ENGINE
(F8, FE, F2 SOHC)

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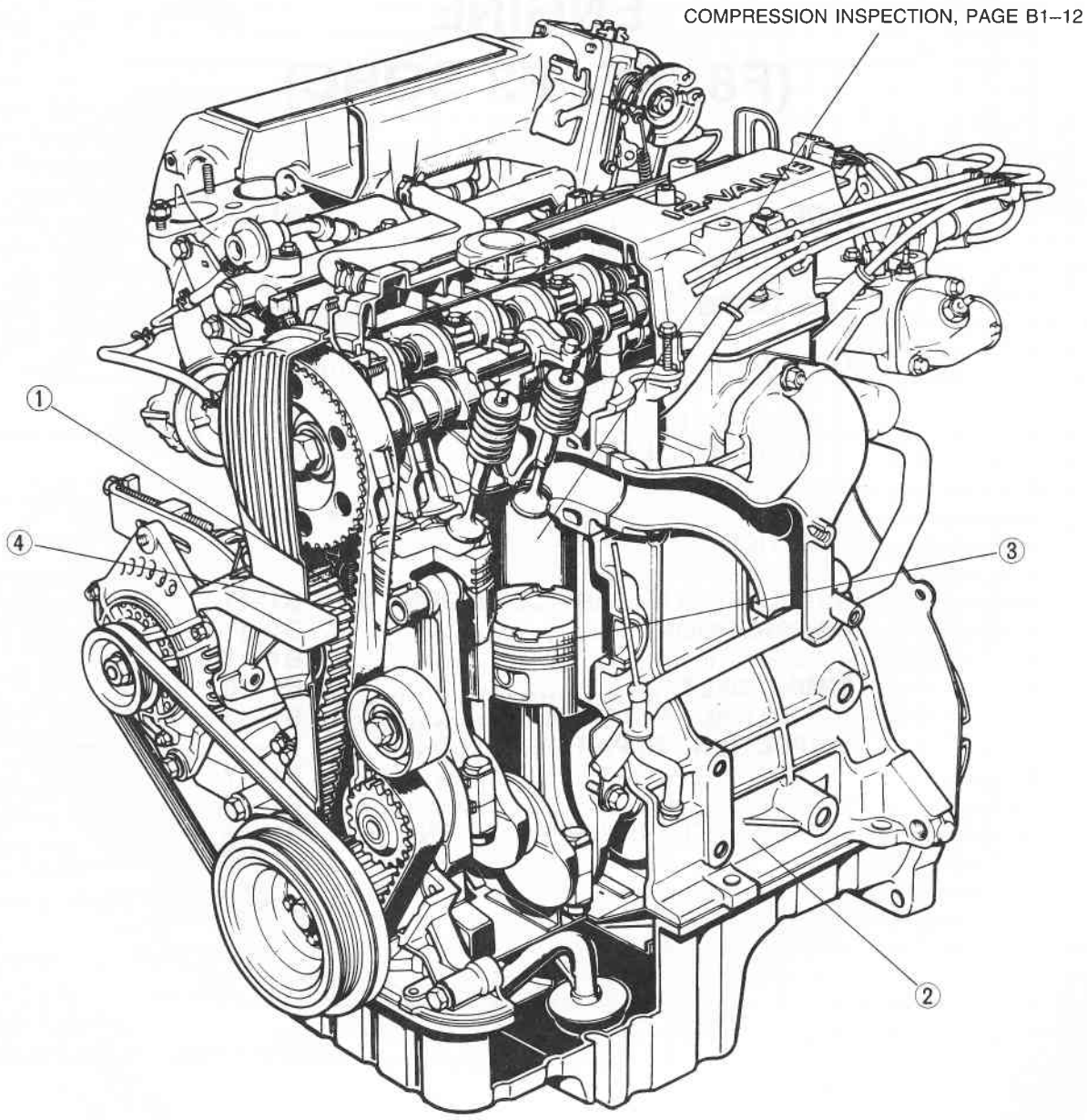

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OUTLINE

OUTLINE OF CONSTRUCTION

This section (B1) explains the F-series SOHC engine.
The variations of the F-series SOHC engine are shown below.

Engine \ Model		Leaded fuel		U.K.		Unleaded fuel	
		New	Previous	New	Previous	New	Previous
F8	8-valve		○		○		
	12-valve	○		○			
FE	8-valve	○					○
	12-valve	○	○	○	○	○	
F2	12-valve					○	○

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1. The FE and F2 engines are basically the same as that of the previous model.
2. The F8 engine is based on the previous model, however, the valve mechanism is changed from two valves per cylinder to three valves per cylinder.
   This valve mechanism (three valves per cylinder) parts are the same as that of the FE 12-valve engine.

SPECIFICATIONS
Leaded fuel model (U.K., ECE)

Item \ Engine				F2	FE 12-valve	F8	
						12-valve (New)	8-valve (Previous)
Type				Gasoline, 4-cycle			
Cylinder arrangement and number				In-line, 4-cylinders			
Combustion chamber				Pentroof			
Valve system				OHC, belt-driven			
Displacement cc (cu in)				2,184 (133.2)	1,998 (121.9)	1,789 (109.1)	
Bore × Stroke mm (in)				86.0 × 94.0 (3.39 × 3.70)	86.0 × 86.0 (3.39 × 3.39)	86.0 × 77.0 (3.39 × 3.03)	
Compression ratio				8.6 : 1	9.5 : 1		
Compression pressure kPa (kg/cm², psi)-rpm				1,120 (11.4, 162)-270	1,422 (14.5, 206)-280	1,442 (14.7, 209)-290	1,275 (13.0, 185)-270
Valve timing	IN	Open	BTDC	10°	14°	10°	17°
		Close	ABDC	49°	56°	49°	56°
	EX	Open	BBDC	55°	69°	55°	64°
		Close	ATDC	12°	13°	8°	15°
Valve clearance (Engine warm) mm (in)	IN			0: Maintenance-free			
	EX			0: Maintenance-free			

