

GENERAL INFORMATION

4G92

Descriptions			4G92-SOHC	4G92-DOHC-MIVEC
Type			In-line OHV, SOHC	In-line OHV, DOHC
Number of cylinders			4	4
Combustion chamber			Pentroof type	Pentroof type
Total displacement dm ³			1,597	1,597
Cylinder bore mm			81.0	81.0
Piston stroke mm			77.5	77.5
Compression ratio			10.0	11.0
Valve timing	Intake valve	Opens (BTDC)	20°, 14°*	17° (Low-speed cam) 47.5° (High-speed cam)
		Closes (ABDC)	42°, 58°*	31° (Low-speed cam) 72.5° (High-speed cam)
	Exhaust valve	Opens (BBDC)	54°, 52°*	41° (Low-speed cam) 70° (High-speed cam)
		Closes (ATDC)	2°, 16°*	11° (Low-speed cam) 35° (High-speed cam)
Lubrication system			Pressure feed, full-flow filtration	Pressure feed, full-flow filtration
Oil pump type			Trochoid type	Trochoid type
Cooling system			Water-cooled forced circulation	Water-cooled forced circulation
Water pump type			Centrifugal impeller type	Centrifugal impeller type

*: LANCER for general export and CARISMA for 6B model

11B 4G9 ENGINE – General Information

4G93

Descriptions			4G93—SOHC	4G93—DOHC	4G93—DOHC—GDI
Type			In-line OHV, SOHC	In-line OHV, DOHC	In-line OHV, DOHC
Number of cylinders			4	4	4
Combustion chamber			Pentroof type	Pentroof type	Pentroof type
Total displacement dm ³			1,834	1,834	1,834
Cylinder bore mm			81.0	81.0	81.0
Piston stroke mm			89.0	89.0	89.0
Compression ratio			10.0, 9.5	10.5	11.7 *1, 12.0 *2
Valve timing	Intake valve	Opens (BTDC)	14°	20°	15°
		Closes (ABDC)	50°	60°	56°
	Exhaust valve	Opens (BBDC)	58°	61°	55°
		Closes (ATDC)	10°	15°	15°
Lubrication system			Pressure feed, full-flow filtration	Pressure feed, full-flow filtration	Pressure feed, full-flow filtration
Oil pump type			Trochoid type	Trochoid type	Trochoid type
Cooling system			Water-cooled forced circulation	Water-cooled forced circulation	Water-cooled forced circulation
Water pump type			Centrifugal impeller type	Centrifugal impeller type	Centrifugal impeller type

*1; Up to 1999 model

*2: From 2000 model

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SPECIFICATIONS

SERVICE SPECIFICATIONS

Items			Standard value	Limit
Timing belt				
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	—
Rocker arms and camshaft				
Camshaft cam height mm	4G92-SOHC*1	Intake	37.34	36.84
		Exhaust	36.79	36.29
	4G92-SOHC*2	Intake	37.78	37.28
		Exhaust	37.83	37.33
	4G93-SOHC	Intake	37.53	37.03
		Exhaust	37.64	37.14
	4G93-DOHC	Intake	35.31	34.81
		Exhaust	35.20	34.70
	4G93-DOHC-GDI*3	Intake	35.49	34.99
		Exhaust	34.91	34.41
	4G93-DOHC-GDI*4	Intake	35.49	34.99
		Exhaust	34.73	34.23
Valve clearance mm		Intake	0.09	—
		Exhaust	0.20	—
Camshaft journal O.D. mm		SOHC	26.0	—
		DOHC	45.0	—
Cylinder head and valve				
Cylinder head gasket surface flatness mm			Less than 0.03	0.2
Grinding limit of cylinder head gasket surface mm			—	0.2*
*Total resurfacing depth of both cylinder head and cylinder block				

*1: LANCER for Europe and CARISMA for Europe

*2: LANCER for general export and CARISMA for 6B model

*3: For CARISMA

*4: For PAJERO io

11B 4G9 ENGINE – Specifications

Items			Standard value	Limit
Cylinder head overall height mm		SOHC	119.9 – 120.1	–
		DOHC	131.9 – 132.1	–
		DOHC–MIVEC	119.8 – 120.0	–
		DOHC–GDI	131.9 – 132.1	–
Thickness of valve head (margin) mm	SOHC	Intake	1.0	0.5
		Exhaust	1.3	0.8
	DOHC	Intake	1.0	0.5
		Exhaust	1.2	0.7
Valve overall height mm	SOHC	Intake	110.15	109.65
		Exhaust	113.70	113.20
	DOHC	Intake	104.19	103.69
		Exhaust	103.87	103.37
	DOHC–MIVEC	Intake	115.63	115.13
		Exhaust	115.63	115.13
	DOHC–GDI	Intake	104.19	103.69
		Exhaust	103.87	103.37
Valve spring free length mm		SOHC	50.9	49.9
		DOHC	45.0	44.0
		DOHC–MIVEC	51.5	50.5
		DOHC–GDI	44.8	43.8
Valve spring out-of-squareness			Max. 2°	4°
Valve stem to valve guide clearance mm	Except DOHC–GDI for PAJERO io	Intake	0.02 – 0.05	0.10
		Exhaust	0.05 – 0.09	0.15
	DOHC–GDI for PAJERO io	Intake	0.02 – 0.05	0.10
		Exhaust	0.04– 0.06	0.15
Valve seat valve contact width mm			0.9 – 1.3	–
Valve guide projection from cylinder head upper surface mm		SOHC	14.0	–
		DOHC	19.0	–
Valve stem projec-tion mm	SOHC	Intake	49.30	49.80
		Exhaust	49.35	49.85
	DOHC	Intake	46.70	47.20
		Exhaust	46.65	47.15
	DOHC–MIVEC	Intake	58.13	58.63
		Exhaust	57.85	58.35
	DOHC–GDI	Intake	46.70	47.20
		Exhaust	46.65	47.15
Cylinder head bolt shank length mm			–	96.4

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11B 4G9 ENGINE – Specifications

Items		Standard value	Limit
Valve stem O.D. mm		6.0	—
Valve face angle		45° – 45.5°	—
Valve spring load/installed height N/mm	SOHC	216/44.2	—
	DOHC	255/44.5	—
	DOHC–MIVEC	255/44.5	—
	DOHC–GDI	196/37.5	—
Valve guide I.D. mm		6.0	—
Font case, oil pump and oil pan			
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
Piston and connecting rod			
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	4G92, 4G93	0.25 – 0.40
		4G94	0.15 – 0.30
Piston ring end gap mm	No. 2		0.40 – 0.55
	Oil ring	SOHC	0.20 – 0.60
		DOHC	0.10 – 0.35
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	4G92, 4G93	81.0	—
	4G94	81.5	—

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11B 4G9 ENGINE – Specifications

Items		Standard value	Limit
Crankshaft, cylinder block, flywheel and drive plate			
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	4G92	243.5	–
	4G93	263.5	–
	4G94	286.7	–
Cylinder block I.D. mm	4G92, 4G93	81.0	–
	4G94	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	–

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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	SOHC	0.30 O.S.	31.80 – 31.83
		0.60 O.S.	32.10 – 32.13
	DOHC	0.30 O.S.	34.30 – 34.32
		0.60 O.S.	34.60 – 34.62
Oversize rework dimensions of exhaust valve seat hole mm	SOHC	0.30 O.S.	29.30 – 29.32
		0.60 O.S.	29.60 – 29.62
	DOHC	0.30 O.S.	30.80 – 30.82
		0.60 O.S.	31.10 – 31.13
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
Alternator and ignition system	
Oil level gauge	13
Distributor	12
Ignition coil	10
Spark plug	25
Crankshaft bolt	181
Alternator brace (M10)	49
Alternator brace (M8)	23
Lock bolt	23
Adjusting bolt	10
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 4G9 ENGINE – 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
Timing belt	
Camshaft sprocket bolt	88
Cam position sensor <DOHC>	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
Fuel system and emission system	
Breather tube	21
Fuel pump	18
Carburetor	17
EGR valve	21
Fuel return pipe	9
Delivery pipe	12
Fuel pressure regulator	9
Throttle body stay	23
Throttle body	19
Vacuum hose and pipe assembly	10
Solenoid valve assembly	11

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11B 4G9 ENGINE – Specifications

Items	Nm
Intake manifold and exhaust manifold	
Exhaust manifold (M10)	29
Exhaust manifold (M8)	18
Exhaust manifold bracket (M8)	19
Exhaust manifold bracket (M10)	35
Engine hanger	12
Oil level gauge guide	14
Boost sensor	5
Intake air temperature sensor	13
Heat protector	13
Intake manifold	20
Intake manifold stay	30
Oxygen sensor	44
Water pump and water hose	
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	14
Engine coolant temperature gauge unit	10
Engine coolant temperature sensor	29
Water fitting	23
Rocker arms and camshaft	
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

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11B 4G9 ENGINE – Specifications

Items	Nm
Cylinder head and valves	
Cylinder head bolt	74 Nm and then completely loosen, finally tighten 20 Nm + 90° + 90°
Oil pressure switch	10
Front case and oil pump	
Oil pump cover	10
Oil pump case	14
Relief plug	44
Oil screen	19
Oil pan	7
Upper oil pan <Only M6 × 121>	7
Upper oil pan <Except M6 × 121>	11
Upper oil pan <M8>	24
Lower oil pan	7
Cover	7
Baffle plate <For CARISMA, SPACE STAR only>	7
Drain plug	39
Oil pressure switch	10
Baffle plate mounting bolt	7
Piston and connecting rod	
Connecting rod cap nut	20 + 90° to 100°
Crankshaft, cylinder block, flywheel and drive plate	
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

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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.

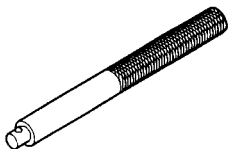
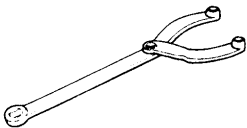
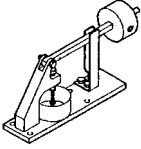
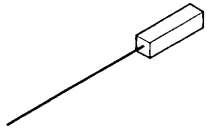
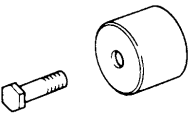
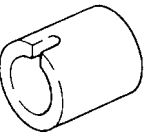
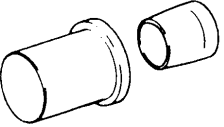
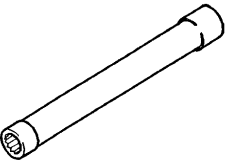
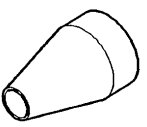
Applied FIPG bead should be of the specified size and without breaks. Also be sure to encircle the bolt hole circumference with a completely continuous bead. The FIPG can be wiped away unless it is hardened. While the FIPG is still moist (in less than 15 minutes), mount the parts in position. When the 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.

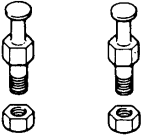
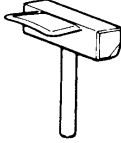
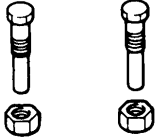
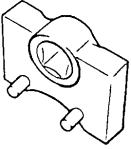
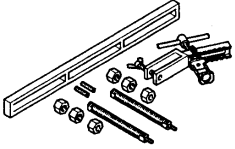
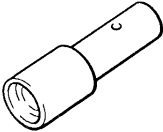
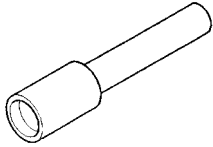
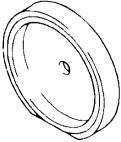
SPECIAL TOOLS

MAIN

Group
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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 4G9 ENGINE – Special Tools

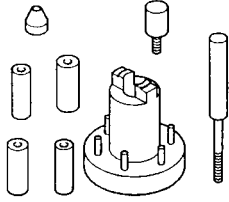
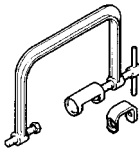
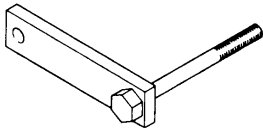
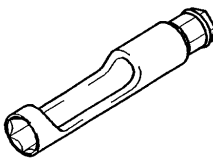
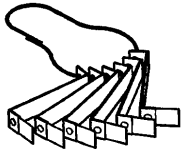
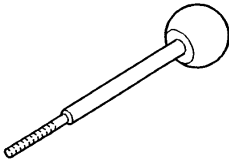
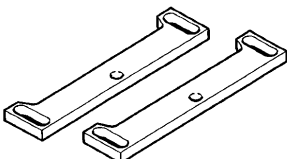
Tool	Number	Name	Use
	MD998719	Pulley holder pin (2)	Use with MB990767
	MD998727	Oil pan remover	Removal of the oil pan
	MD998754	Pin	Use with MB990767
	MD998767	Tensioner pulley socket wrench	Adjustment of timing belt tension
	MD998772	Valve spring compressor	Removal and installation of valve and related 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
4G9

11B 4G9 ENGINE – 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

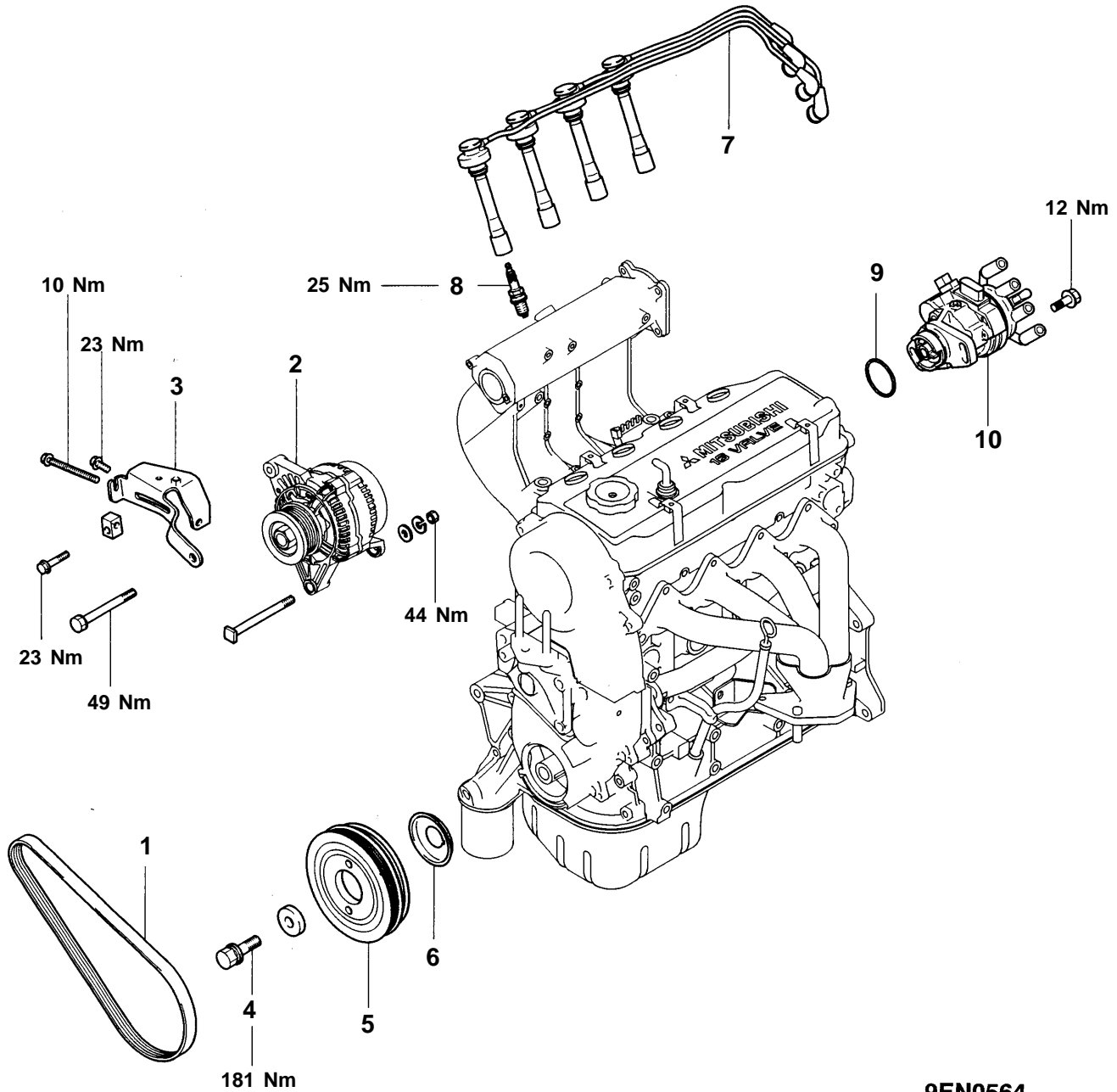
11B
4G9

ALTERNATOR AND IGNITION SYSTEM

REMOVAL AND INSTALLATION <SOHC> (Engines with distributor)

MAIN

Group
11

11B
4G9


9EN0564

Removal steps

1. Drive belt*
2. Alternator
3. Alternator brace
4. Crankshaft bolt
5. Crankshaft pulley

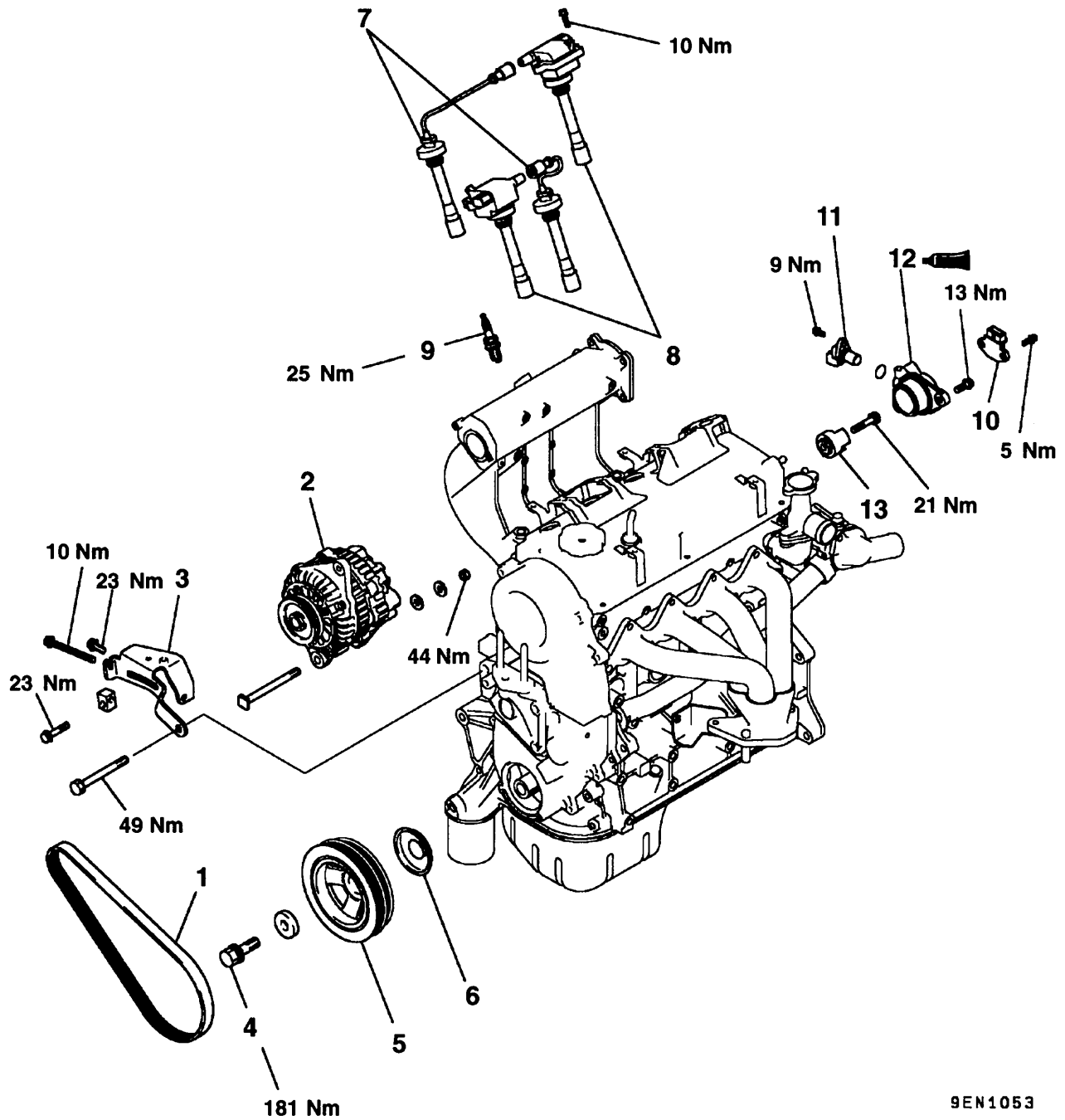
6. Flange
7. Spark plug cable
8. Spark plug
9. O-ring
10. Distributor

NOTE:

*: For details of adjustment, refer to the relevant model's chassis workshop manual.



REMOVAL AND INSTALLATION (Engines without distributor)



9EN1053

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
11. Cam position sensor
12. Cam position sensor support
13. Cam position sensing cylinder

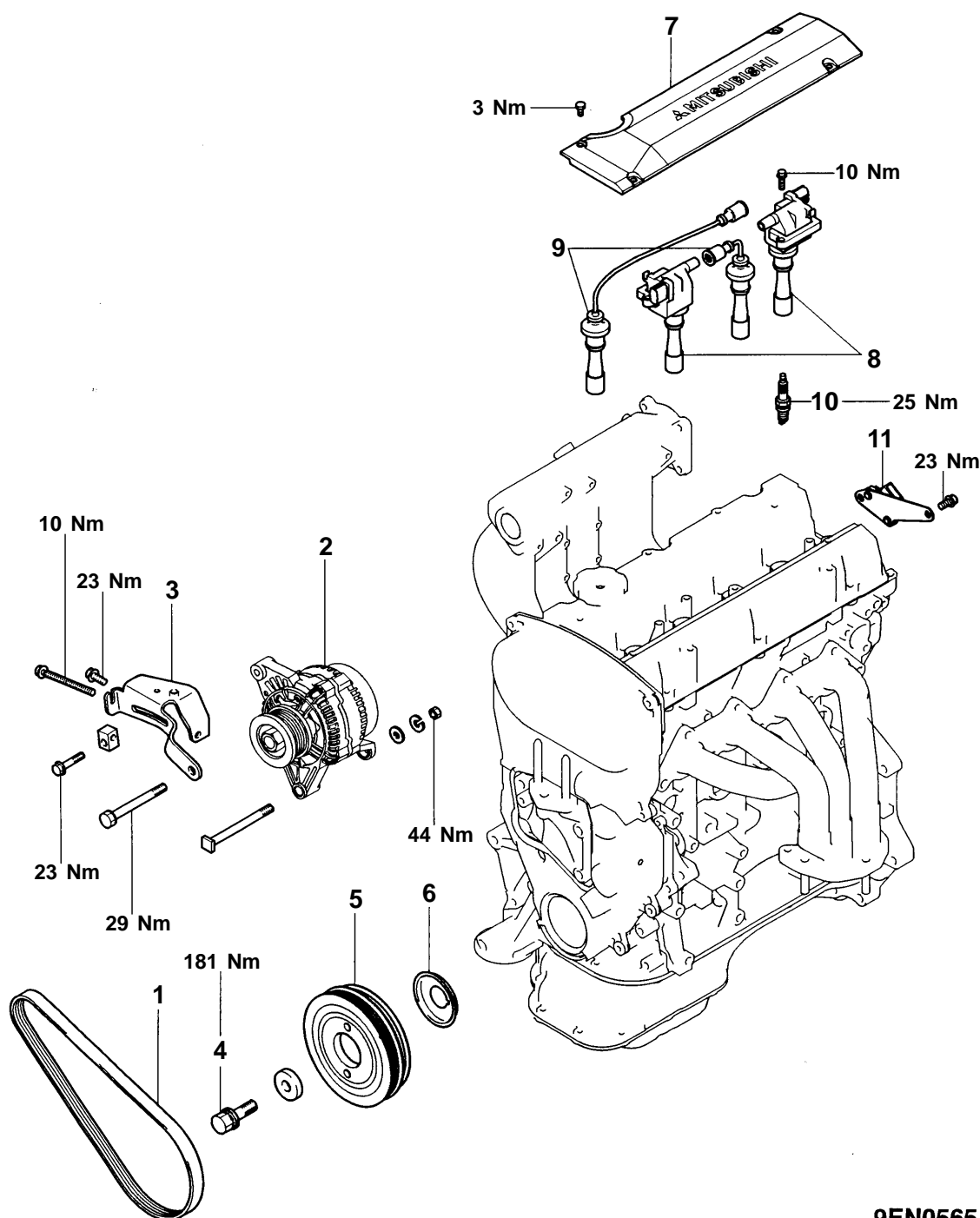
NOTE:

*: For details of adjustment, refer to the relevant model's chassis workshop manual.

REMOVAL AND INSTALLATION <DOHC>

MAIN

Group
11

11B
4G9


9EN0565

Removal steps

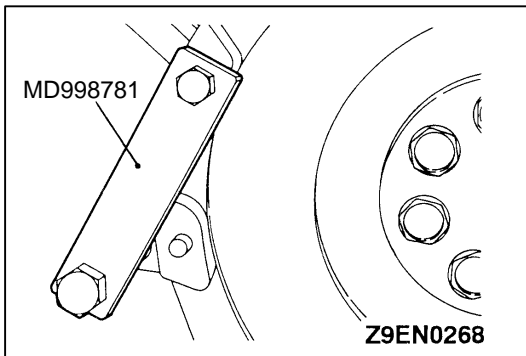
1. Drive belt*
2. Alternator
3. Alternator brace
4. Crankshaft bolt
5. Crankshaft pulley
6. Flange

7. Center cover
8. Ignition coil
9. Spark plug cable
10. Spark plug
11. Ignition failure sensor

NOTE:

*: For details of adjustment, refer to the relevant model's chassis workshop manual.

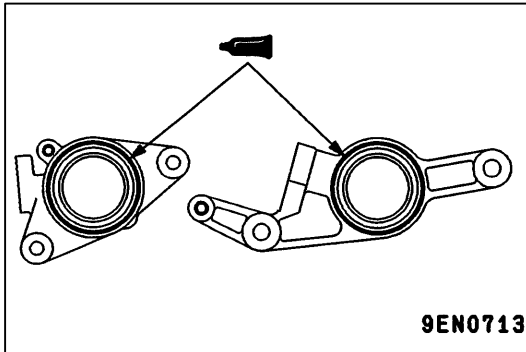
◀A▶ ▶B▶



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.



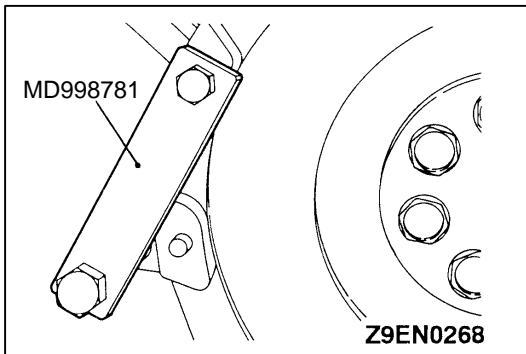
INSTALLATION SERVICE POINTS

▶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.



