

ENGINE OVERHAUL <1.5L>

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11309000388

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GENERAL INFORMATION

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GENERAL SPECIFICATION

Description		Specifications
Type		In-line OHV, SOHC
Number of cylinders		4
Combustion chamber		Hemispherical type
Total displacement dm ³ (cu, in)		1,468 (89.6)
Cylinder bore mm (in.)		75.5 (2.97)
Piston stroke mm (in.)		82.0 (3.23)
Compression ratio		9.0
Number of valve	Intake	8
	Exhaust	4
Valve timing	Intake opening	BTDC 14°
	Intake closing	ABDC 48°
	Exhaust opening	BBDC 54°
	Exhaust closing	ATDC 10°
Lubrication system		Pressure feed, full-flow filtration
Oil pump type		Trochoid type
Cooling system		Water-cooled forced circulation
Water pump type		Centrifugal impeller type

SPECIFICATIONS

SERVICE SPECIFICATIONS

Item	Standard	Limit	
Rocker arms, rocker shafts, and camshaft			
Camshaft cam height mm (in.)	Intake-primary	38.78 (1.53)	38.28 (1.51)
	Intake-secondary	38.78 (1.53)	38.28 (1.51)
	Exhaust	39.10 (1.54)	38.60 (1.52)
Cylinder head and valves			
Cylinder head gasket surface flatness mm (in.)	Less than 0.05 (.002)	0.2 (.008)	
Cylinder head gasket surface grinding limit (including grinding of cylinder block gasket surface) mm (in.)	-	0.2 (.008)	
Cylinder head overall height mm (in.)	106.9 - 107.1 (4.209 - 4.217)	-	
Cylinder head bolt shank length mm (in.)	-	103.2 (40.63)	
Valve margin mm (in.)	Intake	1.0 (.039)	0.5 (.020)
	Exhaust	1.5 (.059)	1.0 (.039)
Valve stem diameter mm (in.)	6.6 (.260)	-	
Valve stem-to-guide clearance mm (in.)	Intake	0.02 - 0.050 (.0008 - .0020)	0.10 (.0039)
	Exhaust	0.050 - 0.085 (.0020 - .0035)	0.15 (.0059)
Valve face angle mm (in.)	45° - 45.5°	-	
Valve stem projection mm (in.)	Intake	43.70 (1.720)	44.20 (1.740)
	Exhaust	43.30 (1.705)	43.80 (1.724)
Overall valve length mm (in.)	Intake	100.75 (3.967)	100.25 (3.947)
	Exhaust	101.05 (3.978)	100.55 (3.957)
Valve spring free height mm (in.)	Intake	46.1 (1.815)	45.6 (1.795)
	Exhaust	46.8 (1.843)	46.3 (1.823)
Valve spring load/installed height N/mm (lbs./in.)	Intake	226/40.0 (51/1.57)	-
	Exhaust	284/39.6 (64/1.57)	-
Valve spring squareness	2° or less	4°	
Valve seat contact width mm (in.)	0.9 - 1.3 (.035 - .051)	-	
Valve guide internal diameter mm (in.)	6.6 (.260)	-	
Valve guide projection mm (in.)	17.0 (.670)	-	
Oil pump and oil pan			
Oil pump tip clearance mm (in.)	0.06 - 0.18 (.0024 - .0071)	-	
Oil pump side clearance mm (in.)	0.04 - 0.10 (.0016 - .0039)	-	
Oil pump body clearance mm (in.)	0.10 - 0.18 (.0039 - .0071)	0.35 (.0138)	
Piston and connecting rods			
Piston outside diameter mm (in.)	75.5 (2.97)	-	
Piston ring side clearance mm (in.)	No.1 ring	0.03 - 0.07 (.0012 - .0028)	0.1 (.0039)
	No.2 ring	0.02 - 0.06 (.0008 - .0024)	0.1 (.0039)
Piston ring end gap mm (in.)	No.1 ring	0.20 - 0.35 (.0079 - .0138)	0.8 (.031)
	No.2 ring	0.35 - 0.50 (.0138 - .0197)	0.8 (.031)
	Oil ring	0.20 - 0.50 (.0079 - .0197)	1.0 (.039)

Item	Standard	Limit
Piston pin outside diameter mm (in.)	18.0 (0.71)	-
Piston pin press-in load (at room temperature) N (lbs.)	4900 - 14700 (1100 - 3300)	-
Crankshaft pin oil clearance mm (in.)	0.01 - 0.04 (.0008 - .0016)	0.1 (.004)
Connecting rod big end side clearance mm (in.)	0.10 - 0.25 (.0039 - .0098)	0.4 (.016)
Crankshaft and cylinder block		
Crankshaft end play mm (in.)	0.05 - 0.18 (.0020 - .0071)	0.25 (.010)
Crankshaft journal diameter mm (in.)	48.0 (1.89)	-
Crankshaft pin diameter mm (in.)	42.0 (1.65)	-
Crankshaft journal oil clearance mm (in.)	0.02 - 0.04 (.0008 - .0016)	0.1 (.004)
Cylinder block gasket surface flatness mm (in.)	0.05 (.020)	0.1 (.004)
Cylinder block gasket surface grinding limit (including grinding of cylinder head gasket surface) mm (in.)	-	0.2 (.008)
Cylinder block overall height mm (in.)	256 (10.1)	-
Cylinder bore cylindricity mm (in.)	0.01 (.0004) or less	-
Cylinder bore mm (in.)	75.5 (2.79)	-
Piston-to-cylinder clearance mm (in.)	0.02 - 0.04 (.0008 - .0016)	-

REWORK DIMENSIONS

Item	Standard		
Cylinder head and valves			
Oversize valve guide hole diameter mm (in.)	0.05 O.S.	12.050 - 12.068 (.4744 - .4752)	
	0.25 O.S.	12.250 - 12.268 (.4823 - .4831)	
	0.50 O.S.	12.500 - 12.518 (.4921 - .4929)	
Oversize intake valve seat ring hole diameter mm (in.)	Primary	0.3 O.S.	27.300 - 27.325 (1.0748 - 1.0758)
		0.6 O.S.	27.600 - 27.625 (1.0866 - 1.0876)
	Secondary	0.3 O.S.	32.300 - 32.325 (1.2717 - 1.2726)
		0.6 O.S.	32.600 - 32.625 (1.2835 - 1.2845)
Oversize exhaust valve seat ring hole diameter mm (in.)	0.3 O.S.	35.300 - 35.325 (1.3898 - 1.3907)	
	0.6 O.S.	35.600 - 35.625 (1.4016 - 1.4026)	

TORQUE SPECIFICATIONS

Item		Nm	ft.lbs.
Generator and ignition system			
Water pump pulley bolt		9	7
Generator brace bolt (generator side)		22	16
Generator brace bolt (tightened with water pump)		23	17
Generator pivot bolt nut		44	32
Oil dipstick guide bolt		23	17
Crankshaft pulley bolt		125	93
Spark plug		25	18
Distributor bolt		12	9
Timing belt			
Timing belt cover bolt		11	8
Timing belt tensioner bolt		23	17
Engine support bracket bolt		35	25
Camshaft sprocket bolt		88	64
Fuel and emission control system			
Fuel rail bolt		11	8
Fuel pressure regulator bolt		9	7
Throttle body bolt		18	13
Air temperature sensor		13	9
EGR valve bolt		21	15
Water pump			
Water inlet fitting bolt		22	16
Water inlet pipe bolt		12	9
Thermostat case bolt		23	17
Engine coolant temperature gauge unit		11	8
Engine coolant temperature sensor		29	21
Water pump		13	9
Intake and exhaust manifolds			
Intake manifold bolt and nut		17	12
Intake manifold stay bolt	M8	17	12
	M10	21	15
Exhaust manifold cover bolt		29	21

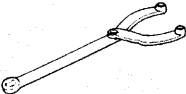

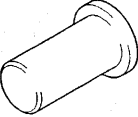
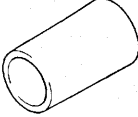
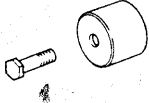
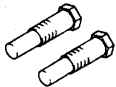

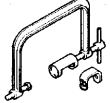
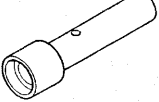
Item	Nm	ft.lbs.
Exhaust manifold nut	17	12
Rocker arms and camshaft		
Rocker cover bolt	4	3
Rocker shaft bolt	31	22
Cylinder head and valves		
Cylinder head bolt [Tighten to 49 Nm (35 ft.lbs.), then completely loosen and retighten as described.]	20 + 90° + 90°	15 + 90° + 90°
Oil pump and oil pan		
Oil pan bolt	7	5
Drain plug	39	28
Oil screen bolt	18	13
Front case bolt	13	9
Relief plug	44	32
Oil pump cover bolt	10	7
Pistons and connecting rods		
Connecting rod nut	17 + 90° to 100°	12 + 90° to 100°
Crankshaft and cylinder block		
Flywheel bolt <M/T>	132	95
Drive plate bolt <A/T>	132	95
Rear plate bolt	10	7
Bell housing cover bolt	10	7
Rear oil seal case bolt	11	8
Bearing cap bolt	51	37
Oil pressure switch	18	13

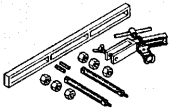
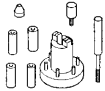
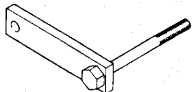
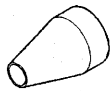
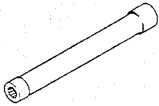
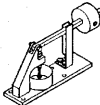

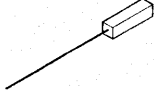

SEALANTS

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Item	Specified sealant	Quantity
Water pump	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Engine coolant temperature sensor	3M Nut Locking Part No.4171 or equivalent	As required
Engine coolant temperature gauge unit	3M ATD Part No.8660 or equivalent	As required
Front case	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Oil pan	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Oil pressure switch	3M ATD Part No.8660 or equivalent	As required

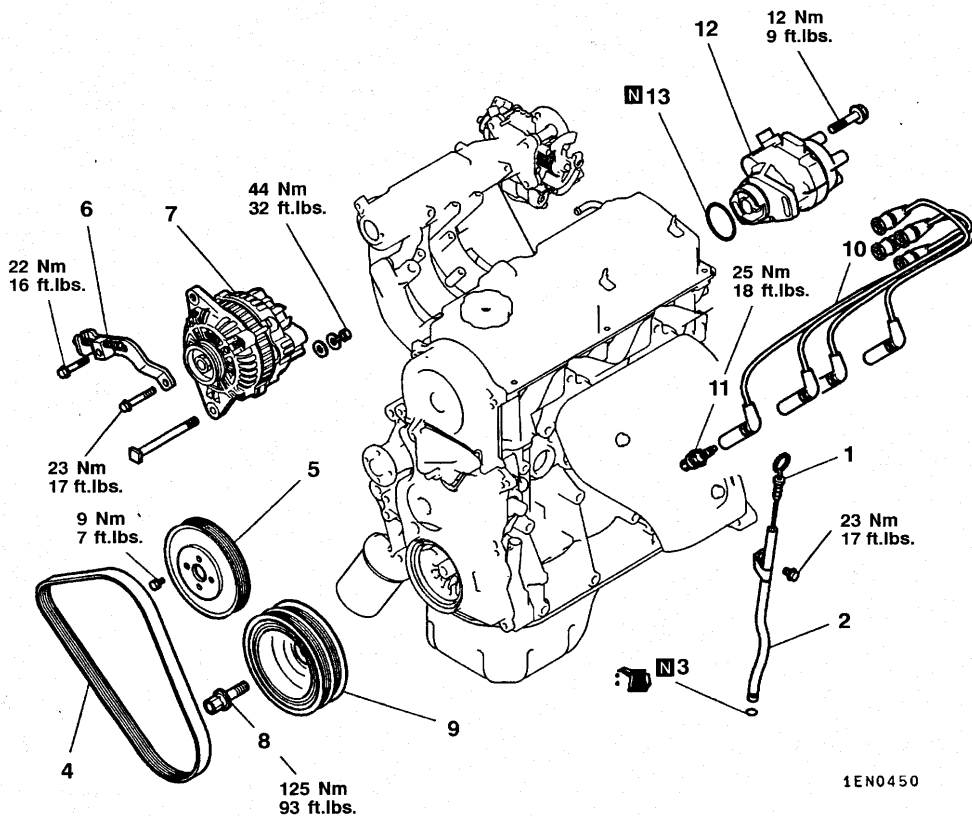
SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB990767 End yoke holder Use with MD998715	MB990767-01 Use with MIT308239	Holding camshaft sprocket when loosening or torquing bolt
	MD998011 Crankshaft rear oil seal installer	MD998011-01 Use with MB990938-01	Installation of crankshaft rear oil seal
	MD998304 Crankshaft front oil seal installer	MD998304-01	Installation of crankshaft front oil seal
	MD998305 Crankshaft front oil seal guide	MD998305-01	Installation of crankshaft front oil seal.
	MD998713 Camshaft oil seal installer	MD998713-01	Installation of camshaft oil seal
	MD998715 Pulley holding pins (2)	MIT308239	Holding camshaft sprocket when loosening or torquing bolt
	MD998727 Oil pan remover	General service tool	Removal of oil pan
	MD998735 Valve spring compressor	MD998735-01	Compression of valve spring
	MD998760 Valve stem seal installer	MD998760-01	Installation of valve stem seal.

Tool	Tool number and name	Supersession	Application
	MD998772 Valve spring compressor	General service tool	Compressing valve spring.
	MD998780 Piston pin setting tool	MIT216941	Removal and installation of piston pin
	MD998781 Flywheel stopper	General service tool	Holding flywheel
	MB991659 Guide-D	-	Guide for removal and Press-fitting of piston pins
	MB991653 Cylinder head bolt wrench	General service tool	Loosening and torquing of cylinder head bolt
	MD998440 Leak down tester	-	Leak down test of lash adjuster
	MD998441 Lash adjuster retainer	-	Air bleeding of lash adjuster
	MD998442 Air bleed wire	-	Air bleeding of lash adjuster
	MD998443 Lash adjuster holder (8)	MD998443-01	Supporting lash adjuster to prevent it from falling when rocker arm shaft assembly is removed or installed.