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Leaded fuel model (General)

Item \ Engine				FE 8-valve	FE 12-valve
Type				Gasoline, 4-cycle	
Cylinder arrangement and number				In-line, 4-cylinders	
Combustion chamber				Multispherical	
Valve system				OHC, belt-driven	
Displacement cc (cu in)				1,998 (121.9)	
Bore × Stroke mm (in)				86.0 × 86.0 (3.39 × 3.39)	
Compression ratio				8.6 : 1	
Compression pressure kPa (kg/cm², psi)-rpm				1,275 (13.0, 185)-270	
Valve timing	IN	Open	BTDC	16°	
		Close	ABDC	54°	
	EX	Open	BBDC	54°	
		Close	ATDC	16°	
Valve clearance (Engine warm) mm (in)	IN			0.30 (0.012)	
	EX			0.30 (0.012)	

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Unleaded fuel model (Swiss, Sweden)

Item \ Engine				F2	FE 12-Valve
Type				Gasoline, 4-cycle	
Cylinder arrangement and number				In-line, 4-cylinders	
Combustion chamber				Pentroof	Multispherical
Valve system				OHC, belt-driven	
Displacement			cc (cu in)	2,184 (133.2)	1,998 (121.9)
Bore × Stroke			mm (in)	86.0 × 94.0 (3.39 × 3.70)	86.0 × 86.0 (3.39 × 3.39)
Compression ratio				8.6 : 1	
Compression pressure			kPa (kg/cm^2, psi)-rpm	1,120 (11.4, 162)-270	1,275 (13.0, 185)-270
Valve timing	IN	Open	BTDC	10°	16°
		Close	ABDC	49°	54°
	EX	Open	BBDC	55°	54°
		Close	ATDC	12°	16°
Valve clearance (Engine warm)			IN	0: Maintenance-free	0.30 (0.012)
			EX	0: Maintenance-free	0.30 (0.012)

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Unleaded fuel model (Australia)

Item \ Engine				F2
Type				Gasoline, 4-cycle
Cylinder arrangement and number				In-line, 4-cylinders
Combustion chamber				Pentroof
Valve system				OHC, belt-driven
Displacement			cc (cu in)	2,184 (133.2)
Bore × Stroke			mm (in)	86.0 × 94.0 (3.39 × 3.70)
Compression ratio				8.6 : 1
Compression pressure			kPa (kg/cm^2, psi)-rpm	1,120 (11.4, 162)-270
Valve timing	IN	Open	BTDC	10°
		Close	ABDC	49°
	EX	Open	BBDC	55°
		Close	ATDC	12°
Valve clearance (Engine warm)			IN	0: Maintenance-free
			EX	0: Maintenance-free

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INTERCHANGEABILITY

1. F8 12-valve ↔ F8 8-valve (Leaded fuel model, U.K.)

The following chart shows interchangeability of the main parts of the new F8 12-valve engine and the previous F8 8-valve engine.

Symbols

○..... Interchangeable ×..... Not interchangeable

Part name			Interchangeability	Remark
Cylinder block related	Cylinder block		○	
	Cylinder head		×	Three valve configuration
	Cylinder head gasket		○	
	Cylinder head cover		×	Shape different
	Oil pan		×	Baffle added
	Vibration reducing stiffener		×	Newly added
	Timing belt cover		○	
	Front housing		×	Shape different
	Rear housing		×	Shape different
	Front oil seal		○	
	Rear oil seal			
Crankshaft related	Crankshaft		○	
	Main bearing			
	Connecting rod and cap		○	
	Crankpin bearing			
	Piston		×	Dome design different
	Piston pin		○	
	Piston ring			
	Crankshaft pulley		○	
	Flywheel		○	
Timing belt related	Timing belt		○	
	Timing belt pulley			
	Timing belt tensioner	Pulley		
		Spring		
	Camshaft pulley			
Valve related	Camshaft		×	Valve layout changed
	Rocker arm		×	Rocker arm shaft diameter increased
	Rocker arm shaft			
	HLA		×	Newly added
	Valve		×	Specification different
	Valve spring and seat		×	Specification different
	Valve guide		×	Inner diameter different
	Valve seal		×	Size different
Lubrication related	Oil pump		○	
	Oil strainer			
	Oil cooler			
	Oil filter			
Cooling related	Water pump		○	
	Thermostat			
	Cooling fan			

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2. F8 12-valve ↔ FE 12-valve (Leaded fuel model, U.K.)

The following chart shows interchangeability of the main parts of the new F8 12-valve engine and the new FE 12-valve engine.

Symbols

○..... Interchangeable ×..... Not interchangeable

Part name			Interchangeability	Remark
Cylinder block related	Cylinder block		×	Block height different
	Cylinder head		○	
	Cylinder head gasket			
	Cylinder head cover			
	Oil pan		○	
	Vibration reducing stiffener			
	Timing belt cover		×	Cylinder block height different
	Front housing		×	Size different
	Rear housing		○	
	Front oil seal		○	
	Rear oil seal			
Crankshaft related	Crankshaft		×	Piston stroke different
	Main bearing		○	
	Connecting rod and cap		×	Length different
	Crankpin bearing		○	
	Piston		×	Dome design different
	Piston pin		○	
	Piston ring			
	Crankshaft pulley		○	
	Flywheel		○	
Timing belt related	Timing belt		×	Length different
	Timing belt pulley		○	
	Timing belt tensioner	Pulley		
		Spring		
	Camshaft pulley			
Valve related	Camshaft		×	Valve timing different
	Rocker arm		○	
	Rocker arm shaft			
	HLA			
	Valve			
	Valve spring and seat			
	Valve guide			
	Valve seal			
Lubrication related	Oil pump		○	
	Oil strainer			
	Oil cooler			
	Oil filter			
Cooling related	Water pump		○	
	Thermostat			
	Cooling fan			

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3. FE 12-valve (Leaded fuel model, U.K.)