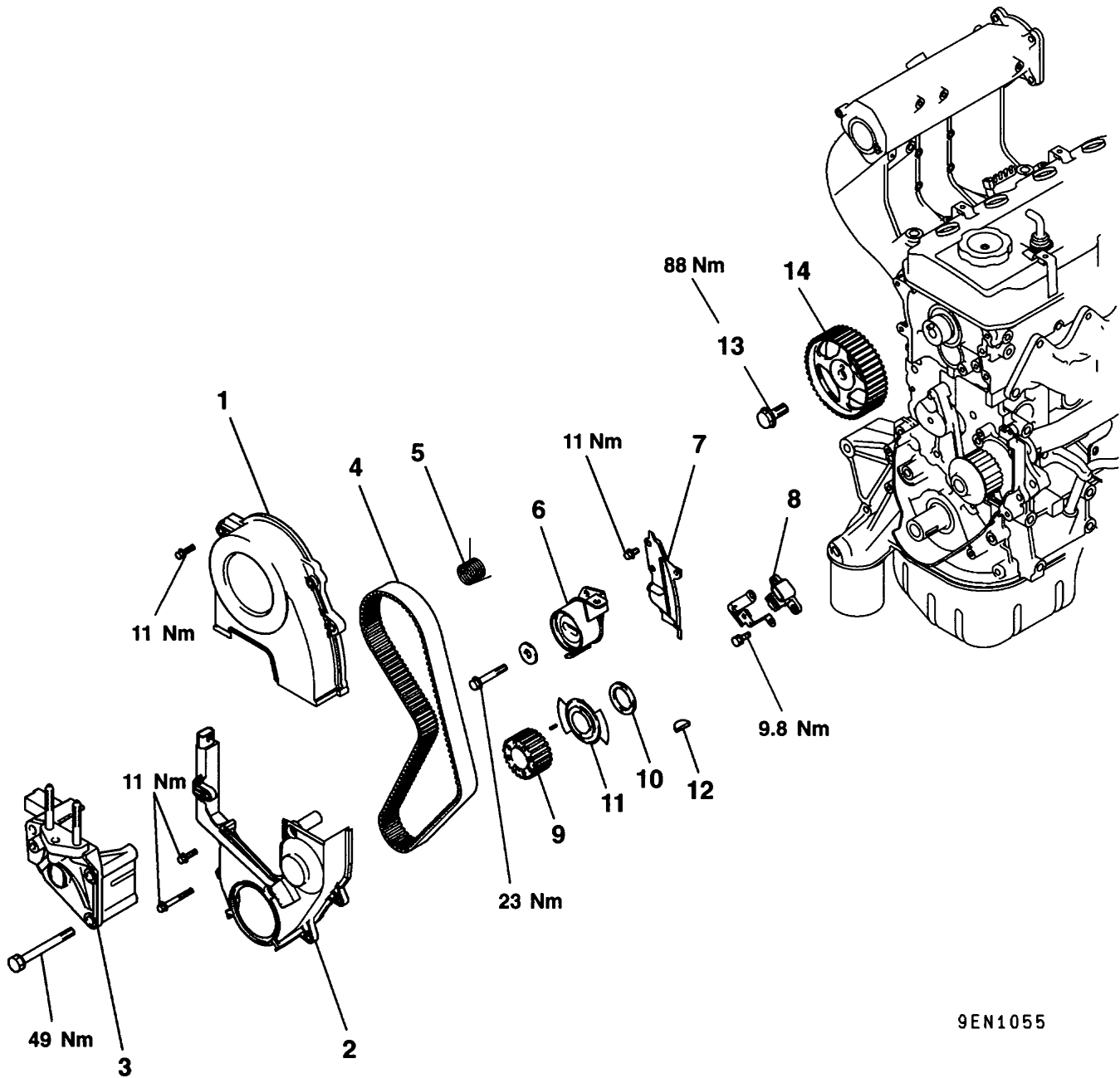
▶B◀ CRANKSHAFT BOLT INSTALLATION

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

REMOVAL AND INSTALLATION <SOHC LANCER from 2001 MODEL>

MAIN

Group
11

11B
4G9


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)

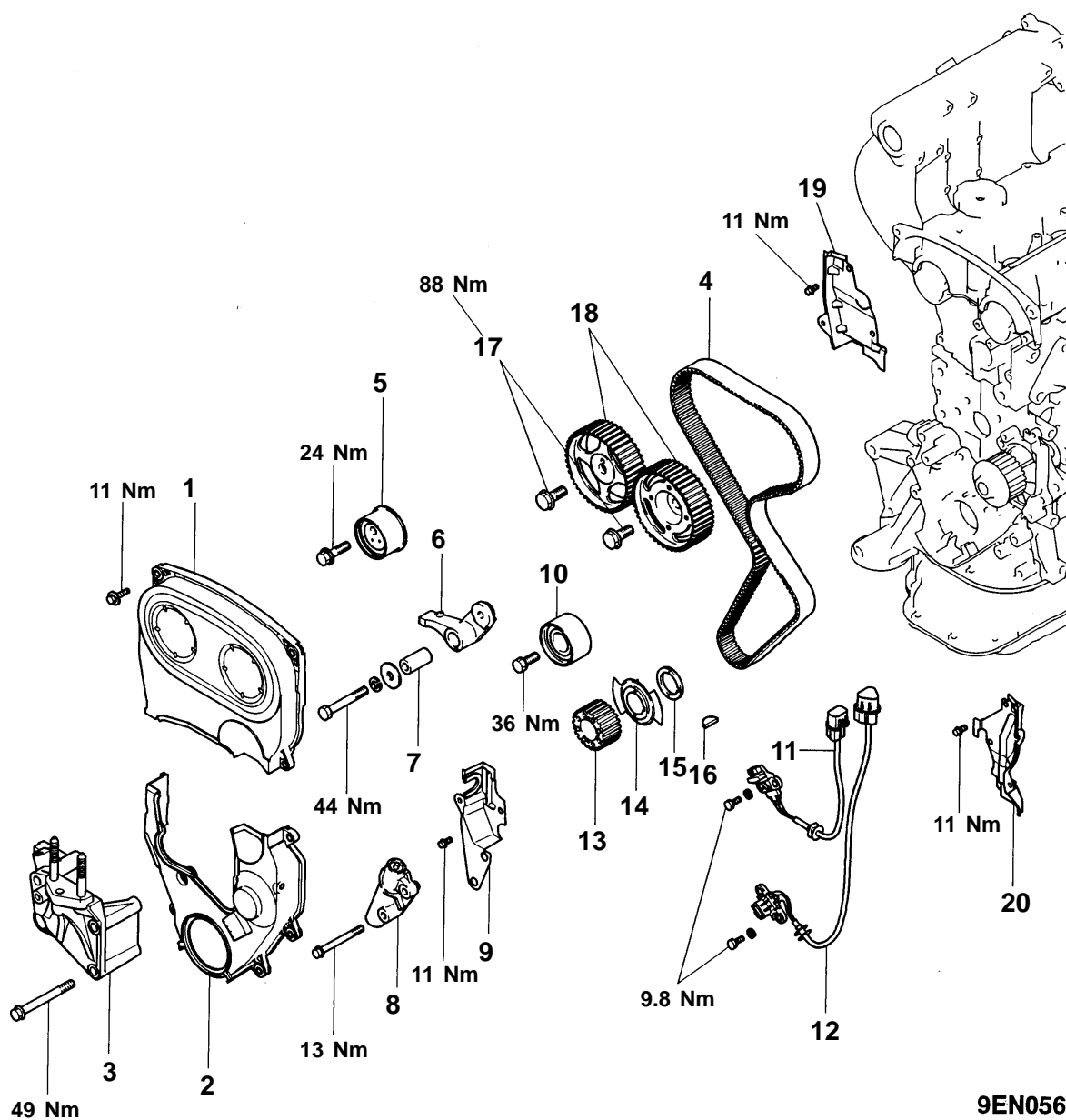
9. Crankshaft sprocket
10. Crankshaft spacer
(Engines without distributor)
11. Crankshaft sensing plate
(Engines without distributor)
12. Crankshaft key
13. Camshaft sprocket bolt
14. Camshaft sprocket



REMOVAL AND INSTALLATION <DOHC>

MAIN

Group
11

11B
4G9


9EN0567

Removal steps

1. Timing belt upper cover
2. Timing belt lower cover
3. Engine support bracket
4. Timing belt
5. Tensioner pulley
6. Tensioner arm
7. Shaft
8. Auto-tensioner
9. Timing belt rear cover
10. Idler pulley

11. Cam position sensor
12. Crank angle sensor
13. Crankshaft sprocket
14. Sensing plate
15. Crankshaft spacer
16. Crankshaft sprocket key
17. Camshaft sprocket bolt
18. Camshaft sprocket
19. Timing belt rear cover
20. Timing belt rear cover

◀A▶ ▶F▶

▶E▶

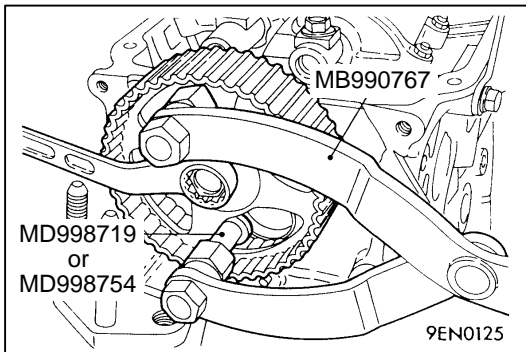
◀B▶ ▶A▶

REMOVAL SERVICE POINTS

◀A▶ TIMING BELT REMOVAL

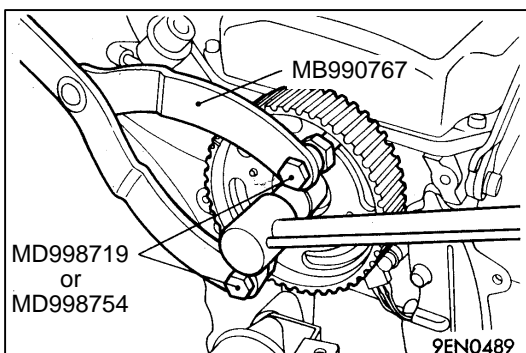
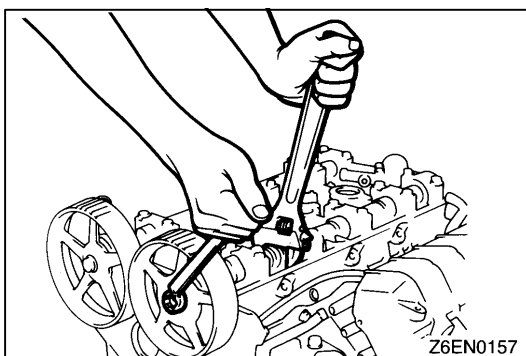
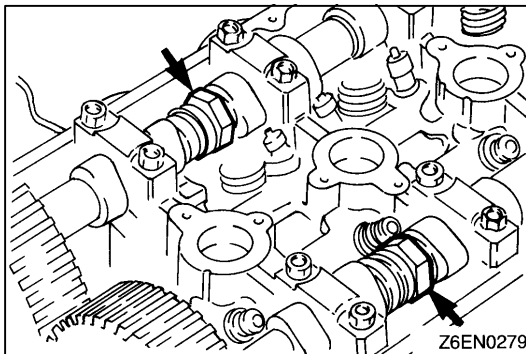
- (1) Mark belt running direction for reinstallation.

◀B▶ CAMSHAFT SPROCKET BOLT REMOVAL



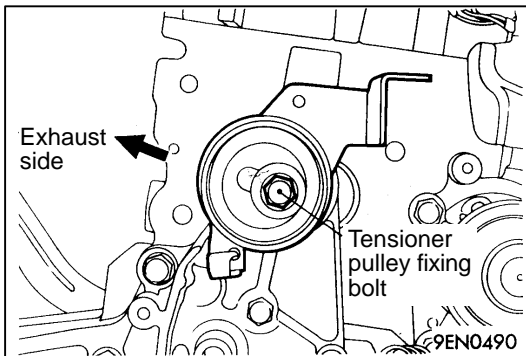
<With rocker cover removed> (Except SOHC)

- (1) Use a wrench to hold the hexagonal part of the camshaft, and then remove the camshaft sprocket mounting bolt.



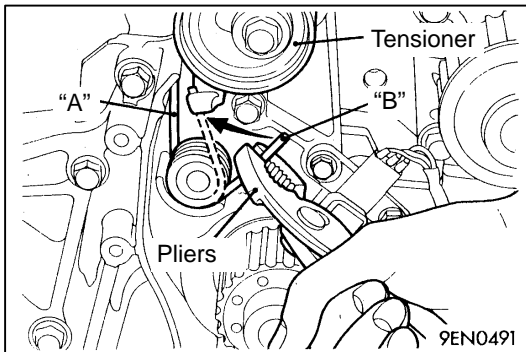
INSTALLATION SERVICE POINTS

▶A◀ CAMSHAFT SPROCKET BOLT INSTALLATION



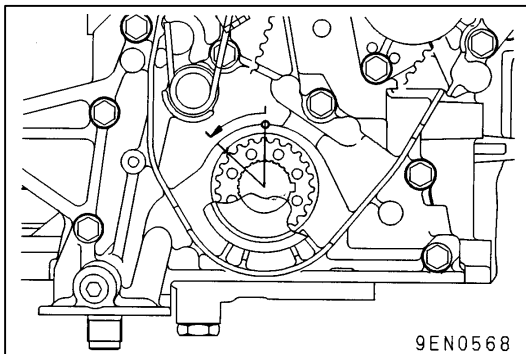
►B◄ TIMING BELT TENSIONER INSTALLATION

- (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.

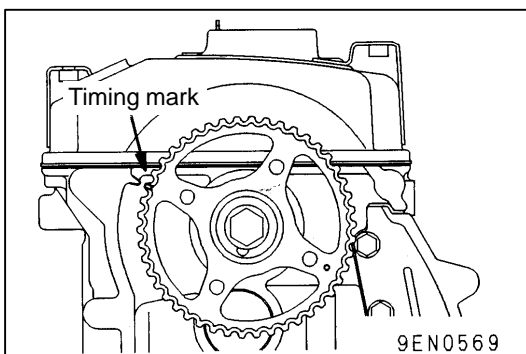


►D◄ TIMING BELT INSTALLATION

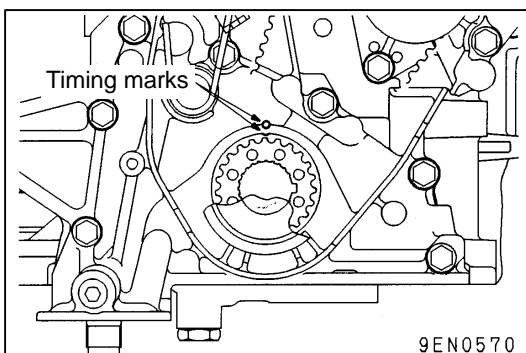
- (1) Turn the crankshaft sprocket by three teeth from the timing mark.

Caution

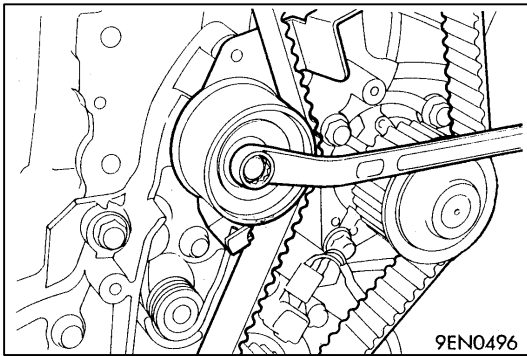
Aligning the timing marks positions the piston to the top dead centre. Then, if the camshaft turns, the valves may hit and damage the pistons.



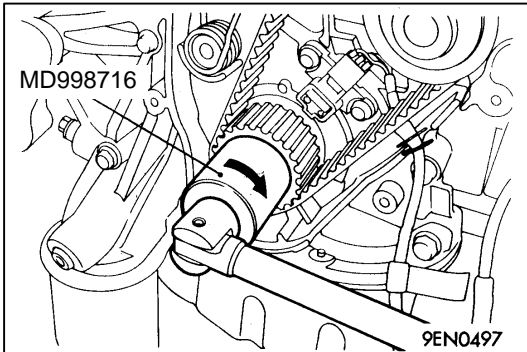
- (2) Check that the timing belt tensioner and tensioner spring are installed correctly. (Refer to the service points B and C.)
- (3) Align the timing marks on the camshaft sprocket to that on the cylinder head.



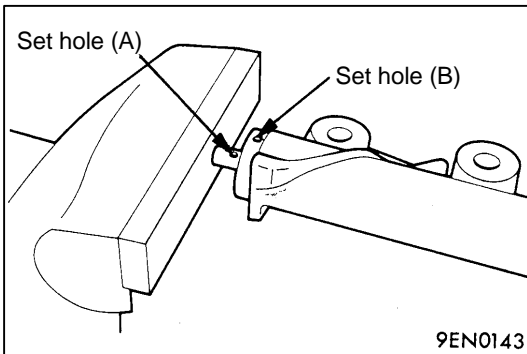
- (4) Align the timing mark on the crankshaft sprocket to that on the oil pump case.
- (5) Place the timing belt over the sprocket according in the following order.
 1. Crankshaft sprocket
 2. Water pump sprocket
 3. Camshaft sprocket
 4. Tension pulley



- (6) Slightly loosen the tensioner pulley fixing bolt which is tightened temporarily to tighten the belt by a force of the tensioner spring.

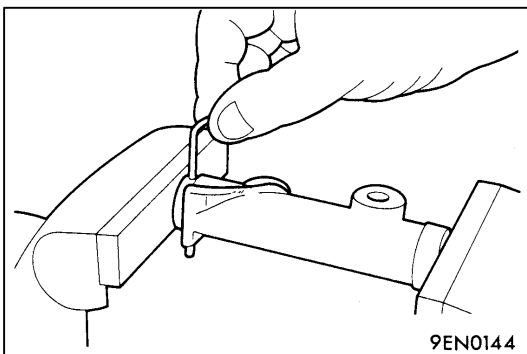


- (7) Turn the crankshaft clockwise by two turns.
- (8) Check that the timing marks are aligned.
- (9) Tighten the fixing bolt of the tensioner pulley.



►E◄ AUTO-TENSIONER INSTALLATION

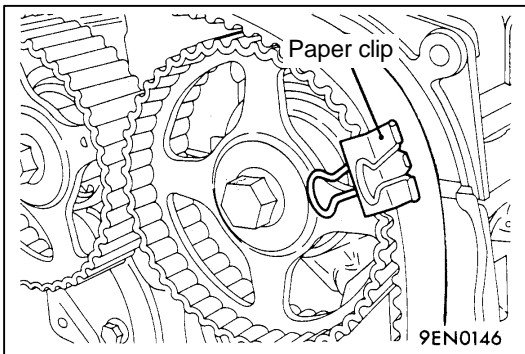
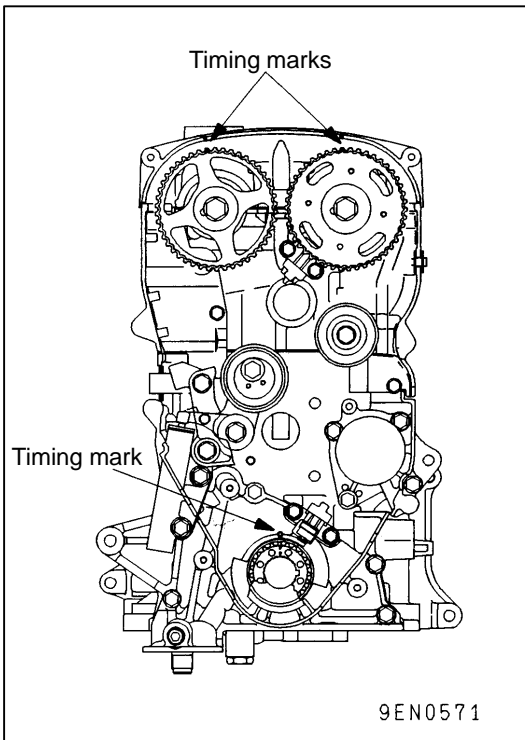
- (1) If the auto-tensioner rod is fully extended, set it in the retracted position with the following procedure.
 - 1) Hold the auto-tensioner in a vice, being careful not to tilt it.
 - 2) Slowly close the vice to force the rod in to align hole (A) of the rod with the set hole (B).
 - 3) Insert a 2.0-mm-Allen key in diameter or similar into the set holes.
 - 4) Remove the auto-tensioner from the vice.



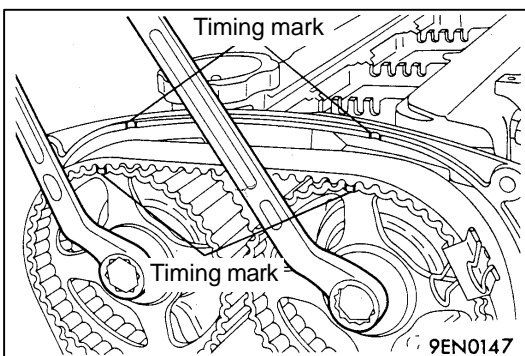
- (2) Install the auto-tensioner
Leave the align key until installation of the timing belt is completed.

►F◄ TIMING BELT INSTALLATION

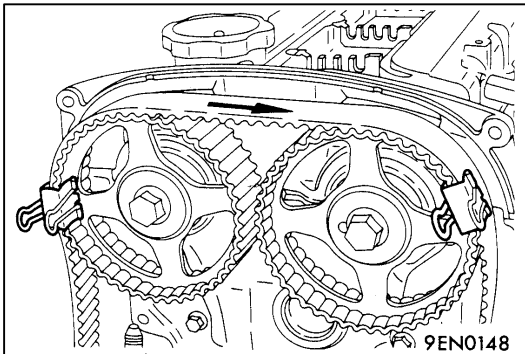
- (1) Make sure that the auto-tensioner is installed properly. (Refer to service point F.)
- (2) Align the timing mark on each sprocket with the corresponding mark on the timing belt.
- (3) Turn the crankshaft sprocket one half the tooth width counterclockwise.



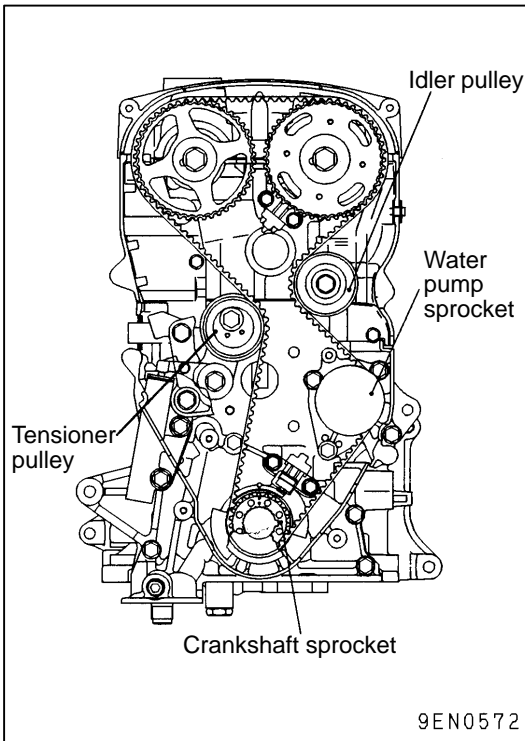
- (4) Fit the timing belt to the intake camshaft sprocket and secure with a paper clip at the illustrated position.



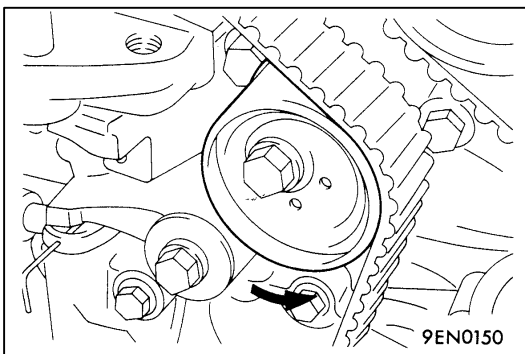
- (5) Use two wrenches to fit the timing belt to the exhaust sprocket while aligning the timing marks.



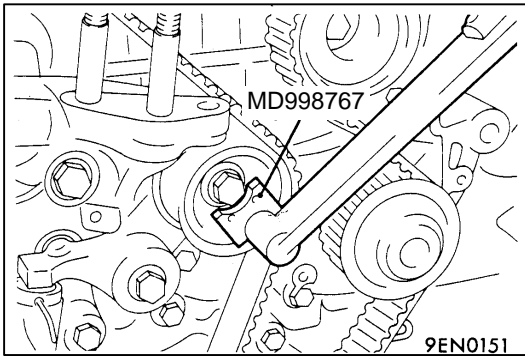
- (6) Secure the timing belt with a paper clip at the illustrated position.



- (7) Fit the belt to the idler pulley water pump sprocket, crankshaft sprocket and tensioner pulley in that order.

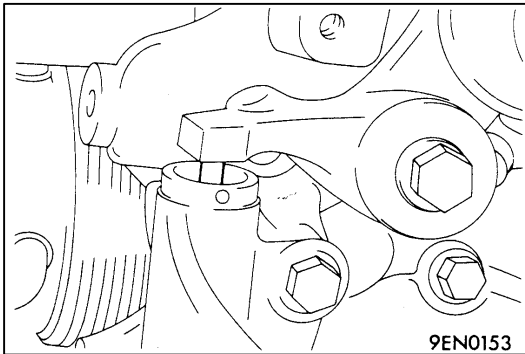


- (8) Raise the tensioner pulley in the direction of an arrow and tighten the tensioner pulley bolt.
(9) Remove the two paper clips.
(10) Make sure that all timing marks are in alignment.
(11) Give a 1/4 counterclockwise turn to the crankshaft. Then turn the crankshaft clockwise to align the timing marks again.



- (12) Install the special tool and a torque wrench to the tensioner pulley.
- (13) Using torque wrench, torque to 2.6 Nm.
- (14) While holding the tensioner pulley to prevent it from turning, tighten the center bolt to the specified torque.
- (15) Give two clockwise turns to the crankshaft and leave as it is for approx. 15 minutes.
- (16) Check if the Allen wrench inserted during installation of the auto-tensioner can be pulled out lightly. If it can be pulled out lightly, the belt is properly tensioned. Therefore, pull out the wrench. The belt is also properly tensioned if the auto-tensioner projection is of standard value.

Standard value: 3.8 – 4.5 mm



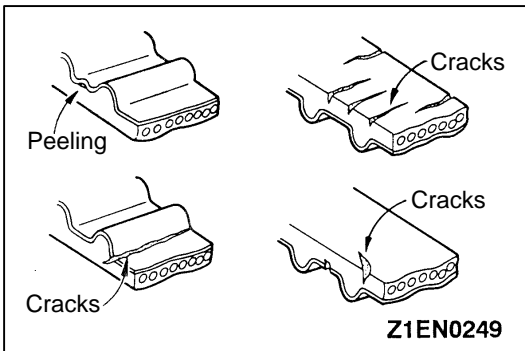
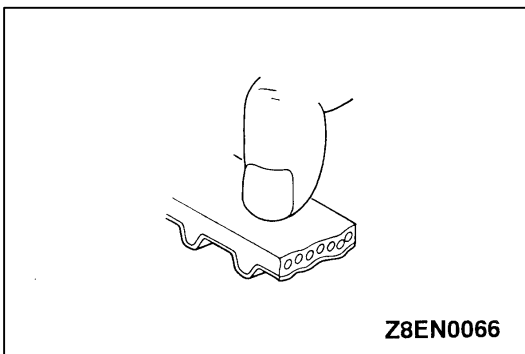
- (17) If the wrench cannot be pulled out lightly, repeat the steps (12) through (15) to obtain appropriate belt tension.

INSPECTION

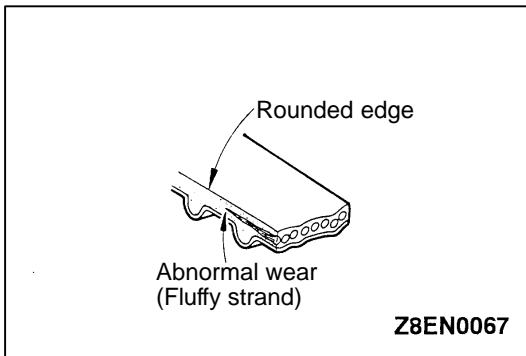
TIMING BELT

Replace belt if any of the following conditions exist.

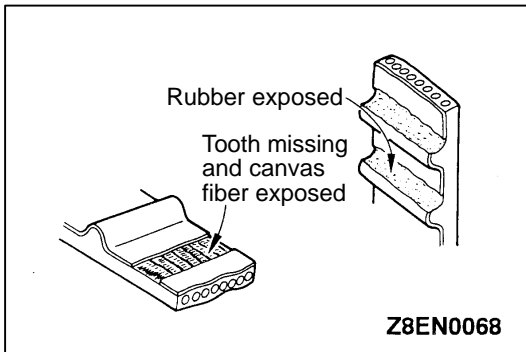
- (1) Hardening of back rubber.
Back side is glossy without resilience and leaves no indent when pressed with fingernail.



