3A-C 4-CYLINDER

ENGINE CODING

ENGINE IDENTIFICATION

Engine serial number and code are stamped on left side of block.

Engine Identification

Application	Code
Tercel (1452 cc)	3A-C

ENGINE, CYLINDER HEAD & MANIFOLDS

ENGINE

Removal – 1) Disconnect negative battery cable. Remove hood, air cleaner and, on models with automatic transmission, grille. Wrap drive shaft boots with shop towels.

2) Drain cooling system and remove hoses and oil cooler lines (if so equipped). Loosen fan shroud and remove radiator. Remove exhaust pipe and bracket, differential plate bolts and oil cooler pipe (if so equipped).

3) Disconnect ignition coil cable and all engine-to-chassis electrical connections at engine. Disconnect carburetor linkage, fuel lines and heater hoses.

4) On models with manual transmission, remove starter cable and windshield washer tank. On models with automatic transmission, remove starter and torque converter cover. On all models, support transmission with a floor jack and remove engine mounts.

5) Attach hoist to engine hangers and, with hoist supporting engine, remove transaxle bolts. On models with manual transmission, remove engine. On models with automatic transmission, remove 4 bolts to torque converter. Pull engine about 2" (50 mm) forward, disconnect torque converter and remove engine. On all models, suspend clutch or converter housing.

Installation – To install, reverse removal procedure, assuring that all adjustments and fluid levels are checked prior to starting engine.

MANIFOLDS

NOTE – *Intake and exhaust manifolds are removed and installed as an assembly.*

Removal – Remove air cleaner. Disconnect fuel and vacuum lines at carburetor. Disconnect choke and throttle linkage at carburetor. Remove heat insulator, PCV valve and PCV hose. Disconnect exhaust pipe at manifold. Remove manifold retaining nuts and bolts; remove manifold.

Installation – To install, reverse removal procedure, ensuring that mating surfaces are clean and new gaskets are used. Tighten 2 center bolts first, then tighten the remainder in a front-rear, top-bottom star pattern.

CYLINDER HEAD

Removal – 1) Drain cooling system and remove upper radiator hose. Remove manifold and carburetor assembly. Disconnect heater hose at rear of head. Remove rocker arm cover.

2) Remove spark plug wires, distributor and fuel pump. Position crankshaft to TDC by aligning mark on pulley to "0" mark on lower timing belt cover. Remove drive belt, water pump pulley and alternator.

3) Using a puller, remove crankshaft pulley. Remove timing belt covers and water pump. Mark position of camshaft timing sprocket and timing belt. Remove timing belt.

NOTE – *Do not bend or twist belt. Keep belt free of oil, water, or steam.*

4) Loosen rocker arm support bolts in 3 or 4 steps and in sequence shown in *Fig. 1*. Remove rocker arm assembly and camshaft timing sprocket. Remove camshaft bearing caps in same general sequence as rocker arm supports and arrange in order.

5) Measure camshaft thrust clearance. Remove camshaft and distributor drive gear. Loosen cylinder head bolts in 2 or 3 steps and in sequence shown in *Fig. 2*. Lift head from engine.

Installation – 1) Ensure that mating surfaces are clean, then install new gasket and head. Tighten head bolts gradually in 2 or 3 steps as shown in *Fig. 2*.

2) Install distributor drive gear on camshaft. Install camshaft on head making sure that arrows on bearing caps face front. Apply grease to and install front oil seal.

3) Install front bearing cap and tighten all bearing cap bolts gradually in 3 or 4 steps. Check camshaft thrust clearance and adjust to specifications. Continue installation in reverse order of removal.

