 280-3000

Z.F.
P.O. Box 1340
Grafvonsoden Strasse
5-9 D7070
Schwaebisch Gmuend
West Germany
Telephone: 7070-7171-31510

Oil Heaters

Fleetguard, Inc.
P.O. Box 6001
Cookeville, TN 38502
Telephone: (615) 526-9551

Kim Hotstart Co.
West 917 Broadway
Spokane, WA 99210
Telephone: (509) 534-6171

Torque Converters

Twin Disc International S.A.
Chaussee de Namur
Nivelles
Belgium
Telephone: 067-224941

Twin Disc Clutch Co.
Racine, WI 53403
Telephone: (414) 634-1981

Rockford Division
Borg-Warner Corporation
1200 Windsor Road
P.O. Box 7007
Rockford, IL 61125-7007
Telephone: (815) 633-7460

Modine
1500 DeKoven Avenue
Racine, WI 53401
Telephone: (414) 636-1640

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The following publications can be purchased by filling in and mailing the Service Publications Order Form:

BULLETIN NO.	TITLE OF PUBLICATION
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3379084	Fuel Pump PT (type G) Rebuild and Calibration Instructions
3379133	Control Parts List
3379209	Fuel Systems Publications
3379352	PT Fuel Pump Rebuilding and Calibration Instructions
3379461	Turbocharger Rebuild Manual (H 2B, H 2C and HC 3)
3379664	Injector Parts Flow and Cross Reference
3387380	STC Familiarization
3810242	Single Cylinder Air Compressor Shop Manual
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3810303	Parts Reuse Guidelines
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3810313	PT Injector - Step Timing Control Shop Manual
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3810344	PT Injector - Top Stop Shop Manual
3810361	Troubleshooting and Repair Manual CELECT™ System L10 Engines
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3810388	Overhead Reuse Guidelines, L10 Series Engines
3810396	Fuel Pump, PT (type G) Calibration Values
3810439	Troubleshooting and Repair Manual L10 COMMAND STC and CELECT™ Models
3810443	PT Pacer Compulink™ Cartridge Manual
3810490	Shop and Installation Manual, Rear Engine Power Takeoff
3666026	Operation and Maintenance Manual, L10 Series Engines, STC and CELECT™ Models (U.S.A., Canada, Australia, New Zealand and Puerto Rico)
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3884338	L10-280/310 (Parts Catalog) Automotive

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United States and Canada	Cummins Distributors or Contact 1-800-DIESELS (1-800-343-7357)
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South and Central America (excluding Brazil and Mexico)	Cummins Americas, Inc. 16085 N.W. 52nd Avenue Hialeah, FL 33104
Brazil and Mexico	Cummins Engine Co., Inc. International Parts Order Dept., MC 40931 Box 3005 Columbus, IN 47202-3005
Far East (excluding Australia and New Zealand)	Cummins Diesel Sales Corp. Literature Center 8 Tanjong Penjuru Jurong Industrial Estate Singapore
Australia and New Zealand	Cummins Diesel Australia Maroondah Highway, P.O.B. 139 Ringwood 3134 Victoria, Australia

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Bulletin No. 3810498

We are always open to any suggestions or recommendations that will aid in improving our manuals. Use this postage paid survey form to evaluate this manual. Please check the appropriate response and use the space provided below to list any additional comments:

	Yes	No
Is the needed information easy to locate in the manual?		
Is the information easy to read?		
Is the information easy to understand?		
Does the information sufficiently cover the subject?		
Are subjects in the Index specific enough to locate in the manual?		
Are the important points sufficiently emphasized?		
Are the illustrations easy to understand?		
Does the text support the operation being illustrated?		
Do you use the Table of Contents?		
Do you use the Index?		

Please comment on any response(s) marked ″No″ in this survey. _____

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Other comments that you feel would help improve the manual. _____

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Bulletin No. 3810498-02
Printed in U.S.A. 12/94