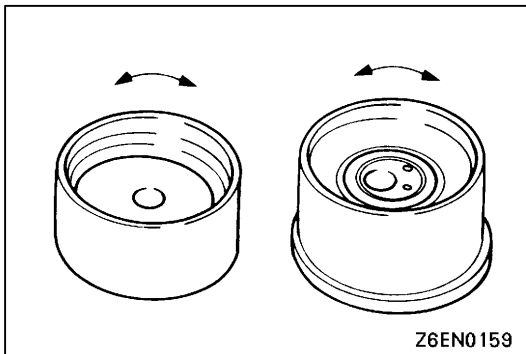
- (2) Cracks on rubber back.
- (3) Cracks or peeling of canvas.
- (4) Cracks on tooth bottom.
- (5) Cracks on belt sides.



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

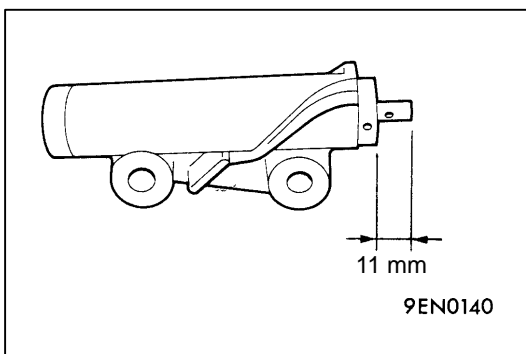


- (7) Abnormal wear on teeth.
(8) Missing tooth.



TENSIONER PULLER, IDLER PULLEY

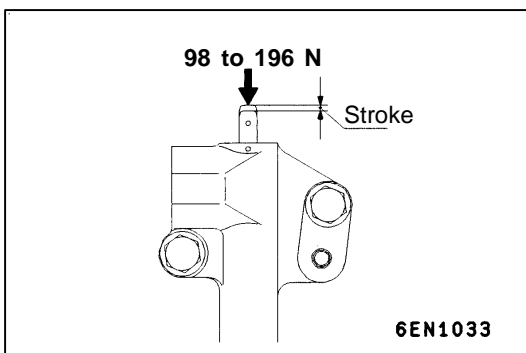
- (1) Check the pulley for smooth rotation, excessive play, abnormal noise. Replace it if necessary.



AUTO-TENSIONER

- (1) Check the tensioner for oil leaks. Replace it if necessary.
(2) Check the rod end for wear or damage. Replace the tensioner if necessary.
(3) Measure the rod projection length. If not within the standard value, replace the tensioner.

Standard value: 11 mm



- (4) Press the rod by a force of 98 to 196 N and measure the rod stroke. If not within the standard value, replace the tensioner.

Standard value: 1 mm or less

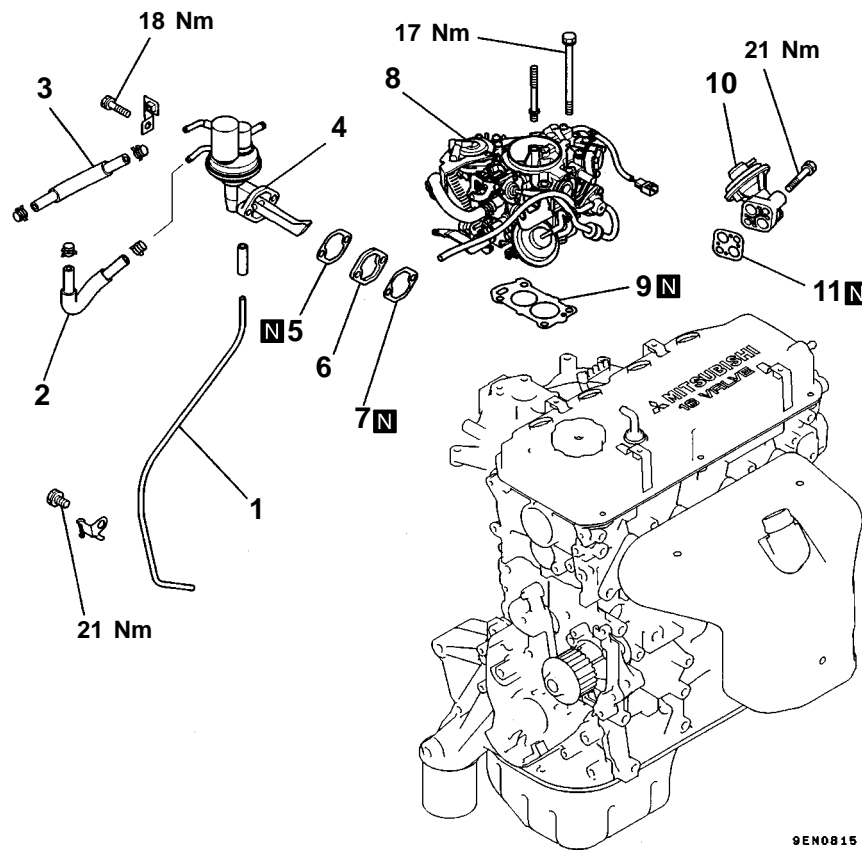
FUEL AND EMISSION CONTROL SYSTEM

REMOVAL AND INSTALLATION <SOHC-CARBURETOR>

MAIN

Group
11

11B
4G9



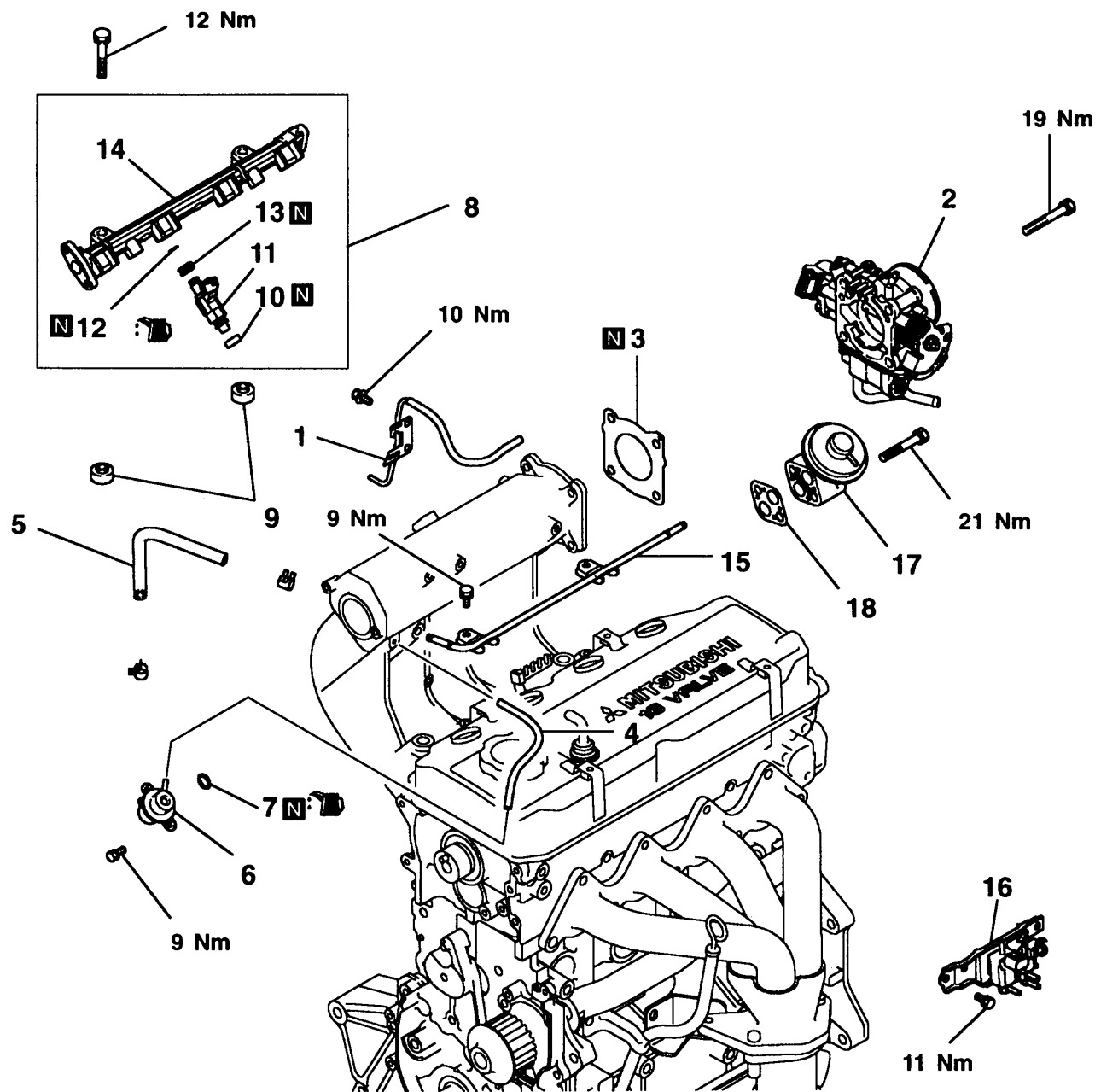
Removal steps

1. Breather tube
2. Fuel hose
3. Fuel hose
4. Fuel pump
5. Gasket
6. Insulator
7. Gasket
8. Carburetor
9. Gasket
10. EGR valve
11. Gasket

REMOVAL AND INSTALLATION <SOHC-MPI>

MAIN

Group
11

11B
4G9


9EN1027

Removal steps

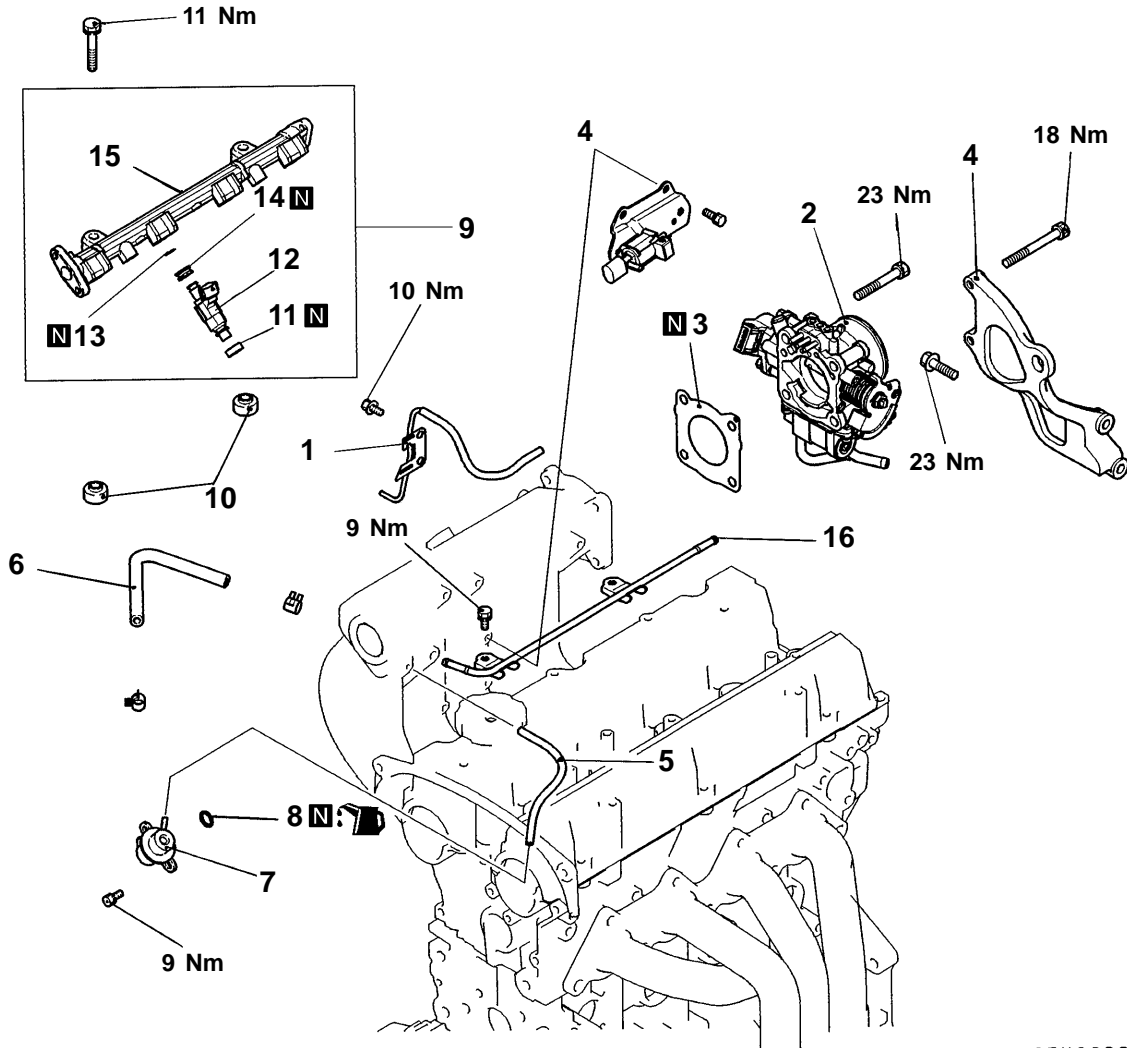
- 1. Vacuum hose and pipe assembly
- 2. Throttle body
- ▶C◀ 3. Gasket
- 4. Vacuum hose
- 5. Fuel hose
- ▶B◀ 6. Fuel pressure regulator
- 7. O-ring
- 8. Delivery pipe and injector
- 9. Insulator

- ▶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

REMOVAL AND INSTALLATION <DOHC>

MAIN

Group
11

11B
4G9


9EN0632

Removal steps

- C◄ 1. Vacuum pipe assembly
- 2. Throttle body assembly
- 3. Gasket
- 4. Throttle body stay (MIVEC)
- 5. Vacuum hose
- 6. Fuel hose
- B◄ 7. Fuel pressure regulator
- 8. O-ring
- 9. Delivery pipe and injector

- A◄ 10. Insulator
- 11. Insulator
- 12. Injector
- 13. O-ring
- 14. Grommet
- 15. Delivery pipe
- 16. Fuel return pipe

INSTALLATION SERVICE POINTS

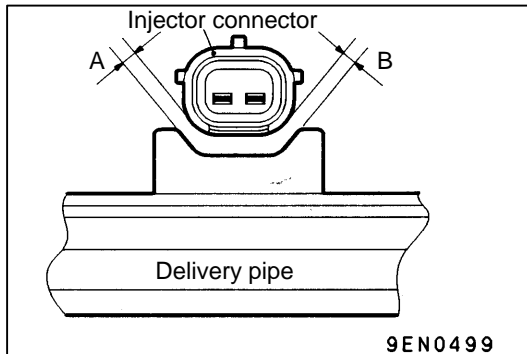
►A◄ INJECTORS INSTALLATION

- (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 ($A = B$).



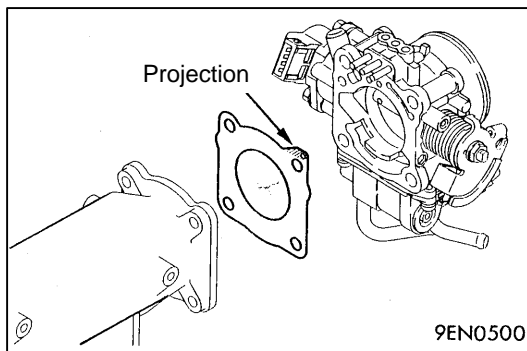
►B◄ FUEL PRESSURE REGULATOR INSTALLATION

- (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.

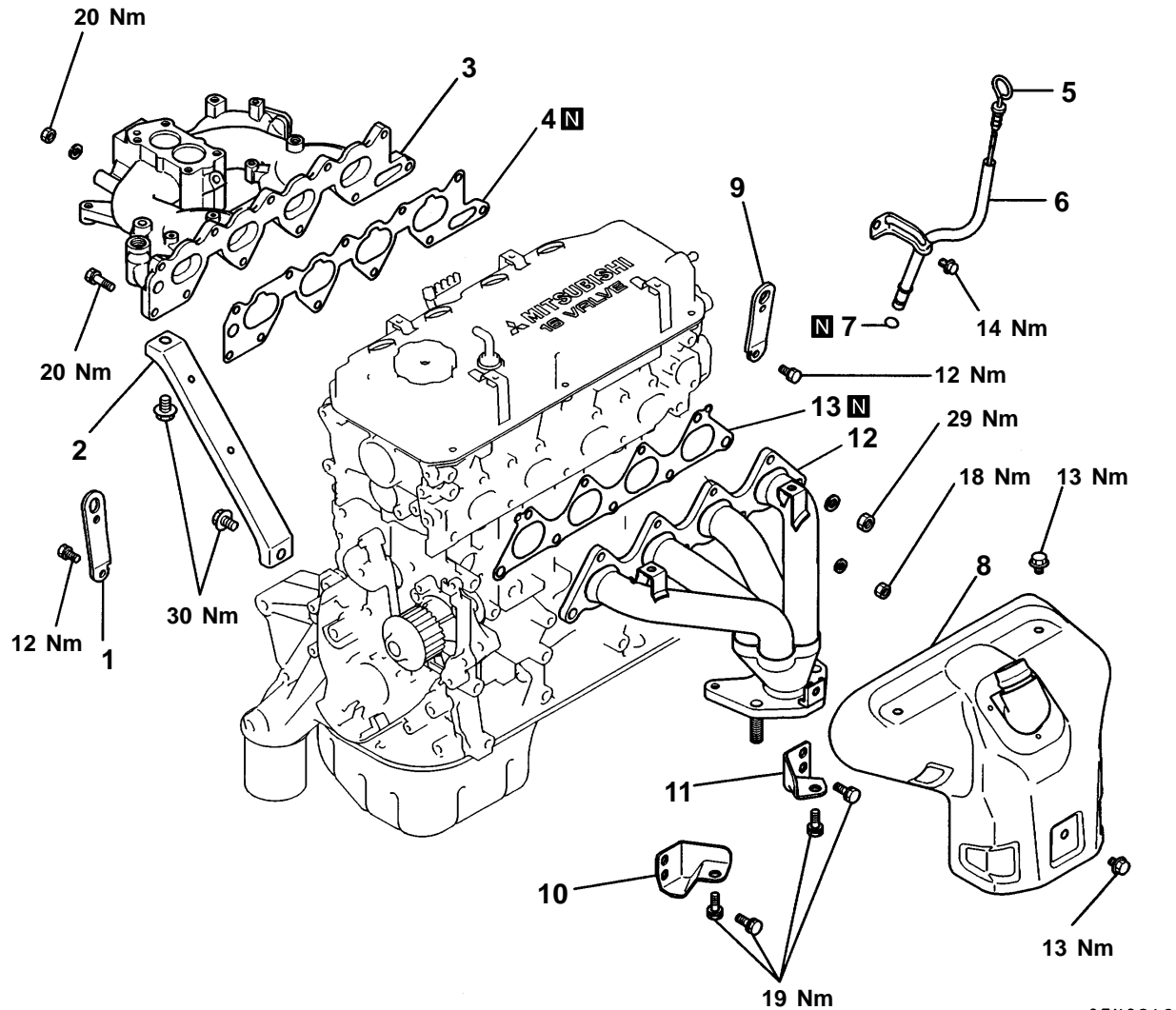


►C◄ GASKET INSTALLATION

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

INTAKE AND EXHAUST MANIFOLD

REMOVAL AND INSTALLATION <SOHC-CARBURETOR>

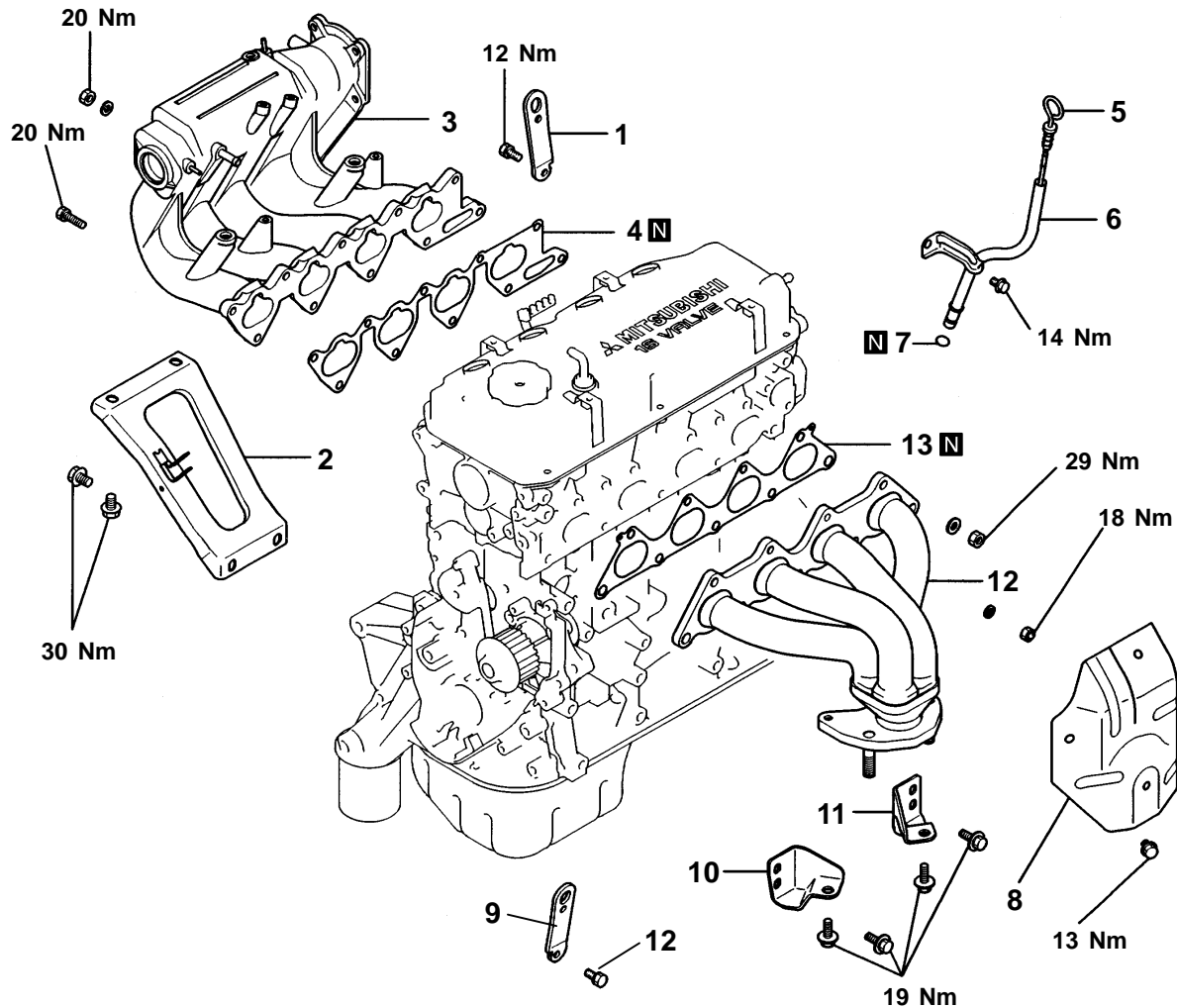


9EN0816

Removal steps

- | | |
|---|--|
| <p>►B◀</p> <ol style="list-style-type: none"> 1. Engine hanger 2. Intake manifold stay 3. Intake manifold 4. Intake manifold gasket 5. Oil level gauge 6. Oil level gauge guide | <p>►A◀</p> <ol style="list-style-type: none"> 7. O-ring 8. Exhaust manifold cover 9. Engine hanger 10. Exhaust manifold bracket A 11. Exhaust manifold bracket B 12. Exhaust manifold 13. Exhaust manifold gasket |
|---|--|

REMOVAL AND INSTALLATION <SOHC-MPI (Up to 2000 model)>



9EN0819

Removal steps

1. Engine hanger
2. Intake manifold stay
3. Intake manifold
4. Intake manifold gasket
5. Oil level gauge
6. Oil level gauge guide

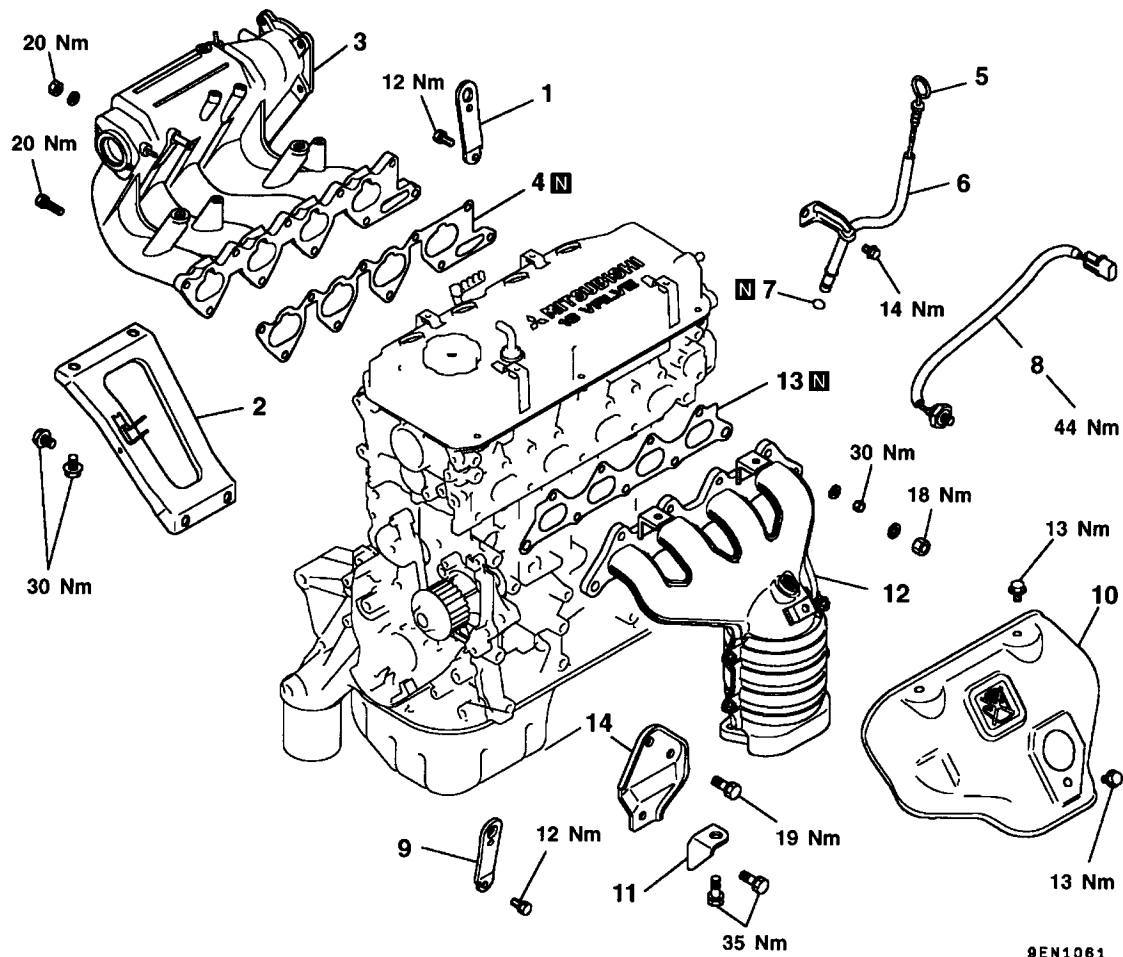
7. O-ring
8. Exhaust manifold cover
9. Engine hanger
10. Exhaust manifold bracket A
11. Exhaust manifold bracket B
12. Exhaust manifold
13. Exhaust manifold gasket

REMOVAL AND INSTALLATION <SOHC-MPI (From 2001 model)>

MAIN

Group
11

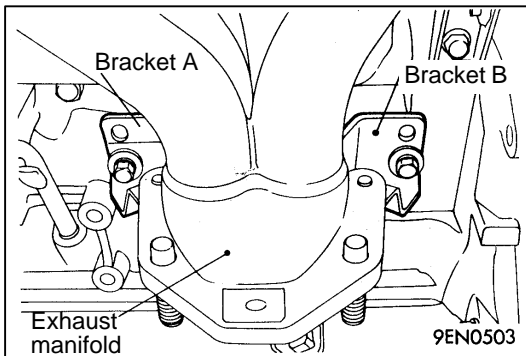
11B
4G9



9EN1061

Removal steps

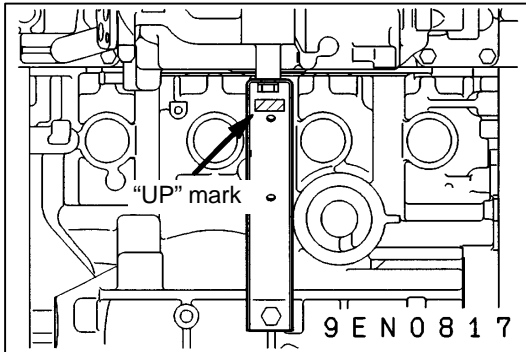
- | | |
|---------------------------|--------------------------------|
| 1. Engine hanger | 8. Oxygen sensor |
| 2. Intake manifold stay | 9. Engine hanger |
| 3. Intake manifold | 10. Exhaust manifold cover |
| 4. Intake manifold gasket | 11. Exhaust manifold bracket B |
| 5. Oil level gauge | 12. Exhaust manifold |
| 6. Oil level gauge guide | 13. Exhaust manifold gasket |
| 7. O-ring | 14. Exhaust manifold bracket A |



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.