The following chart shows interchangeability of the main parts of the new FE 12-valve engine and the previous FE 12-valve engine.

Symbols

○..... Interchangeable ×..... Not interchangeable

Part name			Interchangeability	Remark
Cylinder block related	Cylinder block		○	
	Cylinder head			
	Cylinder head gasket			
	Cylinder head cover			
	Oil pan			
	Vibration reducing stiffener			
	Timing belt cover			
	Front housing			
	Rear housing			
	Front oil seal			
	Rear oil seal			
Crankshaft related	Crankshaft		○	
	Main bearing			
	Connecting rod and cap			
	Crankpin bearing			
	Piston			
	Piston pin			
	Piston ring			
	Crankshaft pulley			
	Flywheel			
Timing belt related	Timing belt		○	
	Timing belt pulley			
	Timing belt tensioner	Pulley		
		Spring		
	Camshaft pulley			
Valve related	Camshaft		○	
	Rocker arm			
	Rocker arm shaft			
	HLA			
	Valve			
	Valve spring and seat			
	Valve guide			
	Valve seal			
Lubrication related	Oil pump		○	
	Oil strainer			
	Oil cooler			
	Oil filter			
Cooling related	Water pump		○	
	Thermostat			
	Cooling fan			

96G0B1-522

4. F2 ↔ FE 12-valve (U.K.)

The following chart shows interchangeability of the main parts of the new F2 engine and the new FE 12-valve engine.

Symbols

○..... Interchangeable

×..... Not interchangeable

Part name			Interchangeability	Remark
Cylinder block related	Cylinder block		×	Block height different
	Cylinder head		○	
	Cylinder head gasket			
	Cylinder head cover			
	Oil pan		×	Shape different
	Vibration reducing stiffener		○	
	Timing belt cover		×	Cylinder block height different
	Front housing		×	Size different
	Rear housing		○	
	Front oil seal		○	
	Rear oil seal			
Crankshaft related	Crankshaft		×	Piston stroke different
	Main bearing		○	
	Connecting rod and cap		×	Length different
	Crankpin bearing		○	
	Piston		×	Dome design different
	Piston pin		○	
	Piston ring			
	Crankshaft pulley		×	Diameter different
	Flywheel		×	Weight different
Timing belt related	Timing belt		×	Length different
	Timing belt pulley		○	
	Timing belt tensioner	Pulley		
		Spring		
	Camshaft pulley			
Valve related	Camshaft		×	Valve timing different
	Rocker arm		○	
	Rocker arm shaft			
	HLA			
	Valve			
	Valve spring and seat			
	Valve guide			
	Valve seal			
Lubrication related	Oil pump		×	Gear type and width different
	Oil strainer		×	Shape different
	Oil filter		○	
Cooling related	Water pump		○	
	Thermostat		×	Two-stage type used
	Cooling fan		○	

96G0B1-523

5. F2 (Unleaded fuel model)

The following chart shows interchangeability of the main parts of the new F2 engine and the previous F2 engine.

Symbols

○..... Interchangeable ×..... Not interchangeable

Part name			Interchangeability	Remark
Cylinder block related	Cylinder block		○	
	Cylinder head			
	Cylinder head gasket			
	Cylinder head cover			
	Oil pan			
	Vibration reducing stiffener			
	Timing belt cover			
	Front housing			
	Rear housing			
	Front oil seal			
	Rear oil seal			
Crankshaft related	Crankshaft		○	
	Main bearing			
	Connecting rod and cap			
	Crankpin bearing			
	Piston			
	Piston pin			
	Piston ring			
	Crankshaft pulley		×	Diameter different
	Flywheel		○	
Timing belt related	Timing belt		○	
	Timing belt pulley			
	Timing belt tensioner	Pulley		
		Spring		
	Camshaft pulley			
Valve related	Camshaft		○	
	Rocker arm			
	Rocker arm shaft			
	HLA			
	Valve			
	Valve spring and seat			
	Valve guide			
	Valve seal			
Lubrication related	Oil pump		○	
	Oil strainer			
	Oil cooler (ATX)			
	Oil filter			
Cooling related	Water pump		○	
	Thermostat			
	Cooling fan			

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SUPPLEMENTAL SERVICE INFORMATION

The following points in this section are changed in comparison with the Mazda 626 Workshop Manual 7/87 (1163-10-87G) and the Mazda 626 Station Wagon Workshop Manual Supplementt 2/88 (1182-10-88B).

Compression
- F2 engine compression inspection procedure is added.

Note
- **The included changes relate to F-series SOHC engines produced after July 1988.**

Timing belt
- F2 engine timing belt removal and installation procedure is added.

Note
- **The included changes relate to F-series SOHC engines produced after July 1988.**

Cylinder block, piston, and timing belt tensioner spring
- The related F2 engine inspection / repair procedures are added.