GENERATOR AND IGNITION SYSTEM

REMOVAL AND INSTALLATION



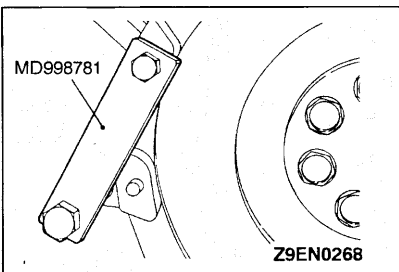
Removal steps

1. Oil dipstick
2. Oil dipstick guide
3. O-ring
4. Drive belt
5. Water pump pulley
6. Generator brace
7. Generator

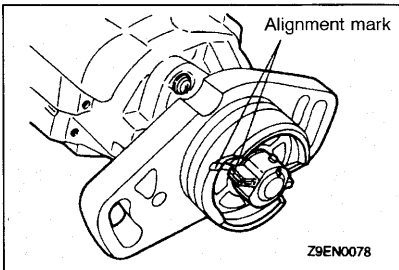
- ◀A▶ ▶B◀ 8. Crankshaft pulley bolt
- ▶A◀ 9. Crankshaft pulley
- ▶A◀ 10. Spark plug cables
- ▶A◀ 11. Spark plugs
- ▶A◀ 12. Distributor
- ▶A◀ 13. O-ring

REMOVAL SERVICE POINT**◀▶ CRANKSHAFT BOLT REMOVAL**

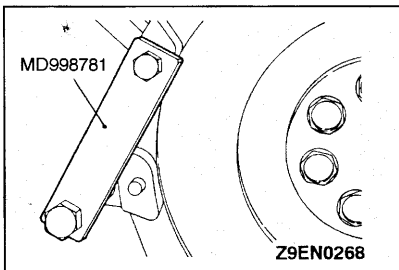
- (1) Lock the flywheel or drive plate in position using the special tool shown in the illustration, then loosen the crankshaft bolt.

**INSTALLATION SERVICE POINTS****▶◀ DISTRIBUTOR INSTALLATION**

- (1) Turn the crankshaft clockwise until cylinder No.1 is at top dead center on its compression stroke.
- (2) Align the alignment marks on the distributor housing and coupling.
- (3) Install the distributor onto the engine, and tighten the mounting bolts to the specified torque.

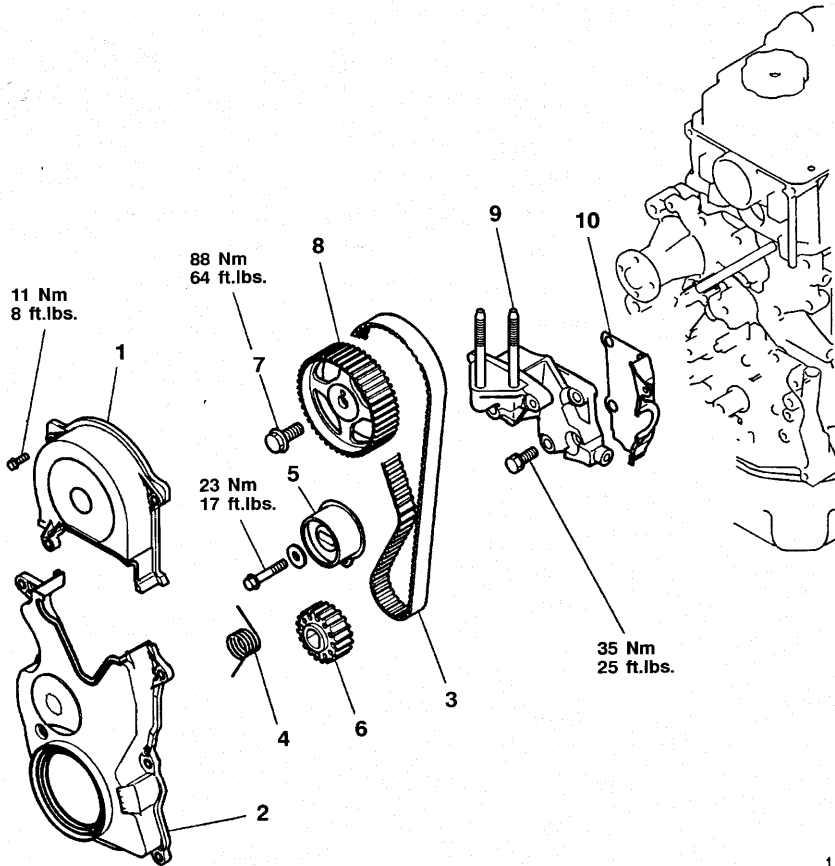
**▶◀ CRANKSHAFT BOLT INSTALLATION**

- (1) Lock the flywheel or drive plate in position using the special tool shown in the illustration, then tighten the crankshaft bolt.



TIMING BELT

REMOVAL AND INSTALLATION



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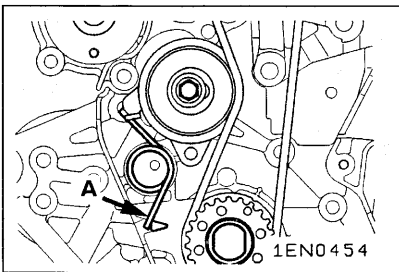
Removal steps

1. Timing belt upper cover
2. Timing belt lower cover
3. Timing belt
4. Tensioner spring
5. Timing belt tensioner

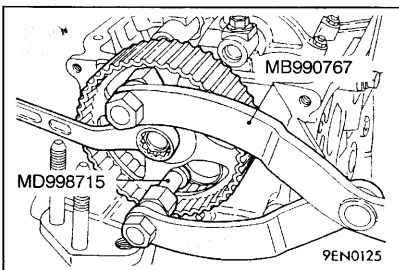


6. Crankshaft sprocket
7. Camshaft sprocket bolt
8. Camshaft sprocket
9. Engine support bracket
10. Timing belt rear cover

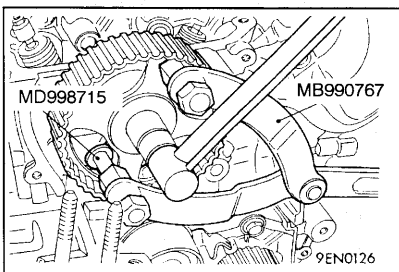


**REMOVAL SERVICE POINTS****◀A▶ TIMING BELT/TENSIONER SPRING/TIMING BELT TENSIONER REMOVAL**

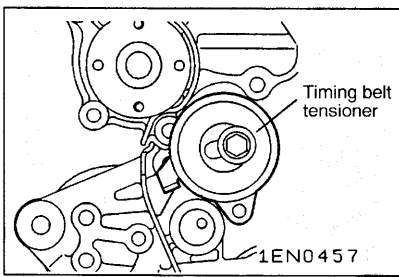
- (1) Using pliers, grip the tensioner spring end (marked "A" in the illustration) and remove it from the oil pump case lug. Then, remove the tensioner spring.
- (2) Remove the timing belt tensioner, and then remove the timing belt.
- (3) If the timing belt is to be reused; chalk an arrow on the belt to indicate the direction of rotation before removing it. This will ensure the timing belt is fitted correctly when reused.

**◀B▶ CAMSHAFT SPROCKET BOLT REMOVAL**

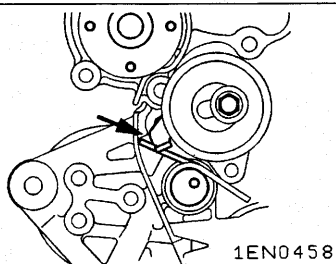
- (1) Using the special tools shown in the illustration, lock the camshaft sprocket in position.
- (2) Loosen the camshaft sprocket bolt.

**INSTALLATION SERVICE POINTS****▶A◀ CAMSHAFT SPROCKET BOLT INSTALLATION**

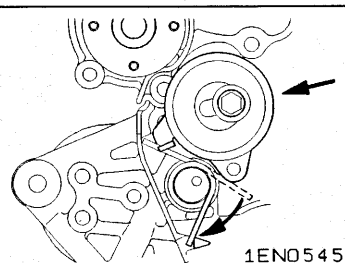
- (1) Using the special tools shown in the illustration, lock the camshaft sprocket in the position.
- (2) Tighten the camshaft sprocket bolt to the specified torque.

**▶B◀ TIMING BELT TENSIONER/TENSIONER SPRING INSTALLATION**

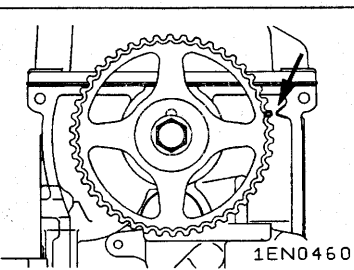
- (1) Install the timing belt tensioner in the illustrated position, and then tighten the tensioner mounting bolt.



- (2) Install the tensioner spring onto the boss of the front case, and then hook the spring end to the tensioner arm.

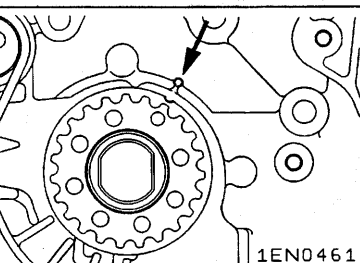


- (3) Grip the other end of the tensioner spring projection and then hook it onto the front case lug as shown in the illustration.
- (4) Move the timing belt tensioner in the direction shown and temporarily tighten the bolt.

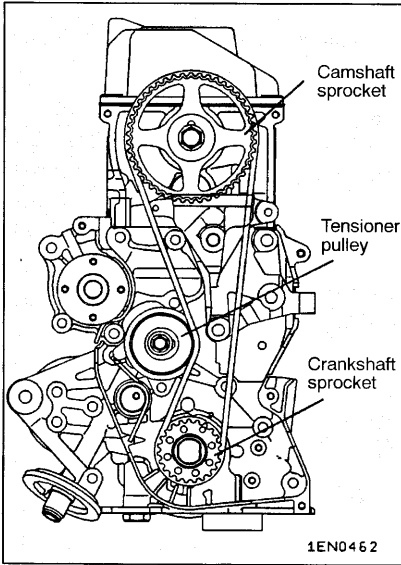


►◄ TIMING BELT INSTALLATION

- (1) Align the camshaft sprocket timing mark with the timing mark on the cylinder head.



- (2) Align the crankshaft sprocket timing mark with the timing mark on the front case.

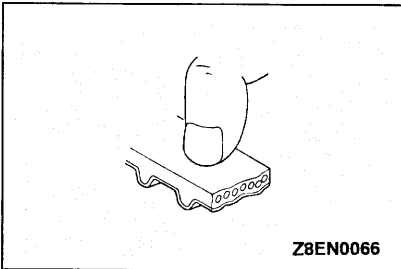


- (3) Keeping the tension side of the timing belt tight, fit the timing belt onto the crankshaft sprocket, camshaft sprocket, and tensioner pulley in that order.
- (4) Loosen the timing belt tensioner pulley mounting bolts by 1/4 to 1/2 of a turn and allow the tensioner spring to apply tension to the timing belt.
- (5) Turn the crankshaft twice clockwise and check that the all timing marks are correctly aligned.

Caution

This procedure utilizes the camshaft's driving torque to apply tension evenly to the timing belt. Be sure to turn the crankshaft as described above. Do not turn the crankshaft counter-clockwise.

- (6) Tighten the timing belt tensioner mounting bolt to the specified torque.



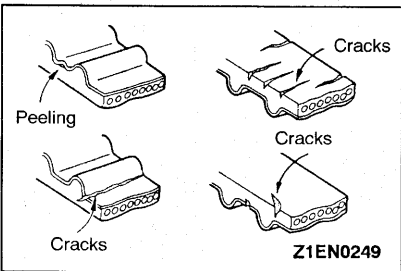
INSPECTION

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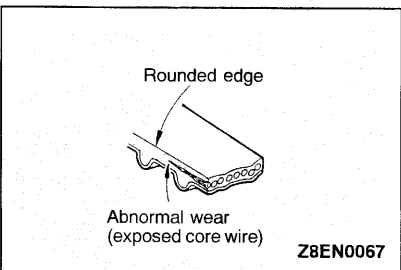
TIMING BELT

Check the timing belt closely. Replace the belt with a new one if any of the following defects are evident:

- (1) Hardened backing rubber (the backing rubber is glossy, non-elastic, and so hard that scratching with fingernails leaves no mark).



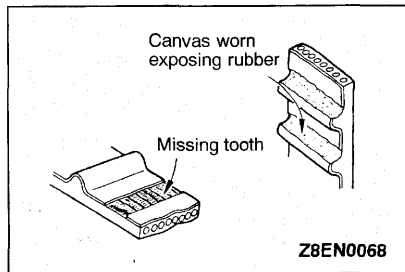
- (2) Surface cracks on the backing rubber.
- (3) Cracks or peeling of the canvas.
- (4) Cracks on the tooth bottom.
- (5) Cracks on the belt sides.



- (6) Abnormal wear on the belt sides.

NOTE

The sides of the belt are normal if they are sharp as if cut by a knife.

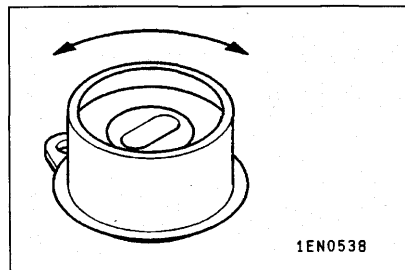


- (7) Abnormal wear on teeth.

Initial stage: Canvas worn (fluffy canvas fibers, rubbery texture gone, white discoloration, canvas texture indistinct)

Final stage: Canvas worn, exposing rubber (tooth width reduced)

- (8) Missing teeth.