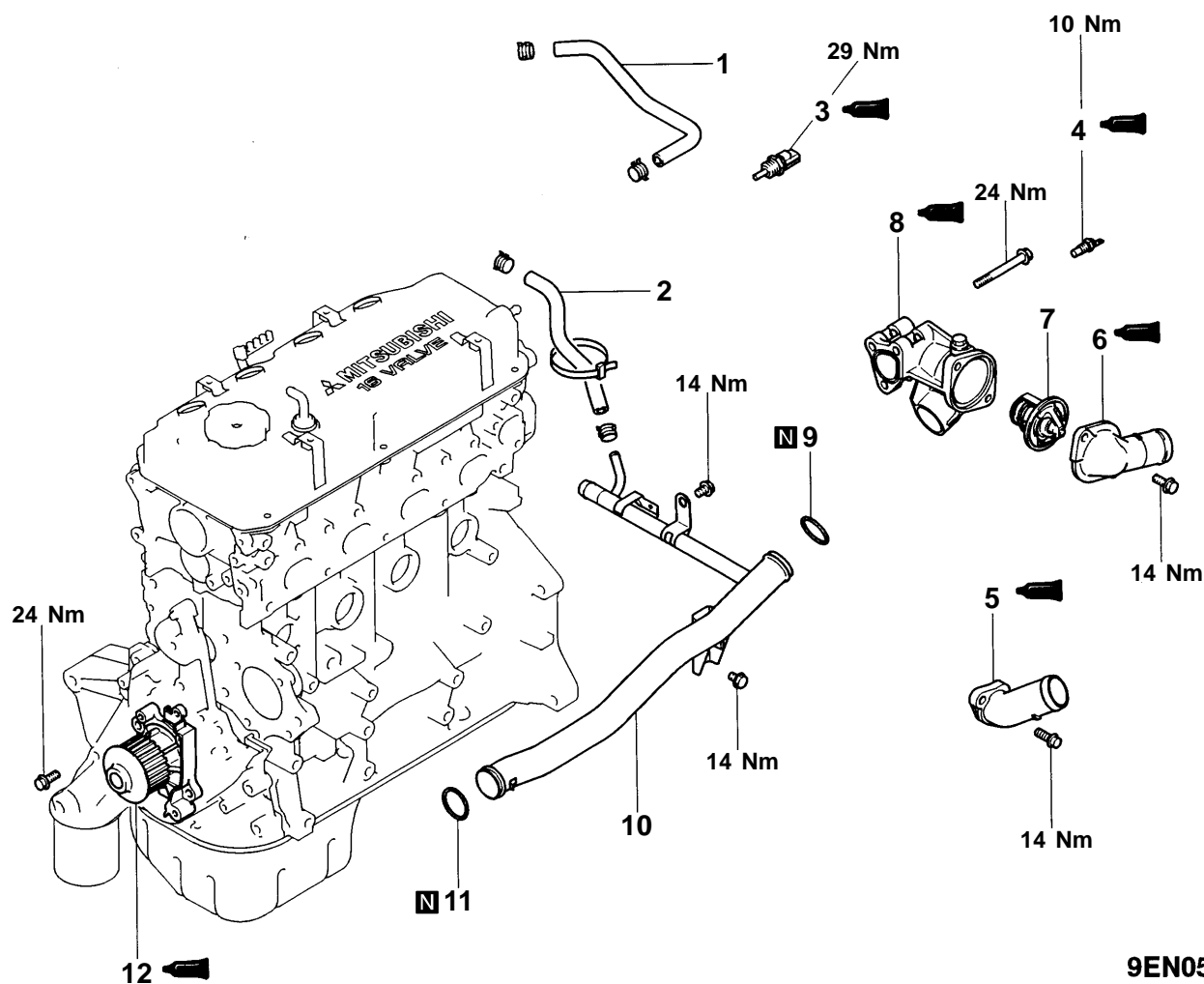
►B◄ INTAKE MANIFOLD STAY INSTALLATION

- (1) Install the intake manifold stay with its "UP" mark directed toward the intake manifold.

WATER PUMP AND WATER HOSE

REMOVAL AND INSTALLATION <SOHC>

MAIN

Group
1111B
4G9

9EN0577

Removal steps

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

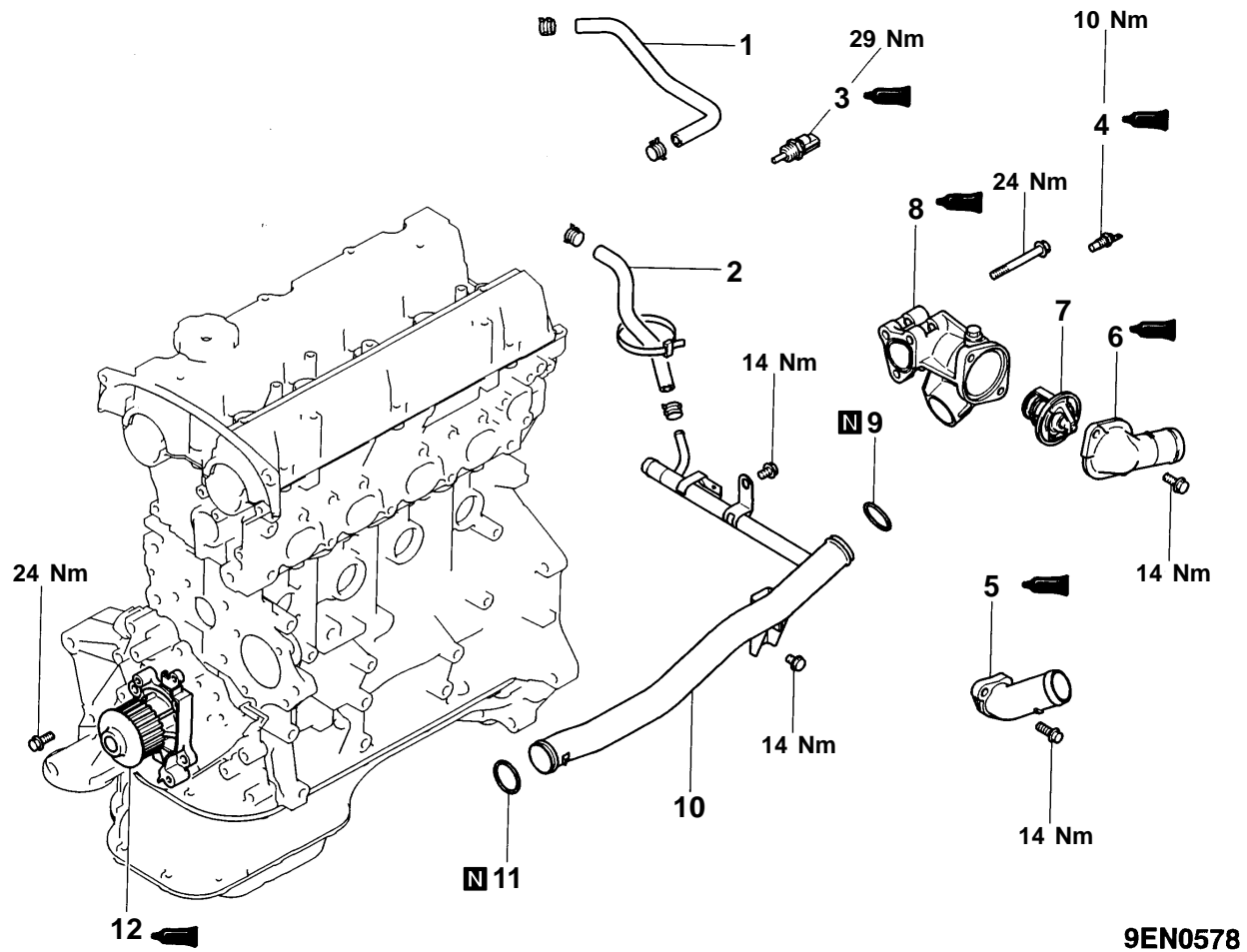
- ▶ **D** ▶ **C** ▶ **B** ▶ **B** ▶ **B** ▶ **A** ▶ 7. Thermostat
8. Thermostat case
9. O-ring
10. Water inlet pipe
11. O-ring
12. Water pump

REMOVAL AND INSTALLATION<DOHC>

MAIN

Group
11

11B
4G9

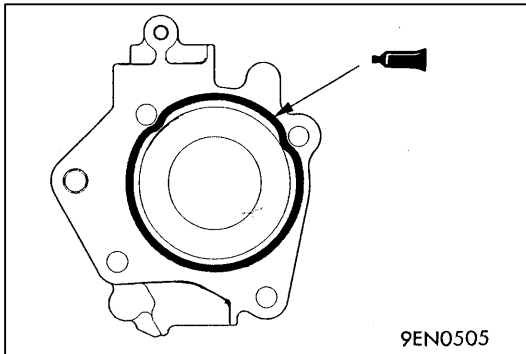


9EN0578

Removal steps

1. Water hose A
2. Water hose B
- ▶ **G** ▶ **F** ▶ 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:

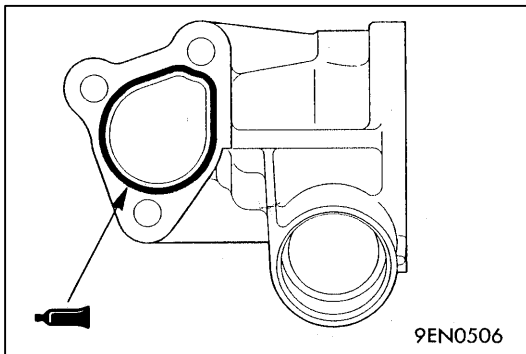
Mitsubishi Genuine Part No.MD970389 or equivalent

►B◄ WATER INLET PIPE <SOHC, DOHC> / WATER PIPE <DOHC-GDI for PAJERO io> / O-RING INSTALLATION

- (1) Replace the O-ring of the water inlet pipe <SOHC, DOHC> or water pipe <DOHC-GDI for PAJERO io>, 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.

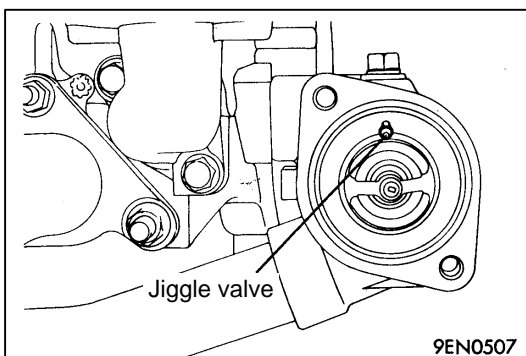


►C◄ THERMOSTAT CASE INSTALLATION

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

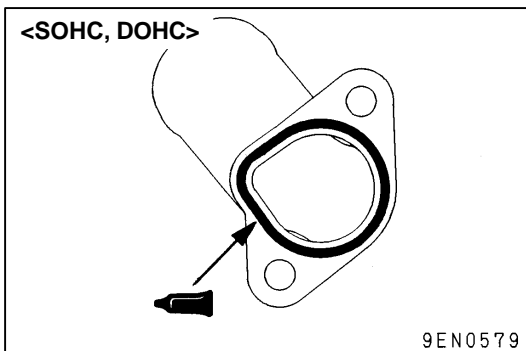
Specified sealant:

Mitsubishi Genuine Part No.MD970389 or equivalent



►D◄ THERMOSTAT INSTALLATION

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

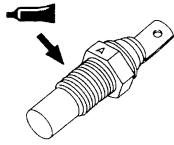


►E◄ WATER OUTLET FITTING INSTALLATION

- (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



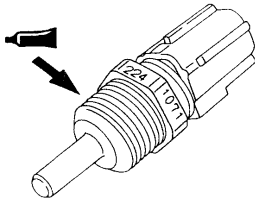
6AE0071

►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

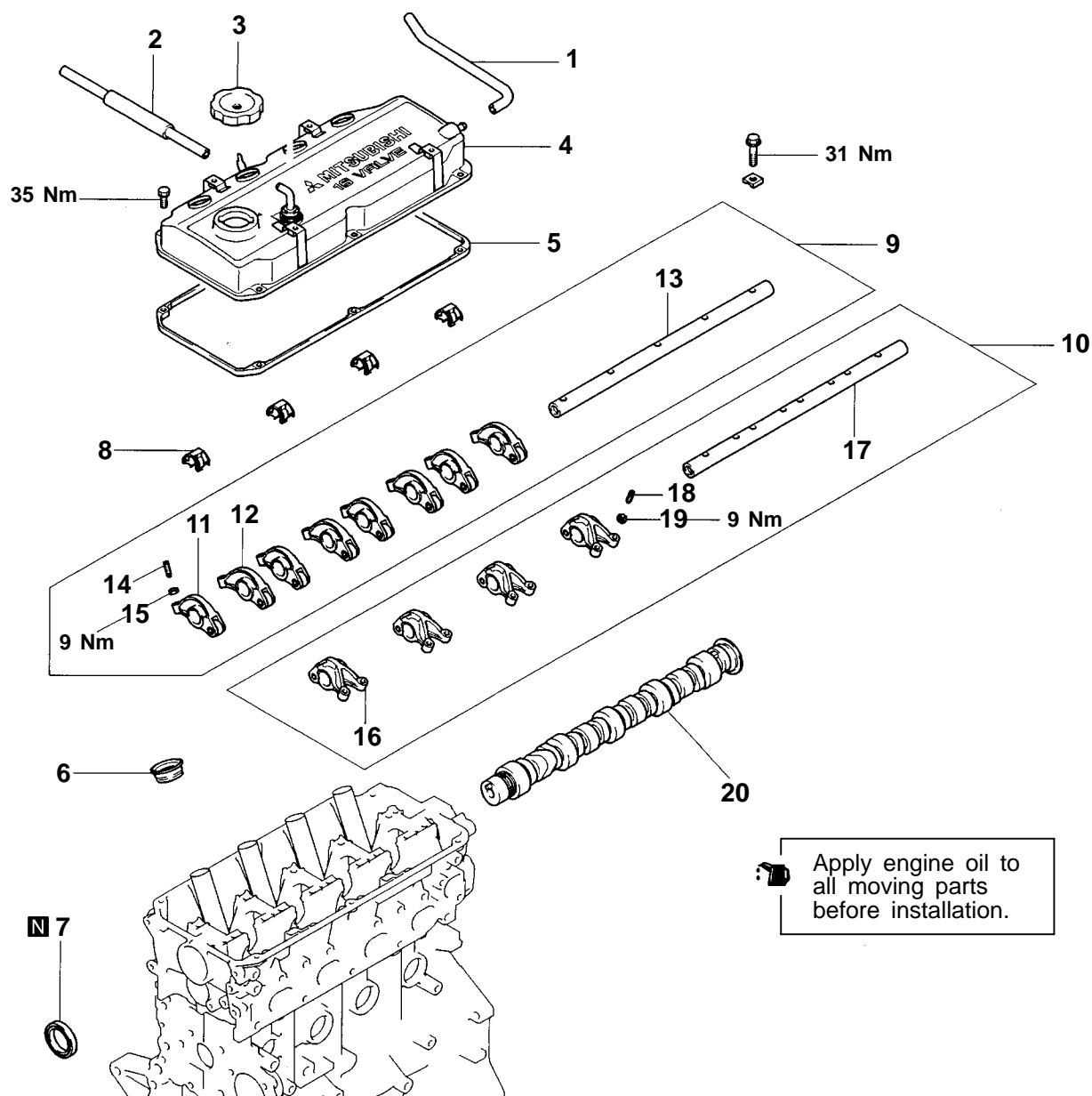
- (1) When reusing the sensor, apply the specified sealant to the threads.

Specified sealant:

3M Nut Locking Part No.4171 or equivalent

ROCKER ARMS AND CAMSHAFTS

REMOVAL AND INSTALLATION <SOHC (Up to 2000 model)>



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



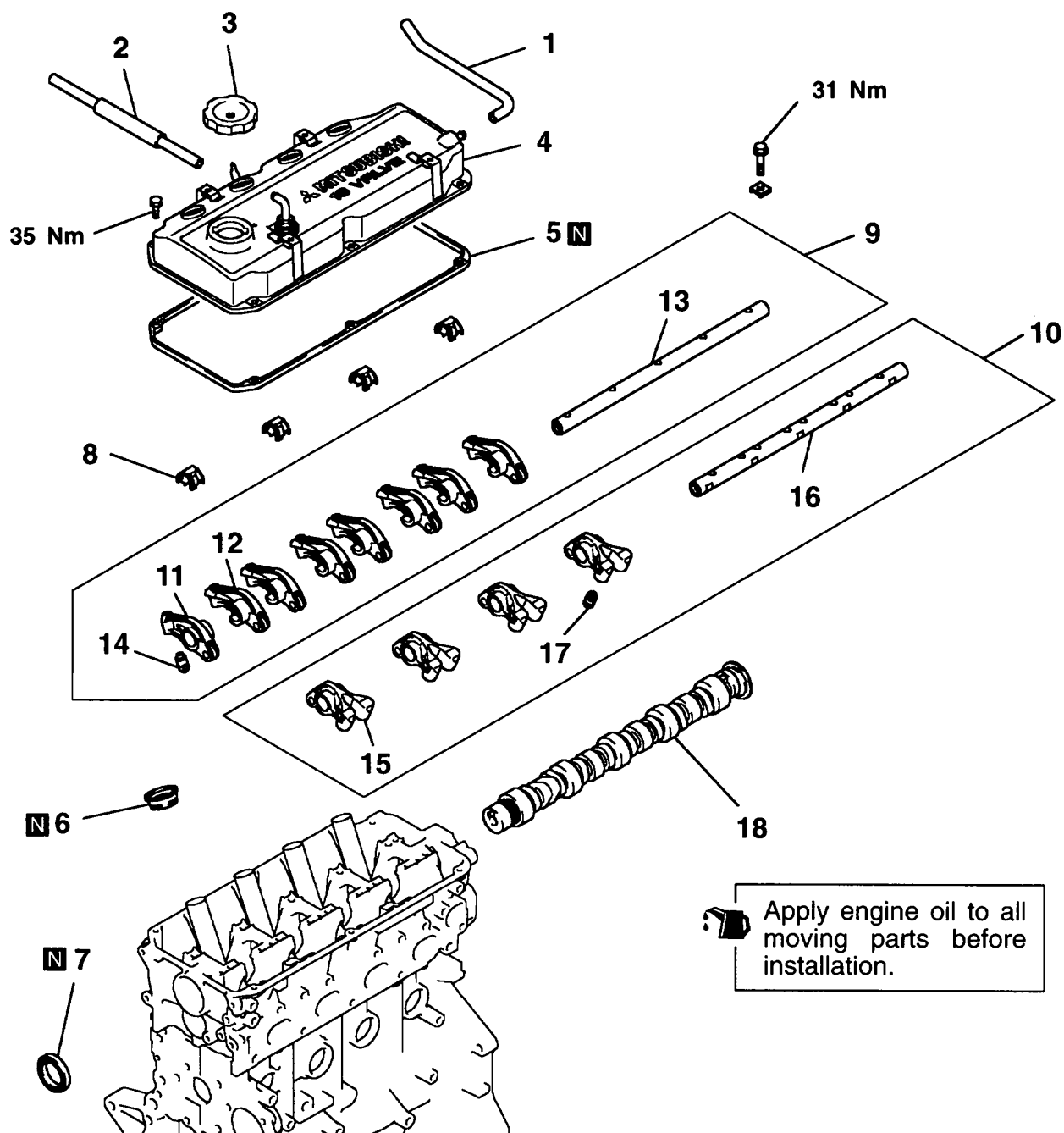
11. Rocker arm B
12. Rocker arm A
13. Rocker arm shaft
14. Adjusting screw
15. Nut
16. Rocker arm C
17. Rocker arm shaft
18. Adjusting screw
19. Nut
20. Camshaft



Apply engine oil to
all moving parts
before installation.

REMOVAL AND INSTALLATION <SOHC (From 2001 model)>

MAIN

Group
1111B
4G9

Apply engine oil to all moving parts before installation.

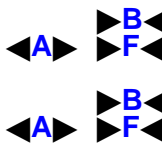
9EN1064

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



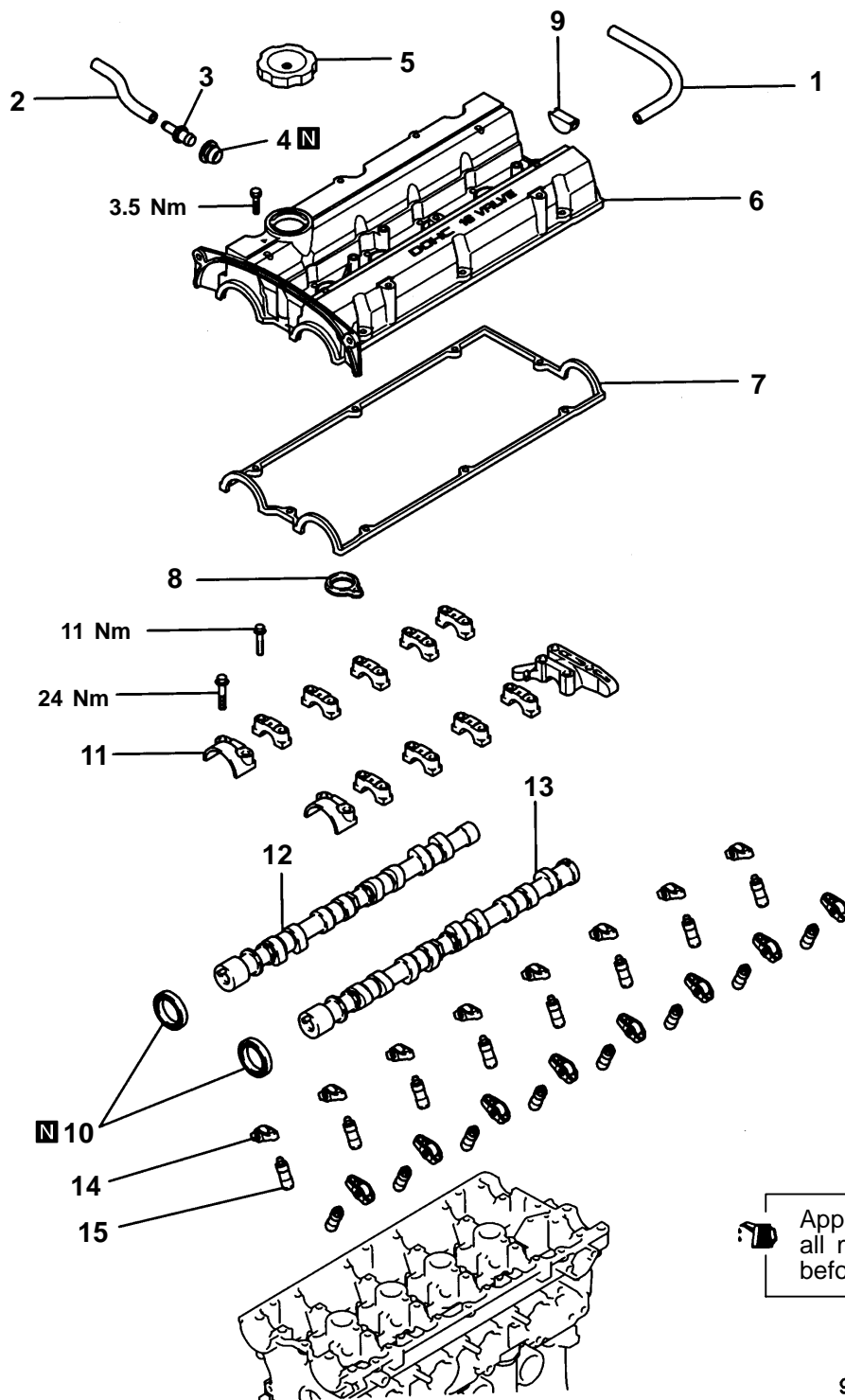
11. Rocker arm B
12. Rocker arm A
13. Rocker arm shaft
14. Lash adjuster
15. Rocker arm C
16. Rocker arm shaft
17. Lash adjuster
18. Camshaft



REMOVAL AND INSTALLATION <DOHC>

MAIN

Group
11

11B
4G9


9EN0999

Removal steps

1. Breather hose
2. P.C.V. hose
3. P.C.V. valve
4. P.C.V. valve gasket
5. Oil filler cap
6. Rocker cover
7. Rocker cover gasket A
8. Rocker cover gasket B
9. Semi-circular packing

10. Oil seal
11. Bearing cap
12. Intake camshaft
13. Exhaust camshaft
14. Rocker arm
15. Lash adjuster

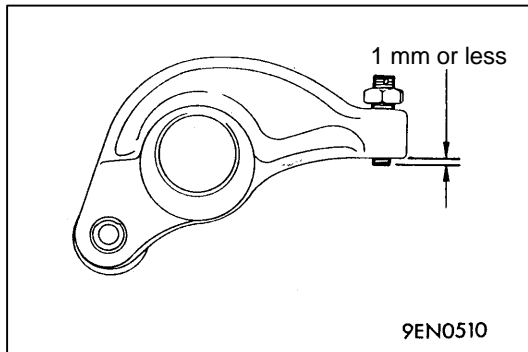


REMOVAL SERVICE POINT

◀A▶ LASH ADJUSTER REMOVAL

Caution

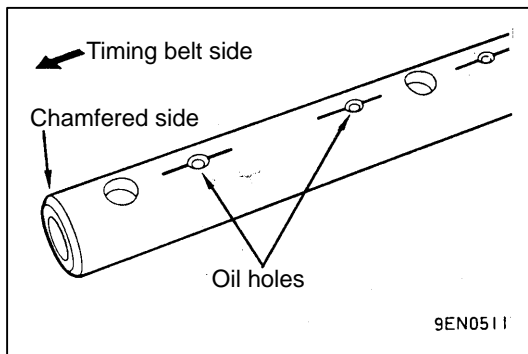
- If the lash adjuster is re-used, clean lash adjusters. (Refer to lash adjuster cleaning <SOHC>, <DOHC>)



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).



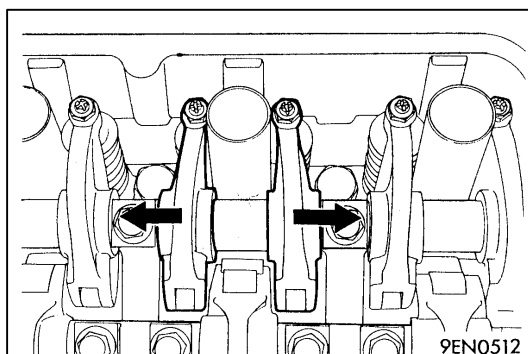
▶B◀ ROCKER ARM SHAFT INSTALLATION

- (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.