Note
- **The included changes relate to F-series SOHC engines produced after July 1988.**

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COMPRESSION

If the engine exhibits low power, poor fuel economy, or poor idle, check the following:
1. Ignition system
2. Compression
3. Fuel system

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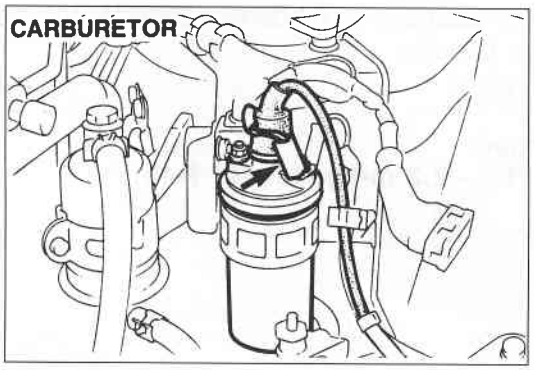

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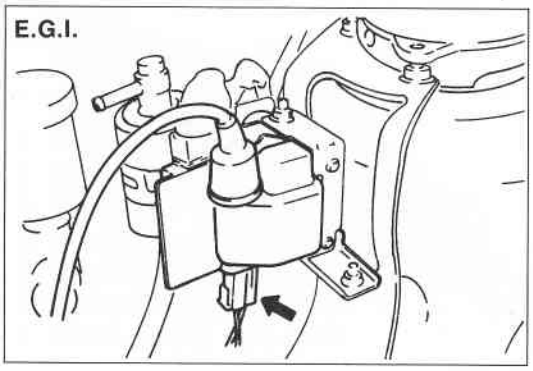
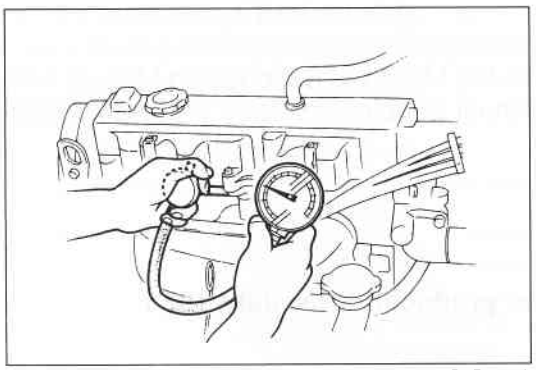


INSPECTION
1. Verify that the battery is fully charged. Recharge it if necessary.
2. Warm up the engine to the normal operating temperature.
3. Turn the engine OFF.
4. Remove all spark plugs.
5. Disconnect the primary wire connector from the ignition coil.



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6. Connect a compression gauge to the No.1 spark plug hole.
7. Fully open the throttle valve and crank the engine.
8. Record the maximum gauge reading.
9. Check each cylinder.

Compression:

kPa (kg/cm^2, psi)-rpm

		Standard	Minimum
F8		1,442 (14.7, 209)-290	1,010 (10.3, 146)-290
FE	8-valve	1,275 (13.0, 185)-270	893 (9.1, 129)-270
	12-valve	1,422 (14.5, 206)-280	1,001 (10.2, 145)-280
F2		1,120 (11.4, 162)-270	785 (8.0, 114)-270

Allowable variation between cylinders:
196 kPa (2.0 kg/cm^2, 28 psi) max.

10. If the compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder and recheck the compression.
    (1) If the compression increases, the piston, piston rings, or cylinder wall may be worn.
    (2) If the compression stays low, the valve may be stuck or seating improperly.
    (3) If the compression in adjacent cylinder(s) stays low, the cylinder head gasket may be defective or the cylinder head distorted.
11. Connect the ignition coil connector.

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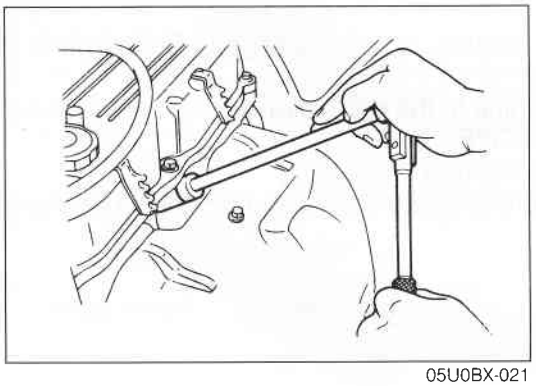