CAUTION – *When installing bearing caps, insure that front marks and imprinted numbers match.*

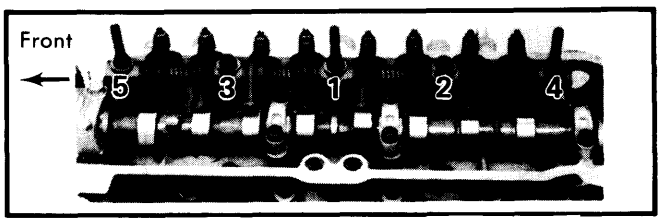

Fig. 1 Rocker Arm Tightening Sequence (Loosen in Reverse Sequence)

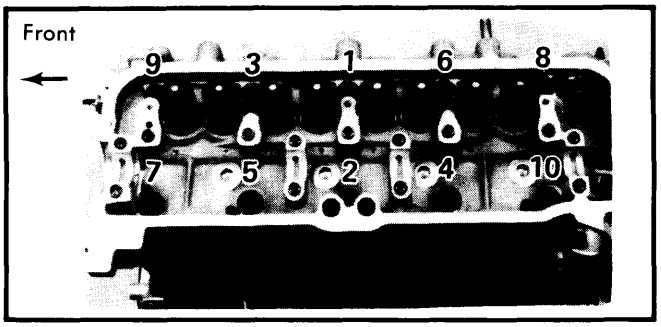

Fig. 2 Cylinder Head Tightening Sequence (Loosen in Reverse Sequence)

3A-C 4-CYLINDER (Cont.)

CAMSHAFT

TIMING BELT

Removal – 1) Remove water pump drive belt and pulley. Position crankshaft to TDC by aligning mark on pulley to "O" mark on lower timing belt cover.

2) Using a puller, remove crankshaft pulley. Remove upper and lower timing belt covers. Mark position of camshaft timing sprocket and timing belt. Remove timing belt.

Inspection – 1) If belt is severed, check timing gear gasket for damage or improper installation. If belt teeth are cracked or damaged, check to see if camshaft is locked.

2) If there is noticeable wear or cracks on belt face, check for nicks on idler pulley lock. If there is damage or wear on only one edge of belt, check belt guide and alignment of each pulley.

Installation – 1) Loosen timing belt idler pulley and move toward the left as far as possible. Using care not to excessively bend or twist timing belt, install timing belt.

2) Turn crankshaft 2 revolutions and align timing mark. Measure timing belt tension as shown in *Fig. 3* and adjust with timing belt idler pulley. Complete installation by reversing removal procedure.

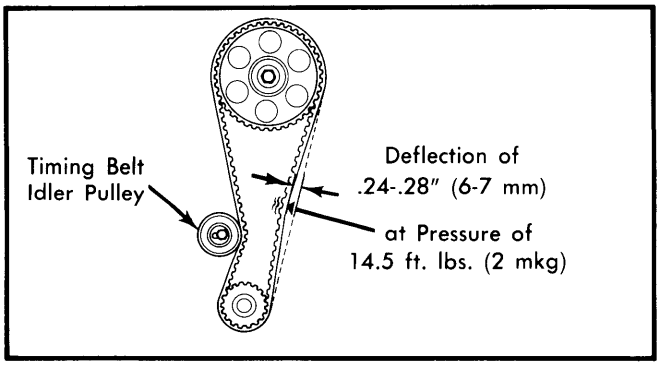

Fig. 3 Measuring Timing Belt Tension

CAMSHAFT

Removal – 1) Remove air cleaner and rocker arm cover. Remove front cover assembly and timing belt. *See TIMING BELT.* Loosen rocker arm support bolts in 3 to 4 steps and in reverse order of sequence shown in *Fig. 1.* Remove rocker arm assembly.

2) Remove camshaft timing sprocket. Remove camshaft bearing caps in same general sequence as rocker arm supports and arrange in order.

3) Remove camshaft and distributor drive gear. Check cam lobe height. Check camshaft for maximum runout of .0024" (.06 mm).

NOTE – *Rotate camshaft one turn clockwise and divide maximum gauge difference by 2.*

Installation – 1) Using plastigage, adjust bearing caps to clearance specifications. Make sure arrows on bearing caps face front. Apply grease to and install front oil seal.

2) Install front bearing cap and tighten all bearing cap bolts gradually in 3 or 4 steps. Check camshaft thrust clearance and adjust to specifications. Continue installation in reverse order of removal.