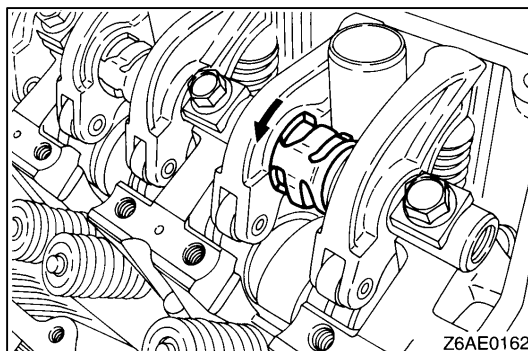


▶C◀ ROCKER ARMS AND ROCKER ARM SHAFT INSTALLATION

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

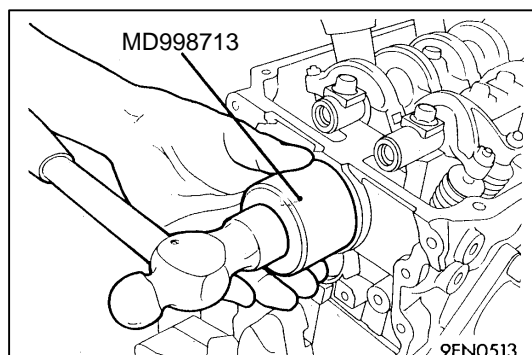
NOTE

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.



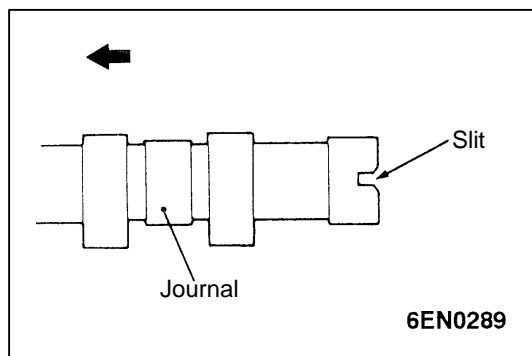
►E◄ OIL SEAL INSTALLATION

►F◄ LASH ADJUSTER INSTALLATION

Caution

- If the lash adjuster is re-used, clean the lash adjuster. (Refer to lash adjuster cleaning.)

- (1) Fit the lash adjuster onto the cylinder head using care not to allow diesel fuel to spill out.

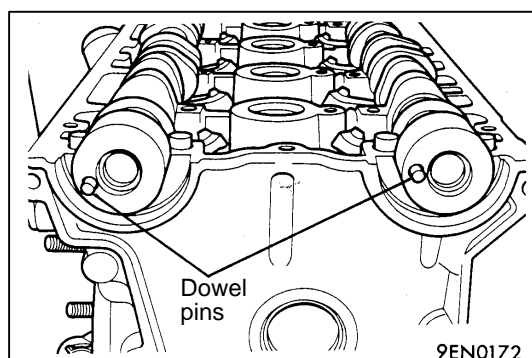


►G◄ CAMSHAFT INSTALLATION

- (1) Apply engine oil to the camshaft journals and cam before installing the camshaft. Use care not to confuse the intake camshaft with the exhaust camshaft.

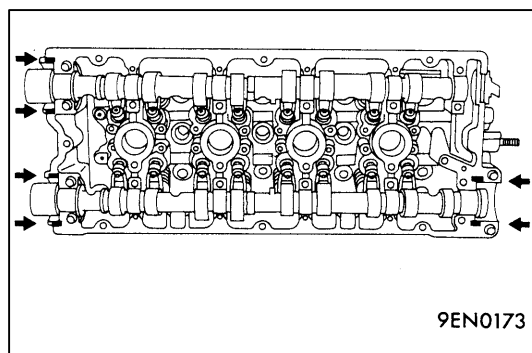
NOTE

The rear end of the intake camshaft is provided with a 4 mm-wide slit.



►H◄ BEARING CAP INSTALLATION

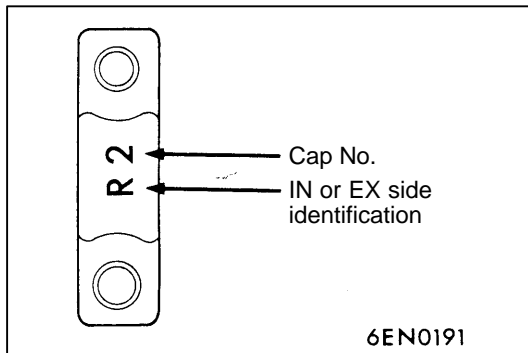
- (1) Locate the camshaft dowel pins as illustrated.



- (2) Apply sealant to the locations shown in the illustration.

Specified sealant:

3M ATD Part No. 8660 or equivalent



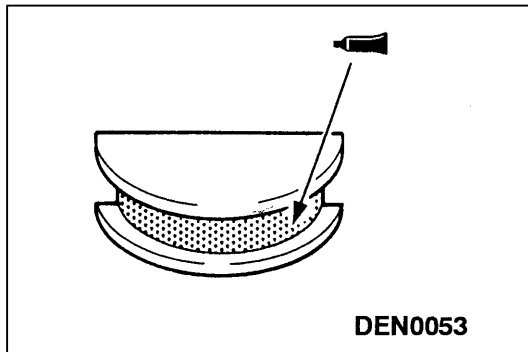
- (3) The bearing caps No. 2 through No. 5 are of the same shape. Before they are installed, check the cap number and the intake and exhaust identification marks.

Identification mark (stamped on front and No. 2 through No. 5 bearing caps)

L: Intake side

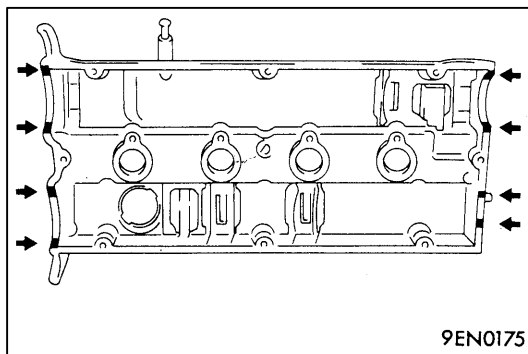
R: Exhaust side

- (4) Make sure that the rocker arms are installed in the specified locations.



►I◄ SEALANT APPLICATION ON SEMI-CIRCULAR PACKING

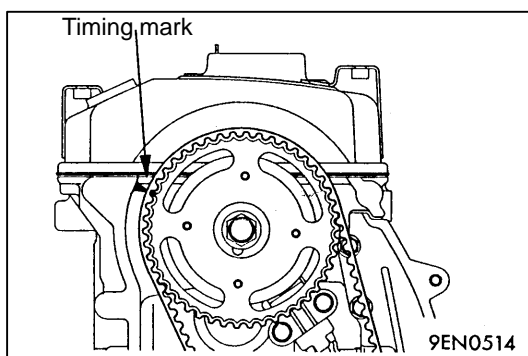
Specified sealant: 3M ATD Part No.8660 or equivalent



►J◄ SEALANT APPLICATION ON ROCKER COVER

- (1) Apply sealant to the areas indicated in the illustration.

Specified sealant: 3M ATD Part No.8660 or equivalent



VALVE CLEARANCE ADJUSTMENT

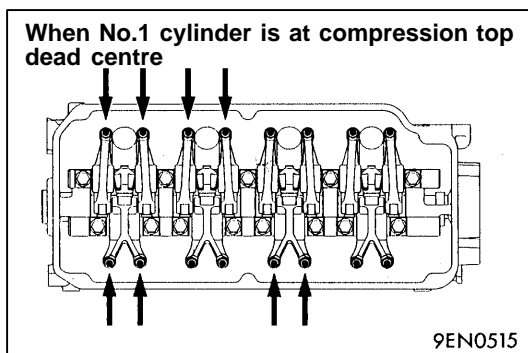
Adjust the valve clearance by the following procedure.

Adjustment values (when engine is cold):

Intake valve: 0.09 mm

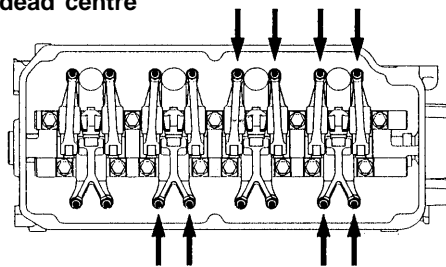
Exhaust valve: 0.20 mm

- (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.



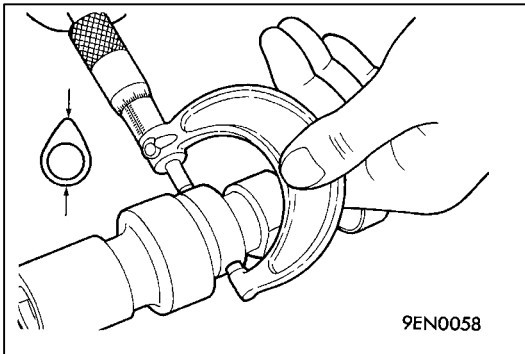
- (2) The valve clearances at the places indicated by arrows in the illustration can be adjusted.
- (3) Use a thickness gauge to adjust the clearance between the ends of the valve stems and the adjusting screws.
- (4) Hold the adjusting screws with a screwdriver so that they do not turn, and then tighten 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.

When No.4 cylinder is at compression top dead centre



9EN0516

- (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	4G92-SOHC*1	37.34	36.84
	4G92-SOHC*2	37.78	37.28
	4G92-SOHC*3	36.92	36.42
	4G93-SOHC	37.53	37.03
	4G93-DOHC	35.49	34.99
	4G93-DOHC-GDI	35.49	34.99
	4G94-DOHC-GDI	35.49	34.99
Exhaust side	4G92-SOHC*1	37.83	37.33
	4G92-SOHC*2	37.83	37.33
	4G92-SOHC*3	36.70	36.65
	4G93-SOHC	37.64	37.14
	4G93-DOHC	35.20	34.70
	4G93-DOHC-GDI	34.73	34.23
	4G94-DOHC-GDI	34.91	34.41

*1: LANCER for Europe and CARISMA for Europe

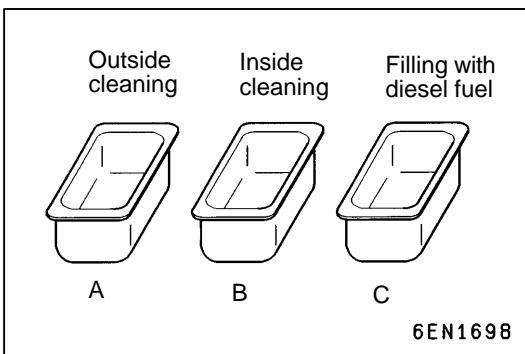
*2: LANCER for general export and CARISMA for 6B model

*3: LANCER for Europe (from 2001 model) and CARISMA for Europe (from 2001 model)

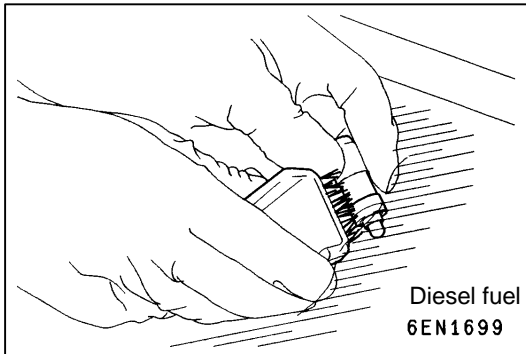
LASH ADJUSTER (SOHC)

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.



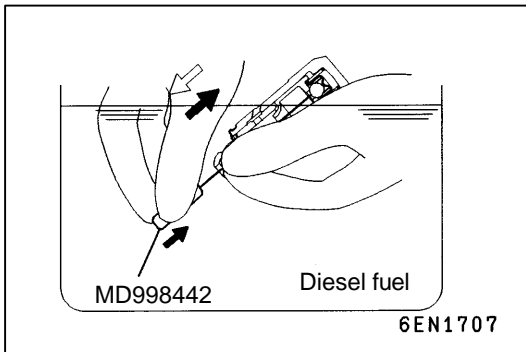
- (1) Prepare three containers and approximately five liters of diesel fuel. Into each container, pour enough diesel fuel to completely cover a lash adjuster when it is standing upright. Then, perform the following steps with each lash adjuster.



- (2) Place the lash adjuster in container A and clean its outside surface.

NOTE

Use a nylon brush if deposits are hard to remove.



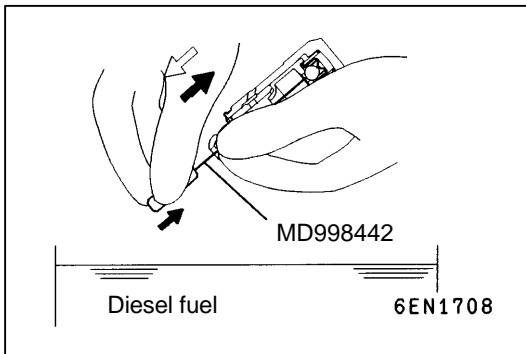
- (3) While gently pushing down the internal steel ball using special tool MD998442, move the plunger through 5 to 10 strokes until it slides smoothly. In addition to eliminating stiffness in the plunger, this operation will remove dirty oil.

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

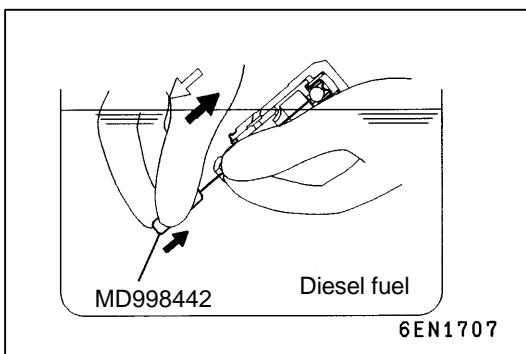
If the plunger remains stiff or the mechanism appears otherwise abnormal, replace the lash adjuster.



- (4) 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.

Caution

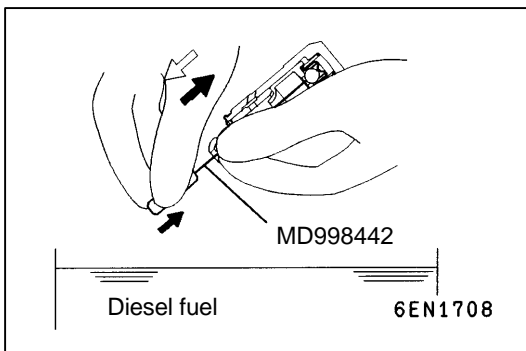
Make sure the oil hole in the side of the body is pointing toward container A. Do not point the oil hole at yourself or other people.



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

Caution

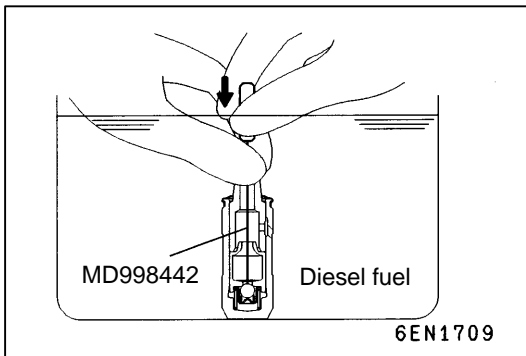
The steel ball spring is extremely weak, so the lash adjuster's functionality may be lost if the air bleed wire is pushed in hard.



- (6) 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.

Caution

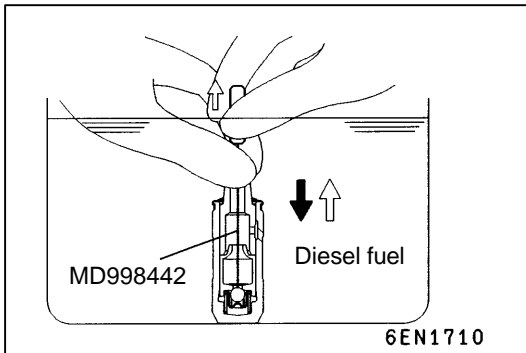
Make sure the oil hole in the side of the body is pointing toward container A. Do not point the oil hole at yourself or other people.



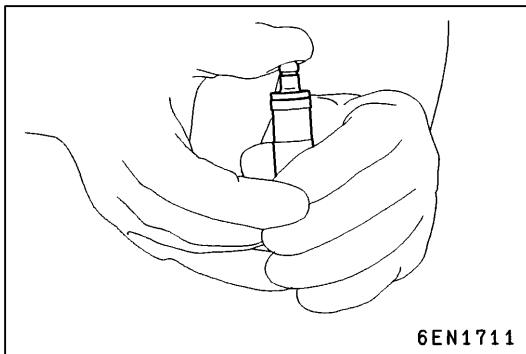
- (7) Place the lash adjuster in container C. Then, gently push down the internal steel ball using special tool.

Caution

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



- (8) 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.



- (9) 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

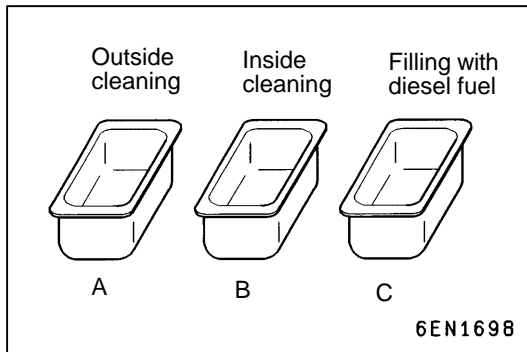
If lash adjuster contracts, perform the operation (7) through (9) again to fill it with diesel fuel completely. Replace the lash adjuster if it still contracts after performing these steps.

- (10) Stand the lash adjuster upright to prevent diesel fuel from 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.

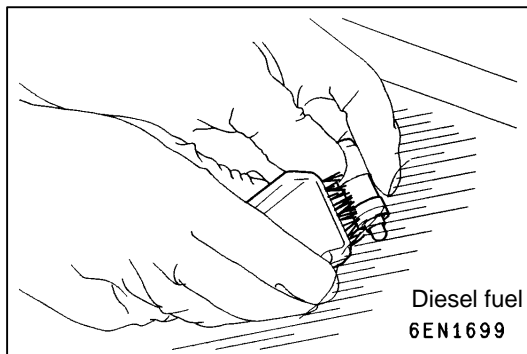
LASH ADJUSTER (DOHC)

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.



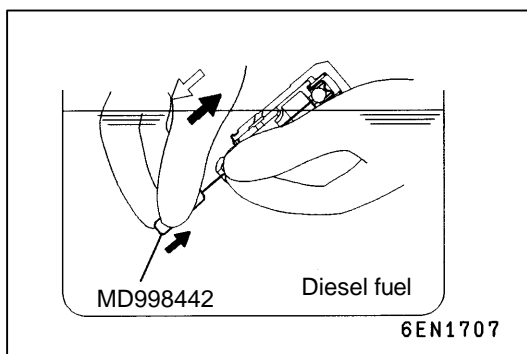
- (1) Prepare three containers and approximately five liters of diesel fuel. Into each container, pour enough diesel fuel to completely cover a lash adjuster when it is standing upright. Then, perform the following steps with each lash adjuster.



- (2) Place the lash adjuster in container A and clean its outside surface.

NOTE

Use a nylon brush if deposits are hard to remove.



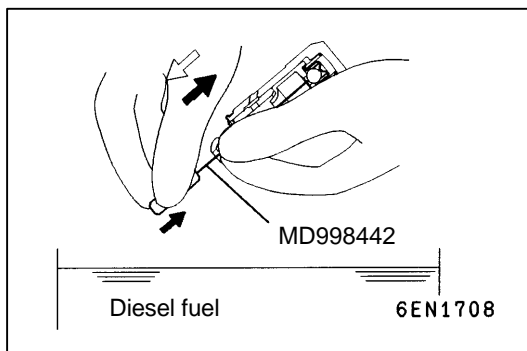
- (3) While gently pushing down the internal steel ball using special tool MD998442, move the plunger through 5 to 10 strokes until it slides smoothly. In addition to eliminating stiffness in the plunger, this operation will remove dirty oil.

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

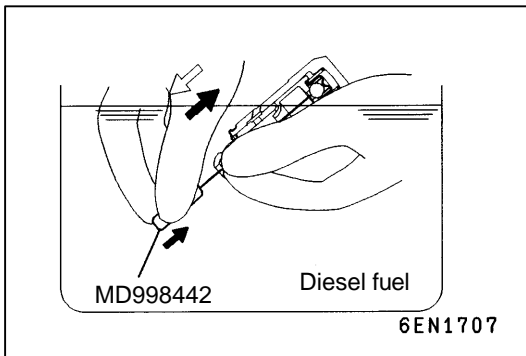
If the plunger remains stiff or the mechanism appears otherwise abnormal, replace the lash adjuster.



- (4) Removal 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.

Caution

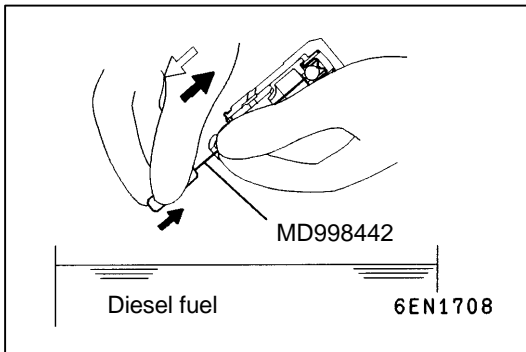
Make sure the oil hole in the side of the body is pointing toward container A. Do not point the oil hole at yourself or other people.



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

Caution

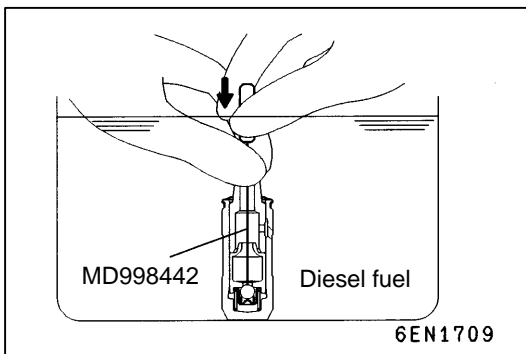
The steel ball spring is extremely weak, so the lash adjuster's functionality may be lost if the air bleed wire is pushed in hard.



- (6) 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.

Caution

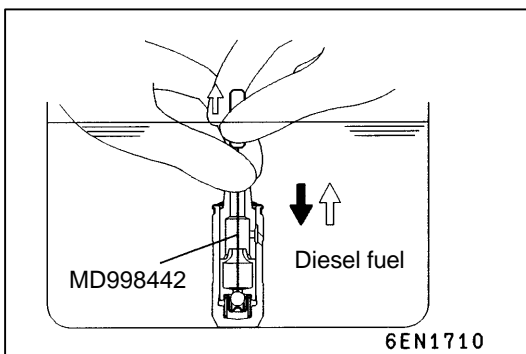
Make sure the oil hole in the side of the body is pointing toward container A. Do not point the oil hole at yourself or other people.



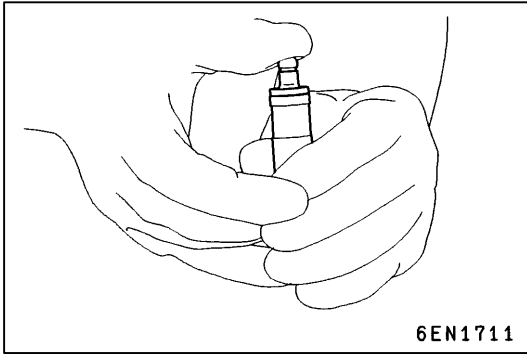
- (7) Place the lash adjuster in container C. Then, gently push down the internal steel ball using special tool.

Caution

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



- (8) 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.



- (9) 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.

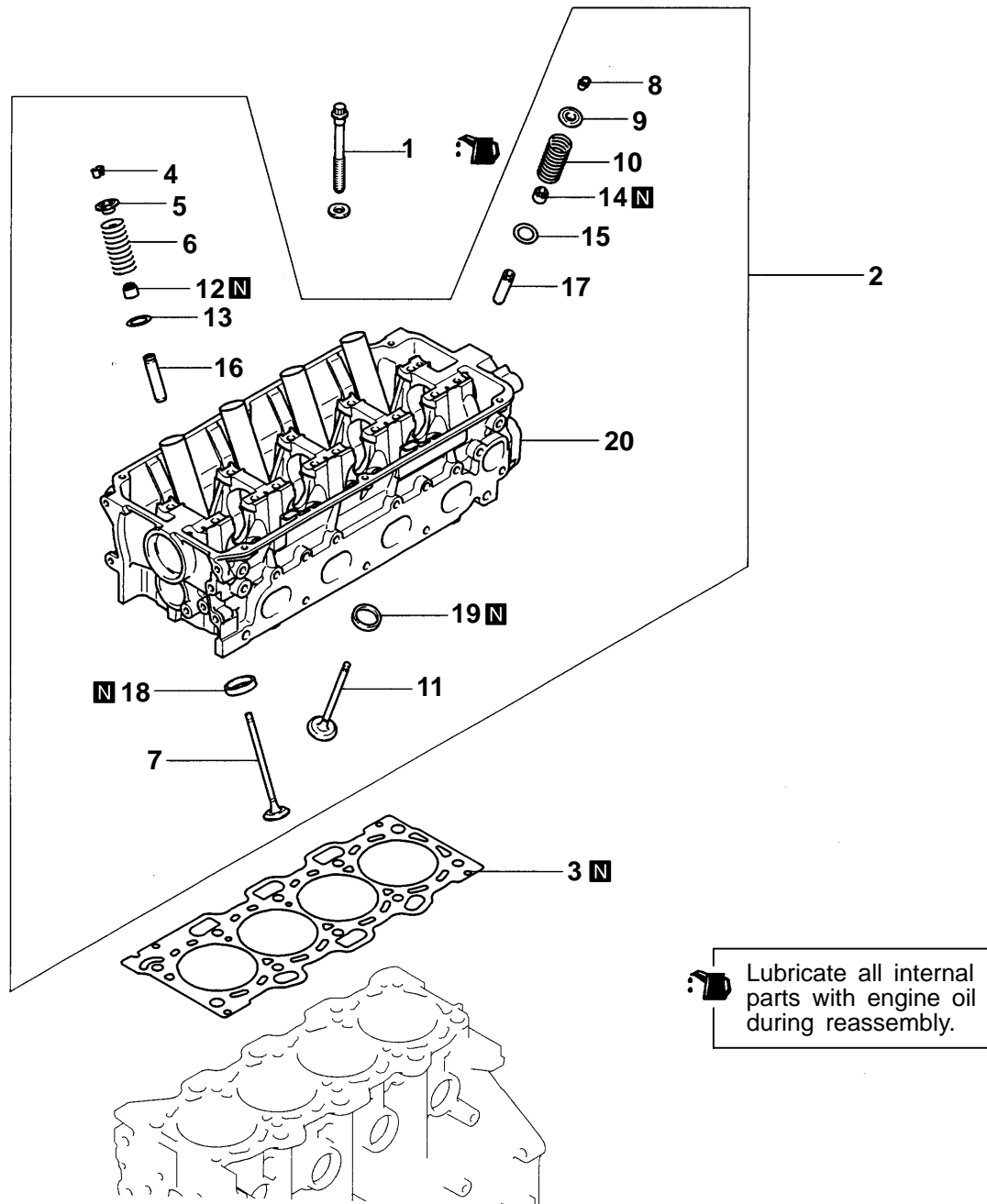
NOTE

If lash adjuster contracts, perform the operation (7) through (9) again to fill it with diesel fuel completely. Replace the lash adjuster if it still contracts after performing these steps.

- (10) Stand the lash adjuster upright to prevent diesel fuel from 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.

