

BACKUP Service Manual

ENGINE 1992 – 1993

FOREWORD

The information contained in this service manual has been prepared for the professional automotive technician involved in daily repair operations. Information in this manual is divided into groups by engine models. Each group is further divided to address individual components within the group. These groups contain general information, specification, removal and installation, disassembly and reassembly procedures for the components. The first page of each group contains an alphabetical index to assist in finding the location of the component. The information, descriptions and specifications were in effect at the time this manual was released.

This BACKUP DSM manual is to be used ONLY as a BACKUP. Please DO NOT REDISTRIBUTE WHOLE SECTIONS. This BACKUP was sold to you under the fact that you do indeed OWN a GENUINE DSM MANUAL. It CANNOT BE considered a REPLACEMENT (Unless your original manual was lost or destroyed.)

Please See README.TXT or README.HTML for additional information.

Thank you. Gimmiemymanual@hotmail.com

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VOLUNTARY TECHNICIAN
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National Institute for
AUTOMOTIVE
SERVICE
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Mitsubishi Motors Corporation reserves the right to make changes in design or to make additions to or improvements in its products without imposing any obligations upon itself to install them on its products previously manufactured.

GROUP INDEX

Introduction

Engine

4G1

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INTRODUCTION

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EXPLANATION OF MANUAL CONTENTS

Maintenance and Servicing Procedures

- (1) A diagram of the component parts is provided near the front of each section in order to give the reader a better understanding of the installed condition of component parts.
- (2) The numbers provided within the diagram indicate the sequence for maintenance and servicing procedures; the symbol **N** indicates a non-reusable part; the tightening torque is provided where applicable.

- Removal steps:

The part designation number corresponds to the number in the illustration to indicate removal steps.

- Disassembly steps:

The part designation number corresponds to the number in the illustration to indicate disassembly steps.

- Installation steps:

Specified in case installation is impossible in reverse order of removal steps. Omitted if installation is possible in reverse order of removal steps.

- Reassembly steps:

Specified in case reassembly is impossible in reverse order of disassembly steps. Omitted if reassembly is possible in reverse order of disassembly steps.

Classification of Major Maintenance/Service Points

When there are major points relative to maintenance and servicing procedures (such as essential maintenance and service points, maintenance and service standard values, information regarding the use of special tools, etc.), these are arranged together as major maintenance and service points and explained in detail.

◀A▶: Indicates that there are essential points for removal or disassembly.

▶A▶: Indicates that there are essential points for installation or reassembly.

Symbols for Lubrication, Sealants and Adhesives

Information concerning the locations for lubrication and for application of sealants and adhesives is provided, by using symbols, in the diagram of component parts, or on the page following the component parts page, and explained.



.. Grease
(multipurpose grease unless there is a brand or type specified)



..... Sealant or adhesive



..... Brake fluid, automatic transmission fluid or air conditioning compressor oil



..... Engine oil or gear oil

Indicates the group number.

Indicates the page number.

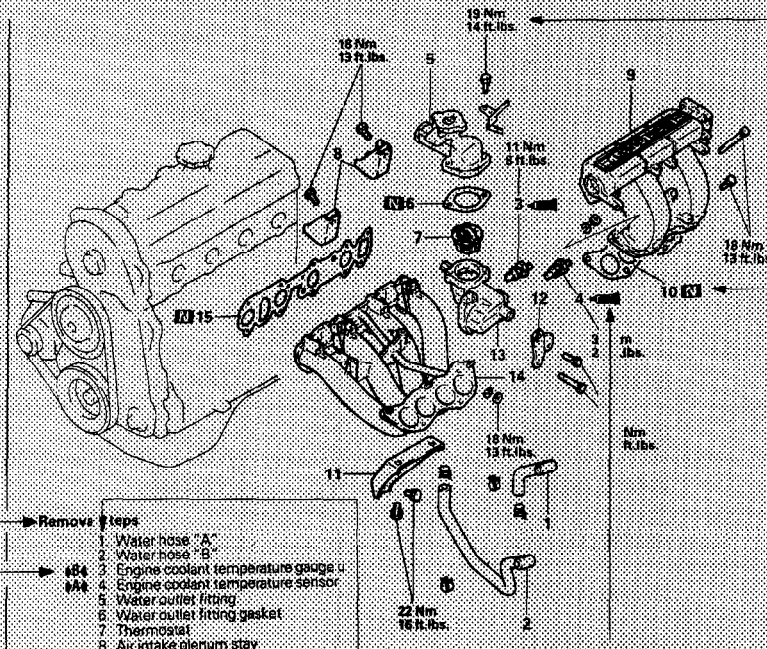
Indicates the group title.

Indicates the section title.

11A-28

4G3 ENGINE - Intake Manifold

INTAKE MANIFOLD REMOVAL AND INSTALLATION



Denotes tightening torque.

Denotes non-reusable part.

Remove Steps

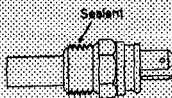
1. Water hose "A"
2. Water hose "B"
3. Engine coolant temperature gauge
4. Engine coolant temperature sensor
5. Water outlet fitting
6. Water outlet fitting gasket
7. Thermostat
8. Air intake plenum stay
9. Air intake plenum
10. Air intake plenum gasket
11. Intake manifold stay
12. Intake manifold
13. Intake manifold gasket
14. Intake manifold
15. Intake manifold gasket

This number corresponds to the number appearing in "Removal steps", "Disassembly steps", "Installation steps" or "Reassembly steps"

INSTALLATION SERVICE POINTS

SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE SENSOR

Specified sealant:
3M Nut Locking Part No. 4171 or equivalent



Operating procedures, cautions, etc. on removal, installation, disassembly and reassembly are described.

ENGINE MODEL TABLE – 1992

Engine Series,	Engine Model	Displacement Liters (cu.in.)	Type	No. of Valves (per cylinder)	Vehicle Model
4G1	4G15	1.5 (92)	In-line, SOHC	3	Mirage
4G3	4G37	1.8 (110)	In-line, SOHC	2	Eclipse
4G6	4G61	1.6 (98)	In-line, DOHC	4	Mirage
	4G63	2.0 (122)	In-line, SOHC	2	Galant
	4G63	2.0 (122)	In-line, DOHC	4	Galant, Eclipse
	4G63 Turbo	2.0 (122)	In-line, DOHC	4	Galant, Exlipse
	4G64	2.4 (146)	In-line, SOHC	2	Expo, Truck
4G9	4G93	1.8 (110)	In-line, SOHC	4	Expo LRV
6G7	6G72	3.0 (183)	60°V, SOHC (per bank)	2	Diamante, Montero, Truck
	6G72	3.0 (183)	60°V, DOHC (per bank)	4	Diamante, 3000GT
	6G72 Turbo	3.0 (183)	60°V, DOHC (per bank)	4	3000GT

ENGINE MODEL TABLE – 1993

Engine Series	Engine Model	Displacement Liters (cu.in.)	Type	No. of Valves (per cylinder)	Vehicle Model
4G1	4G15	1.5 (92)	In-line, SOHC	3	Mirage
4G3	4G37	1.8 (110)	In-line, SOHC	2	Eclipse
4G6	4G63	2.0 (122)	In-line, SOHC	4	Galant
	4G63	2.0 (122)	In-line, DOHC	4	Galant, Eclipse
	4G63 Turbo	2.0 (122)	In-line, DOHC	4	Galant, Exlipse
	4G64	2.4 (146)	In-line, SOHC	2	Truck
	4G64	2.4 (146)	In-line, SOHC	4	Expo-LRV, Expo
4G9	4G93	1.8 (110)	In-line, SOHC	4	Mirage, Expo LRV
6G7	6G72	3.0 (183)	60°V, SOHC (per bank)	2	Diamante, Montero, Truck
	6G72	3.0 (183)	60°V, DOHC (per bank)	4	Diamante, 3000GT
	6G72 Turbo	3.0 (183)	60°V, DOHC (per bank)	4	3000GT

SPECIAL TOOL NOTE

Please refer to the special tool cross reference chart which is located in the service manual at the beginning of each group, for a cross reference from the MMC special tool number to the special tool number that is available in your market.

TORQUE REFERENCES

General tightening torque is as shown in the following table.

The specific part tightening torque is shown at the beginning of each group.

Size mm (dia. x pitch)	Bolt with spring washer						Flange bolt			
	Head mark 4		Head mark 7		Head mark 10		Head mark 4		Head mark 7	
	Nm	ft.lbs.	Nm	ft.lbs.	Nm	ft.lbs.	Nm	ft.lbs.	Nm	ft.lbs.
5 x 0.8	—	—	5.0	4	—	—	—	—	6.0	4
6 x 1.0	—	—	9.0	7	13	9	—	—	11	8
8 x 1.25	11	8	18	13	30	22	14	10	24	17
10 x 1.25	20	14	34	25	60	43	30	22	50	36
12 x 1.25	36	26	62	45	108	78	55	40	90	65
14 x 1.5	55	40	92	67	175	127	—	—	—	—

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 in some parts of the engine. The tightening method for the bolts 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

Remarks:

The bolts in (1) and (2) apply to the 4G6<1993> and 4G93 engines.

The bolts in (3) apply to the 4G15, 4G6<1993> and 4G93 engines.

- 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.

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 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.

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 remaining in the bolt holes.

Form-In-Place Gasket Application

When assembling parts with the FIPG, you must observe some precautions, but the procedure 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.

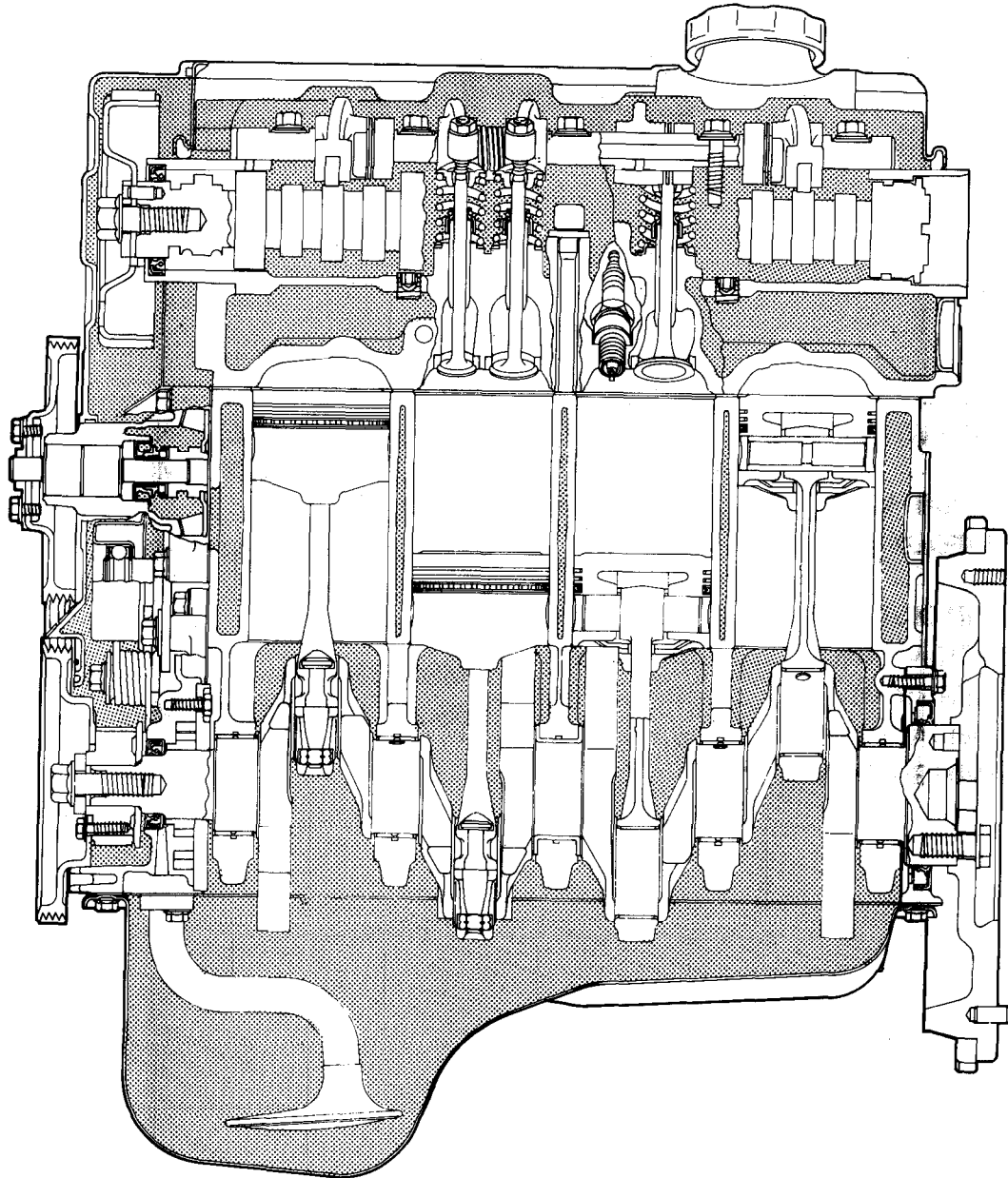
The FIPG application procedure may vary on different areas. Observe the procedure described in the text when applying the FIPG.

ENGINE

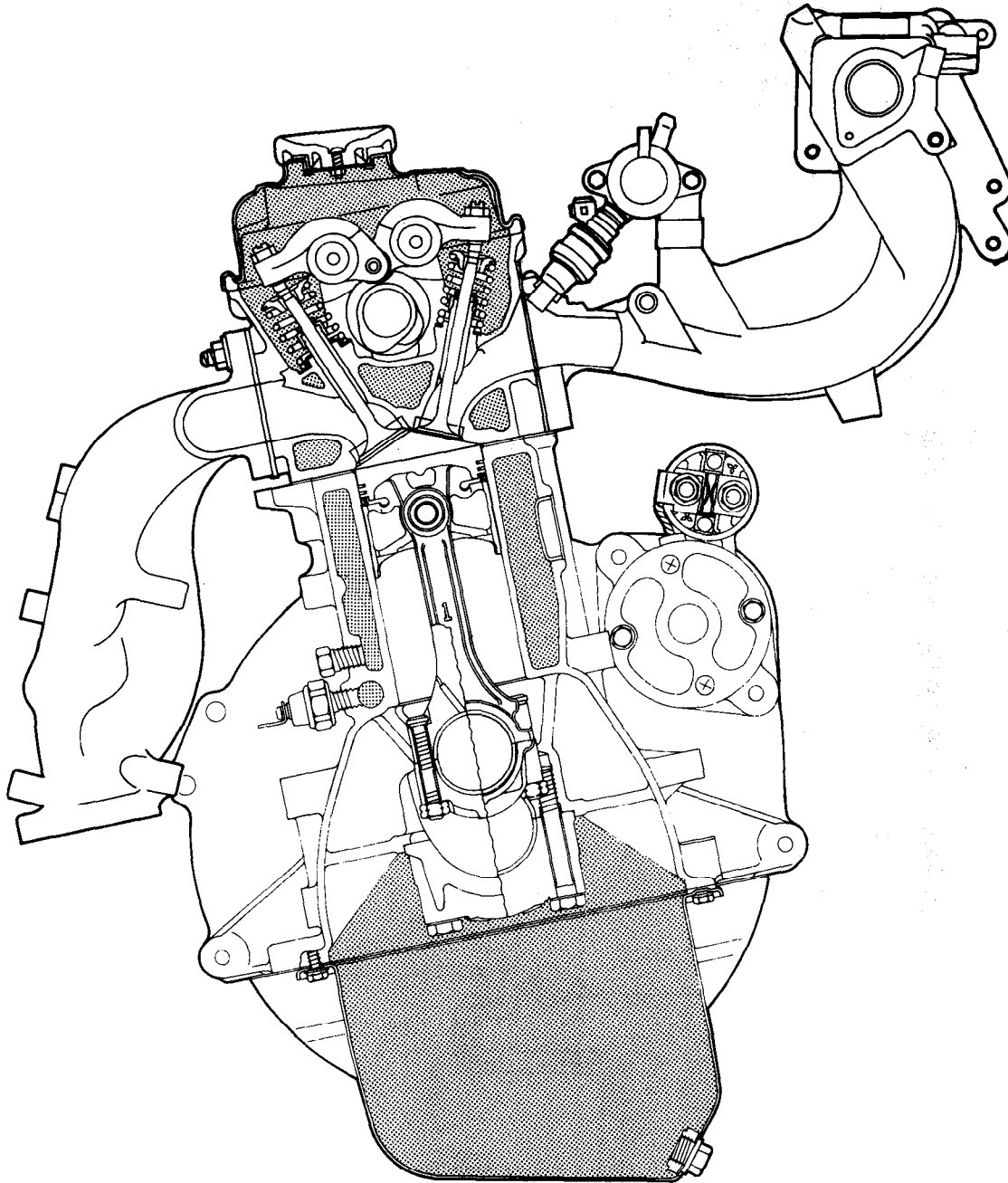
4G15

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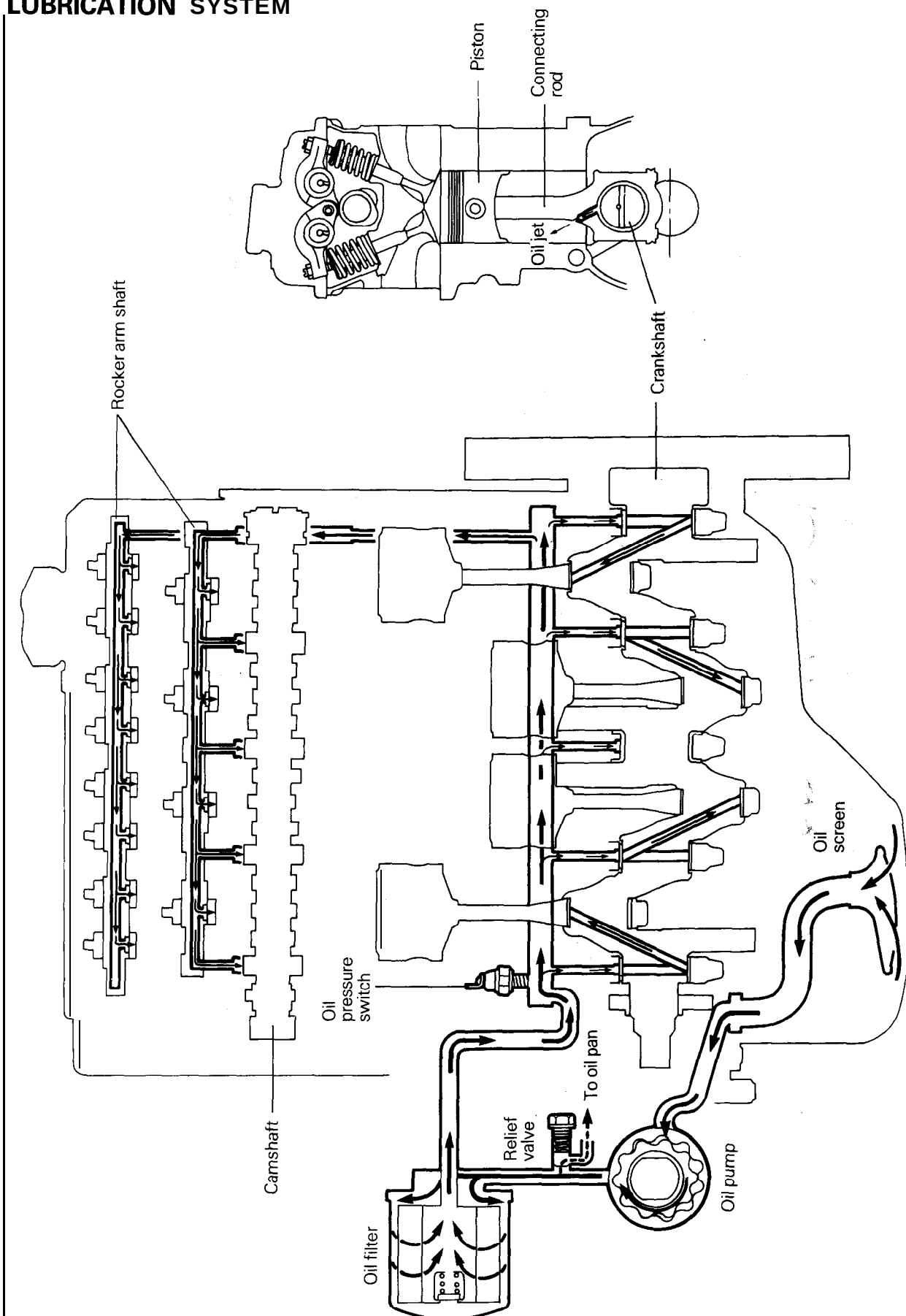
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GENERAL INFORMATION**ENGINE SECTIONAL VIEW**

ISUZU MOTOR CO., LTD.



LUBRICATION SYSTEM



GENERAL SPECIFICATIONS

Items	Specifications	
Type	In-line OHV, SOHC	
Number of cylinders	4	
Combustion chamber	Pentroof type	
Total displacement cm ³ (cu.in.)	1,468 (89.58)	
Cylinder bore mm (in.)	75.5 (2.972)	
Piston stroke mm (in.)	82 (3.228)	
Compression ratio	9.2	
Valve timing		
() : Camshaft identification mark	(1)* ¹	(6)* ²
Intake valve		
Opens BTDC	14"	15"
Closes ABDC	51"	53"
Exhaust valve		
Opens BBDC	51"	57"
Closes ATDC	14"	15"
Lubrication system	Pressure feed, full-flow filtration	
Oil pump type	Trochoid type	
Cooling system	Water-cooled forced circulation	
Water pump type	Centrifugal impeller type	
EGR valve	Single type	
Injector type and number	Electromagnetic, 4	
Injector identification No.	BDH182	
Fuel regulated pressure kpa (psi)	335 (47.6)	
Throttle bore mm (in.)	46 (1.811)	
Throttle position sensor	Variable resistor type	
Closed throttle position switch	Contact type, within idle speed control motor* ¹ Movable contact type within throttle position sensor* ²	

*1: Up to 1992 models

*2: From 1993 models

SERVICE SPECIFICATIONS

mm (in.)

Items	Standard value	Limit
Cylinder head		
Flatness of gasket surface	0.05 (.0020)	0.2 (.008)
Grinding limit of gasket surface		0.2 (.008)
* Total resurfacing depth of both cylinder head and cylinder block		
Overall height	106.9 – 107.1 (4.209 – 4.217)	
Oversize rework dimensions of valve guide hole (both intake and exhaust)		
0.05 (.002)	12.05 – 12.07 (.4744 – .4752)	
0.25 (.010)	12.25 – 12.27 (.4823 – .4831)	
0.50 (.020)	12.50 – 12.52 (.4921 – .4929)	
Oversize rework dimensions of intake valve seat ring hole (primary)		
0.3 (.012)	27.42 – 27.44 (1.0795 – 1.0803)	
0.6 (.024)	27.72 – 27.74 (1.0913 – 1.0922)	
Oversize rework dimensions of intake valve seat ring hole (secondary)		
0.3 (.012)	32.43–32.45 (1.2768 – 1.2776)	
0.6 (.024)	32.73–32.75 (1.2886 – 1.2894)	
Oversize rework dimensions of exhaust valve seat ring hole		
0.3 (.012)	35.43 – 35.45 (1.3949 – 1.3957)	
0.6 (.024)	35.73 – 35.75 (1.4067 – 1.4075)	
Camshaft		
Cam height		
Intake	38.78 (1.5268)	38.28 (1.5071)
Exhaust	39.10 (1.5394)	38.60 (1.5197)
Journal diameter	45.93 – 45.94 (1.8083 – 1.8087)	
Oil clearance	0.06 – 0.10 (.0024 – .0039)	
Rocker arm		
I.D.	18.91 – 18.93 (.7445 – .7453)	
Rocker arm-to-shaft clearance	0.01 – 0.04 (.0004 – .0016)	0.1 (.004)
Rocker arm shaft		
O.D.	18.89 – 18.90 (.7437 – .7441)	
Overall length		
Intake	365 (14.37)	
Exhaust	346 (13.62)	

mm (in.)

Items	Standard value	Limit
Valve		
Overall length		
Intake	100.75 (3.9665)	
Exhaust	101.05 (3.9783)	
Stem diameter		
Intake	6.57 – 6.58 (.2587 – .2591)	
Exhaust	6.53 – 6.55 (.2571 – .2579)	
Face angle	45° – 45°30'	
Thickness of valve head (margin)		
Intake	1.0 (.039)	0.5 (.020)
Exhaust	1.5 (.059)	1.0 (.039)
Stem-to-guide clearance		
Intake	0.02 – 0.05 (.0008 – .0020)	0.10 (.0039)
Exhaust	0.05 – 0.09 (.0020 – .0035)	0.15 (.0059)
Valve clearance		
Intake	0.07 (.0028) Up to 1992 models 0.09 (.0035) From 1993 models	
Exhaust	0.17 (.0067)	
Valve spring		
Free height		
Intake	46.1 (1.815)	45.1 (1.776)
Exhaust	46.8 (1.843)	45.8 (1.803)
Load/installed height N/mm (lbs./in.)		
Intake	230/40 (51/1.57)	
Exhaust	290/40 (64/1.57)	
Out-of-squareness	Max. 2°	4°
Valve guide		
Overall length		
Intake	44 (1.732)	
Exhaust	49.5 (1.949)	
I.D.	6.60 – 6.62 (.2598 – .2606)	
O.D.	12.055 – 12.065 (.4746 – .4750)	
Service size	0.05 (.002), 0.25 (.01), 0.50 (.02) oversize	
Press-in temperature	Room temperature	
Valve seat		
Seat angle	43°30' – 44°	
Valve contact width	0.9 – 1.3 (.035 – .051)	
Sinkage		0 – 2 (.008)
Service size	0.3 (.012), 0.6 (.024) oversize	

mm (in.)

Items	Standard value	Limit
Piston O.D. Piston-to-cylinder clearance Service size	75.48 – 75.50 (2.9716 – 2.9724) 0.02 – 0.04 (.0008 – .0016) 0.25 (.01), 0.50 (.02), 0.75 (.03), 1.00 (.04) oversize	
Piston ring End gap No. 1 ring No. 2 ring Oil ring Ring-to-ring groove clearance No. 1 ring No. 2 ring Service size	 0.20 – 0.40 (.0079 – .0157) 0.20 – 0.35 (.0079 – .0138) 0.20 – 0.70 (.0079 – .0276) 0.03 – 0.07 (.0012 – .0028) 0.02 – 0.06 (.0008 – .0024) 0.25 (.01), 0.50 (.02), 0.75 (.03), 1.00 (.04) oversize	 0.8 (.031) 0.8 (.031) 1.0 (.039) 0.1 (.004) 0.1 (.004)
Piston pin O.D. Press-in load N (psi) Press-in temperature	18.003 – 18.005 (.7088 – .7089) 5,000 – 15,000 (1,102 – 3,307) Room temperature	
Connecting rod Big end center-to small end center length Bend Twist Big end side clearance	130.95 – 131.05 (5.1555–5.1594) 0.05 (.0020) 0.1 (.004) 0.10 – 0.25 (.0039 – .0098)	0.4 (.016)
Crankshaft End play Journal O.D. Pin O.D. Out-of-roundness and taper of journal and pin Oil clearance of journal Oil clearance of pin	0.05 – 0.18 (.0020 – .0071) 48 (1.89) 42 (1.65) 0.005 (.0002) 0.02 – 0.05 (.0008 – .0020) 0.02 – 0.05 (.0008 – .0020)	0.3 (.012) 0.1 (.004) 0.1 (.004)
Cylinder block .D. Flatness of gasket surface Grinding limit of gasket surface Total resurfacing depth of both cylinder block and cylinder head Overall height	75.50 – 75.53 (2.9724 – 2.9736) 0.05 (.002) 255.9 – 256.1 (10.075 – 10.083)	0.1 (.004) *0.2 (.008)

mm (in.)

Items	Standard value	Limit
Oil pump		
Tip clearance	0.03 – 0.08 (.0012 – .0031)	
Side clearance	0.04 – 0.10 (.0016 – .0039)	
Body clearance	0.10 – 0.18 (.0039 – .0071)	0 . 3 5 (.0138)
Drive belt deflection		
New belt	5.5 -7.0 (.22 – .28)	
Used belt	8.0 (.32)	
Injector		
Coil resistance Ω	13 – 16 at 20°C (68°F)	
Throttle position sensor		
Resistance $k\Omega$	3.5-6.5	
Idle speed control motor		
Coil resistance Ω	5 – 35 at 20°C (68°F)	
Idle air control motor		
Coil resistance Ω	28 – 33 at 20°C (68°F)	
Idle speed control motor position sensor		
Resistance $k\Omega$	4 - 6	

TORQUE SPECIFICATIONS

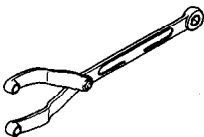
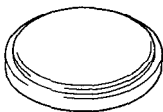
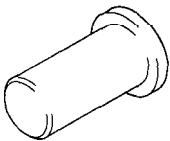
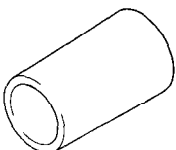
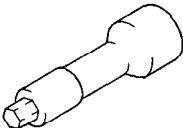
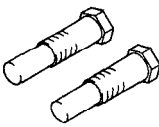
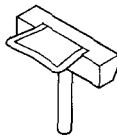
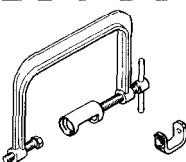
	Nm	ft.lbs.
Generator and ignition system		
Oil level gauge guide mounting bolt	11	8
Water pump pulley bolt	9	7
Generator brace bolt	14	10
Generator brace mounting bolt	24	17
Generator pivot nut	23	17
Crankshaft bolt	85	61
Crankshaft pulley bolt	14	10
Spark plug	25	18
Distributor	12	9
Timing belt		
Engine support bracket, left	36	26
Tensioner bolt	24	17
Camshaft sprocket bolt	70	51
Fuel and emission parts		
Throttle body mounting bolts	19	14
Fuel rail mounting bolts	12	9
Fuel pressure regulator bolts	9	7
EGR valve (California) mounting bolts	13	9
Throttle body		
Throttle position sensor attaching bolts	2.0	1.5
Intake manifold		
Cable bracket bolt	14	11
Engine coolant temperature gauge unit	11	8
Engine coolant temperature sensor	30	22
Thermo switch	8	6
Water outlet fitting bolt	19	14
Thermostat housing bolt and nut	18	13
Intake manifold stay bolt	22	16
Engine support bracket stay	36	26
Intake manifold bolt and nut	18	13
Exhaust manifold and water pump		
Exhaust manifold cover "A" bolt	30	22
Exhaust manifold cover "A" and "B" mounting bolt	9	7
Exhaust manifold cover "B" bolt	24	18
Exhaust manifold nut	18	13
Water inlet pipe bolt	14	11
Water pump bolt	14	11
Oxygen sensor	45	33
Locker arms and camshaft		
Locker cover bolt	1.8	1.3
Locker arm shaft bolt	32	24
Locker arm lock nut	15	11

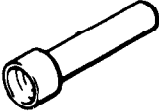
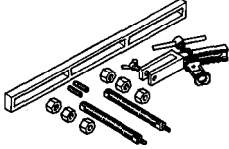
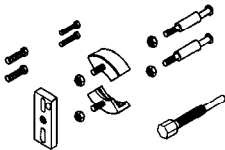
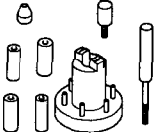
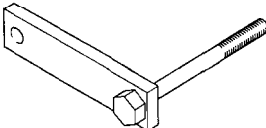
	N m	ft.lbs.
Cylinder head and valves		
Cylinder head bolt	73	53
Front case and oil pump		
Oil drain plug	40	29
Oil pan bolt	7	5
Oil screen bolt	19	14
Oil relief valve plug	45	33
Front case bolt	14	11
Oil pump cover screw	10	8
Piston and connecting rod		
Connecting rod cap nut	20 + 1/4 turns	14.5 + 1/4 turns
Crankshaft, flywheel and drive plate		
Flywheel and drive plate	135	98
Rear plate bolt	11	8
Bell housing cover bolt	9	7
Oil seal case bolt	11	8
Bearing cap bolt	53	38
Oil pressure switch	19	14
Bracket		
Exhaust pipe support bracket	36	26
Engine support bracket, front	60	43
Roll stopper bracket, front	65	47
Roll stopper bracket, rear	120	87

SEALANT

Items	Specified sealant	Quantity
Thermo switch	3M Nut Locking part No. 4171 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
Oil pan	Mitsubishi Genuine Part No. MD970389 or equivalent	As required
Oil pressure switch threads	3M ATD Part No. 8660 or equivalent	As required

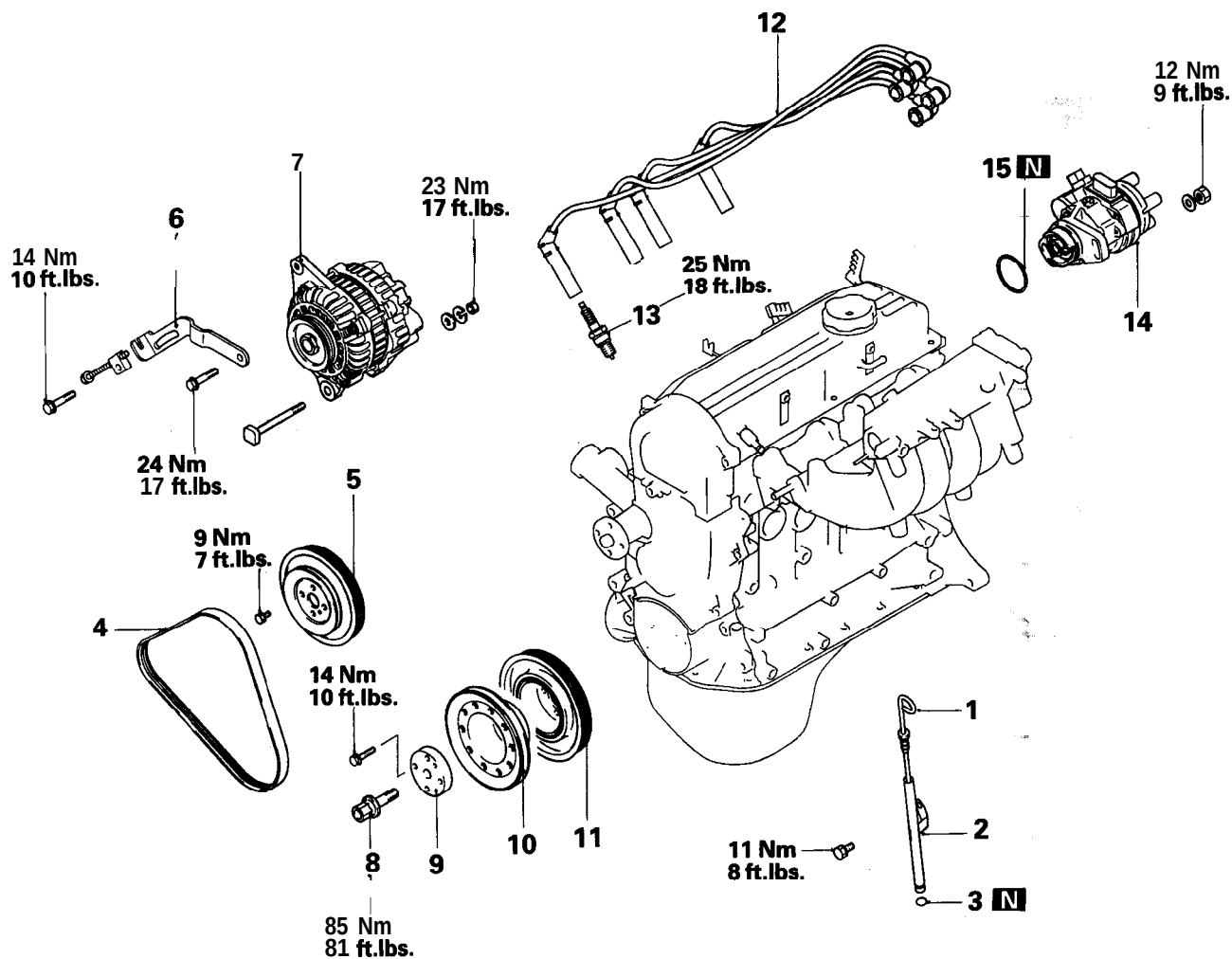
SPECIAL TOOLS

Tool	Number and tool name	Supersession	Application
	MB990767 End yoke holder Use with MD998715	MB990767-01 Use with MIT 308239	Holding camshaft sprocket when loosening or torquing bolt
	MD998011 Crankshaft rear oil seal installer	MD998011-01 Use with MB990938-01	Installation of crankshaft rear oil seal
	MD998304 Crankshaft front oil seal installer	MD998304-01	Installation of crankshaft front oil seal
	MD998305 Crankshaft front oil seal guide	MD998305-01	Installation of crankshaft front oil seal.
	MD998360 Cylinder head bolt wrench		Loosening or torquing cylinder head bolt.
	MD998713 Camshaft oil seal installer	MD998713-01	Installation of camshaft oil seal
	MD998715 Pulley holding pins (2)	MIT308239	Holding camshaft sprocket when loosening or torquing bolt
	MD998727 Oil pan remover		Removal of oil pan
	MD998735 Valve spring compressor	MD998735-01	Compression of valve spring

Tool	Number and tool name	Supersession	Application
	MD998760 Valve stem seal installer	MD998760-01	Installation of valve stem seal.
	MD998772 Valve spring compressor		Compressing valve spring.
	MD998778 Crankshaft sprocket puller		Removal of crankshaft sprocket.
	MD998780 Piston pin setting tool	MIT216941	Removal and installation of piston pin
	MD998781 Flywheel stopper		Holding flywheel

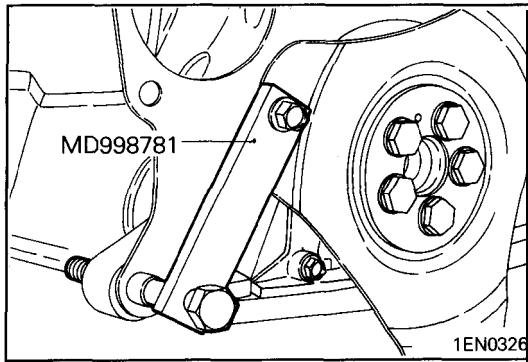
GENERATOR AND IGNITION SYSTEM

REMOVAL AND INSTALLATION



Removal steps

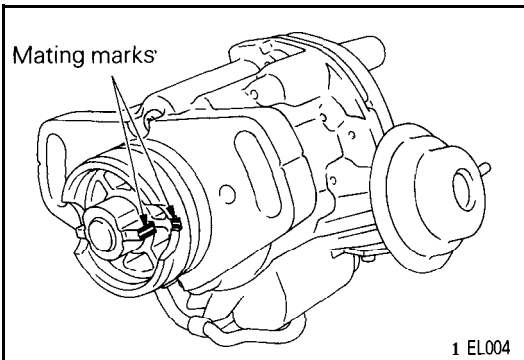
1. Oil level gauge
2. Oil level gauge guide
3. O-ring
- ➡C➡ 4. Drive belt
5. Water pump pulley
6. Generator brace
7. Generator
- ↔A↔ ➡B↔ 8. Crankshaft bolt
9. Special washer
10. Crankshaft pulley
11. Damper pulley
12. Spark plug cable
13. Spark plug
- ➡A↔ 14. Distributor
15. O-ring



REMOVAL SERVICE POINT

❖A❖ CRANKSHAFT BOLT REMOVAL

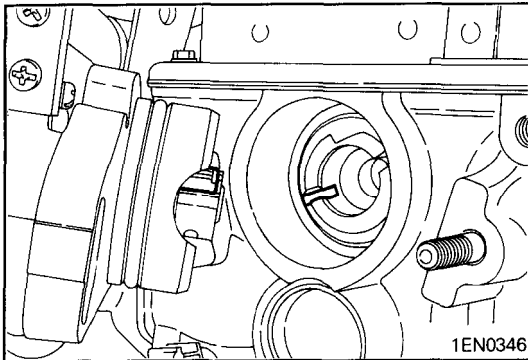
- (1) Using the special tool, hold the drive plate or flywheel.
- (2) Remove the crankshaft bolt.



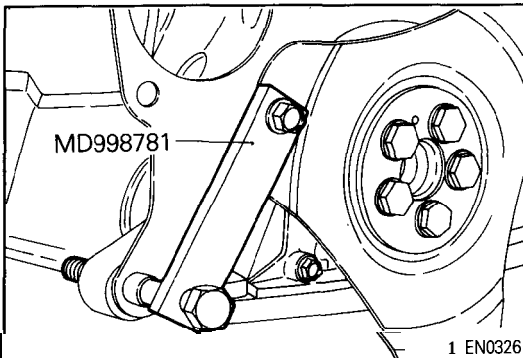
INSTALLATION SERVICE POINTS

❖A❖ DISTRIBUTOR ASSEMBLY INSTALLATION

- (1) Turn the crankshaft to bring the No. 1 cylinder piston to the top dead center on compression stroke.
- (2) Align the mating mark on the distributor housing with that on the coupling key.

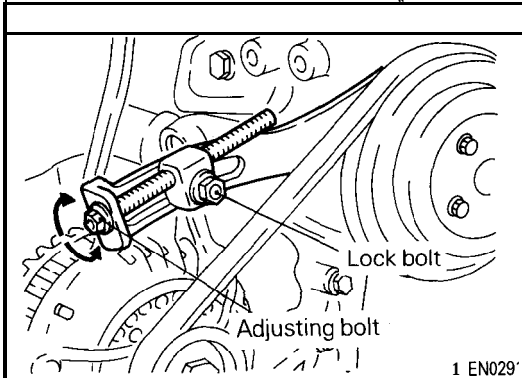


- (3) Install the distributor with the coupling key fitted in the keyway at the end of the camshaft.



❖B❖ CRANKSHAFT BOLT INSTALLATION

- (1) Using the special tool, hold the drive plate or flywheel.
- (2) Install the crankshaft bolt.

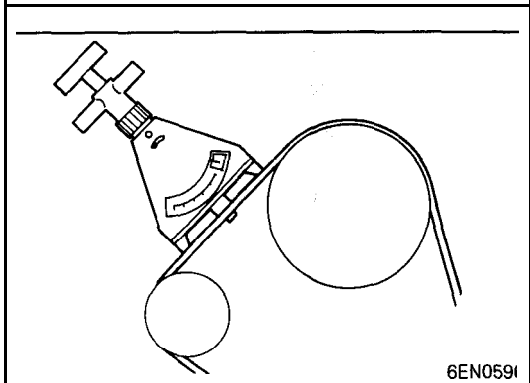
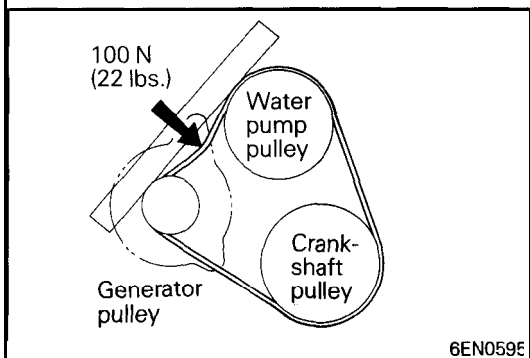


❖C❖ DRIVE BELT TENSION ADJUSTMENT

- (1) Adjust the belt deflection with the adjusting bolt to the standard value.

Standard value:

New belt	5.5 – 7.0 mm (.22 – .28 in.)
Used belt	8.0 mm (.32 in.)



- (2) Or using a tension gauge, adjust the tension to the standard value.

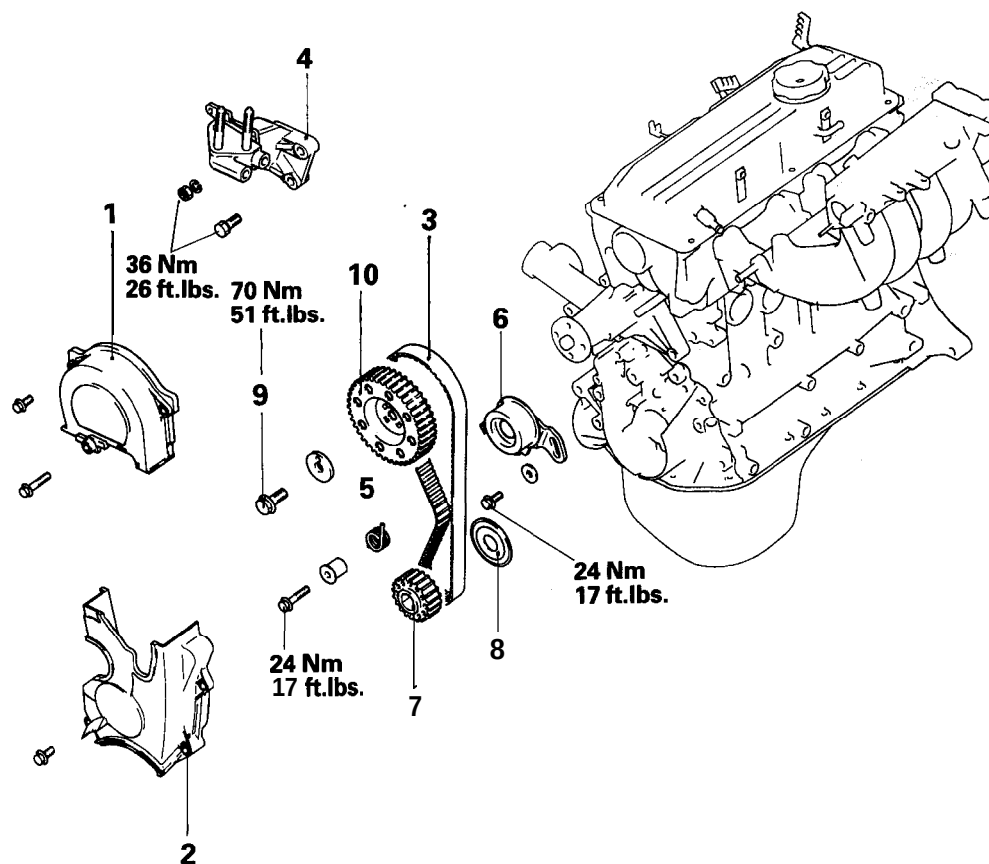
Standard value:

New belt 500 – 700 N (110 – 154 lbs.)
Used belt 400 N (88 lbs.)

- (3) Tighten the lock bolt to the specified torque.
(4) Tighten the nut for pivot bolt to the specified torque.

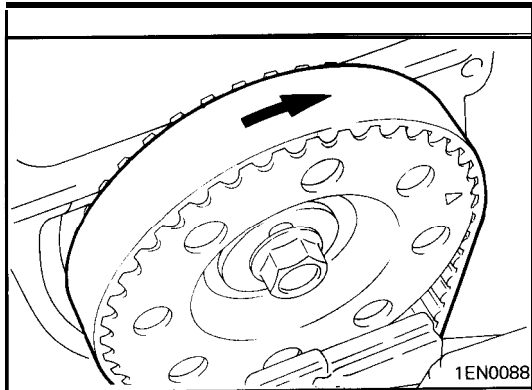
TIMING BELT

REMOVAL AND INSTALLATION

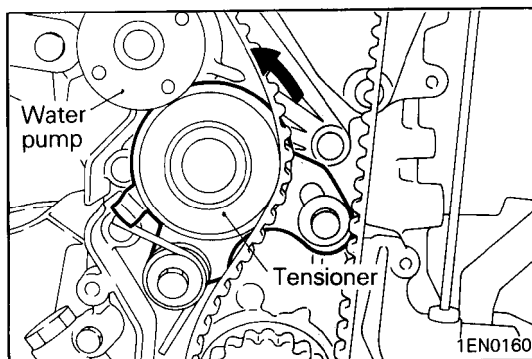


Removal steps

1. Timing belt upper cover
2. Timing belt lower cover
- ↙A↘ ↗C↗ 3. Timing belt
4. Engine support bracket, left
5. Tensioner spring
- ↗B↗ ↘B↘ 6. Tensioner
- ↙B↘ 7. Crankshaft sprocket
8. Flange
- ↙C↘ ↗A↗ 9. Camshaft sprocket bolt
10. Camshaft sprocket

**REMOVAL SERVICE POINTS****◀A▶ TIMING BELT REMOVAL**

(1) Mark belt running direction for reference in reinstallation.



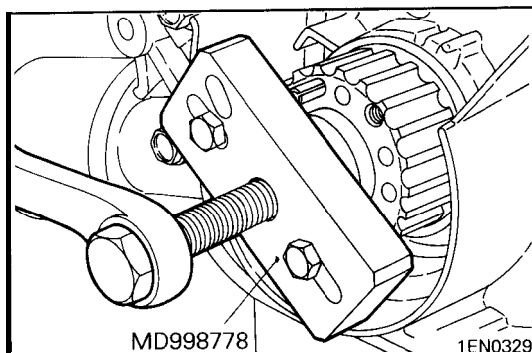
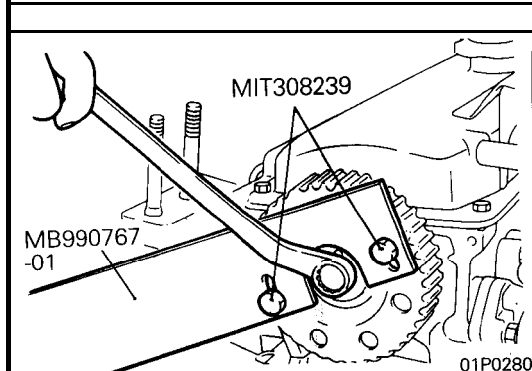
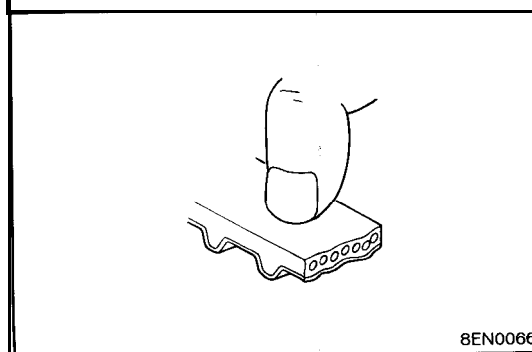
(2) Loosen the tensioner bolts and move the tensioner toward the water pump.

(3) Remove the timing belt.

NOTE

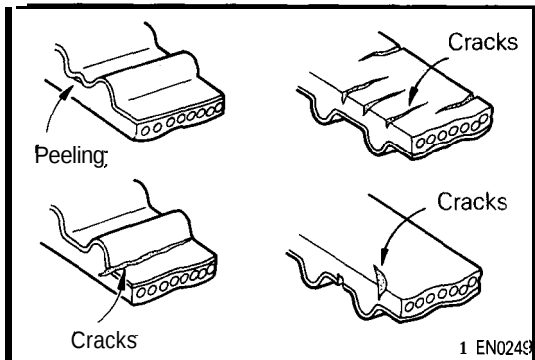
(1) Water or oil on the belt shortens its life drastically, so the removed timing belt, sprocket, and tensioner must be kept free from oil and water. Do not immerse parts in cleaning solvent.

(2) If there is oil or water on any part, check the front case oil seal, camshaft oil seal and water pump for leaks.

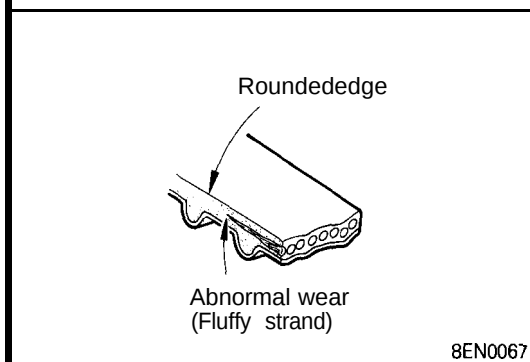
**◀B▶ CRANKSHAFT SPROCKET REMOVAL****◀C▶ CAMSHAFT SPROCKET BOLT LOOSENING****INSPECTION****TIMING BELT**

Replace belt if any of the following conditions exist.

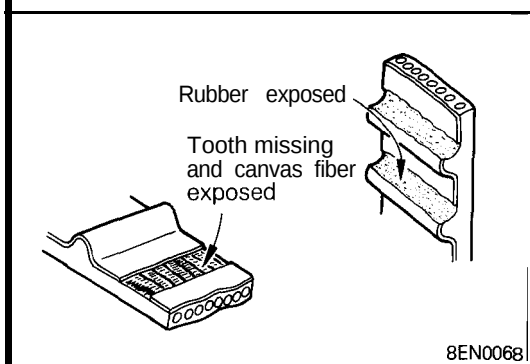
(1) Hardening of back rubber side is glossy without resilience and leaves no indent when pressed with fingernail.



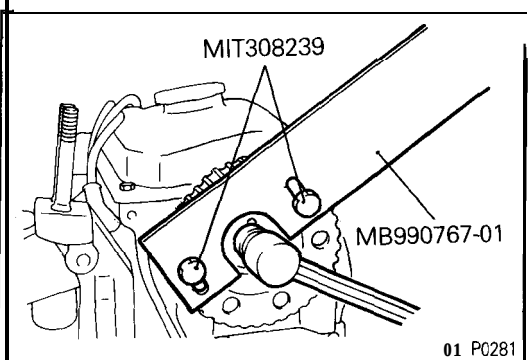
- (2) Cracks on rubber back
- (3) Cracks or peeling of canvas
- (4) Cracks on rib root
- (5) Cracks on belt sides



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

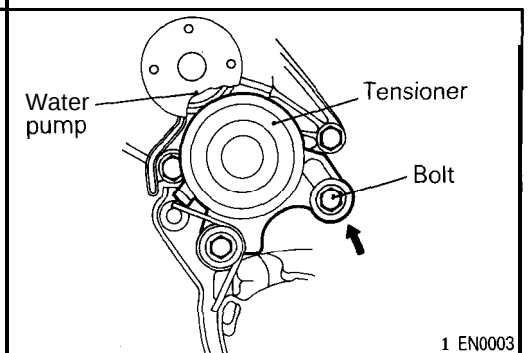


- (7) Abnormal wear on teeth
- (8) Missing tooth



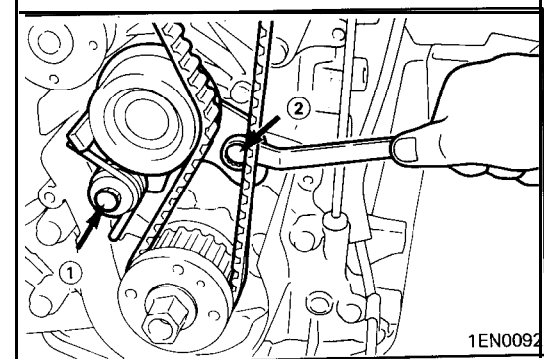
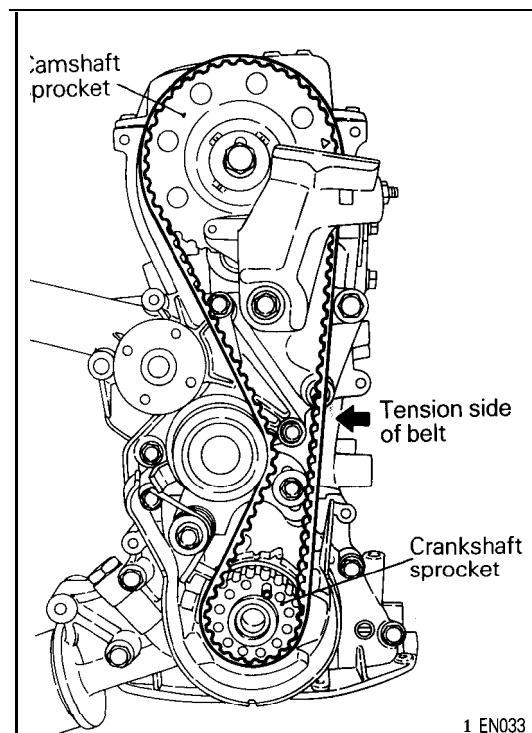
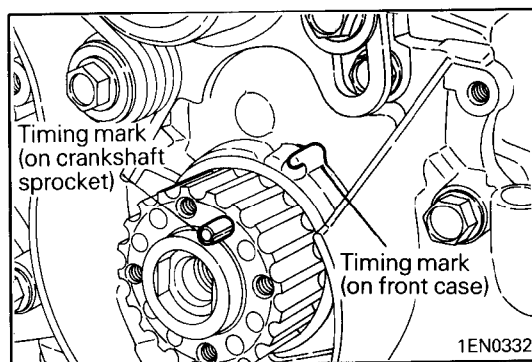
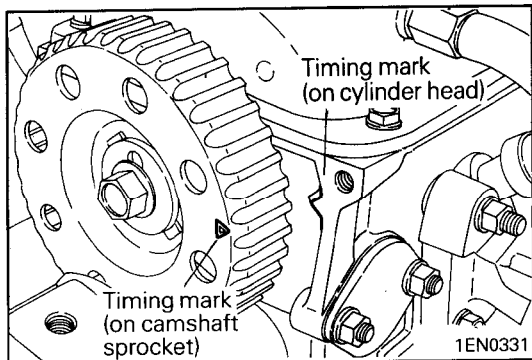
INSTALLATION SERVICE POINTS

◆A◆ CAMSHAFT SPROCKET BOLT TIGHTENING



◆B◆ TENSIONER INSTALLATION

- (1) Move the tensioner pulley toward the water pump and tighten the tensioner mounting bolts.

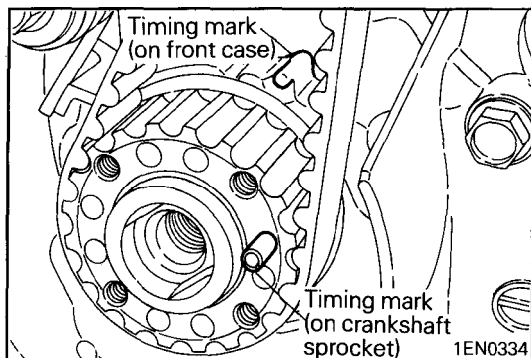


⚙️ TIMING BELT INSTALLATION

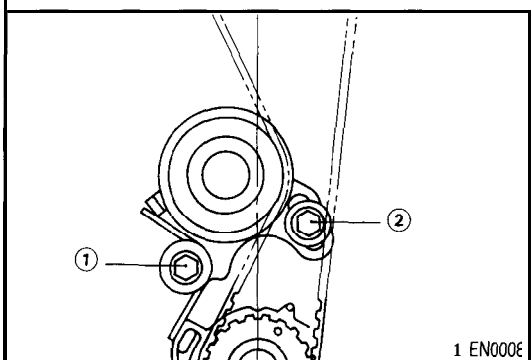
- (1) Align the timing marks on the camshaft sprocket and the crankshaft sprocket with their timing marks.

- (2) Set the timing belt first on crankshaft sprocket and then keeping the tension side belt tight, set on the camshaft sprocket.

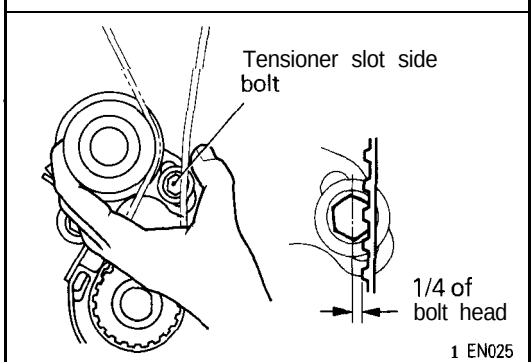
- (3) Loosen the tensioner mounting bolts ① and ②.
- (4) Check that the belt completely meshes with the sprocket. Also check the timing marks on the sprockets for alignment.



- (5) Turn the crankshaft clockwise by 3 crankshaft sprocket teeth.



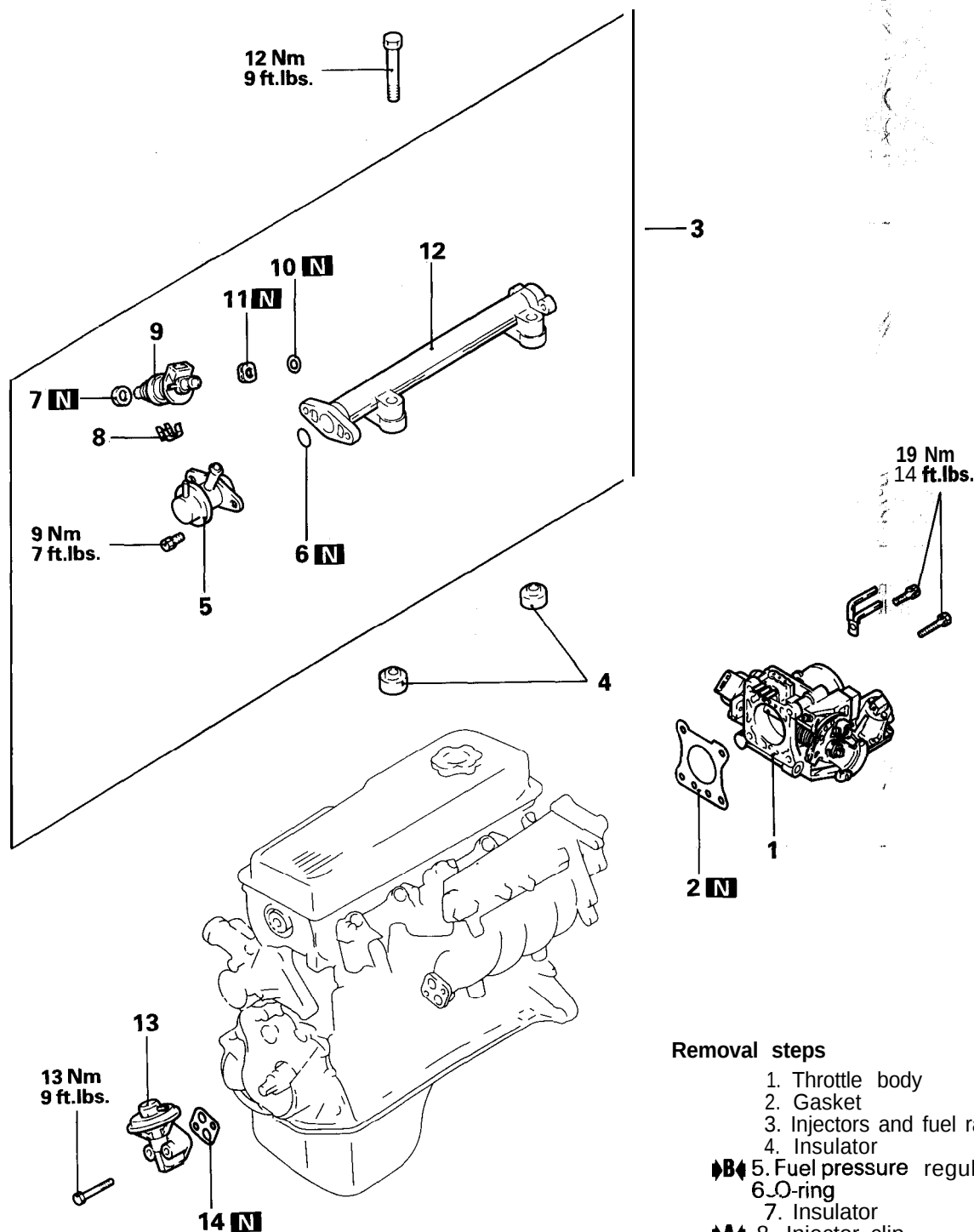
- (6) Tighten bolt ② first and then bolt ①. If bolt ① is tightened first, the tensioner will turn together with the bolt, resulting in an overtensioned belt.



- (7) Check the belt tension. Hold the tensioner and timing belt together by hand and give the belt a slight thumb pressure at a point level with tensioner center. Make sure that belt cog crest comes as deep as about 1/4 of the width of the slot side tensioner bolt head.

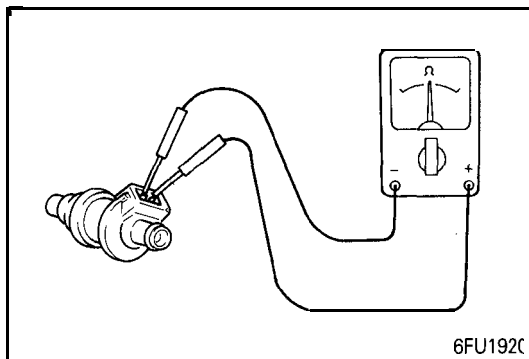
FUEL AND EMISSION PARTS

REMOVAL AND INSTALLATION



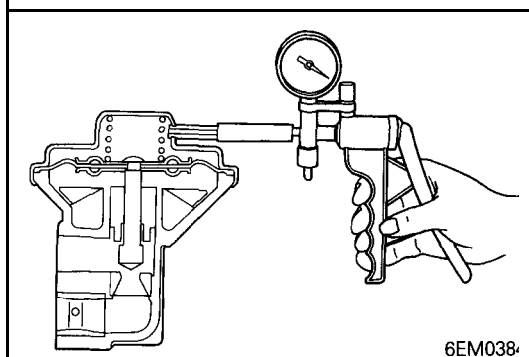
Removal steps

1. Throttle body
2. Gasket
3. Injectors and fuel rail
4. Insulator
5. Fuel pressure regulator
6. O-ring
7. Insulator
8. Injector clip
9. Injector
10. O-ring
11. Grommet
12. Fuel rail
13. EGR valve (For California)
14. Gasket

**INSPECTION****INJECTORS**

- (1) Using an ohmmeter (circuit tester), test for, **continuity** between terminals of injector; the circuit should be closed. If failure is detected, replace the injector.

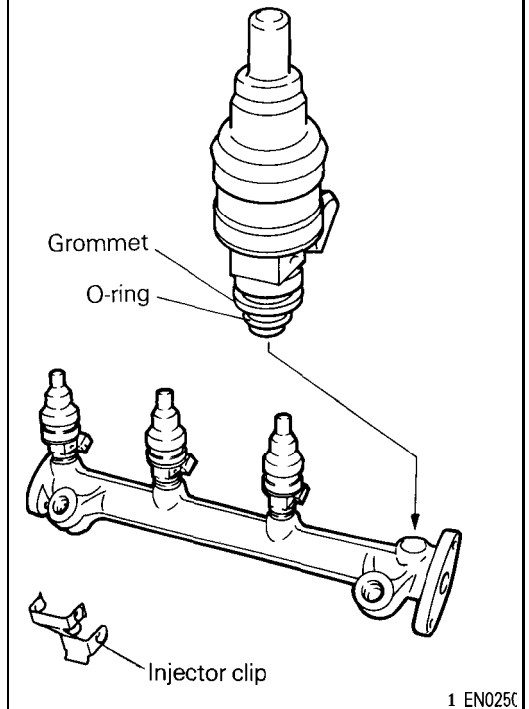
Standard value: 13 – 16 Ω [at 20°C (68°F)]

**EGR VALVE**

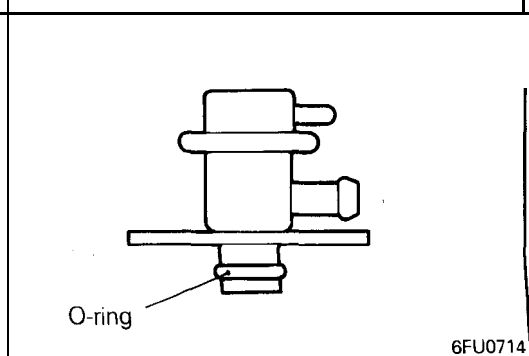
- (1) Check the EGR valve for sticking or carbon deposits. If such conditions exist, clean or replace the EGR valve.
 - (2) Connect a hand vacuum pump to the nipple of the EGR valve and plug the other nipple.
 - (3) Apply a vacuum of 500 mmHg (19.7 in.Hg) to make sure that vacuum is maintained. If there is a leak, replace the EGR valve.
- In addition, check the valve for its opening and closing motion by applying and removing vacuum.

INSTALLATION SERVICE POINTS**◆A◆ INJECTORS / INJECTOR CLIP INSTALLATION**

- (1) Before installing an injector, the rubber O-ring must be lubricated with a drop of clean engine oil to aid in installation.
- (2) Install injector top end into the fuel rail. Be **careful** not to damage O-ring during installation.
- (3) Install injector clip by sliding open ends onto both injector and fuel rail.

**◆B◆ FUEL PRESSURE REGULATOR INSTALLATION**

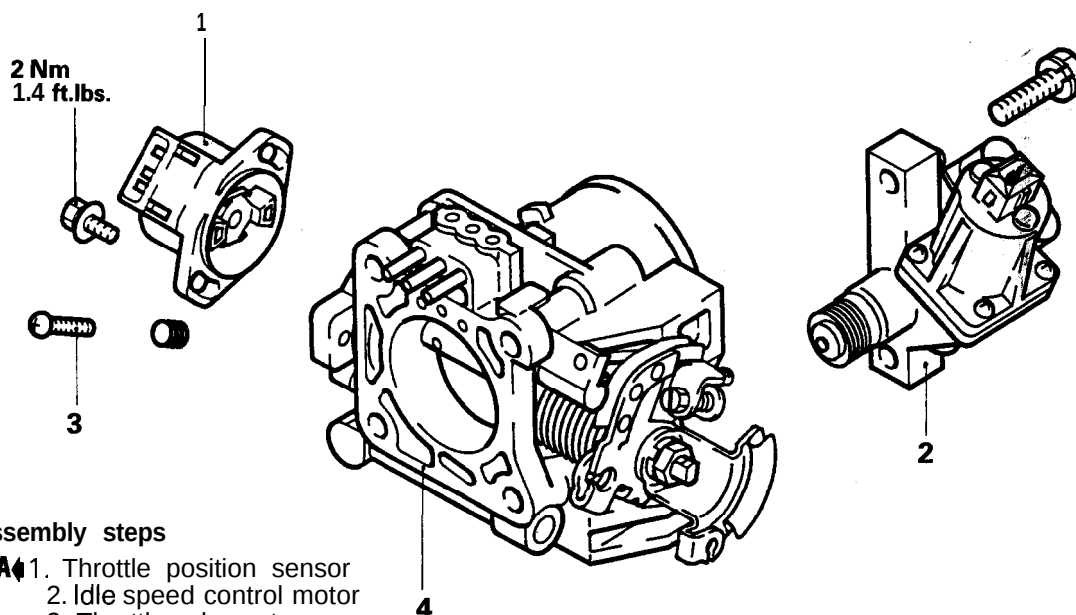
- (1) Before installing the pressure regulator, the O-ring must be lubricated with a drop of clean engine oil to aid in installation.



THROTTLE BODY

DISASSEMBLY AND REASSEMBLY

Up to 1992 models

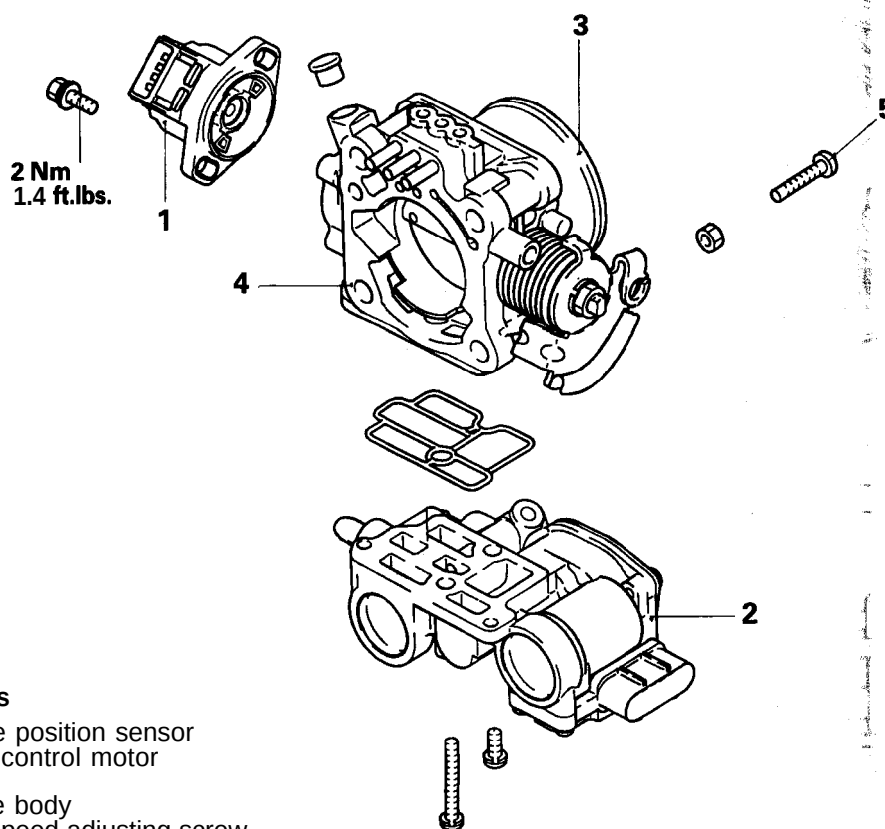


Disassembly steps

- ◀A▶▶A▶ 1. Throttle position sensor
 ◀A▶ 2. Idle speed control motor
 ◀B▶ 3. Throttle valve set screw
 ◀B▶ 4. Throttle body

6FU1292

From 1993 models



Disassembly steps

- ◀A▶▶A▶ 1. Throttle position sensor
 ◀A▶ 2. Idle air control motor
 ◀B▶ 3. O-ring
 ◀B▶ 4. Throttle body
 ◀B▶ 5. Fixed speed adjusting screw

1 EN0336

DISASSEMBLY SERVICE POINTS**⚠A⚠ THROTTLE POSITION SENSOR AND IDLE SPEED CONTROL MOTOR / IDLE AIR CONTROL MOTOR REMOVAL**

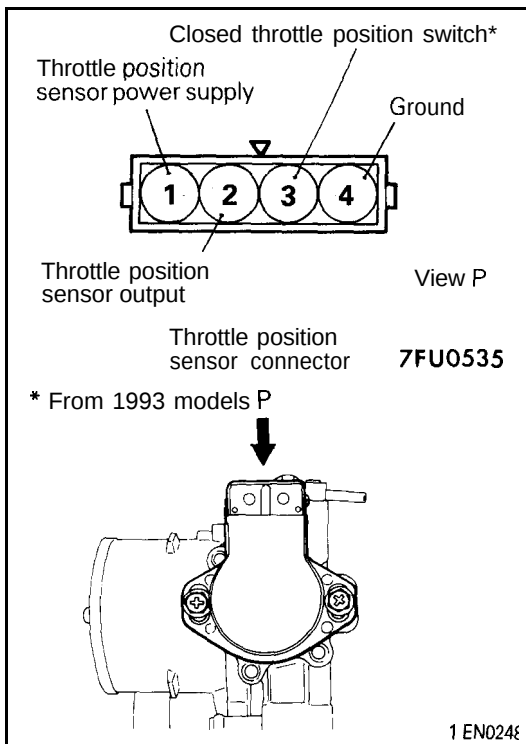
- (1) Do not disassemble the sensor and motor.
- (2) Do not immerse in solvent the sensor and motor to clean. Clean them with shop towel.

⚠B⚠ THROTTLE BODY REMOVAL

- (1) Do not remove the throttle valve.
- (2) Check if the vacuum port or passage is clogged. Use compressed air to clean the vacuum passage.

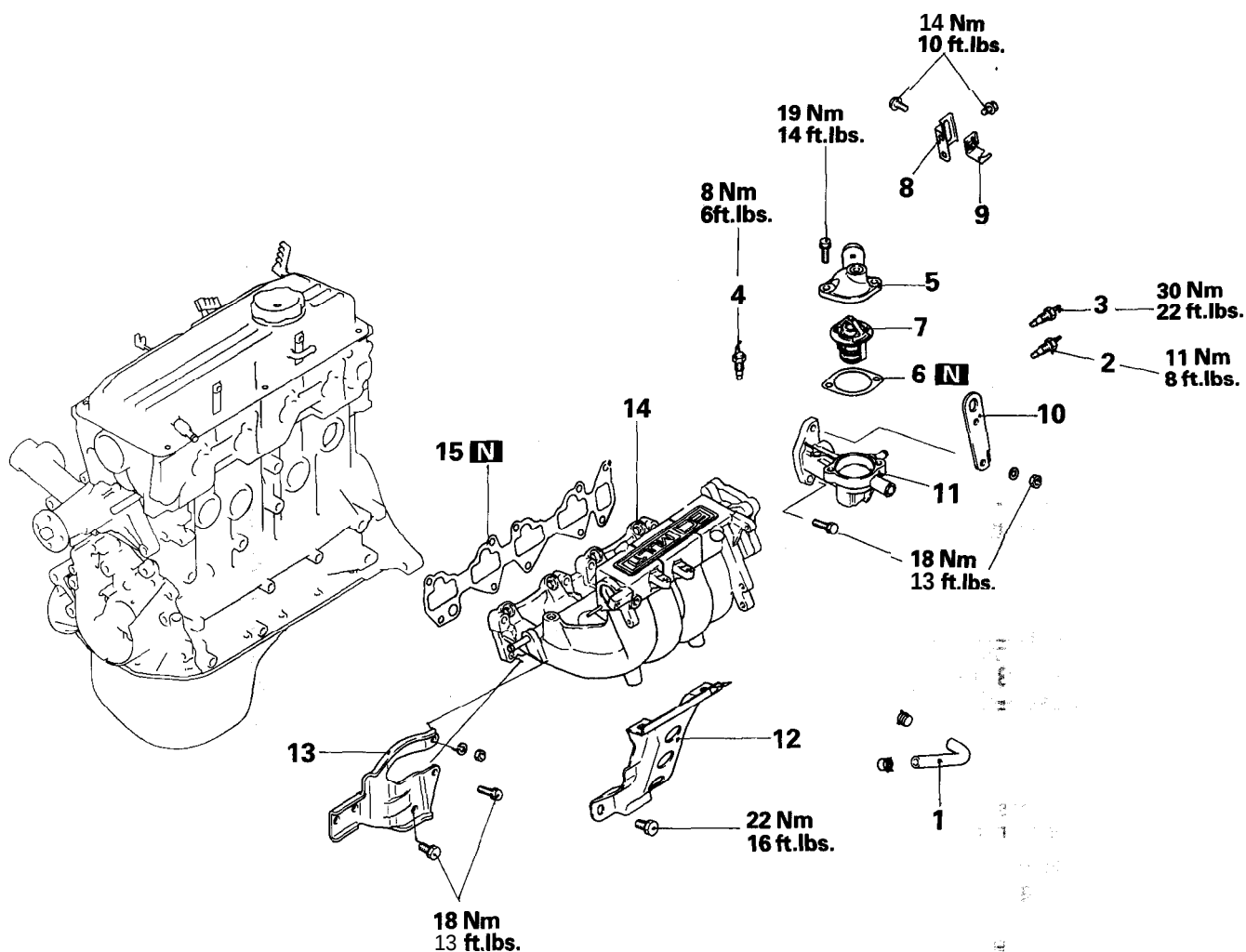
REASSEMBLY SERVICE POINT**⚠A⚠ THROTTLE POSITION SENSOR INSTALLATION**

- (1) Check correct installation of the throttle position sensor. While moving the throttle lever in both open and close directions, check to see that resistance between terminals ① and ② or ② and ④ changes. If the resistance changes smoothly, the throttle position sensor has been installed correctly.



INTAKE MANIFOLD

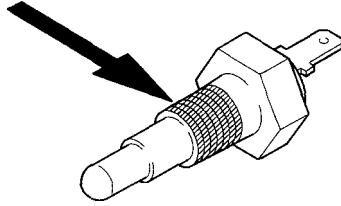
REMOVAL AND INSTALLATION



Removal steps

1. Water hose
- ◆C◆ 2. Engine coolant temperature gauge unit
- ◆B◆ 3. Engine coolant temperature sensor
- ◆A◆ 4. Thermostat For A/T
5. Water outlet fitting
6. Water outlet fitting gasket
7. Thermostat
8. Outer cable bracket For A/T
9. Inner cable bracket For A/T
10. Engine hanger
11. Thermostat housing
12. Intake manifold stay
13. Engine support bracket stay (From 1993 models)
14. Intake manifold
15. Intake manifold gasket

Sealant



1EN033E

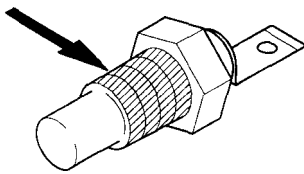
INSTALLATION SERVICE POINTS

▣A▣ SEALANT APPLICATION TO THERMO SWITCH

Specified sealant:

3M Nut Locking Part No. 4171 or equivalent

Sealant



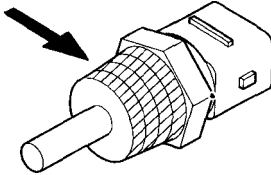
9EN0092

▣B▣ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE GAUGE UNIT

Specified sealant:

3M ATD Part No. 8660 or equivalent

Sealant



9EN0091

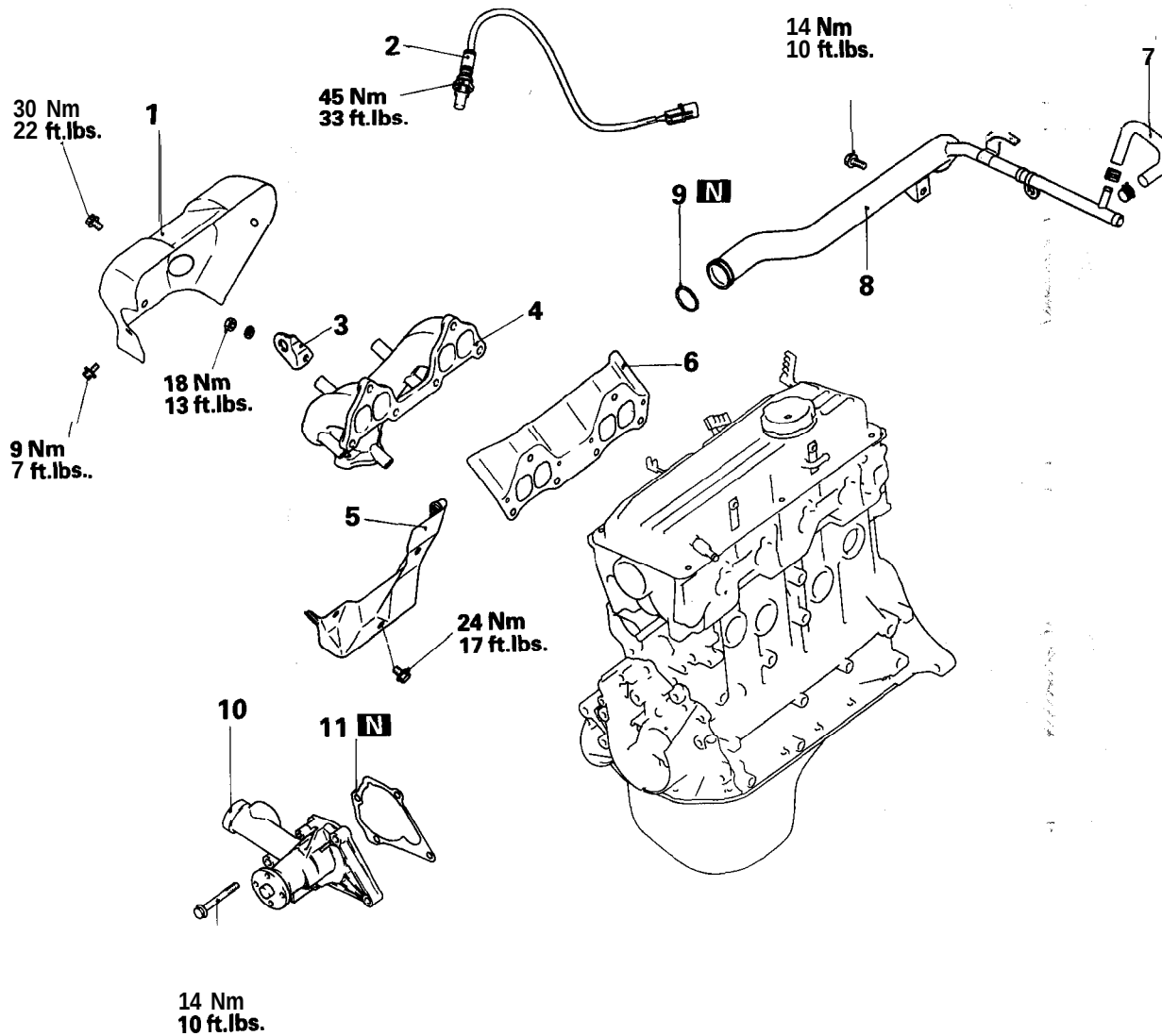
▣C▣ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE SENSOR

Specified sealant:

3M Nut Locking Part No. 4171 or equivalent

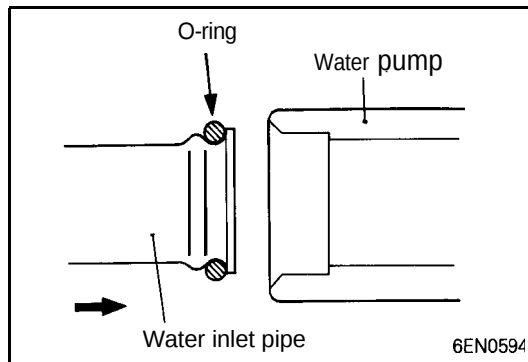
EXHAUST MANIFOLD AND WATER PUMP

REMOVAL AND INSTALLATION



Removal steps

1. Exhaust manifold cover "A"
2. Oxygen sensor — [1992, 1993 (FED) models]
3. Engine hanger
4. Exhaust manifold
5. Exhaust manifold cover "B"
6. Exhaust manifold gasket
7. Water hose
8. Water inlet pipe
9. O-ring
10. Water pump
11. Water pump gasket

**INSTALLATION SERVICE POINT****⚠ WATER PIPE / O-RING INSTALLATION.**

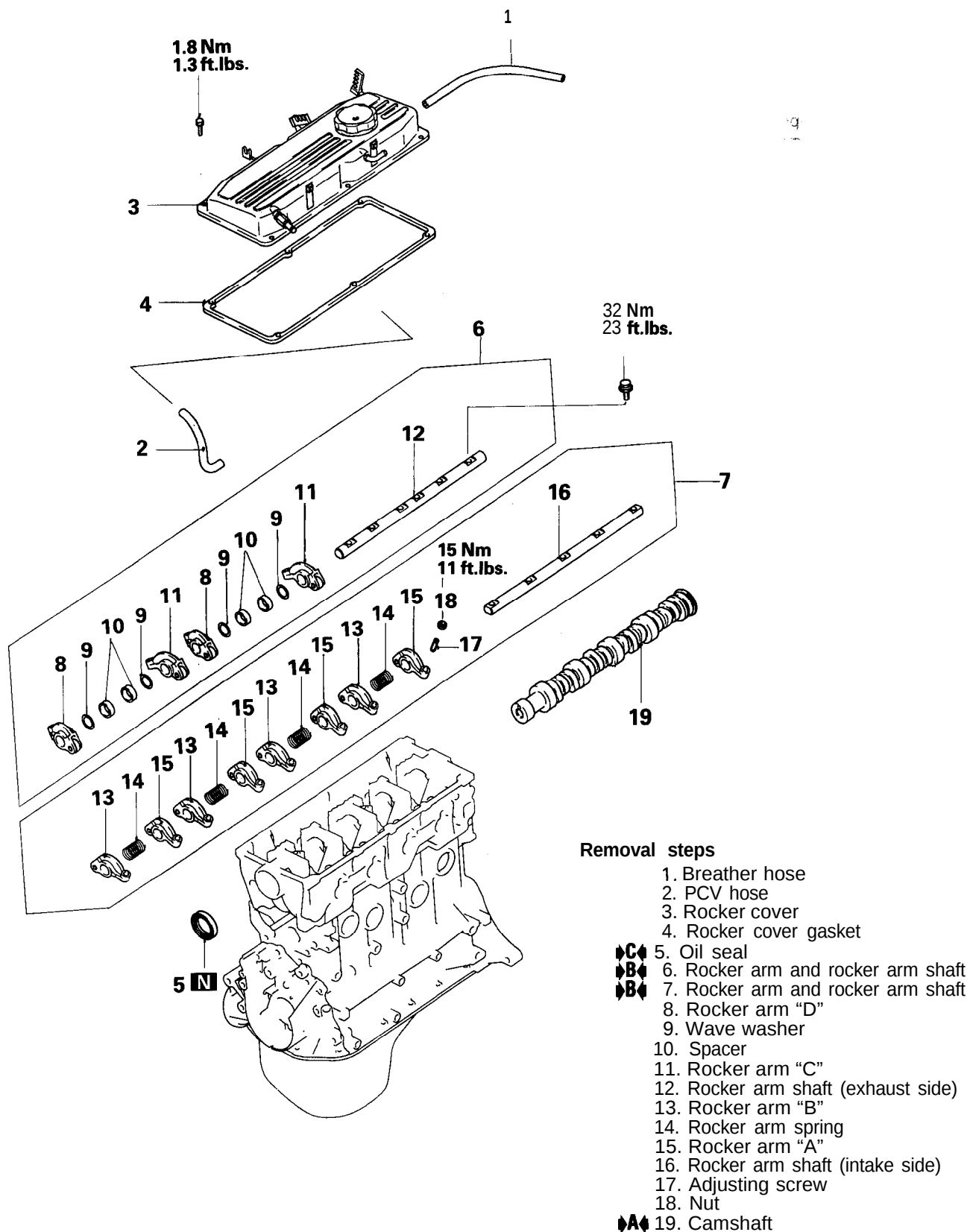
- (1) Wet the O-ring (with water) to facilitate assembly.

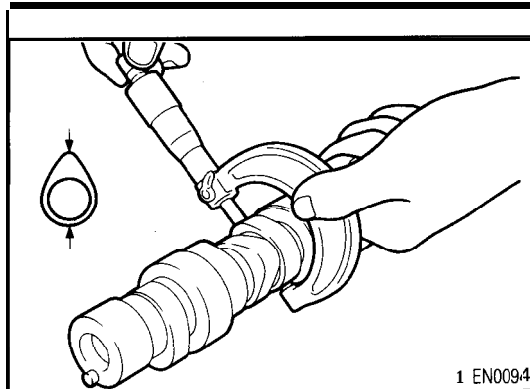
Caution

Keep the O-ring free of oil or grease

ROCKER ARMS AND CAMSHAFT

REMOVAL AND INSTALLATION





INSPECTION

CAMSHAFT

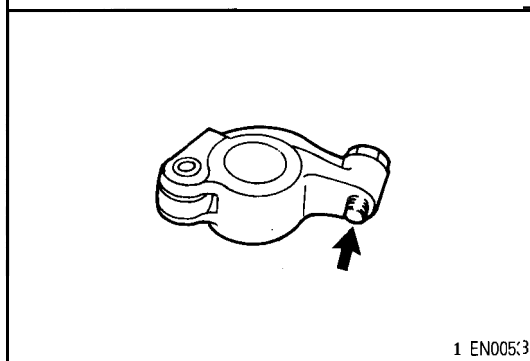
(1) Measure the cam height.

Standard value:

Intake	38.78 mm (1.5268 in.)
Exhaust	39.10 mm (1.5394 in.)

Limit:

Intake	38.28 mm (1.5071 in.)
Exhaust	38.60 mm (1.5197 in.)



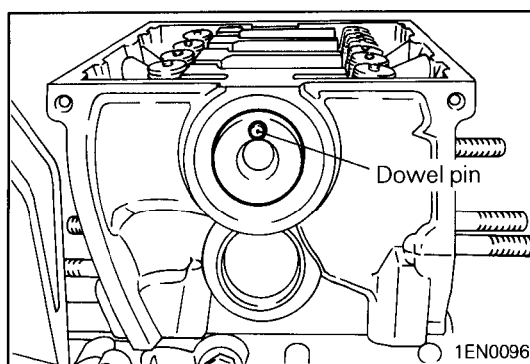
ROCKER ARM

- Check the roller surface. If any dents, damage or seizure is evident, replace the rocker arm.
- Check rotation of the roller. If it does not rotate smoothly or if looseness is evident, replace the rocker arm.
- Check the inside diameter. If damage or seizure is evident, replace the rocker arm.
- Check the screw end for wear. If considerable wear is evident, replace the adjusting screw.

INSTALLATION SERVICE POINTS

▶▶ CAMSHAFT INSTALLATION

(1) Position the dowel pin of the camshaft as shown in the illustration.

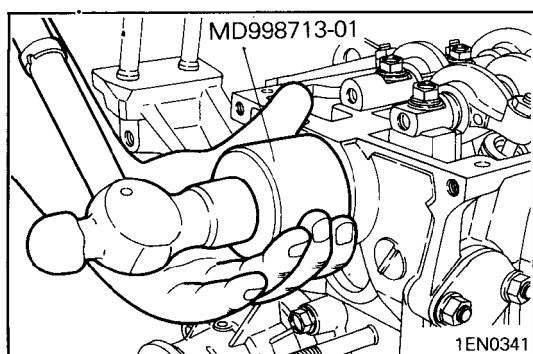
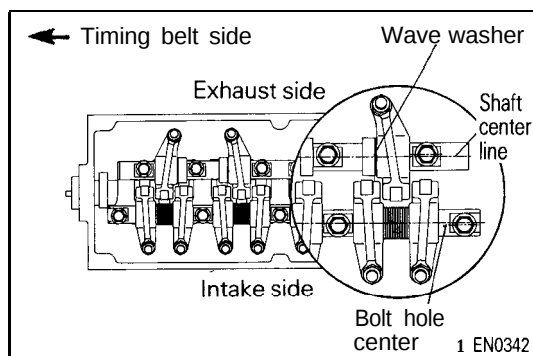


▶▶ ROCKER ARM AND ROCKER ARM SHAFT INSTALLATION

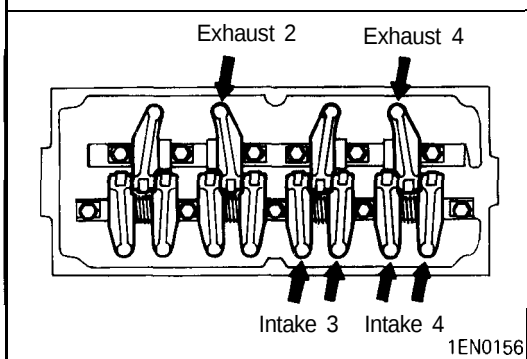
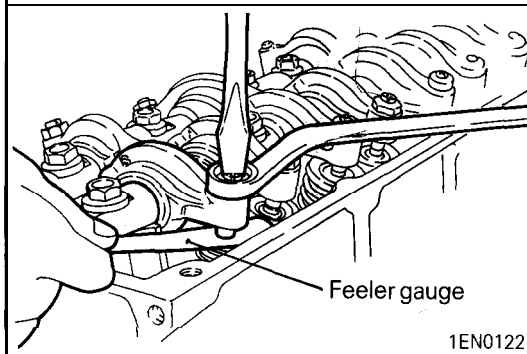
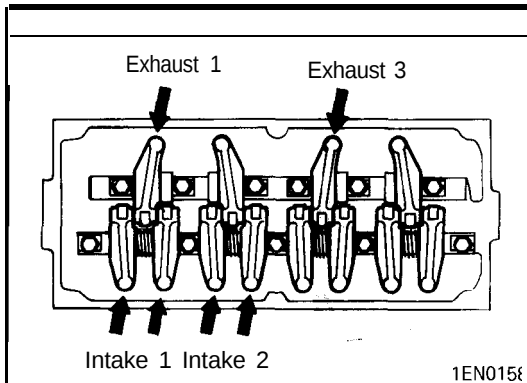
(1) Install the rocker arm shaft assembly while respecting the illustrated positions.

NOTE

Make sure that the bolt hole center is offset toward the indicated side with respect to the rocker arm shaft centerline.



▶▶ OIL SEAL INSTALLATION



VALVE CLEARANCE ADJUSTMENT

- (1) Position the No. 1 cylinder at the top dead center on compression stroke.
- (2) Adjust the valve clearance at the points shown in the illustration.

- (3) Loosen the adjusting screw locknut.
- (4) Using a feeler gauge, adjust the valve clearance by turning the adjusting screw.

Standard value: on cold engine

Intake 0.07 mm (.0028 in.) Up to 1992 models
0.09 mm (.0035 in.) From 1993 models

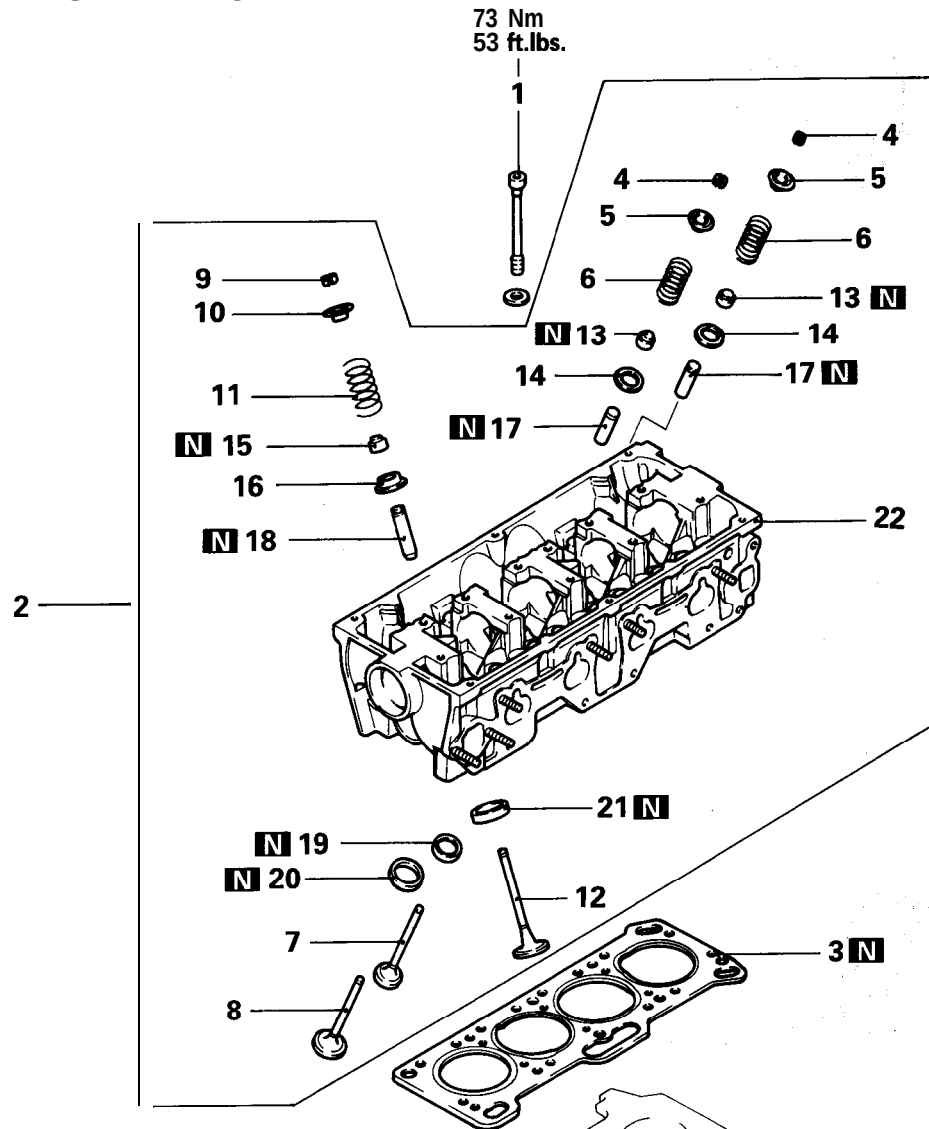
Exhaust 0.17 mm (.0067 in.)

- (5) While holding the adjusting screw with a screwdriver, tighten the lock nut.

- (6) Rotate clockwise the crankshaft one complete turn (360° degrees).
- (7) Adjust the valve clearance at the points shown in the illustration.
- (8) Repeat steps (3) to (5) to adjust the valve clearance of remaining valves.

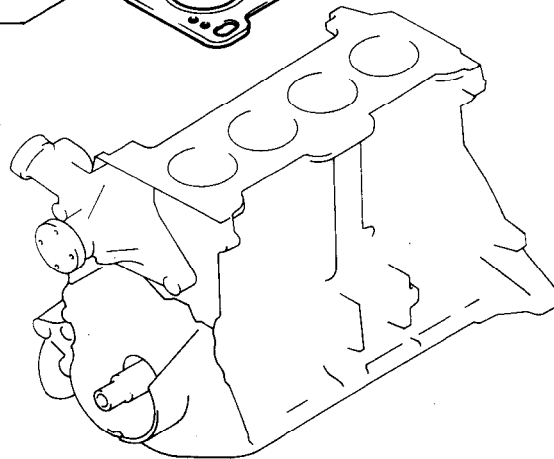
CYLINDER HEAD AND VALVES

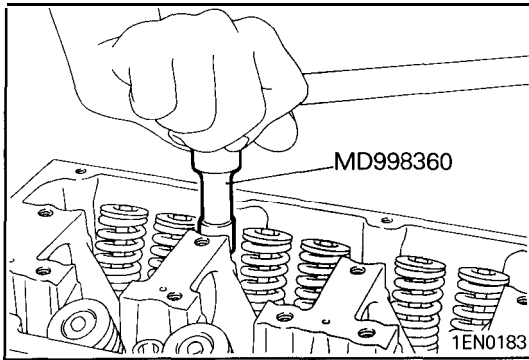
REMOVAL AND INSTALLATION



Removal steps

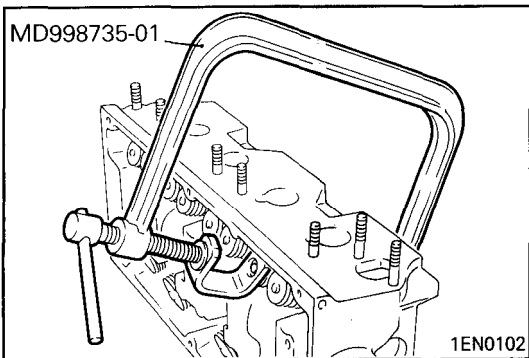
- ◊A◊◊E◊ 1. Cylinder head bolt
- 2. Cylinder head, valve assembly
- ◊D◊◊ 3. Cylinder head gasket
- ◊B◊◊C◊ 4. Retainer lock
- 5. Valve spring retainer
- ◊B◊ 6. Valvespring
- 7. Intake valve (primary)
- 8. intake valve (secondary)
- ◊B◊◊C◊ 9. Retainer lock
- 10. Valve spring retainer
- ◊B◊ 11. Valve spring
- 12. Exhaust valve
- ◊C◊◊A◊ 13. Valve stem seal
- 14. Valve spring seat
- ◊C◊◊A◊ 15. Valve stem seal
- 16. Valve spring seat
- 17. Intake valve guide
- 18. Exhaust valve guide
- 19. Intake valve seat (primary)
- 20. Intake valve seat (secondary)
- 21. Exhaust valve seat
- 22. Cylinder head





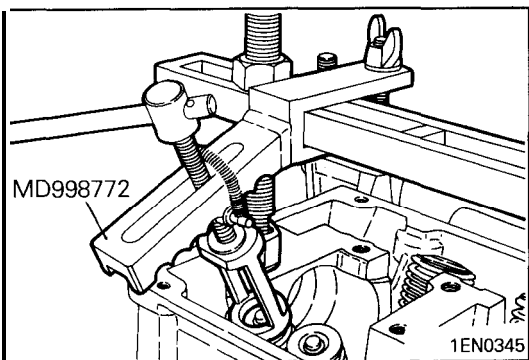
REMOVAL SERVICE POINTS

◊A◊ CYLINDER HEAD BOLT REMOVAL



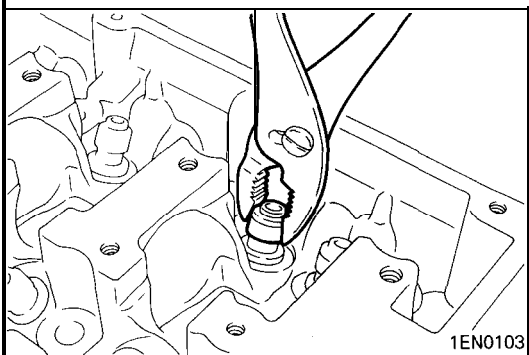
◊B◊ RETAINER LOCK REMOVAL

- (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

- (1) Do not reuse removed valve stem seals.



INSPECTION

CYLINDER HEAD

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

Standard value: 0.05 mm (.0020 in.)

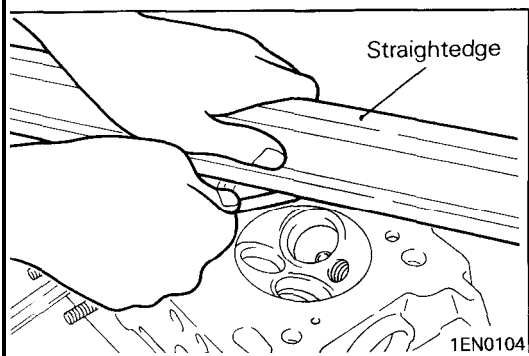
Limit: 0.2 mm (.008 in.)

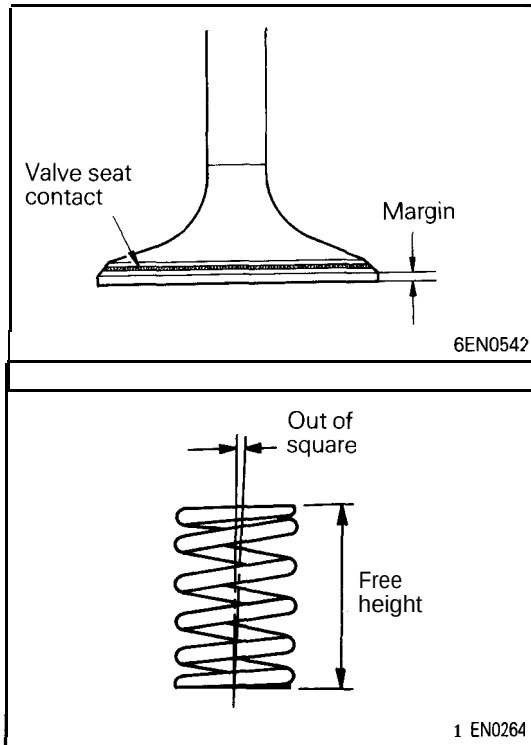
- (2) If the service limit is exceeded, correct to meet specification.

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

* Total resurfacing depth of both cylinder head and cylinder block

Cylinder head height (Specification when new):
106.9 – 107.1 mm (4.209 – 4.217 in.)



**VALVE**

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

Standard value:

Intake 1.0 mm (.039 in.)

Exhaust 1.5 mm (.059 in.)

Limit:

Intake 0.5 mm (.020 in.)

Exhaust 1.0 mm (.039 in.)

VALVE SPRING

- (1) Measure the free height of the spring and, if it is smaller than the limit, replace.

Standard value:

Intake 46.1 mm (1.815 in.)

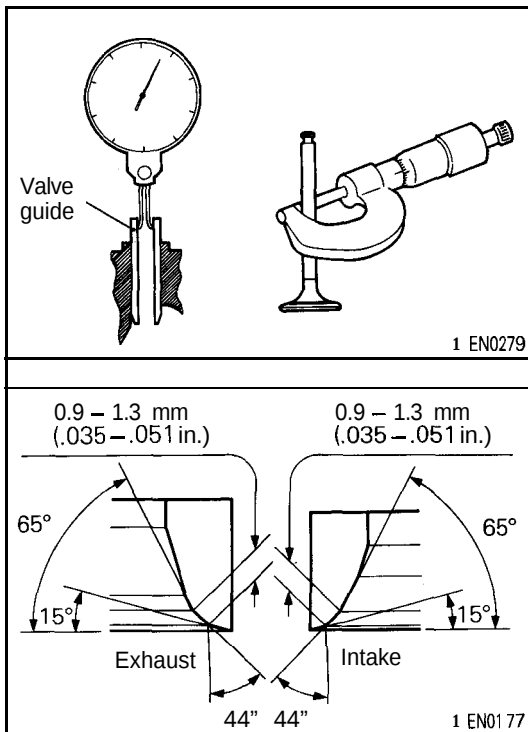
Exhaust 48.8 mm (1.643 in.)

Limit:

Intake 45.1 mm (1.776 in.)

Exhaust 45.8 mm (1.803 in.)

- (2) Measure the squareness of the spring and, if the limit is exceeded, replace.

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

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

Standard value:

Intake 0.02 – 0.05 mm (.0008 – .0020 in.)

Exhaust 0.05 – 0.09 mm (.0020 – .0035 in.)

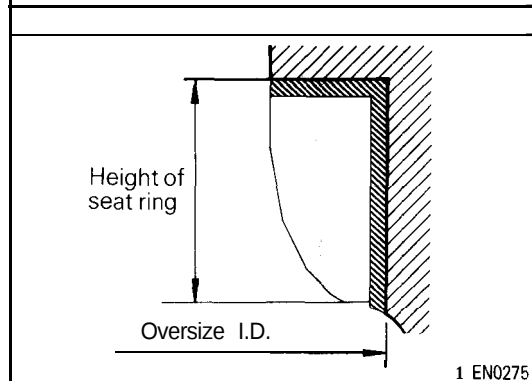
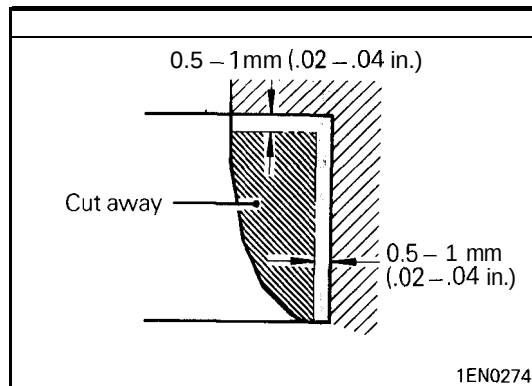
Limit:

Intake 0.10 mm (.0039 in.)

Exhaust 0.15 mm (.0059 in.)

VALVE SEAT RECONDITIONING PROCEDURE

- (1) Before attempting reconditioning of the valve seat, check the valve guide-to-valve stem clearance and replace the valve guide if necessary.
- (2) Recondition to the specified seat width and seat angle.
- (3) After reconditioning, fit up the valve and valve seat using lapping compound.



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 cylinder head to a selected oversize valve seat diameter.

Seat ring hole diameter: See "Service Specifications" in page 11A-6

- (3) Before fitting the valve seat, either heat the cylinder head up to approximately 250°C (482°F) or cool the valve seat using cooling spray, to prevent the cylinder head bore from galling.
- (4) Using valve seat cutter, correct the valve seat to the specified width and angle. See "VALVE SEAT RECONDITIONING PROCEDURE."

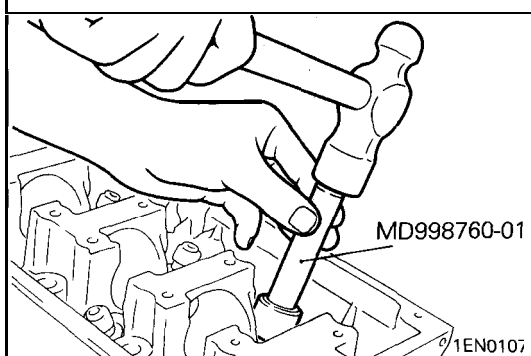
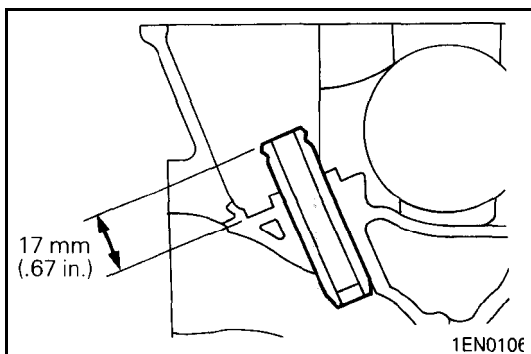
VALVE GUIDE REPLACEMENT PROCEDURE

- (1) Push out the valve guide toward the combustion chamber side using a press.
- (2) Rebore the valve guide hole in the cylinder head to the size corresponding to the oversize valve guide to be installed.

Caution

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

Valve guide hole diameter: See "Service Specifications" in page 11A-6



- (3) Install the valve guide until it projects 17 mm (.67 in.) from the cylinder head as illustrated.

NOTE

- (1) The valve guide must be installed from the upper side of the cylinder head.
- (2) Note that the intake and exhaust valve guides differ in length: 44 mm (1.732 in.) on intake side, 49.5 mm (1.949 in.) on exhaust side.
- (3) After installation of the valve guide, install a new valve and check that it slides smoothly.

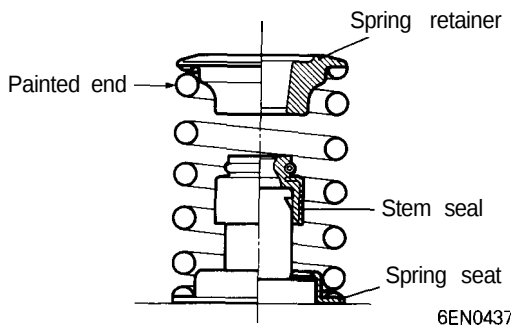
REASSEMBLY SERVICE POINTS

VALVE STEM SEAL INSTALLATION

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

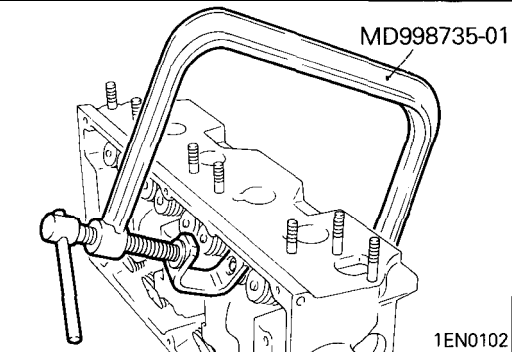
Caution

Do not reuse removed valve stem seal.



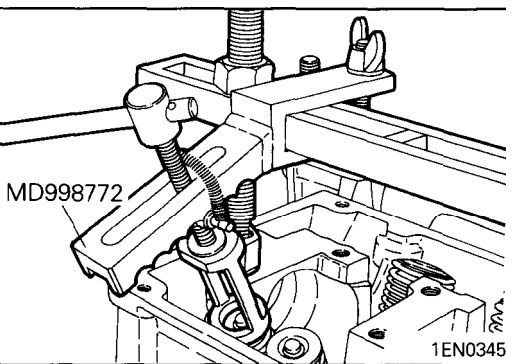
◆B◆ VALVE SPRING INSTALLATION

- (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, and damage, the stem seal.



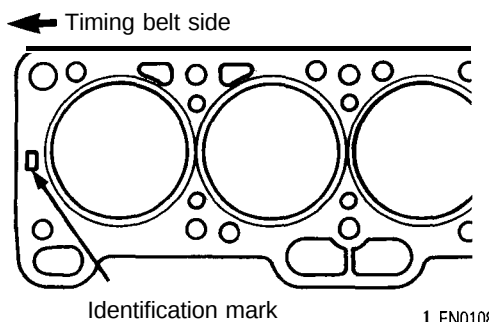
◆D◆ CYLINDER HEAD GASKET INSTALLATION

- (1) Clean both gasket surfaces of cylinder block and cylinder head.
- (2) Do not apply sealant.
- (3) Confirm the identification mark on cylinder head gasket. The identification mark is stamped on the top surface of the gasket at its front end.

Identification mark

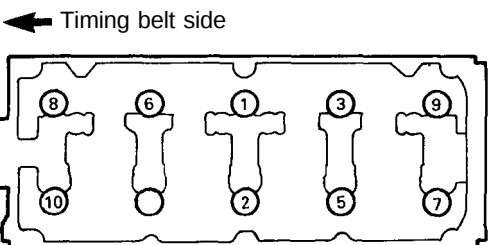
3VII: Up to 1992 models

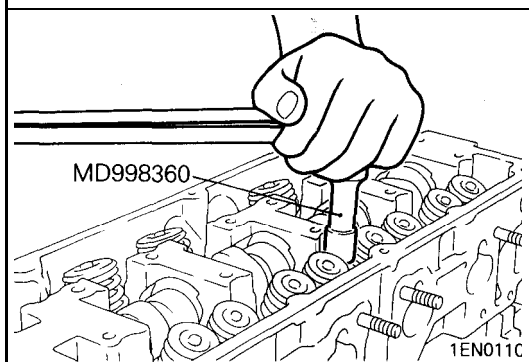
1CG: From 1993 models



◆E◆ CYLINDER HEAD BOLT INSTALLATION

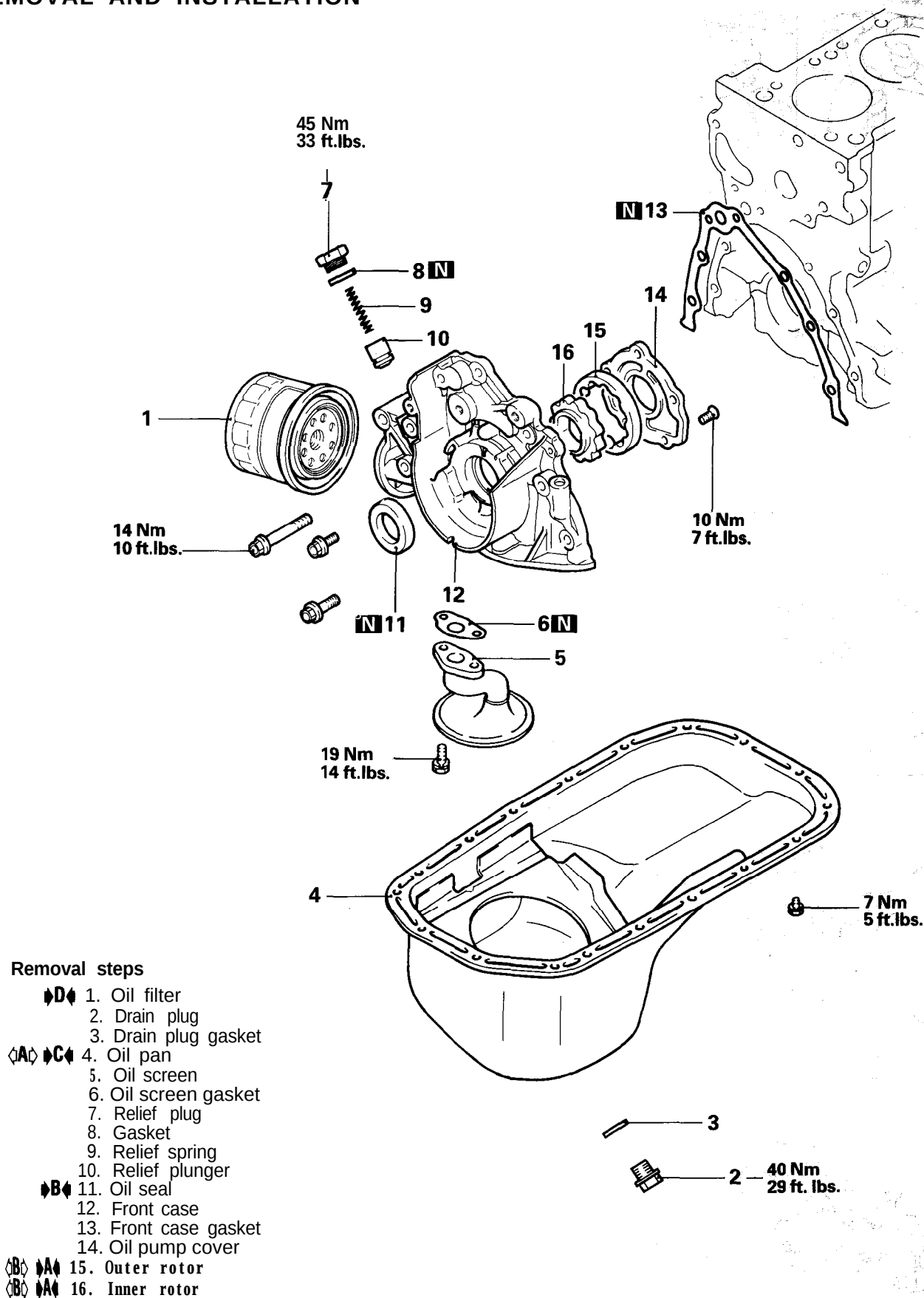
- (1) Using the special tool and a torque wrench, tighten the bolts in the shown sequence.
- (2) Repeat the tightening sequence several times, and torque the bolts to specification in the final sequence.

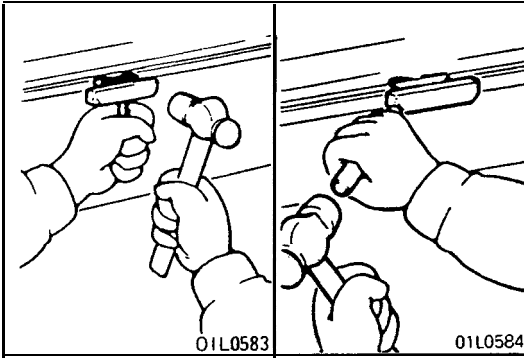




FRONT CASE AND OIL PUMP

REMOVAL AND INSTALLATION

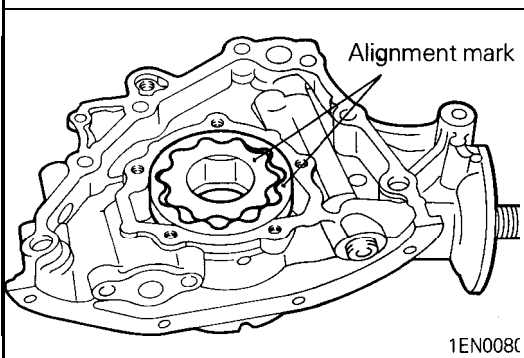




REMOVAL SERVICE POINTS

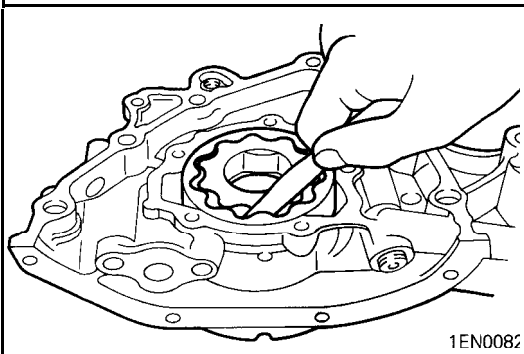
◀A▶ OIL PAN REMOVAL

- (1) Knock 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 it.



◀B▶ OUTER ROTOR / INNER ROTOR REMOVAL

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

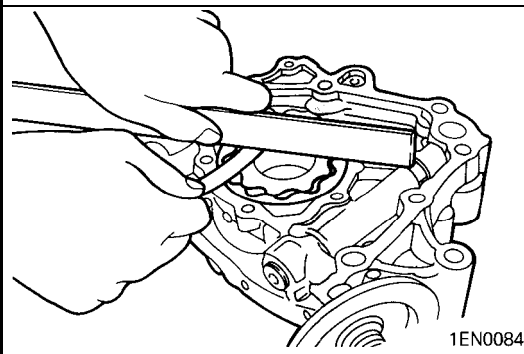


INSPECTION

OIL PUMP

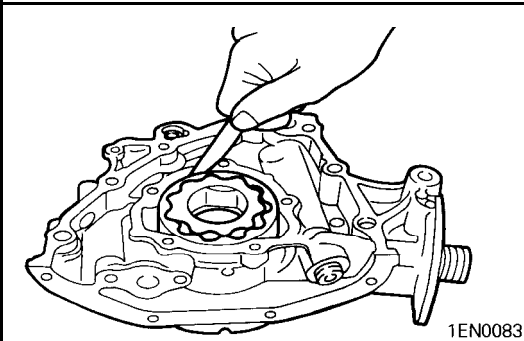
- (1) Check the tip clearance.

Standard value: 0.03 – 0.08 mm (.0012 – .0031 in.)



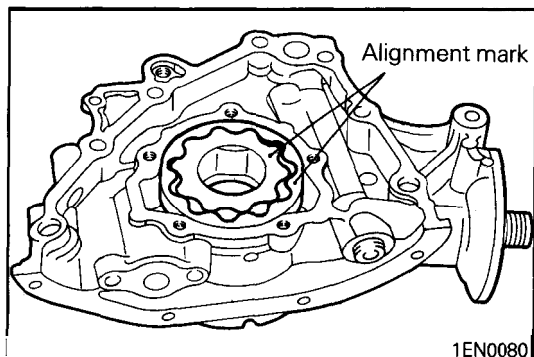
- (2) Check the side clearance.

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



- (3) Check the body clearance.

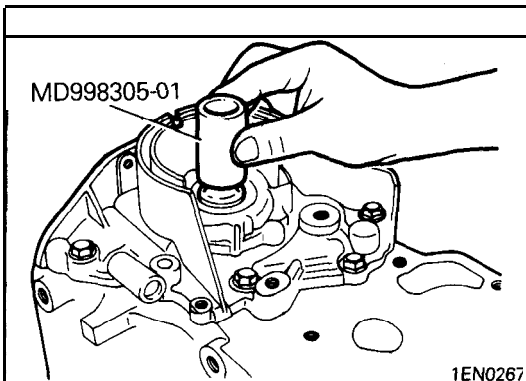
Standard value: 0.10 – 0.18 mm (.0039 – .0071 in.)
Limit: 0.35 (.138 in.)



INSTALLATION SERVICE POINTS

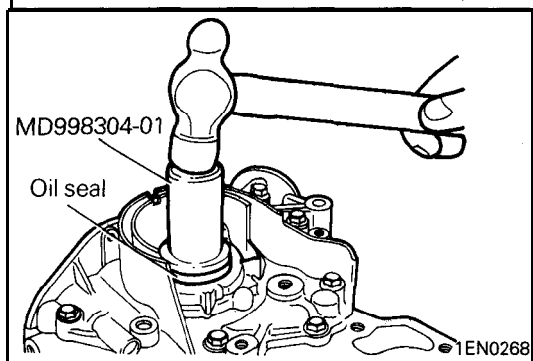
◆A◆ INNER ROTOR / OUTER ROTOR INSTALLATION

- (1) Install the outer rotor in the same direction as before noting the mark put at the time of removal. Apply engine oil to the entire rotor surface.



◆B◆ CRANKSHAFT FRONT OIL SEAL INSTALLATION

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



- (2) Apply a light coat of engine oil to the oil seal lip and then slide the oil seal down along the special tool by hand until it touches the front case. Install the oil seal in the front case using the other special tool.

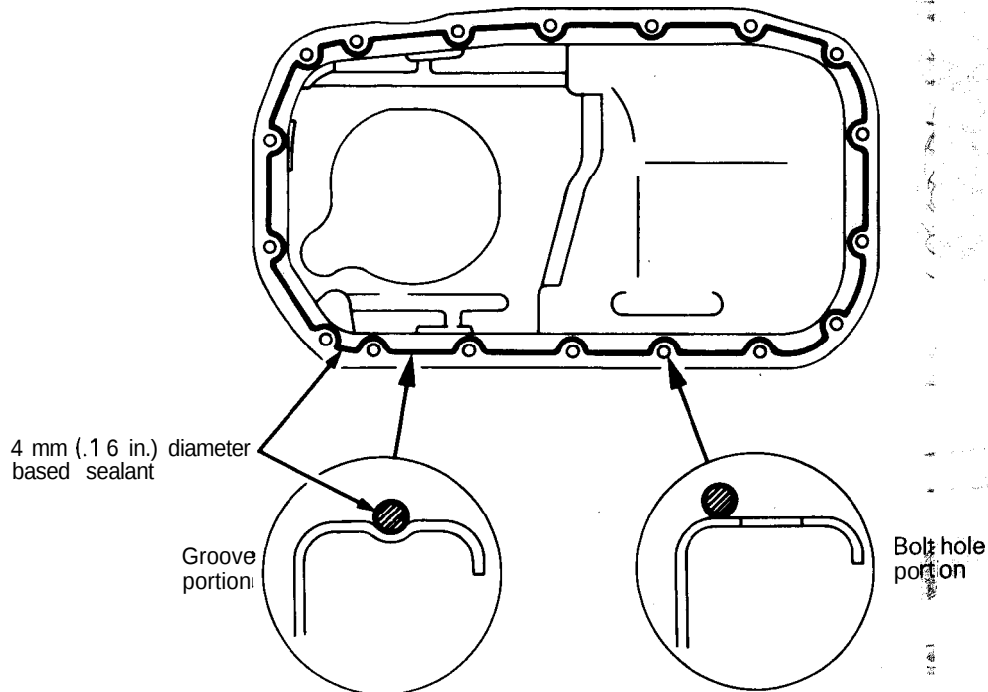
🔧 OIL PAN INSTALLATION

- (1) Scrape clean or wire brush all gasket surfaces removing all loose material.
- (2) Apply a 4 mm (.16 in.) diameter bead of sealant to the oil pan flange.

Specified sealant:

Mitsubishi Genuine Part No. MD970389 or equivalent

- (3) The oil pan should be installed within 15 minutes after the application of sealant.



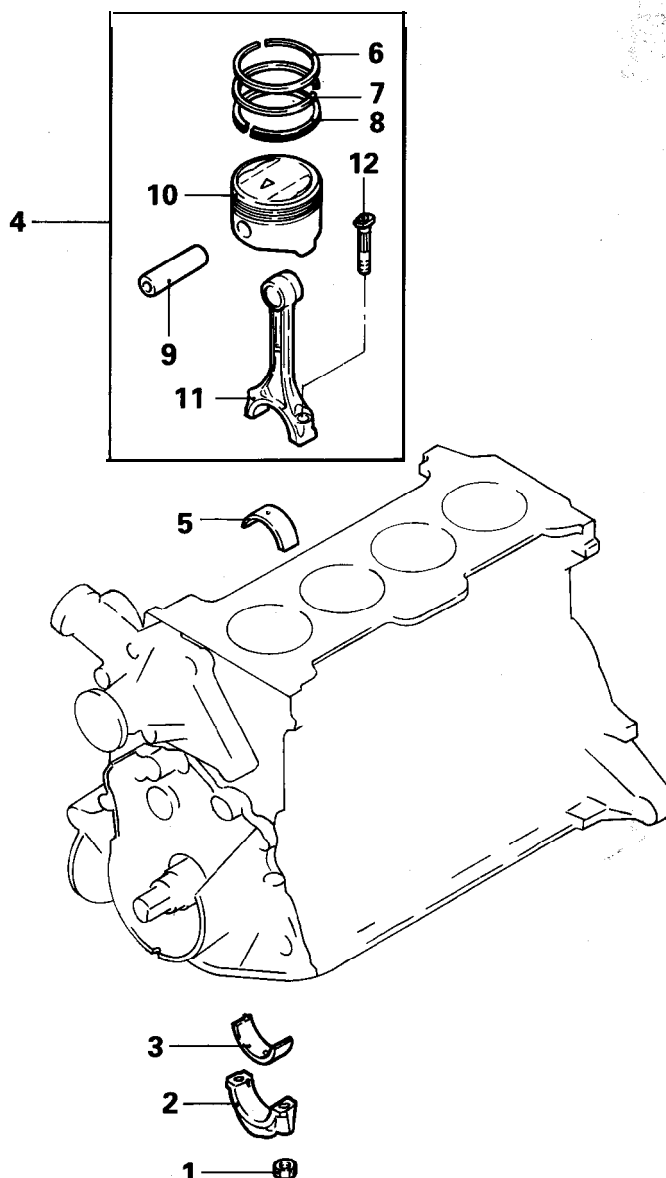
1EN0112

🔧 OIL FILTER INSTALLATION

- (1) Clean the filter installation surface of the filter bracket.
- (2) Apply engine oil to the O-ring of the oil filter.
- (3) Screw the oil filter on the bracket until the O-ring contacts the base. Then tighten one additional turn.

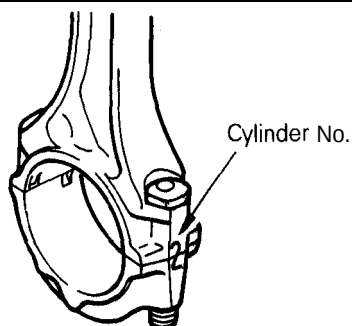
PISTON AND CONNECTING ROD

REMOVAL AND INSTALLATION



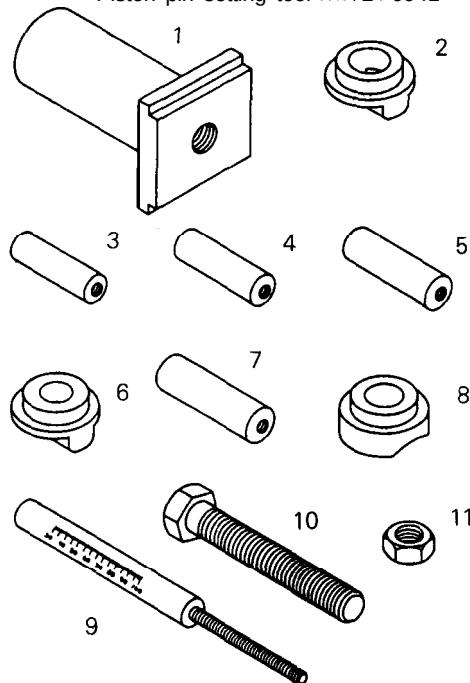
Removal steps

- ◆F◆ 1. Nut
- ◇A◇ ◆E◆ 2. Connecting rod cap
- ◆D◆ 3. Connecting rod bearing
- ◆D◆ 4. Piston and connecting rod
- ◆C◆ 5. Connecting rod bearing
- ◆C◆ 6. Piston ring No. 1
- ◆C◆ 7. Piston ring No. 2
- ◆B◆ 8. Oil ring
- ◇B◇ ◆A◆ 9. Piston pin
- 10. Piston
- 11. Connecting rod
- 12. Bolt

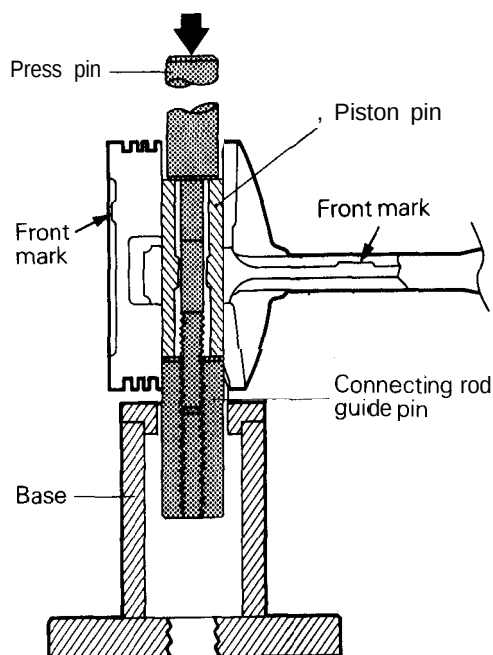


DEN005C

Piston pin setting tool MIT21 6941



7EN042E



7EN042E

DISASSEMBLY SERVICE POINTS**Ⓐ CONNECTING ROD CAP REMOVAL**

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

Ⓑ PISTON PIN REMOVAL

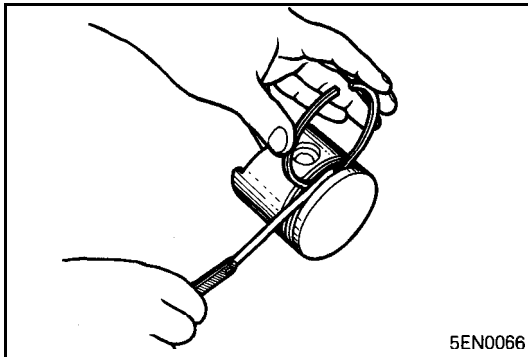
Item No.	Part No.	Description
1	MIT310134	Base
2	MIT310136	Piston Support
3	MIT310137	Connecting Rod Guide Pin
4	MIT310138	Connecting Rod Guide Pin
5	MIT310139	Connecting Rod Guide Pin
6	MIT310140	Piston Support
7	MIT310141	Connecting Rod Guide Pin
8	MIT310142	Piston Support
9	MIT48 143	Press Pin
10	2 16943	Stop Screw
11	10396	Nut

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

IMPORTANT: To avoid piston damage,

- The piston support must seat **squarely** against the piston.
- Verify that the piston pin will **slide** through the hole in the piston support.

- (6) Remove the piston pin from the **press** pin.

**INSPECTION****PISTON RING**

- (1) Check for side clearance.

If the limit is exceeded, replace the ring or piston, or both.

Standard value:

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

No. 2 0.02 – 0.08 mm (.0008 – .0024 in.)

Limit: 0.1 mm (.004 in.)

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

Standard value:

No. 1 0.20 – 0.40 mm (.0079 – .0157 in.)

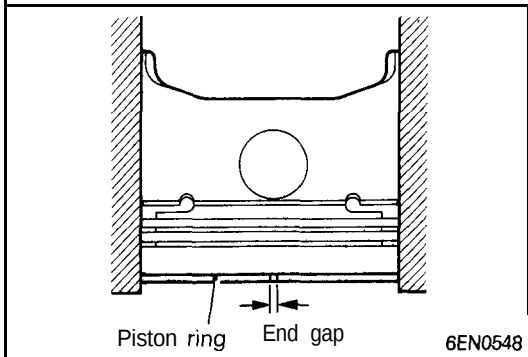
No. 2 0.20 – 0.35 mm (.0079 – .0138 in.)

Oil 0.20 – 0.70 mm (.0079 – .0276 in.)

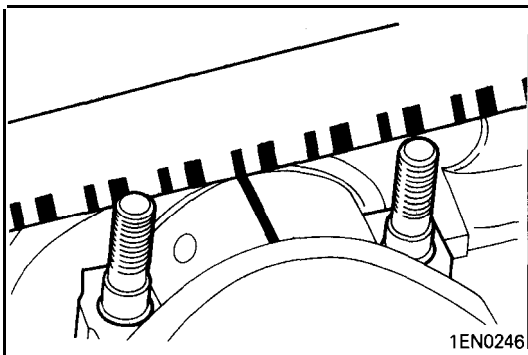
Limit:

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

Oil 1.0 mm (.039 in.)

**CRANKSHAFT PIN OIL CLEARANCE (PLASTIC GAUGE METHOD)**

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



- (3) Install the connecting rod cap carefully and tighten the bolts to specified torque.
 (4) Carefully remove the connecting rod cap.
 (5) Measure the width of the plastic gauge at its widest part by using a scale printed on the plastic gauge package.

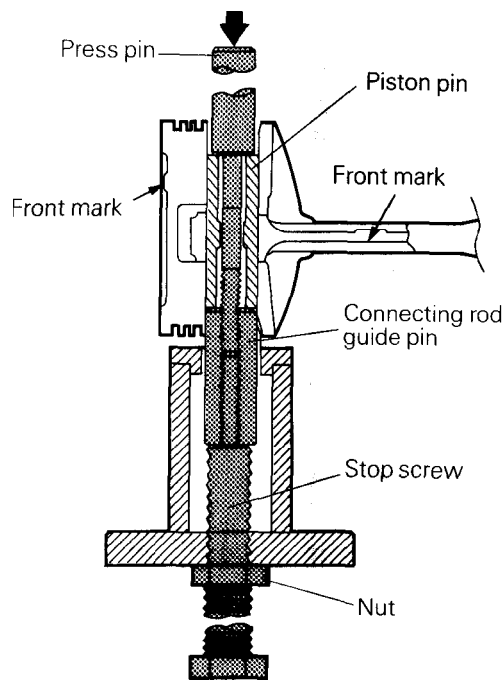
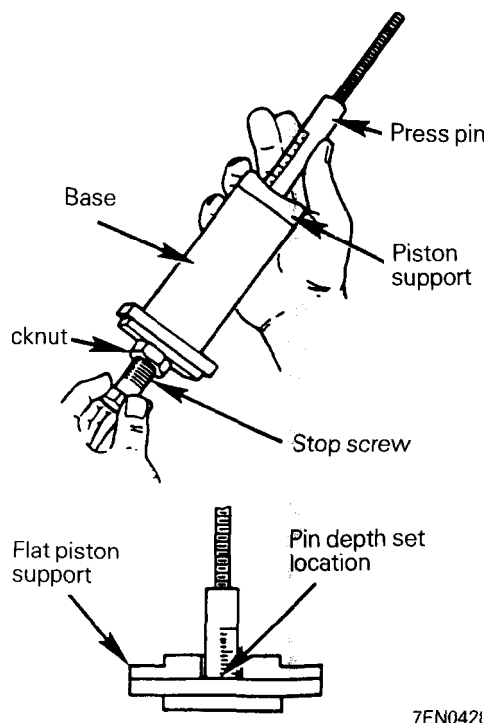
Standard value: 0.02 – 0.05 mm (.0008 – .0020 in.)

Limit: 0.1 mm (.004 in.)

REASSEMBLY SERVICE POINTS

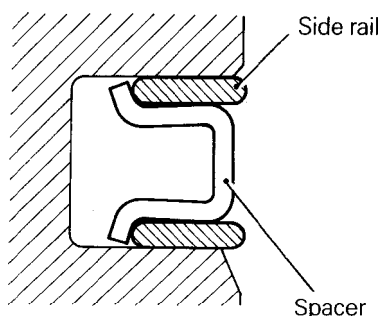
▶▶ PISTON PIN INSTALLATION

- (1) Thread the stop screw and lock nut assembly into the base. Fit the correct piston support on the top of the base. Insert the press pin, threaded end up, into the hole in the piston support until the press pin touches the stop screw.
- (2) Using the graduations on the press pin, adjust the stop screw to the correct depth of 49 mm (1.93 in.)

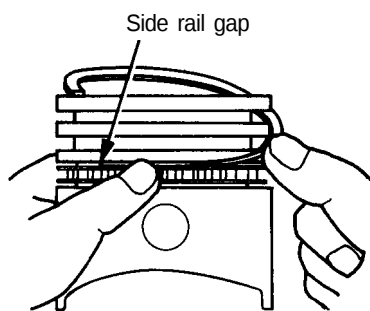


- (3) Place the base on the press support blocks.
- (4) Slide the piston pin over the threaded end of the press pin, and thread the correct guide pin up against it.
- (5) Coat the piston pin with oil, and with the connecting rod held in position, slide the guide pin through the piston and the connecting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

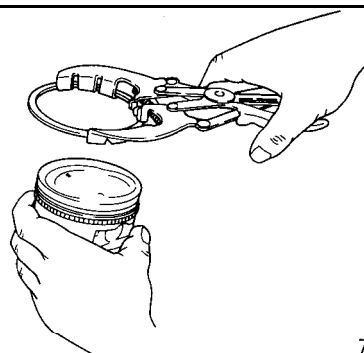
IMPORTANT: Due to production tolerance variations, it is necessary to visually inspect the piston pin depth after installation to verify that the piston pin is centered. Adjust if necessary.



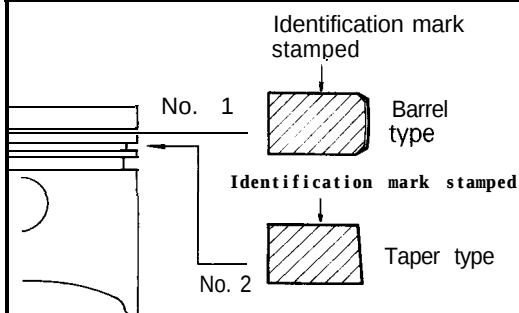
1 EN0277



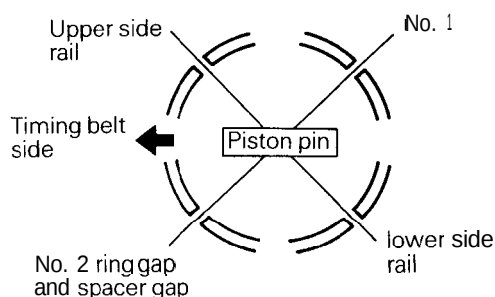
1 EN0269



7EN045



1 EN027C



6EN054

◆B◆ OIL RING INSTALLATION

- (1) Fit the oil ring spacer into the piston ring groove.

NOTE

The side rails and spacer may be installed in either direction.

- (2) Install the upper side rail.

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. See illustration.

Caution

Do not use piston ring expander when installing the side rail.

- (3) Install the lower side rail in the same procedure as described in step (2).
- (4) Make sure that the side rails move smoothly in either direction.

◆C◆ PISTON RING No. 2 / PISTON RING No. 1 INSTALLATION

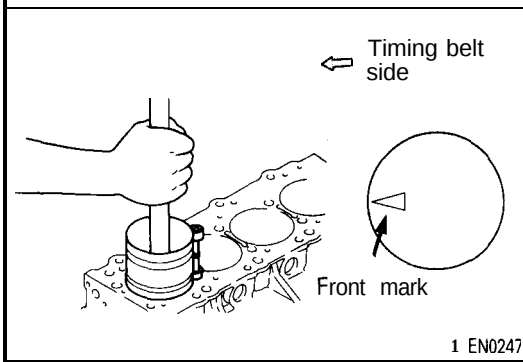
- (1) Using piston ring expander, fit No. 2 and then No. 1 piston ring into position.

NOTE

- (1) Note the difference in shape between No. 1 and No. 2 piston rings.
- (2) Install piston rings No. 1 and No. 2 with their side having marks facing up (on the piston crown side).

◆D◆ PISTON AND CONNECTING ROD ASSEMBLY INSTALLATION

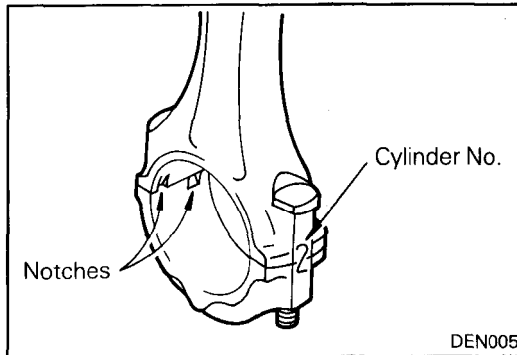
- (1) Apply engine oil to the piston surface, piston rings, and oil ring.
- (2) Align the gaps of piston rings and oil ring (side rails and spacer) as shown in the illustration.



- (3) Rotate crankshaft so that the crank pin is on the center of the cylinder bore.
- (4) Use suitable thread protectors on the connecting rod bolts before inserting piston and connecting rod assembly into the cylinder block.
Care must be taken not to nick the crank pin.
- (5) Using a suitable piston ring compressor tool, install the piston and connecting rod assembly into the cylinder block.

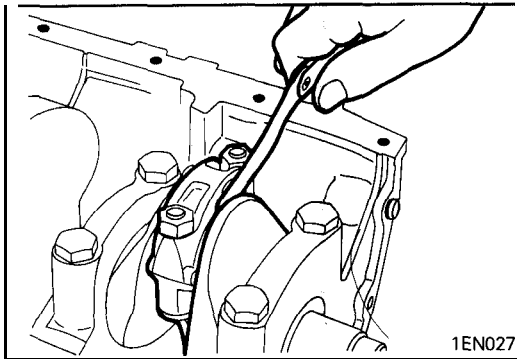
◆E◆ CONNECTING ROD CAP INSTALLATION

- (1) Verifying the mark made during disassembly, install the bearing cap to the connecting rod. If the connecting rod is new with no index mark, make sure that the bearing locking notches come on the same side as shown.



- (2) Make sure that connecting rod big end side clearance meets the specification.

Standard value: 0.10 – 0.25 mm (.0039 – .0098 in.)
Limit: 0.4 mm (.016 in.)

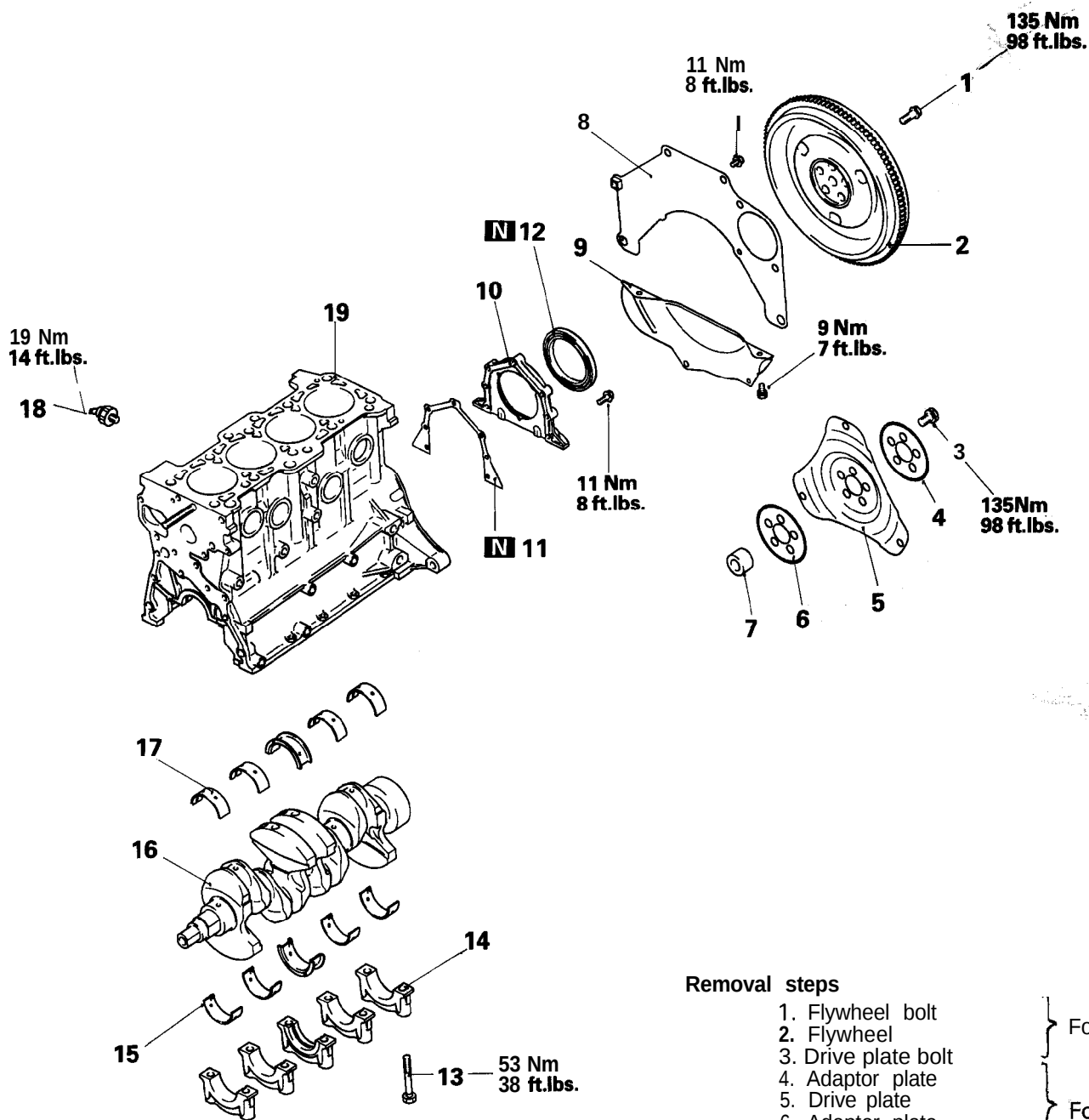


◆F◆ CONNECTING ROD CAP NUT INSTALLATION

- (1) Since the connecting rod bolts and nuts are torqued using a new procedure, they should be examined BEFORE reuse. If the bolt threads are “necked down” the bolts should be replaced.
Necking can be checked by running a nut with fingers to the full length of the bolt’s thread. If the nut does not run down smoothly the bolt should be replaced.
- (2) Install the connecting rod cap on the big end of connecting rod.
- (3) Before installing the nuts the threads should be oiled with engine oil.
- (4) Install both nuts on each bolt finger tight, then alternately torque each nut to assemble the cap properly.
- (5) Tighten the nuts to 20 Nm (14.5 ft.lbs.) and plus 1/4 (90°) turn.