CAUTION – *When installing bearing caps, insure that front marks and imprinted numbers match.*

VALVES

VALVE ARRANGEMENT

I-E-E-I-I-E-E-I

ROCKER ARM ASSEMBLY

Removal – 1) Remove air cleaner and rocker arm cover. Loosen rocker arm support bolts in 3 to 4 steps and in reverse order of sequence shown in *Fig. 1.* Remove rocker arm assembly.

2) Check arm-to-shaft clearance by twisting on shaft. Little or no movement should be felt. If worn excessively, disassemble and check. If clearance exceeds .0024" (.06 mm), replace rocker arm and/or shaft.

NOTE – *Disassemble and mark all parts for reassembly in proper order. Loosen adjusting screws and nuts prior to installation of assembly.*

Installation – To install, reverse removal procedure. Tighten rocker arm support bolts in 3 to 4 steps and in sequence shown in *Fig. 1.*

VALVES & VALVE SPRINGS

1) Mark each valve and, using valve spring compressor, remove valves, valve retainers, retainer locks, springs and valve stem oil seals.

2) Using inside micrometer, measure inside diameter of valve guide at several places (use maximum wear point for calculation). Measure valve stem diameter and subtract difference from valve guide inside diameter. If valve stem clearance exceeds specifications, replace valve and guide.

3) Using a caliper type ruler, measure valve spring free length and check for squareness within .079" (2.0 mm). Using a spring tester, measure tension of each spring at specified height. Replace springs that do not meet specifications.

VALVE GUIDE SERVICING

1) Break off valve guide bushing at snap ring and remove snap ring. Heat cylinder head to approximately 176-212°F (80-100°C) and drive out bushing toward combustion chamber.

2) Re-heat cylinder head and install new guides from top of head. Drive guide in until snap ring makes contact. Using a .28" (7.0 mm) reamer, ream valve guides to provide proper clearance.

VALVE CLEARANCE ADJUSTMENT

1) With No. 1 piston at TDC of compression stroke, adjust cylinder numbers 1 & 2 intake valves and cylinder numbers 1 & 3 exhaust valves to specified clearance.

2) Rotate crankshaft one full turn (360°) clockwise to align timing mark on damper with "O" mark on timing cover. Adjust cylinder numbers 3 & 4 intake valves and cylinder numbers 2 & 3 exhaust valves to specified clearance.

3A-C 4-CYLINDER (Cont.)

NOTE – *Valves should be adjusted with engine at normal operating temperature. Cold specifications are provided for initial settings after assembly.*

Valve Clearance Specifications

Valve	Hot In. (mm)	Cold In. (mm)
Intake	.008 (.20)	.007 (.18)
Exhaust	.012 (.30)	.011 (.28)

PISTONS, PINS & RINGS

PISTON & ROD ASSEMBLY

Removal – With cylinder head and oil pan removed, machine ring ridge from top of cylinder. Mark rods and caps for correct assembly, then remove rod caps. Cover rod bolts with short lengths of hose to prevent crankshaft damage, then push piston/rod assembly out of block.

NOTE – *Ridge on cylinder wall must be removed before removing piston and rod assembly from block or damage to piston ring lands may result.*

Installation – Lubricate piston, cylinder and journal with clean engine oil. Position rings on piston as illustrated in *Fig. 4* and apply ring compressor. Install piston/rod assembly in proper position with notch on connecting rod facing forward. Align rod and cap marks and tighten rod caps to specification.

