

## GENERAL INFORMATION

## 4G94

Descriptions			4G94–SOHC
Type			In-line OHV, SOHC
Number of cylinders			4
Combustion chamber			Pentroof type
Total displacement dm <sup>3</sup>			1,999
Cylinder bore mm			81.5
Piston stroke mm			95.8
Compression ratio			9.5
Valve timing	Intake valve	Opens (BTDC)	2°
		Closes (ABDC)	58°
	Exhaust valve	Opens (BBDC)	58°
		Closes (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

Items		Standard value	Limit
<b>Timing belt</b>			
Auto-tensioner rod protrusion amount (When removed from engine) mm		11	–
Auto-tensioner rod stroke mm		Within 1	–
Auto-tensioner rod protrusion amount (When checking with installed on engine) mm		3.8 – 4.5	–
<b>Rocker arms and camshaft</b>			
Camshaft cam height mm	Intake	37.91	37.41
	Exhaust	37.70	37.20
Valve clearance mm	Intake	0.09	–
	Exhaust	0.20	–
Camshaft journal O.D. mm		26.0	–
<b>Cylinder head and valve</b>			
Cylinder head gasket surface flatness mm		Less than 0.03	0.2
Grinding limit of cylinder head gasket surface mm *Total resurfacing depth of both cylinder head and cylinder block		–	0.2*
Cylinder head overall height mm		119.9 – 120.1	–
Thickness of valve head (margin) mm	Intake	1.0	0.5
	Exhaust	1.3	0.8
Valve overall height mm	Intake	110.15	109.65
	Exhaust	113.70	113.20
Valve spring free length mm		49.5	48.5
Valve spring out-of-squareness		Max. 2°	4°
Valve stem to valve guide clearance mm	Intake	0.02 – 0.05	0.10
	Exhaust	0.05 – 0.09	0.15
Valve seat valve contact width mm		0.9 – 1.3	–
Valve guide projection from cylinder head upper surface mm		14.0	–
Valve stem projection mm	Intake	49.30	49.80
	Exhaust	49.35	49.85
Cylinder head bolt shank length mm		–	96.4
Valve stem O.D. mm		6.0	–
Valve face angle		45° – 45.5°	–
Valve spring load/installed height N/mm		216/44.2	–
Valve guide I.D. mm		6.0	–

# 11B ENGINE OVERHAUL BASE – Specifications

Items		Standard value	Limit
<b>Font case, oil pump and oil pan</b>			
Oil pump tip clearance mm		0.06 – 0.18	–
Oil pump side clearance mm		0.04 – 0.10	–
Oil pump body clearance mm		0.10 – 0.18	0.35
<b>Piston and connecting rod</b>			
Piston ring to piston ring groove clearance mm	No. 1	0.03 – 0.07	0.1
	No. 2	0.02 – 0.06	0.1
Piston ring end gap mm	No. 1	0.15 – 0.30	0.8
Piston ring end gap mm	No. 2	0.40 – 0.55	0.8
	Oil ring	0.20 – 0.60	1.0
Crankshaft pin oil clearance mm		0.02 – 0.05	0.1
Piston pin press-in load N [Room temperature]		4,500 – 14,700	–
Connecting rod big end side clearance mm		0.10 – 0.25	0.4
Piston pin O.D. mm		19.0	–
Piston O.D. mm		81.5	–
<b>Crankshaft, cylinder block, flywheel and drive plate</b>			
Crankshaft journal oil clearance mm		0.02 – 0.04	0.1
Cylinder block gasket surface flatness mm		0.05	0.1
Grinding limit of cylinder block gasket surface mm *Total resurfacing depth of both cylinder head and cylinder block		–	0.2*
Cylinder block overall height mm		286.7	–
Cylinder block I.D. mm		81.5	–
Piston to cylinder clearance mm		0.02 – 0.04	–
Bearing cap bolt shank length mm		–	71.1
Crankshaft end play mm		0.05 – 0.25	0.4
Crankshaft journal O.D. mm		50	–
Crankshaft pin O.D. mm		45	–

MAIN

Group  
11

11B

## REWORK DIMENSIONS

Items		Standard value
Cylinder head and valve		
Oversize rework dimensions of valve guide hole (both intake and exhaust) mm	0.05 O.S.	11.05 – 11.07
	0.25 O.S.	11.25 – 11.27
	0.50 O.S.	11.50 – 11.52
Oversize rework dimensions of intake valve seat hole mm	0.30 O.S.	31.80 – 31.83
	0.60 O.S.	32.10 – 32.13
Oversize rework dimensions of exhaust valve seat hole mm	0.30 O.S.	29.30 – 29.32
	0.60 O.S.	29.60 – 29.62
Crankshaft, flywheel and drive plate		
Crankshaft out of roundness and taper of journal and pin mm		0.005

### NOTE

O.D.: Outer diameter

I.D.: Inner diameter

O.S.: Oversize diameter

## TORQUE SPECIFICATIONS

Items	Nm
<b>Alternator and ignition system</b>	
Oil level gauge	13
Distributor	12
Ignition coil	10
Spark plug	25
Crankshaft bolt	182 ± 4
Alternator brace (M10)	49
Alternator brace (M8)	23
Lock bolt	23
Adjusting bolt	5
Power steering pump pulley	25
Power steering pump bracket stay	49
Power steering pump bracket (M8)	21
Power steering pump bracket (M10)	44
Alternator pivot bolt	44
Center cover	3

## 11B ENGINE OVERHAUL BASE – Specifications

Items	Nm
Ignition failure sensor (M6)	5
Ignition failure sensor (M8)	23
Cam position sensor	9
Cam position sensor support	13
Cam position sensing cylinder	21
Engine cover	2.9
<b>Timing belt</b>	
Camshaft sprocket bolt	88
Cam position sensor	9.8
Crank angle sensor	9.8
Timing belt rear cover	11
Timing belt rear upper cover	11
Timing belt tensioner	24
Engine support bracket, right	49
Accessory mount	49
Timing belt cover	11
Tensioner pulley bolt	49
Tensioner arm bolt	44
Auto-tensioner bolt	13
Idler pulley bolt	36
<b>Fuel system and emission system</b>	
Breather tube	21
Fuel pump	18
EGR valve	21
Cover <without EGR valve>	12
Fuel return pipe	9
Delivery pipe	12
Fuel pressure regulator	9
Throttle body stay	24
Throttle body	19
Vacuum hose and pipe assembly	10
Solenoid valve assembly	9

MAIN

Group  
11

11B

## 11B ENGINE OVERHAUL BASE – Specifications

Items	Nm
<b>Intake manifold and exhaust manifold</b>	
Exhaust manifold (M10)	29
Exhaust manifold (M8)	18
Exhaust manifold bracket (M8)	19
Exhaust manifold bracket (M10)	35
Engine hanger (bolt with head mark “4”)	12
Engine hanger (bolt with head mark “7”)	19
Oil level gauge guide	14
Boost sensor	5
Intake air temperature sensor	13
Heat protector	13
Intake manifold	20
Intake manifold stay	31
Oxygen sensor	44
<b>Water pump and water hose</b>	
Water pump	24
Water inlet pipe	14
Thermostat case	24
Water inlet fitting	19
Water by-pass fitting	23
Water pipe	13
Water outlet fitting	19
Engine coolant temperature gauge unit	10
Engine coolant temperature sensor	29
Water fitting	23
<b>Rocker arms and camshaft</b>	
Lock nut	9
Rocker arm shaft	31
Harness bracket	10
Rocker cover	3.5
Bearing cap bolt (M6)	11
Bearing cap bolt (M8)	24
Beam camshaft cap (M8)	21
Beam camshaft cap (M6)	11

MAIN

Group  
11

11B

## 11B ENGINE OVERHAUL BASE – Specifications

Items	Nm
<b>Cylinder head and valves</b>	
Cylinder head bolt	74 Nm and then completely loosen, finally tighten 20 Nm + 90° + 90°
Oil pressure switch	10
<b>Front case and oil pump</b>	
Oil pump cover	10
Oil pump case	14
Relief plug	44
Oil screen	19
Oil pan	9
Upper oil pan <M6>	9
Upper oil pan <M8>	24
Lower oil pan	11
Cover	7
Baffle plate	11
Drain plug	39
Oil pressure switch	10
<b>Piston and connecting rod</b>	
Connecting rod cap nut	20 + 90° to 100°
<b>Crankshaft, cylinder block, flywheel and drive plate</b>	
Bearing cap bolt	25 + 90° to 100°
Oil seal case	11
Bell housing cover	9
Rear plate	11
Drive plate bolt	98
Flywheel bolt	98
Baffle plate	9
Knock sensor	22

MAIN

Group  
11

11B

## NEW TIGHTENING METHOD – BY USE OF BOLTS TO BE TIGHTENED IN PLASTIC AREA

A new type of bolts, to be tightened in plastic area, is currently used for some parts of the engine. The tightening method for bolts of this type is different from the conventional one. Be sure to observe the method described in the text when tightening the bolts.

Service limits are provided for the bolts. Make sure that the service limits described in the text are strictly observed.

- Areas where the bolts are in use:
  - (1) Cylinder head bolts
  - (2) Main bearing cap bolts
  - (3) Connecting rod cap bolts
- Tightening method  
After tightening the bolts to the specified torque, tighten them another 90° or 180° (twice 90°). The tightening method varies on different areas. Observe the tightening method described in the text.

## SEALANT

Items	Specified sealant	Quantity
Water pump	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Thermostat case	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Water by-pass fitting	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Water fitting	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
Camshaft bearing cap	3M ATD Part No.8660 or equivalent	As required
Semi-circular packing	3M ATD Part No.8660 or equivalent	As required
Rocker cover	3M ATD Part No.8660 or equivalent	As required
Beam camshaft cap	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Cover	3M ATD Part No.8660 or equivalent	As required
Cylinder head	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Oil pressure switch	3M ATD Part No.8660 or equivalent	As required
Water outlet fitting	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Oil pump case	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Oil pan/Upper oil pan/Lower oil pan	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Oil seal case	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Drive plate bolt	3M Nut Locking Part No.4171 or equivalent	As required
Flywheel bolt	3M Nut Locking Part No.4171 or equivalent	As required
Cam position sensor support	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Oil control valve	3M ATD Part No.8660 or equivalent	As required
Camshaft holder	3M ATD Part No.8660 or equivalent	As required



## FORM-IN-PLACE GASKET

The engine has several areas where the form-in-place gasket (FIPG) is in use. To ensure that the gasket fully serves its purpose, it is necessary to observe some precautions when applying the gasket. Bead size, continuity and location are of paramount importance. Too thin a bead could cause leaks. Too thick a bead, on the other hand, could be squeezed out of location, causing blocking or narrowing of the fluid feed line. To eliminate the possibility of leaks from a joint, therefore, it is absolutely necessary to apply the gasket evenly without a break, while observing the correct bead size.

The FIPG used in the engine is a room temperature vulcanization (RTV) type and is supplied in a 100-gram tube (Part No. MD970389 or MD997110). Since the RTV hardens as it reacts with the moisture in the atmospheric air, it is normally used in the metallic flange areas. The FIPG, Part No. MD970389, can be used for sealing both engine oil and coolant, while Part No. 997110 can only be used for engine oil sealing.

### Disassembly

The parts assembled with the FIPG can be easily disassembled without use of a special method. In some cases, however, the sealant between the joined surfaces may have to be broken by lightly striking with a mallet or similar tool. A flat and thin gasket scraper may be lightly hammered in between the joined surfaces. In this case, however, care must be taken to prevent damage to the joined surfaces. For removal of the oil pan, the special tool "Oil Pan Remover" (MD998727) is available. Be sure to use the special tool to remove the oil pan. <Except aluminium die-cast oil pans>

### Surface Preparation

Thoroughly remove all substances deposited on the gasket application surfaces, using a gasket scraper or wire brush. Check to ensure that the surfaces to which the FIPG is to be applied is flat. Make sure that there are no oils, greases and foreign substances deposited on the application surfaces. Do not forget to remove the old sealant remained in the bolt holes.

### Form-In-Place Gasket Application

When assembling parts with the FIPG, you must observe some precautions, but the procedures is very simple as in the case of a conventional precut gasket.

Applied FIPG bead should be of the specified size and without breaks. Also be sure to encircle the bolt hole circumference with a completely continuous bead. The FIPG can be wiped away unless it is hardened. While the FIPG is still moist (in less than 15 minutes), mount the parts in position. When the parts are mounted, make sure that the gasket is applied to the required area only. In addition, do not apply any oil or water to the sealing locations or start the engine until a sufficient amount of time (about one hour) has passed after installation is completed.

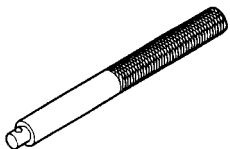
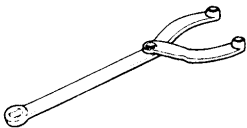
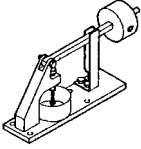
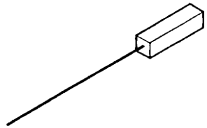
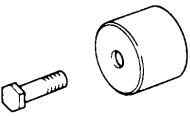
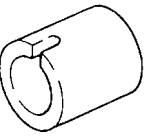
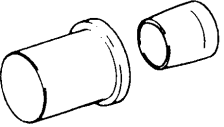
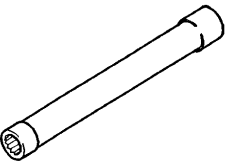
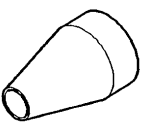
The FIPG application procedure may vary on different areas. Observe the procedure described in the text when applying the FIPG.

## SPECIAL TOOLS

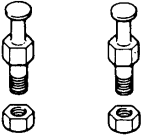
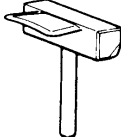
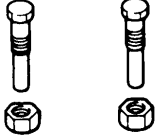
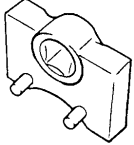
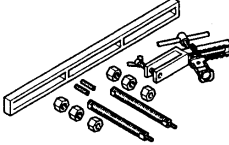
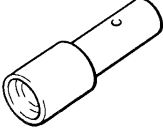
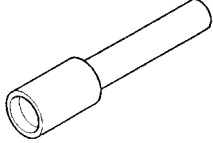
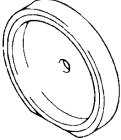
MAIN

Group  
11

11B

Tool	Number	Name	Use
	MB990938	Handle	Use with MD998776
	MB990767	Crankshaft pulley holder	Holding camshaft sprocket when loosening and tightening of bolt. Use with MD998719
	MD998440	Leak-down tester	Leak-down test of lash adjuster
	MD998442	Air bleed wire	Air bleeding of lash adjuster
	MD998713	Camshaft oil seal installer	Installation of camshaft oil seal
	MD998716	Crankshaft wrench	Rotation of crankshaft when installing piston and timing belt.
	MD998717	Crankshaft front oil seal installer	Installation of crankshaft front oil seal
	MB991653	Cylinder head bolt wrench	Tightening and loosening of cylinder head bolt
	MB991659	Guide D	Removal of piston pin (Use with MD998780)

# 11B ENGINE OVERHAUL BASE – Special Tools

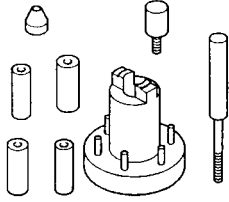
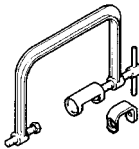
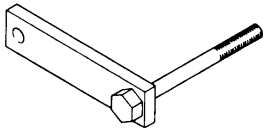
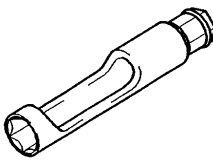
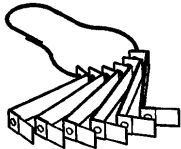
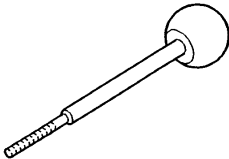
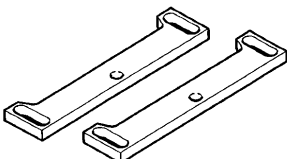
Tool	Number	Name	Use
	MD998719	Pulley holder pin (2)	Use with MB990767
	MD998727	Oil pan remover	Removal of the oil pan
	MD998754	Pin	Use with MB990767
	MD998767	Tensioner pulley socket wrench	Adjustment of timing belt tension
	MD998772	Valve spring compressor	Removal and installation of valve and related parts
	MD998774	Valve stem seal installer	Installation of valve stem seal
	MD998775	Valve stem seal installer	Installation of valve stem seal
	MD998776	Crankshaft rear oil seal installer	Installation of crankshaft rear oil seal Use with MB990938

MAIN

Group  
11

11B

# 11B ENGINE OVERHAUL BASE – Special Tools

Tool	Number	Name	Use
	MD998780	SETTING TOOL Piston pin	Removal and installation of piston pin
	MD998735	Valve spring compressor	Compression of valve spring
	MD998781	Flywheel stopper	Holding flywheel and drive plate
	MB991477	Valve adjusting wrench	Adjustment of valve clearance (MIVEC)
	MB991478	Valve adjusting wrench feeler gauge set	Adjustment of valve clearance (MIVEC)
	MB991479	Rocker arm piston checker	Adjustment of valve clearance (MIVEC)
	MD998784	Valve spring compressor adapter	Compression of valve spring (MIVEC) (Use with MD998772)

MAIN

Group  
11

11B

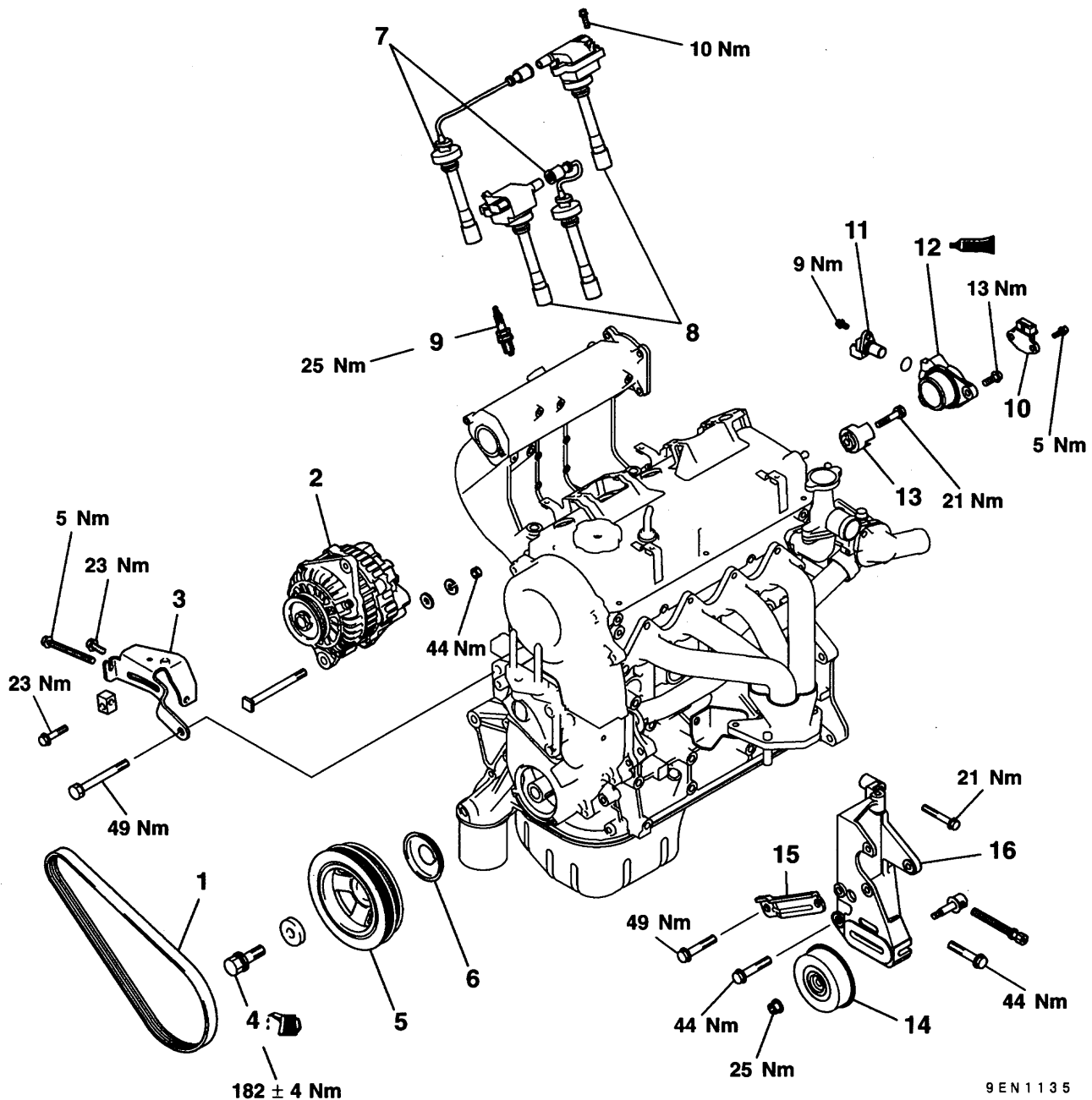
# ALTERNATOR AND IGNITION SYSTEM

## REMOVAL AND INSTALLATION (Engines without distributor)

MAIN

Group  
11

11B



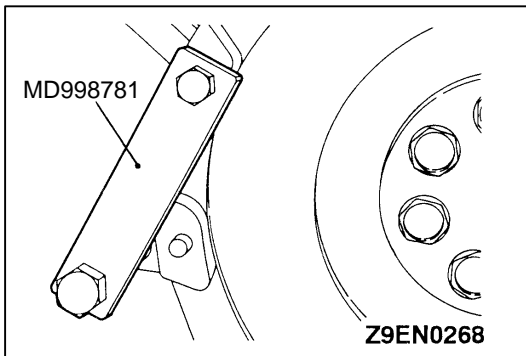
9 EN 1135

### Removal steps

1. Drive belt
2. Alternator
3. Alternator brace
4. Crankshaft bolt
5. Crankshaft pulley
6. Front flange
7. Spark plug cable
8. Ignition coil
9. Spark plug

10. Ignition failure sensor  
<where fitted>
11. Cam position sensor
12. Cam position sensor support
13. Cam position sensing cylinder
14. Power steering pump pulley
15. Power steering pump bracket stay
16. Power steering pump bracket

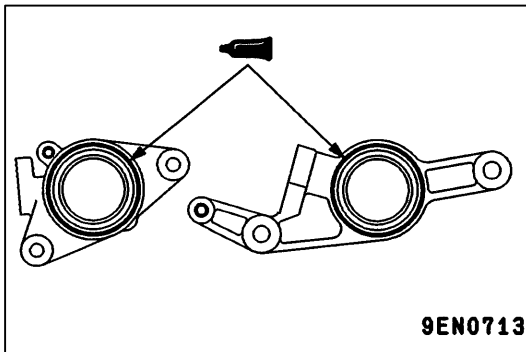




## REMOVAL SERVICE POINT

### ◀A▶ CRANKSHAFT BOLT REMOVAL

- (1) Use the special tool to hold the flywheel or the drive plate, and then loosen the crankshaft mounting bolts.