CRANKSHAFT, FLYWHEEL AND DRIVE PLATE

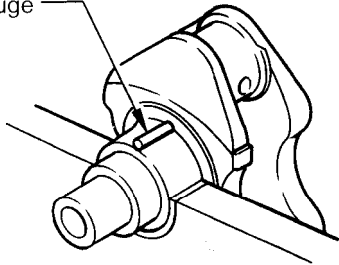
REMOVAL AND INSTALLATION



Removal steps

- | | |
|-------------------------------|-----------|
| 1. Flywheel bolt | } For M/T |
| 2. Flywheel | |
| 3. Drive plate bolt | } For A/T |
| 4. Adaptor plate | |
| 5. Drive plate | |
| 6. Adaptor plate | |
| 7. Crankshaft bushing | |
| 8. Rear plate | |
| 9. Bell housing cover | |
| 10. Oil seal case | |
| 11. Oil seal case gasket | |
| 12. Rear oil seal | |
| 13. Bearing cap bolt | |
| 14. Bearing cap | |
| 15. Crankshaft bearing, lower | |
| 16. Crankshaft | |
| 17. Crankshaft bearing, upper | |
| 18. Oil pressure switch | |
| 19. Cylinder block | |

Plastic gauge

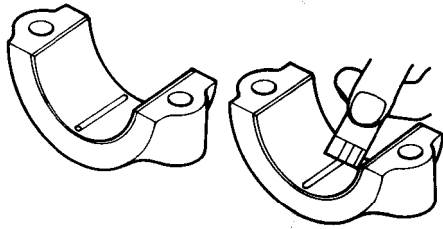


6EN055C

INSPECTION**CRANKSHAFT JOURNAL OIL CLEARANCE (PLASTIC GAUGE METHOD)**

- (1) Remove oil from the crankshaft journal and the crankshaft bearing.
- (2) Install the crankshaft.
- (3) Cut the plastic gauge 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 plastic gauge at its widest part by using a scale printed on the plastic gauge package.

Standard value: 0.02 – 0.05 mm (.0008 – .0020 in.)**Limit: 0.1 mm (.004 in.)**

1EN0556

CYLINDER BLOCK

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

Standard value: 0.05 mm (.002 in.)**Limit: 0.1 mm (.004 in.)**

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

Grinding limit: 0.2 mm (.008 in.)

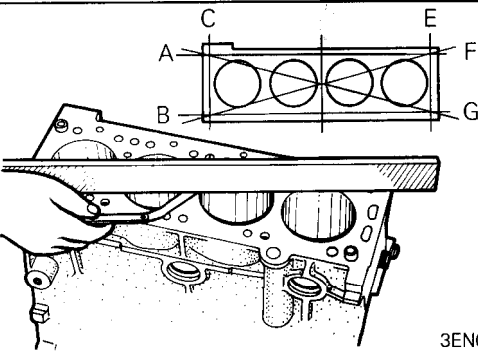
The total resurfacing depth of both cylinder block and mating cylinder head is 0.2 mm (.008 in.) at maximum.

Cylinder block height (When new)?**255.9 – 256.1 mm (10.075 – 10.083 in.)**

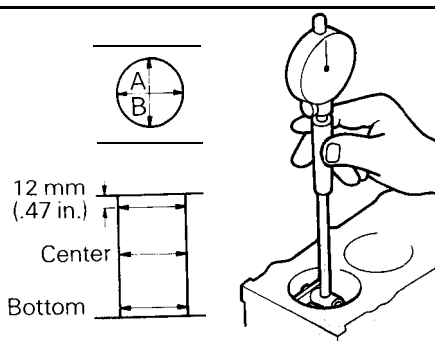
- (3) Check cylinder walls for scratches and seizure. If defects are evident, correct (rebore to an oversize) or replace.
- (4) Using cylinder gauge, measure the cylinder bore and cylindricity. If worn badly, correct the cylinder to an oversize and replace the piston and piston rings. Measure at the points shown in illustration.

Standard value:

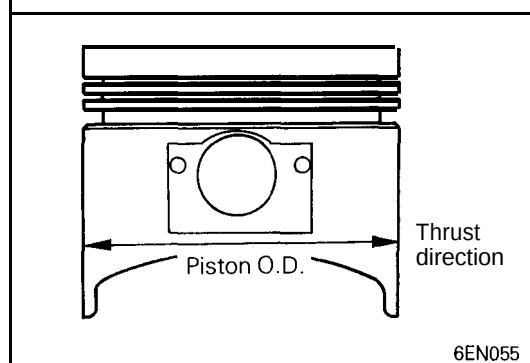
Cylinder I.D. 75.50 – 75.53 mm
(2.9724 – 2.9736 in.)

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

3EN0184



6EN0553

**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
0.25 mm (.01 in.) O.S.	0.25
0.50 mm (.02 in.) O.S.	0.50
0.75 mm (.03 in.) O.S.	0.75
1.00 mm (.04 in.) 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 (.0008 in.) (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 this order: No. 2 to No. 4 to No. 1 to No. 3.

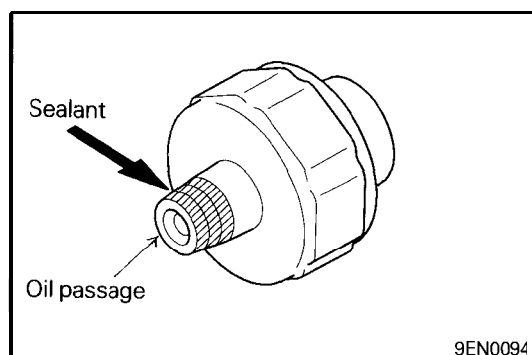
- (5) Hone to the final finish dimension [piston O.D. + clearance between piston O.D. and cylinder.]
 (6) Check the clearance between piston and cylinder.

Clearance between piston and cylinder:

0.02 – 0.04 mm (.0008 – .0016 in.)

NOTE

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

**INSTALLATION SERVICE POINTS****◆A◆ SEALANT APPLICATION TO OIL PRESSURE SWITCH**

- (1) Coat the threads of switch with sealant before installing the switch.

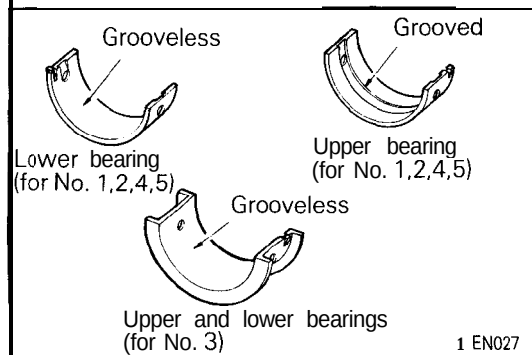
Specified sealant: 3M ATD Part No. 8660 or equivalent

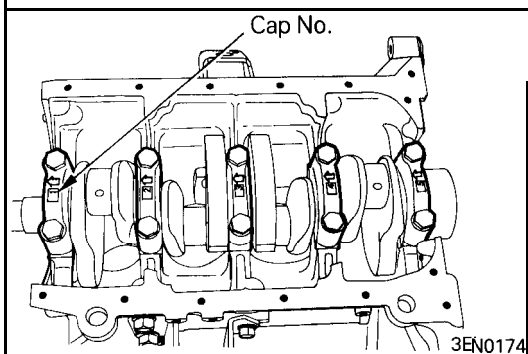
Caution

- 1. Keep the end of threaded portion clear of sealant.
 2. Avoid an overtightening.**

◆B◆ CRANKSHAFT BEARING INSTALLATION

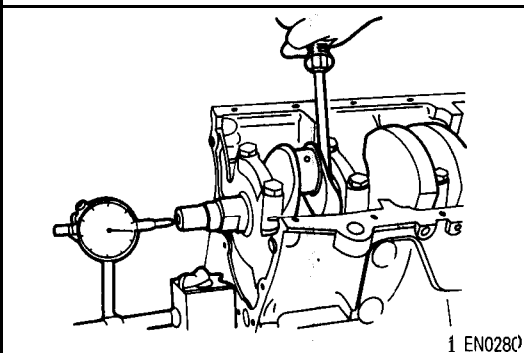
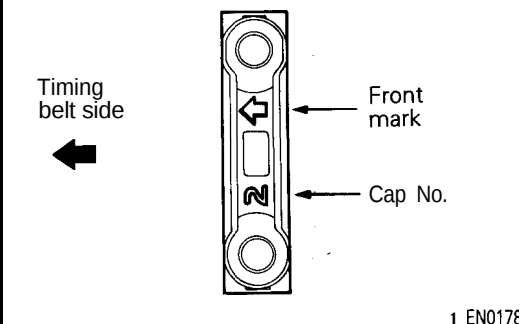
- (1) No. 1, 2, 4 and 5 upper bearings (cylinder block side) are provided with oil groove.
 (2) No. 1, 2, 4 and 5 lower bearings (cap side) are not provided with oil groove.
 (3) No. 3 bearings are flanged and provided with no groove. Common bearings are used on the cap side and cylinder block side.





❖C❖ INSTALLATION OF BEARING CAP

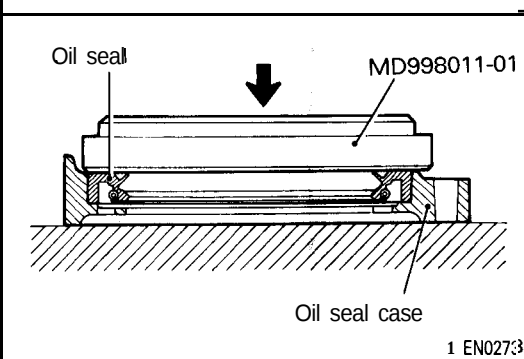
- (1) Install according to the front mark and cap No.



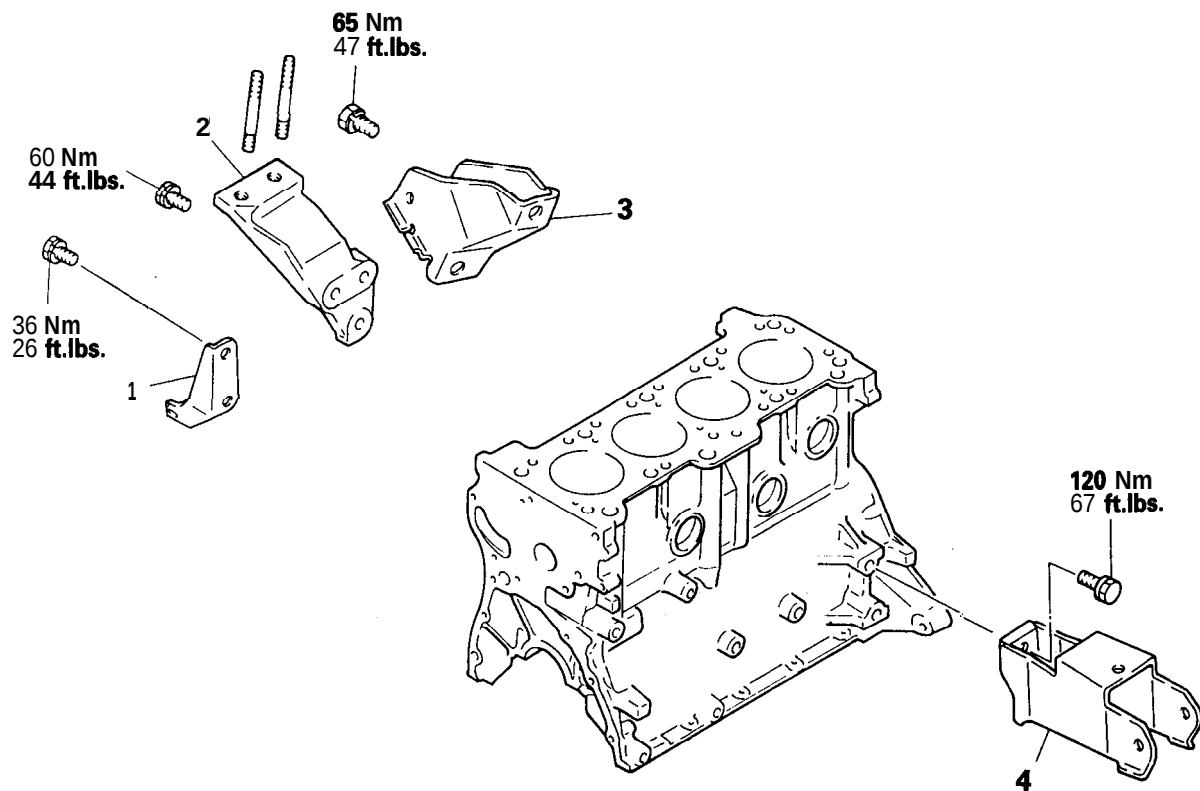
- (2) After installing the bearing caps, make sure that the crankshaft turns smoothly and the end play is correct. If the end play exceeds the limit, replace crankshaft bearings.

Standard value: 0.05 – 0.18 mm (.0020 – .0071 in.)

Limit: 0.3 mm (.012 in.)



❖D❖ OIL SEAL INSTALLATION

BRACKET**REMOVAL AND INSTALLATION****Removal steps**

1. Exhaust pipe support bracket
2. Engine support bracket, front
3. Roll stopper bracket, front
4. Roll stopper bracket, rear

NOTES

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1000

1000
1000
1000
1000
1000

ENGINE

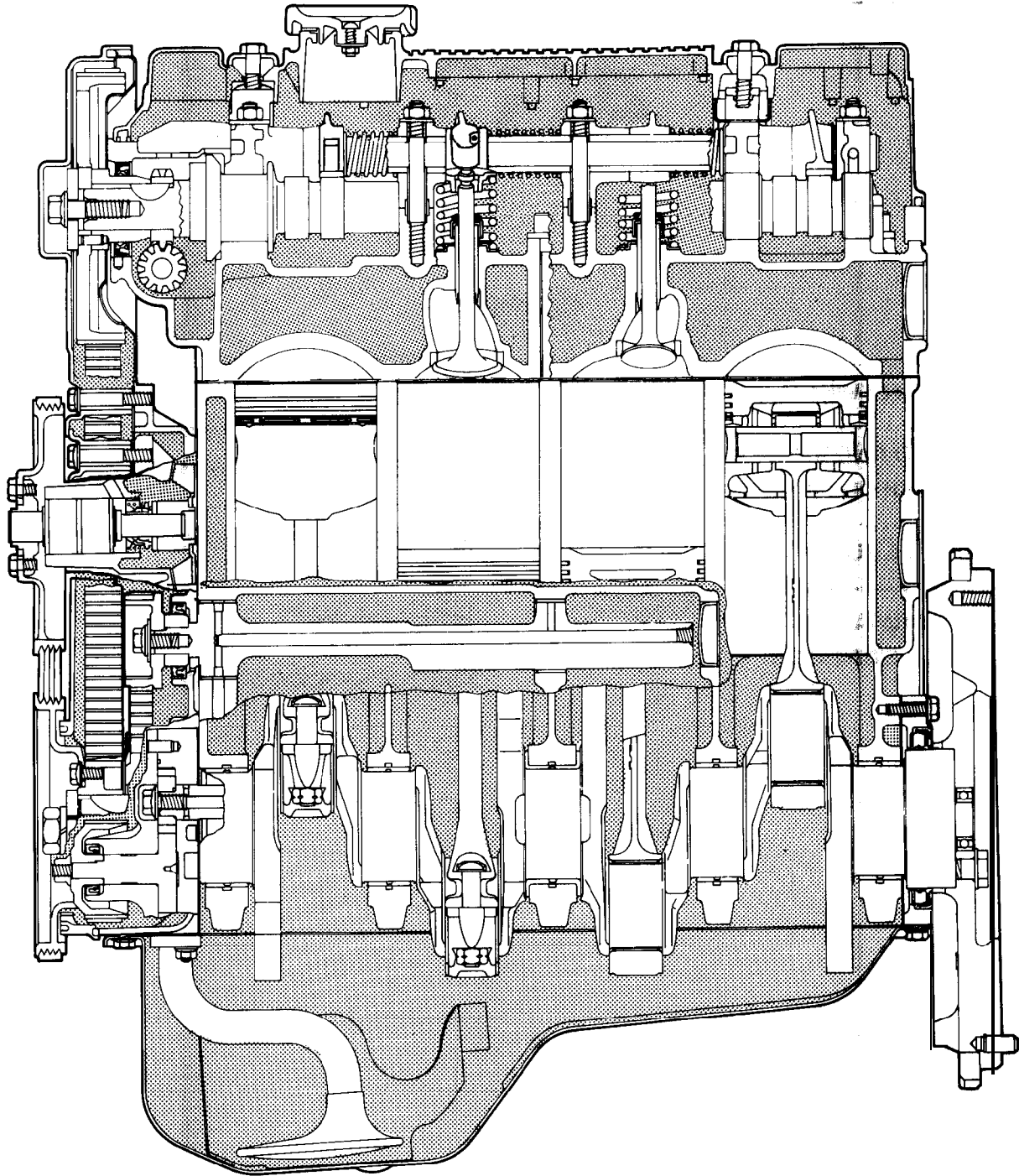
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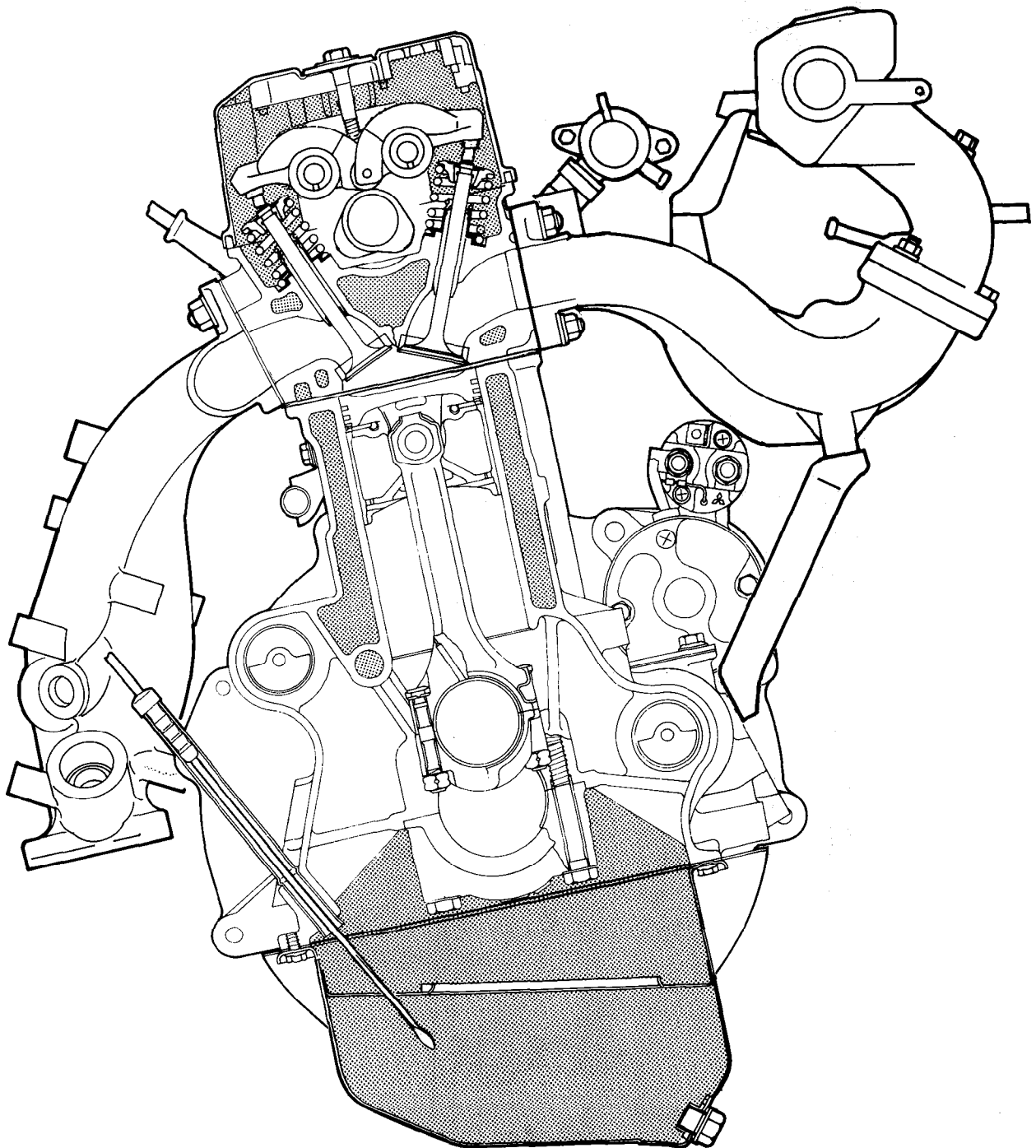
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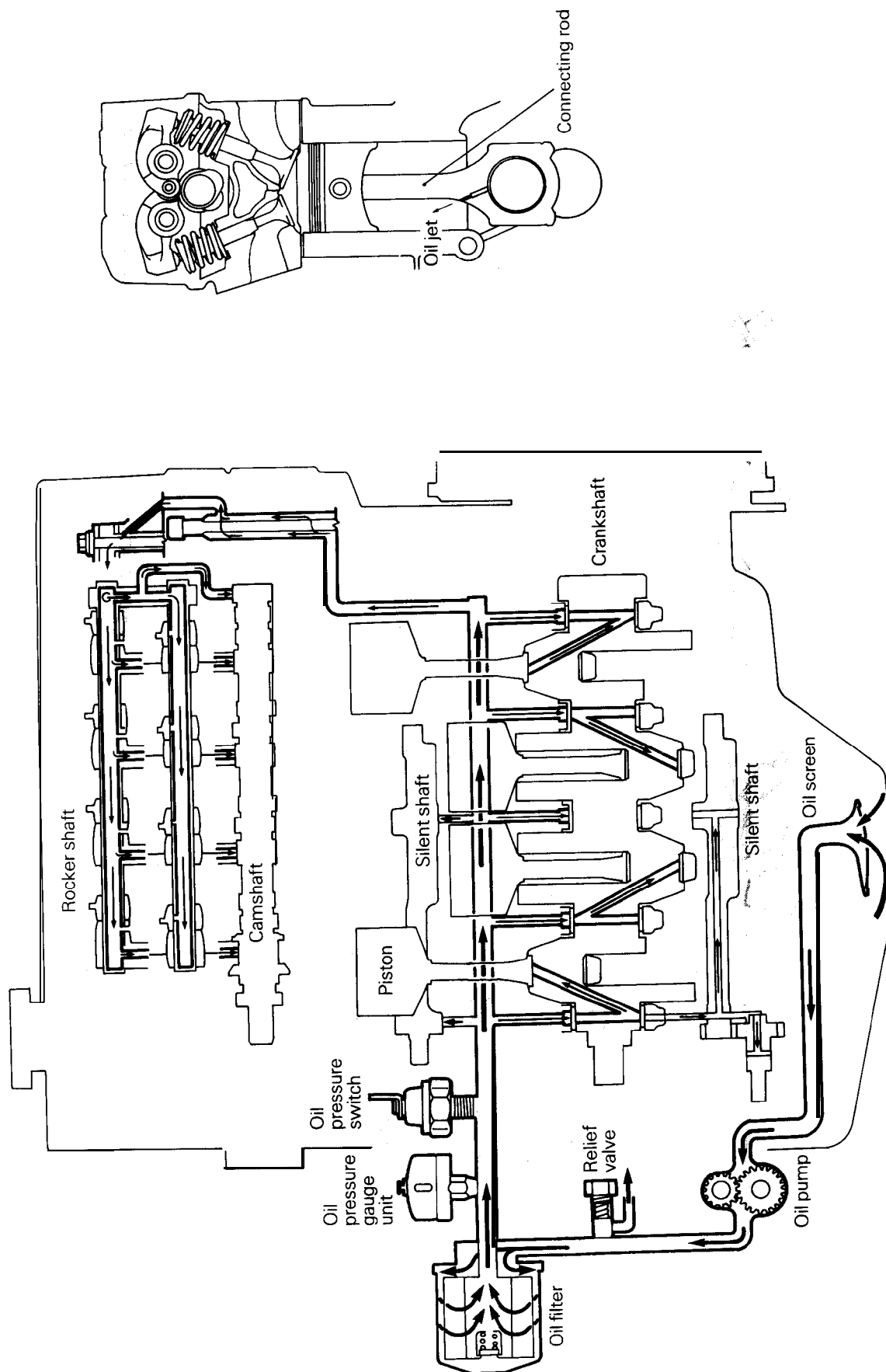
GENERAL INFORMATION

ENGINE SECTIONAL VIEW





LUBRICATION SYSTEM



GENERAL SPECIFICATIONS

Description	Specifications
Type	In-line OHV, SOHC
Number of cylinders	4
Combustion chamber	Compact type
Total displacement cm ³ (cu. in.)	1.755 (107.10)
Cylinder bore mm (in.)	80.6 (3.17)
Piston stroke mm (in.)	86 (3.39)
Compression ratio	9.0
Valve timing:	
(): camshaft identification mark	(AR)
Intake valve	
Opens	20° BTDC
Closes	52° ATDC
Exhaust valve	
Opens	55° BBDC
Closes	17° ATDC
Lubrication system	Pressure feed, full-flow filtration
Oil pump type	Involute gear type
Cooling system	Water-cooled forced circulation
Water pump type	Centrifugal impeller type
EGR type	Single type
Injector type and number	Electromagnetic 4
Injector identification mark	N210H
Fuel regulated pressure kPa (psi)	335 (47.6)
Throttle bore mm (in.)	50 (1.969)
Throttle position sensor	Variable resistor type
Closed throttle position switch	Contact type, within idle speed control motor

10

mm (in.)

	Standard	Limit
Valve		
Overall length		
Intake	98.2 (3.866)	
Exhaust	95.5 (3.760)	
Stem diameter		
Intake	7.96 – 7.98 (.313 – .314)	
Exhaust	7.93 – 7.95 (.312 – .313)	
Face angle	45° – 45°30'	
Thickness of valve head (margin)		
Intake	1.2 (.047)	0.7 (.028)
Exhaust	1.5 (.059)	1.0 (.039)
Stem-to-guide clearance		
Intake	0.03 – 0.06 (.0012 – .0024)	0.10 (.0039)
Exhaust	0.05 – 0.09 (.0020 – .0035)	0.15 (.0059)
Valve spring		
Free height	49.2 (1.937)	48.2 (1.896)
Load/installed height N/mm (lbs./in.)	31 0/37.3 (68/1.469)	
Out-of-squareness	Max. 2"	4"
Valve guide		
Overall length		
Intake	44 (1.73)	
Exhaust	48 (1.89)	
I.D.	7.2 – 7.25 (.2835 – .2854)	
O.D.	13.06 – 13.07 (.5142 – .5146)	
Service size	0.05 (.002), 0.25 (.01), 0.50 (.02) oversize	
Press-in temperature	Room temperature	
Valve seat		
Seat angle	43°30' – 44°	
Valve contact width	0.9 – 1.3 (.035 – .051)	
Sinkage		0.2 (.008)
Service size	0.3 (.012), 0.6 (.024) oversize	

mm (in.)

	Standard	Limit
Silent shaft		
Journal diameter		
Right(front)	38.96 – 38.98 (1.5339 – 1.5346)	
(rear)	35.95 – 35.97 (1.4154 – 1.4161)	
Left (front)	18.47 – 18.48 (.7272 – .7276)	
(rear)	35.95 – 35.97 (1.4154 – 1.4161)	
Oil clearance		
Right(front)	0.02 – 0.06 (.0008 – .0024)	
(rear)	0.05 – 0.09 (.0020 – .0035)	
Left (front)	0.02 – 0.05 (.0008 – .0020)	
(rear)	0.05 – 0.09 (.0020 – .0035)	
Piston		
O.D.	80.57 – 80.60 (3.1720 – 3.1732)	
Piston-to-cylinder clearance	0.02 – 0.04 (.0008 – .0016)	
Service size	0.25 (.01), 0.50 (.02), 0.75 (.03), 1.00 (.04) oversize	
Piston ring		
End gap		
No. 1 ring	0.30 – 0.45 (.0118 – .0177)	0.8 (.031)
No. 2 ring	0.20 – 0.35 (.0079 – .0138)	0.8 (.031)
Oil ring	0.20 – 0.70 (.0079 – .0276)	1.0 (.039)
Ring-to-ring groove clearance		
No. 1 ring	0.05 – 0.09 (.0020 – .0035)	
No. 2 ring	0.02 – 0.06 (.0008 – .0024)	
Service size	0.25 (.01), 0.50 (.02), 0.75 (.03), 1.00 (.04) oversize	
Piston pin		
O.D.	19.00 – 19.01 (.7480 – .7484)	
Press-in load N(lbs.)	5,000 – 15,000 (1, 102 – 3,307)	
Press-in temperature	Room temperature	
Connecting rod		
Big end center-to small end center length	153.6 – 153.7 (6.047 – 6.051)	
Bend	0.05 (.0020)	
Twist	0.1 (.004)	
Big end side clearance	0.10 – 0.25 (.0039 – .0098)	0.4 (.016)

mm (in.)

	Standard	Limit
Crankshaft		
End play	0.05 – 0.18 (.0020 – .0071)	0.3 (.012)
Journal O.D.	57 (2.24)	
Pin O.D.	45 (1.77)	
Out-of-roundness and taper of journal and pin	Within 0.01 (.0004)	
Oil clearance of journal	0.02 – 0.05 (.0008 – .0020)	0.10 (.0039)
Oil clearance of pin	0.02 – 0.05 (.0008 – .0020)	0.10 (.0039)
Journal undersize		
0.25 (.010) U.S.	56.74 – 56.75 (2.2339 – 2.2342)	
0.50 (.020) U.S.	56.49 – 56.50 (2.2240 – 2.2244)	
0.75 (.030) U.S.	56.24–56.25 (2.2142–2.2146)	
Pin undersize		
0.25 (.010) U.S.	44.74 – 44.75 (1.7614 – 1.7618)	
0.50 (.020) U.S.	44.49 – 44.50 (1.7516 – 1.7520)	
0.75 (.030) U.S.	44.24–44.25 (1.7417 – 1.7421)	
Cylinder block		
I.D.	80.60 – 80.63 (3.1732 – 3.1744)	
Flatness of gasket surface	0.05 (.002)	0.1 (.0039)
Grinding limit of gasket surface		*0.2 (.008)
* Total resurfacing depth of both cylinder block and cylinder head		
Overall height	285.1 – 285.3 (11.224 – 11.232)	
Oil pump		
Side clearance		
Drive gear	0.08 – 0.14 (.0031 – .0055)	
Driven gear	0.06 – 0.12 (.0024 – .0047)	
Drive belt deflection		
New belt	6.5 – 8 (.26 – .31)	
Used belt	8 – 11 (.31 – .43)	
Injector		
Coil resistance Ω	13 – 16 at 20°C (68°F)	
Throttle position sensor		
Resistance $k\Omega$	3.5–6.5	
Idle speed control motor		
Coil resistance Ω	5 – 35 at 20°C (68°F)	
Idle speed control motor position sensor		
Resistance $k\Omega$	4 – 6	

TORQUE SPECIFICATIONS

	Nm	ft.lbs.
Generator and ignition system		
Water pump pulley bolt	9	7
Generator brace bolt	14	10
Generator brace mounting bolt	19	14
Generator pivot nut	23	17
Damper pulley bolt	17	12
Crankshaft pulley bolt	17	12
Spark plug	25	18
Distributor mounting nut	12	9
Timing belt		
Tensioner bolt and nut	26	19
Oil pump sprocket nut	37	27
Crankshaft sprocket bolt	120	87
Tensioner "B" bolt	19	14
Engine support bracket, left	36	26
Camshaft sprocket bolt	90	65
Fuel and emission parts		
Throttle body mounting bolts	19	14
Fuel rail mounting bolts	12	9
Fuel pressure regulator bolts	9	7
EGR valve mounting bolts	22	16
Throttle body		
Throttle position sensor attaching bolts	2.0	1.4
Intake manifold		
Engine coolant temperature gauge unit	11	8
Engine coolant temperature sensor	30	22
Water outlet fitting bolt	19	14
Intake manifold plenum stay bolt	18	13
Intake manifold plenum bolt and nut	18	13
Thermostat housing bolt and nut	18	13
Intake manifold stay bolt	22	16
Intake manifold bolt and nut	18	13
Exhaust manifold and water pump		
Oil level gauge guide bolt	14	10
Exhaust manifold cover "A" bolt	30	22
EXhaust manifold cover "A" and "B" mounting bolt	9	7
Exhaust manifold cover "B" bolt	24	17
Exhaust manifold nut	18	13
Water inlet pipe bolt	14	10
Water pump bolt	14	10

	Nm	ft.lbs.
Rocker arms and camshaft		
Rocker cover bolt	6	4.3
Camshaft bearing cap bolt (M8)	20	14
Camshaft bearing cap bolt (M6)	11	8
Cylinder head and valves		
Cylinder head bolt	73	53
Front case, oil pump and oil pan		
Oil pressure switch	10	7
Oil pressure gauge unit	10	7
Oil filter bracket	14	10
Oil pan drain plug	40	29
Oil pan bolt	7	5
Oil screen nut	22	16
Oil pump cover bolt	17	12
Oil pump driven gear bolt	37	27
Oil relief valve plug	45	33
Front case bolt	17	12
Piston and connecting rod		
Connecting rod cap nut	34	25
Crankshaft, flywheel and drive plate		
Flywheel and drive plate bolt	135	98
Rear plate bolt	11	8
Bell housing cover bolt	9	7
Oil seal case bolt	11	8
Bearing cap bolt	53	38
Bracket		
Exhaust pipe support bracket	36	26
Roll stopper bracket, front	65	47
Roll stopper bracket, rear	120	87
Engine support bracket, right	65	47

SEALANT

	Specified sealant	Quantity
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
Semi-circular packing	3M ATD Part No. 8660 or equivalent	As required
Oil pan	MITSUBISHI GENUINE Part MD970389 or equivalent	As required
Oil pressure gauge unit	3M ATD Part No. 8660 or equivalent	As required
Oil pressure switch	3M ATD Part No. 8660 or equivalent	As required

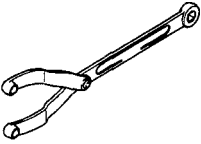
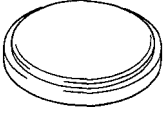
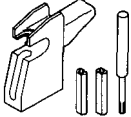
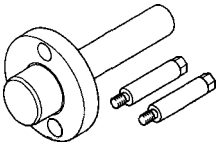
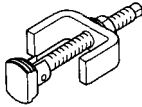
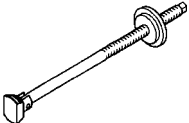
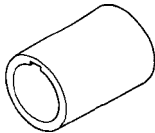
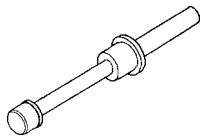
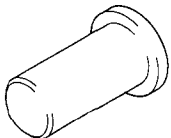
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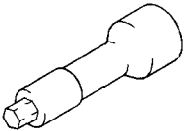
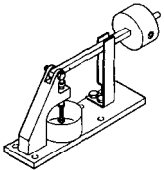
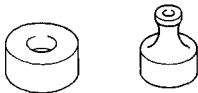
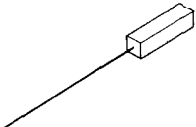
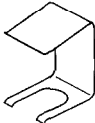
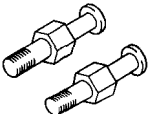
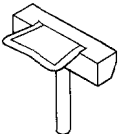
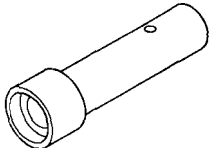
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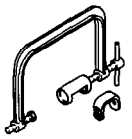
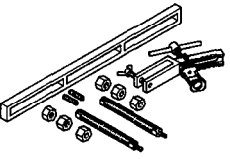
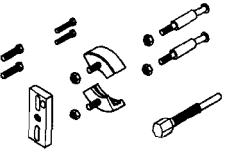
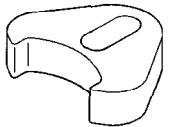
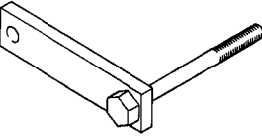
— 11B-12 —
4G3 ENGINE
Oil Pressure
Gauge Unit
Installation

SPECIAL TOOLS

100

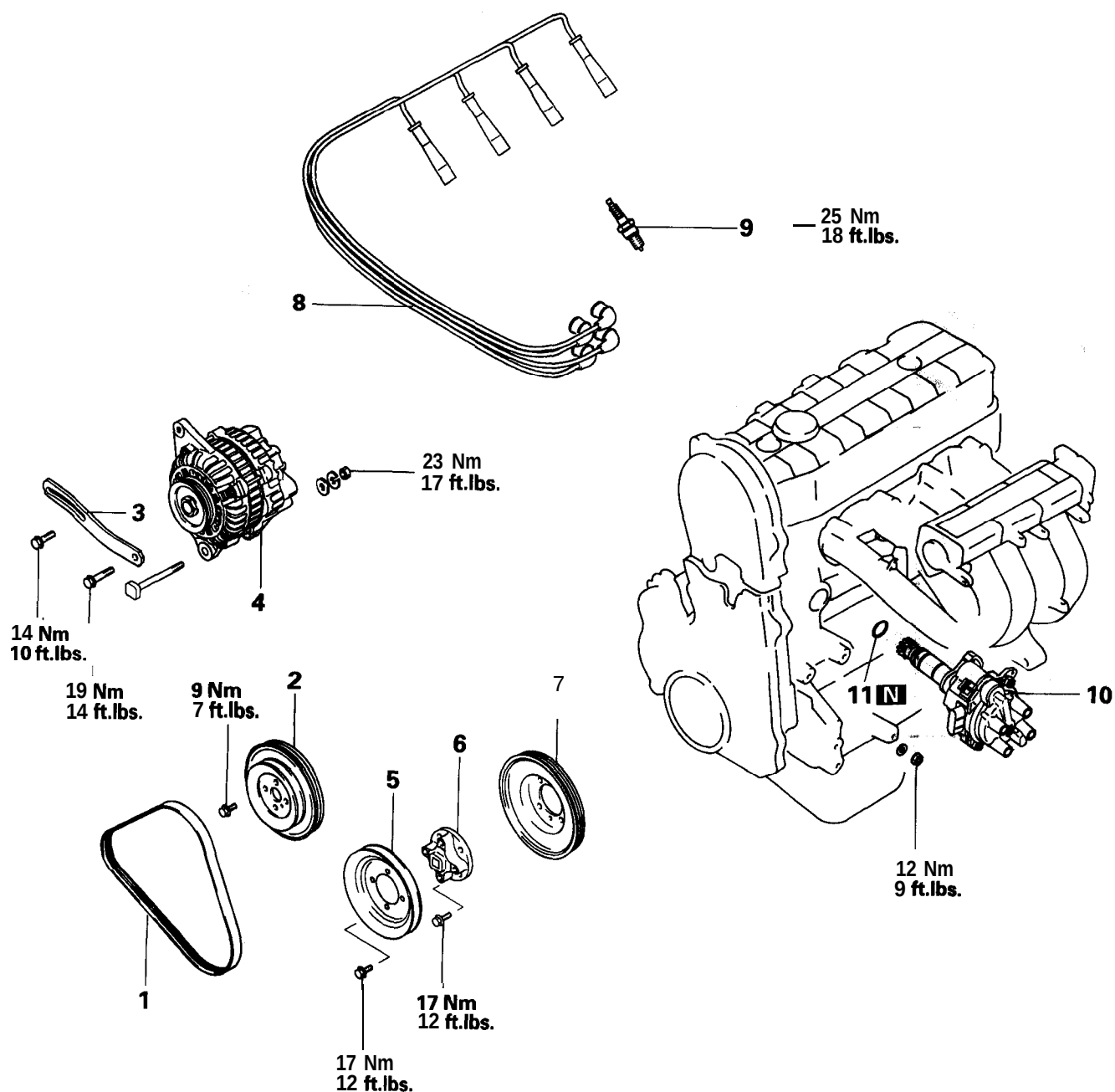
Tool	Number and tool name	Supersession	Application
	MB990767 End yoke holder Use with MD998719	MB990767-01 Use with MIT308239	Holding camshaft sprocket when loosening or torquing bolt.
	MD998011 Crankshaft rear oil seal installer	MD998011-01 Use with MB990938-01	Installation of crankshaft rear oil seal
	MD998128 Piston pin setting tool	MD998184-01	Removal and Installation of piston pin
	MD998280 Silent shaft bearing installer	MD998280-01 Use with MIT215869	Installation of silent shaft bearing front
	MD998282 Silent shaft bearing puller	MD998282-01 Use with MIT304204	Removal of silent shaft bearing front
	MD998283 Silent shaft bearing puller	MD998283-01 Use with MIT304204	Removal of silent shaft bearing rear
	MD998285 Crankshaft front oil seal guide	MD998285-01	Installation of crankshaft front oil seal
	MD998286 Silent shaft bearing installer	MD998286-01	Installation of silent shaft bearing rear
	MD998304 Crankshaft front oil seal installer	MD998304-01	Installation of crankshaft front oil seal

Tool	Number and tool name	Supersession	Application
	MD998360 Cylinder head bolt wrench		Removal and installation of cylinder head bolt
	MD998440 Leak-down tester		Leak-down test of lash adjuster
	MD998441 Lash adjuster retainer		Air bleeding of auto-lash adjuster
	MD998442 Air bleed wire		Air bleeding of auto-lash adjuster
	MD998443 Lash adjuster holder (8)	MD998443-01	Supporting lash adjuster to prevent it from falling when rocker shaft assembly is removed or installed
	MD998713 Camshaft oil seal installer	MD998713-01	Installation of camshaft oil seal
	MD998719 Pulley holding pins (2)	MIT308239	Holding camshaft sprocket when loosening or torquing bolt
	MD998727 Oil pan remover		Removal of oil pan
	MD998728 Valve stem seal installer	MD998728-01	Installation of valve stem seal

Tool	Number and tool name	Supersession	Application
	MD998735 Valve spring compressor	MD998735-01	Compression of valve spring
	MD998772 Valve spring compressor		Compression of valve spring
	MD998778 Crankshaft sprocket puller		Removal of crankshaft sprocket
	MD998779 Sprocket stopper		Holding silent shaft sprocket
	MD998781 Flywheel stopper		Holding flywheel

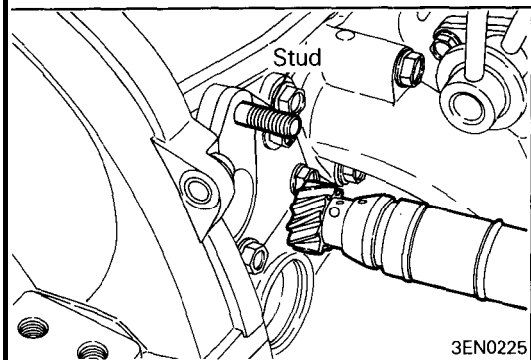
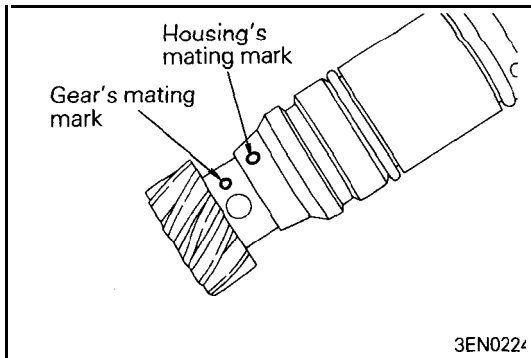
GENERATOR AND IGNITION SYSTEM

REMOVAL AND INSTALLATION



Removal steps

- ◆B◆ 1. Drive belt
- 2. Water pump pulley
- 3. Generator brace
- 4. Generator
- 5. Damper pulley
- 6. Adapter
- 7. Crankshaft pulley
- 8. Spark plug cable
- 9. Spark plug
- ◆A◆ 10. Distributor
- 11. O-ring

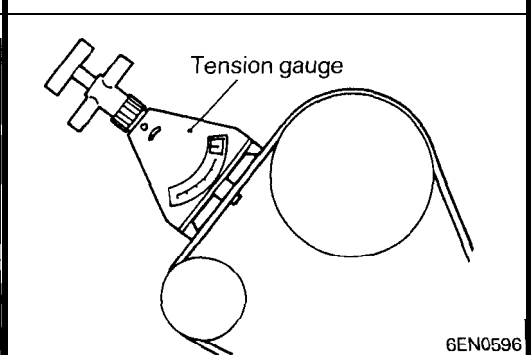
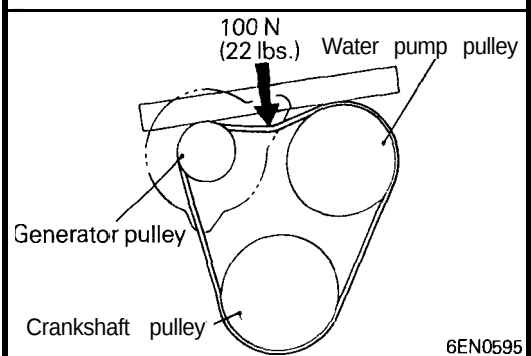
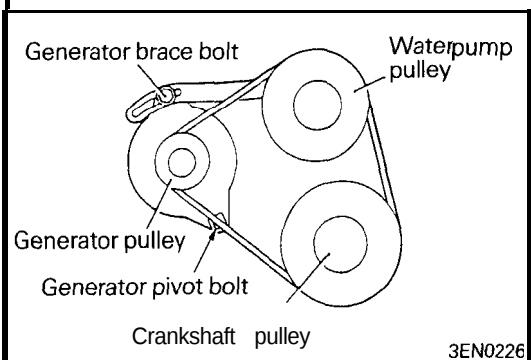


INSTALLATION SERVICE POINTS

◆A◆ DISTRIBUTOR INSTALLATION

- (1) Turn the crankshaft so that the No. 1 cylinder is at top dead center.
- (2) Align the distributor housing and gear mating marks.

- (3) Install the distributor to the engine while aligning the fine cut (groove or projection) of the distributor's installation flange with the center of the distributor installation stud.



◆B◆ DRIVE BELT TENSION ADJUSTMENT

- (1) Move the generator to give greater tension to the belt so that the specified deflection is obtained.

Standard value:

New belt: 6.5 – 8 mm (.26 – .31 in.)

Used belt: 8 – 11 mm (.31 – .43 in.)

Or using a tension gauge, adjust the tension to the standard value.

Standard value:

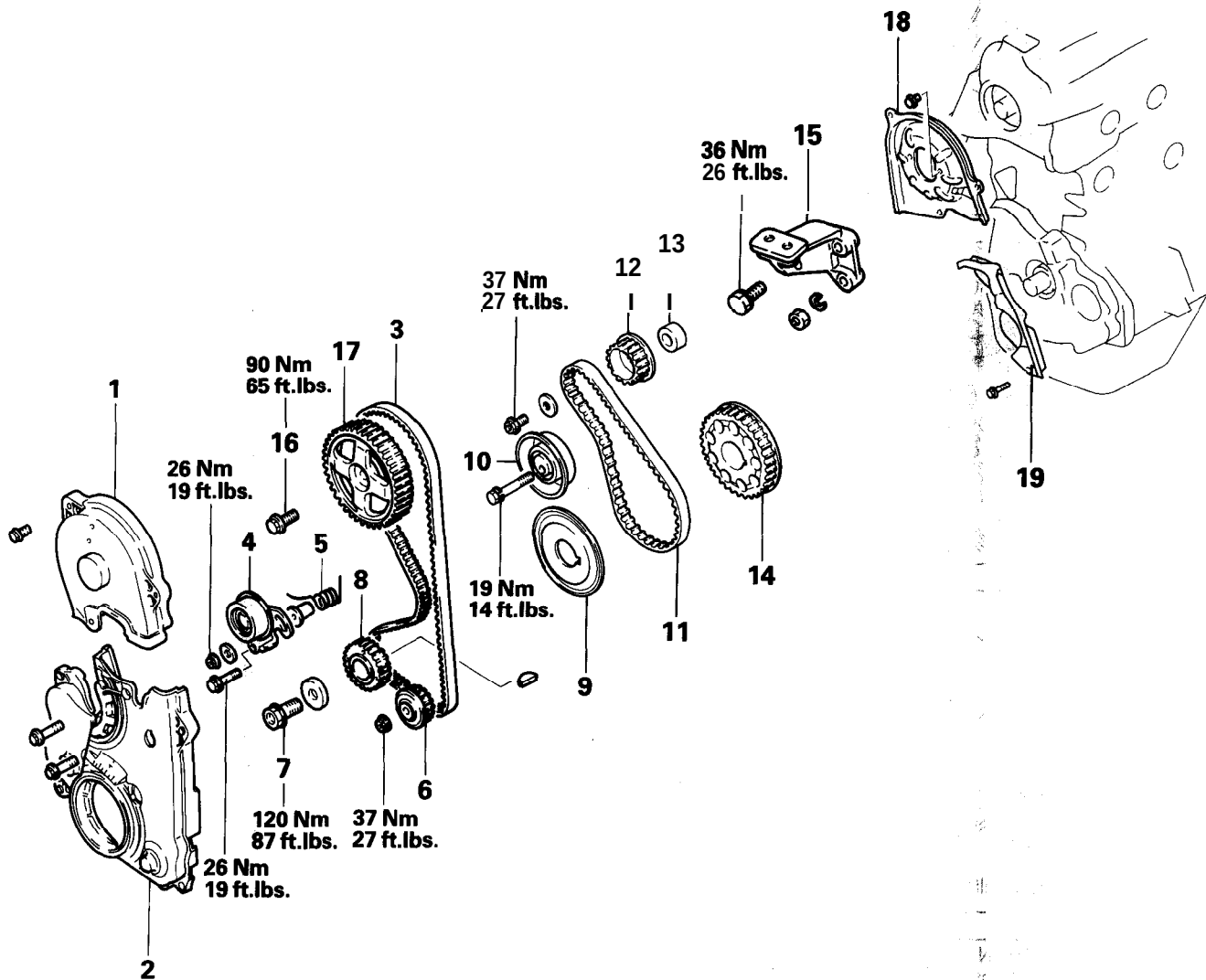
New belt: 500 – 700 N (110 – 154 lbs.)

Used belt: 400 N (88 lbs.)

- (3) Tighten the generator brace bolt.
- (4) Tighten the nut for the generator pivot bolt.

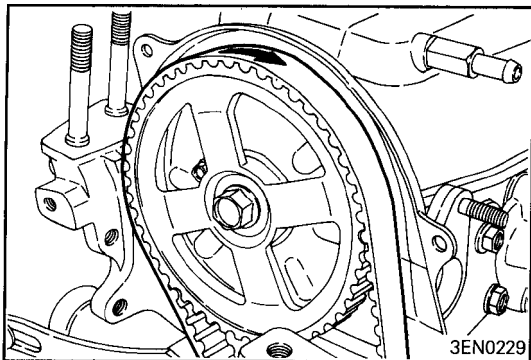
TIMING BELT

REMOVAL AND INSTALLATION

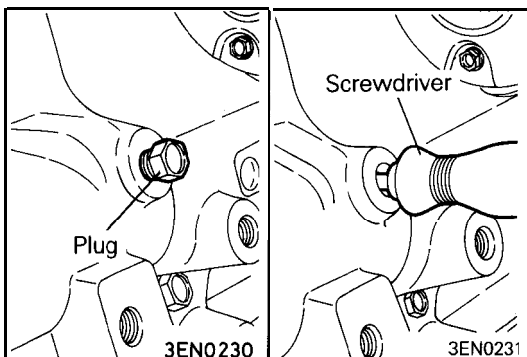


Removal steps

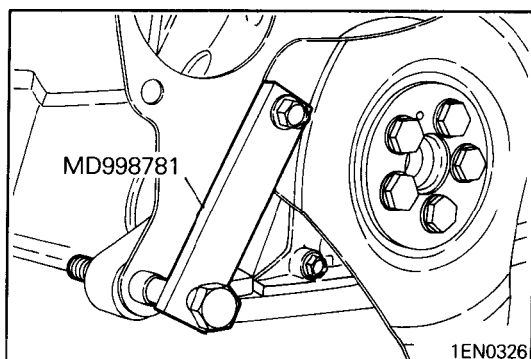
1. Timing belt front upper cover
2. Timing belt front lower cover
- ◁A▷▶H▶ 3. Timing belt
- ▶G▶ 4. Tensioner
- ▶G▶ 5. Tensioner spring
- ◁B▷▶F▶ 6. Oil pump sprocket
- ◁C▷▶E▶ 7. Crankshaft bolt
- ◁D▷ 8. Crankshaft sprocket
9. Flange
10. Tensioner "B"
- ◁E▷▶D▶ 11. Timing belt "B"
- ◁F▷▶C▶ 12. Silent shaft sprocket
- ▶B▶ 13. Spacer
- ◁G▷ 14. Crankshaft sprocket "B"
15. Engine support bracket, left
- ◁H▷▶A▶ 16. Camshaft sprocket bolt
17. Camshaft sprocket
18. Timing belt under upper cover
19. Timing belt under lower cover

**REMOVAL SERVICE POINTS****◀A▶ TIMING BELT REMOVAL**

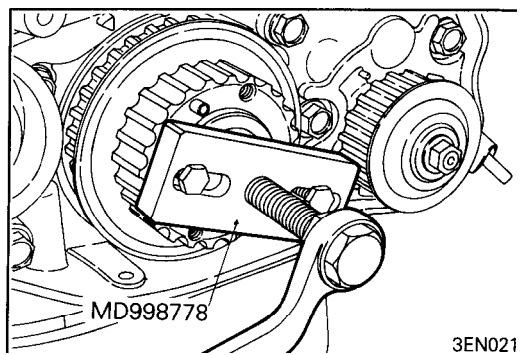
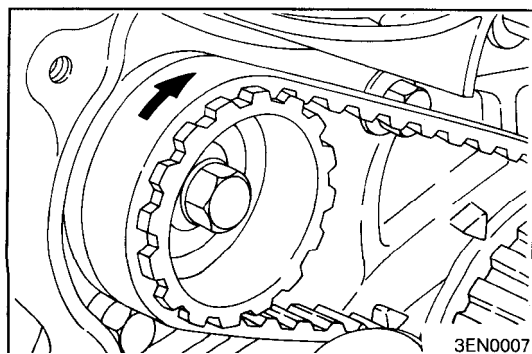
- (1) Mark the belt running direction for reference in reinstallation.

**◀B▶ OIL PUMP SPROCKET REMOVAL**

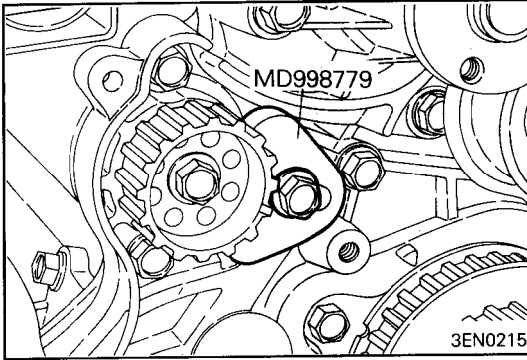
- (1) Remove the plug on the left side of the cylinder block.
- (2) Insert a Phillips screwdriver [shank diameter 8 mm (.31 in.)] to block the left silent shaft.
- (3) Remove the nuts.
- (4) Remove the oil pump sprocket.

**◀C▶ CRANKSHAFT BOLT LOOSENING**

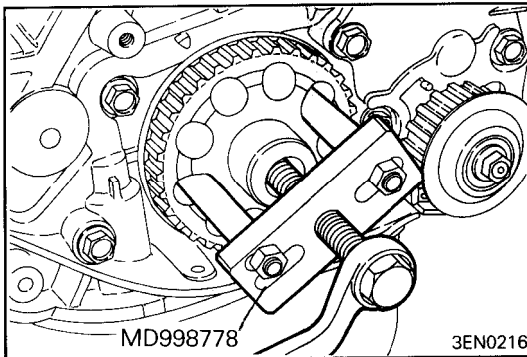
- (1) Using the special tool, hold the drive plate or flywheel.
- (2) Remove the crankshaft bolt.

**◀D▶ CRANKSHAFT SPROCKET REMOVAL****◀E▶ TIMING BELT "B" REMOVAL**

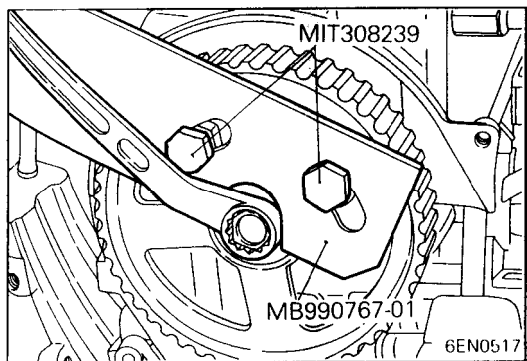
- (1) Mark the belt running direction for reference in reinstallation.



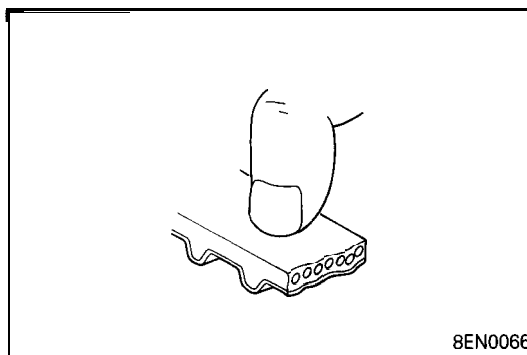
◀F▶ SILENT SHAFT SPROCKET REMOVAL



◀G▶ CRANKSHAFT SPROCKET "B" REMOVAL



◀H▶ CAMSHAFT SPROCKET BOLT LOOSENING

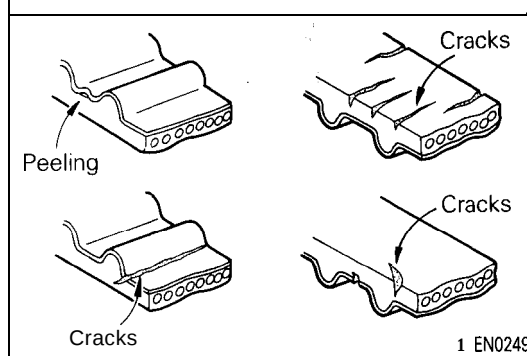


INSPECTION

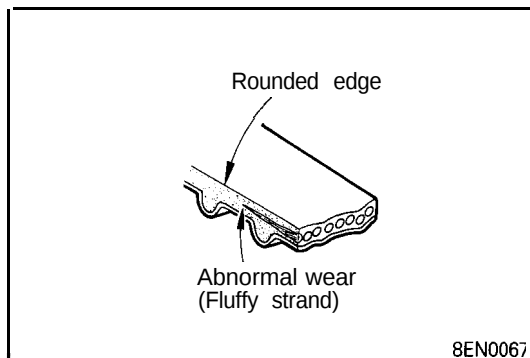
TIMING BELT / TIMING BELT "B"

Replace belt if any of the following conditions exist.

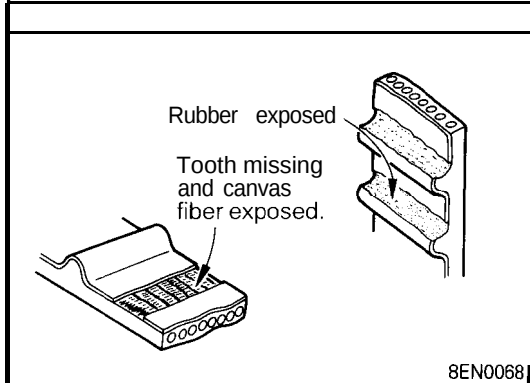
- (1) Hardening of back rubber — the back side is glossy without resilience and leaves no indent when pressed with finger-nail.



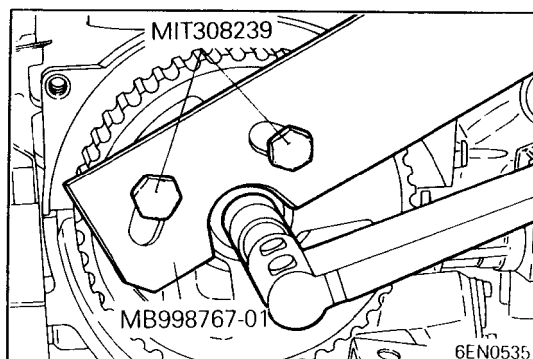
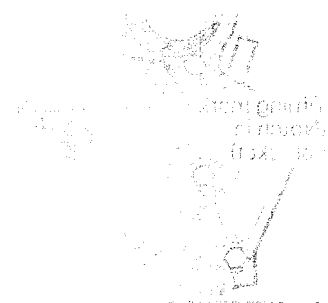
- (2) Cracks on rubber back
- (3) Cracks or peeling of canvas
- (4) Cracks on rib root
- (5) Cracks on belt sides



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

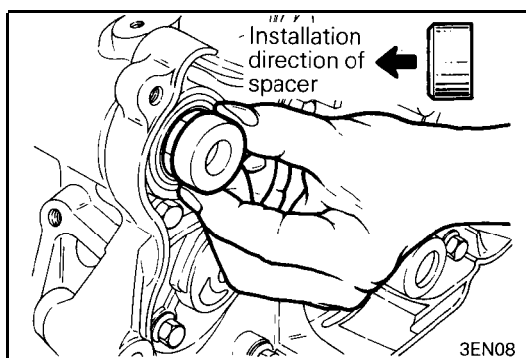


- (7) Abnormal wear in teeth
(8) Missing tooth



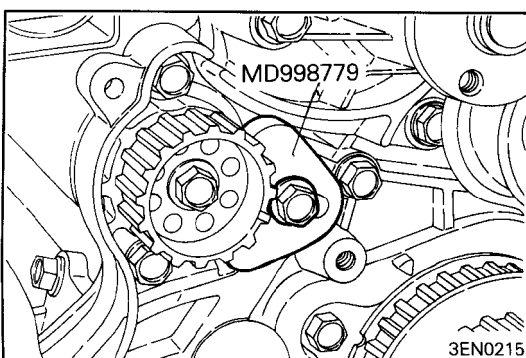
INSTALLATION SERVICE POINTS

▶A▶ CAMSHAFT SPROCKET BOLT INSTALLATION

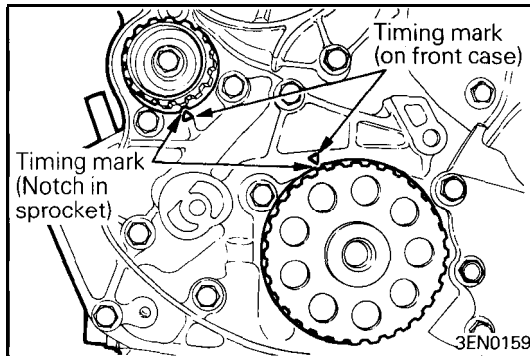


▶B▶ SPACER INSTALLATION

- (1) Install the spacer with the chamfered end toward the oil seal.

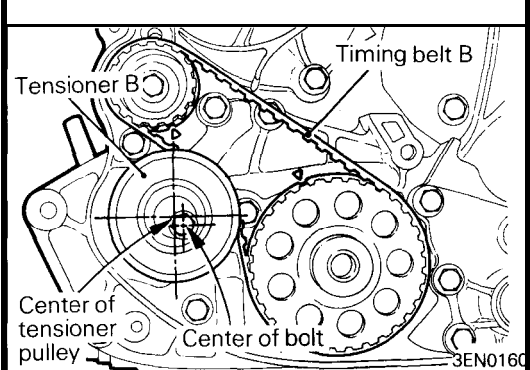


▶C▶ SILENT SHAFT SPROCKET INSTALLATION

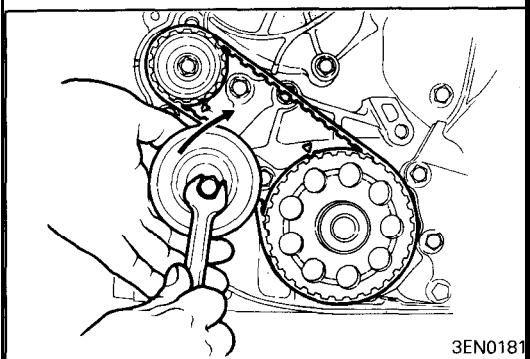


⚡ TIMING BELT “B” INSTALLATION

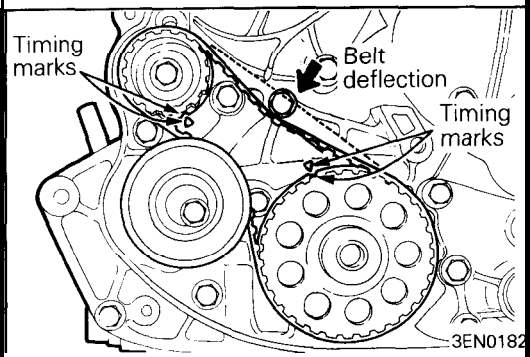
- (1) Align the timing marks on the crankshaft sprocket “B” and silent shaft sprocket with the marks on the front case respectively.



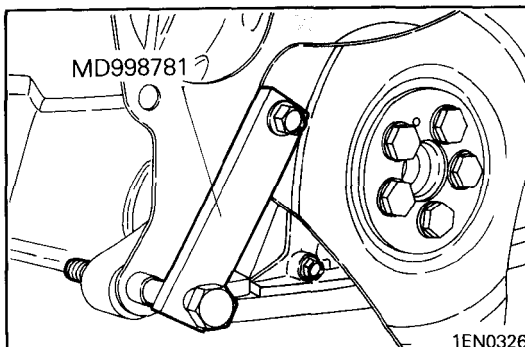
- (2) Install the timing belt “B” on the crankshaft sprocket “B” and silent shaft sprocket. There should be no slack on the tension side.
- (3) Make sure that the relationship between the tensioner pulley center and the bolt center is as shown in the illustration.



- (4) Move the tensioner “B” in the direction of arrow while lifting with a finger to give a sufficient tension to the tension side of timing belt. In this condition, tighten the bolt to secure tensioner “B”. When the bolt is tightened, use care to prevent the shaft from turning together. If the shaft is turned together, the belt will be overtensioned.

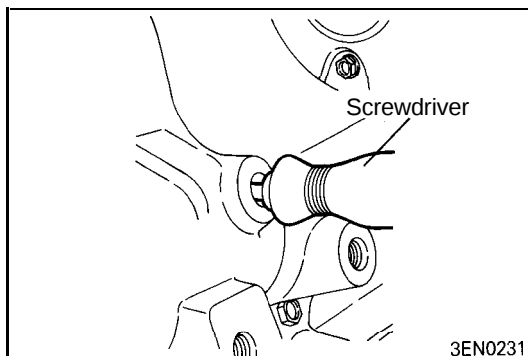


- (5) Check to ensure that the timing marks on the sprockets and front case are in alignment.
- (6) Press with index finger the center of span on the tension side of timing belt “B”. The belt must deflect 5 to 7 mm (.20 to .28 in.).



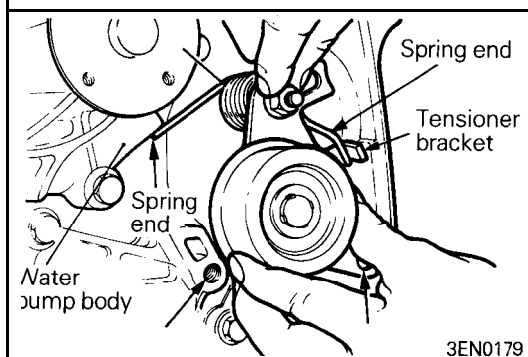
⚡ CRANKSHAFT BOLT TIGHTENING

- (1) Using the special tool, hold the drive plate or flywheel.
- (2) Install the crankshaft bolt.



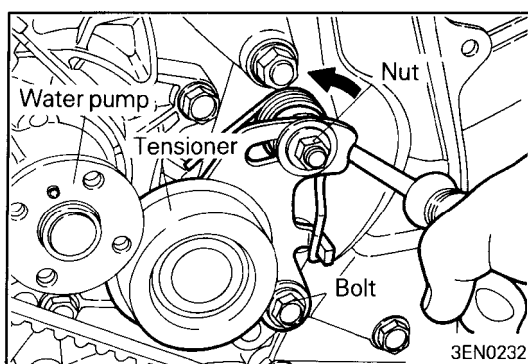
◆F◆ OIL PUMP SPROCKET INSTALLATION

- (1) Insert a Phillips screwdriver [shank diameter 8 mm (.31 in.)] through the plug hole on the left side of the cylinder block to block the left silent shaft.
- (2) Install the oil pump sprocket.
- (3) Tighten the nuts to the specified torque.

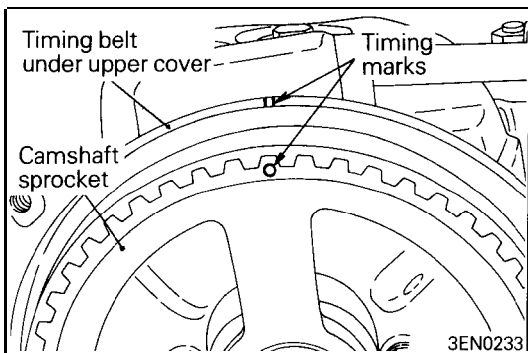


◆G◆ TENSIONER / TENSIONER SPRING INSTALLATION

- (1) Hook the tensioner spring ends to the water pump body and tensioner bracket.

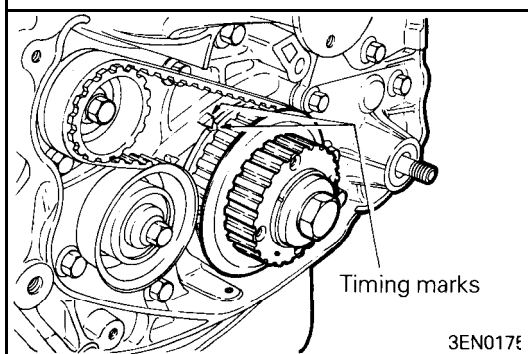


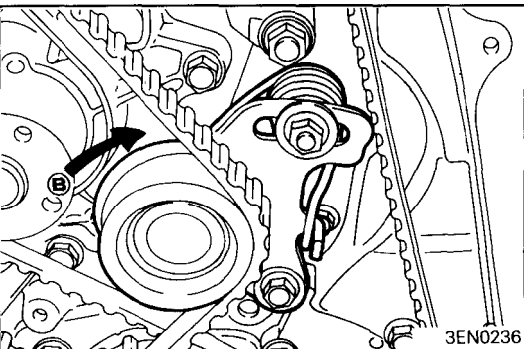
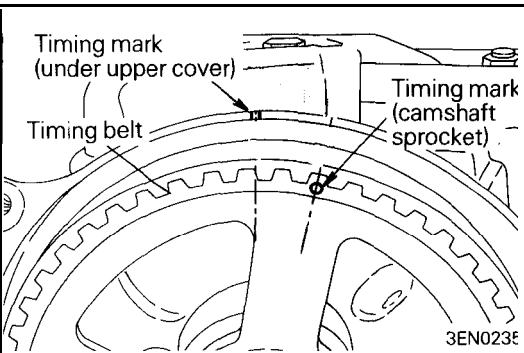
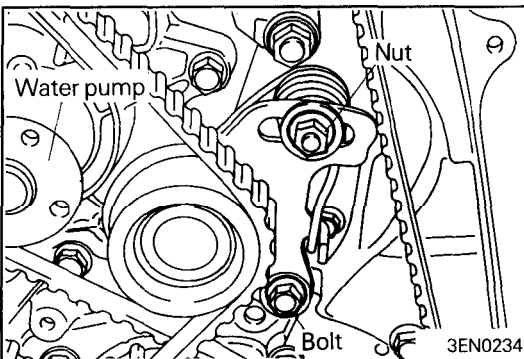
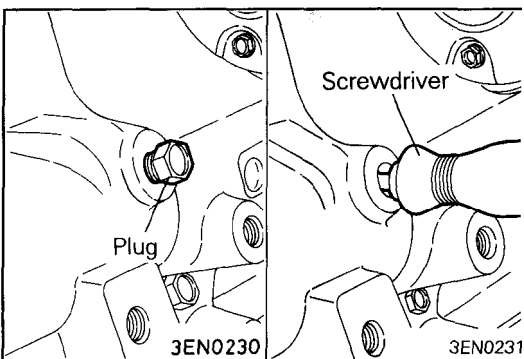
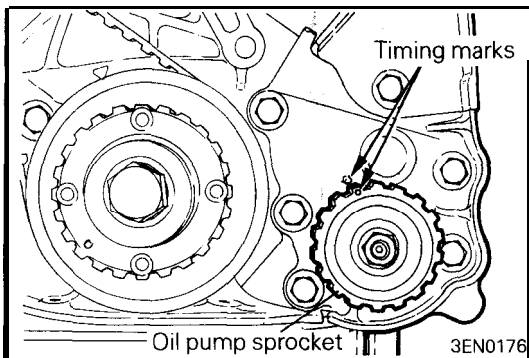
- (2) Move the tensioner fully toward the water pump and tighten the nut and bolt.



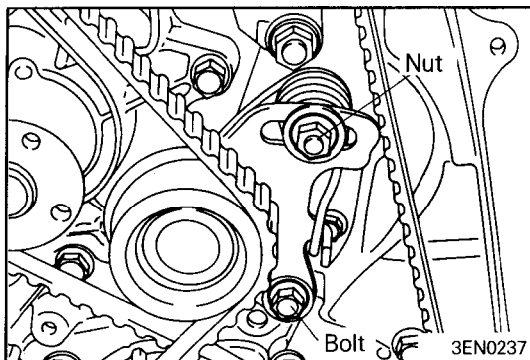
◆H◆ TIMING BELT INSTALLATION

- (1) Align the timing marks on the camshaft sprocket and crankshaft sprocket with their timing marks.





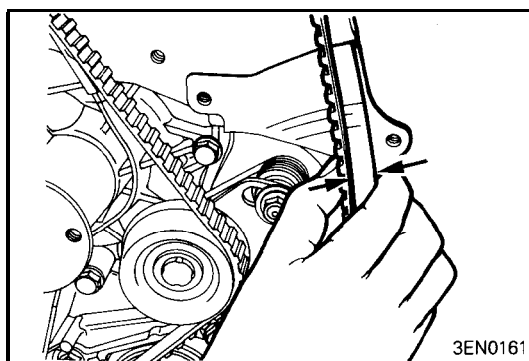
- (2) Align the timing mark on the oil pump sprocket with its mating mark.
- (3) Remove the plug on the cylinder block and insert a Phillips screwdriver [shank diameter 8 mm (.31 in.)] through the hole. If it can be inserted as deep as 60 mm (2.4 in.) or more, the timing marks are correctly aligned. If the inserted depth is only 20 to 25 mm (.8 to 1.0 in.), turn the oil pump sprocket one turn and realign the timing marks. Then check to ensure that the screwdriver can be inserted 60 mm (2.4 in.) or more. Keep the screwdriver inserted until installation of the timing belt is finished.
- (4) Install the timing belt on the crankshaft sprocket, oil pump sprocket and camshaft sprocket in that order. There should be no slack on the tension side.
- (5) Loosen the tensioner mounting bolt and nut.
- (6) Turn the crankshaft clockwise by two teeth of camshaft sprocket (or crankshaft sprocket).
- (7) Apply force to the tensioner in the direction shown by arrow **B** to make the belt engage completely with each sprocket.



- (8) Tighten the tensioner attaching nut, then tighten the tensioner attaching bolt.

Caution

If the bolt is tightened first, tensioner turns as the bolt is tightened, resulting in an excessive belt tension.

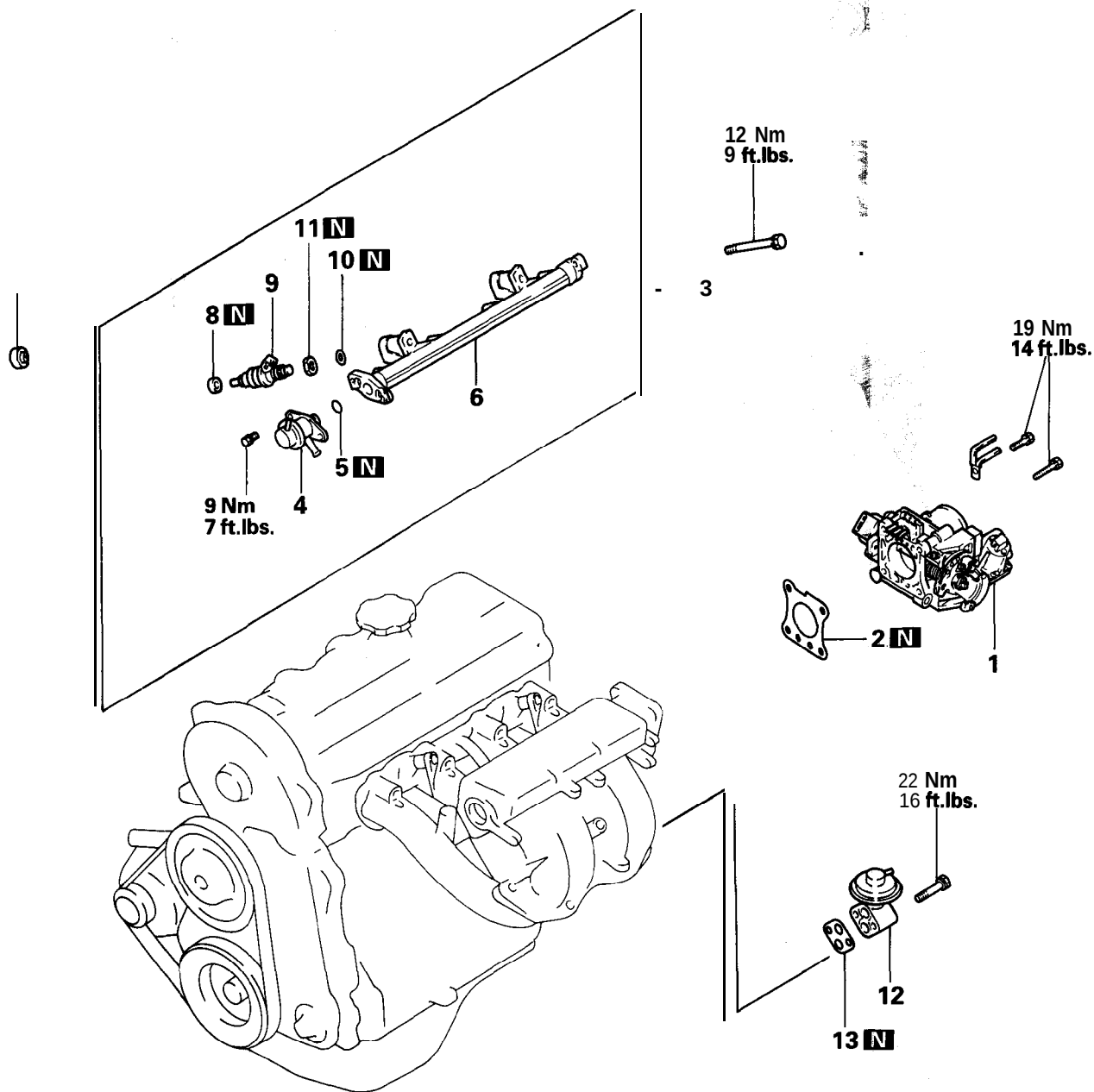


- (9) Hold the center of the tension side span of the timing belt (between the camshaft and oil pump sprockets) between your thumb and index finger as shown. Then, make sure that the clearance between the belt back surface and cover is standard value.

Standard value: 12 mm (.47 in.)

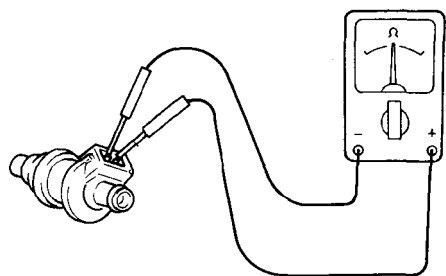
FUEL AND EMISSION PARTS

REMOVAL AND INSTALLATION



Removal steps

1. Throttle body assembly
2. Gasket
3. Injector and fuel rail
- ◆B◆ 4. Fuel pressure regulator
5. O-ring
6. Fuel rail
7. Insulator
8. Insulator
- ◆A◆ 9. Injector
10. O-ring
11. Grommet
12. EGR valve } For California
13. Gasket

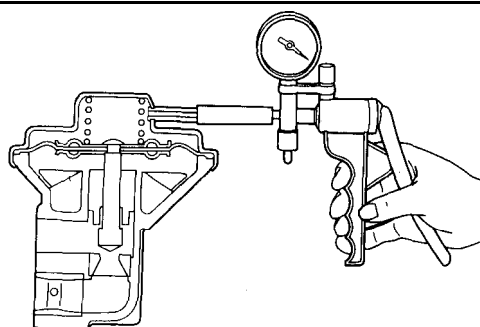


6FU192C

INSPECTION**INJECTORS**

- (1) Using an ohmmeter (circuit tester), test for continuity between terminals of injector; the circuit should be closed. If failure is detected, replace the injector.

Standard value: 13 – 16 Ω at 20°C (68°F)



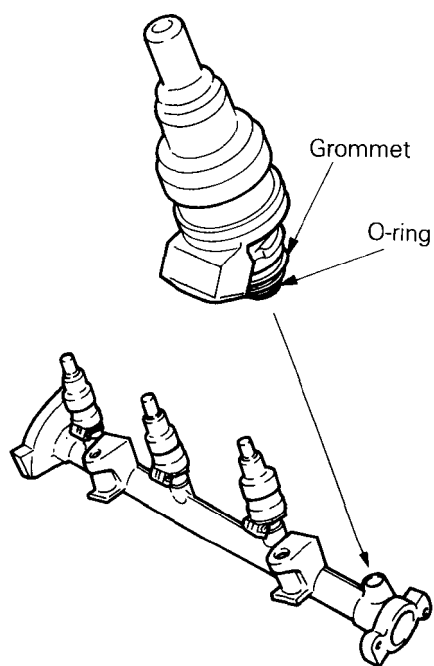
6EM038

EGR VALVE

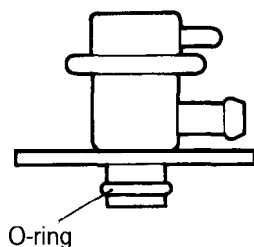
- (1) Check EGR valve for sticking or carbon deposits. If such conditions exist clean or replace EGR valve.
 - (2) Connect a hand vacuum pump to the nipple of EGR valve and plug the other nipple.
 - (3) Apply a vacuum of 500 mm Hg (19.7 in.Hg) to make sure that vacuum is maintained. If there is a leak, replace the EGR valve.
- In addition, check the valve for its opening and closing motion by applying and removing vacuum.

INSTALLATION SERVICE POINTS**◆A◆ INJECTOR INSTALLATION**

- (1) Before installing an injector, the rubber O-ring must be lubricated with a drop of clean engine oil to aid in installation.
- (2) Install injector top end into the fuel pipe. Be careful not to damage O-ring during installation.



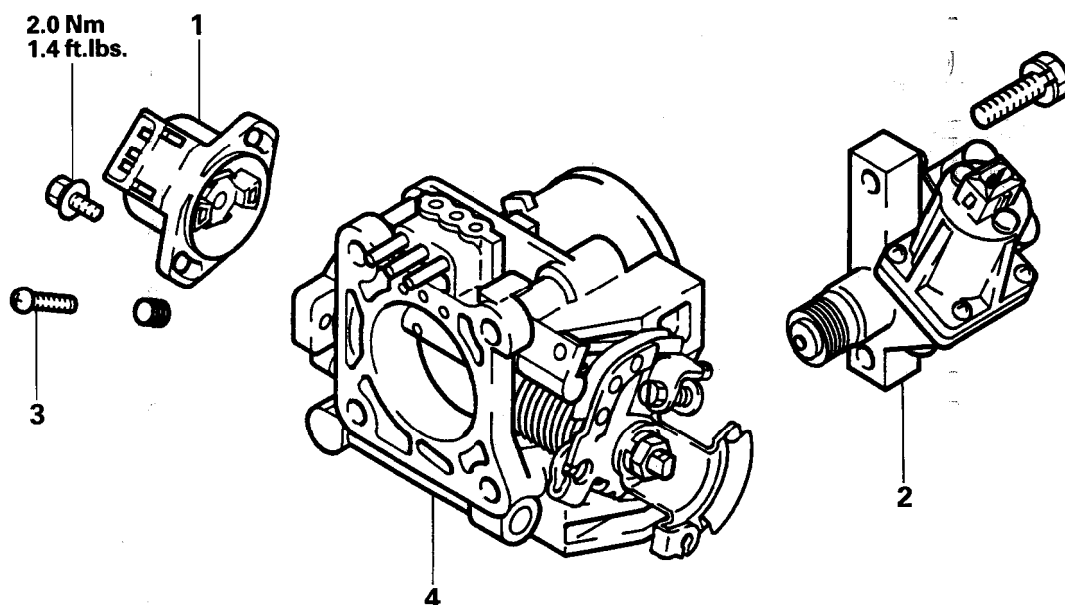
3EN015



6FU0714

◆B◆ FUEL PRESSURE REGULATOR INSTALLATION

- (1) Before installing the pressure regulator, the O-ring must be lubricated with a drop of clean engine oil to aid in installation.

THROTTLE BODY**DISASSEMBLY AND REASSEMBLY****Disassembly steps**

- ◊A◊▶A◊ 1. Throttle position sensor
 ◊A◊ 2. Idle speed control motor
 ◊B◊ 3. Throttle valve set screw
 ◊B◊ 4. Throttle body

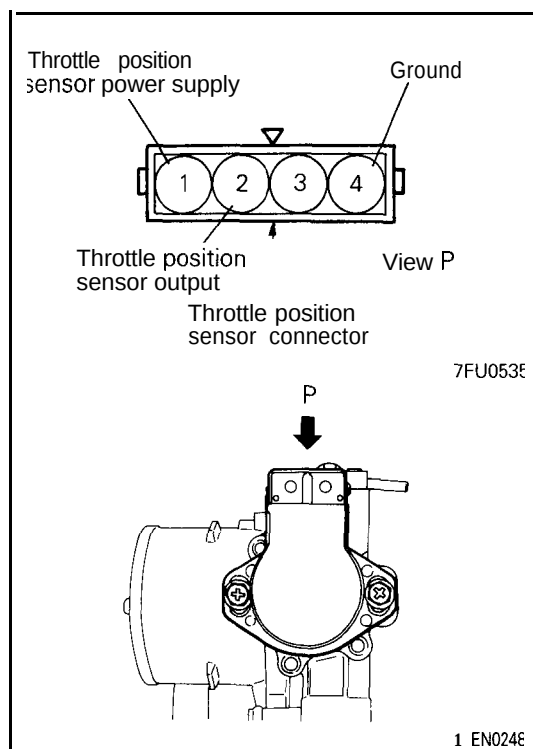
6FU1292

DISASSEMBLY SERVICE POINTS**◊A◊ THROTTLE POSITION SENSOR AND IDLE SPEED CONTROL MOTOR REMOVAL-**

- (1) Do not disassemble the sensor and motor.
- (2) Do not immerse in solvent the sensor and motor.
Clean them with shop towel.

◀B▶ THROTTLE BODY REMOVAL

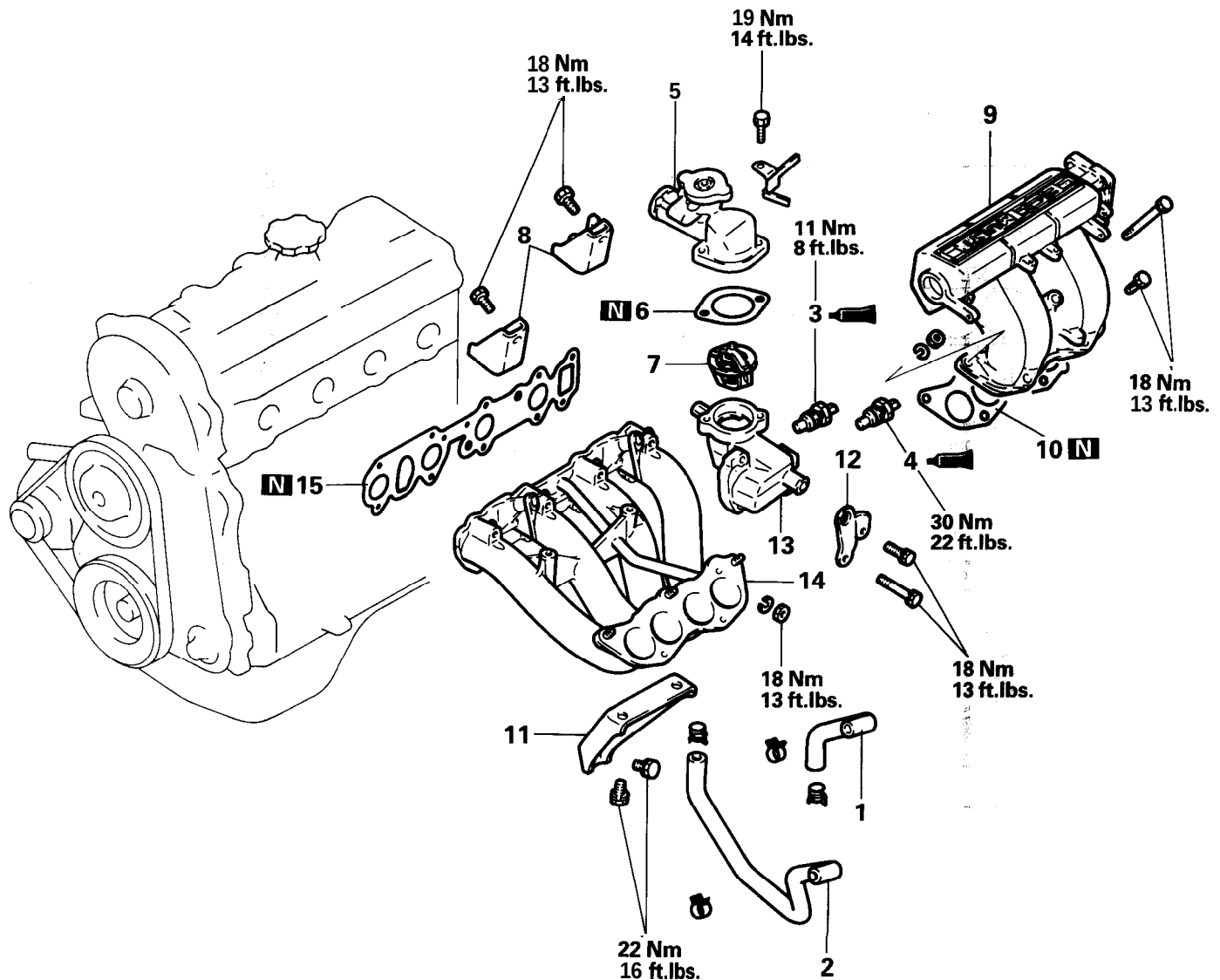
- (1) Do not remove the throttle valve.
- (2) Check if the vacuum port or passage is clogged. Use compressed air to clean the vacuum passage.

**REASSEMBLY SERVICE POINT****▶▶ THROTTLE POSITION SENSOR INSTALLATION**

- (1) Check correct installation of the throttle position sensor. While moving the throttle lever in both open and close directions, check to see that resistance between terminals ① and ② or ② and ④ changes. If resistance changes smoothly, the throttle position sensor has been installed correctly.

INTAKE MANIFOLD

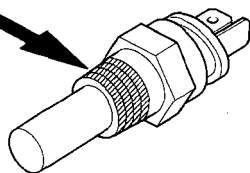
REMOVAL AND INSTALLATION



Removal steps

1. Water hose "A"
2. Water hose "B"
- ▶B▶ 3. Engine coolant temperature gauge unit
- ▶A▶ 4. Engine coolant temperature sensor
5. Water outlet fitting
6. Water outlet fitting gasket
7. Thermostat
8. Intake manifold plenum stay
9. Intake manifold plenum
10. Intake manifold plenum gasket
11. Intake manifold stay
12. Engine hanger
13. Thermostat housing
14. Intake manifold
15. Intake manifold gasket

Sealant



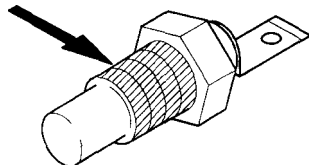
3EN0219

INSTALLATION SERVICE POINTS**◆A◆ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE SENSOR**

Specified sealant:

3M Nut Locking Part No. 4171 or equivalent

Sealant



9EN0092

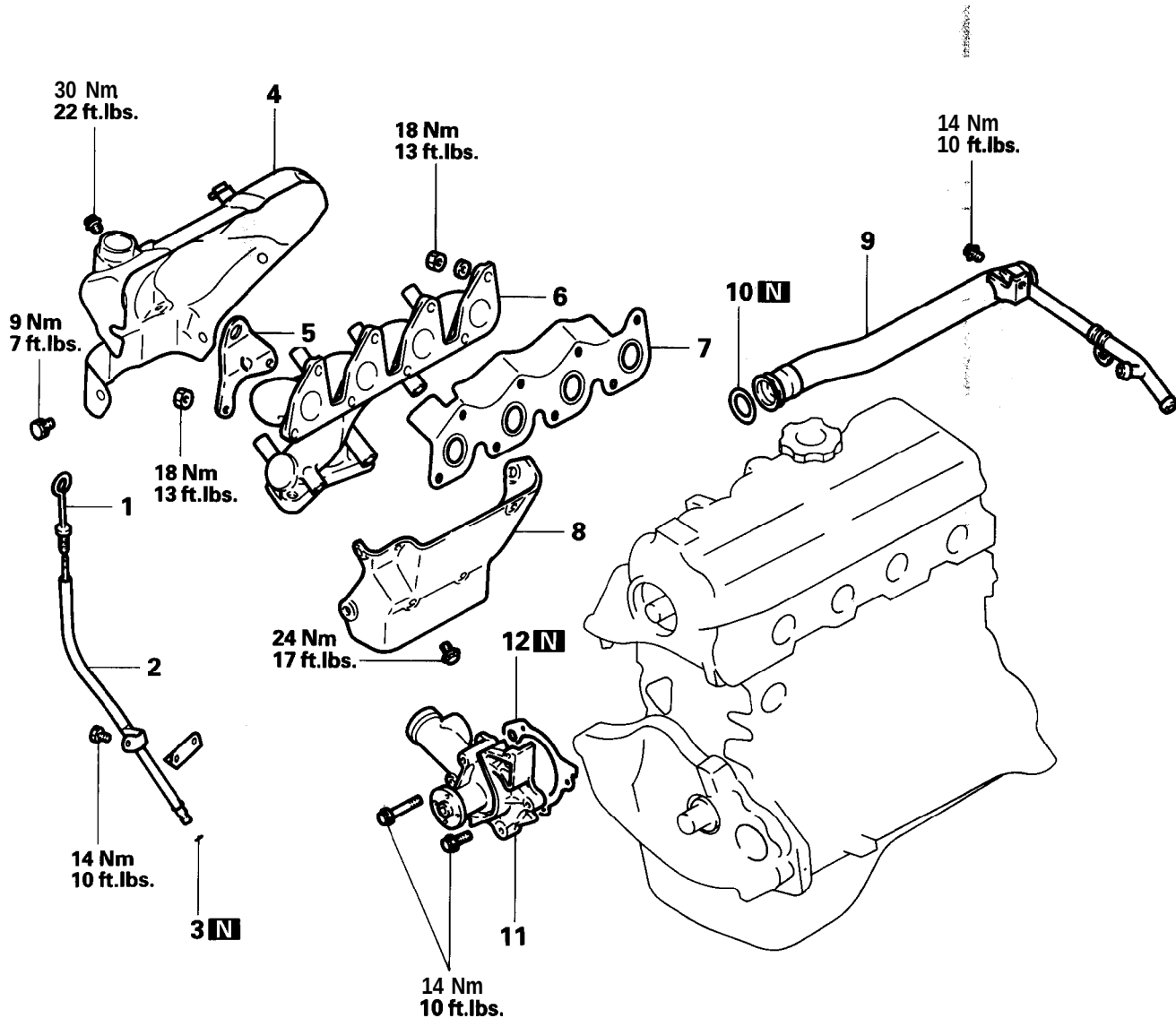
◆B◆ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE GAUGE UNIT

Specified sealant:

3M ATD Part No. 8660 or equivalent

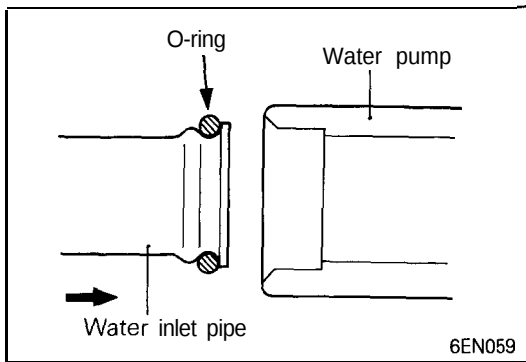
EXHAUST MANIFOLD AND WATER PUMP

REMOVAL AND INSTALLATION



Removal steps

1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Exhaust manifold cover "A"
5. Engine hanger
6. Exhaust manifold
7. Exhaust manifold gasket
8. Exhaust manifold cover "B"
9. Water inlet pipe
10. O-ring
11. Water pump
12. Water pump gasket



INSTALLATION SERVICE POINT

▶▶ WATER INLET PIPE INSTALLATION

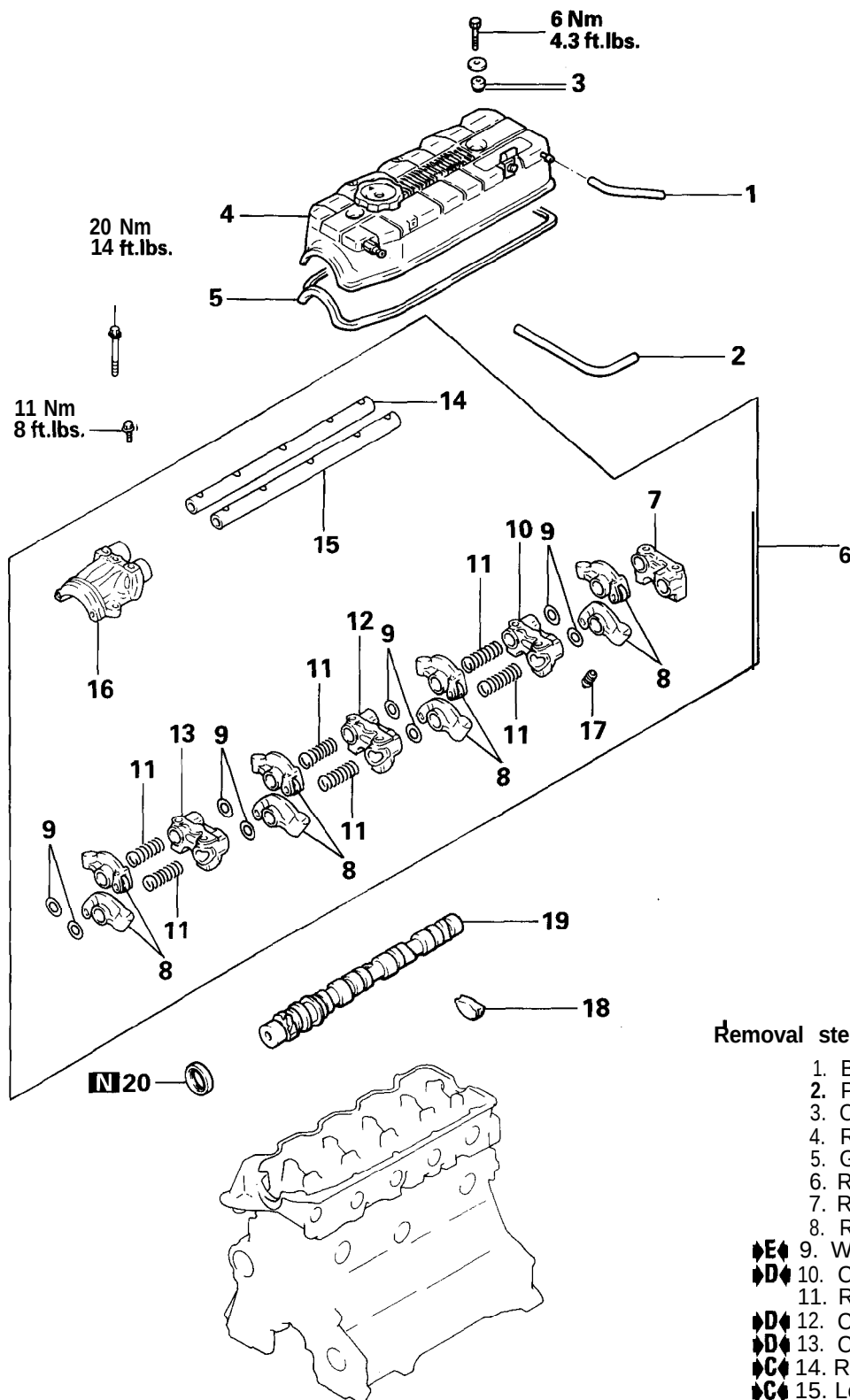
- (1) Wet the O-ring (with water) to facilitate assembly.

Caution

Keep the O-ring free of oil or grease

ROCKER ARMS AND CAMSHAFT

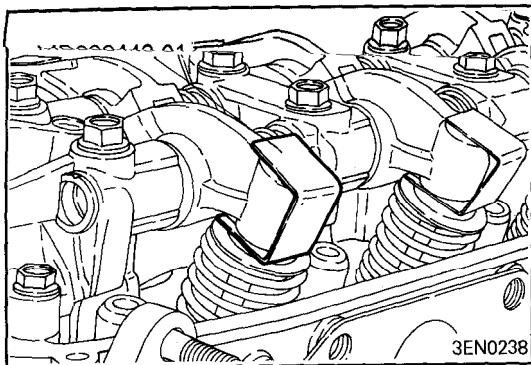
REMOVAL AND INSTALLATION



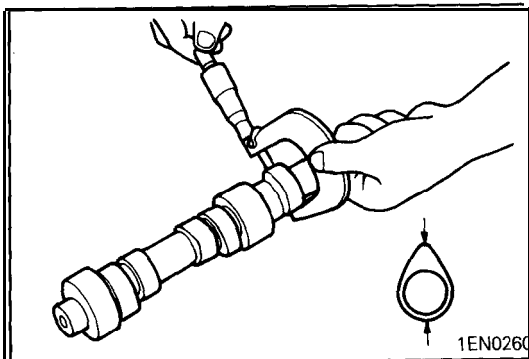
Removal steps

1. Breather hose
2. P.C.V. hose
3. Oil seal
4. Rocker cover
5. Gasket
6. Rocker arm and rocker shaft
7. Rear camshaft bearing cap
8. Rocker arm
9. Wave washer
10. Camshaft bearing cap No. 4
11. Rocker shaft spring
12. Camshaft bearing cap No. 3
13. Camshaft bearing cap No. 2
14. Right rocker shaft
15. Left rocker shaft
16. Front bearing cap
17. Lash adjuster
18. Semi-circular packing
19. Camshaft
20. Camshaft oil seal

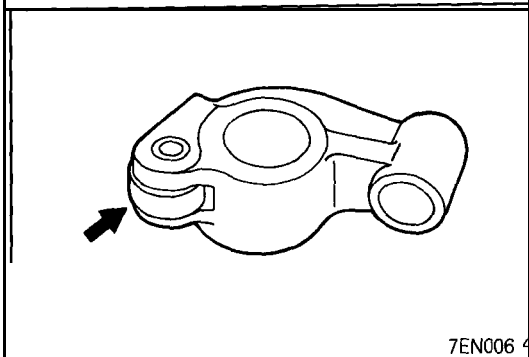
3EN0156

**REMOVAL SERVICE POINT****ROCKER ARM AND ROCKER SHAFT REMOVAL**

- (1) Mark lash adjusters for installation in the same position.
- (2) Remove the lash adjuster holders and the lash adjusters.

**INSPECTION****CAMSHAFT**

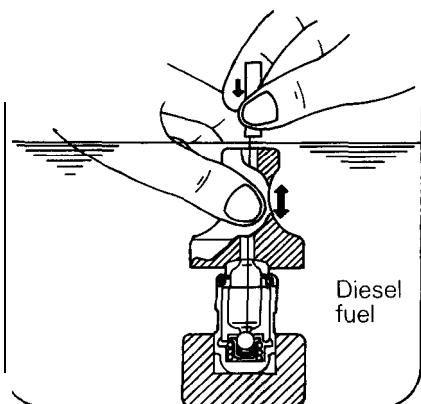
- (1) Measure the cam height.
Standard value: 35.91 mm (1.4138 in.)
Limit: 35.41 mm (1.3941 in.)

**ROCKER ARM**

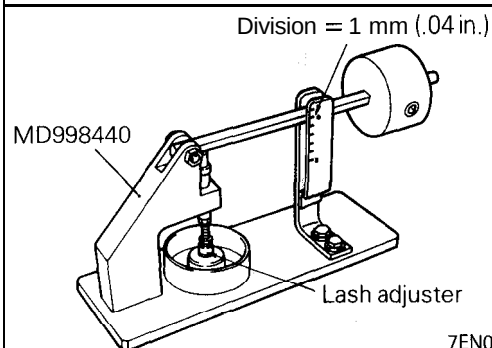
- (1) Visually check the roller and replace if dent, damage, or seizure is evident.
- (2) Check roller for smooth rotation. Replace if it is binding or there is an excessive play.
- (3) Check the inside diameter and replace the rocker arm if damage or seizure is observed.

LASH ADJUSTER LEAK DOWN TEST**Caution**

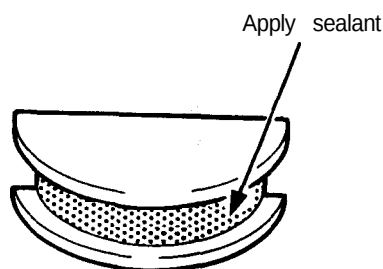
1. The lash adjuster is a precision part. Keep it free from dust and other foreign matters.
2. Do not disassemble lash adjuster.
3. When cleaning lash adjuster, use clean diesel fuel only.



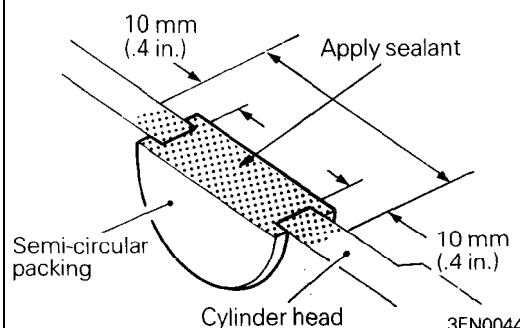
6EN057C



7EN043



DEN005C



3EN004C

- (1) Immerse the lash adjuster in clean diesel fuel.
- (2) While lightly pushing down inner steel ball using a small wire, move the plunger up and down four or five times to bleed air.

Use of the Retainer facilitates the air bleeding of the rocker arm mounted type lash adjuster.

- (3) Remove the small wire and press the plunger. If the plunger is hard to be pushed in, the lash adjuster is normal. If the plunger can be pushed in all the way readily, bleed the lash adjuster again and test again.

If the plunger is still loose, replace the lash adjuster.

Caution

Upon completion of air bleeding, hold the lash adjuster upright to prevent inside diesel fuel from spilling.

- (4) After air bleeding, set the lash adjuster on the special tool (Leak down tester MD998440).

- (5) After the plunger has gone down somewhat 0.2 – 0.5 mm (.008 – .020 in.), measure time taken for it to go down 1 mm (.04 in.). Replace if the measured time is out of specification.

Standard value: 4 – 20 seconds / 1 mm (.04 in.)
[Diesel fuel at 15 – 20°C (59 – 68°F)]

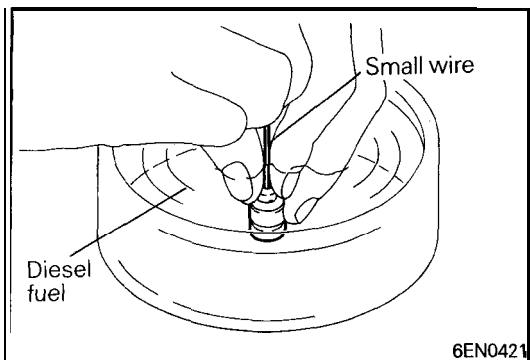
INSTALLATION SERVICE POINTS

◆◆ SEMI-CIRCULAR PACKING INSTALLATION

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

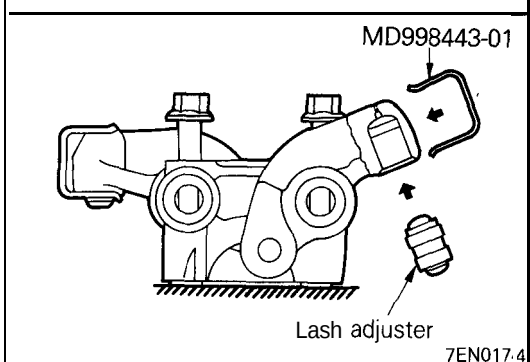
Specified sealant:

3M ATD Part No. 8660 or equivalent

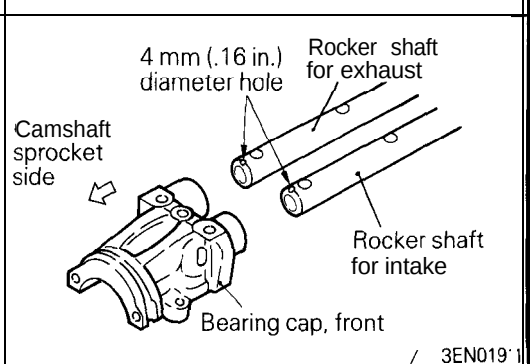


◆B◆ LASH ADJUSTER INSTALLATION

- (1) Dip the lash adjuster in clean diesel fuel.
- (2) While using a small wire to lightly press the check ball downward, move the plunger up and down four or five times to bleed out the air.

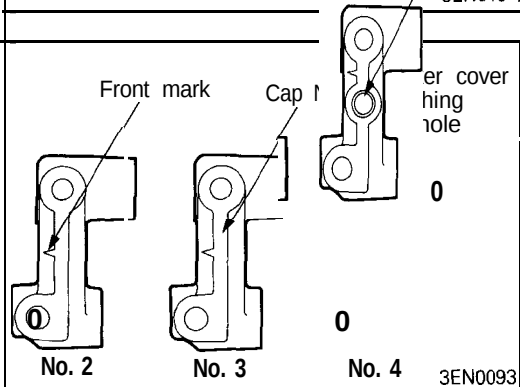


- (3) Insert the lash adjuster to the rocker arm, being careful not to spill the diesel fuel. Then use the special tool to prevent the lash adjuster from falling while installing the rocker arm and shaft assembly to the cylinder head.



◆C◆ ROCKER SHAFT INSTALLATION

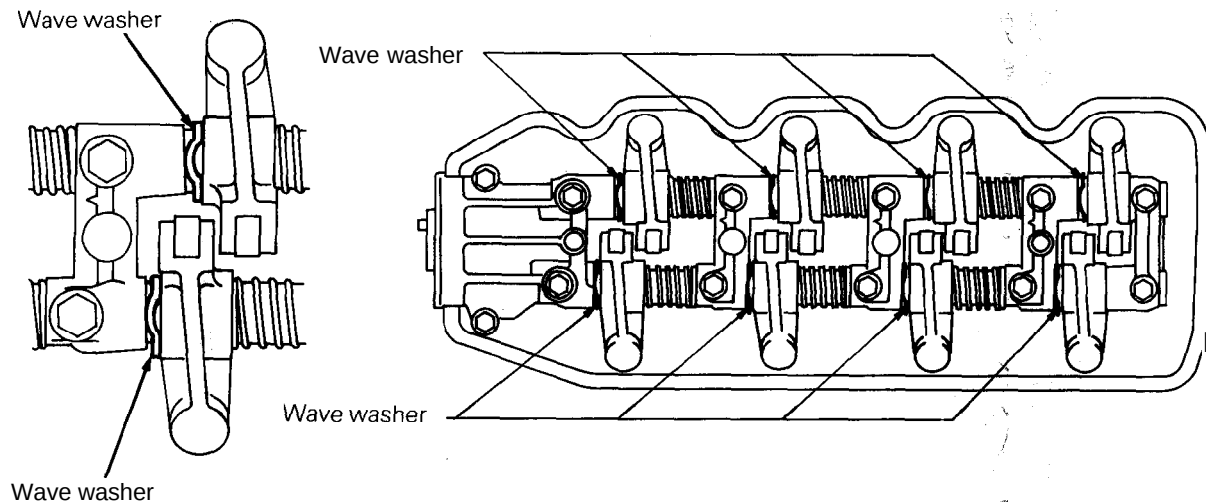
- (1) Install the rocker shafts with notches up and toward the front bearing cap.
- (2) The overall length of the left (intake) rocker shaft is 356.5 mm (14.04 in.); that of right (exhaust) rocker shaft is 350 mm (13.78 in.).



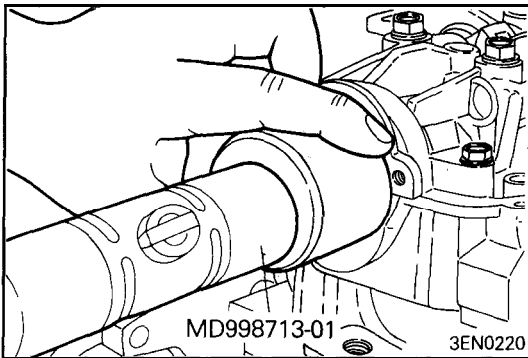
◆D◆ CAMSHAFT BEARING CAP IDENTIFICATION

▶E◀ WAVE WASHER INSTALLATION

Install the wave washer in correct direction as shown.



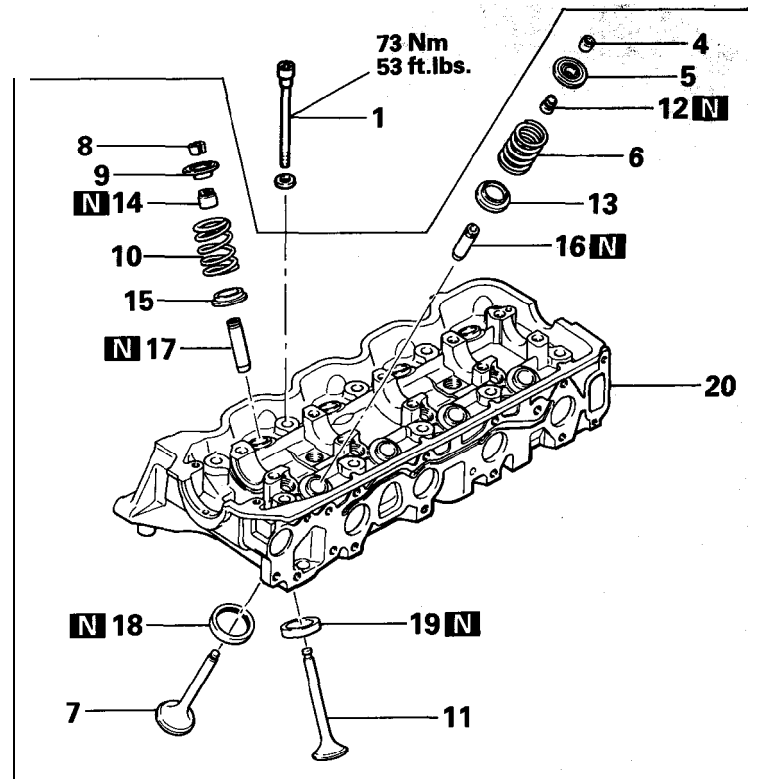
3EN0081

**▶F◀ CAMSHAFT OIL SEAL INSTALLATION**

CYLINDER HEAD AND VALVES

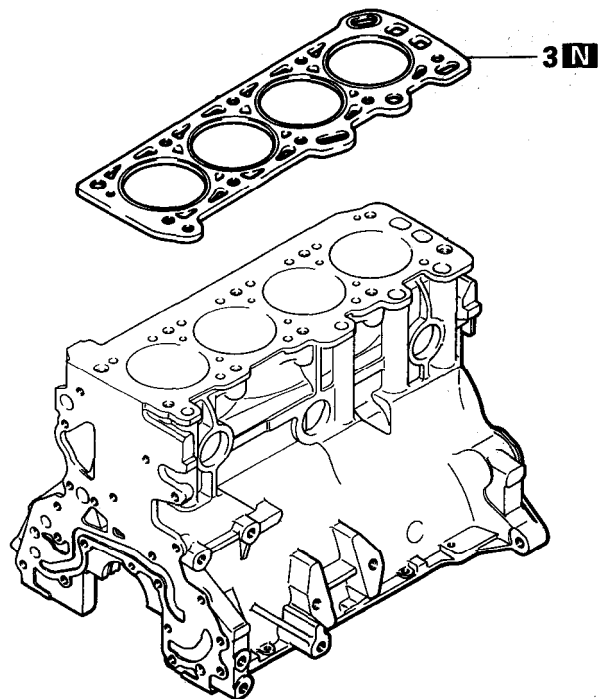
REMOVAL AND INSTALLATION

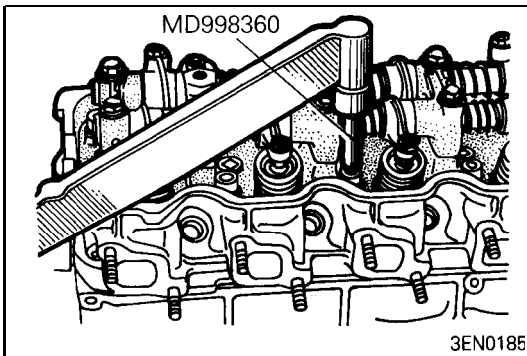
2



Removal steps

- ◀A▶▶E▶ 1. Cylinder head bolt
- ▶D▶ 2. Cylinder head assembly
- ▶D▶▶C▶ 3. Cylinder head gasket
- ◀B▶▶C▶ 4. Retainer lock
- ▶B▶ 5. Valve spring retainer
- ▶B▶ 6. Valve spring
- ▶B▶ 7. Intake valve
- ◀B▶▶C▶ 8. Retainer lock
- ▶B▶ 9. Valve spring retainer
- ▶B▶ 10. Valve spring
- ▶B▶ 11. Exhaust 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. Intake valve guide
- ▶C▶▶A▶ 17. Exhaust valve guide
- ▶C▶▶A▶ 18. Intake valve seat
- ▶C▶▶A▶ 19. Exhaust valve seat
- ▶C▶▶A▶ 20. Cylinder head

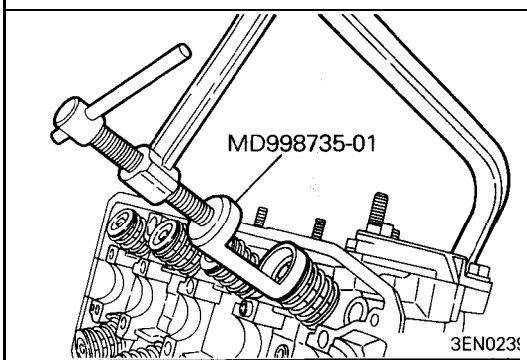




REMOVAL SERVICE POINTS

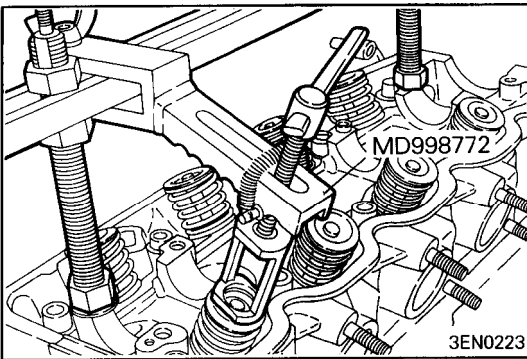
◊A◊ CYLINDER HEAD BOLT REMOVAL

- (1) Using the special tool, loosen the cylinder head bolts. Loosen evenly, little by little.



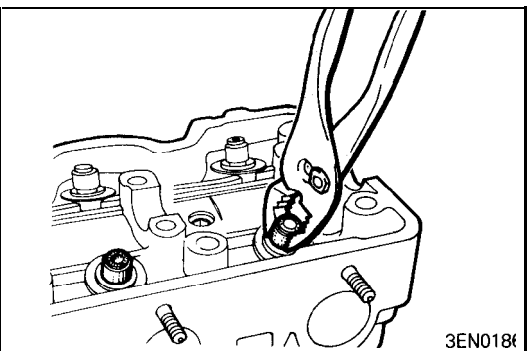
◊B◊ RETAINER LOCK REMOVAL

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



◊C◊ VALVE STEM SEAL REMOVAL

- (1) Do not reuse removed valve stem seals.



INSPECTION

CYLINDER HEAD

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

Standard value: 0.05 mm (.0020 in.)

Limit: 0.2 mm (.008 in.)

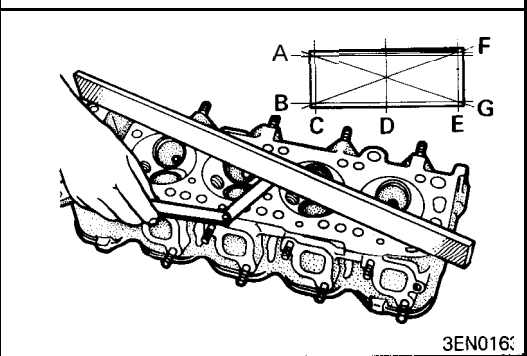
- (2) If the service limit is exceeded, correct to meet the specification.

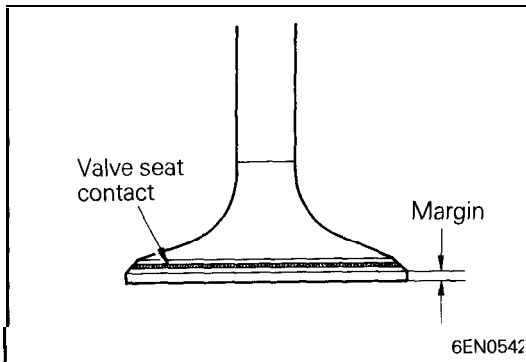
Grinding limit: *0.2 mm (.008 in.)

Total resurfacing depth of both cylinder head and cylinder block

Cylinder head height (Specification when new):

88.4 – 88.6 mm (3.480 – 3.488 in.)





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 center of valve face.
- (2) If the margin is smaller than the service limit, replace the valve.

Standard value:

Intake	1.2 mm (.047 in.)
Exhaust	1.5 mm (.059 in.)

Limit:

Intake	0.7 mm (.028 in.)
Exhaust	1.0 mm (.039 in.)

VALVE SPRING

- (1) Measure the free height of the spring and, if it is smaller than the limit, replace.

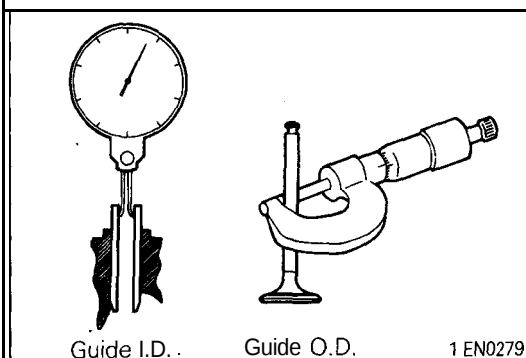
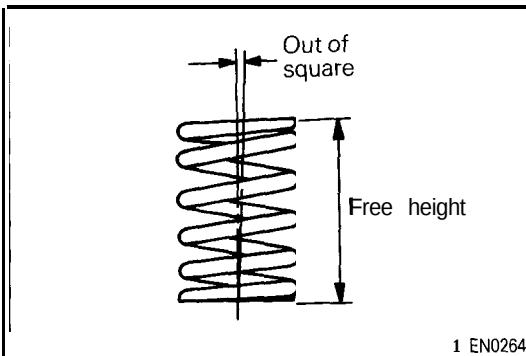
Standard value: 49.2 mm (1.937 in.)

Limit: 48.2 mm (1.898 in.)

- (2) Measure the squareness of the spring and, if the limit is exceeded, replace.

Standard value: 2" or less

Limit: 4"



VALVE GUIDE

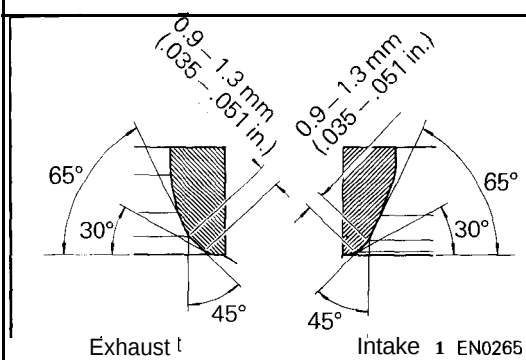
- (1) Measure the clearance between the valve guide and valve stem. If the limit is exceeded, replace the valve guide or valve, or both.

Standard value:

Intake	0.03 – 0.06 mm (.0012 – .0024 in.)
Exhaust	0.05 – 0.09 mm (.0020 – .0035 in.)

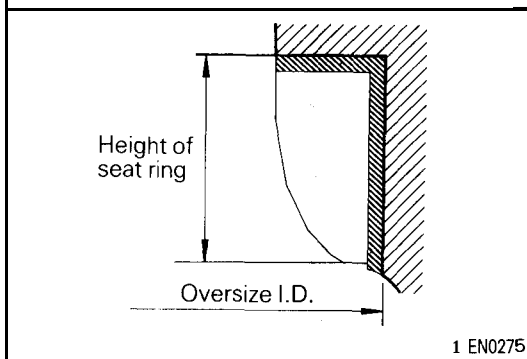
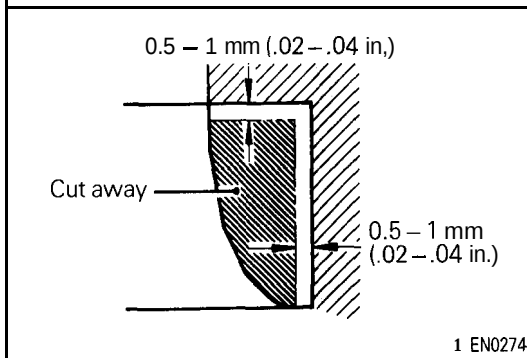
Limit:

Intake	0.10 mm (.0039 in.)
Exhaust	0.15 mm (.0059 in.)



VALVE SEAT RECONDITIONING PROCEDURE

- (1) Before correcting the valve seat, check for clearance between the valve guide and valve and, if necessary, replace the valve guide.
- (2) Using the special tool or seat grinder, correct to obtain the specified seat width and angle.
- (3) After correction, valve and valve seat should be lapped with a lapping compound.



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.

Seat hole diameter: See "Service Specifications" in page 11 B-6.

- (3) Before fitting the valve seat, either heat the cylinder head up to approximately 250°C (482°F) or cool the valve seat in liquid nitrogen, to prevent the cylinder head bore from galling.
- (4) Using a valve seat cutter, correct the valve seat to the specified width and angle. See "VALVE SEAT RECONDITIONING PROCEDURE."

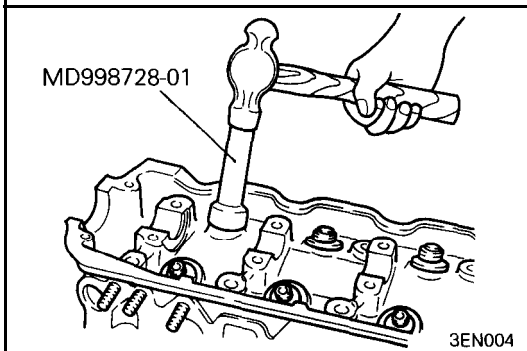
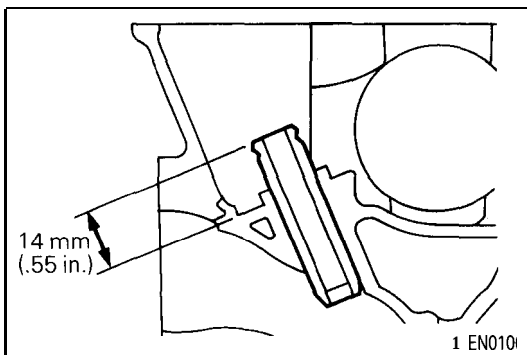
VALVE GUIDE REPLACEMENT PROCEDURE

- (1) Push out the valve guide toward the combustion chamber side using a press.
- (2) Rebore the valve guide hole of the cylinder head to the size corresponding to the oversize valve guide to be installed.

Caution

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

Seat hole diameter: See "Service Specifications" in page 11 B-6.



- (3) Install the valve guide until it projects 14 mm (.55 in.) as illustrated.

NOTE

- (1) The valve guide must be installed from the upper side of the cylinder head.
- (2) Note that the intake and exhaust valve guides differ in length: 44 mm (1.732 in.) on intake side, 49.5 mm (1.949 in.) on exhaust side.
- (3) After installation of the valve guide, install a new valve and check that it slides smoothly.

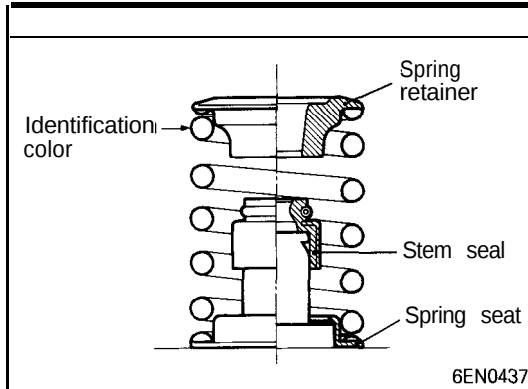
INSTALLATION SERVICE POINTS

▶▶ VALVE STEM SEAL INSTALLATION

- (1) install the valve spring seat.
- (2) Using the special tool, install a new stem seal to the valve guide.

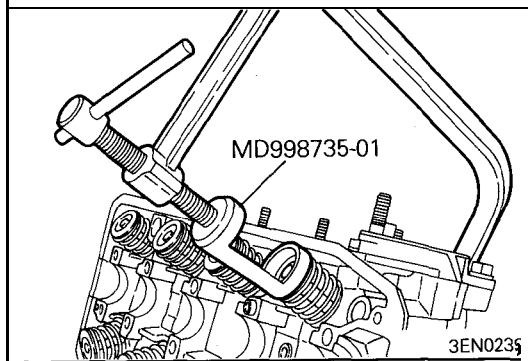
Caution

Do not reuse removed valve stem seals.



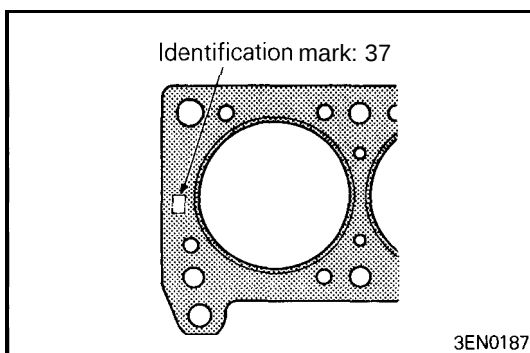
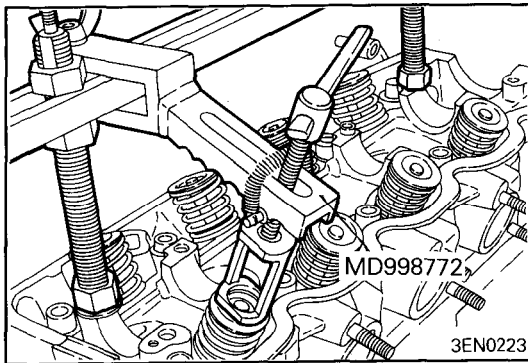
◆B◆ VALVE SPRING INSTALLATION

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



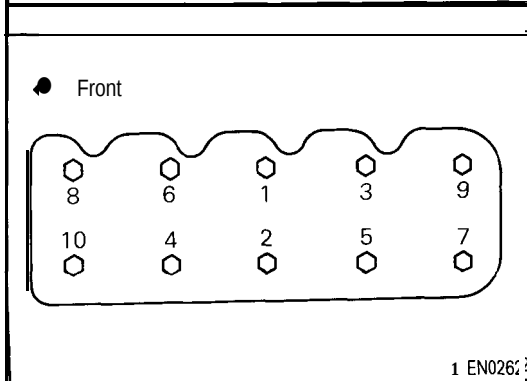
◆C◆ RETAINER LOCK INSTALLATION

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



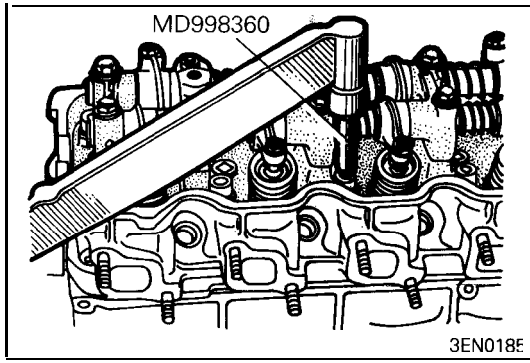
◆D◆ CYLINDER HEAD GASKET INSTALLATION

- (1) Clean both gasket surfaces of cylinder block and cylinder head.
- (2) Do not apply sealant.
- (3) Confirm the identification mark on cylinder head gasket. The identification mark is stamped on the top surface of the gasket at its front end.



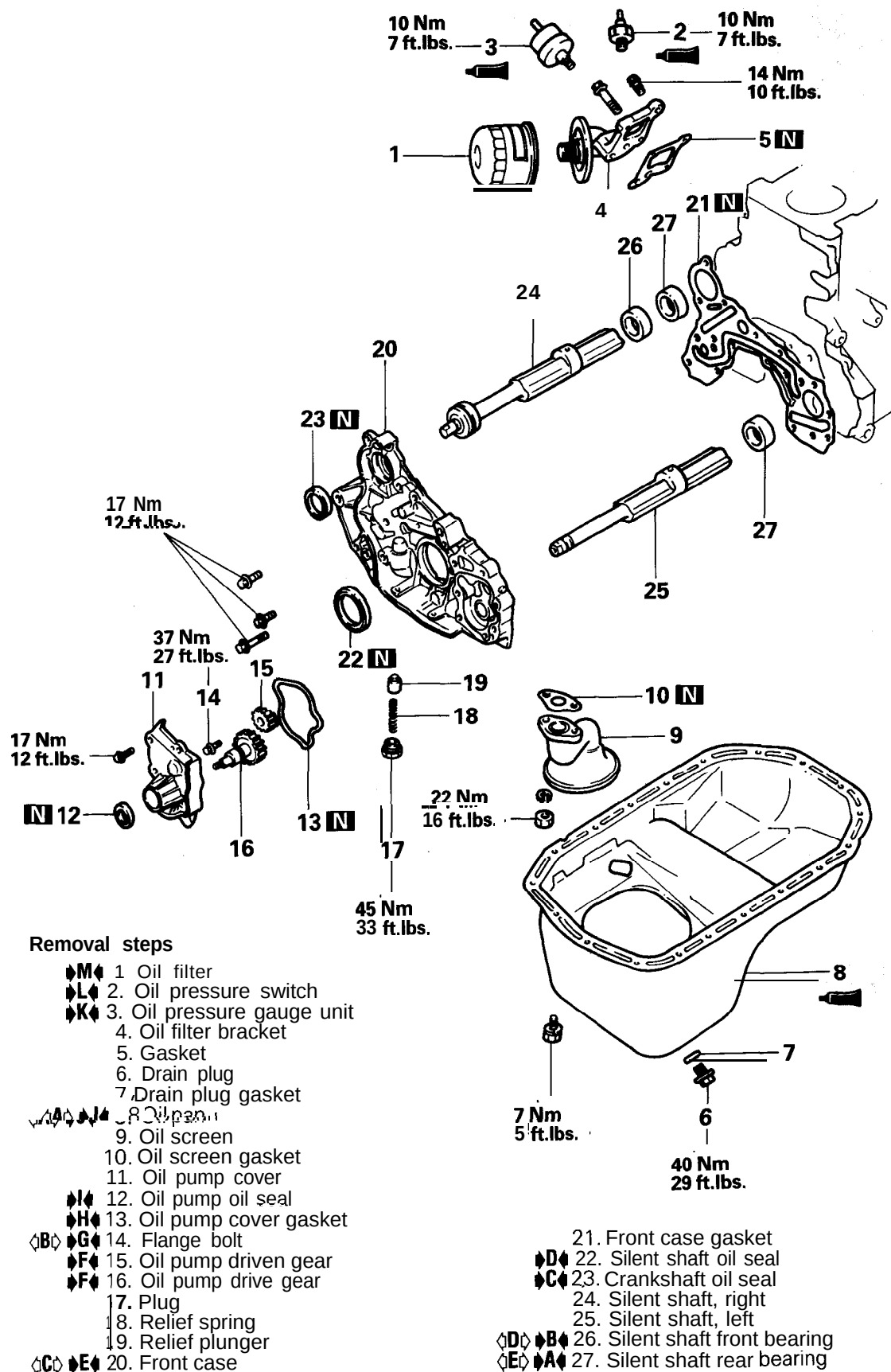
◆E◆ CYLINDER HEAD BOLT INSTALLATION

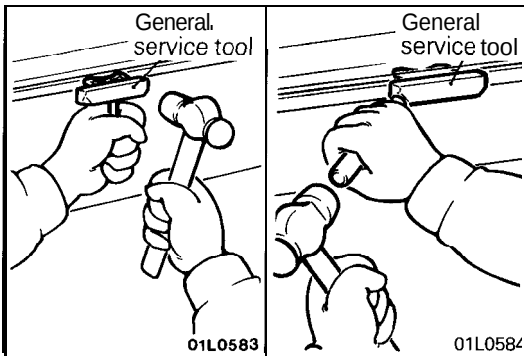
- (1) Using the special tool and a torque wrench, tighten the bolts in the shown sequence.
- (2) Repeat the tightening sequence several times, and torque the bolts to specification in the final sequence.



FRONT CASE, OIL PUMP AND OIL PAN

REMOVAL AND INSTALLATION

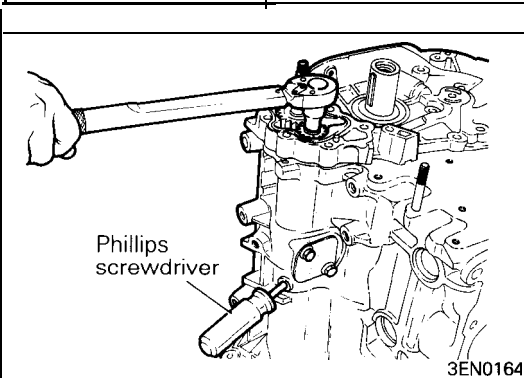


**REMOVAL SERVICE POINTS****◈A◈ OIL PAN REMOVAL**

- (1) Knock 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 it.

◈B◈ FLANGE BOLT REMOVAL

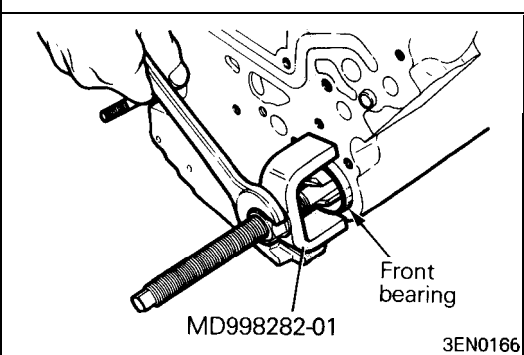
- (1) When loosening the oil pump driven gear flange bolt, first insert a Phillips screwdriver [shank diameter 8 mm (.32 in.)] into the plug hole on the left side of the cylinder block to block the silent shaft.

**◈C◈ FRONT CASE REMOVAL**

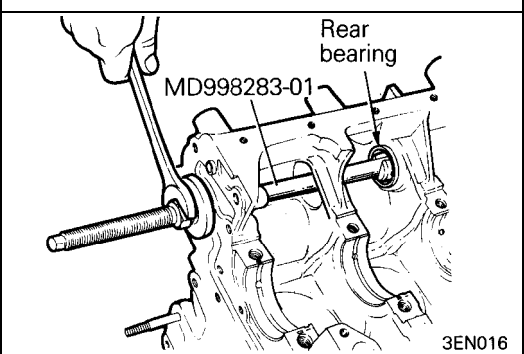
- (1) The front case may be sticking to the cylinder block. In such a case, insert a screwdriver into the slot shown in the illustration and pry up. Never attempt to pry at any other positions where flange is thinner. Also avoid applying impact to the front case for removal.

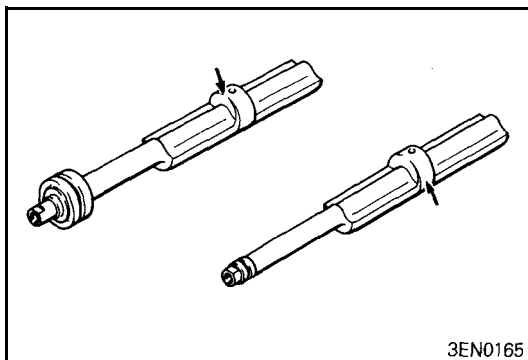
**◈D◈ SILENT SHAFT FRONT BEARING REMOVAL**

- (1) Using the special tool, remove the front bearing from the cylinder block.

**◈E◈ SILENT SHAFT REAR BEARING REMOVAL**

- (1) Using the special tool, remove the rear bearings from the cylinder block.



**INSPECTION****SILENT SHAFT**

- (1) Check oil holes for clogging.
- (2) Check journal for seizure, damage, and contact with bearing. If there is anything wrong with the journal, replace the silent shaft, bearing or front case assembly.
- (3) Check the silent shaft oil clearance. If the clearance is excessive due to wear, replace the silent shaft bearing, silent shaft or front case assembly.

Standard:**Right**

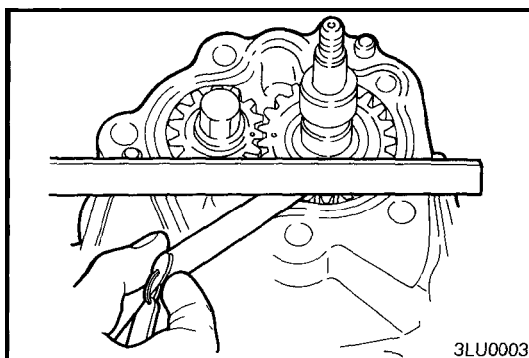
Front 0.02 – 0.06 mm (.0008 – .0024 in.)

Rear 0.05 – 0.09 mm (.0020 – .0036 in.)

Left

Front 0.02 – 0.05 mm (.0008 – .0021 in.)

Rear 0.05 – 0.09 mm (.0020 – .0036 in.)

**OIL PUMP**

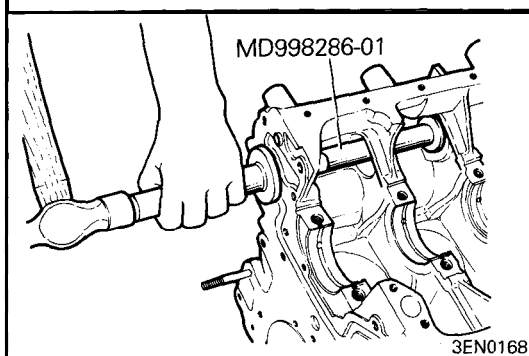
- (1) Check the side clearance of each gear.

Standard value:

0.08 – 0.14 mm (.0031 – .0055 in.) Drive gear

0.06 – 0.12 mm (.0024 – .0047 in.) Driven gear

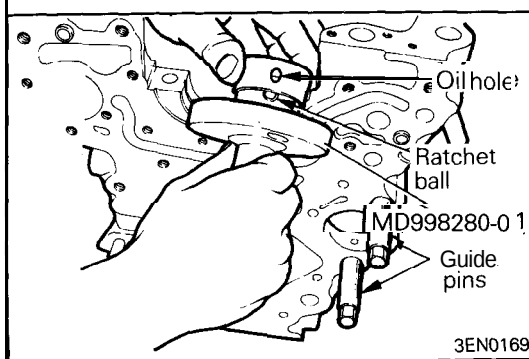
- (2) Check for ridge wear on the surface of the oil pump cover that is in contact with the pump gear side,

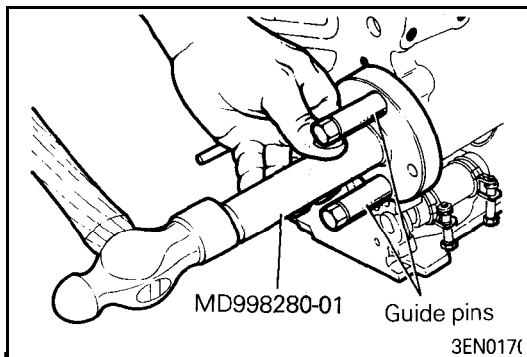
**INSTALLATION SERVICE POINTS****◆A◆ SILENT SHAFT REAR BEARING INSTALLATION**

- (1) Apply engine oil to the rear bearing outer circumference and bearing hole in the cylinder block.
- (2) Using the special tool and a hammer, drive the rear bearing into the cylinder block.

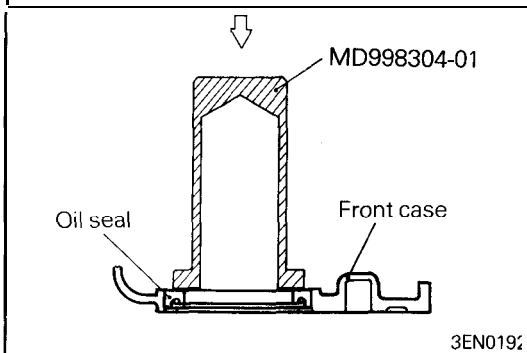
◆B◆ SILENT SHAFT FRONT BEARING INSTALLATION

- (1) Install two guide pins included in the special tool set to the threaded holes in the cylinder block.
- (2) Set the front bearing on the special tool so that the ratchet ball of the special tool fits in the oil hole in the bearing.
- (3) Apply engine oil to the bearing outer circumference and bearing hole in the cylinder block.



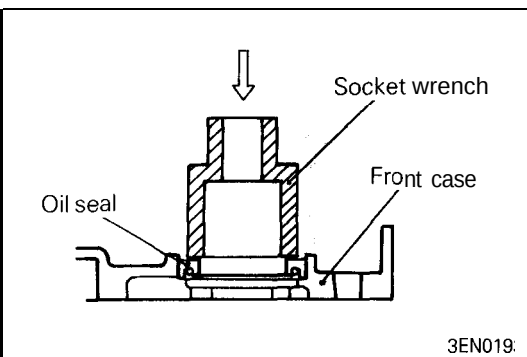


- (4) Set the special tool on the guide pins and drive the bearing into the cylinder block.



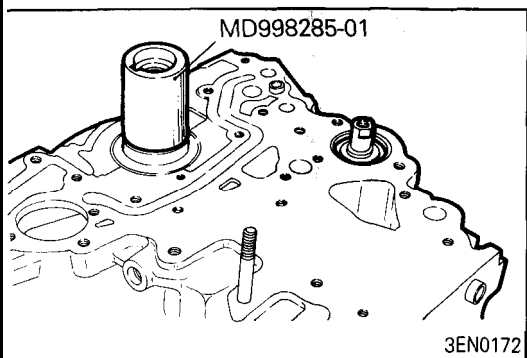
CRANKSHAFT OIL SEAL INSTALLATION

- (1) Using the special tool, install the crankshaft oil seal into the front case.



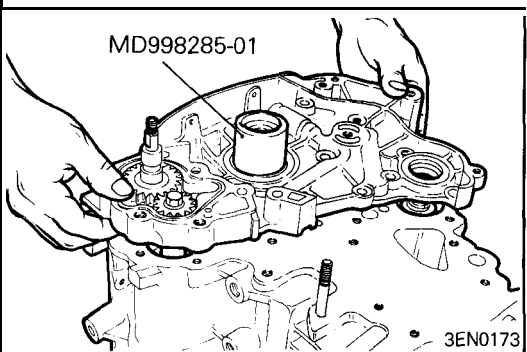
SILENT SHAFT OIL SEAL INSTALLATION

- (1) Using a socket wrench, press-in the silent shaft oil seal into the front case.

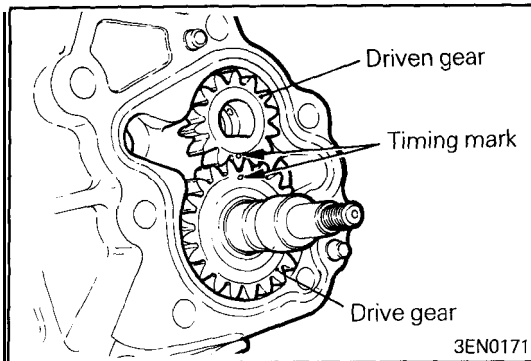


FRONT CASE INSTALLATION

- (1) Set the special tool on the front end of the crankshaft and apply engine oil to the outer circumference of the special tool.

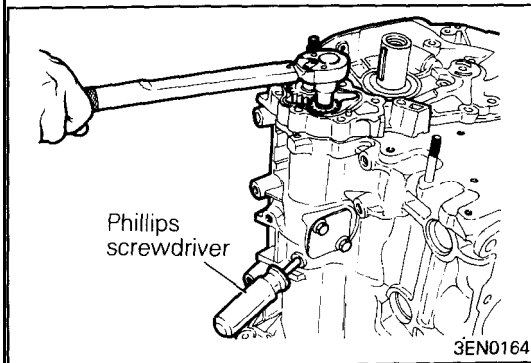


- (2) Install the front case.