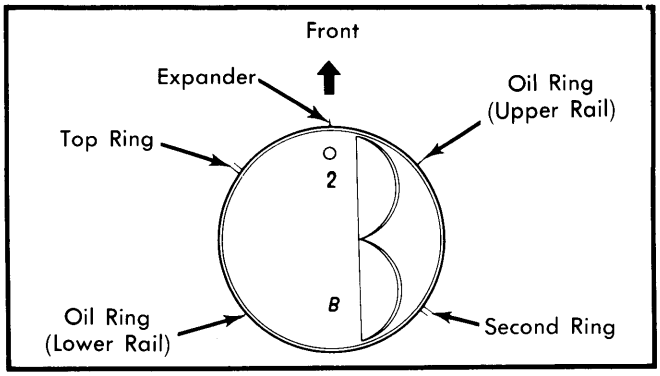

Fig. 4 Correct Piston Ring Gap Arrangement

FITTING PISTONS

Measure piston diameter at right angle to piston pin center line and at room temperature. Normal piston diameter is 3.047" (77.4 mm). Measure cylinder bore at top and bottom of wear area and center of bore, in line with and at 90° to crankshaft. Standard bore is 3.053" (77.5 mm) with a wear limit of .008" (.2 mm). Maximum taper and out of round is .001" (.02 mm). If not within specifications, rebore and/or replace pistons. Measure ring end gap at bottom of ring travel. Check clearance of ring in ring groove. See *Fig. 5*.

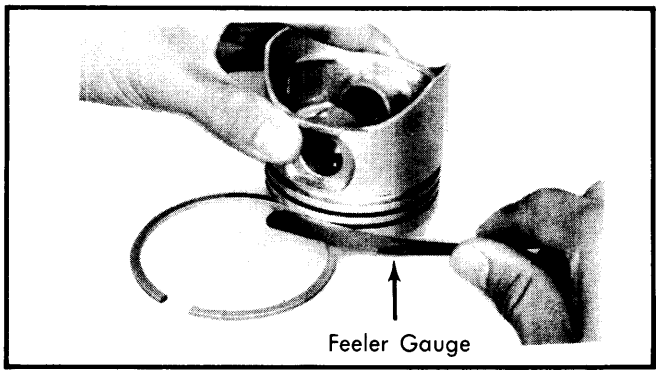

Fig. 5 Measuring Ring Groove Clearance

PISTON PINS

Using a press and piston pin removal tool set, press piston pin out of piston and connecting rod. Lightly coat piston pin and pin hole with engine oil. Press in pin until centered in connecting rod.

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

MAIN & CONNECTING ROD BEARINGS

1) Prior to disassembly, mark main and connecting rod bearing caps for reassembly in their original positions and check crankshaft end play and connecting rod side play. Remove piston and connecting rod assemblies. Remove main bearing caps and remove crankshaft.

2) Measure crankshaft main and rod journal diameter. Check crankshaft for maximum runout of .0024" (.06 mm). If any measurement exceeds specifications, crankshaft must be replaced. Using Plastigage method, determine all bearing clearances. Replace any bearing not meeting specifications.

3) Install crankshaft and main bearing caps with arrows on caps facing front. Tighten bolts to tightening specifications and in sequence shown in *Fig. 6*. Measure crankshaft thrust clearance. If clearance exceeds .012" (.3 mm) replace thrust washers to achieve standard clearance of .0008-.0073" (.02-.18 mm).

4) Install piston and rod assemblies. Measure connecting rod thrust clearance. Standard clearance is .006-.010" (.15-.25 mm) and should not exceed specified limit of .012" (.3 mm).

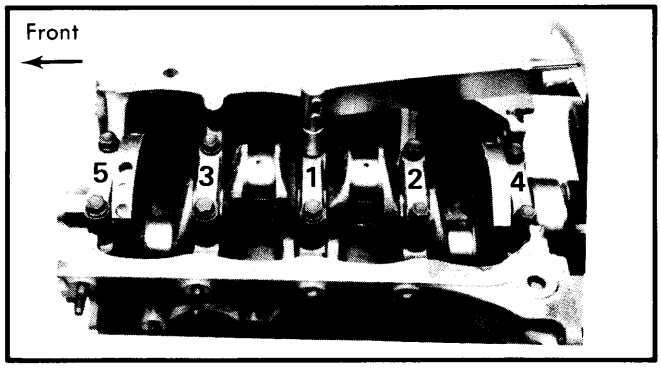

Fig. 6 Main Bearing Tightening Sequence (Loosen in Reverse Order)

CRANKSHAFT FRONT OIL SEAL

Drive out seal from engine front cover using screwdriver. Using oil seal tool, drive new seal into cover making sure that seal goes in straight.