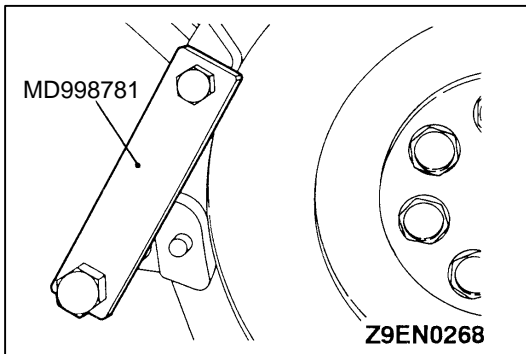
## INSTALLATION SERVICE POINTS

### ▶A◀ CAM POSITION SENSOR SUPPORT INSTALLATION

- (1) Apply a 3 mm bead of form-in-place gasket (FIPG) to the area shown.

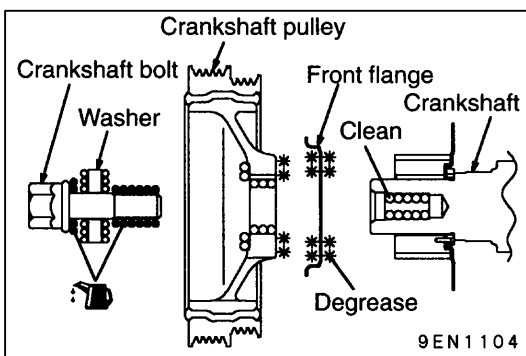
**Specified sealant:**

**Mitsubishi Genuine Part No. MD970389 or equivalent.**



### ▶B◀ FRONT FLANGE / CRANKSHAFT PULLEY / CRANKSHAFT BOLT INSTALLATION

- (1) Use the special tool to hold the flywheel or the drive plate.



- (2) Clean and then degrease the front flange contacting surface of the crankshaft pulley.

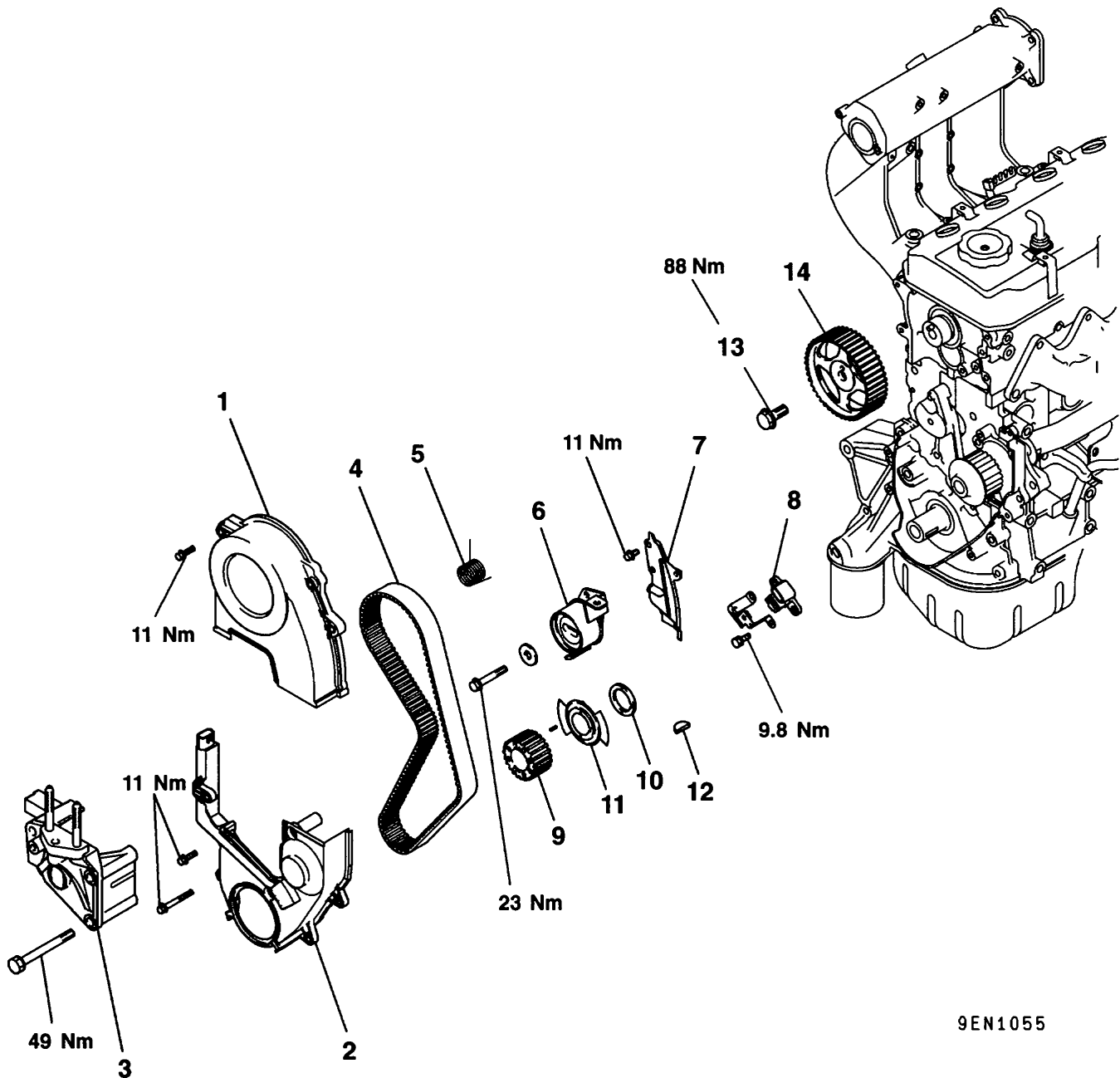
#### NOTE

Degreasing is necessary to prevent decrease in friction between contacting surfaces.

- (3) Clean the bolt hole in the crankshaft, the crankshaft contacting surface and washer contacting surface of the crankshaft pulley, and the washer.
- (4) Apply an appropriately small amount of oil to the threads and seating surface of the crankshaft bolt.
- (5) Tighten the crankshaft bolt to the specified torque of  $182 \pm 4$  Nm.

## TIMING BELT

## REMOVAL AND INSTALLATION



9EN1055

## Removal steps

1. Timing belt front upper cover
2. Timing belt front lower cover
3. Engine support bracket, right
4. Timing belt
5. Tensioner spring
6. Timing belt tensioner
7. Timing belt rear cover
8. Crankshaft angle sensor  
(Engines without distributor)

9. Crankshaft sprocket
10. Crankshaft spacer  
(Engines without distributor)
11. Crankshaft sensing plate  
(Engines without distributor)
12. Crankshaft key
13. Camshaft sprocket bolt
14. Camshaft sprocket

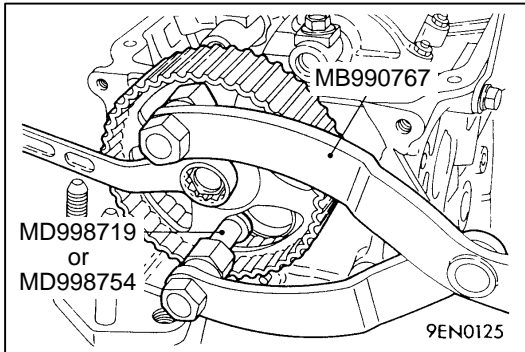


## REMOVAL SERVICE POINTS

### ◀A▶ TIMING BELT REMOVAL

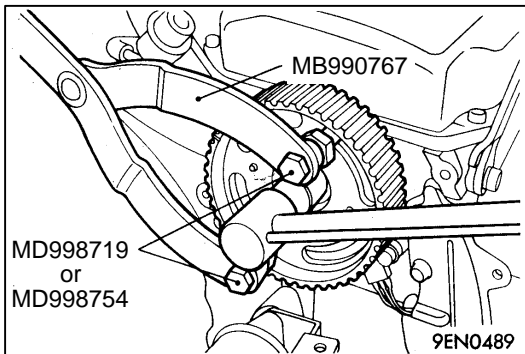
- (1) Mark belt running direction for reinstallation.

### ◀B▶ CAMSHAFT SPROCKET BOLT REMOVAL



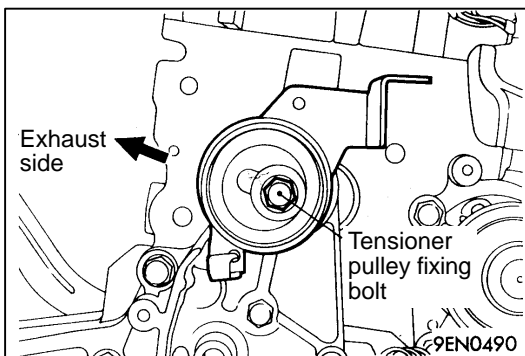
## INSTALLATION SERVICE POINTS

### ▶A▶ CAMSHAFT SPROCKET BOLT INSTALLATION



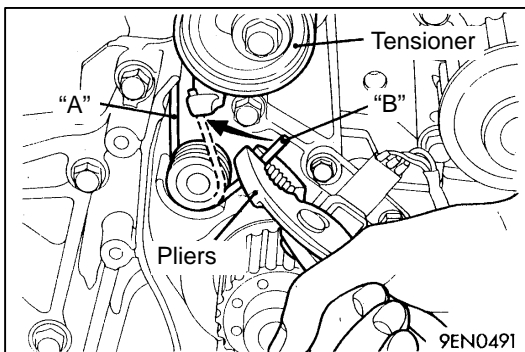
### ▶B▶ TIMING BELT TENSIONER INSTALLATION

- (1) Let the pulley of the timing belt tensioner come closest to the exhaust side. Temporarily tighten the tensioner pulley fixing bolt.



### ▶C▶ TENSIONER SPRING INSTALLATION

- (1) Insert the tip A (shorter one) of the tensioner spring into the oil pump case.
- (2) Use pliers or similar tool to pinch the tip B (longer one), and then hook it to the tensioner bracket arm.



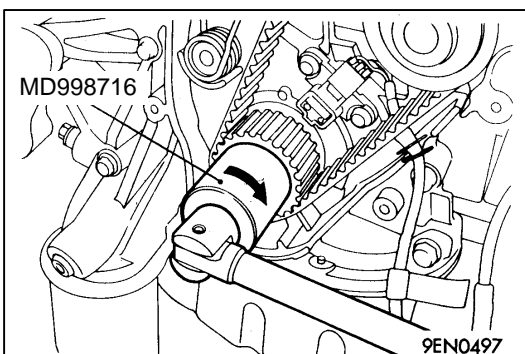
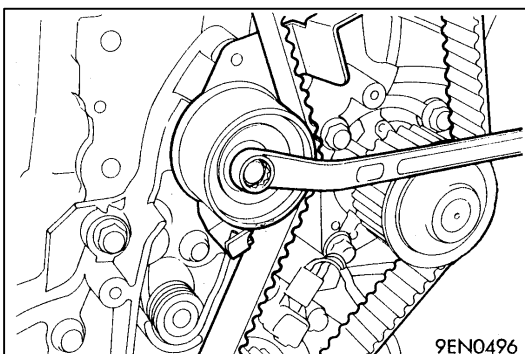
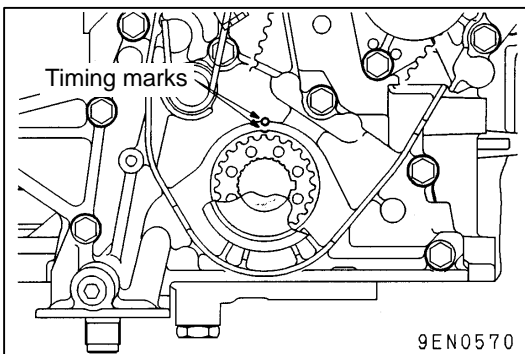
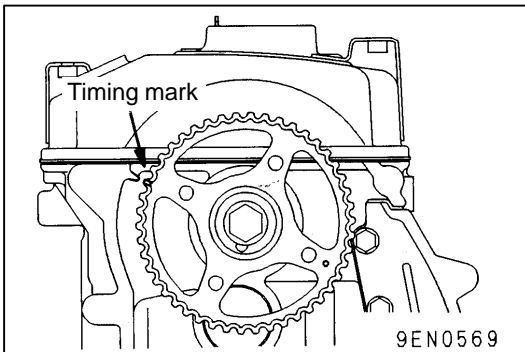
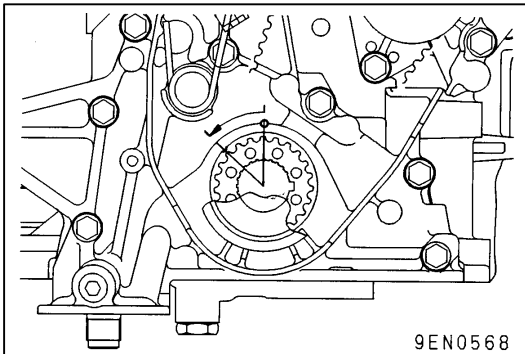


## ►D◄ TIMING BELT INSTALLATION

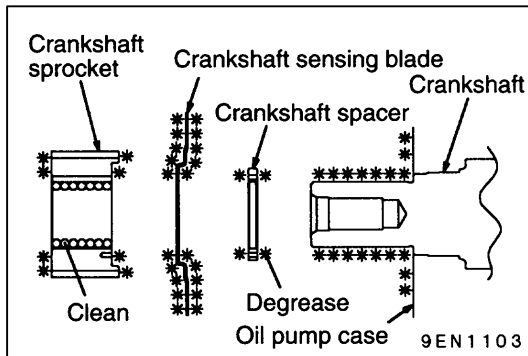
- (1) Turn the crankshaft sprocket by three teeth from the timing mark.

### Caution

**Aligning the timing marks positions the piston to the top dead centre. Then, if the camshaft turns, the valves may hit and damage the pistons.**



- (2) Check that the timing belt tensioner and tensioner spring are installed correctly. (Refer to the service points B and C.)
- (3) Align the timing marks on the camshaft sprocket to that on the cylinder head.
- (4) Align the timing mark on the crankshaft sprocket to that on the oil pump case.
- (5) Place the timing belt over the sprocket according in the following order.
  1. Crankshaft sprocket
  2. Water pump sprocket
  3. Camshaft sprocket
  4. Tension pulley
- (6) Slightly loosen the tensioner pulley fixing bolt which is tightened temporarily to tighten the belt by a force of the tensioner spring.
- (7) Turn the crankshaft clockwise by two turns.
- (8) Check that the timing marks are aligned.
- (9) Tighten the fixing bolt of the tensioner pulley.



## ►E◄ CRANKSHAFT SENSING BLADE / CRANKSHAFT SPACER / CRANKSHAFT SPROCKET INSTALLATION

- (1) Clean and then degrease the following surfaces and parts: front surface of oil pump case, sprocket mounting surface of crankshaft, crankshaft spacer, crankshaft sensing blade and crankshaft sprocket.

### NOTE

Degreasing is necessary to prevent decrease in the friction between contacting surfaces.

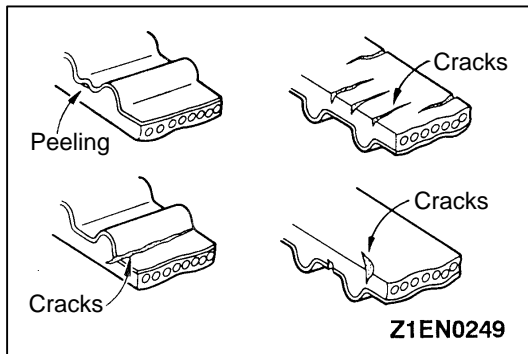
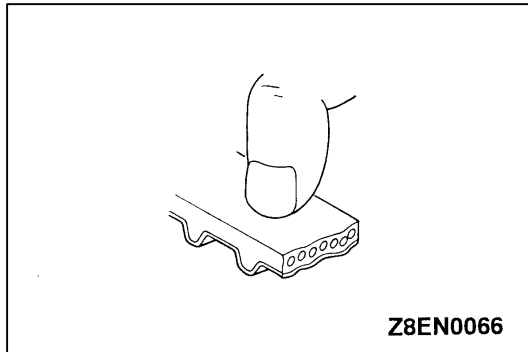
- (2) Clean the crankshaft contacting surface of the crankshaft.

## INSPECTION

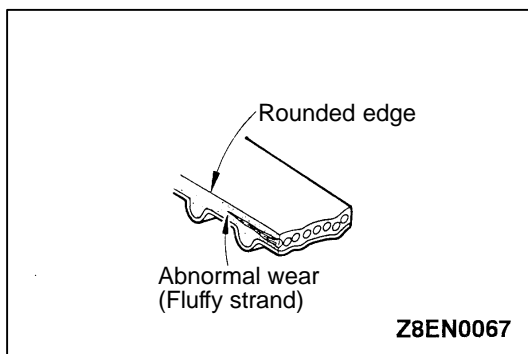
### TIMING BELT

Replace belt if any of the following conditions exist.

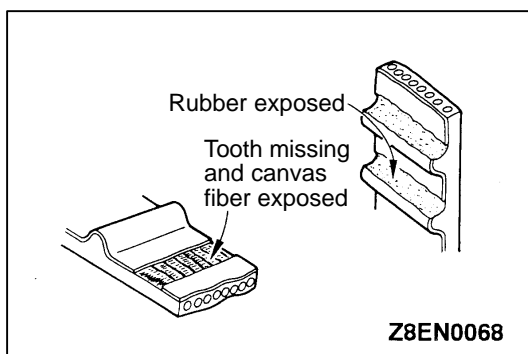
- (1) Hardening of back rubber.  
Back side is glossy without resilience and leaves no indent when pressed with fingernail.



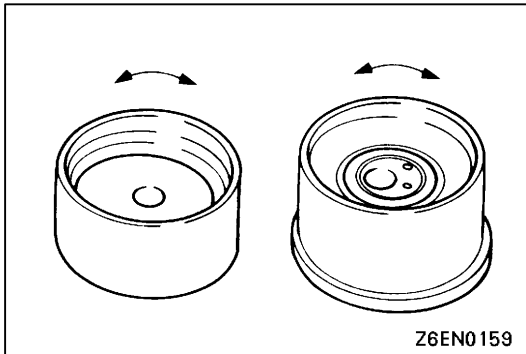
- (2) Cracks on rubber back.
- (3) Cracks or peeling of canvas.
- (4) Cracks on tooth bottom.
- (5) Cracks on belt sides.



- (6) Abnormal wear of belt sides. The sides are normal if they are sharp as if cut by a knife.



- (7) Abnormal wear on teeth.
- (8) Missing tooth.



### TENSIONER PULLER, IDLER PULLEY

- (1) Check the pulley for smooth rotation, excessive play, abnormal noise. Replace it if necessary.