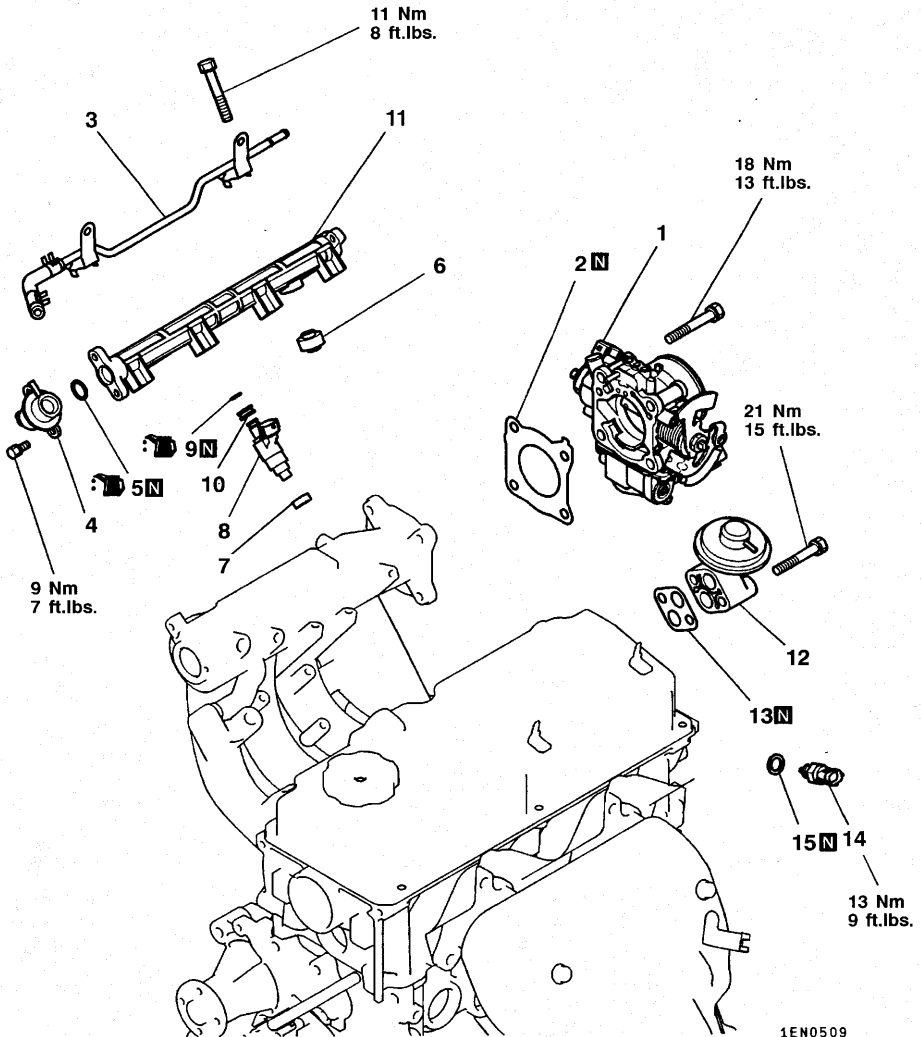


TENSIONER PULLEY

- (1) Check the pulley for smooth rotation without play and are not noisy.

FUEL AND EMISSION CONTROL SYSTEM

REMOVAL AND INSTALLATION



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Removal steps

- ▶B▶ 1. Throttle body assembly
- ▶B▶ 2. Gasket
- ▶B▶ 3. Fuel return pipe
- ▶B▶ 4. Fuel pressure regulator
- ▶B▶ 5. O-ring
- ▶B▶ 6. Insulator
- ▶B▶ 7. Insulator
- ▶A▶ 8. Injector

- 9. O-ring
- 10. Grommet
- 11. Fuel rail
- 12. EGR valve
- 13. Gasket
- 14. Air temperature sensor
- 15. Gasket

INSTALLATION SERVICE POINTS

▶A◀ INJECTOR INSTALLATION

- (1) Fit a new O-ring and grommet onto the injector.
- (2) Apply clean engine oil or gasoline to the injector O-ring.
- (3) Fit the injector onto the fuel rail, turning it to the left and right as it goes in.
- (4) Check that the injector rotates smoothly.

Caution

If the injector does not rotate smoothly, its O-ring may be binding. If this occurs, remove the injector from the fuel rail, check the O-ring, and re-insert the injector.

▶B◀ FUEL PRESSURE REGULATOR INSTALLATION

- (1) Apply a drop of clean engine oil to the O-ring, then insert the fuel pressure regulator into the fuel rail, being careful not to damage the O-ring.

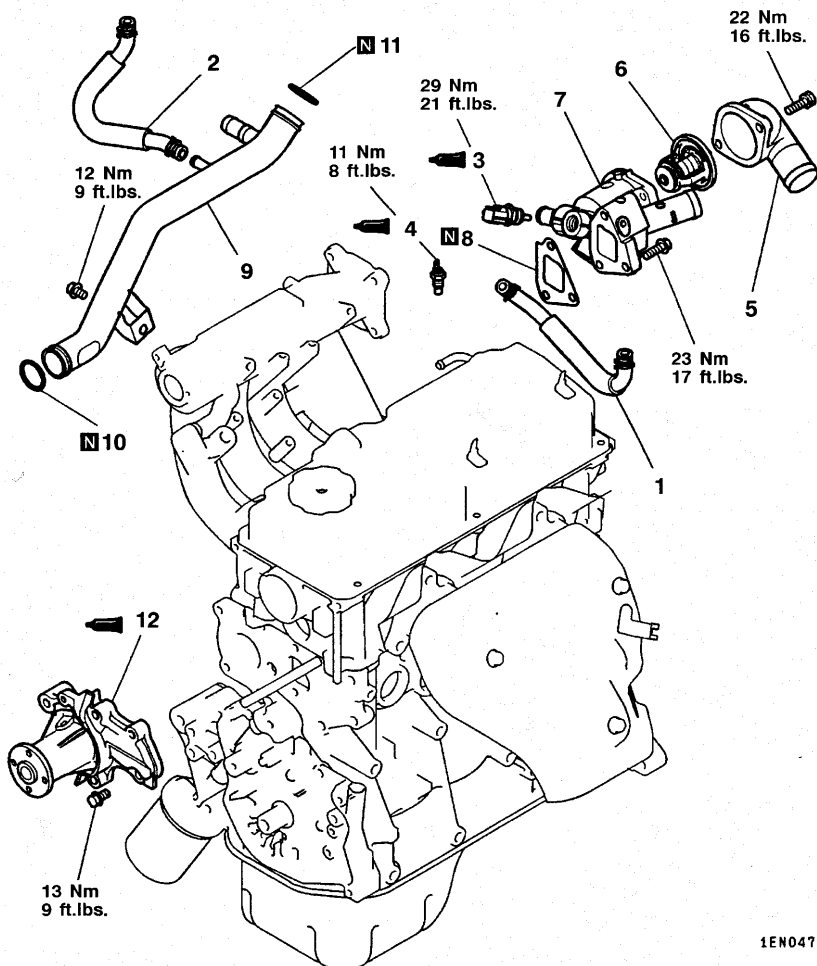
Caution

Do not let engine oil get into the fuel rail.

- (2) Check that the fuel pressure regulator rotates smoothly. If it does not rotate smoothly, the O-ring may be binding. If this occurs, remove the fuel pressure regulator, check the O-ring for damage, then re-insert the regulator into the fuel rail.

WATER PUMP AND WATER HOSE

REMOVAL AND INSTALLATION

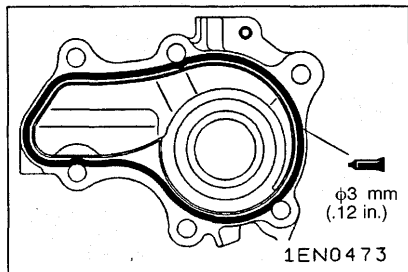


1EN0471

Removal steps

1. Water hose
 2. Water hose
 3. Engine coolant temperature sensor
 4. Engine coolant temperature gauge unit
 5. Water inlet fitting
 6. Thermostat
- ▶E◀
 ▶D◀
 ▶C◀

7. Thermostat case
 8. Gasket
 9. Water inlet pipe
 10. O-ring
 11. O-ring
 12. Water pump
- ▶B◀
 ▶B◀
 ▶B◀
 ▶A◀



INSTALLATION SERVICE POINTS

►A◄ WATER PUMP INSTALLATION

- (1) Clean the sealant application surfaces of water pump case and cylinder block.
- (2) Apply a 3 mm (.12 in.) diameter bead of sealant to the area shown in the illustration. Be sure to install water pump within 15 minutes after applying the sealant.
- (3) After installation, wait at least one hour. Never start the engine or let coolant touch the adhesion surface during that time.

Specified sealant:

Mitsubishi Genuine Part No.MD97C389 or equivalent.

►B◄ O-RING/WATER PIPE INSTALLATION

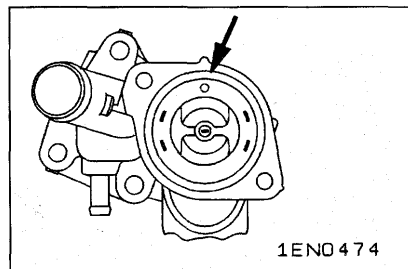
- (1) Replace the water inlet pipe O-ring with new ones, then apply water to the O-rings so that they can be inserted easily into the cylinder block and thermostat case.

Caution

1. Never apply any oil or grease to the O-rings.
2. Secure the water pipe after the thermostat case has been installed.

►C◄ THERMOSTAT INSTALLATION

- (1) Install the thermostat so that the jiggle valve is at the top.

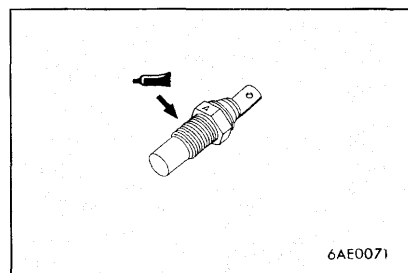


►D◄ ENGINE COOLANT TEMPERATURE GAUGE UNIT INSTALLATION

- (1) When reusing the gauge unit, clean its thread.
- (2) Apply the specified sealant to the thread.

Specified sealant:

3M ATD Part No.8660 or equivalent.

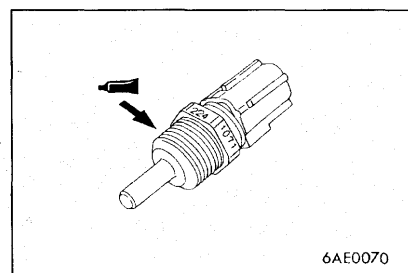


►E◄ ENGINE COOLANT TEMPERATURE SENSOR INSTALLATION

- (1) When reusing the sensor, clean its thread.
- (2) Apply the specified sealant to the thread.

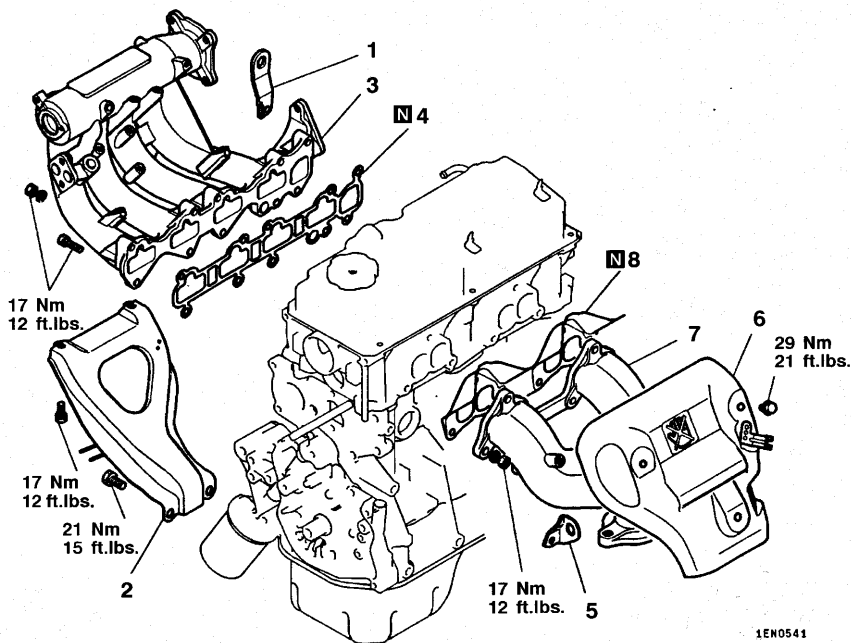
Specified sealant:

3M Nut Locking Part No.4171 or equivalent.



INTAKE AND EXHAUST MANIFOLDS

REMOVAL AND INSTALLATION

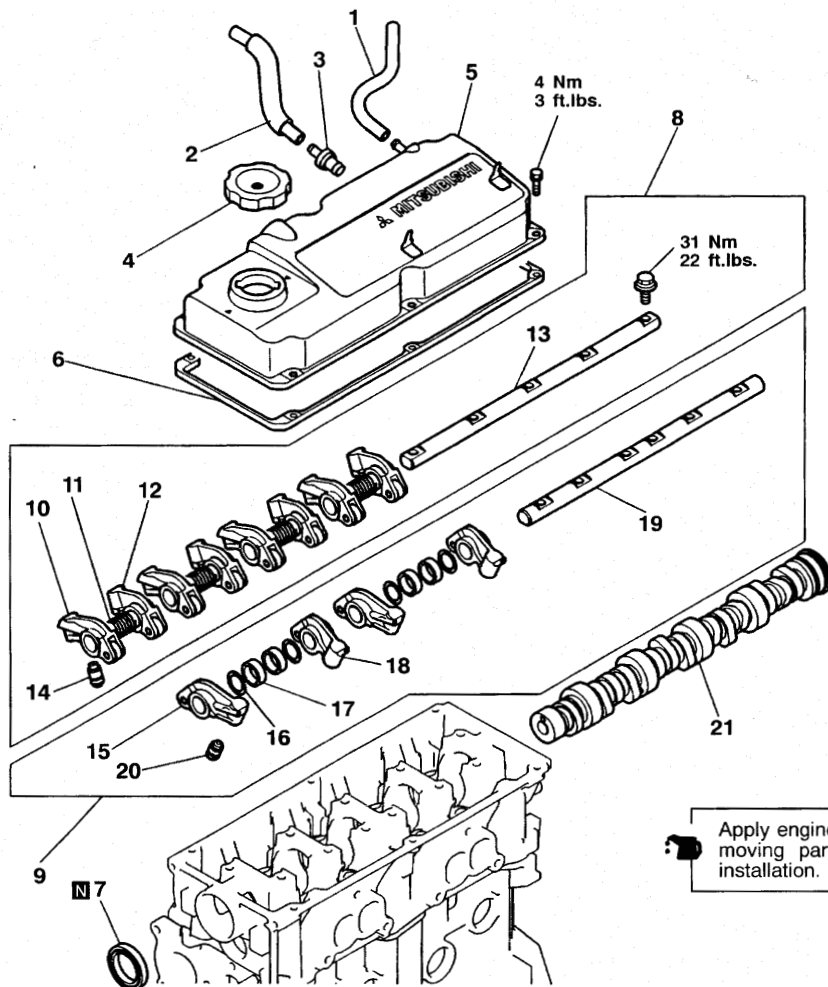


Removal steps

1. Engine hanger
2. Intake manifold stay
3. Intake manifold
4. Intake manifold gasket
5. Engine hanger
6. Exhaust manifold cover
7. Exhaust manifold
8. Exhaust manifold gasket

ROCKER ARMS AND CAMSHAFT

REMOVAL AND INSTALLATION



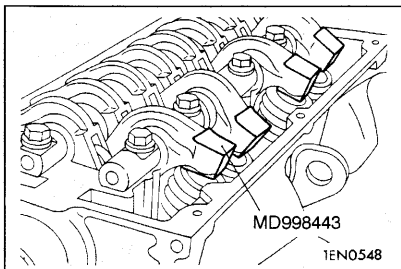
1EN0547

Removal steps

1. Breather hose
2. PCV hose
3. PCV valve
4. Oil filler cap
5. Rocker cover
6. Rocker cover gasket
7. Camshaft oil seal
8. Rocker arm and shaft assembly (intake)
9. Rocker arm and shaft assembly (exhaust)

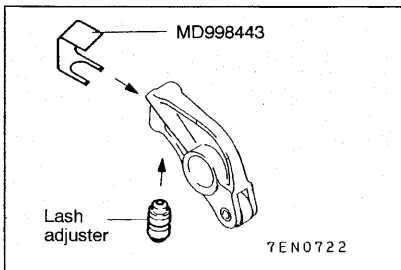
10. Rocker arm A
11. Rocker arm spring
12. Rocker arm B
13. Rocker arm shaft
14. Lash adjuster
15. Rocker arm C
16. Wave washer
17. Spacer
18. Rocker arm D
19. Rocker arm shaft
20. Lash adjuster
21. Camshaft



**REMOVAL SERVICE POINTS****◀A▶ ROCKER ARM AND ROCKER ARM SHAFT REMOVAL****Caution**

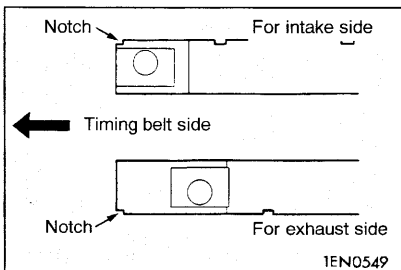
If the lash adjuster is re-used, clean the lash adjuster. (Refer to 11B-24.)