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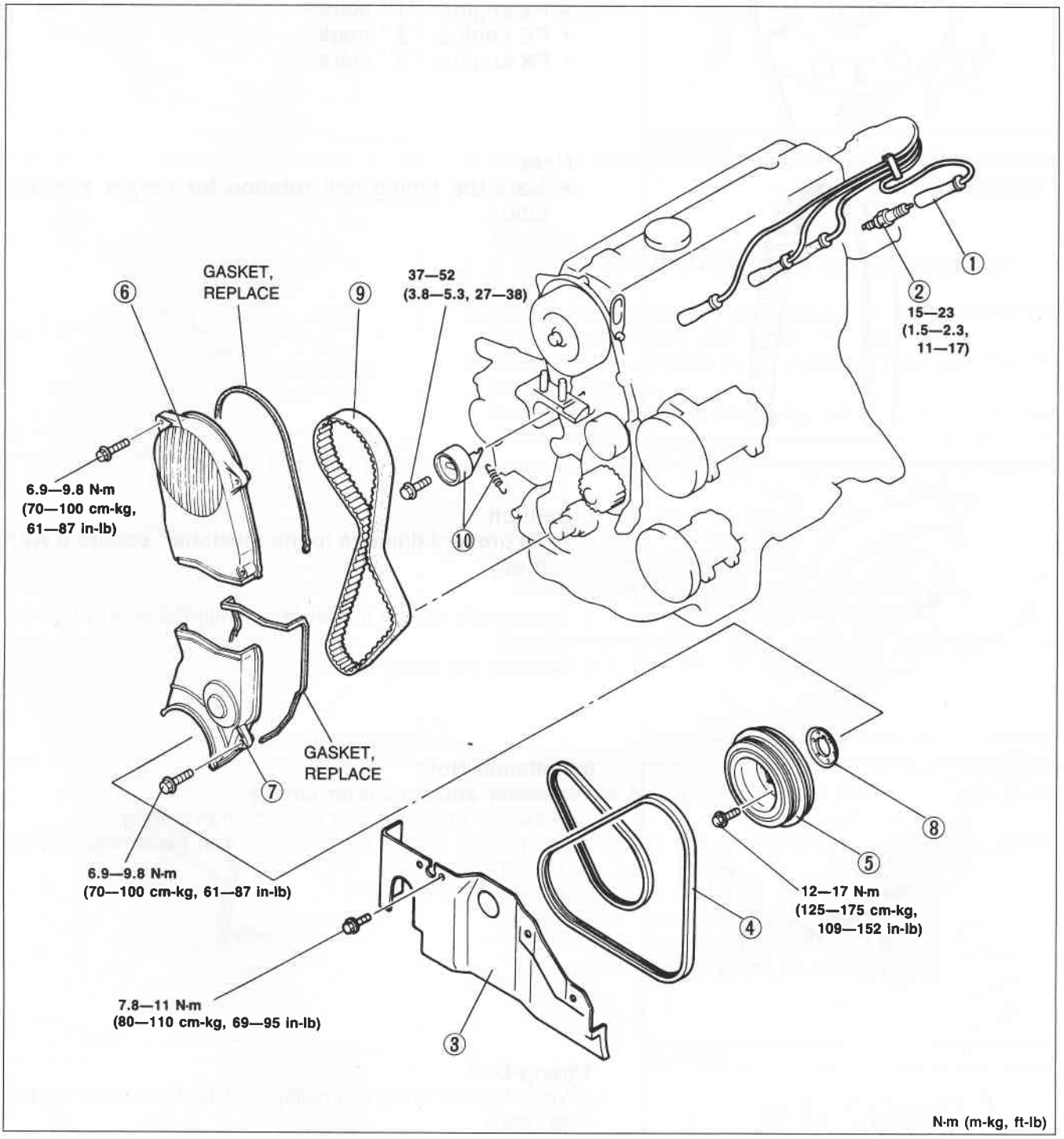
12. Apply antiseize compound or molybdenum-based lubricant to the spark plug threads.
13. Install the spark plugs.

Tightening torque:
15—23 N·m (1.5—2.3 m-kg, 11—17 ft-lb)

TIMING BELT

REMOVAL / INSTALLATION

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure, referring to **Removal Note**.
3. Install in the reverse order of removal, referring to **Installation Note**.



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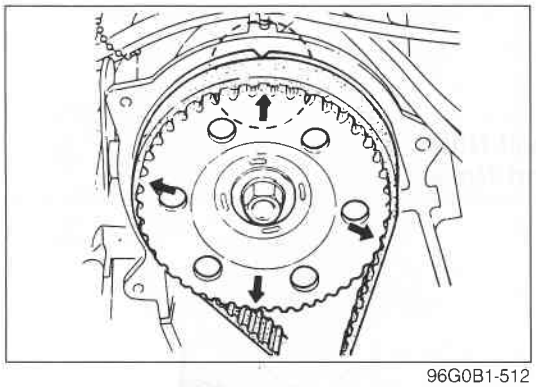
1. High-tension lead
2. Spark plug
3. Side cover (right)
4. Drive belt
5. Crankshaft pulley
6. Upper timing belt cover
7. Lower timing belt cover
8. Baffle plate
   Installation Note..... page B1–15
9. Timing belt
   Removal Note..... page B1–14
   Installation Note..... page B1–14
10. Tensioner and tensioner spring
    Installation Note..... page B1–14



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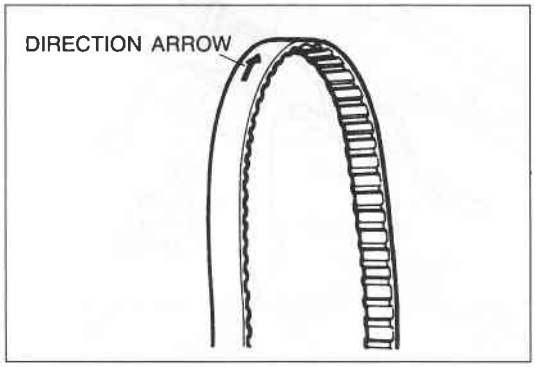

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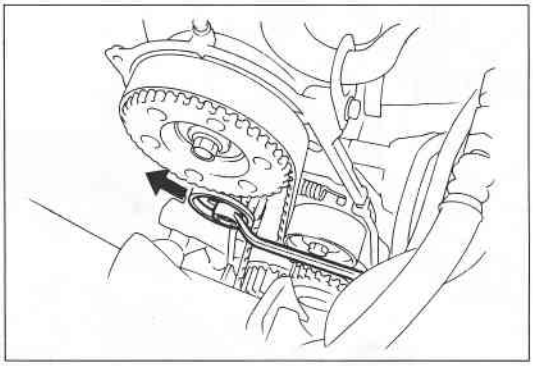

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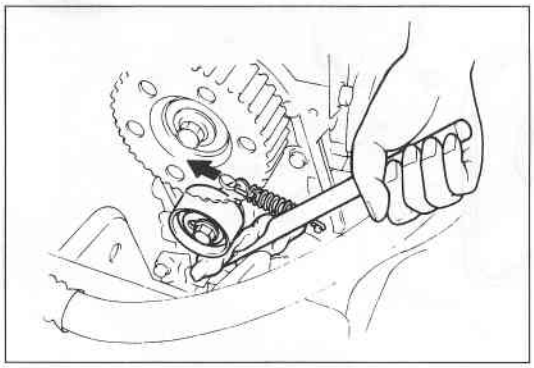