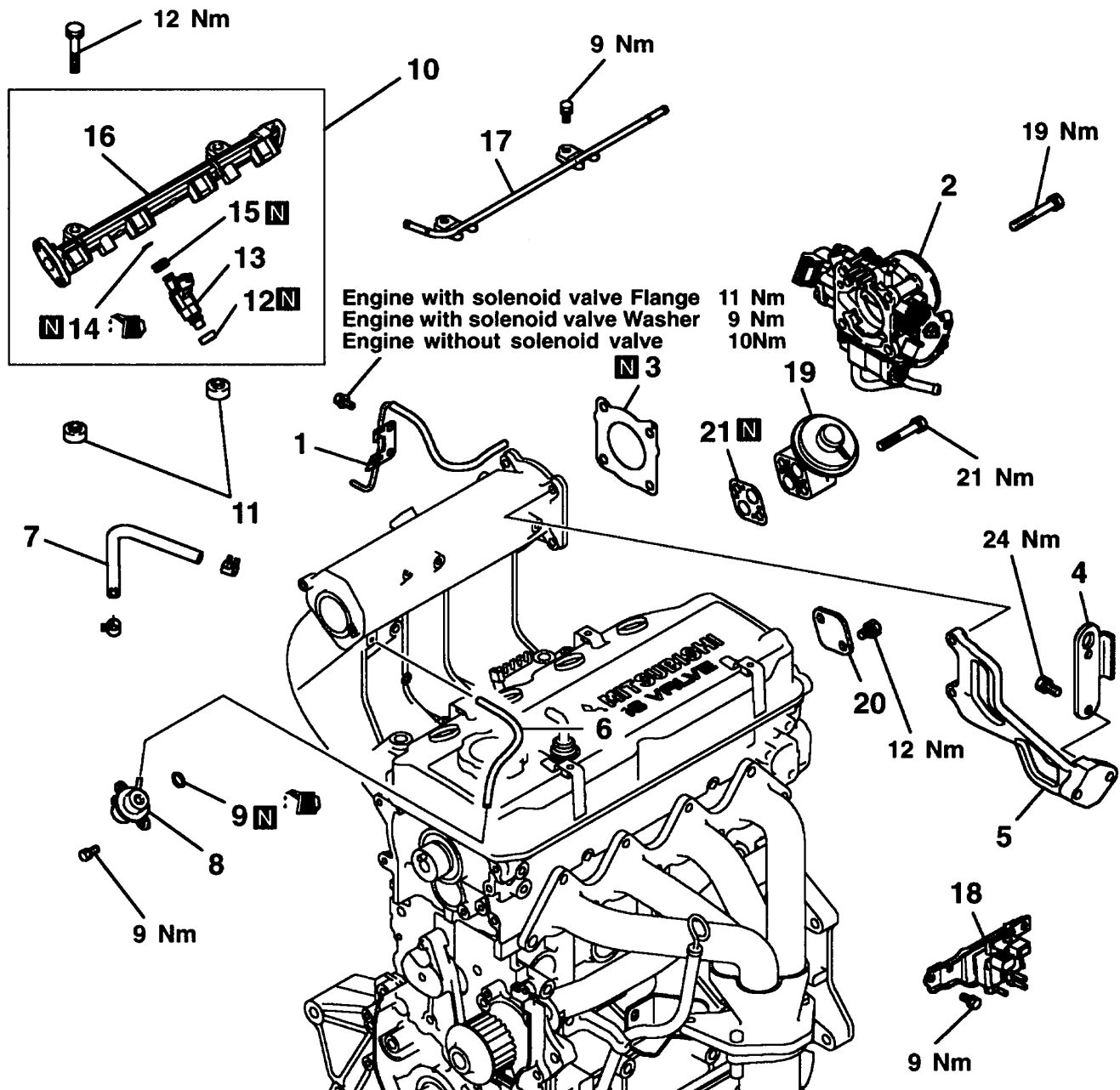
# FUEL AND EMISSION CONTROL SYSTEM

## REMOVAL AND INSTALLATION

MAIN

Group  
11

11B



9EN1111

### Removal steps

- 1. Vacuum hose and pipe assembly
- 2. Throttle body
- ▶ **C** ▶ 3. Gasket
- 4. Vacuum hose
- 5. Fuel hose
- ▶ **B** ▶ 6. Fuel pressure regulator
- 7. O-ring
- 8. Delivery pipe and injector
- 9. Insulator

- ▶ **A** ▶ 10. Insulator
- 11. Injector
- 12. O-ring
- 13. Grommet
- 14. Delivery pipe
- 15. Fuel return pipe
- 16. Solenoid valve assembly
- 17. EGR valve
- 18. Gasket

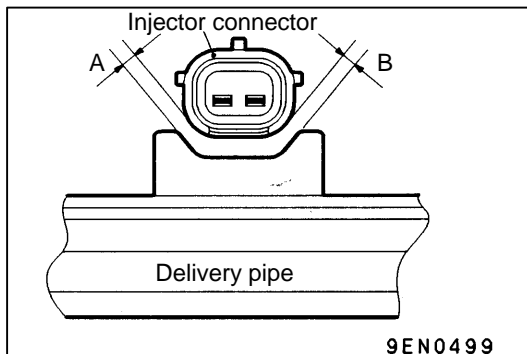
**INSTALLATION SERVICE POINTS****►A◄ INJECTORS INSTALLATION**

- (1) Apply a small amount of new engine oil to the O-ring.

**Caution**

**Be sure not to let engine oil get into the delivery pipe.**

- (2) While turning the injector to the left and right, install it to the delivery pipe.
- (3) Check that the injector turns smoothly. If it does not turn smoothly, the O-ring may be trapped. Remove the injector and check the O-ring for damage, and then re-insert it into the delivery pipe and check once again.
- (4) Check that the clearance between the injector connector and the delivery pipe is uniform ( $A = B$ ).

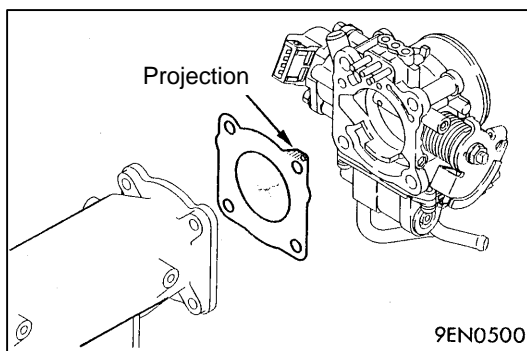
**►B◄ FUEL PRESSURE REGULATOR INSTALLATION**

- (1) Apply a small amount of new engine oil to the O-ring. Insert the fuel pressure regulator into the delivery pipe being careful not to damage the O-ring.

**Caution**

**Be sure not to let engine oil get into the delivery pipe.**

- (2) Check that the fuel pressure regulator turns smoothly. If it does not turn smoothly, the O-ring may be trapped. Remove the fuel pressure regulator and check the O-ring for damage, and then re-insert it into the delivery pipe and check once again.

**►C◄ GASKET INSTALLATION**

- (1) Position the projection as shown in the illustration.

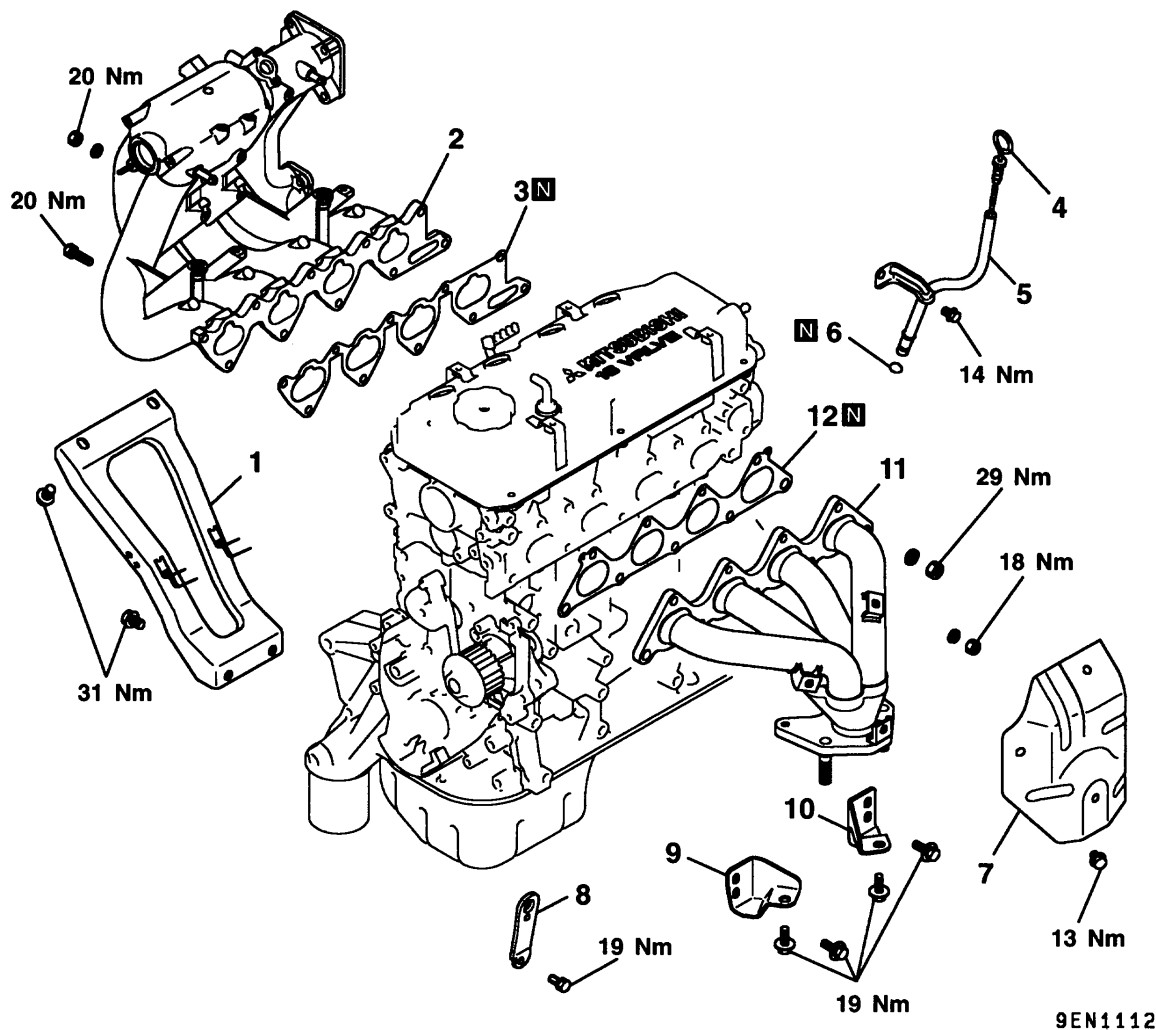
# INTAKE AND EXHAUST MANIFOLD

## REMOVAL AND INSTALLATION

MAIN

Group  
11

11B



### Removal steps

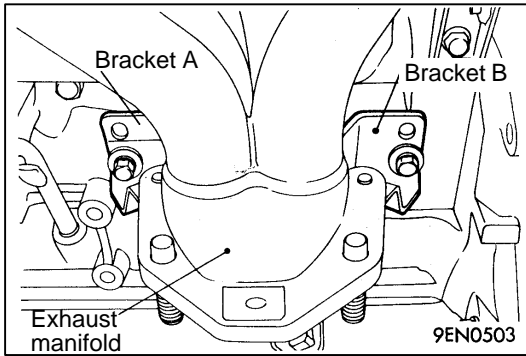


1. Intake manifold stay
2. Intake manifold
3. Intake manifold gasket
4. Oil level gauge
5. Oil level gauge guide
6. O-ring



7. Exhaust manifold cover
8. Engine hanger
9. Exhaust manifold bracket A
10. Exhaust manifold bracket B
11. Exhaust manifold
12. Exhaust manifold gasket

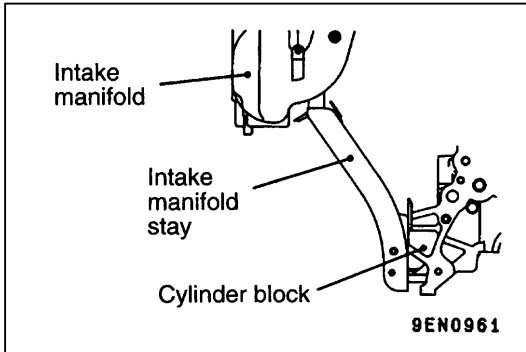
9EN1112



### INSTALLATION SERVICE POINT

#### ►A◄ EXHAUST MANIFOLD INSTALLATION

- (1) Install temporarily the exhaust manifold brackets A and B as shown in the illustration.
- (2) Check that both brackets are in close contact with the bosses, and then tighten fully the bracket mounting bolts.



#### ►B◄ INTAKE MANIFOLD STAY INSTALLATION

- (1) Check to ensure that the intake manifold stay is in close contact with

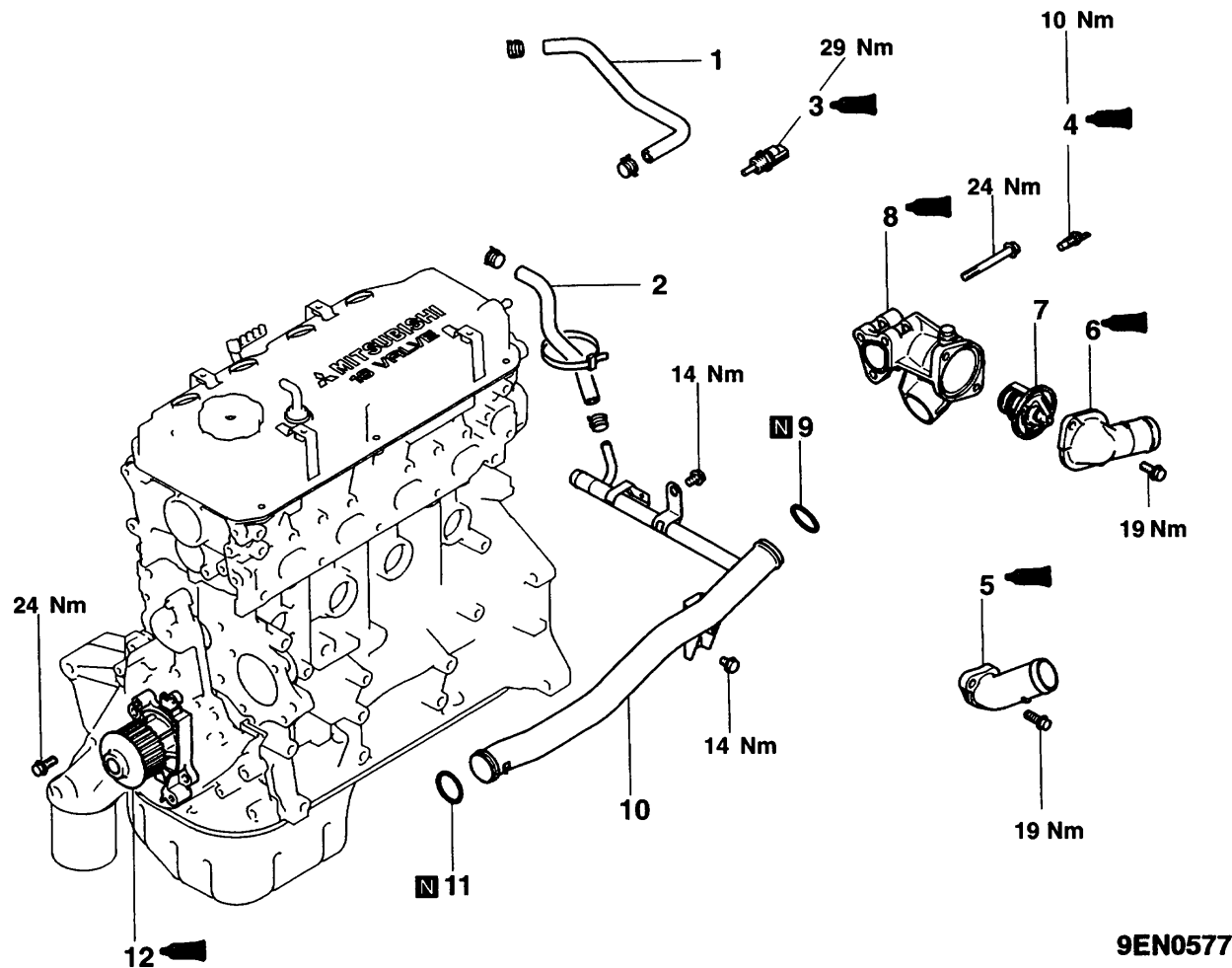
# WATER PUMP AND WATER HOSE

## REMOVAL AND INSTALLATION

MAIN

Group  
11

11B



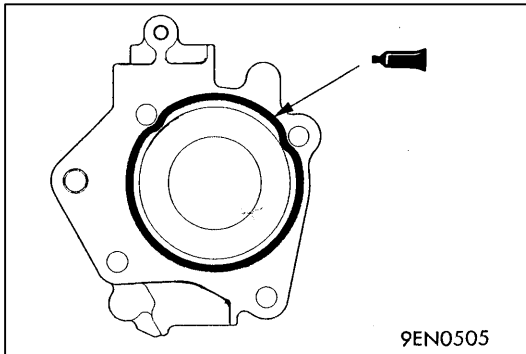
9EN0577

### Removal steps

1. Water hose
2. Water hose
- ▶ **G** ▶ 3. Engine coolant temperature sensor
- ▶ **F** ▶ 4. Engine coolant temperature gauge unit
- ▶ **E** ▶ 5. Water outlet fitting
6. Water inlet fitting

- ▶ **D** ▶ 7. Thermostat
- ▶ **C** ▶ 8. Thermostat case
- ▶ **B** ▶ 9. O-ring
- ▶ **B** ▶ 10. Water inlet pipe
- ▶ **B** ▶ 11. O-ring
- ▶ **A** ▶ 12. Water pump





## INSTALLATION SERVICE POINTS

### ►A◄ WATER PUMP INSTALLATION

- (1) Apply 3 mm diameter of Form-In-Place Gasket (FIPG) to the location shown in the illustration.

**Specified sealant:**

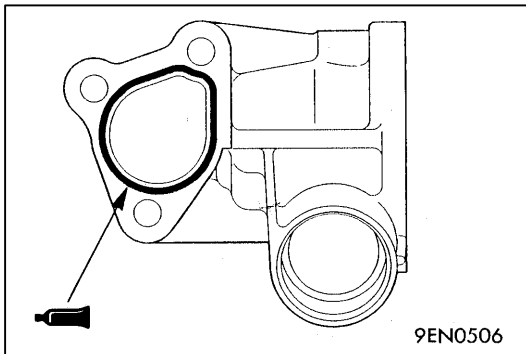
**Mitsubishi Genuine Part No.MD970389 or equivalent**

### ►B◄ WATER INLET PIPE / O-RING INSTALLATION

- (1) Replace the O-ring of the water inlet pipe and then apply water to the O-ring to make installation easy.

#### Caution

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

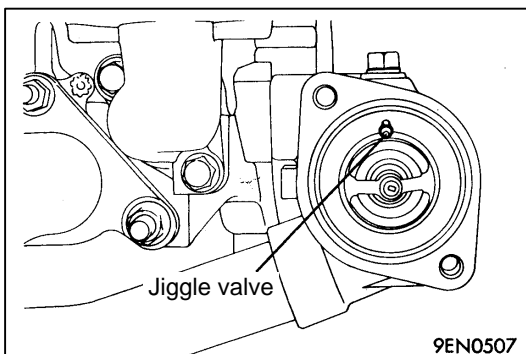


### ►C◄ THERMOSTAT CASE INSTALLATION

- (1) Apply 3 mm diameter of Form-In-Place Gasket (FIPG) to the location shown in the illustration.

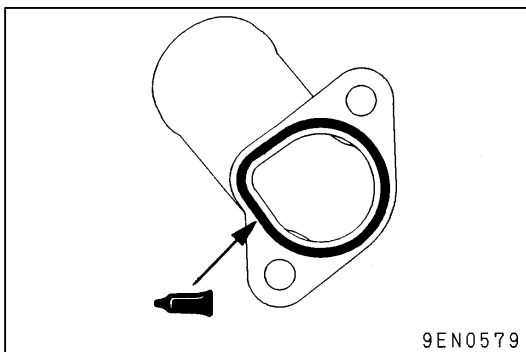
**Specified sealant:**

**Mitsubishi Genuine Part No.MD970389 or equivalent**



### ►D◄ THERMOSTAT INSTALLATION

- (1) Install the thermostat so that the jiggle valve is facing straight up.

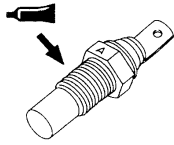


### ►E◄ WATER OUTLET FITTING INSTALLATION

- (1) Apply 3 mm diameter of Form-In-Place Gasket (FIPG) to the location shown in the illustration.

**Specified sealant:**

**Mitsubishi Genuine Part No.MD970389 or equivalent**



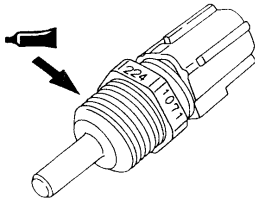
6AE0071

### ►F◄ ENGINE COOLANT TEMPERATURE GAUGE UNIT INSTALLATION

- (1) Apply the specified sealant to the threads.