Set special tool MD998443 to prevent the lash adjuster coming free and falling to the floor.

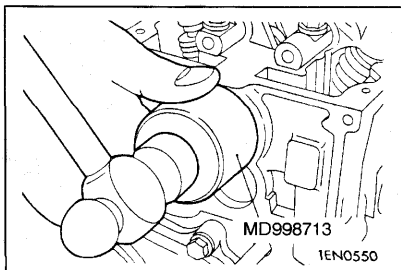
**INSTALLATION SERVICE POINT****▶A◀ LASH ADJUSTER INSTALLATION****Caution**

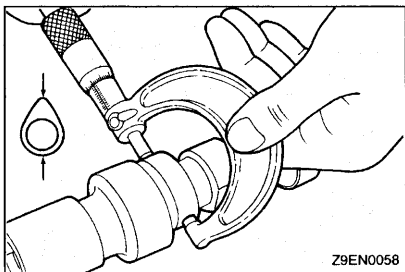
If the lash adjuster is re-used, clean the lash adjuster. (Refer to 11B-24.)

Fit the lash adjuster onto the rocker arm without allowing diesel fuel to spill out. Fit special tool MD998443 to prevent the lash adjuster coming free and falling to the floor.

**▶B◀ ROCKER ARM SHAFT INSTALLATION**

Install the rocker arm shafts, place the end with notched side toward the timing belt side as shown.

**▶C◀ CAMSHAFT OIL SEAL INSTALLATION**



INSPECTION

11300550417

CAMSHAFT

- (1) Measure the cam height and replace the camshaft if any height exceeds the specified limit.

Standard value:

Intake: 38.78 mm (1.53 in.)

Exhaust: 39.10 mm (1.54 in.)

Limit:

Intake: 38.28 mm (1.51 in.)

Exhaust: 38.60 mm (1.52 in.)

LASH ADJUSTERS

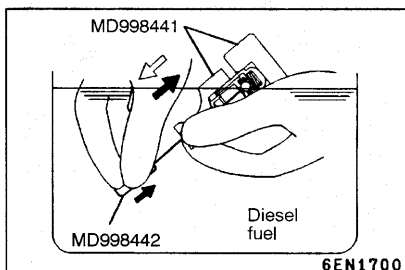
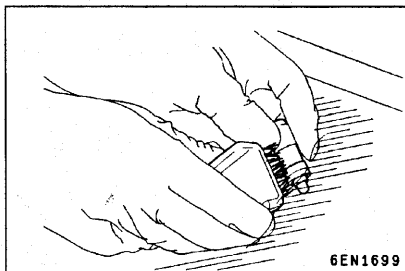
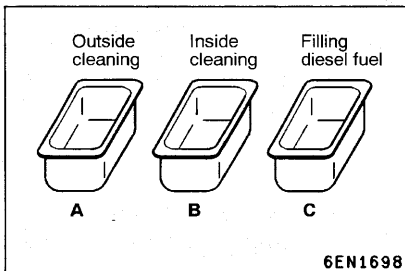
Caution

1. The lash adjusters are precision-engineered mechanisms. Do not allow them to become contaminated by dirt or other foreign substances.
2. Do not attempt to disassemble the lash adjusters.
3. Use only fresh diesel fuel to clean the lash adjusters.

- (1) Prepare three containers and approximately five liters of diesel fuel. Into each container, pour enough diesel fuel to completely cover a lash adjuster when it is standing upright. Then, perform the following steps with each lash adjuster.
- (2) Place the lash adjuster in container A and clean its outside surface.

NOTE

Use a nylon brush if deposits are hard to remove.



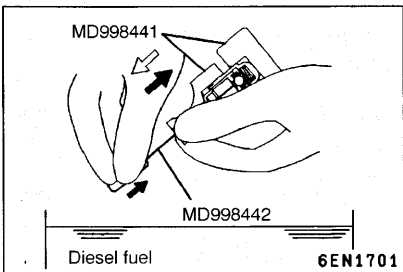
- (3) Fit special tool MD998441 onto the lash adjuster.
- (4) While gently pushing down the internal steel ball using special tool MD998442, move the plunger through 5 to 10 strokes until it slides smoothly. In addition to eliminating stiffness in the plunger, this operation will remove dirty oil.

Caution

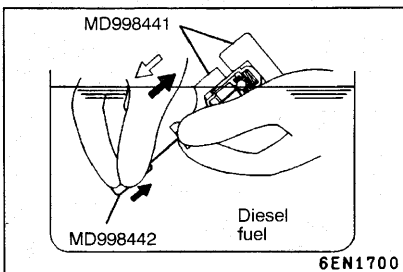
The steel ball spring is extremely weak, so the lash adjuster's functionality may be lost if the air bleed wire is pushed in hard.

NOTE

If the plunger remains stiff or the mechanism appears otherwise abnormal, replace the lash adjuster.



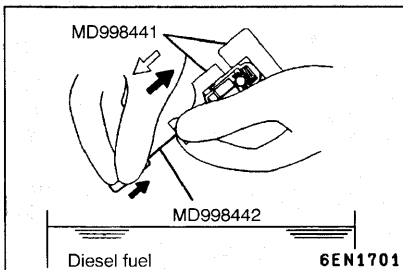
- (5) Remove the lash adjuster from the container. Then, push down the steel ball gently and push the plunger to eliminate diesel fuel from the pressure chamber.



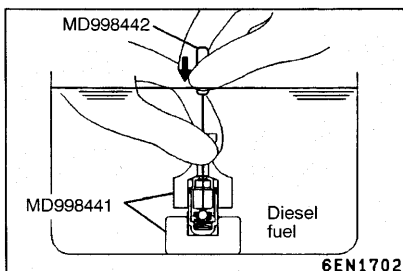
- (6) Fit special tool MD998441 onto the lash adjuster.
 (7) Place the lash adjuster in container B. Then, gently push down the internal steel ball using special tool MD998442 and move the plunger through 5 to 10 strokes until it slides smoothly. This operation will clean the lash adjuster's pressure chamber.

Caution

The steel ball spring is extremely weak, so the lash adjuster's functionality may be lost if the air bleed wire is pushed in hard.



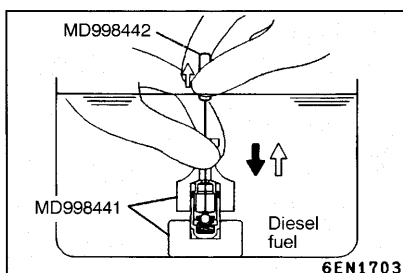
- (8) Remove the lash adjuster from the container. Then, push down the steel ball gently and push the plunger to eliminate diesel fuel from the pressure chamber.



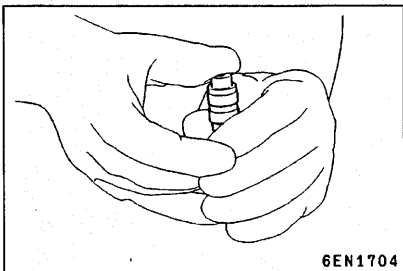
- (9) Place the lash adjuster in container C. Then, gently push down the internal steel ball using special tool MD998442.

Caution

Do not use container C for cleaning. If cleaning is performed in container C, foreign matter could enter the pressure chamber when the chamber is filled with diesel fuel.



- (10) Stand the lash adjuster with its plunger at the top, then push the plunger downward firmly until it moves through its greatest possible stroke. Return the plunger slowly, then release the steel ball and allow the pressure chamber to fill with diesel fuel.
 (11) Remove special tool MD998441.

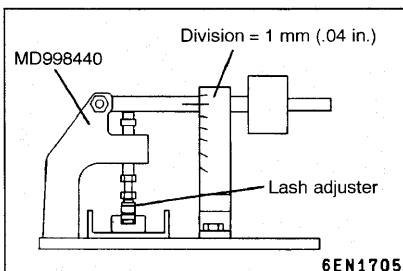


6EN1704

- (12) Remove the lash adjuster from the container, then stand the lash adjuster with its plunger at the top. Push the plunger firmly and check that it does not move. Also, check that the lash adjuster's height matches that of a new lash adjuster.

NOTE

If lash adjuster contracts, perform the operations (9) through (12) again to fill it with diesel fuel completely. Replace the lash adjuster if it still contracts after performing these steps.



6EN1705

- (13) Set the lash adjuster on the special tool MD998440 (leak down tester).

- (14) After the plunger has moved downward slightly [0.2 to 0.5 mm (.008 - .019 in)], measure the time taken for it to move downward by a further 1 mm (.04 in.).

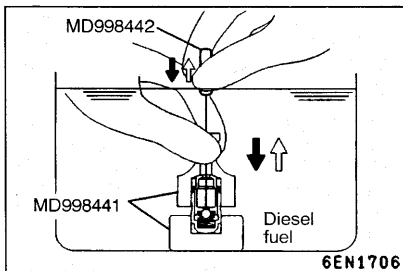
Standard value:

3 - 20 seconds/1 mm (.04 in.)

[with diesel fuel at 15 to 20°C (50 - 68°F)]

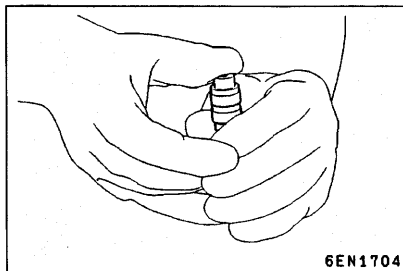
NOTE

Replace the lash adjuster if the time measurement is out of specification.



6EN1706

- (15) Fit special tool MD998441 onto the lash adjuster.
- (16) Place the lash adjuster in container C again, then gently push down the internal steel ball using special tool MD998442.
- (17) Stand the lash adjuster with its plunger at the top, then push the plunger downward firmly until it moves through its greatest possible stroke. Return the plunger slowly, then release the steel ball and allow the pressure chamber to fill with diesel fuel.
- (18) Remove special tool MD998441.



6EN1704

- (19) Remove the lash adjuster from the container, then stand the lash adjuster with its plunger at the top. Push the plunger firmly and check that it does not move. Also, check that the lash adjuster's height matches that of a new lash adjuster.

NOTE

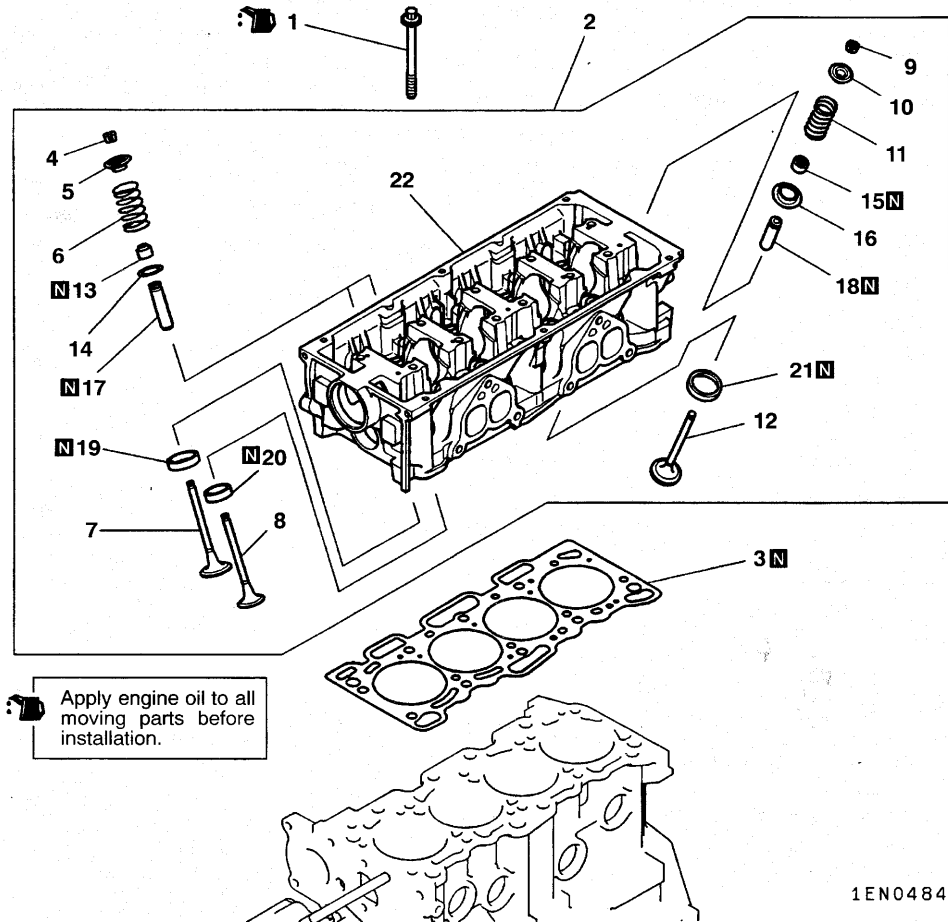
If lash adjuster contracts, perform the operations (15) through (19) again to fill it with diesel fuel completely. Replace the lash adjuster if it still contracts after performing these steps.

- (20) Stand the lash adjuster upright to prevent diesel fuel spilling out. Do not allow the lash adjuster to become contaminated by dirt or other foreign matter. Fit the lash adjuster onto the engine as soon as possible.