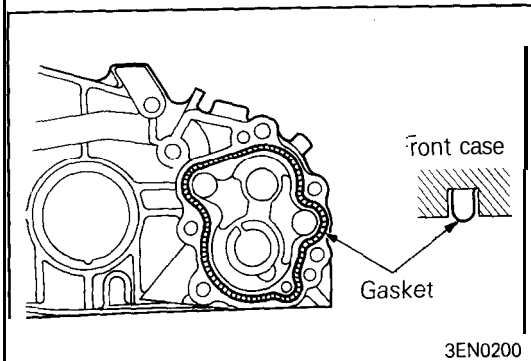
◆F◆ OIL PUMP DRIVEN GEAR / OIL PUMP DRIVE GEAR INSTALLATION

- (1) install the oil pump drive gear and driven gear to the front case, lining up the timing marks. Lubricate the gears with engine oil.



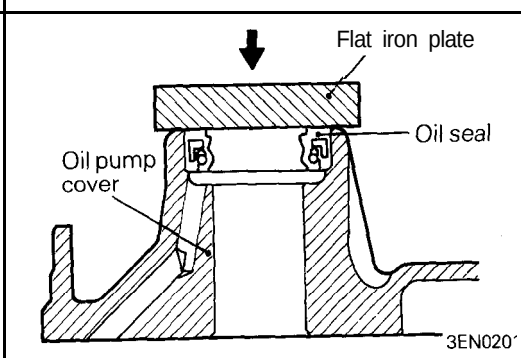
◆G◆ FLANGE BOLT INSTALLATION

- (1) Insert a Phillips screwdriver [shank diameter 8 mm (.32 in.)] into the plug hole on the left side of cylinder block to block the silent shaft, then tighten the flange bolt.



◆H◆ OIL PUMP COVER GASKET INSTALLATION

- (1) Install a new oil pump cover gasket in the groove of the front case.
When installing the gasket, direct the round side to the oil pump cover.



◆I◆ OIL PUMP OIL SEAL INSTALLATION

- (1) Install the oil seal into the oil pump cover, making sure that its lip is in correct direction.

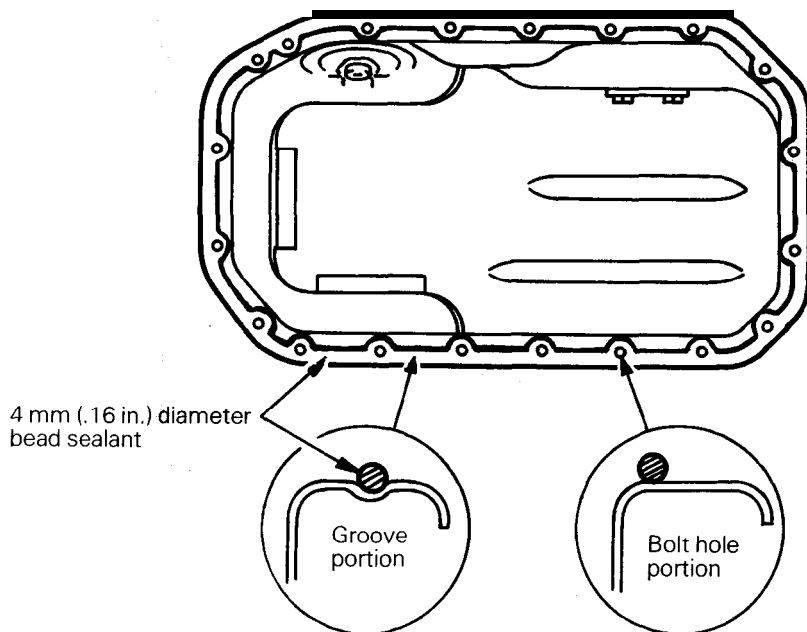
◆◆ OIL PAN INSTALLATION

- (1) Clean mating surfaces of both oil pan and cylinder block.
- (2) Apply a 4 mm (.16 in.) diameter bead of sealant to the oil pan flange.

Specified sealant:

MITSUBISHI GENUINE Part "No. MD970389 or equivalent"

- (3) The oil pan should be installed within 15 minutes after the application of sealant.



3EN0189

◆K SEALANT APPLICATION TO OIL PRESSURE GAUGE UNIT

- (1) Coat the threads of the oil pressure gauge unit with sealant and install the unit using the special tool.

Specified sealant: 3M ATD Part No. 8666 or equivalent

Caution

1. Keep the end of threaded portion clear of sealant.
2. Avoid an **overtightening**.

◆L SEALANT APPLICATION TO OIL PRESSURE SWITCH

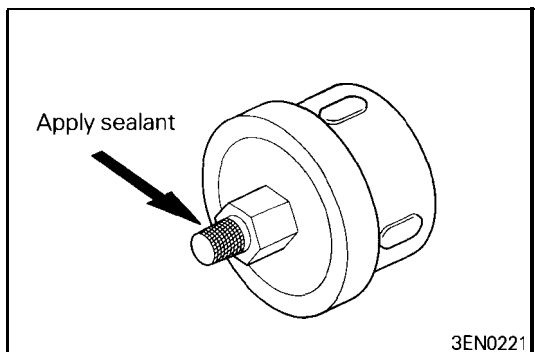
- (1) Coat the threads of the oil pressure switch with sealant and install the switch using the special tool.

Specified sealant:

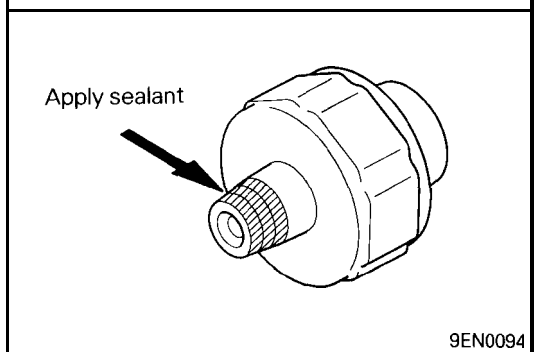
3M ATD Part No. 8660 or equivalent

Caution

1. Keep the end of threaded portion clear of sealant.
2. Avoid an **overtightening**.



3EN0221



9EN0094

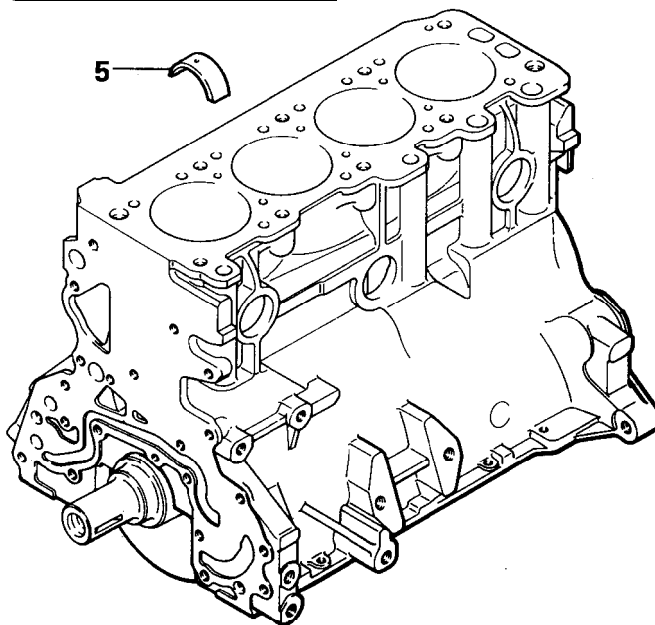
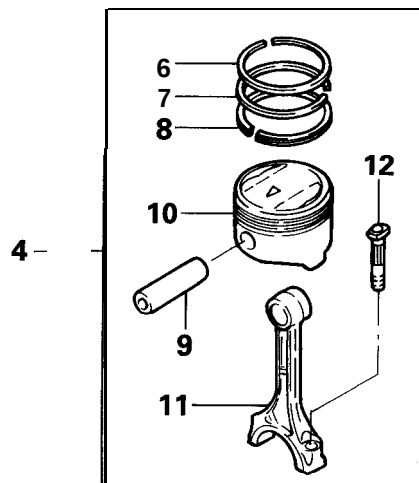
TSB Revision

◆M◆ OIL FILTER INSTALLATION

- (1) Clean the installation surface of the filter bracket side.
- (2) Apply engine oil to the O-ring of the oil filter.
- (3) Screw the oil filter on until the O-ring contacts the base.
Then tighten one turn.

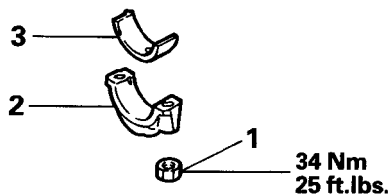
PISTON AND CONNECTING ROD

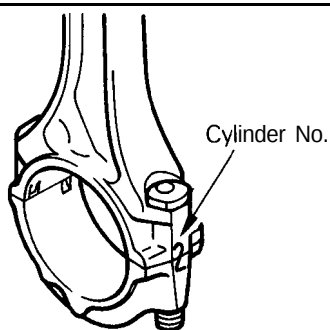
REMOVAL AND INSTALLATION



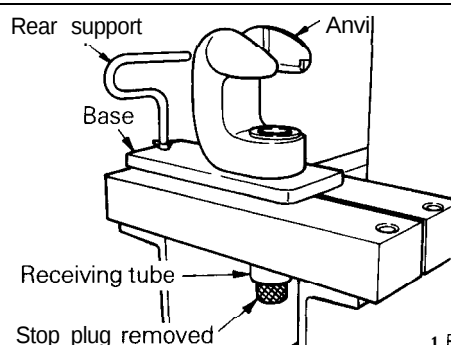
Removal steps

1. Nut
- ↻A↻E 2. Connecting rod cap
3. Connecting rod bearing
- ↻D↻ 4. Piston and connecting rod
5. Connecting rod bearing
- ↻C↻ 6. Piston ring No. 1
- ↻C↻ 7. Piston ring No. 2
- ↻B↻ 8. Oil ring
- ↻B↻A↻ 9. Piston pin
10. Piston
11. Connecting rod
12. Connecting rod bolt

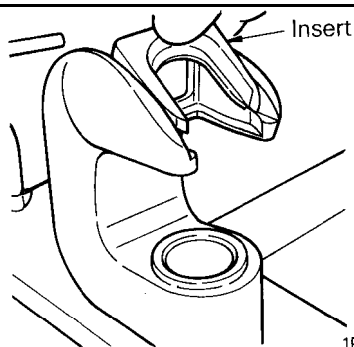




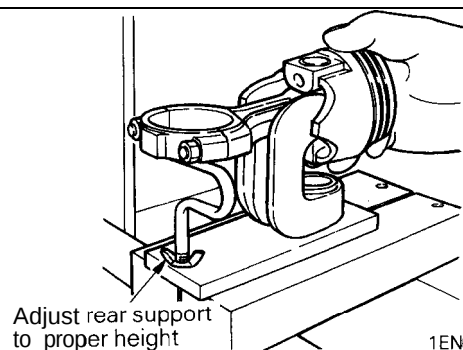
DEN005C



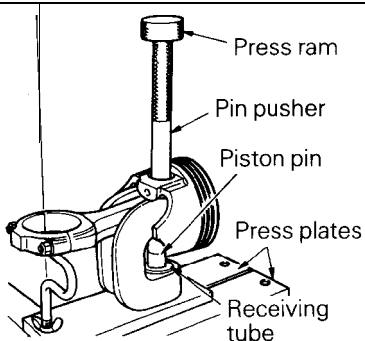
1 EN028E



1EN028I



1EN028J



1 EN028K

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

- (1) Remove the piston and connecting rod using the special tools (MD998184-01).
- (2) Assemble set components on a press, with the press plates under the base.

Caution

Press plates must be used to provide adequate support to the base during pressing operations.

- (3) Place the insert into the anvil opening.

- (4) Place the piston and connecting rod on the anvil with the arrow mark or identification mark facing upward. At this time, push the lip of the insert in between the connecting rod boss and the inside surface of piston. The connecting rod boss should bear on the insert surface as much as possible.
- (5) Adjust the connecting rod rear support until the connecting rod is horizontal to the press bed surface. Misalignment of pin and receiving tube may result if support adjustment is not correct.

- (6) Attach the piston pin pusher to the pin and remove the pin with the press ram.

NOTE

As the piston pin is removed, it must pass through the receiving tube. Check alignment and adjust if necessary.

INSPECTION**PISTON**

- (1) Replace the piston if scratches or seizure is evident on its surfaces (especially the thrust surface). Replace the piston if it is cracked.

PISTON PIN

- (1) Insert the piston pin into the piston pin hole with a thumb. You should feel a slight resistance. Replace the piston pin if it can be easily inserted or there is an excessive play.
- (2) The piston and piston pin must be replaced as an assembly.

PISTON RING

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

Standard value:

No. 1 0.05 – 0.09 mm (.0020 – .0035 in.)

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

Limit: 0.1 mm (.004 in.)

- (2) Insert the piston ring into the cylinder bore. Force it 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 end gap is excessive, replace the piston ring.

Standard value:

No. 1 0.30 – 0.45 mm (.0118 – .0177 in.)

No. 2 0.20 – 0.35 mm (.0079 – .0138 in.)

Oil 0.20 – 0.70 mm (.0079 – .0276 in.)

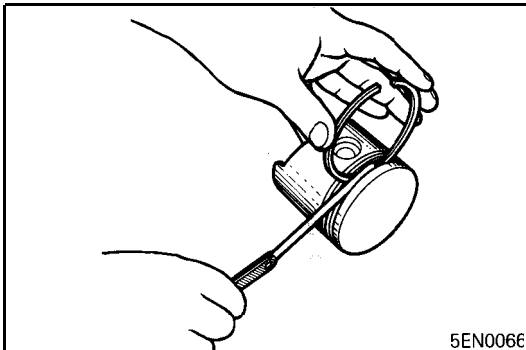
Limit:

0.8 mm (.031 in.)

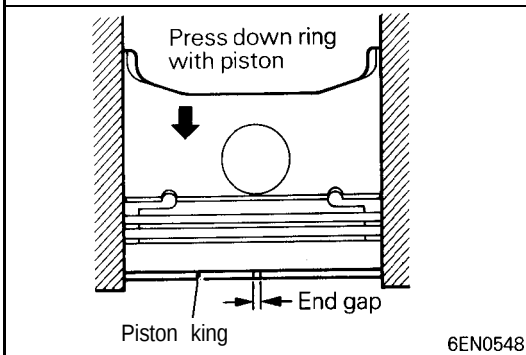
No. 1, No. 2

1.0 mm (.039 in.)

Oil



5EN0066



6EN0548

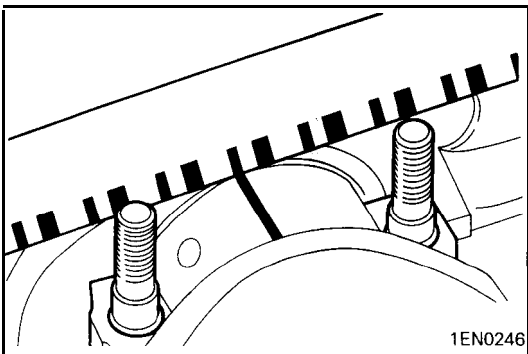
CRANKSHAFT PIN OIL CLEARANCE (PLASTIC GAUGE METHOD)

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

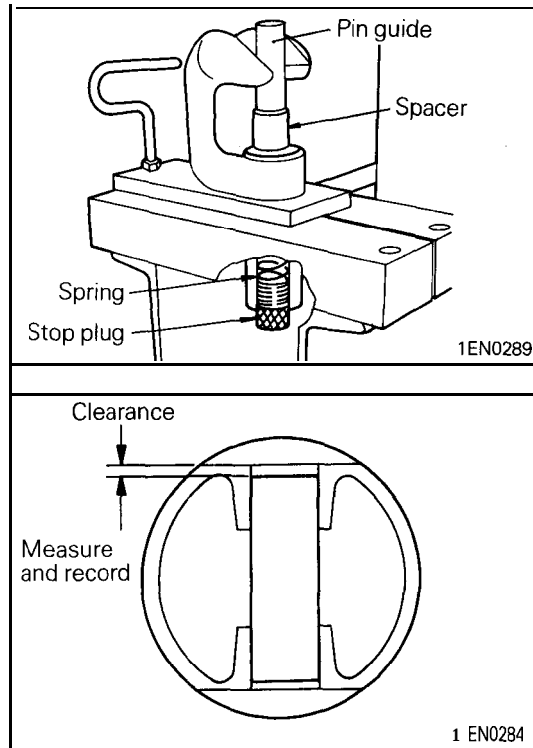
- (3) Install the connecting rod cap carefully and tighten the bolts to the specified torque.
- (4) Carefully remove the connecting rod cap.
- (5) Measure the width of the plastic gauge at its widest part by using a scale printed on the plastic gauge package.

Standard value: 0.02 – 0.05 (.0008 – .0020 in.)

Limit: 0.1 mm (.0039 in.)



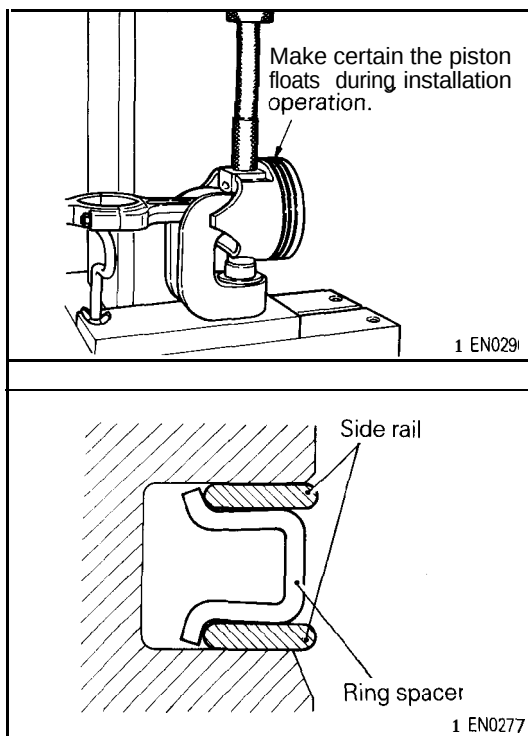
1EN0246

**REASSEMBLY SERVICE POINTS****◆A◆ PISTON PIN INSTALLATION**

- (1) Install the piston and connecting rod as follows, using the special tools (MD998184-01).
- (2) Thread the stop plug approximately half way into the bottom of the receiving tube.
- (3) Select the piston pin guide that will pass through the piston and the connecting rod. Install spring, spacer, and guide into the receiving tube.
- (4) With the connecting rod removed from the piston, insert the piston pin into the piston bore. Carefully measure the projection amount of the pin that protrudes equally from both sides of the piston. Record this measurement for future use.
- (5) Place the connecting rod and piston onto the anvil. The spring loaded piston guide will pass through the piston and connecting rod and align them. Lubricate pin and insert it into the piston.
- (6) Attach the piston pin pusher to the piston pin and push the pin through the connecting rod until the pin protrudes same distance measured and recorded above in step 4:

NOTE

The piston must be free to float during installation; check frequently.



- (7) Apply hydraulic pressure to the pin and adjust the stop plug until it comes in contact with the spacer.
- (8) Remove the piston and pin assembly from the anvil and check the piston pin to make sure it is centered. If it is not centered, shift the stop plug up or down to obtain proper centering. The pin stop is now set for any remaining pistons.

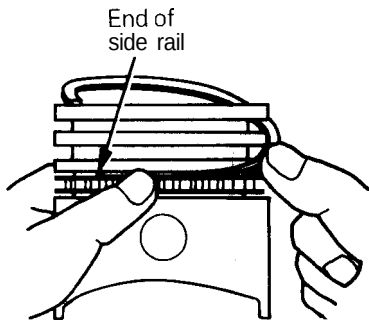
NOTE

If the required installation load does not meet the specification, replace the piston pin and/or connecting rod.

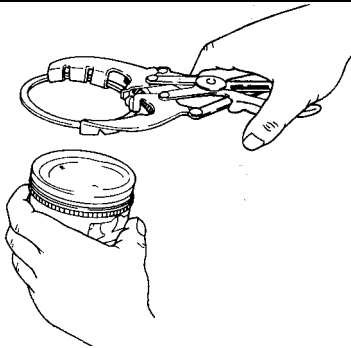
Standard value: 5,000 – 15,000 N (1,100 – 3,300 lbs.)

◆B◆ OIL RING INSTALLATION

- (1) First, install the oil ring spacer in the piston ring groove. Next, install the upper side rail and then the lower side rail. Both upper and lower side rails may be installed with their either side facing up.



1 EN0269



7EN0452

- (2) To install the side rail, first place one end in the gap between the groove and the spacer. While holding the end firmly, press the portion to be inserted with finger as illustrated until the side rail is in position.

Caution

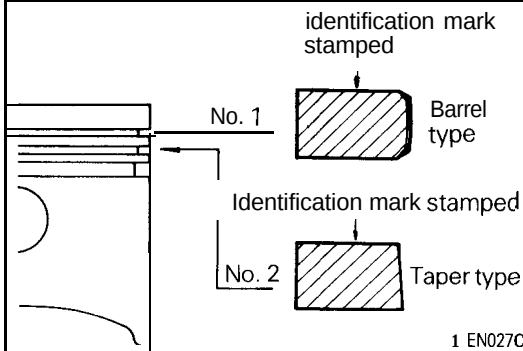
Do not use piston ring expander to install the side rail.

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

- (1) Using a piston ring expander, fit No. 2 and then No. 1 piston ring in position.

NOTE

- (1) Note the difference in shape between No. 1 and No. 2 piston ring.
 (2) Install piston rings No. 1 and No. 2 with the side having marks facing up (on the piston crown side).



1 EN0270

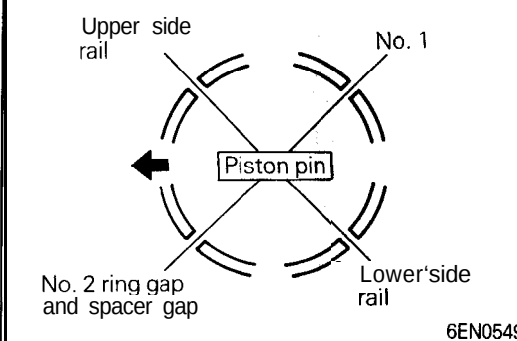
❖❖ PISTON AND CONNECTING ROD ASSEMBLY INSTALLATION

- (1) Apply engine oil on the circumferences 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 figure.
 (3) Rotate the crankshaft so that the crank pin is on the center of the cylinder bore.

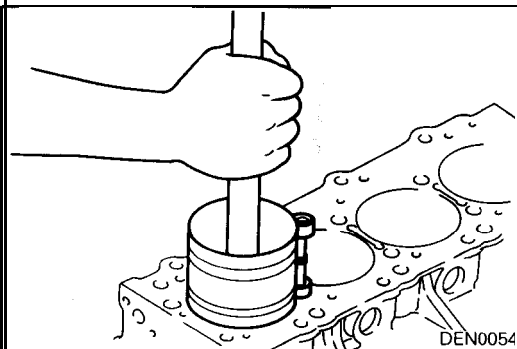
- (4) Use appropriate thread protectors on connecting rod bolts before inserting the piston and connecting rod assembly into the cylinder block.
 Be careful not to nick the crank pin.
 (5) Using an appropriate piston ring compressor, install the piston and connecting rod assembly into the cylinder block.

Caution

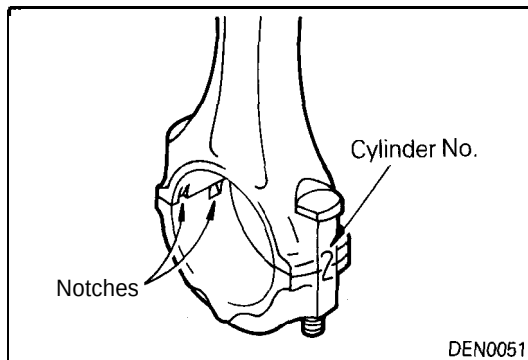
Direct the front mark (arrow) on the piston top towards the engine front (timing belt).



6EN0541



DEN0054

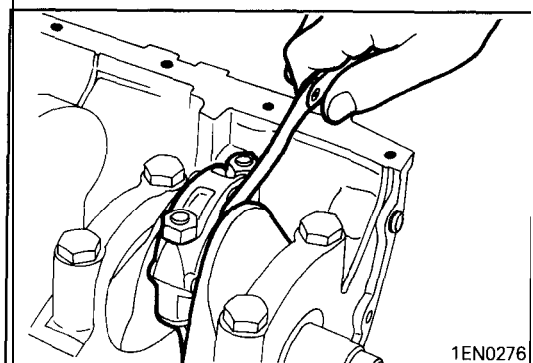
**◆E◆ CONNECTING ROD CAP INSTALLATION**

- (1) Verifying the mark made during disassembly, install the bearing cap to the connecting rod. If the connecting rod is new with no index mark, make sure that the bearing locking notches come on the same side as shown.

- (2) Make sure that connecting rod big end side clearance meets the specification.

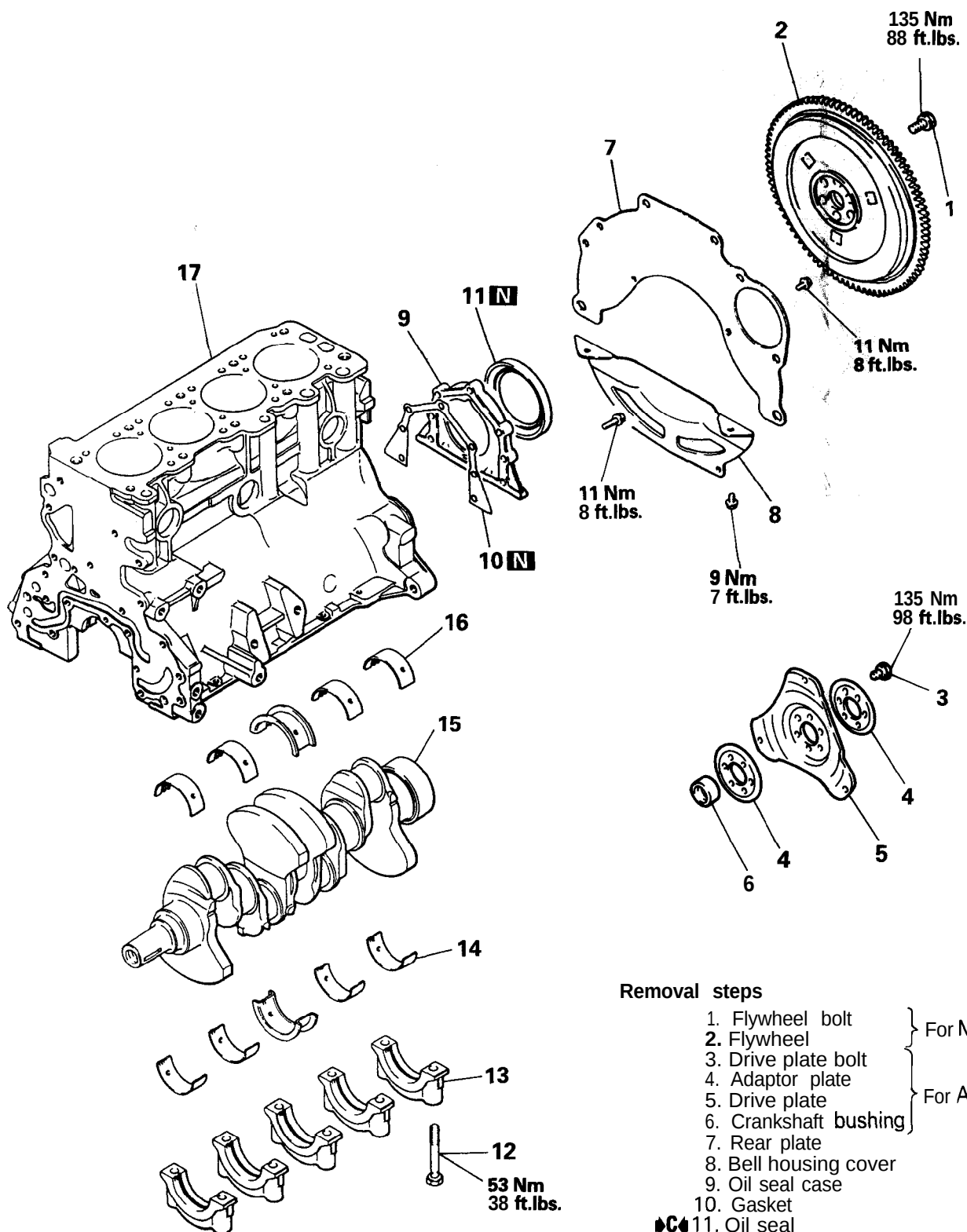
Standard value: 0.10 – 0.25 mm (.0039 – .0098 in.)

Limit: 0.4 mm (.016 in.)



CRANKSHAFT, FLYWHEEL AND DRIVE PLATE

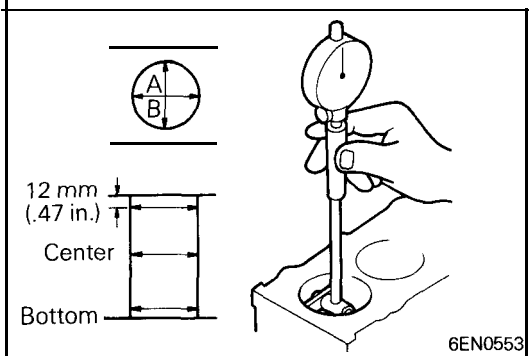
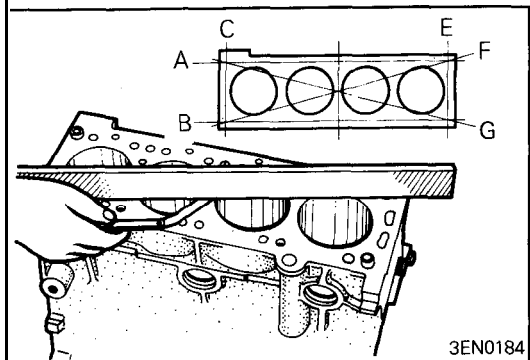
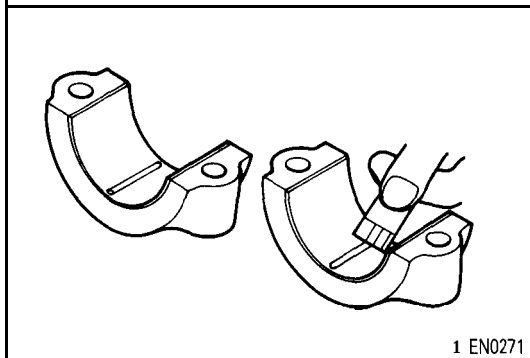
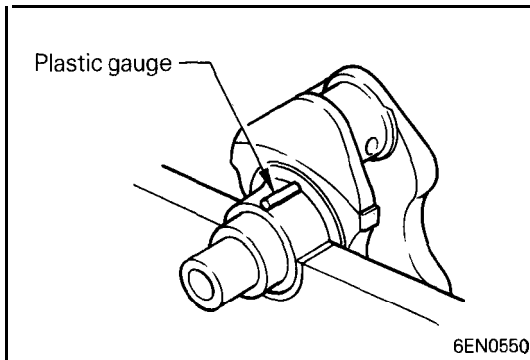
REMOVAL AND INSTALLATION



Removal steps

- | | |
|-------------------------------|-----------|
| 1. Flywheel bolt | } For M/T |
| 2. Flywheel | |
| 3. Drive plate bolt | } For A/T |
| 4. Adaptor plate | |
| 5. Drive plate | |
| 6. Crankshaft bushing | |
| 7. Rear plate | |
| 8. Bell housing cover | |
| 9. Oil seal case | |
| 10. Gasket | |
| 11. Oil seal | |
| 12. Bearing cap bolt | |
| 13. Bearing cap | |
| 14. Crankshaft bearing, lower | |
| 15. Crankshaft | |
| 16. Crankshaft bearing, upper | |
| 17. Cylinder block | |

3EN0036



INSPECTION

CRANKSHAFT JOURNAL OIL CLEARANCE (PLASTIC GAUGE METHOD)

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

- (4) Install the crankshaft bearing cap carefully and tighten the bolts to the specified torque.
- (5) Carefully remove the crankshaft bearing cap.
- (6) Measure the width of the plastic gauge at its widest part by using a scale printed on the plastic gauge bag.

Standard value: 0.02 – 0.05 (.0008 – .0020 in.)

Limit: 0.1 mm (.0039 in.)

INSPECTION

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

Standard value: 0.05 mm (.0020 in.)

Limit: 0.1 mm (.0039 in.)

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

Grinding limit: 0.2 mm (.0079 in.)

The total resurfacing depth of both cylinder block and mating cylinder head is 0.2 mm (.0079 in.) at maximum.

Cylinder block height (When new):

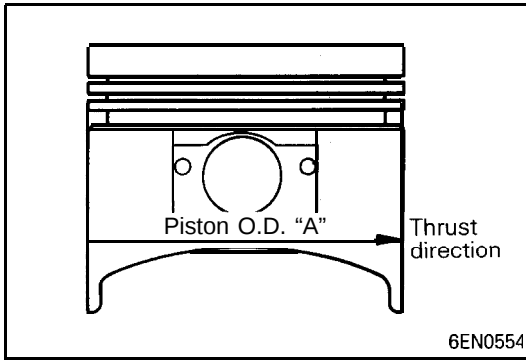
285.1 – 285.3 mm (11.224 – 11.232 in.)

- (3) Check cylinder walls for scratches and seizure. If defects are evident, correct (rebore 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 I.D. 80.60 – 80.63 mm
(3.1732 – 3.1744 in.)**

Cylindricity : 0.01 mm (.0004 in.)



CYLINDER BORING

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

Piston size identification

Size	Identification mark
0.25 mm (.01 in.) O.S.	0.25
0.50 mm (.02 in.) O.S.	0.50
0.75 mm (.03 in.) O.S.	0.75
1.00 mm (.04 in.) 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 (.0008 in.) (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.

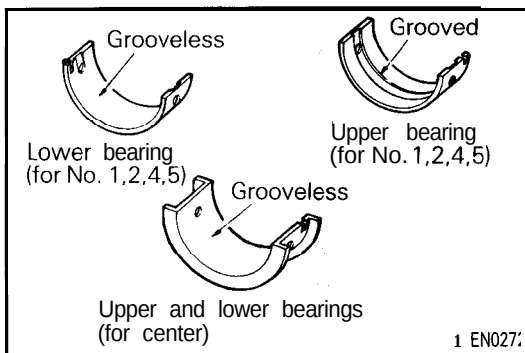
- (5) Hone to final finish dimension [piston O.D. + clearance between piston O.D. and cylinder].
- (6) Check the clearance between piston and cylinder.

Clearance between piston and cylinder:

0.01 – 0.03 mm (.0004 – .0012 in.)

NOTE

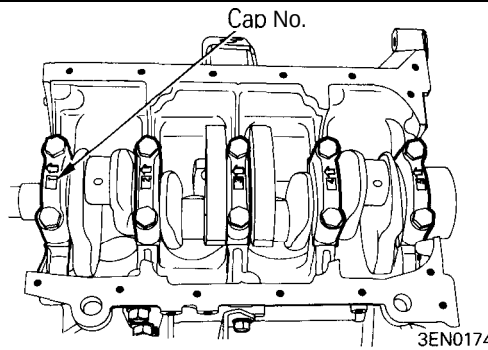
When boring cylinders, finish all of four cylinders to the same oversize. Do not bore only one cylinder to an oversize.



INSTALLATION SERVICE POINTS

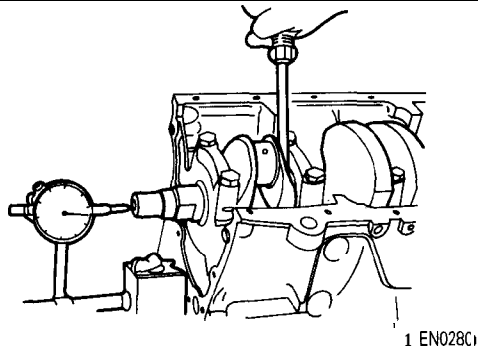
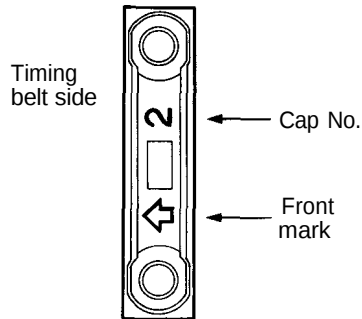
◆A◆ CRANKSHAFT BEARING INSTALLATION

- (1) The upper bearings (on the cylinder block side) for Nos. 1, 2, 4 and 5 journals are provided with oil groove.
- (2) The lower bearings (on the cap side) for Nos. 1, 2, 4 and 5 journals are not provided with oil groove.
- (3) The upper and lower bearings for No. 3 journal are common parts which are flanged and are not provided with oil groove.



▶▶ BEARING CAP INSTALLATION

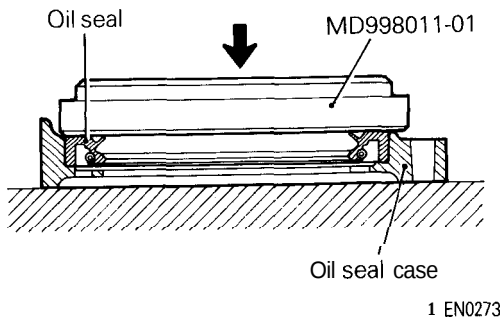
(1) Install according to the front mark and cap No.



(2) 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 the crankshaft bearings.

Standard value: 0.05 – 0.18 mm (.0020 – .0071 in.)

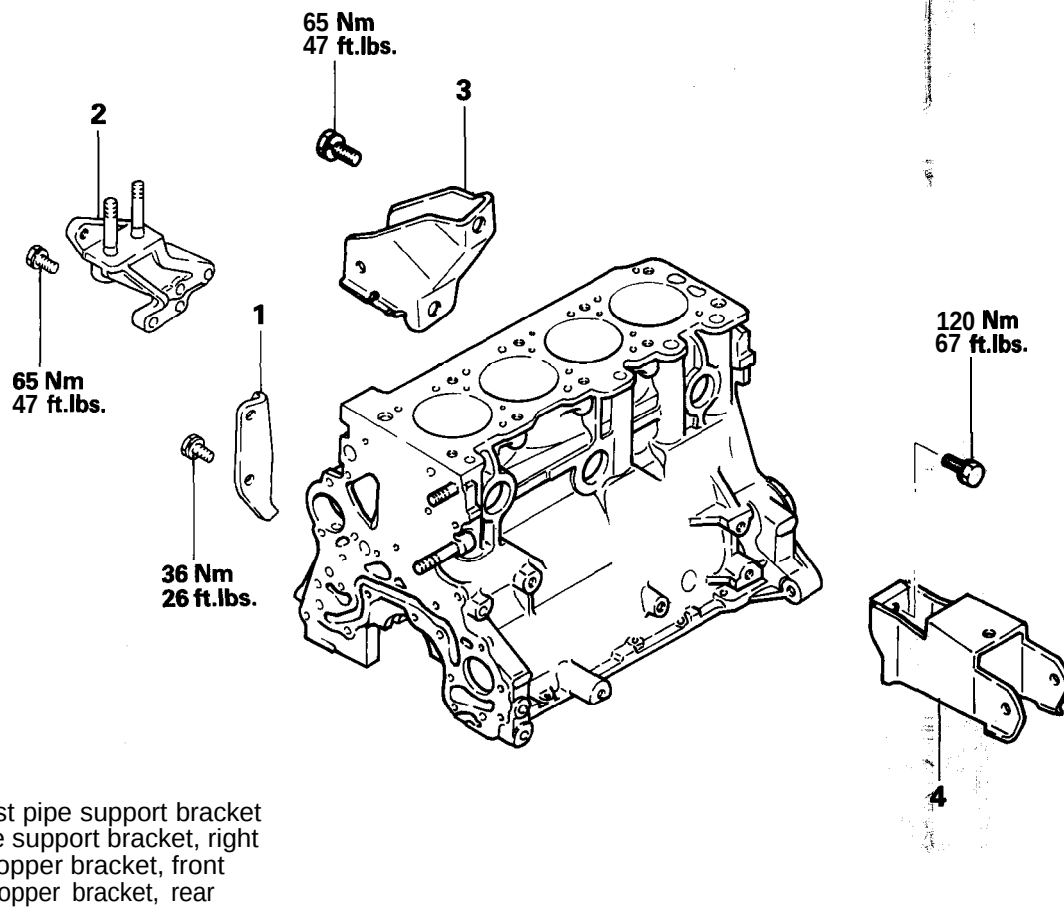
Limit: 0.3 mm' (.012 in.)



▶▶ OIL SEAL INSTALLATION

BRACKET

REMOVAL AND INSTALLATION



3EN0240

ENGINE

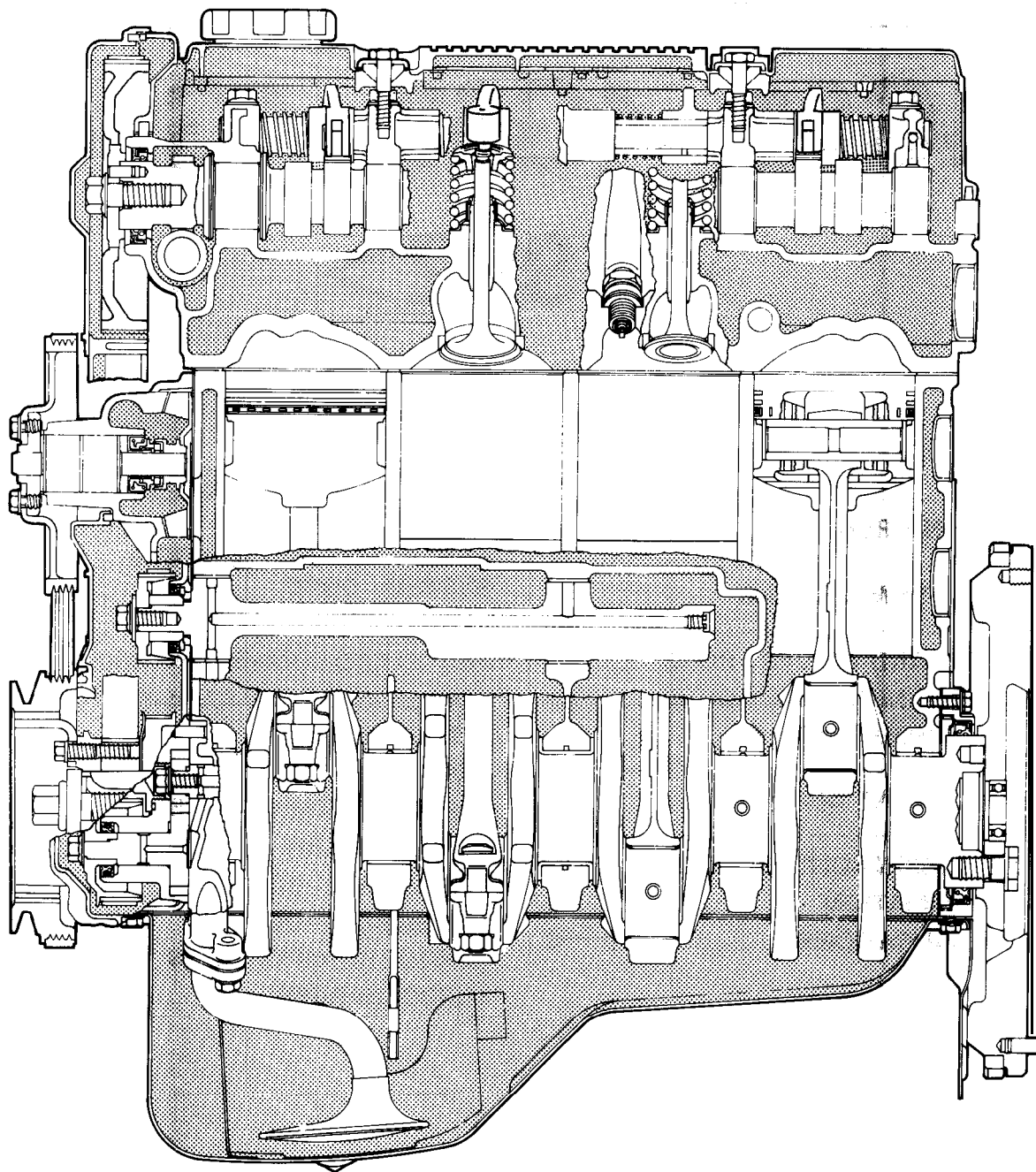
4G61, 4G63, 4G64 <1992>

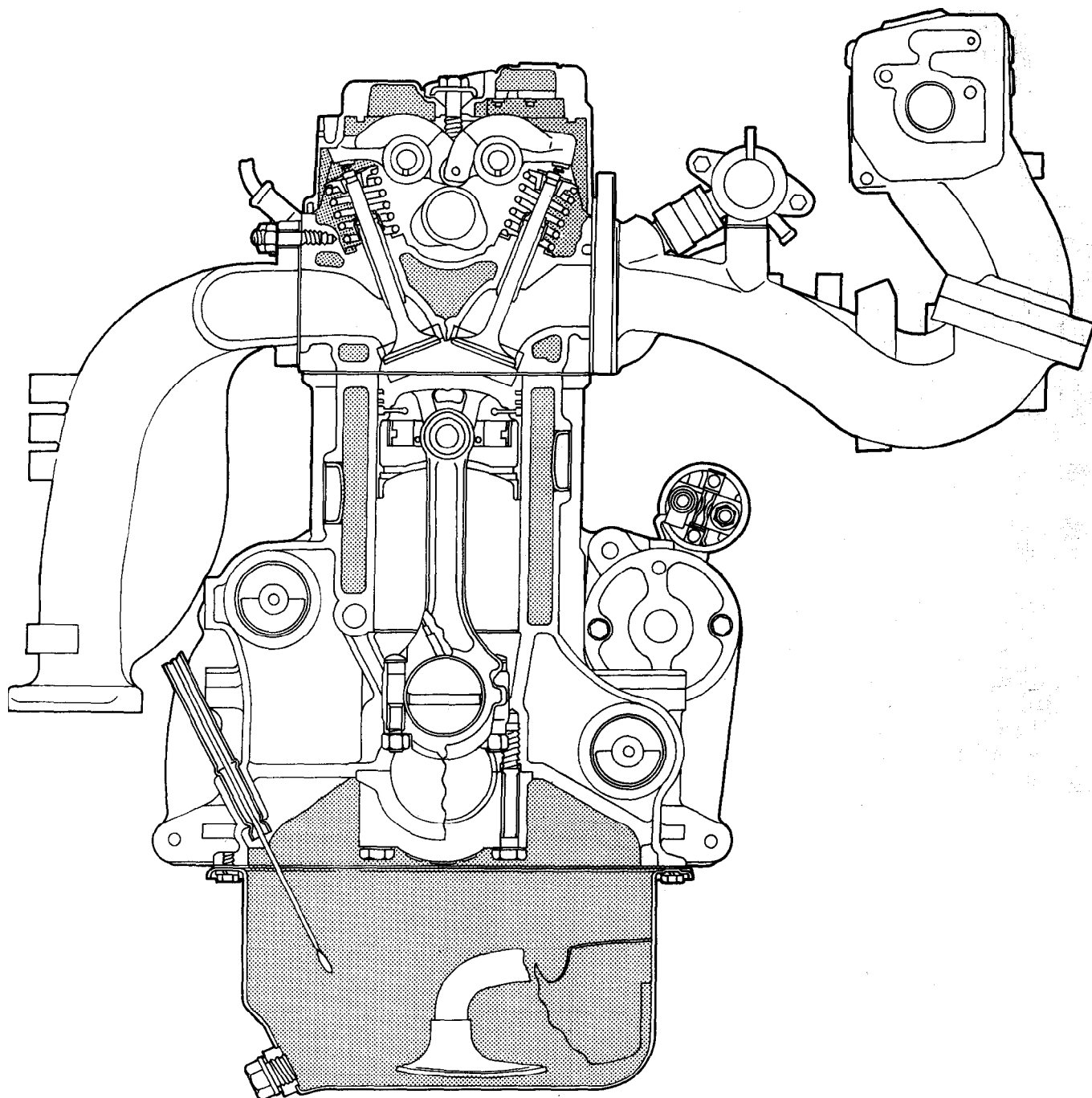
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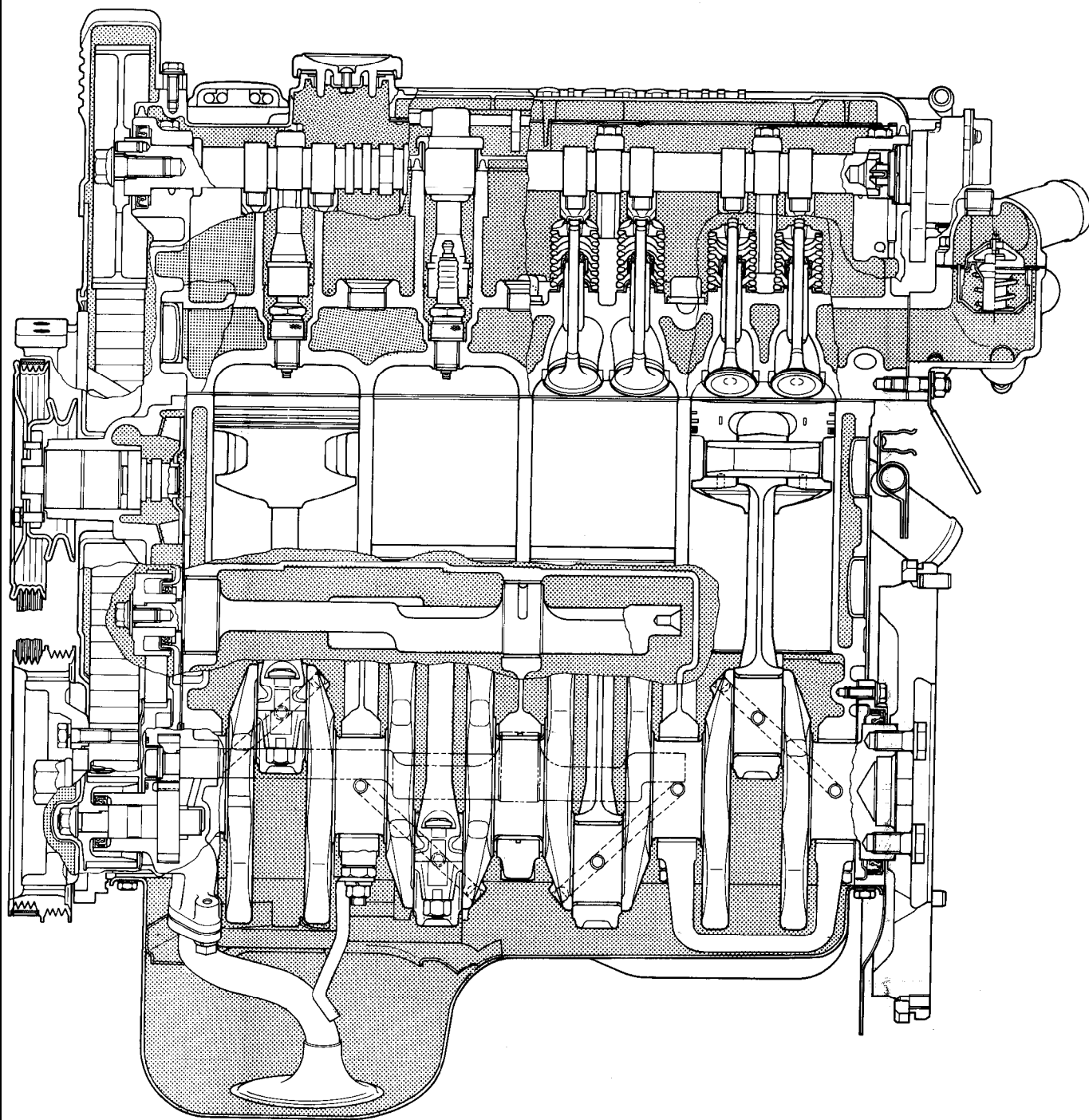
GENERAL INFORMATION

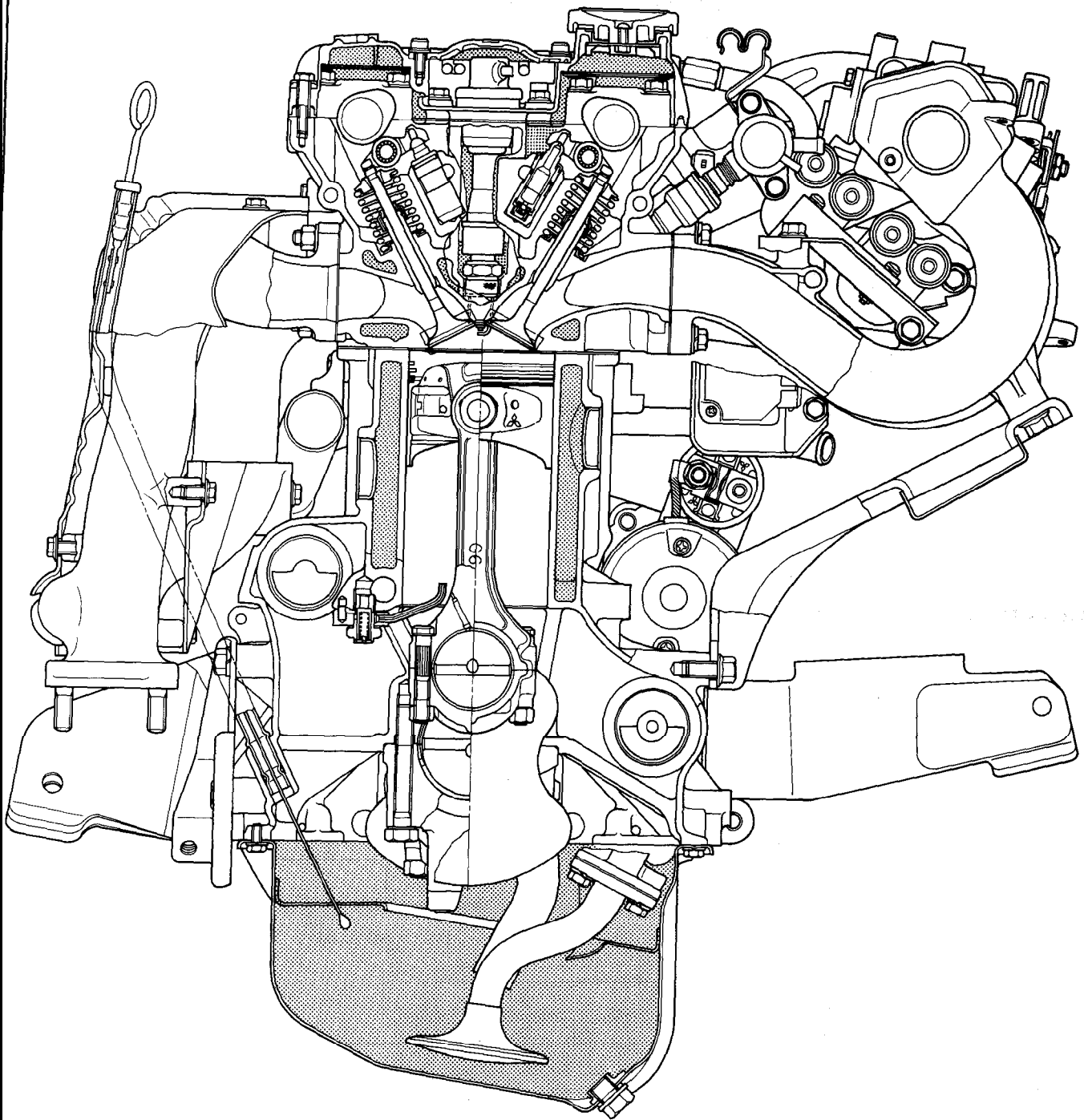
ENGINE SECTIONAL VIEW – SOHC





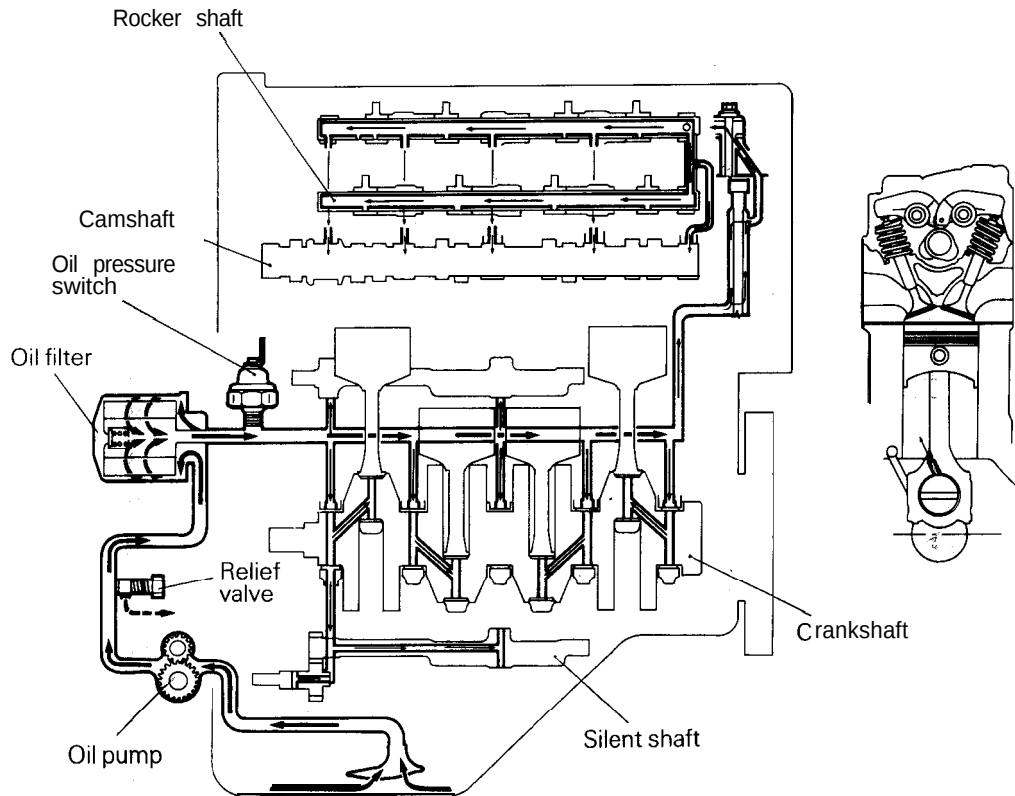
ENGINE SECTIONAL VIEW – DOHC





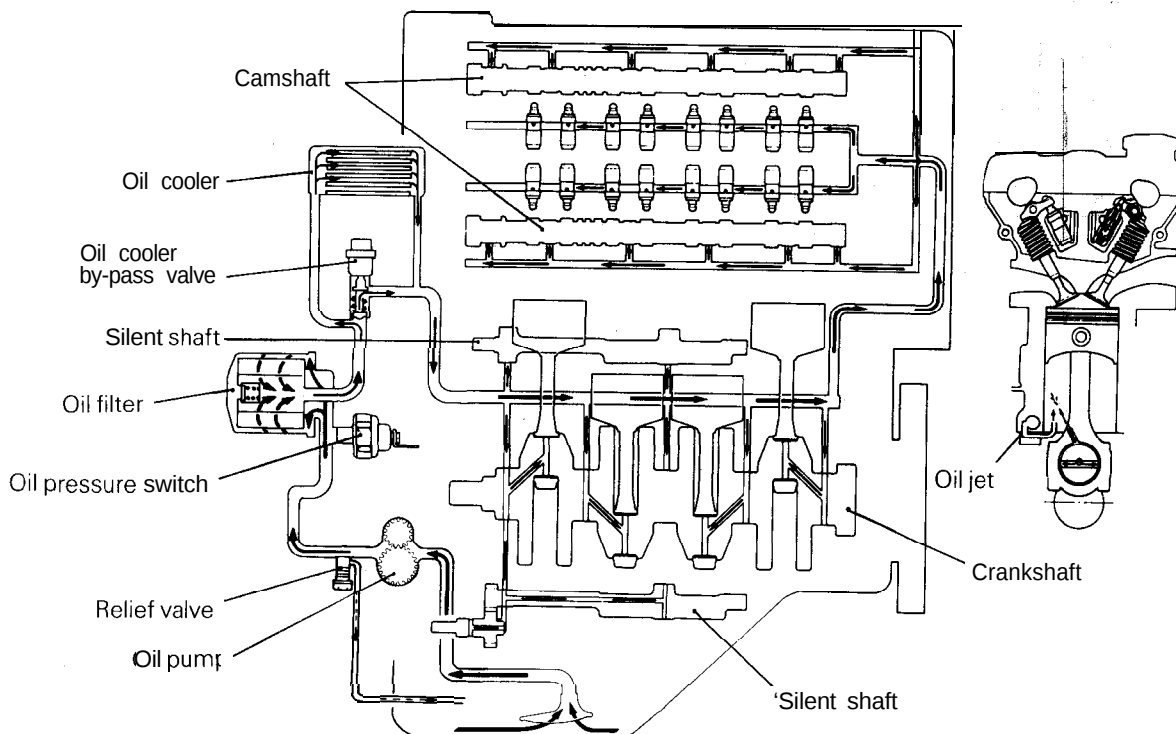
6EN0244

ENGINE LUBRICATION SYSTEM – SOHC

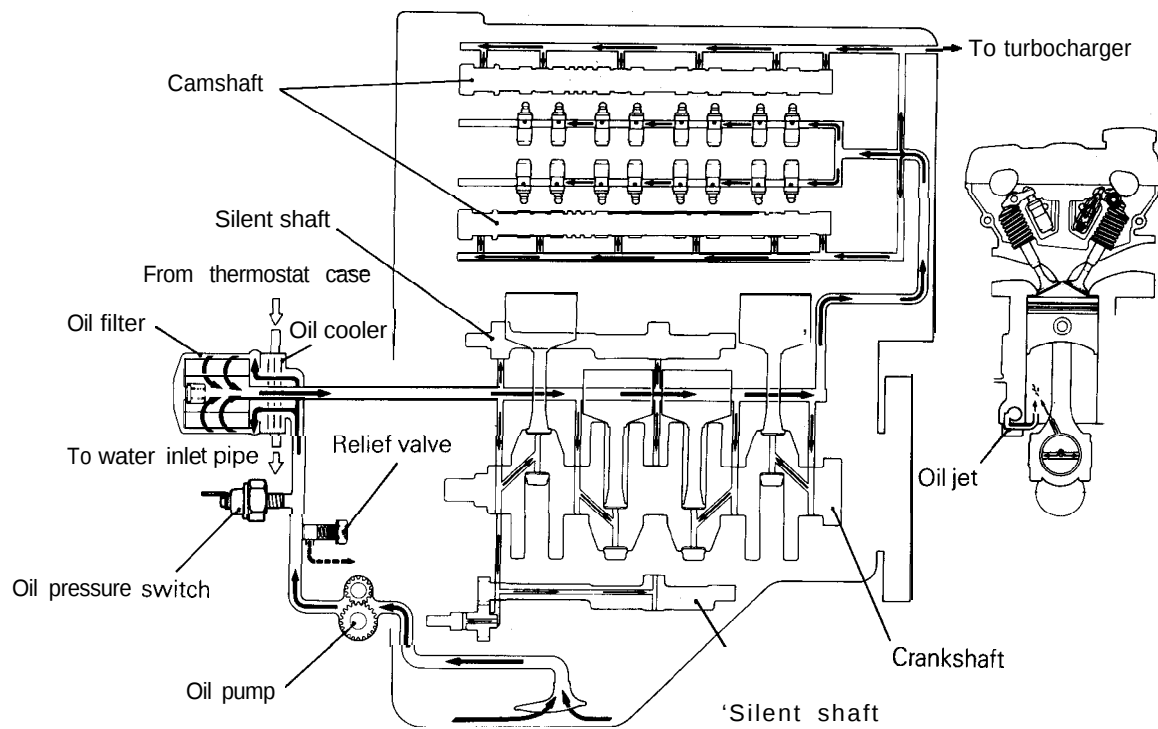


6LU0039

ENGINE LUBRICATION SYSTEM – DOHC



ENGINE LUBRICATION SYSTEM – DOHC-TURBO



6LU0056

GENERAL SPECIFICATIONS

4G63 SOHC

Type	In-line OHV, SOHC
Number of cylinders	4
Combustion chamber	Compact type
Total displacement cm ³ (cu. in.)	1,997 (121.9)
Cylinder bore mm (in.)	85 (3.35)
Piston stroke mm (in.)	88 (3.46)
Compression ratio	8.5
Valve timing	
(): camshaft identification mark	(AR)
Intake valve	
Open BTDC	19"
Close ABDC	57"
Exhaust valve	
Open BBDC	57"
Close ATDC	19"
Lubrication system	Pressure feed, full-flow filtration
Oil pump type	Involute gear type
Cooling system	Water-cooled forced circulation
Water pump type	Centrifugal impeller type
EGR system	Single type
Injector type and number	Electromagnetic 4
Injector identification mark	N210H
Throttle position sensor	Variable resistor type
Closed throttle position switch	Contact type, incorporated in idle speed control motor

4G64 SOHC

Type	In-line OHV, SOHC
Number of cylinders	4
Combustion chamber	Compact type
Total displacement cm ³ (cu. in.)	2,350 (143.4)
Cylinder bore mm (in.)	86.5 (3.35)
Piston stroke mm (in.)	100 (3.46)
Compression ratio	8.5
Valve timing	
(): camshaft identification mark	(D) (AR)
Intake valve	
Open BTDC	20" 19"
Close ABDC	64" 57"
Exhaust valve	
Open BBDC	64" 57"
Close ATDC	20" 19"
Lubrication system	Pressure feed, full-flow filtration
Oil pump type	Involute gear type
Cooling system	Water-cooled forced circulation
Water pump type	Centrifugal impeller type
EGR system	Single type
Injector type and number	Electromagnetic 4
Injector identification mark	N275H
Throttle position sensor	Variable resistor type
Closed throttle position switch	Contact switch type, incorporated in idle speed control motor-TRUCK Movable contact type, incorporated in throttle position sensor – EXPO

4G61 DOHC

Type	In-line OHV, DOHC		
Number of cylinders	4		
Combustion chamber	Pentroof type		
Total displacement cm ³ (cu. in.)	1,595 (97.3)		
Cylinder bore mm (in.)	82.3 (3.24)		
Piston stroke mm (in.)	75 (2.95)		
Compression ratio	3.2		
Valve timing			
(): camshaft identification mark	(E)	(F)	
Intake valve			
Open BTDC	16°	26°	
Close ABDC	48°	38°	
Exhaust valve			
Open BBDC	43°	53°	
Close ATDC	17°	7°	
Lubrication system	Pressure feed, full-flow filtration		
Oil pump type	Involute gear type		
Cooling system	Water-cooled forced circulation		
Water pump type	Centrifugal impeller type		
EGR system	Single type		
Injector type and number	Electromagnetic 4		
Injector identification mark	B275H		
Throttle position sensor	Variable resistor type		
Closed throttle position switch	Contact type		

4G63 DOHC

Type	In-line OHV, DOHC			
Number of cylinders	4			
Combustion chamber	Pentroof type			
Total displacement cm ³ (cu. in.)	1,997 (121.9)			
Cylinder bore mm (in.)	85 (3.35)			
Piston stroke mm (in.)	88 (3.46)			
Compression ratio	7.8 or 9.0 (Specs. varies according to engine model)			
valve timing				
(): camshaft identification mark	(A)	(B,C)	(D,C)	(E,A)
Intake valve				
Open BTDC	26°	21°	21°	16°
Close ABDC	46°	43°	51°	48°
Exhaust valve				
Open BBDC	55°	57°	57°	55°
Close ATDC	3°	15°	15°	9°
Lubrication system	Pressure feed, full-flow filtration			
Oil pump type	Involute gear type			
Cooling system	Water-cooled forced circulation			
Water pump type	Centrifugal impeller type			
EGR system	Single type			
Injector type and number	Electromagnetic 4			
Injector identification mark				
Non-turbo	V240H			
Turbo for GALANT/ECLIPSE/M/T	3450L			
Turbo for ECLIPSE A/T	3390L			
Throttle position sensor	Variable resistor type			
Closed throttle position switch	Contact type			

SERVICE SPECIFICATIONS

mm (in.)

	Standard	Limit
Cylinder head – SOHC		
Flatness of gasket surface	0.05 (.0020)	0.2 (.008)
Grinding limit of gasket surface		*0.2 (.008)
* Total resurfacing depth of both cylinder head and cylinder block.		
Overall height	89.9 – 90.1 (3.539 – 3.547)	
Oversize rework dimensions of valve guide hole (both intake and exhaust)		
0.05 (.002)	13.05 – 13.07 (.5138 – .5146)	
0.25 (.010)	13.25 – 13.27 (.5217 – .5224)	
0.50 (.020)	13.50 – 13.52 (.5315 – .5323)	
Oversize rework dimensions of intake valve seat ring hole		
0.30 (.012) 4G63	44.30 – 44.33 (1.7441 – 1.7453)	
4G64	47.30 – 47.33 (1.8622 – 1.8634)	
0.60 (.024) 4G63	44.60 – 44.63 (1.7559 – 1.7571)	
4G64	47.60 – 47.63 (1.8740 – 1.8752)	
Oversize rework dimensions of exhaust valve seat ring hole		
0.30 (.012) 4G63	38.30 – 38.33 (1.5079 – 1.5091)	
4G64	40.30 – 40.33 (1.5866 – 1.5878)	
0.60 (.012) 4G63	38.60 – 38.63 (1.5197 – 1.5209)	
4G64	40.60 – 40.63 (1.5984 – 1.5996)	
Cylinder head – DOHC		
Flatness of gasket surface	0.05 (.0020)	0.2 (.008)
Grinding limit of gasket surface		*0.2 (.008)
* Total resurfacing depth of both cylinder head and cylinder block.		
Overall height,	131.9-132.1 (5.193 – 5.201)	
Oversize rework dimensions of valve guide hole (both intake and exhaust)		
0.05 (.002)	12.05 – 12.07 (.4744 – .4752)	
0.25 (.010)	12.25 – 12.27 (.4823 – .4831)	
0.50 (.020)	12.50 – 12.52 (.4921 – .4929)	
Oversize rework dimensions of intake valve seat ring hole		
0.30 (.012)	35.30 – 35.33 (1.3898 – 1.3909)	
0.60 (.024)	35.60 – 35.63 (1.4016 – 1.4028)	
Oversize rework dimensions of exhaust valve seat ring hole		
0.30 (.012)	33.30 – 33.33 (1.3110 – 1.3122)	
0.60 (.024)	33.60 – 33.63 (1.3228 – 1.3240)	

mm (in.)

	Standard	Limit
Camshaft – SOHC Identification mark: D Cam height Intake Exhaust Identification mark: AR Cam height Intake Exhaust NOTE: The camshaft identification mark is stamped on the rear end of the camshaft. Fuel pump driving cam diameter Journal diameter Oil clearance	42.40 (1.6693) 42.40 (1.6693) 44.53 (1.7531) 44.53 (1.7531) 38 (1.50) 33.94 – 33.95 (1.3362 – 1.3366) 0.05 – 0.09 (.0020 – .0035)	41.90 (1.6496) 41.90 (1.6496) 44.03 (1.7335) 44.03 (1.7335)
Camshaft – DOHC Intake Identification mark: A,D Cam height Identification mark: B,C,E,F Cam height Exhaust Identification mark: A Cam height Identification mark: C Cam height Identification mark E,F Cam height NOTE: The camshaft identification mark is stamped on the rear end of the camshaft. Journal diameter Oil clearance	35.49 (1.3972) 35.20 (1.3858) 35.20 (1.3858) 35.49 (1.3972) 35.91 (1.3744) 25.95 – 25.97 (1.0217 – 1.0224) 0.05 – 0.09 (.0020 – .0035)	34.99 (1.3776) 34.70 (1.3661) 34.70 (1.3661) 34.99 (1.3776) 34.41 (1.3547)
Rocker arm – SOHC I.D. Rocker arm-to-shaft clearance	18.91 – 18.93 (.7445 – .7453) 0.01 – 0.04 (.0004 – .0016)	0.1 (.004)
Flash adjuster Leak down test Remarks: Diesel fuel at 15 – 20°C (59 – 68°F)	4 – 20 seconds/l mm (.04 in.)	
Rockershaft – SOHC I.D. Overall length Intake Exhaust	18.89 – 18.90 (.7437 – .7441) 385.5 (15.177) 372.5 (14.665)	

mm (in.)

			Standard	Limit
Valve – SOHC				
Overall length	Intake	4G63	109.8 (4.321)	
		4G64	106.6 (4.197)	
	Exhaust	4G63	108.7 (4.280)	
		4G64	105.2 (4.142)	
Stem diameter	Intake		7.96 – 7.98 (.3134–.3142)	
	Exhaust		7.93-7.95 (.3122–.3130)	
Face angle			45° – 45°30'	
Thickness of valve head (margin)	Intake		1.2 (.047)	0.7 (.028)
	Exhaust		2.0 (.079)	1.5 (.059)
Stem-to guide clearance	Intake		0.02 – 0.06 (.0008 – .0024)	0.10 (.004)
	Exhaust		0.05 – 0.09 (.0020 – .0035)	0.15 (.006)
Valve – DOHC				
Overall length	Intake		109.5 (4.311)	
	Exhaust		109.7 (4.319)	
Stem diameter	Intake		6.57 – 6.58 (.2587 – .2591)	
	Exhaust		6.53 – 6.55 (.2571–.2579)	
Face angle			45° – 45°30'	
Thickness of valve head (margin)	Intake		1.0 (.039)	0.7 (.028)
	Exhaust		1.5 (.059)	1.0 (.039)
Stem-to guide clearance	Intake		0.02 – 0.05 (.0008 – .0020)	0.10 (.004)
	Exhaust		0.05 – 0.09 (.0020 – .0035)	0.15 (.006)
Valve spring – SOHC				
Free height			49.8 (1.961)	48.8 (1.921)
Load/installed height			329/40.4 (73/1.591)	
Out-of-squareness			2" or less	Max. 4"
Valve spring – DOHC				
Free height			48.3 (1.902)	47.4 (1.866)
Load/installed height			300/40 (66/1.57)	
Out-of-squareness			1.5" or less	Max. 4"
Valve guide- SOHC				
Overall length	Intake		47 (1.85)	
	Exhaust		52 (2.05)	
I.D.			8.00 – 8.02 (.3150 – .3157)	
O.D.			13.06 – 13.07 (.5142 – .5146)	
Service size			0.05 (.002), 0.25 (.010), 0.50 (.020) over size	
Press-in temperature			Room temperature	

mm (in.)

	Standard	Limit
Valve guide – DOHC Overall length Intake Exhaust I.D. O.D. Service size Press-in temperature	45.5 (1.791) 50.5 (1.988) 6.60 – 6.62 (.2598 – .2606) 12.06 – 12.07 (.4748 – .4752) 0.05 (.002), 0.25 (.010), 0.50 (.020) over size Room temperature	
Valve seat Seat angle Valve contact width Sinkage Service size	43°30' – 44" 0.9 – 1.3 (.035 – .051) 0.3 (.012), 0.6 (.024) over size	0.2 (.008)
Silent shaft Journal diameter Right (front) (rear) Left (front) (rear) Oil clearance Right (front) (rear) Left (front) (rear)	41.96 – 41.98 (1.6520 – 1.6528) 40.95 – 40.97 (1.6122 – 1.6130) 18.47 – 18.48 (.7272 – 0.7276) 40.95 – 40.97 (1.6122 – 1.6130) 0.03 – 0.06 (.0012 – .0024) 0.05 – 0.09 (.0020 – .0036) 0.02 – 0.05 (.0008 – .0020) 0.05 – 0.09 (.0020 – .0036)	
Piston – SOHC O.D. 4G63 4G64 Piston to cylinder clearance Service size	84.97 – 85.00 (3.3453 – 3.3465) 86.47 – 86.50 (3.404 – 3.4055) 0.02 – 0.04 (.0008 – .0016) 0.25 (.010), 0.50 (.020), 0.75 (.030), 1.00 (.039) over size	
Piston – DOHC O.D. 4G61 4G63 – Non-turbo 4G63 -Turbo Piston to cylinder clearance Non-turbo Turbo Service size	82.27 – 82.30 (3.2390 – 3.2401) 84.97 – 85.00 (3.3453 – 3.3465) 84.96 – 84.99 (3.3449 – 3.3461) 0.02 – 0.04 (.0008 – .0016) 0.03 – 0.05 (.0012 – .0020) 0.25 (.010), 0.50 (.020), 0.75 (.030), 1.00 (.039) over size	

mm (in.)

		Standard	Limit
Piston ring – SOHC			
End gap	No. 1 ring	0.25 – 0.40 (.0098 – .0157)	0.8 (.031)
	No. 2 ring		
	4G63	0.20 – 0.35 (.0079 – .0138)	0.8 (.031)
	4G64	0.20 – 0.40 (.0079 – .0157)	0.8 (.031)
	Oil ring	0.20 – 0.70 (.0079 – .0276)	1.0 (.039)
Ring-to-ring groove clearance	No. 1 ring	0.03 – 0.07 (.0012 – .0028)	0.1 (.004)
	No. 2 ring	0.02 – 0.06 (.0008 – .0024)	0.1 (.004)
Service size		0.25 (.010), 0.50 (.020), 0.75 (.030), 1.00 (.039) over size	
Piston ring – DOHC			
End gap	No. 1 ring	0.25 – 0.40 (.0098 – .0157)	0.8 (.031)
	No. 2 ring		
	4G61	0.35 – 0.50 (.0138 – .0197)	0.8 (.031)
	4G63	0.45 – 0.60 (.0177 – .0236)	0.8 (.031)
	Oil ring	0.20 – 0.70 (.0079 – .0276)	1.0 (.039)
Ring-to-ring groove clearance	No. 1 ring	0.03 – 0.07 (.0012 – .0028)	0.1 (.004)
	No. 2 ring	0.03 – 0.07 (.0012 – .0028)	0.1 (.004)
Service size		0.25 (.010), 0.50 (.020), 0.75 (.030), 1.00 (.039) over size	
Piston pin			
O.D.		21.00 – 21.01 (.8268 – .8272)	
Press-in load N(lbs.)		7,500 – 17,500 (1,653 – 3,858)	
press-in temperature		Room temperature	
Connecting rod			
Big end center-to-small end center length		149.9 – 150.0 (5.902 – 5.906)	
Bend		0.05 (.002)	
Twist		0.1 (.004)	
Big end side clearance		0.10 – 0.25 (.0039 – .0098)	0.4 (.016)
Crankshaft			
End play		0.05 – 0.18 (.0020 – .0071)	0.25 (.0098)
Journal O.D.		56.98 – 57.00 (2.2433 – 2.2441)	
Pin O.D.		44.98 – 45.00 (1.7709 – 1.7717)	
Out-of-roundness and taper of journal and pin		Max. 0.01 (.0004)	
Eccentricity of journal		Max. 0.02 (.0008)	
Oil clearance of journal		0.02 – 0.05 (.0008 – .0020)	0.1 (.004)
Oil clearance of pin		0.02 – 0.05 (.0008 – .0020)	0.1 (.004)

mm (in)

	Standard	Limit
Cylinder block		
Cylinder I.D. 4G61	82.30 – 82.33 (3.2402 – 3.2413)	0.1 (.004) *0.2 (.008)
4G63	85.00 – 85.03 (3.3465 – 3.3476)	
4G64	86.50 – 86.53 (3.4055 – 3.4067)	
Flatness of gasket surface	0.05 (.0020)	
Grinding limit		
* Total resurfacing depth of both cylinder head and cylinder block.		
Overall height 4G61	274.9 – 275.1 (10.823 – 10.831)	
4G63	283.9–284.1 (11.177–11.185)	
4G64	289.9 – 290.1 (11.413 – 11.421)	
Oil pump		
Side clearance		
Drive gear	0.08 – 0.14 (.0031–.0055)	
Driven gear	0.06 – 0.12 (.0024 –.0047)	
Drive belt		
Deflection		
V-ribbed type belt New belt	7.5 – 9.0 (.30–.35)	
Used belt	8.0 (.32)	
V type belt	7.0 – 10.0 (.28–.39)	
Tension		
V-ribbed type belt New belt N (lbs.)	500 – 700 (110– 154)	
Used belt N (lbs.)	400 (88)	
Oil cooler by-pass valve		
Dimension (L)	34.5 (1.358) – normal temperature	
By-pass hole closing temperature	40 (1.57) or more	
37 – 103°C (207 – 217°F) or more]		
Injector		
Oil resistance		
Non -turbo Ω	13 – 16 at 20°C (68°F)	
Turbo Ω	2 – 3 at 20°C (68°F)	
Idle speed control motor		
Oil resistance Ω	5 – 35 at 20°C (68°F)	
Idle air control motor		
Oil resistance Ω	28 – 33 at 20°C (68°F)	
Idle speed control motor position sensor		
SOHC engine for GALANT/TRUCK		
Resistance kΩ	4 - 6	

NOTE

O.D.: Outer Diameter

I.D.: Inner Diameter

U.S.: Undersize Diameter

TORQUE SPECIFICATIONS

	Nm	ft.lbs.
Generator and ignition system – SOHC		
Cooling fan bolt	11	8
Water pump pulley bolt – Engine without cooling fan	9	7
Water pump pulley bolt – Engine with cooling fan	11	8
Generator brace bolt	14	10
Generator mounting bolt	24	17
Generator pivot nut	23	17
Crankshaft pulley bolt	25	18
Spark plug	25	18
Distributor nut	11	8
Ignition coil bolt	14	10
Ignition power transistor nut	18	13
Generator and ignition system – DOHC		
Water pump pulley bolt	9	7
Generator brace bolt	14	10
Generator mounting bolt	24	17
Generator pivot nut	23	17
Crankshaft pulley bolt	25	18
Center cover bolt	3	2
Spark plug	25	18
Ignition coil bolt	24	17
Ignition power transistor bolt	11	8
Crankshaft position sensor nut	1	14
Timing belt – SOHC		
Tensioner bolt	49	35
Tensioner spacer	49	35
Oil pump sprocket nut	55	40
Crankshaft sprocket bolt	120	87
Tensioner “B” bolt	19	14
Silent shaft sprocket bolt, right	46	33
Engine supports bracket bolt, left	36	26
Camshaft sprocket bolt	90	65
Timing belt- DOHC		
Tensioner pulley bolt	49	35
Tensioner arm bolt	22	16
Idler pulley bolt	38	27
Oil pump sprocket nut	55	40
Crankshaft sprocket bolt	120	87
Tensioner “B” bolt	19	14
Silent shaft sprocket bolt, right	46	33
Rocker cover bolt	3	22
Camshaft sprocket bolt	90	65
Engine support bracket, left	36	26

	Nm	ft.lbs.
Fuel and emission parts		
EGR valve bolt	19	14
Throttle body stay nut – DOHC	19	14
Throttle body bolt – SOHC	12	9
Throttle body bolt – DOHC	19	14
Fuel pressure regulator bolt	9	7
Fuel rail bolt	12	9
Throttle body		
Throttle position sensor bolt	2	1.4
Idle speed control motor bolt	3.5	2.5
Idle air control motor bolt	3.5	2.5
Intake manifold		
Intake manifold bolt and nut	18	13
Intake manifold nut – DOHC	36	26
Intake manifold stay bolt – SOHC	22	16
Intake manifold stay bolt – DOHC	28	20
Intake manifold plenum bolt and nut	18	13
Intake manifold plenum stay bolt	18	13
Water outlet fitting bolt	19	14
Engine coolant temperature gauge unit	11	8
Engine coolant temperature sensor	30	22
Thermostat case nut	18	13
Exhaust manifold and water pump		
Oil level gauge guide bolt	60	43
Heat protector bolt		
GALANT AND EXPO	14	10
TRUCK	30	22
Exhaust manifold nut – SOHC	18	13
Exhaust manifold nut – DOHC	28	20
Engine hanger bolt – DOHC	14	10
Air outlet fitting bolt	19	14
Turbocharger bolt and nut	60	43
Exhaust fitting bolt	60	43
Water inlet pipe bolt	14	10
Water pump bolt	24	17
Water pipe “A” and “B” eye bolt	43	31
Water pipe “A” bolt	11	8
Water pipe “B” flare nut	45	33
Water pipe bolt		
M8	14	10
M6	11	8
Oil return pipe bolt	9	7
Oil pipe		
Cylinder head side	17	12
Turbocharger side	31	22

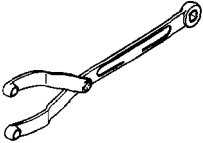
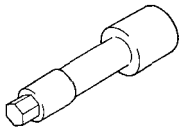
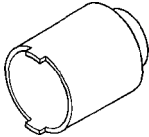
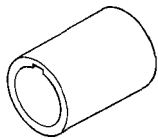
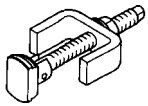
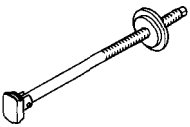
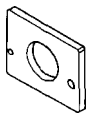
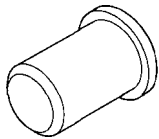
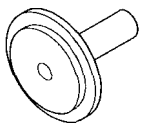
	Nm	ft.lbs.
Turbocharger Turbocharger waste gate actuator bolt	12	9
Rocker arms and camshaft- SOHC Rocker cover bolt Bearing cap bolt M8 x 25 M8 x 65	6 24 20	4 17 14
Camshafts and rocker arms – DOHC Bearing cap bolt Oil delivery body bolt	20 11	14 8
Cylinder head and valves – SOHC Cylinder head bolt	95	69
Cylinder head and valves- DOHC Cylinder head bolt	110	80
Front case, silent shaft and oil pan Oil cooler bolt Drain plug Oil pan bolt Oil screen bolt and nut Oil pump sprocket bolt Plug Silent shaft, left flange bolt Oil filter bracket bolt Front case bolt M8 M10 Oil cooler by-pass valve Oil pressure switch Oil pressure gauge unit Relief plug Oil pump over bolt Check valve	43 40 7 19 55 24 37 19 24 31 55 10 55 45 17 33	31 29 5 14 40 17 27 14 17 22 40 7 40 33 12 24
Piston and connecting rod Connecting rod cap nut	52	38
Crankshaft, flywheel and drive plate Flywheel bolt Drive plate bolt Oil seal case bolt Bearing cap bolt – SOHC Bearing cap bolt – DOHC	135 135 11 53 68	98 98 8 38 49

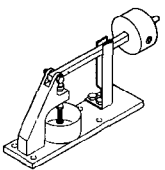
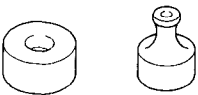
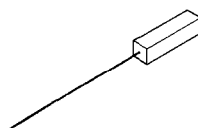
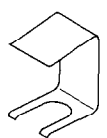
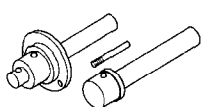
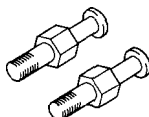
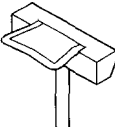
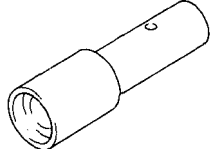
	Nm	ft.lbs.
Bracket		
Left and right engine support bracket bolt	45	33
Roll stopper bracket bolt, front	65	47
Roll stopper bracket bolt, rear	120	87
Engine support bracket bolt, front	60	43
Exhaust pipe support bracket bolt	36	26

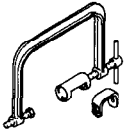
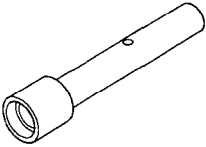
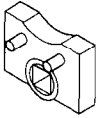
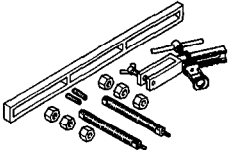
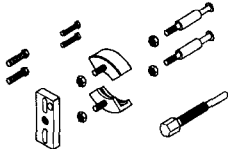
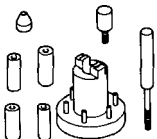
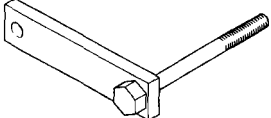
SEALANT

	Specified sealant	Quantity
Rocker cover	3M ATD Part No. 8660 or equivalent	As required
Semi-circular packing	3M ATD Part No. 8660 or equivalent	As required
Oil pan gasket	MITSUBISHI GENUINE PART MD970389 or equivalent	As required
Engine coolant temperature gauge unit	3M ATD Part No. 8660 or equivalent	As required
Engine coolant temperature sensor	3M Nut Locking Part No. 4171 or equivalent	As required
Oil pressure switch	3M ATD Part No. 8660 or equivalent	As required
Oil pressure gauge unit	3M ATD Part No. 8660 or equivalent	As required

SPECIAL TOOLS

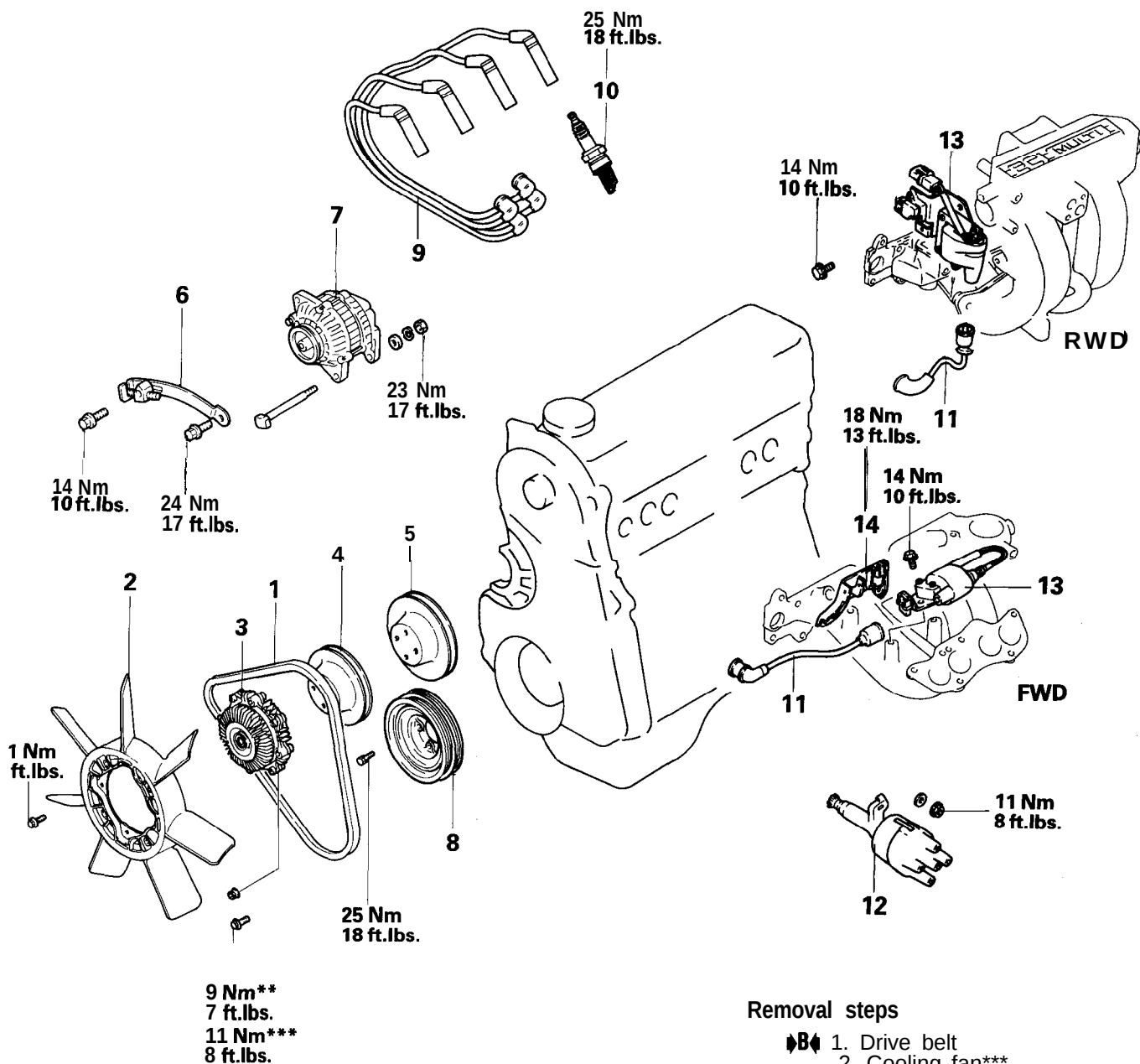
Tool	Number and tool name	Supersession	Application
	MB990767 End yoke holder Use with MD9987 19	MB990767-01 Use with MIT308239	Holding camshaft sprocket when loosening or torquing bolt. For SOHC engine only
	MD998051 Cylinder head bolt wrench	MD998051-01	Loosening or torquing of cylinder head bolt
	MD998162 Plug wrench	MD998162-01	Removal and installation of front case cap plug
	MD998285 Crankshaft front oil seal guide	MD998285-01	Installation of crankshaft front oil seal
	MD998371 Silent shaft bearing puller	MD998371-01 Use with MIT304204	Removal of silent shaft rear
	MD998372 Silent shaft bearing puller	MD998372-01 Use with MIT304204	Removal of silent shaft rear
	MD998374 Bearing installer stopper	MD998374-01	Removal and installation of rear bearing
	MD998375 Crankshaft front oil seal installer	MD998375-01	Installation of crankshaft front oil seal
	MD998376 Crankshaft rear oil seal installer	MD998376-01 Use with MB990938-01	Installation of crankshaft rear oil seal

Tool	Number and tool name	Supersession	Application
	MD998440 Leak-down tester		Leak-down test of lash adjuster
	MD998441 Lash adjuster retainer		Bleeding of air inside the adjuster For SOHC engine only
	MD998442 Air bleed wire		Air bleeding of lash adjuster
	MD998443 Lash adjuster holder (8)	MD998443-01	Supporting of the lash adjuster to prevent it from falling when rocker shaft assembly is removed or installed For SOHC engine only
	MD998705 Silent shaft bearing installer	MD998373-01	Installation of silent shaft bearing
	MD998713 Camshaft oil seal installer	MD998713-01	
	MD998719 Pulley holding pins (2)	MIT308239	Holding camshaft sprocket when loosening or torquing bolt For SOHC engine only
	MD998727 Oil pan remover		Removal of oil pan
	MD998729 Valve stem seal installer	MD998729-01	Installation of valve stem seal For SOHC engine only

Tool	Number and tool name	Supersession	Application
	MD998735 Valve spring compressor	MD998735-01	Compression of valve spring
	MD998737 Valve stem seal installer	MD998737-01	Installation of valve stem seal For DOHC engine only
	MD998767 Tension pulley wrench	MD998752-01	Installation of auto tensioner For DOHC engine only
	MD998772 Valve spring compressor		Compression of valve spring
	MD998778 Crankshaft sprocket puller		Removal of crankshaft sprocket
	MD998779 Sprocket stopper		Holding silent shaft sprocket
	MD998780 Piston pin setting tool	MIT216941	Removal and installation of piston pin
	MD998781 Flywheel stopper		Holding flywheel

GENERATOR AND IGNITION SYSTEM – SOHC

REMOVAL AND INSTALLATION



Removal steps

1. Drive belt
2. Cooling fan***
3. Fan clutch***
4. Water pump pulley*
5. Water pump pulley
6. Generator brace
7. Generator
8. Crankshaft pulley
9. Spark plug cable
10. Spark plug
11. High tension cable
12. Distributor
13. Ignition coil
14. Ignition power transistor

NOTE

* : Engine with power steering

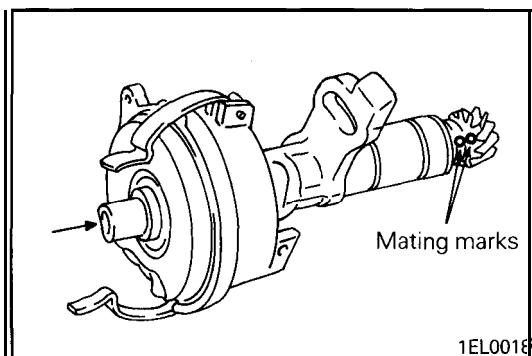
** : Engine with cooling fan

Engine without cooling fan

INSTALLATION SERVICE POINTS

◆◆ DISTRIBUTOR INSTALLATION

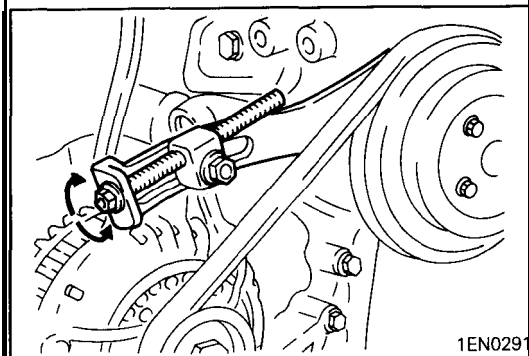
- (1) Align the marks put at the time of disassembly, and install the gear to the distributor shaft.



- (2) When aligning the driven gear's mating mark and the housing's mating marks, make the combination so that notch "A" at the shaft end is at the position shown in the figure, and then align the spring pin holes and drive in a new spring pin.

Caution

Drive in the spring pin so that the slit is at a right angle relative to the shaft.



◆B DRIVE BELT TENSION ADJUSTMENT

ADJUSTER TYPE

- (1) Adjust the belt deflection to the standard value. Turn the adjusting bolt clockwise to increase the belt tension and turn the adjusting bolt counterclockwise to decrease the belt tension.

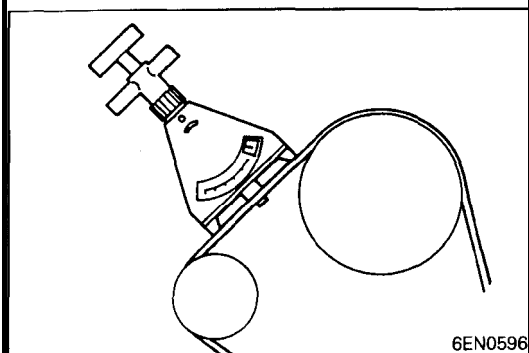
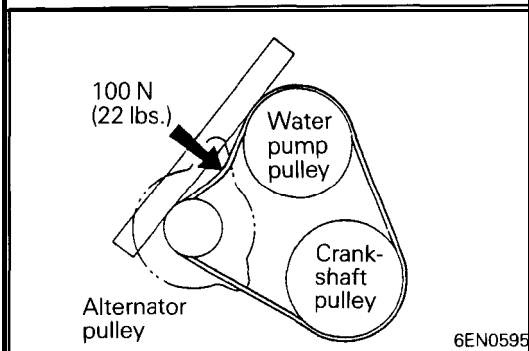
Standard value:

V-ribbed type belt

New belt 7.5 – 9.0 mm (.30 – .35 in.)

Used belt 8.0 mm (.32 in.)

V-type belt 7.0 – 10.0 mm (.28 – .39 in.)



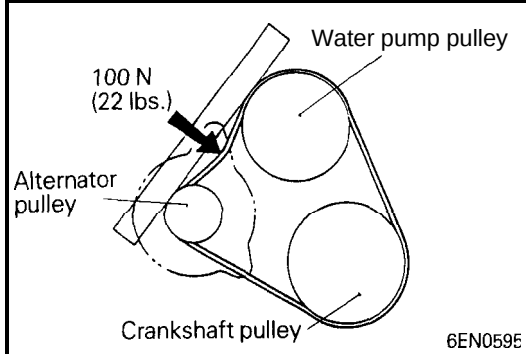
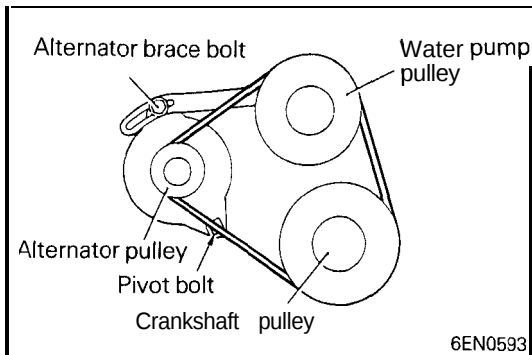
When using a tension gauge for V-ribbed belt only.

Standard value:

New belt 500 – 700 N (110 – 154 lbs.)

Used belt 400 N (88 lbs.)

- (2) Tighten the lock bolt to the specified torque.
- (3) Tighten the nut for the pivot bolt to the specified torque.

**BRACE BOLT TYPE**

- (1) Move the generator to adjust the belt deflection to the standard value.

Standard value:**V-ribbed type belt**

New belt 7.5 – 9.0 mm (.30 – .35 in.)

Used belt 8.0 mm (.32 in.)

V-type belt 7.0 – 10.0 mm (.28 – .39 in.)

When using a tension gauge for V-ribbed belt only.

Standard value:

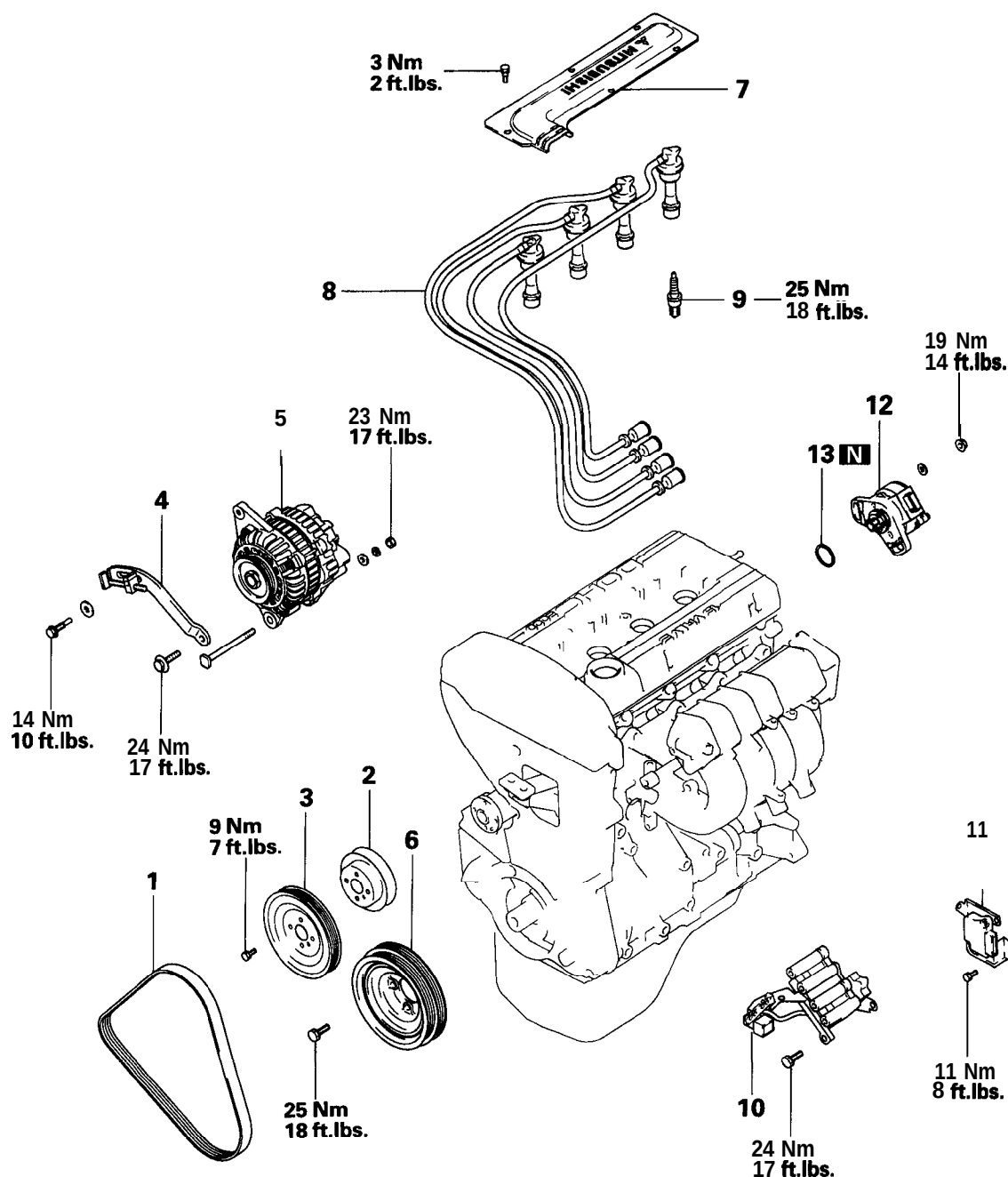
New belt 500 – 700 N (110 – 154 lbs.)

Used belt 400 N (88 lbs.)

- (2) Tighten the brace bolt to the specified torque.
- (3) Tighten the nut for the pivot bolt to the specified torque.

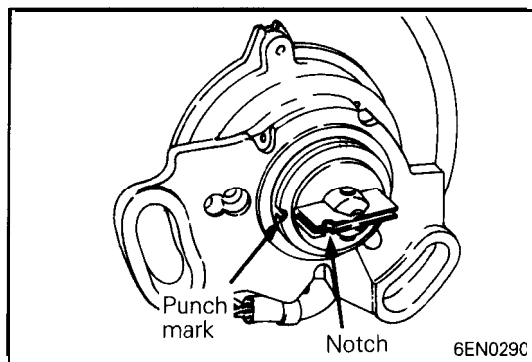
GENERATOR AND IGNITION SYSTEM – DOHC

REMOVAL AND INSTALLATION



Removal steps

- ◆B◆ 1. Drive belt
- 2. Water pump pulley
- 3. Water pump pulley
(For driving power steering pump)
- 4. Generator brace
- 5. Generator
- 6. Crankshaft pulley
- 7. Center cover
- 8. Spark plug cable
- 9. Spark plug
- 10. Ignition coil
- 11. Ignition power transistor
- ◆A◆ 12. Crankshaft position sensor
- 13. O-ring



INSTALLATION SERVICE POINTS

◆A◆ CRANKSHAFT POSITION INSTALLATION

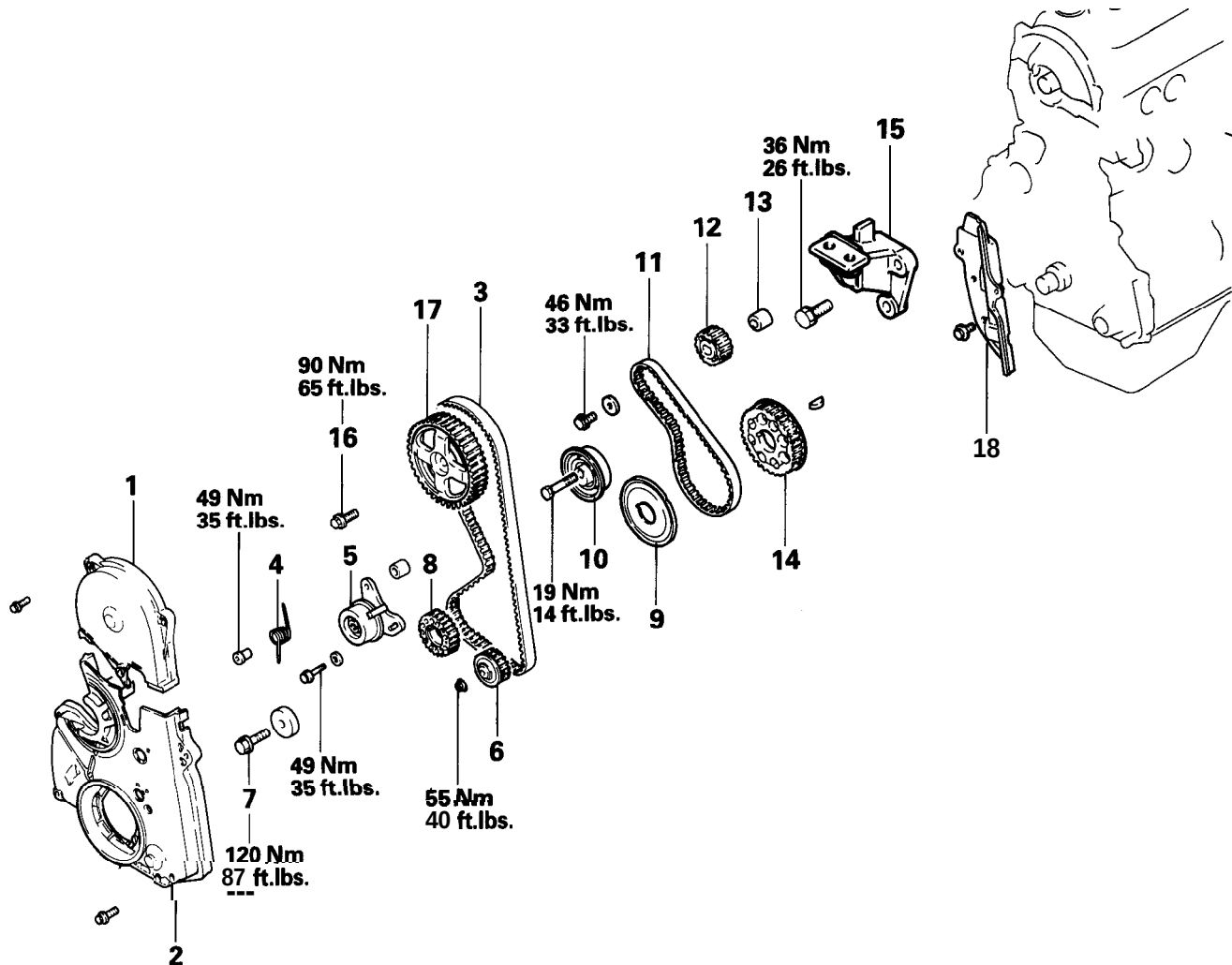
- (1) Turn the crankshaft so that the No. 1 cylinder is at top dead center.
- (2) Align the punch mark on the crankshaft position sensor housing with the notch in the plate.
- (3) Install the crankshaft position sensor on the cylinder head.

◆B◆ DRIVE BELT TENSION ADJUSTMENT

Refer to "◆B◆ DRIVE BELT TENSION ADJUSTMENT" on page 11C-24.

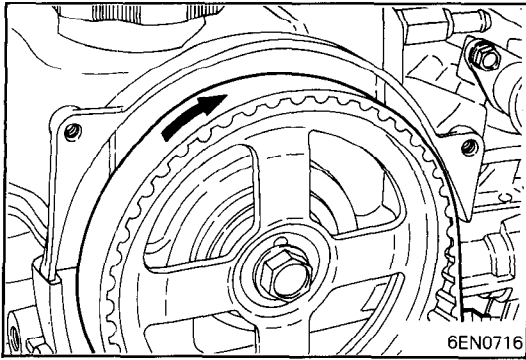
TIMING BELT – SOHC

REMOVAL AND INSTALLATION



Removal steps

1. Timing belt front upper cover
2. Timing belt front lower cover
- ◇A◇ ◇H◇ 3. Timing belt
- ◇G◇ 4. Tensioner spring
- ◇G◇ 5. Tensioner
- ◇B◇ ◇F◇ 6. Oil pump sprocket
- ◇C◇ ◇E◇ 7. Crankshaft bolt
- ◇D◇ 8. Crankshaft sprocket
9. Flange
10. Tensioner "B"
- ◇E◇ ◇D◇ 11. Timing belt "B"
- ◇F◇ ◇C◇ 12. Silent shaft sprocket, right
- ◇B◇ 13. Spacer
- ◇G◇ 14. Crankshaft sprocket "B"
15. Engine support bracket, left
- ◇H◇ ◇A◇ 16. Camshaft sprocket bolt
17. Camshaft sprocket
18. Timing belt rear cover

**REMOVAL SERVICE POINTS****◊A◊ TIMING BELT REMOVAL**

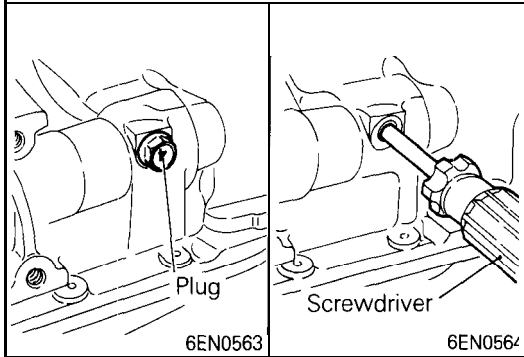
- (1) Mark the belt running direction for reference in reinstallation.

NOTE

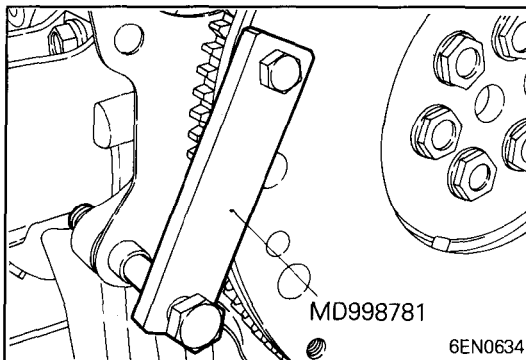
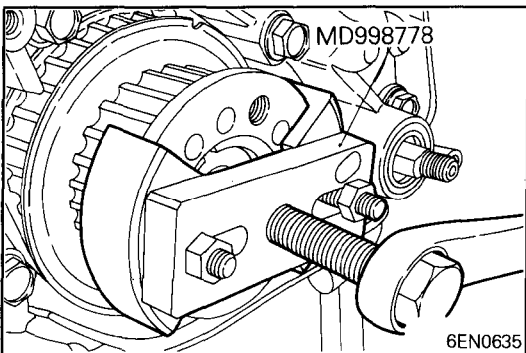
- (1) Water or oil on the belt shortens its life drastically, so the removed timing belt, sprocket, and tensioner must be free from oil and water. These parts should not be washed. Replace parts if seriously contaminated.
- (2) If there is oil or water on each part, check the front case oil seals, camshaft oil seal and water pump for leaks.

◊B◊ OIL PUMP SPROCKET REMOVAL

- (1) Remove the plug on the left side of the cylinder block.
- (2) Insert a Phillips screwdriver [shank diameter 8 mm (.31 in.)] to block the left silent shaft.
- (3) Remove the nut.
- (4) Remove the oil pump sprocket.

**◊C◊ CRANKSHAFT BOLT REMOVAL**

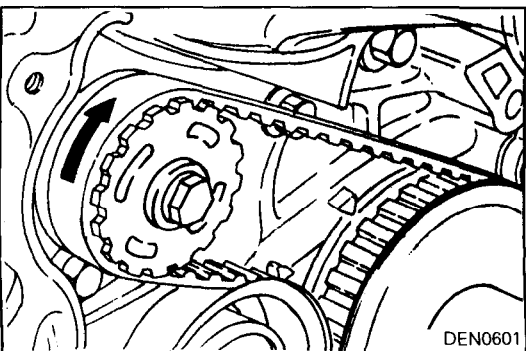
- (1) Using the special tool, hold the drive plate or flywheel.
- (2) Remove the crankshaft bolt.

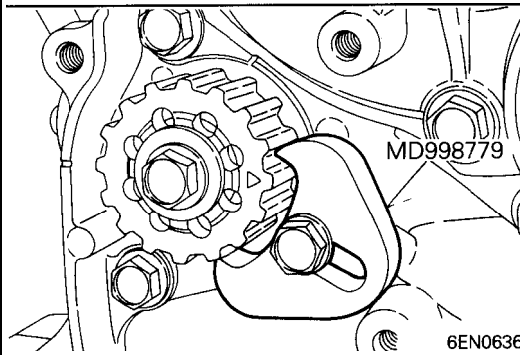
**◊D◊ CRANKSHAFT SPROCKET REMOVAL****◊E◊ TIMING BELT "B" REMOVAL**

- (1) Make a mark on the back of the timing belt indicating the direction of rotation so that it may be reassembled in the same direction if it is to be reused.

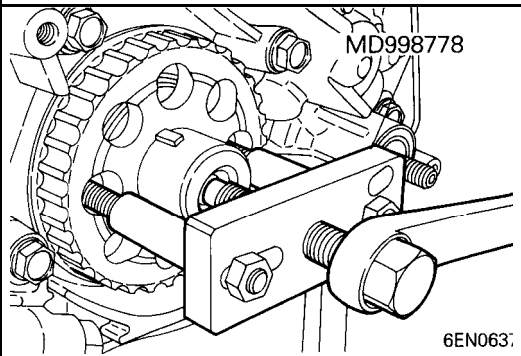
NOTE

- (1) Water or oil on the belt shortens its life drastically, so the removed timing belt, sprocket, and tensioner must be free from oil and water. These parts should not be washed. Replace parts if seriously contaminated.
- (2) If there is oil or water on each part, check the front case oil seals, camshaft oil seal and water pump for leaks.

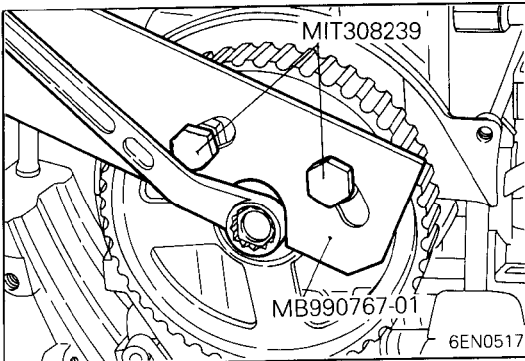




◊F◊ SILENT SHAFT SPROCKET REMOVAL



◊G◊ CRANKSHAFT SPROCKET "B" REMOVAL



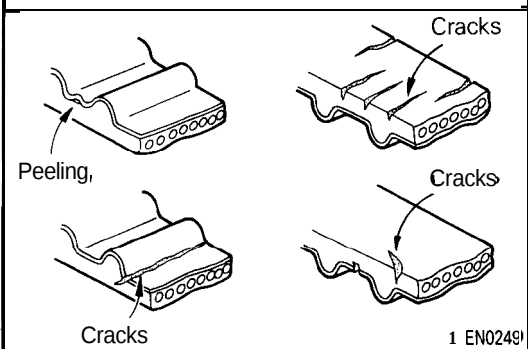
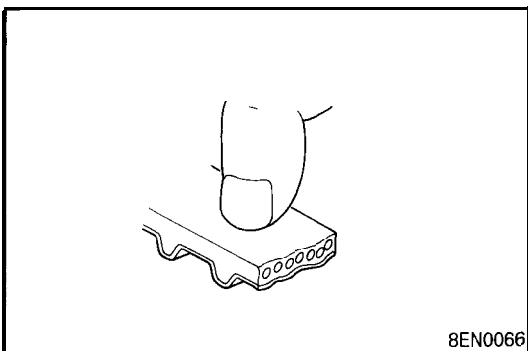
◊H◊ CAMSHAFT SPROCKET BOLT REMOVAL

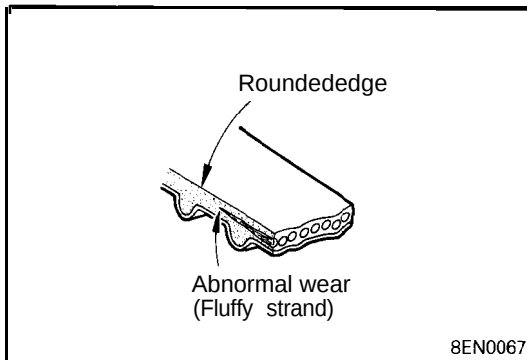
INSPECTION

TIMING BELT

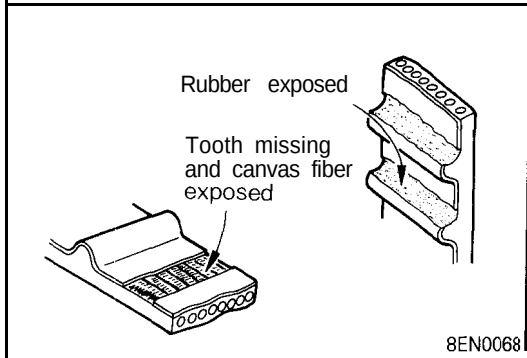
Replace belt if any of the following conditions exist.

- (1) Hardening of back rubber – the back side is glossy without resilience and leaves no indent when pressed with finger-nail.
- (2) Cracks on rubber back.
- (3) Cracks or peeling of canvas.
- (4) Cracks on rib root.
- (5) Cracks on belt sides.



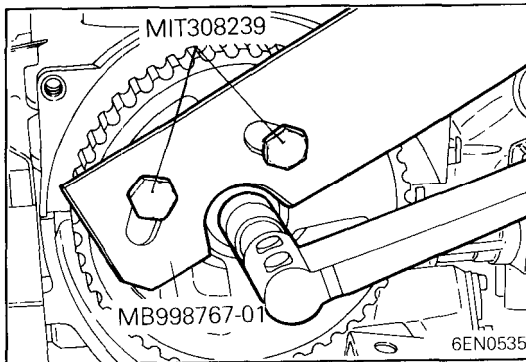


(6) Abnormal wear of belt sides. The sides are normal if they are sharp as if cut by a knife.



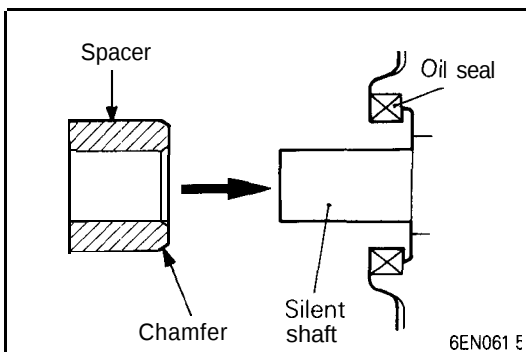
(7) Abnormal wear on teeth.

(8) Missing tooth.



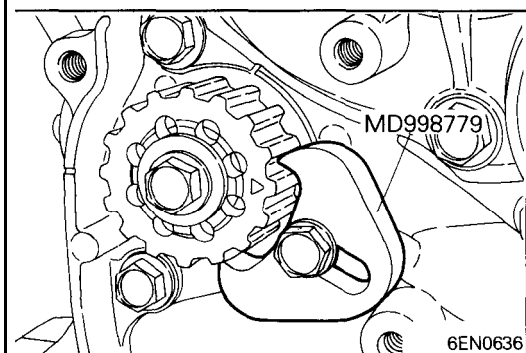
INSTALLATION SERVICE POINTS

▶▶ CAMSHAFT SPROCKET BOLT INSTALLATION

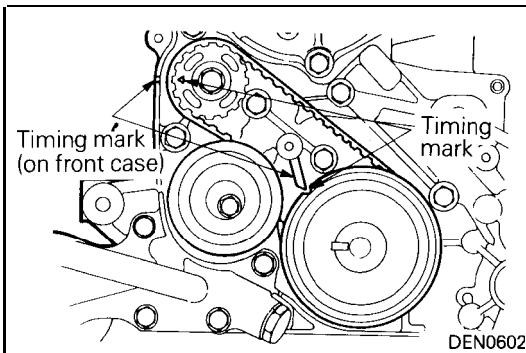


▶▶ SPACER INSTALLATION

(1) Install the spacer with the chamfered end toward the oil seal.

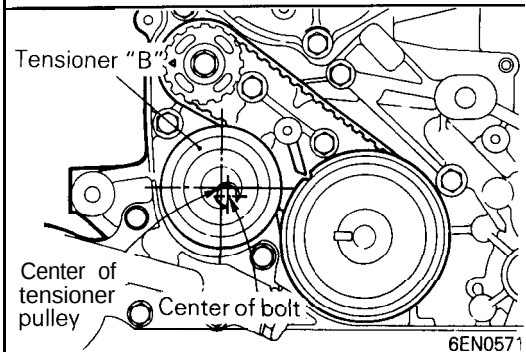


▶▶ SILENT SHAFT SPROCKET INSTALLATION

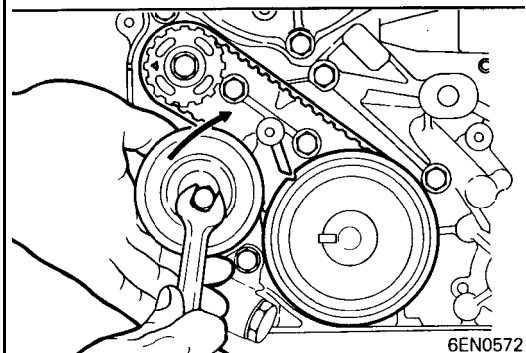


◆D TIMING BELT “B” INSTALLATION

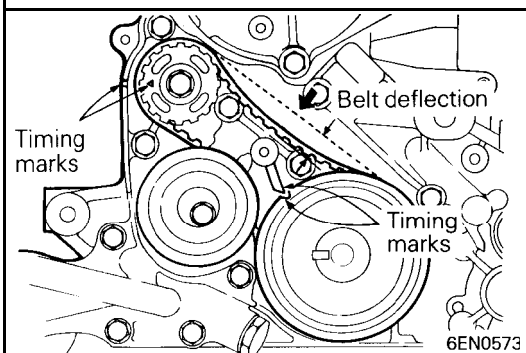
- (1) Align timing marks on the crankshaft sprocket “B” and silent shaft sprocket with the marks on the front case respectively.
- (2) Install the timing belt “B” on the crankshaft sprocket “B” and silent shaft sprocket. There should be no slack on the tension side.



- (3) Make sure that the relationship between the tensioner pulley center and the bolt center is as shown in the illustration.



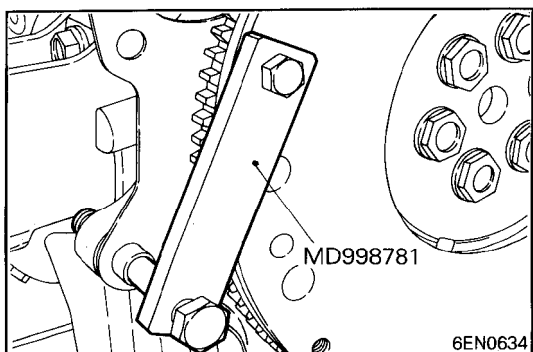
- (4) Move the tensioner “B” in the direction of arrow while lifting with a finger to give a sufficient tension to the tension side of timing belt. In this condition, tighten the bolt to secure tensioner “B”. When the bolt is tightened, use care to prevent shaft from turning together. If the shaft is turned together, the belt will be overtensioned.

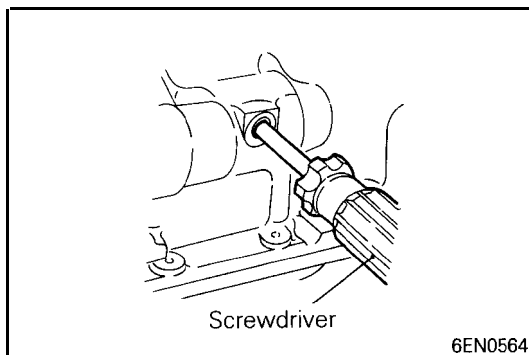


- (5) Check to ensure that the timing marks on the sprockets and front case are in alignment.
- (6) Press with index finger the center of span on the tension side of timing belt “B”. The belt must deflect 5 – 7 mm (.20 – .28 in.).

◆E CRANKSHAFT BOLT INSTALLATION

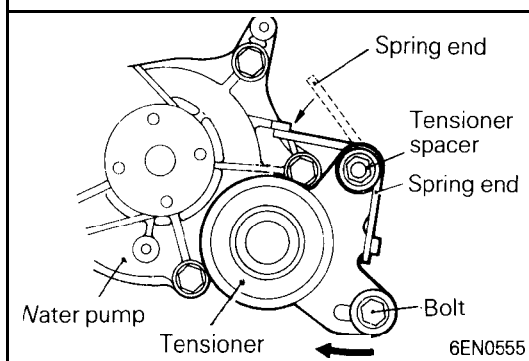
- (1) Using the special tool, hold the drive plate or flywheel.
- (2) Install the crankshaft bolt.





◆F◆ OIL PUMP SPROCKET INSTALLATION

- (1) Insert a Phillips screwdriver [shank diameter 8 mm (.31 in.)] through the plug hole on the left side of the cylinder block to block the left silent shaft.
- (2) Install the oil pump sprocket.
- (3) Apply an appropriate amount of engine oil to the bearing surface of the nut.
- (4) Tighten the nut to the specified torque.

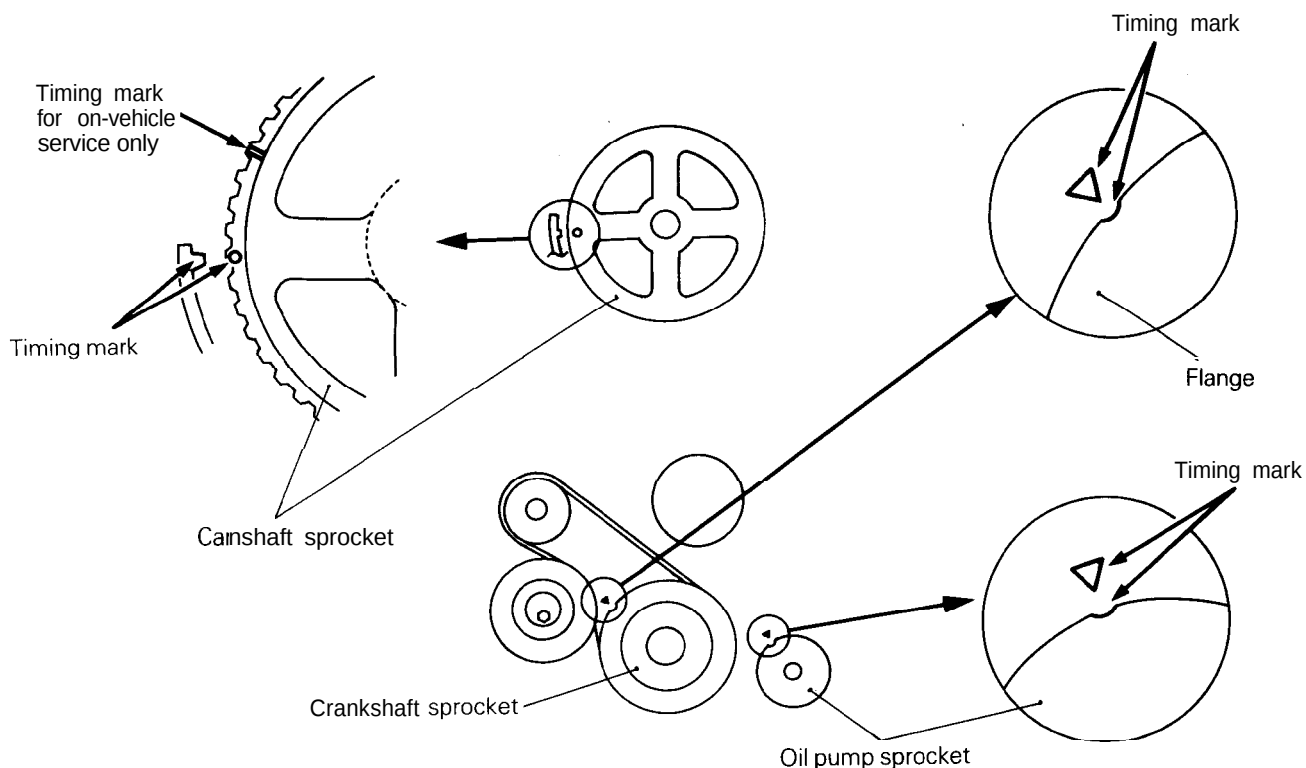


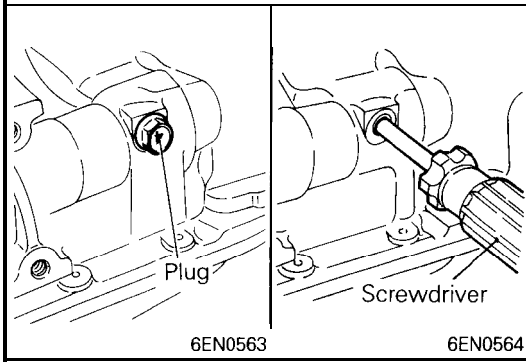
◆G◆ TENSIONER INSTALLATION

- (1) Hook the tensioner spring ends to the water pump body projection and tensioner bracket.
- (2) Move the tensioner fully toward the water pump and tighten the bolt and tensioner spacer.

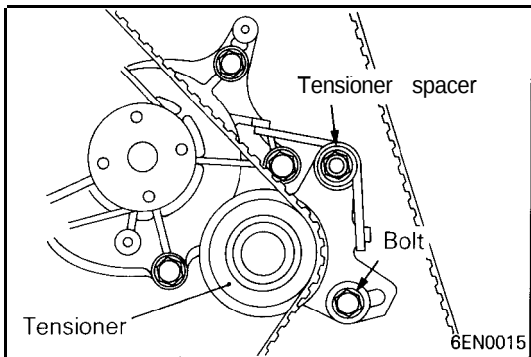
◆H◆ TIMING BELT INSTALLATION

- (1) Align the timing marks on camshaft sprocket and crankshaft sprocket with their mating marks.
- (2) Align the timing mark on the oil pump sprocket with its mating mark.

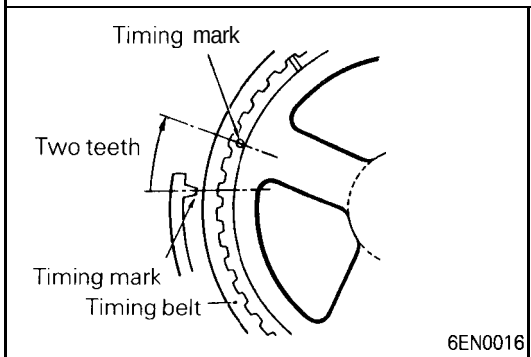




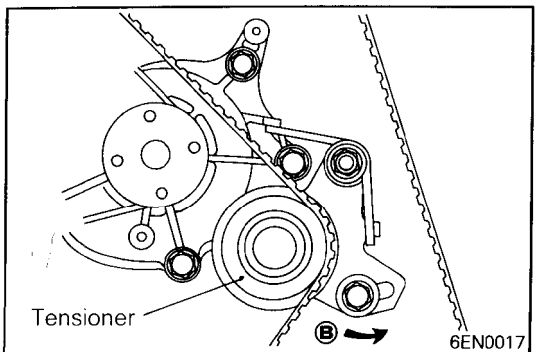
- (3) Remove the plug on the cylinder block and insert a Phillips screwdriver [shank diameter 8 mm (.31 in.)] through the hole (Engine with silent shafts).
If it can be inserted as deep as 60 mm (2.4 in.) or more, the timing marks are correctly aligned. If the inserted depth is only 20 – 25 mm (.8 – 1.0 in.), turn the oil pump sprocket one turn and realign the timing marks. Then check to ensure that the screwdriver can be inserted 60 mm (2.4 in.) or more. Keep the screwdriver inserted until installation of the timing belt is finished.
- (4) Install the timing belt on the crankshaft sprocket, oil pump sprocket and camshaft sprocket in that order. There should be no slack on the tension side.



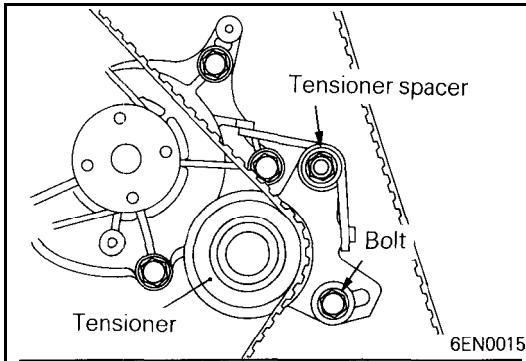
- (5) Loosen the tensioner mounting bolt and tensioner spacer.



- (6) Turn the crankshaft clockwise by two teeth of camshaft sprocket (or crankshaft sprocket).



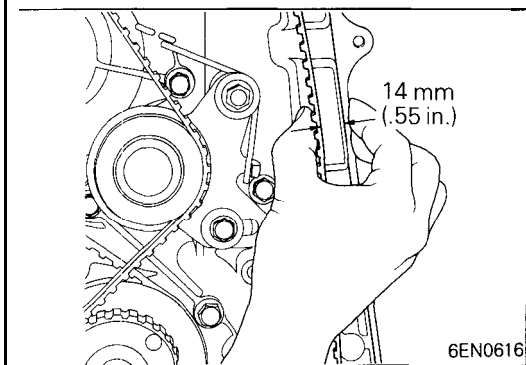
- (7) Apply force to the tensioner in the direction shown by arrow **B** to make the belt engage completely with each sprocket.



- (8) Tighten the tensioner attaching bolt, then tighten the tensioner spacer.

Caution

If the tensioner spacer is tightened first, the tensioner turns as the tensioner spacer is tightened, resulting in an excessive belt tension.

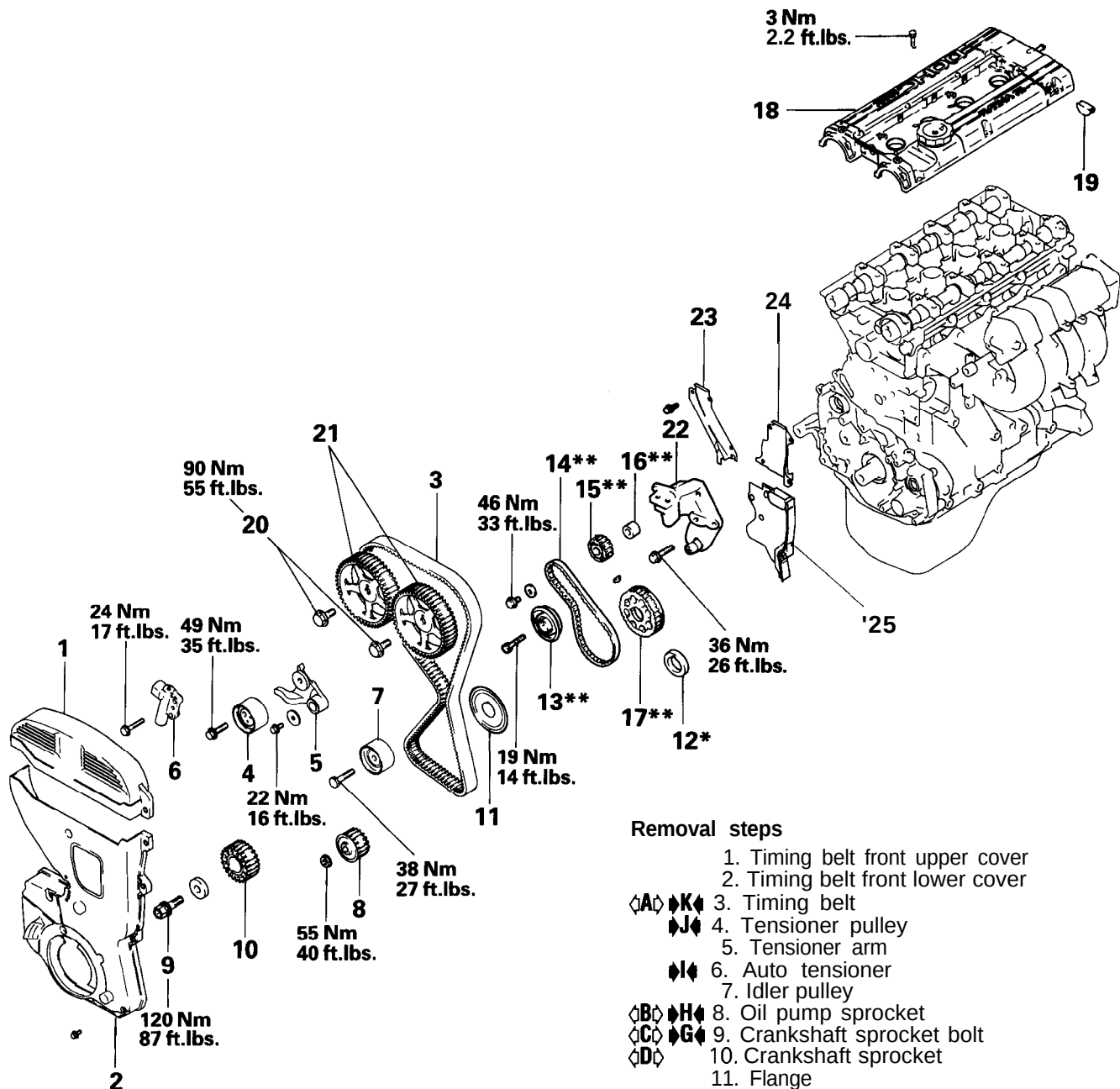


- (9) Hold the center of the tension side span of the timing belt (between the camshaft and oil pump sprockets) between your thumb and index finger as shown. Then, make sure that the clearance between the belt back surface and cover is standard value.

Standard value: 14 mm (.55 in.)

TIMING BELT – DOHC

REMOVAL AND INSTALLATION

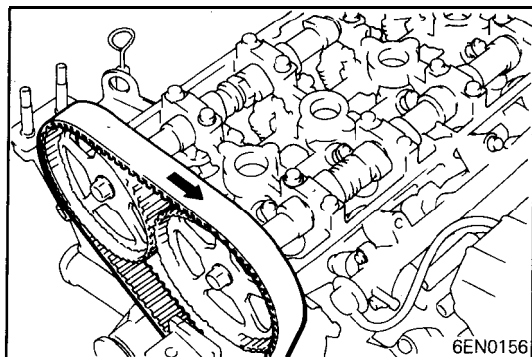


Removal steps

1. Timing belt front upper cover
2. Timing belt front lower cover
3. Timing belt
4. Tensioner pulley
5. Tensioner arm
6. Auto tensioner
7. Idler pulley
8. Oil pump sprocket
9. Crankshaft sprocket bolt
10. Crankshaft sprocket
11. Flange
12. Spacer*
13. Tensioner "B"***
14. Timing belt "B"***
15. Silent shaft sprocket**
16. Spacer**
17. Crankshaft sprocket "B"***
18. Rocker cover
19. Semi-circular packing
20. Camshaft sprocket bolt
21. Camshaft sprocket
22. Engine support bracket
23. Timing belt rear right cover
24. Timing belt rear left upper cover
25. Timing belt rear left lower cover

NOTE

- * : Engine without silent shafts
 ** Engine with silent shafts

**REMOVAL SERVICE POINTS****◊A◊ TIMING BELT REMOVAL**

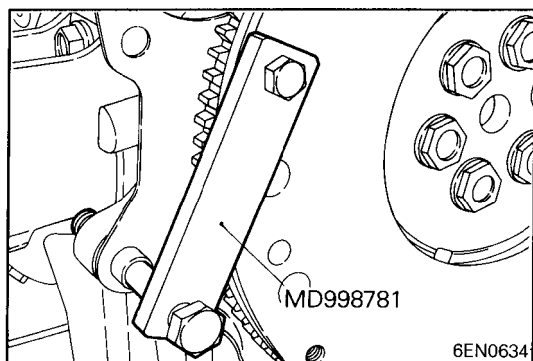
- (1) Make a mark on the back of the timing belt indicating the direction of rotation so that it may be reassembled in the same direction if it is to be reused.

NOTE

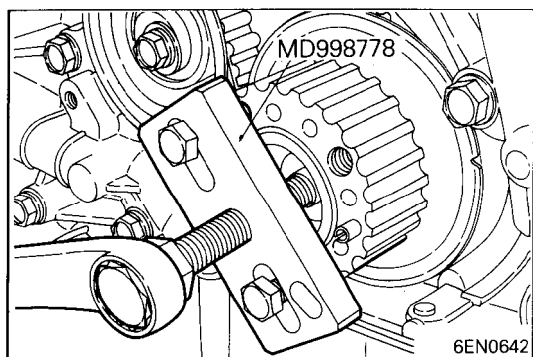
- (1) Water or oil on the belt shortens its life drastically, so the removed timing belt, sprocket, and tensioner must be free from oil and water. These parts should not be washed. Replace parts if seriously contaminated.
- (2) If there is oil or water on each part, check the front case oil seals, camshaft oil seal and water pump for leaks.

◊B◊ OIL PUMP SPROCKET REMOVAL (ENGINE WITH SILENT SHAFTS)

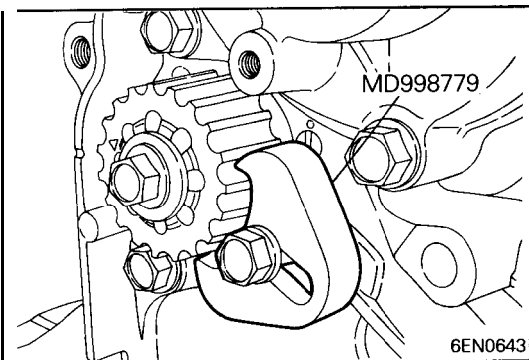
Refer to "◊B◊ OIL PUMP SPROCKET REMOVAL" on page 11 C-29.

**◊C◊ CRANKSHAFT BOLT REMOVAL**

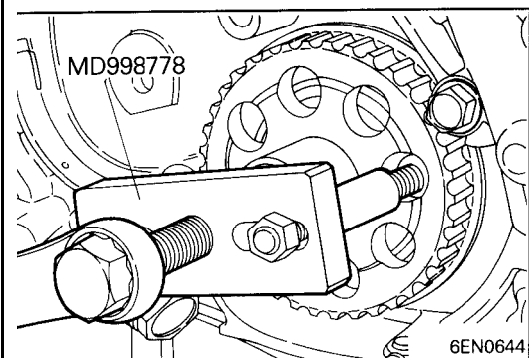
- (1) Using the special tool, hold the drive plate or flywheel.
- (2) Remove the crankshaft bolt.

**◊D◊ CRANKSHAFT SPROCKET REMOVAL****◊E◊ TIMING BELT "B" REMOVAL (ENGINE WITH SILENT SHAFTS)**

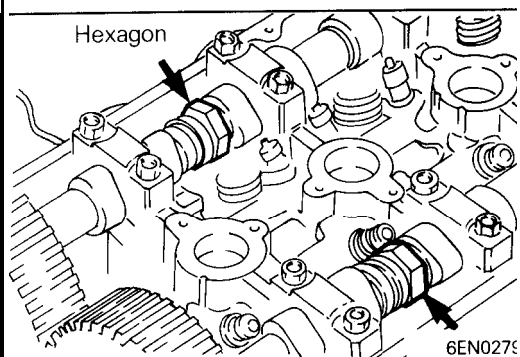
Refer to "◊E◊ TIMING BELT "B" REMOVAL" on page 11 C-29.



◁F▷ SILENT SHAFT SPROCKET REMOVAL



◁G▷ CRANKSHAFT SPROCKET "B" REMOVAL



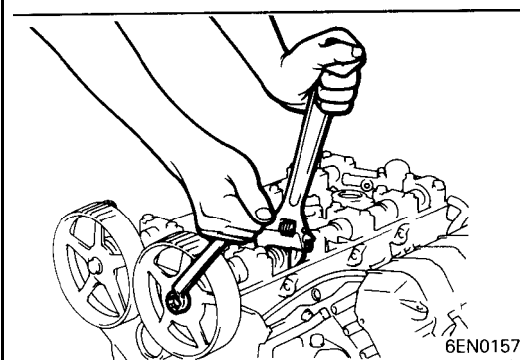
◁H▷ CAMSHAFT SPROCKET REMOVAL

- (1) Using a wrench, hold the camshaft at its hexagon (between the No. 2 and No. 3 journals) and remove the camshaft sprocket bolt.

Caution

Locking the camshaft sprocket with a tool damages the sprocket.

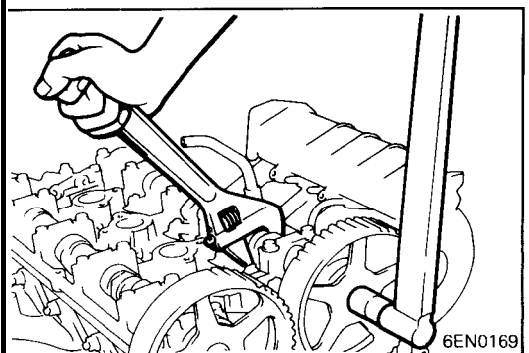
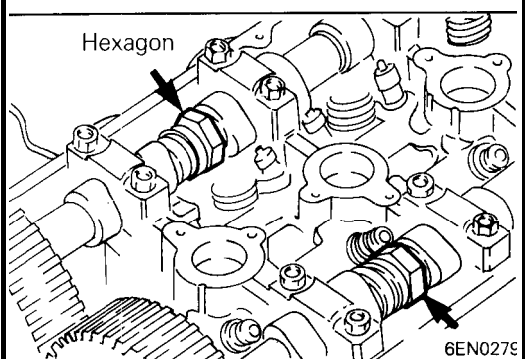
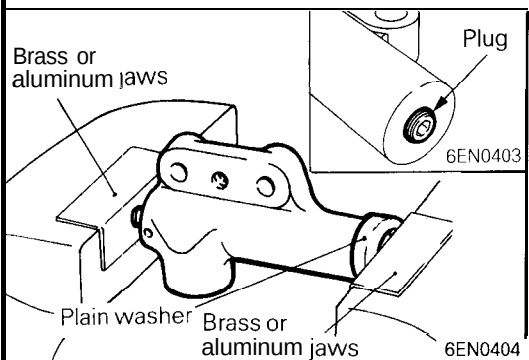
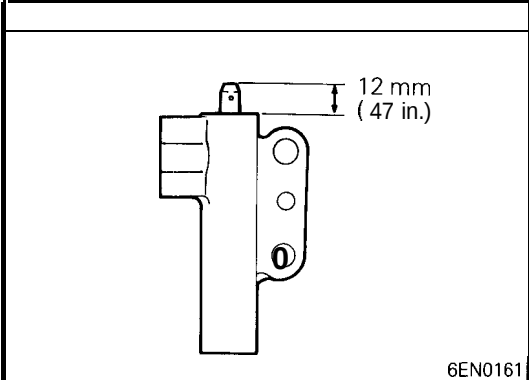
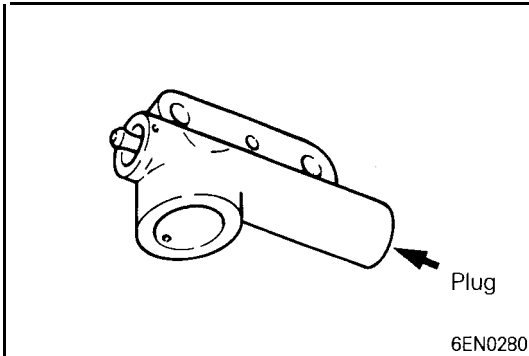
- (2) Remove the camshaft sprockets.



INSPECTION

TIMING BELTS

Refer to "INSPECTION" on page 1 1C-29.



AUTO TENSIONER

- (1) Check the auto tensioner for possible leaks and replace as necessary.
- (2) Check the rod end for wear or damage and replace as necessary.

- (3) Measure the rod protrusion. If it is out of specification, replace the auto tensioner.

Standard value: 12 mm (.47 in.)

- (4) Clamp the auto tensioner in a vise with soft jaws.