**Specified sealant:**

**3M ATD Part No.8660 or equivalent**



6AE0070

### ►G◄ ENGINE COOLANT TEMPERATURE SENSOR INSTALLATION

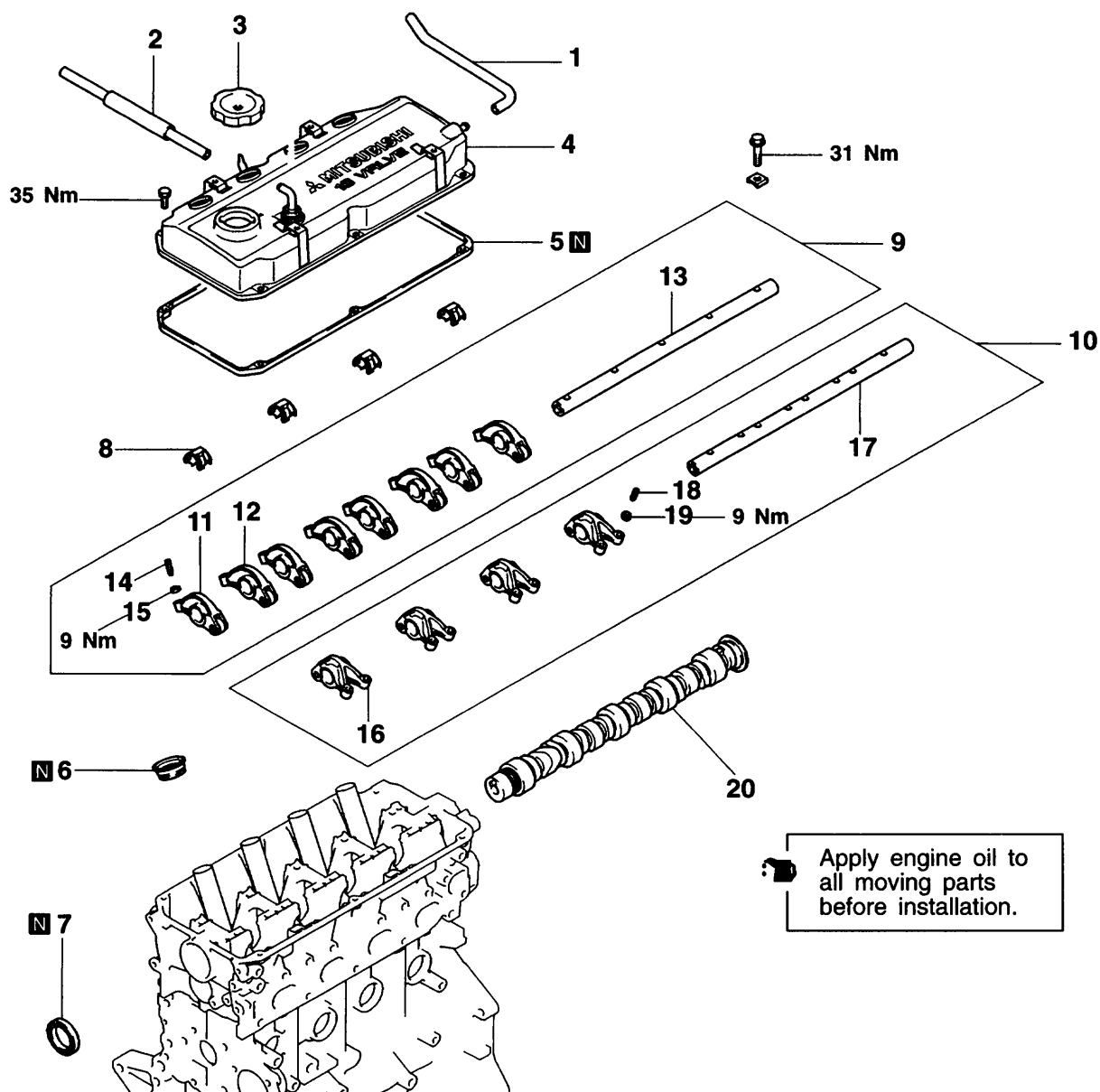
- (1) When reusing the sensor, apply the specified sealant to the threads.

**Specified sealant:**

**3M Nut Locking Part No.4171 or equivalent**

## ROCKER ARMS AND CAMSHAFTS

## REMOVAL AND INSTALLATION



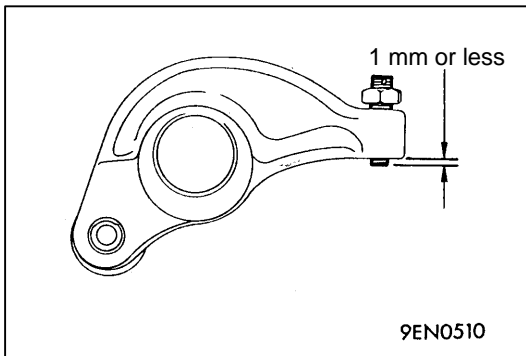
Apply engine oil to  
all moving parts  
before installation.

9EN0580

## Removal steps

1. Breather hose
2. P.C.V. hose
3. Oil filler cap
4. Rocker cover
5. Rocker cover gasket
6. Oil seal
7. Oil seal
8. Rocker arm spring
9. Rocker arms and rocker arm shaft  
IN
10. Rocker arms and rocker arm shaft  
EX

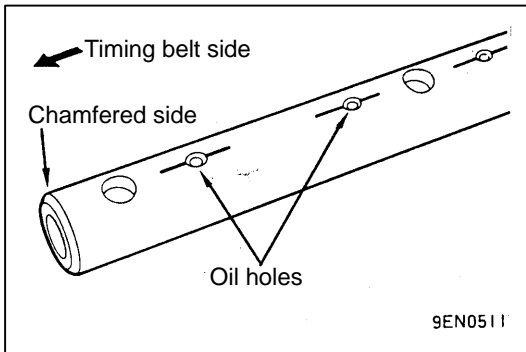
11. Rocker arm B
12. Rocker arm A
13. Rocker arm shaft
14. Adjusting screw
15. Nut
16. Rocker arm C
17. Rocker arm shaft
18. Adjusting screw
19. Nut
20. Camshaft



## INSTALLATION SERVICE POINTS

### ►A◄ ADJUSTING SCREW INSTALLATION

- (1) Install provisionally the screw to the rocker arm. Insert it so that the end of the screw is flush with the edge of the rocker arm or projects slightly (1 mm or less).



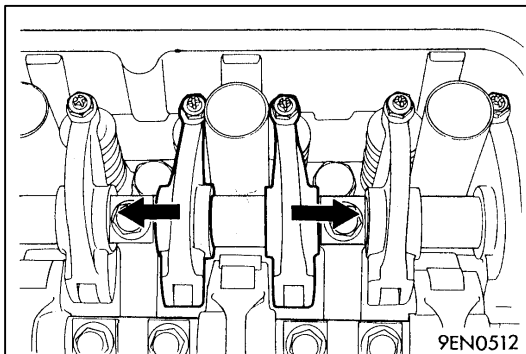
### ►B◄ ROCKER ARM SHAFT INSTALLATION

- (1) Place the end with the larger chamfered side toward the timing belt side.

#### NOTE

The rocker arm shaft for intake valves has eight oil holes.

- (2) Install the shaft with the oil holes toward the cylinder head.

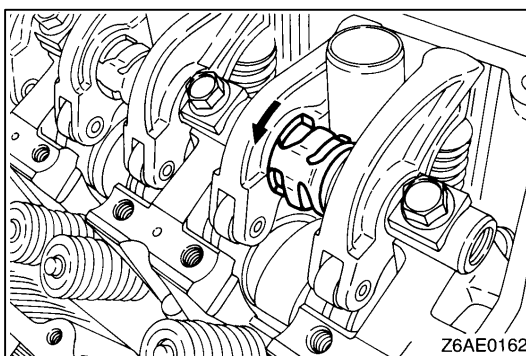


### ►C◄ ROCKER ARMS AND ROCKER ARM SHAFT INSTALLATION

- (1) Move the rocker arms in the directions shown in the illustration before tightening the rocker arm shaft bolts.

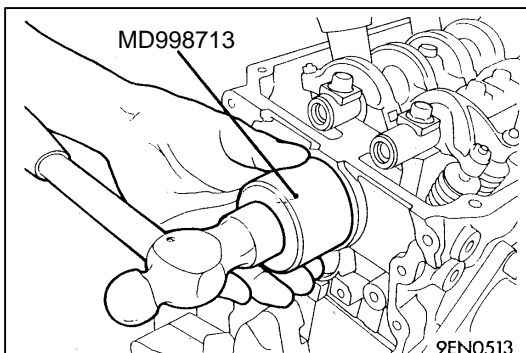
#### NOTE

Move the rocker arms until they touch the rocker arm shaft mounting bosses on the cylinder head.

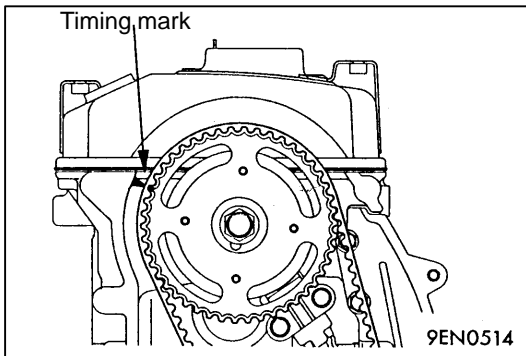


### ►D◄ ROCKER ARM SPRING INSTALLATION

- (1) Insert the rocker arm spring at an angle to the spark plug guide and then install it so that it is at a right angle to the guide.



### ►E◄ OIL SEAL INSTALLATION



## VALVE CLEARANCE ADJUSTMENT

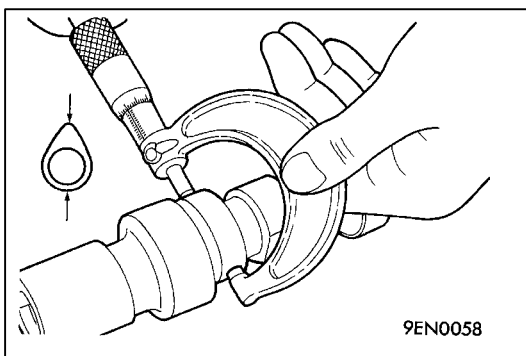
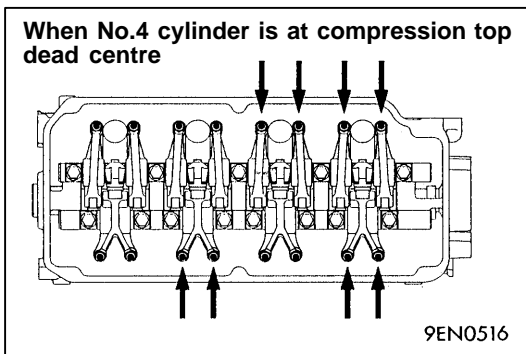
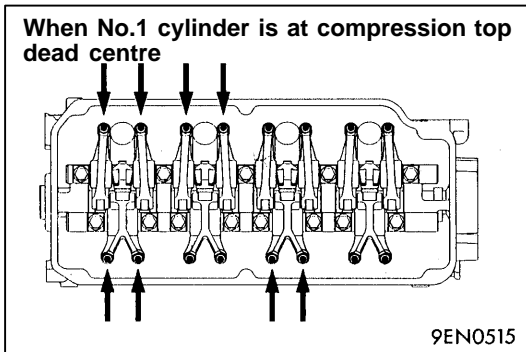
Adjust the valve clearance by the following procedure.

**Adjustment values (when engine is cold):**

**Intake valve: 0.09 mm**

**Exhaust valve: 0.20 mm**

- (1) Turn the crankshaft in the clockwise direction to align the camshaft sprocket timing marks and to set the No.1 cylinder to the compression top dead centre position.
- (2) The valve clearances at the places indicated by arrows in the illustration can be adjusted.
- (3) Use a thickness gauge to adjust the clearance between the ends of the valve stems and the adjusting screws.
- (4) Hold the adjusting screws with a screwdriver so that they do not turn, and then tighten the lock nuts.
- (5) Turn the crankshaft once in the clockwise direction to set the No.4 cylinder to the compression top dead centre position.
- (6) Adjust the valve clearances indicated by arrows in the illustration by the same procedure as in steps (3) and (4) above.



## INSPECTION

### CAMSHAFT

- (1) Measure the cam height.

		Standard value mm	Limit mm
Intake side	4G94	37.91	36.41
Exhaust side	4G94	37.70	37.20

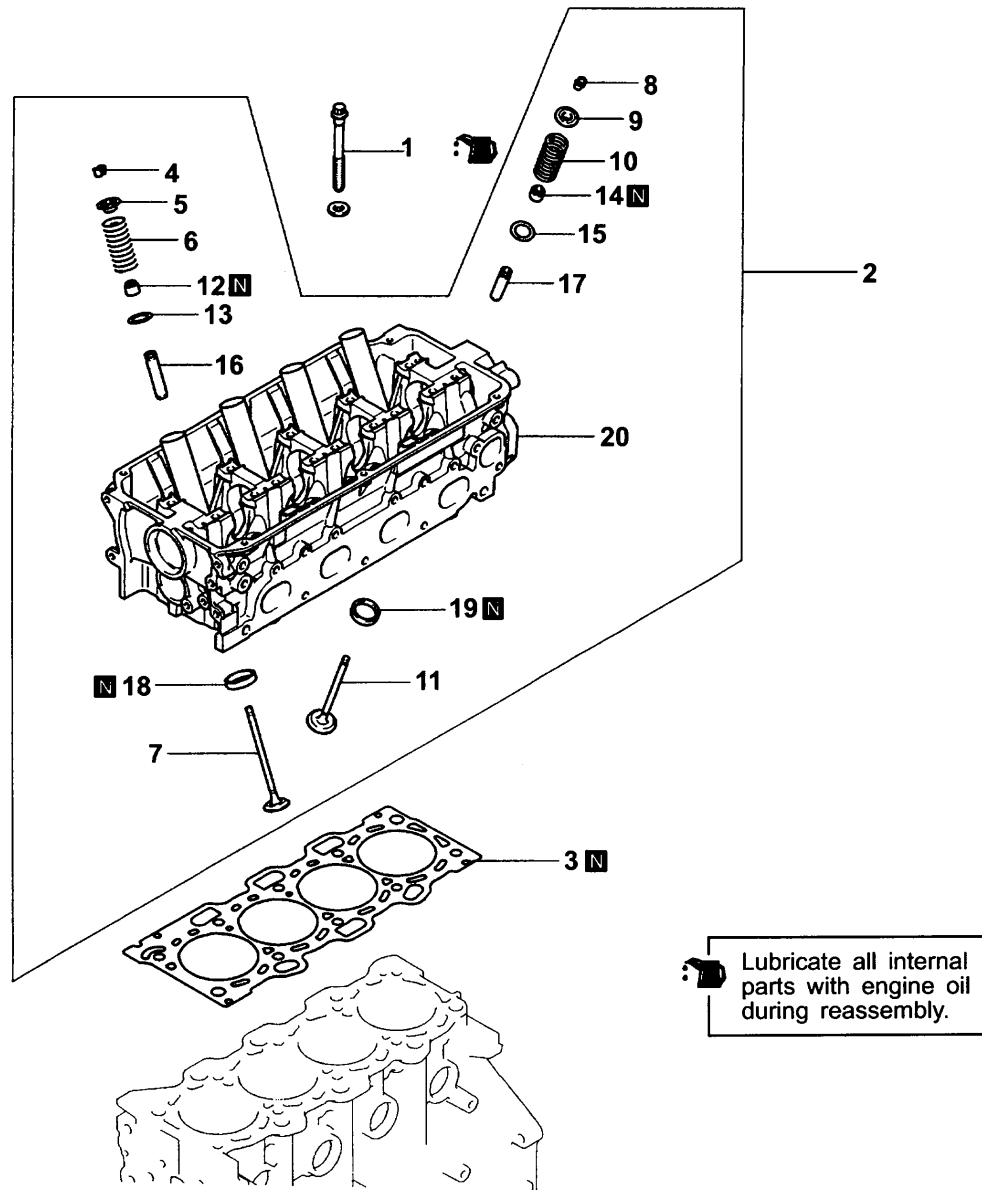
## CYLINDER HEAD AND VALVES

## REMOVAL AND INSTALLATION

MAIN

Group  
11

11B

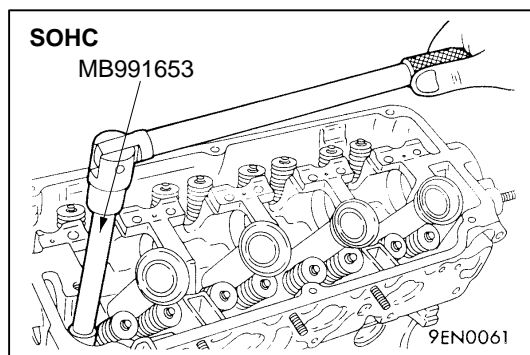


9EN0517

## Removal steps

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

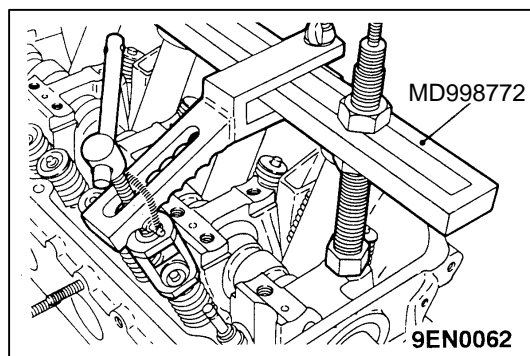
- 11. Intake valve
- ◀C▶ ▶A▶ 12. Valve stem seal
- 13. Valve spring seat
- ◀C▶ ▶A▶ 14. Valve stem seal
- 15. Valve spring seat
- 16. Exhaust valve guide
- 17. Intake valve guide
- 18. Exhaust valve seat
- 19. Intake valve seat
- 20. Cylinder head



## REMOVAL SERVICE POINTS

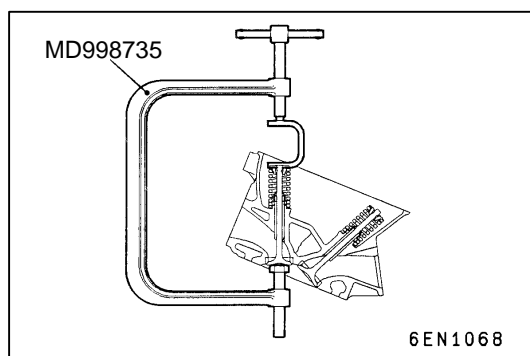
### ◀A▶ CYLINDER HEAD BOLT REMOVAL

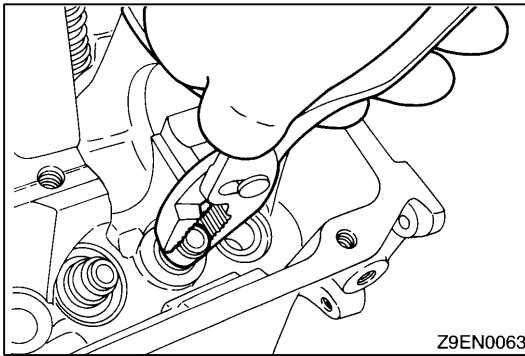
- (1) Loosen the cylinder head bolts using the special tool.



### ◀B▶ RETAINER LOCK REMOVAL

- (1) Store the removed valves, springs and other parts, tagged to indicate their cylinder No. and location to aid reassembly.





### ◀C▶ VALVE STEM SEAL REMOVAL

### ◀D▶ VALVE HANDLING PRECAUTIONS

- (1) Sodium reacts violently with water or moisture generation heat and liberating hydrogen. It must be handled with utmost care because otherwise the following dangerous conditions may result:  
Loss of eyesight if sodium gets in eyes.  
Burns if sodium contact skin.  
Fire hazard.
- (2) Handling of Sodium-filled Exhaust Valves  
Sodium-filled exhaust valves are not dangerous and may be handled in the same way as ordinary valves unless they are broken.  
Never try to break the valves and expose sodium to the air. When worn exhaust valves are to be discarded, have them disposed of by a salvage company equipped with special disposal system, notifying them that the valves contain sodium.  
Should the exhaust valves be broken, neutralize sodium using the method described below, and discard the valves in the same way as ordinary valves.
- (3) How to Neutralize Sodium  
Place a container filled with more than 10 liters of water in a well ventilated large space.  
Wear rubber gloves and goggles, and carefully take out broken valves from the cylinder head.  
Put a broken valve in the water-filled container and quickly get away from the container at least 2 or 3 m (6.6 or 10 ft.)



**Caution**

- Valves must be neutralized one at a time.
- Put a valve in the container only after sodium in the preceding one has completely reacted with water.

Keep fire away from the container during the neutralization. The resulting hydrogen gas is highly explosive.

When the reaction has finished (there is no more generation of hydrogen gas), take the valves out of the container with large tweezers or the like.