11300690164

CYLINDER HEAD AND VALVES

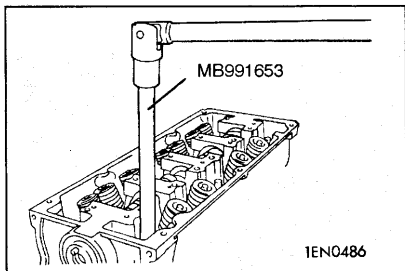
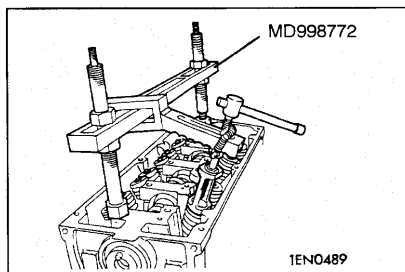
REMOVAL AND INSTALLATION



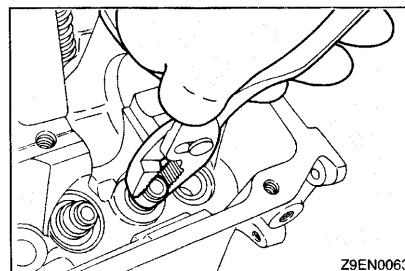
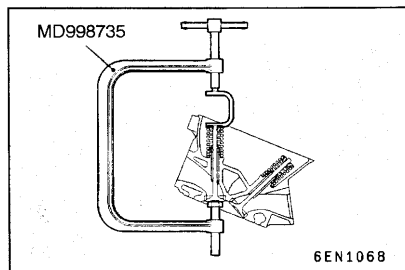
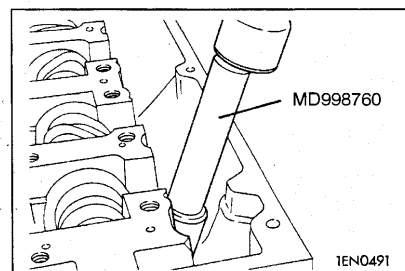
Removal steps

- ◀A▶ ▶D▶ 1. Cylinder head bolt
 ▶B▶ ▶C▶ 2. Cylinder head assembly
 ▶B▶ ▶C▶ 3. Cylinder head gasket
 ▶B▶ ▶C▶ 4. Retainer lock
 ▶B▶ ▶C▶ 5. Valve spring retainer
 ▶B▶ ▶C▶ 6. Valve spring
 ▶B▶ ▶C▶ 7. Intake valve (primary)
 ▶B▶ ▶C▶ 8. Intake valve (secondary)
 ▶B▶ ▶C▶ 9. Retainer lock
 ▶B▶ ▶C▶ 10. Valve spring retainer
 ▶B▶ ▶C▶ 11. Valve spring

- ▶C▶ ▶A▶ 12. Exhaust valve
 ▶C▶ ▶A▶ 13. Valve stem seal
 ▶C▶ ▶A▶ 14. Valve spring seat
 ▶C▶ ▶A▶ 15. Valve stem seal
 ▶C▶ ▶A▶ 16. Valve spring seat
 ▶C▶ ▶A▶ 17. Intake valve guide
 ▶C▶ ▶A▶ 18. Exhaust valve guide
 ▶C▶ ▶A▶ 19. Intake valve seat (primary)
 ▶C▶ ▶A▶ 20. Intake valve seat (secondary)
 ▶C▶ ▶A▶ 21. Exhaust valve seat
 ▶C▶ ▶A▶ 22. Cylinder head

**REMOVAL SERVICE POINTS****◀A▶ CYLINDER HEAD BOLT REMOVAL****◀B▶ RETAINER LOCK REMOVAL**

- (1) Tag removed valves, springs, and other components, noting their cylinder numbers and locations to facilitate reassembly. Store these components safely.

**◀C▶ VALVE STEM SEAL REMOVAL****INSTALLATION SERVICE POINTS****▶A▶ VALVE STEM SEAL INSTALLATION**

- (1) Install the valve spring seat.
- (2) Install a new valve stem seal using the special tool shown in the illustration.

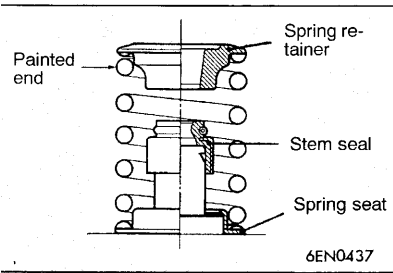
Caution

1. Do not reuse the removed valve stem seals.
2. The valve stem seal must be installed using the correct special tool. Incorrect installation could result in oil leaking past the valve guide.

►B◄ VALVE SPRING INSTALLATION

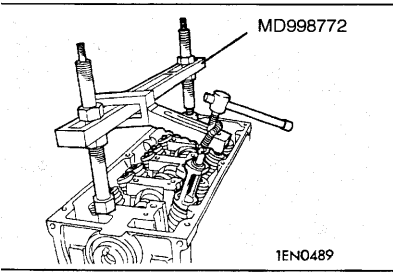
- (1) Install the valve spring so that the painted end is on the rocker arm side.

Paint colors:
Intake: Orange
Exhaust: Yellow



►C◄ RETAINER LOCK INSTALLATION

- (1) The valve spring, if excessively compressed, causes the bottom end of the retainer to be in contact with the stem seal, and damage it.

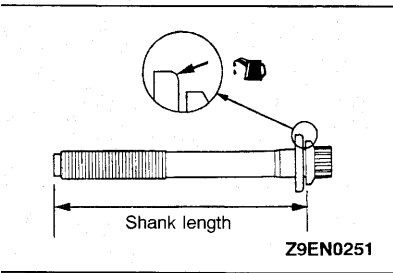
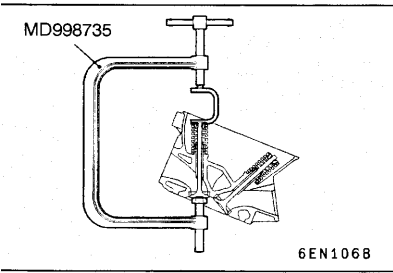


►D◄ CYLINDER HEAD BOLT INSTALLATION

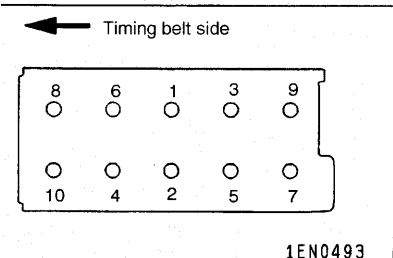
- (1) When reusing the cylinder head bolt, measure that its shank length does not exceed the specified limit. Replace the bolt if this measurement exceeds the limit.

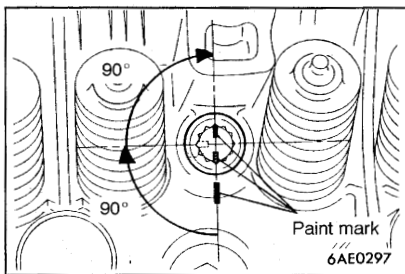
Limit: Max. 103.2 mm (40.63 in.)

- (2) Fit the washer as shown.
- (3) Apply engine oil to the bolt thread and washer.



- (4) Tighten the bolts in the sequence shown until each is torqued to 49 Nm (35 ft.lbs.) using the special tool (MB991653).
- (5) Loosen all bolts fully.
- (6) Retighten the bolts in the sequence shown until each is torqued to 20 Nm (15 ft.lbs.)



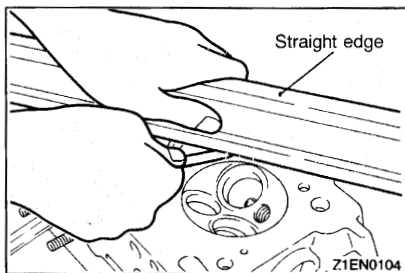


- (7) Make paint marks on the cylinder head bolt heads and cylinder head as shown.
- (8) In accordance with the tightening sequence, tighten each bolt by 90° (1/4 turn).
- (9) Tighten each bolt by a further 90° (1/4 turn) and check that the paint marks on the bolt head and cylinder head are aligned.

Caution

If the bolts are tightened by an angle of less than 90° (1/4 turn), they may not hold the cylinder head with sufficient strength.

If the bolts are tightened by an angle exceeding 90° , completely remove them and carry out the installation procedure again.



INSPECTION

11300700188

CYLINDER HEAD

- (1) Before cleaning the cylinder head, check it for water leaks, gas leaks, cracks, and other damage.
- (2) Remove all oil, water scale, sealant, and carbon. After cleaning the oil passages, blow air through them to verify that they are not blocked.
- (3) Check the cylinder head gasket surface for flatness by using a straight edge and feeler gauge.

Standard value: 0.05 mm (.002 in.) or less

Limit: 0.2 mm (.008 in.)

- (4) If flatness exceeds the specified limit, grind the gasket surface to specification.

Grinding limit: *0.2 mm (.008 in.)

***Includes/combined with cylinder block grinding.**

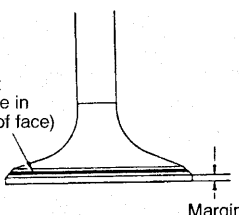
**Cylinder head height (specification when new):
106.9 - 107.1 mm (4.209 - 4.217 in.)**

VALVES

- (1) Check the valve face for correct contact. If contact is uneven or incomplete, reface the valve seat.
- (2) If the margin is less than specified, replace the valve.

Standard value:**Intake:** 1.0 mm (.039 in.)**Exhaust:** 1.5 mm (.059 in.)**Limit:****Intake:** 0.5 mm (.020 in.)**Exhaust:** 1.0 mm (.039 in.)

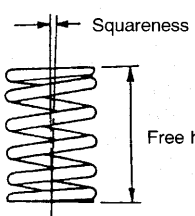
- (3) Measure the valve length. If the measurement is less than specified, replace the valve.

Standard value:**Intake:** 100.75 mm (3.967 in.)**Exhaust:** 101.05 mm (3.978 in.)**Limit:****Intake:** 100.25 mm (3.947 in.)**Exhaust:** 100.55 mm (3.955 in.)


Contact
(must be in
center of face)

Margin

6EN0542



Squareness

Free height

1EN0264

VALVE SPRING

- (1) Measure the valve spring free height. If the measurement is less than specified, replace spring.

Standard value:**Intake:** 46.1 mm (1.815 in.)**Exhaust:** 46.8 mm (1.843 in.)**Limit:****Intake:** 45.6 mm (1.795 in.)**Exhaust:** 46.3 mm (1.823 in.)

- (2) Measure the squareness of the spring. If the measurement is less than specified, replace the spring.

Standard value: 2° or less**Limit:** 4°


Valve guide

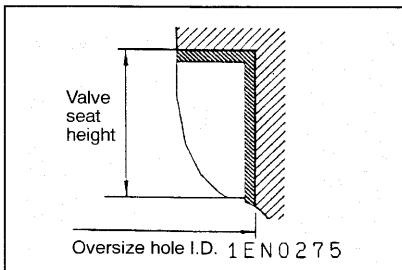
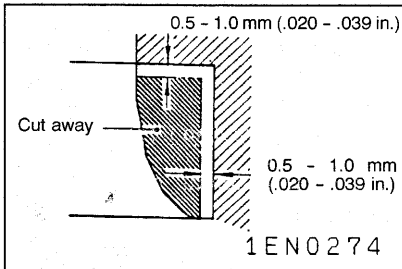
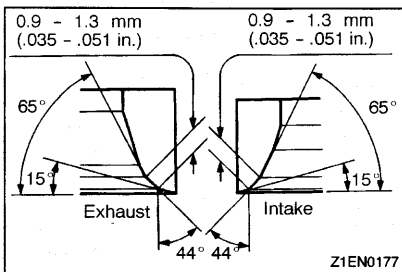
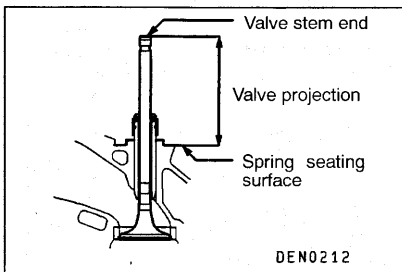
Guide I.D.

Stem O.D. Z1EN0279

VALVE GUIDES

- (1) Measure the clearance between the valve guide and valve stem. If the clearance exceeds the specified limit, replace the valve guide and/or valve.

Standard value:**Intake:** 0.020 - 0.050 mm (.0008 - .0020 in.)**Exhaust:** 0.050 - 0.085 mm (.0020 - .0035 in.)**Limit:****Intake:** 0.10 mm (.0039 in.)**Exhaust:** 0.15 mm (.0059 in.)



VALVE SEATS

- (1) Assemble the valve, then measure the valve stem projection between the end of the valve stem and the spring seating surface. If the measurement exceeds the specified limit, replace the valve seat.

Standard value:

Intake: 43.70 mm (1.720 in.)

Exhaust: 43.30 mm (1.705 in.)

Limit:

Intake: 44.20 mm (1.740 in.)

Exhaust: 43.80 mm (1.724 in.)

VALVE SEAT RECONDITIONING PROCEDURE

- (1) Before correcting the valve seat, check the clearance between the valve guide and valve. If necessary, replace the valve guide.
- (2) Using the appropriate special tool or seat grinder, correct the valve seat to achieve the specified seat width and angle.
- (3) After correcting the valve seat, lap the valve and valve seat using lapping compound. Then, check the valve stem projection (refer to VALVE SEAT in INSPECTION).

VALVE SEAT REPLACEMENT PROCEDURE

- (1) Cut the valve seat to be replaced from the inside to reduce the wall thickness. Then, remove the valve seat.
- (2) Rebore the valve seat hole in the cylinder head to match the selected oversize valve seat diameter.

Intake valve seat hole diameters (0.3 O.S.)

Primary: 27.300 - 27.325 mm

(1.0748 - 1.0758 in.)

Secondary: 32.300 - 32.325 mm

(1.2717 - 1.2726 in.)

Intake valve seat hole diameters (0.6 O.S.)

Primary: 27.600 - 27.625 mm

(1.0866 - 1.0876 in.)

Secondary: 32.600 - 32.625 mm

(1.2835 - 1.2845 in.)

Exhaust valve seat hole diameters (0.3 O.S.)

35.300 - 35.325 mm (1.3898 - 1.3907 in.)

Exhaust valve seat hole diameters (0.6 O.S.)

35.600 - 35.625 mm (1.4016 - 1.4026 in.)

- (3) Prevent galling of the cylinder head bore by cooling the valve seat with liquid nitrogen before press-fitting it.
- (4) Correct the valve seat to achieve the specified width and angle (refer to VALVE SEAT RECONDITIONING PROCEDURE).

VALVE GUIDE REPLACEMENT PROCEDURE

- (1) Using a press, push the valve guide out toward the cylinder block side.
- (2) Rebore the valve guide hole in the cylinder head to match the oversize valve guide that is to be fitted.