CYLINDER HEAD AND VALVES

REMOVAL AND INSTALLATION <SOHC>



9EN0517

Removal steps

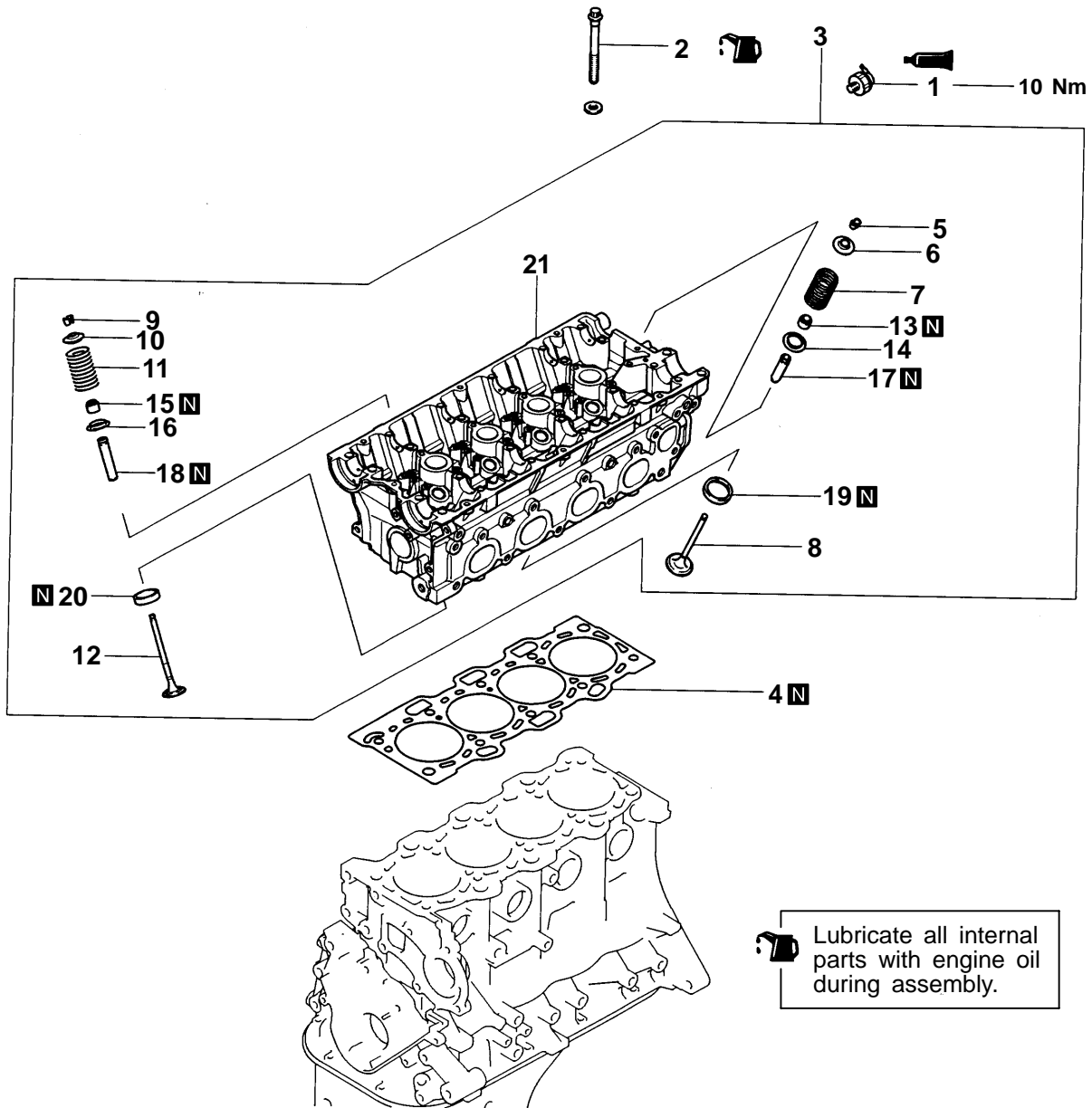
- ◀A▶ ▶D▶ 1. Cylinder head bolt
 ▶B▶ ▶C▶ 2. Cylinder head assembly
 ▶B▶ ▶C▶ 3. Cylinder head gasket
 ▶B▶ ▶C▶ 4. Retainer lock
 ▶B▶ ▶C▶ 5. Valve spring retainer
 ▶B▶ ▶C▶ 6. Valve spring
 ▶B▶ ▶C▶ 7. Exhaust valve
 ▶B▶ ▶C▶ 8. Retainer lock
 ▶B▶ ▶C▶ 9. Valve spring retainer
 ▶B▶ ▶C▶ 10. Valve spring

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

REMOVAL AND INSTALLATION <DOHC>

MAIN

Group
11

11B
4G9


9EN0582

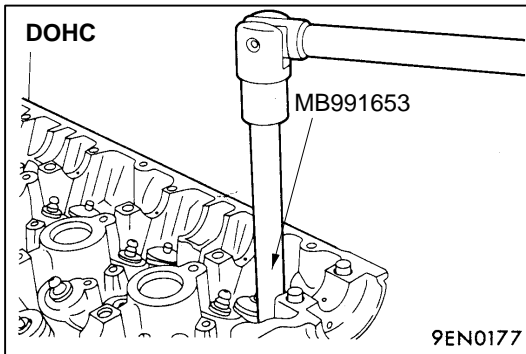
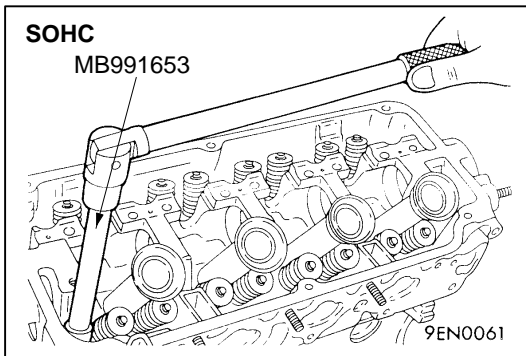
Removal steps

- | | | | |
|---------|---------------------------|---------|-------------------------|
| ◀A▶ ▶E▶ | 1. Oil pressure switch | ▶C▶ ▶A▶ | 12. Intake valve |
| ▶D▶ | 2. Cylinder head bolt | ▶C▶ ▶A▶ | 13. Valve stem seal |
| | 3. Cylinder head assembly | | 14. Valve spring seat |
| ▶B▶ ▶C▶ | 4. Cylinder head gasket | | 15. Valve stem seal |
| | 5. Retainer lock | | 16. Valve spring seat |
| ▶B▶ | 6. Valve spring retainer | | 17. Exhaust valve guide |
| | 7. Valve spring | | 18. Intake valve guide |
| ▶B▶ ▶C▶ | 8. Exhaust valve | | 19. Exhaust valve seat |
| | 9. Retainer lock | | 20. Intake valve seat |
| ▶B▶ | 10. Valve spring retainer | | 21. Cylinder head |
| ▶B▶ | 11. Valve spring | | |

REMOVAL SERVICE POINTS

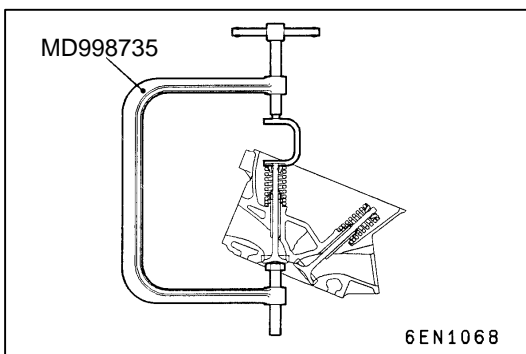
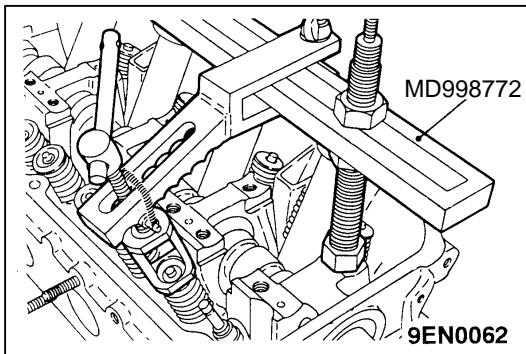
◀A▶ CYLINDER HEAD BOLT REMOVAL

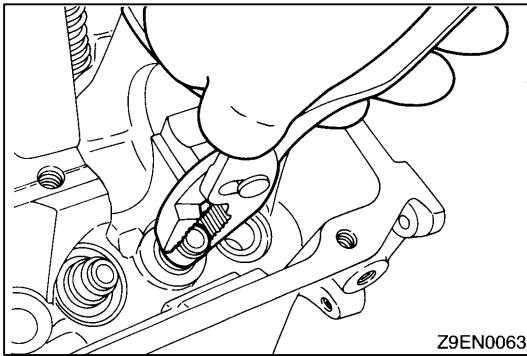
- (1) Loosen the cylinder head bolts using the special tool.



◀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.

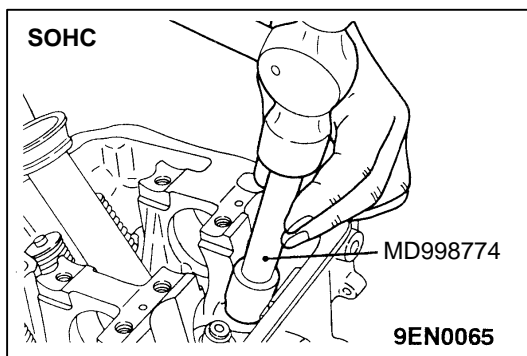
NOTE

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

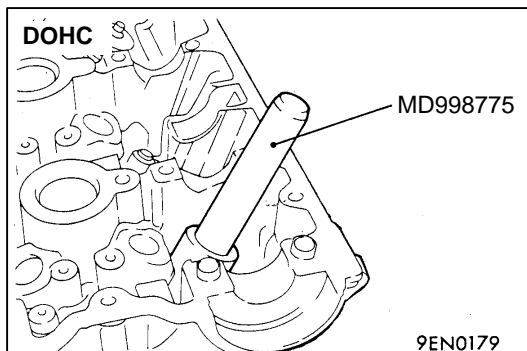
- Do not let the solution contact the eyes or the skin.
- Should it get in the eyes, immediately flush them with clean water thoroughly, and receive medical attention. When it contacts the skin, wash with ample amounts of clean water.

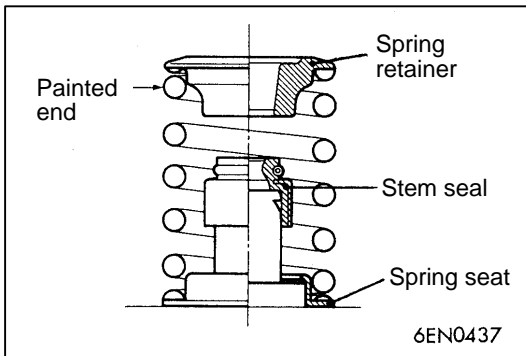
**INSTALLATION SERVICE POINTS****▶A◀ VALVE STEM SEAL INSTALLATION**

- (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

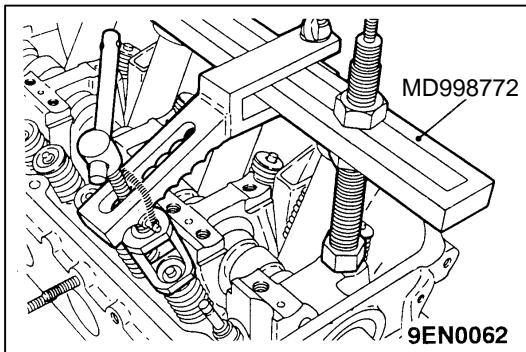
Do not reuse removed valve stem seals.





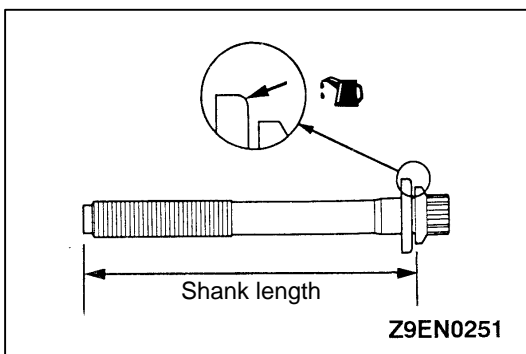
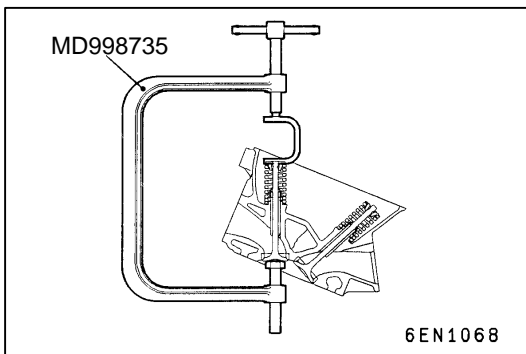
►B◄ VALVE SPRING INSTALLATION

- (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.

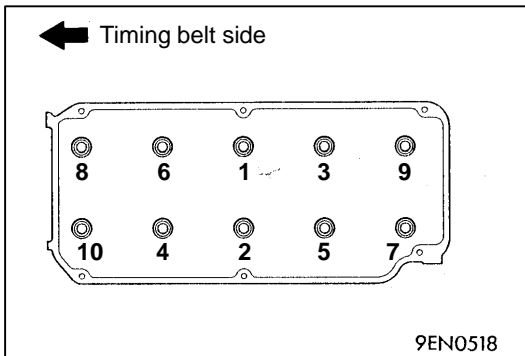


►D◄ CYLINDER HEAD BOLT INSTALLATION

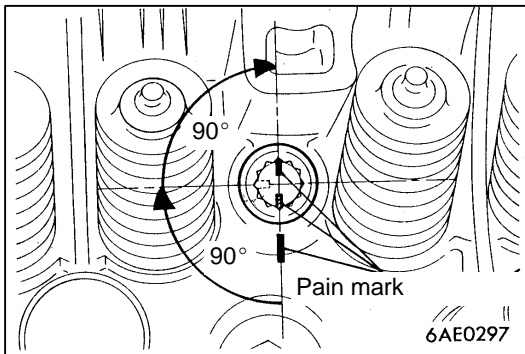
- (1) When installing the cylinder head bolts, check that the shank length of each bolt meets the limit. If the limit is exceeded, replace the bolts.

Limit: Max. 96.4 mm

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

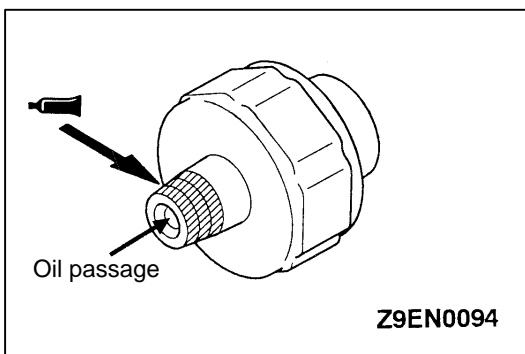


- (4) According to the tightening sequence, tighten the bolts to the specified torque 74 Nm.
- (5) Loosen all bolts fully.
- (6) Retighten the loosened bolts to a torque of 20 Nm in the specified tightening sequence.
- (7) Make paint marks on the cylinder head bolt heads and cylinder head.
- (8) Give 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

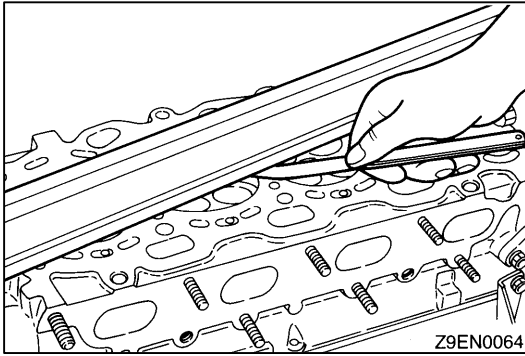
- (1) Apply sealant to the threads of the switch.

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

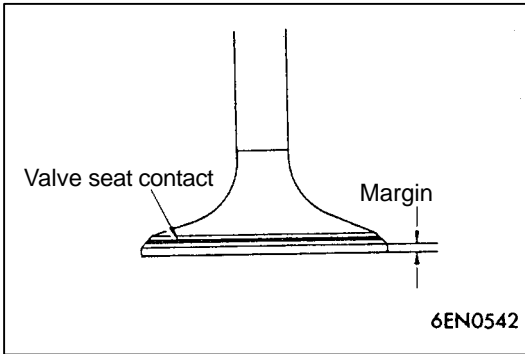
Cylinder head height (Specification when new):

119.9 – 120.1 mm <SOHC>

131.9 – 132.1 mm <DOHC>

119.8 – 120.0 mm <DOHC-MIVEC>

131.9 – 132.1 mm <DOHC-GDI>



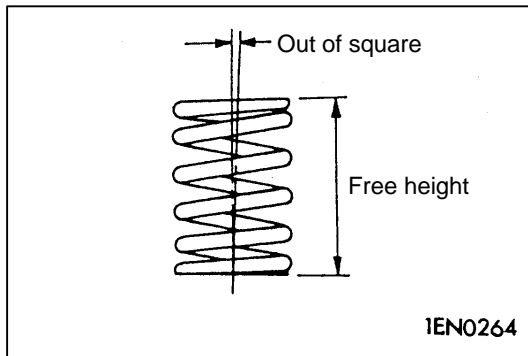
VALVE

- (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	SOHC	1.3	0.8
	DOHC	1.2	0.7

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

		Standard value mm	Limit mm
Intake	SOHC	110.15	109.65
	DOHC	104.19	103.69
	DOHC-MIVEC	115.63	115.13
	DOHC-GDI	104.19	103.69
Exhaust	SOHC	113.70	113.20
	DOHC	103.87	103.37
	DOHC-MIVEC	115.63	115.13
	DOHC-GDI	103.87	103.37



VALVE SPRING

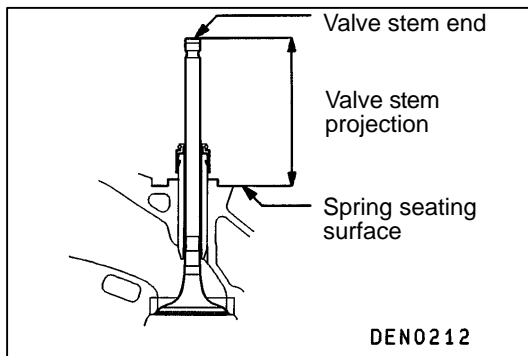
- (1) Measure the valve spring's free height. If the measurement is less than specified, replace the spring.

	Standard value mm	Limit mm
SOHC	50.9	49.9
DOHC	45.0	44.0
DOHC-MIVEC	51.5	50.5
DOHC-GDI	44.8	43.8

- (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
	DOHC	46.70	47.20
	DOHC-MI-VEC	57.85	58.35
	DOHC-GDI	46.65	47.15
Exhaust	SOHC	49.35	49.85
	DOHC	46.65	47.15
	DOHC-MI-VEC	58.13	58.63
	DOHC-GDI	46.70	47.20

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:

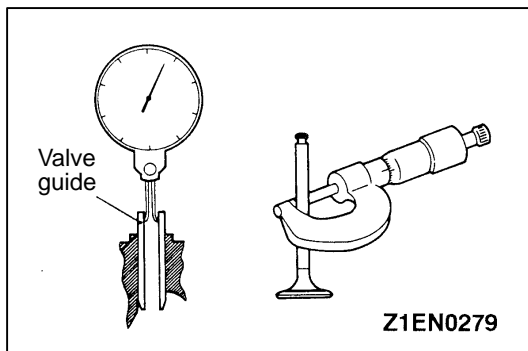
Intake: 0.02 – 0.05 mm

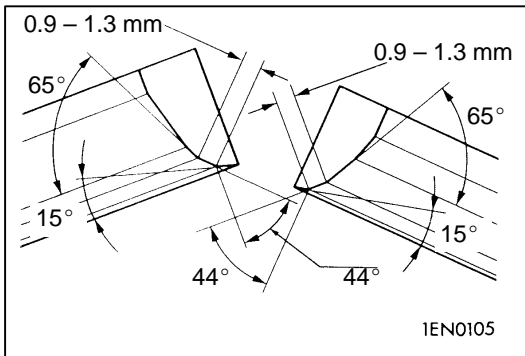
Exhaust: 0.05 – 0.09 mm

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

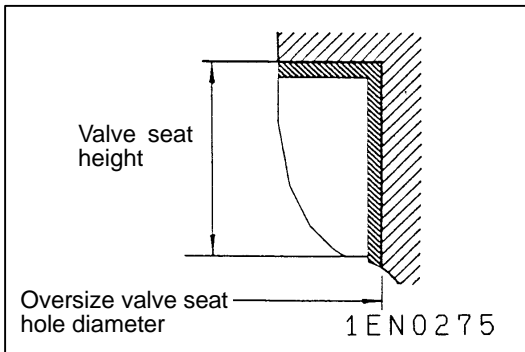
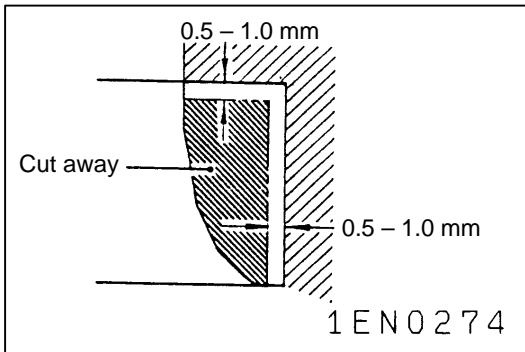
- (1) Cut the valve seat to be replaced from the inside to thin the wall thickness. Then, remove the valve seat.
- (2) Rebore the valve seat hole in the cylinder head to a selected oversize valve seat diameter.

Intake valve seat hole diameter

0.3 O.S.	<SOHC>	31.80 – 31.83 mm
	<DOHC>	34.30 – 34.33 mm
0.6 O.S.	<SOHC>	32.10 – 32.13 mm
	<DOHC>	34.60 – 34.63 mm

Exhaust valve seat hole diameter

0.3 O.S.	<SOHC>	29.30 – 29.32 mm
	<DOHC>	30.80 – 30.83 mm
0.6 O.S.	<SOHC>	29.60 – 29.62 mm
	<DOHC>	31.10 – 31.13 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

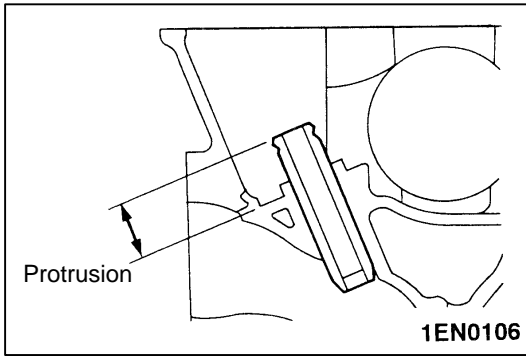
- (1) Force the valve guide out toward the cylinder block using a press.
- (2) Machine the valve guide hole in the cylinder head to the size of the oversize valve guide to be installed.

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



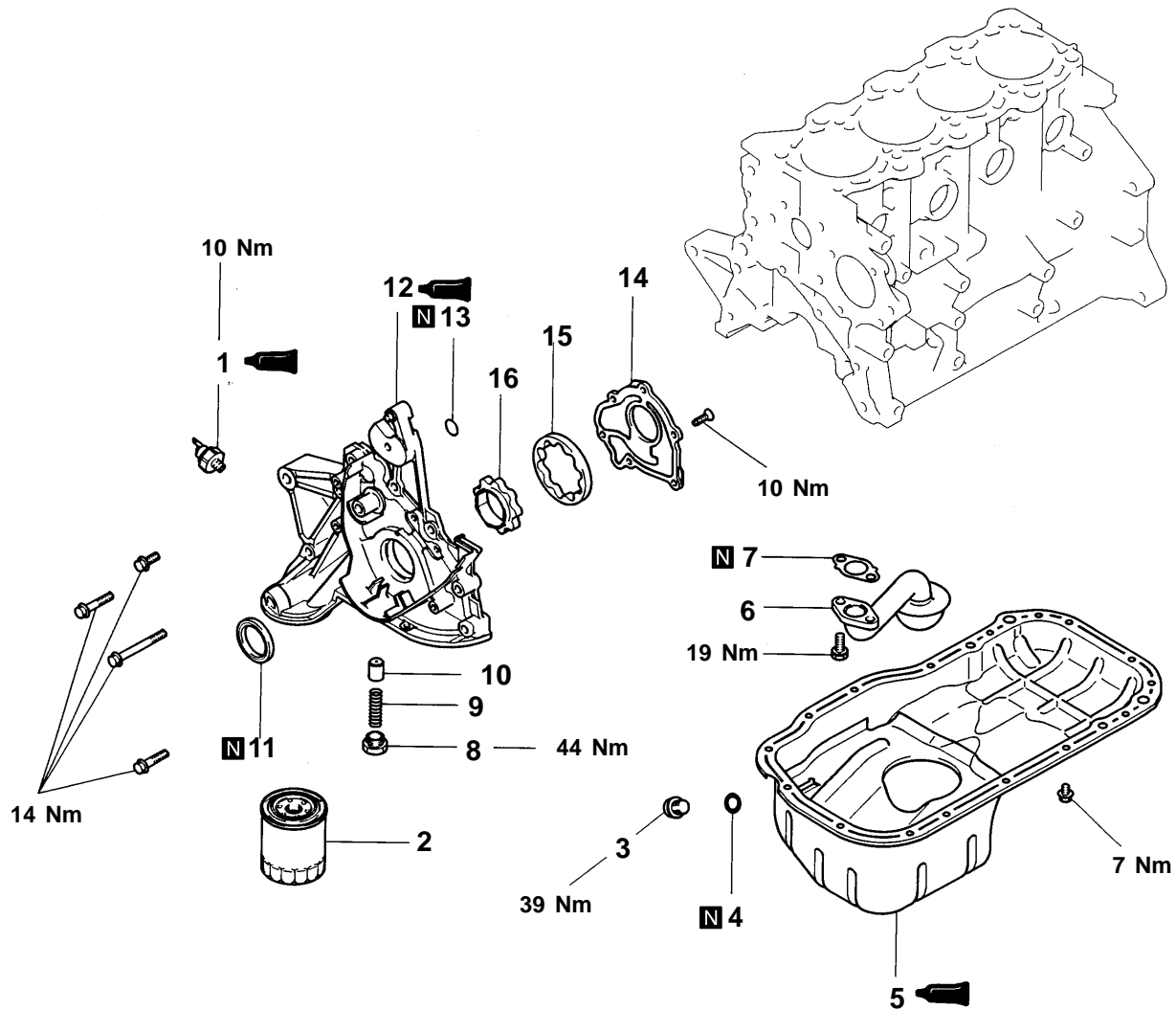
- (3) Press-fit the valve guide until it protrude specified value (SOHC: 14 mm, DOHC: 19 mm) as shown in the illustration.

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 <SOHC>



Apply engine oil to all moving parts before installation.