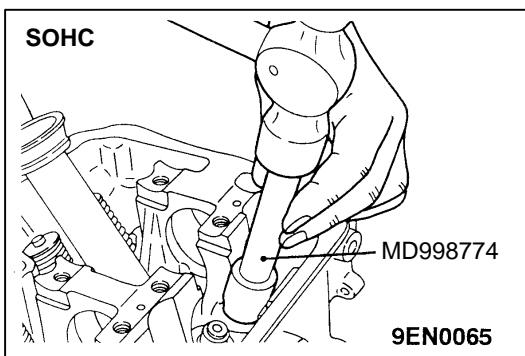
**NOTE**

The reaction occurs when water enters the cavity in the valve. Hydrogen gas may be trapped inside the valve, temporarily blocking the water passage. In such a case, wait until hydrogen gas is released and remaining sodium reacts with water.

After the neutralization of sodium, water in the container contains sodium hydroxide and is highly alkaline. The water solution should be disposed of according to local regulations.

**Caution**

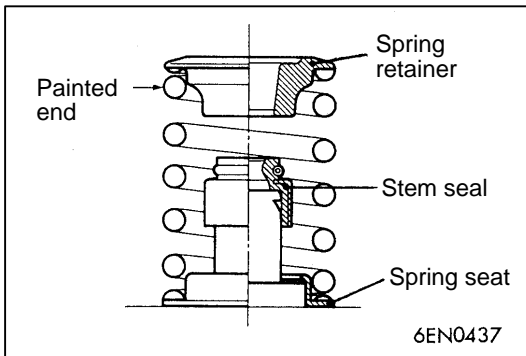
- Do not let the solution contact the eyes or the skin.
- Should it get in the eyes, immediately flush them with clean water thoroughly, and receive medical attention. When it contacts the skin, wash with ample amounts of clean water.

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

- (1) Install the valve spring seat.
- (2) Use the special tool to install the valve stem seal. Improper installation could result oil leaking past the valve guide.

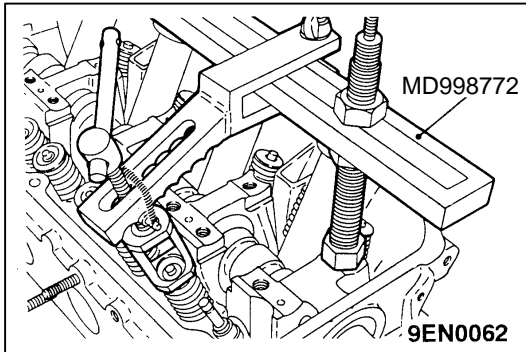
**Caution**

**Do not reuse removed valve stem seals.**



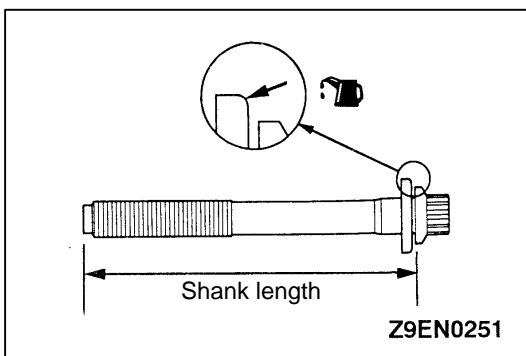
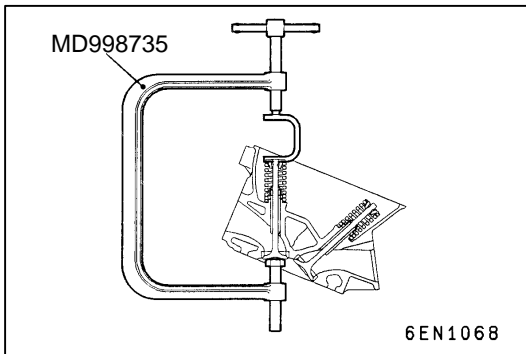
## ►B◄ VALVE SPRING INSTALLATION

- (1) Install the valve spring with the painted end on the rocker arm side.



## ►C◄ RETAINER LOCK INSTALLATION

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

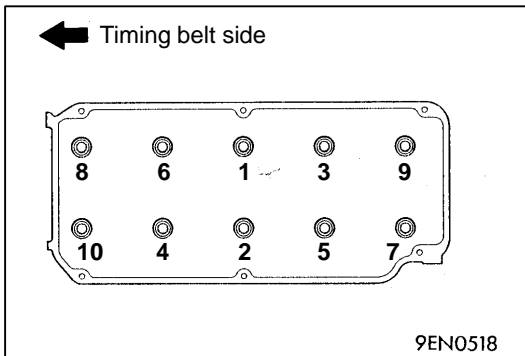


## ►D◄ CYLINDER HEAD BOLT INSTALLATION

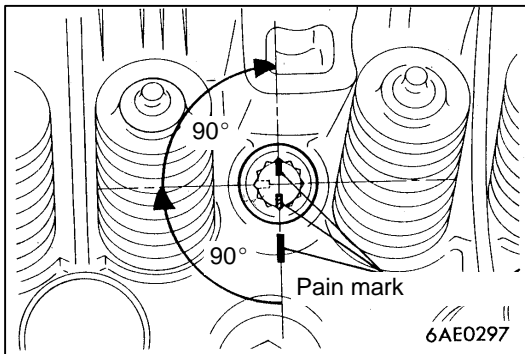
- (1) When installing the cylinder head bolts, check that the shank length of each bolt meets the limit. If the limit is exceeded, replace the bolts.

**Limit: Max. 96.4 mm**

- (2) Install the washers as illustrated.
- (3) Apply engine oil to the bolt threads and washers.

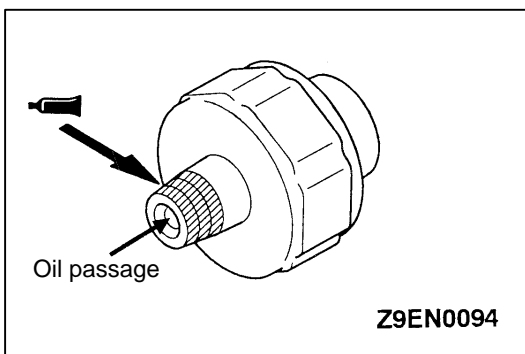


- (4) According to the tightening sequence, tighten the bolts to the specified torque 74 Nm.
- (5) Loosen all bolts fully.
- (6) Retighten the loosened bolts to a torque of 20 Nm in the specified tightening sequence.
- (7) Make paint marks on the cylinder head bolt heads and cylinder head.
- (8) Give a 90° turn to the cylinder head bolts in the specified tightening sequence.
- (9) Give another 90° turn to the cylinder head bolts and make sure that the paint mark on the head of each cylinder head bolt and that on the cylinder head are on the same straight line.



## Caution

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



## ►E◄ SEALANT APPLICATION TO OIL PRESSURE SWITCH

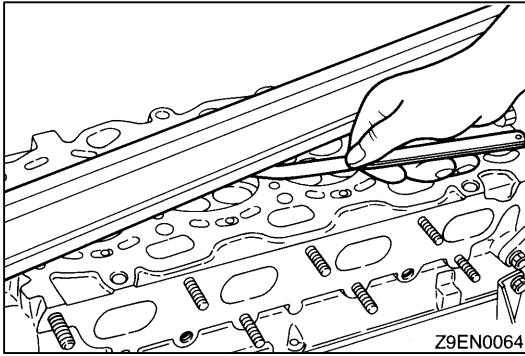
- (1) Apply sealant to the threads of the switch.

### Specified sealant:

3M ATD Part No. 8660 or equivalent

### Caution

Use care not to allow the sealant to plug the oil passage.



## INSPECTION

### CYLINDER HEAD

- (1) Check the cylinder head gasket surface for flatness by using a straightedge and thickness gauge.

**Standard value: 0.03 mm**

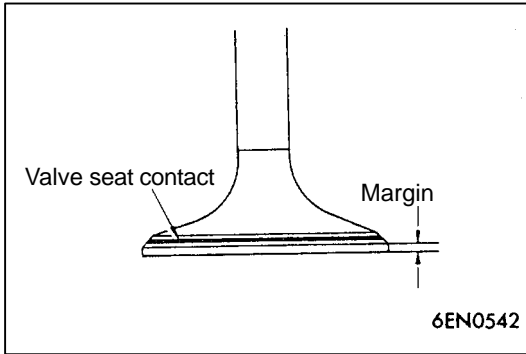
**Limit: 0.2 mm**

- (2) If the service limit is exceeded, correct to meet the specification.

**Grinding limit: \*0.2 mm**

\*Includes/combined with cylinder block grinding

**Cylinder head height (Specification when new):  
119.9 – 120.1 mm**



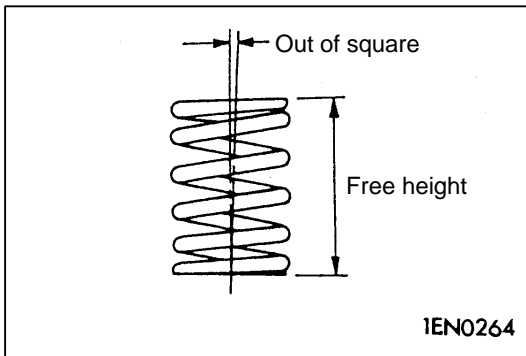
### VALVE

- (1) Check the valve face for correct contact. If incorrect, reface using a valve refacer. Valve should make a uniform contact with the seat at the centre of valve face.
- (2) If the margin is smaller than the service limit, replace the valve.

	Standard value mm	Limit mm
Intake	1.0	0.5
Exhaust	1.3	0.8

- (3) Measure the overall height of the valve. If the specified limit is exceeded, replace the valve.

	Standard value mm	Limit mm
Intake	110.15	109.65
Exhaust	113.70	113.20



## VALVE SPRING

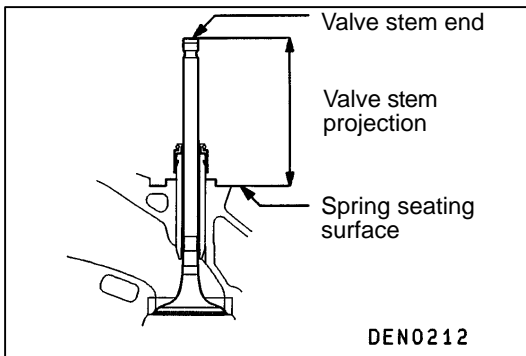
- (1) Measure the valve spring's free height. If the measurement is less than specified, replace the spring.

	Standard value mm	Limit mm
SOHC	50.9	49.9

- (2) Measure the squareness of the spring. If the measurement exceeds the specified limit, replace the spring.

**Standard value: 2° or less**

**Limit: 4°**



## VALVE SEAT

- (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 mm	Limit mm
Intake	SOHC	49.30	49.80
Exhaust	SOHC	49.35	49.85

## VALVE GUIDE

- (1) Measure the clearance between the valve guide and valve stem. If the limit is exceeded, replace the valve guide or valve, or both.

**Standard value:**

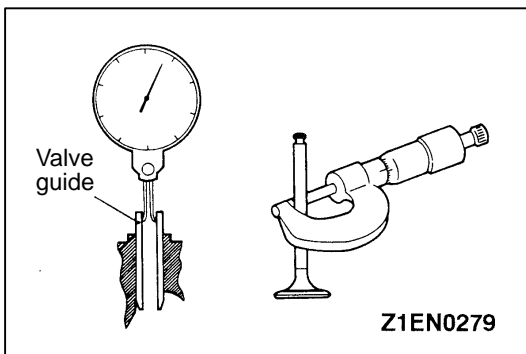
**Intake: 0.02 – 0.05 mm**

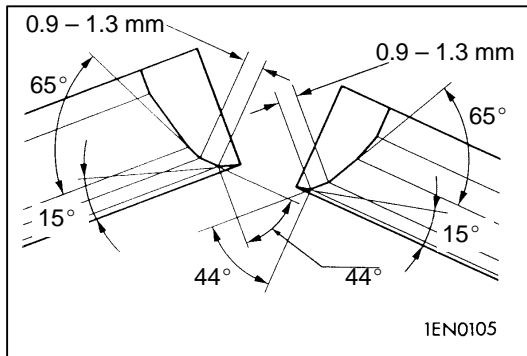
**Exhaust: 0.05 – 0.09 mm**

**Limit:**

**Intake: 0.10 mm**

**Exhaust: 0.15 mm**





## VALVE SEAT RECONDITIONING PROCEDURE

- (1) Before correcting the valve seat, check the clearance between the valve guide and valve. If necessary, replace the valve and/or 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 thin the wall thickness. Then, remove the valve seat.
- (2) Rebore the valve seat hole in the cylinder head to a selected oversize valve seat diameter.

### Intake valve seat hole diameter

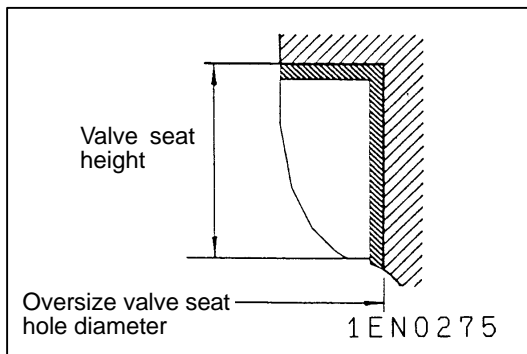
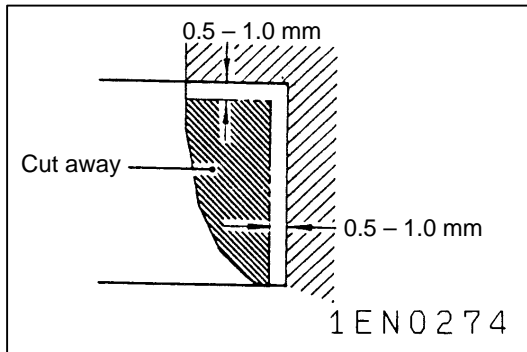
0.3 O.S. <SOHC>: 31.80 – 31.83 mm

0.6 O.S. <SOHC>: 32.10 – 32.13 mm

### Exhaust valve seat hole diameter

0.3 O.S. <SOHC>: 29.30 – 29.32 mm

0.6 O.S. <SOHC>: 29.60 – 29.62 mm



- (3) Before fitting the valve seat, either heat the cylinder head up to approximately 250°C or cool the valve seat in liquid nitrogen, to prevent the cylinder head bore from galling.
- (4) Correct the valve seat to the specified width and angle.

## VALVE GUIDE REPLACEMENT

- (1) Force the valve guide out toward the cylinder block using a press.
- (2) Machine the valve guide hole in the cylinder head to the size of the oversize valve guide to be installed.

### Caution

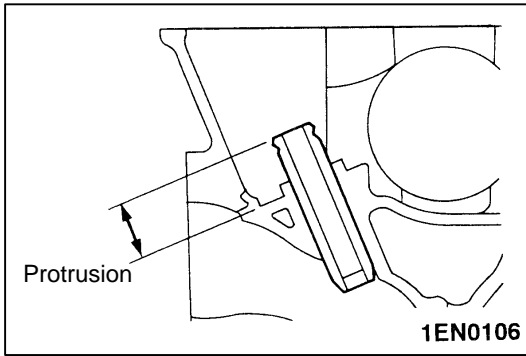
**Do not use the valve guide of the same size as the removed one.**

### Valve guide hole diameters in cylinder head

0.05 O.S.: 11.05 – 11.07 mm

0.25 O.S.: 11.25 – 11.27 mm

0.50 O.S.: 11.50 – 11.52 mm



- (3) Press-fit the valve guide until it protrude specified value (SOHC: 14 mm) as shown in the illustration.

**Caution**

1. Press the valve guide from the cylinder head top surface.
  2. Valve guide for intake valve and that for exhaust valve are different in length. (45.5 mm for intake valve; 50.5 mm for exhaust valve)
- (4) After the valve guide has been installed, insert a new valve to check for smooth sliding motion.

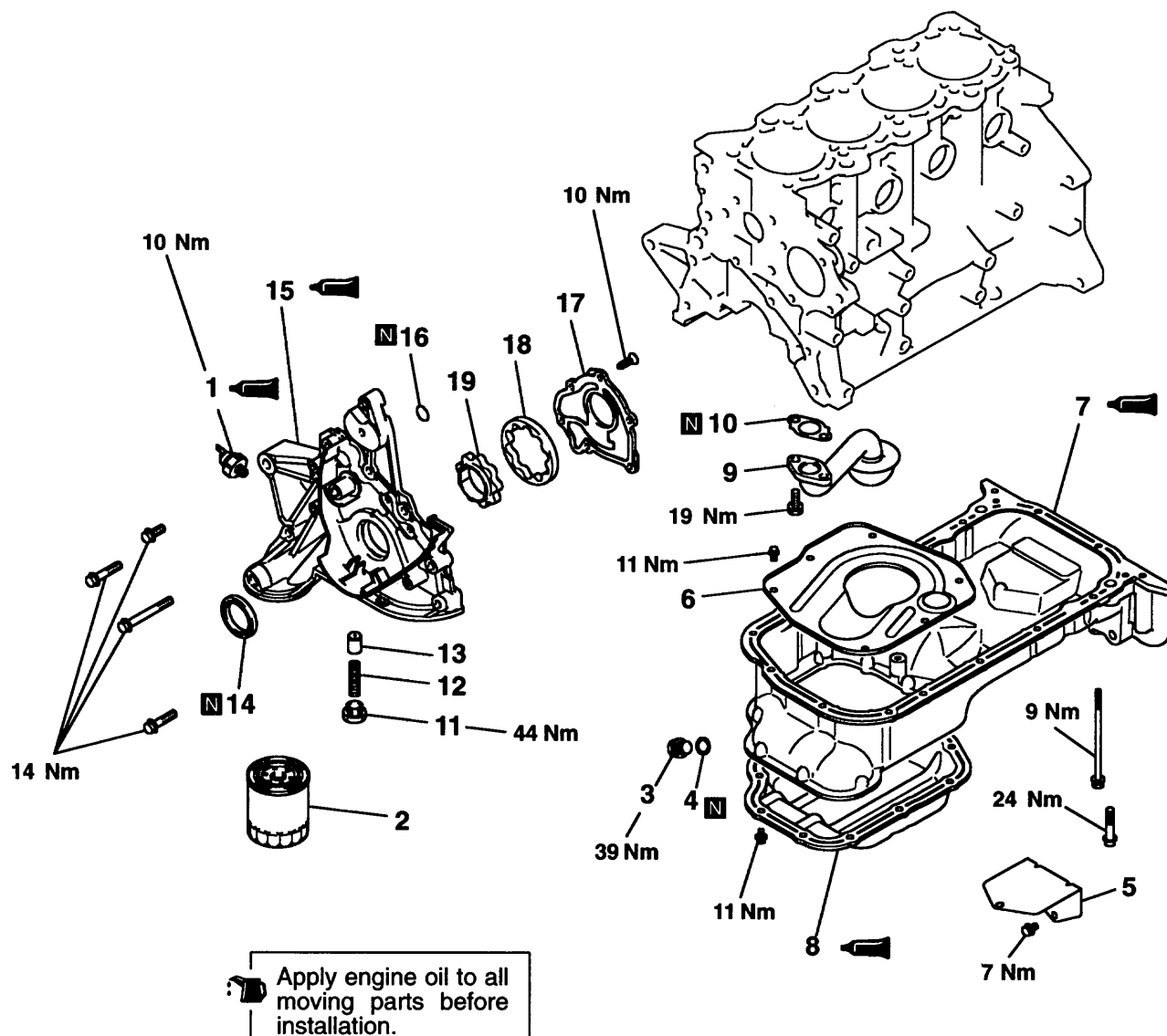
## FRONT CASE AND OIL PUMP

## REMOVAL AND INSTALLATION

MAIN

Group  
11

11B



9EN1113

## Removal steps



1. Oil pressure switch
2. Oil filter
3. Drain plug
4. Drain plug gasket
5. Cover



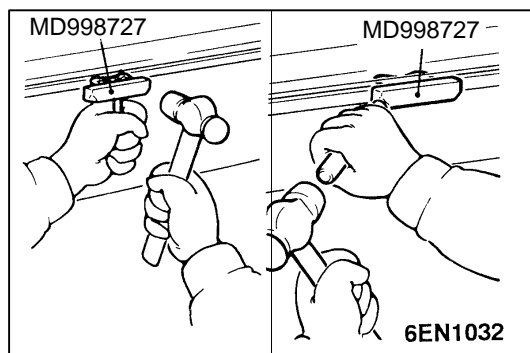
6. Baffle plate
7. Upper oil pan
8. Lower oil pan
9. Oil screen
10. Oil screen gasket



11. Relief plug
12. Relief spring
13. Relief plunger
14. Oil seal
15. Oil pump case
16. O-ring
17. Oil pump case cover
18. Outer rotor
19. Inner rotor







## REMOVAL SERVICE POINTS

### ◀A▶ OIL PAN REMOVAL

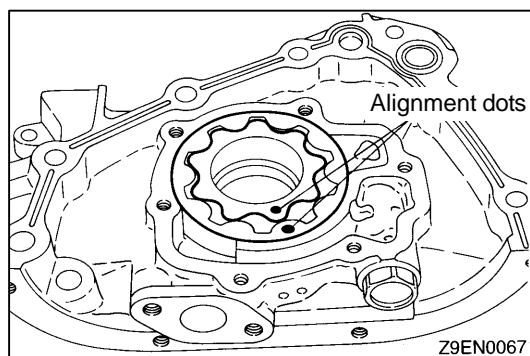
- (1) Knock in the special tool deeply between the oil pan and the cylinder block.
- (2) Hitting the side of the special tool, slide the special tool along the oil pan to remove the oil pan.