3A-C 4-CYLINDER (Cont.)

REAR MAIN BEARING OIL SEAL

Remove oil seal from case by driving out with a scewdriver. Using oil seal tool, drive new seal into cover making sure that seal goes in straight. Lightly coat seal lip with multi-purpose grease.

ENGINE OILING

Crankcase Capacity (Drain and Refill) – 3.7 qts. (Includes filter).

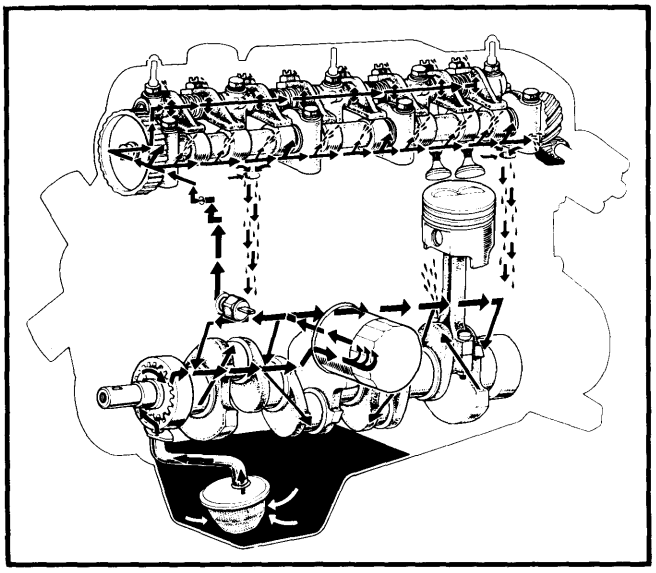

Fig. 7 Engine Oiling System

OIL PUMP

Removal – Remove timing covers and timing belt. See *TIMING BELT*. Remove oil pan and strainer. Remove oil pump and disassemble by removing (in order) cover, drive gear, driven gear, oil seal and relief valve. See *Fig. 8*.

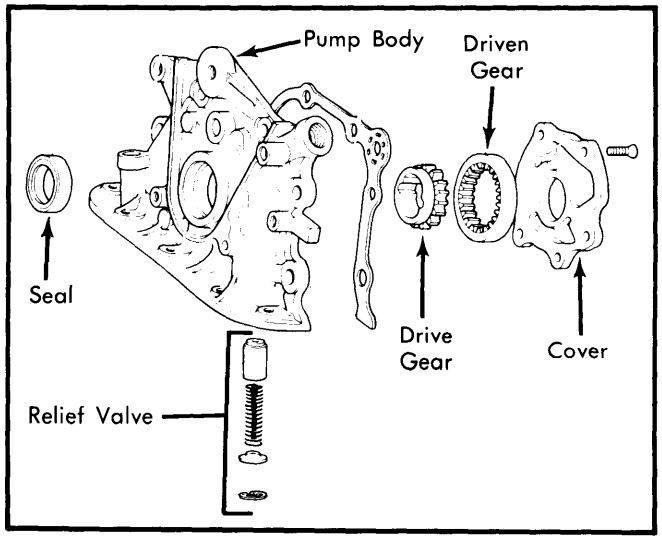

Fig. 8 Exploded View of Oil Pump and Pressure Relief Valve Assembly

Inspection – Check gears for wear or damage. Install new oil seal using proper seal tool. Measure clearances between gear tip of drive gear and driven gear, side clearance, and gear-to-body clearance. If any clearance exceeds specifications replace necessary part(s). Check relief valve for wear or damage.

Installation – To install, ensure that mating surfaces are clean and use new gasket. Reverse removal procedures to complete installation.