Caution

The plug protrudes at the bottom of the auto tensioner. Insert a plain washer as illustrated to prevent the plug from being in direct contact with the vise.

- (5) Turning the vise handle, push in the auto tensioner rod. If the rod can be easily retracted, replace the auto tensioner. You should feel a fair amount of resistance when pushing the rod in.

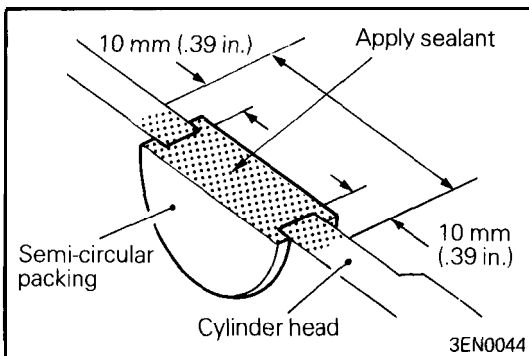
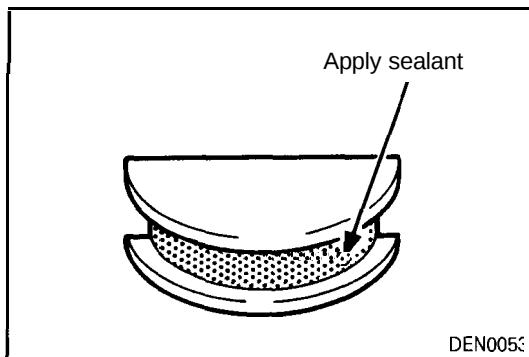
INSTALLATION SERVICE POINTS

⚠ CAMSHAFT SPROCKET INSTALLATION

- (1) Using a wrench, hold the camshaft at its hexagon (between the No. 2 and No. 3 journals) and tighten the bolt to the specification.

Caution

Locking the camshaft sprocket with a tool damages the sprocket.



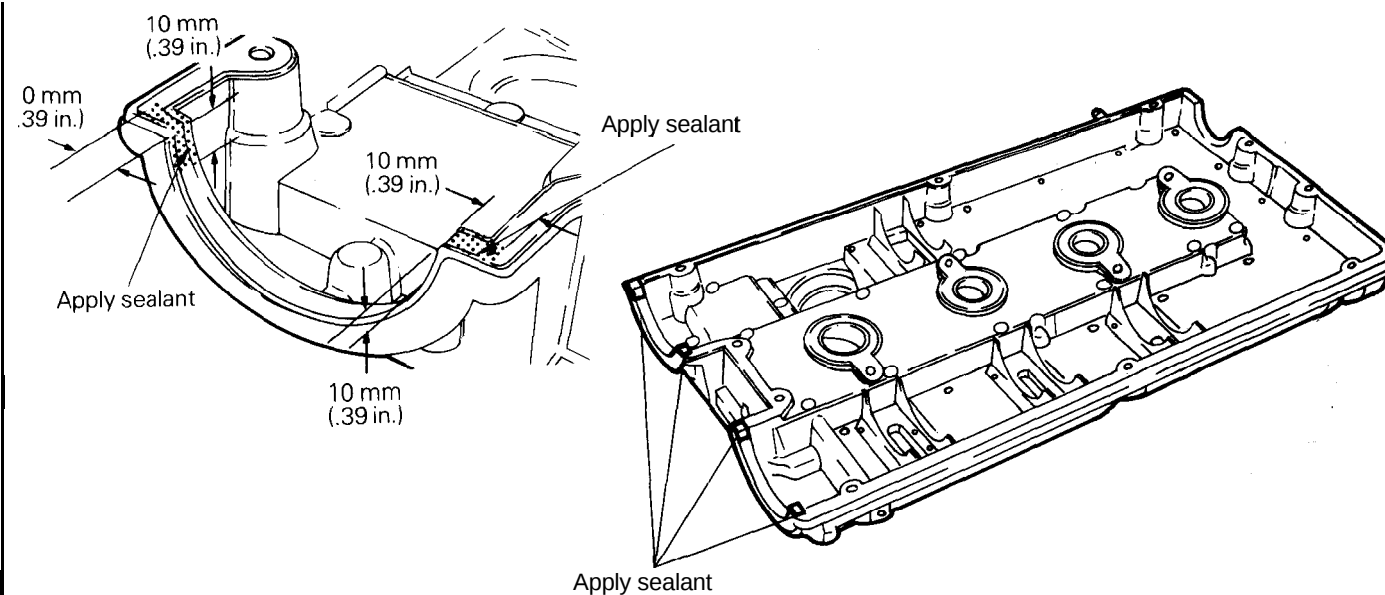
▶B▶ SEALANT APPLICATION ON SEMI-CIRCULAR PACKING

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

▶C▶ SEALANT APPLICATION ON ROCKER COVER

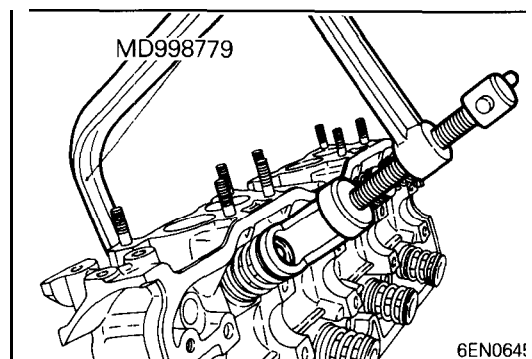
Apply sealant to the areas indicated in the illustration.

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

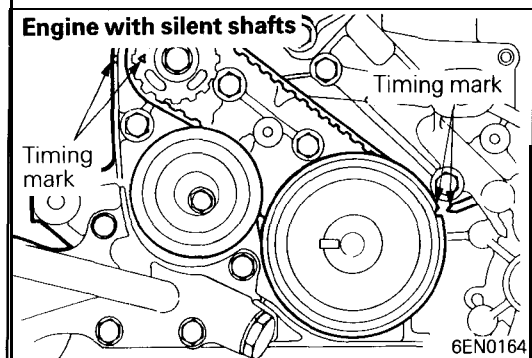


◆D◆ SPACER INSTALLATION (ENGINE WITH SILENT SHAFTS)

Refer to "◆B◆ SPACER INSTALLATION" on page 11C-31.

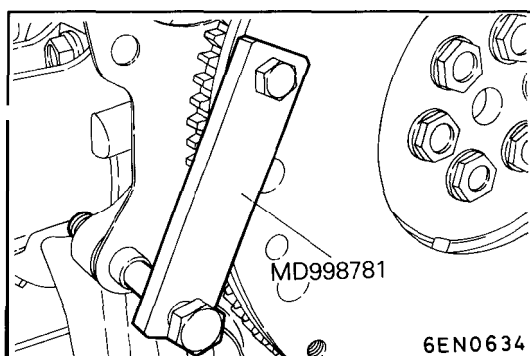


◆E◆ SILENT SHAFT SPROCKET INSTALLATION



◆F◆ TIMING BELT "B" INSTALLATION (ENGINE WITH SILENT SHAFTS)

Refer to Page 11 C-32. Note that the timing mark locations differ from those on the single camshaft engine.

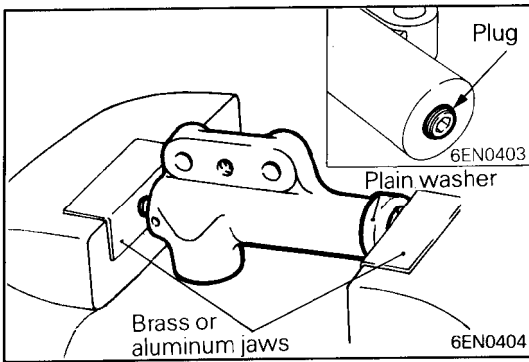


◆G◆ CRANKSHAFT BOLT INSTALLATION

- (1) Using the special tool, hold the drive plate or flywheel.
- (2) Install the crankshaft bolt.

◆H◆ OIL PUMP SPROCKET INSTALLATION (ENGINE WITH SILENT SHAFTS)

Refer to "◆F◆ OIL PUMP SPROCKET INSTALLATION" on page 11 C-33.

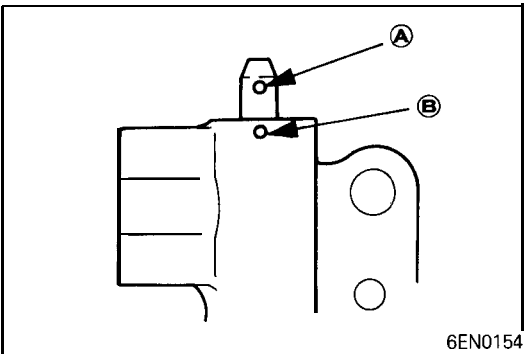


❖❖ AUTO TENSIONER INSTALLATION

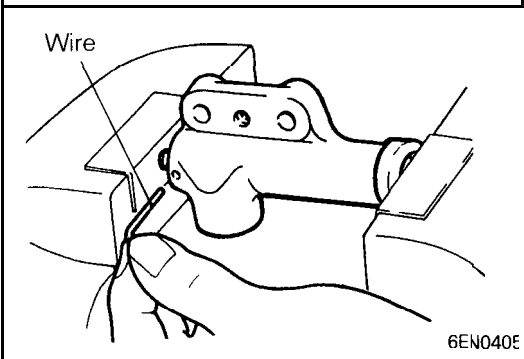
- (1) If the auto tensioner rod is in its fully extended position, reset it as follows.
- (2) Clamp the auto-tensioner in the vise with soft jaws.

Caution

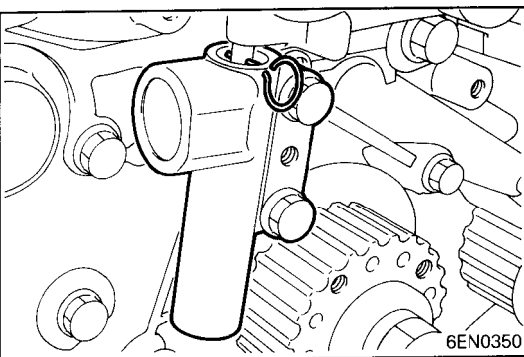
The plug protrudes at the bottom of the auto tensioner. Insert a plain washer as illustrated to prevent the plug from being in direct contact with the vise.



- (3) Push in the rod little by little with the vise until the set hole (A) in the rod is aligned with the hole (B) in the cylinder.



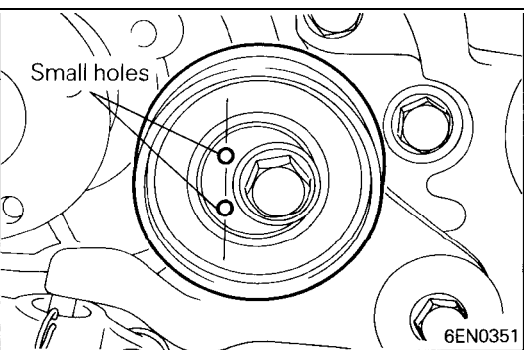
- (4) Insert a wire [1.4 mm (.055 in.) in diameter] into the set holes.
- (5) Unclamp the auto tensioner from the vise.



- (6) Install the auto tensioner to front case and tighten to the specified torque.

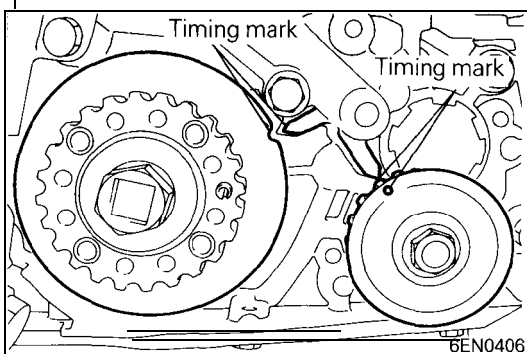
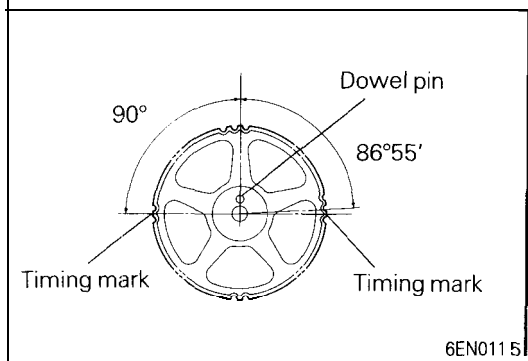
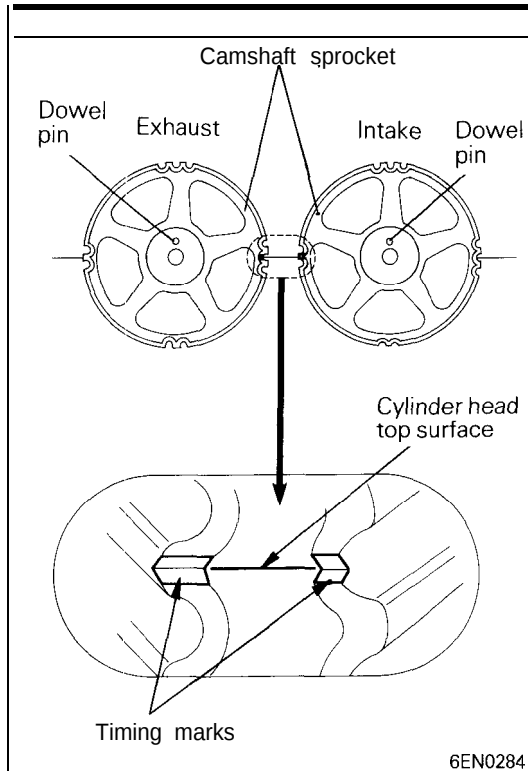
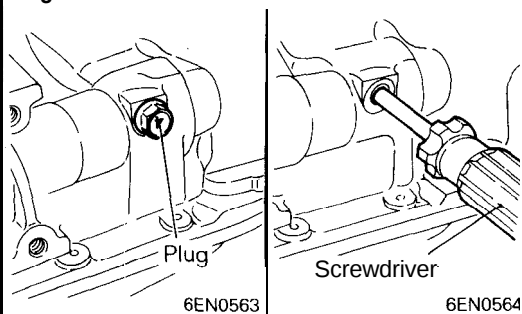
Caution

Leave the wire installed in the auto tensioner.



❖❖ TENSIONER PULLEY INSTALLATION

- (1) Install the tensioner pulley in such direction that its two small holes are arranged vertically.

**Engine with silent shafts****⚡ TIMING BELT INSTALLATION**

- (1) Turn the two sprockets so that their dowel pins are located on top. Then, align the timing marks facing each other with the top surface of the cylinder head. When you let go of the exhaust camshaft sprocket, it will rotate one tooth in the counterclockwise direction. This should be taken into account when installing the timing belt on the sprockets.

NOTE

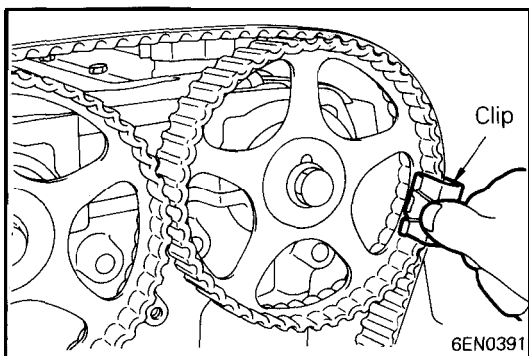
The same camshaft sprocket which is provided with two timing marks is used for the intake and exhaust camshafts. When the sprocket is mounted on the exhaust camshaft, use the timing mark on the right with the dowel pin hole on top. For the intake camshaft sprocket, use the one on the left with the dowel pin hole on top.

- (2) Align the crankshaft sprocket timing marks.
- (3) Align the oil pump sprocket timing marks (Engine with silent shafts).

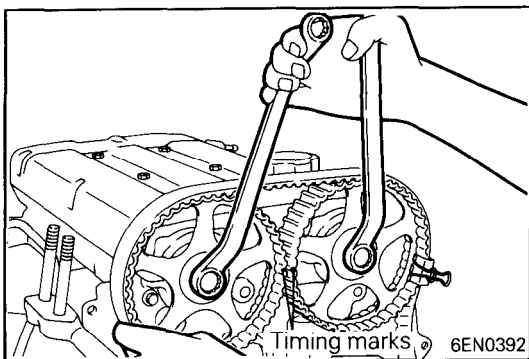
- (4) Insert a Phillips screwdriver [shank diameter 8 mm (.31in.)] through the plug hole (Engine with silent shafts). If it can be inserted as deep as 60 mm (2.4 in.) or more, the timing marks are correctly aligned. If the inserted depth is only 20 – 25 mm (.8 – 1.0 in.), turn the oil pump sprocket one turn and realign timing marks. Then check to ensure that the screwdriver can be inserted 60 mm (2.4 in.) or more. Keep the screwdriver inserted until the installation of the timing belt is finished.

NOTE

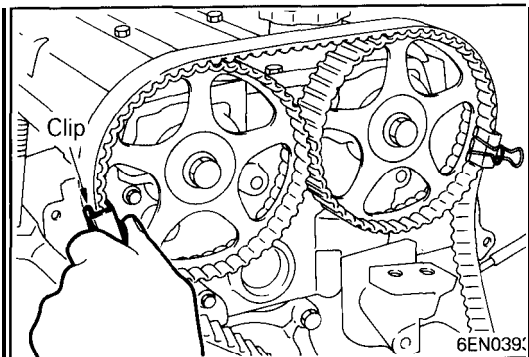
Step (4) is performed to ensure that the oil pump sprocket is correctly positioned with reference to the silent shafts.



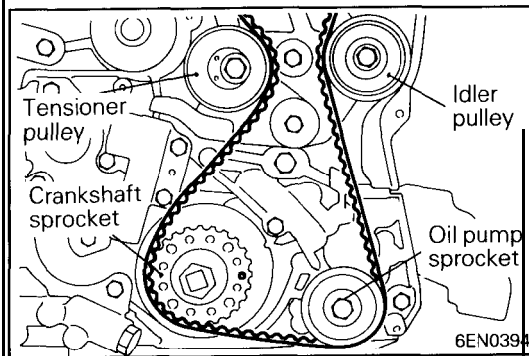
- (5) Thread the timing belt over the intake side camshaft sprocket and fix it at indicated position by a clip.



- (6) Thread the timing belt over the exhaust side sprocket, while aligning the timing marks with the cylinder head top surface using two wrenches.

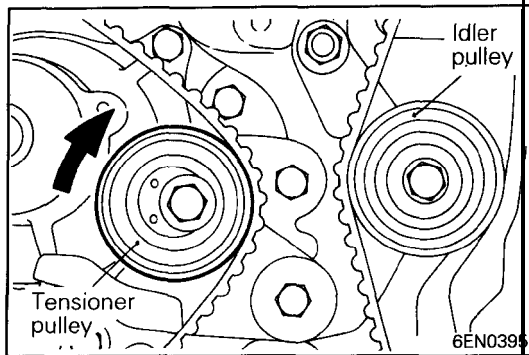


- (7) Fix the belt at indicated position by a clip.



- (8) Thread the timing belt over the idler pulley, the oil pump sprocket, the crankshaft sprocket and the tensioner pulley in the order shown.

- (9) Remove the two clips.

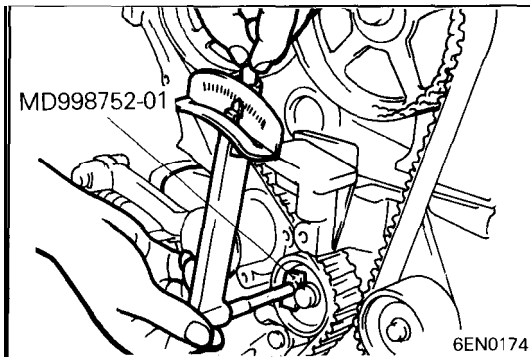


- (10) Lift up the tensioner pulley in the direction of arrow and tighten the center bolt.

- (11) Check to see that all timing marks are lined up.

- (12) Remove the screwdriver inserted in step (4) and fit the plug.
(Engine with silent shafts)

- (13) Give the crankshaft a quarter counter-clockwise turn. Then, turn it clockwise until the timing marks are lined up again.



- (14) Install the special tool, Socket Wrench and Torque Wrench, on the tensioner pulley, and loosen the tensioner pulley center bolt.

NOTE

If the special tool is not available, use a commercially available torque wrench that is capable of measuring 0 – 3 Nm (0 – 2.2 ft.lbs.).

- (15) Torque to 2.6 – 2.8 Nm (1.88 – 2.03 ft.lbs.) with the torque wrench.

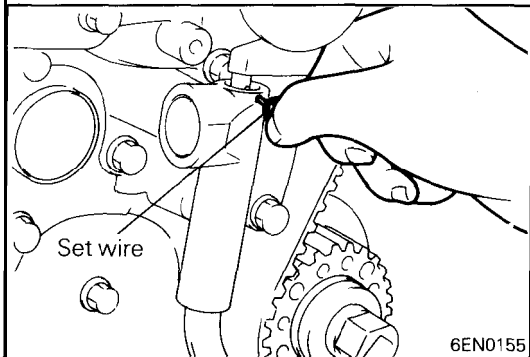
- (16) Holding the tensioner pulley with the special tool and torque wrench, tighten the center bolt to the specification.

- (17) After giving two clockwise turns to the crankshaft, let it alone for approx. 15 minutes. Then, make sure that the auto tensioner setting wire moves freely.

NOTE

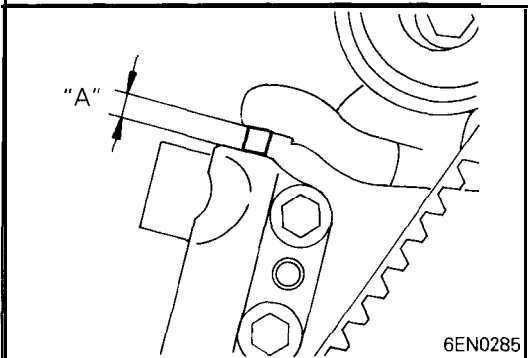
If the wire does not move freely, repeat step (13) above until it moves freely.

- (18) Remove the auto tensioner setting wire.



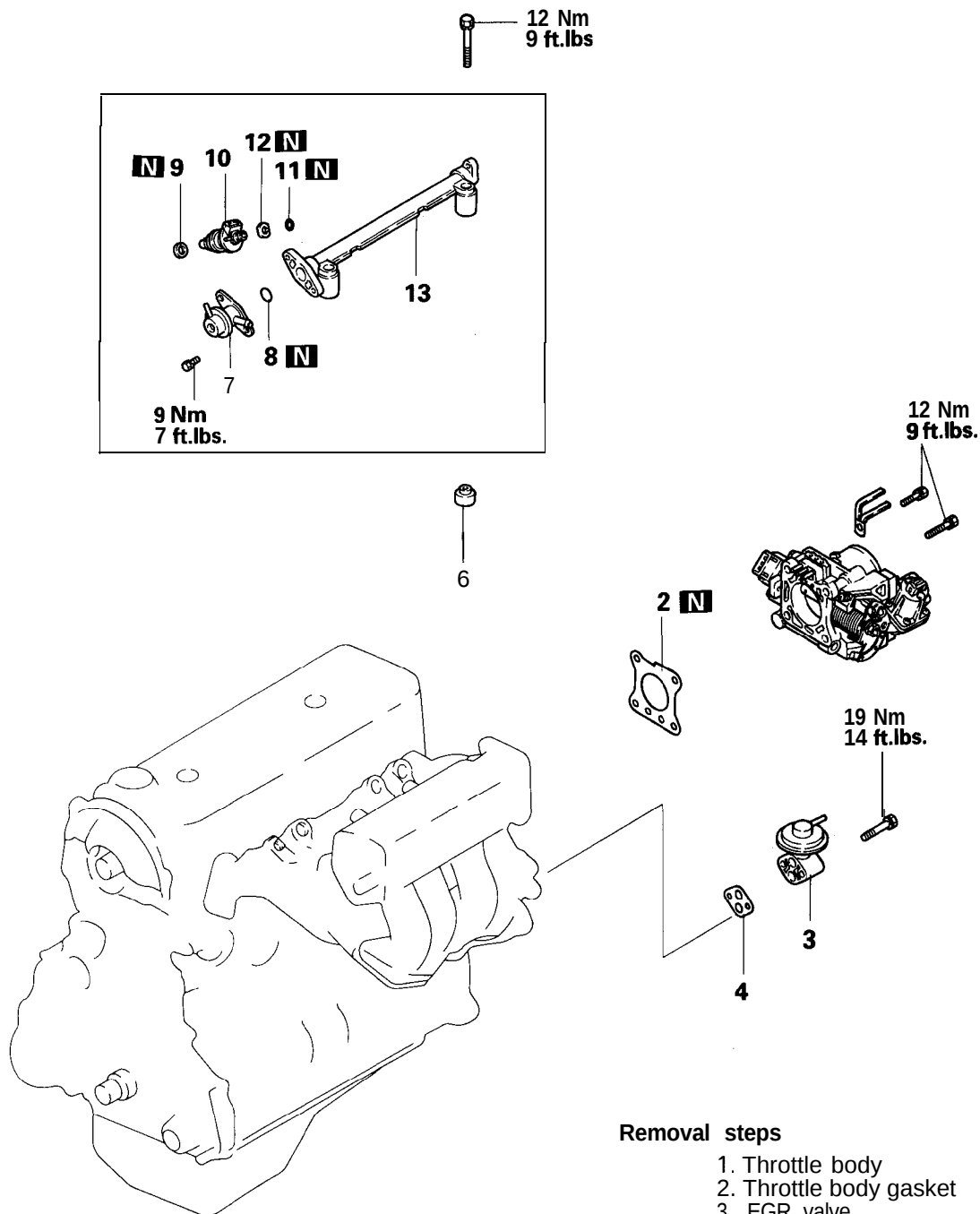
- (19) Measure the distance "A" (between the tensioner arm and auto tensioner body).

Standard value: 3.8 – 4.5 mm (.15 – .18 in.)



FUEL AND EMISSION CONTROL PARTS

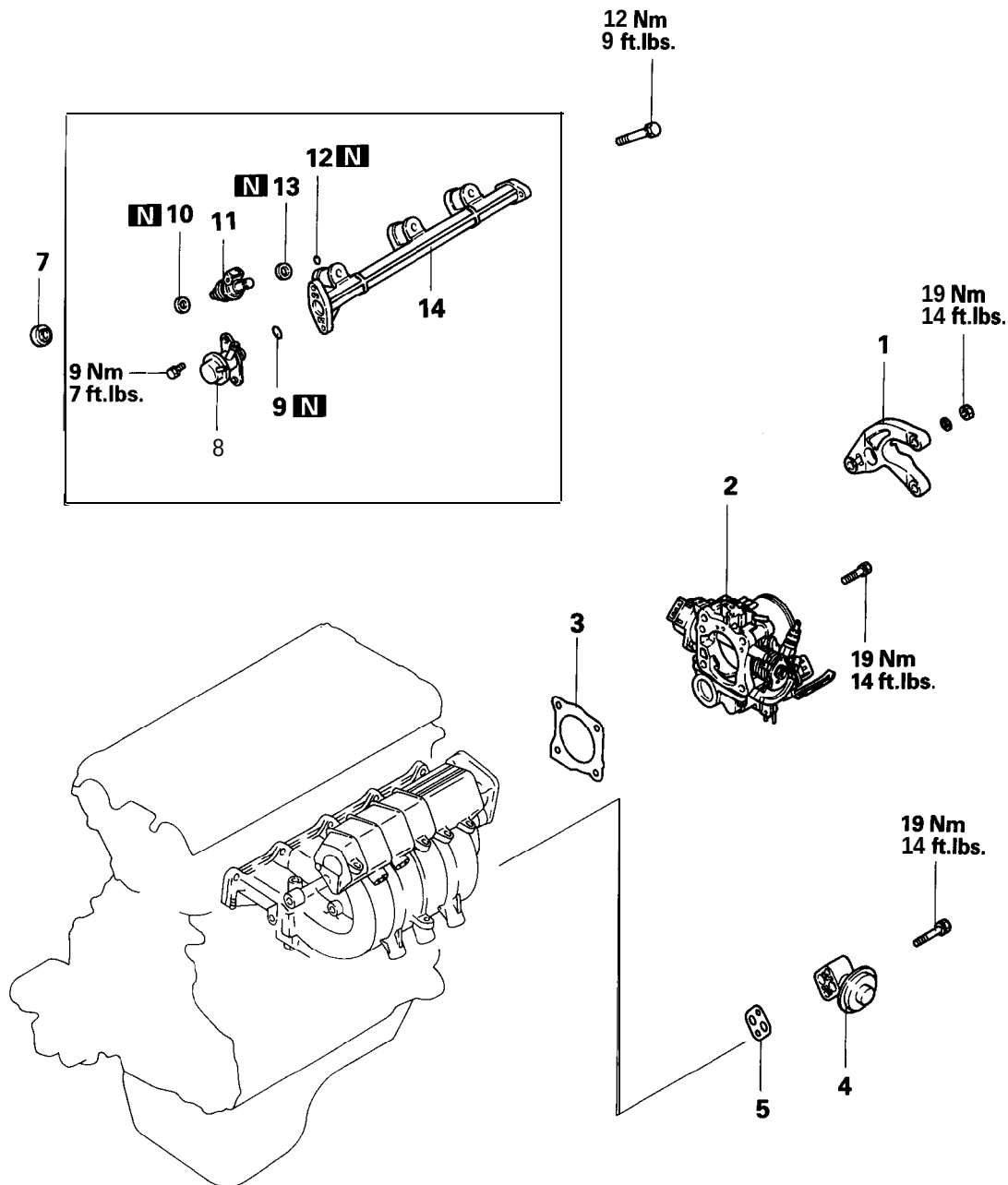
REMOVAL AND INSTALLATION – SOHC for GALANT/EXPO



Removal steps

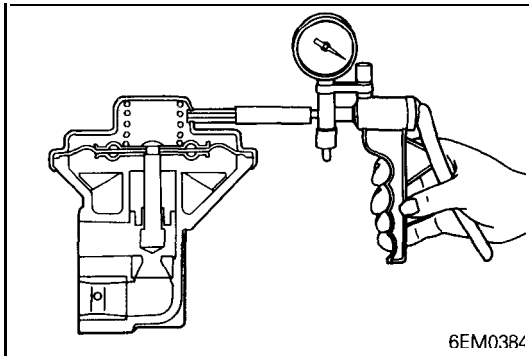
1. Throttle body
2. Throttle body gasket
3. EGR valve
4. EGR valve gasket
5. Injectors and fuel rail
6. Insulator
7. Fuel pressure regulator
- ◆B◆ 8. O-ring
9. Insulator
- ◆A◆ 10. Injectors
11. O-ring
12. Grommet
13. Fuel rail

REMOVAL AND INSTALLATION – DOHC

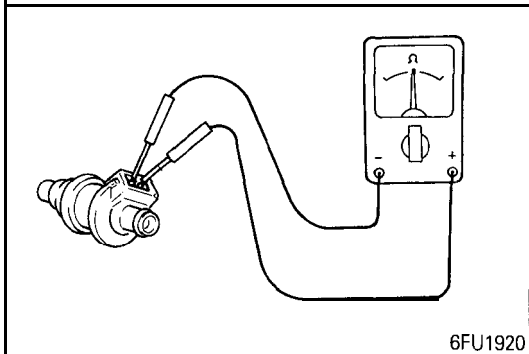


Removal steps

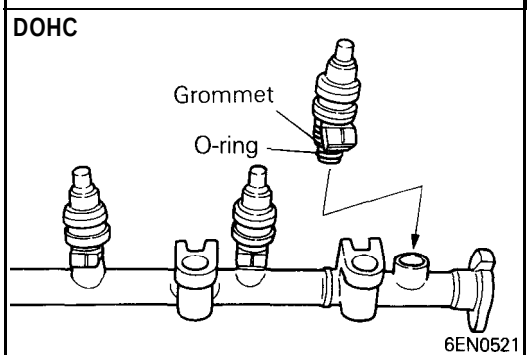
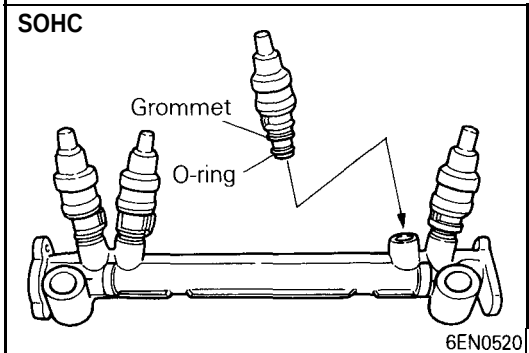
1. Throttle body stay
2. Throttle body
3. Throttle body gasket
4. EGR valve
5. EGR valve gasket
6. Injectors and fuel rail
7. Insulator
8. Fuel pressure regulator
- ◆B◆ 9. O-ring
10. Insulator
- ◆A◆ 11. Injectors
12. O-ring
13. Grommet
14. Fuel rail

**INSPECTION****EGR VALVE**

- (1) Check EGR valve for sticking or carbon deposits. If such conditions exist, clean or replace EGR valve.
- (2) Connect a hand vacuum pump to the nipple of EGR valve and plug other nipple.
- (3) Apply a vacuum of 500 mmHg (19.7 in. Hg) to make sure that a vacuum is maintained. If there is a leak, replace the EGR valve. In addition, check the valve for its opening and closing by applying and removing a vacuum.

**INJECTORS**

- (1) Using an ohmmeter (circuit tester), test for continuity between terminals of injector; the circuit should be closed. If failure is detected, replace the injector.

Standard value:**Non-turbo 13 – 16 Ω [at 20°C (68°F)]****Turbo 2 – 3 Ω [at 20°C (68°F)]****INSTALLATION SERVICE POINTS****◆A◆ INJECTOR INSTALLATION**

- (1) Before installing an injector the rubber O-ring must be lubricated with a drop of clean engine oil to aid in installation.

- (2) Install the injectors from the top end into the fuel rail. Be careful not to damage the O-ring during installation.

◆B◆ FUEL PRESSURE REGULATOR INSTALLATION

- (1) Before installing the pressure regulator the O-ring must be lubricated with a drop of clean engine oil to aid in installation.

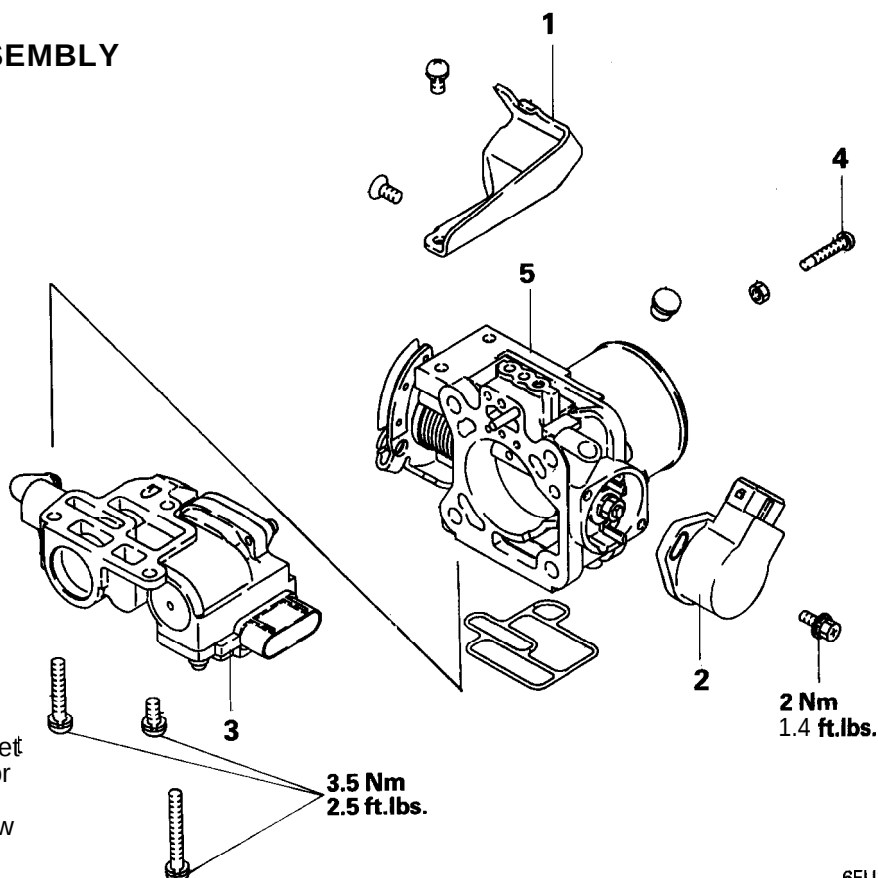
THROTTLE BODY

DISASSEMBLY AND REASSEMBLY

SOHC for EXPO

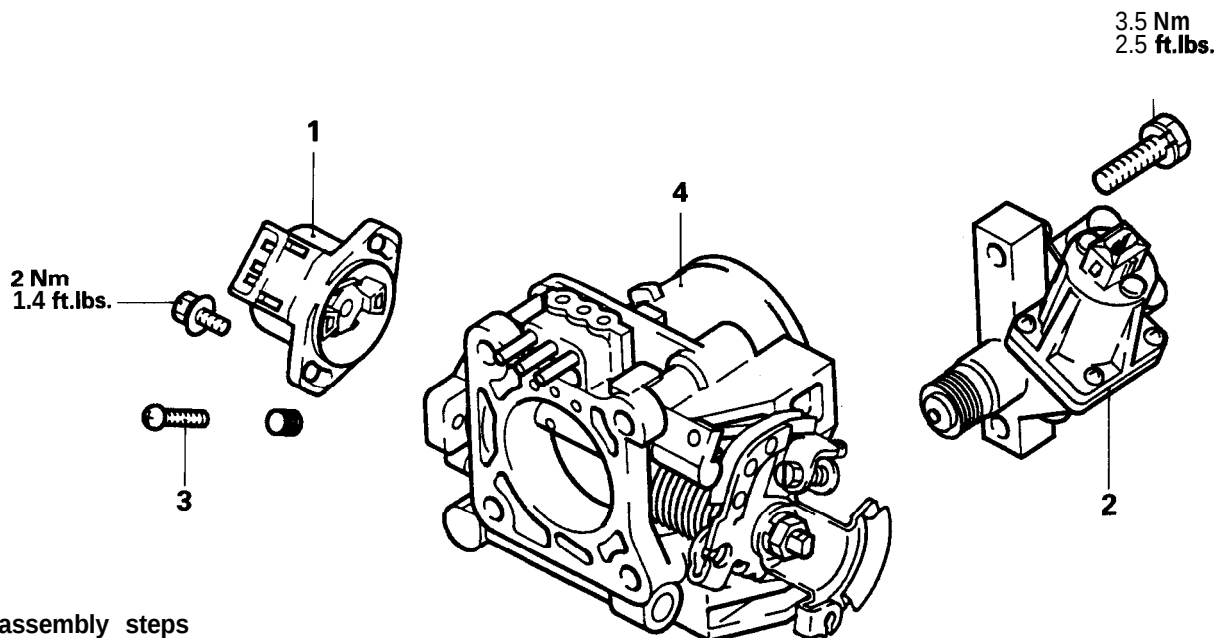
Disassembly steps

1. Accelerator wire bracket
 2. Throttle position sensor
 3. Idle air control motor
 4. Throttle valve set screw
 5. Throttle body



6FU1857

SOHC for GALANT/TRUCK

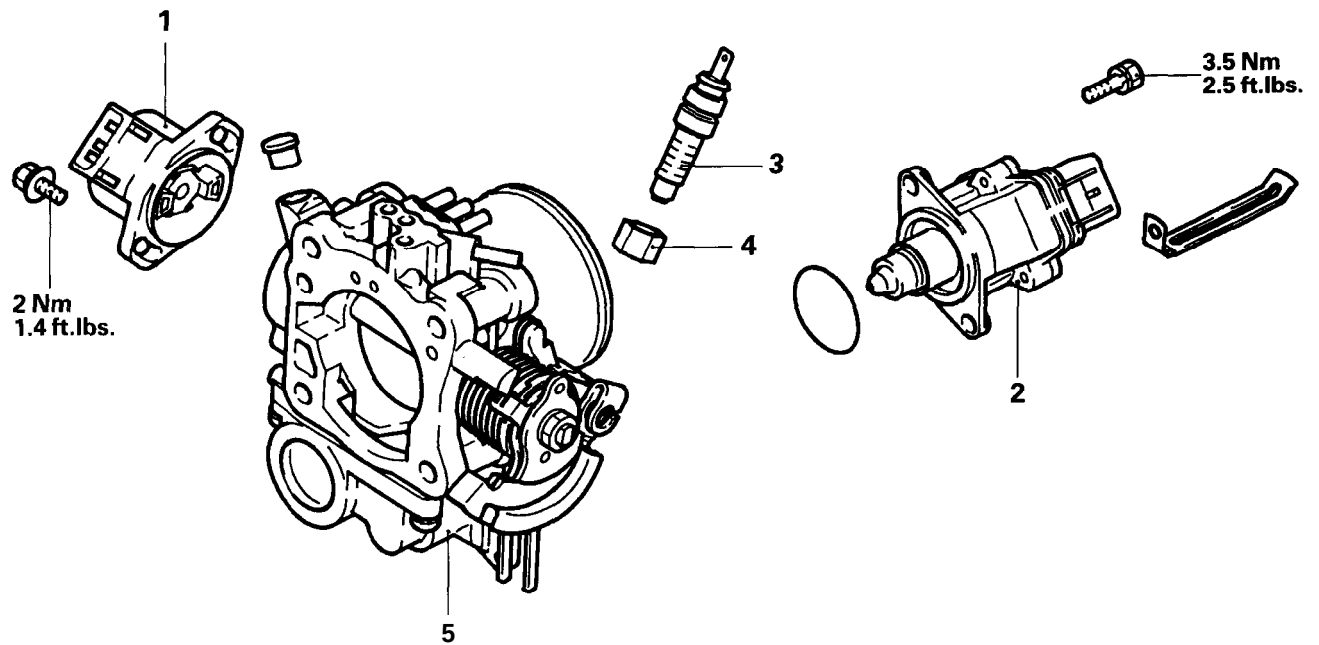


Disassembly steps

1. Throttle position sensor
 2. Idle speed control motor
 3. Throttle valve set screw
 4. Throttle body

6FU1292

DOHC

**Disassembly steps**

- ◊A◊ ◊A◊ 1. Throttle position sensor
 ◊A◊ 2. Idle air control motor (stepper motor)
 3. Closed throttle position switch
 4. Adjusting nut
 ◊B◊ 5. Throttle body

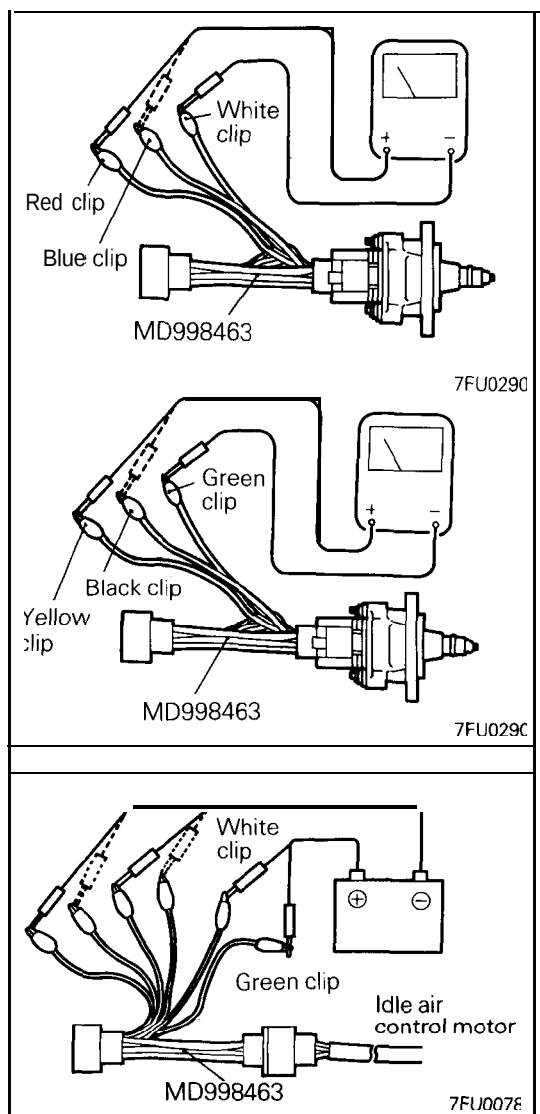
6FU1427

DISASSEMBLY SERVICE POINTS**⚡A⚡ THROTTLE POSITION SENSOR AND IDLE AIR/SPEED CONTROL MOTOR REMOVAL**

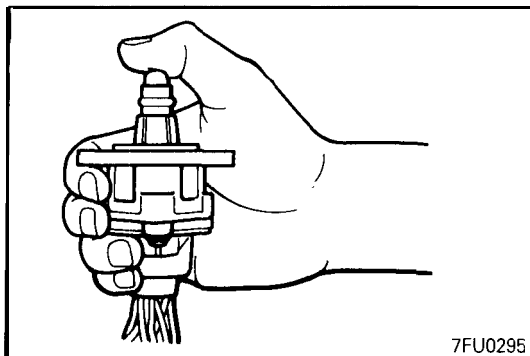
- (1) Do not disassemble the sensor and motor.
- (2) Do not immerse the sensor and motor in cleaning solvent. Clean them with shop towel.

⚡B⚡ THROTTLE BODY REMOVAL

- (1) Do not remove the throttle valve.
- (2) Check if the vacuum port or passage is clogged. Use compressed air to clean the vacuum passage.

**Operational Check**

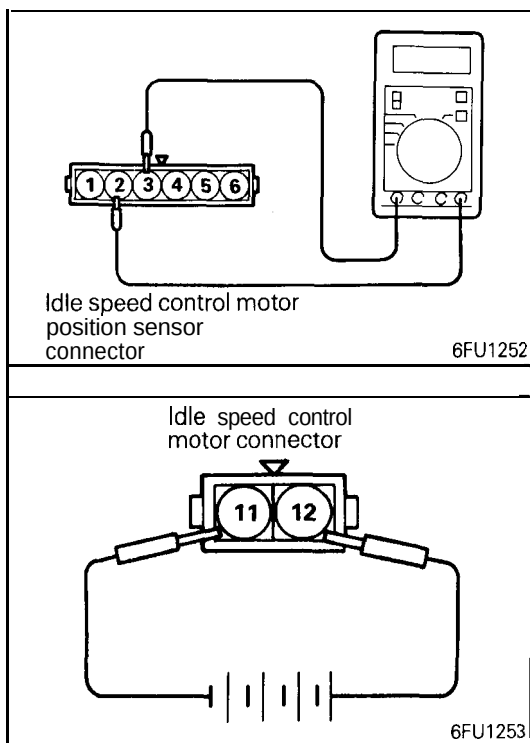
- (1) Connect Test Harness to the idle air control motor connector.
- (2) Connect the positive ⊕ terminal of 6 volt battery to white clip and green clip of Test Harness.



(3) Holding the idle air control motor as shown in the illustration, connect the negative $\ominus$ terminal of the power supply to each clip as described in the following steps, and check whether or not a vibrating feeling (a feeling of very slight vibration of the stepper motor) is generated as a result of the activation of the stepper motor.

- ① Connect the negative $\ominus$ terminal of the power supply to the red and black clip.
- ② Connect the negative $\ominus$ terminal of the power supply to the blue and black clip.
- ③ Connect the negative $\ominus$ terminal of the power supply to the blue and yellow clip.
- ④ Connect the negative $\ominus$ terminal of the power supply to the red and yellow clip.
- ⑤ Connect the negative $\ominus$ terminal of the power supply to the red and black clip.
- ⑥ Repeat the tests in sequence from ⑤ to ①.

(4) If, as a result of these tests, vibration is detected, the stepper motor can be considered to be normal.



IDLE SPEED CONTROL MOTOR POSITION SENSOR – SOHC for GALANT and TRUCK

- (1) Measure the resistance between terminals ② and ③

Standard value: 4 – 6 k Ω

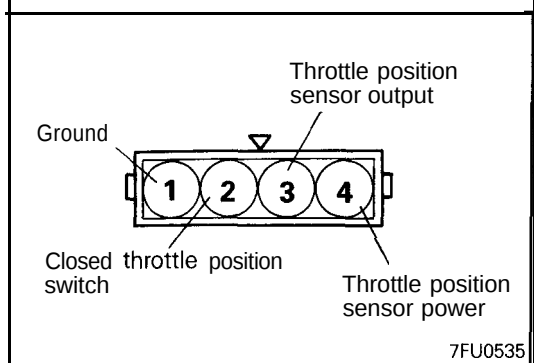
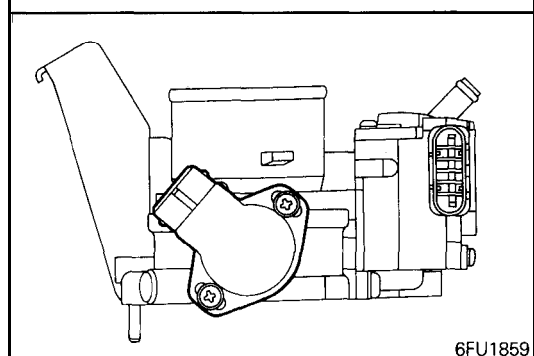
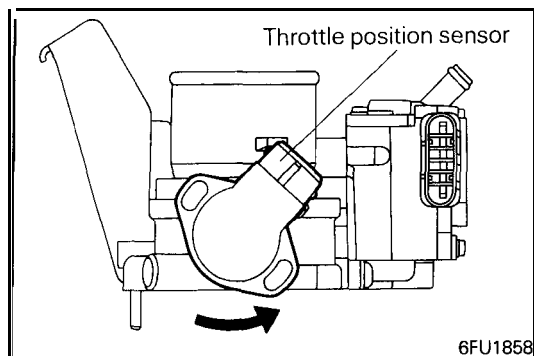
- (2) Disconnect the idle speed control motor connector.
- (3) Connect DC 6V between terminals ⑪ and ⑫ of the idle speed control motor connector, and then measure the resistance between terminals ③ and ⑤ of the idle speed control motor position sensor connector when the idle speed control motor is activated (caused to extend and retract).

Standard value: It should decrease smoothly as the idle speed control motor plunger retracts.

Caution

Apply only a 6V DC or lower voltage. Application of higher voltage could cause locking of the motor gears.

- (4) If there is a deviation from the standard value, or if the change is not smooth, replace the idle speed control motor assembly.



REASSEMBLY SERVICE POINTS

◆A◆ THROTTLE POSITION SENSOR INSTALLATION – SOHC FOR EXPO

(1) Install the throttle position sensor to the throttle body as shown in the illustration.

(2) Turn the throttle position sensor 90° counterclockwise to set it in position and tighten the screws.

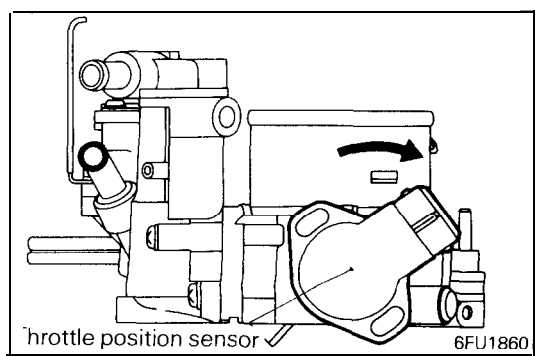
(3) Connect a circuit tester between ① (ground) and ③ (output), or between ④ (power) and ② (output). Then make sure that the resistance changes smoothly when the throttle valve is slowly moved to the fully open position.

(4) Check for continuity between terminals ② (closed throttle position switch) and ① (ground) with the throttle valve both fully closed and fully open.

Throttle valve position	Continuity
Fully closed	Conductive
Fully open	Non-conductive

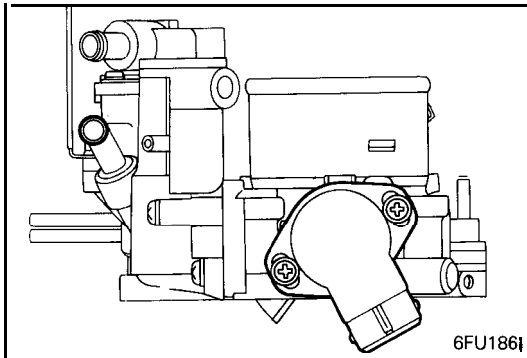
If there is no continuity with the throttle valve fully closed, turn the throttle position sensor clockwise, and then check again.

(5) If the above specifications are not met, replace the throttle position sensor.

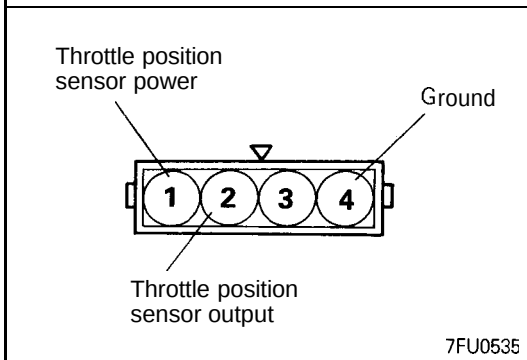


◆B◆ THROTTLE POSITION SENSOR INSTALLATION – GALANT, ECLIPSE, MIRAGE, TRUCK

(1) Install the throttle position sensor to the throttle body as shown in the illustration.



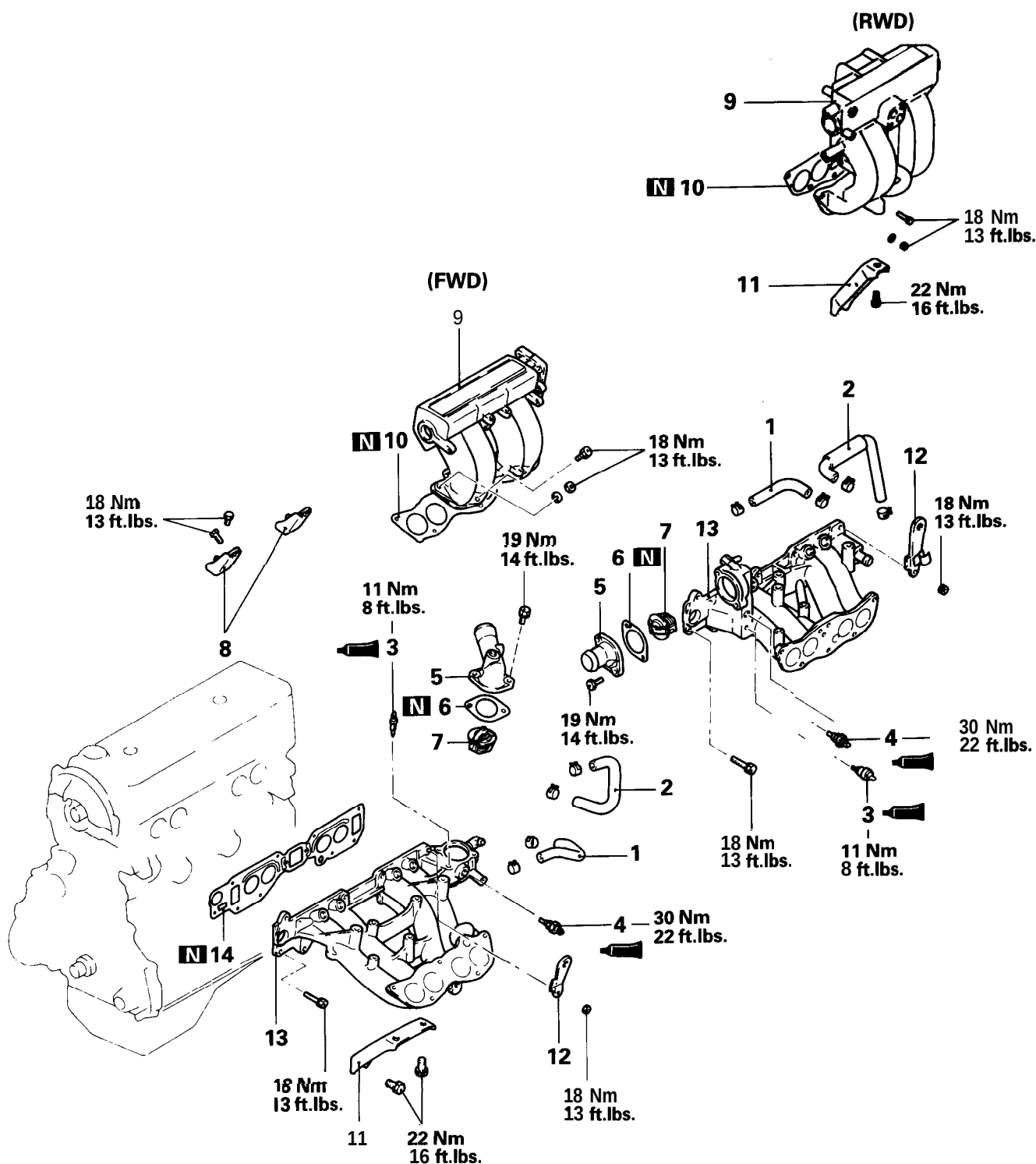
- (2) Turn the throttle position sensor 90° clockwise to set it and tighten the screws.



- (3) Connect a circuit tester between ④ (ground) and ② (output), or between ② (output) and ① (power). Then, make sure that the resistance changes smoothly when the throttle valve is slowly moved to the fully open position.

INTAKE MANIFOLD

REMOVAL AND INSTALLATION – SOHC

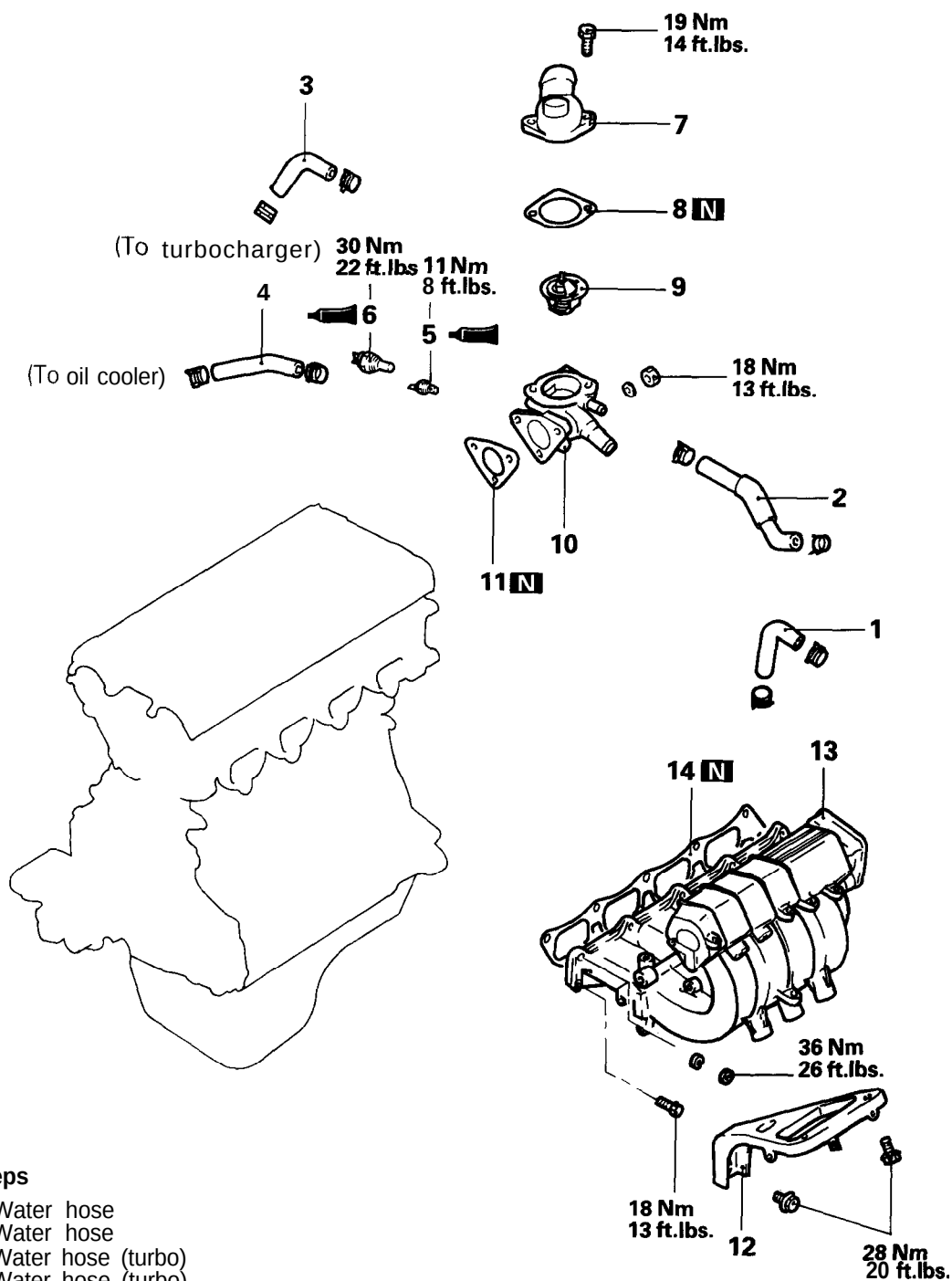


Removal steps

1. Water hose
2. Water hose
- ▶D▶ 3. Engine coolant temperature gauge unit
- ▶C▶ 4. Engine coolant temperature sensor
- ▶B▶ 5. Water outlet fitting
6. Gasket
7. Thermostat

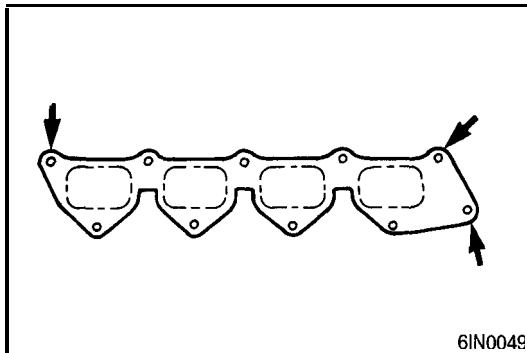
8. Intake manifold plenum stay
9. Intake manifold plenum
10. Intake manifold plenum gasket
11. Intake manifold stay
12. Engine hanger
13. Intake manifold
14. Intake manifold gasket

REMOVAL AND INSTALLATION – DOHC

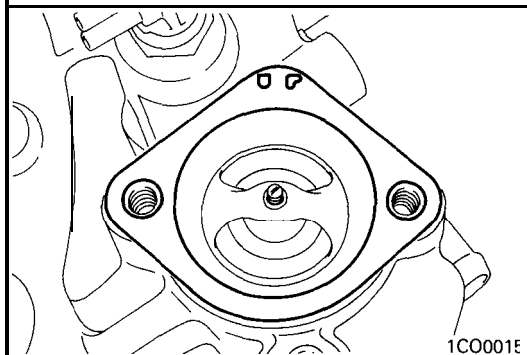


Removal steps

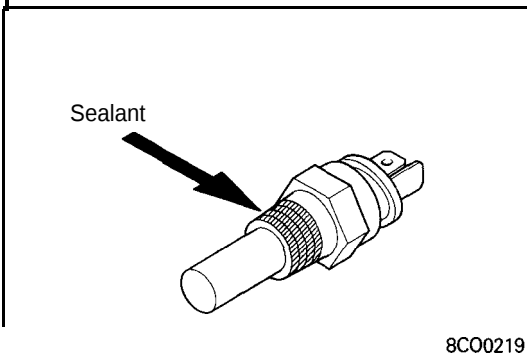
1. Water hose
2. Water hose
3. Water hose (turbo)
4. Water hose (turbo)
- ◆D◆ 5. Engine coolant temperature gauge unit
- ◆C◆ 6. Engine coolant temperature sensor
7. Water outlet fitting
- ◆B◆ 8. Gasket
9. Thermostat
10. Thermostat case
11. Gasket
12. Intake manifold stay
- ◆A◆ 13. Intake manifold
14. Intake manifold gasket

**INSTALLATION SERVICE POINTS****◆A◆ INTAKE MANIFOLD INSTALLATION – DOHC**

- (1) Tighten the intake manifold bolts. Note that the bolts installed at the locations indicated in the illustration are tightened to a different torque.

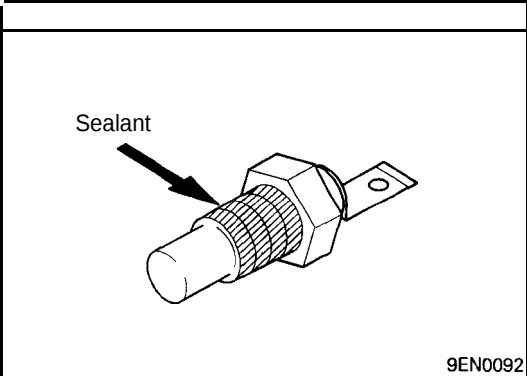
**◆B◆ WATER OUTLET FITTING GASKET INSTALLATION (FOR RUBBER COATED METAL GASKET ONLY)**

- (1) Install the water outlet fitting gasket with its “UP” mark facing up (toward the water outlet fitting side).

**◆C◆ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE SENSOR**

Specified sealant:

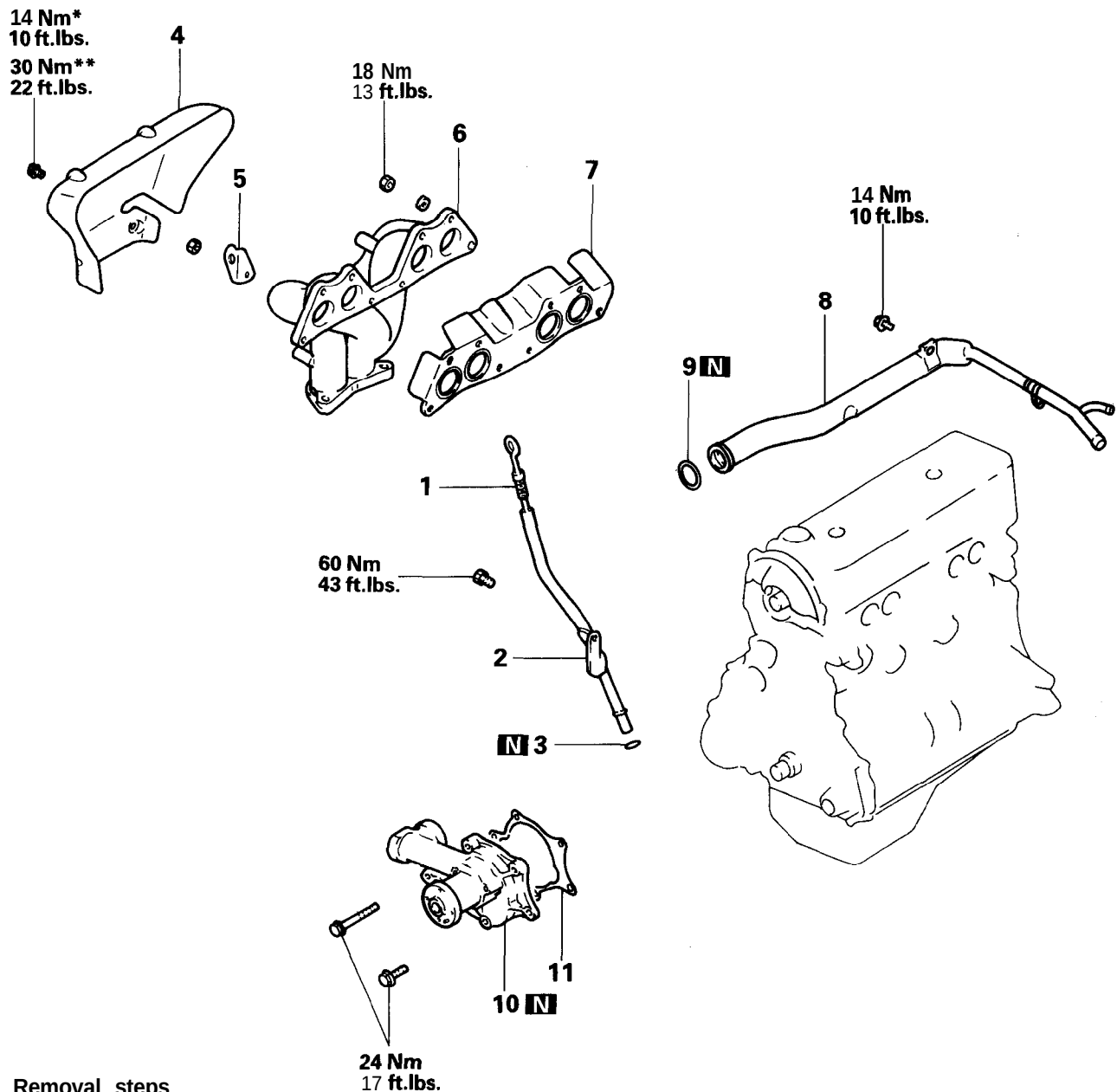
3M Nut Locking Part No. 4171 or equivalent

**◆D◆ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE GAUGE UNIT**

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

EXHAUST MANIFOLD AND WATER PUMP

REMOVAL AND INSTALLATION – SOHC



Removal steps

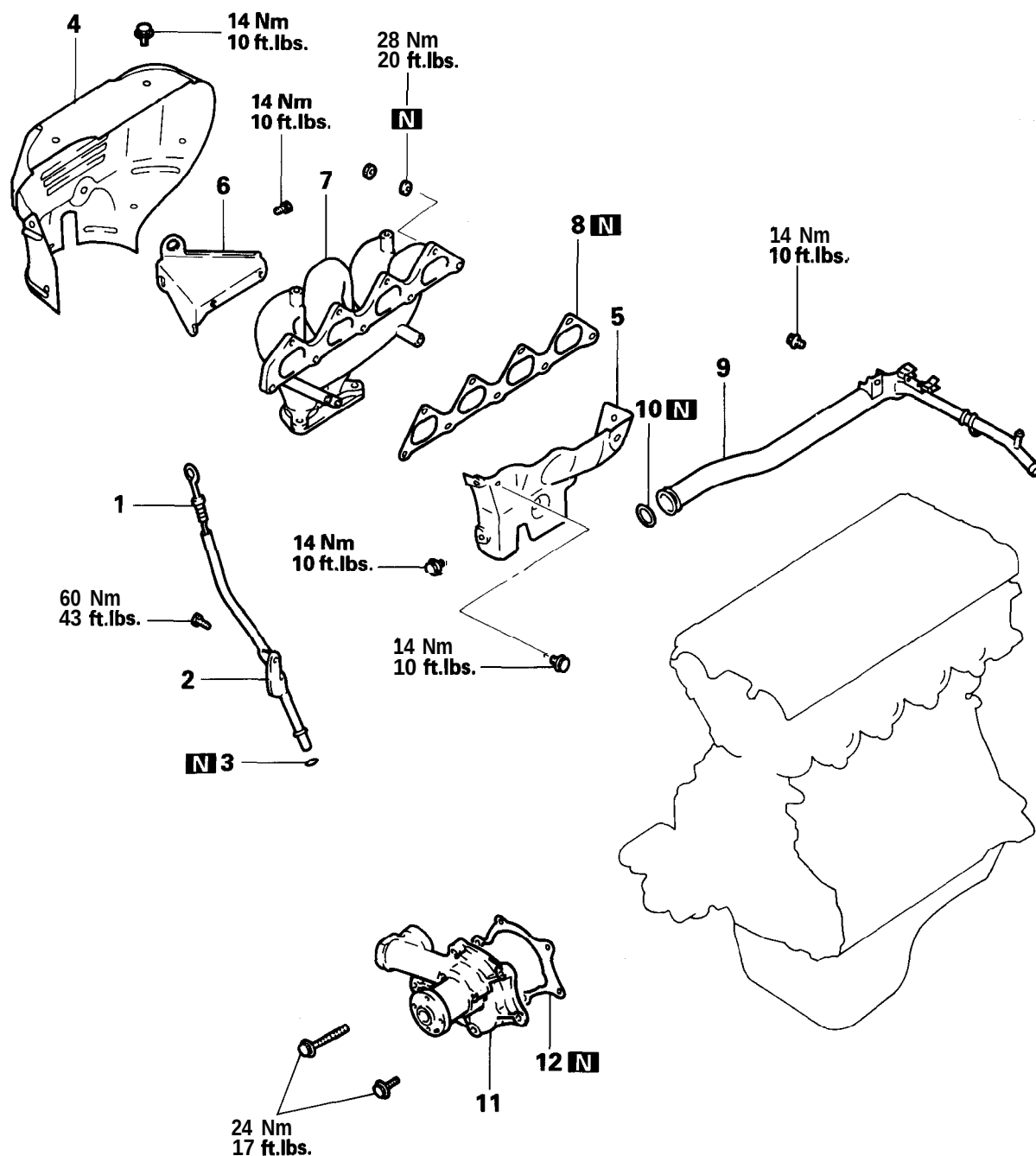
1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Heat protector
5. Engine hanger
6. Exhaust manifold
7. Exhaust manifold gasket
8. Water inlet pipe
9. O-ring
10. Water pump
11. Water pump gasket

NOTE

*: GALANT and EXPO

**: TRUCK

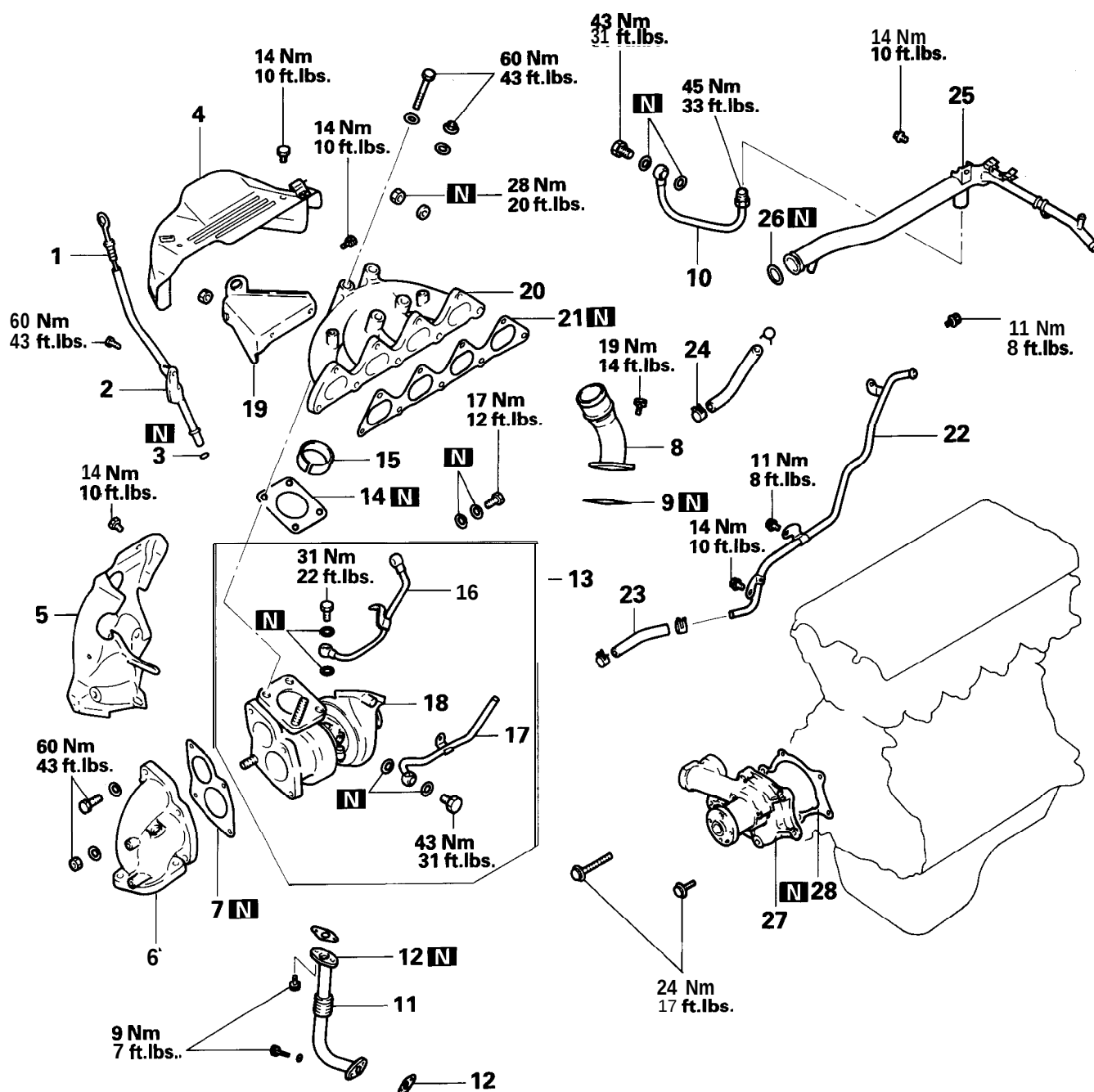
REMOVAL AND INSTALLATION – DOHC FOR NON-TURBO



Removal steps

1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Heat protector "A"
5. Heat protector "B"
6. Engine hanger
7. Exhaust manifold
8. Exhaust manifold gasket
9. Water inlet pipe
10. O-ring
11. Water pump
12. Gasket

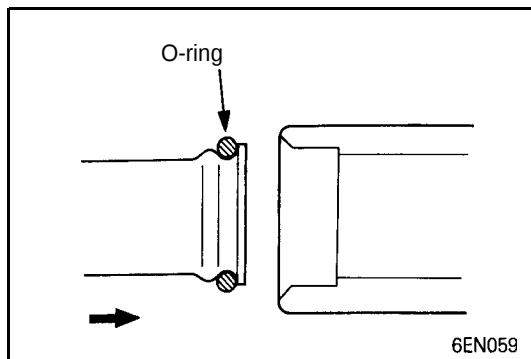
REMOVAL AND INSTALLATION – DOHC TURBO



Removal steps

1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Heat protector "A"
5. Heat protector "B"
6. Exhaust fitting
7. Gasket
8. Air outlet fitting
9. Gasket
10. Water pipe "B"
11. Oil return pipe
12. Gasket
13. Turbocharger assembly
14. Gasket

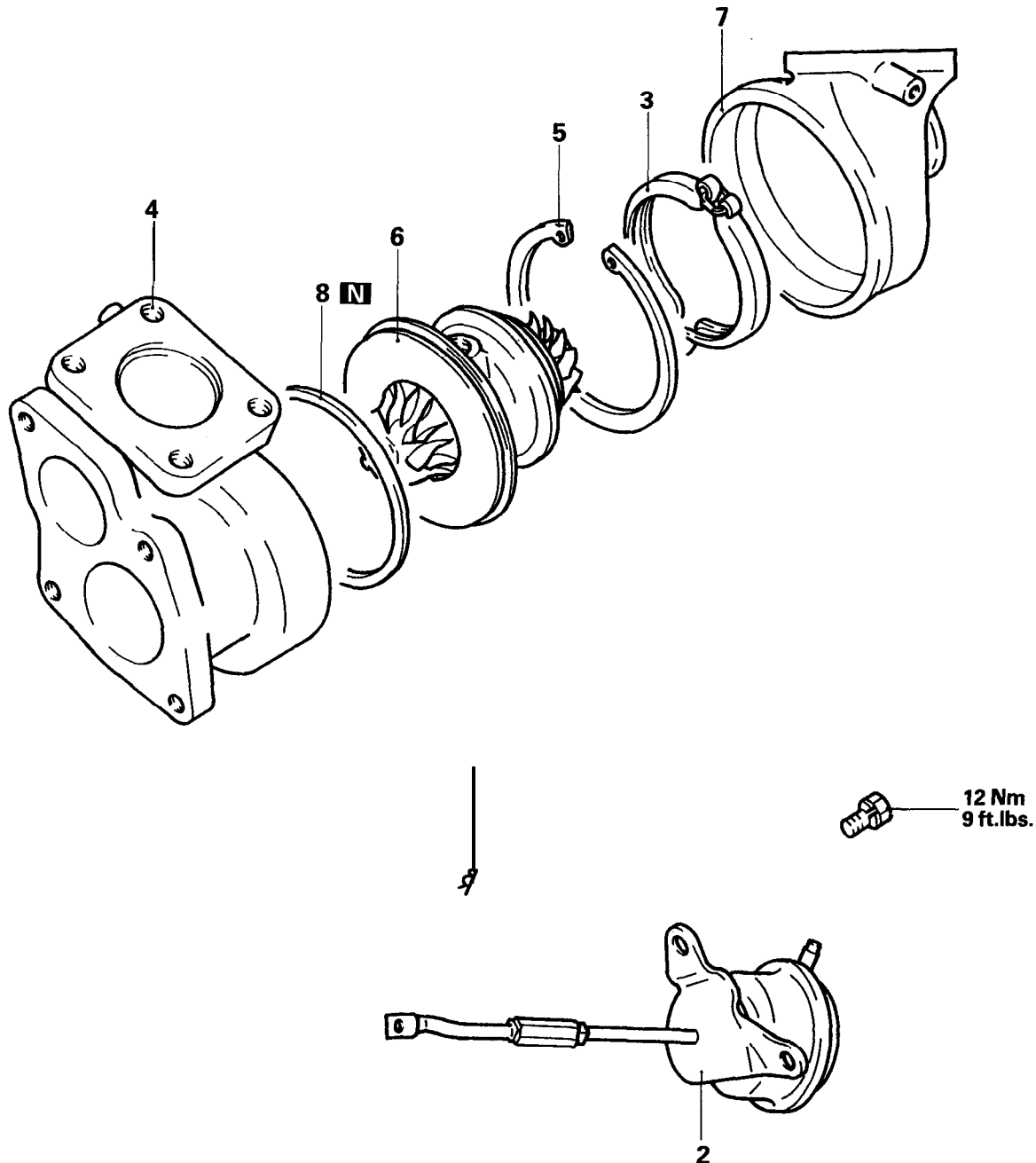
15. Ring
16. Oil pipe
17. Water pipe "A"
18. Turbocharger
19. Engine hanger
20. Exhaust manifold
21. Exhaust manifold gasket
22. Water pipe
23. Water hose
24. Water hose
25. Water inlet pipe
26. O-ring
27. Water pump
28. Gasket

**INSTALLATION SERVICE POINT****◆A◆ WATER PIPE/O-RING INSTALLATION**

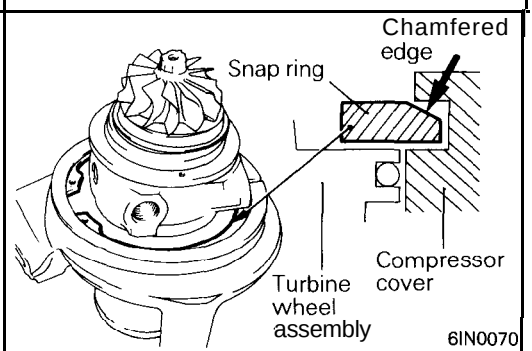
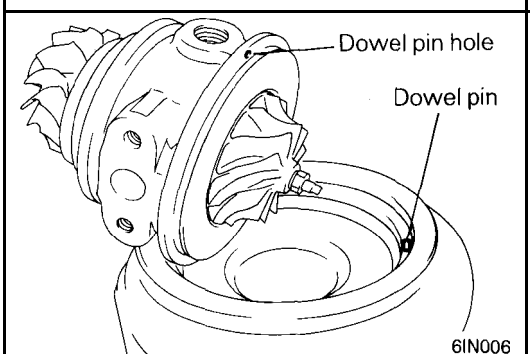
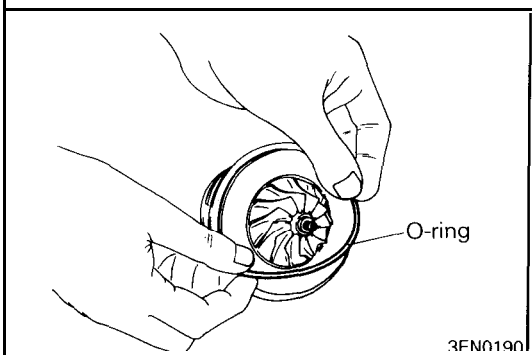
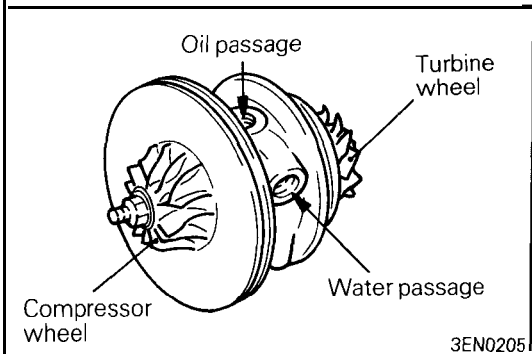
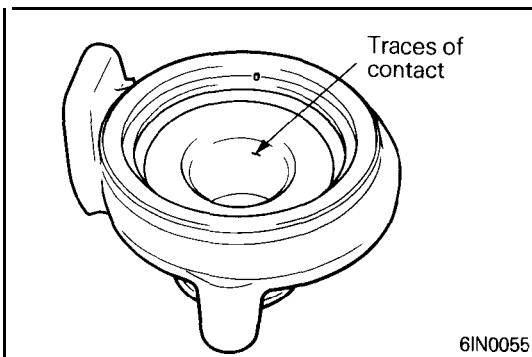
- (1) Wet the O-ring (with water) to facilitate assembly

Caution

Keep the O-ring free of oil or grease.

TURBOCHARGER**DISASSEMBLY AND REASSEMBLY****Disassembly steps**

- ♦F♦ inspection of turbocharger waste gate actuator operation
- 1. Snap pin
- 2. Turbocharger waste gate actuator
- ♦E♦ 3. Coupling
- ♦D♦ 4. Turbine housing
- ♦C♦ 5. Snap ring
- ♦B♦ 6. Turbine wheel assembly
- 7. Compressor cover
- ♦A♦ 8. O-ring



INSPECTION

TURBINE HOUSING

- (1) Check the housing for traces of contact with the turbine wheel, cracks due to overheating, pitching, deformation and other damage. Replace with a new turbine housing if cracked.
- (2) Operate the waste gate valve lever manually to check that the gate can be opened and closed smoothly.

COMPRESSOR COVER

- (1) Check the compressor cover for traces of contact with the compressor wheel and other damage.

TURBINE WHEEL ASSEMBLY

- (1) Check the turbine and compressor wheel blades for bend, burr, damage, corrosion and traces of contact on the back side and replace if defective.
- (2) Check the oil passage of the turbine wheel assembly for deposit and clogging.
- (3) In the case of water cooled type, check also the water passage for deposit and clogging.
- (4) Check the turbine wheel and compressor wheel for light and smooth turning.

REASSEMBLY SERVICE POINTS

◆A◆ O-RING INSTALLATION

- (1) Apply a light coat of engine oil to a new O-ring and fit the O-ring in the groove of the turbine wheel assembly.

◆B◆ TURBINE WHEEL ASSEMBLY INSTALLATION

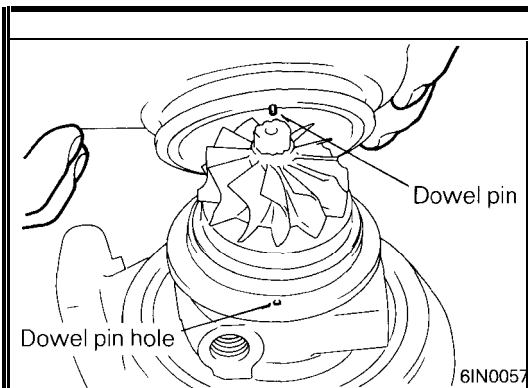
- (1) Install the turbine wheel assembly to the compressor cover while aligning the dowel pin with the dowel pin hole.

Caution

Use care not to damage the blades of turbine wheel and compressor wheel.

◆C◆ SNAP RING INSTALLATION

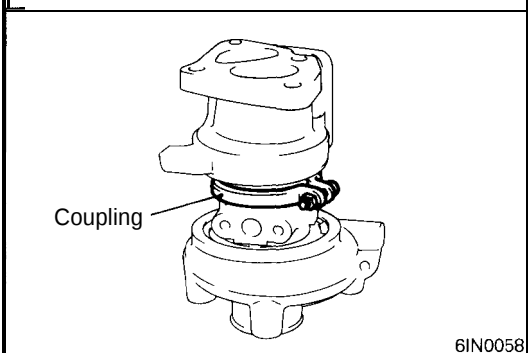
- (1) Fit the snap ring with its chamfered side facing up.

**◆D◆ TURBINE HOUSING INSTALLATION**

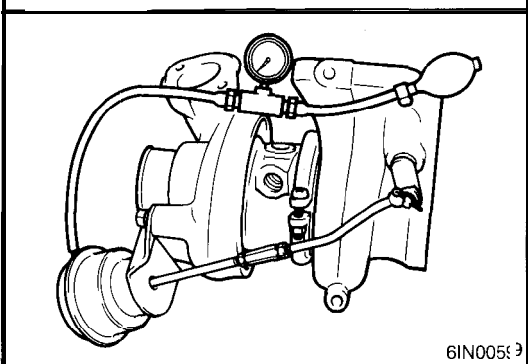
- (1) Install the turbine housing on the compressor cover while aligning the dowel pin with the dowel pin hole.

Caution

Use care not to damage the blades of the turbine wheel.

**◆E◆ COUPLING INSTALLATION**

- (1) Install the coupling and tighten it to the specified torque.

**◆F◆ WASTE GATE ACTUATOR OPERATION CHECK**

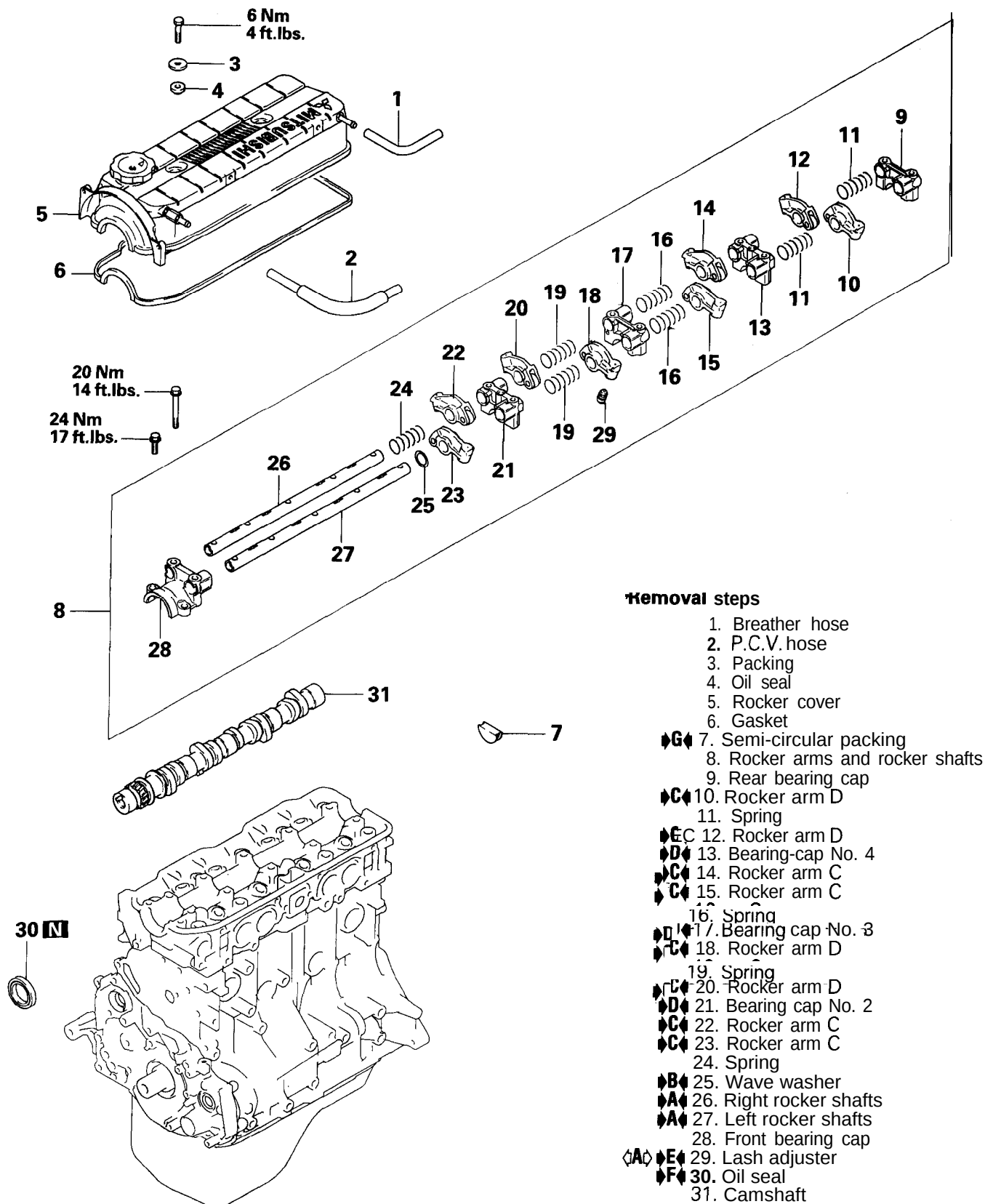
- (1) Using a tester, apply a pressure of approx. 72 kPa (10.3 psi) to the actuator and make sure that the rod moves.

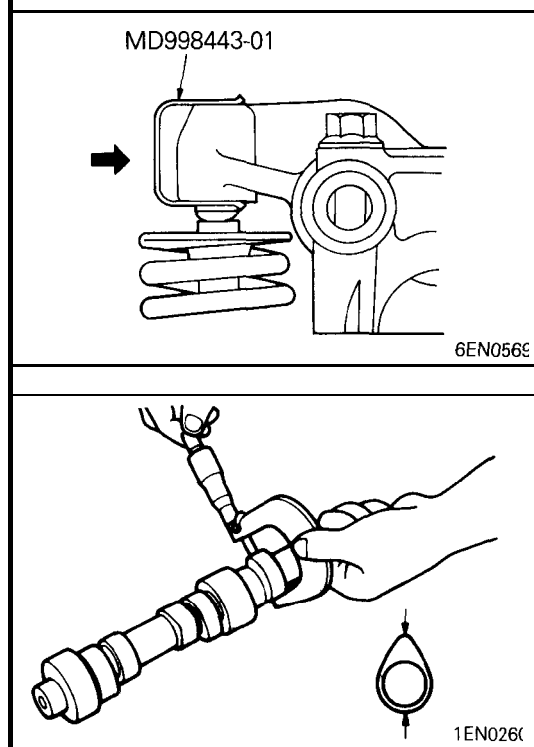
Caution

Do not apply a pressure of more than 85 kPa (12.4 psi) to the actuator. Otherwise, the diaphragm may be damaged. Never attempt to adjust the waste gate valve.

ROCKER ARMS AND CAMSHAFT — SOHC

REMOVAL AND INSTALLATION





REMOVAL SERVICE POINT

ROCKER ARM AND CAMSHAFT REMOVAL

- (1) Before removing rocker arms and shafts assembly, install the special tool as illustrated to prevent adjuster from dropping.

INSPECTION

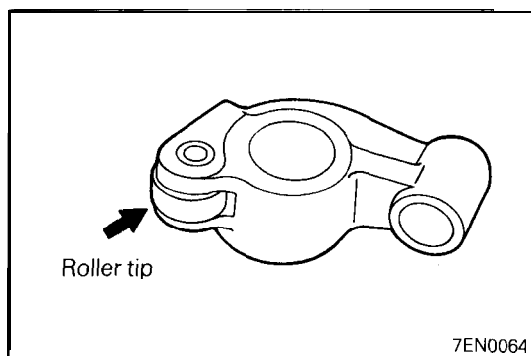
CAMSHAFT

- (1) Measure the cam height

Identification mark (Standard value		Limit
D: Intake	42.40 (1.6692)	41.90 (1.6496)
Exhaust	42.40 (1.6692)	41.90 (1.6496)
AR: Intake	44.53 (1.7531)	44.03 (1.7335)
Exhaust	44.53 (1.7531)	44.03 (1.7335)

NOTE

The camshaft identification mark is stamped on the opposite end of the camshaft sprocket side.



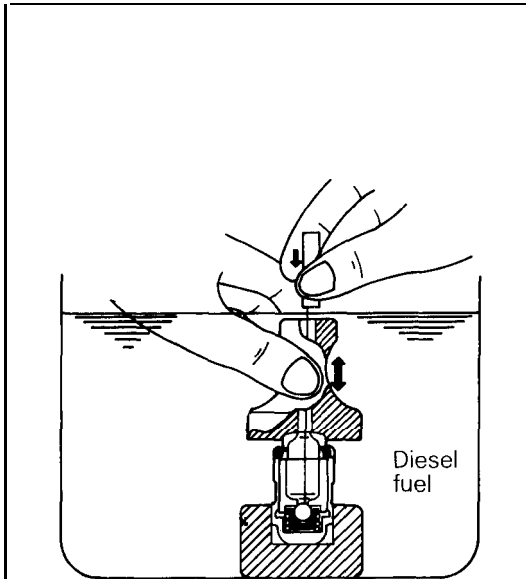
ROCKER ARM

- (1) Check the roller surface. If any dent, damage or seizure is evident, replace the rocker arm.
- (2) Check rotation of the roller. If it does not rotate smoothly or if looseness is evident, replace the rocker arm.
- (3) Check the inside diameter. If damage or seizure is evident, replace the rocker arm.

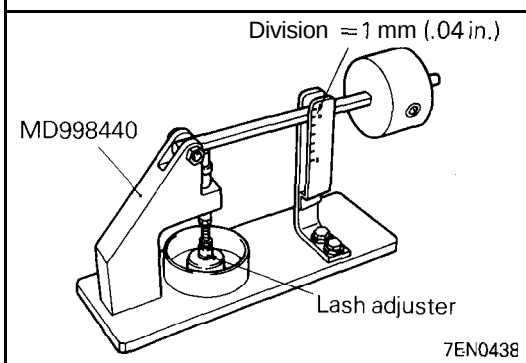
LASH ADJUSTER LEAK DOWN TEST

Caution

1. The lash adjuster is a precision part. Keep it free from dust and other foreign matters.
2. Do not disassemble the lash adjusters.
3. When cleaning the lash adjusters, use clean diesel fuel only.



6EN0571



7EN0438

- (1) Immerse the lash adjuster in clean diesel fuel.
- (2) While lightly pushing down the inner steel ball using a small wire, move the plunger up and down four or five times to bleed air.
Use of the retainer facilitates the air bleeding of a rocker arm mounted type lash adjuster.
- (3) Remove the small wire and press the plunger. If the plunger is hard to be pushed in, the lash adjuster is normal. If the plunger can be pushed in all the way readily, bleed the lash adjuster again and test again. If the plunger is still loose, replace the lash adjuster.

Caution

Upon completion of air bleeding, hold the lash adjuster upright to prevent inside diesel fuel from spilling.

- (4) After air bleeding, set the lash adjuster on the special tool (Leak down tester MD998440).
- (5) After the plunger has gone down somewhat (.2 – .5 mm), measure time taken for it to go down 1 mm. Replace if the measured time is out of the specification.

Standard value: 4 – 20 seconds / 1 mm (.04 in.)
[Diesel fuel at 15 – 20°C (59 – 68°F)]

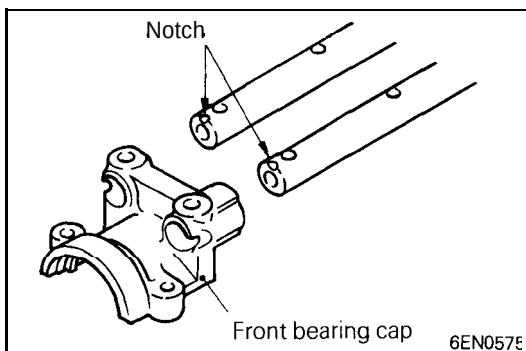
INSTALLATION SERVICE POINTS**CAMSHAFT IDENTIFICATION**

Identification:

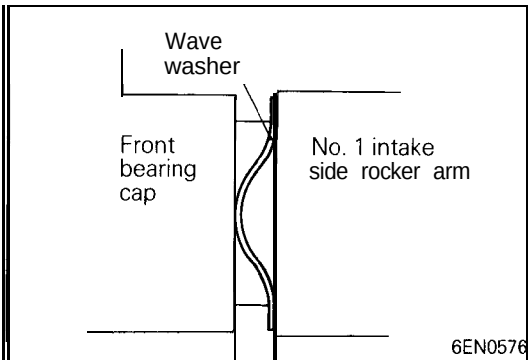
E X P O / GALANT A R
TRUCK D

ROCKER SHAFT INSTALLATION

- (1) Insert the rocker arm shaft into the front bearing cap with the notch on the shaft facing up, and insert the installation bolt without tightening it.

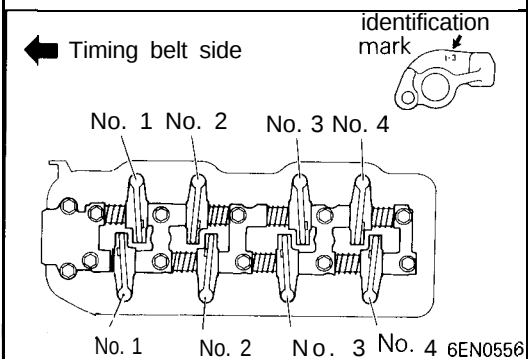


6EN0571



◆B◆ WAVE WASHER INSTALLATION

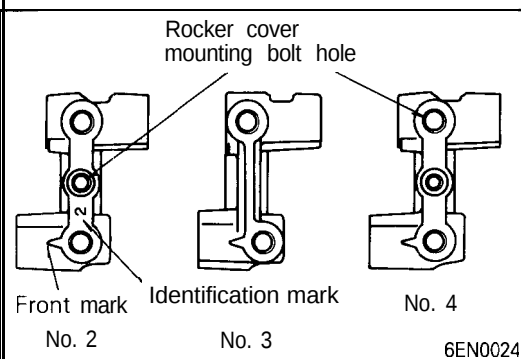
- (1) Install the wave washer in the correct direction as shown.



◆C◆ ROCKER ARM IDENTIFICATION

Identification mark:

- | | |
|-------|---------------------------|
| 1 - 3 | for No. 1 and 3 cylinders |
| 2 - 4 | for No. 2 and 4 cylinders |



◆D◆ CAMSHAFT BEARING CAP IDENTIFICATION

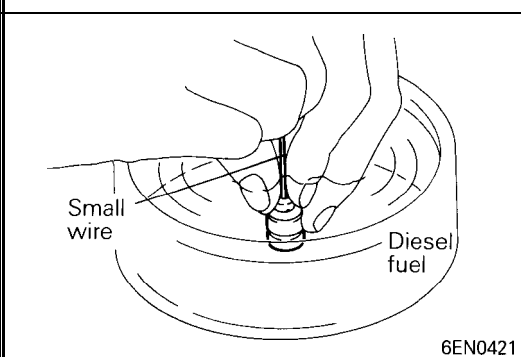
- (1) No. 3 bearing cap looks very similar to No. 2 and No. 4 bearing caps.

Use the identification marks shown at left for identification.

NOTE

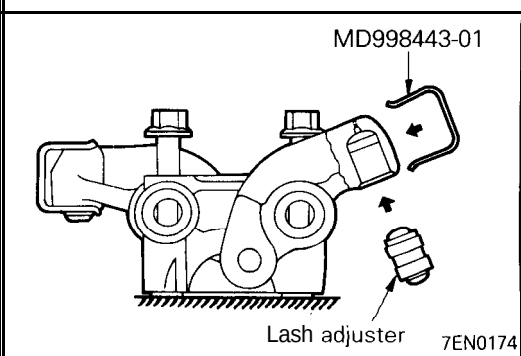
No. 2 bearing cap is the same as No. 4 bearing cap.

- (2) Install the bearing caps with their front marks pointing to camshaft sprocket side.

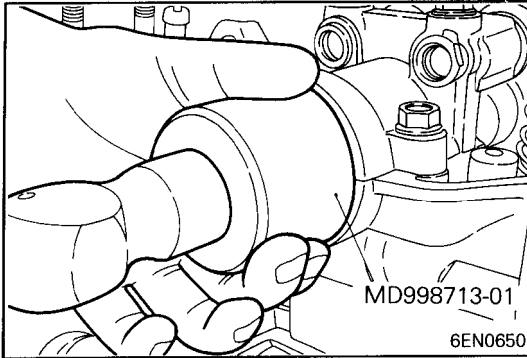


◆E◆ LASH ADJUSTER INSTALLATION

- (1) Immerse the lash adjuster in clean diesel fuel.
- (2) Using a small wire, move the plunger up and down 4 or 5 times while pushing down lightly on the check ball in order to bleed out the air.

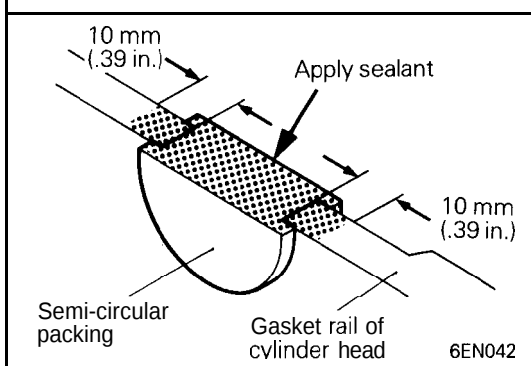
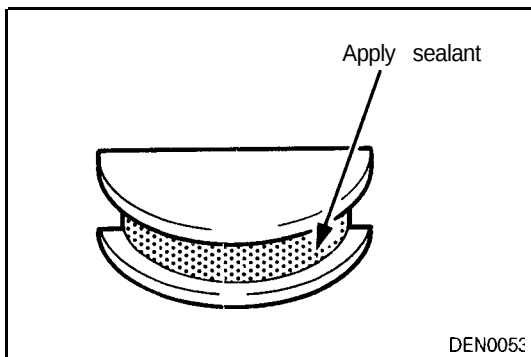


- (3) Insert the lash adjuster to rocker arm, being careful not to spill the diesel fuel. Use the special tool to prevent adjuster from falling while installing it.

**◆F◆ CAMSHAFT OIL SEAL INSTALLATION****◆G◆ SEMI-CIRCULAR PACKING INSTALLATION**

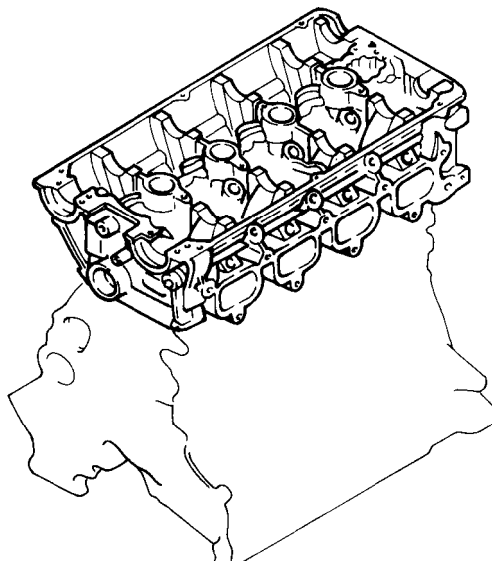
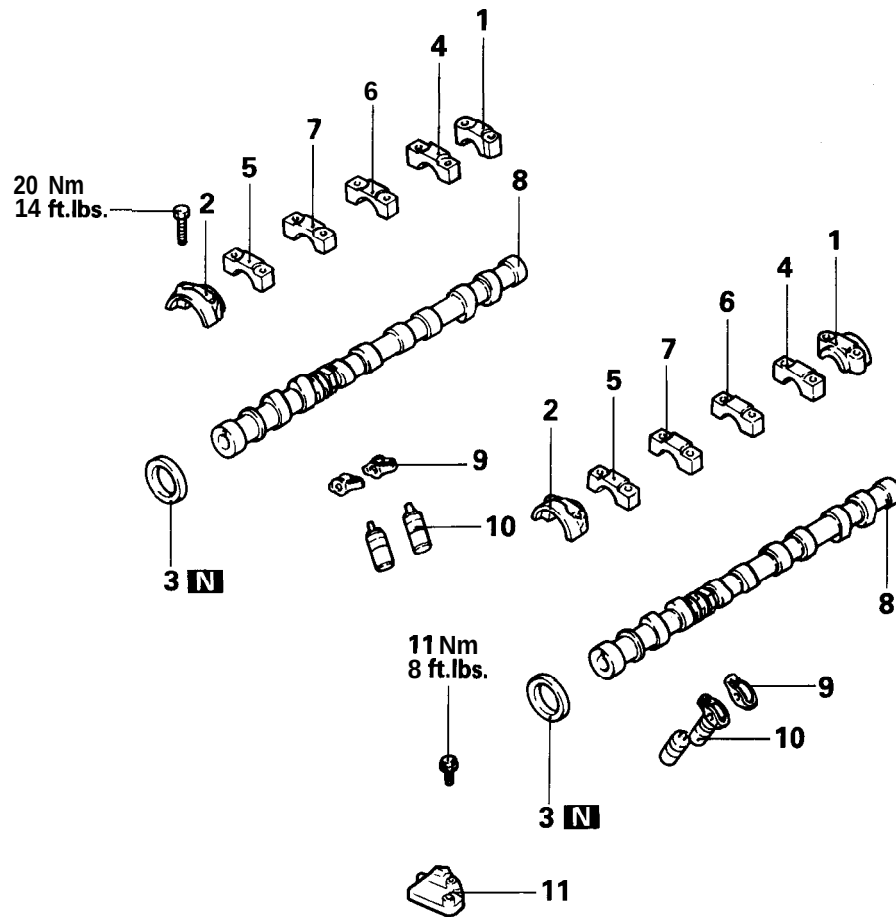
Specified sealant:

3M ATD Part No. 8660 or equivalent



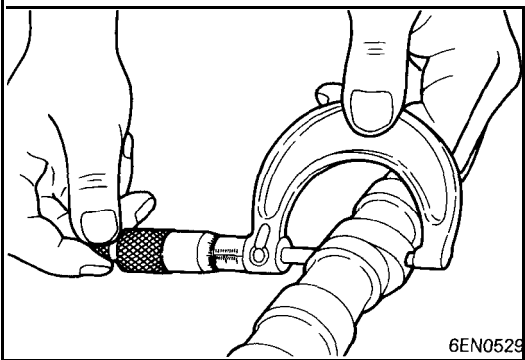
CAMSHAFTS AND ROCKER ARMS – DOHC

REMOVAL AND INSTALLATION



Removal steps

- ➡C 1. Bearing cap rear
- ➡C 2. Bearing cap front
- ➡D 3. Camshaft oil seal
- ➡C 4. Bearing cap No. 5
- ➡C 5. Bearing cap No. 2
- ➡C 6. Bearing cap No. 4
- ➡C 7. Bearing cap No. 3
- ➡B 8. Camshaft
- ➡B 9. Rocker arm
- ➡A 10. Lash adjuster
- 11. Oil delivery body



INSPECTION

CAMSHAFT

- (1) Measure the cam height.

Identification mark	Standard value	Limit
Intake A,D	35.49 (1.3972)	34.99 (1.3776)
B,C,F,F	35.20 (1.3858)	34.70 (1.3661)
Exhaust A	35.49 35.20 (1.3972) (1.3858)	34.99 34.70 (1.3776) (1.3661)
C		
E,F	35.91 (1.3744)	34.41 (1.3547)

The camshaft identification mark is stamped on the rear end of camshaft.

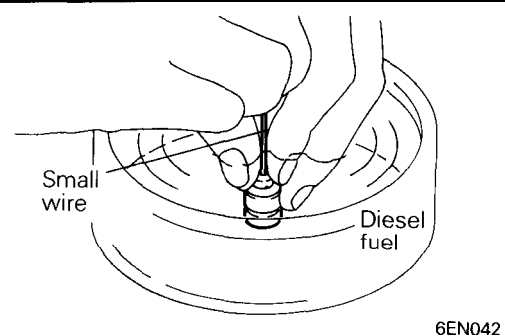
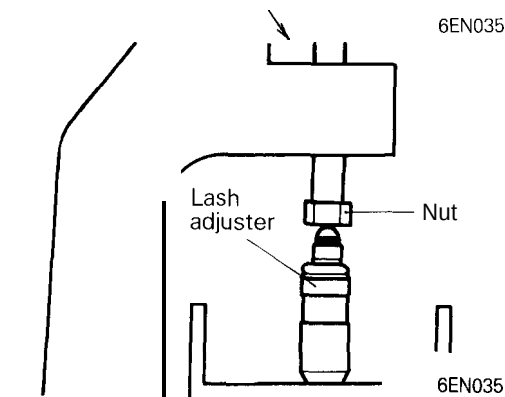
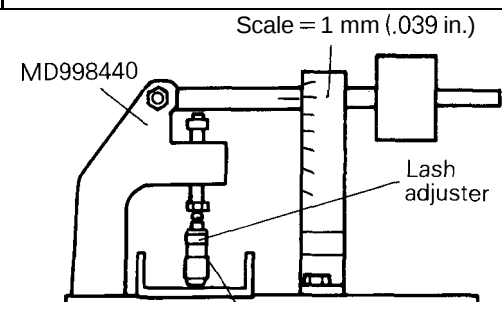
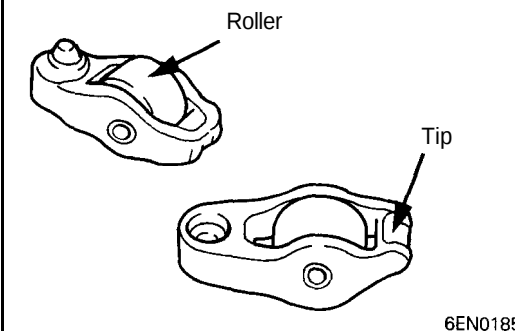
ROCKER ARM

- (1) Check the roller surface. If any dent, damage or seizure is evident, replace the rocker arm.
- (2) Check rotation of the roller. If it does not rotate smoothly or if looseness is evident, replace the rocker arm.
- (3) Check the inside diameter. If damage or seizure is evident, replace the rocker arm.

LASH ADJUSTER LEAK DOWN TEST

Refer to "LASH ADJUSTER LEAK DOWN TEST" on pages 11C-67 and 11C-68. Also note the following.

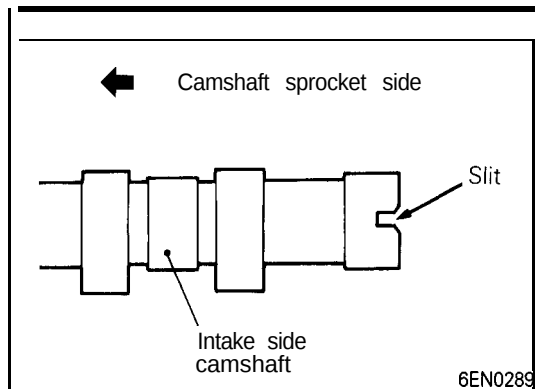
When the lash adjuster is set on a tester, remove the adjusting screw of the tester and adjust it to the height of the lash adjuster as shown in the illustration.



INSTALLATION SERVICE POINTS

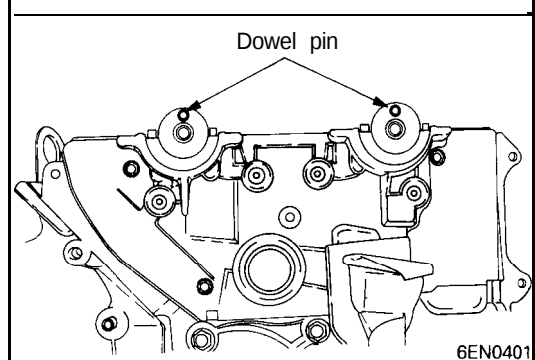
LASH ADJUSTER INSTALLATION

- (1) Immerse the lash adjuster in clean diesel fuel.
- (2) Using a small wire, move the plunger up and down 4 to 5 times while pushing down lightly on the check ball in order to bleed out the air.

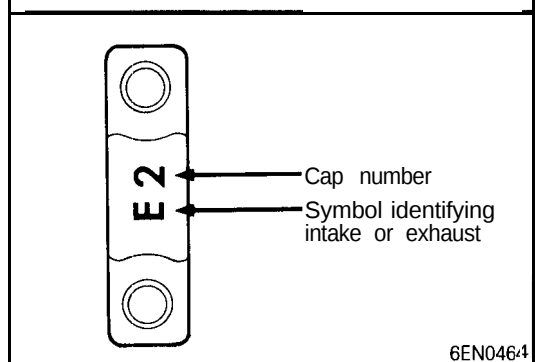


◆B◆ INSTALLATION OF CAMSHAFT

- (1) Apply engine oil to journals and cams of the camshafts.
- (2) Install the camshafts on the cylinder head.
Use care not to confuse the intake camshaft with the exhaust one. The intake camshaft has a slit on its rear end for driving the crankshaft position sensor.



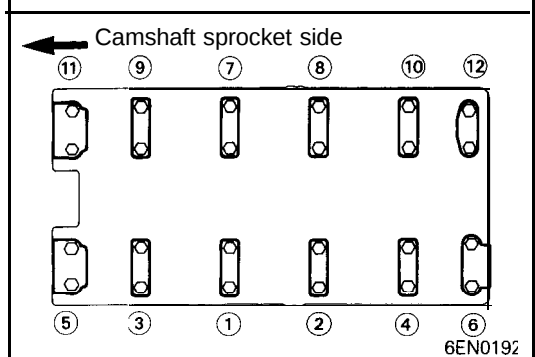
- (3) Install the crankshaft sprocket B or spacer and flange to an end of the crankshaft, and turn the crankshaft until the timing marks are lined up, setting No. 1 cylinder to the TDC.
- (4) Set the camshafts so that their dowel pins are positioned at top.



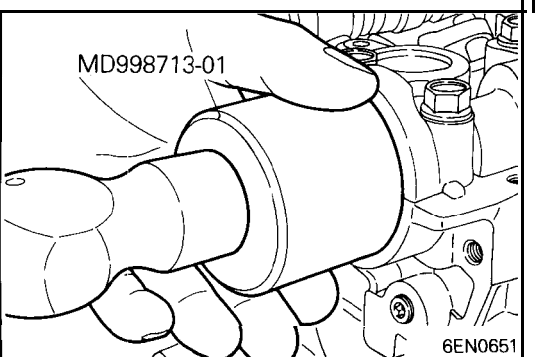
◆C◆ BEARING CAP INSTALLATION

- (1) According to the identification mark stamped on top of each bearing cap, install the caps to the cylinder head. Only "L" or "R" is stamped on No. 1 bearing cap. Cap No. is stamped on No. 2 to No. 5 bearing caps. No. 6 bearing cap has no stamping.

L: For intake camshaft side
E: For exhaust camshaft side



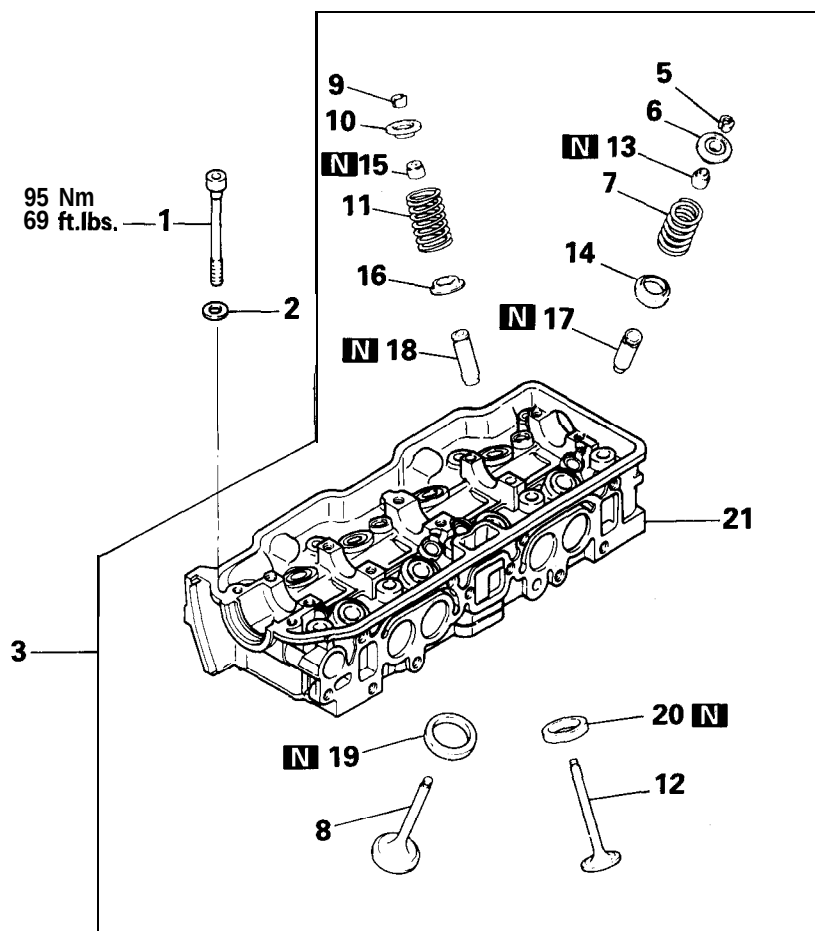
- (2) Tighten the bearing caps in the order shown by torquing progressively in two to three stages.
Tighten to the specification in the final sequence.
- (3) Check to ensure that the rocker arm is held in position on the lash adjuster and valve stem end.



◆D◆ CAMSHAFT OIL SEAL INSTALLATION

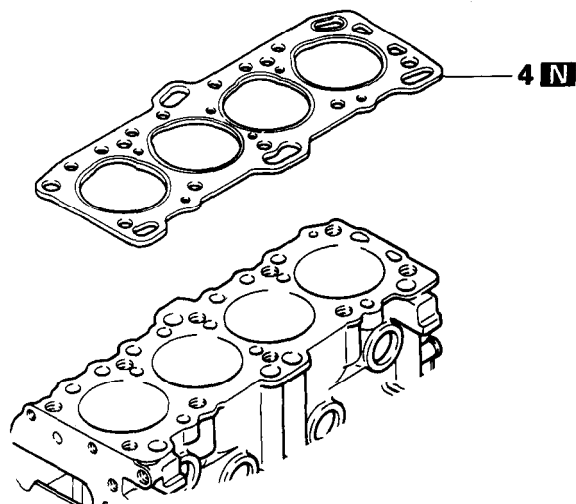
CYLINDER HEAD AND VALVES – SOHC

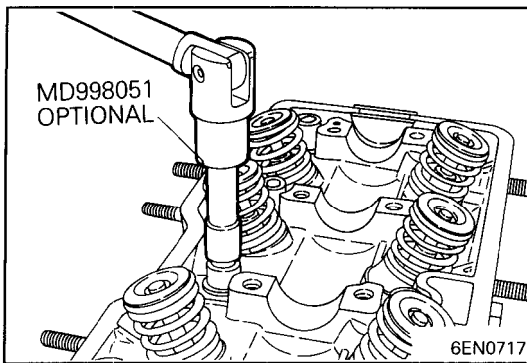
REMOVAL AND INSTALLATION



Removal steps

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

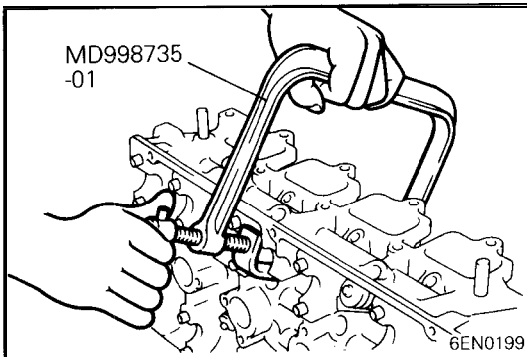


**REMOVAL SERVICE POINTS****PRECAUTION FOR REMOVED PARTS**

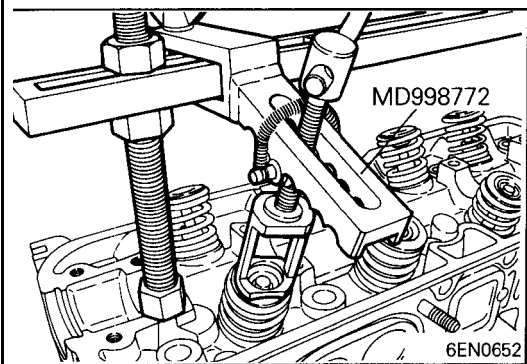
- (1) Keep removed parts in order according to the cylinder number and intake/exhaust.

⇄A⇄ CYLINDER HEAD BOLT REMOVAL

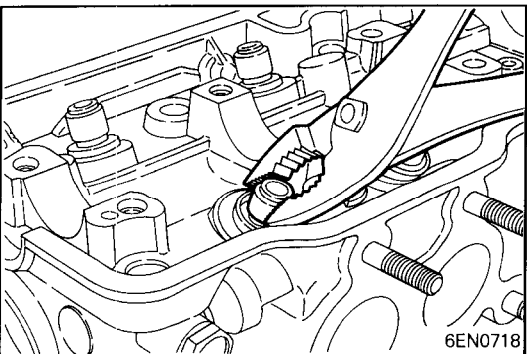
- (1) Using the special tool, loosen the cylinder head bolts.
Loosen evenly, little by little.

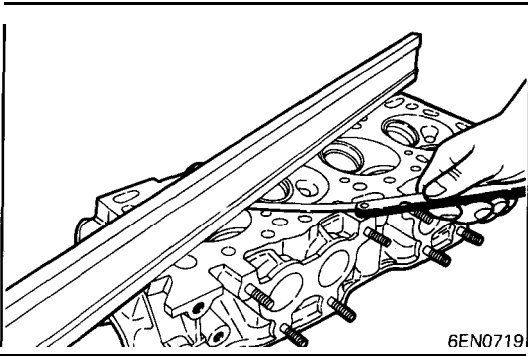
**⇄B⇄ RETAINER LOCK REMOVAL**

- (1) Using the special tool, compress the spring.
- (2) Remove the retainer locks.
Keep removed parts in order according to the cylinder number and intake/exhaust.

**⇄C⇄ VALVE STEM SEAL REMOVAL**

- (1) Do not reuse valve stem seal.





INSPECTION

CYLINDER HEAD

- (1) Check the cylinder head gasket surface for flatness by using a straightedge in the directions of A through G shown in the illustration.

Standard value: 0.05 mm (.0020 in.)

Limit: 0.2 mm (.008 in.)

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

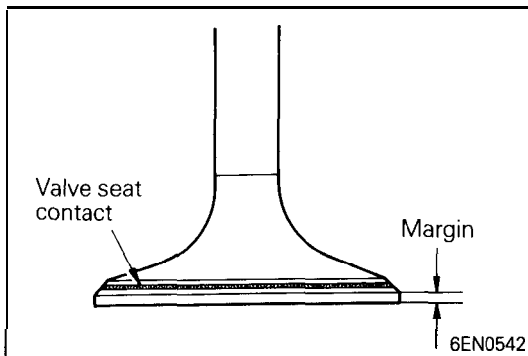
Grinding limit: *0.2 mm (.008 in.)

Caution

*** Total resurfacing depth of both cylinder head and cylinder block.**

Cylinder head height (Specification when new):

89.9 – 90.1 mm (3.539 – 3.547 in.)



VALVE

- (1) Check the valve face for correct contact. If incorrect, reface using a valve refacer. The valve seat contact should be maintained uniform at the center of the valve face.
- (2) If the margin exceeds the service limit, replace the valve.

Standard value:

Intake 1.2 mm (.047 in.)

Exhaust 2.0 mm (.079 in.)

Limit:

Intake 0.7 mm (.028 in.)

Exhaust 1.5 mm (.059 in.)

VALVE SPRING

- (1) Measure the free height of spring and, if it is smaller than the limit, replace.

Identification color: White

Standard value: 49.8 mm (1.961 in.)

Limit: 48.8 mm (1.922 in.)

- (2) Measure the squareness of the spring and, if the limit is exceeded, replace.

Standard value: 2" or less

Limit: Max. 4"

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:

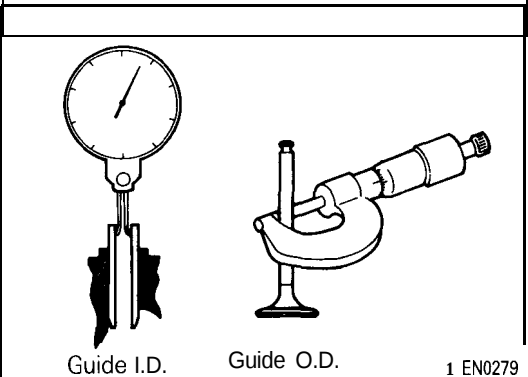
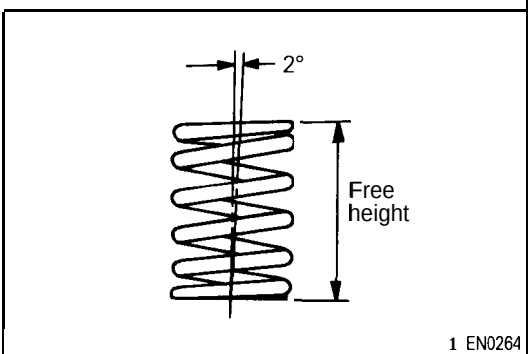
Intake 0.02 – 0.06 mm (.0008 – .0024 in.)

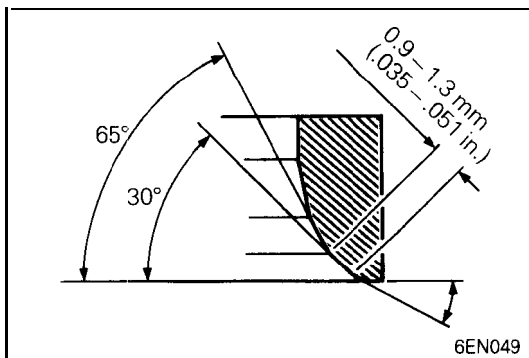
Exhaust 0.05 – 0.09 mm (.0020 – .0035 in.)

Limit:

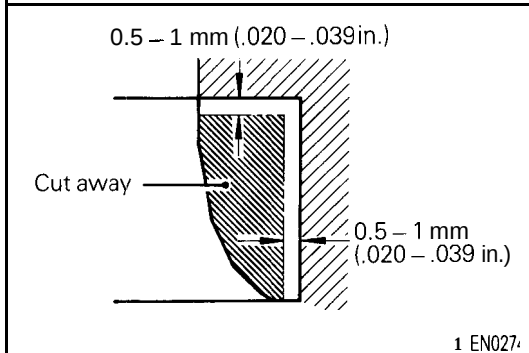
Intake 0.10 mm (.004 in.)

Exhaust 0.15 mm (.006 in.)

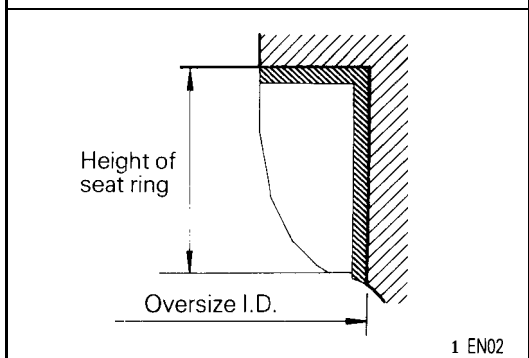


**VALVE SEAT RECONDITIONING PROCEDURE**

- (1) Before correcting the valve seat, check for clearance between the valve guide and valve and, if necessary, replace the valve guide.
- (2) Using the special tool or seat grinder, correct to obtain the specified seat width and angle.
- (3) After correction, valve and valve seat should be lapped with a lapping compound.

**VALVE SEAT REPLACEMENT PROCEDURE**

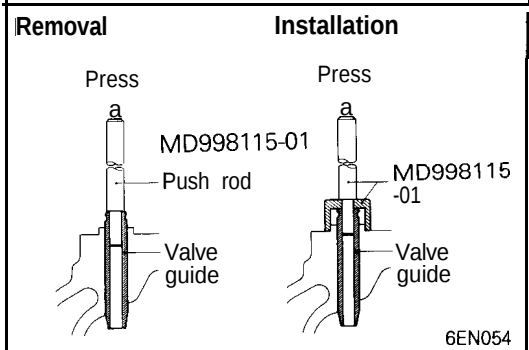
- (1) Cut the valve seat to be replaced from the inside to thin the wall thickness. Then, remove the valve seat.



- (2) Rebore the valve seat hole in the cylinder head to a selected oversize valve seat diameter.

Seat ring hole diameter: See “Service Specifications” on page 11C-10.

- (3) Before fitting the valve seat, either heat the cylinder head up to approximately 250°C (482°F) or cool the valve seat in liquid nitrogen, to prevent the cylinder head bore from galling.
- (4) Using a valve seat cutter, correct the valve seat to the specified width and angle.
See “VALVE SEAT RECONDITIONING PROCEDURE”.

VALVE GUIDE REPLACEMENT PROCEDURE

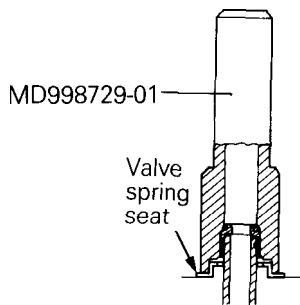
- (1) Using the special tool and a press, remove the valve guide toward cylinder head gasket surface.
- (2) Rebore valve guide hole to the new oversize valve guide outside diameter.

Valve guide hole diameter: See “Service Specifications” on page 11C-10.

NOTE

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

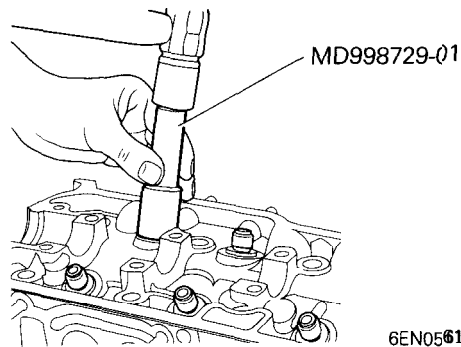
- (3) Using the special tool, press-fit the valve guide, working from the cylinder head top surface.
- (4) After installing valve guides, insert new valves in them to check for sliding condition.
- (5) When valve guides have been replaced, check for valve contact and correct valve seats as necessary.



5EN001 E

INSTALLATION SERVICE POINTS**◆A◆ VALVE STEM SEAL INSTALLATION**

- (1) Install the valve spring seat.



6EN0561

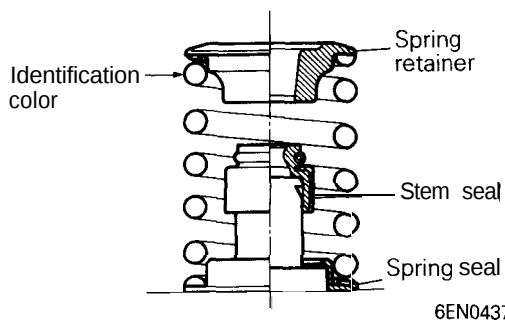
- (2) Using the special tool, install a new stem seal to the valve guide.

Caution

Do not reuse the valve stem seal.

◆B◆ VALVE SPRING INSTALLATION

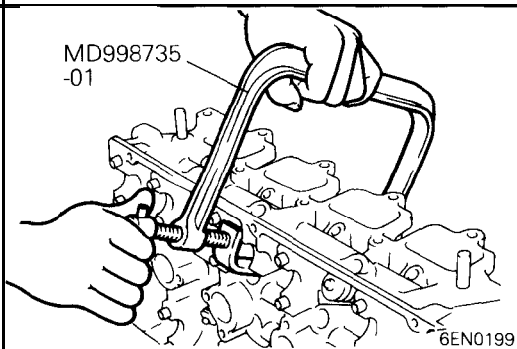
- (1) Direct the valve spring end with identification color end toward the spring retainer.



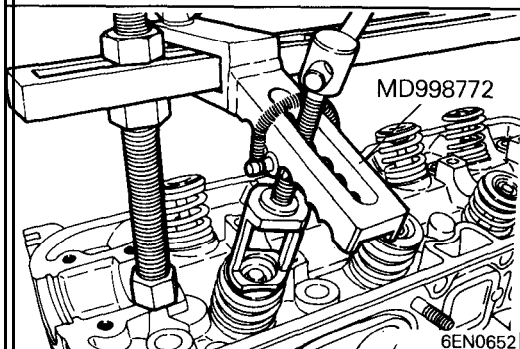
6EN0437

◆C◆ RETAINER LOCK INSTALLATION

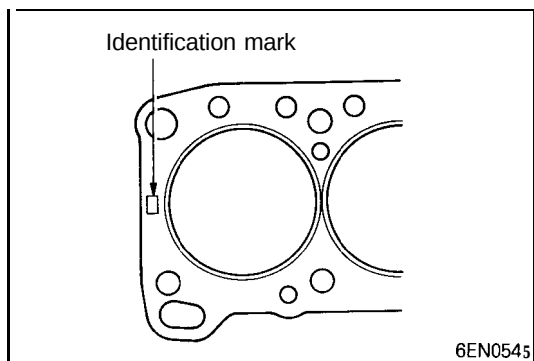
- (1) Using the special tool, compress the valve spring and insert the retainer lock into position.



6EN0199



6EN0652



◆D◆ CYLINDER HEAD GASKET IDENTIFICATION

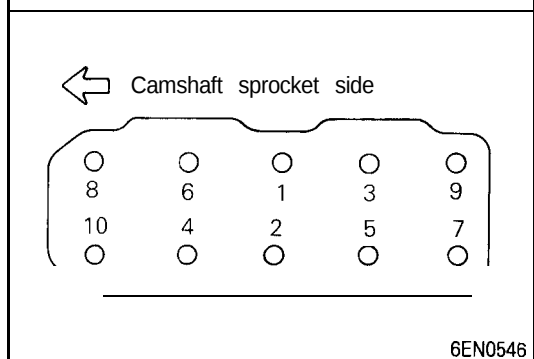
Identification mark:

4G63 63

4G64 64

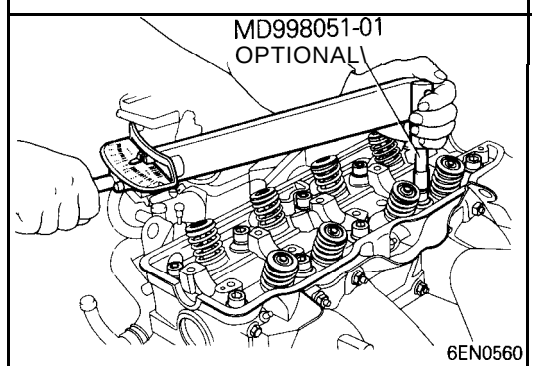
Caution

Do not apply sealant to cylinder head gasket.



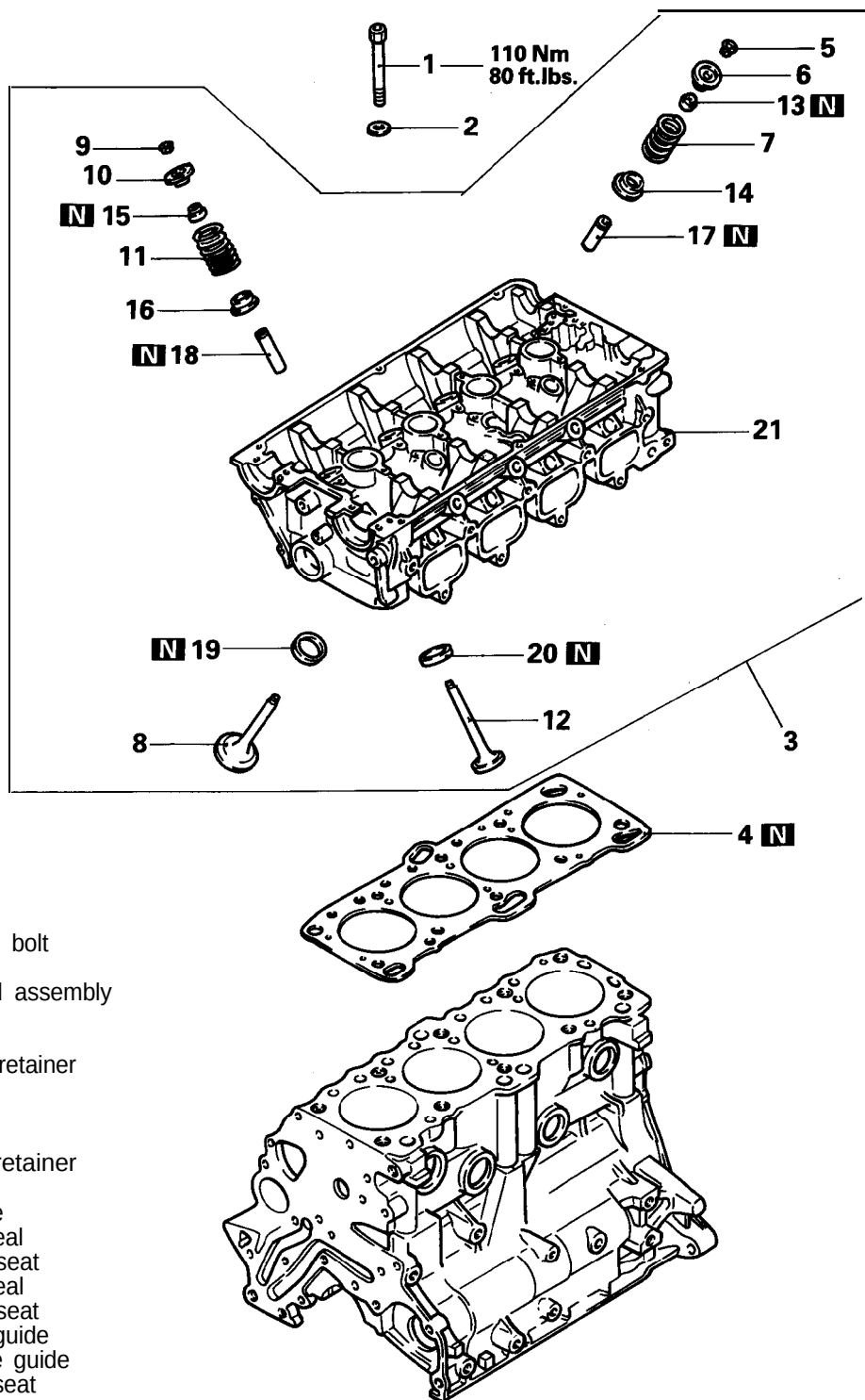
◆E◆ CYLINDER HEAD BOLT INSTALLATION

- (1) Tighten the cylinder head bolts in the sequence shown. Each bolt should be tightened in two to three steps, torquing progressively. Tighten to the specified torque in the final sequence.



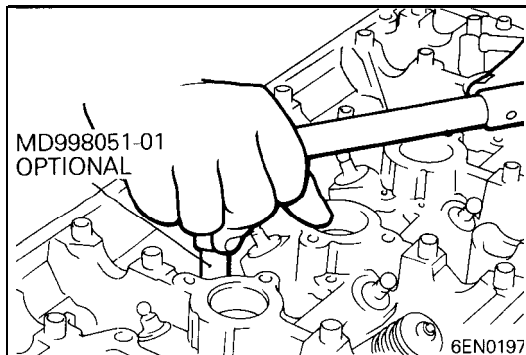
CYLINDER HEAD AND VALVES – DOHC

REMOVAL AND INSTALLATION

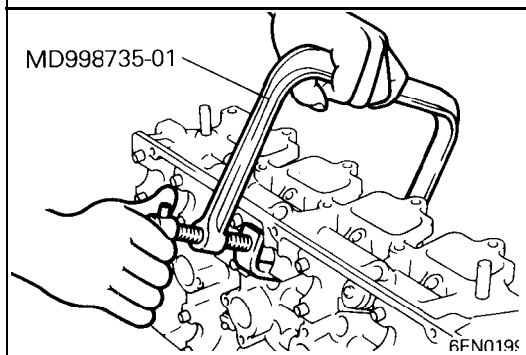


Removal steps

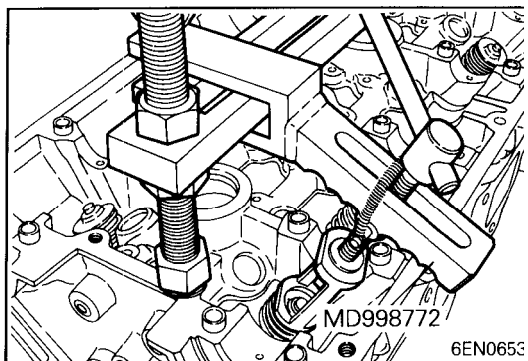
- ◊A◊ ◊E◊ 1. Cylinder head bolt
- 2. Washer
- 3. Cylinder head assembly
- ◊D◊ 4. Gasket
- ◊B◊ ◊C◊ 5. Retainer lock
- 6. Valve spring retainer
- ◊B◊ 7. Valve spring
- 8. Intake valve
- ◊B◊ ◊C◊ 9. Retainer lock
- 10. Valve spring retainer
- ◊B◊ 11. Valve spring
- 12. Exhaust valve
- ◊C◊ ◊A◊ 13. Valve stem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

**REMOVAL SERVICE POINTS****◊A◊ CYLINDER HEAD BOLT REMOVAL**

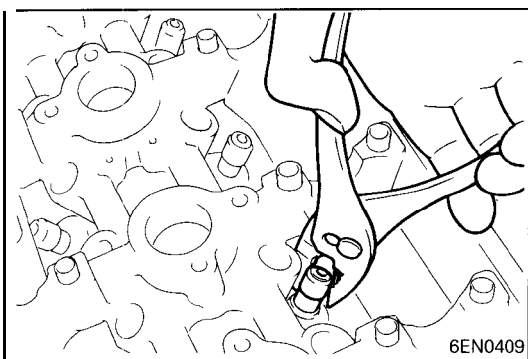
- (1) Using the special tool, loosen the cylinder head bolts. Loosen evenly, little by little.

**◊B◊ RETAINER LOCK REMOVAL**

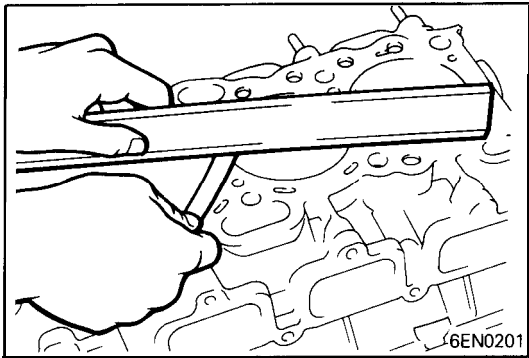
- (1) Using the special tool, compress the spring.
- (2) Remove the retainer locks. Keep removed parts in order according to the cylinder number and intake/exhaust.

**◊C◊ VALVE STEM SEAL REMOVAL**

- (1) Do not reuse the stem seals.

**INSPECTION**

- (1) Only features differing from the single camshaft engine are described in the following. (Refer to Pages 1 1C-76.)



CYLINDER HEAD

Cylinder head height (when new):
131.9 – 132.1 mm (5.193 – 5.201 in.)

VALVE

Margin:

Intake **1.0 mm (.039 in.)**

Exhaust **1.5 mm (.059 in.)**

Limit:

Intake **0.7 mm (.028 in.)**

Exhaust **1.0 mm (.039 in.)**

VALVE SPRING

Free height: **48.3 mm (1.902 in.)**

Limit: **47.4 mm (1.866 in.)**

Squareness: **1.5" or less**

Limit: **Max. 4"**

VALVE GUIDE

Valve guide to valve stem clearance:

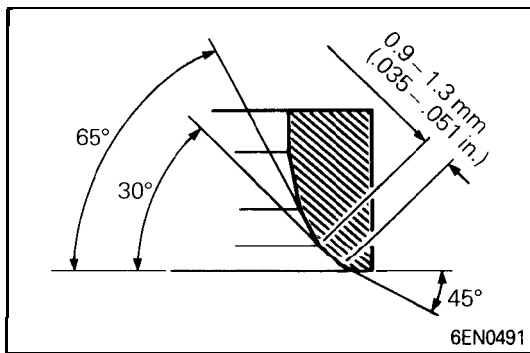
Intake **0.02 – 0.05 mm (.0008 – .0020 in.)**

Exhaust **0.05 – 0.09 mm (.0020 – .0035 in.)**

Limit:

Intake **0.10 mm (.004 in.)**

Exhaust **0.15 mm (.006 in.)**



VALVE SEAT RECONDITIONING PROCEDURE

- (1) Refer to Page 11C-77, noting that the only difference is in the special tool (Cutter).

VALVE SEAT REPLACEMENT PROCEDURE

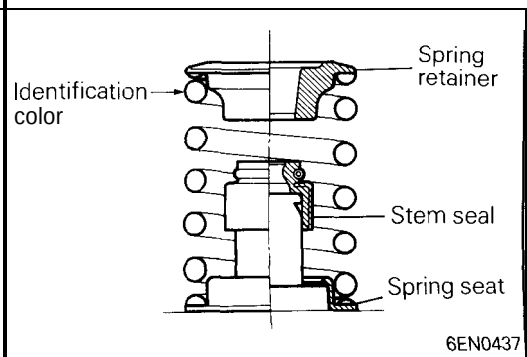
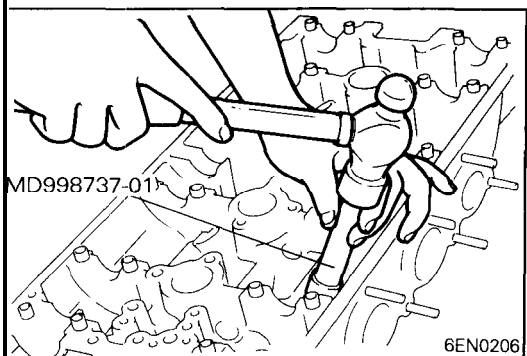
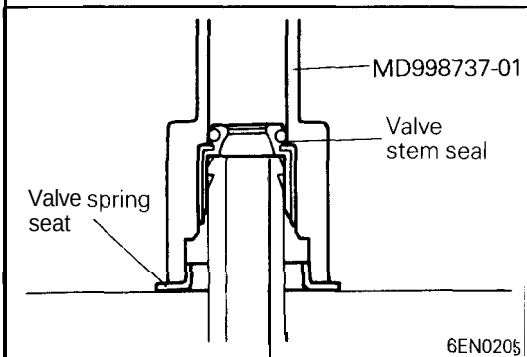
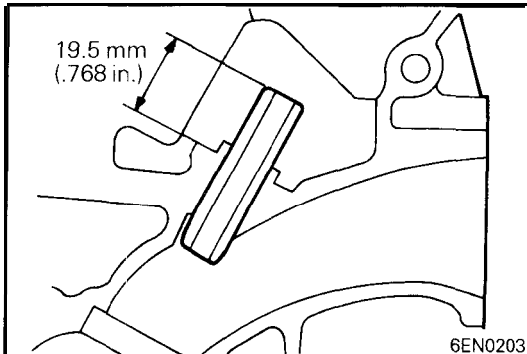
- (1) Refer to Page 11C-77 noting that the only difference is in the reboring size.