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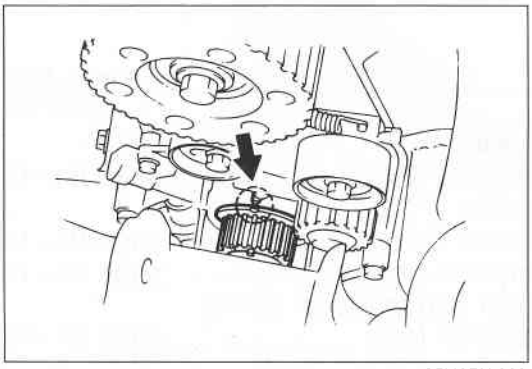

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Removal Note
Timing belt

1. Turn the crankshaft and align the mark of the camshaft pulley with the front housing mark.

Caution
- **F2 engine: "1" mark**
- **FE engine: "2" mark**
- **F8 engine: "3" mark**

Note
- **Mark the timing belt rotation for proper reinstallation.**

2. Loosen the tensioner lock bolt.

Caution
- **To prevent damage to the tensioner, secure it with a rag.**

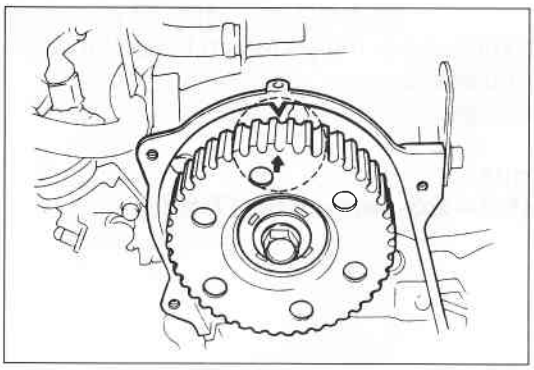
3. Temporarily secure the tensioner with the spring fully extended.
4. Remove the timing belt.

Installation Note
Tensioner and tensioner spring

1. Install the tensioner and the tensioner spring.
2. Temporarily secure the tensioner with the spring fully extended.

Timing belt

1. Verify that the timing belt pulley mark is aligned with the timing mark.



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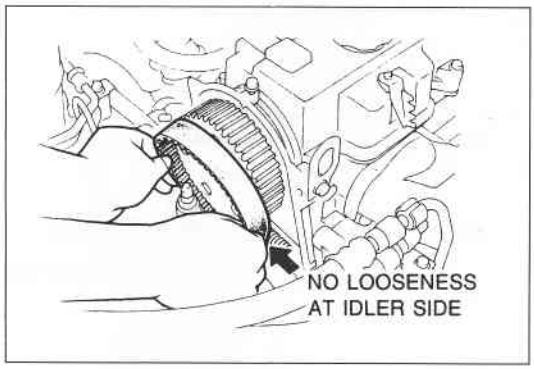
2. Verify that the camshaft pulley mark is aligned with the front housing mark.

Caution
- **F2 engine: "1" mark**
- **FE engine: "2" mark**
- **F8 engine: "3" mark**



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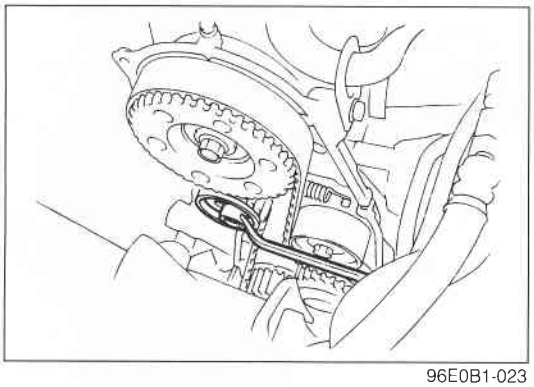
3. Install the timing belt so that there is no looseness at the idler side.

Caution
- **Do not turn the crankshaft counterclockwise.**

4. Turn the crankshaft two turns clockwise, and align the timing belt pulley mark with the timing mark.
5. Verify that the camshaft pulley mark is aligned with the front housing mark.
   If not aligned, remove the timing belt and repeat from tensioner installation.
6. Loosen the tensioner lock bolt to apply tension to the timing belt.
7. Tighten the tensioner lock bolt.

Tightening torque:
37—52 N·m (3.8—5.3 m-kg, 27—38 ft-lb)



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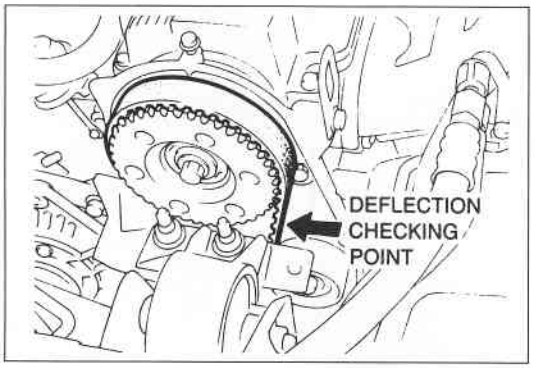
8. Turn the crankshaft two turns clockwise and verify that the timing marks are correctly aligned.



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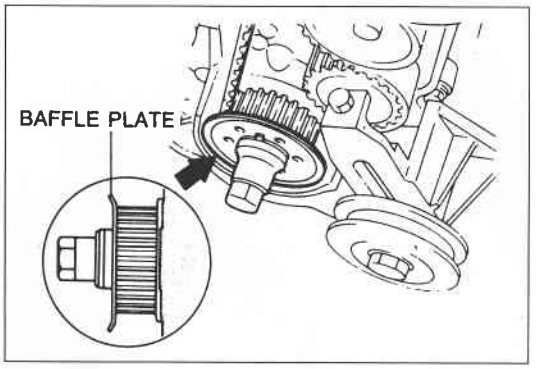
9. Measure the timing belt deflection by applying moderate pressure **(98 N, 10 kg, 22 lb)** at the point shown in the figure.
   If the deflection is not correct, repeat from Step 6 above.