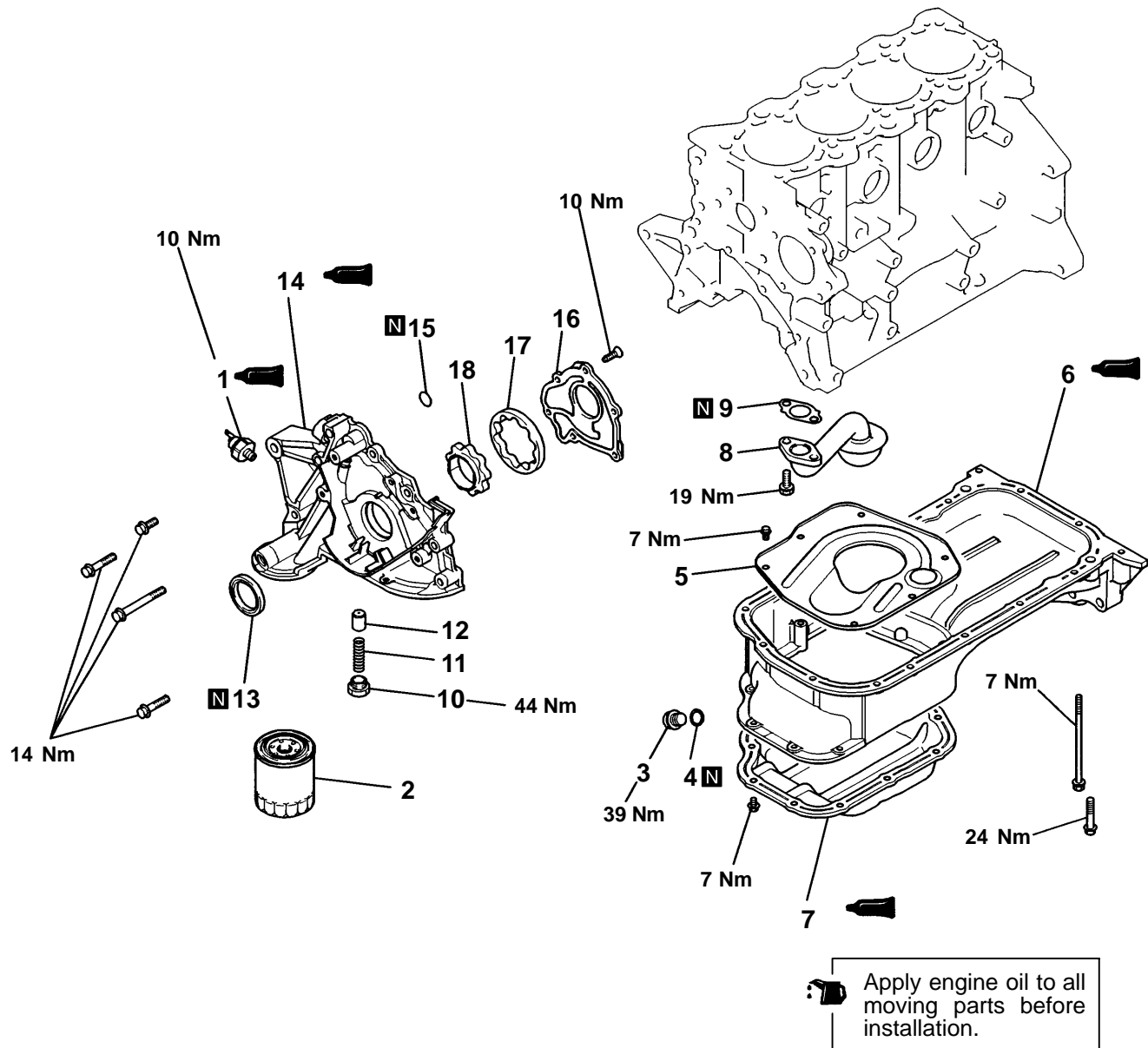
9EN0519

Removal steps

1. Oil pressure switch
 2. Oil filter
 3. Drain plug
 4. Drain plug gasket
 5. Oil pan
 6. Oil screen
 7. Oil screen gasket
 8. Relief plug

9. Relief spring
 10. Relief plunger
 11. Oil seal
 12. Oil pump case
 13. O-ring
 14. Oil pump case cover
 15. Outer rotor
 16. Inner rotor

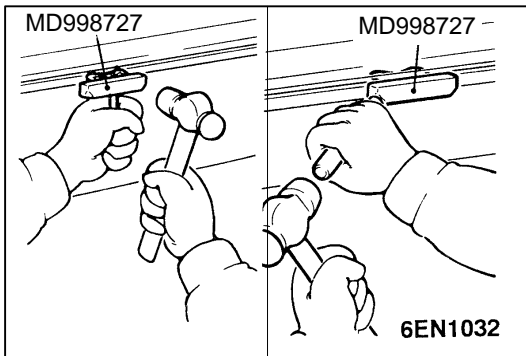
REMOVAL AND INSTALLATION <DOHC>



9EN0888

Removal steps

- 
- | | | | | |
|---|---|---|---|-------------------------|
|  | 1. Oil pressure switch | | | 10. Relief plug |
|  | 2. Oil filter | | | 11. Relief spring |
| | 3. Drain plug | | | 12. Relief plunger |
| | 4. Drain plug gasket | |  | 13. Oil seal |
| | 5. Baffle plate <For CARISMA,
SPACE STAR only> |  |  | 14. Oil pump case |
|  | 6. Upper oil pan | | | 15. O-ring |
|  | 7. Lower oil pan | | | 16. Oil pump case cover |
|  | 8. Oil screen |  |  | 17. Outer rotor |
| | 9. Oil screen gasket |  |  | 18. Inner rotor |



REMOVAL SERVICE POINTS

◀A▶ OIL PAN REMOVAL

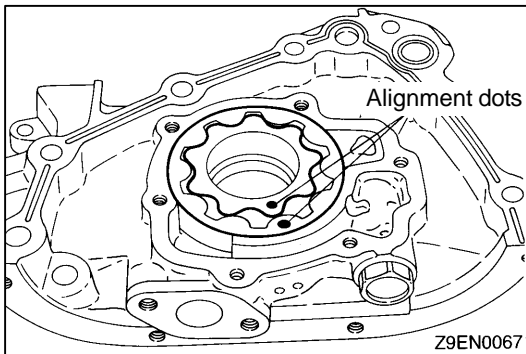
- (1) Knock in the special tool deeply between the oil pan and the cylinder block.
- (2) Hitting the side of the special tool, slide the special tool along the oil pan to remove the oil pan.

◀B▶ REMOVAL OF UPPER OIL PAN

- (1) At first remove the bolt (Length: 121 mm <DOHC, DOHC-GDI for CARISMA>, 116 mm <DOHC-GDI for PAJERO io>) which is nearest to flywheel, and then remove the other bolts.

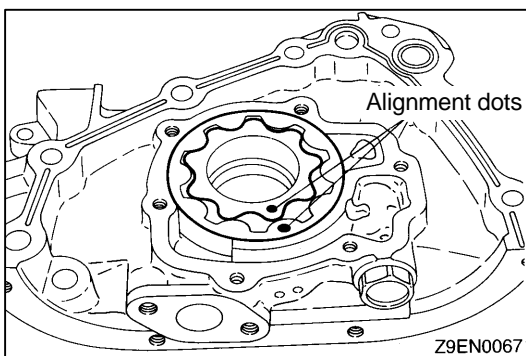
Caution

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



◀C▶ OUTER ROTOR/INNER ROTOR REMOVAL

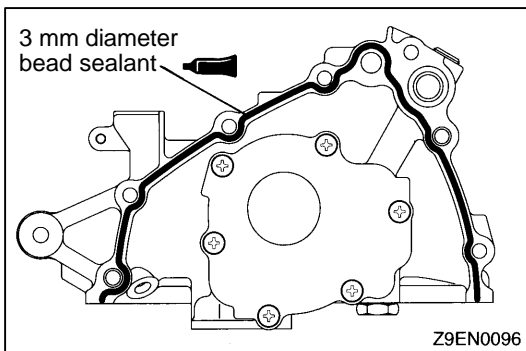
- (1) Make alignment dots on the outer and inner rotors for reference in reassembly.



INSTALLATION SERVICE POINTS

▶A◀ INNER ROTOR/OUTER ROTOR INSTALLATION

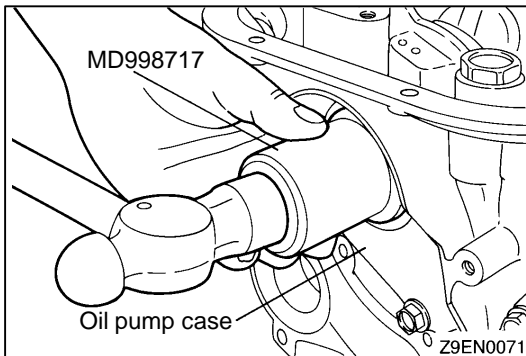
- (1) Apply engine oil to the rotors. Then, install the rotors ensuring that the alignment dots made at disassembly are properly aligned.



▶B◀ SEALANT APPLICATION TO OIL PUMP CASE

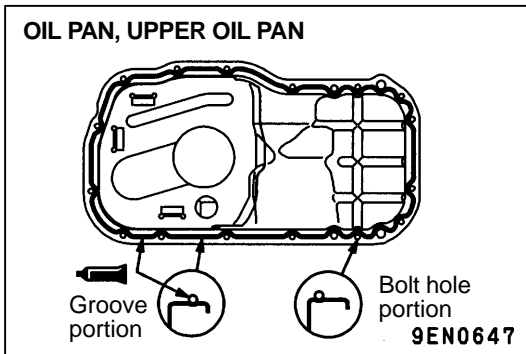
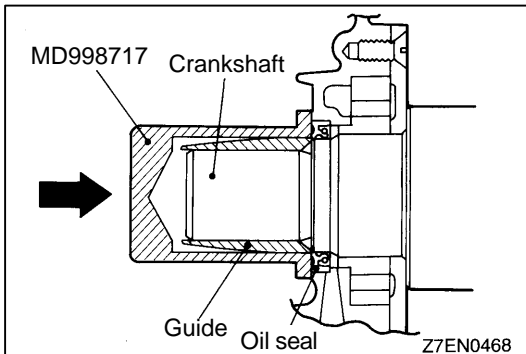
Specified sealant:

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

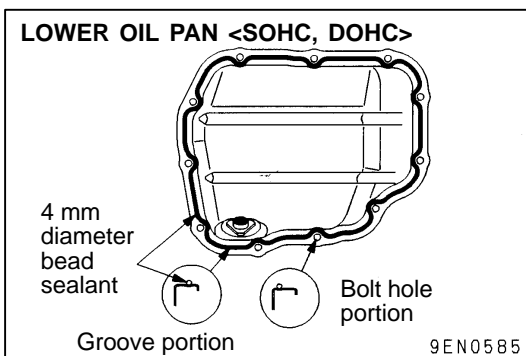
- (1) Remove all the remaining gasket from the mating surfaces using a scraper or a wire brush.
- (2) Apply a 4 mm diameter bead of sealant to the oil pan flange.

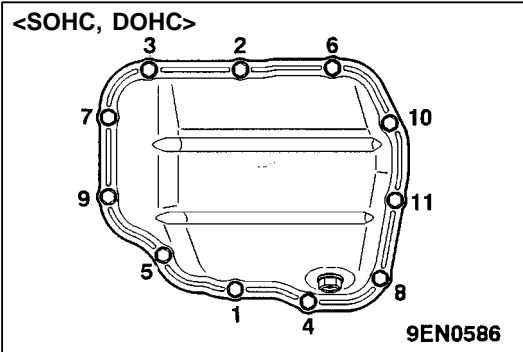
See **“Form-In-Place Gasket”** in **“SPECIFICATIONS”**.

Specified sealant:

Mitsubishi Genuine Part No. MD970389 or equivalent

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

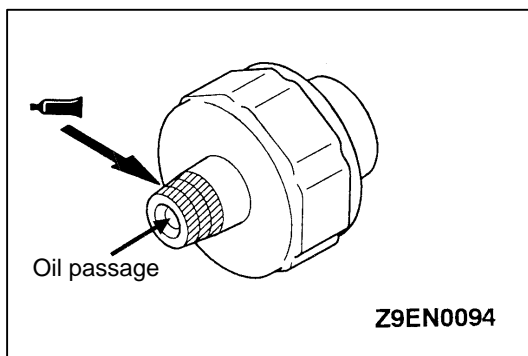




- (4) Tighten the lower oil pan mounting bolts in the sequence shown in the illustration.

►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

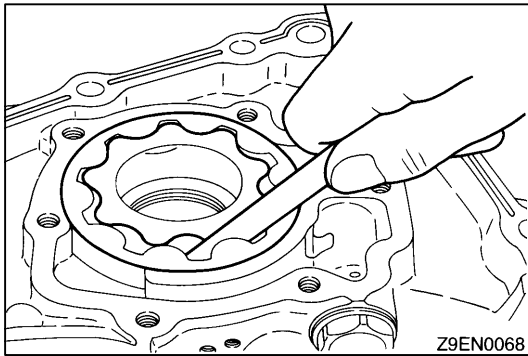
- (1) Apply sealant to the threads of the switch.

Specified sealant:

3M ATD Part No. 8660 or equivalent

Caution

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

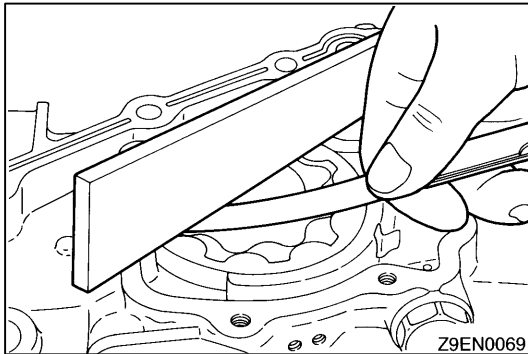


INSPECTION

OIL PUMP

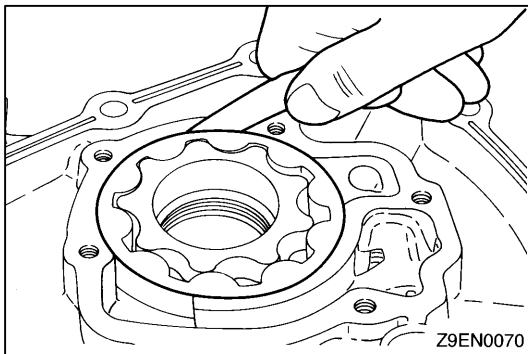
- (1) Check the tip clearance.

Standard value: 0.06 – 0.18 mm



- (2) Check the side clearance.

Standard value: 0.04 – 0.10 mm




- (3) Check the body clearance.

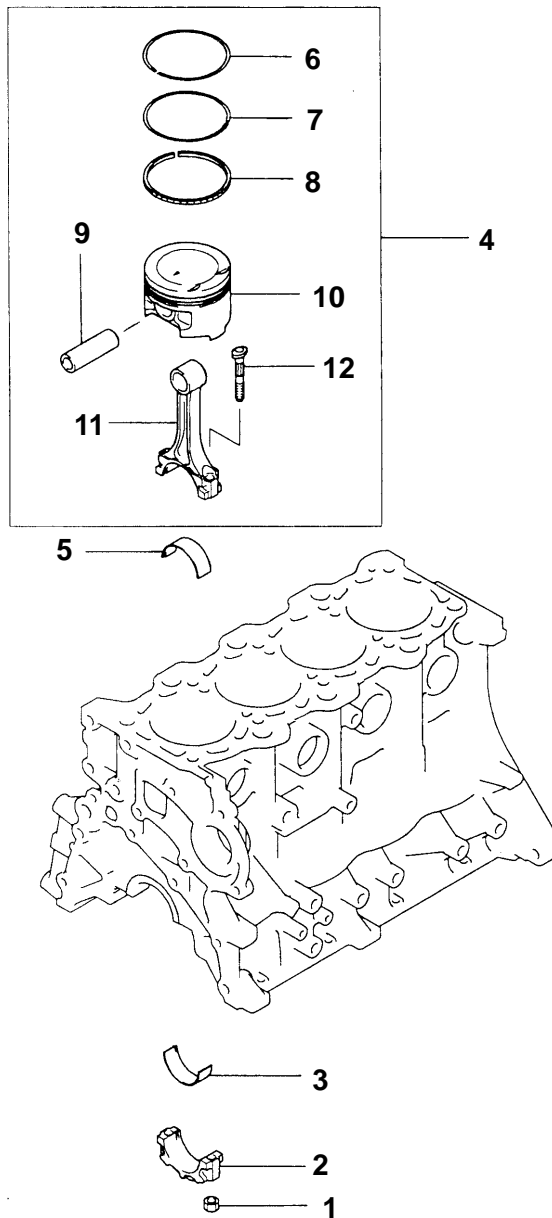
Standard value: 0.10 – 0.18 mm

Limit: 0.35 mm

PISTON AND CONNECTING ROD

REMOVAL AND INSTALLATION

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

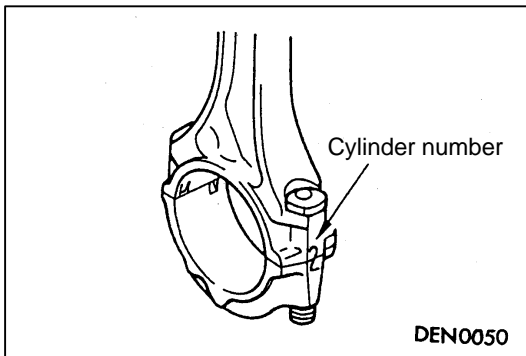


Z9EN0043

Removal steps

- | | |
|--|---|
| <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> <div style="background-color: black; color: white; padding: 2px 5px;">A</div> </div> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="background-color: black; color: white; padding: 2px 5px;">G</div> <div style="background-color: black; color: white; padding: 2px 5px;">F</div> <div style="background-color: black; color: white; padding: 2px 5px;">E</div> <div style="background-color: black; color: white; padding: 2px 5px;">D</div> <div style="background-color: black; color: white; padding: 2px 5px;">E</div> <div style="background-color: black; color: white; padding: 2px 5px;">C</div> </div> </div> | 1. Nut
2. Connecting rod cap
3. Connecting rod bearing
4. Piston and connecting rod
5. Connecting rod bearing
6. Piston ring No. 1 |
|--|---|

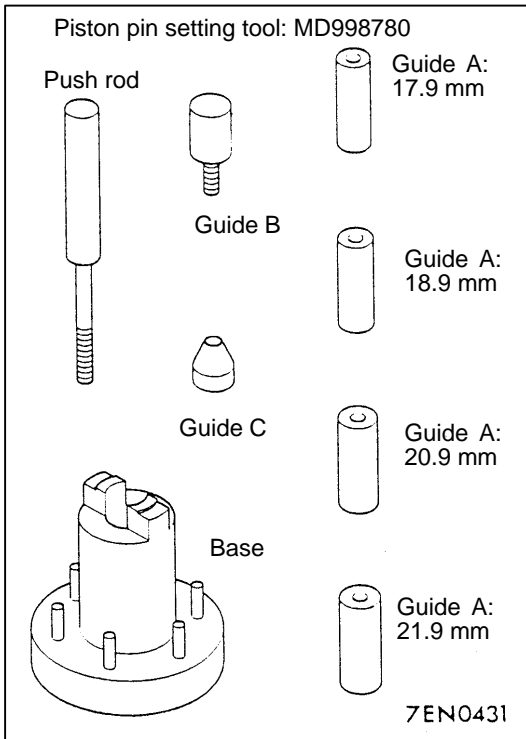
- | | |
|--|--|
| <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> <div style="background-color: black; color: white; padding: 2px 5px;">B</div> </div> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="background-color: black; color: white; padding: 2px 5px;">C</div> <div style="background-color: black; color: white; padding: 2px 5px;">B</div> <div style="background-color: black; color: white; padding: 2px 5px;">A</div> </div> </div> | 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

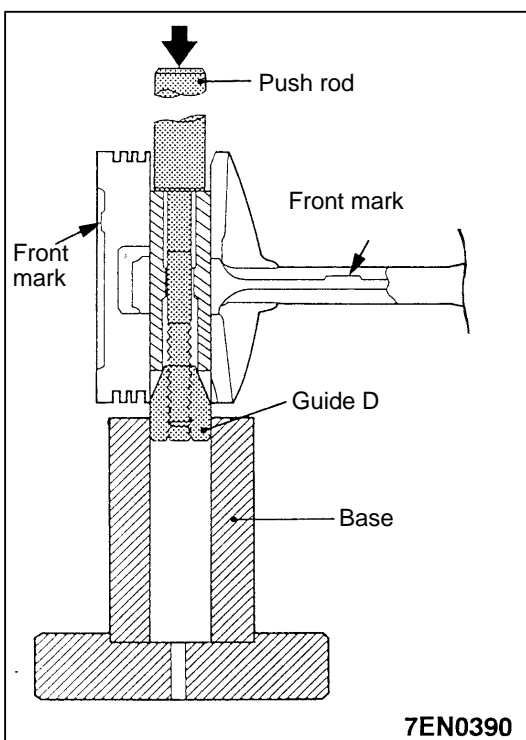
- (1) Mark the cylinder number on the side of the connecting rod big end for correct reassembly.



◀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

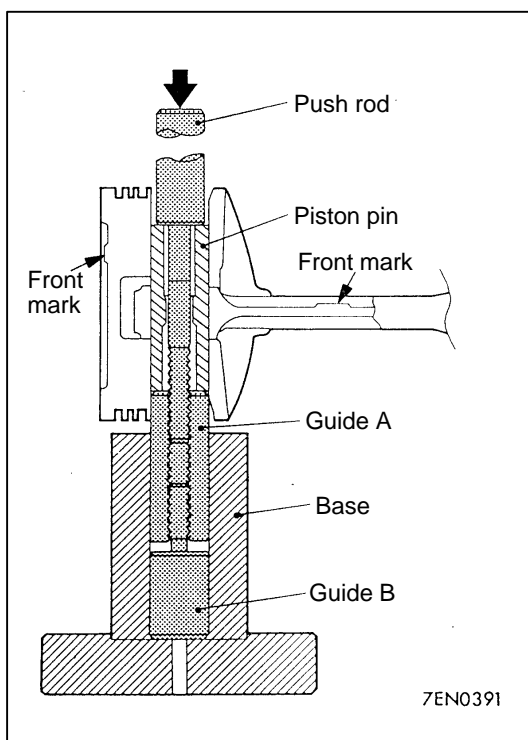
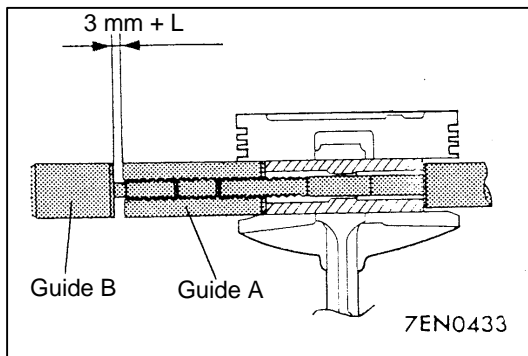
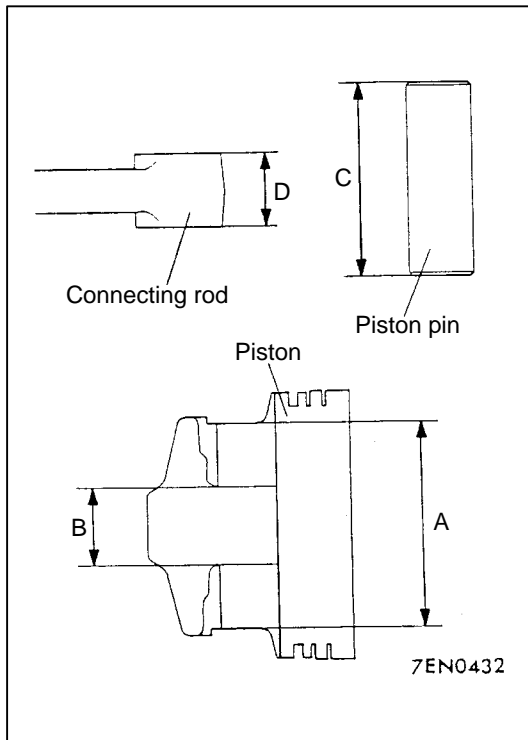
- (1) Measure the following dimensions of the piston, piston pin and connecting rod.
A: Piston pin insertion hole length
B: Distance between piston bosses
C: Piston pin length
D: Connecting rod small end width
- (2) Calculate the following formula by substituting the measured value.

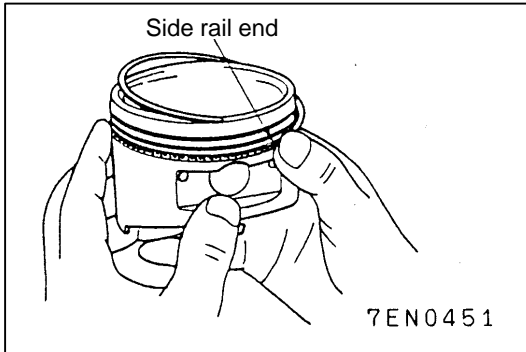
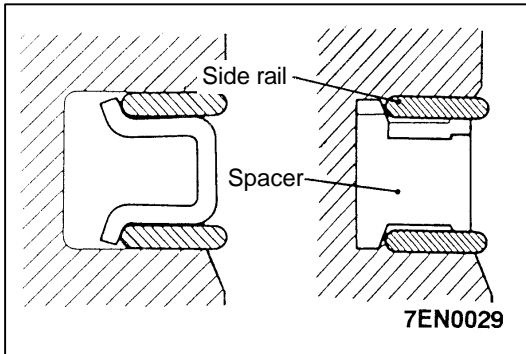
$$L = ((A - C) - (B - D)) / 2$$
- (3) Insert the Push Rod (special tool) into the piston pin and attach the guide A to the push rod end.
- (4) Assemble the connecting rod in the piston with their front marks facing the same direction.
- (5) Apply engine oil to the entire periphery of the piston pin.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

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

NOTE

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

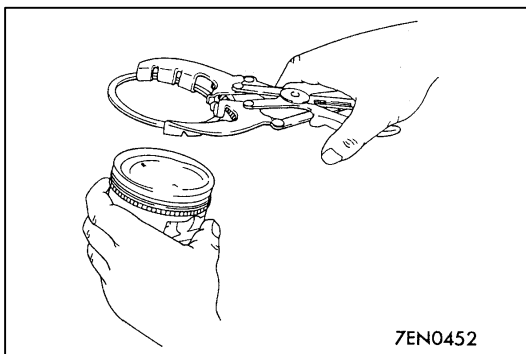
Size	Identification colour
Standard size	None
0.50 mm O.S.	Blue
1.00 mm O.S.	Yellow

- 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.

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



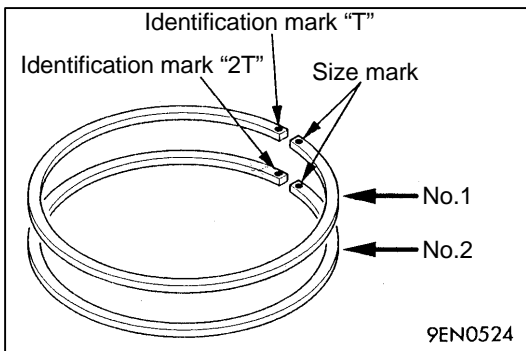
C PISTON RING NO.2/PISTON RING NO.1 INSTALLATION

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

Identification mark:

No.1 ring: T

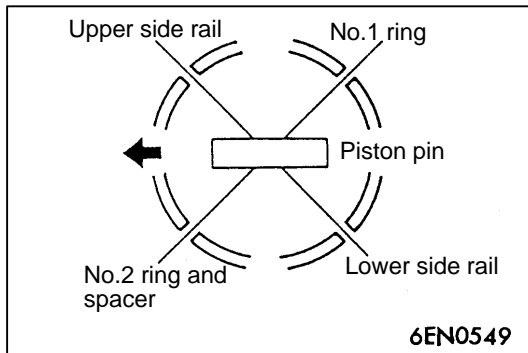
No.2 ring: 2T



NOTE

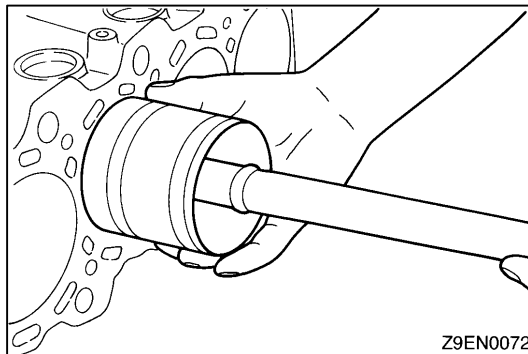
The piston ring is stamped with the following size mark.

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



►D◄ PISTON AND CONNECTING ROD INSTALLATION

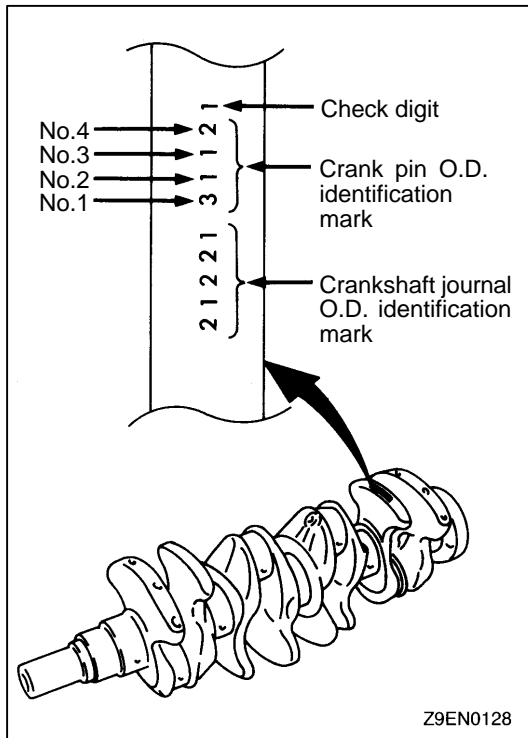
- (1) Liberally coat engine oil on the circumference of the piston, piston ring and oil ring.
- (2) Arrange the piston ring and oil ring gaps (side rail and spacer) as shown in the illustration.
- (3) Face the front mark (arrow) on the top of the piston toward the camshaft sprocket.