Intake valve seat hole diameter

0.3 mm (.012 in.) O.S.	35.30 – 35.33 mm (1.3898 – 1.3909 in.)
0.6 mm (.024 in.) O.S.	35.60 – 35.63 mm (1.4016 – 1.4028 in.)

Exhaust valve seat hole diameter

0.3 mm (.012 in.) O.S.	33.30 – 33.33 mm (1.3110 – 1.3122 in.)
0.6 mm (.024 in.) O.S.	33.60 – 33.63 mm (1.3228 – 1.3240 in.)

**VALVE GUIDE REPLACEMENT PROCEDURE**

- (1) Refer to Page 11C-77, noting that there are differences in the diameter of the valve guide hole as well as in the guide's installed height.

Valve Guide Hole Diameter

0.05 mm (.002 in.) O.S.	12.05 – 12.07 mm (.4744 – .4752 in.)
0.25 mm (.010 in.) O.S.	12.25 – 12.27 mm (.4823 – .4831 in.)
0.50 mm (.002 in.) O.S.	12.50 – 12.52 mm (.4921 – .4929 in.)

INSTALLATION SERVICE POINTS**◆A◆ VALVE STEM SEAL INSTALLATION**

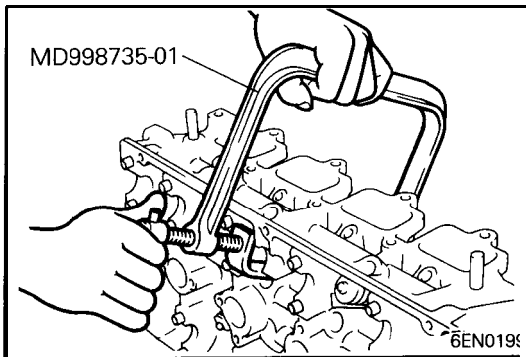
- (1) Install the valve spring seat.
- (2) Using the special tool, install a new stem seal to the valve guide.

Caution

Do not reuse the valve stem seal.

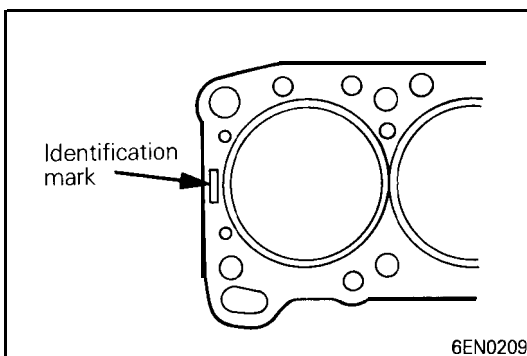
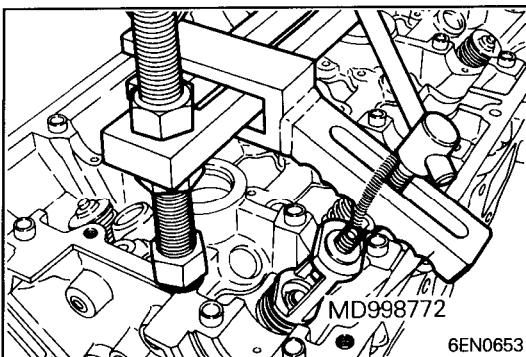
◆B◆ VALVE SPRING INSTALLATION

- (1) Install the valve spring so that its end with identification color is positioned on the rocker arm end.



◆C◆ RETAINER LOCK INSTALLATION

- (1) Using the special tool, compress the valve spring and insert the retainer lock into position.

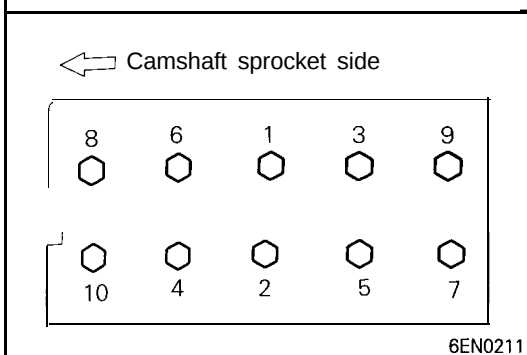


◆D◆ CYLINDER HEAD GASKET IDENTIFICATION

Identification mark:

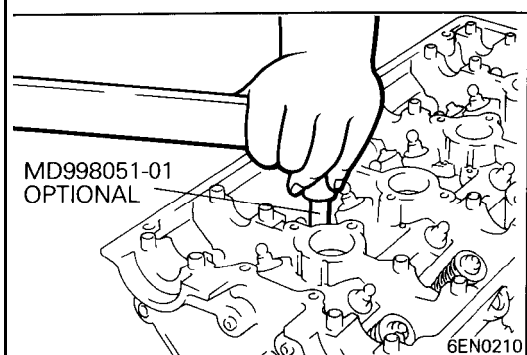
16 4G61

2 0 4G63



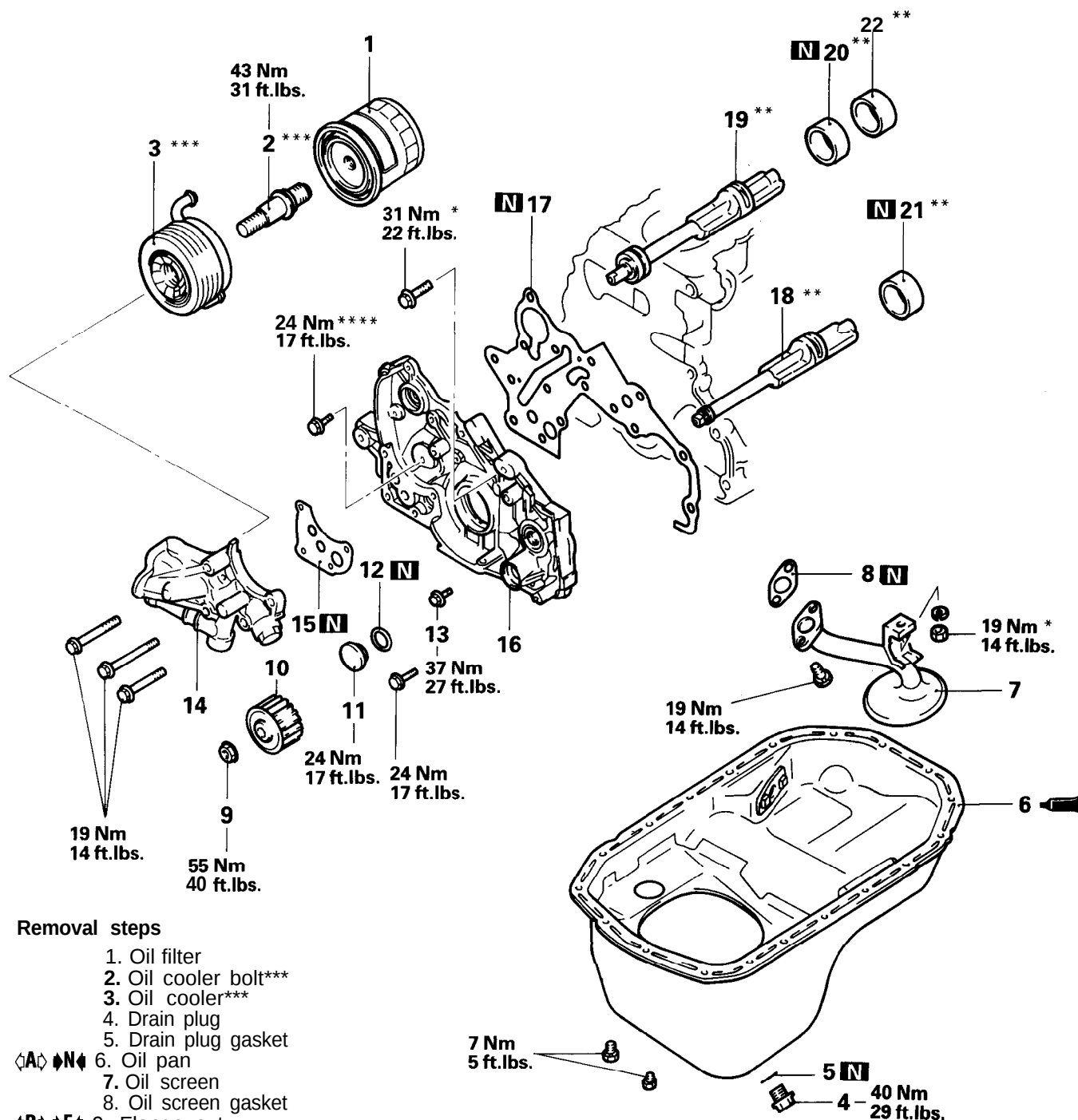
◆E◆ CYLINDER HEAD BOLT INSTALLATION

- (1) Tighten the cylinder head bolts in the sequence shown. Each bolt should be tightened in two to three steps, torquing progressively. Tighten to the specified torque in the final sequence.



FRONT CASE, SILENT SHAFT AND OIL PAN

REMOVAL AND INSTALLATION



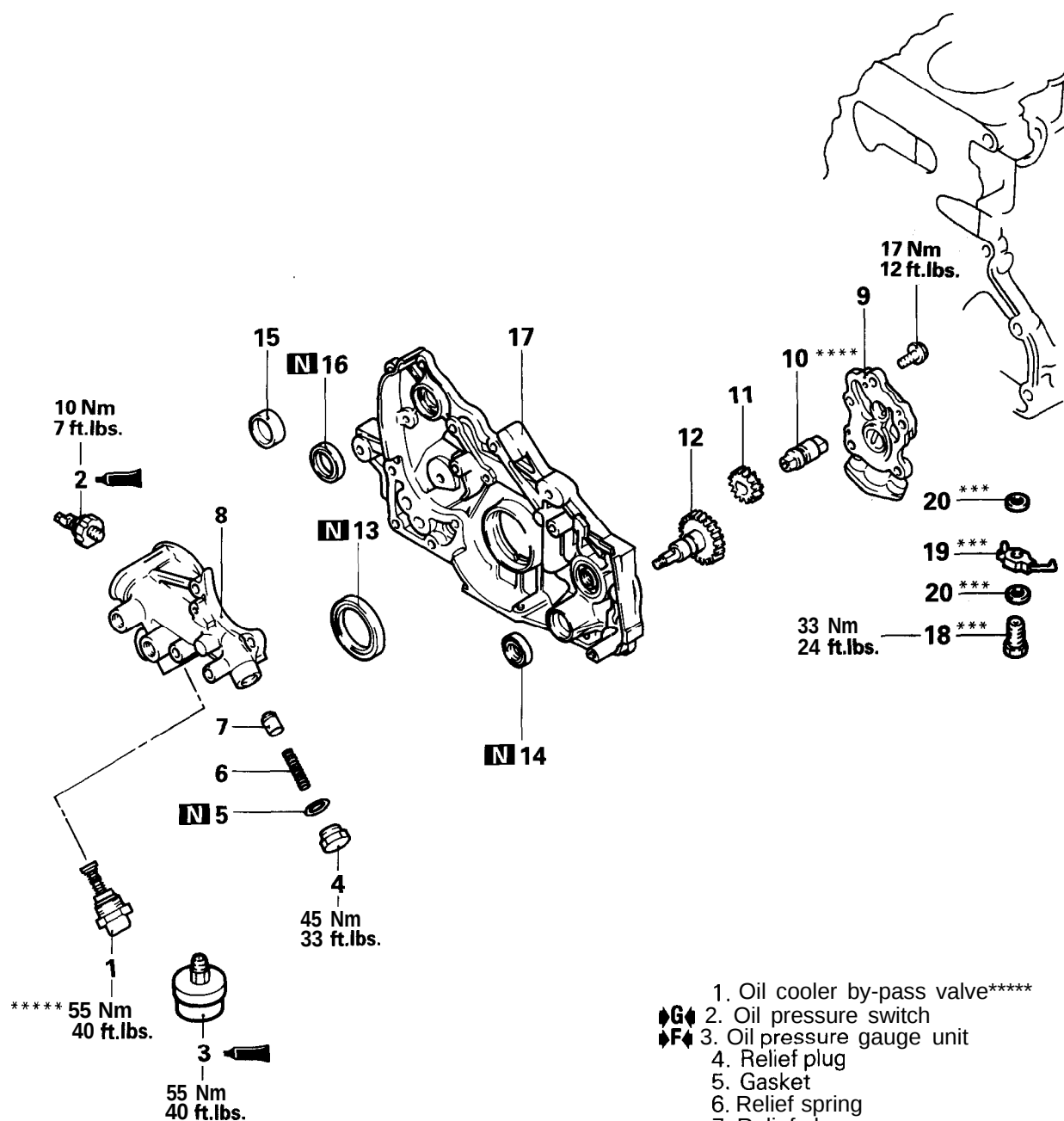
Removal steps

1. Oil filter
2. Oil cooler bolt***
3. Oil cooler***
4. Drain plug
5. Drain plug gasket
- ⧫A⧫N⧫ 6. Oil pan
7. Oil screen
8. Oil screen gasket
- ⧫B⧫E⧫ 9. Flange nut
10. Oil pump sprocket**
- ⧫C⧫M⧫ 11. Plug
12. O-ring
- ⧫D⧫L⧫ 13. Flange bolt
14. Oil filter bracket
15. Oil filter bracket gasket
- ⧫K⧫ 16. Front case
17. Front case gasket
18. Silent shaft, left**
19. Silent shaft, right**
- ⧫E⧫J⧫ 20. Silent shaft, front bearing**
- ⧫F⧫I⧫ 21. Silent shaft, rear bearing, left**
- ⧫G⧫H⧫ 22. Silent shaft, rear bearing, right**

NOTE

- * : DOHC
- ** : Engine with silent shafts
- *** : Engine with turbocharger
- **** : Engine without silent shafts
- ***** : Engine with air-cooling type oil cooler

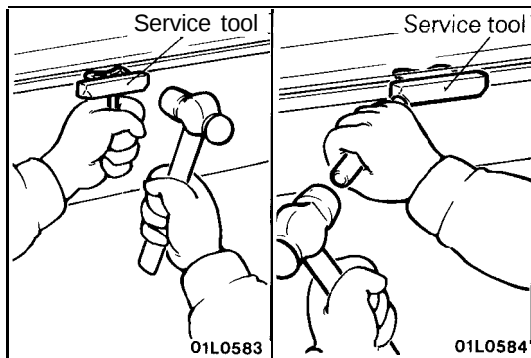
6EN0533



NOTE

- * : DOHC
 ** : Engine with silent shafts
 *** : Engine with turbocharger
 **** : Engine without silent shafts
 ***** : Engine with air-cooling type oil cooler

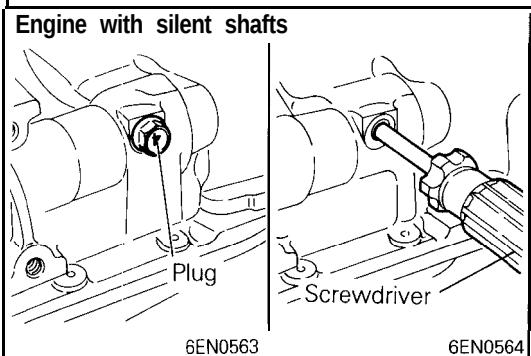
1. Oil cooler by-pass valve*****
 ♦G♦ 2. Oil pressure switch
 ♦F♦ 3. Oil pressure gauge unit
 4. Relief plug
 5. Gasket
 6. Relief spring
 7. Relief plunger
 8. Oil filter bracket
 9. Oil pump cover
 10. Oil pump shaft*****
 ♦D♦ 11. Oil pump driven gear
 ♦D♦ 12. Oil pump drive gear
 ♦C♦ 13. Crankshaft front oil seal
 ♦B♦ 14. Oil pump oil seal
 15. Plug*****
 ♦A♦ 16. Silent shaft oil seal**
 17. Front case
 18. Check valve
 19. Oil jet
 20. Gasket

**REMOVAL SERVICE POINTS****◊A◊ OIL PAN REMOVAL**

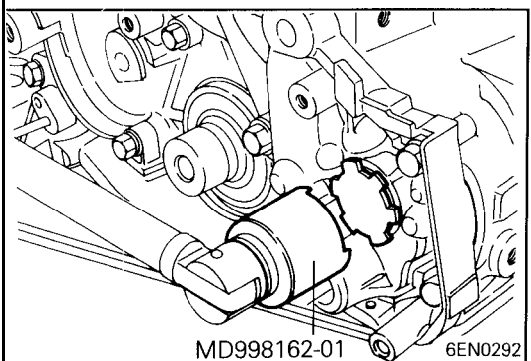
- (1) Remove the all oil pan bolts.
- (2) Drive in the service tool between the cylinder block and oil pan.

NOTE

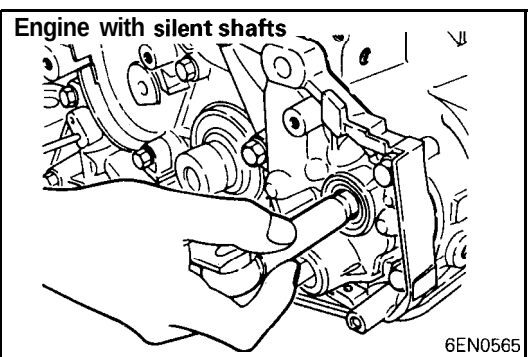
Never use a screwdriver or chisel, instead of the service tool, as a deformed oil pan flange will result in oil leakage.

**◊B◊ FLANGE NUT REMOVAL
(ENGINE WITH SILENT SHAFTS)**

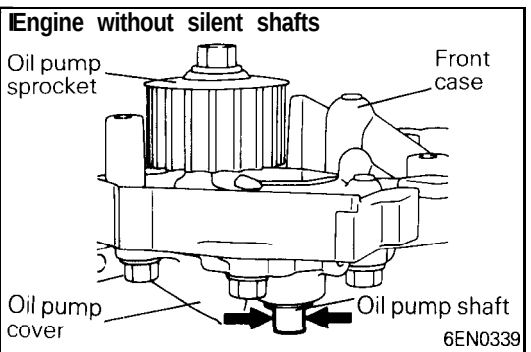
- (1) Remove the plug on the side of the cylinder block.
- (2) Insert a Phillips screwdriver [shank diameter 8 mm (.32 in.)] into the plug hole to lock the silent shaft.
- (3) Loosen the oil pump sprocket flange nut.

**◊C◊ PLUG REMOVAL**

- (1) If the plug is too tight, hit the plug head with a hammer two to three times, and the plug will be easily loosened.

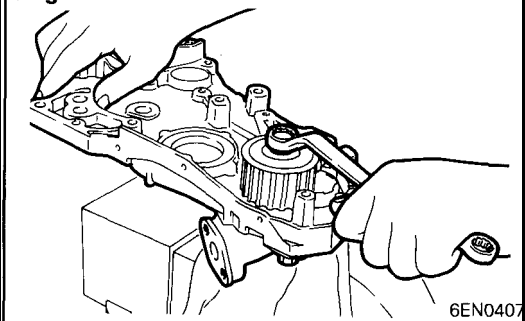
**◊D◊ FLANGE BOLT REMOVAL
(ENGINE WITH SILENT SHAFTS)**

- (1) Referring to ◊B◊ (2), lock the silent shaft.
- (2) Loosen the flange bolt.

**◊D◊ FLANGE NUT REMOVAL
(ENGINE WITHOUT SILENT SHAFTS)**

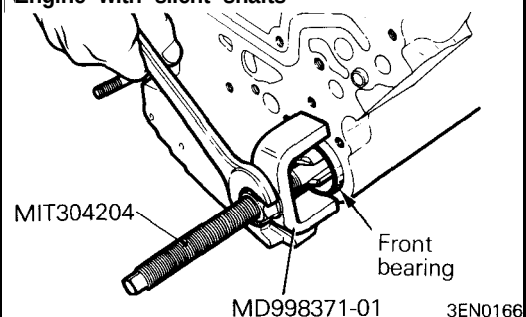
- (1) Clamp the oil pump shaft end in a vise.

Engine without silent shafts



(2) Remove the oil pump sprocket nut.

Engine with silent shafts



⦿E⦿ SILENT SHAFT FRONT BEARING REMOVAL (ENGINE WITH SILENT SHAFTS)

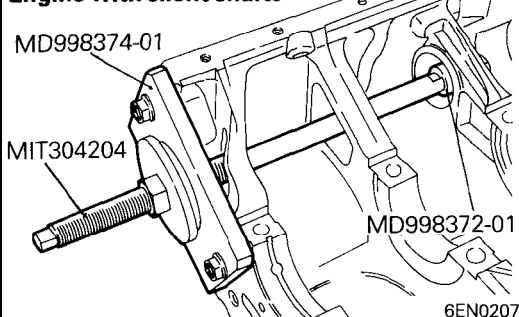
Using the special tool, remove the silent shaft front bearing from the cylinder block.

NOTE

Be sure to remove the front bearing first.

If it has not been removed, the Rear Bearing Puller cannot be used.

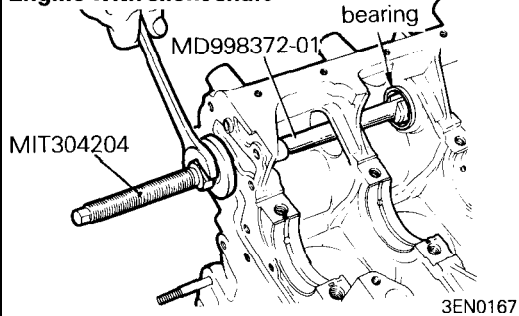
Engine with silent shafts



⦿F⦿ LEFT SILENT SHAFT REAR BEARING REMOVAL (ENGINE WITH SILENT SHAFTS)

Using the special tool, remove the left silent shaft rear bearing from the cylinder block.

Engine with silent shaft



⦿G⦿ REAR BEARING REMOVAL (ENGINE WITH SILENT SHAFTS)

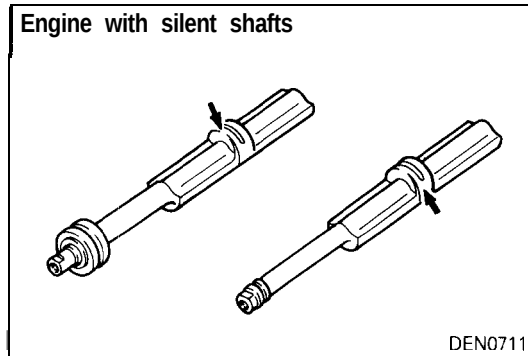
Using the special tool, remove the right silent shaft rear bearing from the cylinder block.

INSPECTION FRONT CASE

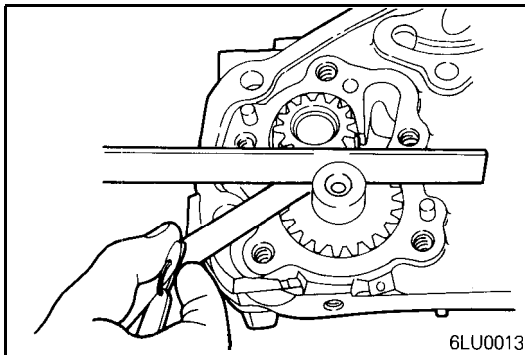
- (1) Check oil holes for clogging and clean if necessary.
- (2) Check left silent shaft front bearing section for wear, damage and seizure. If there is anything wrong with the section, replace the front case.
- (3) Check the front case for cracks and other damage. Replace cracked or damaged front case.

OIL SEAL

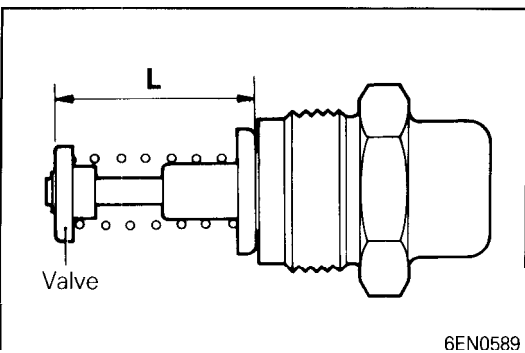
- (1) Check the oil seal lip for wear and damage. Replace the oil seal if necessary.
- (2) Check the oil seal lip for deterioration. Replace the oil seal if necessary.

**SILENT SHAFT (ENGINE WITH SILENT SHAFTS)**

- (1) Check oil holes for clogging.
- (2) Check journal for seizure, damage and contact with bearing. If there is anything wrong with the journal, replace silent shaft, bearing or front case assembly.
- (3) Check the silent shaft oil clearance. If the clearance is excessively due to wear, replace the silent shaft bearing, silent shaft or front case assembly.

Standard value:**Front****Right** 0.03 – 0.06 mm (.0012 – .0024 in.)**Left** 0.02 – 0.05 mm (.0008 – .0020 in.)**Rear****Right** 0.05 – 0.09 mm (.0020 – .0036 in.)**Left** 0.05 – 0.09 mm (.0020 – .0036 in.)**OIL PUMP**

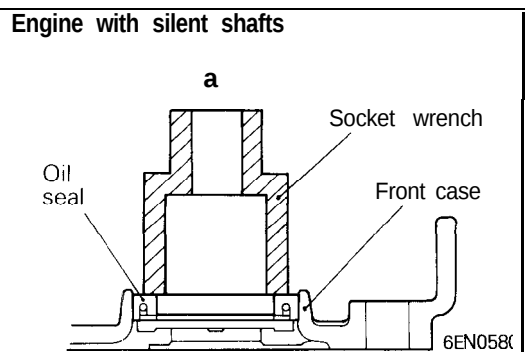
- (1) Assemble the oil pump gears in the front case and rotate them to ensure smooth rotation with no looseness.
- (2) Ensure that there is no ridge wear on the gear contact surface of the front case and the oil pump cover.
- (3) Check the side clearance

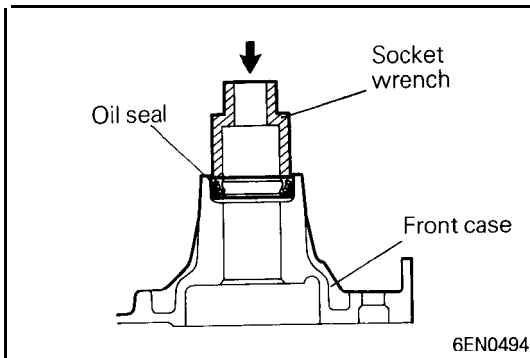
Standard value:**Drive gear** 0.08 – 0.14 mm (.0031 – .0055 in.)**Driven gear** 0.06 – 0.12 mm (.0024 – .0047 in.)**OIL COOLER BYPASS VALVE****(ENGINE WITH AIR COOLING TYPE OIL COOLER)**

- (1) Make sure that the valve moves smoothly.
- (2) Ensure that the dimension (L) measures the standard value under normal temperature and humidity.

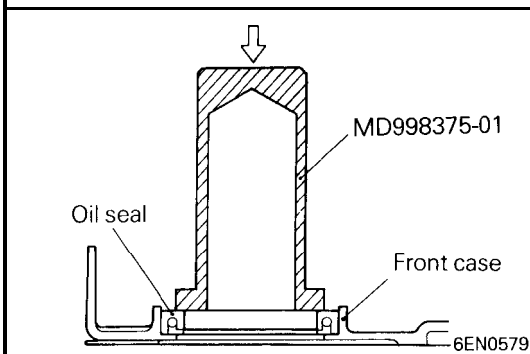
Standard value (L): 34.5 (.358 in.)

- (3) The dimension must be the standard value when measured after the valve has been dipped in 100°C (212°F) oil.

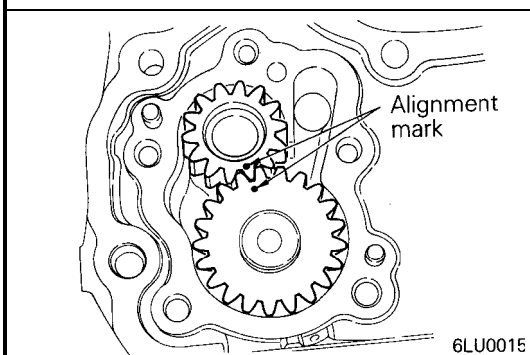
Standard value (L): 40 mm (1.57 in.) or more**INSTALLATION SERVICE POINTS**
◆◆ SILENT SHAFT OIL SEAL INSTALLATION
(ENGINE WITH SILENT SHAFTS)

**OIL PUMP OIL SEAL INSTALLATION****CRANKSHAFT FRONT OIL SEAL INSTALLATION**

- (1) Using the special tool, install the crankshaft front oil seal into the front case.

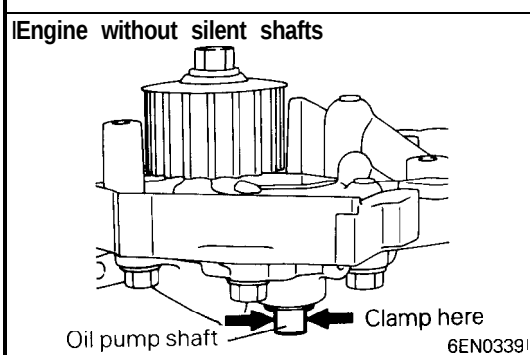
**OIL PUMP DRIVEN GEAR / OIL PUMP DRIVE GEAR INSTALLATION**

- (1) Apply engine oil amply to the gears and line up the alignment marks.

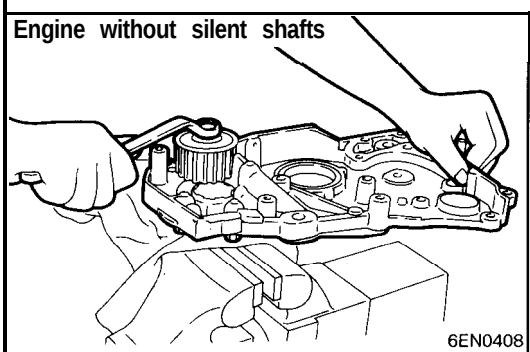
**FLANGE NUT INSTALLATION
(ENGINE WITHOUT SILENT SHAFTS)****Caution**

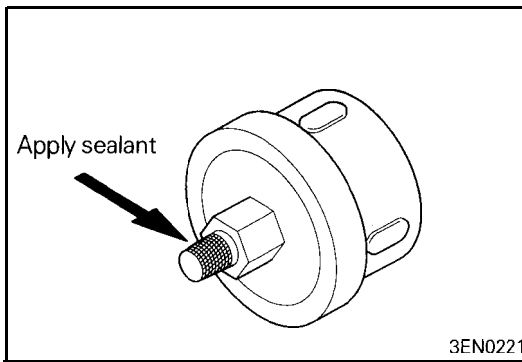
Before installing the flange nut, apply an appropriate amount of oil to the seating surface.

- (1) Clamp the oil pump shaft end in a vise.



- (2) Tighten the oil pump sprocket nut to the specified torque.





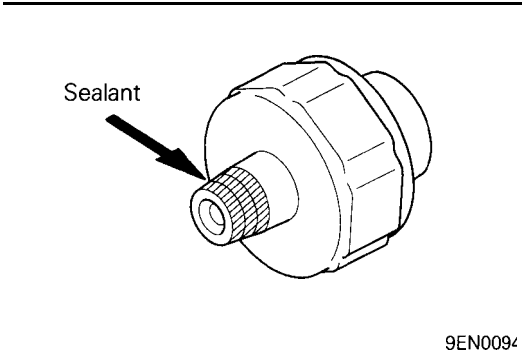
◆F◆ SEALANT APPLICATION TO OIL PRESSURE GAUGE UNIT

- (1) Coat the threads of the oil pressure gauge unit with sealant and install the unit using the special tool.

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

Caution

1. Keep the end of threaded portion clear of sealant.
2. Avoid an **overtightening**.



◆G◆ SEALANT APPLICATION TO OIL PRESSURE SWITCH

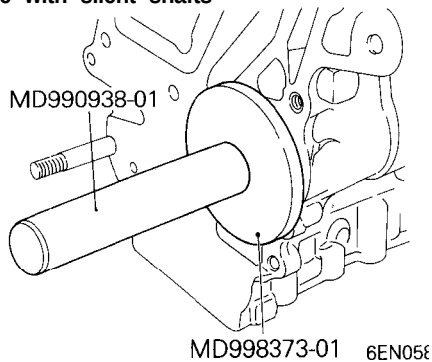
- (1) Coat the threads of the oil pressure switch with sealant and install the switch using the special tool.

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

Caution

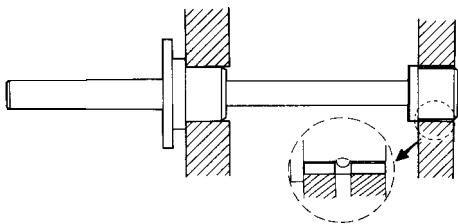
1. Keep the end of threaded portion clear of sealant.
2. Avoid an **overtightening**.

Engine with silent shafts

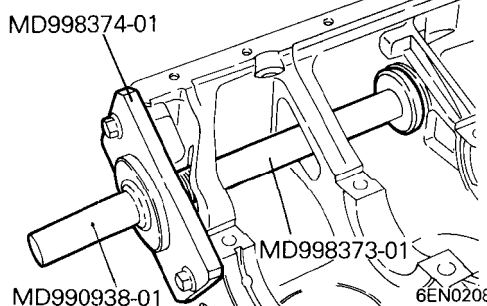


◆H◆ RIGHT SILENT SHAFT REAR BEARING INSTALLATION (ENGINE WITH SILENT SHAFTS)

- (1) Apply engine oil to the outer surface of the bearing.
- (2) Using special tools, install the right rear bearing. Make sure that the oil hole of the bearing is aligned with the oil hole of the cylinder block.



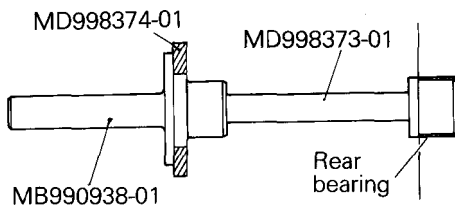
Engine with silent shafts



◆I◆ LEFT SILENT SHAFT REAR BEARING INSTALLATION (ENGINE WITH SILENT SHAFTS)

- (1) Install the special tool (Guide Plate) to the cylinder block.
- (2) Apply engine oil to the rear bearing outer circumference and bearing hole in the cylinder block.

Engine with silent shafts



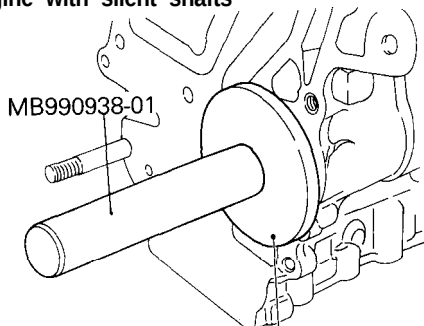
6EN0578

- (3) Using the special tool, install the rear bearing.

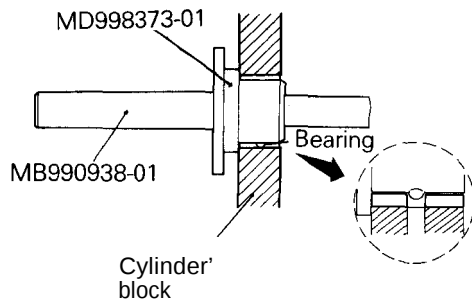
NOTE

The left rear bearing has no oil holes.

Engine with silent shafts



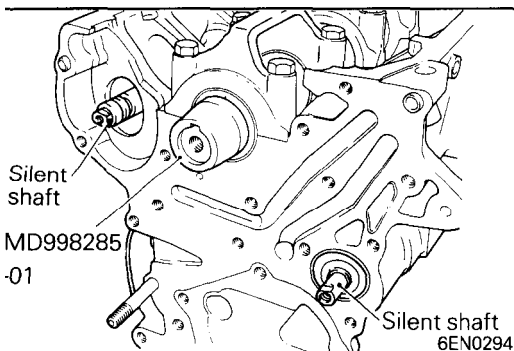
MD998373-01 6EN0586



6EN0588

SILENT SHAFT FRONT BEARING INSTALLATION
(ENGINE WITH SILENT SHAFTS)

- (1) Using the special tools, install the front bearing.

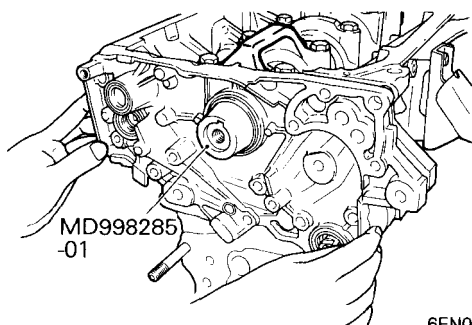


6EN0294



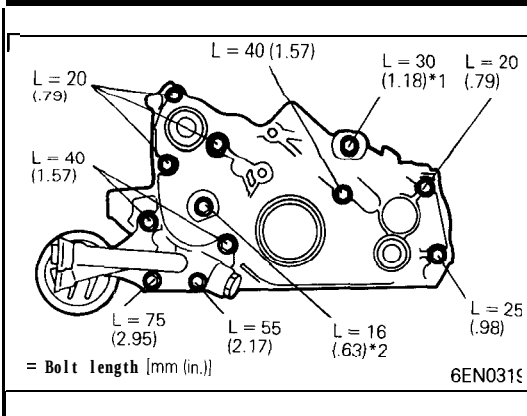
FRONT CASE INSTALLATION

- (1) Set the special tool on the front end of the crankshaft and apply a thin coat of engine oil to the outer circumference of the special tool to install the front case.



6EN0262

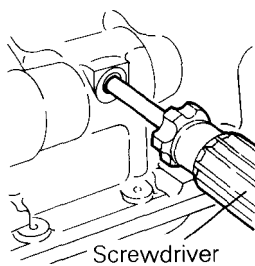
- (2) Install the front case assembly through a new front case gasket and temporarily tighten the flange bolts (other than those for tightening the filter bracket).



- (3) Mount the oil filter bracket with oil filter bracket gasket. Then, install the four bolts with washers.
- (4) Tighten the bolts to the specification.

NOTE

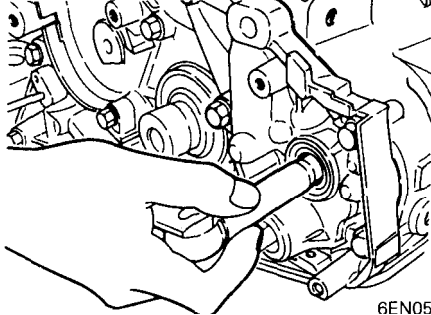
- (1) The bolt marked with *1 in the illustration differs in tightening torque.
- (2) The bolt marked with *2 in the illustration is for engine without silent shafts only.

Engine with silent shafts**1**

6EN0564

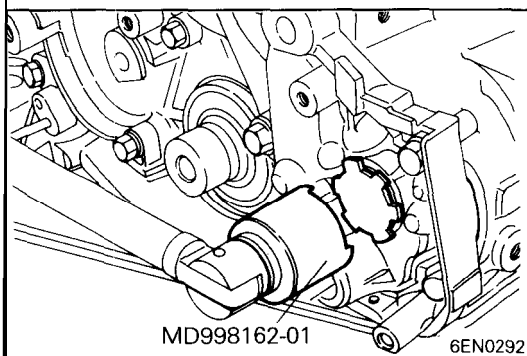
**◆L◆ FLANGE BOLT INSTALLATION
(ENGINE WITH SILENT SHAFTS)**

- (1) Insert a Phillips screwdriver into the hole on the left side of the cylinder block to lock the silent shaft.

Engine with silent shafts

6EN056F

- (2) Secure the oil pump driven gear on the left silent shaft by tightening the flange bolt to the specified torque.

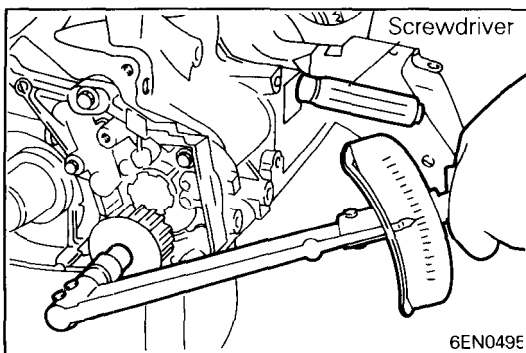


MD998162-01

6EN0292

◆M◆ PLUG INSTALLATION

- (1) Install a new O-ring in the groove of the front case.
- (2) Using the special tool, install the plug and tighten to the specified torque.



6EN049E

**◆E◆ FLANGE NUT INSTALLATION
(ENGINE WITH SILENT SHAFTS)**

- (1) Referring to ◆J◆ (1), lock the silent shaft.
- (2) Tighten the flange nut to the specified torque.

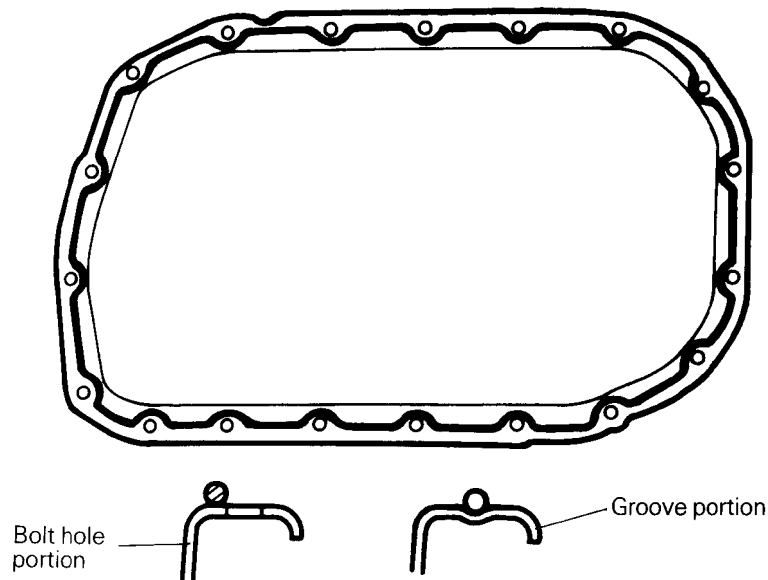
◆N◆ OIL PAN INSTALLATION

- (1) Clean both mating surface of the oil pan and the cylinder block.
- (2) Apply a 4 mm (.16 in.) wide bead of sealant to the entire circumference of the oil pan flange.

Specified sealant:

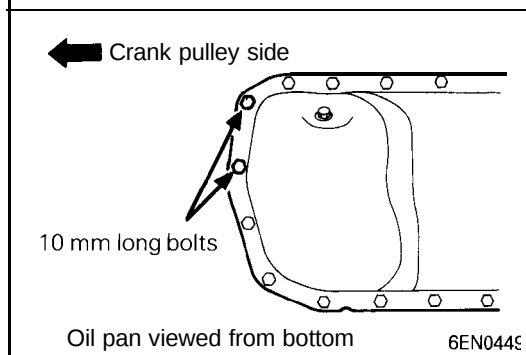
MITSUBISHI GENUINE PART No. MD970389 or equivalent

- (3) The oil pan should be installed in 15 minutes after the application of sealant.



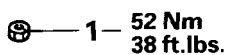
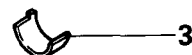
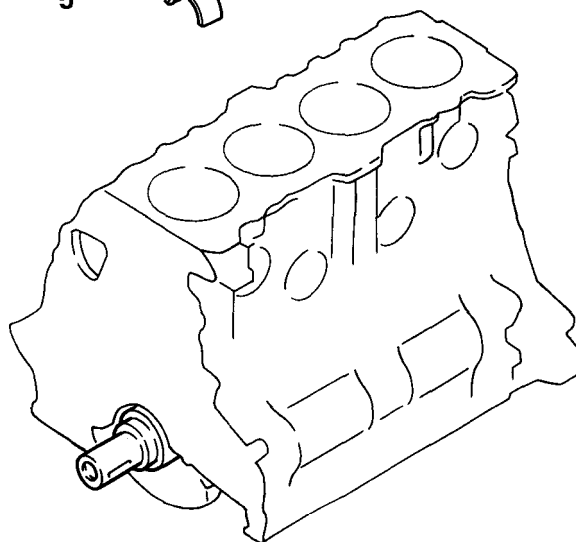
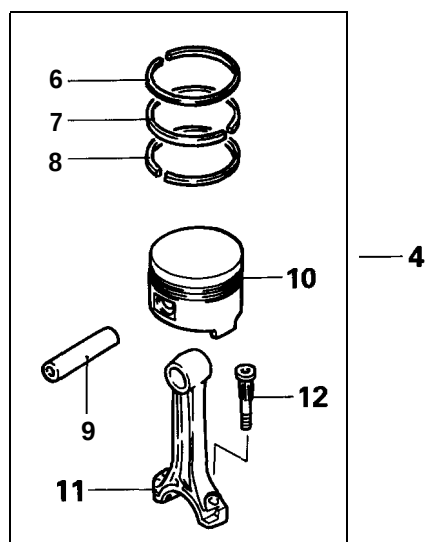
6FN0213

- (4) Note that the bolts at the location shown are different in length from the others.



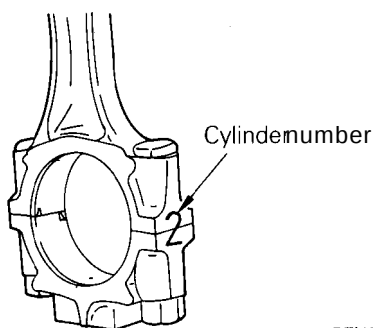
PISTON AND CONNECTING ROD

REMOVAL AND INSTALLATION



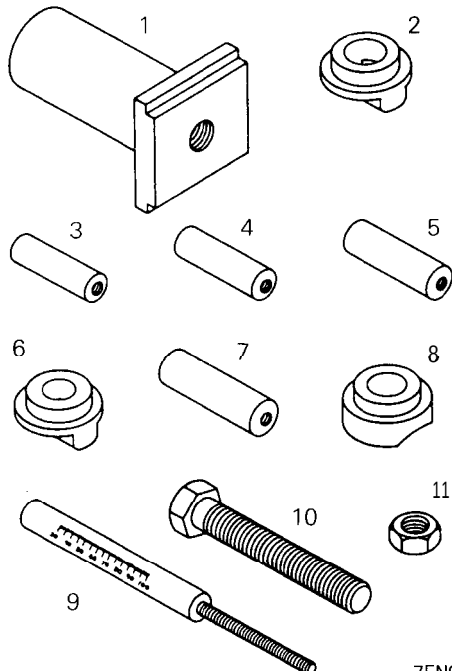
Removal steps

1. Nut
- ↻A↻E 2. Connecting rod cap
3. Connecting rod bearing
- ↻D 4. Piston and connecting rod assembly
5. Connecting rod bearing
- ↻C 6. Piston ring No. 1
- ↻C 7. Piston ring No. 2
- ↻B 8. Oil ring
- ↻B↻A 9. Piston pin
10. Piston
11. Connecting rod
12. Bolt

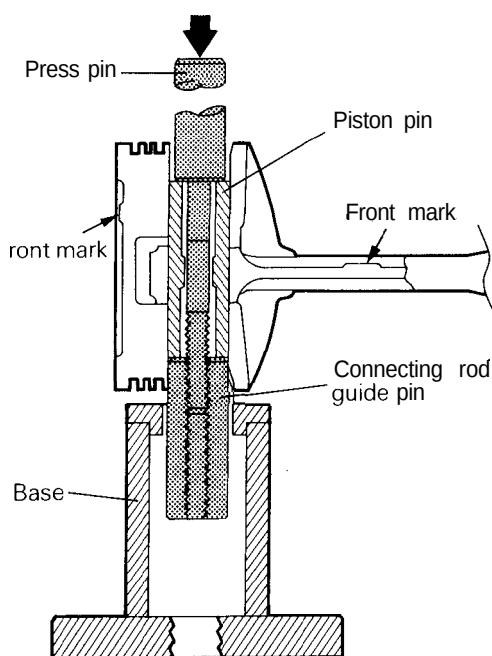


7EN0448

Piston pin setting
tool MIT216941



7EN0425



7EN0426

REMOVAL SERVICE POINTS

⚠A⚠ CONNECTING ROD CAP REMOVAL

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

⚠B⚠ PISTON PIN REMOVAL

Item No.	Part No.	Description
1	MIT310134	Base
2	MIT310136	Piston Support
3	MIT310137	Connecting Rod Guide Pin
4	MIT310138	Connecting Rod Guide Pin
5	MIT310139	Connecting Rod Guide Pin
6	MIT310140	Piston Support
7	MIT310141	Connecting Rod Guide Pin
8	MIT310142	Piston Support
9	MIT48143	Press Pin
10	2 16943	Stop Screw
11	10396	Nut

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

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

IMPORTANT: To avoid piston damage,

1. The piston support must seat squarely against the piston.
2. Verify that the piston pin will slide through the hole in the piston support.

- (6) Remove the piston pin from the press pin.

INSPECTION**PISTON**

- (1) Replace the piston if scratches or seizure is evident on its surfaces (especially the thrust surface). Replace the piston if it is cracked.

PISTON PIN

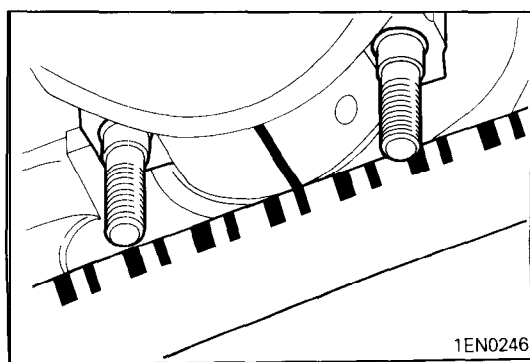
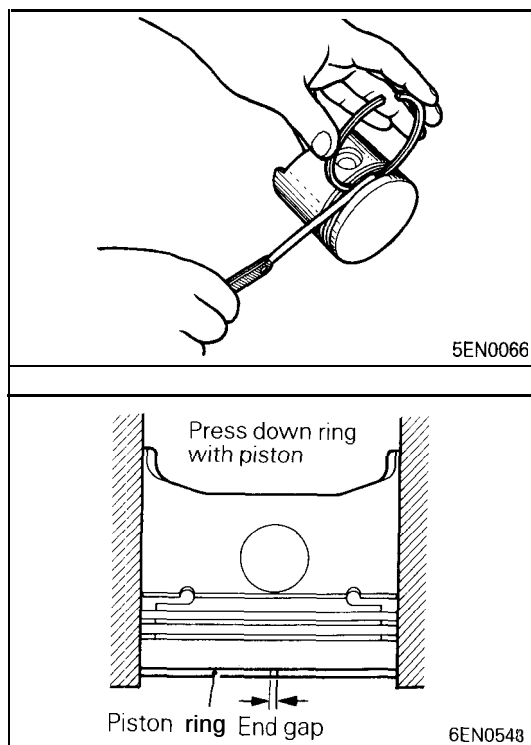
- (1) Insert the piston pin into the piston pin hole with a thumb. You should feel a slight resistance. Replace the piston pin if it can be easily inserted or there is an excessive play.
- (2) The piston and piston pin must be replaced as an assembly.

PISTON RING

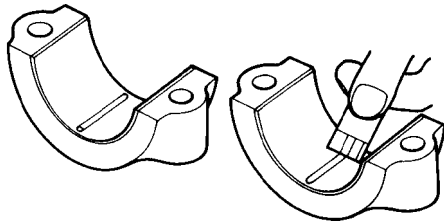
- (1) Check the piston ring for damage, excessive wear, and breakage and replace if defects are evident. If the piston has been replaced with a new one, the piston rings must also be replaced with new ones.
- (2) Check for the clearance between the piston ring and ring groove. If the limit is exceeded, replace the ring or piston, or both.

Standard value:**No.1** 0.03 – 0.07 mm (.0012 – .0028 in.)**No.2 SOHC** 0.02 – 0.06 mm (.0008 – .0024 in.)**No. 2 DOHC** 0.03 – 0.07 mm (.0012 – .0028 in.)**Limit: 0.1 mm (.004 in.)**

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

Standard value:**No. 1** 0.25 – 0.40 mm (.0098 – .0157 in.)**No. 2** 0.35 – 0.50 mm
(.0138 – .0197 in.) **4G61**0.20 – 0.35 mm
(.0079 – .0138 in.) **4G63 – SOHC**0.45 – 0.60 mm
(.0177 – .0236 in.) **4G63 – DOHC**0.20 – 0.40 mm
(.0079 – .0157 in.) **4G64****Oil** 0.20 – 0.70 mm (.0079 – .0276 in.)**Limit:****No. 1, No. 2** 0.8 mm (.031 in.)**Oil** 1.0 mm (.039 in.)**CRANKSHAFT PIN OIL CLEARANCE
(PLASTIC GAUGE METHOD)**

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



1 EN027

- (3) Install the connecting rod cap carefully and tighten the bolts to the specified torque.
- (4) Carefully remove the connecting rod cap.
- (5) Measure the width of the plastic gauge at its widest part by using a scale printed on the plastic gauge package.

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

Limit: 0.1 mm (.004 in.)

INSTALLATION SERVICE POINTS

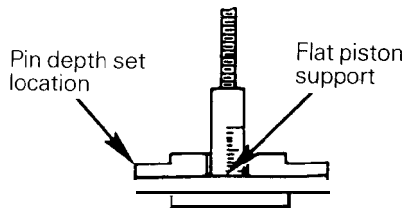
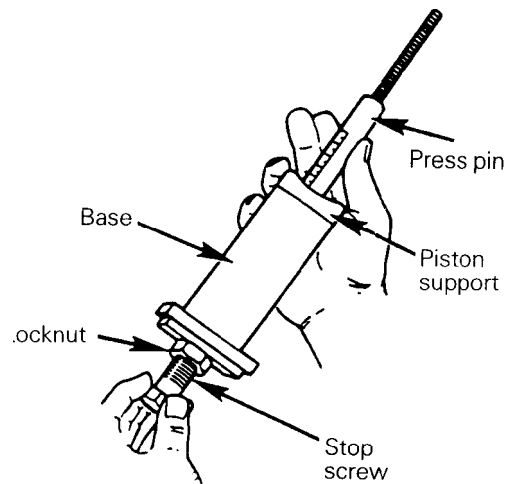
◆A◆ PISTON PIN INSTALLATION

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

Depth:

SOHC and 4G61 DOHC 56 mm (2.20 in.)

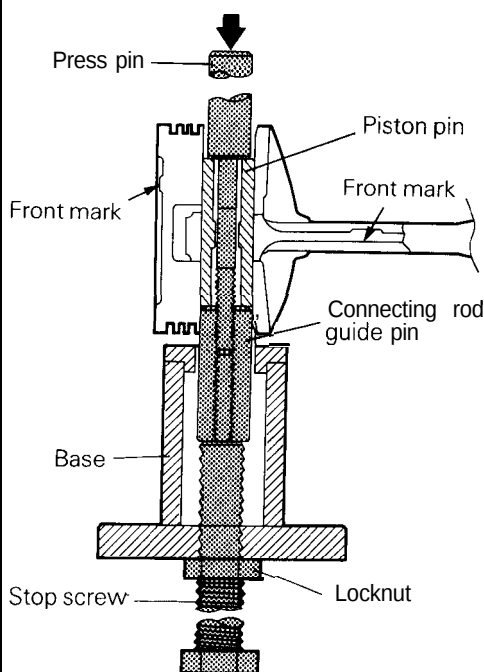
4G63 DOHC 55 mm (2.17 in.)



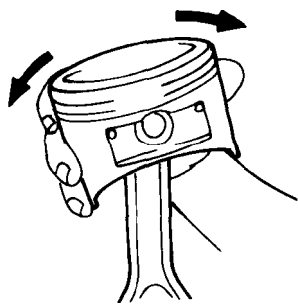
7EN0428

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

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

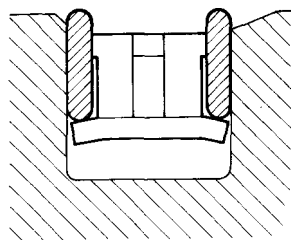


7EN0429



6EN0298

(8) Check that the piston moves smoothly.



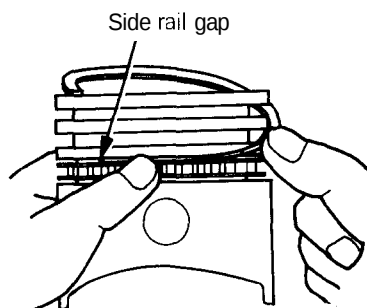
6EN0585

▶B▶ OIL RING INSTALLATION

(1) Fit the oil ring spacer into the piston ring groove.

NOTE

The side rails and spacer may be installed in either direction.



1 EN0269

(2) Install the upper side rail.

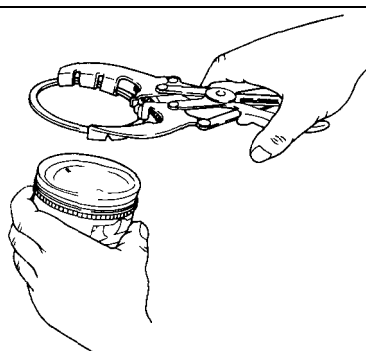
To install the side rail, first fit one end of the rail into the piston groove, then press the remaining portion into position by finger. See illustration.

Caution

Do not use piston ring expander when installing side rail.

(3) Install the lower side rail in the same procedure as described in step (2).

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



7EN0452

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

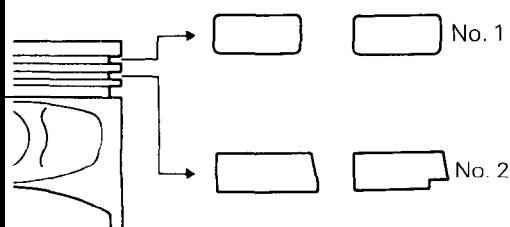
(1) Using a piston ring expander, fit No. 2 and then No. 1 piston ring into position.

NOTE

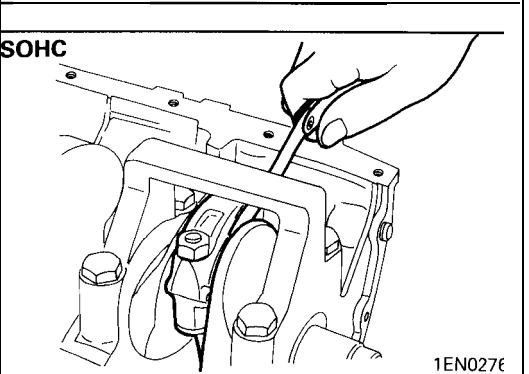
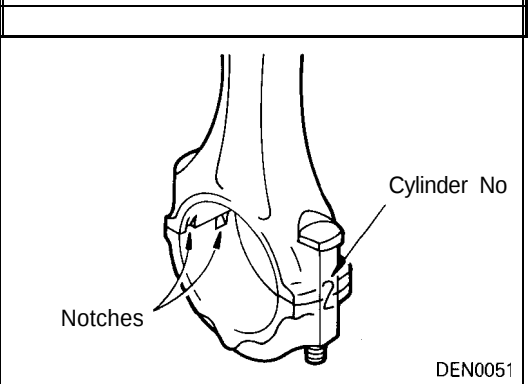
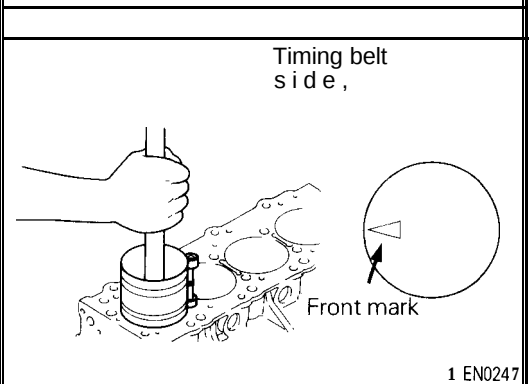
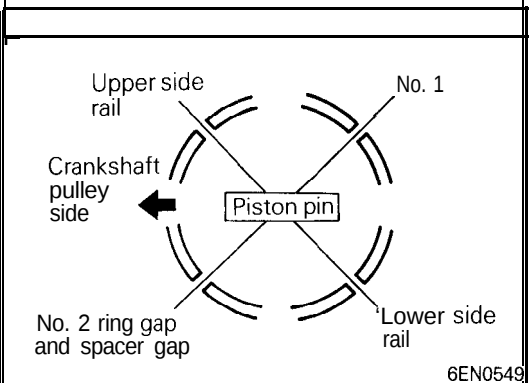
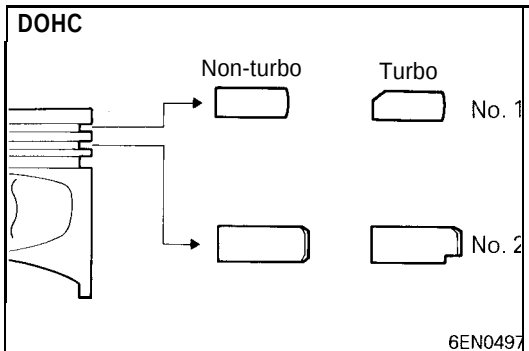
(1) Note the difference in shape between No. 1 and No. 2 piston rings.

(2) Install piston rings No. 1 and No. 2 with their side having marks facing up (on the piston crown side).

SOHC



6EN0527



◆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 figure.

- (3) Rotate the crankshaft so that the crank pin is on the center of the cylinder bore.
- (4) Use suitable thread protectors on the connecting rod bolts before inserting the piston and connecting rod assembly into the cylinder block.
Care must be taken not to nick the crank pin.
- (5) Using a suitable piston ring compressor tool, install the piston and connecting rod assembly into the cylinder block.

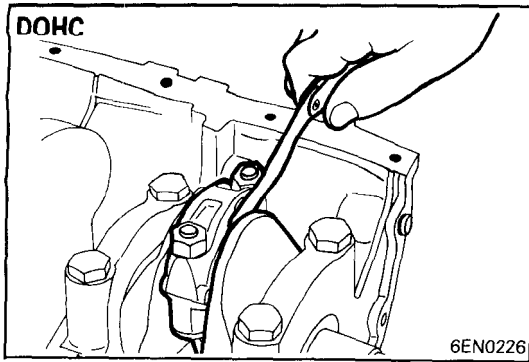
◆E◆ CONNECTING ROD CAP INSTALLATION

- (1) Verifying the mark made during disassembly, install the bearing cap to the connecting rod. If the connecting rod is new with no index mark, make sure that the bearing locking notches come on the same side as shown.

- (2) Make sure that the connecting rod big end side clearance meets the specification.

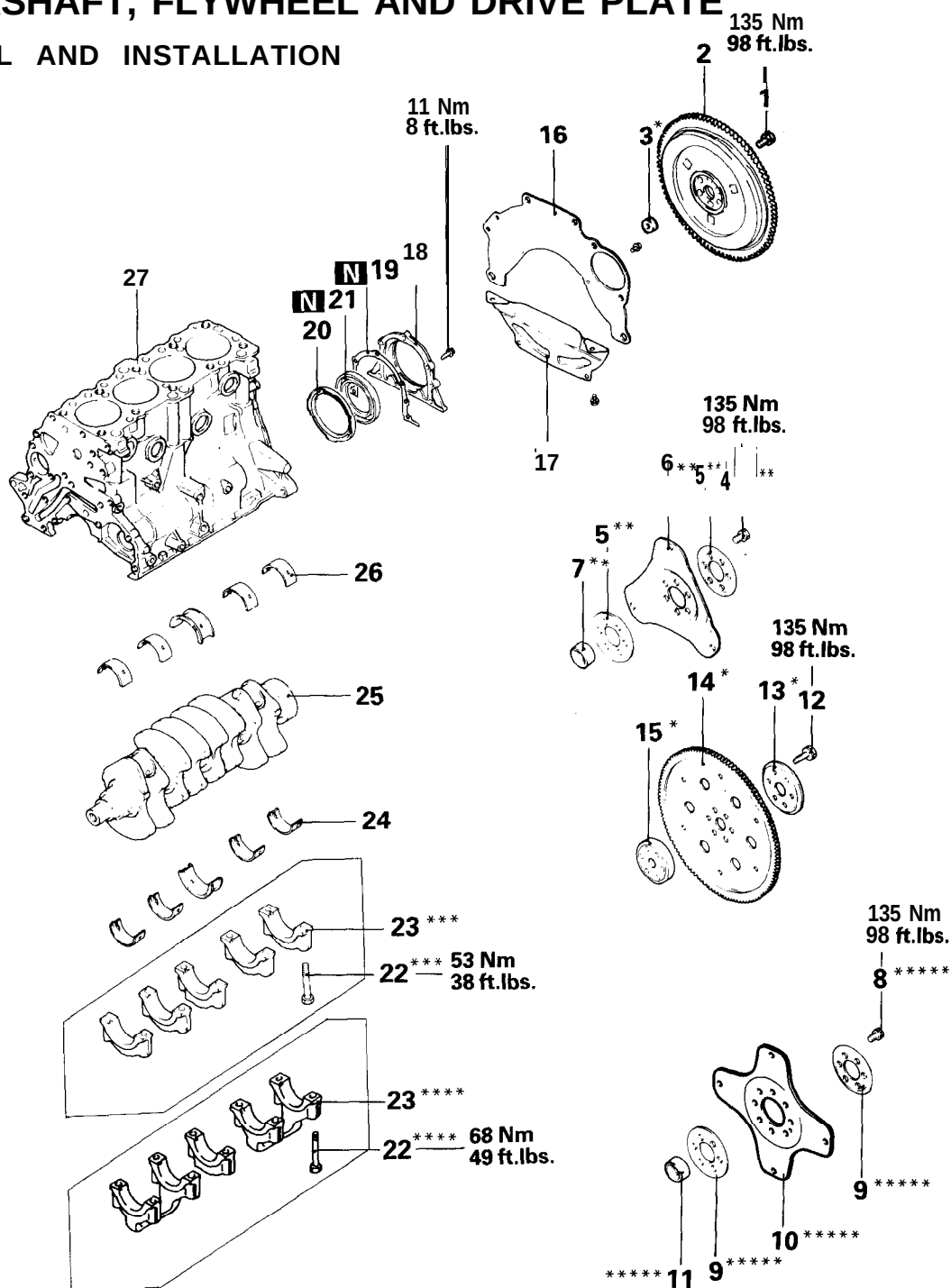
Standard value: 0.10 – 0.25 mm (.0039 – .0098 in.)

Limit: 0.4 mm (.016 in.)



CRANKSHAFT, FLYWHEEL AND DRIVE PLATE

REMOVAL AND INSTALLATION

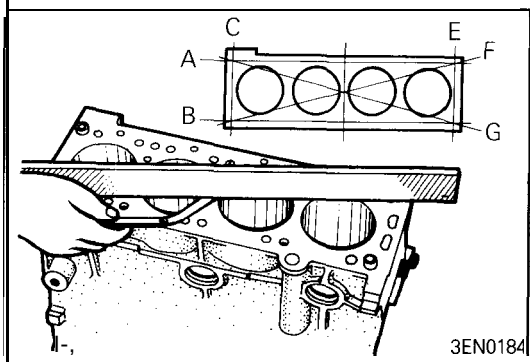
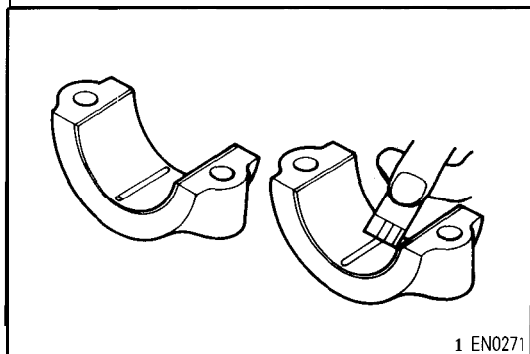
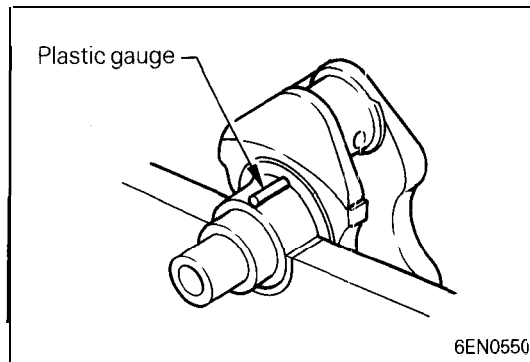


Removal steps

1. Flywheel bolt
2. Flywheel
3. Ball bearing*
4. Drive plate bolt**
5. Adapter plate**
6. Drive plate**
7. Crankshaft bushing**
8. Drive plate bolt
9. Adapter plate
10. Drive plate
11. Crankshaft bushing
12. Drive plate bolt*
13. Adapter plate*
14. Drive plate*
15. Crankshaft adapter*
16. Rear plate
17. Bell housing cover
18. Oil seal case
19. Gasket
20. Oil separator
21. Oil seal
22. Bearing cap bolt
23. Bearing cap
24. Crankshaft bearing (lower)
25. Crankshaft
26. Crankshaft bearing (upper)
27. Cylinder block

NOTE

- * : Rear wheel drive
- ** : Front wheel drive
- *** : SOHC
- **** : DOHC
- ***** : DOHC Turbo for ECLIPSE



INSPECTION

CRANKSHAFT OIL CLEARANCE (PLASTIC GAUGE METHOD)

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

- (4) Install the crankshaft bearing cap carefully and tighten the bolts to the specified torque.
- (5) Carefully remove the crankshaft bearing cap.
- (6) Measure the width of the plastic gauge at its widest part by using a scale printed on the plastic gauge package.

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

Limit: 0.1 mm (.004 in.)

CYLINDER BLOCK

- (1) Visually check for scratches, rust, and corrosion. Use also a flaw detecting agent for the check. If defects are evident, correct, or replace.
- (2) Using a straightedge and feeler 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 (.0020 in.)

Limit: 0.1 mm (.004 in.)

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

Grinding limit: 0.2 mm (.008 in.)

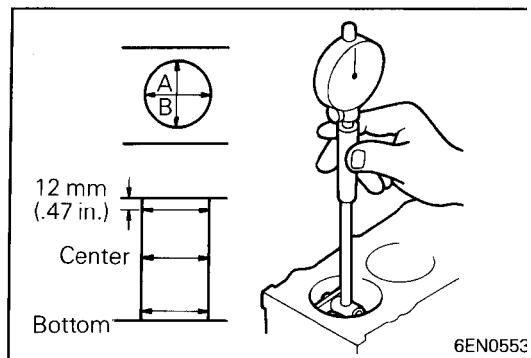
The total resurfacing depth of both cylinder block and mating cylinder head is 0.2 mm (.008 in.) at maximum.

Cylinder block height (when new):

4G61 274.9 – 275.1 mm
(10.823 – 10.831 in.)

4G63 283.9 – 284.1 mm
(11.177 – 11.185 in.)

4G64 289.9 – 290.1 mm
(11.413 – 11.421 in.)



- (4) Check cylinder walls for scratches and seizure. If defects are evident, correct (rebore to an oversize) or replace.
- (5) 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 I.D.

4G61

82.30 – 82.33 mm (3.2402 – 3.2413 in.)

4G63

85.00 – 85.03 mm (3.3465 – 3.3476 in.)

4G64

86.50 – 86.53 mm (3.4055 – 3.4067 in.)

Cylindricity 0.01 mm (.0004 in.)

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
0.25 mm (.01 in.) O.S.	0.25
0.50 mm (.02 in.) O.S.	0.50
0.75 mm (.03 in.) O.S.	0.75
1.00 mm (.04 in.) 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 (.0008 in.) (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, working from No. 2 to No. 4 to No. 1 to No. 3.

- (5) Hone to 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:

4G63 SOHC

0.01 – 0.03 mm (.0004 – .0012 in.)

4G63 DOHC T/C

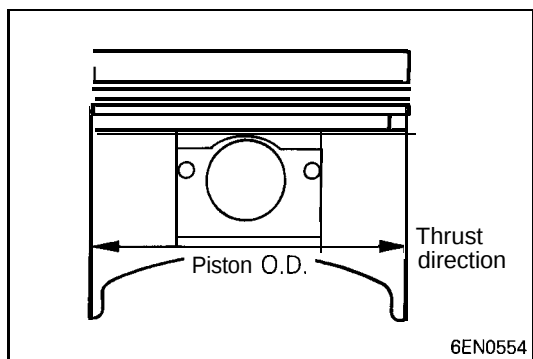
0.03 – 0.05 mm (.0012 – .0020 in.)

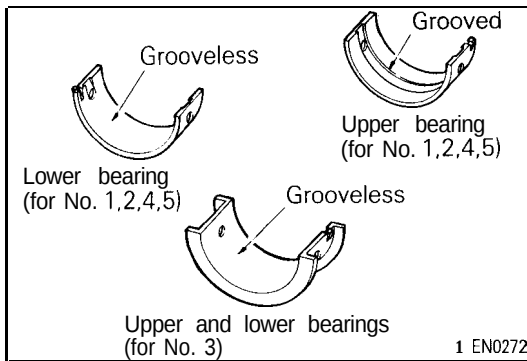
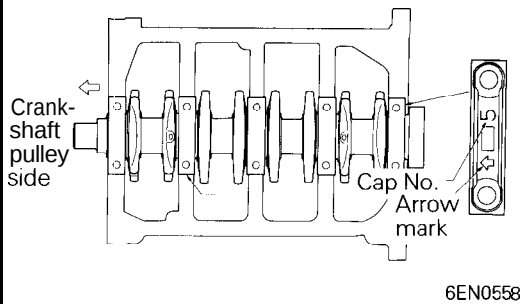
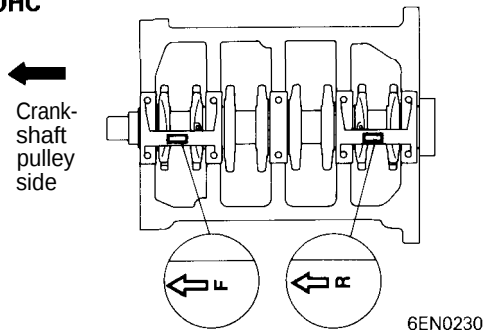
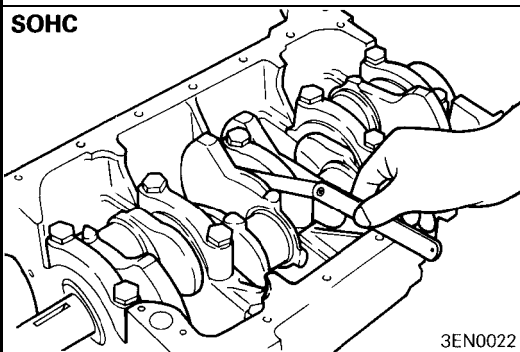
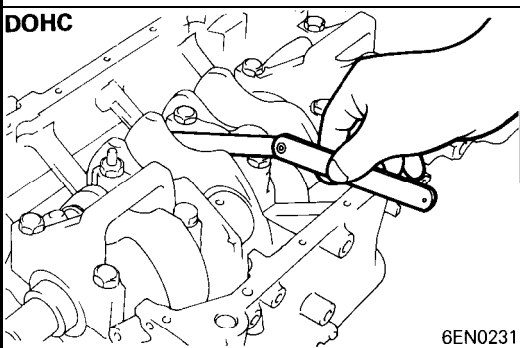
4G61, 4G63 DOHC, 4G64

0.02 – 0.04 mm (.0008 – .0016 in.)

NOTE

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



**SOHC****DOHC****SOHC****DOHC****INSTALLATION SERVICE POINTS****◆A◆ CRANKSHAFT BEARING IDENTIFICATION**

- (1) The upper bearings (on the cylinder block side) for Nos. 1, 2, 4 and 5 journals are provided with oil groove.
- (2) The lower bearings (on the cap side) for Nos. 1, 2, 4 and 5 journals are not provided with oil groove.
- (3) No.3 bearings are flanged and provided with no groove. Common bearings are used on the cap side and cylinder block side.

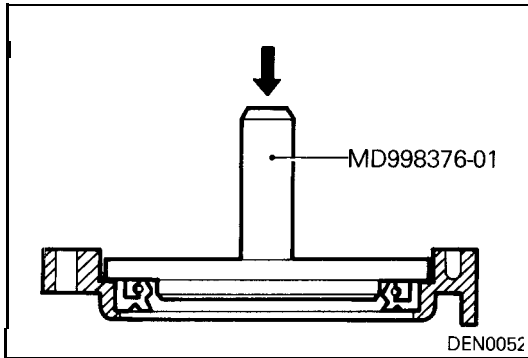
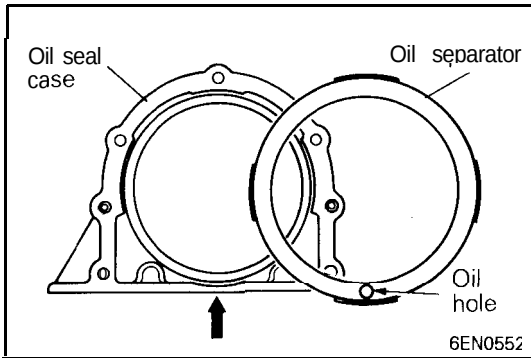
◆B◆ BEARING CAP INSTALLATION

- (1) Check the bearing cap for the identification mark before it is installed.

- (2) 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 – 0.18 mm (.0020 – .0071 in.)

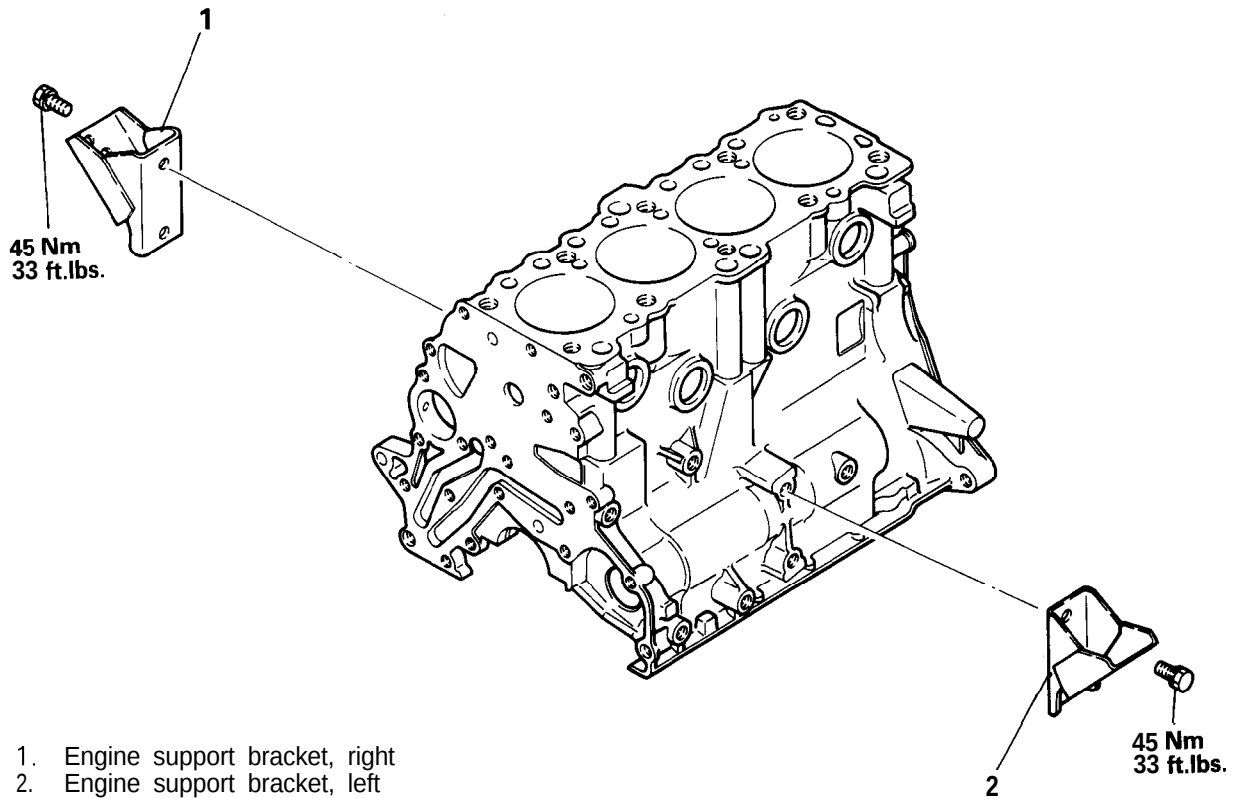
Limit: 0.25 mm (.0098 in.)

**❖C❖ OIL SEAL INSTALLATION****❖D❖ OIL SEPARATOR INSTALLATION**

- (1) Force the oil separator into the oil seal case so that the oil hole in the separator is directed downward (arrow in illustration).

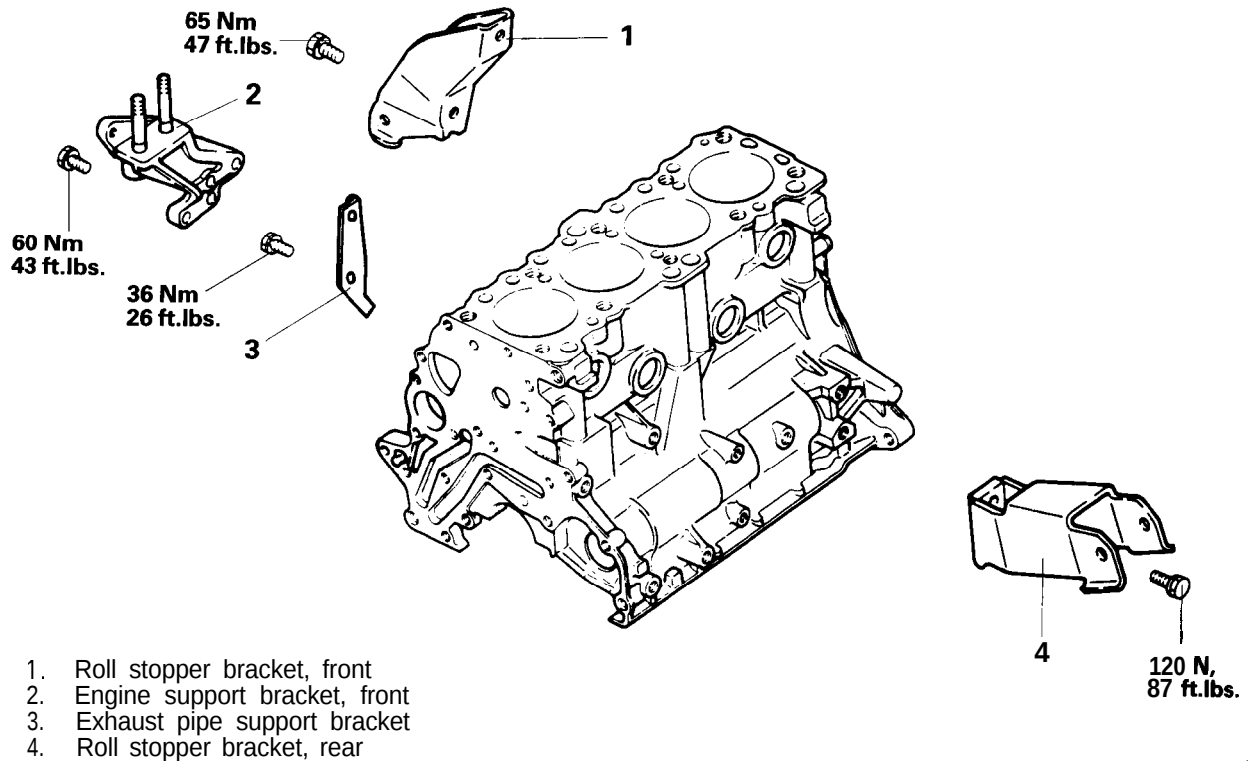
BRACKET

Rear wheel drive and four wheel drive



6EN350

Front wheel drive and all wheel drive



6EN0722

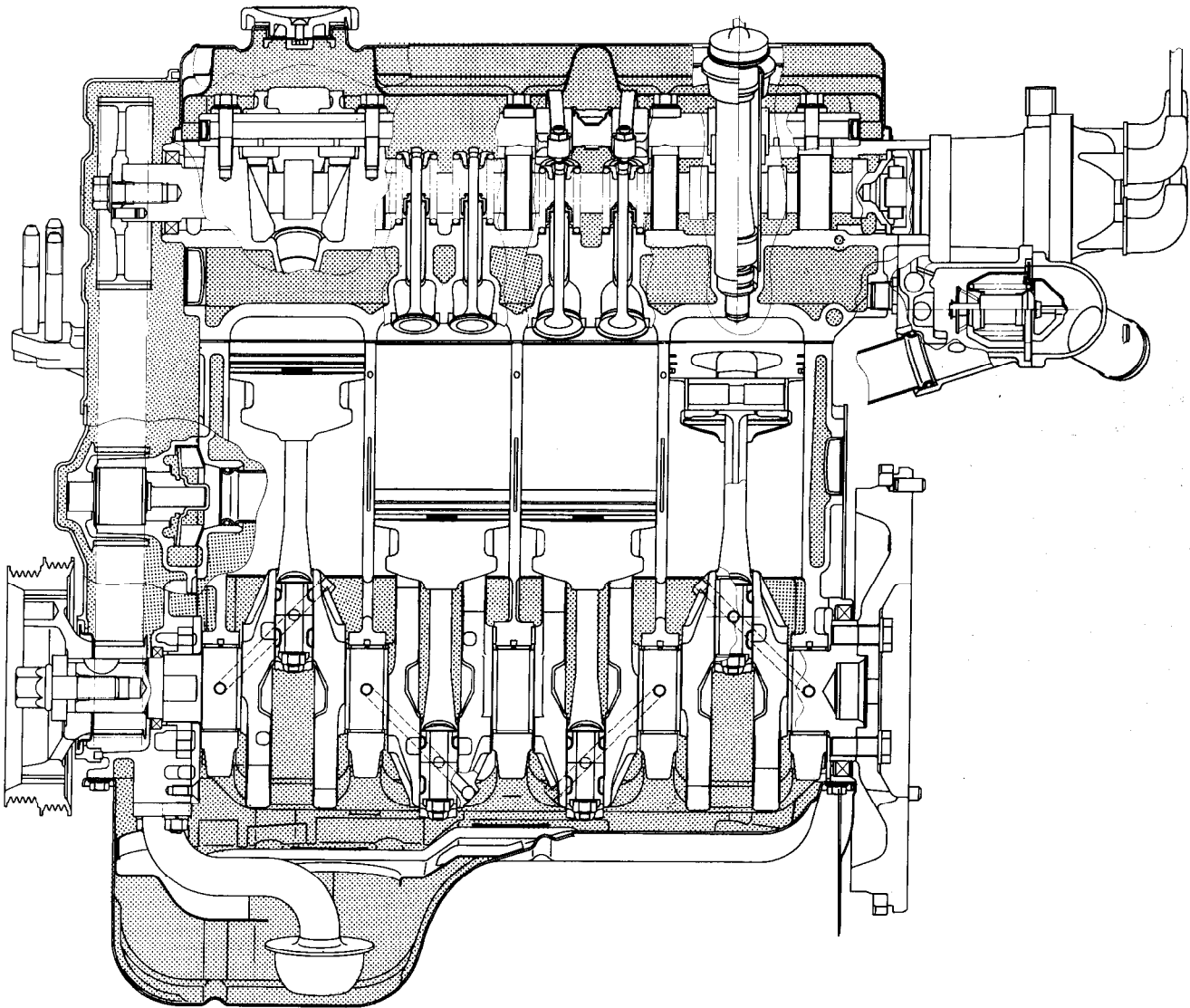
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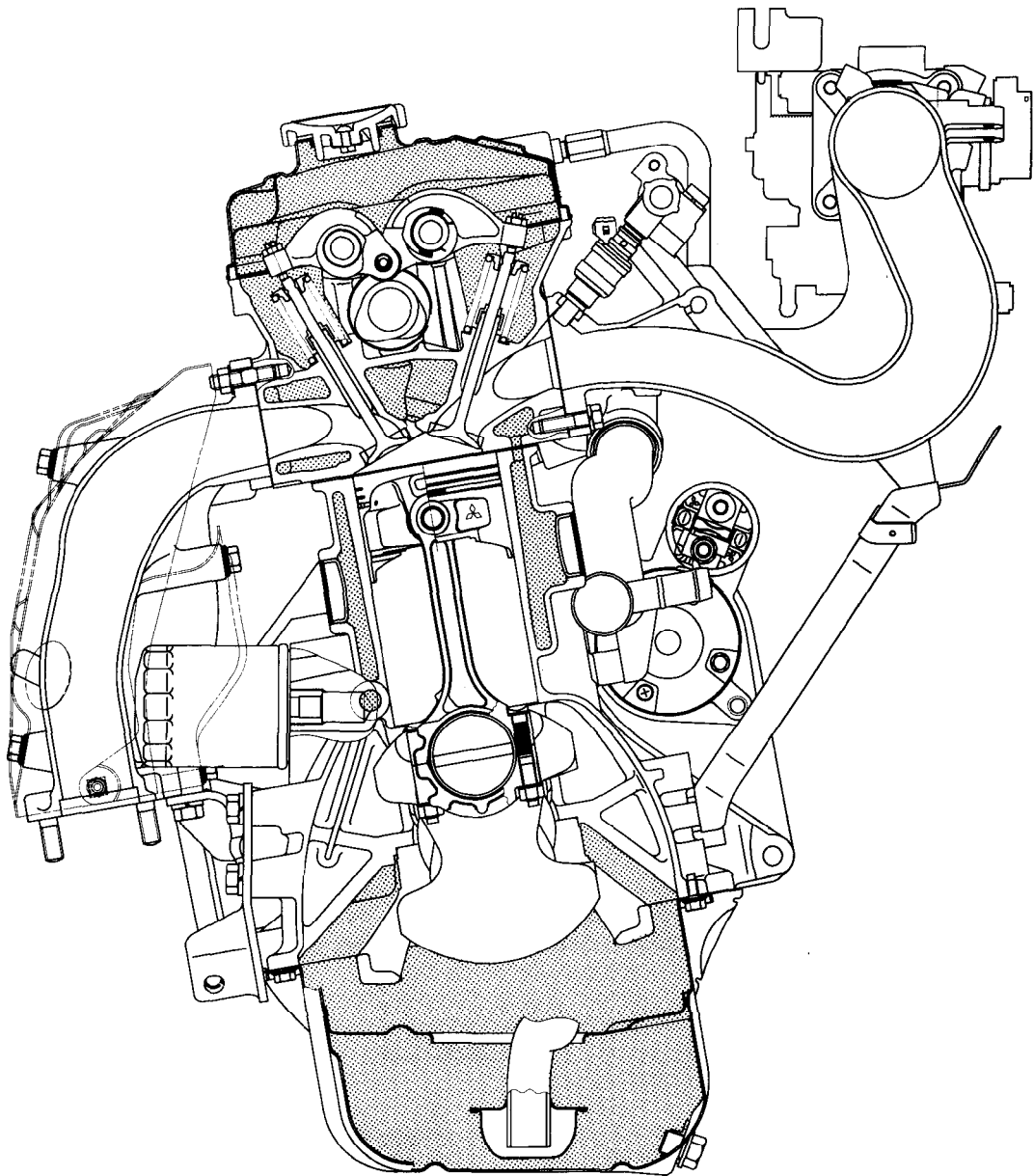
ENGINE

4G93

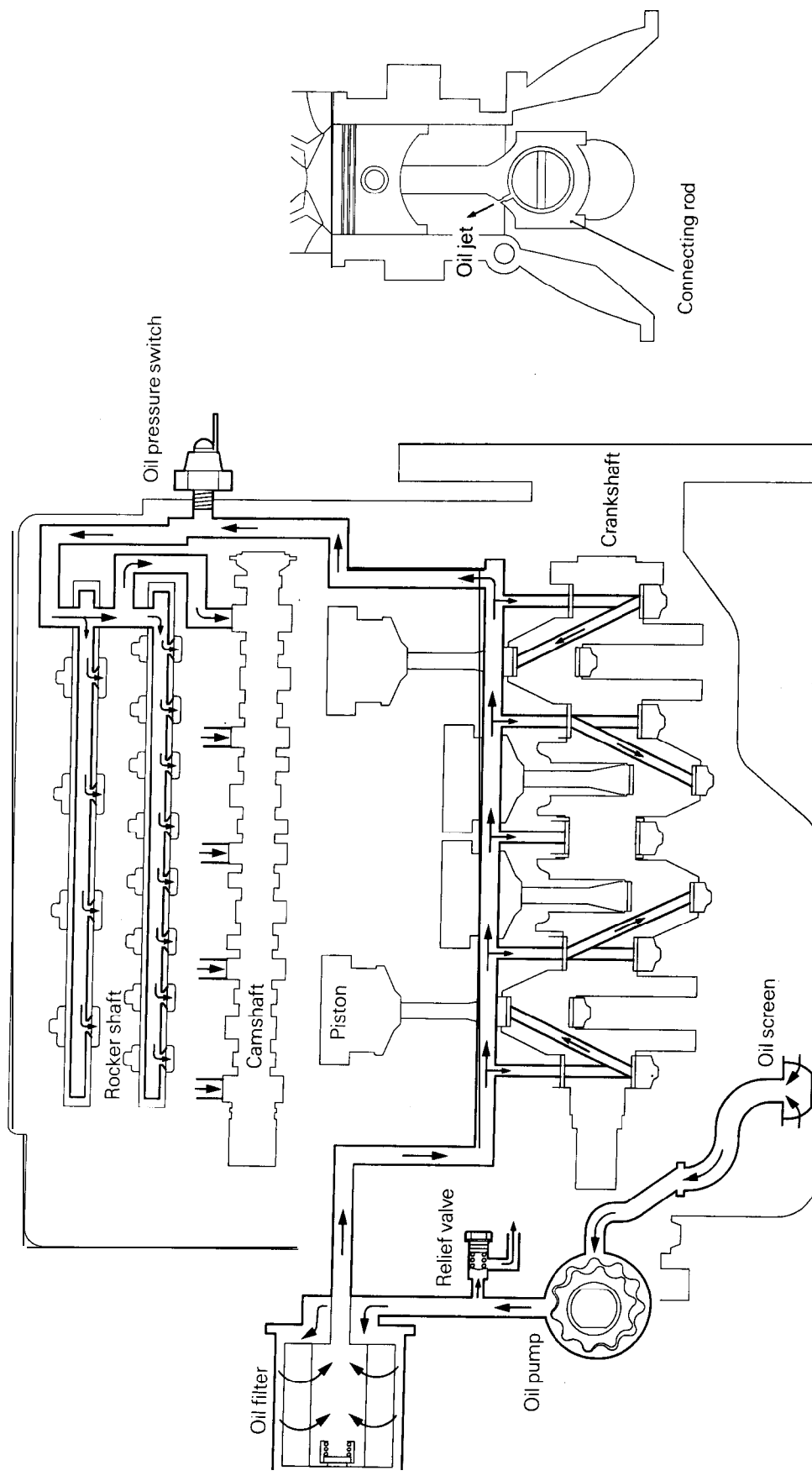
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GENERAL INFORMATION**ENGINE SECTIONAL VIEW**



LUBRICATION SYSTEM



GENERAL SPECIFICATIONS

Description	Specifications
Type	In-line OHV, SOHC
Number of cylinders	4
Combustion chamber	Pentroof type
Total displacement cm ³ (cu. in.)	1834 (111.9)
Cylinder bore mm (in.)	81 (3.19)
Piston stroke mm (in.)	89 (3.50)
Compression ratio	9.5
Valve timing	
(): camshaft identification mark	(1)
Intake valve	
Opens	18° BTDC
Closes	50° ATDC
Exhaust valve	
Opens	58° BBDC
Closes	10° ABDC
Lubrication system	Pressure feed, full-flow filtration
Oil pump type	Trochoid type
Cooling system	Water-cooled forced circulation
Water pump type	Centrifugal impeller type
EGR valve	Single type
Injector type and number	Electromagnetic, 4
Injector identification mark	MDH210
Fuel regulated pressure	335 (47.6)
Throttle bore	50 (1.969)
Throttle position sensor	Variable resistor type
Closed throttle position switch	Movable contact type, within throttle position sensor

SERVICE SPECIFICATIONS

mm (in.)

Items	Standard value	Limit
Cylinder head		
Flatness of gasket surface	0.03 (.0012)	0.2 (.008)
Grinding limit of gasket surface		“0.2 (.008)
* Total resurfacing depth of both cylinder head and cylinder block		
Overall height	119.9 – 120.1 (4.720 – 4.728)	
Oversize rework dimensions of valve guide hole (both intake and exhaust)		
0.05 (.002) O.S.	11.05 – 11.07 (.4350 – .4358)	
0.25 (.010) O.S.	11.25 – 11.27 (.4429 – .4437)	
0.50 (.020) O.S.	11.50 – 11.52 (.4528 – .4535)	
Oversize rework dimensions of valve seat ring hole		
Intake 0.3 (.012) O.S.	31.80 – 31.83 (1.2520 – 1.2531)	
0.6 (.024) O.S.	32.10 – 32.13 (1.2638 – 1.2650)	
Exhaust 0.3 (.012) O.S.	29.30 – 29.32 (1.1535 – 1.1543)	
0.6 (.024) O.S.	29.60 – 29.62 (1.1654 – 1.1661)	
Camshaft		
Cam height		
Intake	37.78 (1.4874)	37.28 (1.4677)
Exhaust	38.09 (1.4996)	37.59 (1.4799)
Journal O.D.	44.93 – 44.94 (1.7689 – 1.7693)	
Bearing oil clearance	0.05 – 0.09 (.0020 – .0035)	
Rocker arm		
I.D.	20.02 – 20.04 (.7882 – .7890)	
Rocker arm-to-shaft clearance	0.02 – 0.05 (.0008 – .0020)	0.1 (.004)
Rocker arm shaft		
O.D.	19.99 – 20.00 (.7870 – .7874)	
Valve		
Valve length		
Intake	110.15 (4.3366)	
Exhaust	113.7 (4.4764)	
Stem O.D.		
Intake	5.97 – 5.98 (.2350 – .2354)	
Exhaust	5.95 – 5.97 (.2343 – .2350)	
Face angle	45° – 45°30'	
Thickness of valve head (margin)		
Intake	1.0 (.039)	0.5 (.020)
Exhaust	1.3 (.051)	0.8 (.031)
Valve stem-to-valve guide clearance		
Intake	0.02 – 0.04 (.0008 – .0016)	0.10 (.0039)
Exhaust	0.03 – 0.06 (.0012 – .0024)	0.15 (.0059)
Valve clearance		
Intake	0.09 (.004)	
Exhaust	0.20 (.008)	

mm (in.)

Items	Standard value	Limit
Valve spring		
Free height	50.9 (2.004)	49.9 (1.965)
Load/installed height N/mm (lbs./in.)	220/44.2 (49/1.74)	
Out of squareness	Less than 2"	4"
Valve guide		
Length		
Intake	45.5 (1.791)	
Exhaust	50.5 (1.988)	
I.D.	6.00 – 6.01 (.2362 – .2366)	
O.D.	11.055 – 11.065 (.4350 – .4356)	
Service size	0.05 (.002), 0.25 (.01), 0.50 (.02) oversize	
Press-in temperature	Room temperature	
Valve seat		
Seat angle	43°30' – 44	
Valve contact width	0.9 – 1.3 (.035 – .051)	
Sinkage		0.2 (.008)
Service size	0.3 (.012), 0.6 (.024) oversize	
Piston		
O.D.	80.98 – 80.99 (3.1882 – 3.1886)	
Piston-to-cylinder clearance	0.02 – 0.04 (.0008 – .0016)	
Service size	0.25 (.01), 0.50 (.02), 0.75 (.03), 1.00 (.04) oversize	
Piston ring		
End gap		
No. 1 ring	0.25 – 0.40 (.0098 – .0157)	0.8 (.031)
No. 2 ring	0.40 – 0.55 (.0157 – .0217)	0.8 (.031)
Oil ring	0.20 – 0.60 (.0079 – .0236)	1.0 (.039)
Ring-to-ring groove clearance		
No. 1 ring	0.03 – 0.07 (.0012 – .0028)	0.1 (.004)
No. 2 ring	0.02 – 0.06 (.0008 – .0024)	0.1 (.004)
Service size	0.25 (.01), 0.50 (.02), 0.75 (.03), 1.00 (.04) oversize	
Piston pin		
O.D.	19.002 – 19.005 (.7481 – .7482)	
Press-in load N (Psi)	5,000 – 15,000 (1,102 – 3,307)	
Press-in-temperature	Room temperature	
Connecting rod		
Big end center-to-small end center length	133.4 – 133.5 (5.252 – 5.256)	
Big end	0.05 (.0020)	
Wrist	0.1 (.004)	
Big end side clearance	0.10 – 0.25 (.0039 – .0098)	0.4 (.016)

mm (in.)

Items	Standard value	Limit
Crankshaft		
End play	0.05 – 0.25 (.0020 – .0098)	0.4 (.016)
Journal O.D.	49.982 – 49.994 (1.9678 – 1.9683)	
Pin O.D.	44.980 – 44.995 (1.7709 – 1.7715)	
Out-of-roundness and taper of journal and pin	0.003 (.0001)	
Oil clearance of journal	0.02 – 0.04 (.0008 – .0016)	0.1 (.004)
Oil clearance of pin	0.02 – 0.05 (.0008 – .0020)	0.1 (.004)
Cylinder block		
I.D.	81.00 – 81.03 (3.1890 – 3.1902)	
Flatness of gasket surface	0.05 (.002)	0.1 (.004)
Grinding limit of gasket surface		*0.2 (.008)
Total resurfacing depth of both cylinder head and cylinder block		
Overall height	263.5 (10.37)	
Flywheel		
Runout		0.13 (.0051)
Oil pump		
Tip clearance	0.03 – 0.08 (.0012 – .0031)	
Side clearance	0.04 – 0.10 (.0016 – .0039)	
Body clearance	0.10 – 0.18 (.0039 – .0071)	0.35 (.0138)
Drive belt deflection		
New belt	7.0 – 8.5 (.28 – .33)	
Used belt	9.5 (.37)	
Injector		
Coil resistance Ω	13 – 16 at 20°C (68°F)	
Throttle position sensor		
Resistance Ω	3.5-6.5	
Idle air control motor		
Coil resistance Ω	5 – 35 at 20°C (68°F)	

TORQUE SPECIFICATIONS

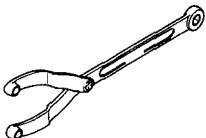
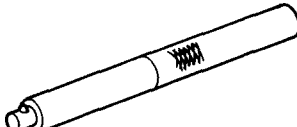
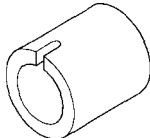
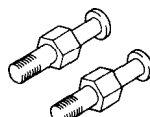
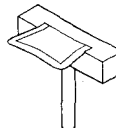
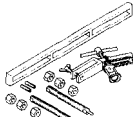
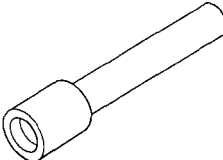
	Nm	ft.lbs.
Generator and ignition system		
Oil level gauge guide mounting bolt	11	8
Generator brace bolt	23	17
Generator brace mounting bolt	50	36
Generator pivot nut	45	33
Crankshaft bolt	185	134
Spark plug	25	18
Distributor	12	9
Timing belt		
Tensioner bolt	24	18
Tensioner spring bolt	45	33
Camshaft sprocket bolt	90	65
Fuel and emission parts		
Throttle body mounting bolt	19	14
Fuel rail mounting bolt	12	9
Fuel pressure regulator bolt	9	7
EGR valve mounting bolt (California)	13	9
EGR temperature sensor (California)	11	8
Throttle body		
Throttle position sensor mounting bolt	2	1.4
Intake manifold and water pump		
Intake manifold stay mounting bolt	31	22
Intake manifold mounting bolt and nut	20	14
Water pump mounting bolt	24	17
Timing belt cover mounting bolt	10	7
Engine support bracket left mounting bolt	50	36
Water pipe mounting bolt	14	10
Engine coolant temperature sensor	30	22
Engine coolant temperature gauge unit	11	8
Thermostat housing mounting bolt	24	17
Water outlet fitting mounting bolt	19	14
Exhaust manifold		
Oxygen sensor	45	33
Exhaust manifold cover "A" mounting bolt M8	27	20
M6	9	7
Exhaust manifold bracket mounting bolt	36	26
Exhaust manifold mounting nut M10	30	22
M8	18	13
Exhaust manifold cover "B" mounting bolt	24	17
Rocker arms and camshaft		
Rocker cover mounting bolt	3.3	2.4
Rocker arm shaft mounting bolt	32	23
Adjusting screw lock nut	9	7

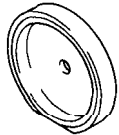
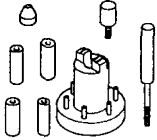
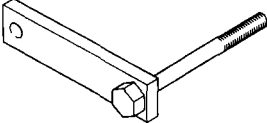
	N m	ft.lbs.
Cylinder head and valves		
Engine hanger mounting bolt	12	9
Water outlet fitting mounting bolt	14	10
Oil pressure switch	10	7
Cylinder head bolt [Tighten to 75 Nm (54 ft.lbs) and then completely loosen before finally tightening with above procedure.]	20 + 1/4 turns + 1/4 turns	14.5 + 1/4 turns + 1/4 turns
Front case and oil pump		
Drain plug	40	29
Oil pan mounting bolt	7	5
Oil screen	19	14
Relief plug	45	33
Oil pump case mounting bolt	14	10
Oil pump case cover mounting bolt	10	7
Piston and connecting rod		
Connecting rod cap nut	20 + 1/4 turns	14.5 + 1/4 turns
Crankshaft, cylinder block, flywheel and drive plate		
Flywheel bolt	100	72
Drive plate bolt	100	72
Rear plate mounting bolt	11	8
Bell housing cover mounting bolt	9	7
Oil seal case mounting bolt	11	8
Bearing cap bolt	25 + 11/4 turns	18 + 1/4 turns

SEALANT

Items	Specified sealant	Quantity
Water pump	Mitsubishi Genuine Part No. MD970389 or equivalent	As required
Thermostat housing	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
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	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

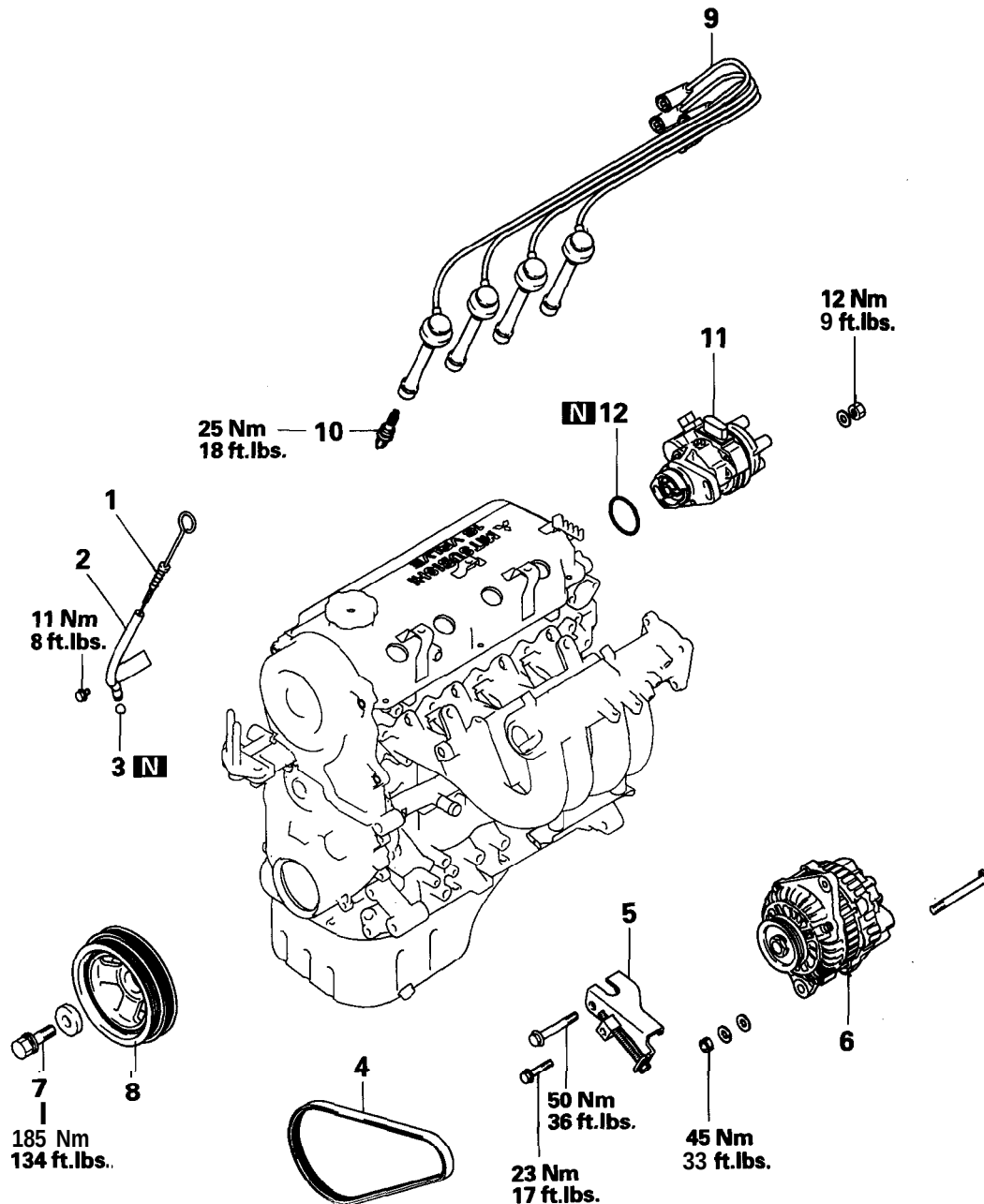
SPECIAL TOOLS

Tool	Number and tool name	Supersession	Application
	MB990767 End yoke holder Use with MD998719	MB990767-01 Use with MIT308239	Holding camshaft sprocket when loosening or torquing bolt
	MB990938 Handle	MB990938-01	Installation of crankshaft rear oil seal
	MD998713 Camshaft oil seal installer	MD998713-01	Installation of camshaft oil seal
	MD998716 Crankshaft wrench	MD998716-01	Turning crankshaft
	MD998717 Crankshaft front oil seal installer	MD998717-01	Installation of front oil seal
	MD998719 Pulley holding pins (2)	MIT308239	Holding crankshaft sprocket
	MD998727 Oil pan remover		Removal of oil pan
	MD998772 Valve spring compressor		Compressing valve spring
	MD998774 Valve stem seal installer		Installation of valve stem seal

Tool	Number	IName	I Use
	MD998776 Crankshaft rear oil seal installer Use with MB990938	Use with MB990938-01	Installation of crankshaft rear oil seal
	MD998780 Piston pin setting tool	MIT216941	Removal and installation of piston pin
	MD998781 Flywheel stopper		Holding flywheel

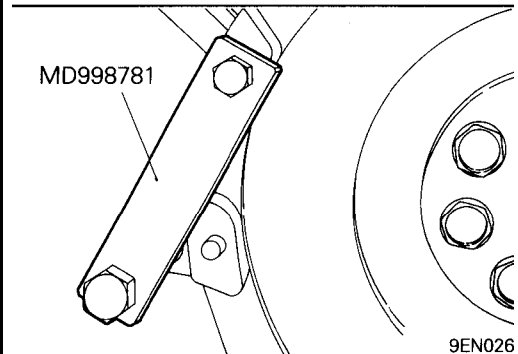
GENERATOR AND IGNITION SYSTEM

REMOVAL AND INSTALLATION

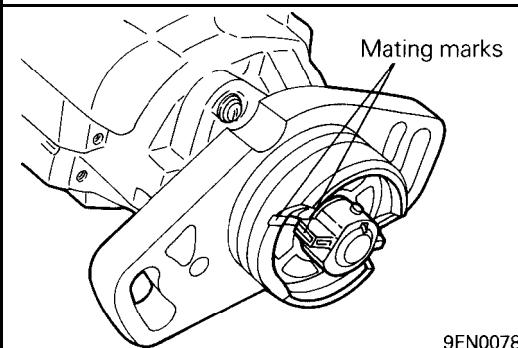


Removal steps

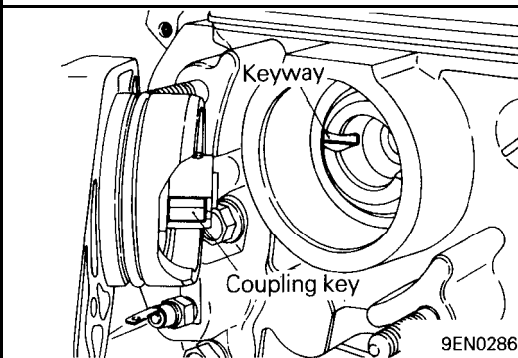
1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Drive belt
5. Generator brace
6. Generator
7. Crankshaft bolt
8. Crankshaft pulley
9. Spark plug cable
10. Spark plug
11. Distributor
12. O-ring

**REMOVAL SERVICE POINT****❖A❖ CRANKSHAFT BOLT LOOSENING**

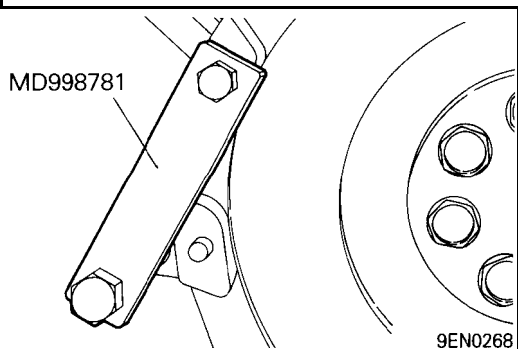
- (1) Using the special tool, hold the drive plate on flywheel.
- (2) Remove the crankshaft bolt.

**INSTALLATION SERVICE POINTS****❖A❖ DISTRIBUTOR ASSEMBLY INSTALLATION**

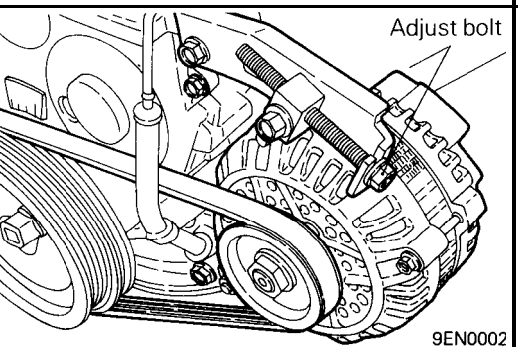
- (1) Turn the crankshaft to bring No. 1 cylinder to the top dead center on compression stroke.
- (2) Align the mating marks on the distributor housing with that of the coupling key.



- (3) Install the distributor with the coupling key fitted in the keyway at the end of camshaft.

**❖B❖ CRANKSHAFT BOLT TIGHTENING**

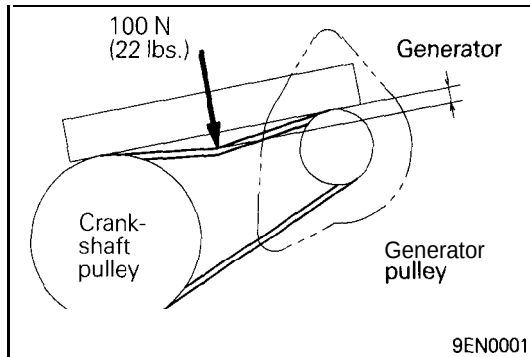
- (1) Using the special tool, hold the drive plate or flywheel.
- (2) Install the crankshaft bolt.

**❖C❖ DRIVE BELT TENSION ADJUSTMENT**

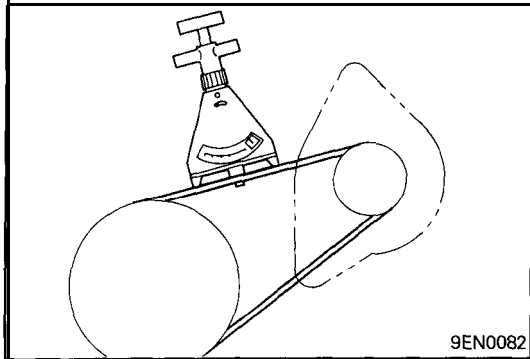
- (1) Adjust the belt deflection with the adjusting bolt to the standard value.

Standard value:

New belt 7.0 – 8.5 mm (.28 – .33 in.)
 Used belt 9.5 mm (.37 in)



9EN0001



9EN0082

- (2) Or using a tension gauge, adjust the tension to the standard value.

Standard value:

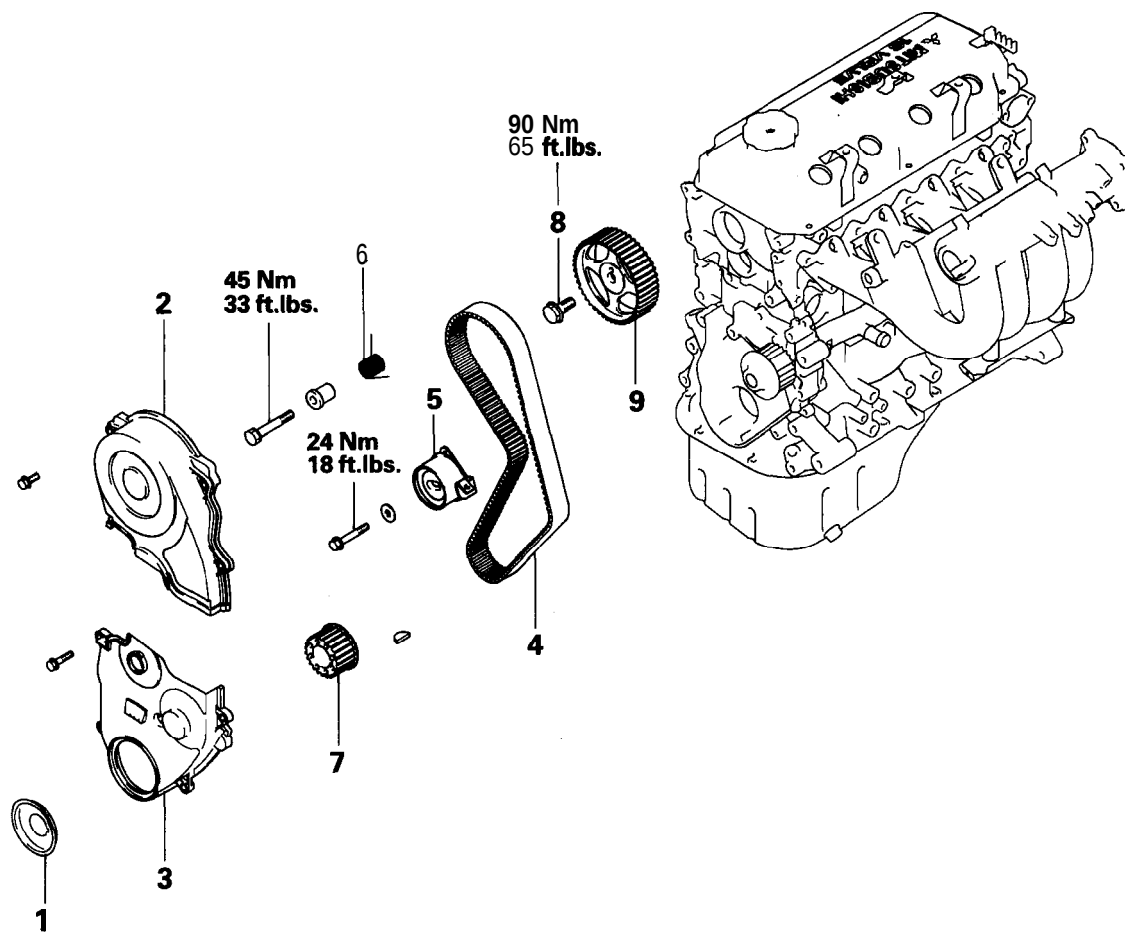
New belt 500 – 700 N (110 – 154 lbs.)

Used belt 400 N (88 lbs.)

- (3) Tighten the lock bolt to the specified torque.
 (4) Tighten the nut for pivot bolt to the specified torque.

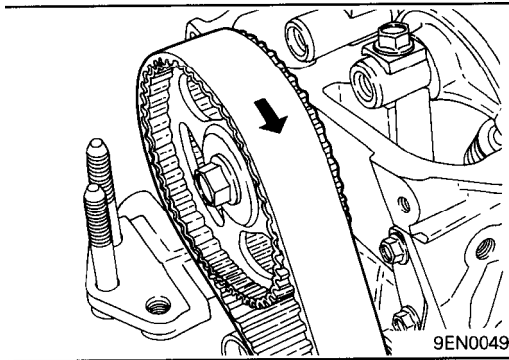
TIMING BELT

REMOVAL AND INSTALLATION

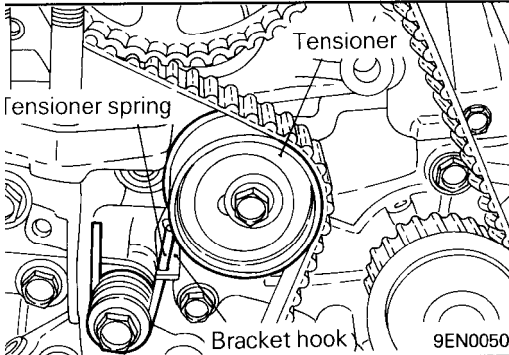


Removal steps

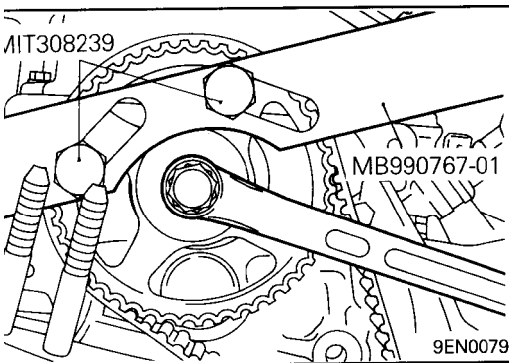
1. Flange
2. Timing belt upper cover
3. Timing belt lower cover
4. Timing belt
5. Tensioner
6. Tensioner spring
7. Crankshaft sprocket
8. Camshaft sprocket bolt
9. Camshaft sprocket

**REMOVAL SERVICE POINTS****◀A▶ TIMING BELT REMOVAL**

(1) Mark the belt running direction for reference in installation.

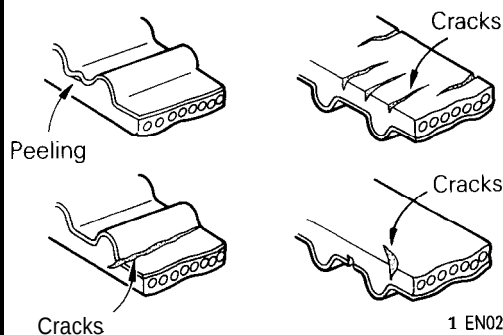
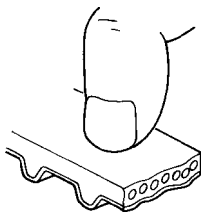


- (2) Back off the tensioner spring mounting bolt three turns.
- (3) Pinching the end of the tensioner spring on the tensioner side with pliers, unhook it from the bracket hook on the tensioner to free the tensioner spring.
- (4) Loosen the tensioner mounting bolt and remove the timing belt.

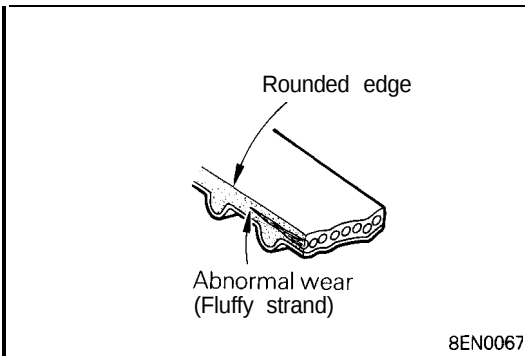
**◀B▶ CAMSHAFT SPROCKET BOLT LOOSENING****INSPECTION****TIMING BELT**

Replace belt if any of the following conditions exist.

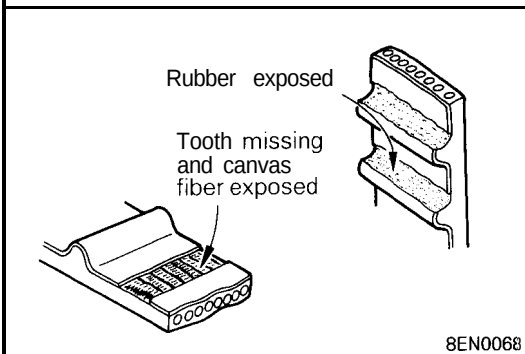
- (1) Hardening of back rubber.
Back side is glossy without resilience and leaves no indent when pressed with fingernail.



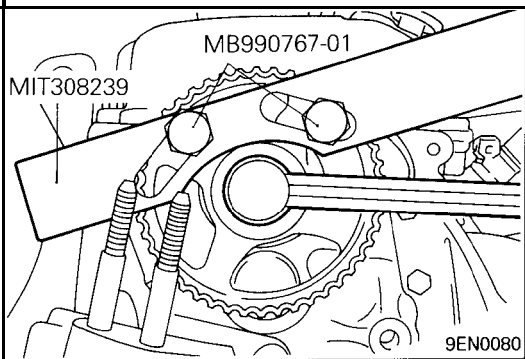
- (2) Cracks on rubber back.
- (3) Cracks or peeling of canvas.
- (4) Cracks on tooth bottom.
- (5) Cracks on belt sides.



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

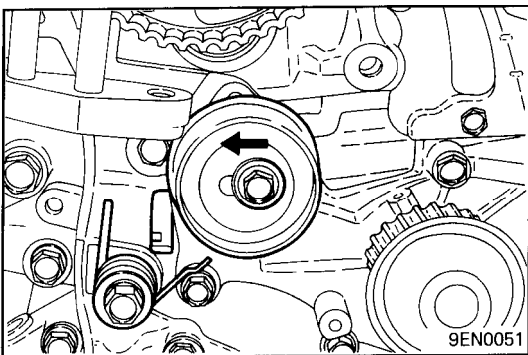


- (7) Abnormal wear on teeth.
(8) Missing tooth.



INSTALLATION SERVICE POINTS

◆A◆ CAMSHAFT SPROCKET BOLT TIGHTENING



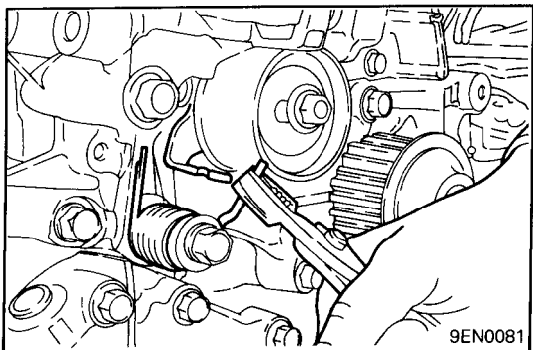
◆B◆ TENSIONER SPRING / TENSIONER INSTALLATION

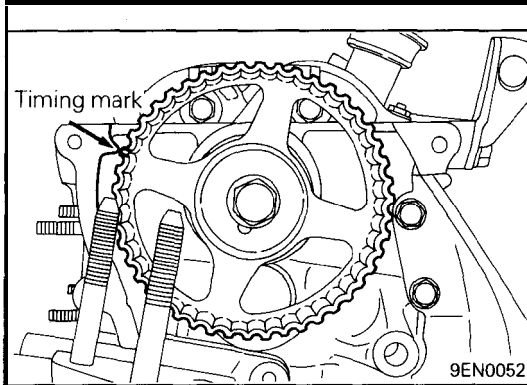
- (1) Install the tensioner spring and spacer. Do not fully tighten the bolt: from the tightened position, back it off three turns.
- (2) Mount the timing belt tensioner. Push the tensioner in the direction of the arrow and tighten the bolt to secure the tensioner in that position.
- (3) Pinching the front end of the tensioner spring, hook it onto the tensioner bracket hook.

Caution

When hooking the tensioner spring, use care not to damage the tensioner pulley surfaces with the spring end or pliers.

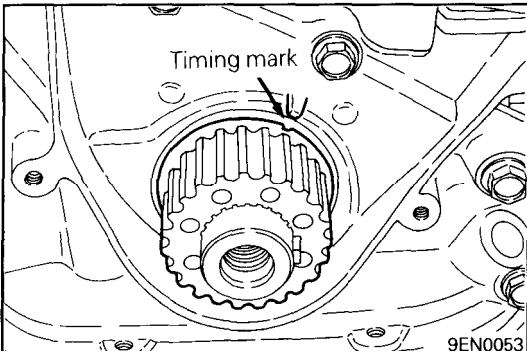
- (4) Tighten the tensioner spring mounting bolt to the specification.



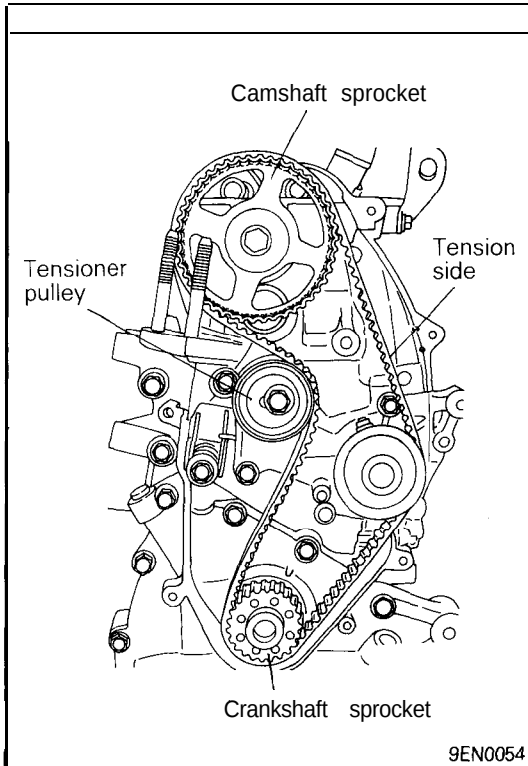


⚡ TIMING BELT INSTALLATION

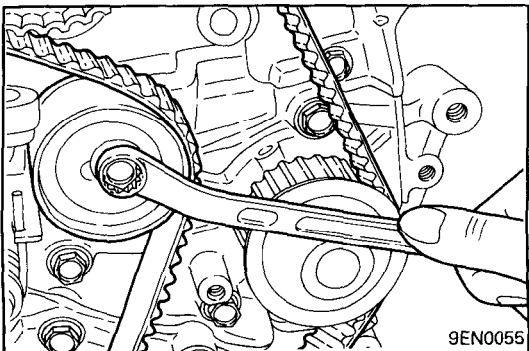
- (1) Check that the timing belt tensioner and spring have been installed in position. (See ⚡.)
- (2) Align the timing mark on the camshaft sprocket with that on the cylinder head.



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



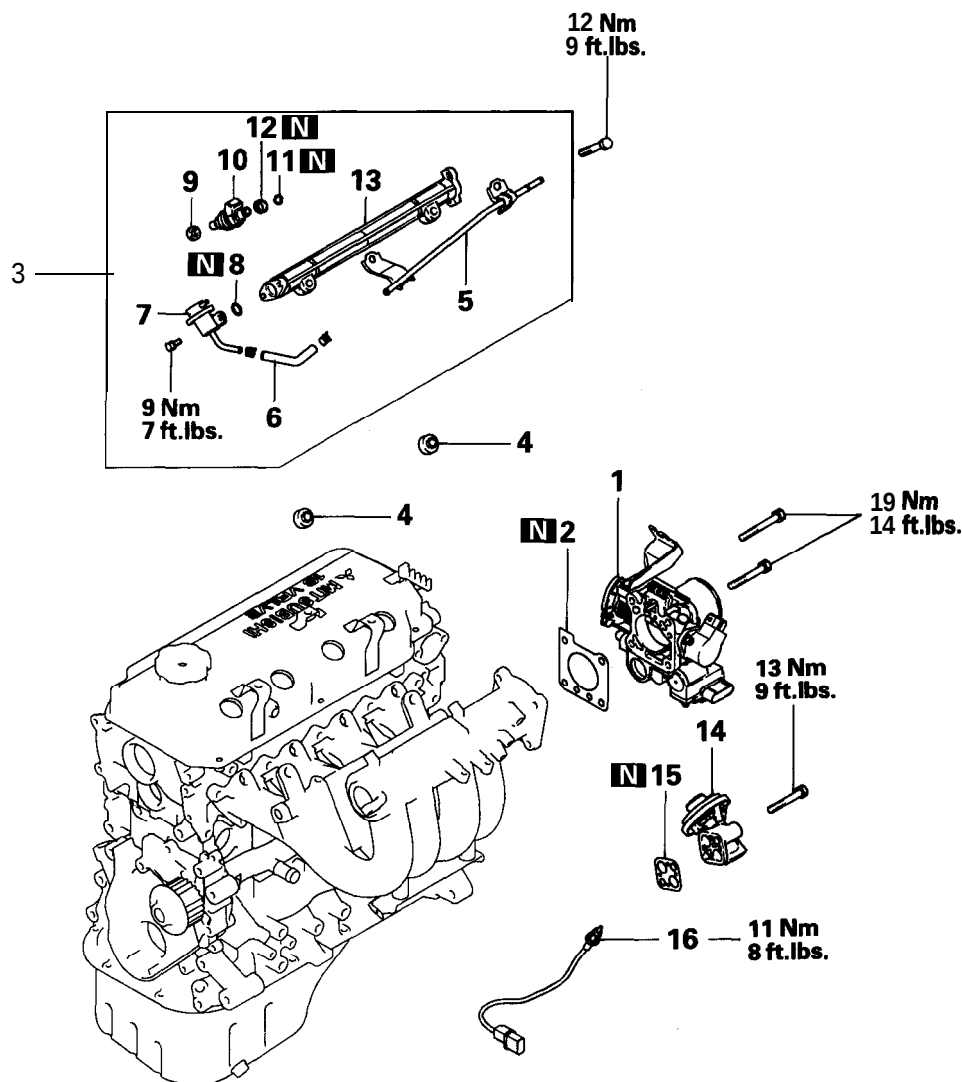
- (4) Install the timing belt first on the crankshaft sprocket and then keeping the tension side belt tight, set on the camshaft sprocket. Finally, get the belt around the tensioner pulley.



- (5) Back off one turn the tensioner pulley mounting bolt which has been temporarily tightened.

FUEL AND EMISSION PARTS

REMOVAL AND INSTALLATION

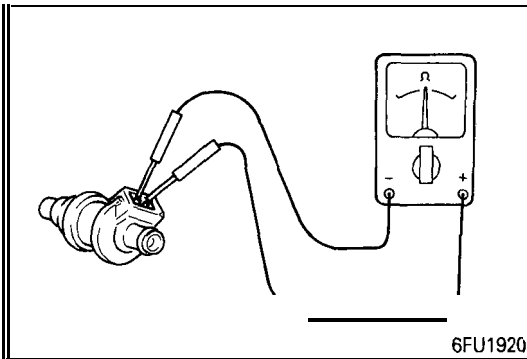


Removal steps

1. Throttle body
2. Gasket
3. Fuel rail and injector
4. Insulator
5. Fuel return pipe
6. Fuel hose
7. Fuel pressure regulator
8. O-ring
9. Insulator
10. Injector
11. O-ring
12. Grommet
13. Fuel rail
14. EGR valve
15. Gasket
16. EGR temperature sensor

} MIRAGE

} For California

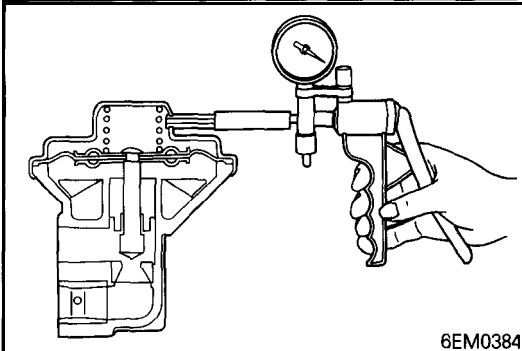


INSPECTION

INJECTORS

- (1) Using an ohmmeter (circuit tester), **test for continuity** between terminals of injectors; the circuit should be closed. If failure is detected, replace the injector.

Standard value: **13 – 16 Ω at 20°C (68°F)**



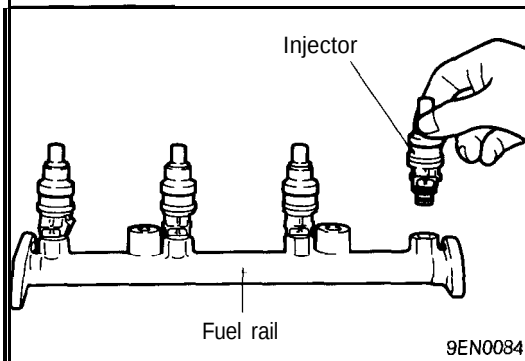
EGR VALVE

- (1) Check the EGR valve for sticking or carbon deposits. If such conditions exist, clean or replace the EGR valve.
- (2) Connect a hand vacuum pump to the nipple of EGR valve and plug other nipple.
- (3) Apply a vacuum of 500 mmHg (19.7 in.Hg) to check that the vacuum is retained. If there is a leak, replace the EGR valve.
- (4) Check also that the valve opens and closes properly by applying and releasing a vacuum.

INSTALLATION SERVICE POINTS

◆A◆ INJECTOR INSTALLATION

- (1) Before installing an injector, the rubber O-ring must be lubricated with a drop of clean engine oil to aid in installation.
- (2) Insert injector top end into the fuel rail. Be careful not to damage the O-ring during installation.



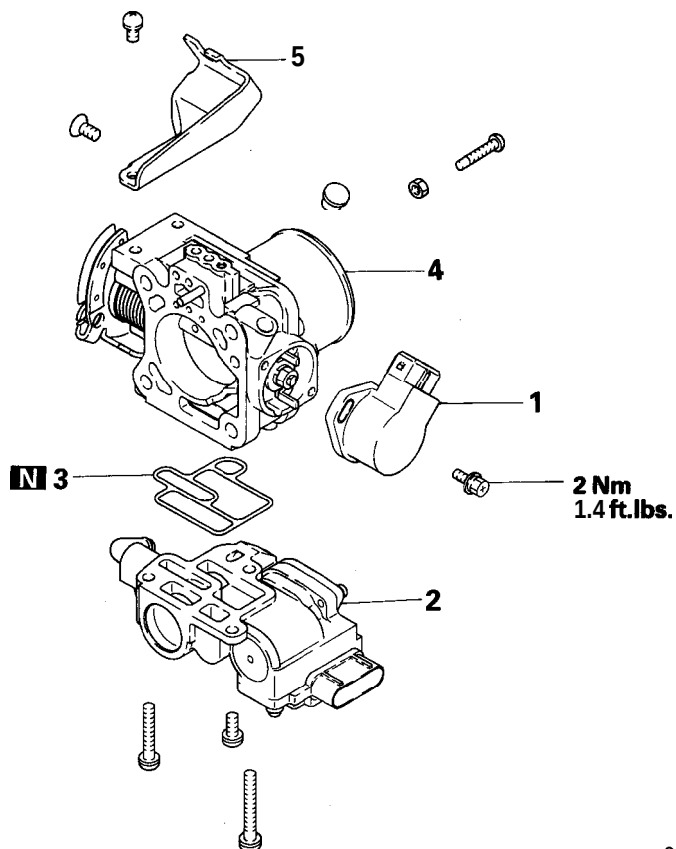
◆B◆ FUEL PRESSURE REGULATOR INSTALLATION

- (1) Before installing the pressure regulator, the O-ring must be lubricated with a drop of clean engine oil to aid in installation.

THROTTLE BODY

DISASSEMBLY AND REASSEMBLY

EXPO

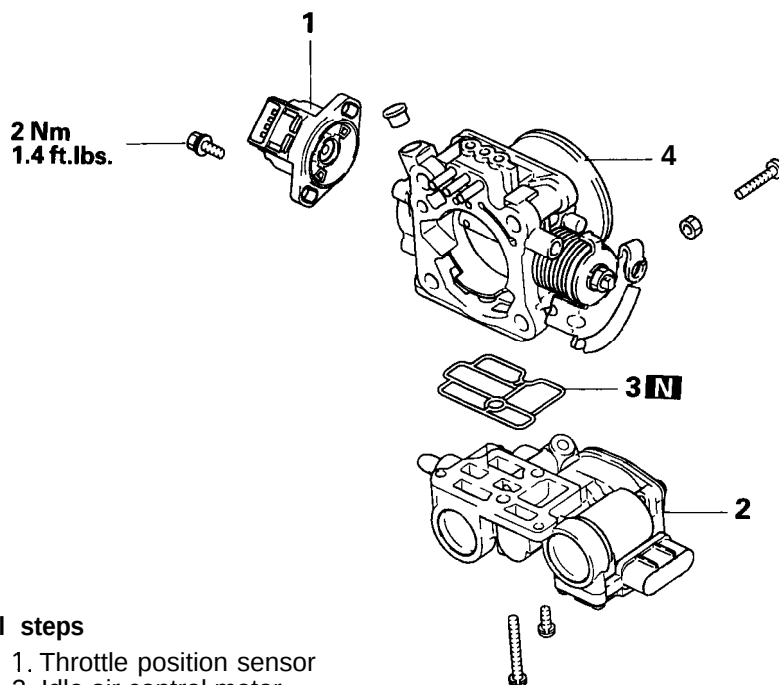


Removal steps

- ◊A◊ ◊A◊ 1. Throttle position sensor
- ◊A◊ 2. Idle air control motor
- ◊B◊ 3. O-ring
- ◊B◊ 4. Throttle body
- 5. Accelerator cable bracket

9EN0275

MIRAGE



Removal steps

- ◊A◊ ◊A◊ 1. Throttle position sensor
- ◊A◊ 2. Idle air control motor
- ◊B◊ 3. O-ring
- ◊B◊ 4. Throttle body

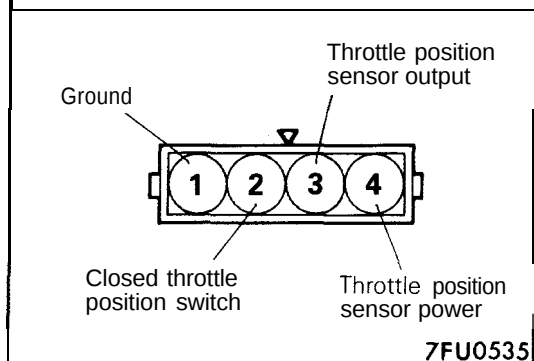
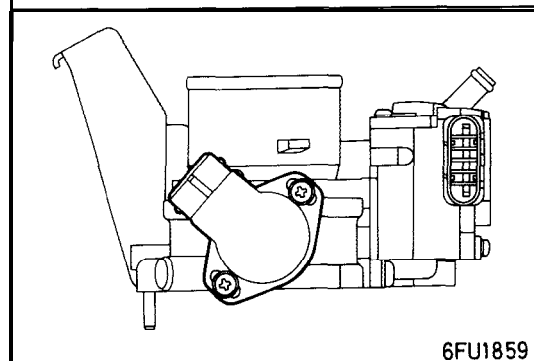
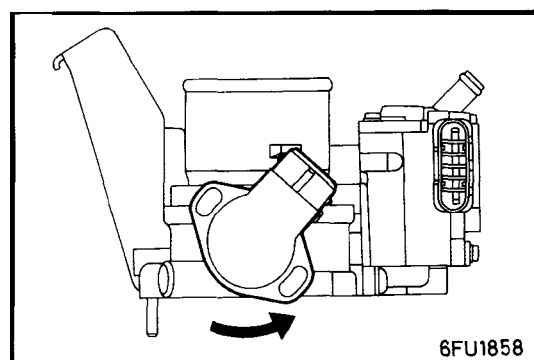
1 EN0336

DISASSEMBLY SERVICE POINTS**◀A▶ THROTTLE POSITION SENSOR AND IDLE AIR CONTROL MOTOR REMOVAL**

- (1) Do not disassemble the sensor and motor.
- (2) Do not clean the sensor and motor using solvent. Clean them with shop towel.

◀B▶ THROTTLE BODY REMOVAL

- (1) Do not remove the throttle valve.
- (2) Check if the vacuum port or passage is clogged. Use compressed air to clean the vacuum passage.

**REASSEMBLY SERVICE POINTS****▶A▶ THROTTLE POSITION SENSOR INSTALLATION – EXPO**

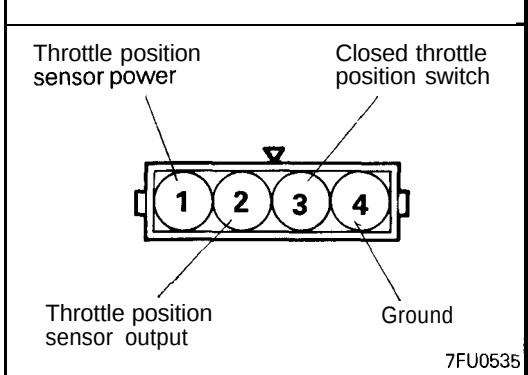
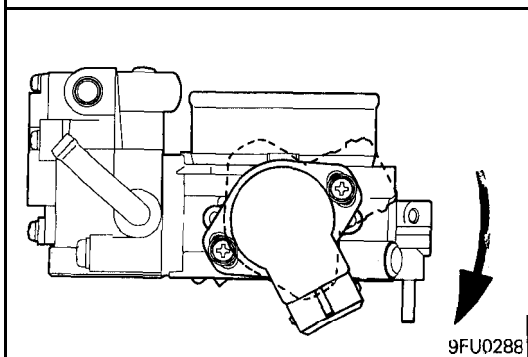
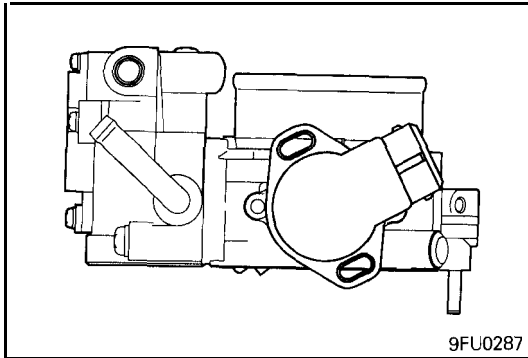
- (1) Install the throttle position sensor to the throttle body as shown in the illustration.

- (2) Turn the throttle position sensor 90° counterclockwise, and tighten the screws.
- (3) Connect a circuit tester between ① (ground) and ③ (output), or between ③ (output) and ④ (power). Then, make sure that the resistance changes smoothly when the throttle valve is slowly moved to the fully open position.
- (4) Check for continuity across terminals ② (Closed throttle position switch) and ① (ground) with the throttle valve both fully closed and fully open.

Throttle valve position	Continuity
Fully closed	Conductive
Fully open	Non-conductive

If there is not continuity with the throttle valve fully closed, turn the throttle position sensor in clockwise direction, and then check again.

- (5) If failure is detected, replace the throttle position sensor.



◆A◆ THROTTLE POSITION SENSOR INSTALLATION <MIRAGE>

(1) Install the throttle position sensor to the throttle body as shown in the illustration.

(2) Turn the throttle position sensor 90° clockwise, and tighten the screws.

(3) Connect a circuit tester between ④ (ground) and ② (output), or between ② (output) and ① (power). Then, make sure that the resistance changes smoothly when the throttle valve is slowly moved to the fully open position.

(4) Check for continuity across terminals ③ (Closed throttle position switch) and ④ (ground) with the throttle valve both fully closed and fully open.

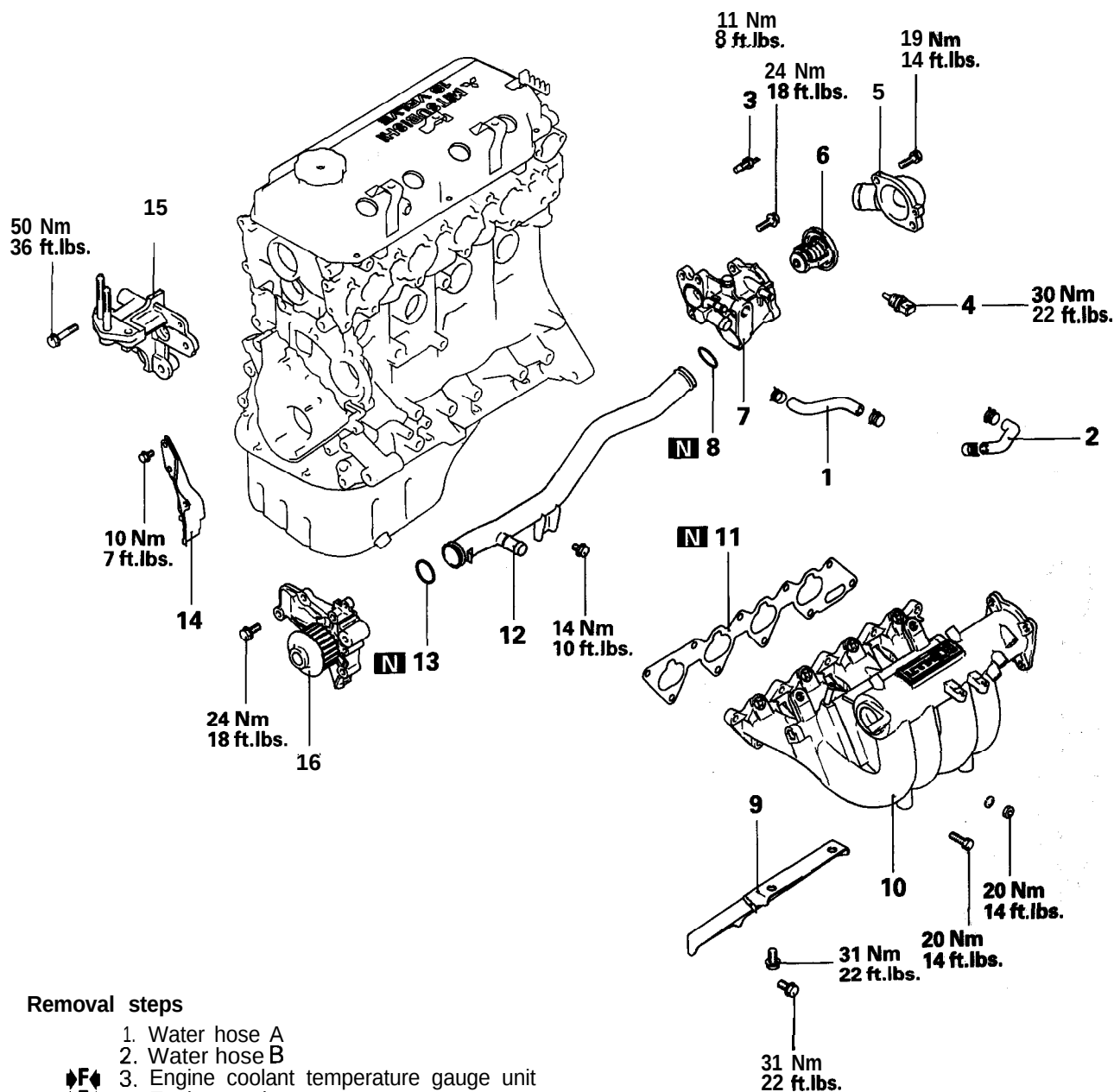
Throttle valve position	Continuity
Fully closed	Conductive
Fully open	Non-conductive

If there is not continuity with the throttle valve fully closed, turn the throttle position sensor in clockwise direction, and then check again.