Deflection
F2 engine: 8.0—9.0mm (0.31—0.35 in)
FE engine: 5.5—6.5mm (0.22—0.26 in)
F8 engine: 4.0—5.0mm (0.16—0.20 in)

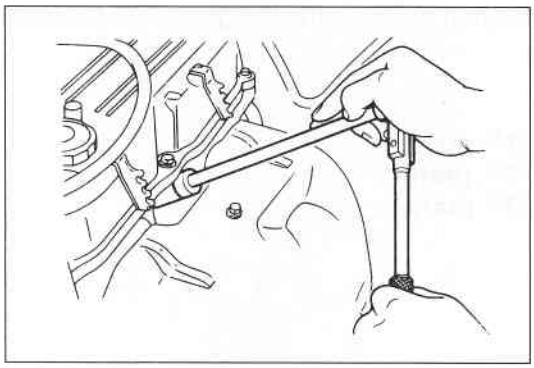


96E0B1-025

Baffle plate

Caution
- **Make sure the baffle plate is installed in the proper direction.**

1. Install the baffle plate.



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Steps After Installation

1. Connect the negative battery cable.
2. Start the engine and check as follows:
   (1) Engine coolant leakage.
   (2) Ignition timing.
3. Check the engine coolant level.
4. Check the drive belt deflection.

Spark plug

1. Apply antiseize compound or molybdenum-based lubricant to the spark plug threads.
2. Install the spark plugs.

Tightening torque:
15—23 N·m (1.5—2.3 m-kg, 11—17 ft-lb)

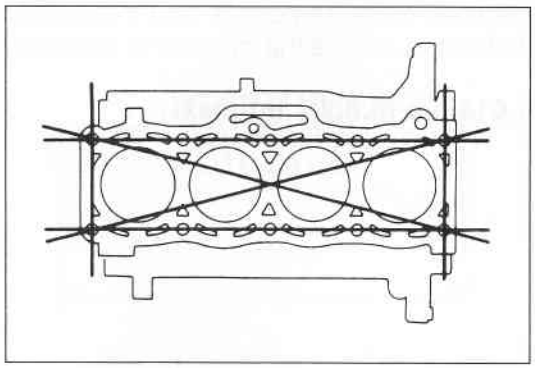
96E0B1-026

INSPECTION / REPAIR

1. Clean all parts, being sure to remove all gasket fragments, dirt, oil, and other foreign materials.
2. Inspection and repairs must be performed in the order specified.

Caution
- **Do not damage the joints or friction surfaces of aluminum alloy components (such as the cylinder head or pistons).**

96E0B1-028



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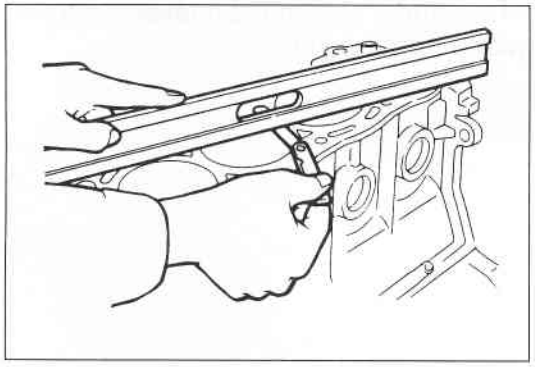

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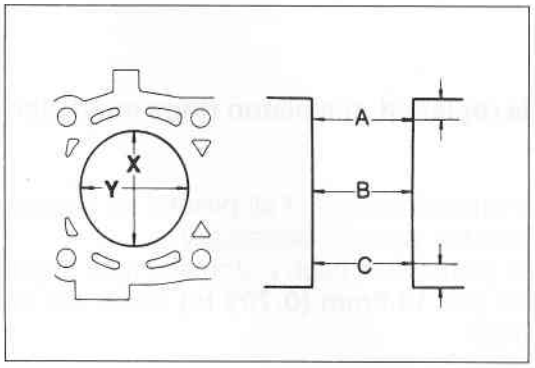

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CYLINDER BLOCK

1. Inspect the cylinder block for the following. Repair or replace the cylinder block as necessary.
   (1) Leakage damage.
   (2) Cracks.
   (3) Scoring of wall.
2. Measure the distortion of the top surface of the cylinder block in the six directions shown in the figure.

   Distortion: 0.15mm (0.006 in) max.

3. If the distortion exceeds specification, repair by grinding or replace the cylinder block.

   Height
   F2 engine: 301.5mm (11.87 in)
   FE engine: 289.0mm (11.38 in)
   F8 engine: 268.5mm (10.57 in)
   Grinding: 0.20mm (0.008 in) max.