### ◀B▶ REMOVAL OF UPPER OIL PAN

- (1) At first remove the bolts which is nearest to flywheel, and then remove the other bolts.

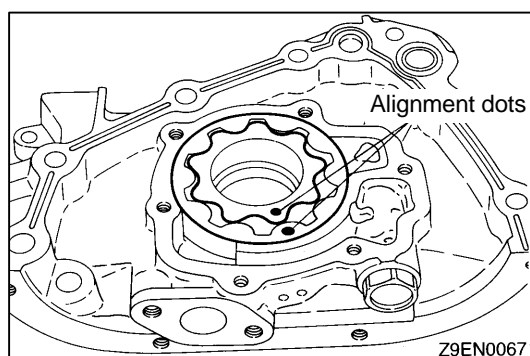
#### Caution

Never use the special tool (oil pan remover), etc.



### ◀C▶ OUTER ROTOR/INNER ROTOR REMOVAL

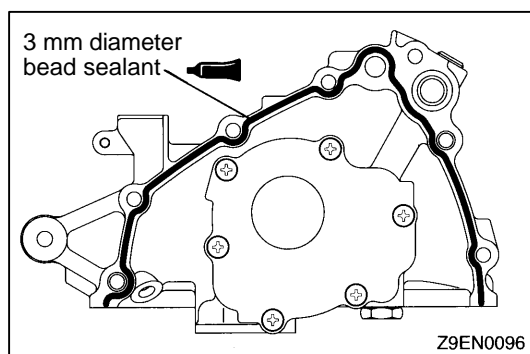
- (1) Make alignment dots on the outer and inner rotors for reference in reassembly.



## INSTALLATION SERVICE POINTS

### ▶A◀ INNER ROTOR/OUTER ROTOR INSTALLATION

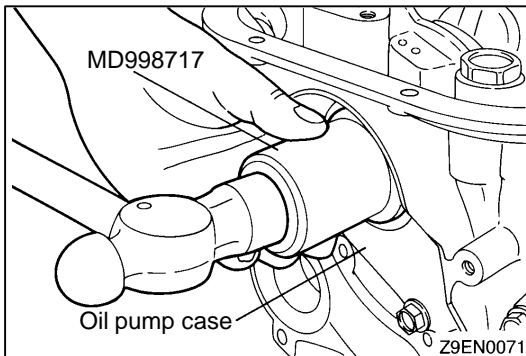
- (1) Apply engine oil to the rotors. Then, install the rotors ensuring that the alignment dots made at disassembly are properly aligned.



### ▶B◀ SEALANT APPLICATION TO OIL PUMP CASE

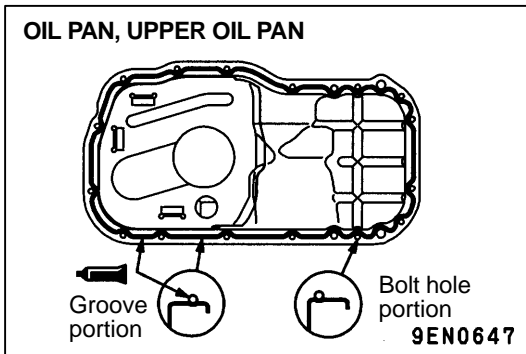
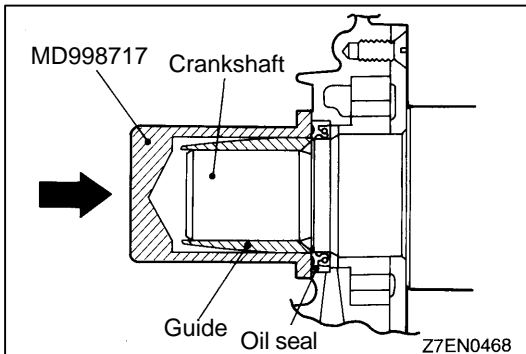
#### Specified sealant:

Mitsubishi Genuine Part No. MD970389 or equivalent



## ►C◄ CRANKSHAFT FRONT OIL SEAL INSTALLATION

Using the special tool, knock the oil seal into the oil pump case.



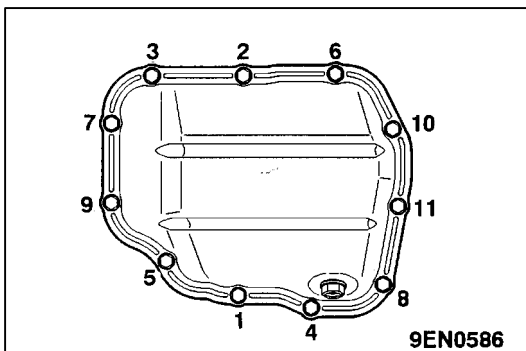
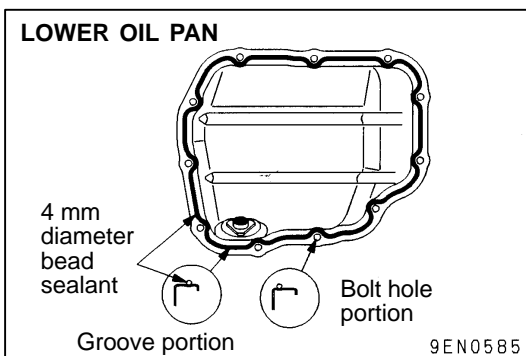
## ►D◄ OIL PAN/UPPER OIL PAN/LOWER OIL PAN INSTALLATION

- (1) Remove all the remaining gasket from the mating surfaces using a scraper or a wire brush.
- (2) Apply a 4 mm diameter bead of sealant to the oil pan flange.  
See "Form-In-Place Gasket" in "SPECIFICATIONS".

**Specified sealant:**

**Mitsubishi Genuine Part No. MD970389 or equivalent**

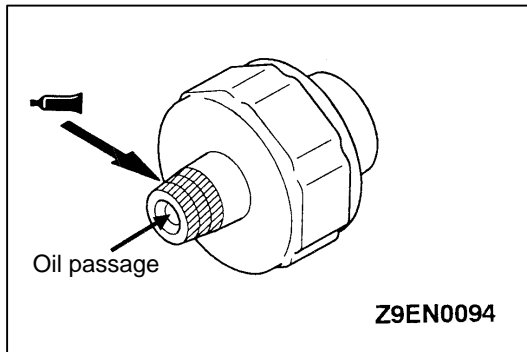
- (3) Install the oil pan within 15 minutes after applying the sealant.



- (4) Tighten the lower oil pan mounting bolts in the sequence shown in the illustration.

## ►E◄ OIL FILTER INSTALLATION

- (1) Clean the filter installation surface of the cylinder block.
- (2) Apply engine oil to the O-ring of the oil filter.
- (3) Screw in the oil filter until its O-ring comes in contact with the base. Then tighten one more turn.



## ►F◄ SEALANT APPLICATION TO OIL PRESSURE SWITCH

- (1) Apply sealant to the threads of the switch.

**Specified sealant:**

**3M ATD Part No. 8660 or equivalent**

**Caution**

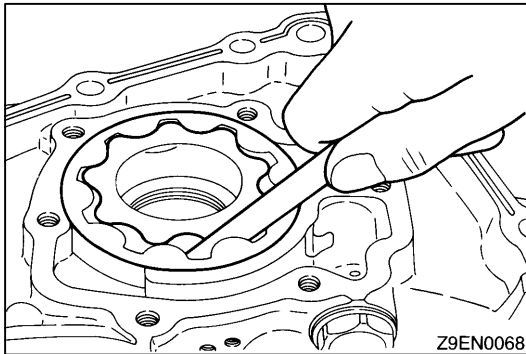
**Use care not to allow the sealant to plug the oil passage.**

## INSPECTION

### OIL PUMP

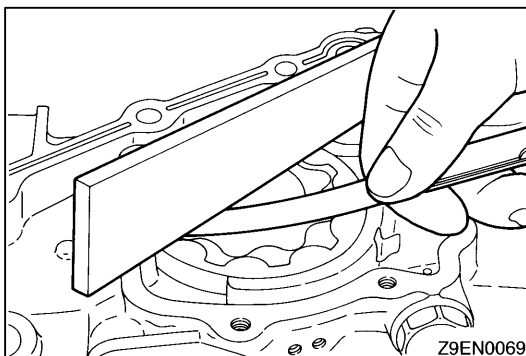
- (1) Check the tip clearance.

**Standard value: 0.06 – 0.18 mm**



- (2) Check the side clearance.

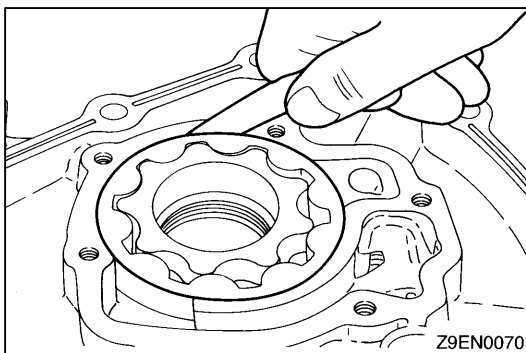
**Standard value: 0.04 – 0.10 mm**



- (3) Check the body clearance.


**Standard value: 0.10 – 0.18 mm**

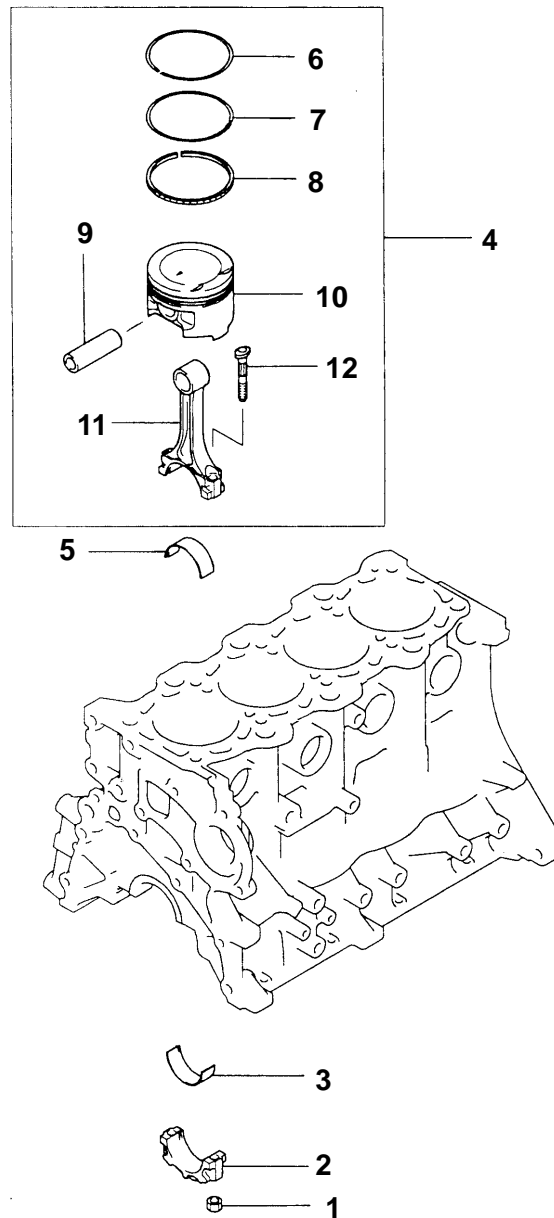
**Limit: 0.35 mm**



## PISTON AND CONNECTING ROD

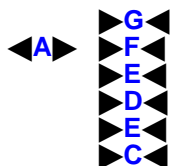
## REMOVAL AND INSTALLATION

 Lubricate all internal parts with engine oil during re-assembly.



Z9EN0043

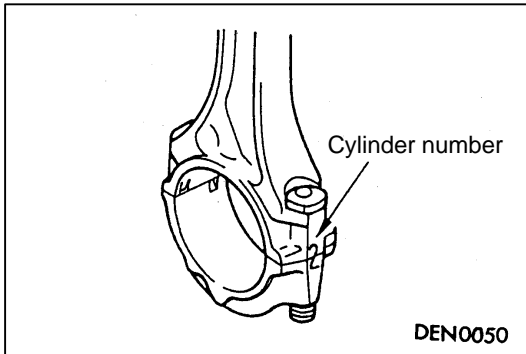
## Removal steps



1. Nut
2. Connecting rod cap
3. Connecting rod bearing
4. Piston and connecting rod
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



## REMOVAL SERVICE POINTS

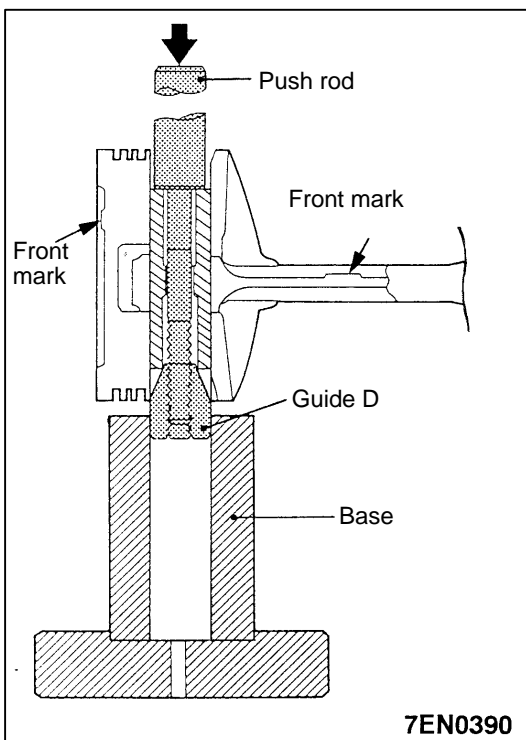
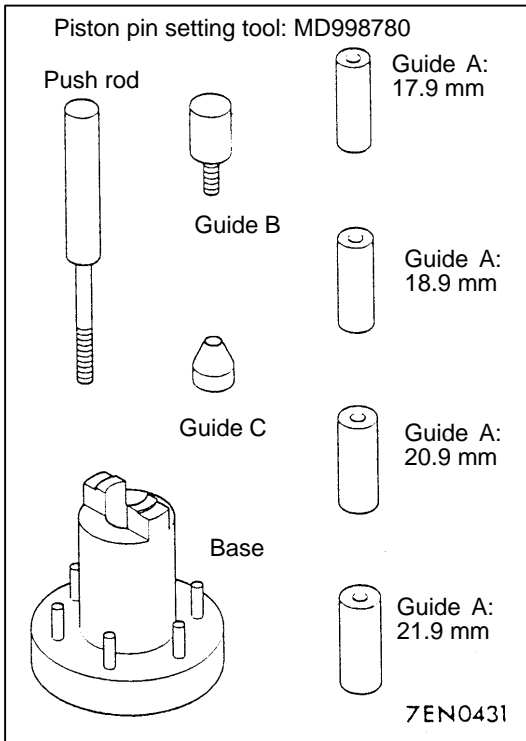
### ◀A▶ CONNECTING ROD CAP REMOVAL

- (1) Mark the cylinder number on the side of the connecting rod big end for correct reassembly.

### ◀B▶ PISTON PIN REMOVAL

Piston pin setting tool (MD998780) consists of the parts shown in the illustration at left.

To remove the piston pin, Guide D (MB991659) is also used in combination with the Piston pin setting tool.



- (1) Insert the Push Rod (special tool) into the piston from the side on which the front mark is stamped in the piston head, and attach the guide D to the push rod end.
- (2) Place the piston and connecting rod assembly on the Piston Pin Setting Base (special tool) with the front mark facing upward.
- (3) Using a press, remove the piston pin.

#### NOTE

Keep the disassembled pistons, piston pins and connecting rods in order according to the cylinder number.

## INSTALLATION SERVICE POINTS

### ►A◄ PISTON PIN INSTALLATION

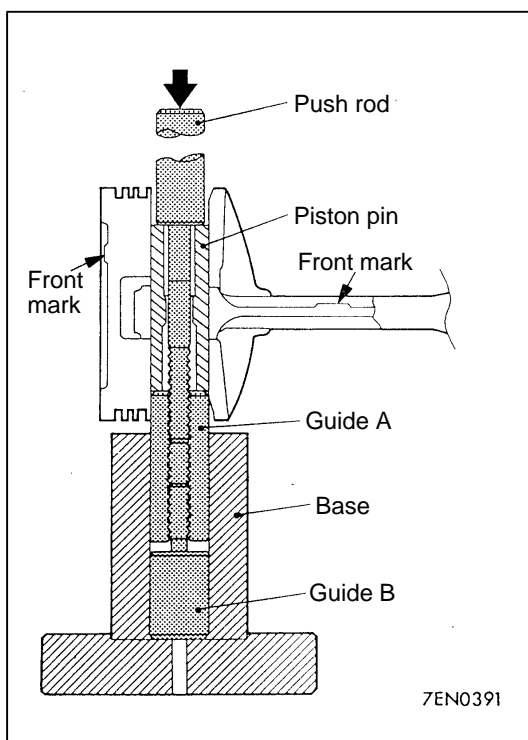
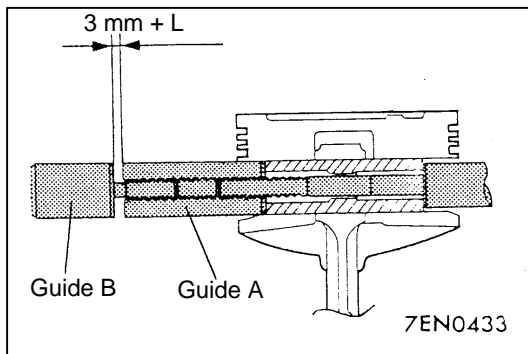
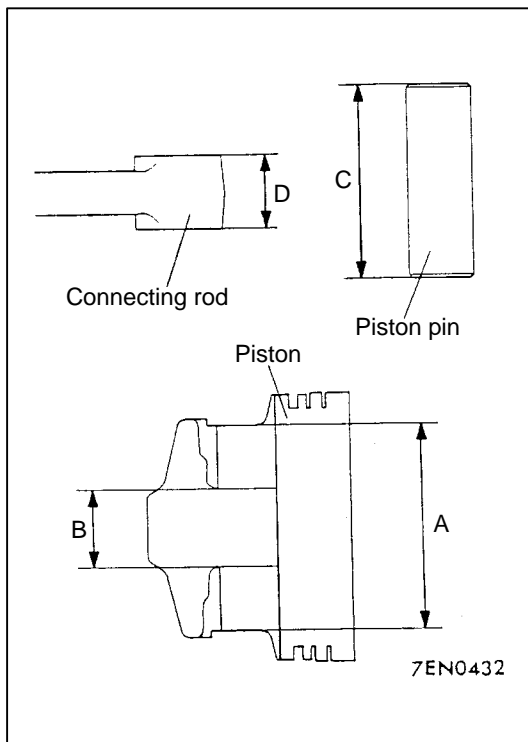
- (1) Measure the following dimensions of the piston, piston pin and connecting rod.  
A: Piston pin insertion hole length  
B: Distance between piston bosses  
C: Piston pin length  
D: Connecting rod small end width
- (2) Calculate the following formula by substituting the measured value.  

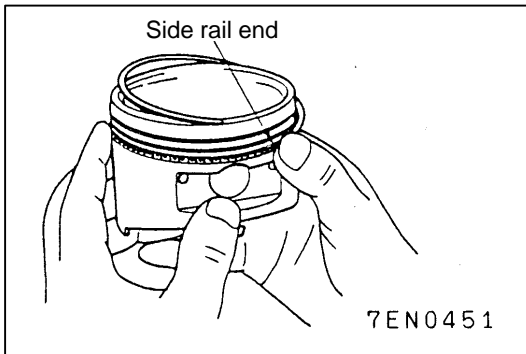
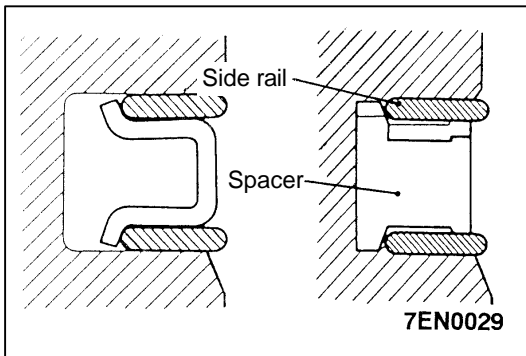
$$L = ((A - C) - (B - D))/2$$
- (3) Insert the Push Rod (special tool) into the piston pin and attach the guide A to the push rod end.
- (4) Assemble the connecting rod in the piston with their front marks facing the same direction.
- (5) Apply engine oil to the entire periphery of the piston pin.
- (6) Insert the piston pin, push rod and guide A assembly having assembled in step (3) from the guide A side into the piston pin hole on the front marked side.

- (7) Screw the guide B into the guide A until the gap between both guides amounts to the value L obtained in step (2) plus 3 mm.

- (8) Place the piston and connecting rod assembly onto the piston setting base with the front marks directed upward.
- (9) Press-fit the piston pin using a press. If the press-fitting force required is less than the standard value, replace the piston and piston pin set or/and the connecting rod.