(5) If failure is detected, replace the throttle position sensor.

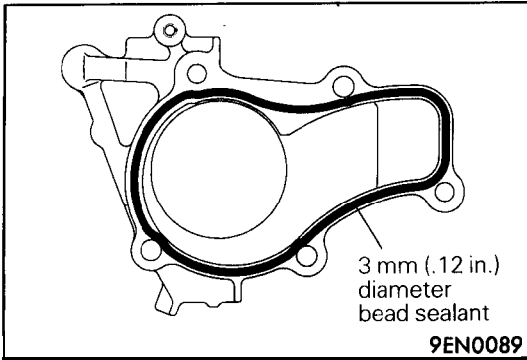
INTAKE MANIFOLD AND WATER PUMP

REMOVAL AND INSTALLATION



Removal steps

1. Water hose A
2. Water hose B
- ♦F♦ 3. Engine coolant temperature gauge unit
- ♦E♦ 4. Engine coolant temperature sensor
5. Water inlet fitting
- ♦D♦ 6. Thermostat
- ♦C♦ 7. Thermostat housing
- ♦B♦ 8. O-ring
9. Intake manifold stay
10. Intake manifold
11. Gasket
- ♦B♦ 12. Water pipe
- ♦B♦ 13. O-ring
14. Timing belt cover
15. Engine support bracket, left
- ♦A♦ 16. Water pump



INSTALLATION SERVICE POINTS

◆A◆ SEALANT APPLICATION TO WATER PUMP

Specified sealant:

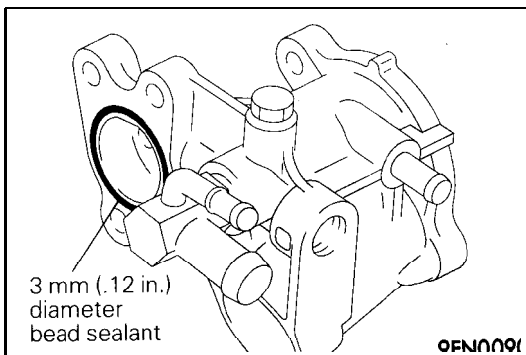
Mitsubishi Genuine Part No. **MD970389** or equivalent

◆B◆ WATER PIPE / O-RING INSTALLATION

(1) Wet the O-ring (with water) to facilitate the assembly.

Caution

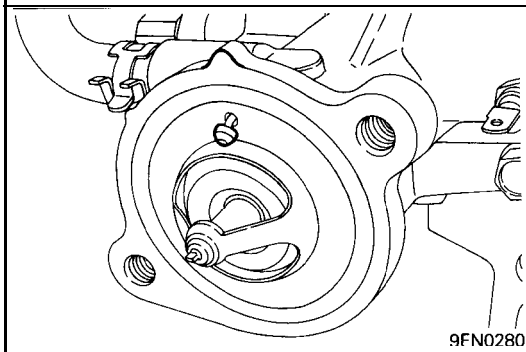
1. Keep the O-ring free of oil or grease.
2. Secure the water pipe after the thermostat housing has been installed.



◆C◆ SEALANT APPLICATION TO THERMOSTAT HOUSING

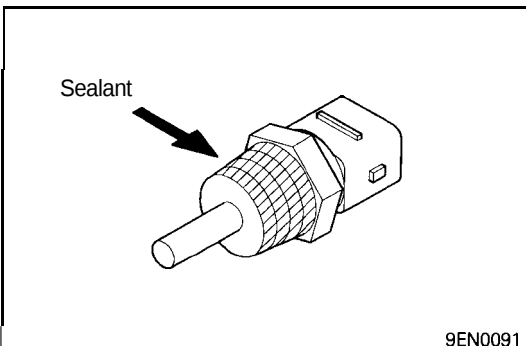
Specified sealant:

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



◆D◆ THERMOSTAT INSTALLATION

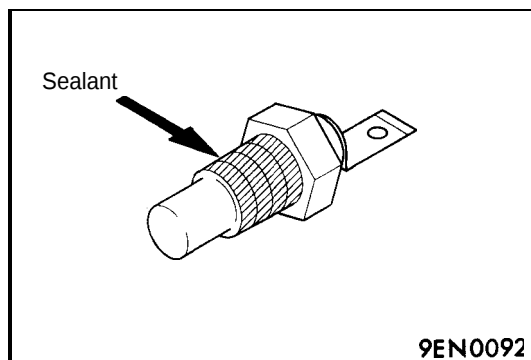
(1) Install the thermostat in the thermostat housing in such a way that the jiggle valve is located as illustrated.



◆E◆ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE SENSOR

Specified sealant:

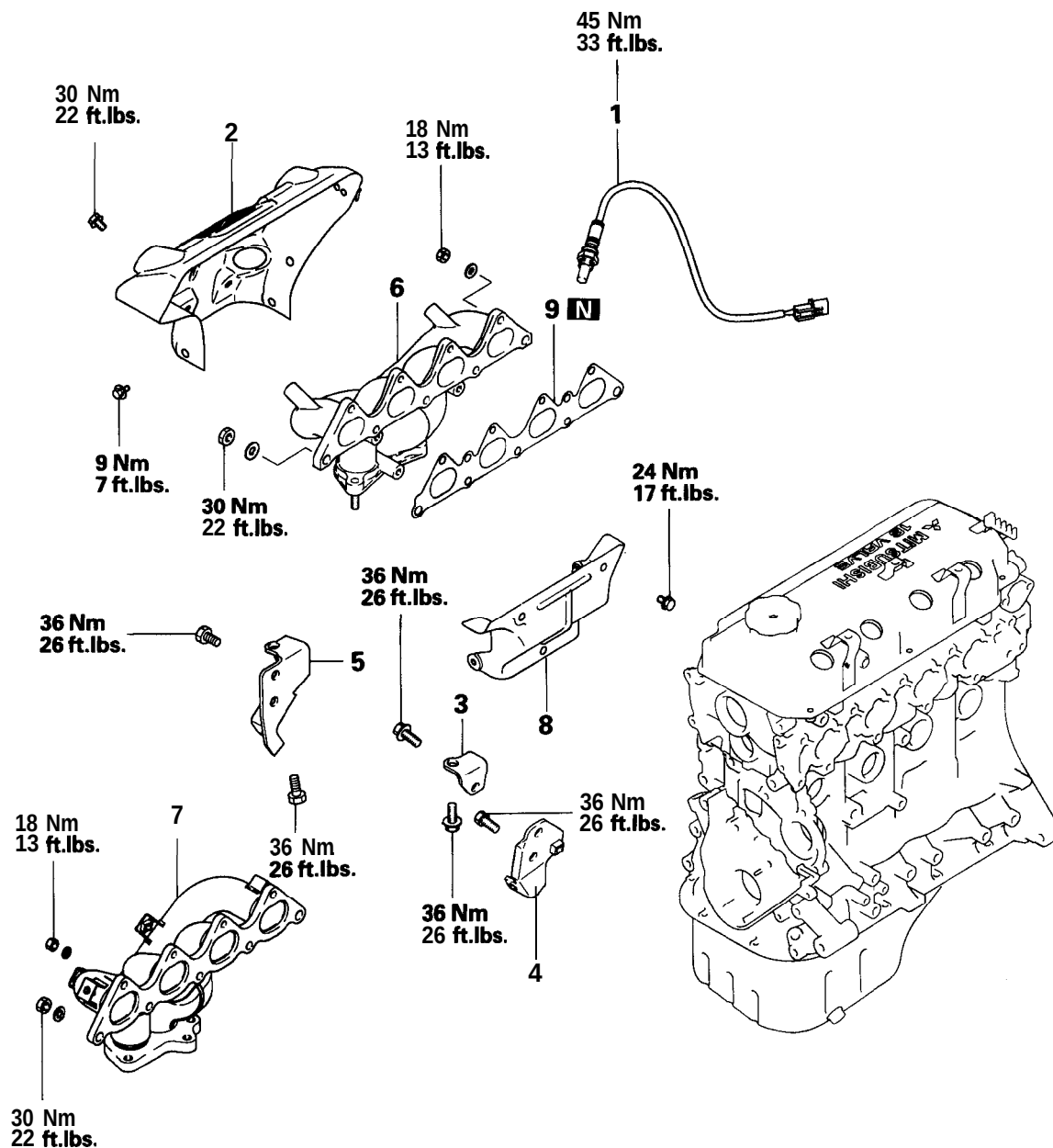
3M Nut Locking Part No. 4171 or equivalent



◆F◆ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE GAUGE UNIT

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

EXHAUST MANIFOLD REMOVAL AND INSTALLATION

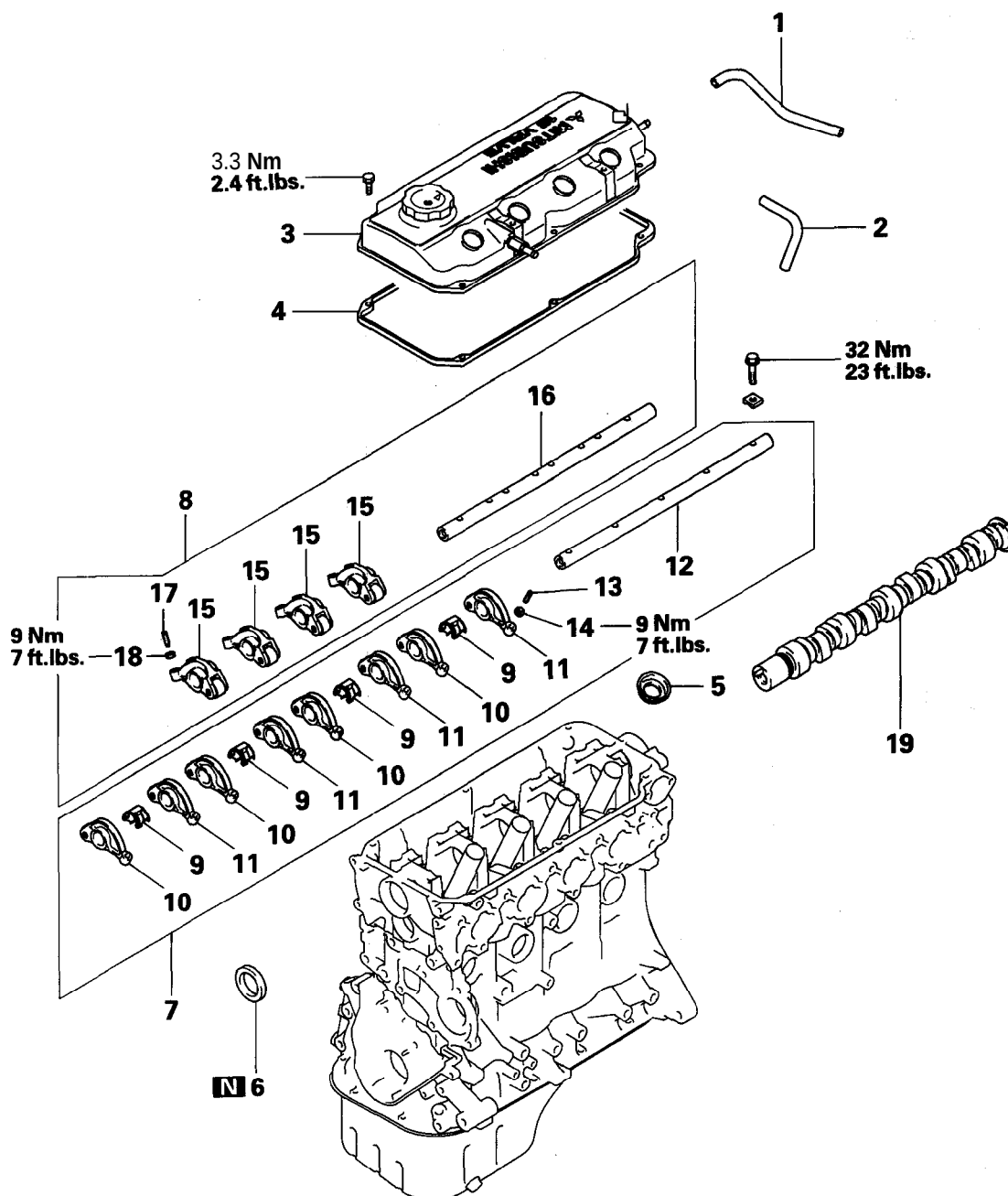


Removal steps

1. Oxygen sensor ————— 1992,1993 (Federal) models
2. Exhaust manifold cover A
3. Exhaust manifold bracket B } 1993 models
4. Exhaust manifold bracket A }
5. Exhaust manifold bracket ————— 1992 models
6. Exhaust manifold ————— 1992, 1993 (Federal) models
7. Exhaust manifold ————— 1993 (California) models
8. Exhaust manifold cover B — 1992, 1993 (Federal) models
9. Gasket

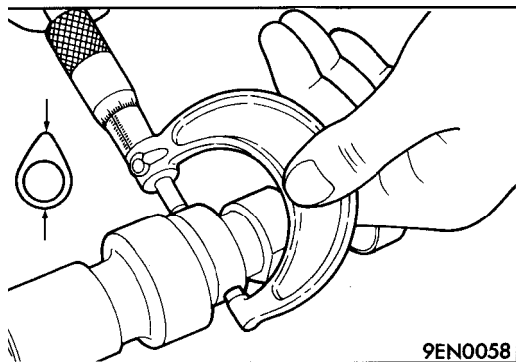
ROCKER ARMS AND CAMSHAFT

REMOVAL AND INSTALLATION



Removal steps

- | | |
|-------------------------------------|-------------------------------------|
| 1. Breather hose | 11. Rocker arm B |
| 2. P.C.V. hose | 12. Rocker arm shaft (Intake side) |
| 3. Rocker cover | 13. Adjusting screw |
| 4. Rocker cover gasket | 14. Nut |
| 5. Oil seal | 15. Rocker arm C |
| 6. Oil seal | 16. Rocker arm shaft (Exhaust side) |
| 7. Rocker arms and rocker arm shaft | 17. Adjusting screw |
| 8. Rocker arms and rocker arm shaft | 18. Nut |
| 9. Rocker shaft spring | 19. Camshaft |
| 10. Rocker arm A | |



INSPECTION

CAMSHAFT

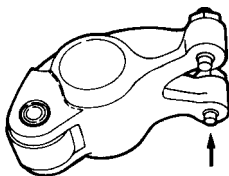
- (1) Measure the cam height

Standard value:

Intake	37.78 mm (1.4874 in.)
Exhaust	38.09 mm (1.4996 in.)

Limit:

Intake	37.28 mm (1.4677 in.)
Exhaust	37.59 mm (1.4799 in.)



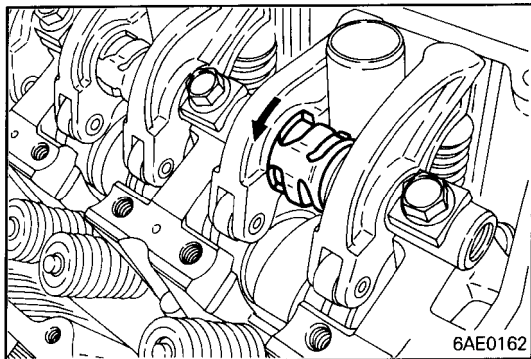
ROCKER ARM

- Check the roller surface. If any dents, damage or seizure is evident, replace the rocker arm.
- Check rotation of the roller. If it does not rotate smoothly or if looseness is evident, replace the rocker arm.
- Check the inside diameter. If damage or seizure is evident, replace the rocker arm.
- Check the screw end for wear. If considerable wear is evident, replace the adjusting screw.

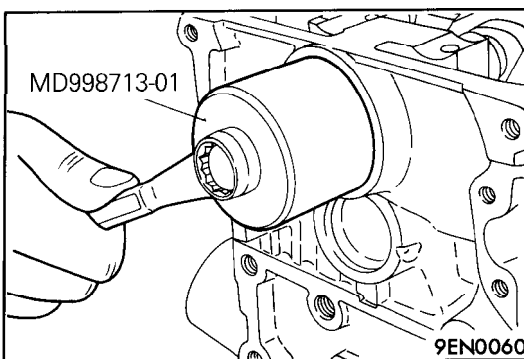
INSTALLATION SERVICE POINTS

▶▶ ROCKER SHAFT SPRING / ROCKER ARMS / ROCKER ARM SHAFT INSTALLATION

- (1) Temporarily tighten the rocker shaft with the bolt so that all rocker arms on the inlet valve side do not push the valves.
- (2) Fit the rocker shaft spring from the above and position it so that it is right angles to the plug guide.
- (3) Tighten the rocker arm shaft bolt to the specification.

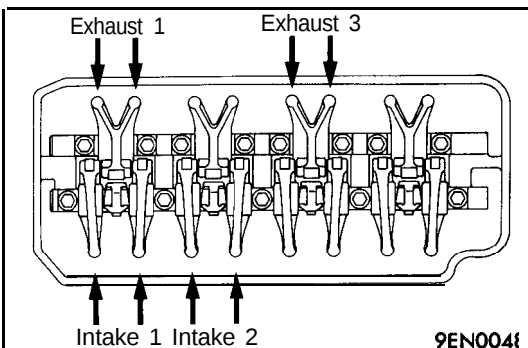


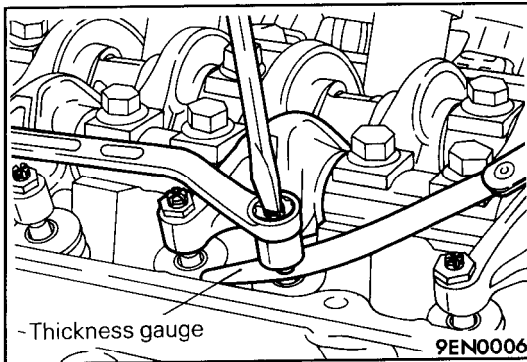
▶▶ OIL SEAL INSTALLATION



VALVE CLEARANCE ADJUSTMENT

- (1) Position the No. 1 cylinder at the top dead center on the compression stroke.
- (2) Adjust the valve clearance at the points shown in the illustration.



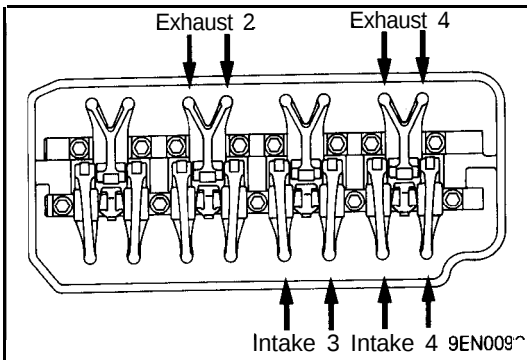


- (3) Loosen the adjusting screw locknut.
- (4) Using a feeler gauge, adjust the valve clearance by turning the adjusting screw.

Standard value:

Intake	0.09 mm (.004 in.)
Exhaust	0.20 mm (.008 in.)

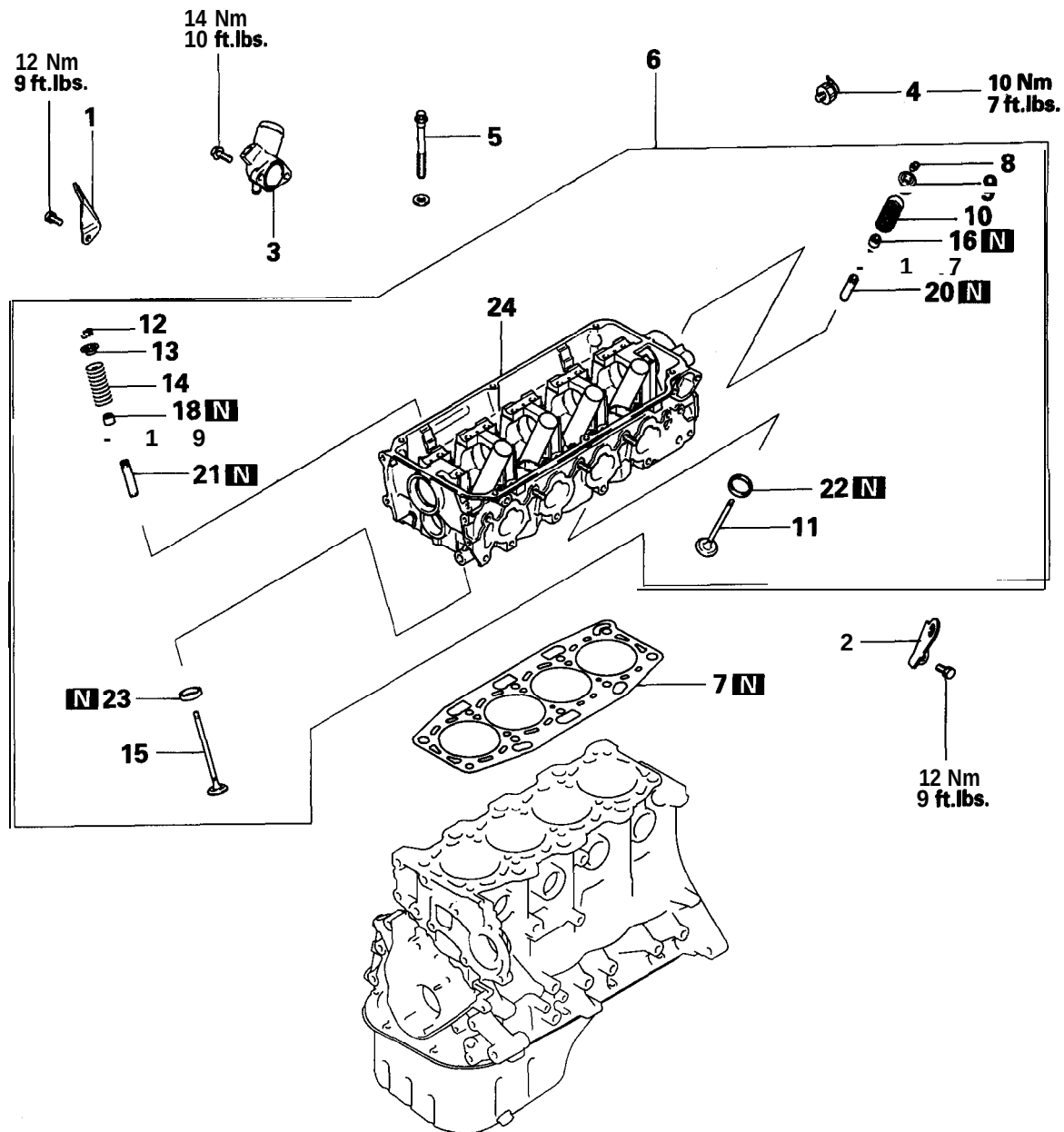
- (5) While holding the adjusting screw with a screwdriver, tighten the lock nut.



- (6) Rotate clockwise the crankshaft one complete turn.
- (7) Adjust the valve clearance at the points shown in the illustration.
- (8) Repeat steps (3) to (5) to adjust the valve clearance of remaining valves.

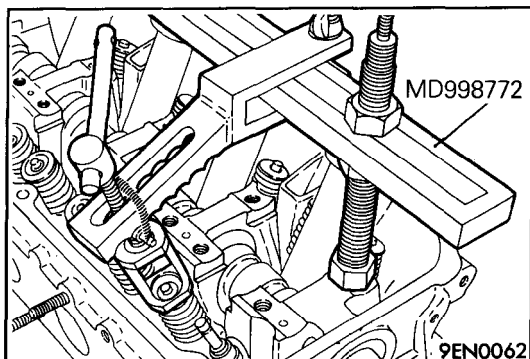
CYLINDER HEAD AND VALVES

REMOVAL AND INSTALLATION

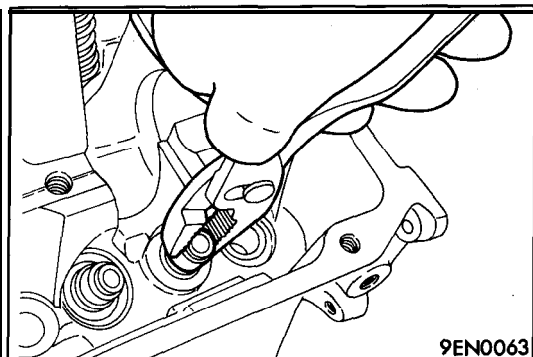


Removal steps

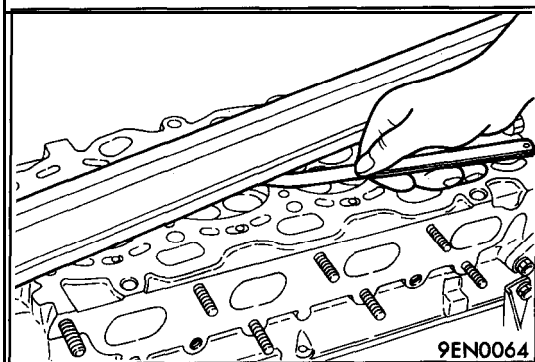
- | | |
|---------------------------|---------------------------|
| 1. Engine hanger | 13. Valve spring retainer |
| 2. Engine hanger | 14. Valve spring |
| 3. Water outlet fitting | 15. Exhaust valve |
| 4. Oil pressure switch | 16. Valve stem seal |
| 5. Cylinder head bolt | 17. Valve spring seat |
| 6. Cylinder head assembly | 18. Valve stem seal |
| 7. Cylinder head gasket | 19. Valve spring seat |
| 8. Retainer lock | 20. Intake valve guide |
| 9. Valve spring retainer | 21. Exhaust valve guide |
| 10. Valve spring | 22. Intake valve seat |
| 11. Intake valve | 23. Exhaust valve seat |
| 12. Retainer lock | 24. Cylinder head |

**REMOVAL SERVICE POINTS****◀A▶ RETAINER LOCK REMOVAL**

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

**◀B▶ VALVE STEM SEAL REMOVAL**

- (1) Do not reuse removed valve stem seals.

**INSPECTION****CYLINDER HEAD**

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

Standard value: 0.03 mm (.0012 in.)

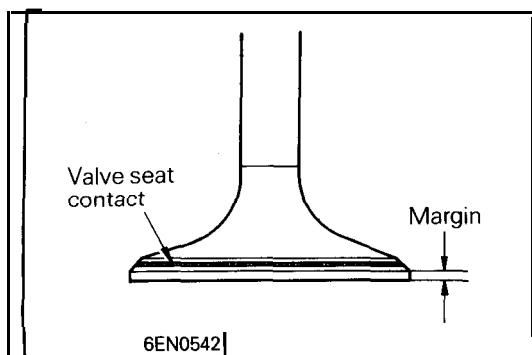
Limit: 0.2 mm (.008 in.)

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

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

* Total resurfacing depth of both cylinder head and cylinder block

Cylinder head height (Specification when new):
119.9 – 120.1 mm (4.720 – 4.728 in.)

**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 center of valve face.
- (2) If the margin is smaller than the service limit, replace the valve.

Standard value:

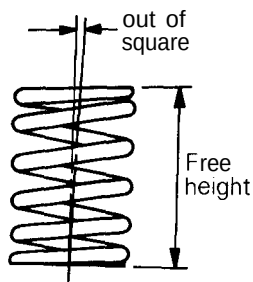
Intake 1.0 mm (.039 in.)

Exhaust 1.3 mm (.051 in.)

Limit:

Intake 0.5 mm (.020 in.)

Exhaust 0.8 mm (.031 in.)



1 EN0264

VALVE SPRING

- (1) Measure the free height of the spring and, if it is smaller than the limit, replace.

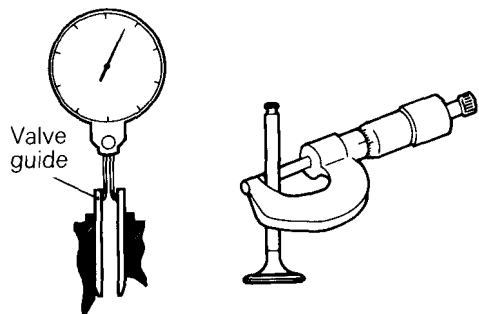
Standard value: 50.9 mm (2.004 in.)

Limit: 49.9 mm (1.965 in.)

- (2) Measure the squareness of the spring and, if the limit is exceeded, replace.

Standard value: 2° or less

Limit: 4°



1 EN0279

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:

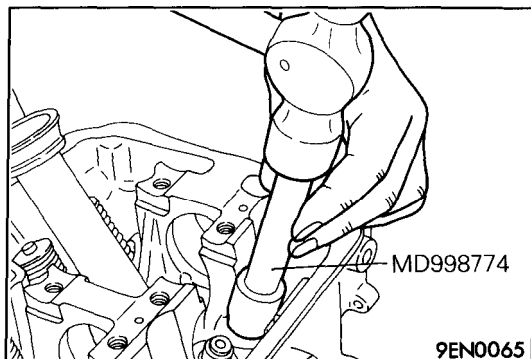
Intake 0.02 – 0.04 mm (.0008 – .0016 in.)

Exhaust 0.03 – 0.06 mm (.0012 – .0024 in.)

Limit:

Intake 0.10 mm (.0039 in.)

Exhaust 0.15 mm (.0059 in.)



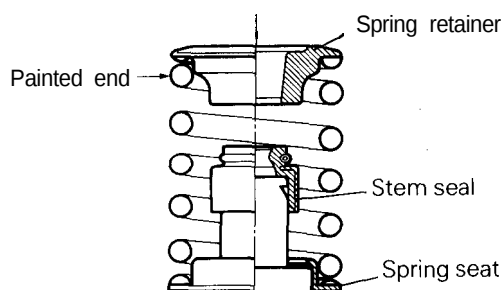
9EN0065

REASSEMBLY SERVICE POINTS**◆A◆ VALVE STEM SEAL INSTALLATION**

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

Caution

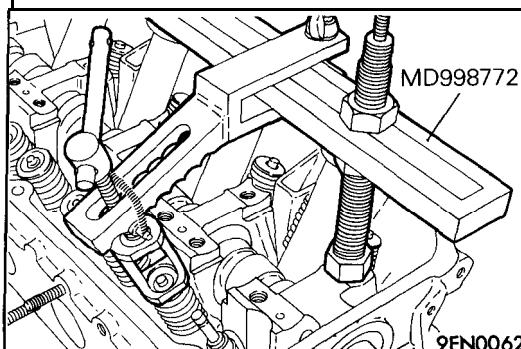
Do not reuse removed valve stem seals.



6EN0437

◆B◆ VALVE SPRING INSTALLATION

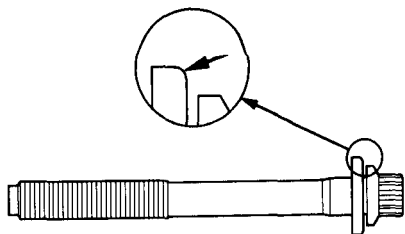
- (1) Install the valve spring with the painted end on the rocker arm side.



9EN0062

◆C◆ RETAINER LOCK INSTALLATION

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



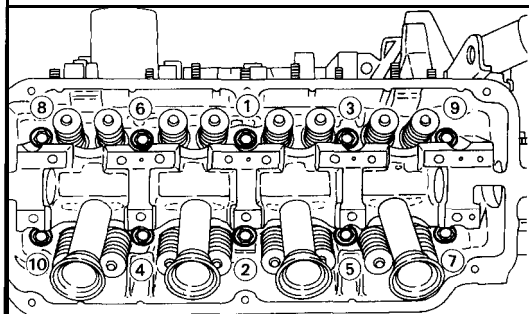
9EN0251

◆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 bolt.

Limit: Max. 96.4 mm (3.79 in.)

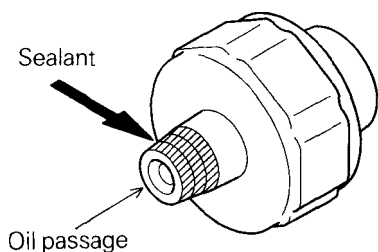
- (2) Install the washers as illustrated.
- (3) Apply engine oil to the bolt threads and washers.



← Timing belt side

9EN0066

- (4) According to the tightening sequence, tighten the bolts to 75 Nm (54 ft.lbs.).
- (5) Loosen the bolts completely.
- (6) Torque the bolts to 20 Nm (14.5 ft.lbs.)
- (7) Tighten the bolts 1/4 turns (90°) more.
- (8) Tighten the bolts 1/4 turns (90°) additionally.



9FN0094

◆E◆ SEALANT APPLICATION TO OIL PRESSURE SWITCH

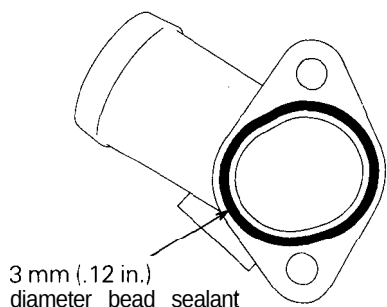
- (1) Apply sealant to the threads of the switch.

Specified sealant:

3M ATD Part No. 8660 or equivalent

Caution

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



9EN0095

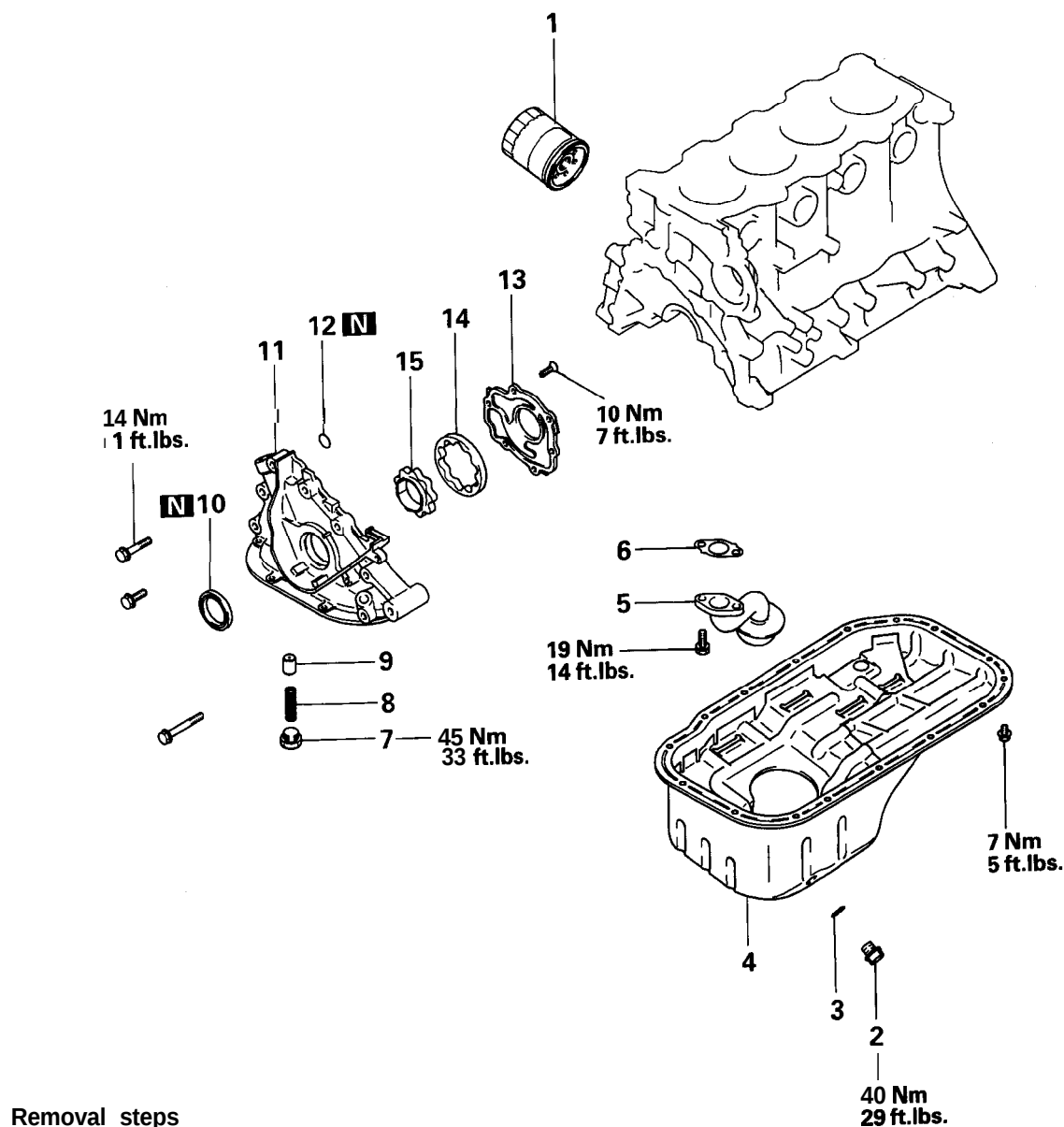
◆F◆ SEALANT APPLICATION TO WATER OUTLET FITTING

Specified sealant:

Mitsubishi Genuine Part No. MD970389 or equivalent

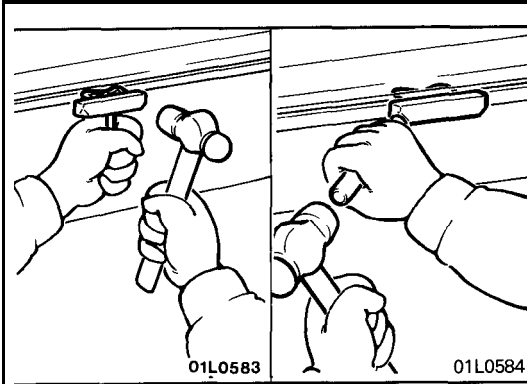
FRONT CASE AND OIL PUMP

REMOVAL AND INSTALLATION



Removal steps

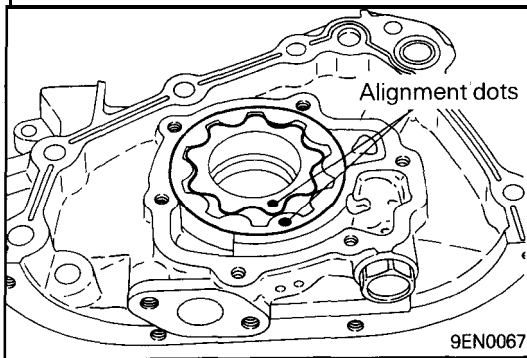
- ◆E◆ 1. Oil filter
- 2. Drain plug
- 3. Drain plug gasket
- ◆A◆◆D◆ 4. Oil pan
- 5. Oil screen
- 6. Oil screen gasket
- 7. Relief plug
- 8. Relief spring
- 9. Relief plunger
- ◆C◆ 10. Oil seal
- ◆B◆ 11. Oil pump case
- 12. O-ring
- 13. Oil pump case cover
- ◆B◆◆A◆ 14. Outer rotor
- ◆B◆◆A◆ 15. Inner rotor



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▶ OUTER ROTOR / INNER ROTOR REMOVAL

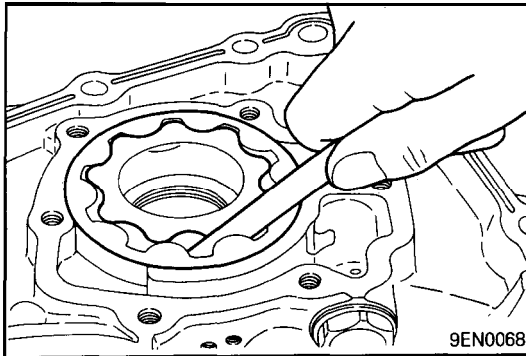
- (1) Make alignment dots on the outer and inner rotors for reference in reassembly.

INSPECTION

OIL PUMP

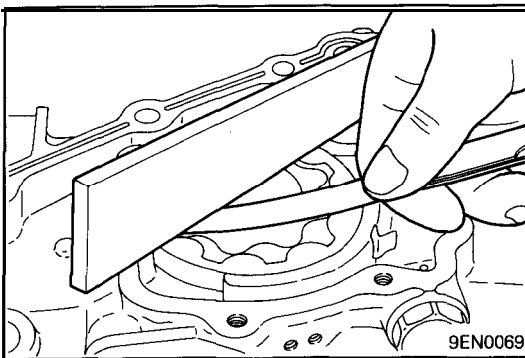
- (1) Check the tip clearance.

Standard value: **0.03 – 0.08 mm (.0012 – .0031 in.)**



- (2) Check the side clearance.

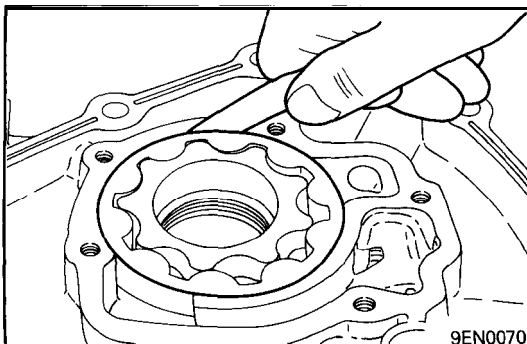
Standard value: **0.04 – 0.10 mm (.0016 – .0039 in.)**

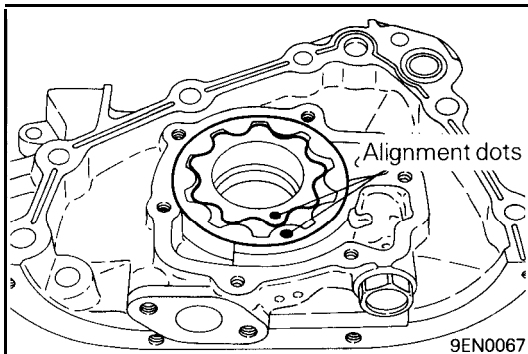


- (3) Check the body clearance.

Standard value: **0.10 – 0.18 mm (.0039 – .0071 in.)**

Limit: **0.35 mm (.0138 in.)**

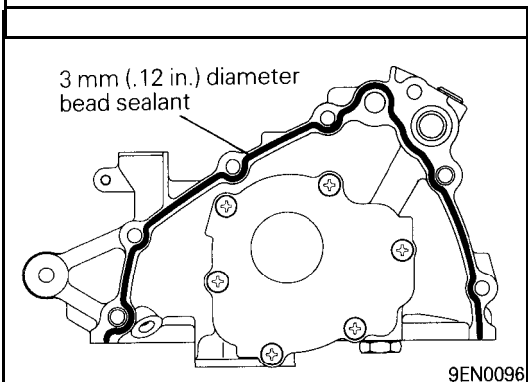




INSTALLATION SERVICE POINTS

◆A◆ INNER ROTOR / OUTER ROTOR INSTALLATION

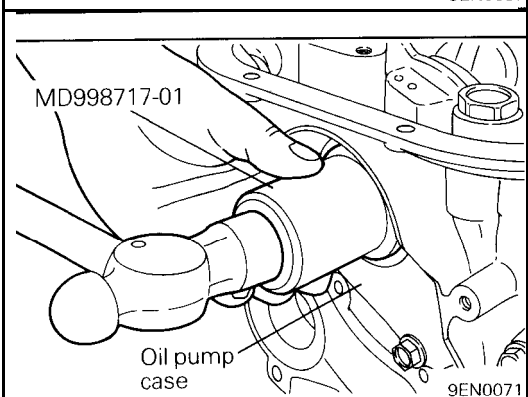
- (1) Apply engine oil to the rotors. Then, install the rotors ensuring that the alignment dots made at disassembly are properly aligned.



◆B◆ SEALANT APPLICATION TO OIL PUMP CASE

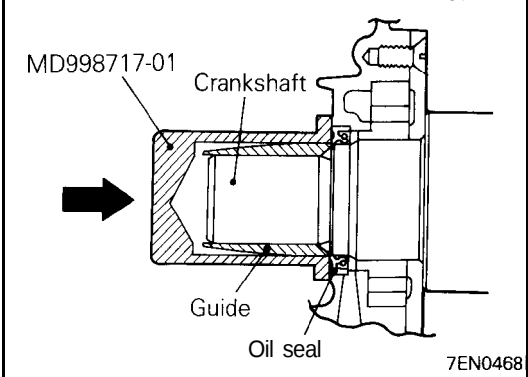
Specified sealant:

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



◆C◆ CRANKSHAFT FRONT OIL SEAL INSTALLATION

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



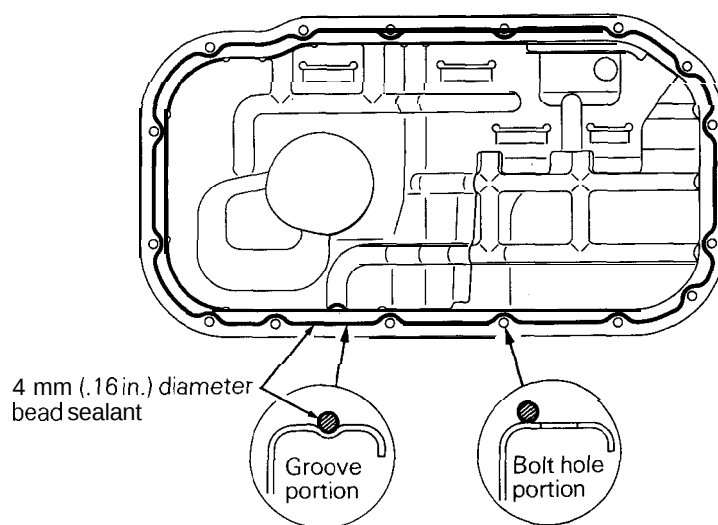
DI OIL PAN INSTALLATION

- (1) Remove all the remaining gasket from the mating surfaces using a scraper or a wire brush.
- (2) Apply a 4 mm (.16 in.) diameter bead of sealant to the oil pan flange.
See "Form In-Place Gasket" in introduction.

Specified sealant:

Mitsubishi Genuine Part No. MD970389 or equivalent

- (3) The oil pan should be installed within 15 minutes after the application of sealant.



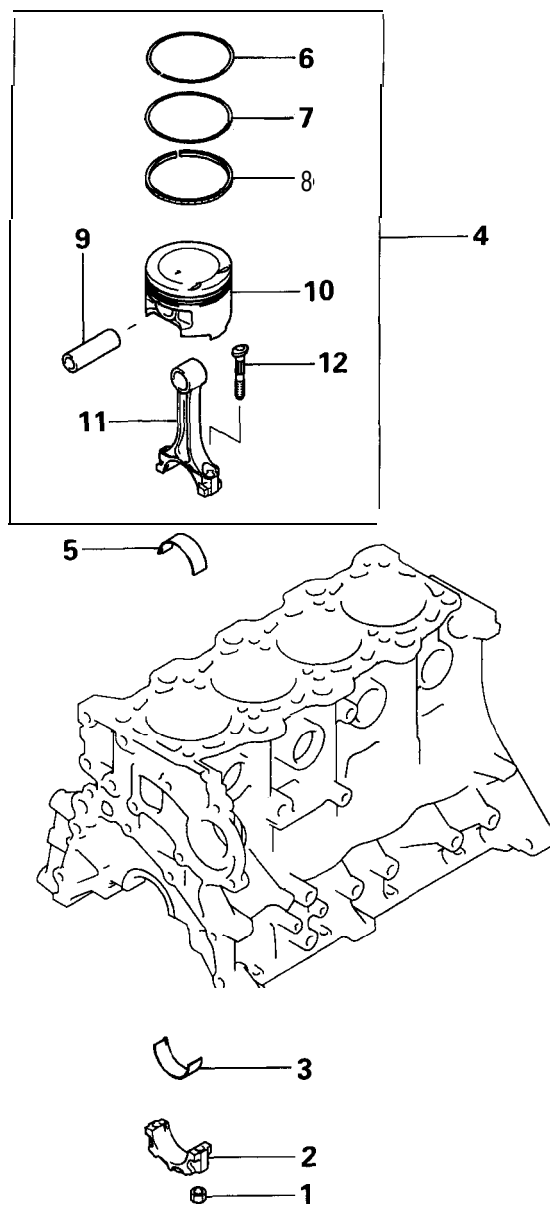
9EN0097

DE OIL FILTER INSTALLATION

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

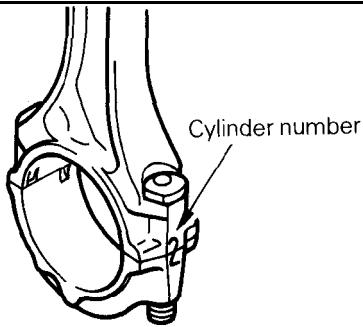
PISTON AND CONNECTING ROD

REMOVAL AND INSTALLATION



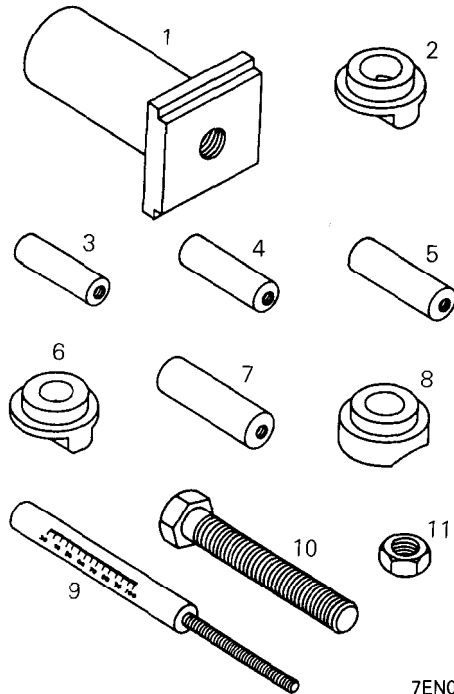
Removal steps

- ◆G◆ 1. Nut
- ◆A◆ ◆F◆ 2. Connecting rod cap
- ◆E◆ 3. Connecting rod bearing
- ◆D◆ 4. Piston and connecting rod
- ◆E◆ 5. Connecting rod bearing
- ◆C◆ 6. Piston ring No. 1
- ◆C◆ 7. Piston ring No. 2
- ◆B◆ 8. Oil ring
- ◆B◆ ◆A◆ 9. Piston pin
- ◆B◆ 10. Piston
- 11. Connecting rod
- 12. Bolt

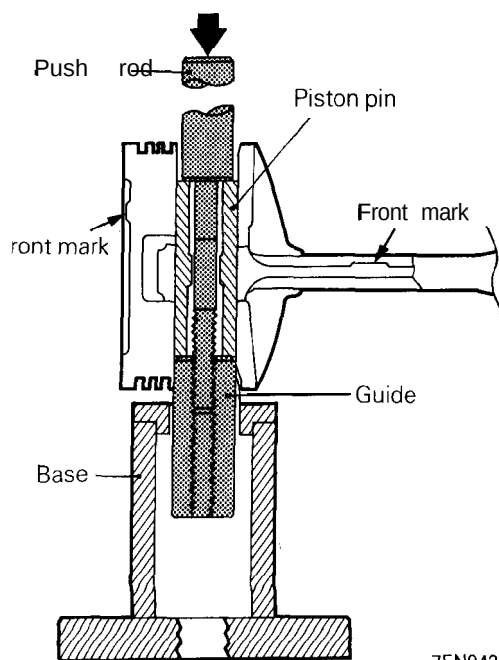


DEN0050

Piston pin setting tool MIT21 6941



7EN0425



7FN0426

DISASSEMBLY 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

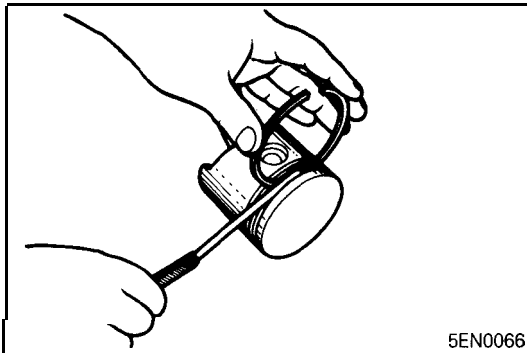
Item No.	Part No.	Description
1	MIT310134	Base
2	MIT310136	Piston Support
3	MIT310137	Connecting Rod Guide Pin
4	MIT310138	Connecting Rod Guide Pin
5	MIT310139	Connecting Rod Guide Pin
6	MIT31 0140	Piston Support
7	MIT310141	Connecting Rod Guide Pin
8	MIT310142	Piston Support
9	MIT481 43	Press Pin
10	216943	Stop Screw
11	10396	Nut

- (2) Select the correct piston support for your application. (See above.) Fit the piston support onto the base. Place the base on the press support blocks.
- (3) Insert the press pin through the piston pin hole. Select the correct connecting rod guide pin. (See Above.) Thread the guide pin onto the threaded portion of the press pin.
- (4) Position the piston assembly on the piston support in the press. With the press pin up as shown in the illustration, insert the guide pin through the hole in the piston and through the hole in the piston support.
- (5) Press the piston pin out of the assembly.

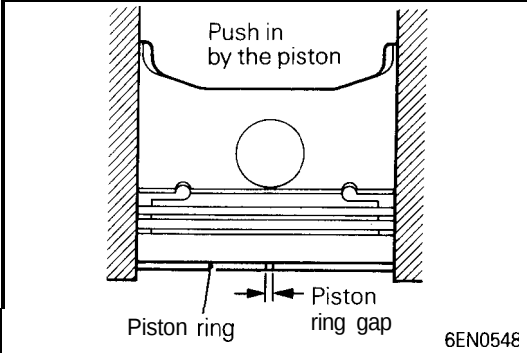
IMPORTANT: To avoid piston damage

- The piston support must seat squarely against the piston.
- Verify that the piston pin will slide through the hole in the piston support

- (6) Remove the piston pin from the press pin.



5EN0066



6EN0548

INSPECTION

PISTON RING

- (1) Check the side 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 (.0012 – .0028 in.)

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

Limit:

No. 1 0.1 mm (.004 in.)

No. 2 0.1 mm (.004 in.)

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

Standard value:

No. 1 0.25 – 0.40 mm (.0098 – .0157 in.)

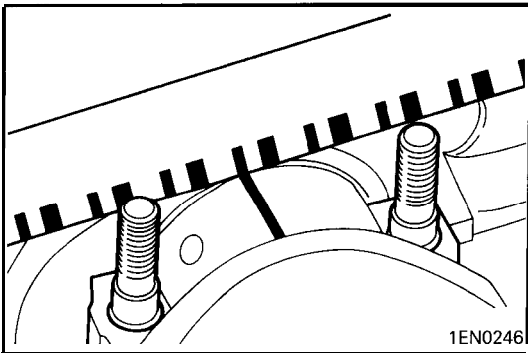
No. 2 0.40 – 0.55 mm (.0157 – .0217 in.)

Oil 0.20 – 0.60 mm (.0079 – .0236 in.)

Limit:

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

Oil 1.0 mm (.039 in.)



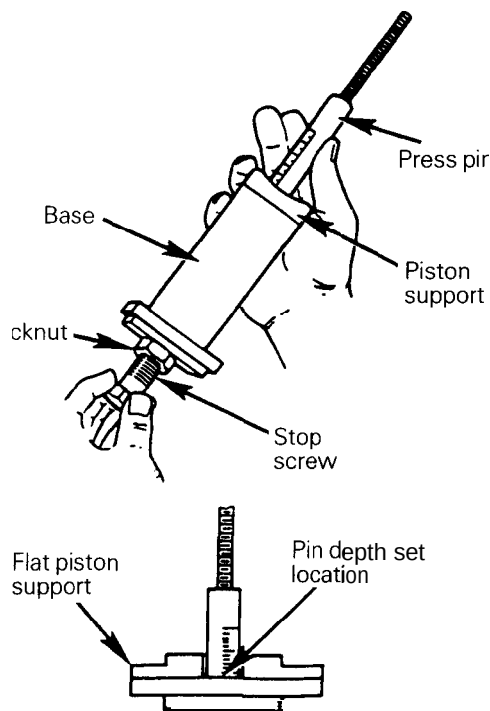
1EN0246

CRANKSHAFT PIN OIL CLEARANCE (PLASTIC GAUGE METHOD)

- (1) Remove oil from crankshaft pin and connecting rod bearing.
- (2) Cut the plastic gauge 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 plastic gauge at its widest part by using a scale printed on the plastic gauge package.

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

Limit: 0.1 mm (.004 in.)



7EN0428

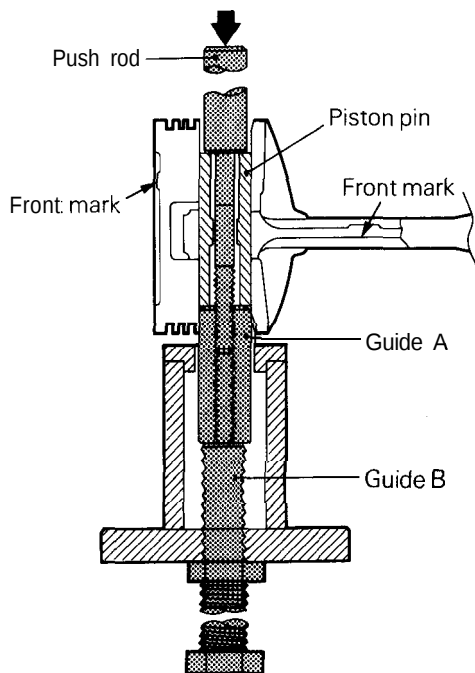
INSTALLATION SERVICE POINTS

◆A◆ PISTON PIN INSTALLATION

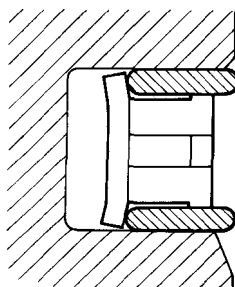
- (1) Thread the stop screw and lock nut assembly into the base. Fit the correct piston support on the top of the base. Insert the press pin, threaded end up, into the hole in the piston support until the press pin touches the stop screw.
- (2) Using the graduations on the press pin, adjust the stop screw to the correct depth of 50 mm (1.97 in.)
- (3) Place the base on the press support blocks.
- (4) Slide the piston pin over the threaded end of the press pin, and thread the correct guide pin up against it.
- (5) Coat the piston pin with oil, and with the connecting rod held in position, slide the guide pin through the piston and the connecting rod.
- (6) Press the piston pin through the connecting rod until the guide pin contacts the stop screw.
- (7) Remove the piston assembly from the base. Remove the guide pin and the press pin from the assembly.

IMPORTANT:

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



7EN0428



6EN0585

◆B◆ OIL RING INSTALLATION

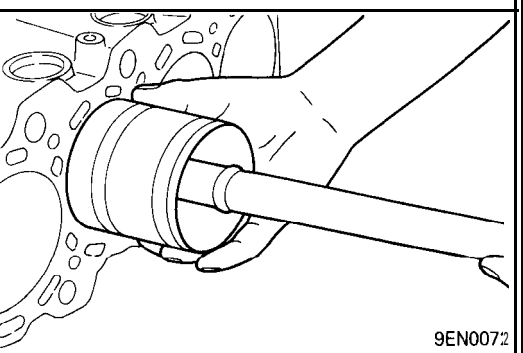
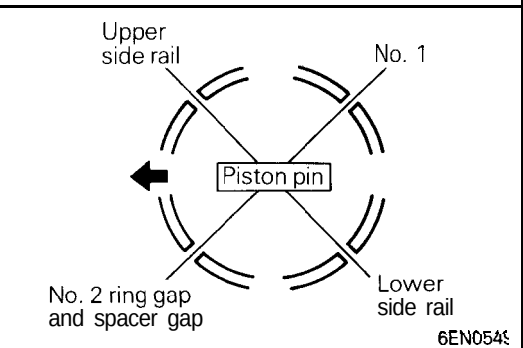
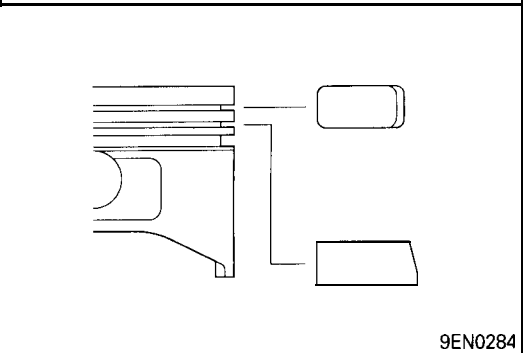
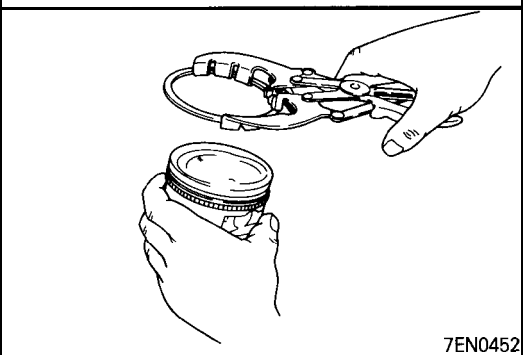
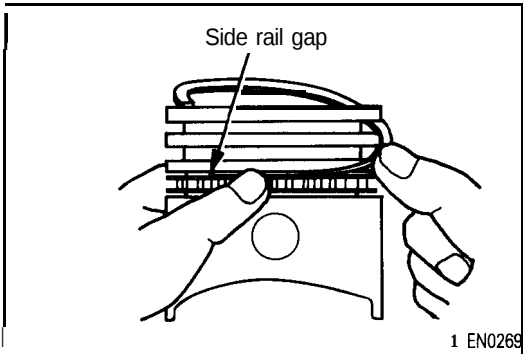
- (1) Fit the oil ring spacer into the piston ring groove.

NOTE

The side rails and spacer may be installed in either direction.

- (2) Install the upper side rail.

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. See the illustration.

**NOTE**

Do not use any piston ring expander when installing the side rail.

Use of a ring expander to expand the side rail end gap can break the side rail, unlike other piston rings.

- (3) Install the lower side rail in the same procedure as described in step (2).
- (4) Make sure that the side rails move smoothly in either direction.

❖C❖ PISTON RING No. 2 / PISTON RING No. 1 INSTALLATION

- (1) Using a piston ring expander, fit No. 2 and then No. 1 piston ring into position.

NOTE

1. Note the difference in shape between No. 1 and No. 2 piston rings.
2. Install piston rings No. 1 and No. 2 with their side having marks facing up (on the piston crown side).

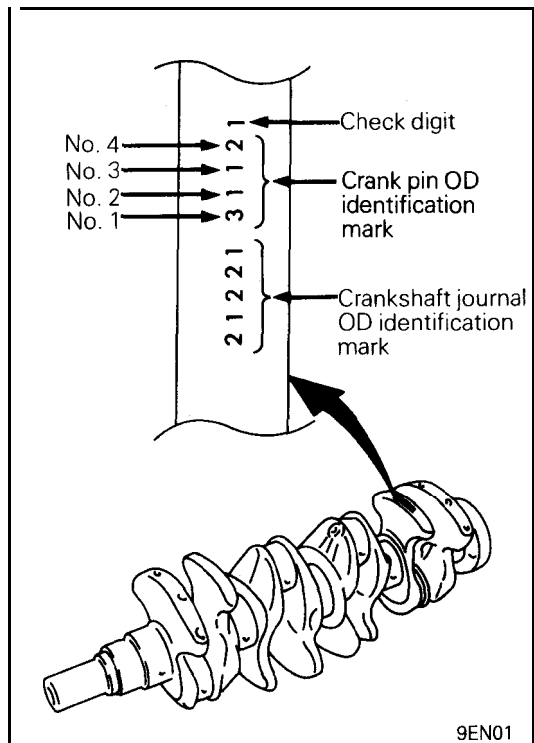
❖D❖ PISTON AND CONNECTING ROD INSTALLATION

- (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) Rotate crankshaft so that the crank pin is on center of the cylinder bore.

- (4) Use suitable thread protectors on the connecting rod bolts before inserting the piston and connecting rod assembly into the cylinder block. Care must be taken not to nick the crank pin.
- (5) Using a suitable the piston ring compressor tool, install the piston and connecting rod assembly into the cylinder block.

Caution

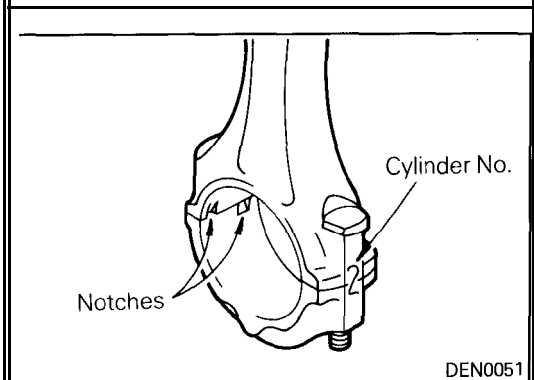
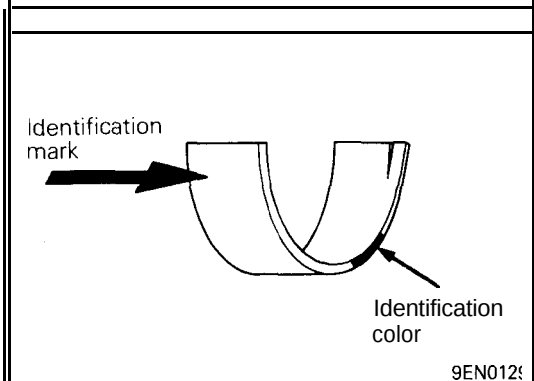
Insert the piston and connecting rod assembly so that the front mark (arrow) on the top of the piston faces the engine front (timing belt side).



◆E◆ CONNECTING ROD BEARING INSTALLATION

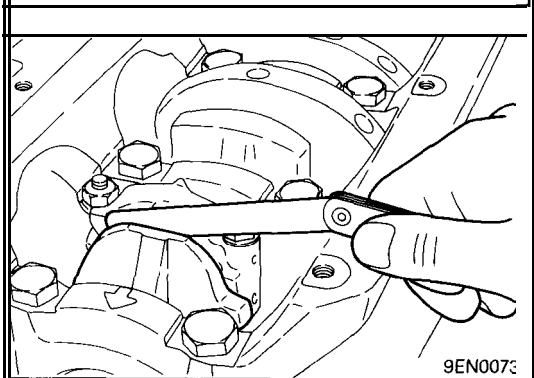
- (1) When the bearings are to be replaced, select correct ones and install them in the correct positions according to the identification marks stamped in the crankshaft.

Crank pin OD identification mark	Connecting rod bearing	
	Identification mark	Identification color
1	S1	Brown
2	S2	Black 1
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 is used which 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 (.0039 – .0098 in.)
Limit: 0.4 mm (.016 in.)

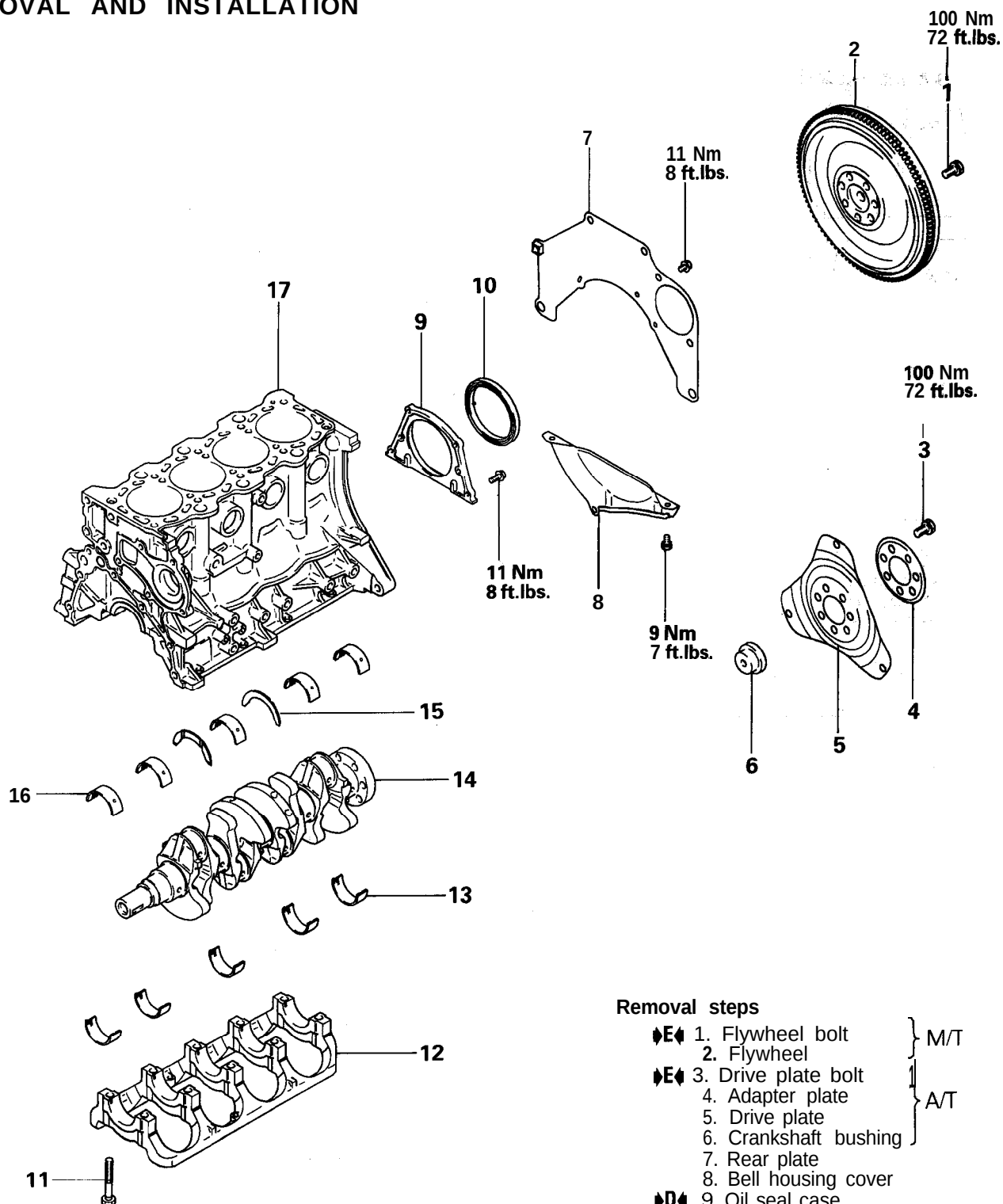
◆G◆ CONNECTING ROD CAP NUT INSTALLATION

- (1) Since the connecting rod cap bolts and nuts are torqued using a new procedure, they should be examined BEFORE reuse. If the bolt threads are “necked down”, the bolts should be replaced.

Necking can be checked by running a nut with fingers to the full length of the bolt’s thread. If the nut does not run down smoothly, the bolt should be replaced.

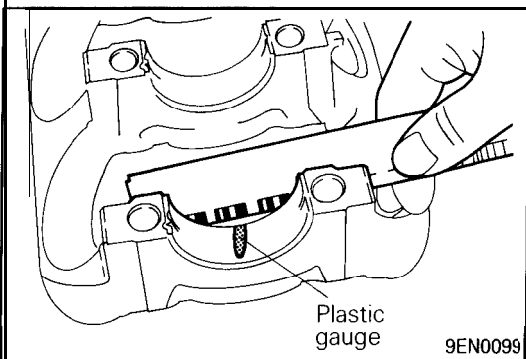
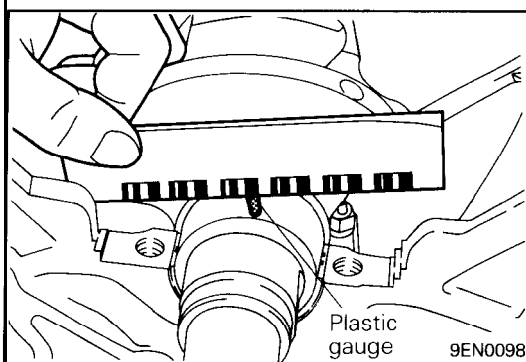
- (2) Install the connecting rod cap on the big end of the connecting rod.
- (3) Before installing the nuts, the threads should be oiled with engine oil.
- (4) Install both nuts on each bolt finger tight, then alternately torque each nut to assemble the cap properly.
- (5) Tighten the nuts to 20 Nm (14.5 ft.lbs.) and plus 1/4 (90°) turn.

CRANKSHAFT, CYLINDER BLOCK, FLYWHEEL AND DRIVE PLATE REMOVAL AND INSTALLATION



Removal steps

- | | | |
|-----|-------------------------------|-------|
| ◆E◆ | 1. Flywheel bolt | } M/T |
| | 2. Flywheel | |
| ◆E◆ | 3. Drive plate bolt | } A/T |
| | 4. Adapter plate | |
| | 5. Drive plate | |
| | 6. Crankshaft bushing | |
| | 7. Rear plate | |
| | 8. Bell housing cover | |
| ◆D◆ | 9. Oil seal case | |
| ◆C◆ | 10. Oil seal | |
| ◆B◆ | 11. Bearing cap bolt | |
| ◆B◆ | 12. Bearing cap | |
| ◆A◆ | 13. Crankshaft bearing, lower | |
| | 14. Crankshaft | |
| ◆A◆ | 15. Thrust bearing | |
| ◆A◆ | 16. Crankshaft bearing, upper | |
| | 17. Cylinder block | |



INSPECTION

CRANKSHAFT OIL CLEARANCE (PLASTIC GAUGE METHOD)

- (1) Remove oil from the crankshaft journal and the crankshaft bearing.
- (2) Install the crankshaft.
- (3) Cut the plastic gauge 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 plastic gauge at its widest part by using a scale printed on the plastic gauge package.

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

Limit: 0.1 mm (.004 in.)

CYLINDER BLOCK

- (1) Using a straightedge and feeler 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 (.0020 in.) or less

Limit: 0.1 mm (.0040 in.)

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

Grinding limit: 0.2 mm (.008 in.)

The total thickness of the stock allowed to be removed from cylinder block and mating cylinder head is 0.2 mm (.008 in.) at maximum.

Cylinder block height (when new): 243.5 mm (9.587 in.)

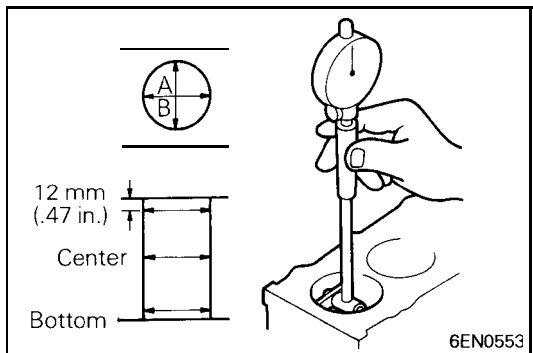
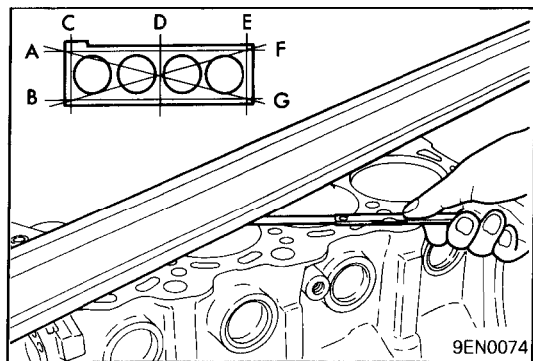
- (3) Check the cylinder walls for scratches and seizure. If defects are evident, correct (bored to oversize) or replace.
- (4) Using a cylinder gauge, measure the cylinder bore and cylindricity. If worn badly, correct the cylinder to an oversize and replace the piston and piston rings. Measure at the points shown in illustration.

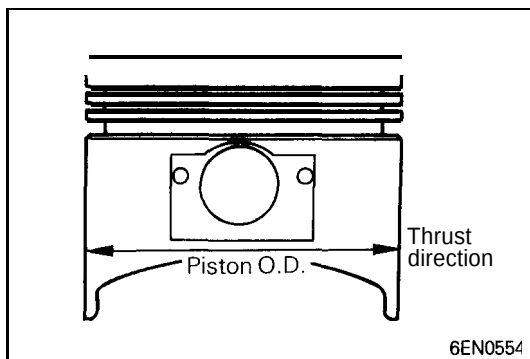
Standard value:

Cylinder I.D.: 81.00 – 81.03 mm (3.1890 – 3.1902 in.)

Out-of-roundness and taper of cylinder bore:

0.01 mm (.0004 in.) 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
0.25 mm (.01 in.) O.S.	0.25
0.50 mm (.02 in.) O.S.	0.50
0.75 mm (.03 in.) O.S.	0.75
1.00 mm (.04 in.) 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 (.0008 in.) (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 (.0008 – .0016 in.)

NOTE

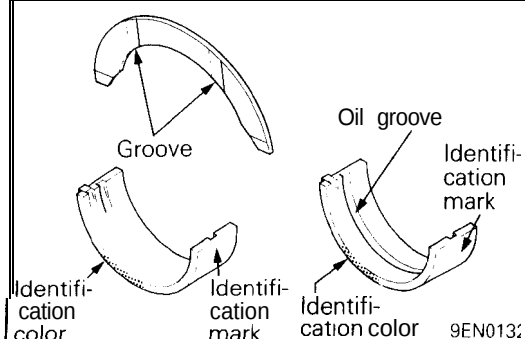
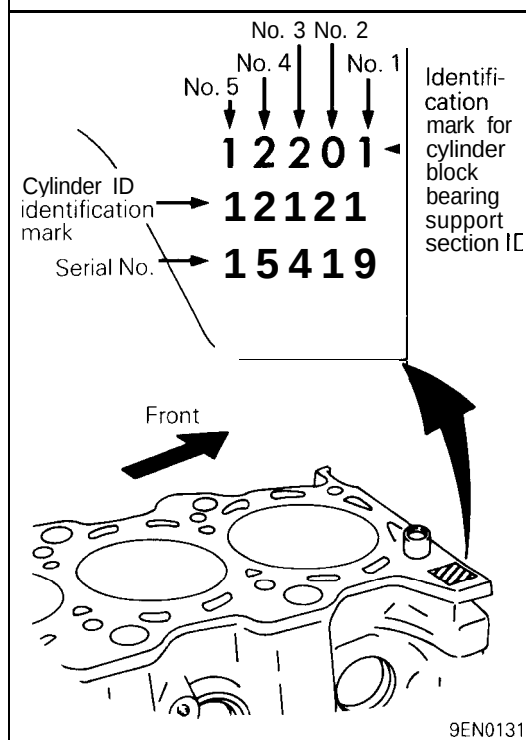
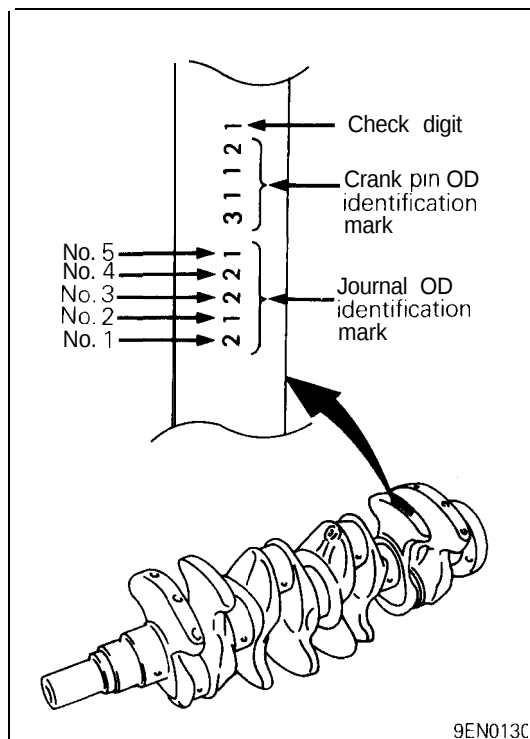
When boring cylinders, finish all of four cylinders to the same oversize. Do not bore only one cylinder to an oversize.

REASSEMBLY SERVICE POINTS

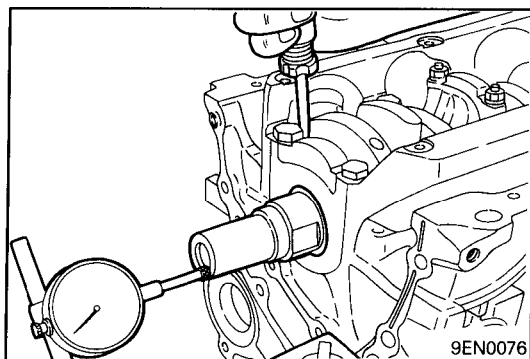
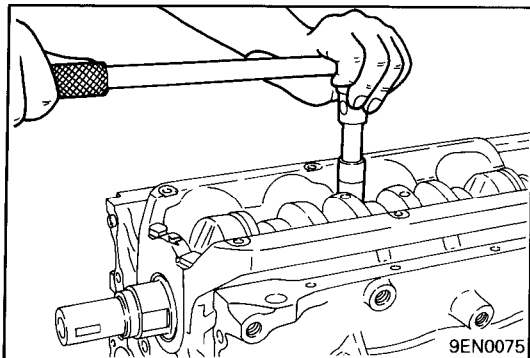
A CRANKSHAFT BEARING INSTALLATION

- (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.

Journal OD identification mark	Identification mark for cylinder block bearing support section ID	Crankshaft bearing	
		Identification mark	Identification color
1	0	S1	Brown
	1	S2	Black
	2	S3	Green
2	0	S2	Black
	1	S3	Green
	2	S4	Yellow
3	0	S3	Green
	1	S4	Yellow
	2	S5	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 toward the crank web.



◆B◆ BEARING CAP / BEARING CAP BOLT INSTALLATION

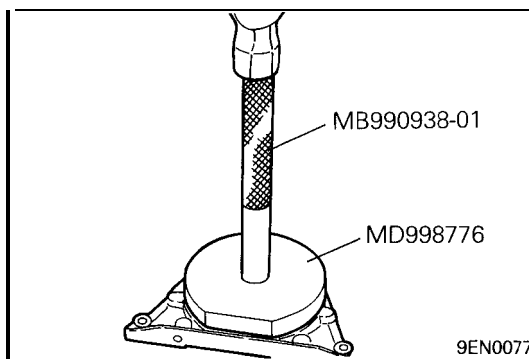
- (1) Install the bearing caps so that their arrows are positioned on the timing belt side.
- (2) When installing the bearing cap bolts, check that the shank length of each bolt meet the limit. If the limit is exceeded, replace the bolt.

Limit: Max. 71.1 mm (2.79 in.)

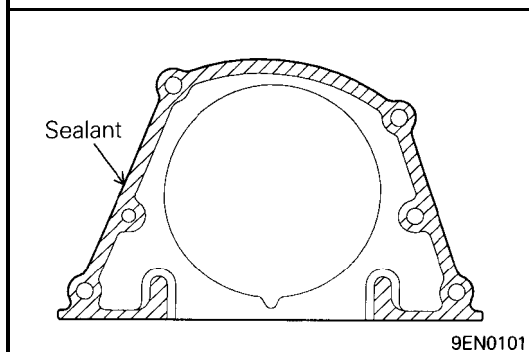
- (3) Torque the bearing cap bolts to 25 Nm (18 ft.lbs.) and, from that position, retighten them further 1/4 (90°) turns.
- (4) After installing the bearing caps, make sure that the crankshaft turns smoothly and the end play is correct. If the end play exceeds the limit, replace the crankshaft bearings.

Standard value: 0.05 – 0.25 mm (.0020 – .0098 in.)

Limit: 0.4 mm (.016 in.)



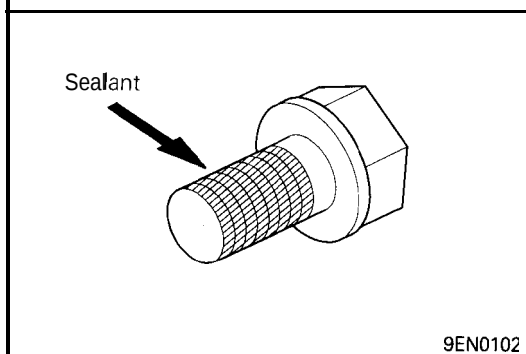
◆C◆ OIL SEAL INSTALLATION



◆D◆ SEALANT APPLICATION TO OIL SEAL CASE

Specified sealant:

Mitsubishi Genuine Part No. MD970389 or equivalent



◆E◆ DRIVE PLATE BOLT / FLYWHEEL BOLT INSTALLATION

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

Specified sealant:

3M Nut Locking Part No. 4171 or equivalent

- (5) Tighten the bolts to the specified torque.

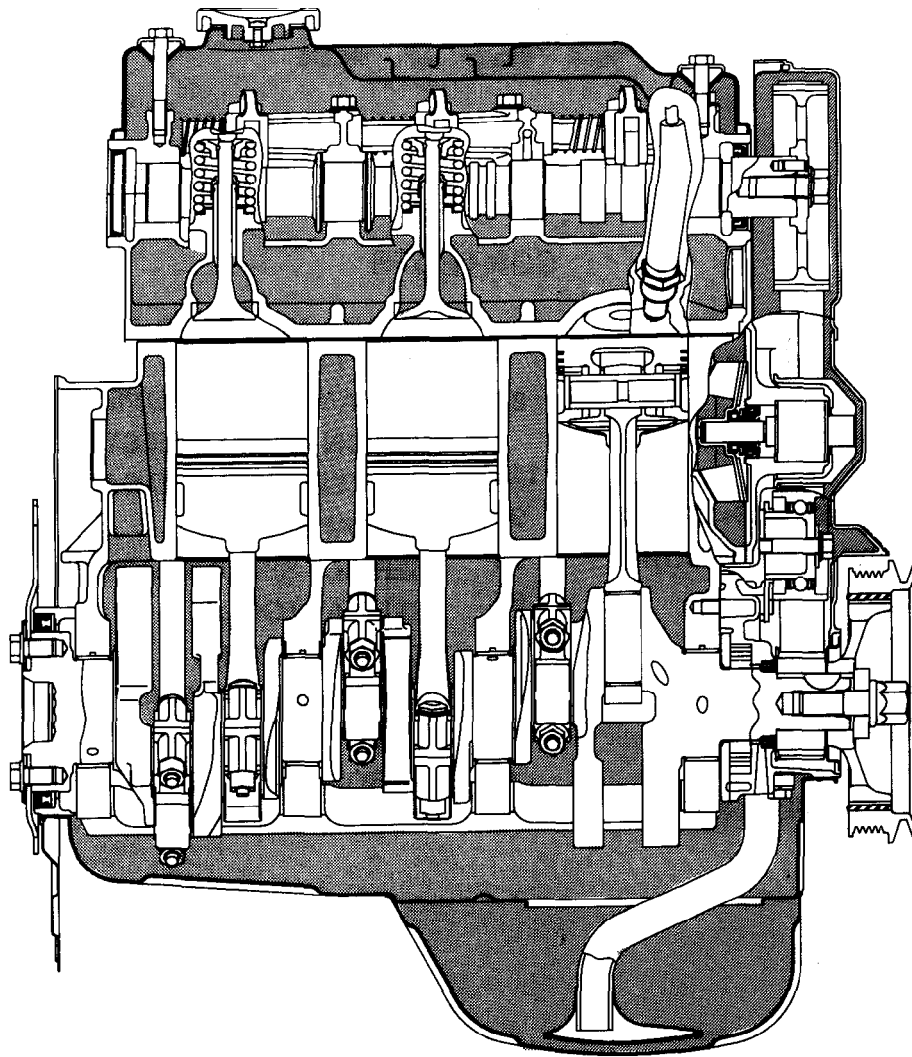
NOTES

ENGINE

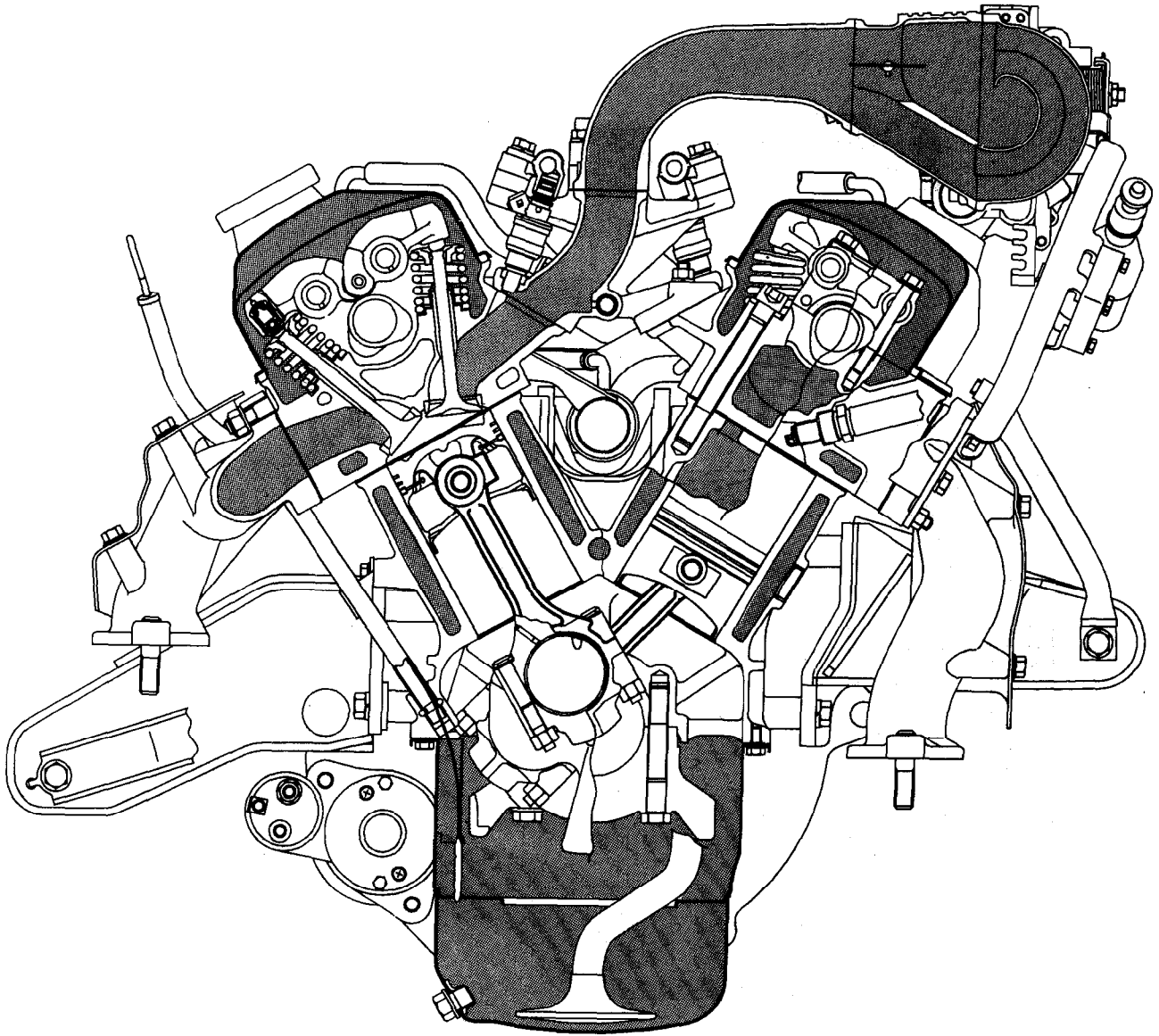
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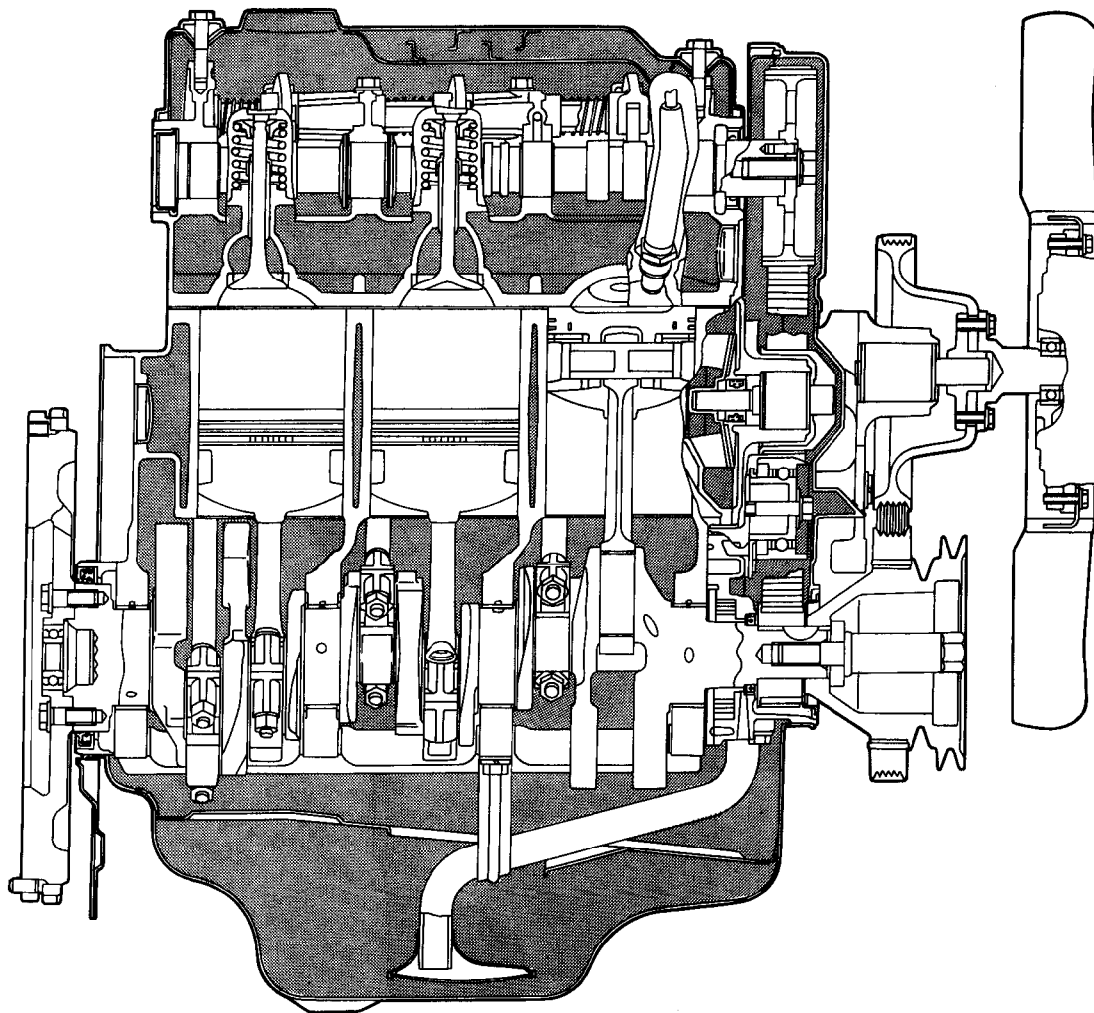
GENERAL INFORMATION**SECTIONAL VIEW – SOHC ENGINE for DIAMANTE**

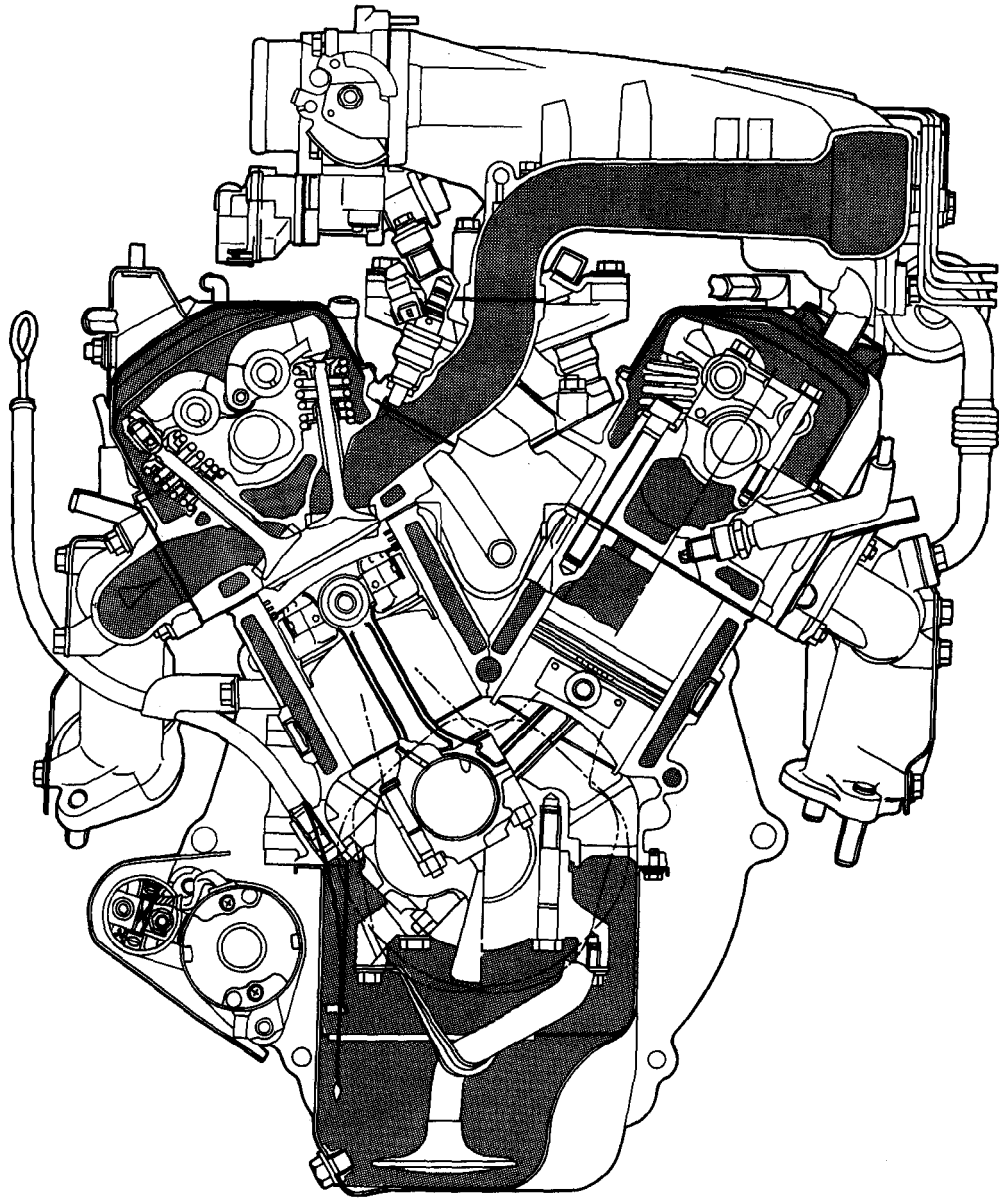
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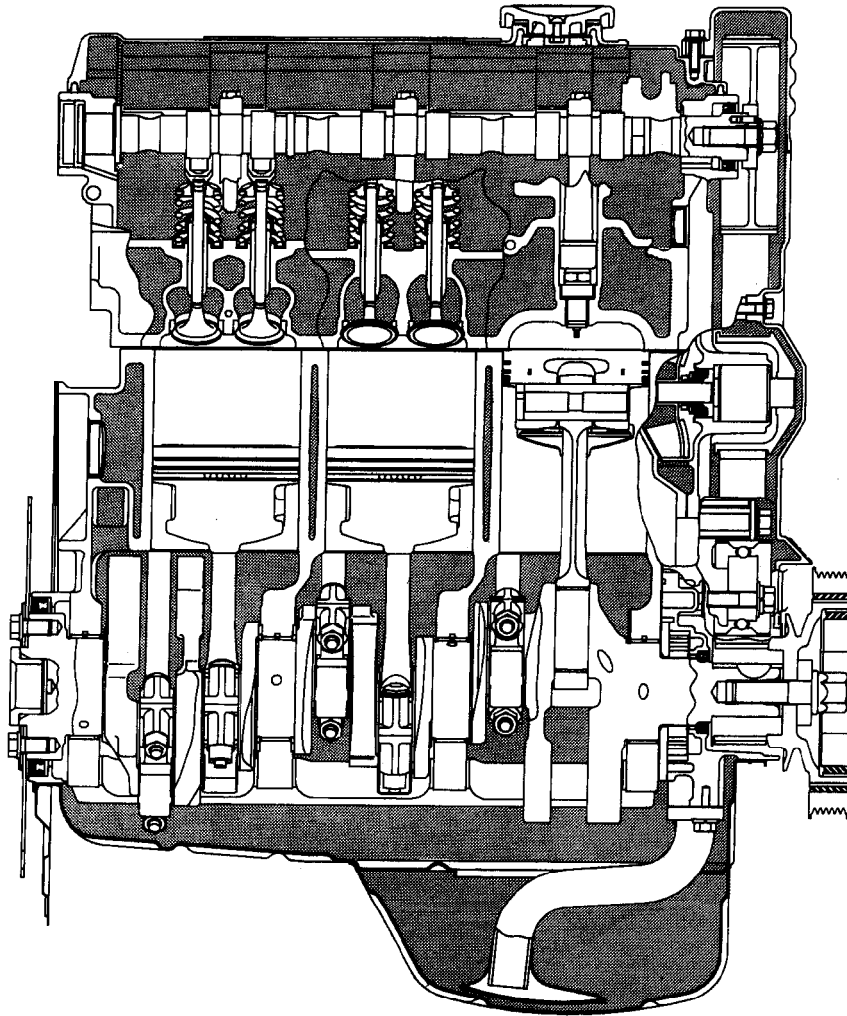
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SECTIONAL VIEW – SOHC ENGINE for MONTERO AND TRUCK

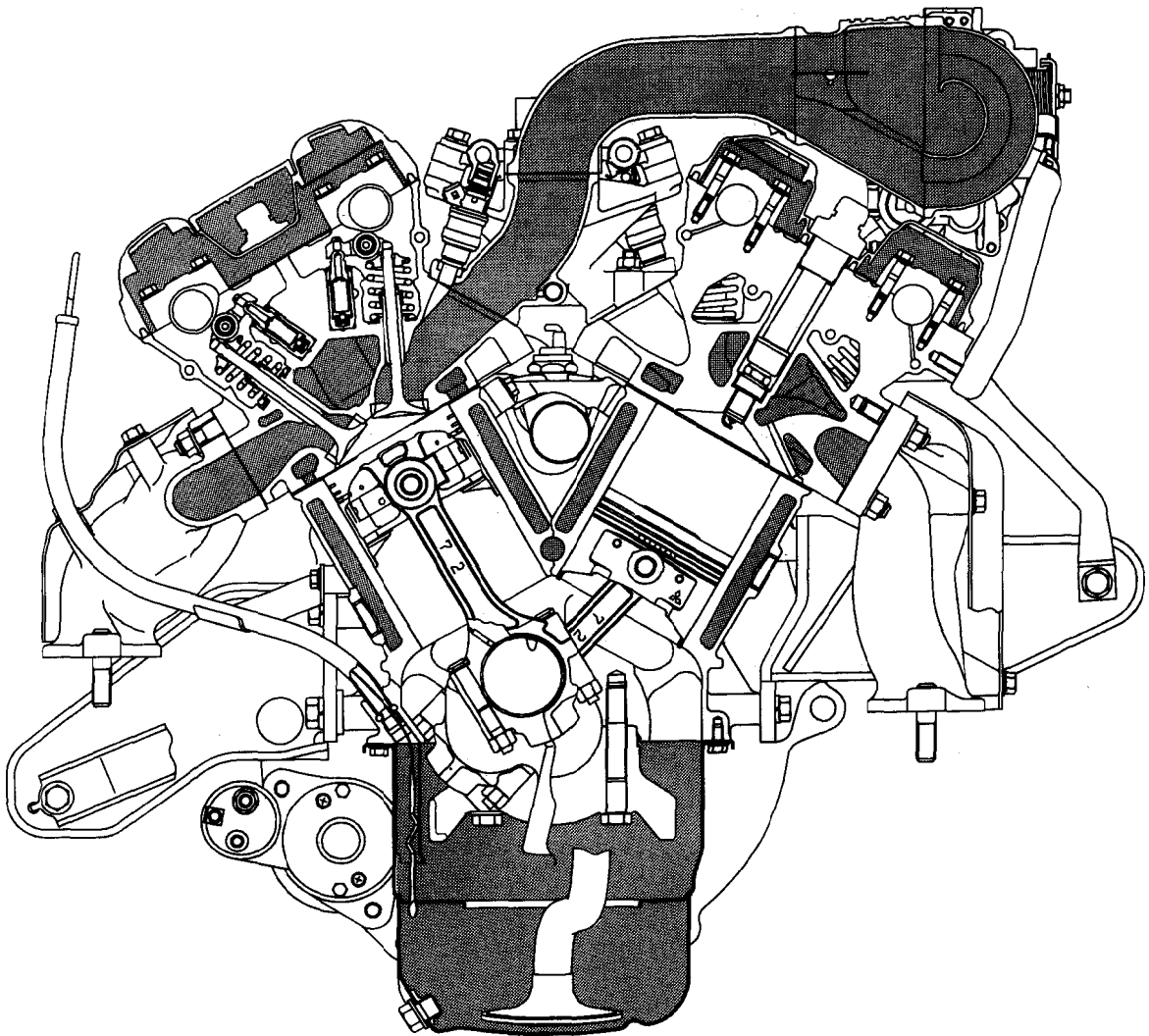




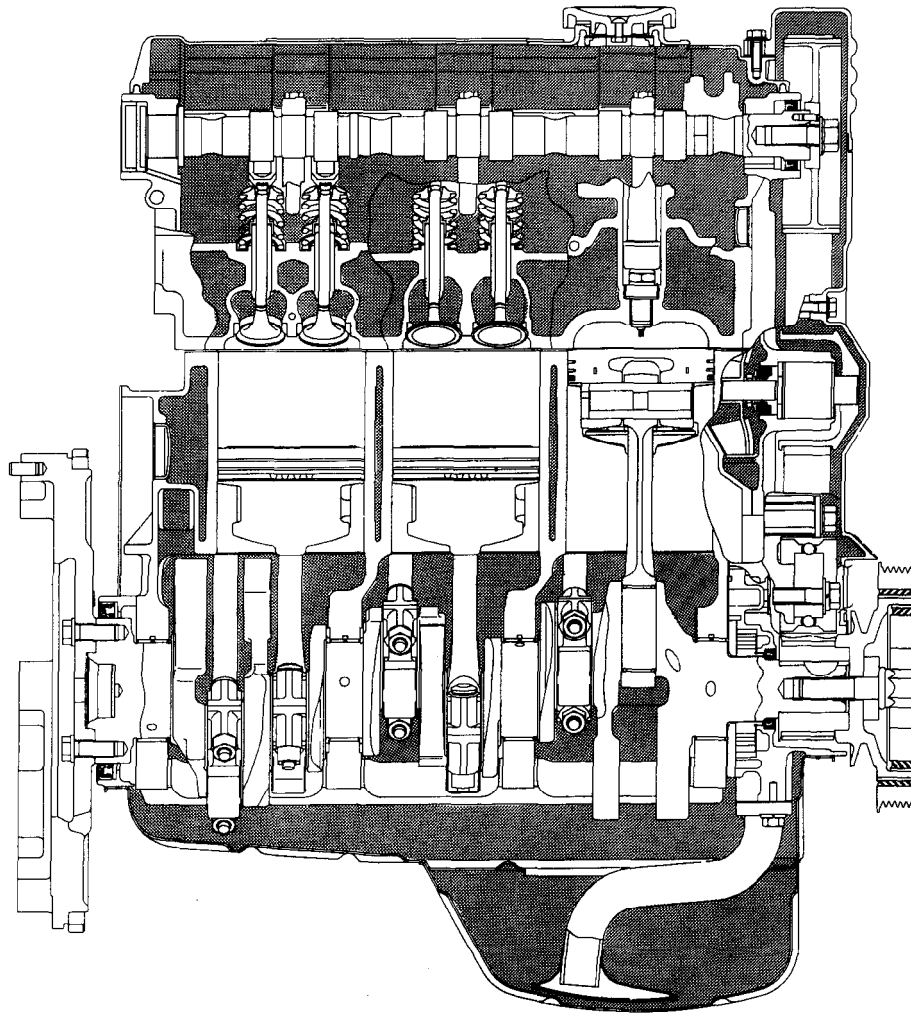
SECTIONAL VIEW – DOHC NON-TURBO ENGINE

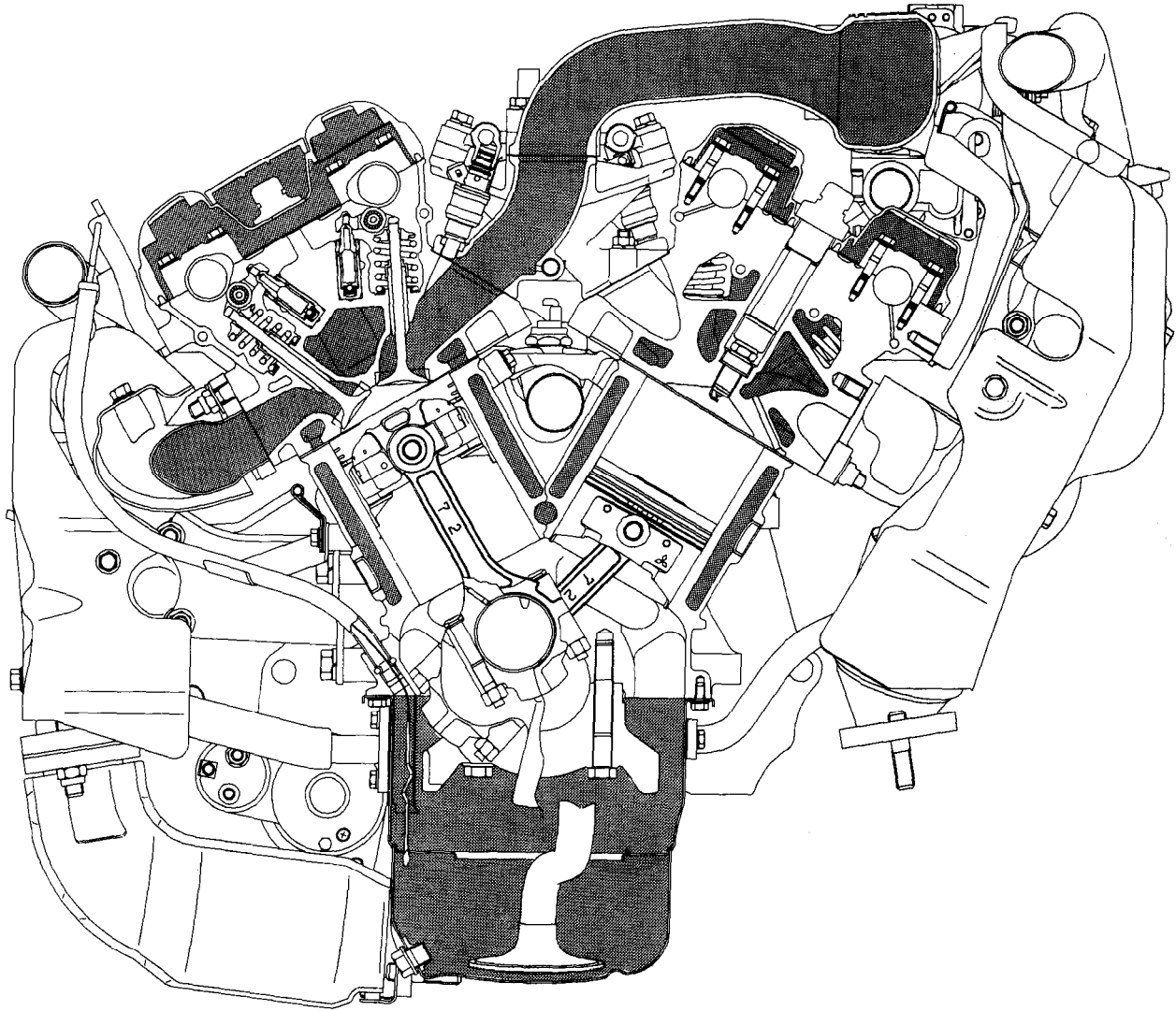


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SECTIONAL VIEW – DOHC TURBO ENGINE

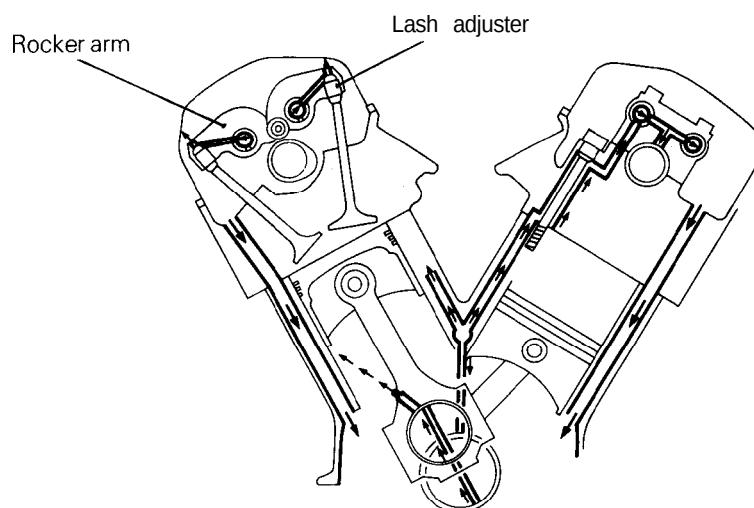
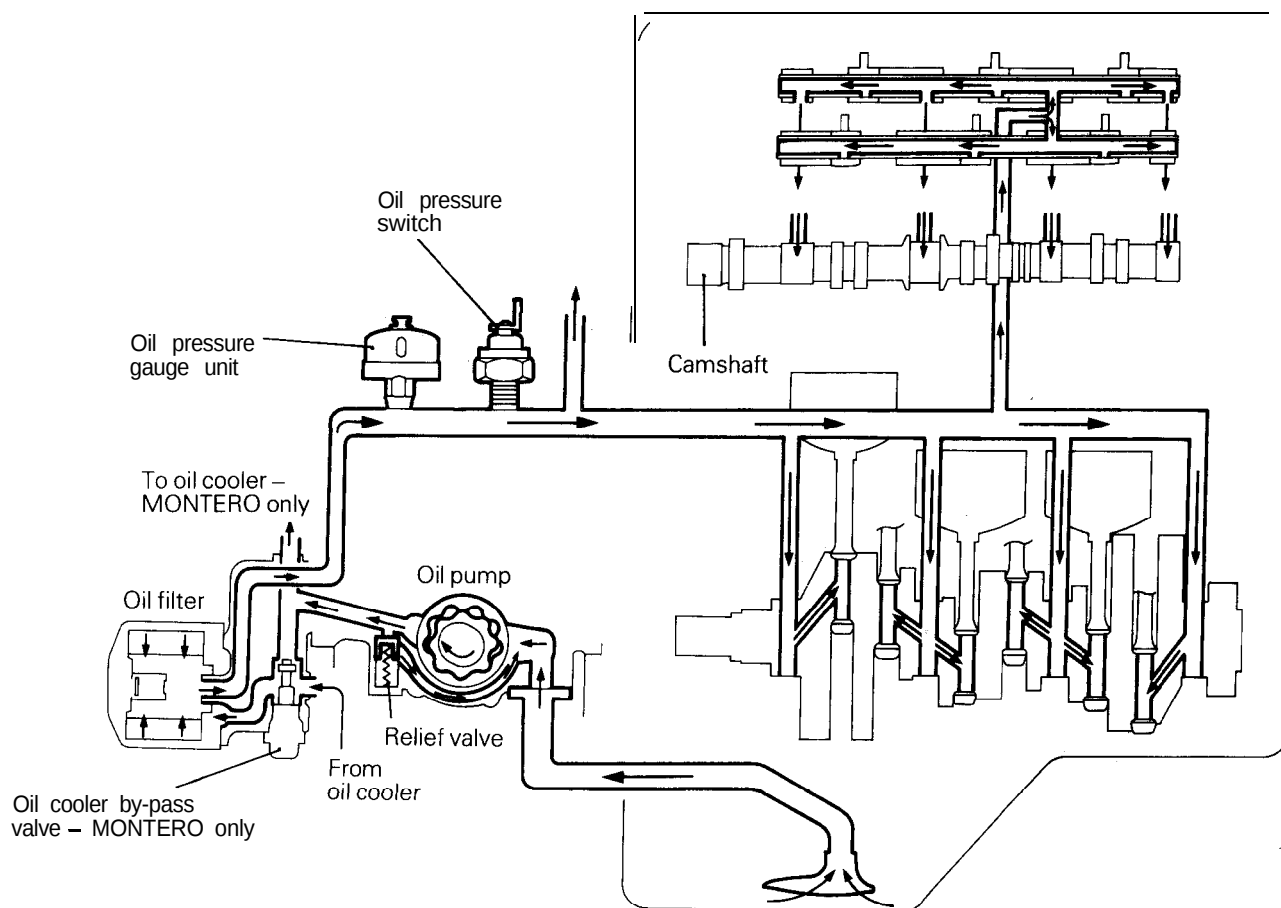




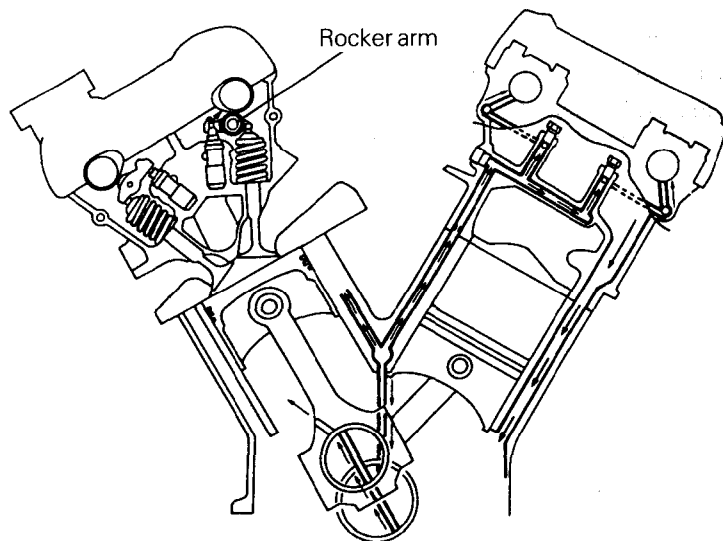
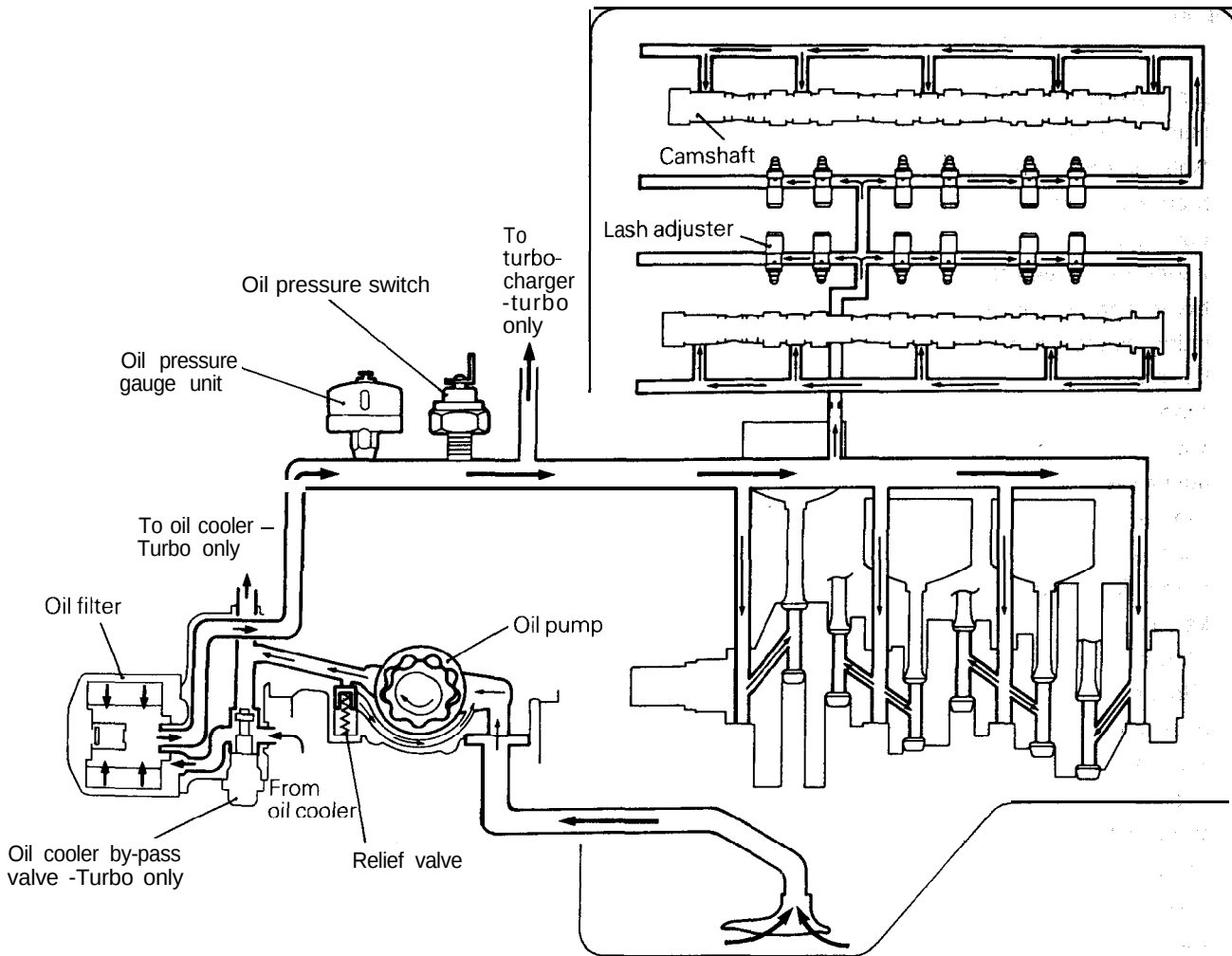
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TSB Revision

LUBRICATION SYSTEM – SOHC



LUBRICATION SYSTEM – DOHC



GENERAL SPECIFICATIONS

SOHC

Description	Specifications
Type	60°V, SOHC (per bank)
Number of cylinders	6
Combustion chamber	Compact type
Total displacement cm ³ (cu.in.)	2,972 (181.4)
Cylinder bore x stroke mm (in.)	91.1 x 76.0 (3.59 x 2.99)
Compression ratio	
Front wheel drive vehicle	10.0
Rear wheel drive vehicle	8.9
Valve timing: Front wheel drive	
Intake valve	
Opens	16° BTDC
Closes	66° ABDC
Exhaust valve	
Opens	56° BBDC
Closes	26° ATDC
Valve timing: Rear wheel drive	
Intake valve	
Opens	19° BTDC
Closes	59° ABDC
Exhaust valve	
Opens	59° BBDC
Closes	19° ATDC
Lubrication system	Pressure feed, full-flow filtration
Oil pump type	Trochoid type
Cooling system	Water-cooled forced circulation
Water pump type	Centrifugal impeller type
EGR type	Single type
Injector type and number	Electromagnetic, 6
Injector identification mark For MONTERO and TRUCK	B210H
For DIAMANTE and TRUCK	N210H
Throttle bore mm (in.)	60 (2.362)
Throttle position sensor	Variable resistor type
Closed throttle position switch	Movable contact type

DOHC

Description	Specifications
Type	60°V, DOHC (per bank)
Number of cylinders	6
Combustion chamber	Compact type
Total displacement cm ³ (cu.in.)	2,972 (181.4)
Cylinder bore x stroke mm (in.)	91.1 x 76.0 (3.59 x 2.99)
Compression ratio Non-turbo	10.0
Turbo	8.0
Valve timing-Non-turbo	
Intake valve	
Opens	16° BTDC
Closes	55° ABDC
Exhaust valve	
Opens	48° BBDC
Closes	15° ATDC
Valve timing -Turbo	
Intake valve	
Opens	16° BTDC
Closes	55° ABDC
Exhaust valve	
Opens	50° BBDC
Closes	17° ATDC
Lubrication system	Pressure feed, full-flow filtration
Oil pump type	Trochoid type
Cooling system	Water-cooled forced circulation
Water pump type	Centrifugal impeller type
EGR type	Single type
Injector type	Electromagnetic, 6
Injector identification mark Non-turbo	BDH210
Turbo	BDL360
Throttle bore mm (in.)	60 (2.362)
Throttle position sensor	Variable resistor type
Closed throttle position switch	Movable contact type

SERVICE SPECIFICATIONS

mm (in.)

	Standard	Limit
Cylinder head – SOHC Flatness of gasket surface Grinding limit of gasket surface * Total resurfacing depth of both cylinder head and cylinder block Overall height Oversize rework dimensions of valve guide hole (both intake and exhaust) 0.05 (.002) 0.25 (.010) 0.50 (.020) Oversize rework dimension of valve seat hole Intake 0.3 (.012) 0.6 (.024) Exhaust 0.3 (.012) 0.6 (.024)	Less than 0.05 (.0019) 84 (3.31) 13.05 – 13.07 (.5138 – .5147) 13.25 – 13.27 (.5217 – .5224) 13.50 – 13.52 (.5315 – .5323) 44.30 – 44.33 (1.7441 – 1.7453) 44.60 – 44.63 (1.7559 – 1.7571) 38.30 – 38.33 (1.5079 – 1.5091) 38.60 – 38.63 (1.5197 – 1.5209)	0.2 (.008) *0.2 (.008)
Cylinder head – DOHC Flatness of gasket surface Grinding limit of gasket surface * Total resurfacing depth of both cylinder head and cylinder block Overall height Oversize rework dimensions of valve guide hole (both intake and exhaust) 0.05 (.002) 0.25 (.010) 0.50 (.020) Oversize rework dimension of valve seat hole Intake 0.3 (.012) 0.6 (.024) Exhaust 0.3 (.012) 0.6 (.024)	Less than 0.03 (.0012) 132 (5.20) 12.05 – 12.07 (.4744 – .4752) 12.25 – 12.27 (.4823 – .4831) 12.50 – 12.52 (.4921 – .4929) 36.30 – 36.33 (1.4291 – 1.4303) 36.60 – 36.63 (1.4409 – 1.4421) 33.30 – 33.33 (1.3110 – 1.3122) 33.60 – 33.63 (1.3228 – 1.3240)	0.2 (.008) "0.2 (.008)"
Camshaft – SOHC Cam height Intake Exhaust Journal diameter Oil clearance Identification mark for DIAMANTE for MONTERO and TRUCK	41.25 (1.6240) 41.25 (1.6240) 34 (1.34) 0.05 – 0.09 (.0020 – .0035) H G	40.75 (1.6043) 40.75 (1.6043)

mm (in.)

	Standard	Limit
Camshaft — DOHC		
Cam height		
Intake	35.49 (1.3972)* ¹ , 34.91 (1.3744)* ²	34.99 (1.3776)* ¹ 34.41 (1.3547)* ¹
Exhaust	35.20 (1.3858)* ¹ , 34.91 (1.3744)* ²	34.70 (1.3661)* ¹ 34.41 (1.3547)* ²
Journal diameter	26 (1.02)	
Oil clearance	0.05 – 0.09 (.020 – .0035)	
Rocker arm — SOHC		
I.D.	18.91 – 18.93 (.7445 – .7453)	
Rocker arm-to-shaft clearance	0.01 – 0.04 (.0004 – .0016)	0.10 (.004)
Rocker shaft — SOHC		
O.D.	18.89 – 18.90 (.7437 – .7441)	
Overall length	333.5 (13.130)	
Valve — SOHC		
Overall length		
Intake	102.97 (4.0539)	
Exhaust	102.67 (4.0421)	
Stem diameter		
Intake	7.96 – 7.98 (.3134 – .3142)	
Exhaust	7.93–7.95 (.3122 – .3130)	
Face angle	45° – 45.5°	
Stem-to guide clearance		
Intake	0.03 – 0.06 (.0012 – .0024)	0.10 (.0039)
Exhaust	0.05 – 0.09 (.0020 – .0035)	0.15 (.0059)
Thickness of valve head (Margin)		
Intake	1.2 (.047)	0 . 7 (.028)
Exhaust	2.0 (.079)	1.5 (.059)
Valve — DOHC		
Overall length		
Intake	106.28 (4.1842)	
Exhaust	105.40 (4.1496)	
Stem diameter		
Intake	6.57 – 6.58 (.2587 – .2591)	
Exhaust	6.53 – 6.55 (.2571 – .2579)	
Face angle	45° – 45.5°	
Stem-to guide clearance		
Intake	0.02 – 0.05 (.0008 – .0020)	0.10 (.0039)
Exhaust	0.05 – 0.09 (.0020 – .0035)	0.15 (.0059)
Thickness of valve head (Margin)		
Intake	1.0 (.039)	0.5 (.019)
Exhaust	1.5 (.059)	1.0 (.039)

NOTE

*1= Up to 1992 models

*2= from 1993 models

mm (in.)

	Standard	Limit
Valve spring – SOHC		
Free length	49.8 (1.961)	48.8 (1.921)
Load/Installed height N/mm (lbs./in.)	329/40.4 (72.5/1.591)	
Out-of-squareness	Less than 2"	4"
Valve spring – DOHC		
Free length	45.2 (1.780)* ¹ , 46.4 (1.827)* ²	44.2 (1.740)* ¹ 45.4 (1.787)"
Load/installed height N/mm (lbs.in.)	240/37.9 (52.9/1.492)	
Out-of-squareness	Less than 2"	4"
Valve guide – SOHC		
Overall length		
Intake	44 (1.73)	
Exhaust	48 (1.89)	
I.D.	8.00 – 8.02 (.315 – .316)	
O.D.	13.06 – 13.07 (.5142 – .5146)	
Service size	0.05 (.002), 0.25 (.010) 0.50 (.020) Oversize	
Valve guide – DOHC		
Overall length		
Intake	45.5 (1.791)	
Exhaust	50.5 (1.988)	
I.D.	6.60 – 6.62 (.2598 – .2607)	
O.D.	12.06 – 12.07 (.4748 – .4752)	
Service size	0.05 (.002), 0.25 (.010) 0.50 (.020) Oversize	
Valve seat		
Seat angle	44 – 44.5"	
Valve contact width	0.9 – 1.3 (.035 – .051)	
Sinkage		0.2
Service size	0.30 (.012), 0.60 (.024) Oversize	
Piston – SOHC		
O.D.	91.1 (3.587)	
Piston-to-cylinder clearance	0.02 – 0.04 (.0008 – .0016)	
Service size	0.25 (.010), 0.50 (.020) 0.75 (.030), 1.00 (.039) Oversize	
Piston – DOHC		
O.D.	91.1 (3.587)	
Piston-to-cylinder clearance	0.02 – 0.04 (.0008 – .0016)	
Service size	0.25 (.010), 0.50 (.020) 0.75 (.030), 1.00 (.039) Oversize	

NOTE

O.D. = Outer Diameter

I.D. = Inner Diameter

*1= Up to 1992 models

*2= From 1993 models

mm (in.)

	Standard	Limit
Piston ring – SOHC		
End gap		
No. 1 ring	0.30 – 0.45 (.0118 – .0177)	0.8 (.031)
No. 2 ring		
Front wheel drive vehicle	0.45 – 0.60 (.0177 – .0236)	0.8 (.031)
Rear wheel drive vehicle	0.25 – 0.45 (.0098 – .0177)	0.8 (.031)
Oil ring		
Front wheel drive vehicle	0.20 – 0.60 (.0079 – .0236)	1.0 (.039)
Rear wheel drive vehicle	0.20 – 0.70 (.0079 – .0276)	1.0 (.039)
Ring to ring groove clearance		
No.1 ring		
Front wheel drive vehicle	0.03 – 0.07 (.0012 – .0028)	0.1 (.004)
Rear wheel drive vehicle	0.05 – 0.09 (.0020 – .0035)	0.1 (.004)
No.2 ring	0.02 – 0.06 (.0008 – .0024)	0.1 (.004)
Piston ring – DOHC		
End gap		
No. 1 ring	0.30 – 0.45 (.0118 – .0177)	0.8 (.031)
No. 2 ring	0.45 – 0.60 (.0177 – .0236)	1.0 (.039)
Oil ring	0.20 – 0.70 (.0079 – .0276)	1.0 (.039)
Ring to ring groove clearance		
No. 1 ring	0.03 – 0.07 (.0012 – .0028)	0.1 (.004)
No. 2 ring	0.02 – 0.06 (.0008 – .0024)	0.1 (.004)
Piston pin		
O.D.	22.001 – 22.007 (.8662 – .8664)	
Press-in load N (lbs.)	75.00 – 175.00 (1,653 – 3,858)	
Press-in temperature	Room temperature	
Connecting rod		
Big end center-to-small end center length	140.9 – 141.0	
Big end	0.05 (.0020) or less	
Twist	0.1 (.004) or less	
Big end side clearance	0.10 – 0.25 (.0039 – .0098)	0.4 (.016)
Crankshaft		
End play	0.05 – 0.25 (.0020 – .0098)	0.3 (.012)
Journal O.D.	60 (2.36)	
Pin O.D.	50 (1.97)	
Out-of-roundness of journal and pin		
Two-camshaft engine	Less than 0.005 (.0002)	
Four-camshaft engine	Less than 0.003 (.0001)	
taper of journal and pin	Less than 0.005 (.0002)	
Oil clearance of journal	0.020 – 0.050 (.0008 – .0020)	0.1 (.004)
Oil clearance of pin	0.020 – 0.050 (.0008 – .0020)	0.1 (.004)

NOTE

O.D. = Outer Diameter

mm (in.)

	Standard	Limit
Cylinder block Cylinder bore Flatness of gasket surface Grinding limit of top surface * Total resurfacing depth of both cylinder head and cylinder block	91.1 (3.587) 0.05 (.002)	"0.2 (.008)
Oil pump Tip clearance Side clearance Body clearance	0.03 – 0.08 (.0012 – .0031) 0.04 – 0.10 (.0016 – .0039) 0.10 – 0.18 (.0040 – .0070)	0.35 (.0138)
Drive belt – SOHC for DIAMANTE Deflection New belt Used belt Tension gauge N (lbs.) New belt Used belt	4.0 – 5.0 (.157 – .197) 7.0 (.276) 700 – 900 (154 – 198) 500 (110)	
Drive belt – SOHC for MONTERO and TRUCK Deflection New belt Used belt Tension gauge N (lbs.) New belt Used belt	6.5 – 8.0 (.256 – .315) 9.0 (.354) 500 – 700 (110 – 154) 400 (88)	
Drive belt – DOHC Deflection New belt Used belt Tension N (lbs.) New belt Used belt	3.5 – 4.0 (.138 – .157) 4.0 – 5.0 (.157 – .197) 650 – 850 (143 – 187) 450 – 500 (99 – 132)	
Injector Coil resistance Non-turbo Ω Turbo Ω	13 – 16 at 20°C (68°F) 2 – 3 at 20°C (68°F)	
Idle air control motor Coil resistance Ω	28 – 33 at 20°C (68°F)	
Throttle position sensor Resistance $k\Omega$	3.5 – 6.5	
Accelerator pedal position sensor Resistance $k\Omega$	3.5-6.5	
Variable induction control motor Resistance Ω	5 – 35 at 20°C (68°F)	

	Nm	ft.lbs.
Generator and drive belt		
Cooling fan bolt	11	8
Fan pulley bolt	11	8
Tensioner pulley nut		
SOHC DIAMANTE, DOHC	50	36
SOHC MONTERO AND TRUCK	45	33
Tensioner bracket bolt		
SOHC DIAMANTE	42	30
SOHC MONTERO AND TRUCK M10	24	17
M12	42	30
DOHC	19	14
Idler pulley bolt		
SOHC MONTERO AND TRUCK	45	33
DOHC	50	36
Cooling fan bracket bolt	42	30
Tensioner bracket stay bolt	24	17
Generator pivot nut	23	17
Generator brace bolt		
SOHC DIAMANTE	14	10
SOHC MONTERO AND TRUCK- Side bolt	10	7
– Exhaust manifold tightening side bolt	13	9
Generator bracket bolt	24	17
	45	33
Crankshaft bolt SOHC	155	122
DOHC	185	134
Intake manifold plenum and throttle body		
EGR pipe bolt	18	13
Intake manifold plenum stay bolt	18	13
EGR valve bolt	22	16
Throttle body bolt	12	8
SOHC MONTERO AND TRUCK	14	10
Ignition coil bolt	2.5	1.8
Ignition power transistor bolt	5	3.6
Throttle body		
Throttle position sensor bolt	2	1.4
Air control motor bolt	3.5	2.5
SOHC DIAMANTE DOHC Non-TURBO	2.5	1.8
Accelerator pedal position sensor bolt	2	1.4
Vacuum actuator bolt	3.5	2.5

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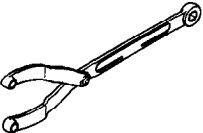
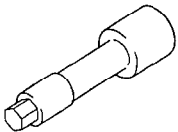
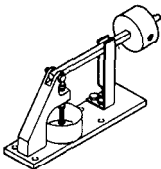
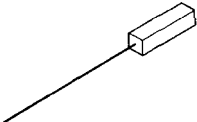
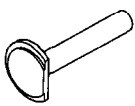
	Nm	ft.lbs.
Exhaust manifold		
Oil level guide bolt	14	10
Heat protector bolt	14	10
Engine hanger bolt		
SOHC DIAMANTE	24	17
SOHC MONTERO AND TRUCK	19	14
DOHC NON-TURBO	13	9
Exhaust manifold nut		
SOHC	19	14
DOHC NON-TURBO	45	33
DOHC TURBO	30	22
Heater pipe bolt	12	9
Water pipe bolt	14	10
SOHC MONTERO AND TRUCK	12	9
Water pump bolt	24	17
Heat protector C	30	22
Turbocharger stay bolt	60	43
Exhaust fitting bolt	14	10
Oil pipe eye bolt	17	12
Flare nut	25	18
Water pipe eye bolt	31	22
Oil return pipe bolt	9	7
Turbocharger		
Turbocharger waste gate actuator bolt	12	9
Locker arms and camshafts - SOHC		
Oil filler bolt	9	7
Locker cover bolt	9	7
Distributor adaptor bolt	13	9
Locker arm shaft and bearing cap bolt	20	14
Camshafts, rocker arms and bearing caps- DOHC		
Crankshaft position sensor adaptor bolt	24	17
Bearing caps, front and rear bolt	20	14
Bearing cap bolts No. 2, 3, 4	11	8
Cylinder head and valve- SOHC		
Cylinder head bolt	110	80
Cylinder head and valve - DOHC		
Cylinder head bolt		
NON-TURBO	110	80
TURBO	125 → Back off → 125	90 → Back off → 90

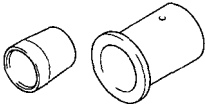
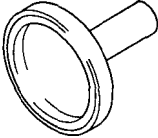
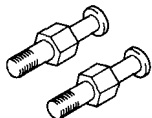
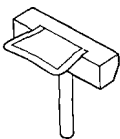
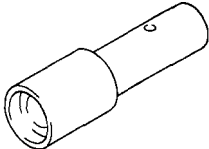
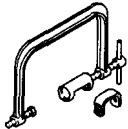
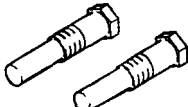
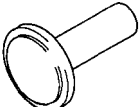
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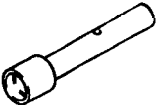
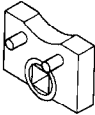
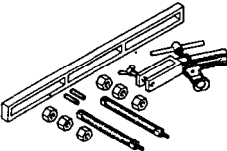
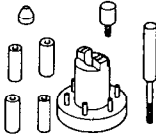
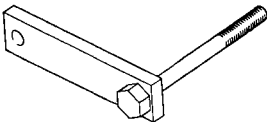
SEALANT

Items	Specified sealant	Quantity
Auto tensioner bolt -Turbo	3M ATD Part No. 8660	As required
Engine coolant temperature sensor	3M NUT Locking Part No.41 71	As required
Engine coolant temperature gauge unit	3M ATD Part No.8660	As required
Rocker cover	3M ATD Part No.8660	As required
Bearing cap	3M NUT Locking Part No.41 71	As required
Oil pressure switch	3M ATD Part No.8660	As required
Oil pressure gauge unit	3M ATD Part No.8660	As required
Oil pan	MITSUBISHI GENUINE Part No.MD970389	As required
Oil seal case	MITSUBISHI GENUINE Part No.MD970389	As required

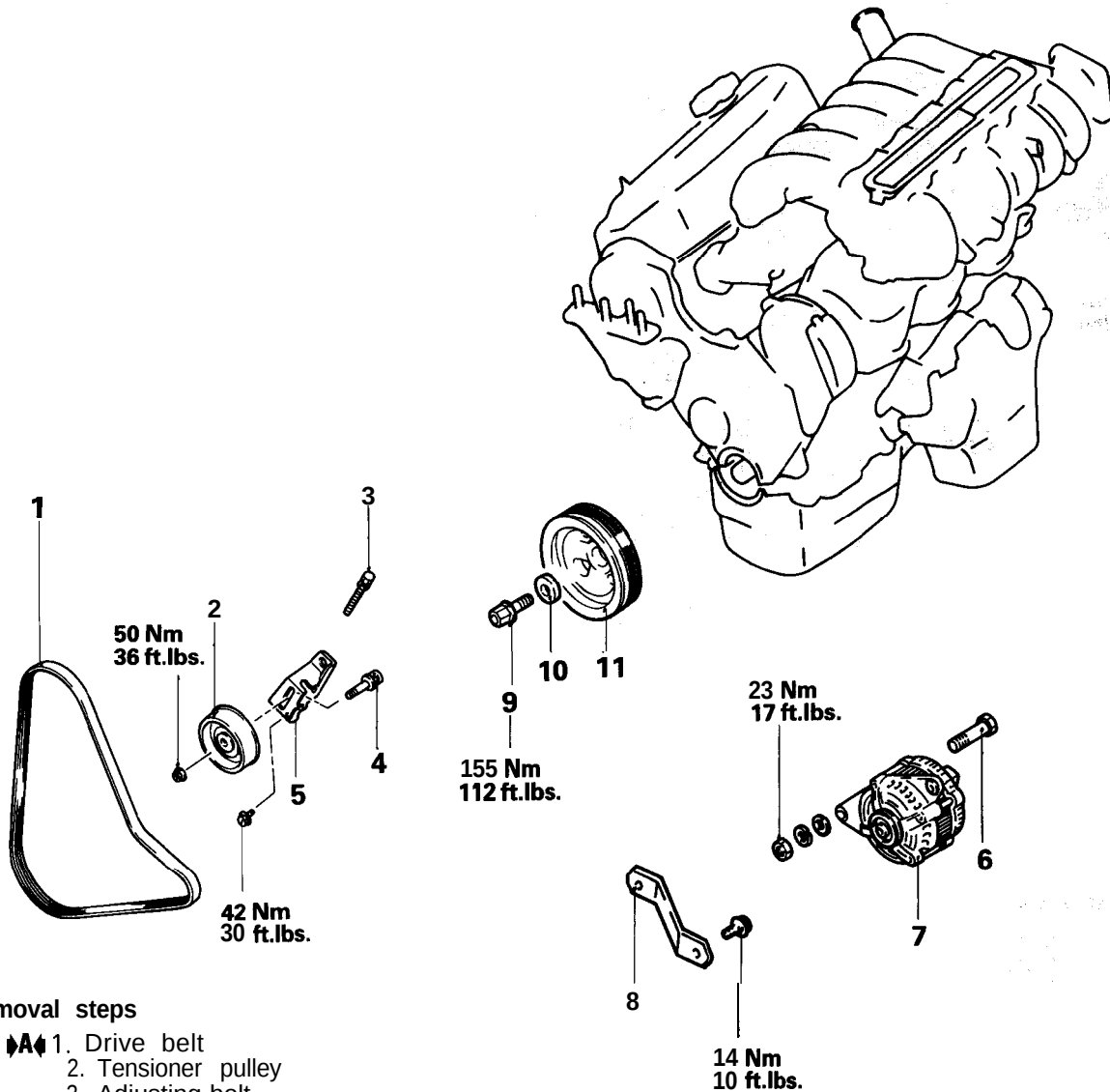
SPECIAL TOOLS

Tool	Number and tool name	Supersession	Application
	MB990767 End yoke holder Use with MD998719 or MD998754	MB990767-01 Use with MIT308239	Holding camshaft sprocket when loosening bolt For SOHC engine only
	MD998051 Cylinder head bolt wrench	MD998051-01	Loosening and tightening cylinder head bolts
	MD998440 Leak-down tester		Leak-down test of lash adjuster
	MD998441 Lash adjuster retainer		Bleeding of air inside adjuster For SOHC engine only
	MD998442 Air bleed wire		Air bleeding of auto lash adjuster
	MD998443 Lash adjuster holder (8)	MD998443-01	Supporting lash adjuster to prevent it from falling when rocker shaft assembly is removed or installed For SOHC engine only
	MD998713 Camshaft oil seal installer	MD998713-01	Installation of camshaft oil seal For SOHC engine only
	MD998714 Circular packing installer	MD998714-01 MB990938-01	Installation of circular packing For SOHC engine only
	MD998716 Crankshaft wrench	MD998716-01	Rotation of crankshaft when installing piston and timing belt For SOHC engine only

Tool	Number and tool name	Supersession	Application
	MD998717 Crankshaft front oil seal installer	MD998717-01	Installation of crankshaft front oil seal
	MD998718 Crankshaft rear oil seal installer	MD998718-01 Use with MB990938-01	Installation of crankshaft rear oil seal
	MD998719 Pulley holding pins (2)	MIT308239	Holding camshaft sprocket when loosening or torquing bolt For SOHC engine only
	MD998727 Oil pan remover		Removal of oil pan
	MD998729 Valve stem seal installer		Installation of valve stem seal For SOHC engine only
	MD998735 Valve spring compressor	MD998735-01	Removal and installation of valve and related parts
	MD998754 Pulley holding pins (2)	MIT308239	Holding crankshaft sprocket when loosening or torquing bolt
	MD998761 Camshaft oil seal installer	MD998761-01	Installation of camshaft oil seal For DOHC engine only
	MD998762 Circular packing installer	MD998762-01	Installation of circular packing For DOHC engine only

Tool	Number and tool name	Supersession	Application
	MD998763 Valve stem seal installer		Installation of valve stem seal For DOHC engine only
	MD998767 Tension pulley wrench	MD998752-01	Adjustment of timing belt tension For DOHC engine only
	MD998769 Crankshaft spacer		Rotation of crankshaft when installing piston and timing belt For DOHC engine only
	MD998772 Valve spring compressor		Compression of valve spring
	MD998780 Piston pin setting tool	MIT216941	Removal and installation of piston pin
	MD998781 Flywheel stopper		Installation of flywheel

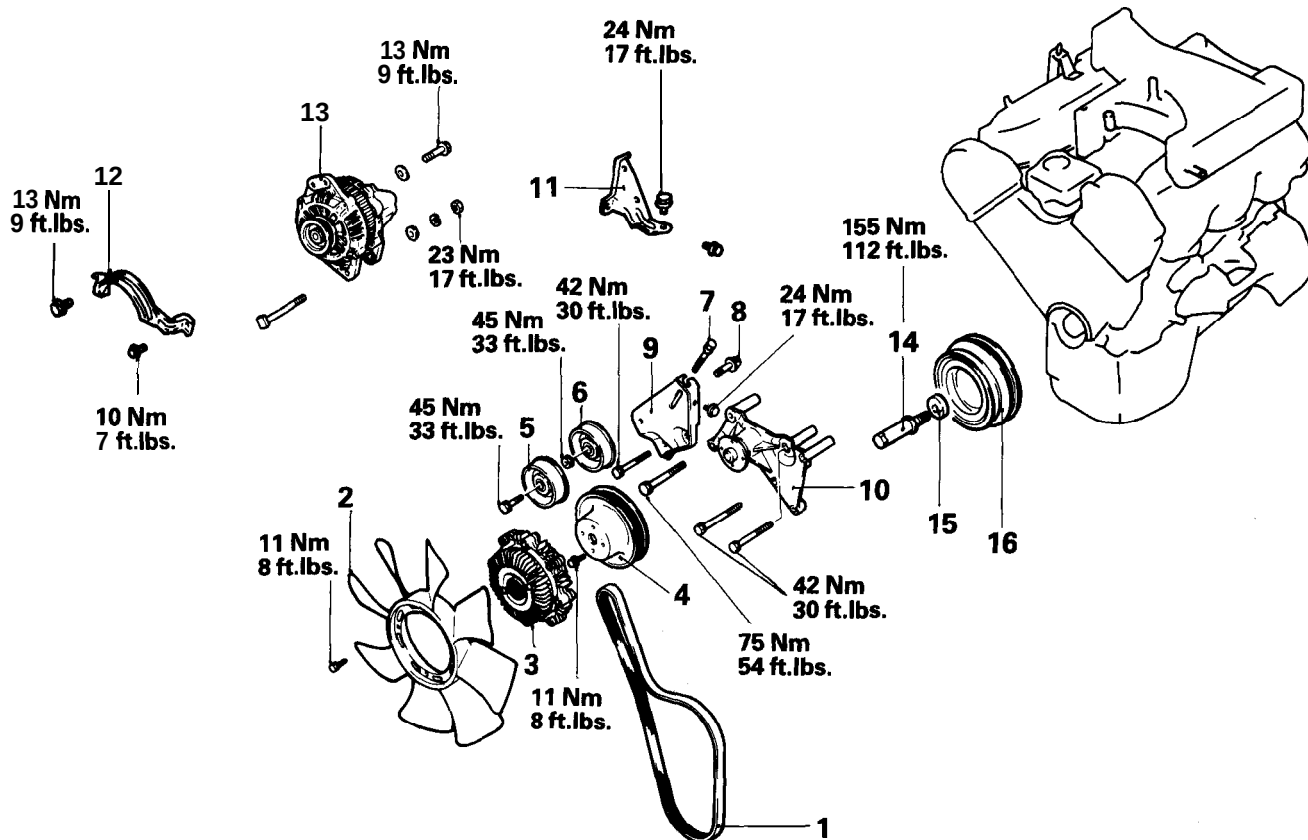
GENERATOR AND DRIVE BELT

REMOVAL AND INSTALLATION – SOHC for **DIAMANTE**

Removal steps

- ▶A▶ 1. Drive belt
- 2. Tensioner pulley
- 3. Adjusting bolt
- 4. Adjusting stud
- 5. Tensioner bracket
- 6. Pivot bolt
- 7. Generator
- 8. Generator brace
- ◀A▶▶B▶ 9. Crankshaft bolt
- 10. Special washer
- 11. Crankshaft pulley

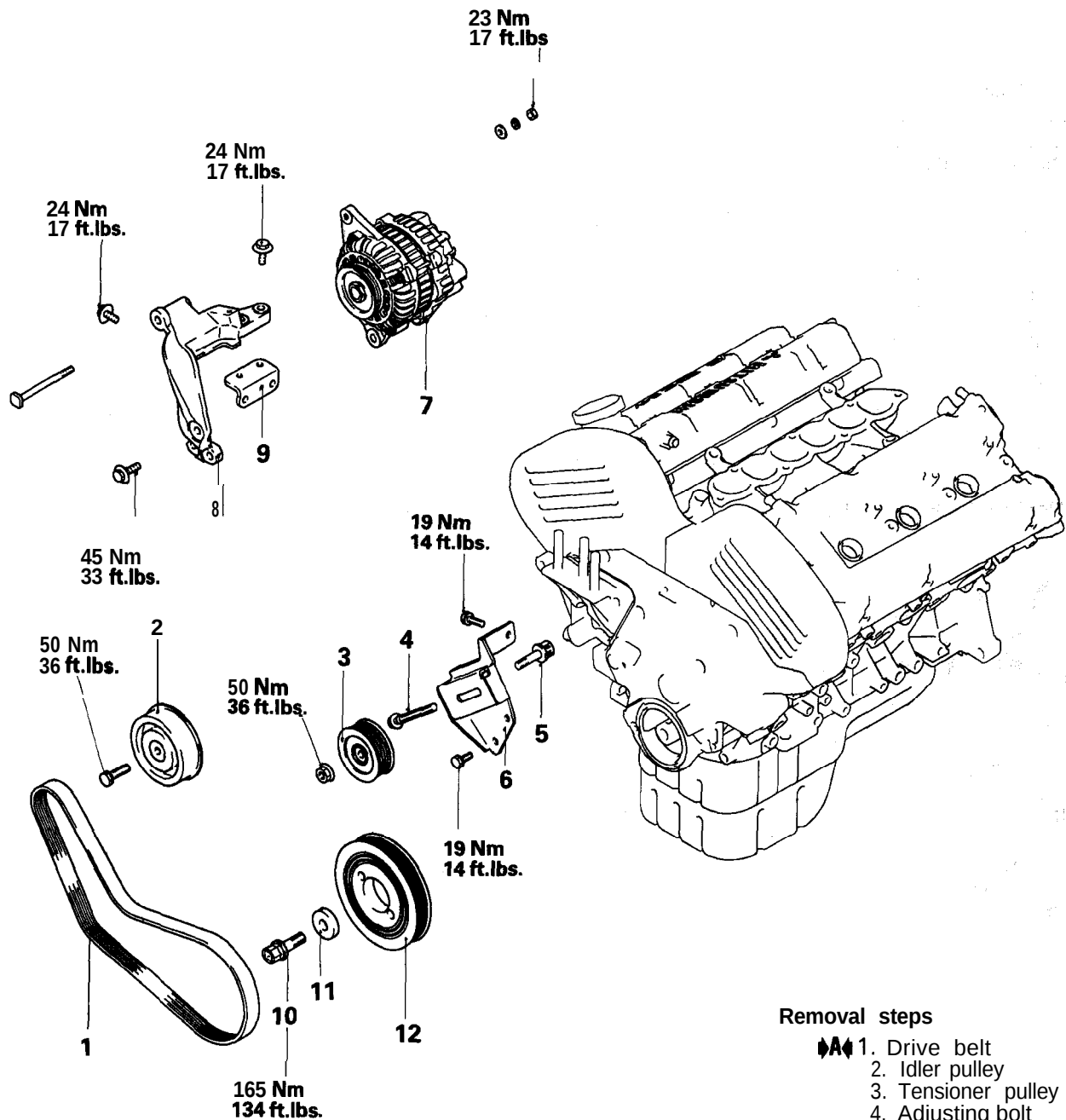
REMOVAL AND INSTALLATION – SOHC for MONTERO and TRUCK



Removal steps

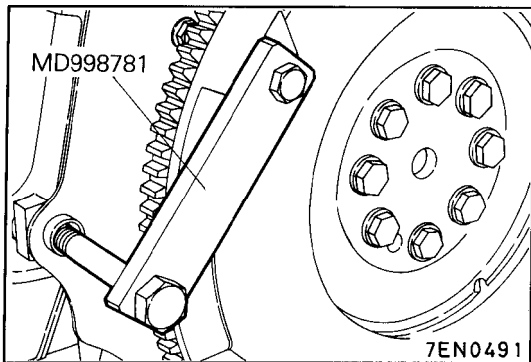
1. Drive belt
 2. Cooling fan
 3. Fan clutch
 4. Fan pulley
 5. Idler pulley
 6. Tensioner pulley
 7. Adjusting bolt
 8. Adjusting stud
 9. Tensioner bracket
 10. Cooling fan bracket assembly
 11. Tensioner bracket stay
 12. Generator brace
 13. Generator
 14. Crankshaft bolt
 15. Special washer
 16. Crankshaft pulley

REMOVAL AND INSTALLATION – DOHC

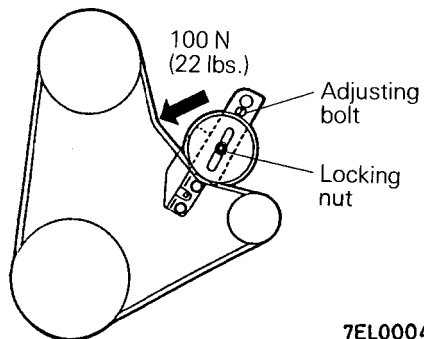
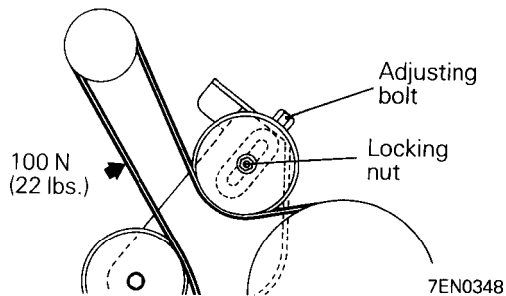
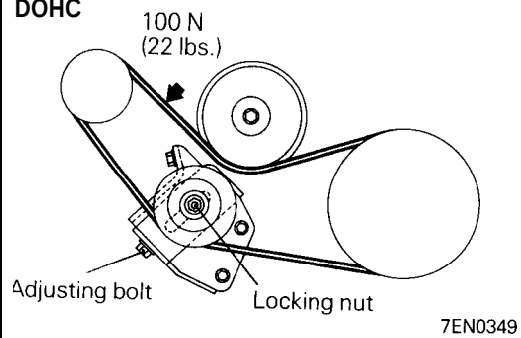


Removal steps

- ◆A◆ 1. Drive belt
- 2. Idler pulley
- 3. Tensioner pulley
- 4. Adjusting bolt
- 5. Adjusting stud
- 6. Tensioner bracket
- 7. Generator
- 8. Generator bracket
- 9. Bracket
- ◆A◆ ◆B◆ 10. Crankshaft bolt
- 11. Special washer
- 12. Crankshaft pulley

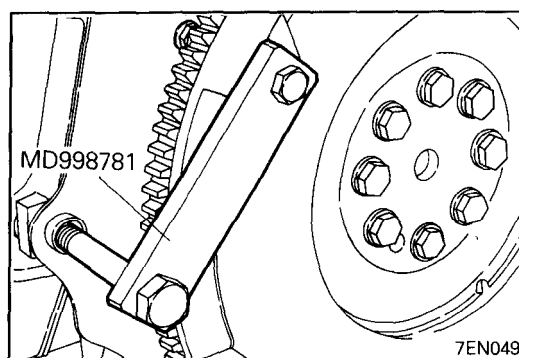
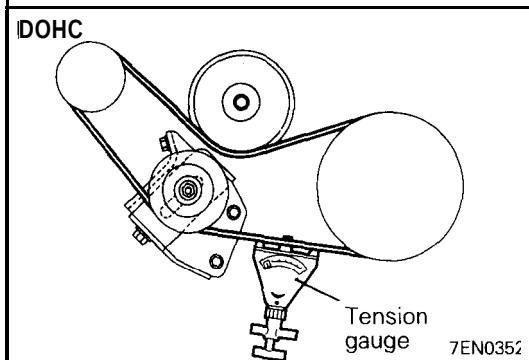
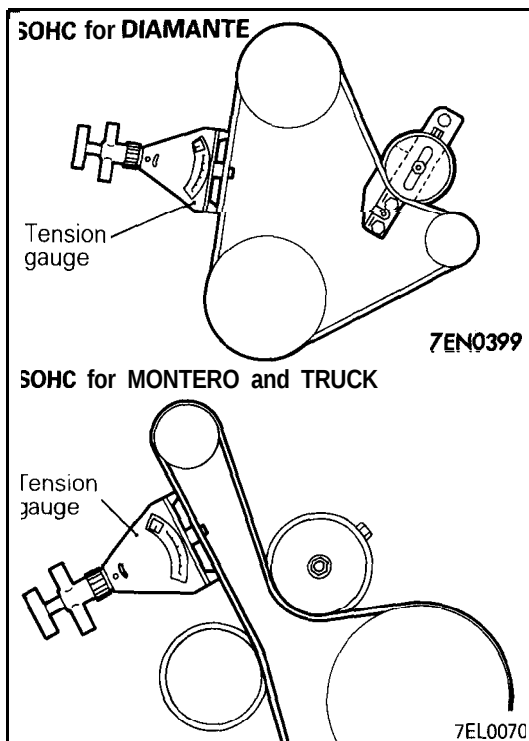
**REMOVAL SERVICE POINT****⚠️ CRANKSHAFT BOLT LOOSENING**

- (1) Using the special tool, hold the drive plate or flywheel.
- (2) Remove the crankshaft bolt.