Caution

Do not install a valve guide of the same size again.

Valve guide hole diameters

0.05 O.S.: 12.050 - 12.068 mm (.4744 - .4752 in.)

0.25 O.S.: 12.250 - 12.268 mm (.4823 - .4831 in.)

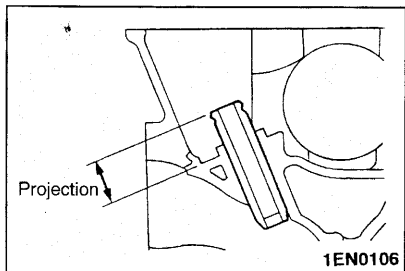
0.50 O.S.: 12.500 - 12.518 mm (.4921 - .4929 in.)

- (3) Press-fit the valve guide until it projects by the specified amount.

Standard value: 17 mm (.670 in.)

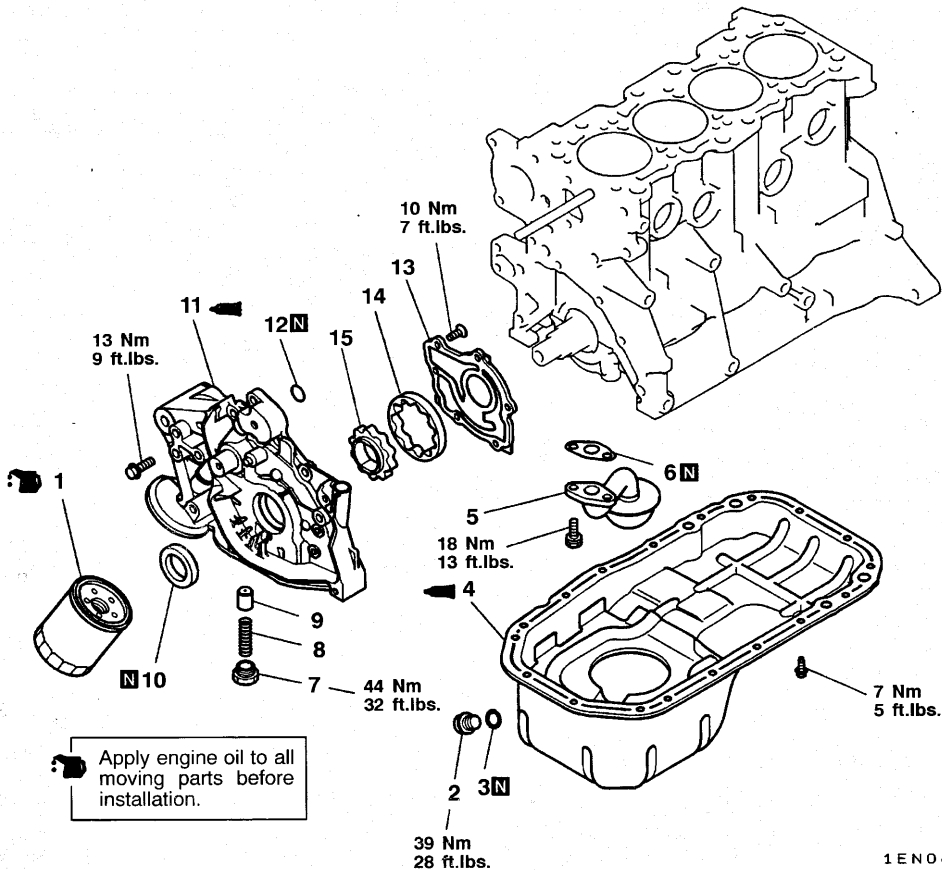
Caution

- 1. The valve guide must be installed from the upper side of the cylinder head.**
- 2. The valve guides differ in length on the intake and exhaust sides.**
- 3. VALVE GUIDE LENGTH**
INTAKE: 44.0 mm (1.732 in.)
EXHAUST: 49.5 mm (1.949 in.)
- 4. After press-fitting the valve guide, insert a new valve and check that it slides smoothly.**



OIL PUMP AND OIL PAN

REMOVAL AND INSTALLATION

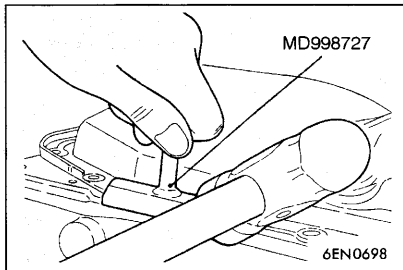


1EN0494

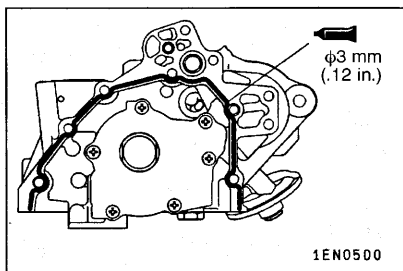
Removal steps

1. Oil filter
2. Drain plug
3. Gasket
4. Oil pan
5. Oil screen
6. Gasket
7. Relief valve
8. Relief valve spring

9. Relief plunger
10. Front oil seal
11. Front case
12. O-ring
13. Oil pump cover
14. Oil pump outer rotor
15. Oil pump inner rotor

**REMOVAL SERVICE POINTS****◀A▶ OIL PAN REMOVAL**

- (1) Remove the oil pan mounting bolts.
- (2) Knock the special tool between the oil pan and cylinder block as shown in the illustration.
- (3) Tapping the side of the special tool, slide the tool along the oil pan/cylinder block seal and thus remove the oil pan.

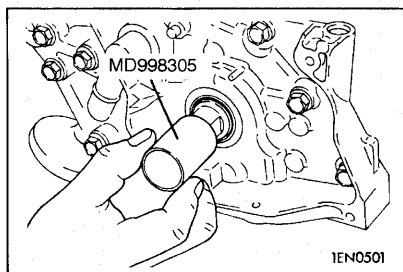
**INSTALLATION SERVICE POINTS****▶A◀ FRONT CASE INSTALLATION**

- (1) Clean the sealant application surfaces on the cylinder block and front case.
- (2) Apply a 3 mm (.12 in.) diameter bead of sealant to the area shown. Be sure to install the front case within 15 minutes after apply the sealant.

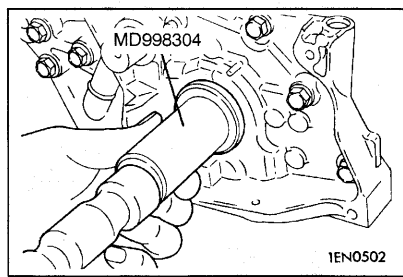
Specified sealant:

Mitsubishi Genuine Part No.MD970389 or equivalent.

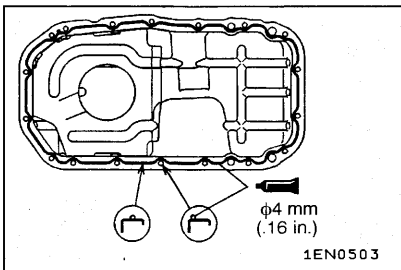
- (3) Tighten the front case bolts to the specified torque.
- (4) After installation, wait at least one hour. Never start the engine or let engine oil touch the adhesion surface during that time.

**▶B◀ FRONT OIL SEAL INSTALLATION**

- (1) Place the special tool on the crankshaft front end and apply engine oil to the its outer diameter.



- (2) Apply engine oil to the oil seal lip, then push the oil seal along the guide by hand until it touches the front case. Tap the oil seal into place using the special tool.



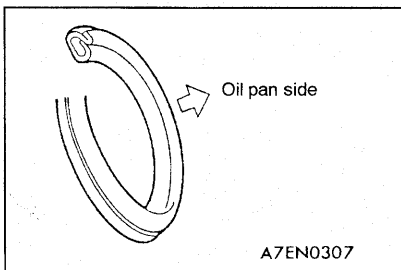
►C◀ OIL PAN INSTALLATION

- (1) Clean the mating surfaces of the oil pan and cylinder block.
- (2) Apply a 4 mm (.16 in.) diameter bead of sealant to the oil pan flange. Be sure to install the oil pan within 15 minutes after applying the sealant

Specified sealant:

Mitsubishi Genuine Part No.MD970389 or equivalent.

- (3) Tighten the oil pan bolts to specified torque.
- (4) After installation, wait at least one hour. Never start the engine or let engine oil touch the adhesion surface during that time.



►D◀ DRAIN PLUG GASKET INSTALLATION

- (1) Replace the drain plug gasket with a new one. Fit the new gasket as shown.

►E◀ OIL FILTER INSTALLATION

- (1) Clean the filter mounting surface on the front case.
- (2) Apply clean engine oil to the O-ring of the oil filter.
- (3) Screw on the oil filter until the O-ring is seated on the mounting surface. Then, give the oil filter one further turn.

Caution

The oil filter must be tightened using a commercially available filter wrench. If the filter is tightened by hand only, it will be insufficiently torqued, resulting in oil leaks.

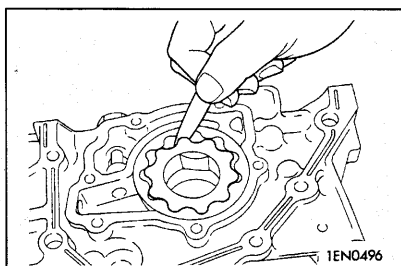
INSPECTION

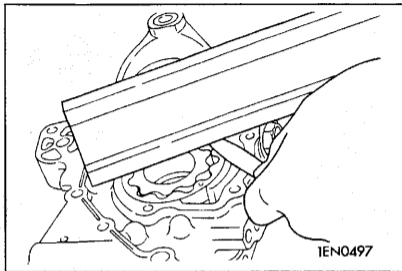
11300820082

OIL PUMP

- (1) Fit the rotors into the front case.
- (2) Check the tip clearance using a feeler gauge.

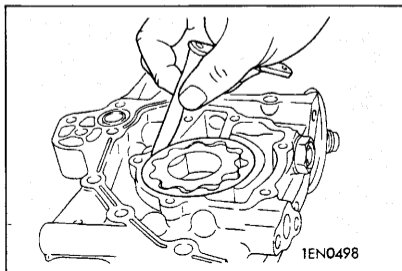
Standard value: 0.06 - 0.18 mm (.0024 - .0071 in.)





- (3) Check the side clearance using a straight edge and feeler gauge.

Standard value: 0.04 - 0.10 mm (.0016 - .0039 in.)



- (4) Check the body clearance using a feeler gauge.

Standard value: 0.04 - 0.10 mm (.0016 - .0039 in.)

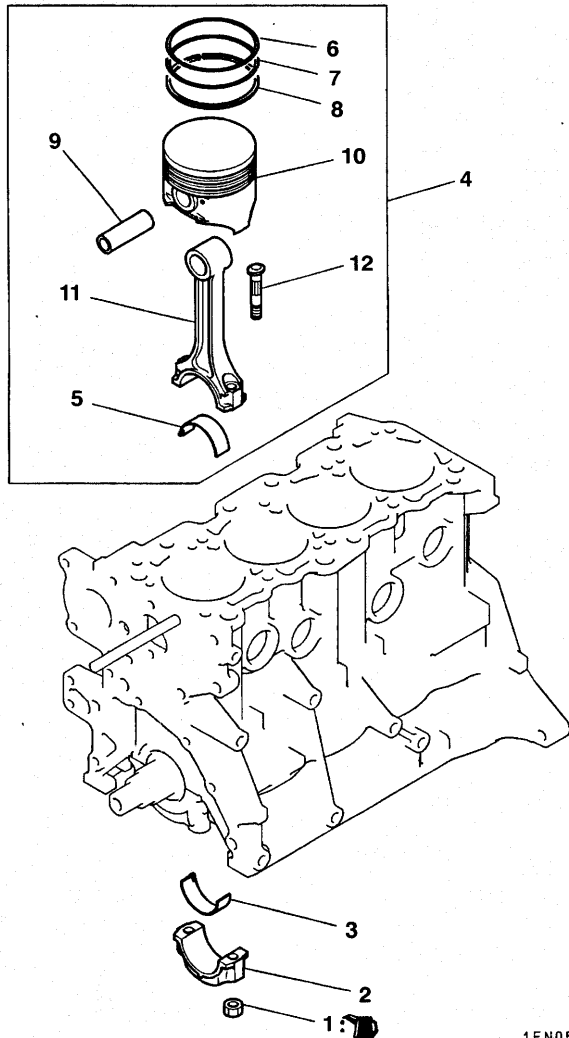
Limit: 0.35 mm (.0138 in.)

PISTONS AND CONNECTING RODS

REMOVAL AND INSTALLATION



Apply engine oil to all moving parts before installation.



Removal steps

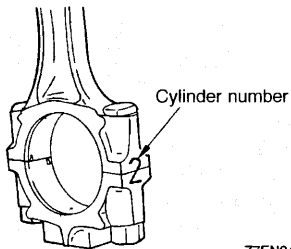
1. Connecting rod nut
2. Connecting rod cap
3. Connecting rod bearing
4. Piston and connecting rod assembly
5. Connecting rod bearing
6. Piston ring No.1

7. Piston ring No.2
8. Oil ring
9. Piston pin
10. Piston
11. Connecting rod
12. Bolt

1EN0523

REMOVAL SERVICE POINTS**◀A▶ CONNECTING ROD CAP REMOVAL**

- (1) Mark the cylinder number on the side of the connecting rod big end for correct reassembly.
- (2) Keep the removed connecting rods, caps, and bearings in order according to the cylinder number.



Z7EN0448

◀B▶ PISTON PIN REMOVAL

Item No.	Part No.	Description
1	MIT310134	Base
2	MIT310136	Piston Support
3	MIT310137	Connecting Rod Guide Pin
4	MIT310138	Connecting Rod Guide Pin
5	MIT310139	Connecting Rod Guide Pin
6	MIT310140	Piston Support
7	MIT310141	Connecting Rod Guide Pin
8	MIT310142	Piston Support
9	MIT48143	Press Pin
10	216943	Stop Screw
11	10396	Nut

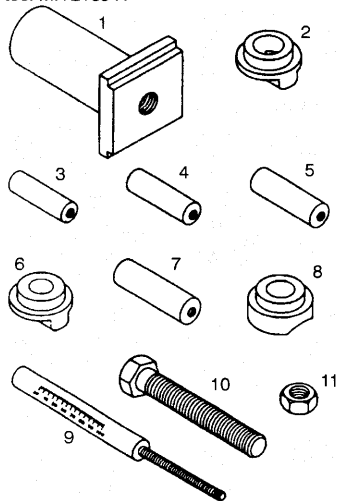
- (1) Remove the stop screw from the base.
- (2) Select the correct piston support for your application (See above). Fit the piston support onto the base. Place the base on press support blocks.