**Standard value: 4,500 – 14,700 N**





### ►B◄ OIL RING INSTALLATION

- (1) Fit the oil ring spacer into the piston ring groove. Install the upper side rail, and then install the lower side rail.

#### NOTE

1. The side rails and spacer may be installed in either direction.
2. New spacer and side rail are painted with the following identification colour according to the size.

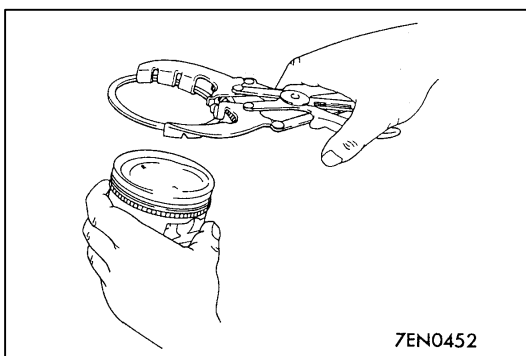
Size	Identification colour
Standard size	None
0.50 mm O.S.	Blue
1.00 mm O.S.	Yellow

3. To install the side rail, first fit one end of the rail into the piston groove, then press the remaining portion into position by finger as shown in the illustration.

#### Caution

**Do not use piston ring expander when installing side rail. Use of piston ring expander to expand the side rail end gap can break the side rail, unlike other piston rings.**

- (3) Make sure that the side rails move smoothly in either direction.



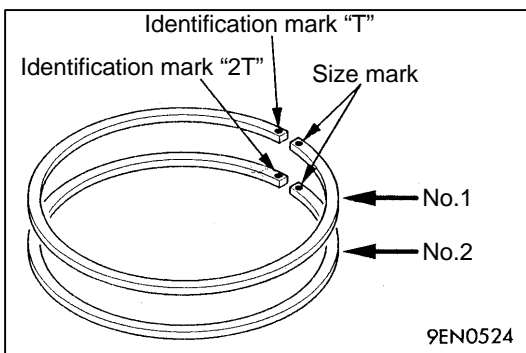
### ►C◄ PISTON RING NO.2/PISTON RING NO.1 INSTALLATION

- (1) Using piston ring expander, install the piston rings with their side having identification marks facing up.

#### Identification mark:

**No.1 ring: T**

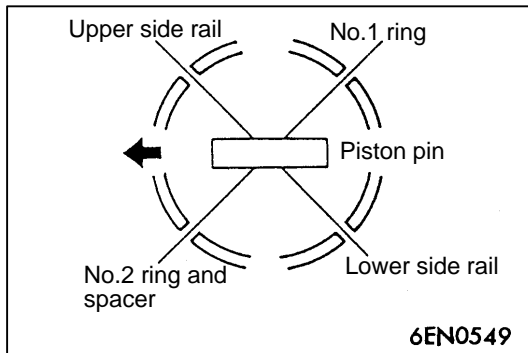
**No.2 ring: 2T**



#### NOTE

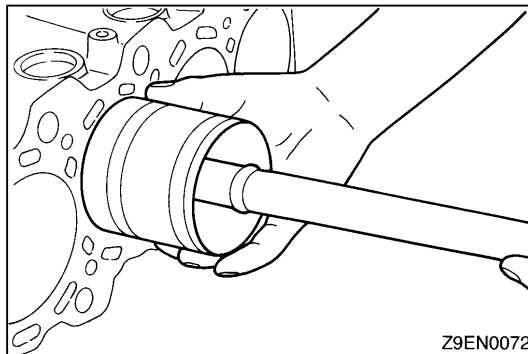
The piston ring is stamped with the following size mark.

Size	Size mark
Standard size	None
0.50 mm O.S.	50
1.00 mm O.S.	100



### ►D◄ PISTON AND CONNECTING ROD INSTALLATION

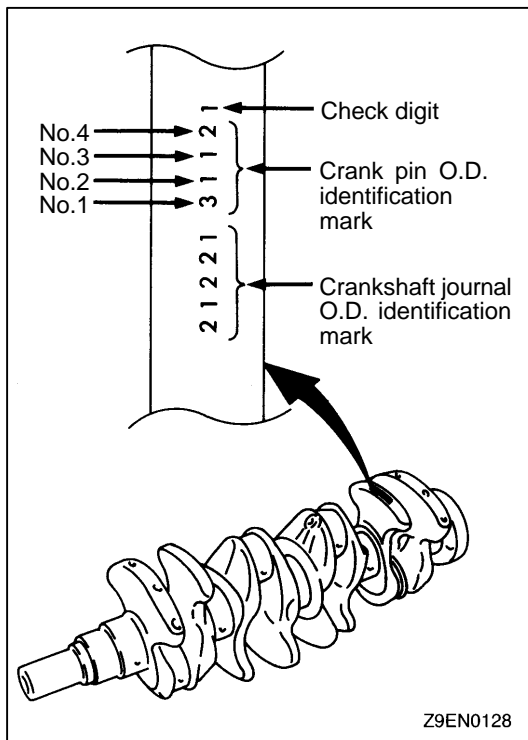
- (1) Liberally coat engine oil on the circumference of the piston, piston ring and oil ring.
- (2) Arrange the piston ring and oil ring gaps (side rail and spacer) as shown in the illustration.
- (3) Face the front mark (arrow) on the top of the piston toward the camshaft sprocket.



- (4) Using a suitable piston ring compressor tool, insert the piston and connecting rod assembly into the cylinder block.

#### Caution

**Do not strike the piston into the cylinder block because the piston ring or crank pin will be damaged.**

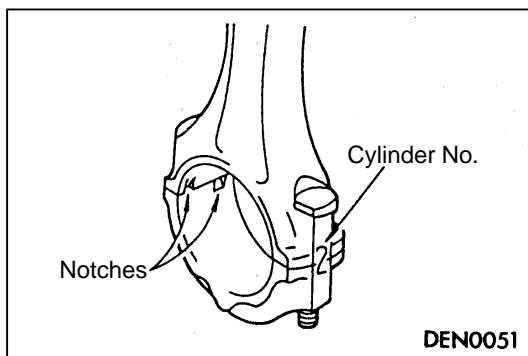
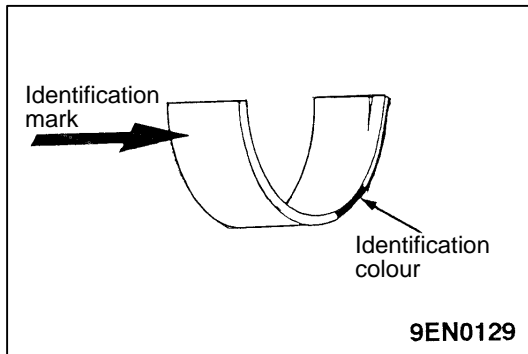
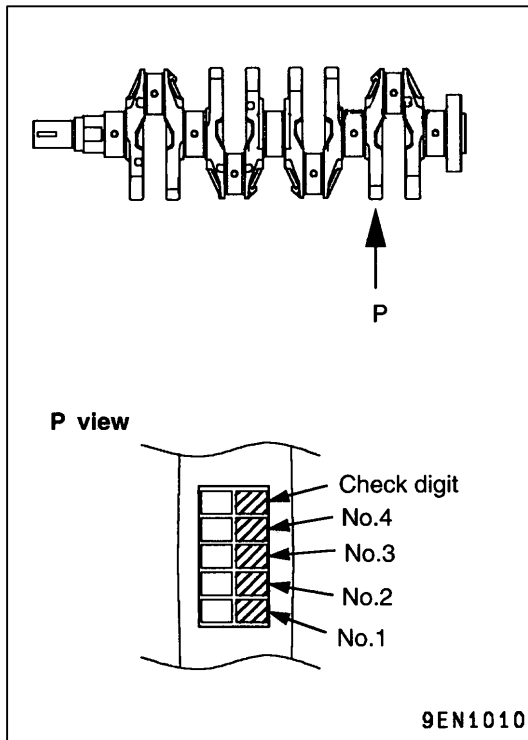


### ►E◄ CONNECTING ROD BEARING INSTALLATION

- (1) When the bearings are to be replaced, select correct ones according to the identification marks stamped in the crankshaft.

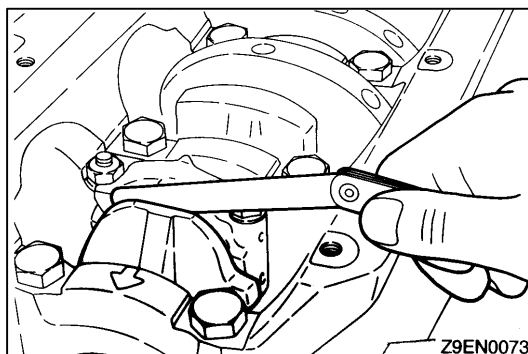
Crankshaft	Connecting rod bearing	
Pin O.D. identification mark	Identification mark (service part)	Identification colour (Line production part)
1	S1 or 1	Brown
2	S2 or 2	Black
3	S3 or 3	Green





### ►F◄ CONNECTING ROD CAP INSTALLATION

- (1) Mate the correct bearing cap with the correct connecting rod by checking with the alignment marks marked during disassembly. If a new connecting rod has no alignment mark, position the notches for locking the bearing on the same side.



- (2) Check if the thrust clearance in the connecting rod big end is correct.

**Standard value: 0.10 – 0.25 mm**

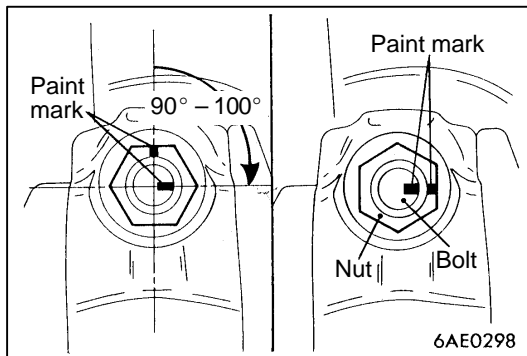
**Limit: 0.4 mm**

## ►G◀CONNECTING ROD CAP NUT INSTALLATION

**Caution**

If the cylinder head has been installed before installing the connecting rod cap nut, be sure to remove the spark plugs.

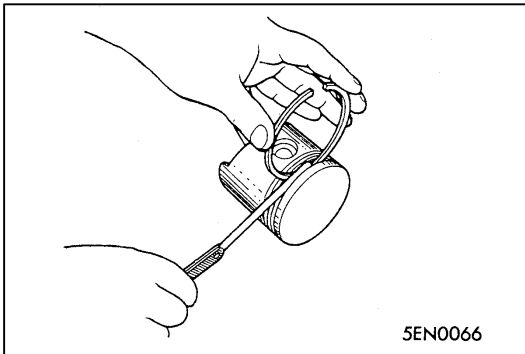
- (1) Since the connecting rod cap bolts and nuts are torqued using the plastic area tightening method, the bolts should be examined BEFORE reuse. If the bolt threads are “necked down”, the bolt should be replaced.  
Necking can be checked by running a nut with fingers to the full length of the bolt 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 thread portion and bearing surface of the nut.
- (3) Install each nut to the bolt and tighten it with fingers. Then tighten the nuts alternately to install the cap properly.
- (4) Tighten the nuts to a torque of 20 Nm.



- (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 nut, 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

### PISTON RING

- (1) Check the clearance between the piston ring and ring groove. If the limit is exceeded, replace the ring or piston, or both.

#### Standard value:

No.1: 0.03 – 0.07 mm

No.2: 0.02 – 0.06 mm

#### Limit:

No.1: 0.1 mm

No.2: 0.1 mm

Install 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 thickness gauge.

If the ring gap is excessive, replace the piston ring.

#### Standard value:

No.1: 0.15 – 0.30 mm

No.2: 0.40 – 0.55 mm

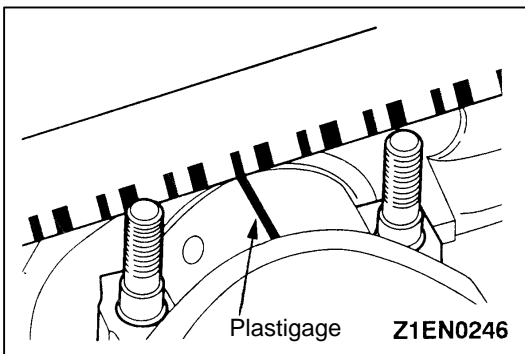
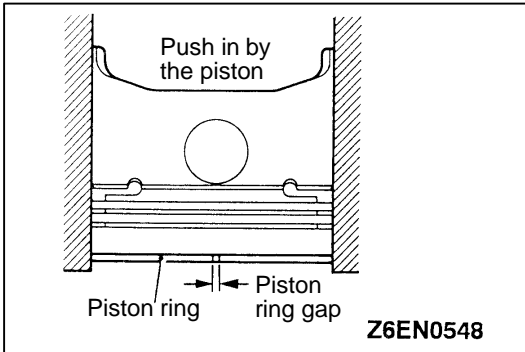
#### Oil:

0.10 – 0.35 mm

#### Limit:

No.1, No.2: 0.8 mm

Oil: 1.0 mm



### CRANKSHAFT PIN OIL CLEARANCE (PLASTIGAGE METHOD)

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

#### Standard value: 0.02 – 0.05 mm

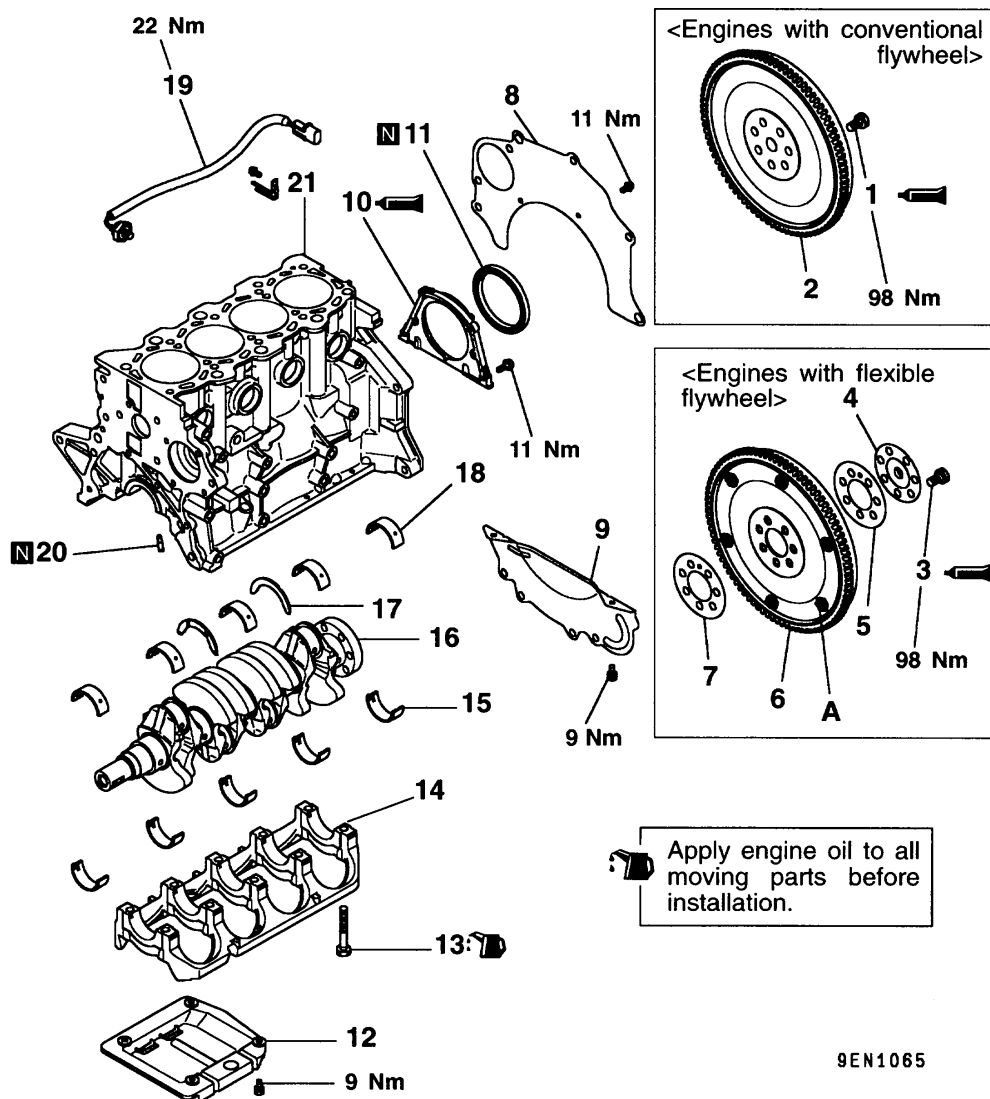
#### Limit: 0.1 mm

# CRANKSHAFT, CYLINDER BLOCK, FLYWHEEL AND DRIVE PLATE REMOVAL AND INSTALLATION (MANUAL TRANSMISSION)

MAIN

Group  
11

11B



## Removal steps

- |     |                                 |     |                                 |
|-----|---------------------------------|-----|---------------------------------|
| ▶F◀ | 1. Flywheel bolt                | ▶C◀ | 13. Bearing cap bolt            |
| ▶F◀ | 2. Flywheel                     | ▶C◀ | 14. Bearing cap                 |
| ▶F◀ | 3. Flywheel bolt                | ▶B◀ | 15. Crankshaft bearing, lower   |
|     | 4. Plate                        | ▶B◀ | 16. Crankshaft                  |
|     | 5. Adapter plate                | ▶B◀ | 17. Thrust plate                |
|     | 6. Flywheel                     | ▶B◀ | 18. Crankshaft bearing, upper   |
|     | 7. Adapter plate                | ◀A▶ | 19. Knock sensor <where fitted> |
|     | 8. Rear plate                   | ▶A◀ | 20. Oil jet <where fitted>      |
|     | 9. Bell housing cover           |     | 21. Cylinder block              |
| ▶E◀ | 10. Rear oil seal case          |     |                                 |
| ▶D◀ | 11. Oil seal                    |     |                                 |
|     | 12. Baffle plate <where fitted> |     |                                 |

## Caution

On the flexible wheel equipped engines, do not remove any of the bolts “A” of the flywheel shown in the illustration.

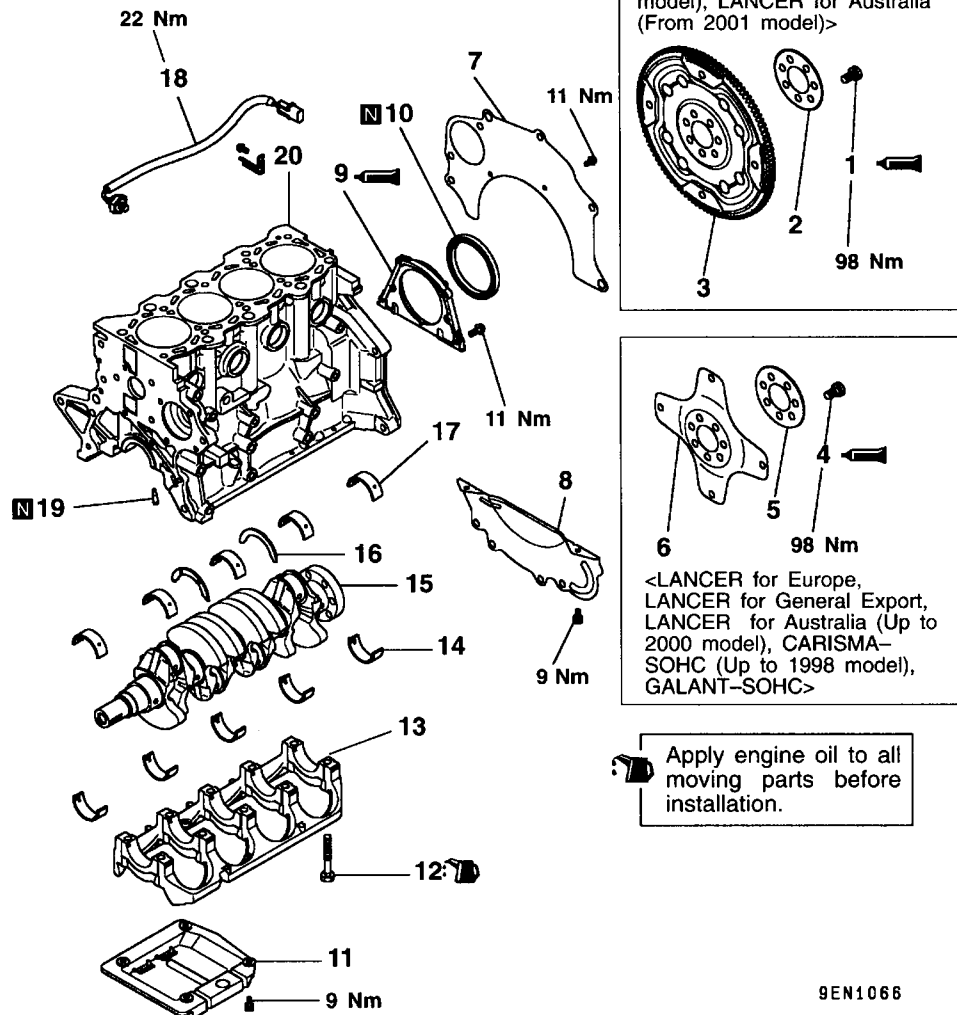
The balance of the flexible flywheel is adjusted in an assembled condition. Removing the bolt, therefore, can cause the flexible flywheel to be out of balance, giving damage to the flywheel.