SOHC for DIAMANTE**SOHC for MONTERO and TRUCK****DOHC****INSTALLATION SERVICE POINT****⚠️ DRIVE BELT TENSION ADJUSTMENT****DRIVE BELT – TENSION CHART**

Generator drive belt		Deflection mm (in.)	Tension gauge N (lbs.)
SOHC for DIAMANTE	New	4.5 (.16 – .20)	700 – 900 (154 – 198)
	Used	7 (.28)	500 (110)
SOHC for MONTERO and TRUCK	New	6.5 – 8.0 (.26 – .32)	500 – 700 (110 – 154)
	Used	9 (.35)	400 (88)
DOHC	New	3.5 – 4.0 (.14 – .16)	650 – 850 (143 – 187)
	Used	4 – 5 (.16 – .20)	450 – 600 (99 – 132)

- (1) Loosen the tensioner pulley locking nut.
- (2) Tighten the adjusting bolt to adjust the belt deflection to the specification shown in the chart.



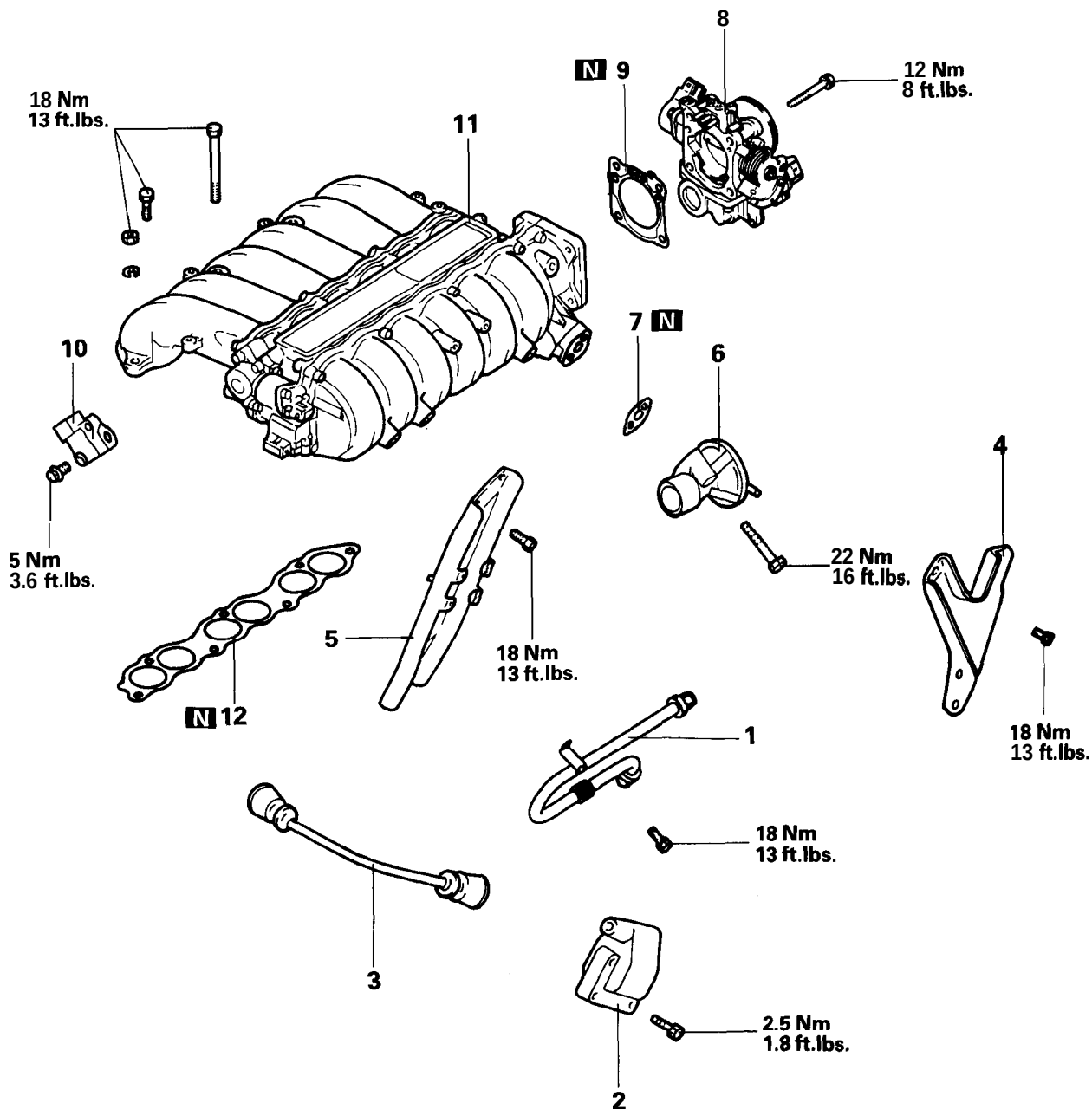
- (3) If you use a tension gauge, tighten the adjusting bolt to adjust the belt tension to the specification shown in the chart.

⚡ B4 CRANKSHAFT BOLT TIGHTENING

- (1) Using the special tool, hold the drive plate or flywheel.
- (2) Install the crankshaft bolt.

INTAKE MANIFOLD PLENUM AND THROTTLE BODY

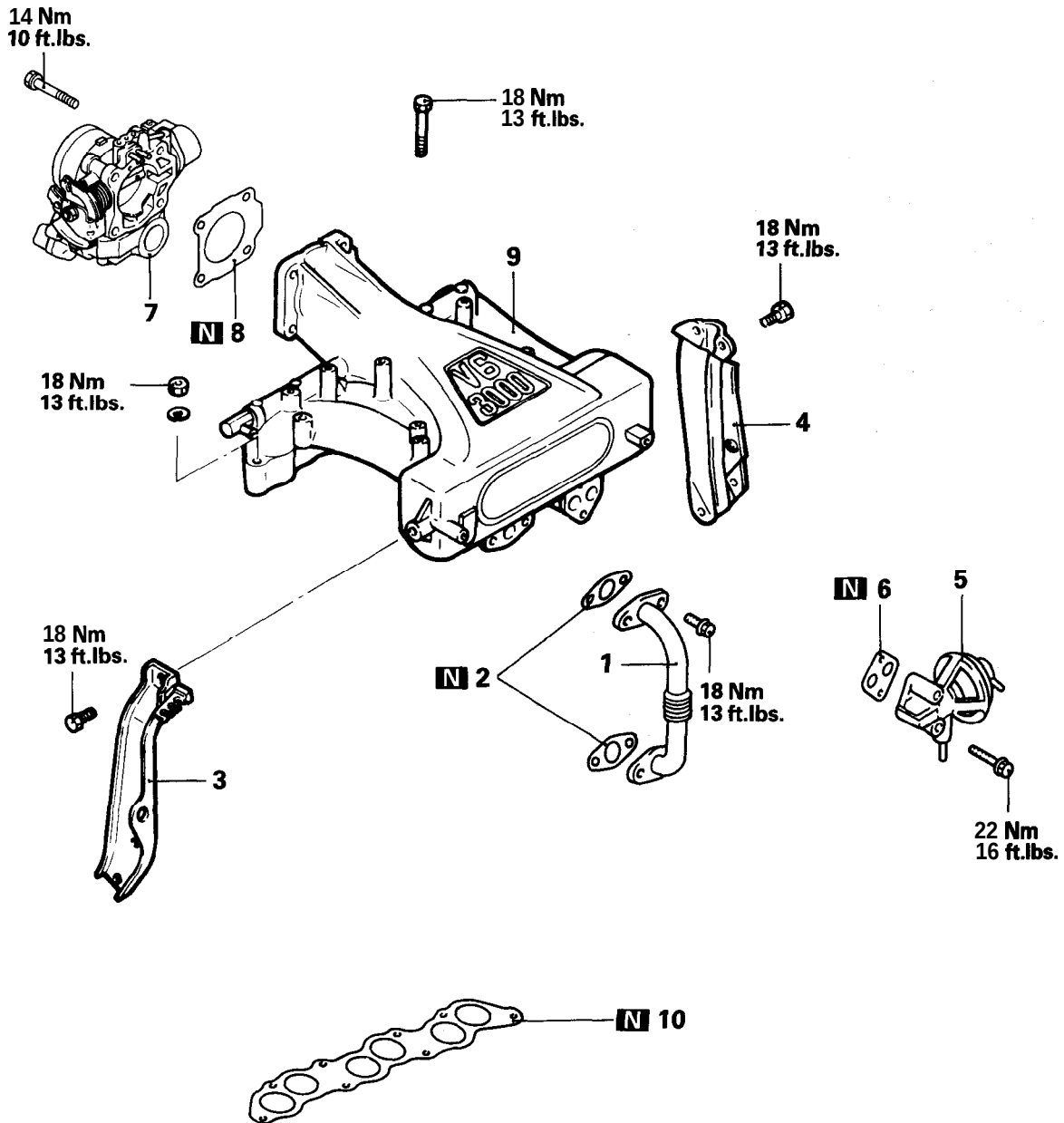
REMOVAL AND INSTALLATION – SOHC for DIAMANTE



Removal steps

1. EGR pipe ————— For California
2. Ignition coil
3. High tension cable
4. Intake manifold plenum stay, rear
5. Intake manifold plenum stay, front
6. EGR valve
7. EGR valve aasket } For California
8. Throttle body
9. Throttle body gasket
10. Ignition power transistor
11. Intake manifold plenum
12. Intake manifold plenum gasket

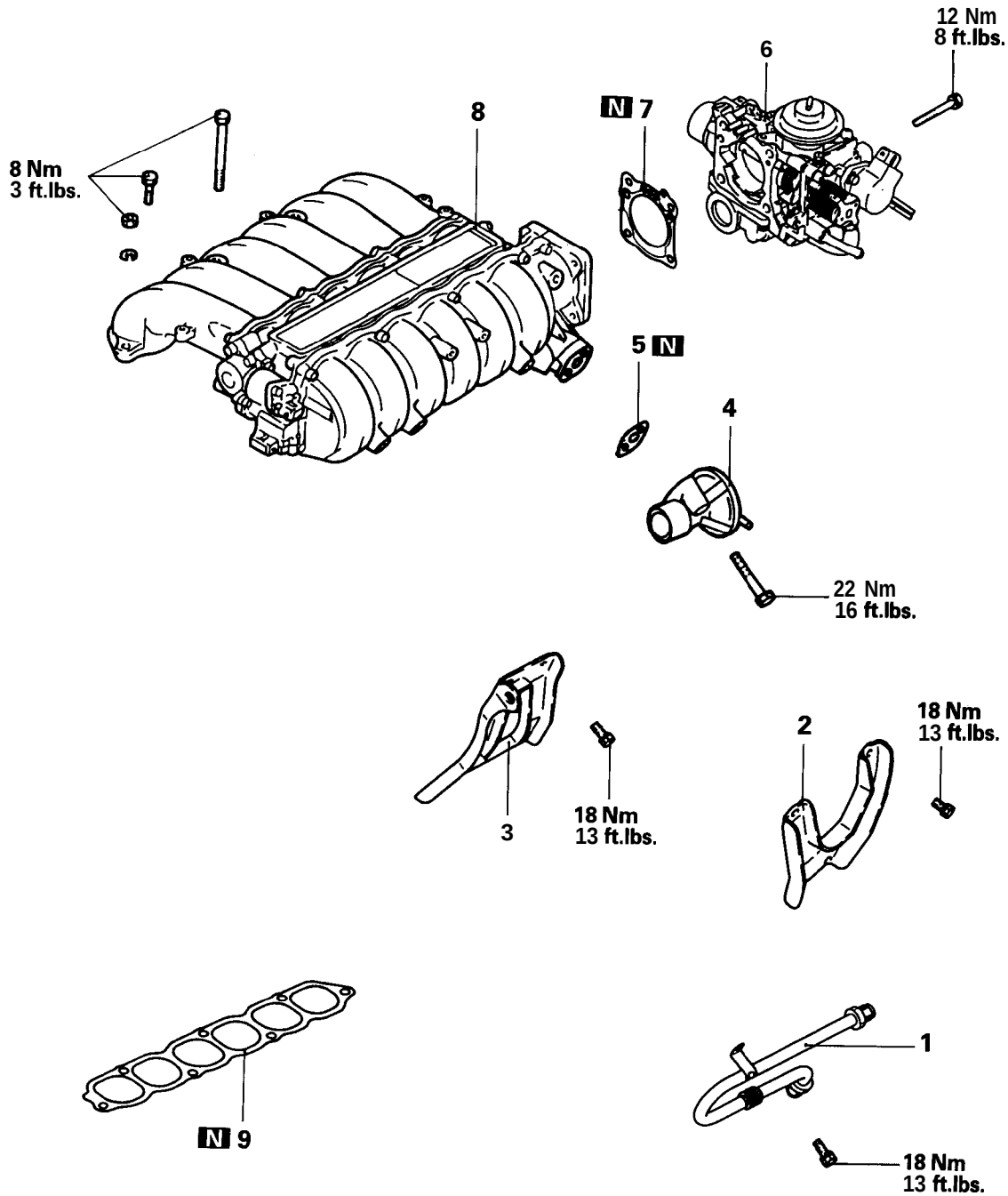
REMOVAL AND INSTALLATION – SOHC for MONTERO and TRUCK



Removal steps

1. EGR pipe
2. EGR pipe gasket
3. Intake manifold plenum stay, rear
4. Intake manifold plenum stay, front
5. EGR valve
6. EGR valve gasket
7. Throttle body
8. Throttle body gasket
9. Intake manifold plenum
10. Intake manifold plenum gasket

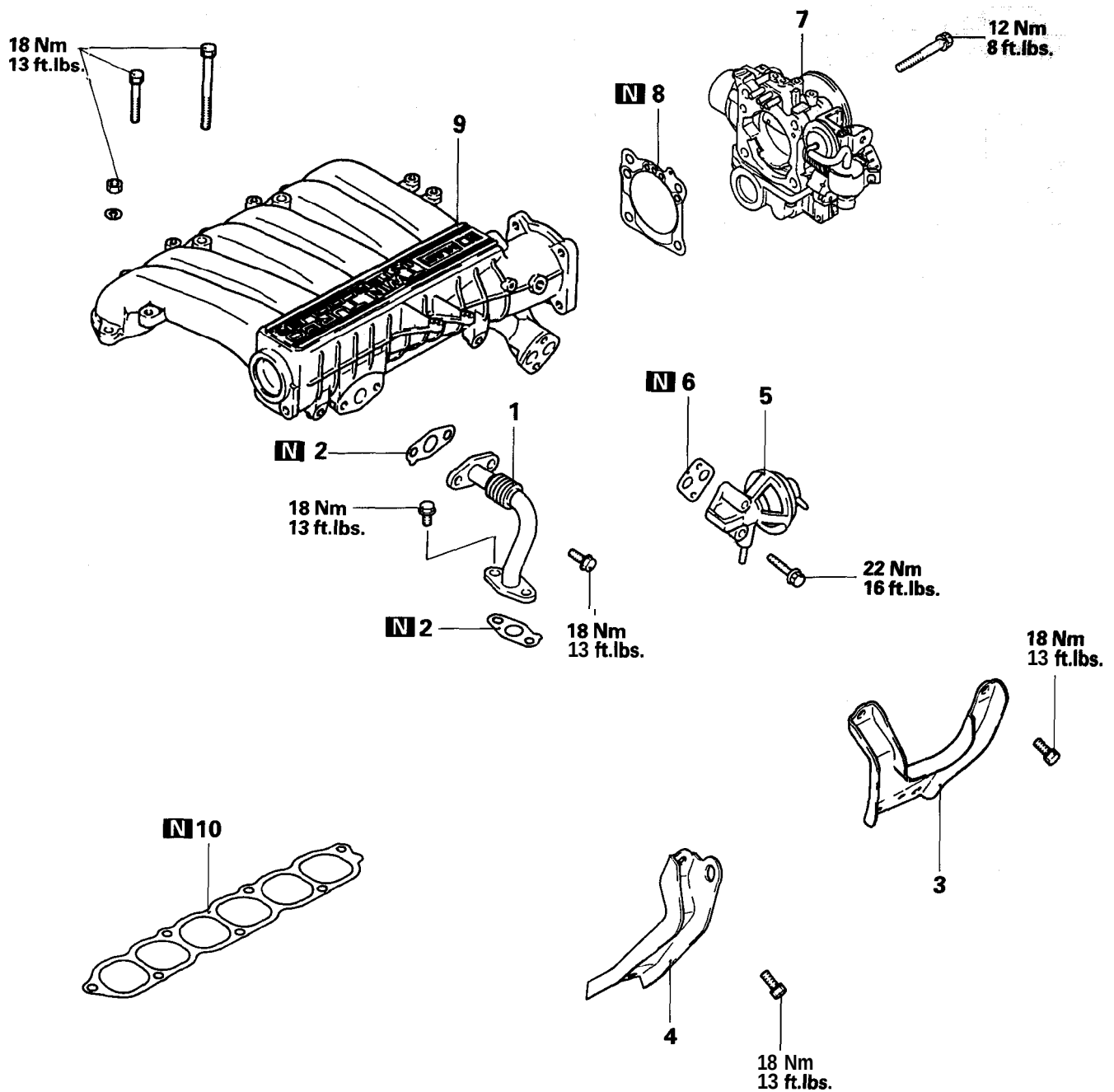
REMOVAL AND INSTALLATION – DOHC NON-TURBO



Removal steps

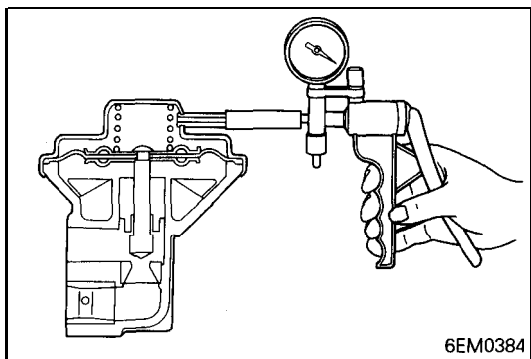
1. EGR pipe ————— For California
2. Intake manifold plenum stay, rear
3. Intake manifold plenum stay, front
5. EGR valve } For California
6. EGR valve gasket }
7. Throttle body
8. Intake manifold plenum
9. Intake manifold plenum gasket

REMOVAL AND FUEL SYSTEM – DOHC TURBO



Removal steps

1. EGR pipe
 2. EGR pipe gasket
 3. Intake manifold plenum stay, rear
 4. Intake manifold plenum stay, front
 5. EGR valve
 6. EGR valve gasket
 7. Throttle body
 8. Throttle body gasket
 9. Intake manifold plenum
 10. Intake manifold plenum gasket
- } For California
- } For California

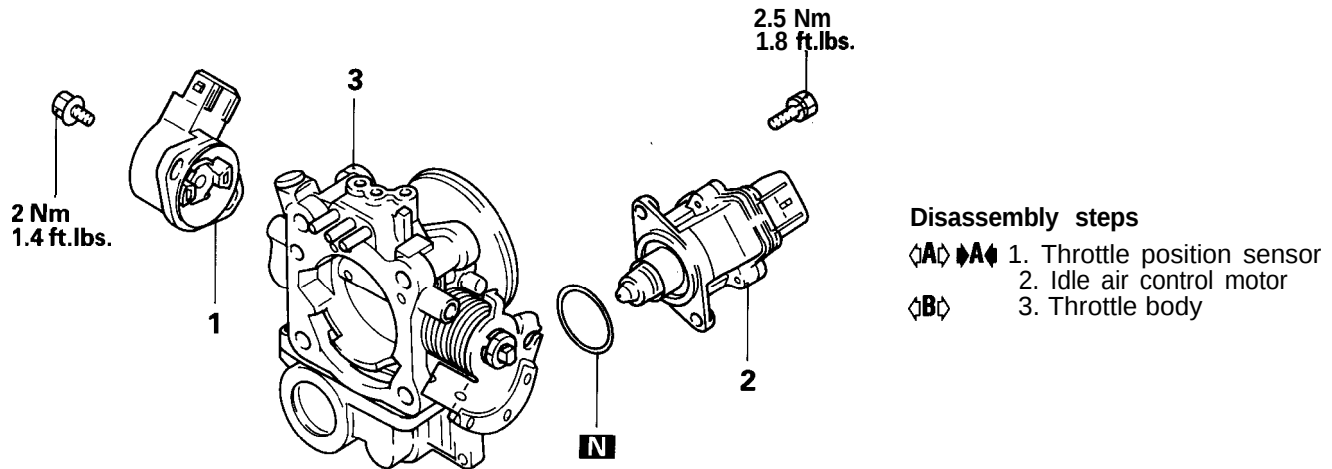
**INSPECTION****EGR VALVE**

- (1) Check the EGR valve for sticking or carbon deposits.
If such conditions exist, clean or replace the EGR valve.
- (2) Connect a hand vacuum pump to the nipple of the EGR valve and plug other nipple.
- (3) If there is vacuum leakage, replace the EGR valve.
- (4) Blow air in from one passage of the EGR to check its condition as follows.

Applying vacuum	Result
45 mmHg (1.8 in.Hg.) or less	Air does not blow through
230 mmHg (9.1 in.Hg.) or more	Air blow through

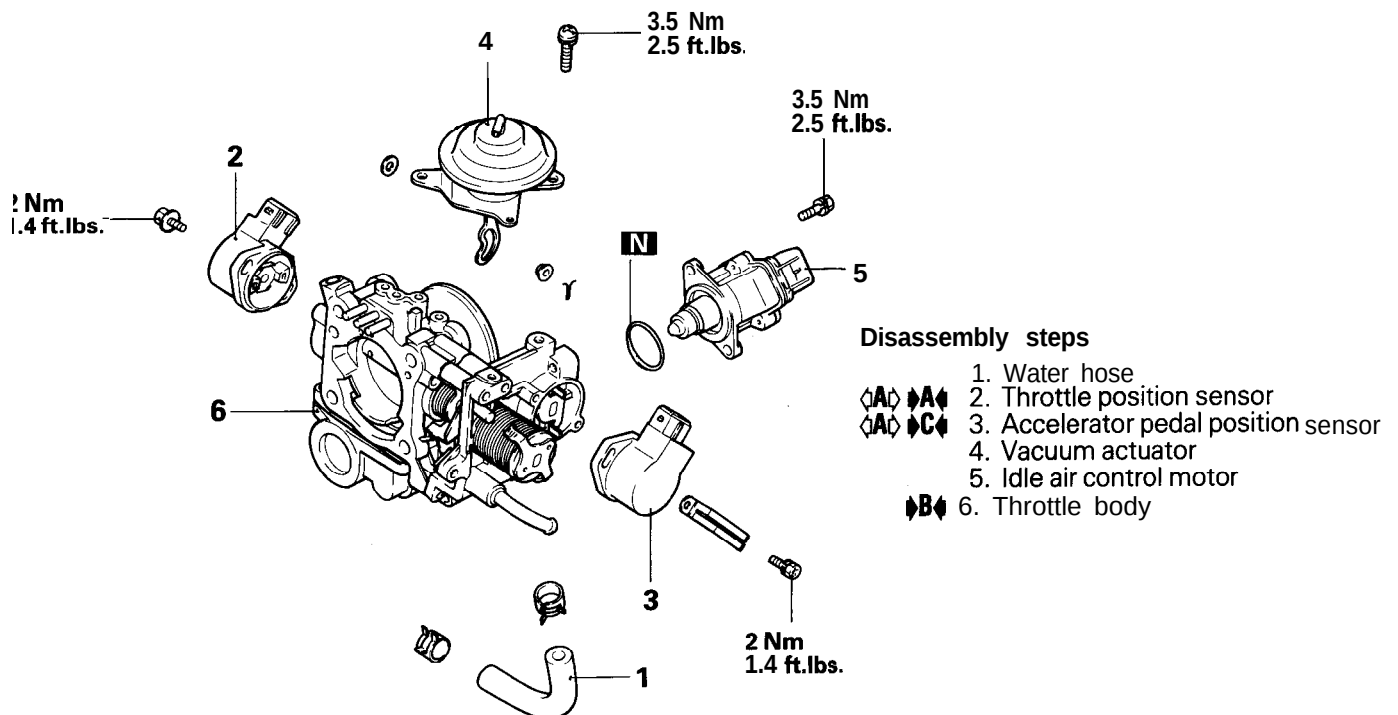
THROTTLE BODY

DISASSEMBLY AND REASSEMBLY – SOHC for DIAMANTE, DOHC NON-TURBO



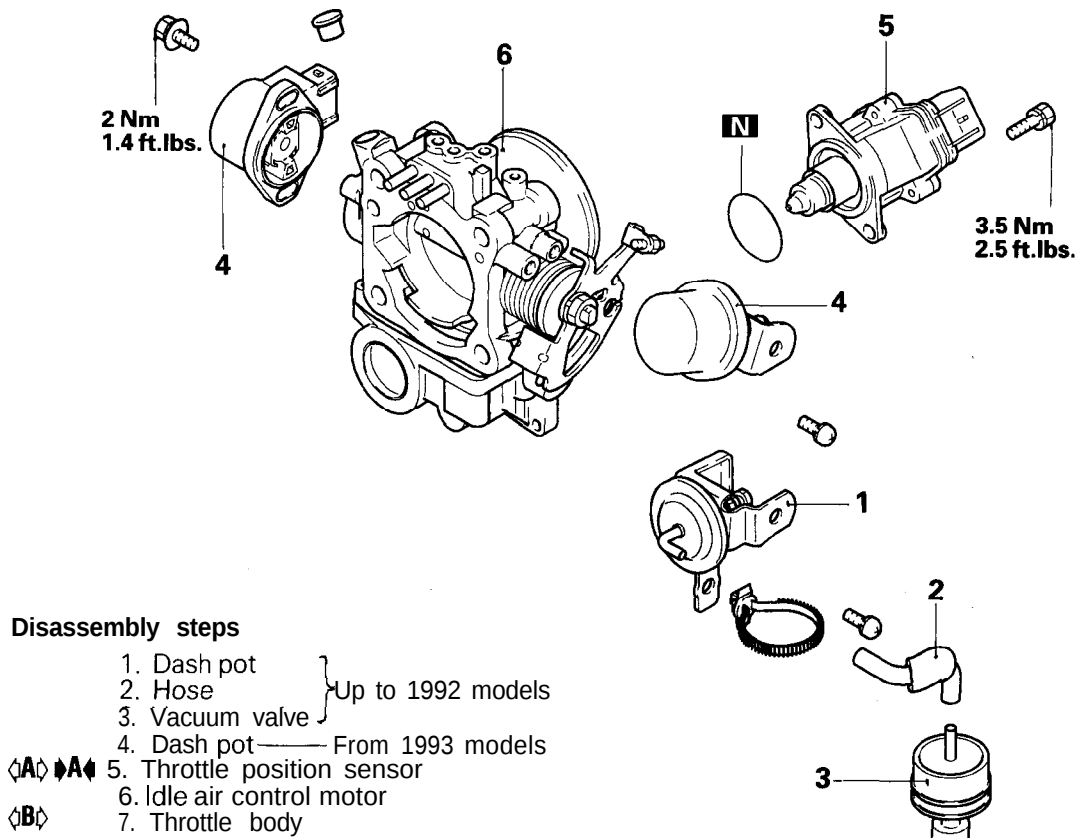
7FU1282

DISASSEMBLY AND REASSEMBLY – For VEHICLES with TRACTION CONTROL



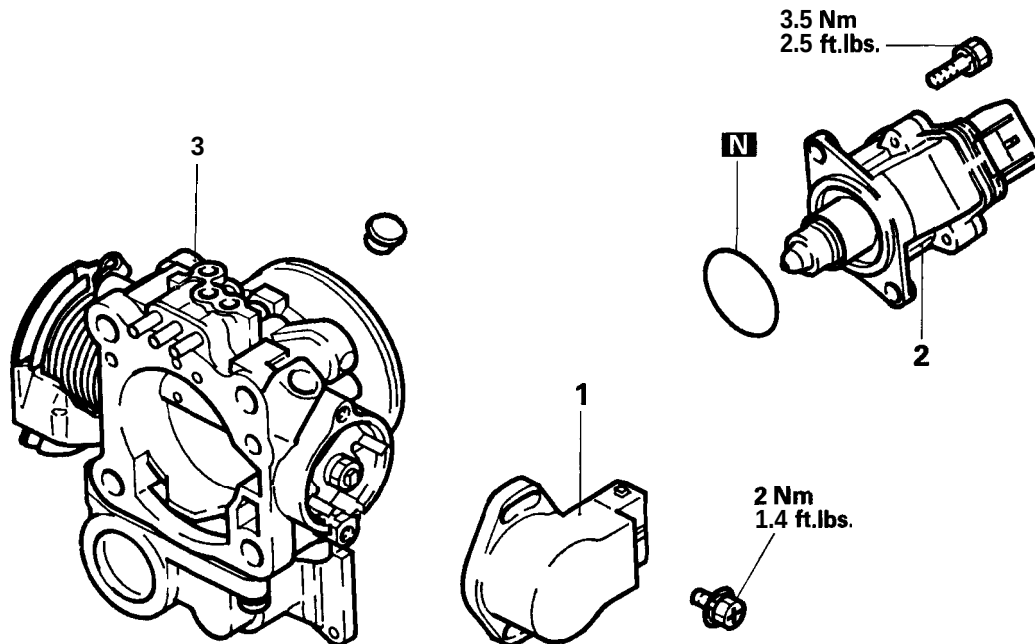
7FU1283

DISASSEMBLY AND REASSEMBLY – DOHC TURBO



7EN0525

DISASSEMBLY AND REASSEMBLY – SOHC for MONTERO and TRUCK



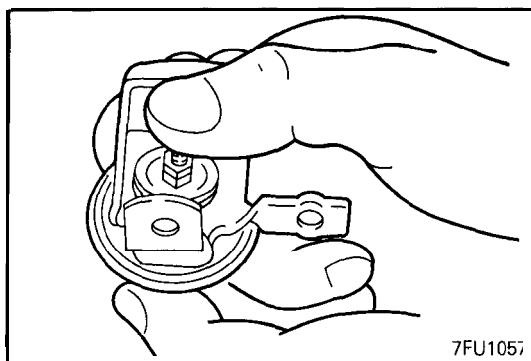
7FU0532

DISASSEMBLY SERVICE POINTS**◀A▶ THROTTLE POSITION SENSOR, ACCELERATOR PEDAL POSITION SENSOR AND IDLE AIR CONTROL MOTOR REMOVAL**

- (1) Do not disassemble the sensor and motor.
- (2) Do not clean the sensor and motor by dipping them into the solvent. Clean them with shop towel.

◀B▶ THROTTLE BODY REMOVAL

- (1) Do not remove the throttle valve.
- (2) Check if the vacuum port or passage is clogged. Use compressed air to clean the vacuum passage.

**INSPECTION****DASH POT – DOHC TURBO**

Up to 1992 models

- (1) Push the rod of the dash pot all the way in and close the nipple with the fingers,
- (2) If the rod does not protrude after releasing it, the dash pot is functioning normally.
- (3) If the rod protrudes, a broken diaphragm is suspected. Therefore, replace the dash pot.

From 1993 models

- (1) Push the dash pot rod in lightly and confirm the resistance.

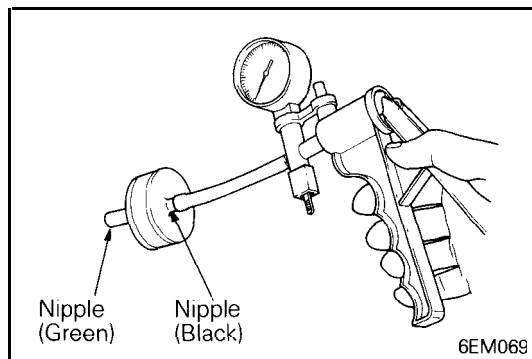
NOTE

1. Resistance increases as the rod is pushed harder.
2. If the rod can be pushed in with no resistance, either the diaphragm or check valve is faulty.

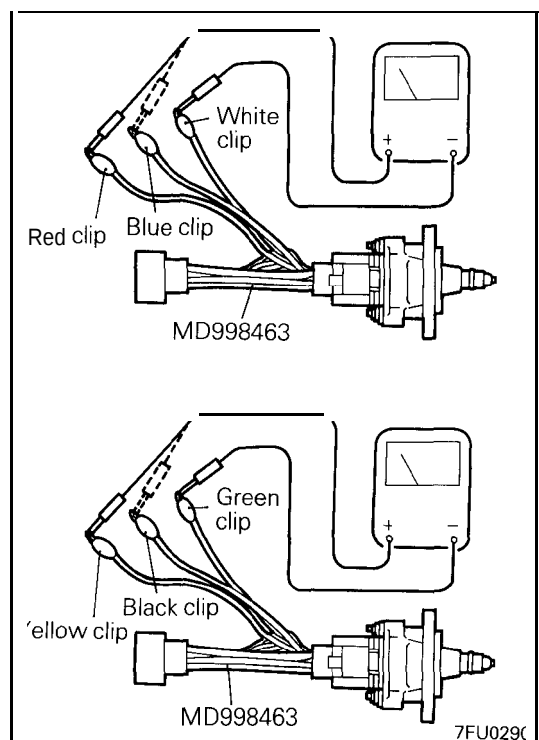
- (2) Release finger and confirm that the rod returns to its original position quickly.

NOTE

If the rod returns slowly, the check valve is faulty.

**VACUUM VALVE – DOHC TURBO****Up to 1992 models**

- (1) Remove the filter from the vacuum valve.
- (2) Connect a hand vacuum pump to the black nipple of the vacuum valve.
- (3) With the other nipple closed by the finger, apply a negative pressure of 500 mmHg (19.7 in.Hg.) to make sure that the negative pressure is maintained.
- (4) Let go your finger and make sure that the negative pressure leaks out gradually.
- (5) Disconnect the hand vacuum pump and connect it to the green nipple.
- (6) Make sure that the negative pressure leaks out as soon as it is applied.
- (7) Remove the hand vacuum pump from the valve.
- (8) Install the filter onto the black nipple of the valve.

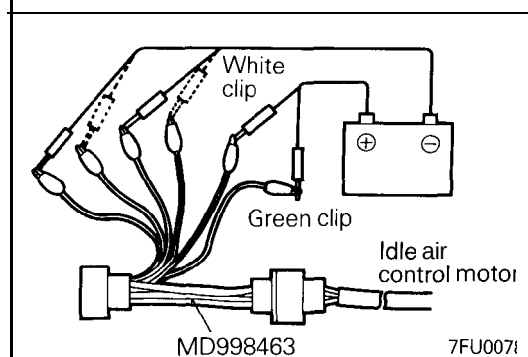
**IDLE AIR CONTROL MOTOR****Checking the Coil Resistance**

- (1) Connect Test Harness to the motor connector.
- (2) Measure the resistance between the white clip of Test Harness and the red clip or blue clip.

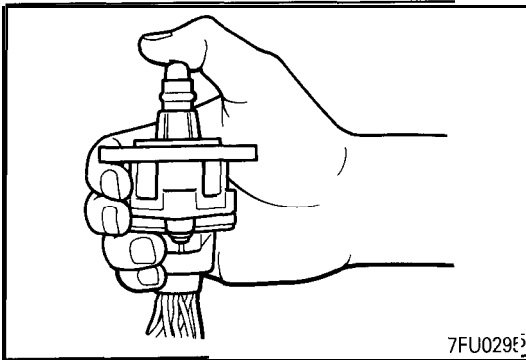
Standard value: 28 – 33 Ω at 20°C (68°F)

- (3) Measure the resistance between the green clip of Test Harness and the yellow clip or black clip.

Standard value: 28 – 33 Ω at 20°C (68°F)

**Operational Check**

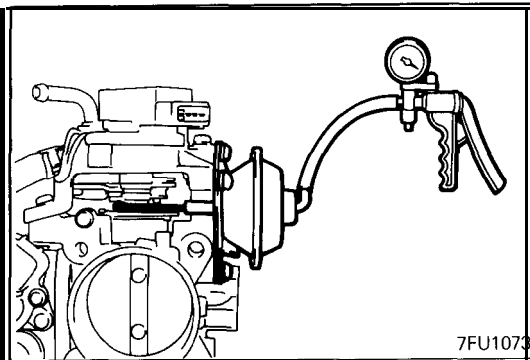
- (1) Connect Test Harness to the idle air control motor connector.
- (2) Connect the positive $\oplus$ terminal of 6 volt battery to the white clip and the green clip of Test Harness.



(3) Hold the idle air control motor as shown in the illustration, connect the negative $\ominus$ terminal of the power supply to each clip as described in the following steps, and check whether or not a vibrating feeling (a feeling of very slight vibration of the stepper motor) is generated as a result of the activation of the stepper motor.

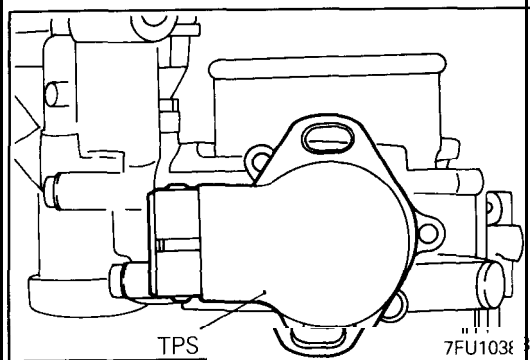
- ① Connect the negative $\ominus$ terminal of the power supply to the red and black clip.
- ② Connect the negative $\ominus$ terminal of the power supply to the blue and black clip.
- ③ Connect the negative $\ominus$ terminal of the power supply to the blue and yellow clip.
- ④ Connect the negative $\ominus$ terminal of the power supply to the red and yellow clip.
- ⑤ Connect the negative $\ominus$ terminal of the power supply to the red and black clip.
- ⑥ Repeat the tests in sequence from ⑤ to ①.

(4) If, as a result of these tests, vibration is detected, the stepper motor can be considered to be normal.



CHECKING VACUUM ACTUATOR – VEHICLES with TRACTION CONTROL

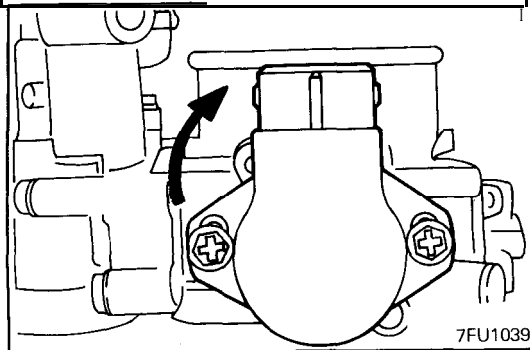
- (1) With the throttle valve opened, apply a vacuum of 200 mmHg (7.9 in.Hg.) to the vacuum actuator to make sure that the throttle valve closes.
- (2) Then lower the level of vacuum gradually to make sure that the vacuum actuator opens.



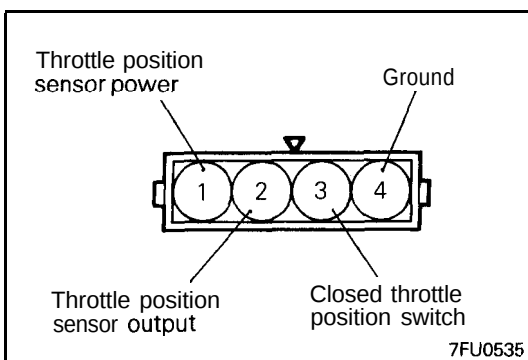
REASSEMBLY SERVICE POINTS

◆A◆ THROTTLE POSITION SENSOR (TPS) INSTALLATION – SOHC for DIAMANTE, DOHC

- (1) Install the throttle position sensor to the throttle body as shown in the illustration.



- (2) Turn the throttle position sensor 90° clockwise to set it, and tighten the screws.



- (3) Connect a circuit tester between 4 (ground) and 2 (output), or between 2 (output) and 1 (power). Then, make sure that the resistance changes smoothly when the throttle valve is slowly moved to the fully open position.
- (4) Check for continuity across terminals 3 (closed throttle position switch) and 4 (ground) with the throttle valve both fully closed and fully open.

Throttle valve position	Continuity
Fully closed	Conductive
Fully open	Non-conductive

If there is no continuity with the throttle valve fully closed, turn TPS counterclockwise, and then check again.

NOTE

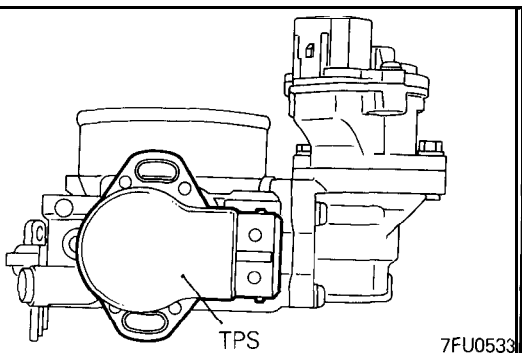
Some throttle position sensors are not provided with the position switch. In that case, the check described in step (4) cannot be accomplished.

- (5) If the above specifications are not met, replace TPS.

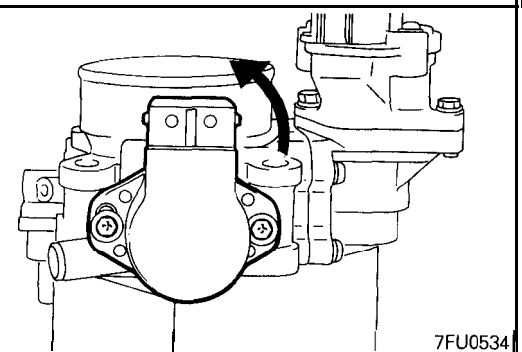
◆B◆ THROTTLE POSITION SENSOR (TPS) INSTALLATION

– SOHC for MONTERO and TRUCK

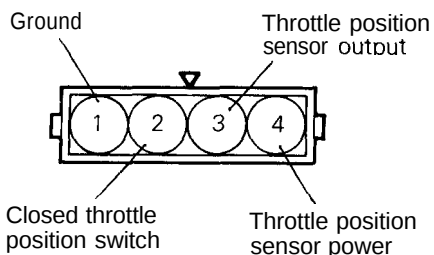
- (1) Install the throttle position sensor to the throttle body as shown in the illustration.



- (2) Turn the throttle position sensor 90° counterclockwise to set it, and tighten the screws.



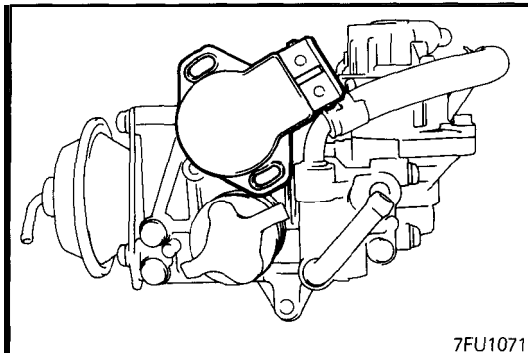
- (3) Connect a circuit tester between ① (ground) and ③ (output), or between ③ (output) and ④ (power). Then, make sure that the resistance changes smoothly when the throttle valve is slowly moved to the fully open position.
- (4) Check for continuity across terminals ② (closed throttle position switch) and ① (ground) with the throttle valve both fully closed and fully open.



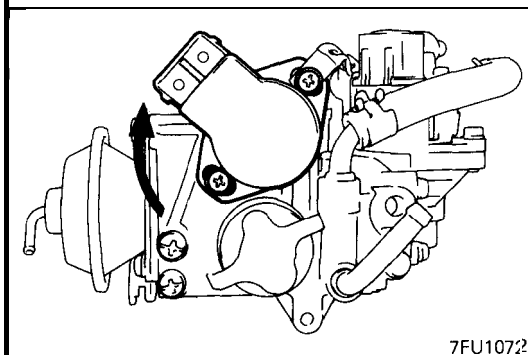
Throttle valve position	Continuity
Fully closed	Conductive
Fully open	Non-conductive

If there is no continuity with throttle valve fully closed, turn the throttle position sensor clockwise, and then check again.

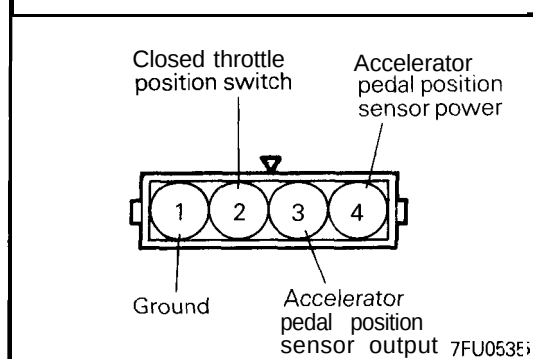
- (5) If the above specifications are not met, replace TPS.



7FU1071



7FU1072



❖C❖ ACCELERATOR PEDAL POSITION SENSOR (APS) INSTALLATION

- (1) Install the accelerator pedal position sensor to the throttle body as shown in the illustration.

- (2) Turn the accelerator pedal position sensor 90° clockwise to set it, and tighten the screws.

- (3) Connect a circuit tester between (ground) and (output), or between (output) and (power). Then, make sure that the resistance changes smoothly when the throttle valve is slowly moved to the fully open position.

- (4) Check for continuity across terminals (closed throttle position switch) and (ground) with the throttle valve both fully closed and fully open.

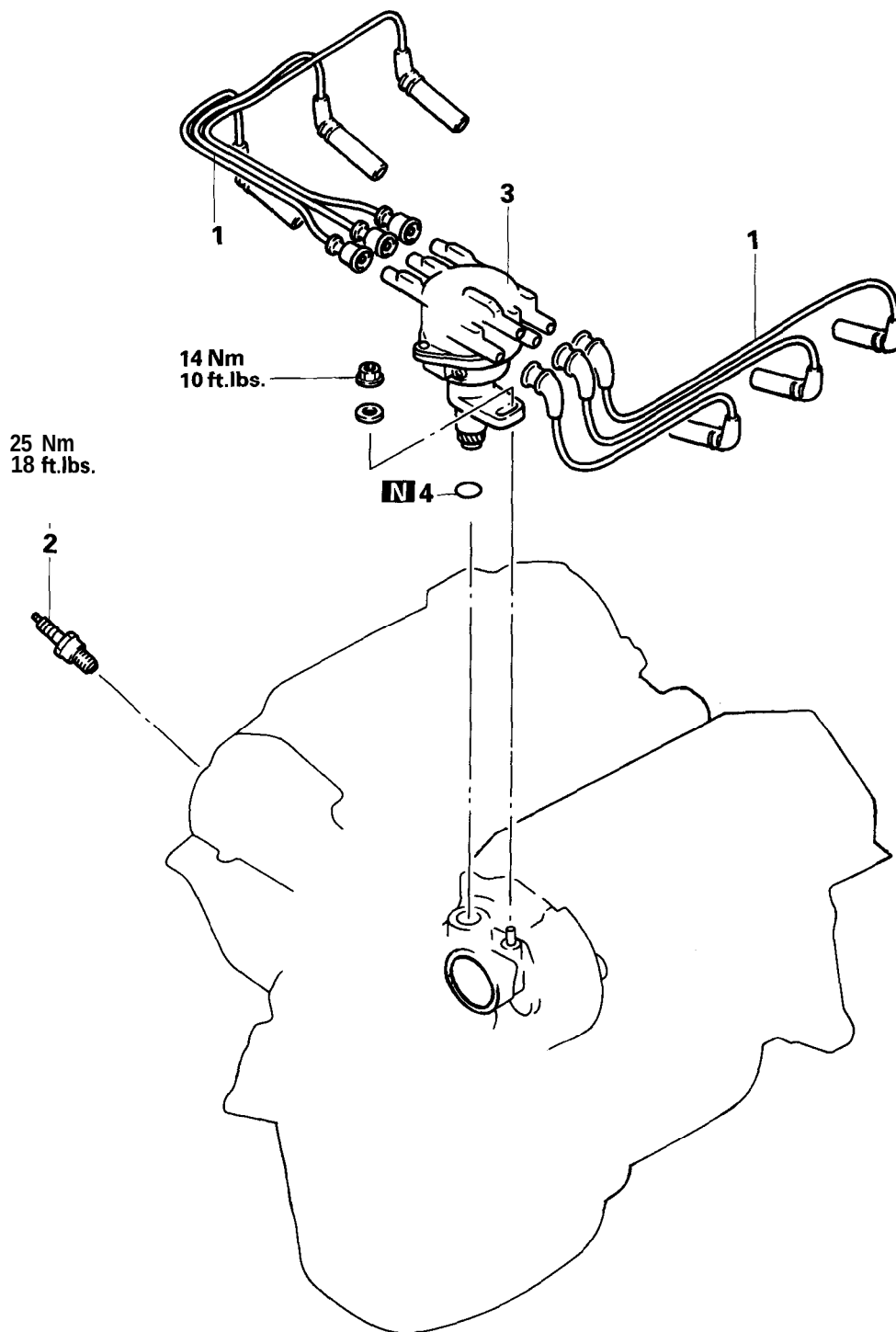
Throttle valve position	Continuity
Fully closed	Conductive
Fully open	Non-conductive

If there is no continuity with the throttle valve fully closed, turn APS counterclockwise, and then check again.

- (5) If the above specifications are not met, replace APS.

IGNITION SYSTEM

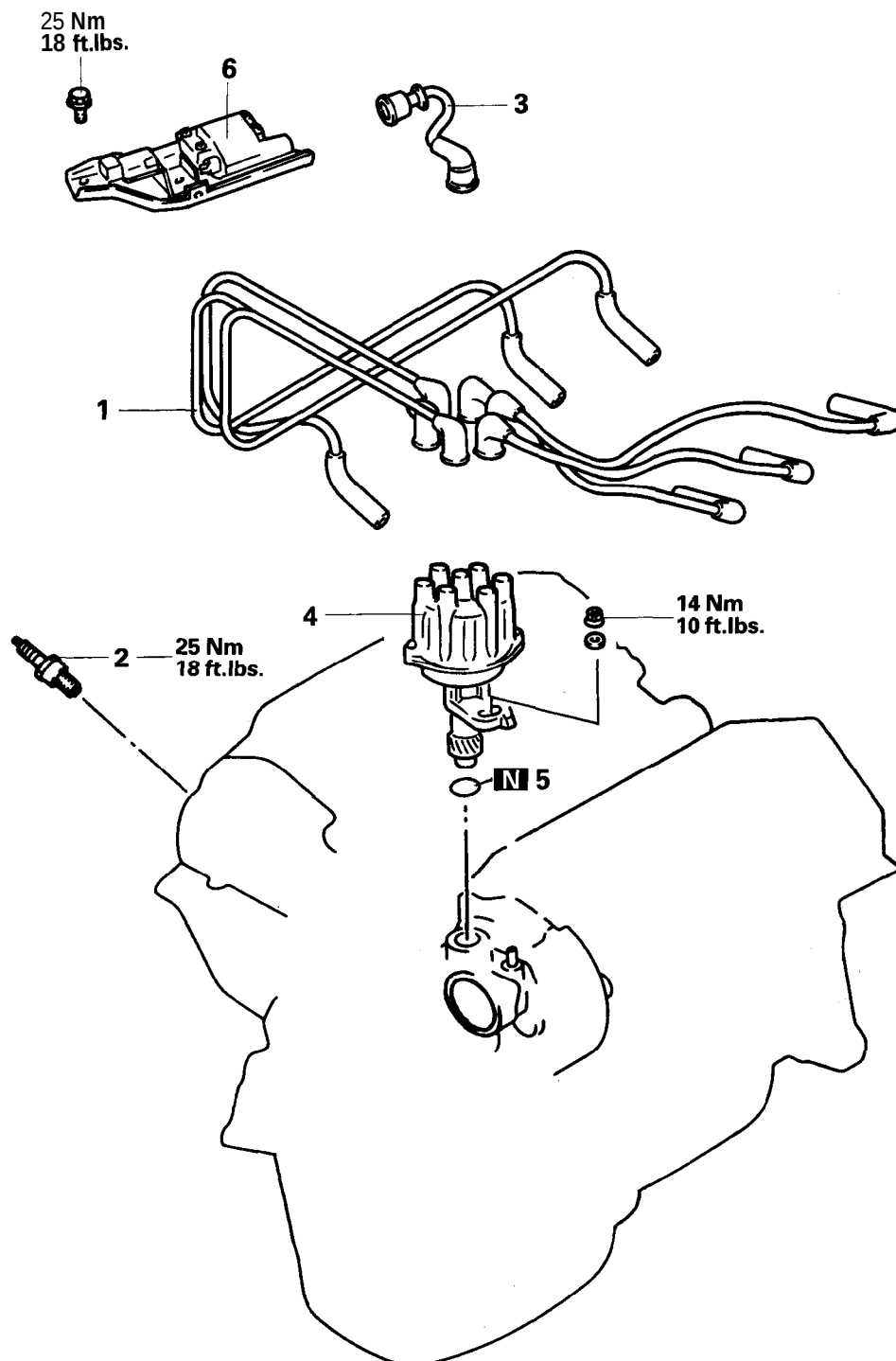
SOHC for DIAMANTE



Removal steps

1. Spark plug cables
2. Spark plug
3. Distributor
4. O-ring

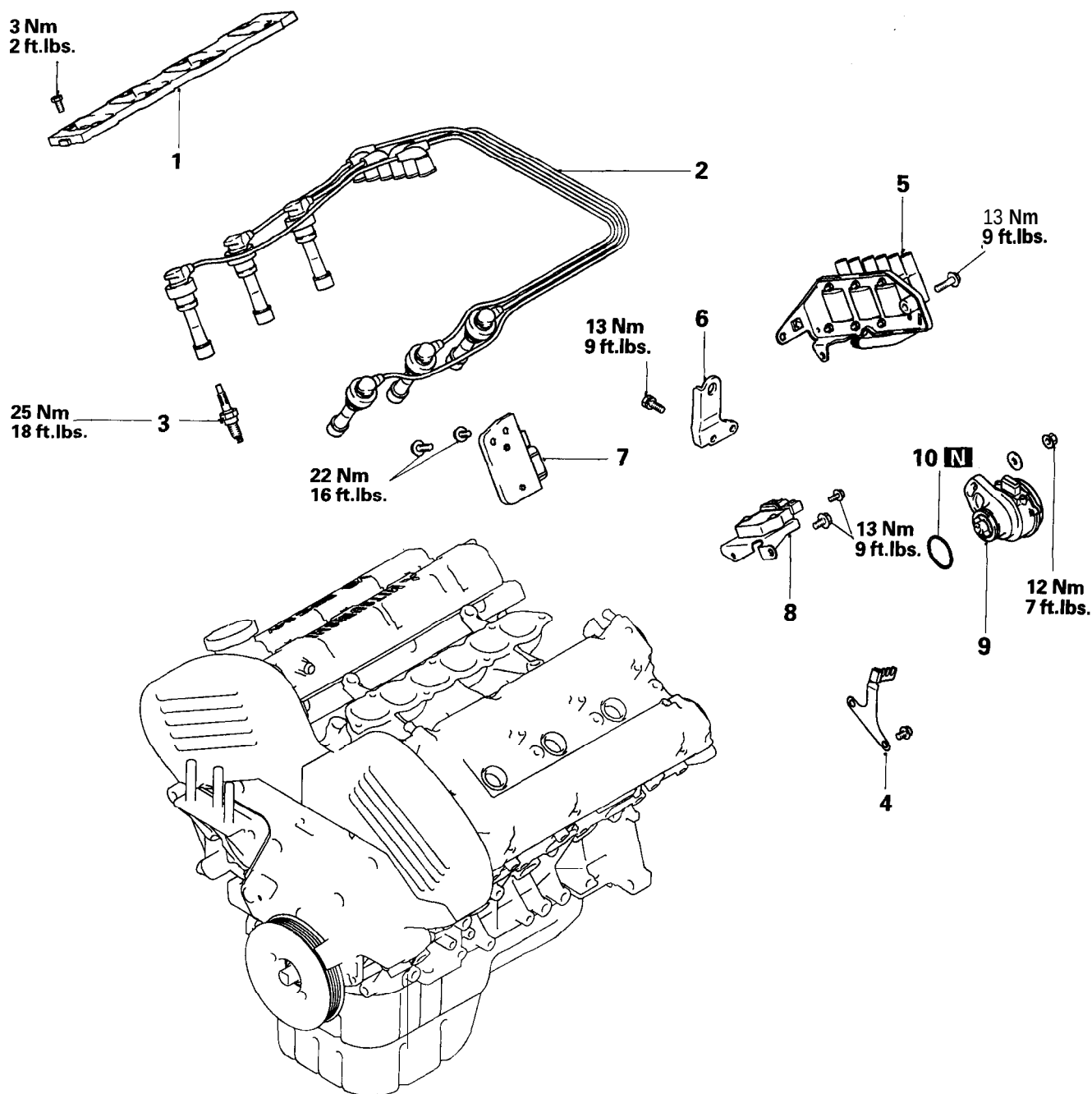
SOHC for MONTERO AND TRUCK



Removal steps

1. Spark plug cables
2. Spark plugs
3. High tension cable
4. Distributor
5. O-ring
6. Ignition coil

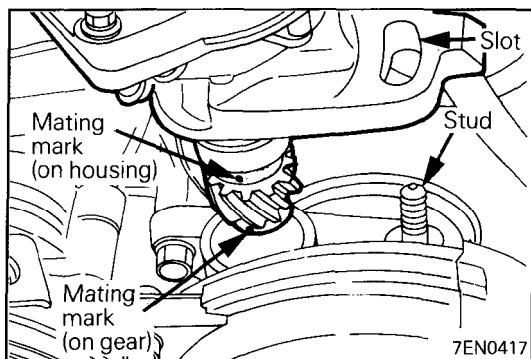
DOHC for DIAMANTE AND 3000GT



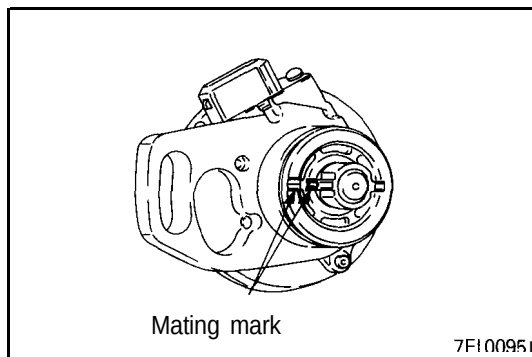
Removal steps

1. Center cover
2. Spark plug cables
3. Spark plugs
4. Clamp ————— From 1993 models
5. Ignition coil
6. Engine hanger
7. Ignition power transistor- DIAMANTE
8. Ignition power transistor — 3000GT
9. Crankshaft position sensor- Up to 1992 models
10. O-ring



**INSTALLATION SERVICE POINTS****▶A▶ DISTRIBUTOR INSTALLATION – SOHC**

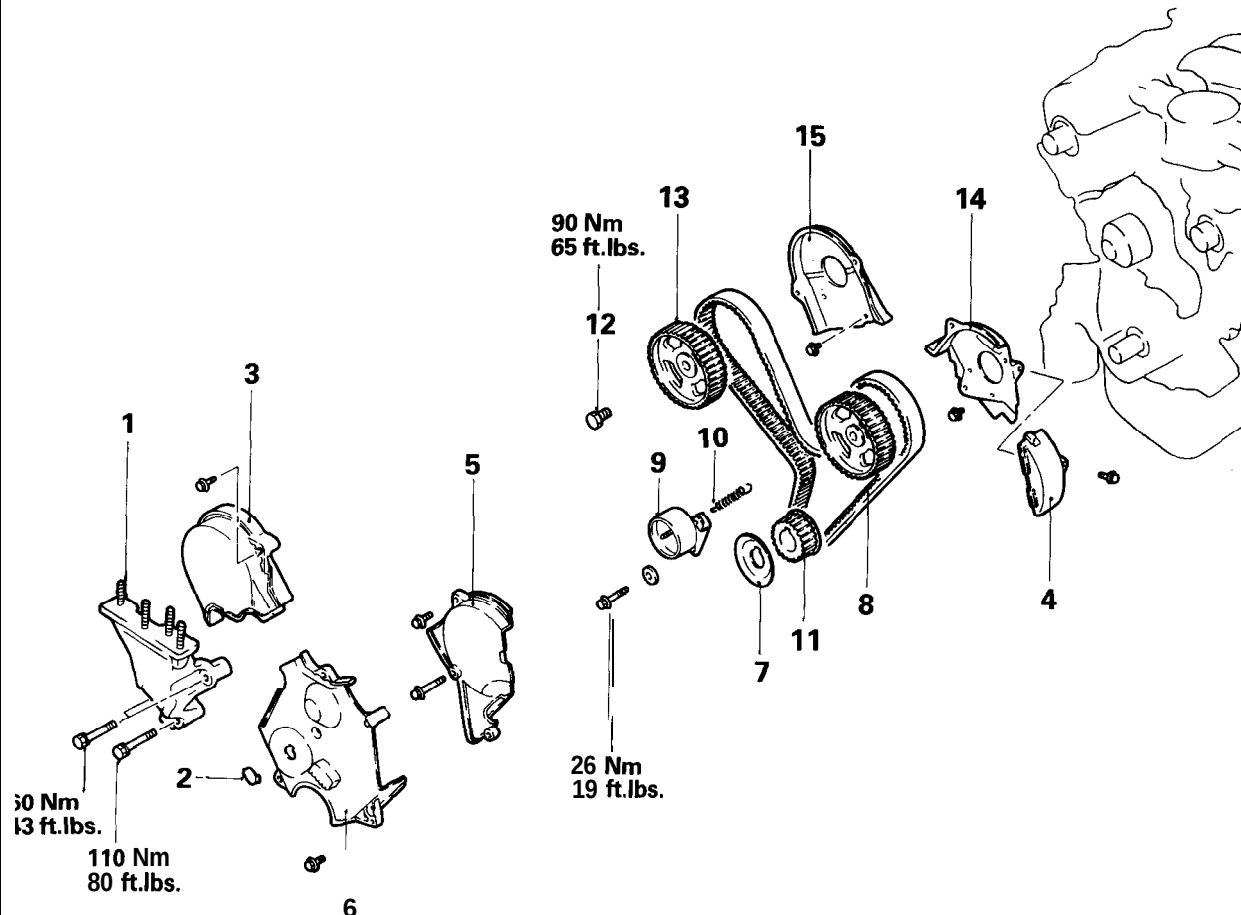
- (1) Turn the crankshaft so that the No. 1 cylinder is at compression top dead center.
- (2) Align the distributor housing and gear mating marks.
- (3) With the stud located in the center of the adjusting slot at the distributor, install the distributor.

**▶B▶ CRANKSHAFT POSITION SENSOR INSTALLATION – DOHC**

- (1) Turn the crankshaft so that the No. 1 cylinder is at compression top dead center.
- (2) Install, lining up the matchmarks on the crankshaft position sensor housing and the coupling.

TIMING BELT – SOHC

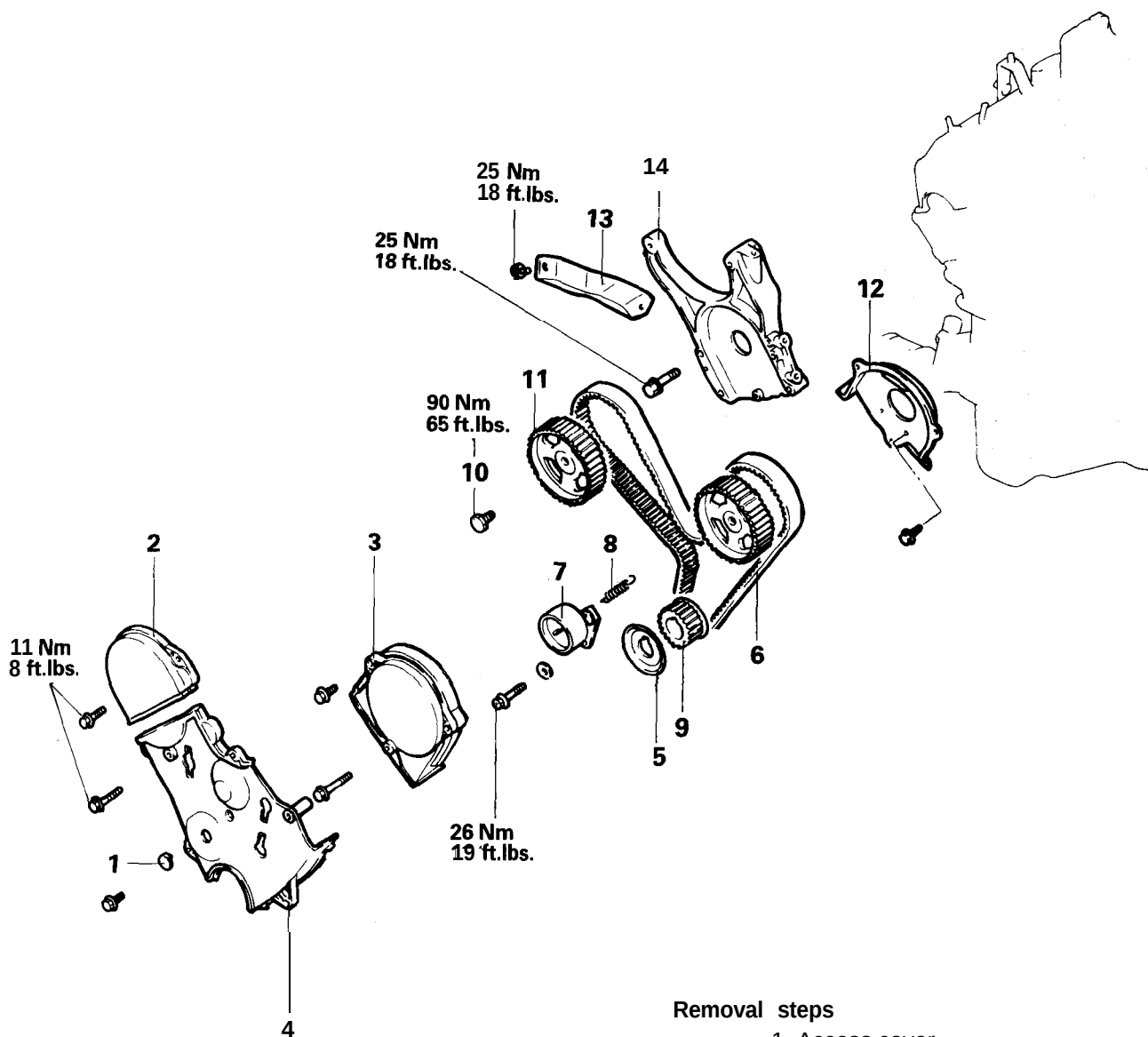
REMOVAL AND INSTALLATION – DIAMANTE



Removal steps

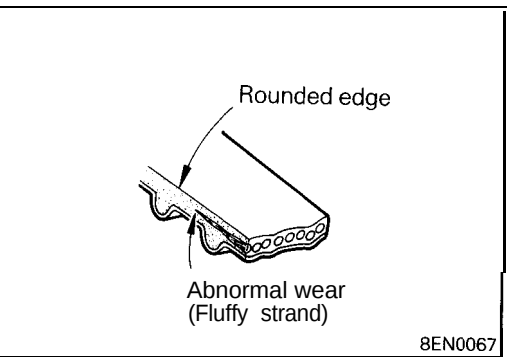
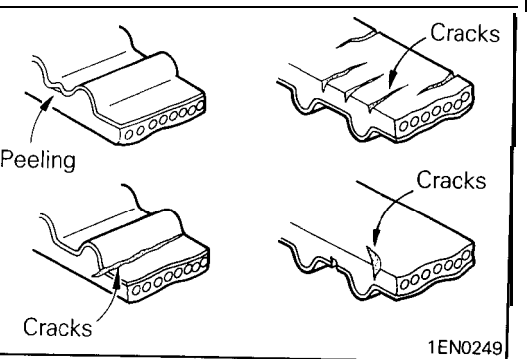
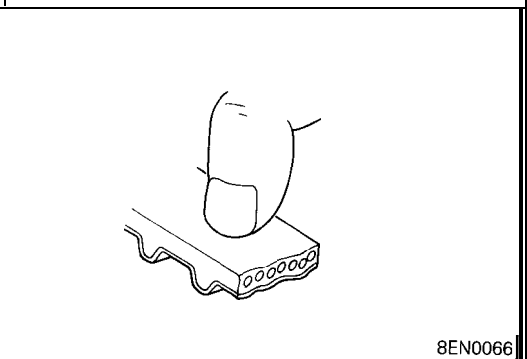
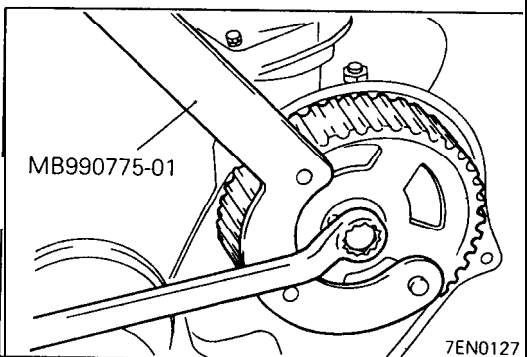
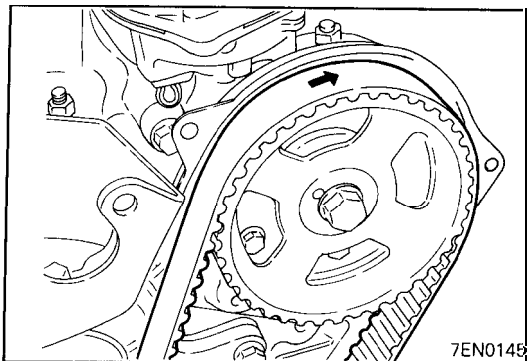
- ◆D◆ 1. Engine support bracket
- 2. Access cover
- 3. Timing belt front upper cover, right
- 4. Timing belt cover cap
- 5. Timing belt front upper cover, left
- 6. Timing belt front lower cover
- 7. Flange
- ◆A◆ ◆C◆ 8. Timing belt
- ◆B◆ 9. Tensioner
- 10. Tensioner spring
- 11. Crankshaft sprocket
- ◆B◆ ◆A◆ 12. Camshaft sprocket bolt
- 13. Camshaft sprocket
- 14. Timing belt rear cover, left
- 15. Timing belt rear cover, right

REMOVAL AND INSTALLATION – MONTERO AND TRUCK



Removal steps

1. Access cover
2. Timing belt front upper cover, right
3. Timing belt front upper cover, left
4. Timing belt front lower cover
5. Flange
- ◀A▶▶C▶▶B▶▶ 6. Timing belt
- ▶B▶▶A▶▶ 7. Tensioner
8. Tensioner spring
9. Crankshaft sprocket
- ▶B▶▶A▶▶ 10. Camshaft sprocket bolt
11. Camshaft sprocket
12. Timing belt rear upper cover, left
13. Generator stay
14. Generator bracket



REMOVAL SERVICE POINTS

◀A▶ TIMING BELT REMOVAL

- (1) Mark the belt running direction for reference in reinstallation.

NOTE

- (1) Water or oil on the belt shortens its life drastically, so the removed timing belt, sprocket, and tensioner must be kept free from oil and water. Do not immerse parts in cleaning solvent.
- (2) If there is oil or water on any part, check the front case oil seal, camshaft oil seal and water pump for leaks.

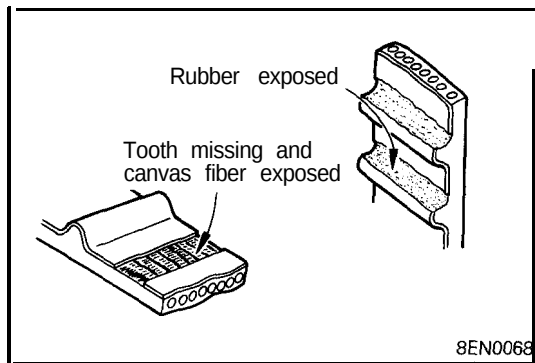
◀B▶ CAMSHAFT SPROCKET BOLT REMOVAL

INSPECTION

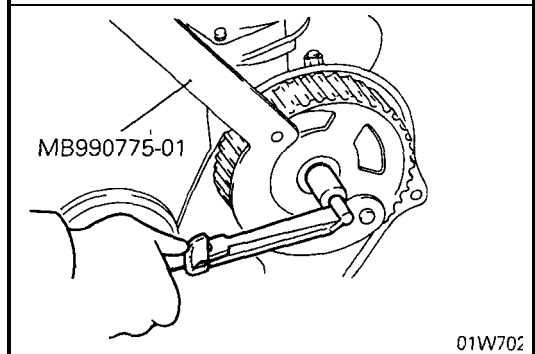
TIMING BELT

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 finger-nail.
- (2) Cracks on rubber back
- (3) Cracks or peeling of canvas
- (4) Cracks on tooth bottom
- (5) Cracks on belt
- (6) Abnormal wear of belt sides. The sides are normal if they are sharp as if cut by a knife.

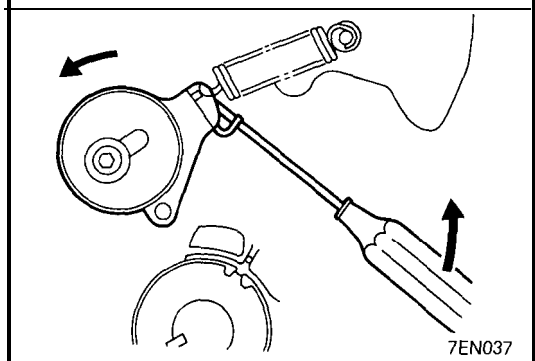


- (7) Abnormal wear on teeth
- (8) Tooth missing and canvas fiber exposed.



INSTALLATION SERVICE POINTS

◆A◆ CAMSHAFT SPROCKET BOLT INSTALLATION

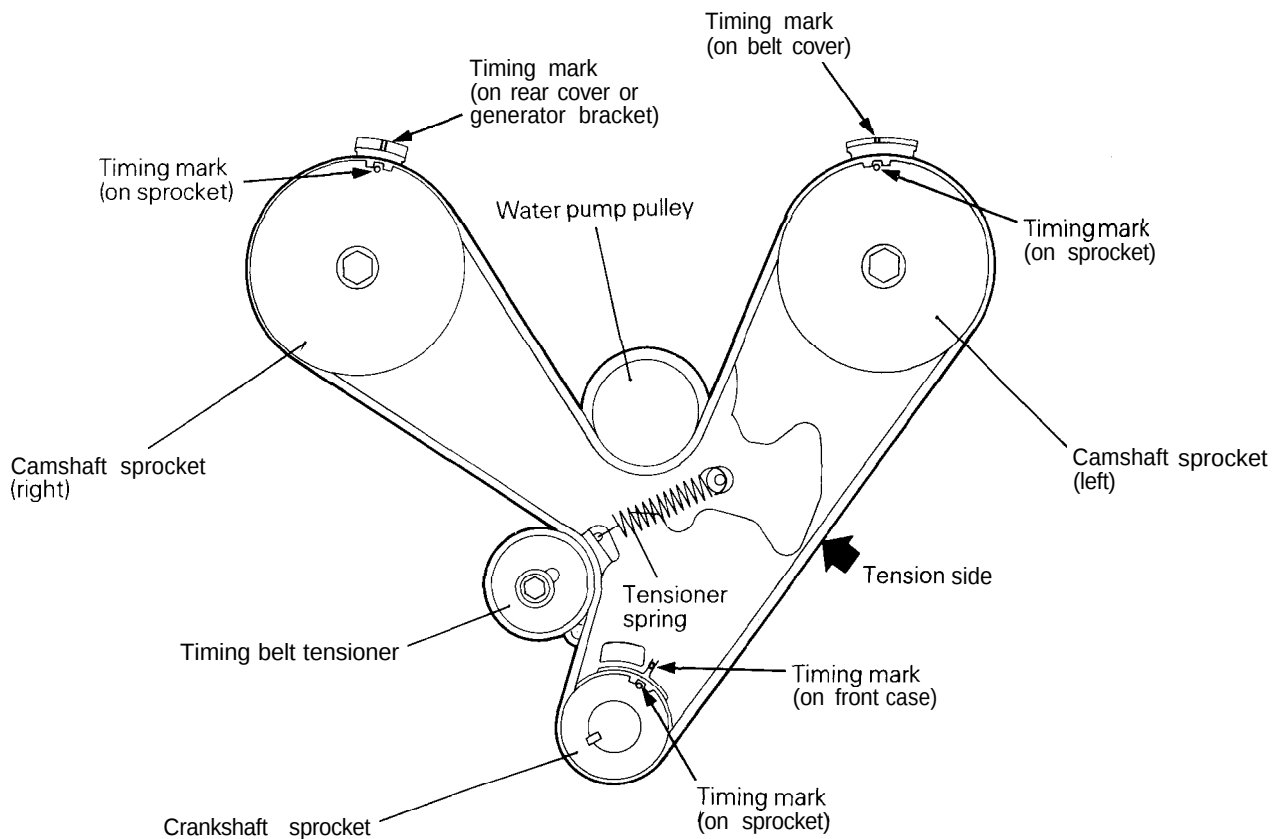


◆B◆ TIMING BELT TENSIONER INSTALLATION

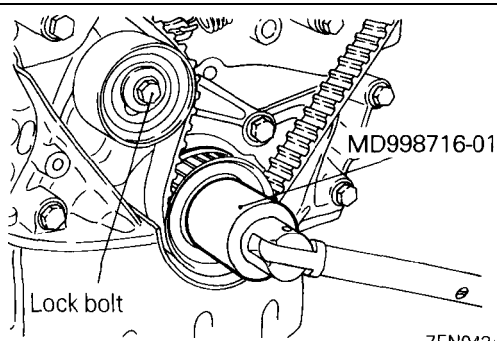
- (1) Insert a screwdriver into the hole of the timing belt tensioner arm, move it all the way in the direction of the arrow, and tighten the tensioner lock bolt to temporarily hold this position.

⚙️ TIMING BELT INSTALLATION

- (1) Align the timing marks of the camshaft sprockets and the crankshaft sprocket.
- (2) Install the timing belt on the crankshaft sprocket first and while keeping the belt tight on the tension side, install the belt on the left camshaft sprocket.
- (3) Then, install on the water pump pulley and on the right camshaft sprocket and finally on the timing belt tensioner.

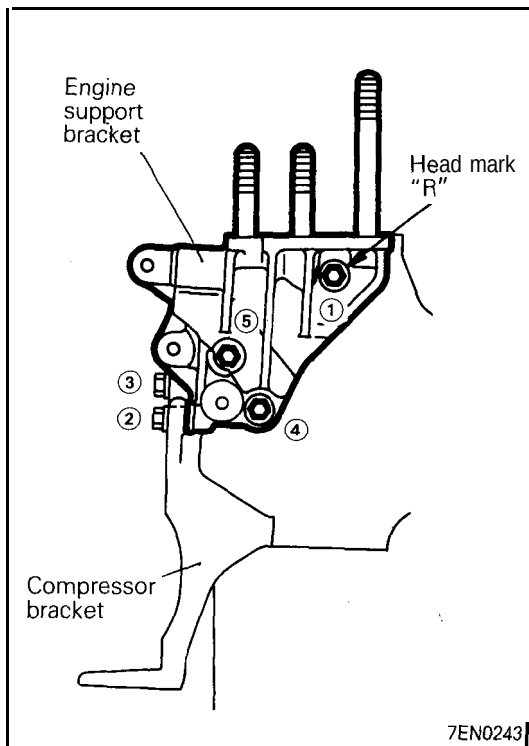


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- (4) Install the flange onto the front end of the crankshaft.
- (5) Install the special tool onto the crankshaft.
- (6) Loosen the tensioner lock bolt one or two turns and allow the spring to tension the timing belt.
- (7) Turn the crankshaft two full turns clockwise. Turn smoothly and in clockwise direction only.
- (8) Again line up the timing marks on the sprockets and tighten the tensioner lock bolt to the specified torque.



ENGINE SUPPORT BRACKET INSTALLATION – DIAMANTE

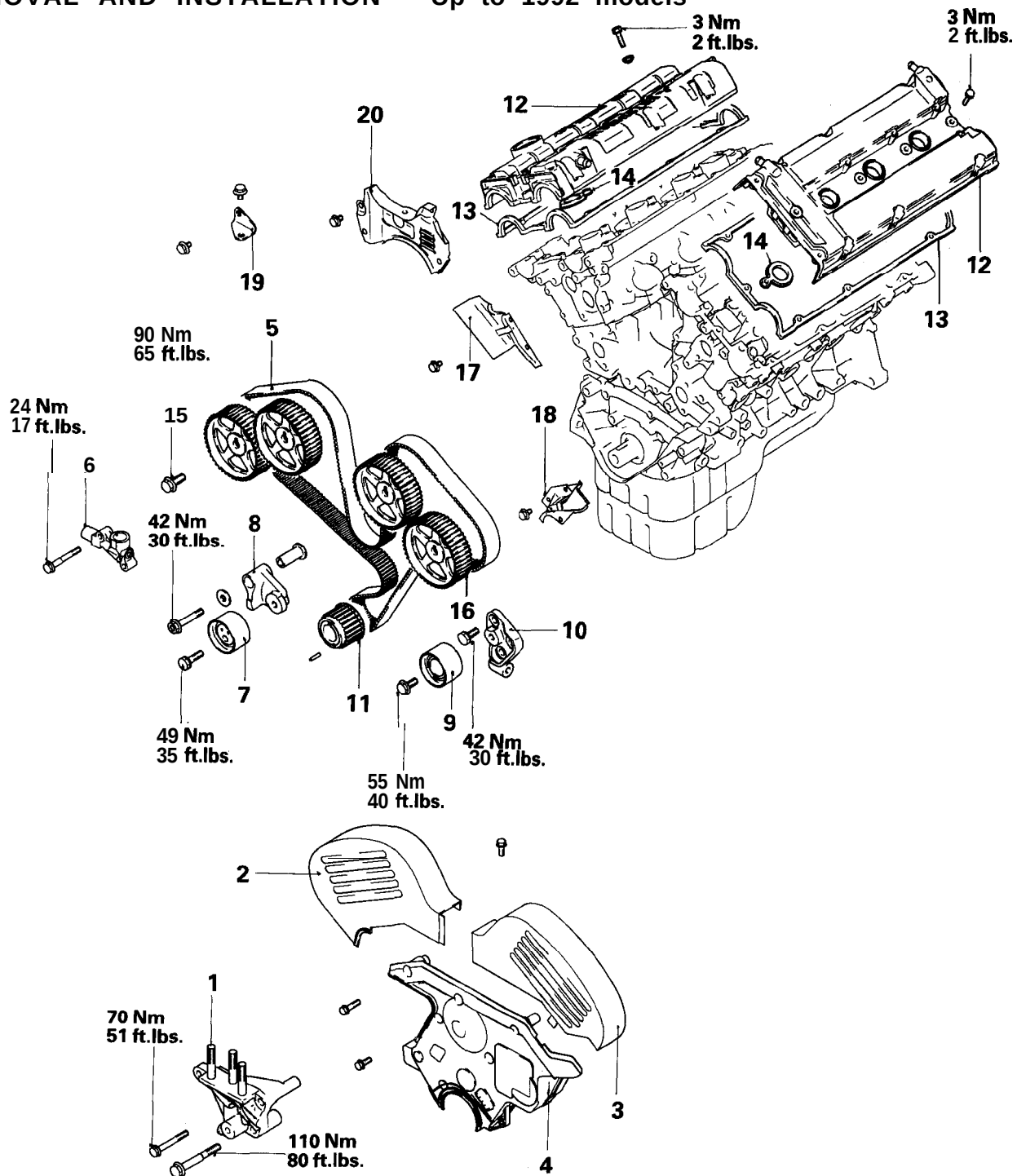
- (1) Tighten the engine support bracket bolts in the order shown in the illustration.

NOTE

The bolt used at the location shown in the illustration is a reamer bolt (head mark "R").

TIMING BELT – DOHC

REMOVAL AND INSTALLATION – Up to 1992 models

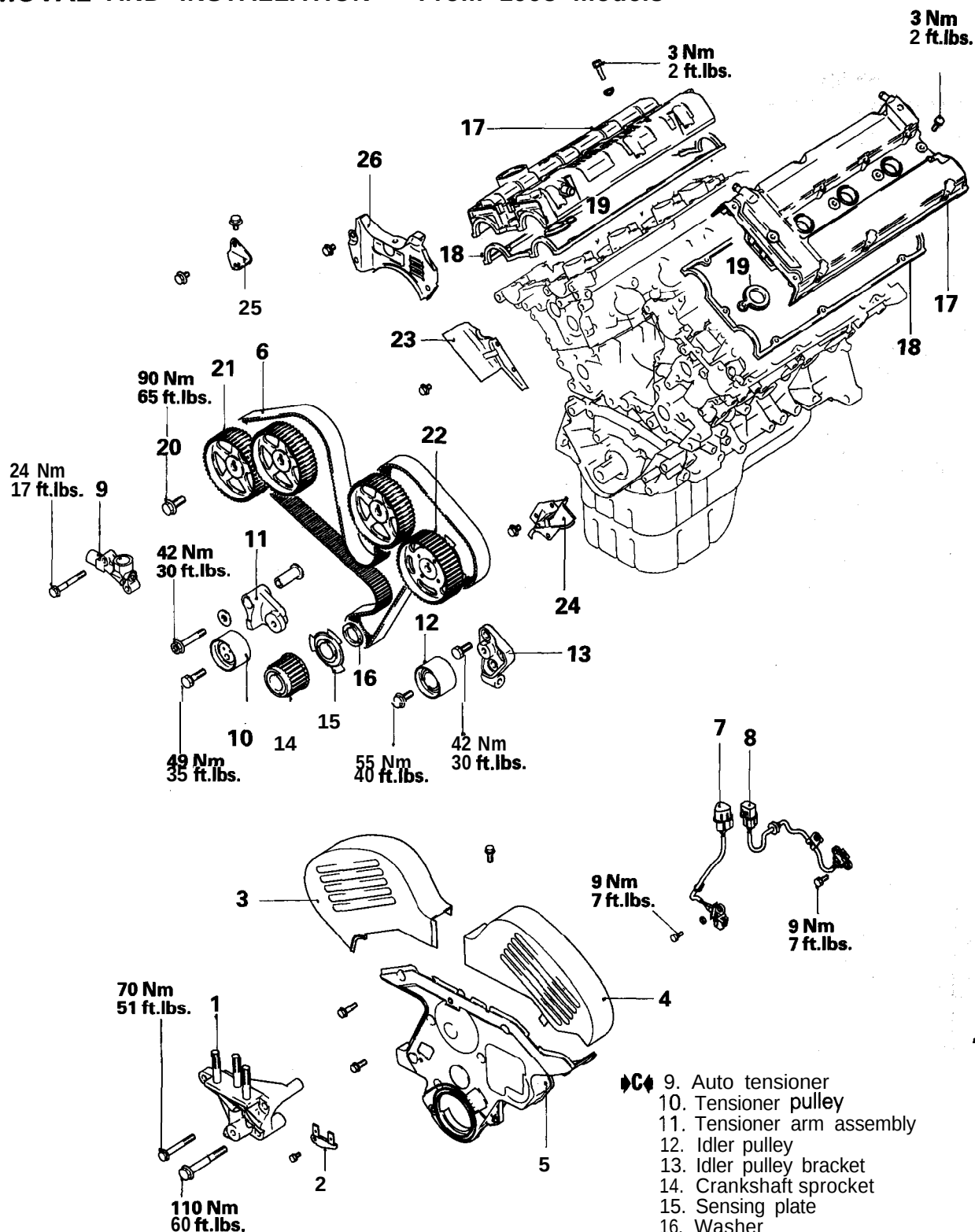


Removal steps

- | | |
|---|------------------------------------|
| ◆E◆ 1. Engine support bracket | 11. Crankshaft sprocket |
| 2. Timing belt front upper cover, right | ◆B◆ 12. Rocker cover |
| 3. Timing belt front upper cover, left | 13. Rocker cover gasket, A |
| 4. Timing belt front lower cover | 14. Rocker cover gasket, B |
| ◆A◆ ◆D◆ 5. Timing belt | ◆B◆ ◆A◆ 15. Camshaft sprocket bolt |
| ◆C◆ 6. Auto tensioner | 16. Camshaft sprocket |
| 7. Tensioner pulley | 17. Timing belt rear cover, right |
| 8. Tensioner arm assembly | 18. Timing belt rear cover, left |
| 9. Idler pulley | 19. Bracket |
| 10. Idler pulley bracket | 20. Timing belt rear cover, center |

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REMOVAL AND INSTALLATION — From 1993 models

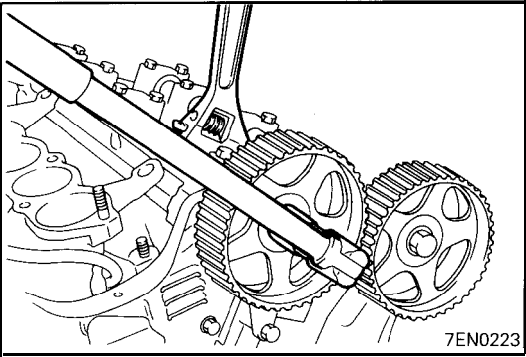
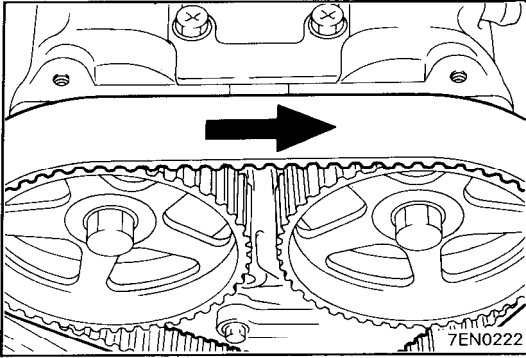


Removal steps

- ♦E♦ 1. Engine support bracket
 2. Crankshaft position sensor bracket
 3. Timing belt front upper cover, right
 4. Timing belt front upper cover, left
 5. Timing belt front lower cover
 ◀A♦ ♦D♦ 6. Timing belt
 7. Crankshaft position sensor
 8. Camshaft position sensor

- ♦C♦ 9. Auto tensioner
 10. Tensioner pulley
 11. Tensioner arm assembly
 12. Idler pulley
 13. Idler pulley bracket
 14. Crankshaft sprocket
 15. Sensing plate
 16. Washer
 ♦B♦ 17. Rocker cover
 18. Rocker cover gasket, A
 19. Rocker cover gasket, B
 ◀B♦ ♦A♦ 20. Camshaft sprocket bolt
 21. Camshaft sprocket
 22. Camshaft sprocket
 23. Timing belt rear cover, right
 24. Timing belt rear cover, left
 25. Bracket
 26. Timing belt rear cover, center

7EN0498



REMOVAL SERVICE POINTS

◊A◊ TIMING BELT REMOVAL

- (1) Mark the belt running direction for reference in reinstallation.

NOTE

- (1) Water or oil on the belt shortens its life drastically, so the removed timing belt, sprocket, and tensioner must be kept free from oil and water. Do not immerse parts in cleaning solvent.
- (2) If there is oil or water on any part, check the front case oil seal, camshaft oil seal and water pump for leaks.

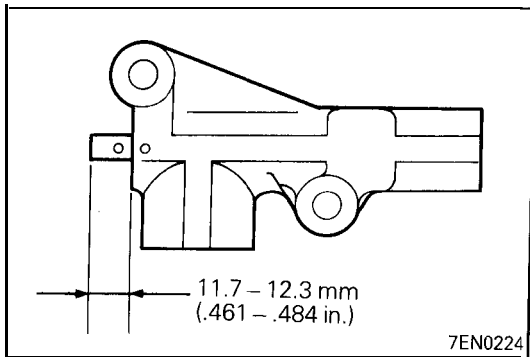
◊B◊ CAMSHAFT SPROCKET BOLT REMOVAL

- (1) Hold the hexagonal portion of the camshaft with a wrench, when removing the camshaft sprocket bolt.

INSPECTION

TIMING BELT

Refer to "INSPECTION" on page 11E-50.

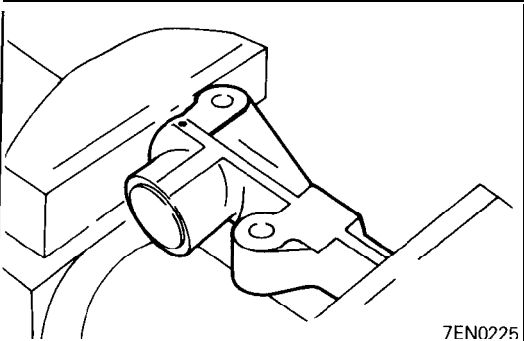


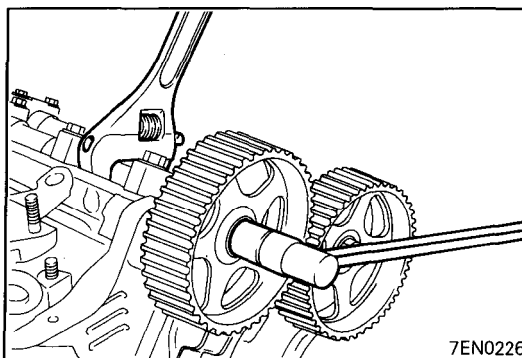
AUTO-TENSIONER

- (1) Check for oil leaks. If oil leaks are evident, replace the auto-tensioner.
- (2) Check the rod end for wear or damage and replace the auto-tensioner if necessary.
- (3) Measure the rod projection length. If the reading is outside the standard value, replace the auto tensioner.

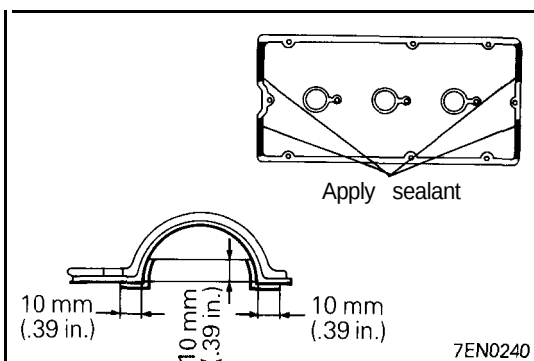
Standard value: 11.7 – 12.3 mm (.461 – .484 in.)

- (4) Use a vice to force the auto tensioner rod in. If the rod slides in easily, replace the tensioner. If there is nothing wrong, the rod will offer considerable resistance.



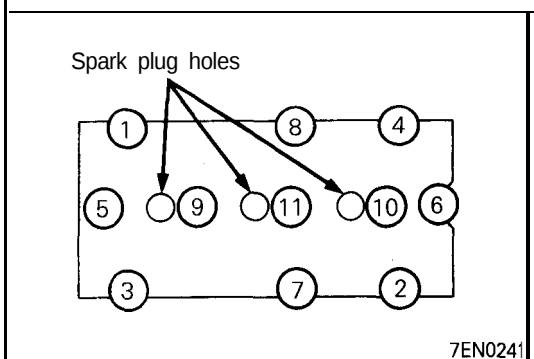
**INSTALLATION SERVICE POINTS****◆A◆ CAMSHAFT SPROCKET BOLT TIGHTENING**

- (1) Hold the hexagonal portion of the camshaft with a wrench when tightening the camshaft sprocket bolt. Tighten the bolt to the specified torque.

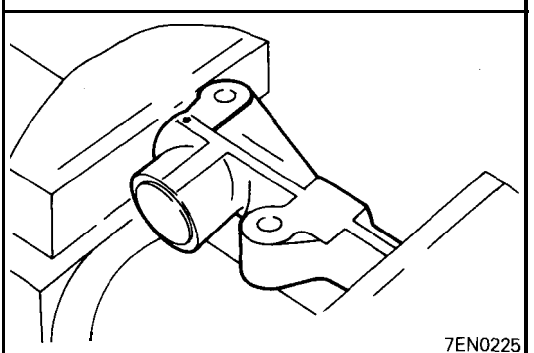
**◆B◆ ROCKER COVER INSTALLATION**

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

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

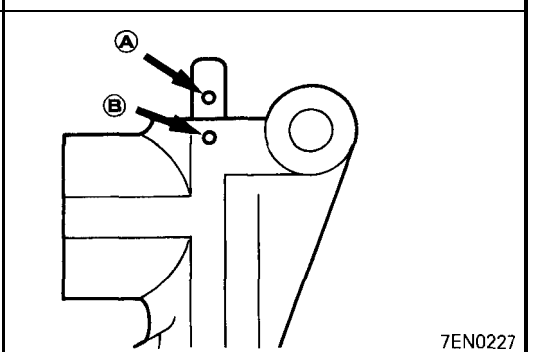


- (2) Tighten the rocker cover bolts in the sequence shown in the illustration.

**◆C◆ AUTO-TENSIONER INSTALLATION**

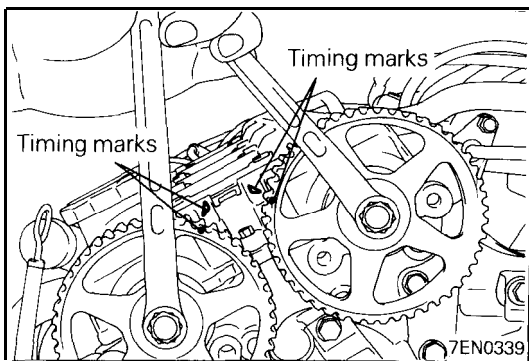
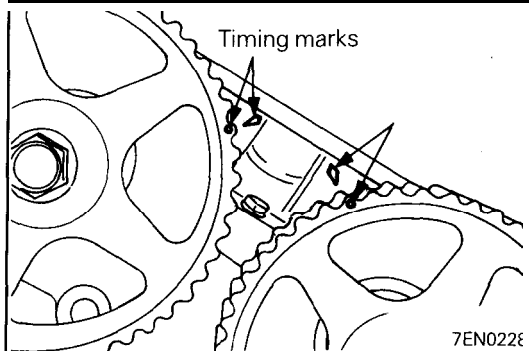
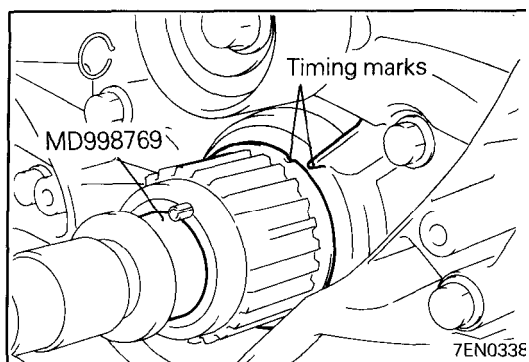
If the auto-tensioner rod is fully extended, set it in the retracted position with the following procedure.

- (1) Set the auto tensioner in a vice.



- (2) Slowly close the vice to force the rod in until the set hole (A) of the rod is lined up with the set hole (B) of the cylinder.
- (3) Insert a wire [1.4 mm (.055 in.) in diameter] into the set holes.
- (4) Remove the auto tensioner from the vice.
- (5) On engines with turbocharger, apply sealant to the threads of the auto tensioner mounting bolt.

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



⚡ TIMING BELT INSTALLATION

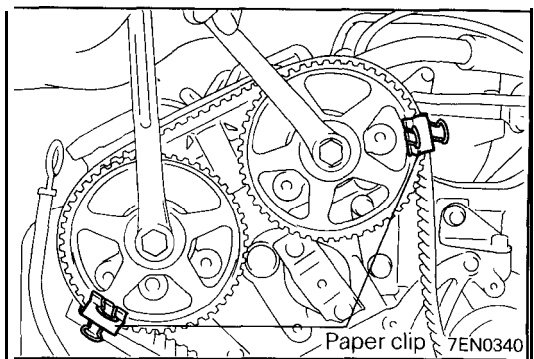
- (1) Using the special tool, line up the crankshaft sprocket timing marks, and then rotate the sprocket one tooth counterclockwise.

- (2) Line up the timing marks of the camshaft sprockets for left bank.

- (3) Using two wrenches, line up the timing marks of the camshaft sprockets for right bank.

Caution

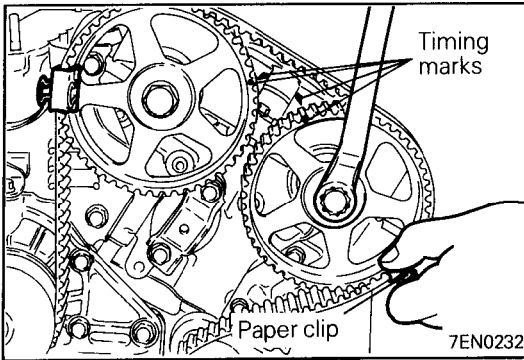
1. Since valve spring force can turn the camshaft sprocket, be careful not to catch your finger.
2. If either camshaft sprocket is rotated one complete turn clockwise or counterclockwise after lining up the timing marks of the other camshaft sprocket, the intake and exhaust valves might interfere. Consequently, if a camshaft sprocket was turned too far in lining up the timing marks, be sure to rotate it back from that position to line up again the timing marks.



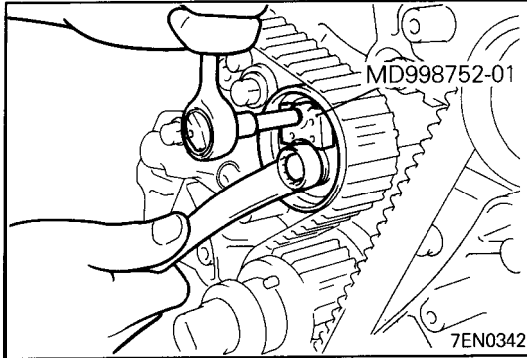
- (4) Install the timing belt on the exhaust side camshaft sprocket for right bank and hold it with a paper clip at the position shown in the illustration.
- (5) Install the timing belt on the intake side camshaft sprocket and hold it with a paper clip at the positions shown in the illustration.

Caution

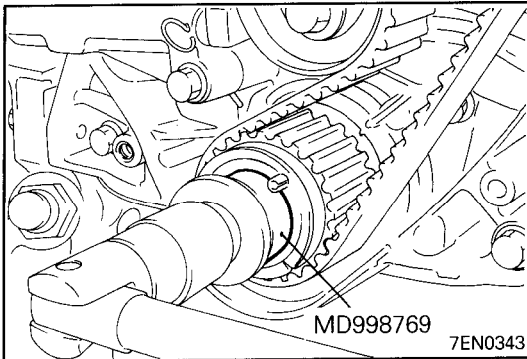
Since the camshaft sprocket turns easily, avoid excessive pulling on the timing belt.



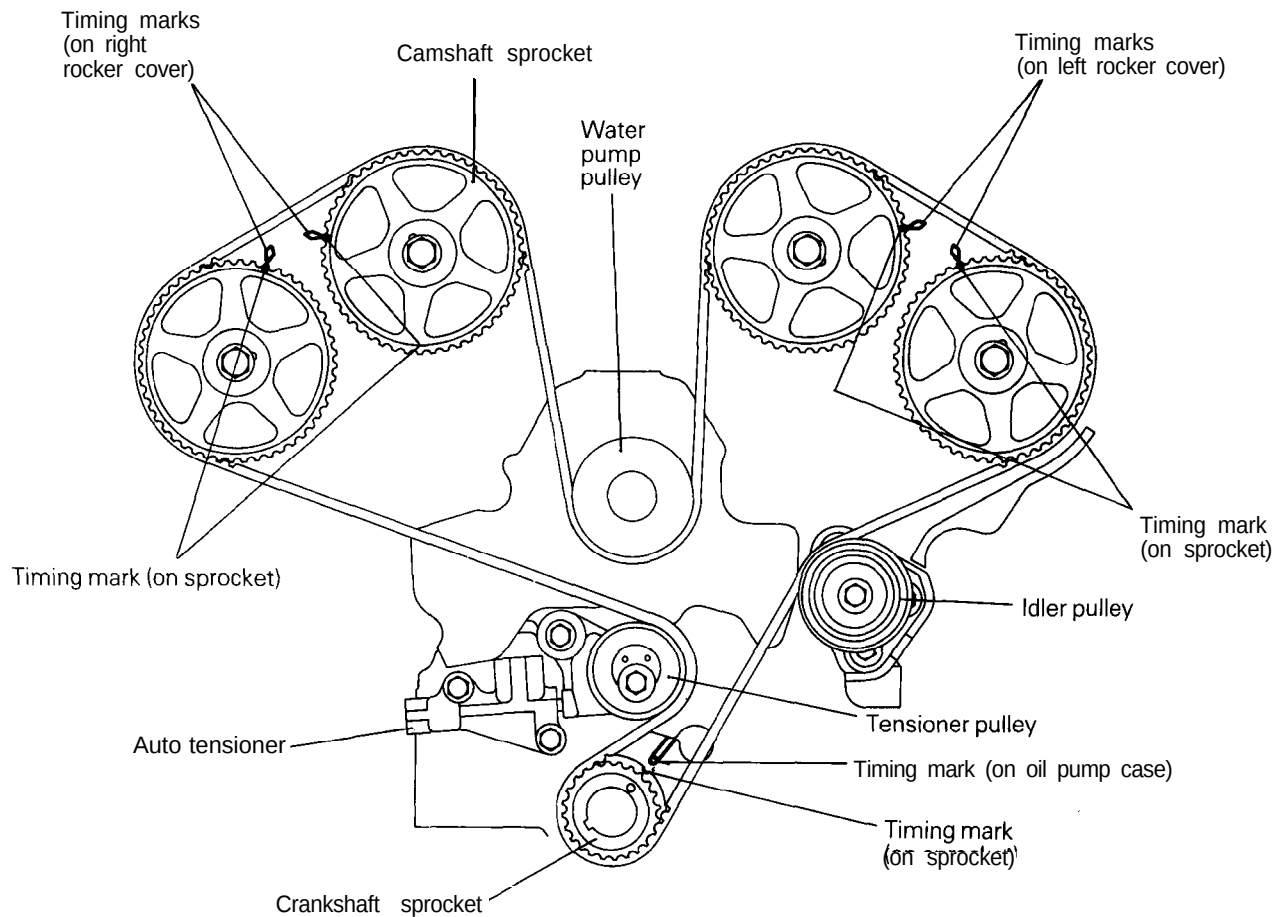
- (6) Check that the timing marks of the camshaft sprockets for left bank are in alignment. Then install the timing belt on these sprockets and hold it with a paper clip at the positions shown in the illustration.
- (7) Install the timing belt on the idler pulley.
- (8) Install the timing belt on the crankshaft sprocket.
- (9) Install the timing belt on the tensioner pulley.



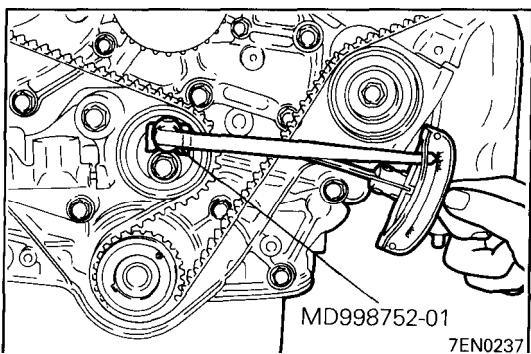
- (10) Using the special tool, rotate the tensioner pulley clockwise to tighten the center bolt.
- (11) Remove the four paper clips.



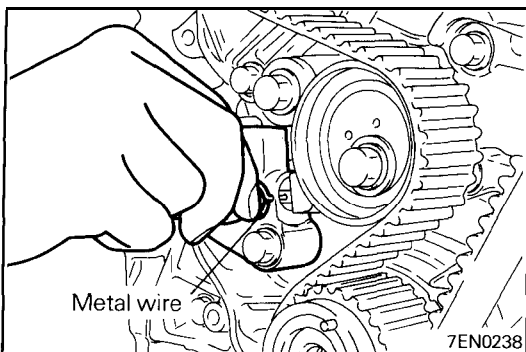
- (12) Using the special tool, turn the crankshaft a quarter turn counterclockwise. Then rotate it clockwise to line up the timing marks and check that all the timing marks are in alignment.



7EN0235



- (13) Loosen the center bolt of the auto-tensioner pulley, and install the special tool and a torque wrench on the pulley. While holding the pulley with approximately 10 Nm (7 ft.lbs.) torque to prevent it from turning, tighten the center bolt to the specified torque.

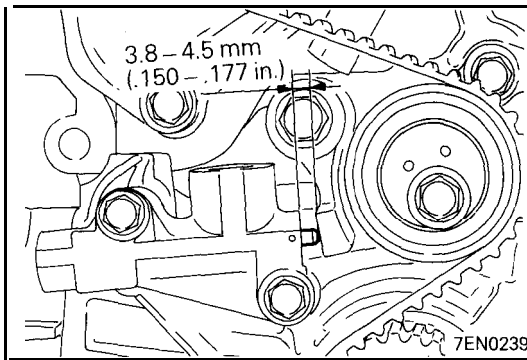


- (14) Turn the crankshaft two turns clockwise, and leave it alone for about five minutes. Then move in and out the auto-tensioner setting metal wire to check that the wire moves smoothly.

NOTE

If the metal wire does not move smoothly, repeat step (12) until it does move smoothly.

- (15) Remove the auto tensioner setting metal wire.



(16) Check that the spacing between the tensioner arm and auto tensioner is within the standard limit.

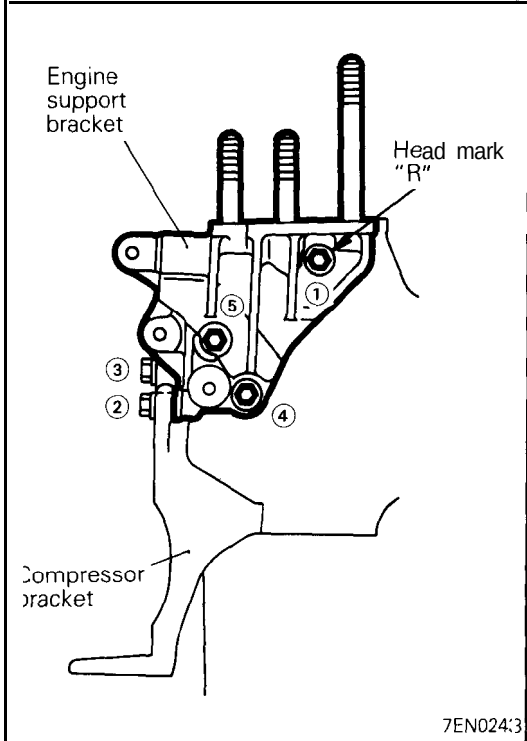
Standard value: 3.8 – 4.5 mm (.150 – .177 in.)

ENGINE SUPPORT BRACKET INSTALLATION

(1) Tighten the engine support bracket bolts in the order shown in the illustration.

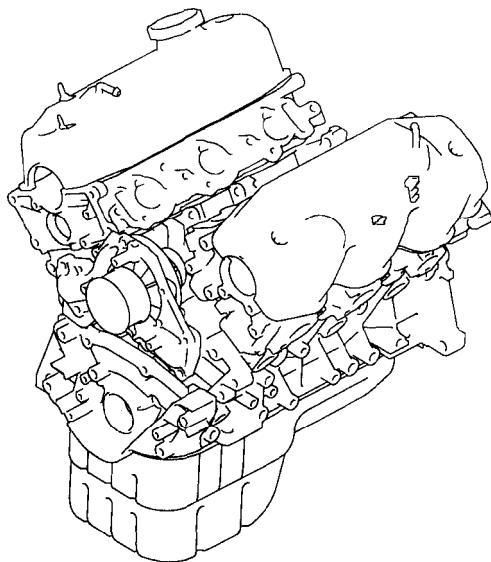
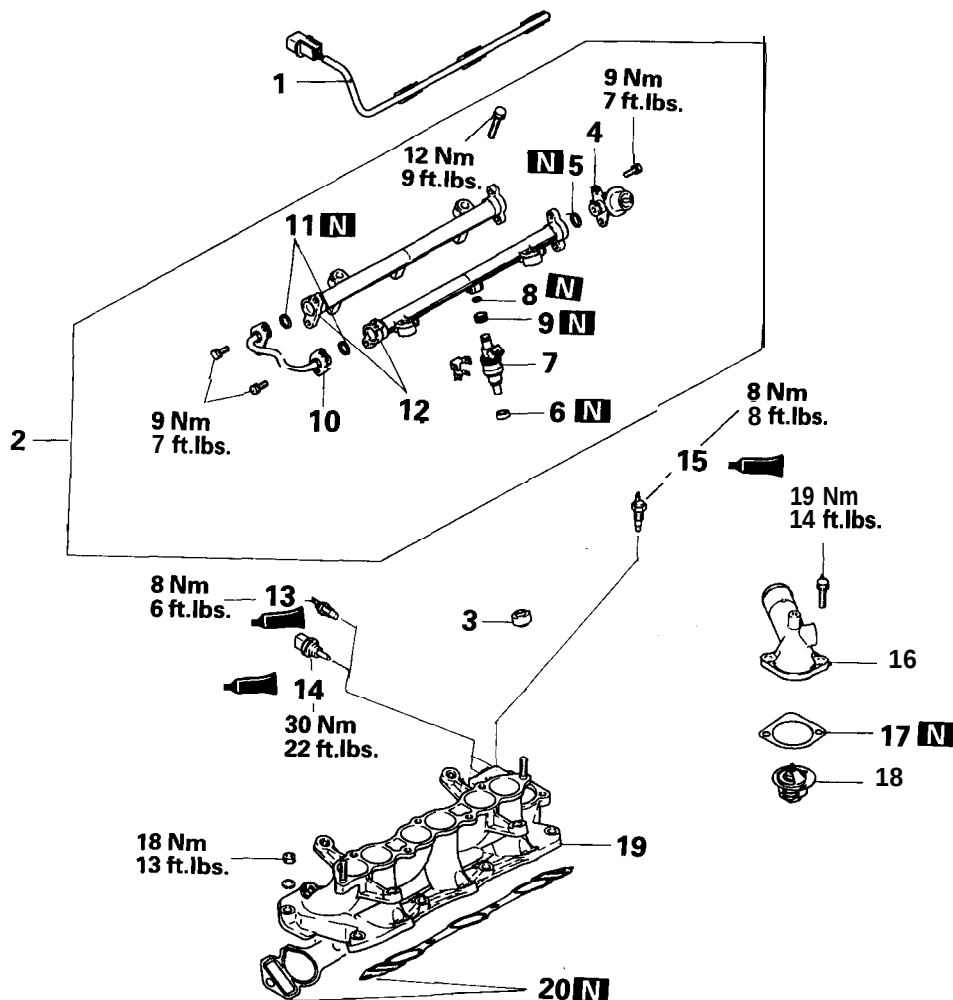
NOTE

The bolt used at the location shown in the illustration is a reamer bolt (head mark "R").



INTAKE MANIFOLD AND FUEL PARTS

REMOVAL AND INSTALLATION – SOHC for DIAMANTE

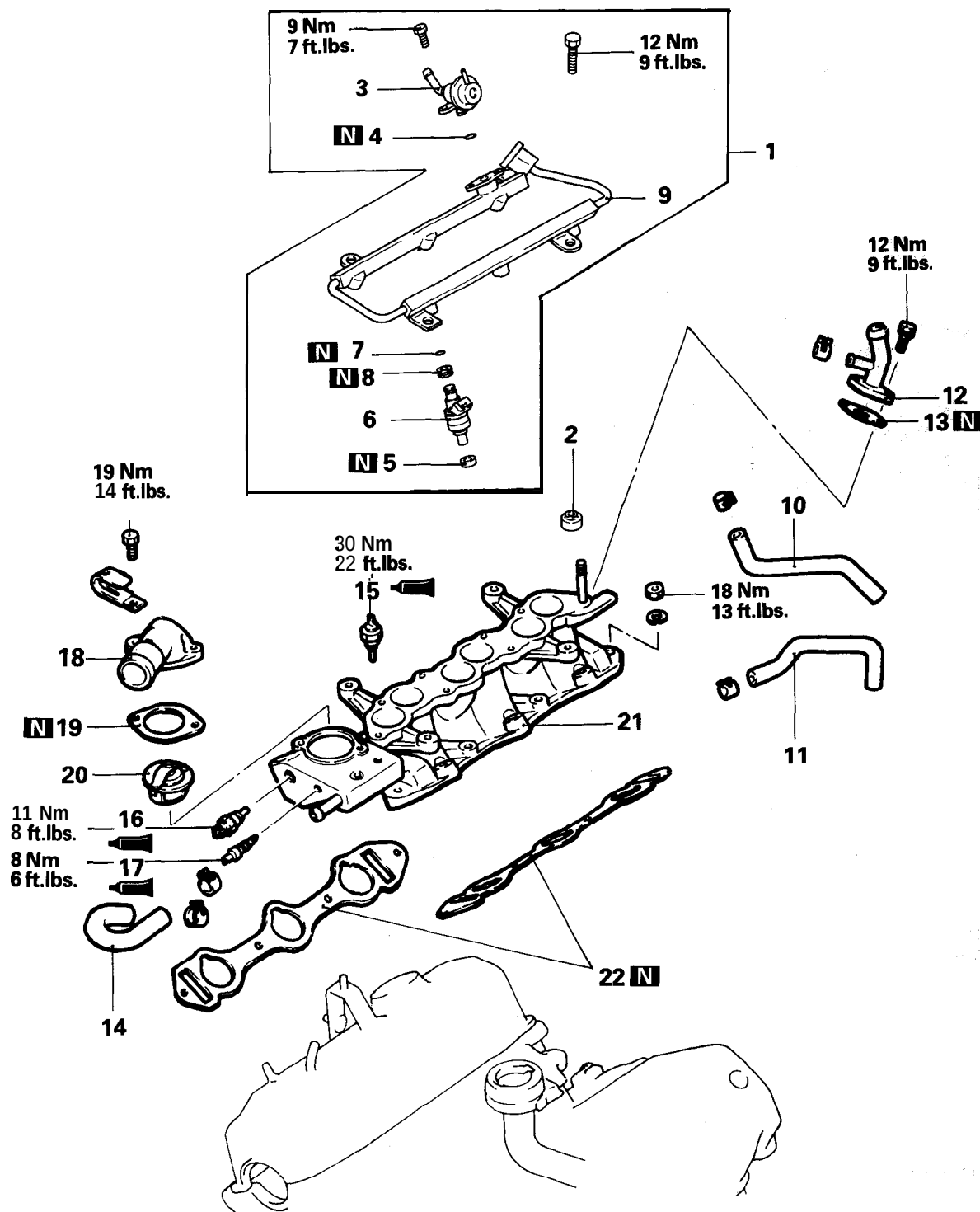


Removal steps

1. Injector harness
2. Injector and fuel rail
3. Insulator
- ◆G◆ 4. Fuel pressure regulator
5. O-ring
- ◆F◆ 6. Insulator
- ◆F◆ 7. Injectors
8. O-ring
9. Gromet
10. Fuel pipe
11. O-ring
12. Fuel rail
- ◆D◆ 13. Engine coolant temperature gauge unit
- ◆C◆ 14. Engine coolant temperature sensor
- ◆B◆ 15. Thermo switch
16. Water outlet fitting
17. Water outlet fitting gasket
18. Thermostat
19. Intake manifold
20. Intake manifold gasket

7EN0499

REMOVAL AND INSTALLATION – SOHC for MONTERO AND TRUCK

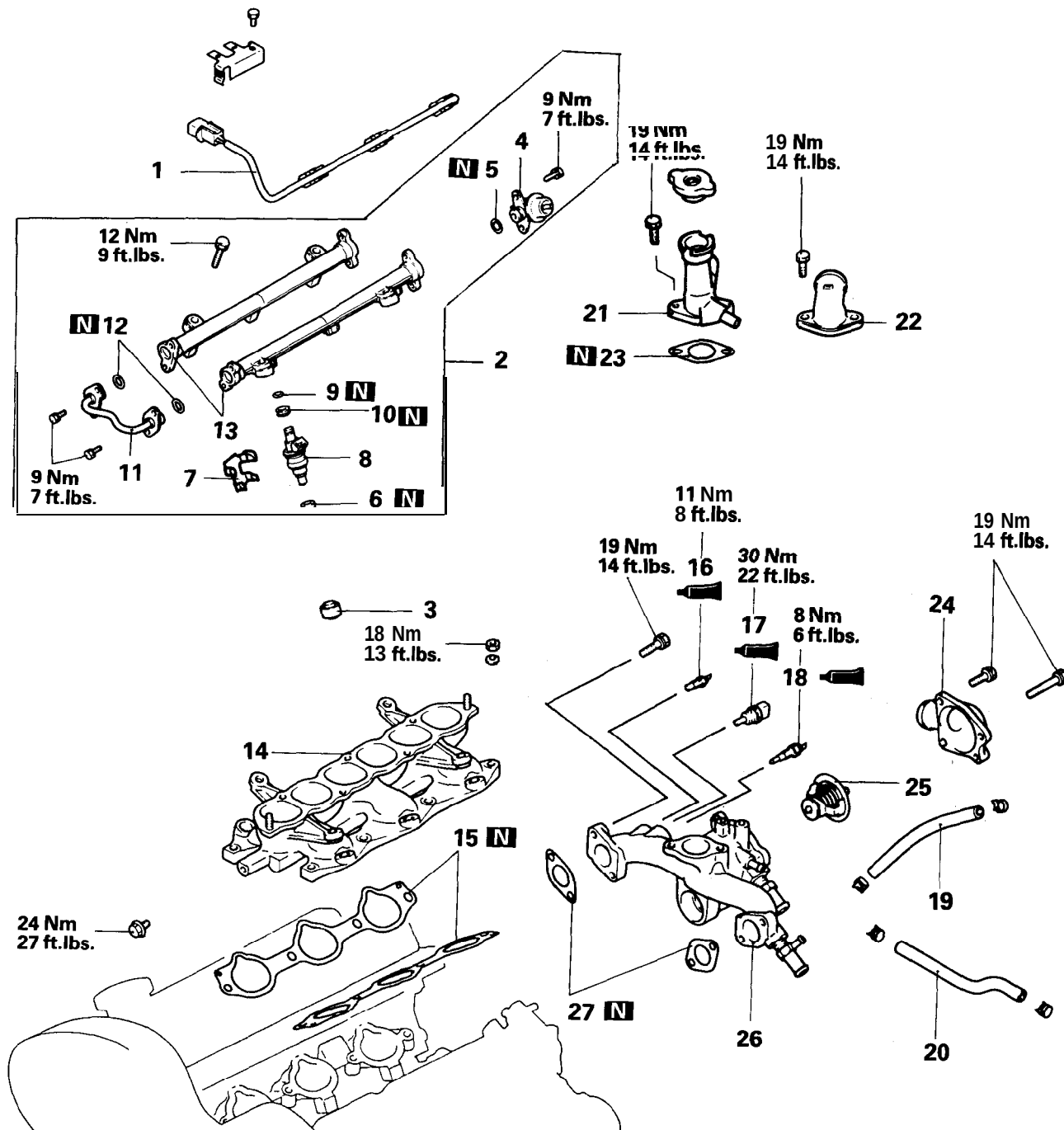


Removal steps

- | | |
|--------------------------------|---|
| 1. Injector and fuel rail | 12. Heat pipe |
| 2. Insulator | 13. Heat pipe gasket |
| ♦G♦ 3. Fuel pressure regulator | 14. Water hose |
| 4. O-ring | ♦D♦ 15. Engine coolant temperature gauge unit |
| ♦F♦ 5. Insulator | ♦C♦ 16. Engine coolant temperature sensor |
| 6. Injectors | ♦B♦ 17. Thermo switch |
| 7. O-ring | 18. Water outlet fitting |
| 8. Gromet | 19. Water outlet fitting gasket |
| 9. Fuel rail | 20. Thermostat |
| 10. Water hose A | 21. Intake manifold |
| 11. Water hose B | 22. Intake manifold gasket |

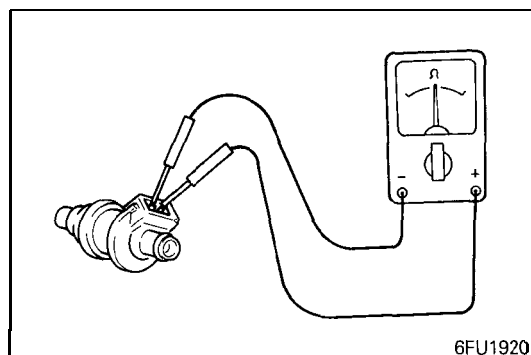
7EN0500

REMOVAL AND INSTALLATION – DOHC



Removal steps

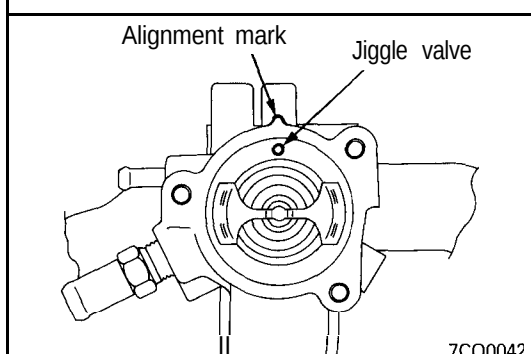
1. Injector harness
2. Injector and fuel rail
3. Insulator
- ◆G◆ 4. Fuel pressure regulator
5. O-ring
6. Insulator
7. Injector clip
- ◆F◆ 8. Injectors
9. O-ring
10. Gromet
11. Fuel pipe
12. O-ring
13. Fuel rail
- ◆E◆ 14. Intake manifold
15. Intake manifold gasket
- ◆D◆ 16. Engine coolant temperature gauge unit
- ◆C◆ 17. Engine coolant temperature sensor
- ◆B◆ 18. Thermo switch
19. Water hose
20. Water hose A
21. Water outlet fitting — 3000GT
22. Water outlet fitting — DIAMANTE
23. Water outlet fitting gasket
24. Water inlet fitting
- ◆A◆ 25. Thermostat
26. Thermostat housing
27. Thermostat housing gasket

**INSPECTION****INJECTORS**

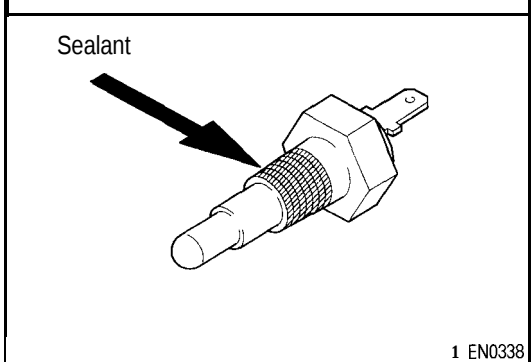
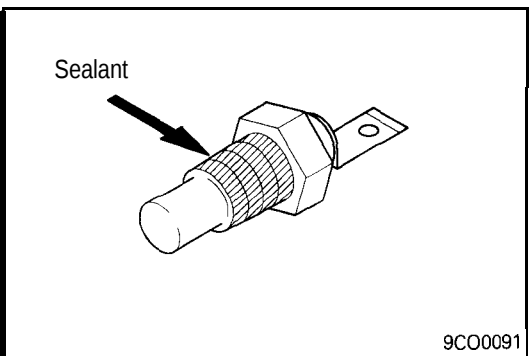
- (1) Measure the resistance between the terminals of the injectors using a circuit tester. If the resistance is out of the specification, replace the injector.

Standard value:

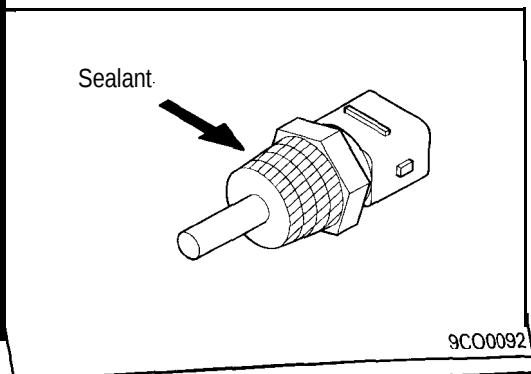
Non Turbo	13 – 16 Ω at 20°C (68°F)
Turbo	2 – 3 Ω at 20°C (68°F)

**INSTALLATION SERVICE POINTS****◆A◆ THERMOSTAT INSTALLATION — DOHC**

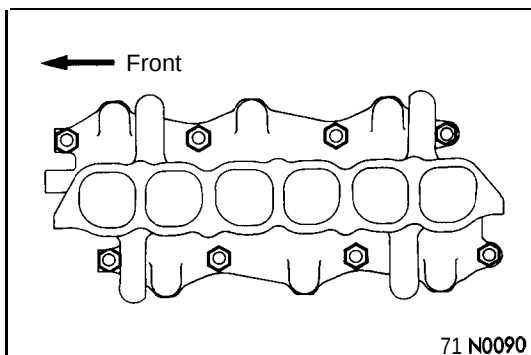
- (1) install the thermostat and line up the jiggle valve with the alignment mark on the thermostat housing.

**◆B◆ SEALANT APPLICATION TO THERMO SWITCH**
Specified sealant: **3M** Part No. 8660 or equivalent**◆C◆ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE SENSOR**

Specified sealant:
3M Nut Locking No. 4171 or equivalent

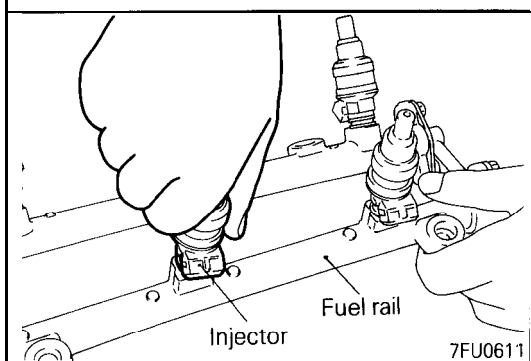
**◆D◆ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE GAUGE UNIT**

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



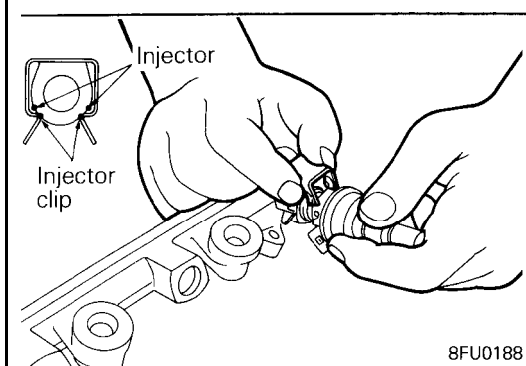
◆E◆ INTAKE MANIFOLD INSTALLATION – DOHC

- (1) Tighten the nuts on the right bank to 4 Nm (2.2 ft.lbs.).
- (2) Tighten the nuts on the left bank to the specified torque. Then tighten the nuts on right bank to the specified torque.
- (3) Tighten the nuts on the left bank and those on the right bank again in that order.



◆F◆ INSTALLATION OF INJECTOR

- (1) Before installing the injector, the rubber O-ring must be lubricated with a drop of clean engine oil for easy installation.

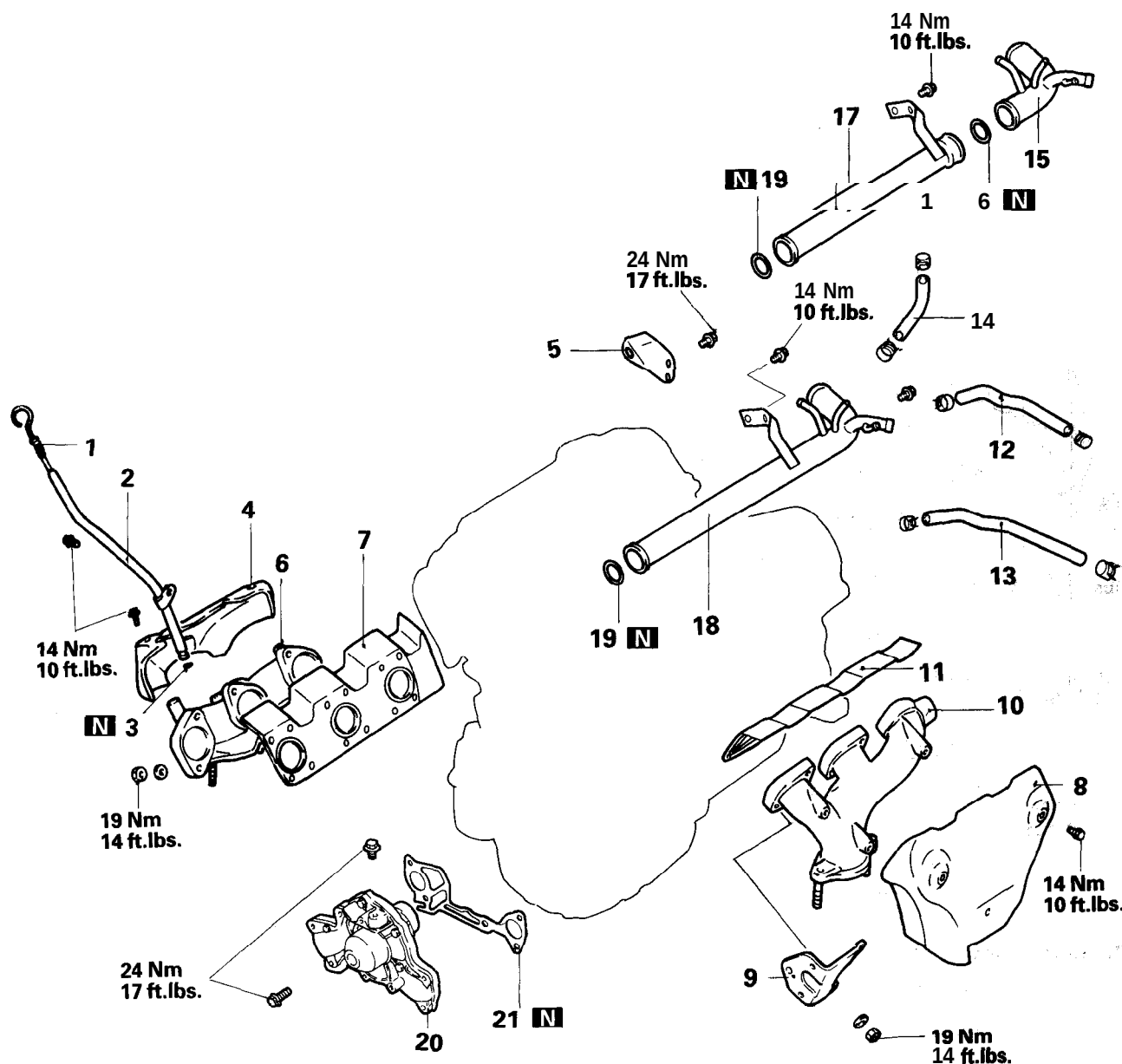


- (2) Insert the injector top end into the fuel rail. Be careful not to damage O-ring during installation.
- (3) Install the injector clip by sliding the open ends onto both injector and fuel rail.

◆G◆ FUEL PRESSURE REGULATOR INSTALLATION

- (1) Before installing the pressure regulator, the O-ring must be lubricated with a drop of clean engine oil for easy installation.