- (3) Insert the press pin through the piston pin hole. Select the correct connecting rod guide pin (See above). Thread the guide pin onto the threaded portion of the press pin.
- (4) Position the piston assembly on the piston support in the press. With the press pin up as shown in Figure 4, insert the guide pin through the hole in the piston and through the hole in the piston support.
- (5) Press the piston pin out of the assembly.

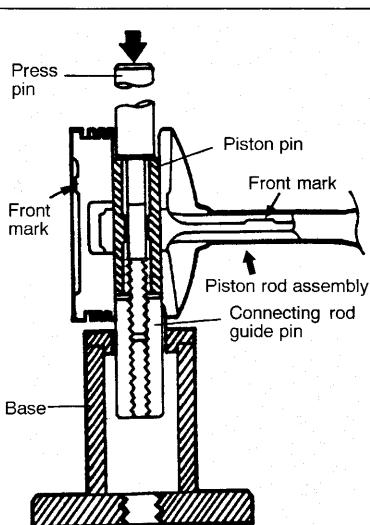
IMPORTANT: To avoid piston damage,

- THE PISTON SUPPORT MUST SEAT SQUARELY AGAINST THE PISTON.
 - VERIFY THAT THE PISTON PIN WILL SLIDE THROUGH THE HOLE IN THE PISTON SUPPORT.
- (6) Remove the piston pin from the press pin.

Piston pin setting tool MIT216941



Z7EN0425



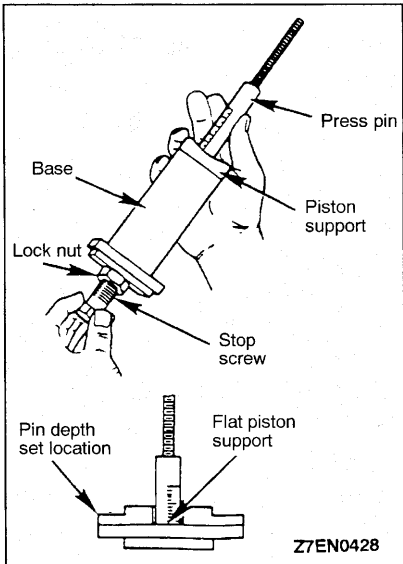
7EN0979

INSTALLATION SERVICE POINTS

▶A◀ PISTON PIN INSTALLATION

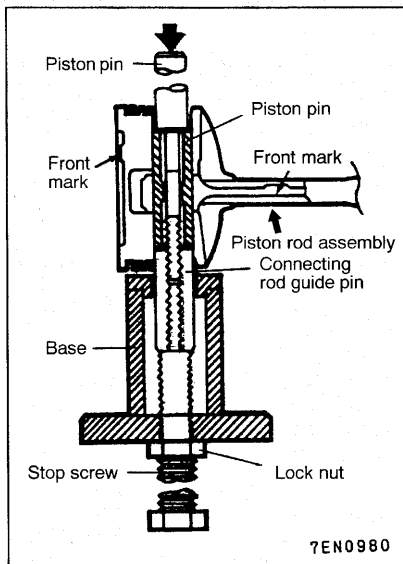
- (1) Thread the stop screw and lock nut on top of the base. Fit the correct piston support on top of the base. Insert the press pin, threaded end up, into the hole in the piston support until the press pin touches the stop screw.
- (2) Using the markings on the press pin, adjust the stop screw to the depth as shown below.

Depth: Refer to the operating instructions on the special tool.

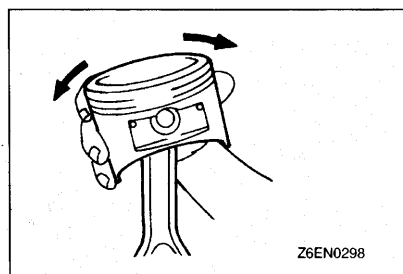


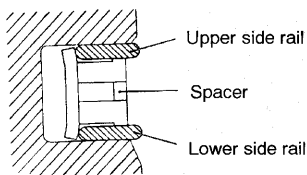
- (3) Place the base on press support blocks.
- (4) Slide the piston pin over the threaded end of the press pin, and thread the correct guide pin up against it.
- (5) Coat the piston pin with oil, and with the connecting rod held in position, slide the guide pin through the piston and connecting rod.
- (6) Press the piston pin through the connecting rod until the guide pin contacts the stop screw.
- (7) Remove the piston assembly from the base. Remove the guide pin and press pin from the assembly.

IMPORTANT: Due to production tolerance variations, it is necessary to visually inspect the piston pin depth after installation to verify that the piston pin is centered. Adjust if necessary.



- (8) Check that the piston moves smoothly.





A6EN0585

►B◄ OIL RING INSTALLATION

- (1) Fit the oil ring spacer into the piston ring groove. Then, fit the upper and lower side rails.

NOTE

- (1) The spacer and side rails may be fitted in either direction. No distinction is made between top and bottom.
- (2) Spacer and side rail sizes are color-coded as follows:

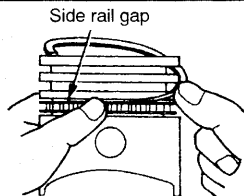
Size	Color
STD	None
0.50 mm O.S.	Blue
1.00 mm O.S.	Yellow

To install a side rail, fit one end of the rail into the groove then press the rest of the rail into position by hand as shown.

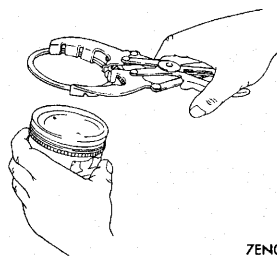
Caution

Do not fit side rails using a piston ring expander since they may break.

- (2) After installing the side rails, check that they move smoothly in both directions.



Z1EN0296



7EN0452

►C◄ PISTON RING No.2/PISTON RING No.1 INSTALLATION

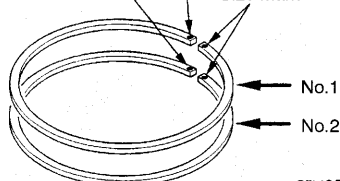
- (1) Using a ring expander, fit ring No.2 and ring No.1 with their identification marks facing upward (on the piston crown side).

Identification marks:

No.1 ring: 1T

No.2 ring: 2T

"1T" identification mark
"2T" identification mark
Size mark

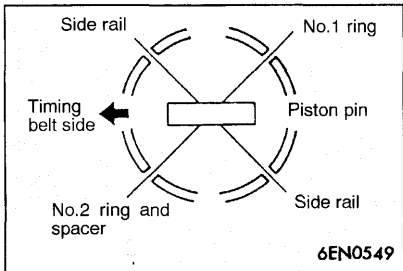


9EN0524

NOTE

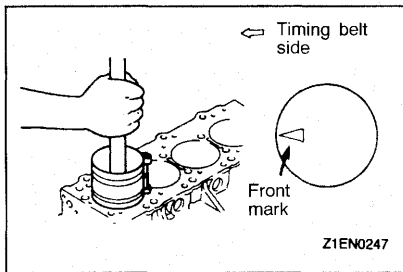
Piston rings are stamped with size marks as follows:

Size	Size mark
STD	None
0.50 mm O.S.	50
1.00 mm O.S.	100

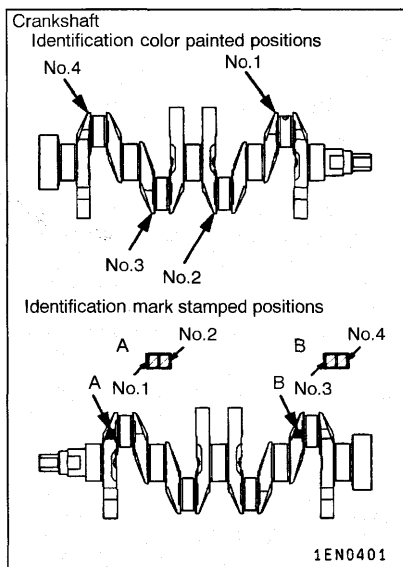


▶D◀ PISTON AND CONNECTING ROD ASSEMBLY INSTALLATION

- (1) Apply oil to the piston, piston rings, and oil ring.
- (2) Align the gaps of the piston rings and oil ring (side rails and spacer) as shown.
- (3) With the piston crown's front arrow mark pointing toward the timing belt side, press the piston and connecting rod assembly into the cylinder from the top of the cylinder.



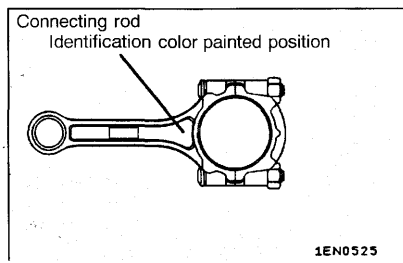
- (4) Compress the piston rings tightly with a suitable ring compression tool, then press the piston and connecting rod fully into the cylinder. Do not strike the piston hard since the piston rings may break and the crank pin may be nicked.

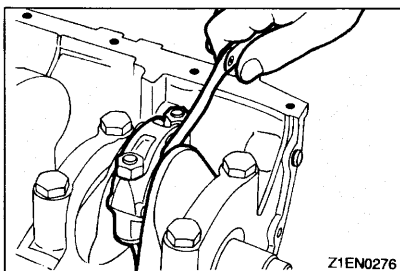
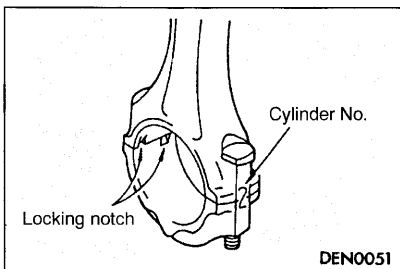
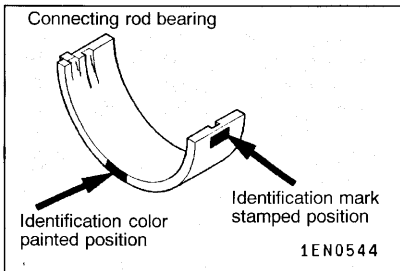


▶E◀ CONNECTING ROD BEARING INSTALLATION

- (1) When replacing the bearings, crankshaft and/or connecting rod, read off the identification mark and color on the crankshaft and connecting rod (as illustrated), and select a bearing according to the following table.

Crankshaft pin O.D.		Connecting rod big end I.D.		Connecting rod bearing
Identification color	Identification mark	Identification color	Identification mark	Identification color
Yellow	I	White	1	Yellow
		None	1	Yellow
		Yellow	2	None
None	II	White	1	Yellow
		None	2	None
		Yellow	3	Blue
White	III	White	2	None
		None	3	Blue
		Yellow	3	Blue





►F◄ CONNECTING ROD CAP INSTALLATION

- (1) Aligning the marks made during disassembly, fit the bearing cap onto the connecting rod. If the connecting rod is new and has no index mark, ensure that the bearing locking notches are both on the same side.

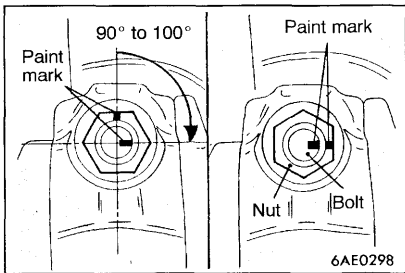
- (2) Check that the connecting rod big end side clearance confirms with specifications.

Standard value: 0.10 - 0.25 mm (.0039 - .0098 in.)

Limit: 0.4 mm (.016 in.)

►G◄ CONNECTING ROD CAP NUT TIGHTENING

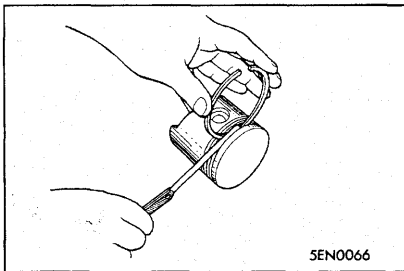
- (1) Since the connecting rod cap bolts and nuts are torqued using the plastic area tightening method, the bolts should be examined BEFORE reuse. If the bolt threads are "necked down", the bolt should be replaced. Necking can be checked by running a nut with your fingers the full length of the bolt threads. If the nut does not run down smoothly, the bolt should be replaced.
- (2) Before installation of each nut, apply engine oil to the nut.
- (3) Install each nut to the bolt and finger-tighten it. Then tighten the nuts alternately to install the cap properly.
- (4) Tighten the nuts to 17 Nm (12 ft.lbs.)



- (5) Make a paint mark on the head of each nut.
- (6) Make a paint mark on the bolt end at the position 90° to 100° from the paint mark made on the nut in the direction of tightening the nut.
- (7) Give a 90° to 100° turn to the nut and make sure that the paint mark on the nut and that on the bolt are in alignment.

Caution

1. If the nut is turned less than 90°, proper fastening performance may not be expected. When tightening the nuts, therefore, be careful to give a sufficient turn to it.
2. If the nut is overtightened (exceeding 100°), loosen the nut completely and then retighten it by repeating the tightening procedure from step (1).



INSPECTION

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PISTON RING

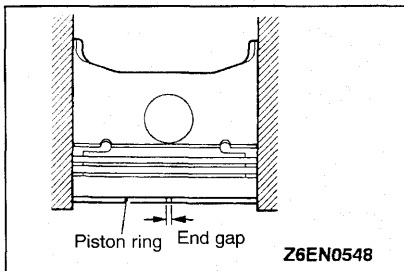
- (1) Check for side clearance.
If the limit is exceeded, replace the ring or piston, or both.

Standard value:

No.1 0.03 - 0.07 mm (.0012 - .0028 in.)

No.2 0.02 - 0.06 mm (.0008 - .0024 in.)

Limit: 0.1 mm (.004 in.)



- (2) Insert the piston ring into the cylinder bore. Force the ring down with a piston, the piston crown being in contact with the ring, to correctly position it at right angles to the cylinder wall. Then, measure the end gap with a feeler gauge. If the end gap is excessive, replace the piston ring.

Standard value:

No.1 ring: 0.20 - 0.35 mm (.0079 - .0138 in.)

No.2 ring: 0.35 - 0.50 mm (.0138 - .0197 in.)

Oil ring: 0.20 - 0.50 mm (.079 - .0197 in.)

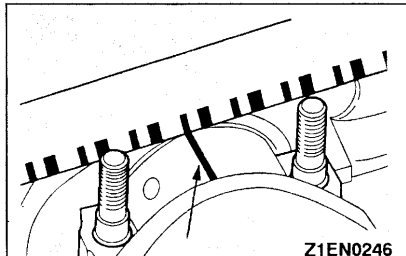
Limit:

No.1, No.2 0.8 mm (.031 in.)

Oil 1.0 mm (.039 in.)