Oil Pump Specifications

Application	In. (mm)
Gear Tip Clearance	
Drive Gear	.004-.010 (.10-.25)
	Limit .013 (.35)
Driven Gear	.002-.012 (.05-.31)
	Limit .013 (.35)
Gear Side Clearance	.001-.003 (.03-.08)
	Limit .004 (.10)
Gear-to-Body Clearance	.004-.007 (.10-.19)
	Limit .008 (.20)

ENGINE COOLING

Coolant Capacity – Approximately 5.5 quarts.

Thermostat – Starts to open at 176-183°F (80-84°C) and is fully open at 203°F (95°C).

Radiator Cap – 13 psi (.9 kg/cm²).

Fan Thermoswitch – Operates at 181-194°F (83-90°C).

WATER PUMP

Removal – Drain cooling system. Remove pulley and drive belt. Remove water pump and disassemble by removing (in order) pulley seat, shaft and bearing, rotor and seals. Before pressing out shaft and rotor, heat water pump body to about 167-185°F (75-85°C).

Inspection – Check all parts for cracks, damage or excessive wear and replace if necessary.

Installation – To install, use new gasket on clean mating surfaces and reverse removal procedures.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (N·m)
Camshaft Sprocket Bolt	29-39 (39-53)
Connecting Rod Cap Nuts	26-32 (36-44)
Crankshaft Pulley Bolt	80-94 (109-128)
Cylinder Head Bolts	40-47 (54-64)
Flywheel Bolts	55-61 (75-83)
Main Bearing Cap Bolts	40-47 (54-64)
Manifold Nuts	15-21 (20-29)

3A-C 4-CYLINDER (Cont.)

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Year	Displ.		Carburetor	HP at RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore		Stroke	
	cu. ins.	cc					in.	mm	in.	mm
1981	88.6	1452	1x2-Bbl	60@4800	75 @ 2400	9.0:1	3.05	77.5	3.03	77.0

VALVES

Engine & Valve	Head Diam. In. (mm)	Face Angle	Seat Angle	Seat Width In. (mm)	Stem Diameter In. (mm)	Stem Clearance In. (mm)	Valve Lift In. (mm)
1452 cc							
Intake	.....	44.5°	45°	.055 (1.4)	.2744-.2750 (6.969-6.985)	.0010-.0024 (.025-.060)	.....
Exhaust	.....	44.5°	45°	.055 (1.4)		.0012-.0026 (.030-.065)	.....

PISTONS, PINS, RINGS

Engine	PISTONS	PINS		RINGS		
	Clearance In. (mm)	Piston Fit In. (mm)	Rod Fit In. (mm)	Rings	End Gap In. (mm)	Side Clearance In. (mm)
1452 cc	.004-.005 (.10-.12)	Press Fit	Press Fit	No. 1	.008-.015 (.20-.40)	.0016-.0031 (.04-.08)
				No. 2	.006-.013 (.15-.35)	.0012-.0028 (.03-.07)
				Oil	.004-.024① (.10-.60)	.....

① — For TP type rings; Riken type — .012-.035" (.30-.90 mm).

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

Engine	MAIN BEARINGS				CONNECTING ROD BEARINGS		
	Journal Diam. In. (mm)	Clearance In. (mm)	Thrust Bearing	Crankshaft End Play In. (mm)	Journal Diam. In. (mm)	Clearance In. (mm)	Side Play In. (mm)
1452 cc	1.889-1.890 (47.98-48.00)	.0005-.0019 (.012-.049)	Center	.0008-.0073 (.020-.185)	1.5742-1.5748 (39.985-40.000)	.0008-.0020 (.020-.051)	.006-.010 (.15-.25)

VALVE SPRINGS

Engine	Free Length In. (mm)	PRESSURE Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
1452 cc	1.756 (44.60)	52.0@1.520 (23.6@38.6)	.....

CAMSHAFT

Engine	Journal Diam. In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
1452 cc	1.101-1.102 (27.97-27.99)	.0015-.0029 (.037-.073)	1.553 (39.45)