4. Measure the cylinder bores in X and Y directions at three levels (A, B, and C) in each cylinder as shown.

Cylinder bore

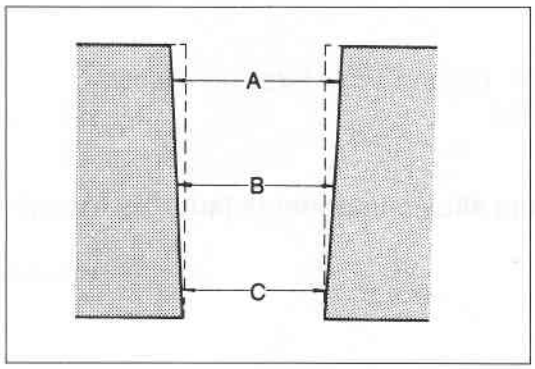
mm (in)

	Bore size	Diameter
F2 FE F8	Standard size	86.000—86.019 (3.3858—3.3866)
	0.25 (0.010) oversize	86.250—86.269 (3.3957—3.3964)
	0.50 (0.020) oversize	86.500—86.519 (3.4055—3.4062)

Caution
- **The boring size should be based on the size of an oversize piston and be the same for all cylinders.**

5. If the cylinder bore exceeds the maximum, rebore the cylinder to oversize.

96E0B1-031



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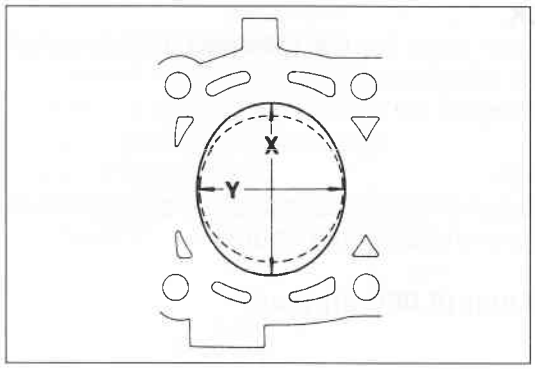
6. If the difference between measurements A and C exceeds the maximum taper, rebore the cylinder to oversize.

Taper: 0.019mm (0.0007 in) max.



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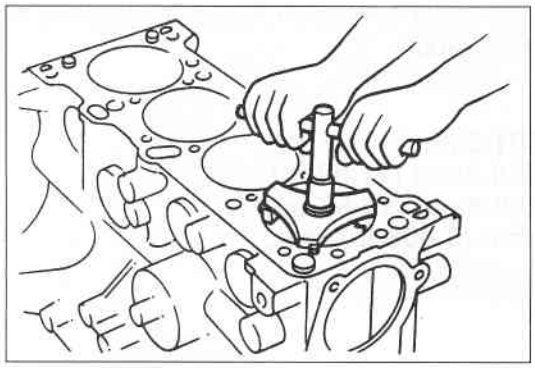
7. If the difference between measurements X and Y exceeds the maximum out-of-round, rebore the cylinder to oversize.

Out-of-round: 0.019mm (0.0007 in) max.



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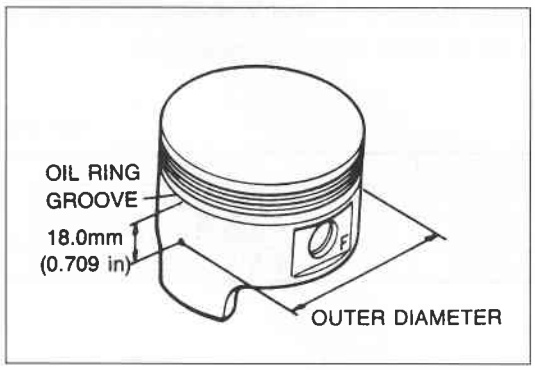
8. If the upper part of a cylinder wall shows uneven wear, remove the ridge with a ridge reamer.



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PISTON

Caution

- **If the piston is replaced, the piston rings must also be replaced.**

1. Inspect the outer circumferences of all pistons for seizure or scoring. Replace the piston if necessary.
2. Measure the outer diameter of each piston at a right angle **(90°)** to the piston pin, **18.0mm (0.709 in)** below the oil ring land lower edge.

Piston diameter

mm (in)

	Piston size	Diameter
F2 FE F8	Standard size	85.944—85.964 (3.3836—3.3844)
	0.25 (0.010) oversize	86.194—86.214 (3.3935—3.3942)
	0.50 (0.020) oversize	86.444—86.464 (3.4033—3.4041)

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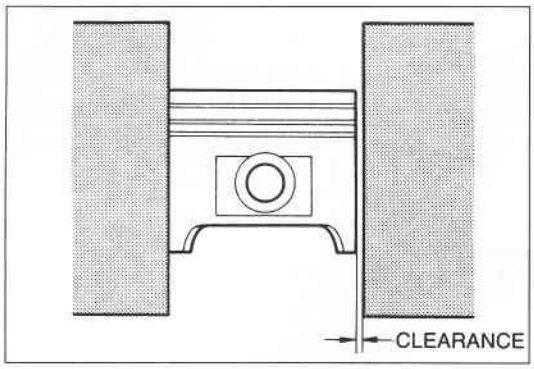

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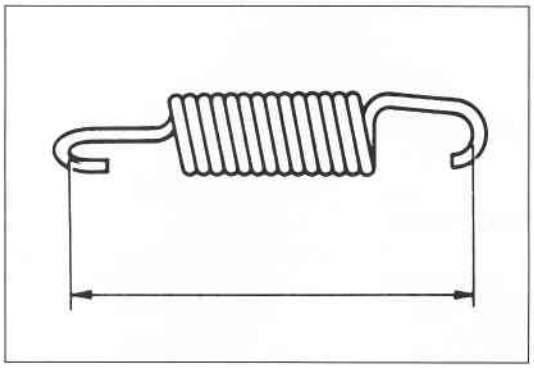
3. Measure the piston-to-cylinder clearance.

Clearance: 0.036—0.075mm (0.0014—0.0030 in)
Maximum : 0.15mm (0.006 in)

4. If the clearance exceeds the maximum, replace the piston or rebore the cylinders to fit oversize pistons.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TIMING BELT TENSIONER SPRING

1. Measure the free length of the tensioner spring. Replace the tensioner spring if necessary.

Free length
F2, F8 engine : 63.0mm (2.480 in)
FE 12-valve engine: 53.9mm (2.122 in)
FE 8-valve engine : 56.9mm (2.240 in)