CRANKSHAFT PIN OIL CLEARANCE (PLASTIC GAUGING MATERIAL METHOD)

- (1) Remove oil from crankshaft pin and connecting rod bearing.
- (2) Cut the plastic gauging material to the same length as the width of bearing and place it on a crankshaft pin in parallel with its axis.




- (3) Install the connecting rod cap carefully and tighten the nuts to the specified torque. (See "Connecting rod cap nut tightening" procedure.)
- (4) Carefully remove the connecting rod cap.
- (5) Measure the width of the plastic gauging material at its widest part by using a scale printed on the plastic gauging material package.

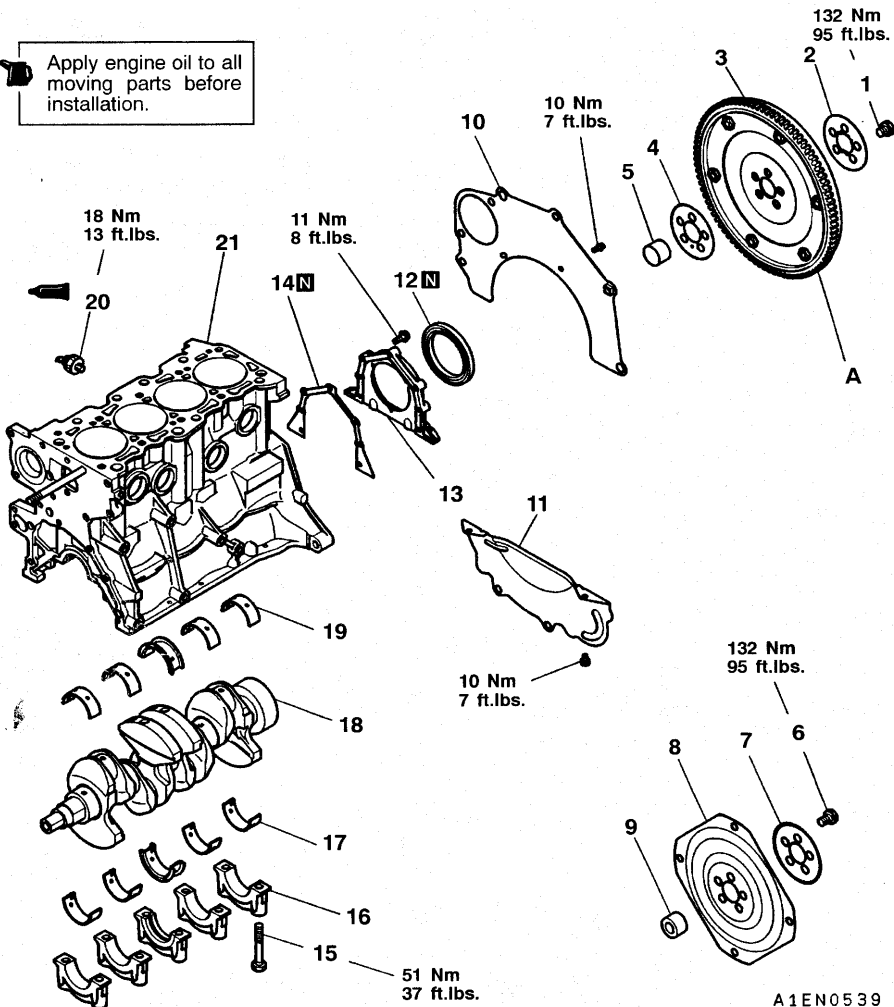
Standard value: 0.02 - 0.05 mm (.0008 - .0020 in.)

Limit: 0.1 mm (.004 in.)

CRANKSHAFT AND CYLINDER BLOCK








REMOVAL AND INSPECTION

 Apply engine oil to all moving parts before installation.



Removal steps

1. Flywheel bolt <M/T>
2. Adapter plate <M/T>
3. Flywheel (Non-disassemblable part) <M/T>
4. Adapter plate <M/T>
5. Crankshaft bushing <M/T>
6. Drive plate bolt <A/T>
7. Adapter plate <A/T>
8. Drive plate <A/T>
9. Crankshaft bushing <A/T>
10. Rear plate
11. Bell housing cover
12. Rear oil seal
13. Rear oil seal case
14. Rear oil seal case gasket

-  15. Bearing cap bolt
-  16. Bearing cap
-  17. Crankshaft bearing (lower)
-  18. Crankshaft
-  19. Crankshaft bearing (upper)
-  20. Oil pressure switch
-  21. Cylinder block

Caution

Do not remove any of the bolts "A" of the flywheel shown in the illustration. The balance of the flexible type flywheel is adjusted in an assembled condition. Removing the bolt, therefore, can cause the flexible type flywheel to be out of balance, giving damage to the flywheel.

INSTALLATION SERVICE POINTS

▶A◀ OIL PRESSURE SWITCH INSTALLATION

- (1) Apply the specified sealant to the thread of the switch.

Specified sealant:

3M ATD Part No.8660 or equivalent.

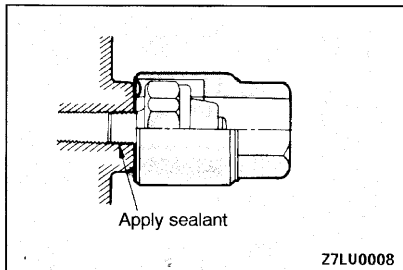
Caution

Use care to allow the sealant to plug the oil passage.

- (2) Install and tighten the switch to the specified torque by using the socket wrench and torque wrench.

Caution

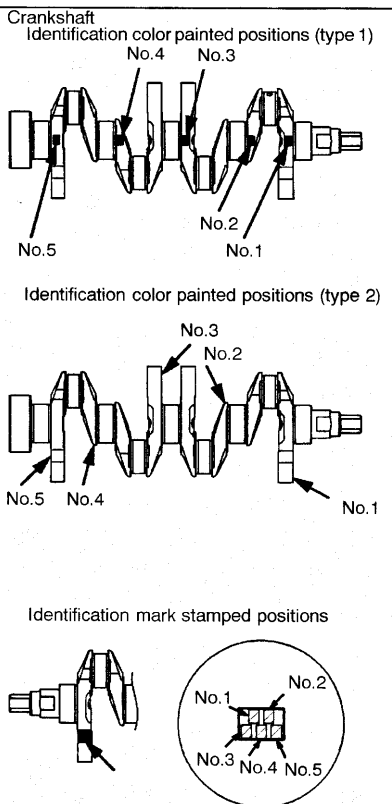
If the switch is tightened with a spanner or offset wrench, an over-torque may be applied and the switch to be damaged.



Z7LU0008

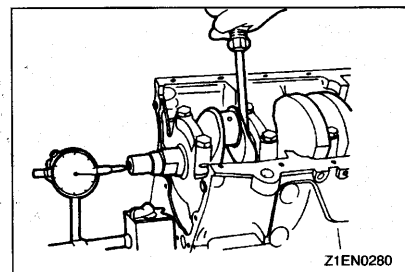
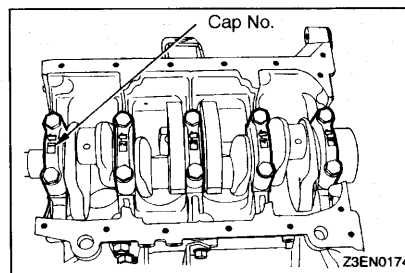
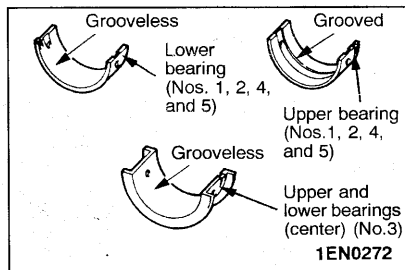
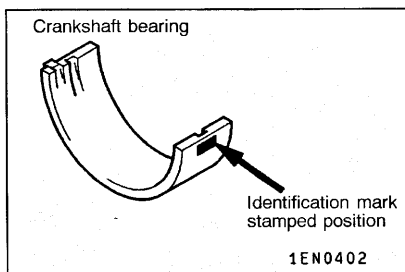
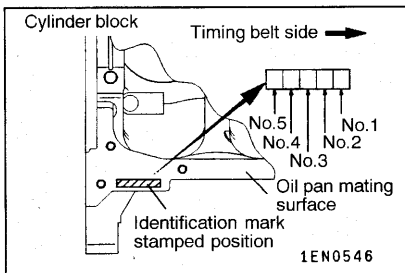
▶B◀ CRANKSHAFT BEARING INSTALLATION

- (1) When replacing the bearings, crankshaft and/or cylinder block, read off the identification color or mark on the crankshaft and cylinder block (as illustrated), and select a bearing according to the following table.



1EN0404

Crankshaft journal O.D.		Cylinder block bearing bore I.D.	Crankshaft bearing
Identification color	Identification mark	Identification mark	Identification mark
Yellow	1	0	1
		1	2
		2	3
None	2	0	2
		1	3
		2	4
White	3	0	3
		1	4
		2	5



- (2) Install the crankshaft bearings to the cylinder block and bearing caps as shown illustration.

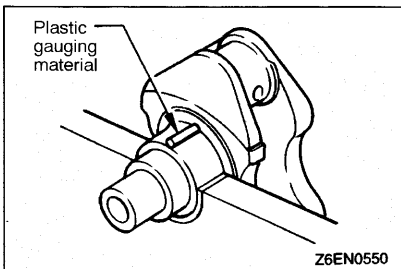
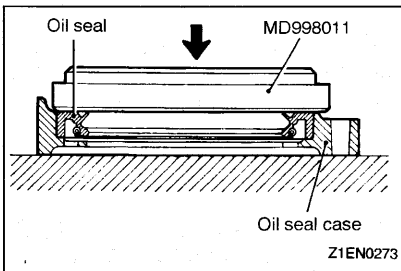
▶◀ BEARING CAP INSTALLATION

- (1) On the bottom surface of each bearing cap is the cap's number and an arrow. Starting at the timing belt side, install the bearing caps in numerical order. Ensure that the arrows point toward the timing belt side.
- (2) Check that the crankshaft rotates smoothly.

- (3) Measure the end play in the crankshaft. If the measurement exceeds the specified limit, replace the crankshaft bearings.

Standard value: 0.05 - 0.18 mm (.0020 - .0071 in.)
Limit: 0.25 mm (.010 in.)

►◄ REAR OIL SEAL INSTALLATION



INSPECTION

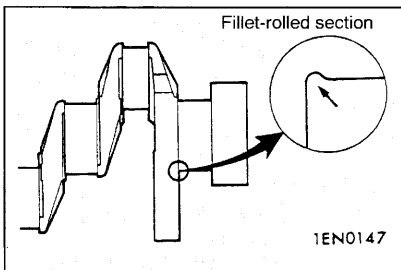
11300880141

CRANKSHAFT JOURNAL OIL CLEARANCE (PLASTIC GAUGING MATERIAL METHOD)

- (1) Remove all oil from crankshaft journal and the crankshaft bearing.
- (2) Install the crankshaft.
- (3) Cut the plastic gauging material to the same length as the width of the bearing, and place it on the journal in parallel with its axis.
- (4) Install the crankshaft bearing cap carefully and tighten the bolts to the specified torque.
- (5) Carefully remove the crankshaft bearing cap.
- (6) Measure the width of the plastic gauging material at its widest part by using a scale printed on plastic gauging material package.

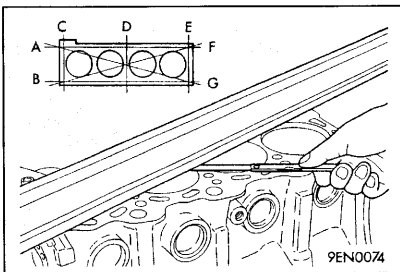
Standard value: 0.02 - 0.04 mm (.0008 - .0016 in.)

Limit: 0.1 mm (.0039 in.)



NOTE

The crankshaft pins and journals are fillet-rolled and must not be machined to undersize dimensions.



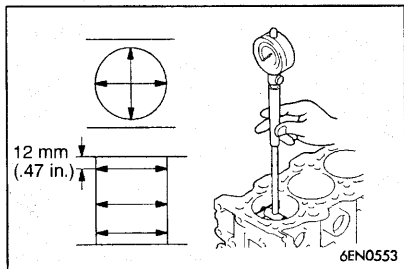
9EN0074

CYLINDER BLOCK

- (1) Visually check for cracks, rust, and corrosion, and inspect the cylinder block using a flaw detecting agent. Rectify defects where possible or replace the cylinder block.
- (2) Ensure that the top surface is free of gasket chips and other foreign material. Check the cylinder block top surface for distortion using a straight edge and feeler gauge.

Standard value: 0.05 mm (.0020 in.) or less
Limit: 0.1 mm (.0039 in.)

- (3) Check the cylinder walls for cracks and seizure marks. If defects are evident, bore all the cylinders to oversize or replace the cylinder block.



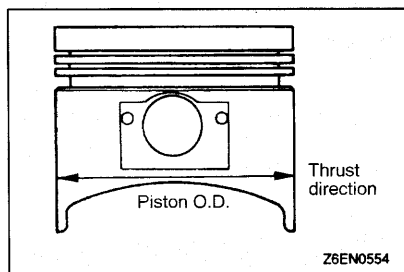
6EN0553

- (4) Using a cylinder gauge, measure each cylinder bore and cylindricity. If any cylinder is severely worn, bore all the cylinders to oversize and replace the piston and piston rings accordingly. Take measurements at the points shown.

Standard value:

Cylinder bore: I.D. 75.5 mm (2.79 in.)

Cylindricity: 0.01 mm (.0004 in.) or less



Z6EN0554

BORING CYLINDERS

- (1) Oversize pistons should be based on the largest bore cylinder.

Piston side identification

Size	Identification mark
0.50 mm O.S.	0.50
1.00 mm O.S.	1.00

NOTE

The size mark is stamped on the piston top.

- (2) Measure the outside diameter of the piston to be used. Measure it in the thrust direction as shown.
- (3) Based on the measured piston O.D., calculate the boring finish dimension.

Boring finish dimension = Piston O.D. + (Clearance between piston O.D. and cylinder) - 0.02 mm (.0008 in.) (honing margin)

- (4) Bore each cylinder to the calculated boring finish dimension.

Caution

To prevent distortion caused by heat increased during boring, bore the cylinders in the following order: No.2, No.4, No.1, No.3.

- (5) Hone the cylinders to the final finish dimension (piston O.D. + piston-to-cylinder clearance).
- (6) Check the clearance between the pistons and cylinders.

Standard value: 0.02 - 0.04 mm (.0008 - .0016 in.)

NOTE

When boring cylinders, finish all of four cylinders to the same oversize. Do not bore only one cylinder to an oversize.