# REMOVAL AND INSTALLATION (AUTOMATIC TRANSMISSION)

MAIN

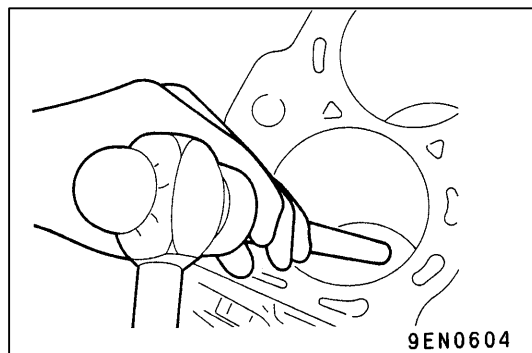
Group  
11

11B



## Removal steps

- |     |                                 |     |                                |
|-----|---------------------------------|-----|--------------------------------|
| ▶F◀ | 1. Flywheel bolt                | ▶C◀ | 12. Bearing cap bolt           |
| ▶F◀ | 2. Adaptor plate                | ▶C◀ | 13. Bearing cap                |
| ▶F◀ | 3. Drive plate                  | ▶B◀ | 14. Crankshaft bearing, lower  |
| ▶F◀ | 4. Drive plate bolt             | ▶B◀ | 15. Crankshaft                 |
| ▶F◀ | 5. Adapter plate                | ▶B◀ | 16. Thrust plate               |
| ▶F◀ | 6. Drive plate                  | ▶B◀ | 17. Crankshaft bearing, upper  |
| ▶F◀ | 7. Rear plate                   | ▶A◀ | 18. Knock sensor<where fitted> |
| ▶F◀ | 8. Bell housing cover           | ▶A◀ | 19. Oil jet <where fitted>     |
| ▶E◀ | 9. Rear oil seal case           |     | 20. Cylinder block             |
| ▶D◀ | 10. Oil seal                    |     |                                |
| ▶D◀ | 11. Baffle plate <where fitted> |     |                                |



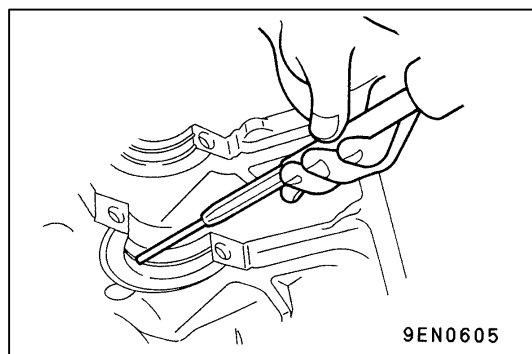
## REMOVAL SERVICE POINT

### ◀A▶ OIL JET REMOVAL

- (1) Knock out the oil jets using an appropriate metal rod.

#### Caution

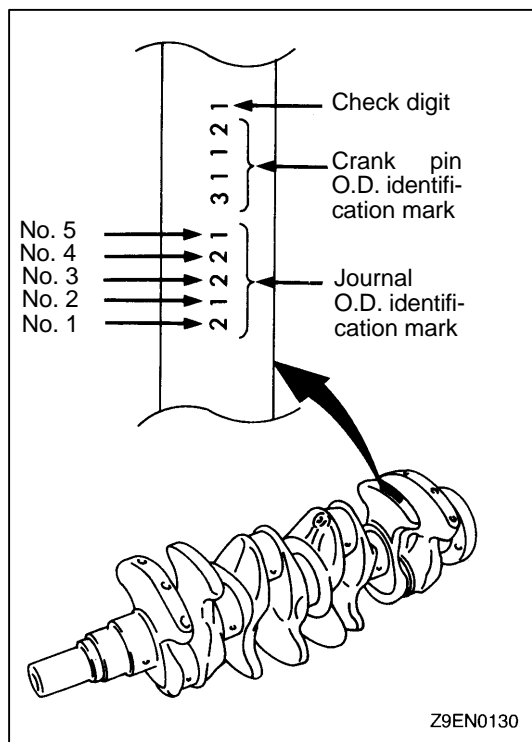
1. Be careful not to scratch the cylinder wall.
2. Do not reuse the removed oil jets.



## INSTALLATION SERVICE POINTS

### ▶A◀ OIL JET INSTALLATION

- (1) Using a 4.5 mm diameter pin punch, drive in the oil jet to the crankshaft journal until it seats to the bottom.

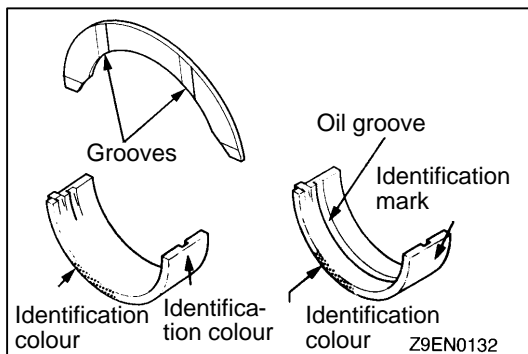
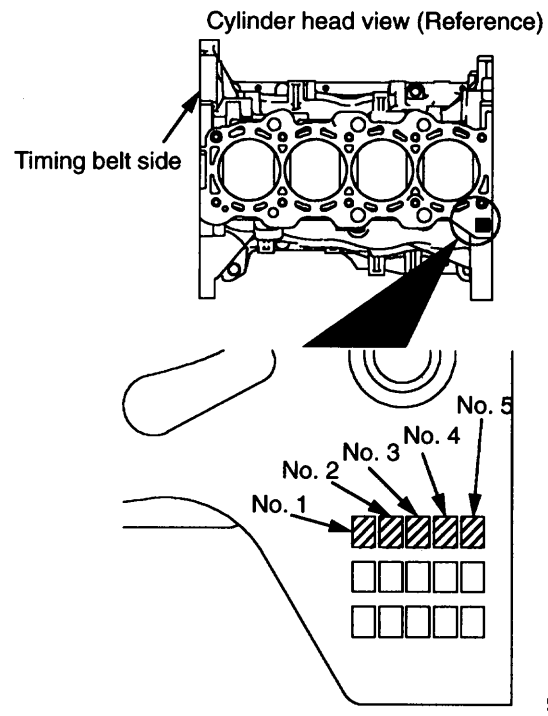
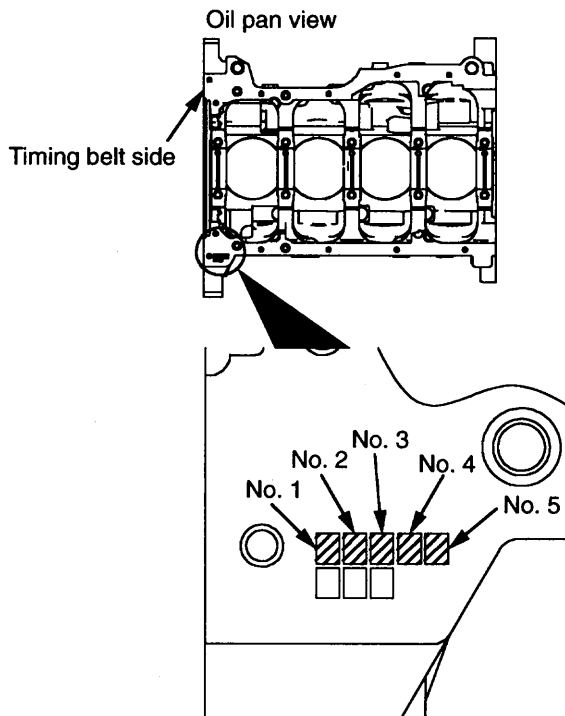
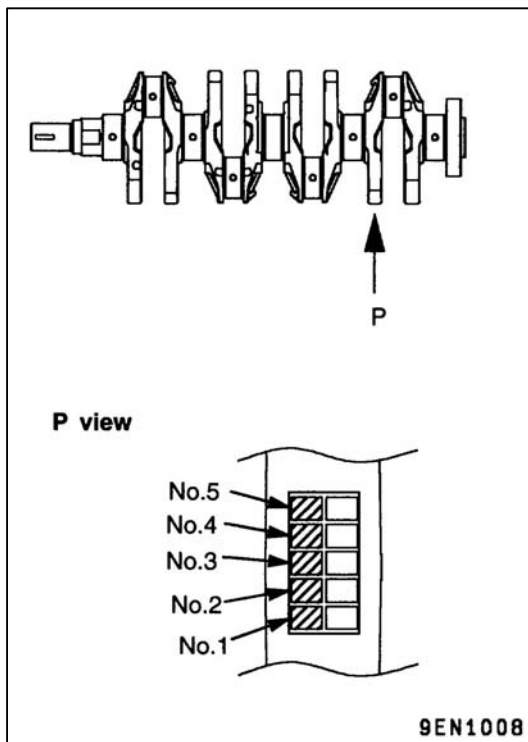


### ▶B◀ CRANKSHAFT BEARING INSTALLATION

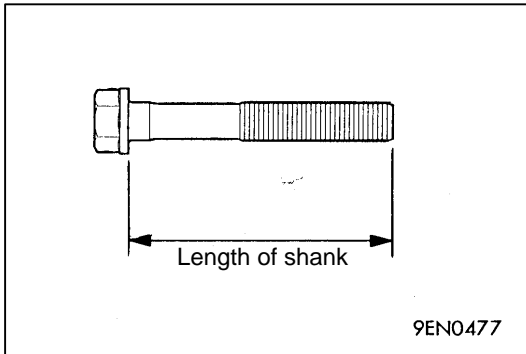
- (1) When the bearings are to be replaced, select correct ones and install them in the correct positions according to the identification marks stamped on the crankshaft and the top surface of the cylinder block.

Crankshaft journal	Cylinder block bearing bore	Crankshaft bearing	
Identification mark	Identification mark	Identification mark (service parts)	Identification colour (Line production parts)
1	0	1	Brown
	1	2	Black
	2	3	Green
2	0	2	Black
	1	3	Green
	2	4	Yellow
3	0	3	Green
	1	4	Yellow
	2	5	Pink*

\*: Older bearings may be marked in red.



- (2) Install the bearings having an oil groove to the cylinder block.
- (3) Install the bearings having no oil groove on the bearing caps.
- (4) Install the thrust bearings at the No. 3 upper bearing with the grooved side towards the crank web.

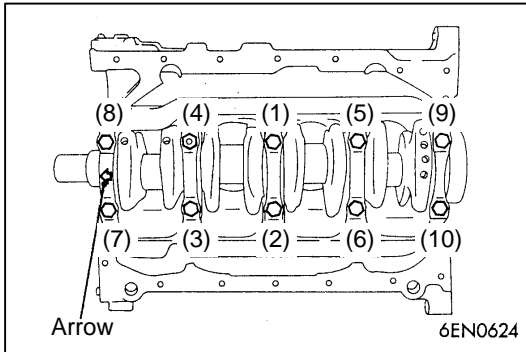


### ►C◄ BEARING CAP/BEARING CAP BOLT INSTALLATION

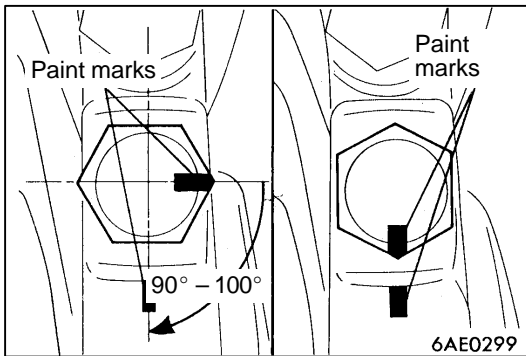
- (1) Install the bearing caps so that their arrows are positioned on the time belt side.
- (2) When installing the bearing cap bolts, check that the shank length of each bolt meets the limit. If the limit is exceeded, replace the bolt.

**Limit: max. 71.1 mm**

- (3) Apply engine oil to the threaded portion and bearing surface of the bolt.



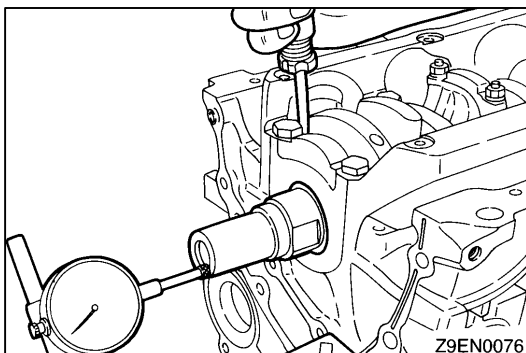
- (4) Tighten the bearing cap bolts to 25 Nm torque in the tightening sequence.



- (5) Make a paint mark on the head of each bolt.
- (6) Make a paint mark on the area around the bolt bearing surface at location 90° to 100° in the direction of tightening the bolt, as referenced from the paint mark on the bolt head.
- (7) Give a 90° to 100° turn to the bolts in the tightening sequence. Make sure that the paint mark on the bolt and that on the area around the bolt bearing surface are in alignment.

#### Caution

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

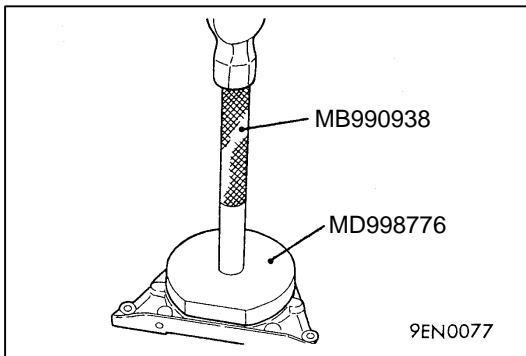


- (8) After installing the bearing caps, make sure that the crankshaft turns smoothly and the end play is correct. If the end play exceeds the limit, replace crankshaft bearings.

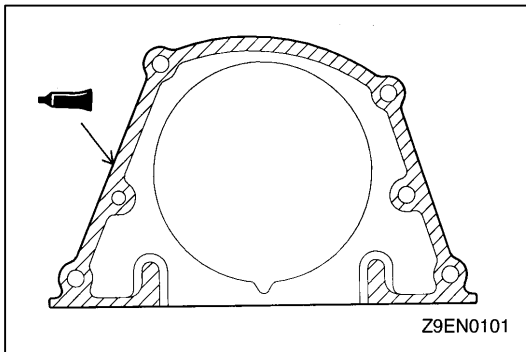
**Standard value: 0.05 – 0.25 mm**

**Limit: 0.4 mm**





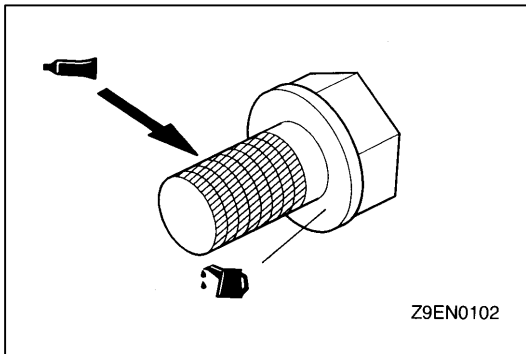
## ►D◄ OIL SEAL INSTALLATION



## ►E◄ SEALANT APPLICATION TO OIL SEAL CASE

**Specified sealant:**

**Mitsubishi Genuine Part No. MD970389 or equivalent**



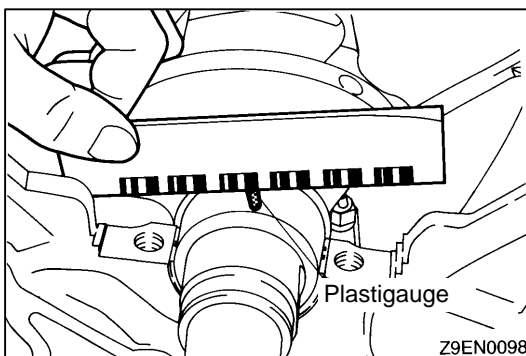
## ►F◄ DRIVE PLATE BOLT/FLYWHEEL BOLT INSTALLATION

- (1) Remove all the remaining sealant from bolts and thread holes of crankshaft.
- (2) Apply engine oil to the flange of bolt.
- (3) Apply engine oil into the thread holes of crankshaft.
- (4) Apply specified sealant to the thread of bolts.

**Specified sealant:**

**3M Nut Locking Part No. 4171 or equivalent**

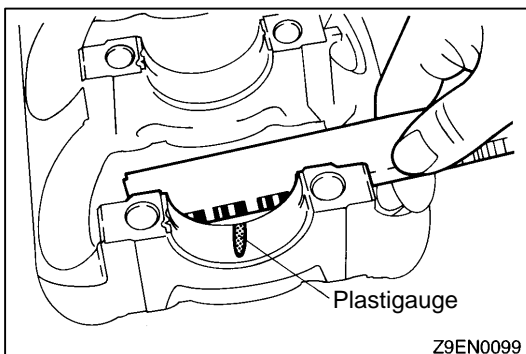
- (5) Tighten the bolts to specified torque.



## INSPECTION

### CRANKSHAFT JOURNAL OIL CLEARANCE (PLASTIGAUGE METHOD)

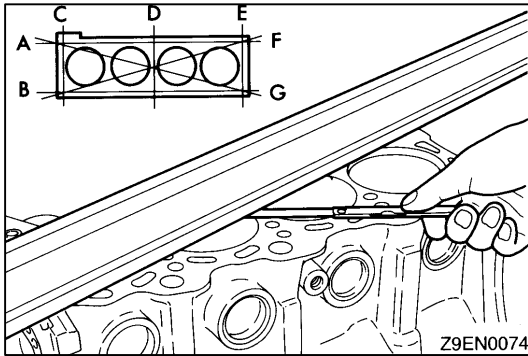
- (1) Remove oil from the crankshaft journal and the crankshaft bearing.
- (2) Install the crankshaft.
- (3) Cut the Plastigauge to the same length as the width of bearing and place it on the journal in parallel with its axis.



- (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 Plastigauge at its widest part by using a scale printed on the Plastigauge package.

**Standard value: 0.02 – 0.04 mm**

**Limit: 0.1 mm**



## CYLINDER BLOCK

- (1) Using a straightedge and thickness gauge, check the block top surface for warpage. Make sure that the surface is free from gasket chips and other foreign matter.

**Standard value: 0.05 mm or less**

**Limit: 0.1 mm**

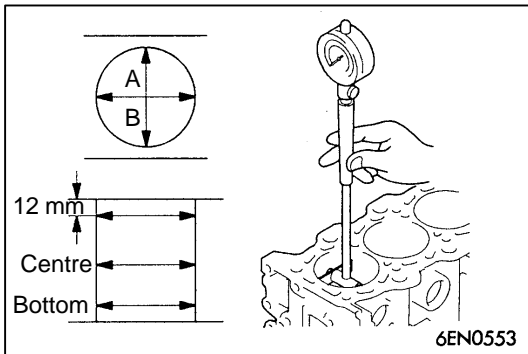
- (2) If the distortion is excessive, correct within the allowable limit or replace.

**Grinding limit: 0.2 mm**

**The total thickness of the stock allowed to be removed from cylinder block and mating cylinder head 0.2 mm at maximum.**

**Cylinder block height (when new):  
286.7 mm**

- (3) Check the cylinder walls for scratches and seizure. If defects are evident, correct (bored to oversize) or replace.

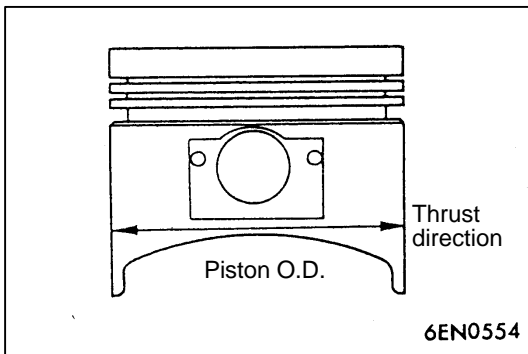


- (4) Using a cylinder gauge, measure the cylinder bore and cylindricity. If worn badly, correct the cylinder to an oversize and replace the piston and piston rings. Measure at the points shown in illustration.

**Standard value:**

**Cylinder inner diameter:  
81.50 – 81.53 mm**

**Out-of-roundness and taper of cylinder bore: 0.01 mm or less**



## BORING CYLINDER

- (1) Oversize pistons to be used should be determined on the basis of the largest bore cylinder.

### Piston size identification

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

#### NOTE

Size mark is stamped on the piston top.

- (2) Measure outside diameter of piston to be used. Measure it in 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 (honing margin)**

- (4) Bore all cylinders to the calculated boring finish dimension.

**Caution**

**To prevent distortion that may result from temperature rise during honing, bore cylinders, in the order of No. 2, No. 4, No.1 and No. 3.**

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

**Clearance between piston and cylinder:**

**0.02 – 0.04 mm**

**NOTE**

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