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

Caution

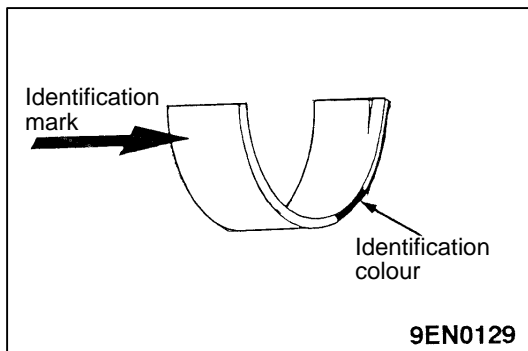
Do not strike the piston into the cylinder block because the piston ring or crank pin will be damaged.

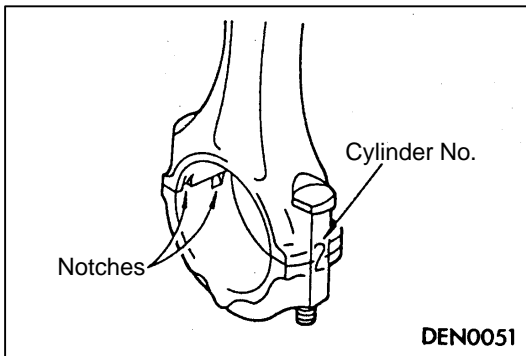


►E◄ CONNECTING ROD BEARING INSTALLATION

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

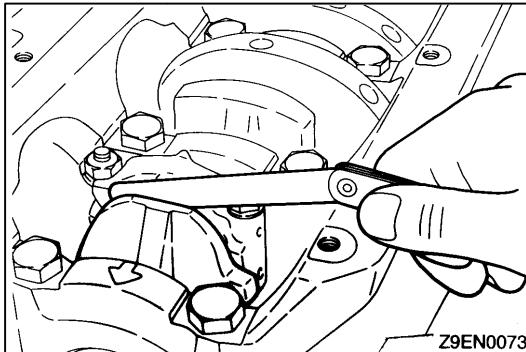
Crankshaft	Connecting rod bearing	
Pin O.D. identification mark	Identification mark (service part)	Identification colour (Line production part)
1	S1	Brown
2	S2	Black
3	S3	Green





►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

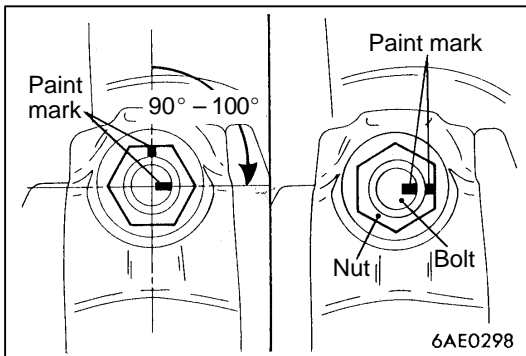
Limit: 0.4 mm

►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.

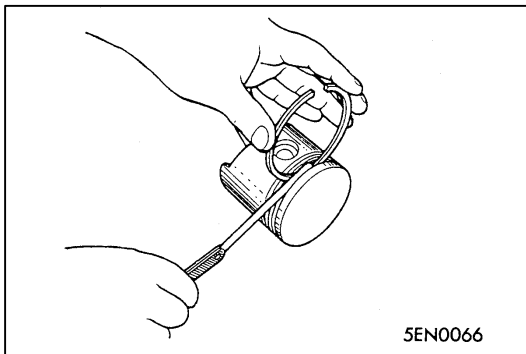
- (1) Since the connecting rod cap bolts and nuts are torqued using the plastic area tightening method, the bolts should be examined BEFORE reuse. If the bolt threads are “necked down”, the bolt should be replaced.
Necking can be checked by running a nut with fingers to the full length of the bolt threads. 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: 0.25 – 0.40 mm (4G92, 4G93)

0.15 – 0.30 mm (4G94)

No.2: 0.40 – 0.55 mm

Oil:

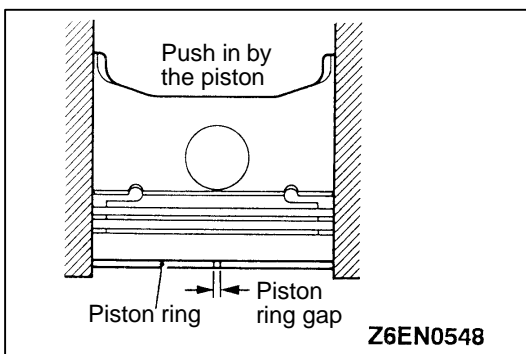
SOHC: 0.20 – 0.60 mm

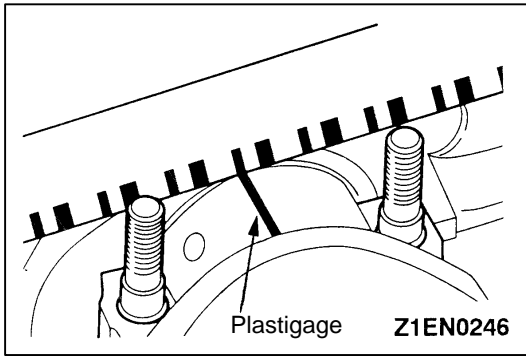
DOHC: 0.10 – 0.35 mm

Limit:

No.1, No.2: 0.8 mm

Oil: 1.0 mm





CRANKSHAFT PIN OIL CLEARANCE (PLASTIGAGE METHOD)

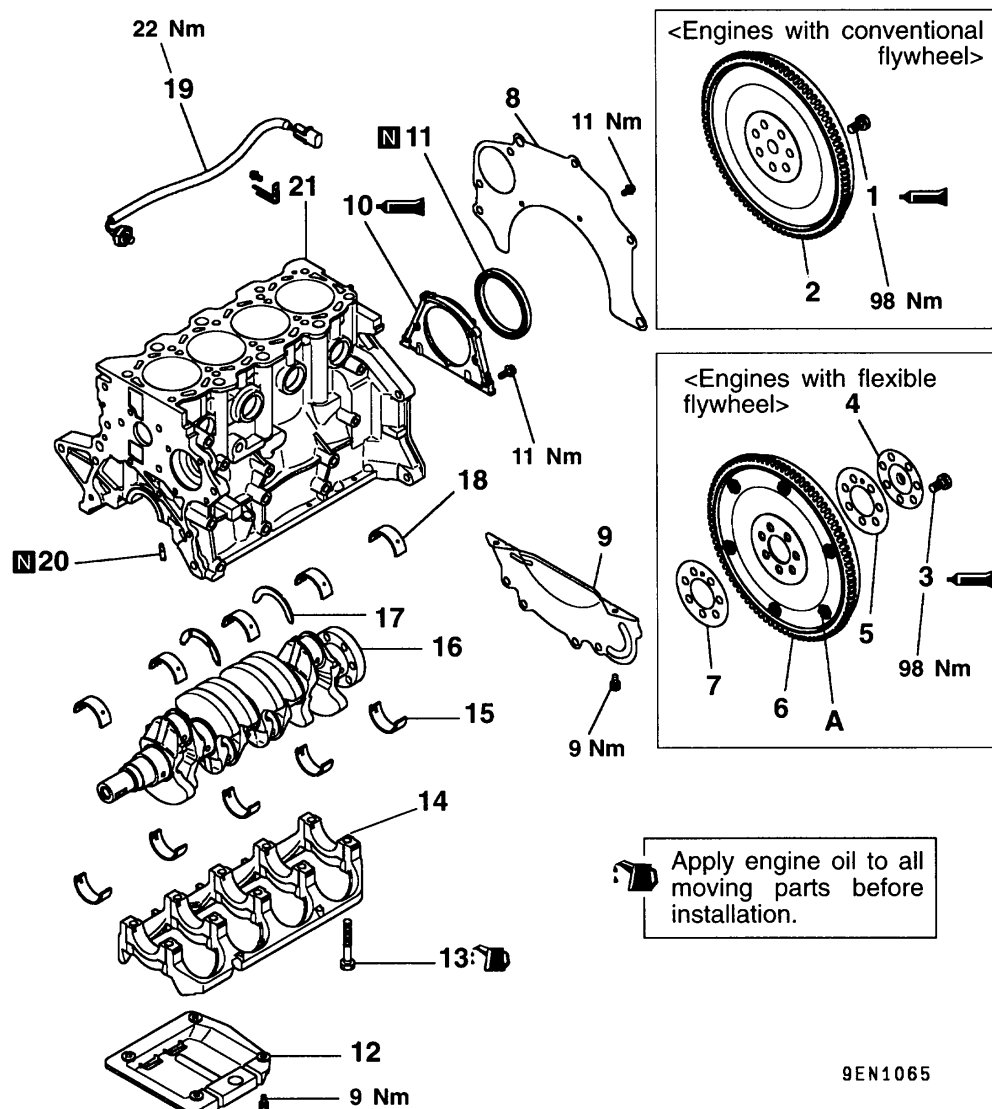
- (1) Remove oil from crankshaft pin and connecting rod bearing.
- (2) Cut the Plastigage to the same length as the width of bearing and place it on crankshaft pin in parallel with its axis.
- (3) Install the connecting rod cap carefully and tighten the bolts to specified torque.
- (4) Carefully remove 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



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 | | 19. Knock sensor |
| | 8. Rear plate | | <DOHC-MIVEC> |
| | 9. Bell housing cover <SOHC> | ▶A◀ | 20. Oil jet |
| ▶E◀ | 10. Rear oil seal case | ▶A◀ | <DOHC-MIVEC> |
| ▶D◀ | 11. Oil seal | | 21. Cylinder block |
| | 12. Baffle plate | | |
| | <DOHC-MIVEC and DOHC-GDI> | | |

Caution

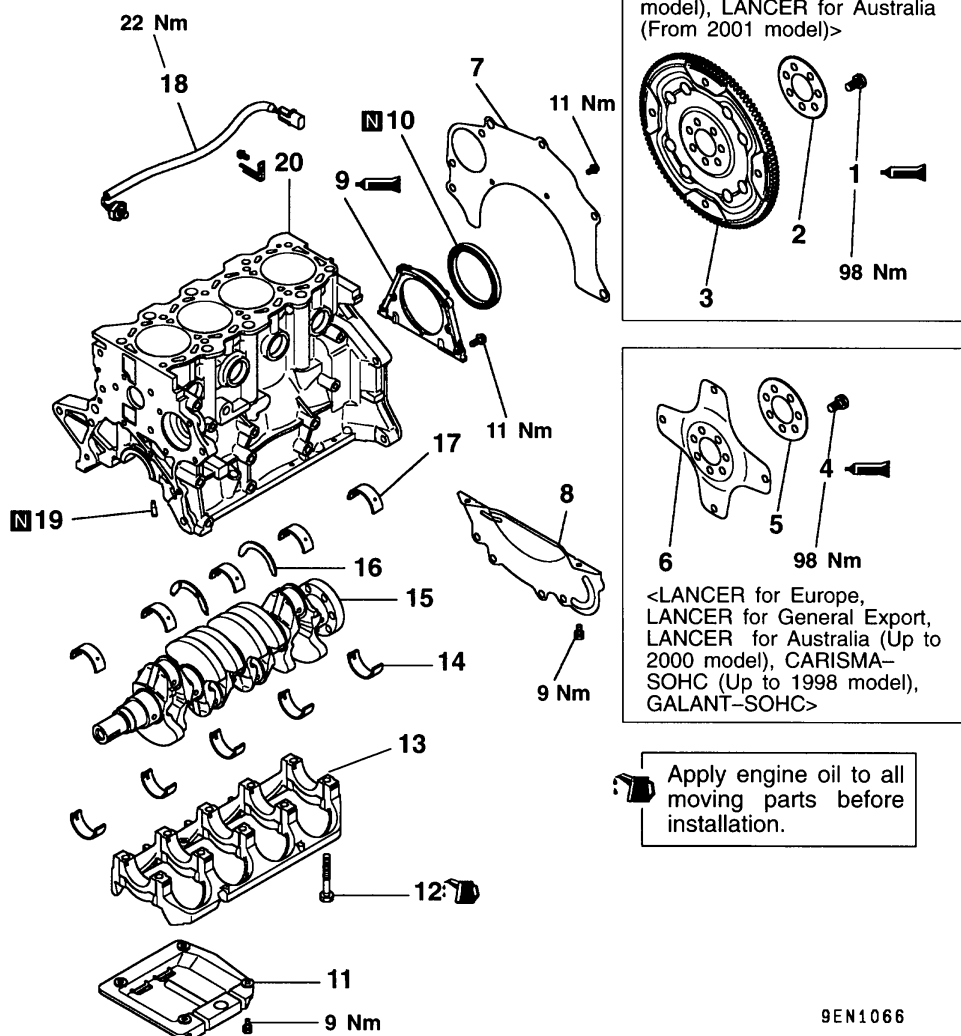
On the flexible wheel equipped engines, do not remove any of the bolts "A" of the flywheel shown in the illustration.

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

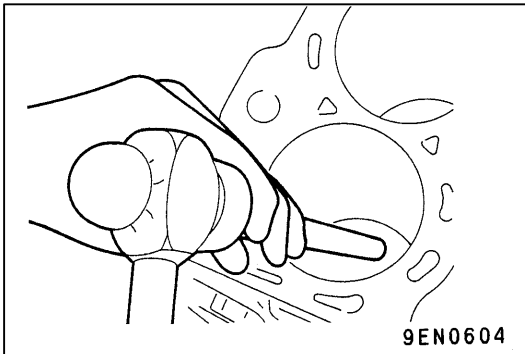
MAIN

Group
11

11B
4G9


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 | ▶B◀ | 18. Knock sensor<DOHC-MIVEC> |
| ▶F◀ | 8. Bell housing cover <SOHC> | ▶B◀ | 19. Oil jet <DOHC-MIVEC> |
| ▶E◀ | 9. Rear oil seal case | ▶A◀ | 20. Cylinder block |
| ▶D◀ | 10. Oil seal | | |
| ▶D◀ | 11. Baffle plate | | |
| | <DOHC-MIVEC and DOHC-GDI> | | |



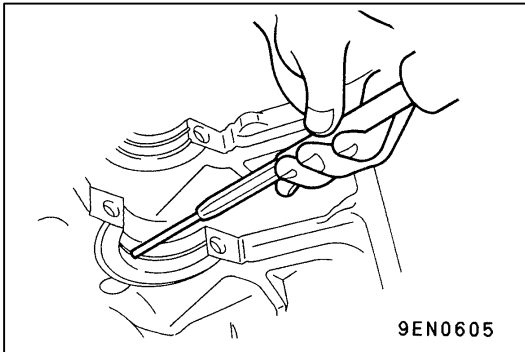
REMOVAL SERVICE POINT

◀A▶ OIL JET REMOVAL

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

Caution

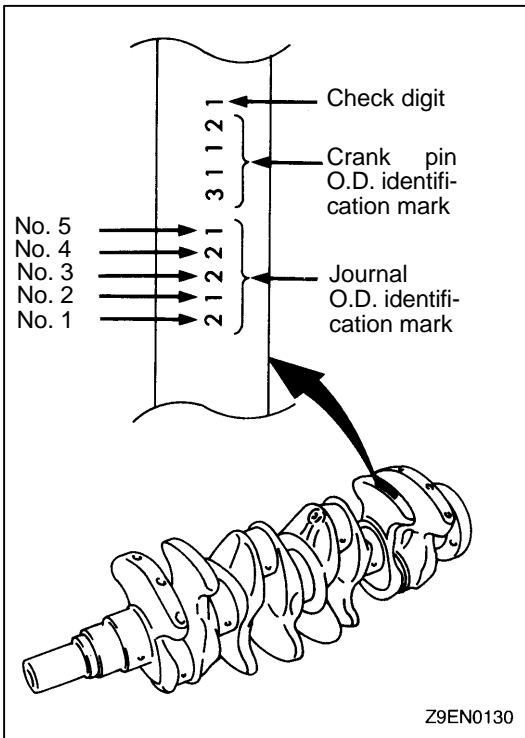
1. Be careful not to scratch the cylinder wall.
2. Do not reuse the removed oil jets.



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.

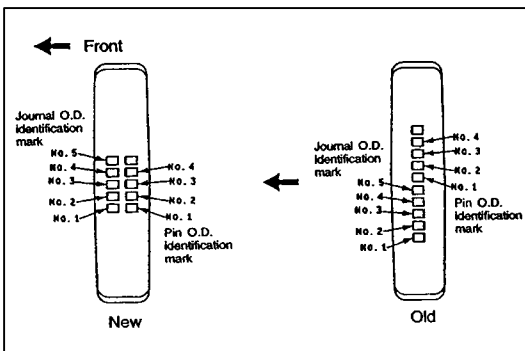


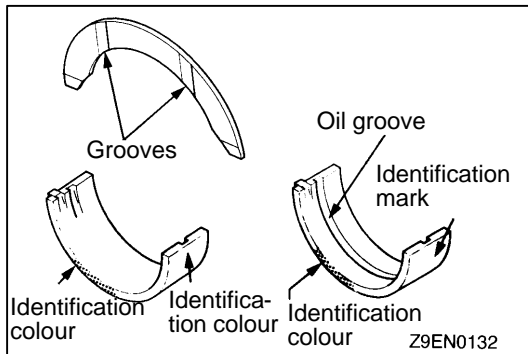
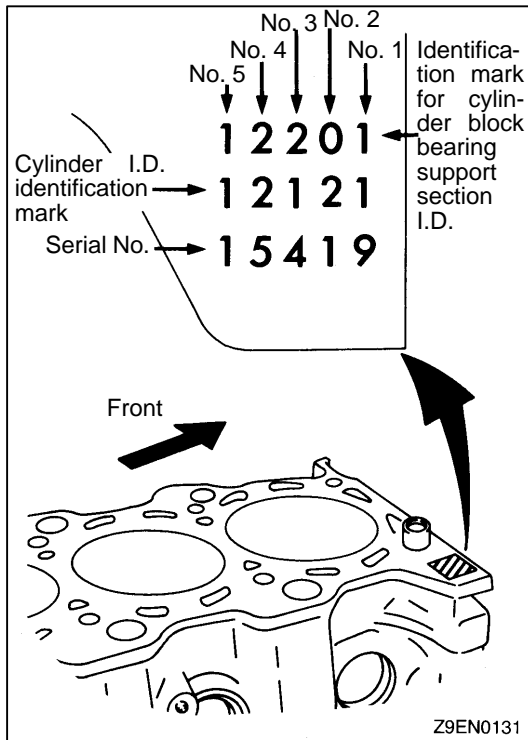
▶B◀ CRANKSHAFT BEARING INSTALLATION

- (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.

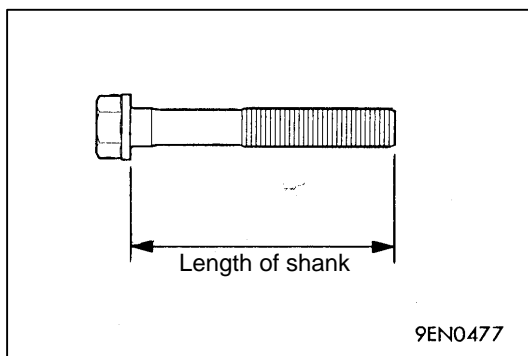
Crankshaft journal	Cylinder block bearing bore	Crankshaft bearing	
Identification mark	Identification mark	Identification mark (service parts)	Identification colour (Line production parts)
1	0	1	Brown
	1	2	Black
	2	3	Green
2	0	2	Black
	1	3	Green
	2	4	Yellow
3	0	3	Green
	1	4	Yellow
	2	5	Pink*

*: 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.

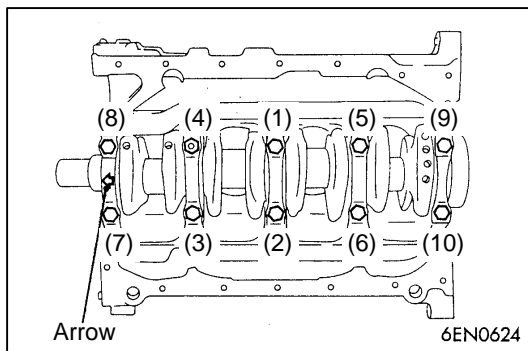


►C◄ BEARING CAP/BEARING CAP BOLT INSTALLATION

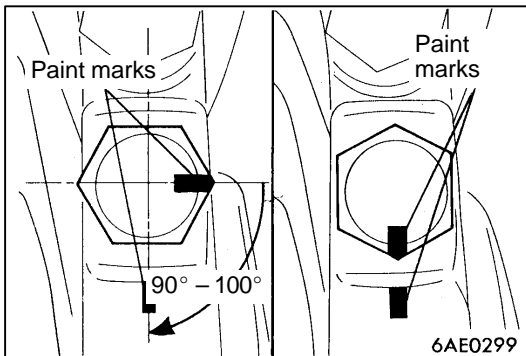
- (1) Install the bearing caps so that their arrows are positioned on the time belt side.
- (2) When installing the bearing cap bolts, check that the shank length of each bolt meets the limit. If the limit is exceeded, replace the bolt.

Limit: max. 71.1 mm

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



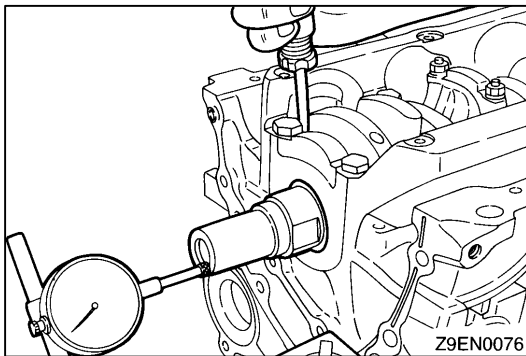
- (4) Tighten the bearing cap bolts to 25 Nm torque in the tightening sequence.



- (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

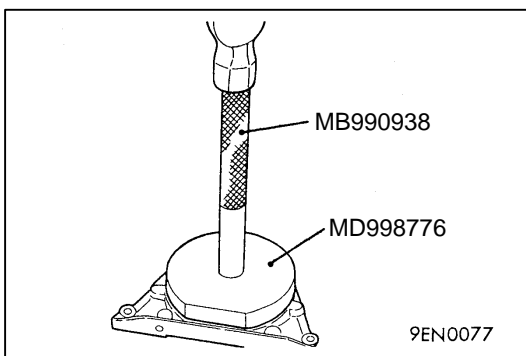
1. If the nut is turned less than 90°, proper fastening performance may not be expected. When tightening the nut, therefore, be careful to give a sufficient turn to it.
2. If the nut is overtightened (exceeding 100°), loosen the nut completely and then retighten it by repeating the tightening procedure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



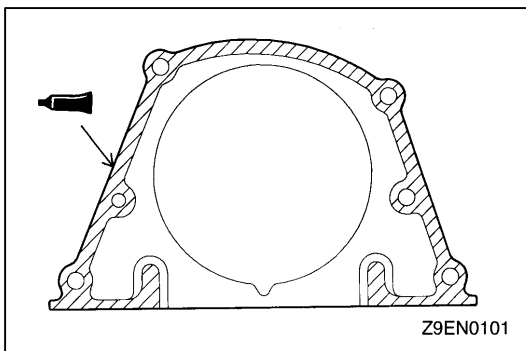
- (8) After installing the bearing caps, make sure that the crankshaft turns smoothly and the end play is correct. If the end play exceeds the limit, replace crankshaft bearings.

Standard value: 0.05 – 0.25 mm

Limit: 0.4 mm



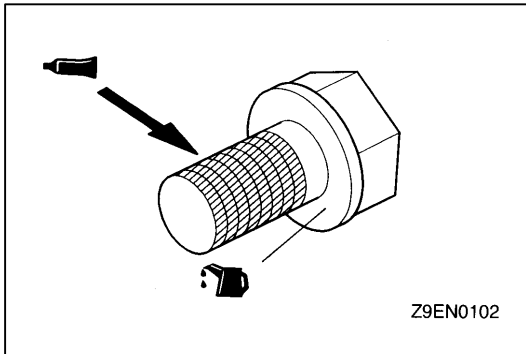
►D◄ OIL SEAL INSTALLATION



►E◄ SEALANT APPLICATION TO OIL SEAL CASE

Specified sealant:

Mitsubishi Genuine Part No. MD970389 or equivalent



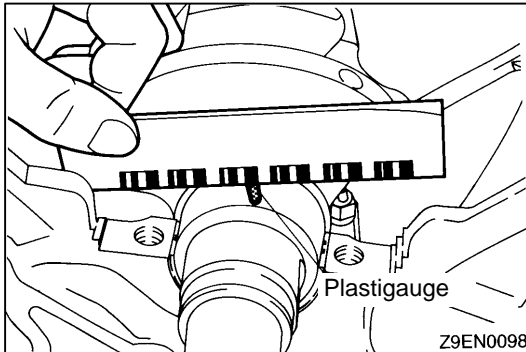
►F◄ DRIVE PLATE BOLT/FLYWHEEL BOLT INSTALLATION

- (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

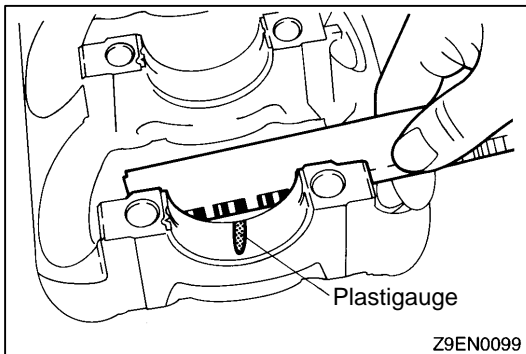
- (5) Tighten the bolts to specified torque.



INSPECTION

CRANKSHAFT JOURNAL OIL CLEARANCE (PLASTIGAUGE METHOD)

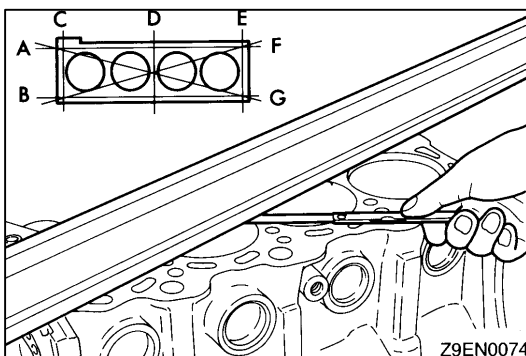
- (1) Remove oil from the crankshaft journal and the crankshaft bearing.
- (2) Install the crankshaft.
- (3) Cut the Plastigauge to the same length as the width of bearing and place it on the journal in parallel with its axis.



- (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.

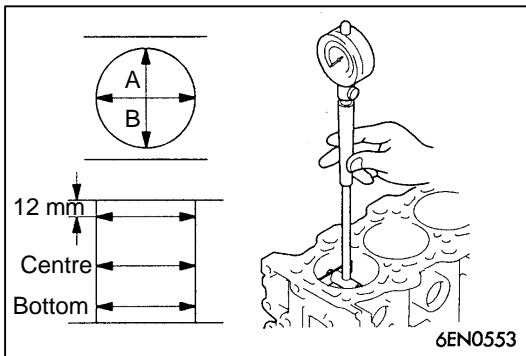
Cylinder block height (when new):

243.5 mm <4G92>

263.5 mm <4G93>

286.7 mm <4G94>

- (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.

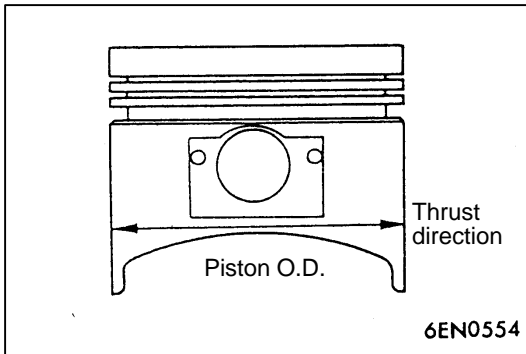
Standard value:

Cylinder inner diameter:

4G92, 4G93 81.00 – 81.03 mm

4G94 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.