EXHAUST MANIFOLD

REMOVAL AND INSTALLATION – SOHC for **DIAMANTE**

Removal steps

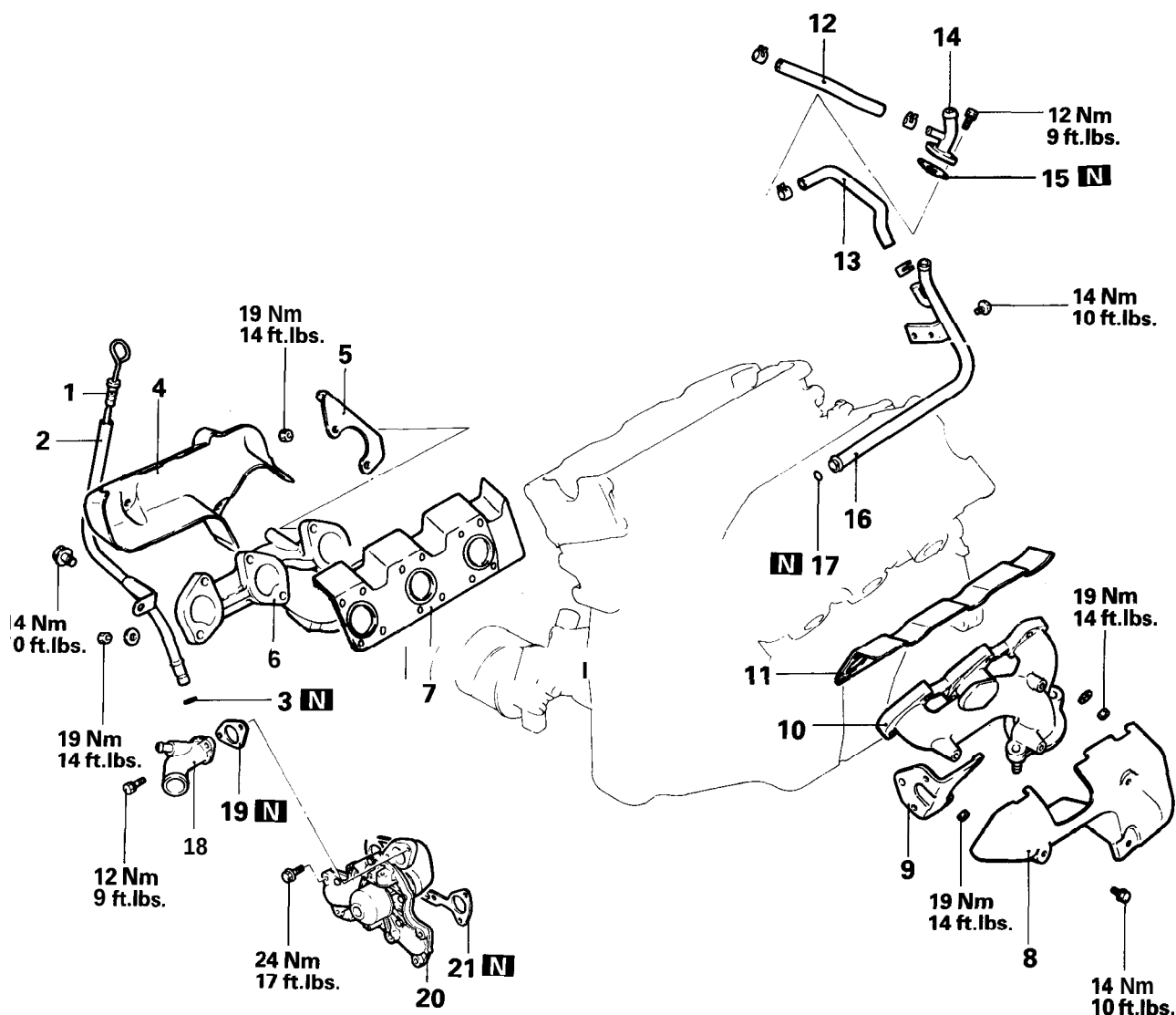
1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Heat protector
5. Engine hanger, right
6. Exhaust manifold, right
7. Exhaust manifold gasket
8. Heat protector, right
9. Bracket
10. Exhaust manifold, left
11. Exhaust manifold gasket
12. Water hose
13. Water hose
14. Water by-pass hose

15. Water inlet pipe B
16. O-ring
17. Water inlet pipe A
18. Water inlet pipe
19. O-ring
20. Water pump
21. Water pump gasket

For M/T

For A/T

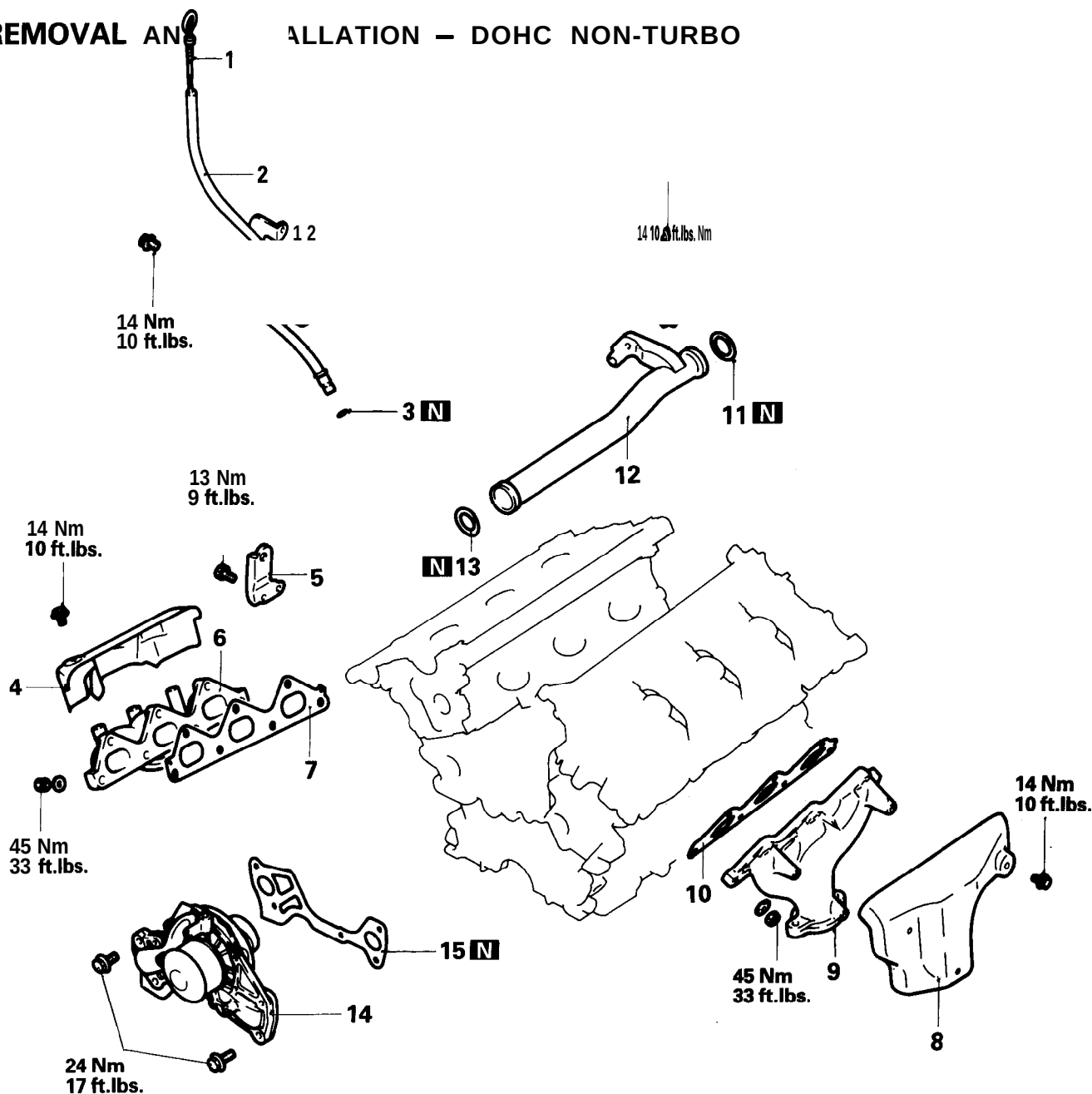
REMOVAL AND INSTALLATION – SOHC for MONTERO AND TRUCK



Removal steps

1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Heat protector, right
5. Engine hanger
6. Exhaust manifold, right
- ◆B◆ 7. Exhaust manifold gasket
8. Heat protector, left
9. Bracket
10. Exhaust manifold, left
- ◆B◆ 11. Exhaust manifold gasket
12. Water hose
13. Water hose A
14. Heater pipe
15. Heater pipe gasket
16. Water pipe
- ◆A◆ 17. O-ring
- ◆A◆ 18. Water inlet pipe
19. Water inlet fitting gasket
20. Water pump
21. Water pump gasket

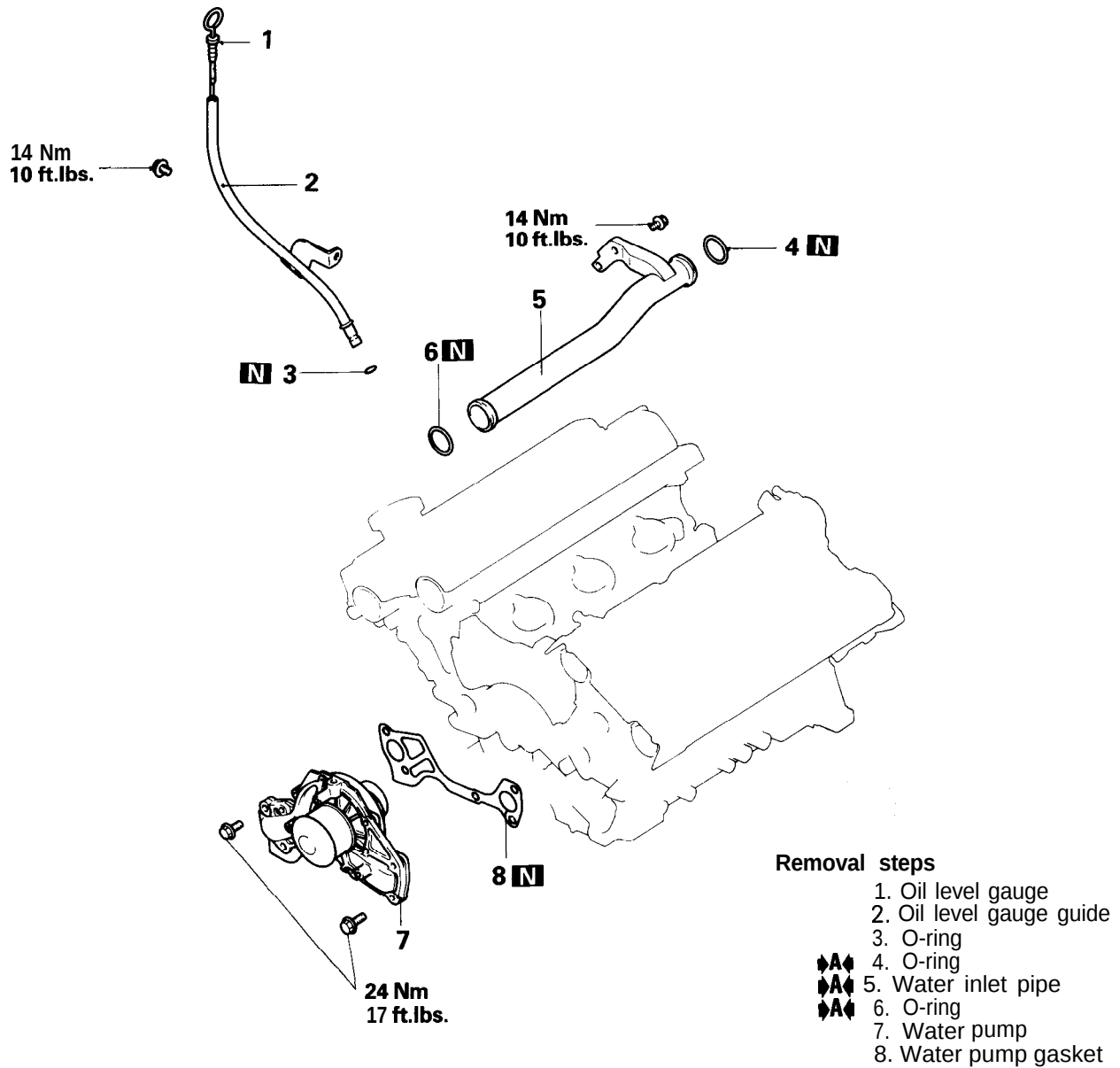
REMOVAL AND INSTALLATION – DOHC NON-TURBO



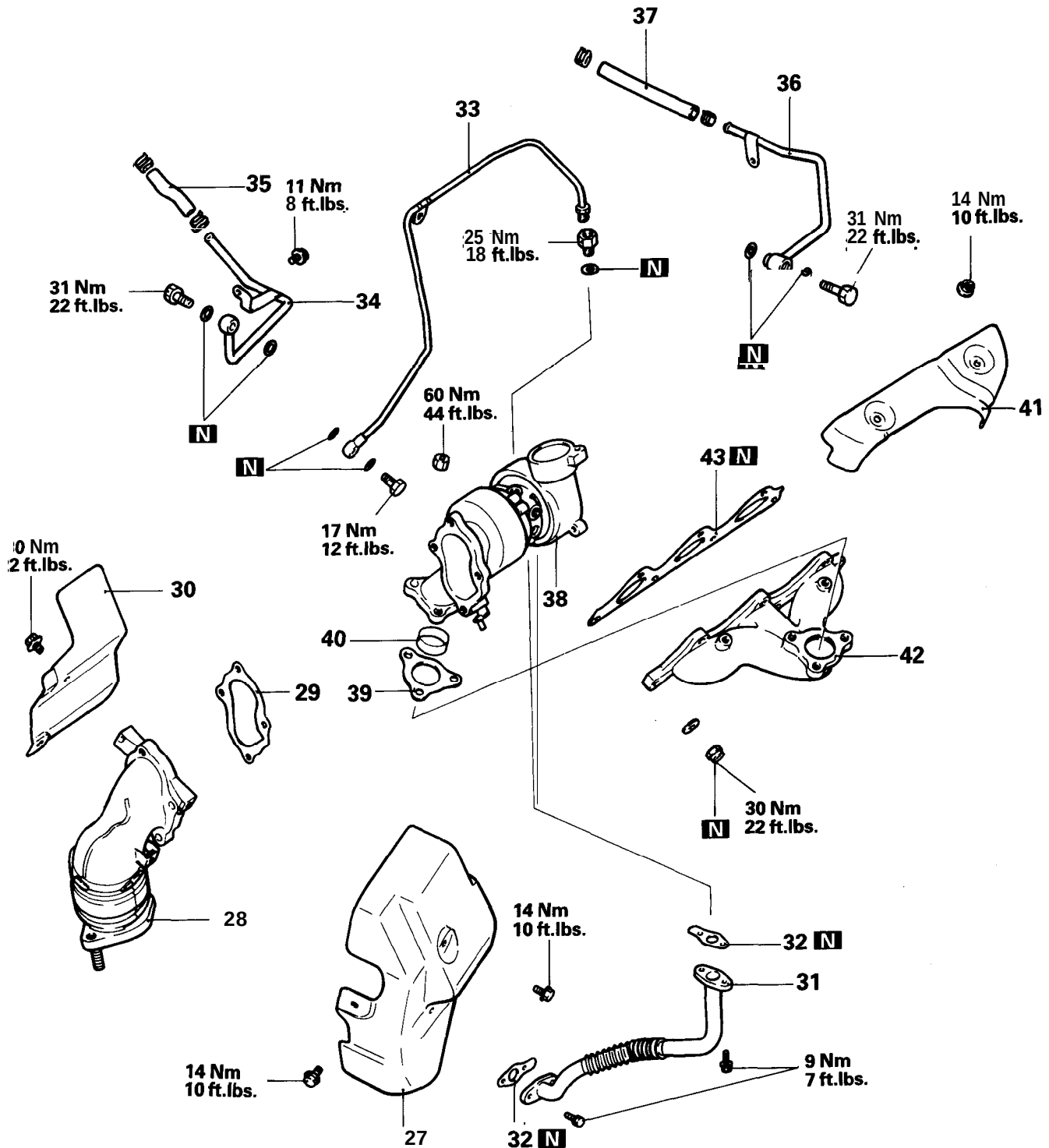
Removal steps

1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Heat protector, right
5. Engine hanger
6. Exhaust manifold, right
7. Exhaust manifold gasket
8. Heat protector, left
9. Exhaust manifold, left
10. Exhaust manifold gasket
11. O-ring
12. Water inlet pipe
13. O-ring
14. Water pump
15. Water pump gasket

REMOVAL AND INSTALLATION – DOHC TURBO

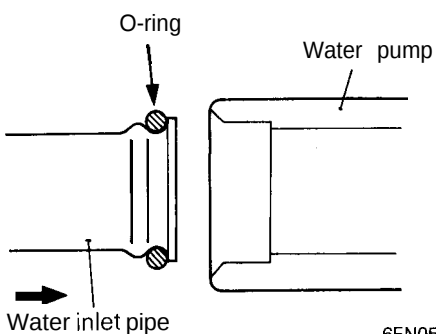


7EN0504



- 27. Heat protector D
- 28. Exhaust fitting, left
- 29. Exhaust fitting gasket, left
- 30. Heat protector C
- 31. Oil return pipe
- 32. Oil return pipe gasket
- 33. Oil pipe
- 34. Water pipe B, left
- 35. Water hose

- 36. Water pipe A, left
- 37. Water hose
- 38. Turbocharger, left
- 39. Turbocharger gasket
- 40. Ring
- 41. Heat protector E
- 42. Exhaust manifold, left
- 43. Exhaust manifold gasket



6EN05941

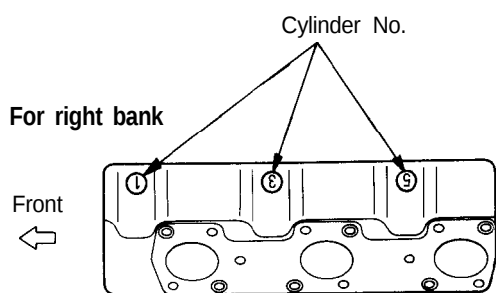
INSTALLATION SERVICE POINTS

◆A◆ O-RING AND WATER PIPE INSTALLATION

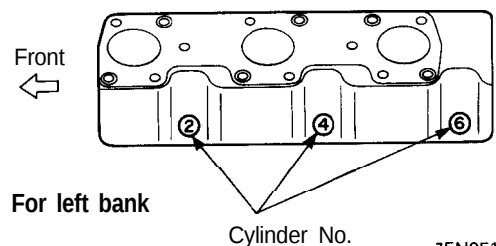
- (1) Wet the O-ring (with water) to facilitate assembly.

Caution

Keep the O-ring free of oil or grease.



7IN0010



7FN051E

◆B◆ EXHAUST MANIFOLD GASKET IDENTIFICATION – SOHC

- (1) Install gaskets with cylinder number ①, ③ and ⑤ embossed on their top side to the right bank and install those with cylinder number ②, ④ and ⑥ to the left bank.

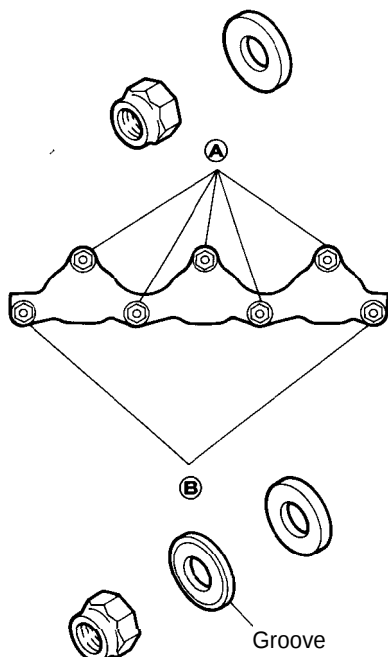
◆C◆ RIGHT EXHAUST MANIFOLD INSTALLATION – DOHC TURBO

Tighten the nuts in the following order.

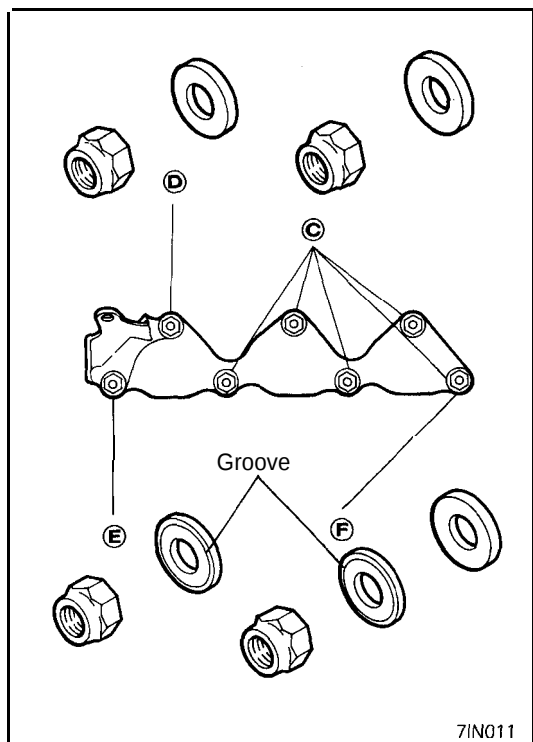
- (1) Tighten five nuts **A** to 30 Nm (22 ft.lbs.).
- (2) Tighten nuts **B** to 50 Nm (36 ft.lbs.).
- (3) Back off nuts **B** until a torque value of 10 Nm (7 ft.lbs.) is achieved.
- (4) Tighten nuts **B** to 30 Nm (22 ft.lbs.).

NOTE

- (1) Fit the cone disc spring with the grooved side facing the nut.
- (2) Install the nut, cone disc spring and washer in the order shown in the illustration.



7IN0111



◆D◆ LEFT EXHAUST MANIFOLD INSTALLATION – DOHC TURBO

Tighten the nuts in the following order.

- (1) Tighten four nuts **C** to 30 Nm (22 ft.lbs.).
- (2) Temporarily tighten the turbocharger to the exhaust manifold.
- (3) Tighten nut **D** to 30 Nm (22 ft.lbs.).
- (4) Tighten nuts **E** and **F** to 50 Nm (36 ft.lbs.).
- (5) Back off nuts **E** and **F** until a torque value of 10 Nm (7 ft.lbs.) is achieved.
- (6) Tighten nuts **E** and **F** to 30 Nm (22 ft.lbs.).

NOTE

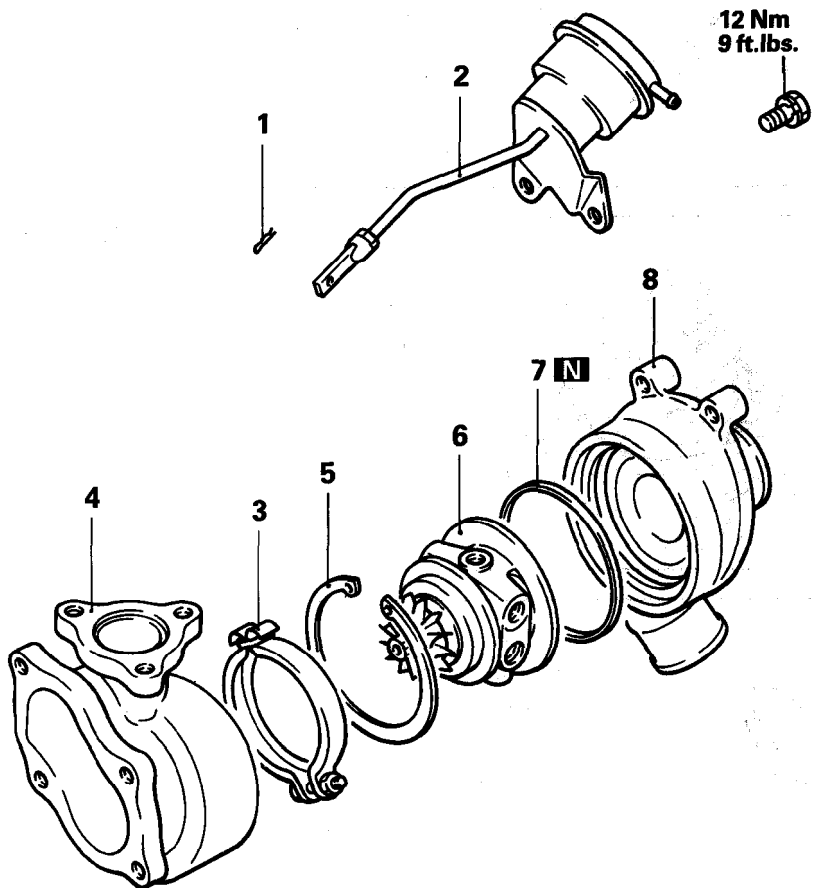
- (1) Fit the cone disc spring with the grooved side facing the nut.
- (2) Install the nut, cone disc spring and washer in the order shown in the illustration.

TURBOCHARGER

DISASSEMBLY AND REASSEMBLY

Disassembly steps

1. Snap pin
2. Turbocharger waste gate actuator
3. Coupling
4. Turbine housing
5. Snap ring
6. Turbine wheel assembly
7. O-ring
8. Compressor cover



7IN0098

INSPECTION

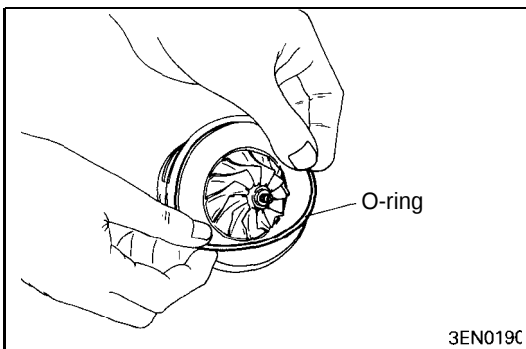
TURBOCHARGER

- (1) Manually open and close the waste gate valve to make sure it operates freely.
- (2) Inspect the oil passage in the cartridge for signs of deposits or blockage.
- (3) Clean the inlet section of the compressor cover with a rag. Inspect it for signs of contact with the compressor turbine. If worn, replace it.

REASSEMBLY SERVICE POINTS

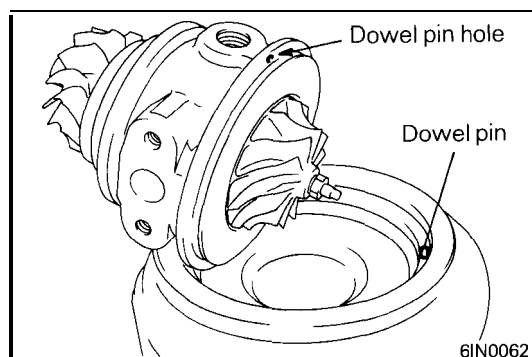
◆◆ O-RING INSTALLATION

- (1) Apply a light coat of engine oil to a new O-ring and fit it in the groove of the turbine wheel assembly.



3EN019C

TSB Revision

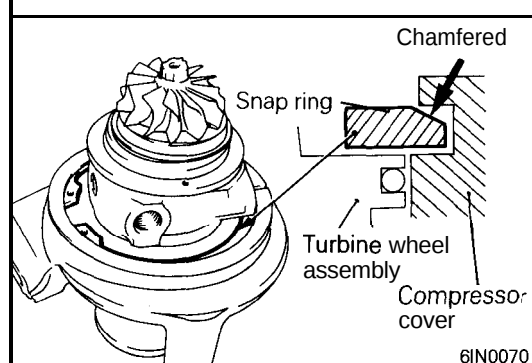


◆B◆ TURBINE WHEEL ASSEMBLY INSTALLATION

- (1) Install the turbine wheel assembly to the compressor cover while aligning the dowel pin and the hole.

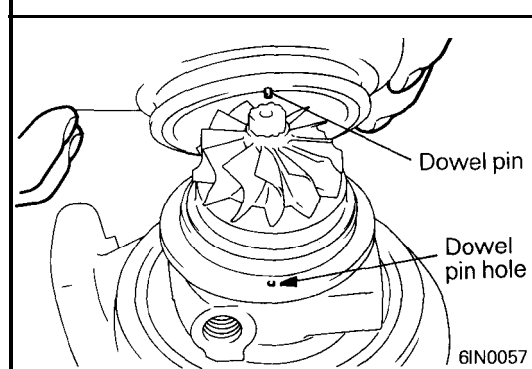
Caution

Use care not to damage the blades of the turbine wheel and compressor wheel.



◆C◆ SNAP RING INSTALLATION

- (1) Fit the snap ring with its chamfered side facing up.



◆D◆ TURBINE HOUSING INSTALLATION

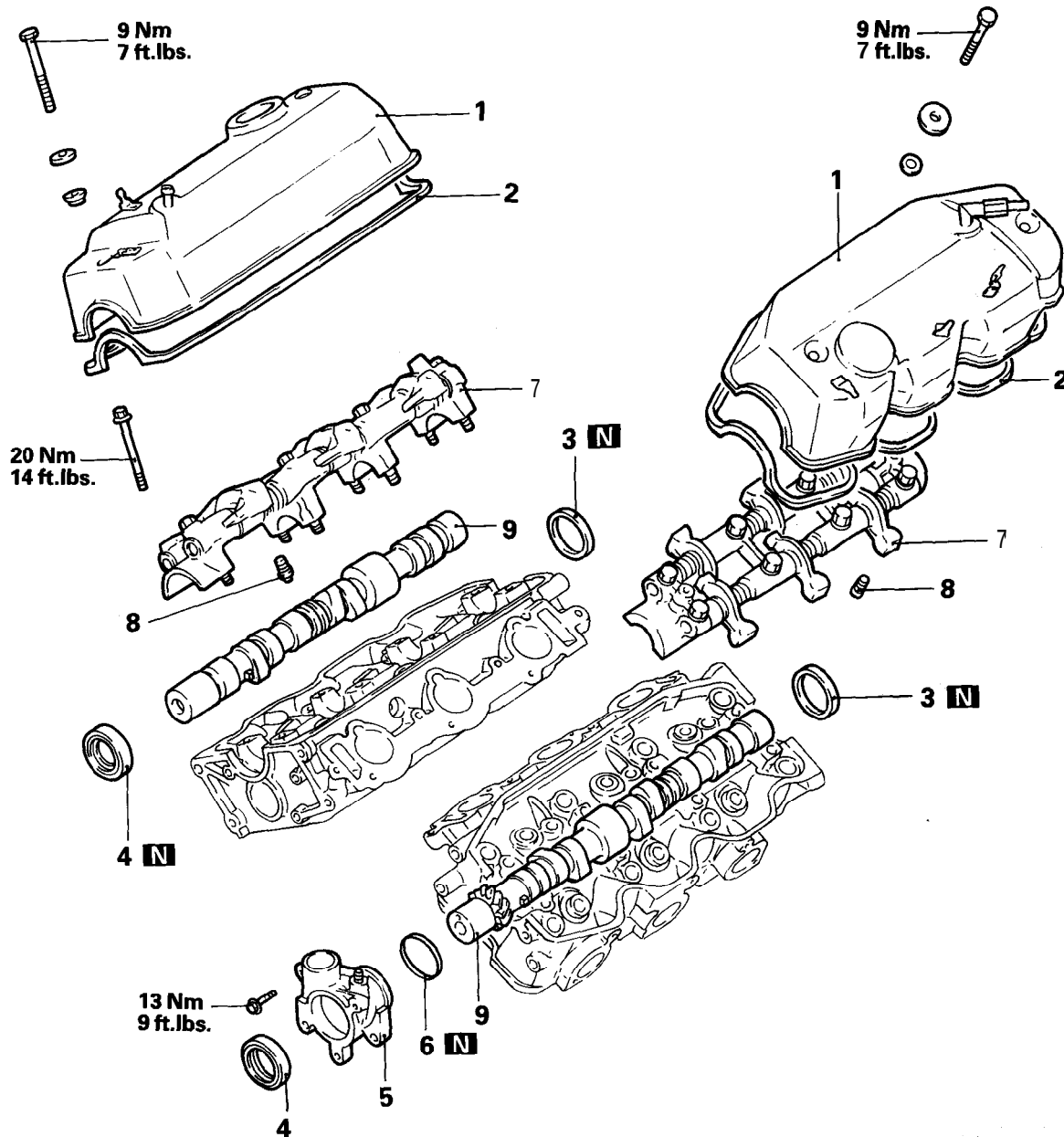
- (1) Install the turbine housing while aligning the dowel pin and the hole.

Caution

Use care not to damage the blades of the turbine wheel.

ROCKER ARMS AND CAMSHAFTS – SOHC

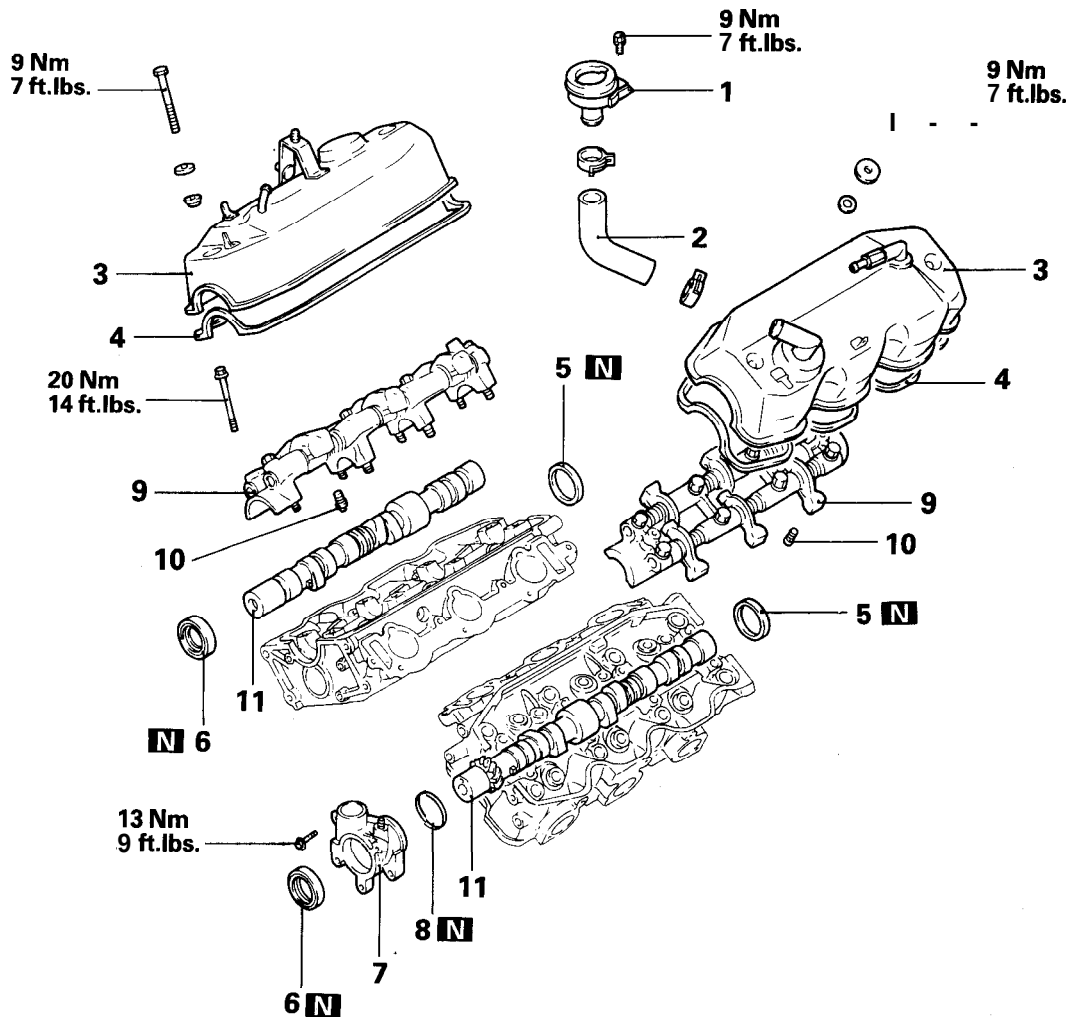
REMOVAL AND INSTALLATION – DIAMANTE



Removal steps

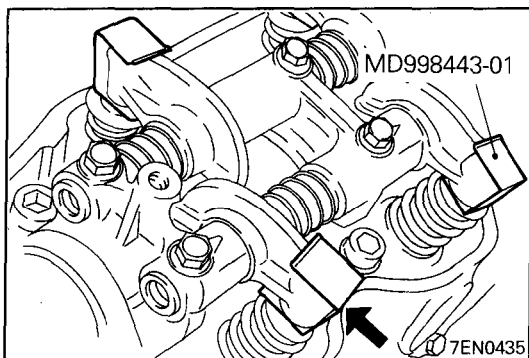
- ◆E◆ 1. Rocker cover
- 2. Gasket
- ◆D◆ 3. Circular packing
- ◆C◆ 4. Camshaft oil seal
- 5. Distributor adaptor
- 6. O-ring
- ◆B◆ 7. Rocker arms, shafts and bearing caps
- ◆A◆ 8. Lash adjuster
- 9. Camshaft

REMOVAL AND INSTALLATION – MONTERO AND TRUCK

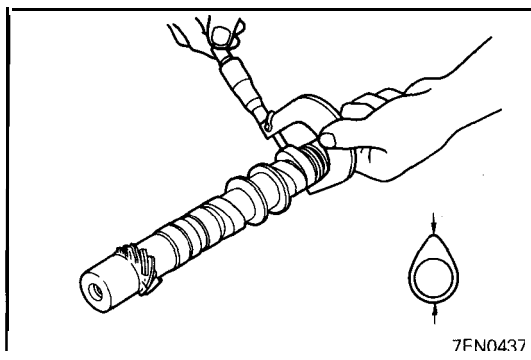


Removal steps

1. Oil filler
2. Oil filler tube
- ◆E◆ 3. Rocker cover
4. Gasket
- ◆D◆ 5. Circular packing
- ◆C◆ 6. Camshaft oil seal
7. Distributor adaptor
8. O-ring
- ◆B◆ 9. Rocker arms, shafts and bearing caps
- ◆A◆ 10. Lash adjuster
11. Camshaft

**REMOVAL SERVICE POINT****ROCKER ARM, SHAFT AND BEARING CAP REMOVAL**

- (1) Install the special tools to the rocker arm to hold the lash adjuster.
- (2) Loosen the camshaft bearing cap bolt. Do not remove the bolts from the cap.
- (3) Remove the rocker arm, shaft and bearing cap as an assembly.

**INSPECTION****CAMSHAFT**

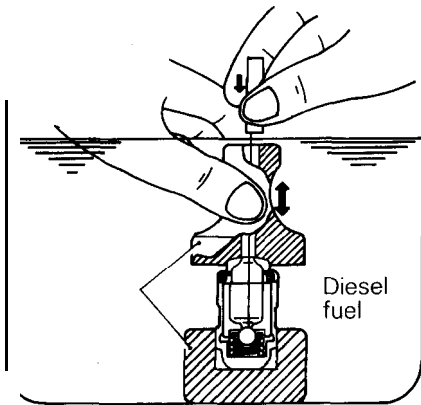
- (1) Inspect the camshaft bearing journals for damage and binding. If the journals are binding, also check the cylinder head for damage. Also check the cylinder head oil holes for clogging.
- (2) Check the tooth surface of the distributor drive gear teeth of the camshaft and replace if abnormal wear is evident.
- (3) Check the cam surface for abnormal wear and damage and replace if defective. Also measure the cam height and replace if out of limit.

Standard value: 41.25 mm (1.6240 in.)

Limit: 40.75 mm (1.6643 in.)

LASH ADJUSTER LEAK DOWN TEST**Caution**

1. The lash adjuster is a precision part. Keep it free from dust and other foreign matters.
2. Do not disassemble the lash adjusters.
3. When cleaning the lash adjusters, use clean diesel fuel only.

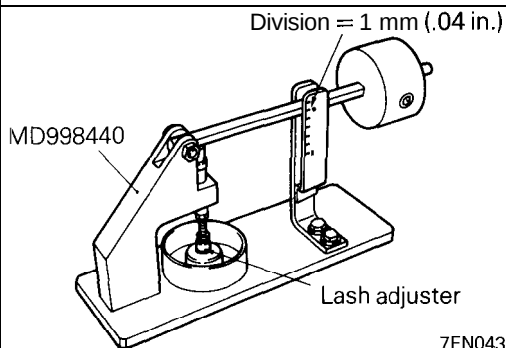


6EN057

- (1) Immerse the lash adjuster in clean diesel fuel.
- (2) While lightly pushing down the inner steel ball using the small wire, move the plunger up and down four or five times to bleed air.
Use of the Retainer facilitates the air bleeding of the rocker arm mounted type lash adjuster.
- (3) Remove the small wire and press the plunger. If the plunger is hard to be pushed in, the lash adjuster is normal. If the plunger can be pushed in all the way readily, bleed the lash adjuster again and test again. If the plunger is still loose, replace the lash adjuster.

Caution

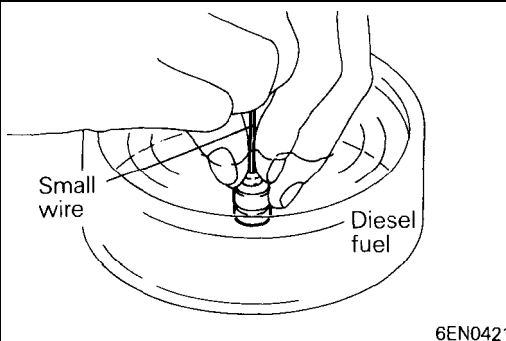
Upon completion of air bleeding, hold the lash adjuster upright to prevent the inside diesel fuel from spilling.



7EN0438

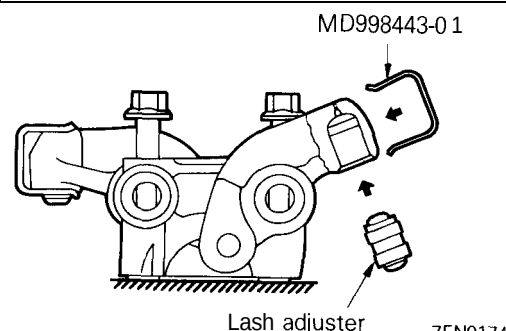
- (4) After air bleeding, set the lash adjuster on the special tool (Leak down tester MD998440).
- (5) After the plunger has gone down somewhat 0.2 – 0.5 mm (.008 – .020 in.), measure the time taken for it to go down 1 mm (.04 in.). Replace if the measured time is out of specification.

Standard value: 4 – 20 seconds / 1 mm (.04 in.)
[Diesel fuel at 15 – 20°C (50 – 68°F)]

INSTALLATION SERVICE POINTS**◆◆ LASH ADJUSTER INSTALLATION**

6EN0421

- (1) Immerse the lash adjuster in clean diesel fuel.
- (2) Using a small wire, move the plunger up and down 4 or 5 times while pushing down lightly on the check ball in order to bleed out the air.



7EN0174

- (3) Insert the lash adjuster to rocker arm, being careful not to spill the diesel fuel. Then use the special tool to prevent the adjuster from falling while installing it.

◆B◆ ROCKER ARM, SHAFT AND BEARING CAP INSTALLATION

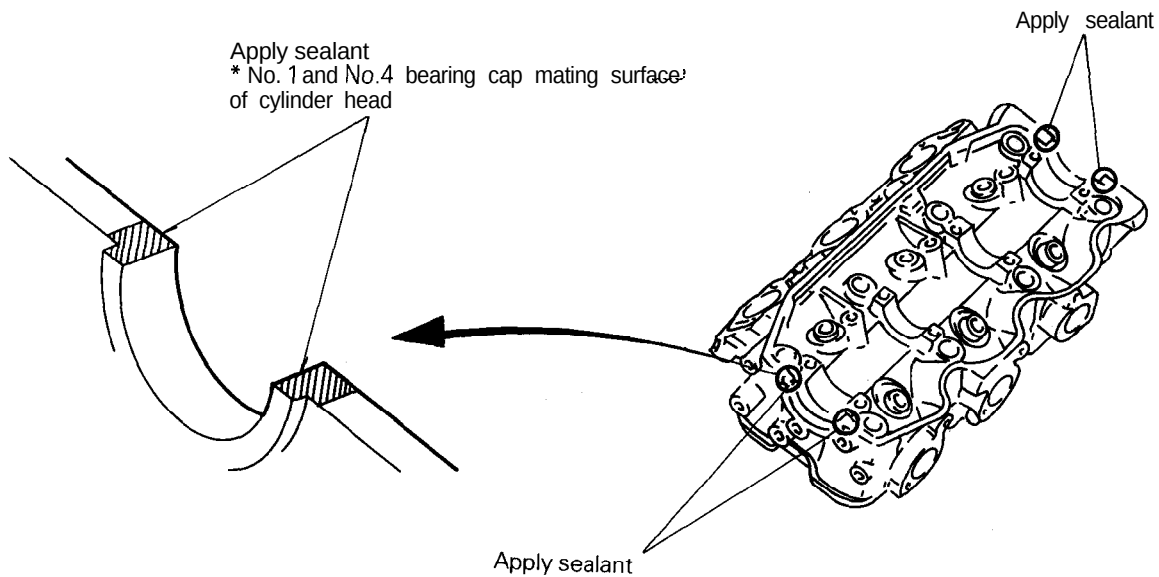
- (1) Apply a minimum amount of the specified sealant on the four places of the cylinder head.

NOTE

Be sure the sealing agent does not swell out onto the cam journal surface of the cylinder head. If it swells out, immediately wipe it off before it can dry.

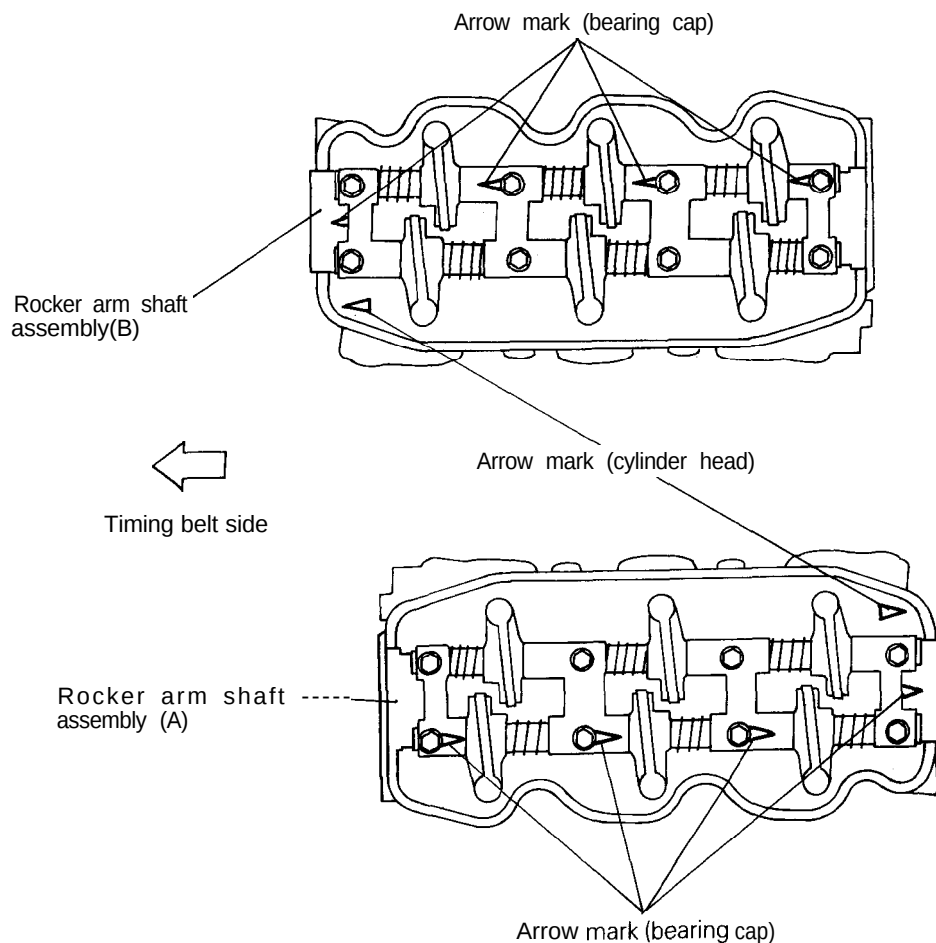
Specified sealant:

3M NUT Locking No. 4171 or equivalent

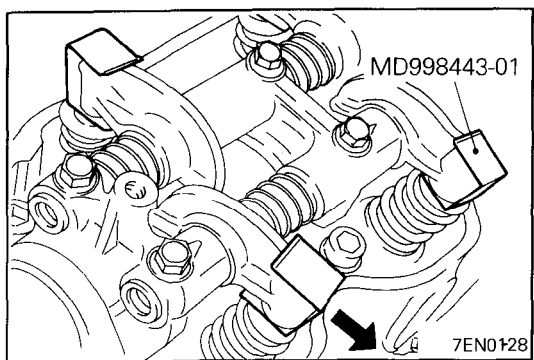


7EN0175

- (2) Install the rocker arms, shafts and bearing caps such that the arrow mark on the bearing cap faces in the same direction as the arrow mark on the cylinder head.



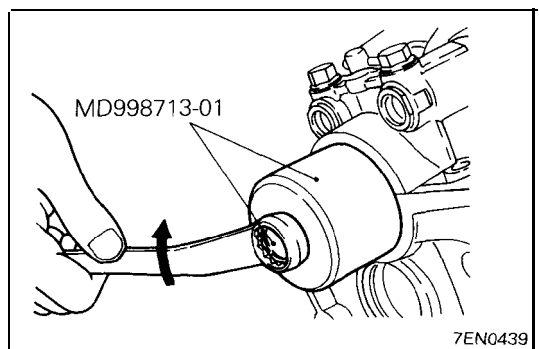
7EN0176

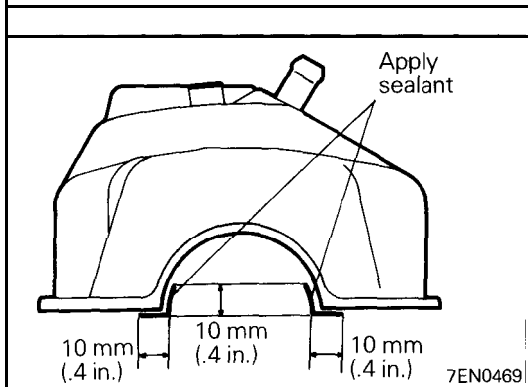
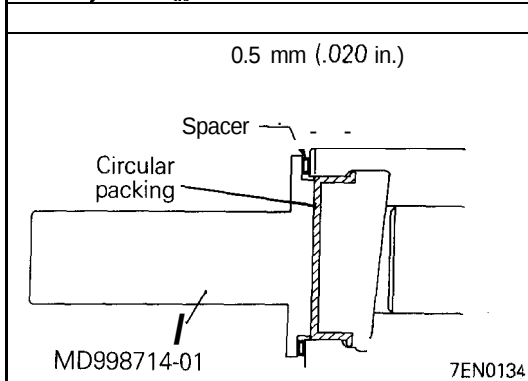
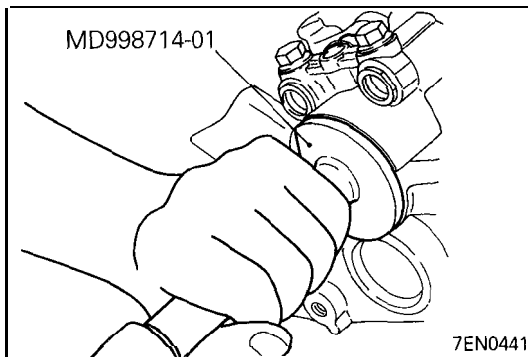


- (3) Tighten the bearing cap bolts to the specified torque.
- (4) Remove the special tools from all rocker arms.

⚡ CAMSHAFT OIL SEAL INSTALLATION

- (1) Apply a slight amount of engine oil all over the circumference of the camshaft oil seal lip.
- (2) Using the special tool, insert the oil seal.





◆D◆ CIRCULAR PACKING INSTALLATION

- (1) Install a 1.3 to 1.5 mm (.052 to .059 in.) thick spacer to the special tool and drive in the circular packing.

NOTE

Use of MD724328 spacer for transmission is recommended.

Caution

The packing is overdriven if no spacer is fitted to the special tool.

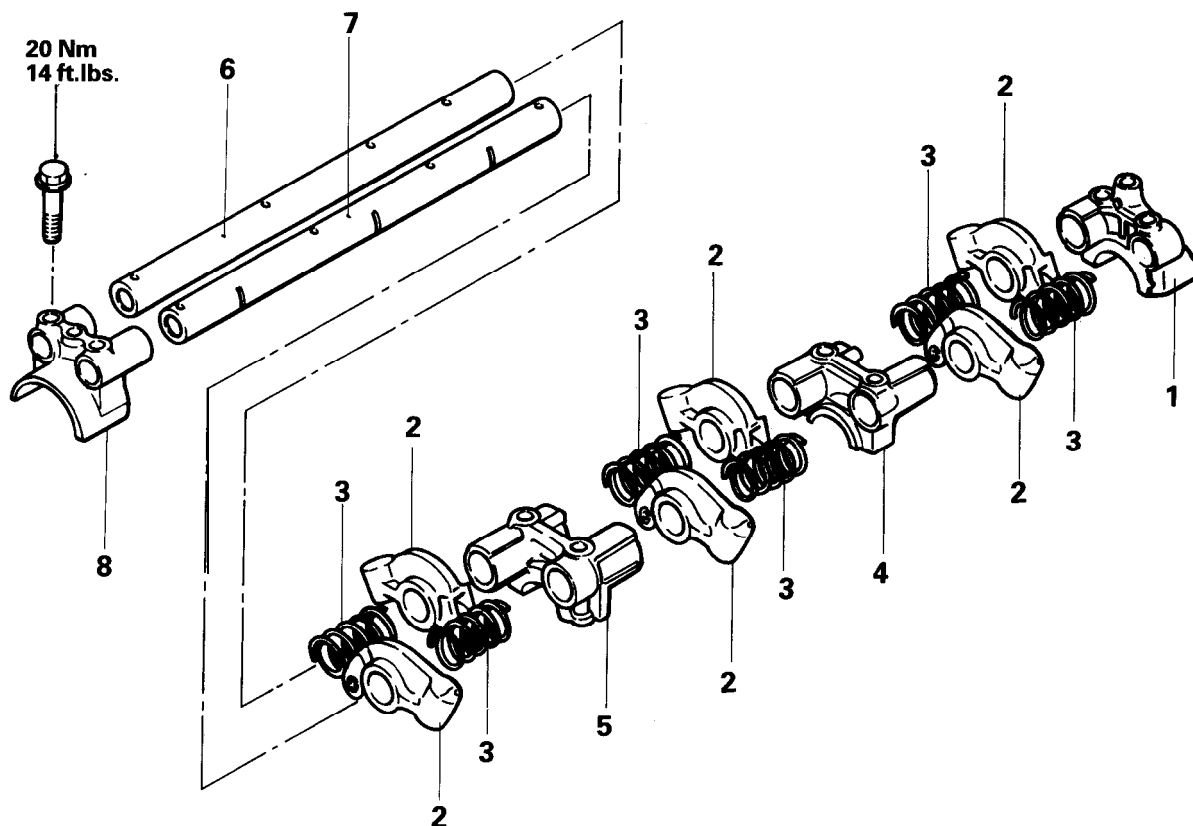
◆E◆ ROCKER COVER INSTALLATION

- (1) Apply specified sealant on the area specified in the illustration.

Specified sealant:

3M ATD Part No. 6660 or equivalent

DISASSEMBLY AND REASSEMBLY



Disassembly steps

- 1. Bearing cap No.4
- 2. Rocker arm
- 3. Spring
- 4. Bearing cap No. 3
- 5. Bearing cap No. 2
- 6. Rocker arm shaft "B"
- 7. Rocker arm shaft "A"
- 8. Bearing cap No. 1

7EN0078

DISASSEMBLY SERVICE POINT

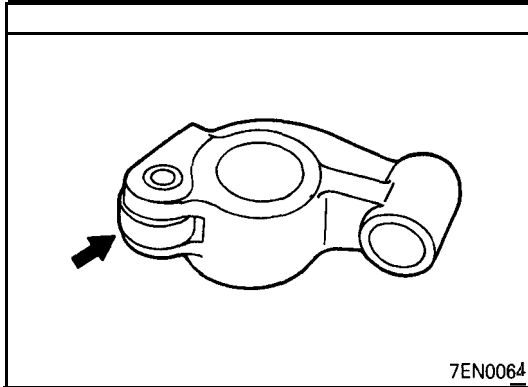
ROCKER ARM REMOVAL

(1) Before disassembly, identify the original location of each rocker arm by a symbol.

For example, put symbols as shown below.

1 IN: For No.1 cylinder intake

6EX: For No.6 cylinder exhaust



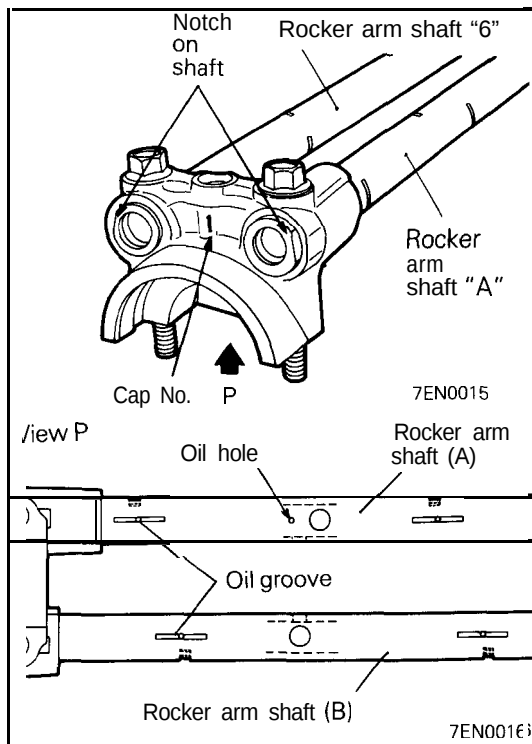
INSPECTION

ROCKER ARM

- (1) Check the roller surface and replace the rocker arm if recesses, damage or heat seizure is observed.
- (2) Check roller rotation and replace the rocker arm if uneven rotation or roller backlash is observed.
- (3) Check the inside diameter and replace the rocker arm if damage or seizure is observed.

ROCKER ARM SHAFT

- (1) Check the rocker arm mounting portions of the rocker arm shafts for wear or damage. Replace as necessary.
- (2) Check to ensure that the oil holes are clear.

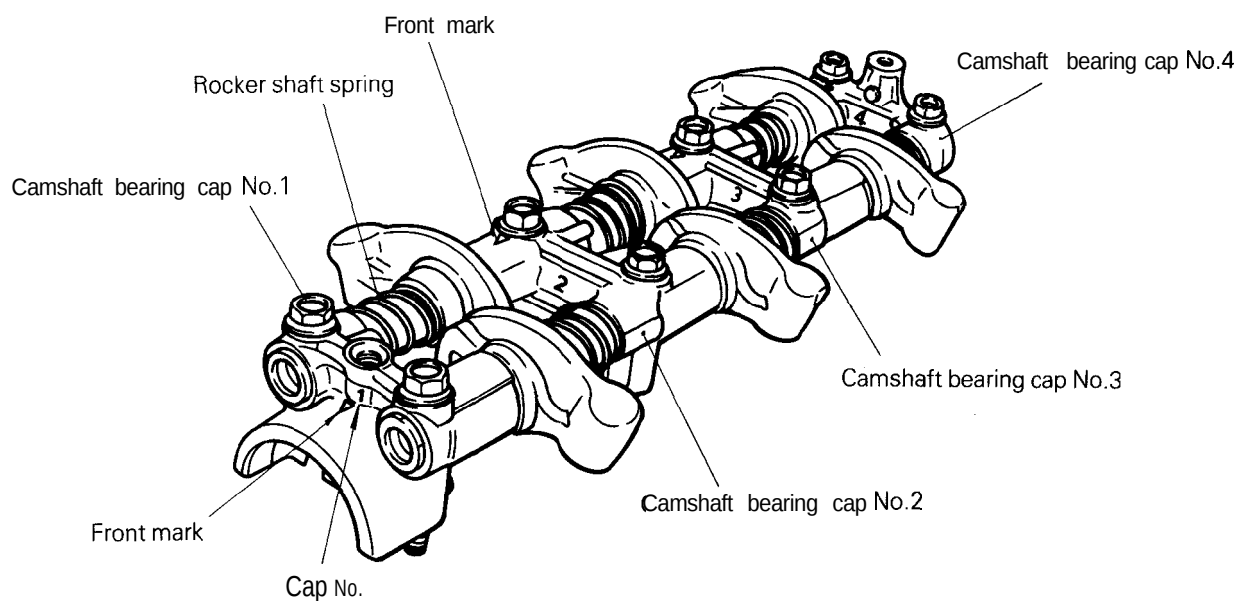


REASSEMBLY SERVICE POINT

ROCKER ARM SHAFT INSTALLATION

- (1) Install the rocker arm shafts "A" and "B" to the camshaft bearing cap No.1 and insert the bolts into the holes of the bearing cap and shafts.
- (2) Install the rocker arm shafts with the notched side facing the bearing cap No.1 and the oil grooved side facing downward. The shaft with a smaller oil hole is the rocker arm shaft "A".

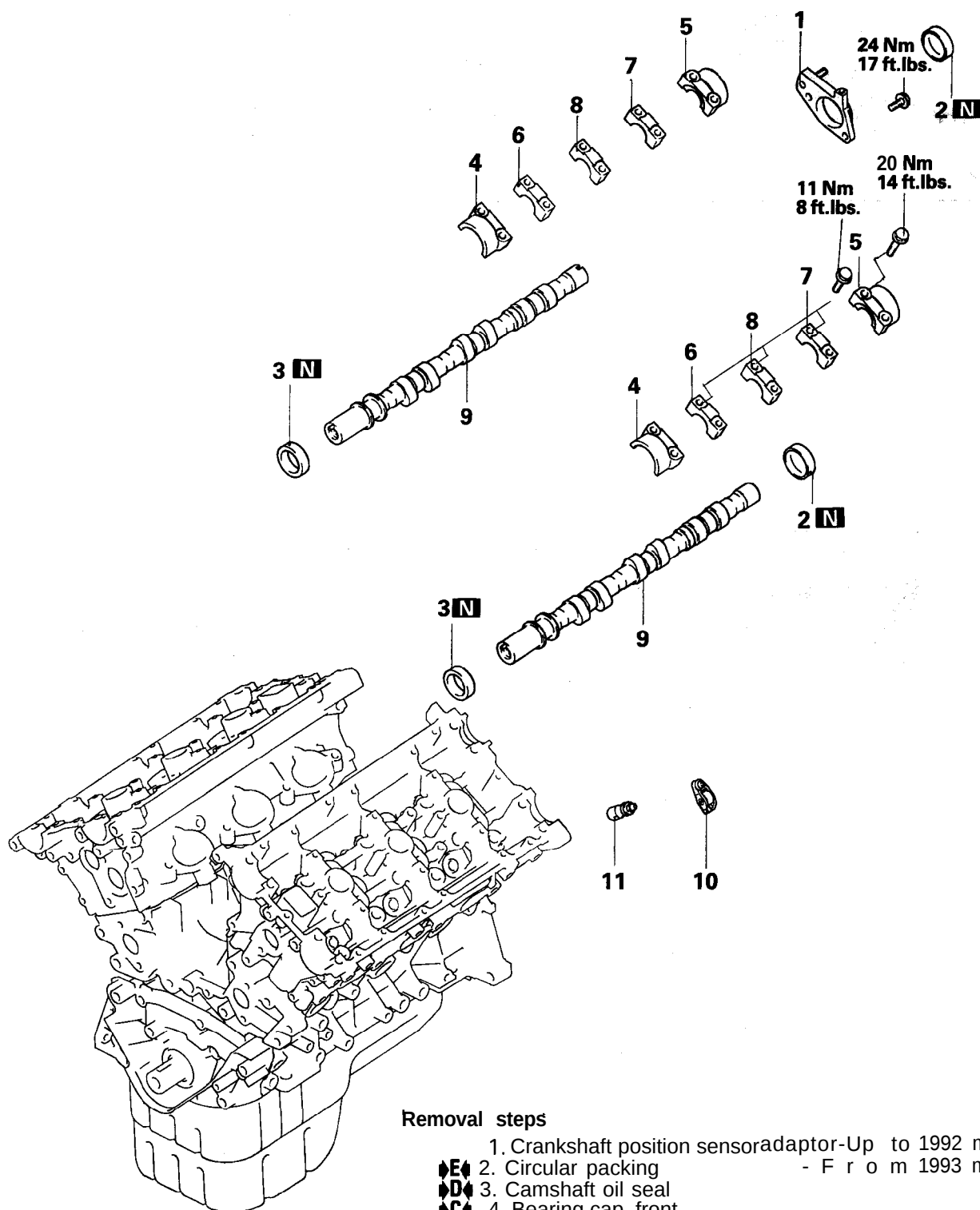
- (3) Install the rocker arms, springs and camshaft bearing caps as illustrated. The rocker arms are all equally shaped. Assemble the rocker arms according to the symbols put before disassembly. The bearing caps are also equally shaped. Assemble the caps according to the identification marks as to right and left banks put before disassembly.



7EN0079

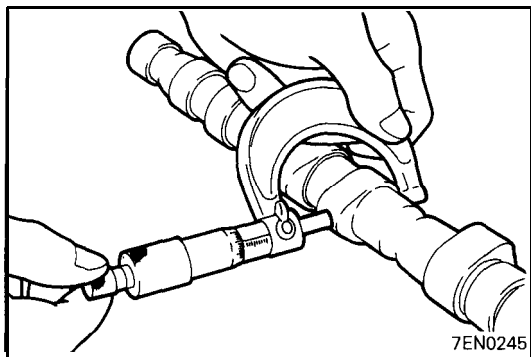
CAMSHAFTS, ROCKER ARMS AND BEARING CAPS — DOHC

REMOVAL AND INSTALLATION



Removal steps

1. Crankshaft position sensor adaptor-Up to 1992 models
- F r o m 1993 models
2. Circular packing
3. Camshaft oil seal
4. Bearing cap, front
5. Bearing cap, rear
6. Bearing cap No. 2
7. Bearing cap No. 4
8. Bearing cap No. 3
9. Camshaft
10. Rocker arm
11. Lash adjuster



INSPECTION

CAMSHAFT

Measure the cam height (longer diameter of the cam). If it exceeds the limit, replace the camshaft.

Standard value:

Up to 1992 models

Intake side 35.49 mm (1.3972 in.)

Exhaust side 35.20 mm (1.3858 in.)

From 1993 models

Intake side 34.91 mm (1.3744 in.)

Exhaust side 34.91 mm (1.3744 in.)

Limit:

Up to 1992 models

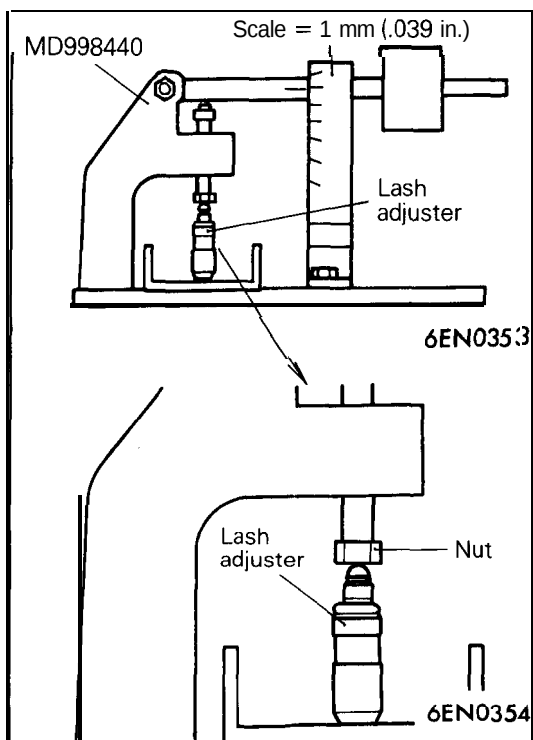
Intake side 34.99 mm (1.3778 in.)

Exhaust side 34.70 mm (1.3661 in.)

From 1993 models

Intake side 34.41 mm (1.3547 in.)

Exhaust side 34.41 mm (1.3547 in.)



LASH ADJUSTER LEAK DOWN TEST

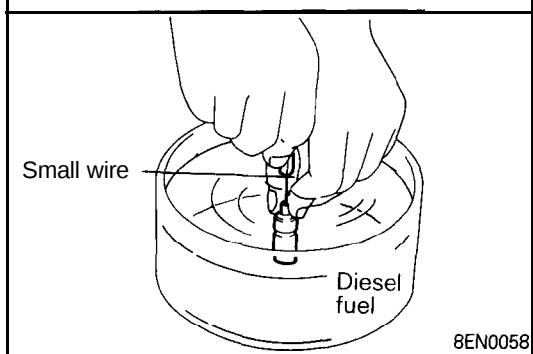
Refer to "LASH ADJUSTER LEAK DOWN TEST" on pages 11E-79 and 11 E-80. Also note the following:

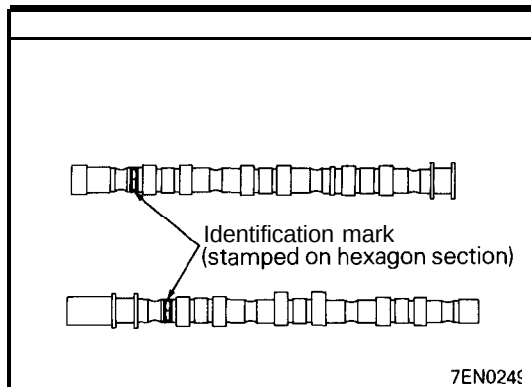
When the lash adjuster is set on a tester, remove the adjusting screw of the tester and adjust it to the height of the lash adjuster as shown in the illustration.

INSTALLATION SERVICE POINTS

◆A◆ LASH ADJUSTER INSTALLATION

- (1) Immerse the lash adjuster in clean diesel fuel.
- (2) Using a small wire, move the plunger up and down 4 or 5 times while lightly pushing down the check ball in order to bleed out the air.
- (3) Install the lash adjuster to the cylinder head.





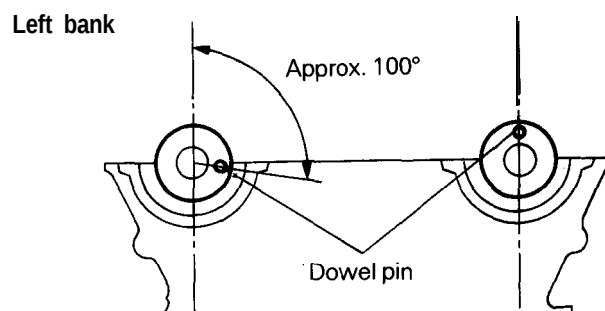
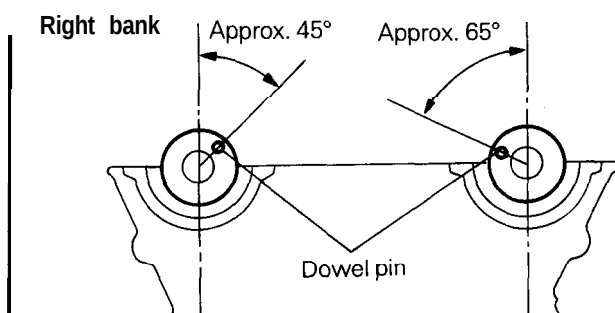
◆B◆ CAMSHAFT INSTALLATION

- (1) Turn the crankshaft to bring No.1 cylinder to the top dead center.
- (2) Check that the rocker arm is installed correctly on the lash adjuster and valve.
- (3) Install the camshaft while noting the identification mark (stamped on the hexagon section).

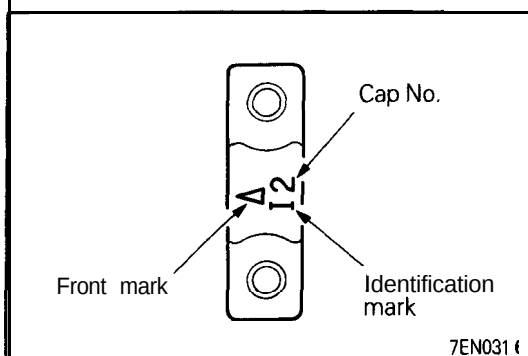
Identification mark:

		Up to 1992 models	From 1993 models
Turbo	Intake side	B	J
	Exhaust side	D	N
Non-turbo	Intake side	B	J
	Exhaust side	D	K

- (4) Install the camshafts with their dowel pins positioned as shown in the illustration.



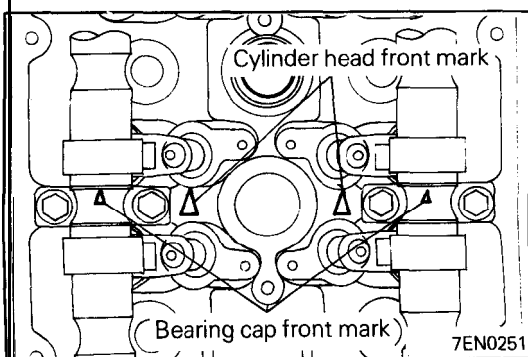
7EN0315



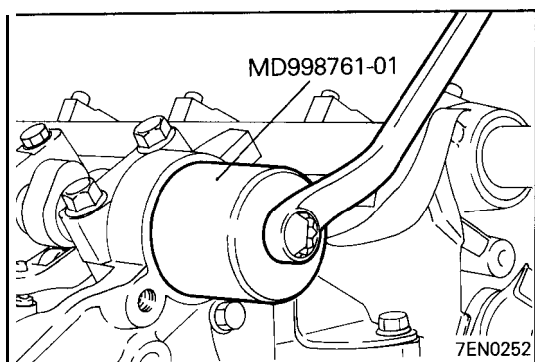
◆C◆ BEARING CAP INSTALLATION

- (1) Install the bearing caps according to the identification mark and cap number. No.2, 3 and 4 bearing caps bear the front mark. Install these caps with the front mark directed in the same direction as that on the cylinder head.

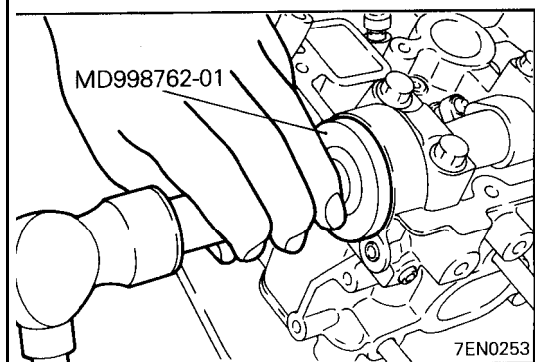
Identification mark: Intake side **I**
Exhaust side **E**



- (2) Gradually tighten the bearing caps in two or three steps. In the final step, tighten to the specified torque.

**◆◆ CAMSHAFT OIL SEAL**

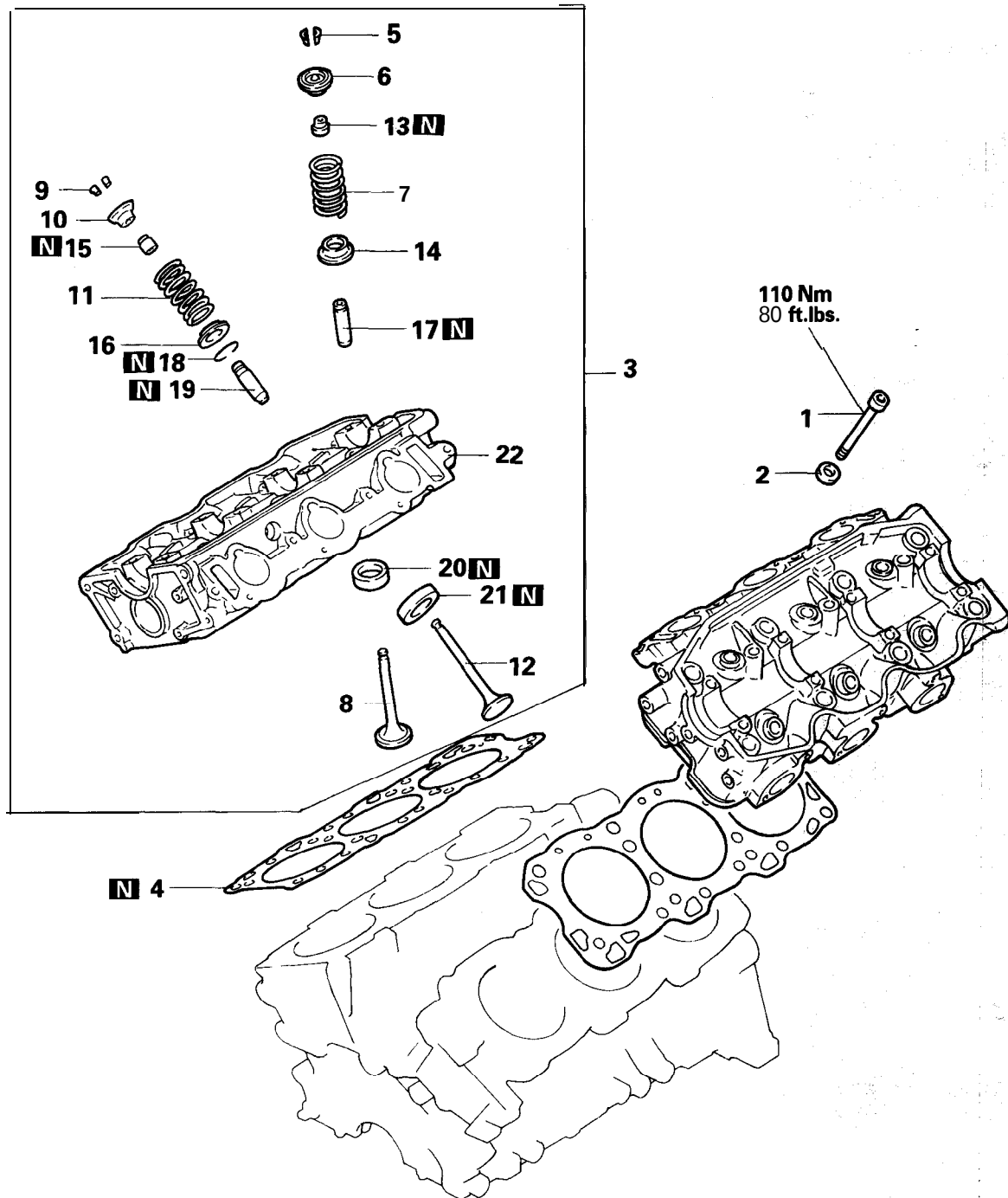
- (1) Apply engine oil sparingly all around the lip of the camshaft oil seal.
- (2) Using the special tool, install the oil seal.

**◆E CIRCUAR PACKING**

- (1) Install the circular packing with the special tool.

CYLINDER HEAD AND VALVE – SOHC

REMOVAL AND INSTALLATION

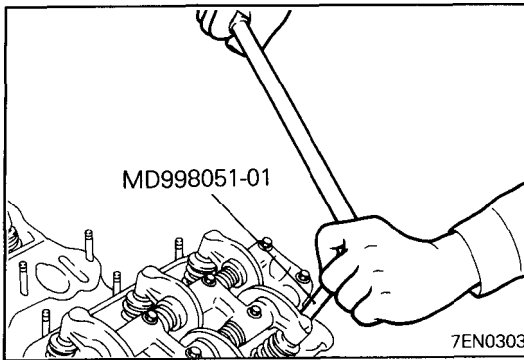


Removal steps

- ◊A◊ ◊E◊ 1. Cylinder head bolt
- 2. Washer
- 3. Cylinder head assembly
- ◊D◊ ◊C◊ 4. Cylinder head gasket
- ◊B◊ ◊C◊ 5. Retainer lock
- ◊B◊ 6. Valve spring retainer
- ◊B◊ 7. Valve spring
- ◊B◊ ◊C◊ 8. Inlet valve
- ◊B◊ ◊C◊ 9. Retainer lock
- 10. Valve spring retainer

- ◊B◊ 11. Valve spring
- 12. Exhaust valve
- ◊C◊ ◊A◊ 13. Valve stem seal
- ◊C◊ ◊A◊ 14. Valve spring seat
- ◊C◊ ◊A◊ 15. Valve stem seal
- 16. Valve spring seat
- 17. Inlet valve guide
- 18. Snap ring
- 19. Exhaust valve guide
- 20. Inlet valve seat
- 21. Exhaust valve seat
- 22. Cylinder head

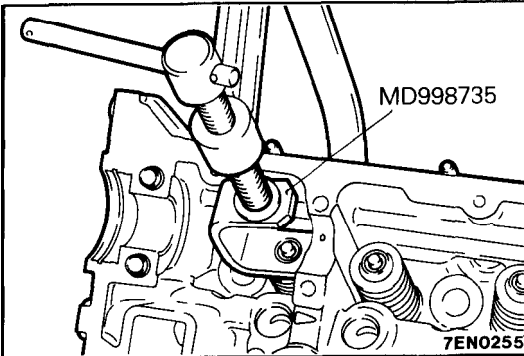
7EN0522

**REMOVAL SERVICE POINTS****PRECAUTION FOR REMOVED PARTS**

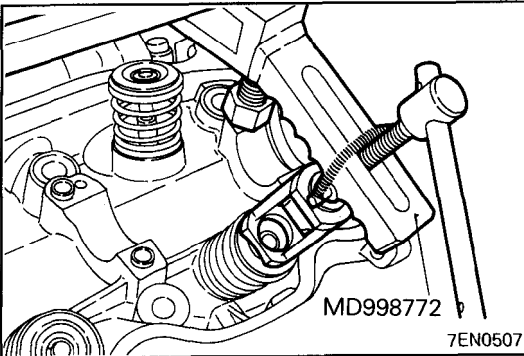
- (1) Keep removed parts in order according to the cylinder number and intake/exhaust.

◊A◊ CYLINDER HEAD BOLT REMOVAL

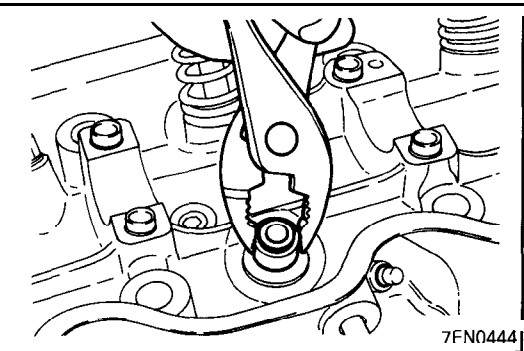
- (1) Using the special tool, loosen the cylinder head bolts. Loosen evenly, little by little.

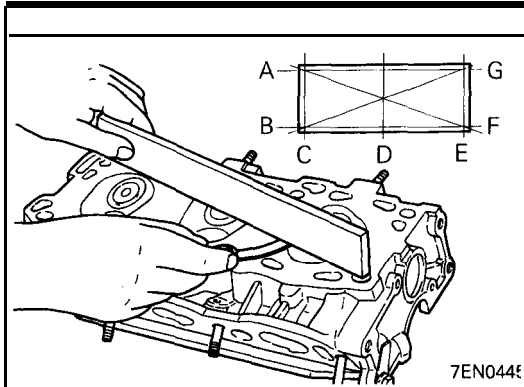
**◊B◊ RETAINER LOCK REMOVAL**

- (1) Using the special tool, compress the spring.
- (2) Remove the retainer locks.

**◊C◊ VALVE STEM SEAL REMOVAL**

- (1) Do not reuse removed valve stem seals.



**INSPECTION****CYLINDER HEAD**

- (1) Check the cylinder head gasket surface for flatness by using a straightedge in the directions of A through G shown in the illustration.

Standard value: 0.05 mm (.0020 in.)

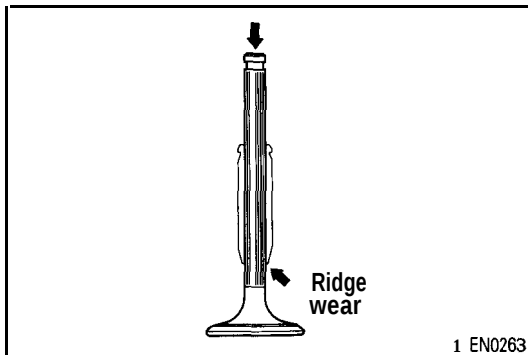
Limit: 0.2 mm (.008 in.)

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

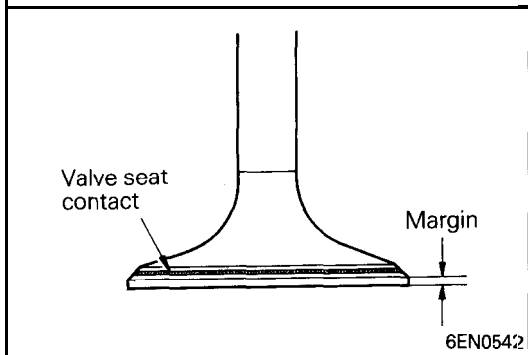
Grinding limit: *0.2 mm (.008 in.)

* Total resurfacing depth of both cylinder head and cylinder block.

Overall height: 84 mm (3.31 in.)

**VALVE**

- (1) If the valve stem is worn (ridge wear) or otherwise damaged, replace. Also replace the valve if the stem end (that contacts the rocker arm adjusting screw) has a dent.



- (2) 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 center of valve face.
- (3) If the margin exceeds the service limit, replace the valve.

Standard value:

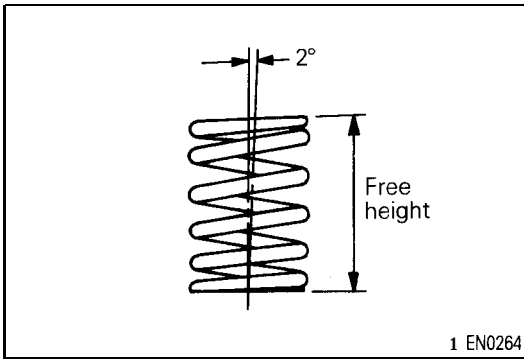
Intake 1.2 mm (.047 in.)

Exhaust 2.0 mm (.079 in.)

Limit:

Intake 0.7 mm (.028 in.)

Exhaust 1.5 mm (.059 in.)

**VALVE SPRINGS**

- (1) Measure the free height of the spring and, if it is smaller than the limit, replace.

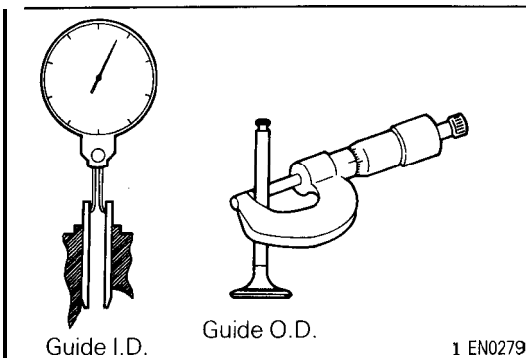
Standard value:

SOHC		49.8 mm (1.961 in.)
DOHC		
up to 1992 models		45.2 mm (1.780 in.)
From 1993 models		46.4 mm (1.827 in.)

Limit:

SOHC		48.8 mm (1.921 in.)
DOHC		
up to 1992 models		44.2 mm (1.740 in.)
From 1993 models		45.4 mm (1.878 in.)

- (2) Measure the squareness of the spring and, if the limit is exceeded, replace.

Standard value: 2°**Limit: 4°****VALVE GUIDES**

- (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	0.03 – 0.06 mm (.0012 – .0024 in.)
Exhaust	0.05 – 0.09 mm (.0020 – .0035 in.)

Limit

Intake	0.10 mm (.0039 in.)
Exhaust	0.15 mm (.0059 in.)

VALVE SEAT RECONDITIONING PROCEDURES

- (1) Before valve seat reconditioning, check the valve stem-to-guide clearance.
- (2) Recondition the valve seat with a seat grinder or cutter. The valve seat width should be the specified value at the center of the valve face.

Inspect the valve seat with prussian blue to determine where the valve contacts the seat. To do this, coat the valve seat lightly with prussian blue, and then set the valve in place.

Rotate the valve with a light pressure. If the blue is transferred to the center of the valve face, contact is satisfactory.

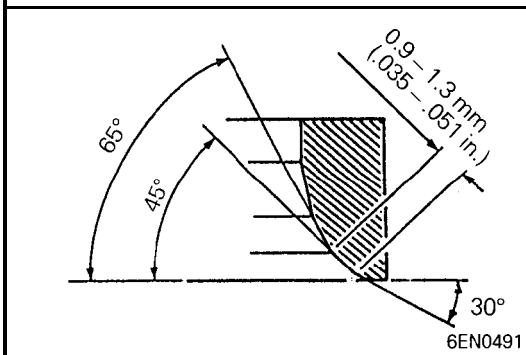
If the blue is transferred to the top edge of the valve face, lower the valve seat with a 30 degrees stone or cutter. If the blue is transferred to the bottom edge of the valve face, raise the valve seat with a 65 degrees stone or cutter.

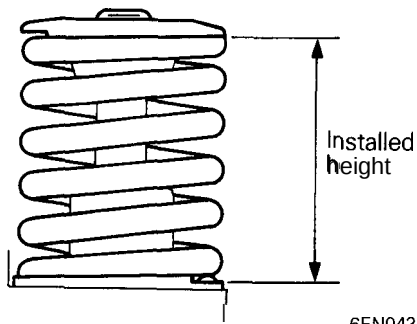
Valve seat diameter:

Intake	44 mm (1.73 in.)
Exhaust	38 mm (1.50 in.)

Seat width: 0.9 – 1.3 mm (.035 – .051 in.)

- (3) The valve and valve seat should be lapped with lapping compound.

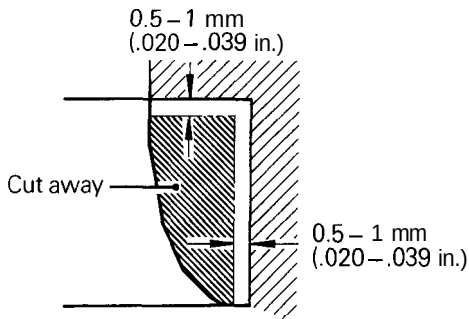




6EN0432

(4) Check the valve seat sinkage.

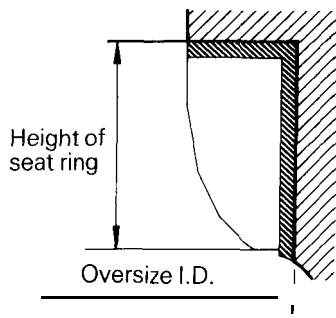
The valve seat sinkage can be determined by measuring the valve spring's installed height. (If the valve seat sinkage is great, the valve seat's installed height also is great.) If the valve spring's installed height exceeds the service limit, replace the insert with an oversize part as described below.

Installed height of spring (both intake and exhaust)**Standard value: 40.4 mm (1.591 in.)****Limit: 41.4 mm (1.630 in.)**

1 EN0274

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.



1 EN0275

- (2) Rebore the valve seat hole in the cylinder head to a selected oversize valve seat diameter.

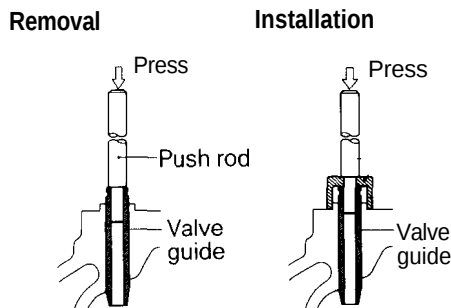
Intake valve seat hole diameter**0.30 O.S.: 44.30 – 44.33 mm (1.7441 – 1.7453 in.)****0.60 O.S.: 44.66 – 44.63 mm (1.7559 – 1.7571 in.)****Exhaust valve seat hole diameter****0.30 O.S.: 38.30 – 38.33 mm (1.5079 – 1.5091 in.)****0.60 O.S.: 38.60 – 38.63 mm (1.5197 – 1.5209 in.)**

- (3) Before fitting the valve seat, either heat the cylinder head up to approximately 250°C (482°F) or cool the valve seat in liquid nitrogen, to prevent the cylinder head bore from galling.

- (4) Using a valve seat cutter, correct the valve seat to the specified width and angle.

See "VALVE SEAT RECONDITIONING PROCEDURE".

504



6EN0543

VALVE GUIDE REPLACEMENT PROCEDURE

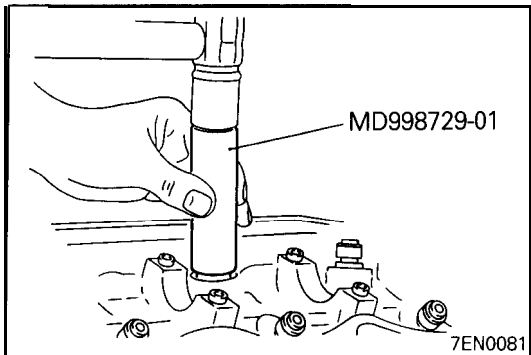
- (1) Remove the snap ring from the exhaust valve; guide.
- (2) Using the push rod and a press, remove the valve guide toward the cylinder head gasket surface.
- (3) Rebore the valve guide hole to the new oversize valve guide outside diameter.

Valve guide hole diameter**0.05 O.S.: 13.05 – 13.07 mm (.5138 – .5145 in.)****0.25 O.S.: 13.25 – 13.27 mm (.5217 – .5224 in.)****0.50 O.S.: 13.50 – 13.52 mm (.5315 – .5322 in.)**

NOTE

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

- (4) Using the special tool, press-fit the valve guide, working from the cylinder head top surface.
- (5) After installing valve guides, insert new valves in them to check for sliding condition.
- (6) When valve guides have been replaced, check for valve contact and correct the valve seats as necessary.



INSTALLATION SERVICE POINTS

◆A◆ VALVE STEM SEAL INSTALLATION

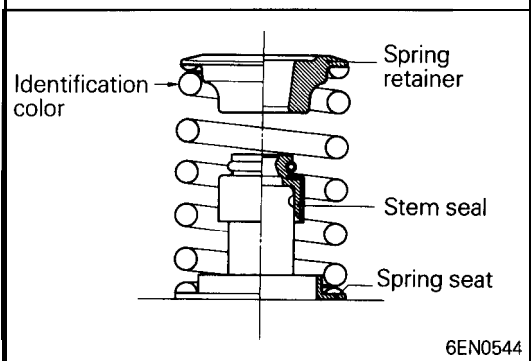
- (1) Install the valve spring seat.
- (2) Using the special tool, install a new stem seal to the valve guide.

Caution

Do not reuse removed valve stem seals.

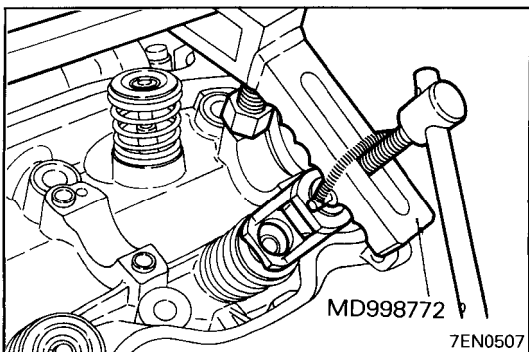
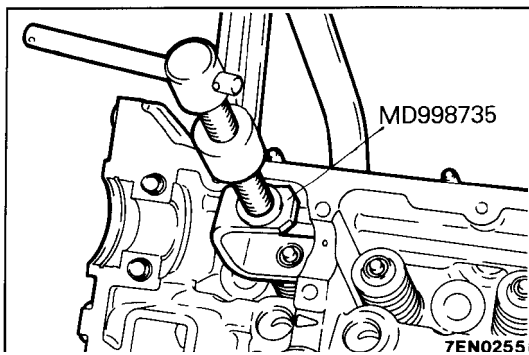
◆B◆ VALVE SPRING INSTALLATION

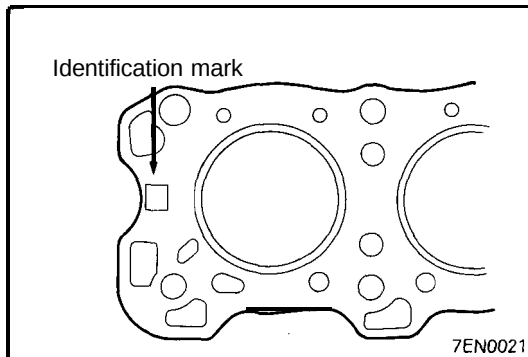
- (1) Direct the valve spring end with identification color toward the spring retainer.



◆C◆ RETAINER LOCK INSTALLATION

- (1) Using the special tool, compress the valve spring and insert the retainer lock into position.

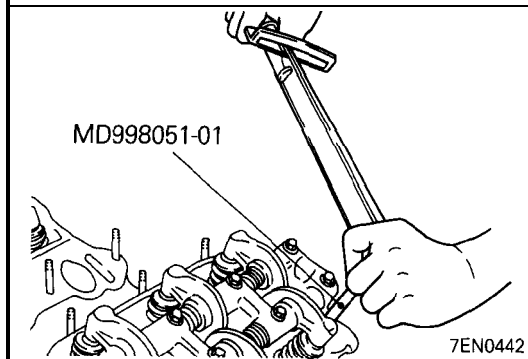


**◆D◆ CYLINDER HEAD GASKET IDENTIFICATION****Caution**

Do not apply sealant to the cylinder head gasket.

Identification mark:

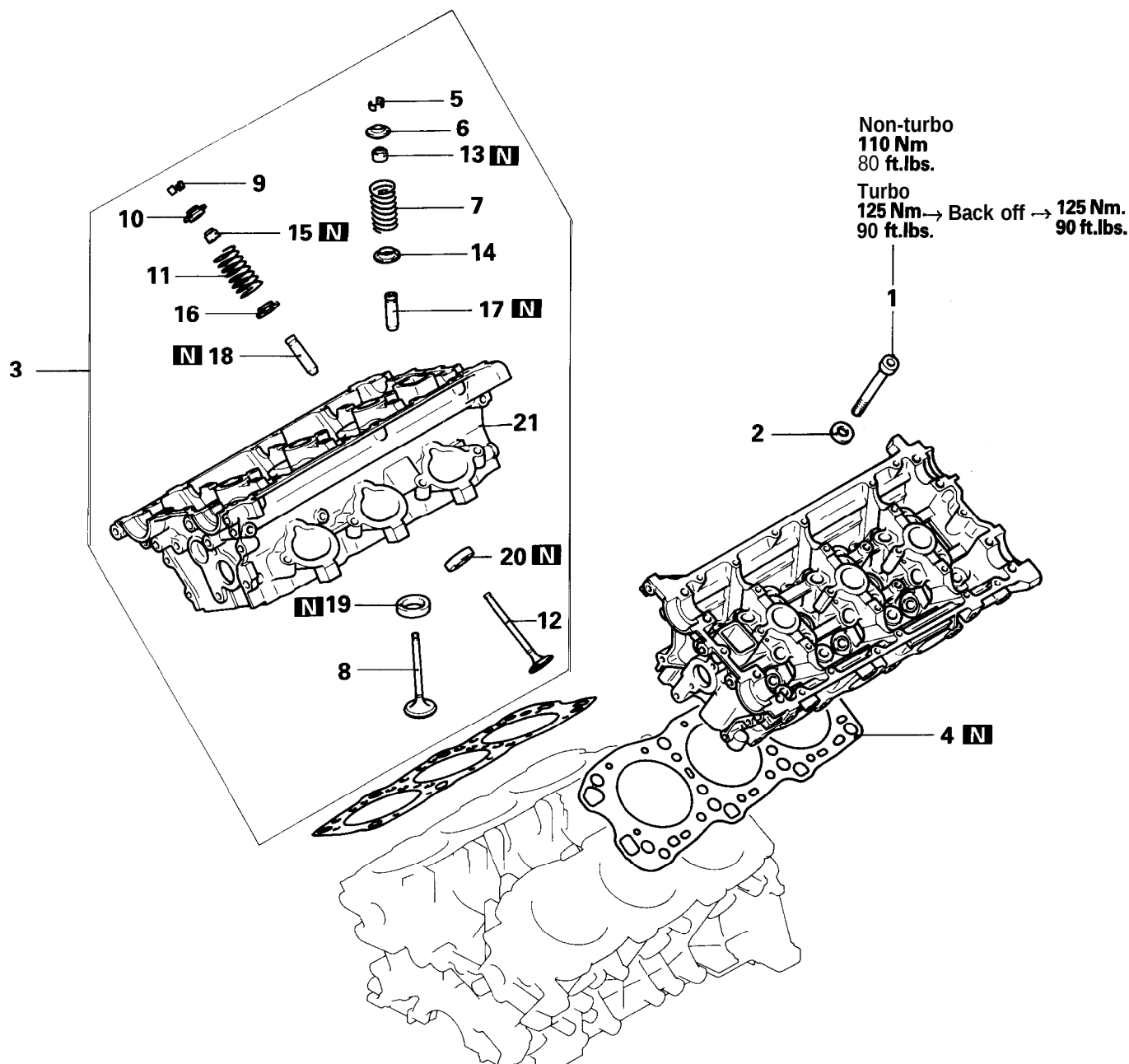
DIAMANTE and MONTERO 72
TRUCK 72W

**◆E◆ CYLINDER HEAD BOLT INSTALLATION**

- (1) Tighten the cylinder head bolts in the sequence shown. Each bolt should be tightened in two to three steps, torquing progressively. Tighten to the specified torque in the final sequence.

CYLINDER HEAD AND VALVES – DOHC

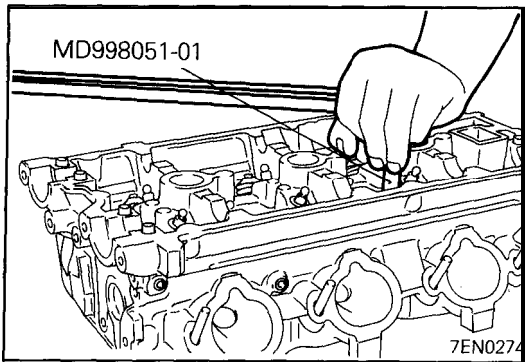
REMOVAL OF INSTALLATION



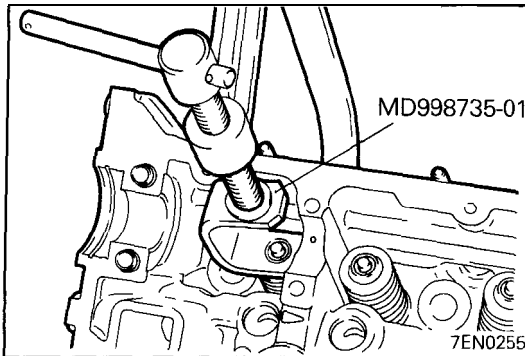
Removal steps

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

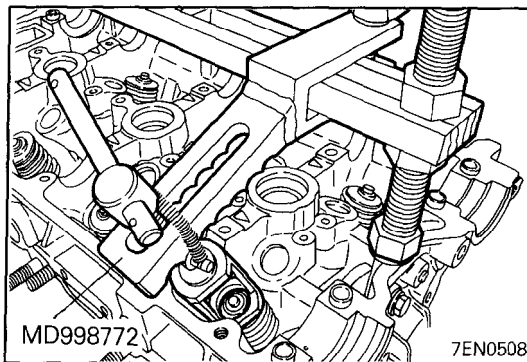
- ♦B▶ 11. Valve spring
- 12. Exhaust valve
- ◀C▶ ♦A▶ 13. Valve stem seal
- 14. Valve spring seat
- ◀C▶ ♦A▶ 15. Valve stem seal
- 16. Valve spring seat
- 17. Intake valve guide
- 18. Exhaust valve guide
- 19. Intake valve seat
- 20. Exhaust valve seat
- 21. Cylinder head

**REMOVAL SERVICE POINTS****◊A◊ CYLINDER HEAD BOLT REMOVAL**

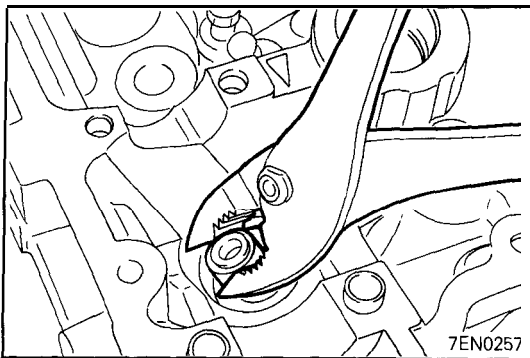
- (1) Using the special tool, loosen the cylinder head bolts.
Loosen evenly, little by little.

**◊B◊ RETAINER LOCK REMOVAL**

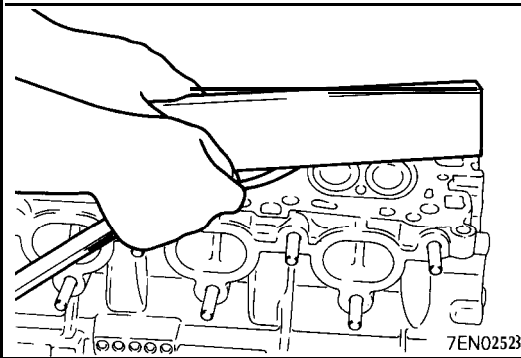
- (1) Using the special tool, compress the spring.
- (2) Remove the retainer locks.

**◊C◊ VALVE STEM SEAL REMOVAL**

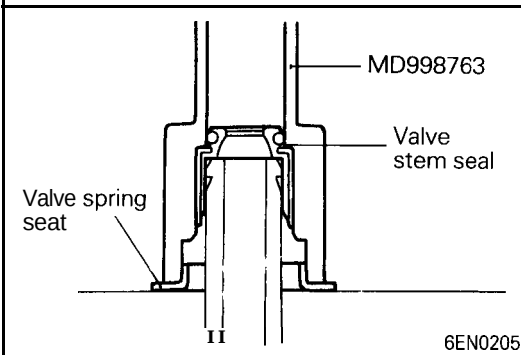
- (1) Do not reuse removed stem seals.

**INSPECTION**

For inspection, only variations from the SOHC engine are described below.
(Refer to page 11 E-93, 94, 95 and 96)

**CYLINDER HEAD**

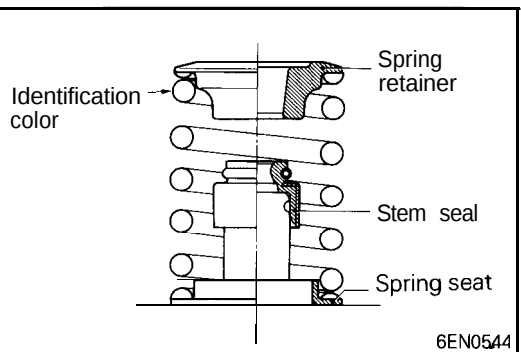
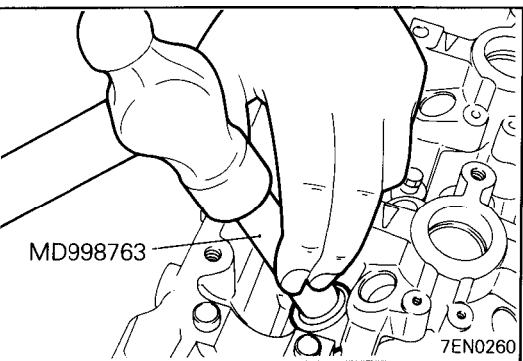
Cylinder head height (when new):
131.9 – 132.1 mm (5.193 – 5.201 in.)

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

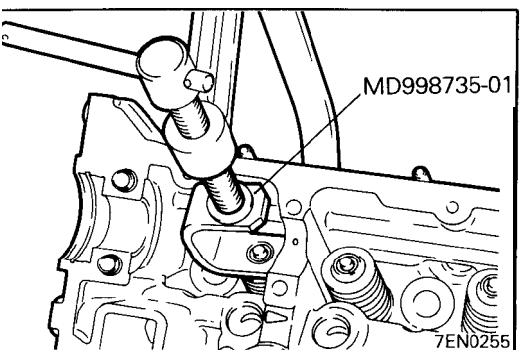
- (1) Install the valve spring seat.
- (2) Using the special tool, install a new stem seal to the valve guide.

Caution

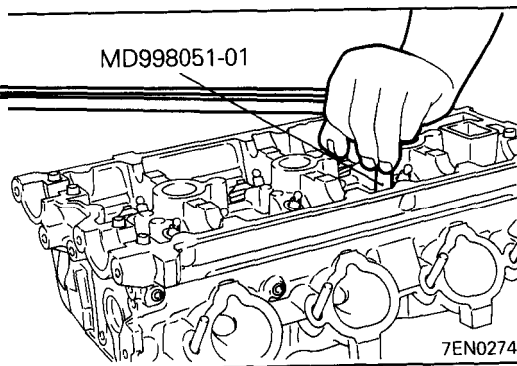
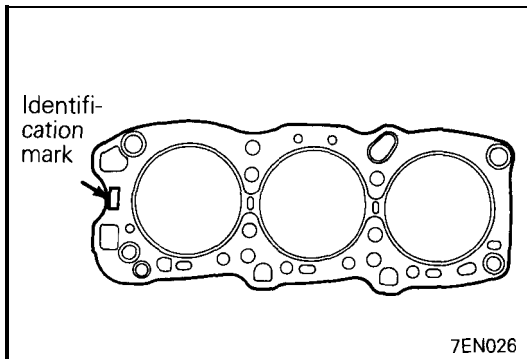
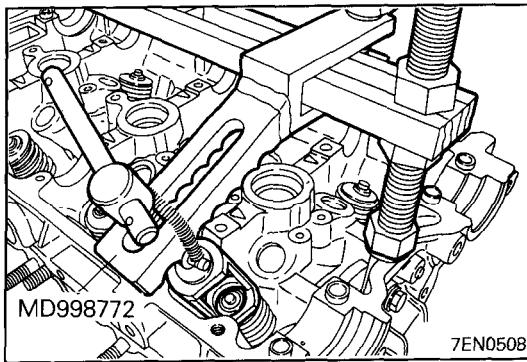
Do not reuse removed valve stem seal.

**▶▶ VALVE SPRING INSTALLATION**

- (1) Install the valve spring so that the end with identification color is positioned on the rocker arm end.

**▶▶ INSTALLATION OF RETAINER LOCKS**

- (1) Using the special tool, compress the valve spring and insert the retainer lock into position.



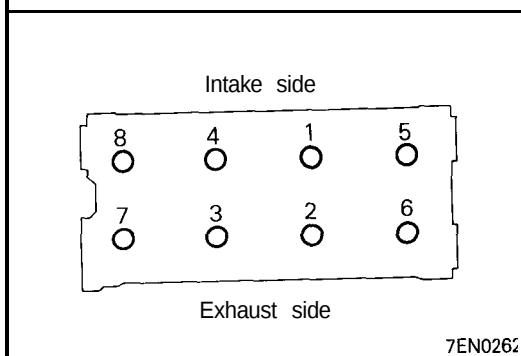
◆D◆ CYLINDER HEAD GASKET IDENTIFICATION

Identification mark	
Non-turbo	2DN
Turbo	2DT

◆E◆ CYLINDER HEAD BOLT INSTALLATION

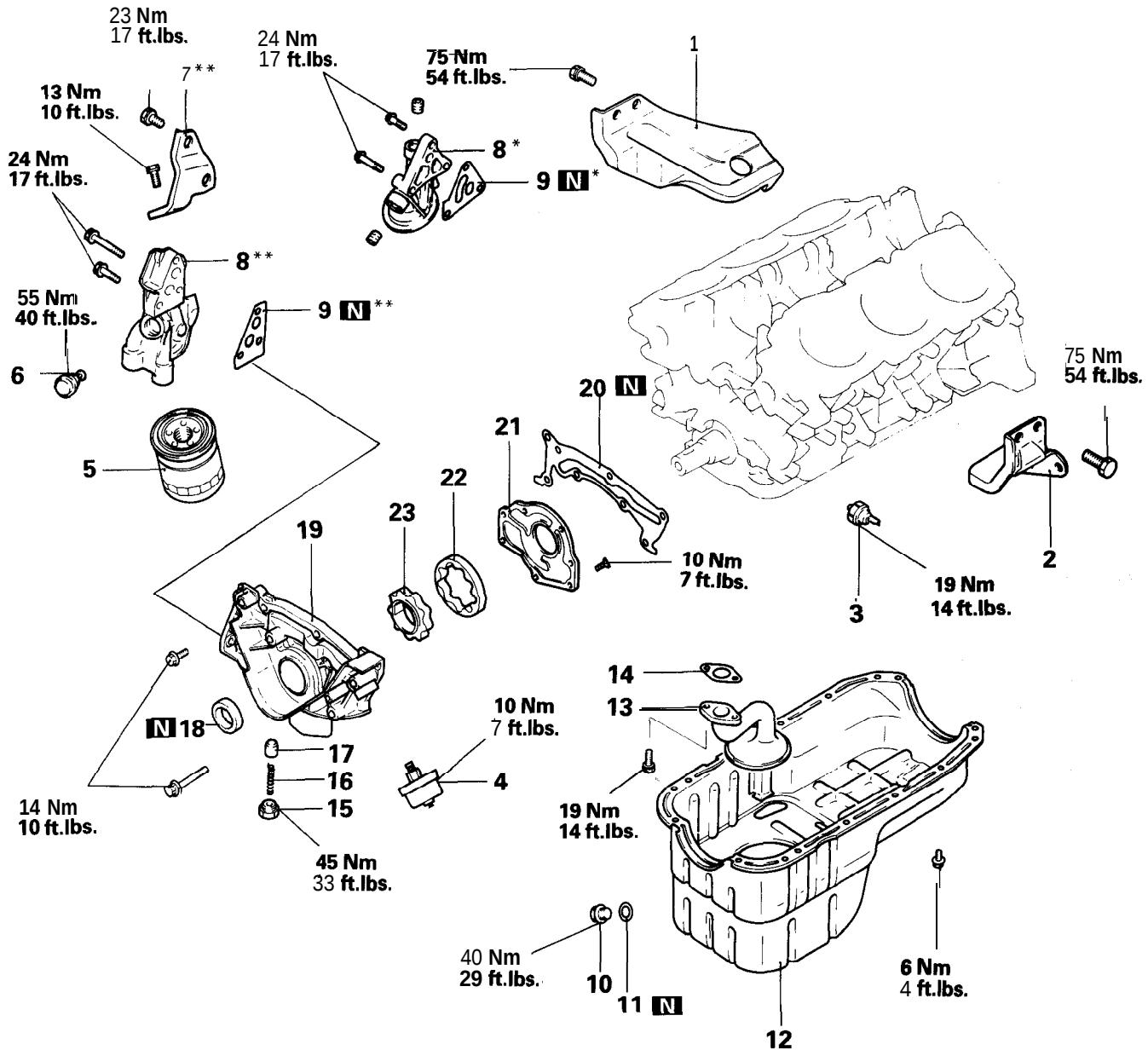
<Turbo engine>

- (1) Tighten the bolts in two to three stages in the illustrated sequence.
- (2) Back off the bolts once and tighten them to the specified torque in the same procedure as shown in step (1).



OIL PAN AND OIL PUMP

REMOVAL AND INSTALLATION – DIAMANTE and 3000GT



Removal steps

1. Transmission stay, right
2. Transmission stay, left
- ♦G♦ 3. Oil pressure switch
- ♦F♦ 4. Oil pressure gauge unit
- ♦E♦ 5. Oil filter
6. Oil cooler by-pass valve***
7. Oil filter bracket stay
8. Oil filter bracket
9. Oil filter bracket gasket
10. Drain plug
- ♦D♦ 11. Drain plug gasket
- ♦A♦ ♦C♦ 12. Oil pan
13. Oil screen
14. Oil screen gasket
15. Plug

16. Relief spring
17. Relief plunger
- ♦B♦ 18. Crankshaft oil seal
19. Oil pump case
20. Oil pump gasket
21. Oil pump cover
- ♦B♦ ♦A♦ 22. Oil pump outer rotor
- ♦B♦ ♦A♦ 23. Oil pump inner rotor

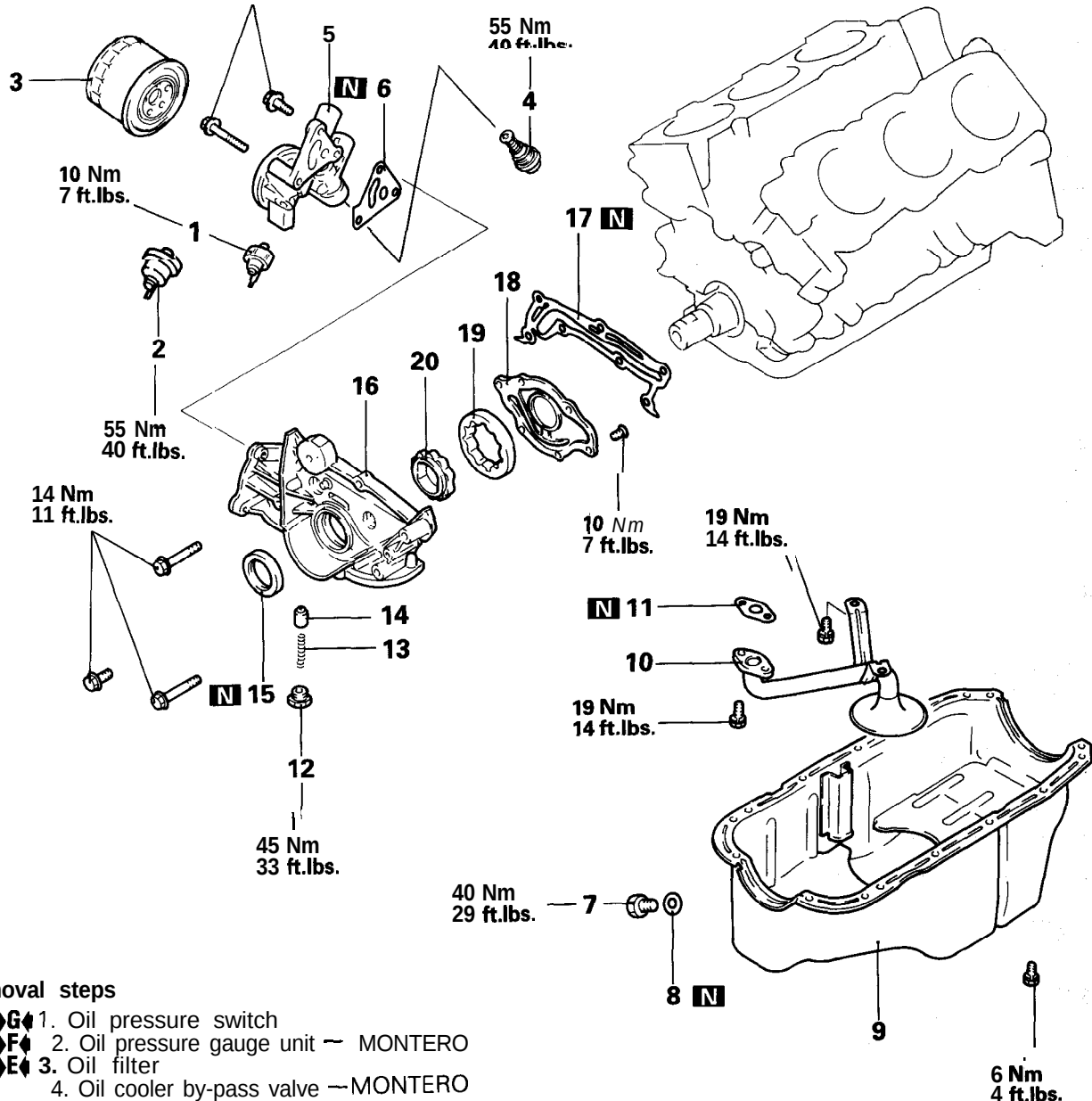
NOTE

*: SOHC
 **: DOHC
 ***: DOHC Turbo

REMOVAL AND INSTALLATION – MONTERO and TRUCK

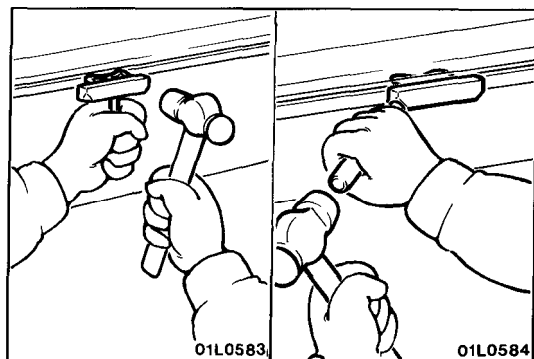
Bolt with head mark "4" **24 Nm**
17 ft.lbs.

Bolt with head mark "7" **14 Nm**
10 ft.lbs.

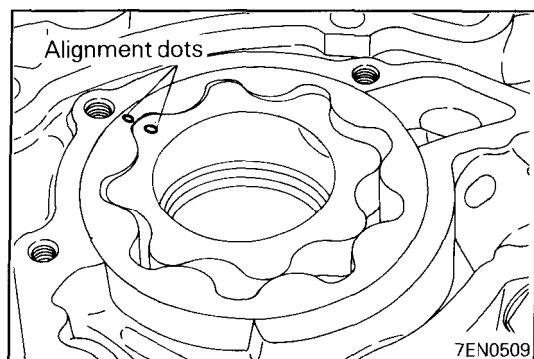


Removal steps

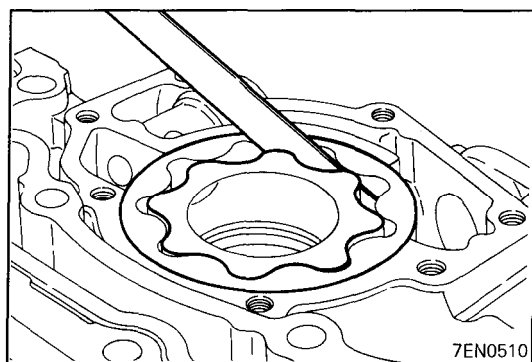
- ◆G◆ 1. Oil pressure switch
- ◆F◆ 2. Oil pressure gauge unit — MONTERO
- ◆E◆ 3. Oil filter
- 4. Oil cooler by-pass valve — MONTERO
- 5. Oil filter bracket
- 6. Oil filter bracket gasket
- 7. Drain plug
- ◆D◆ 8. Drain plug gasket
- ◆A◆ ◆C◆ 9. Oil pan
- 10. Oil screen
- 11. Oil screen gasket
- 12. Plug
- 13. Relief spring
- 14. Relief plunger
- ◆B◆ 15. Crankshaft oil seal
- 16. Oil pump case
- 17. Oil pump gasket
- 18. Oil pump cover
- ◆B◆ ◆A◆ 19. Oil pump outer rotor
- ◆B◆ ◆A◆ 20. Oil pump inner rotor

**REMOVAL SERVICE POINT****◇A◇ OIL PAN REMOVAL**

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

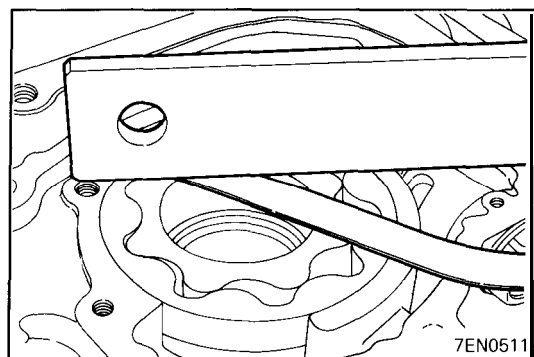
**◇B◇ OUTER ROTOR / INNER ROTOR REMOVAL**

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

**INSPECTION****OIL PUMP**

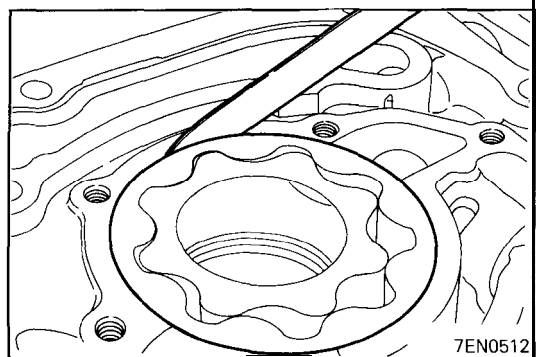
- (1) Check the tip clearance.

Standard value: 0.03 – 0.08 mm (.0012 – .0031 in.)



- (2) Check the side clearance.

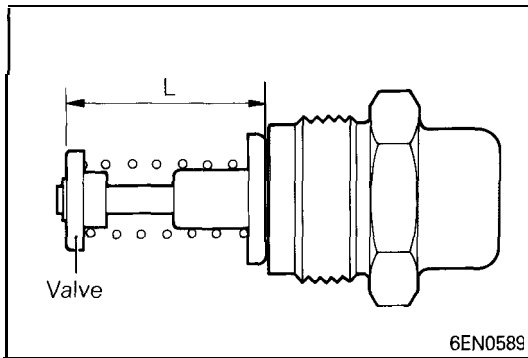
Standard value: 0.04 – 0.10 mm (.0016 – .0039)



- (3) Check the body clearance.

Standard value: 0.10 – 0.18 mm (.0040 – .0070)

Limit: 0.35 mm (.0138)

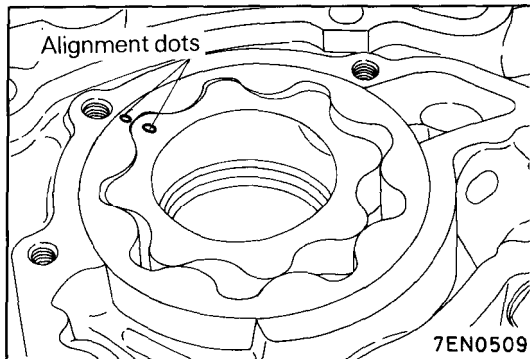
**OIL COOLER BYPASS VALVE**

- (1) Make sure that the valve moves smoothly.
- (2) Ensure that the dimension L measures the standard value under normal temperature and humidity.

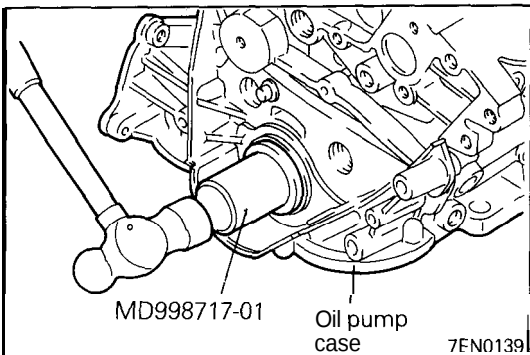
Dimension L: 34.5 mm (1.358 in.)

- (3) The dimension must be the standard value when measured after the valve has been dipped in 100°C (212°F) oil.

Dimension L: 40 mm (1.57 in.) or more

**INSTALLATION SERVICE POINTS****◆A◆ INNER ROTOR / OUTER ROTOR INSTALLATION**

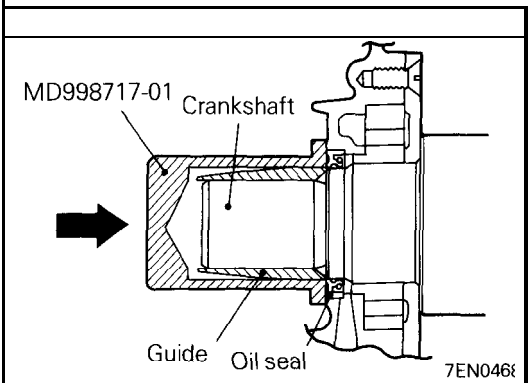
- (1) Apply engine oil to the rotors. Then, install the rotors ensuring that the alignment dots made at disassembly are properly aligned.

**◆B◆ CRANKSHAFT FRONT OIL SEAL INSTALLATION**

- (1) Using the special tool, knock the oil seal into the oil pump case.

NOTE

Knock it as far as it goes.



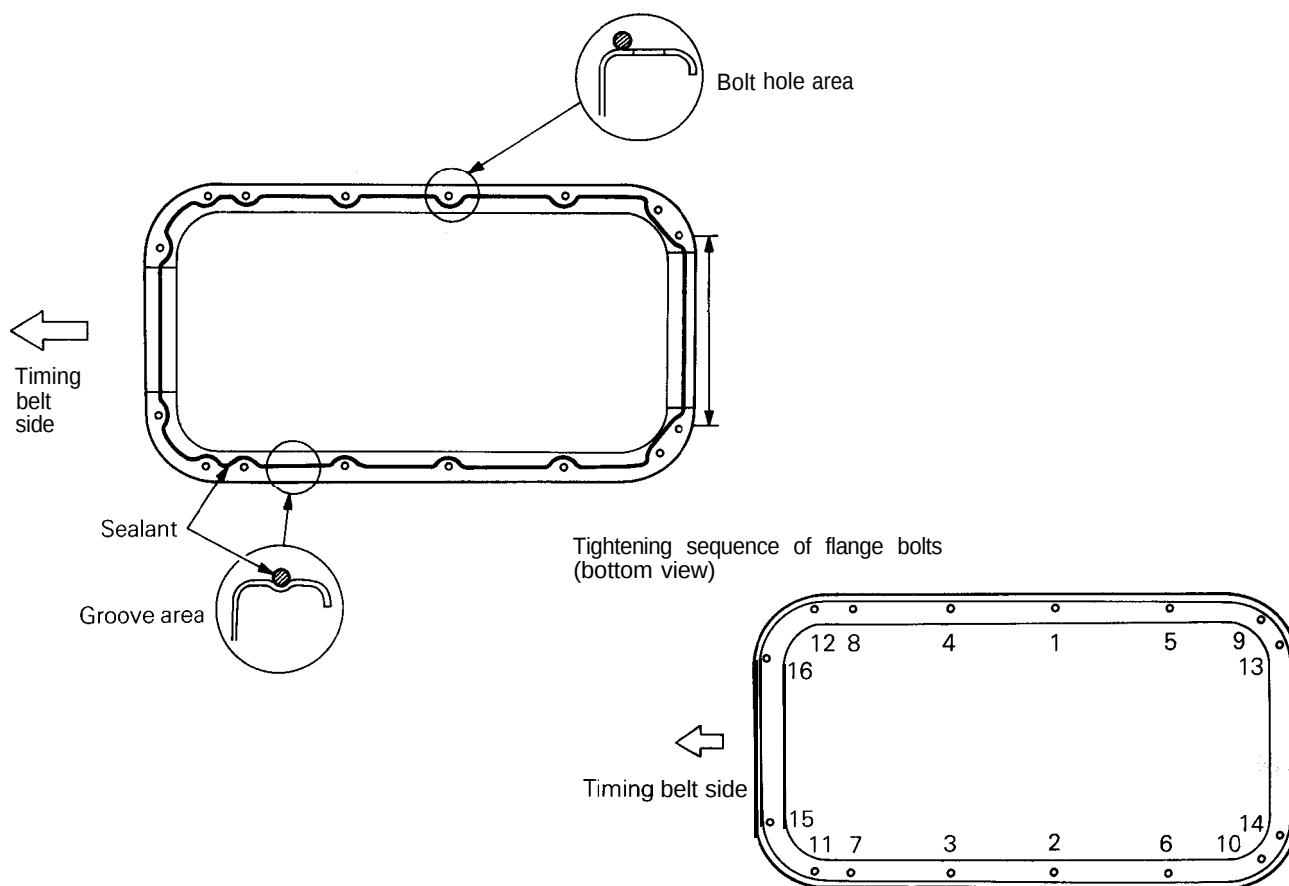
🔧 OIL PAN INSTALLATION

- (1) Remove all the remaining gasket from the mating surfaces using a scraper or a wire brush.
- (2) Apply a 4 mm (.16 in.) diameter bead of sealant to the oil pan flange.
See "Form In-Place Gasket" in introduction.

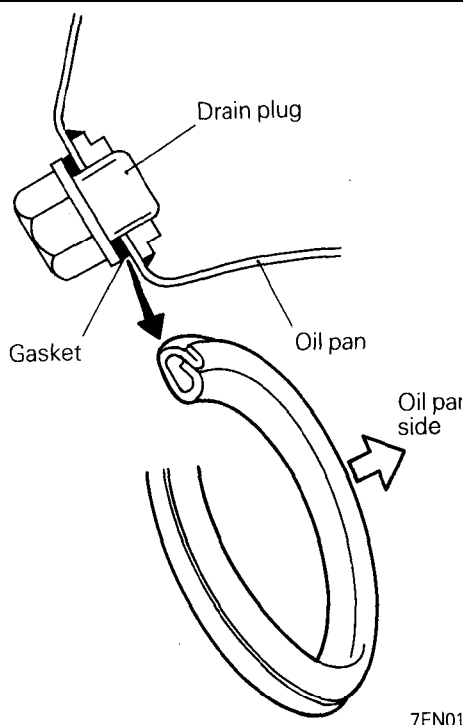
Specified sealant:

Mitsubishi Genuine Part No. MD970389 or equivalent

- (3) The oil pan should be installed within 15 minutes after the application of sealant.
- (4) Tighten the flange bolts in the sequence shown in the illustration.

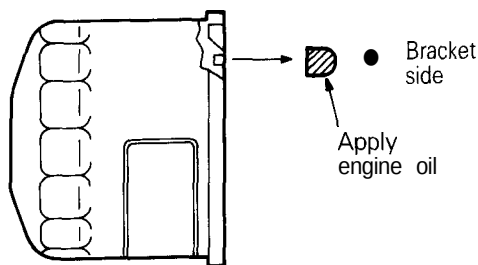


7EN0456



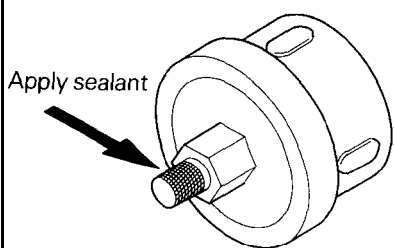
◆D◆ DRAIN PLUG GASKET INSTALLATION

- (1) Install the drain plug gasket as illustrated.



◆E◆ OIL FILTER INSTALLATION

- (1) Clean the installation surface of the filter bracket.
- (2) Apply engine oil to the O-ring of the oil filter.
- (3) Screw the oil filter on until the O-ring contacts the bracket. Then tighten 3/4 turn.



◆F◆ SEALANT APPLICATION TO OIL PRESSURE GAUGE UNIT

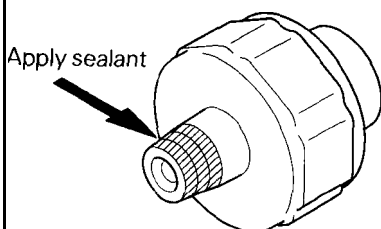
- (1) Coat the threads of the gauge unit with sealant and install it using the special tool.

Specified sealant:

3M ATD Part No.8660 or equivalent

Caution

1. Keep the end of threaded portion clear of sealant.
2. Avoid an overtightening.



◆G◆ SEALANT APPLICATION TO OIL PRESSURE SWITCH

- (1) Coat the threads of the switch with sealant and install the switch using the special tool.

Specified sealant:

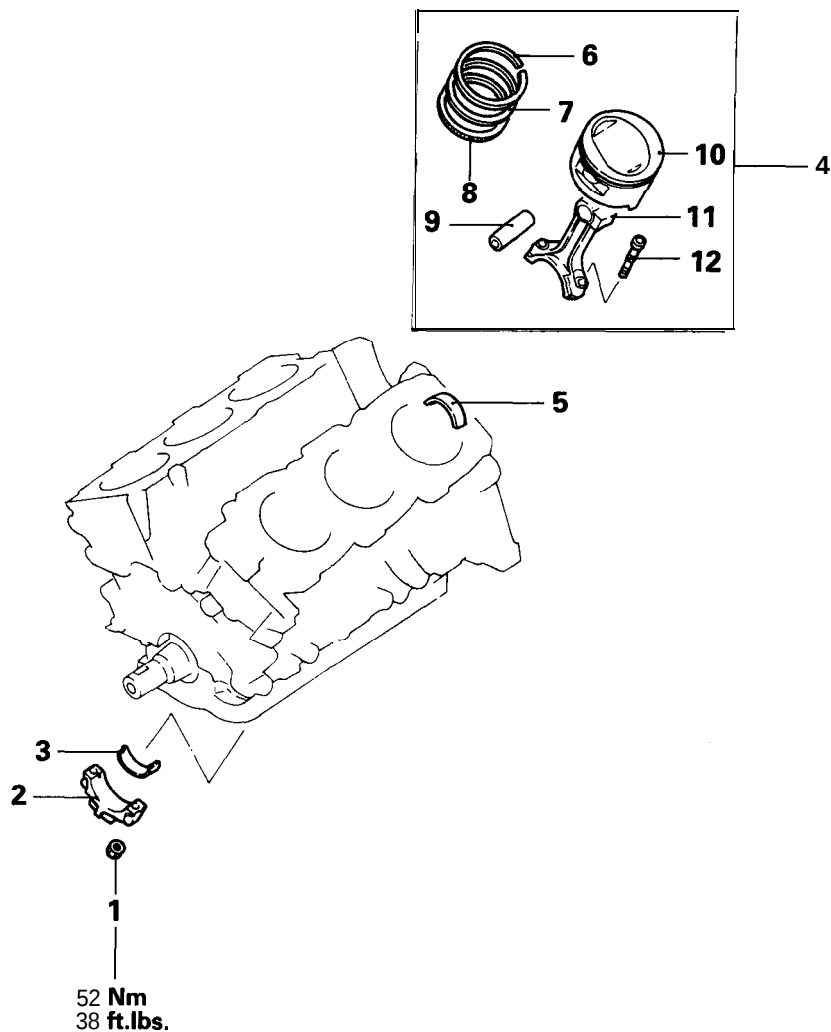
3M ATD Part No.8660 or equivalent

Caution

1. Keep the end of threaded portion clear of sealant.
2. Avoid an overtightening.

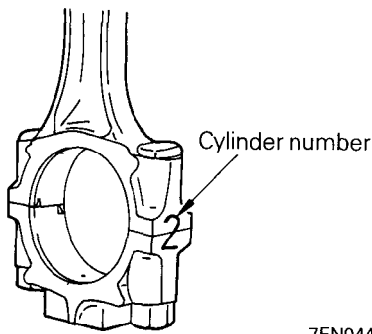
PISTON AND CONNECTING ROD

REMOVAL AND INSTALLATION



Removal steps

1. Nut
- ◊A◊ ♦E♦ 2. Connecting rod cap
3. Connecting rod bearing (lower)
- ♦D♦ 4. Piston, connecting rod assembly
5. Connecting rod bearing (upper)
- ♦C♦ 6. Piston rina_No.?
- ♦C♦ 7. Piston ring No.2
- ♦B♦ 8. Oil ring
- ◊B◊ ♦A♦ 9. Piston pin
10. Piston
11. Connecting rod
12. Bolt



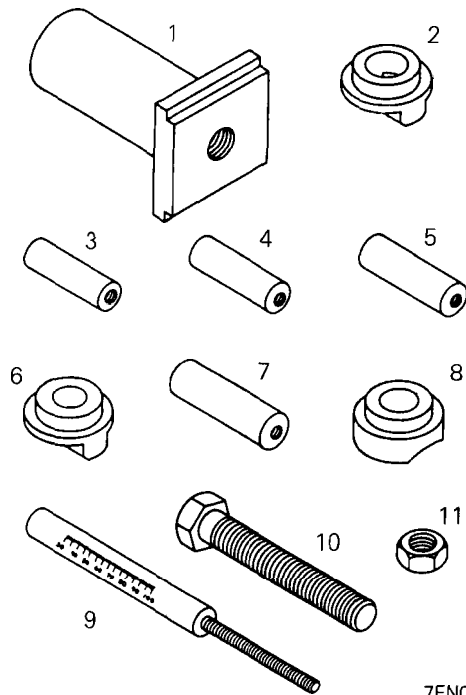
7EN044E

REMOVAL SERVICE POINTS

⚠A⚠ CONNECTING ROD CAP REMOVAL

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

Piston pin setting tool MIT21 6941



7EN042E

⚠B⚠ PISTON PIN REMOVAL

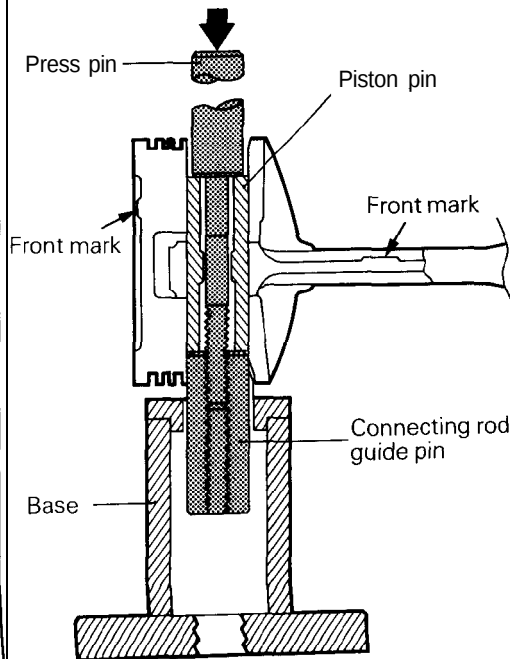
Item No.	Part No.	Description
1	MIT310134	Base
2	MIT310136	Piston Support
3	MIT310137	Connecting Rod Guide Pin
4	MIT310138	Connecting Rod Guide Pin
5	MIT310139	Connecting Rod Guide Pin
6	MIT310140	Piston Support
7	MIT310141	Connecting Rod Guide Pin
8	MIT310142	Piston Support
9	MIT48143	Press Pin
10	216943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

- (1) Remove the stop screw from the base.
- (2) Select the correct piston support for your application. (See above) Fit the piston support onto the base. Place the base on the press support blocks.
- (3) Insert the press pin through the piston pin hole. Select the correct connecting rod guide pin. (See above.) Thread the guide pin onto the threaded portion of the press pin.
- (4) Position the piston assembly on the piston support in the press. With the press pin up as shown in the illustration, insert the guide pin through the hole in the piston and through the hole in the piston support.
- (5) Press the piston pin out of the assembly.

IMPORTANT: To avoid piston damage,

- The piston support must seat squarely against the piston.
- Verify that the piston pin will slide through the hole in the piston support.

- (6) Remove the piston pin from the piston pin.



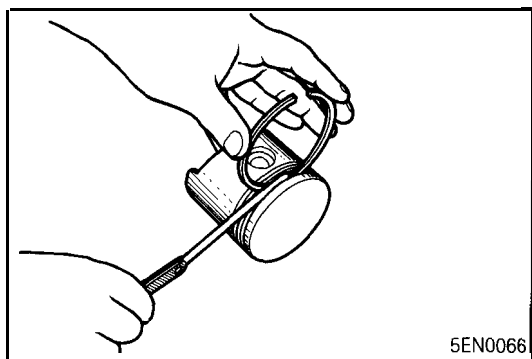
7EN042E

INSPECTION**PISTON**

- (1) Replace the piston if scratches or seizure is evident on its surfaces (especially the thrust surface). Replace the piston if it is cracked.

PISTON PIN

- (1) Insert the piston pin into the piston pin hole with a thumb. You should feel a slight resistance. Replace the piston pin if it can be easily inserted or there is an excessive play.
- (2) The piston and piston pin must be replaced as an assembly.

**PISTON RING**

- (1) Check the piston ring for damage, excessive wear, and breakage and replace if defects are evident. If the piston has been replaced with a new one, the piston rings must also be replaced with new ones.
- (2) Check for clearance between the piston ring and ring groove. If the limit is exceeded, replace the ring or piston, or both.

Standard value:**No. 1****DIAMANTE and 3000GT**

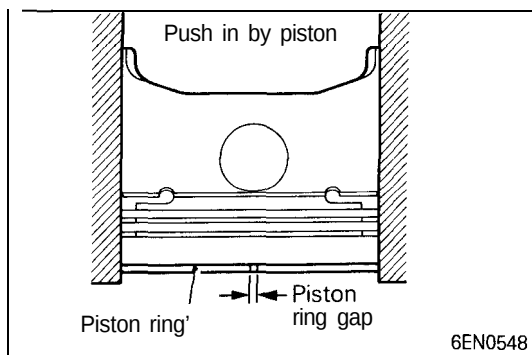
0.03 – 0.07 mm (.0012 – .0026 in.)

MONTERO and TRUCK

0.05 – 0.09 mm (.0020 – .0035 in.)

No. 2

0.02 – 0.06 mm (.0008 – .0024 in.)

Limit: 0.1 mm (.004 in.)

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

Standard value:**No. 1**

0.30 – 0.45 mm (.0118 – .0177 in.)

No. 2**DIAMANTE and 3000GT**

0.45 – 0.60 mm (.0177 – .0236 in.)

MONTERO and TRUCK

0.25 – 0.45 mm (.0098 – .0177 in.)

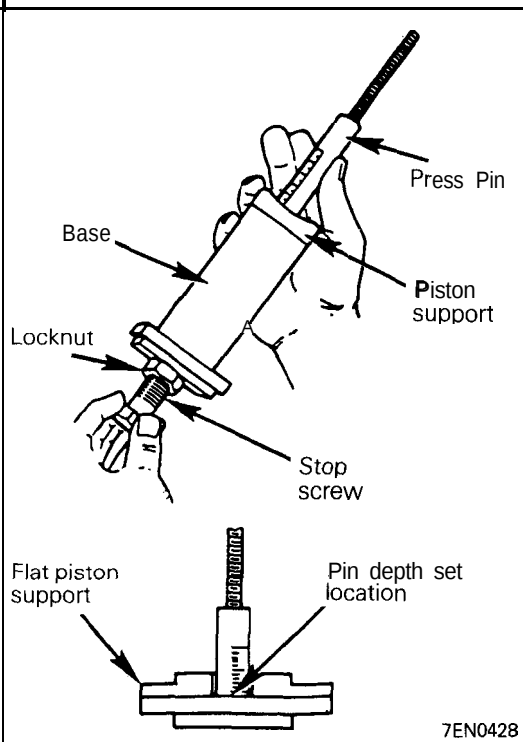
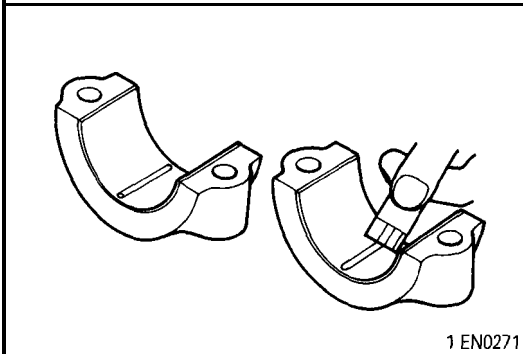
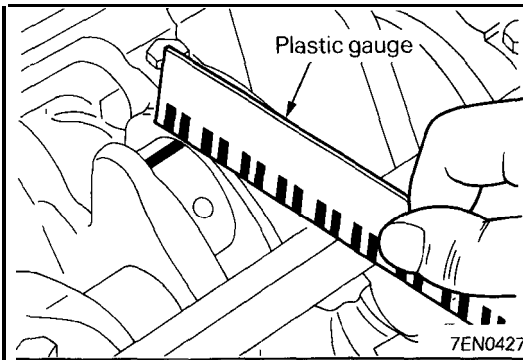
Oil**DIAMANTE and 3000GT**

0.20 – 0.60 mm (.0079 – .0236 in.)

MONTERO and TRUCK

0.20 – 0.70 (.0079 – .0276 in.)

Limit:**No. 1, No. 2 0.8 mm (.031 in.)****Oil 1.0 mm (.039 in.)**



CRANKSHAFT PIN OIL CLEARANCE (PLASTIC GAUGE METHOD)

The crankshaft oil clearance can be measured easily by using a plastic gauge, as follows:

- (1) Remove oil and grease and any other foreign matters from the crankshaft pin and the bearing inner surface.
- (2) Install the crankshaft.
- (3) Cut the plastic gauge to the same length as the width of the bearing and place it on the pin in parallel with its axis.
- (4) Gently place the crankshaft bearing cap over it and tighten the bolts to the specified torque.
- (5) Remove the bolts and gently remove the crankshaft bearing cap.
- (6) Measure the width of the smashed plastic gauge at its widest section by using a scale printed on the plastic gauge bag.

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

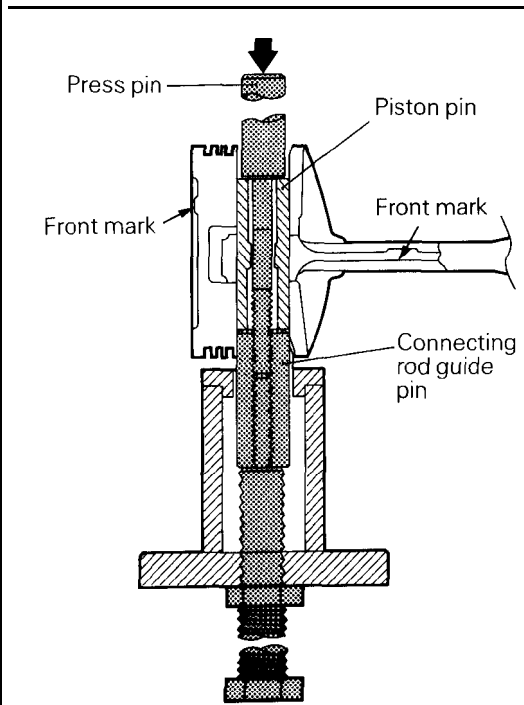
Limit: 0.1 mm (.004 in.)

INSTALLATION SERVICE POINTS

◆◆ PISTON PIN INSTALLATION

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

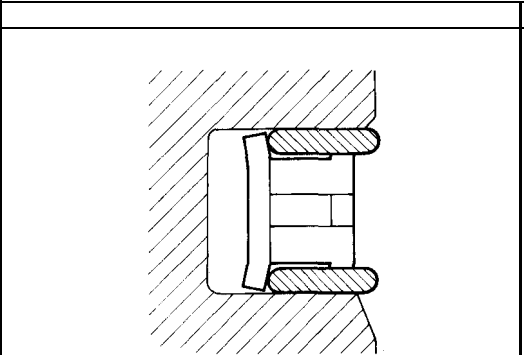
Depth: MONTERO and TRUCK 60 mm
DIAMANTE, 3000GT 62 mm



7EN042E

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

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



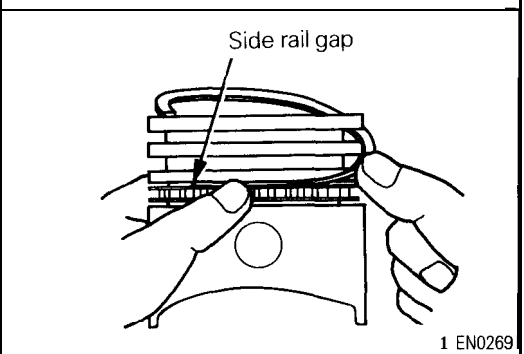
6EN058E

Oil RING INSTALLATION

- (1) Fit the oil ring spacer into the piston ring groove.

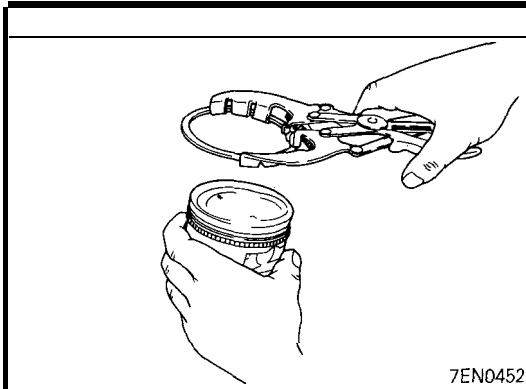
NOTE

The side rails and spacer may be installed in either direction.



1 EN0269

- (2) Install the upper side rail
To install the side rail, first fit one end of the rail into the piston groove, then press the remaining portion into the position by finger. See illustration.
Use of a ring expander to expand the side rail end gap can break the side rail, unlike other piston rings.
- NOTE**
Do not use any piston ring expander when installing the side rail.
- (3) Install the lower side rail in the same procedure as described in step (2).
- (4) Make sure that the side rails move smoothly in either direction.



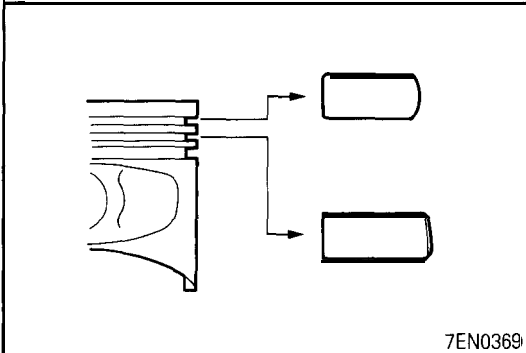
7EN0452

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

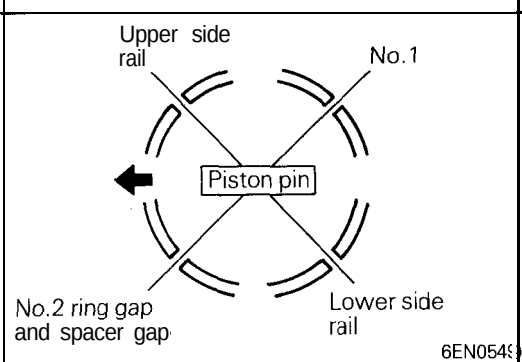
- (1) Using a piston ring expander, fit No.2 and then No.1 piston ring into position.

NOTE

1. Note the difference in shape between No.1 and No.2 piston rings.
2. Install piston rings No.1 and No.2 with their side having marks facing up (on the piston crown side.)



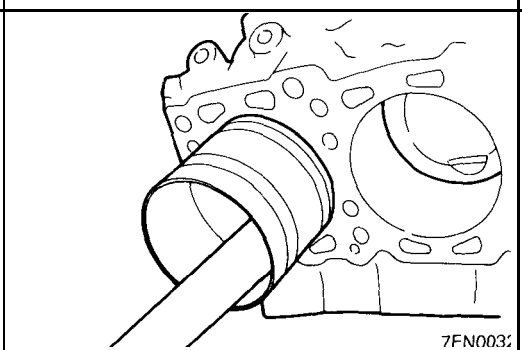
7EN0369



6EN0543

❖D❖ PISTON AND CONNECTING ROD INSTALLATION

- (1) Liberally coat the circumference of the piston, piston ring, and oil ring with engine oil.
- (2) Arrange the piston ring and oil ring gaps (side rail and spacer) as shown in the illustration.
- (3) Rotate the crankshaft so that the crank pin is on the center of the cylinder bore.



7FN0032

- (4) Use suitable thread protectors on the connecting rod bolts before inserting the piston and connecting rod assembly into the cylinder block. Care must be taken not to nick the crank pin.
- (5) Using a suitable piston ring compressor tool, install the piston and connecting rod assembly into the cylinder block.

Caution

Install the piston with the front mark (arrow mark) on the top of the piston directed towards the engine front (timing belt side).

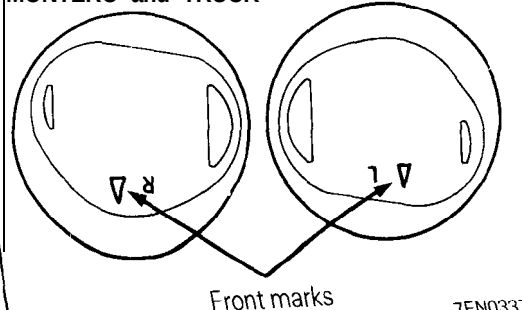
NOTE

For MONTERO and TRUCK, two types of pistons, one for cylinders 1, 3 and 5 and the other for cylinders 2, 4 and 6, have been used.

Piston with R: For cylinders 1, 3 and 5

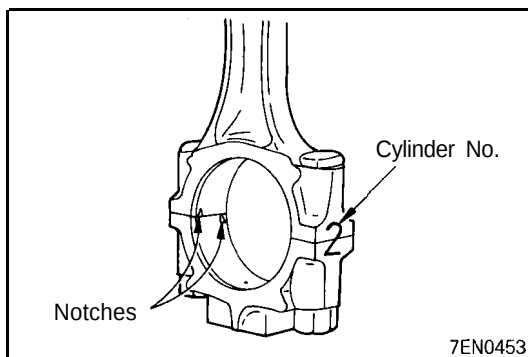
Piston with L: For cylinders 2, 4 and 6

MONTERO and TRUCK



Front marks

7EN0337



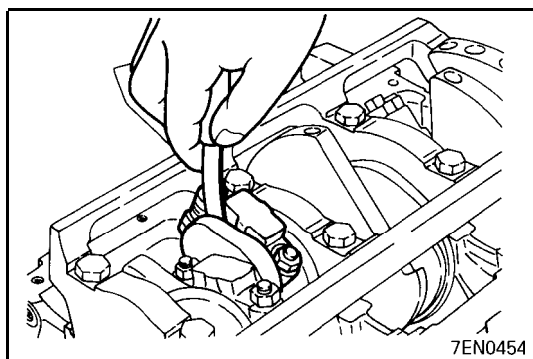
◆E◆ CONNECTING ROD CAP INSTALLATION

- (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 is used which 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.

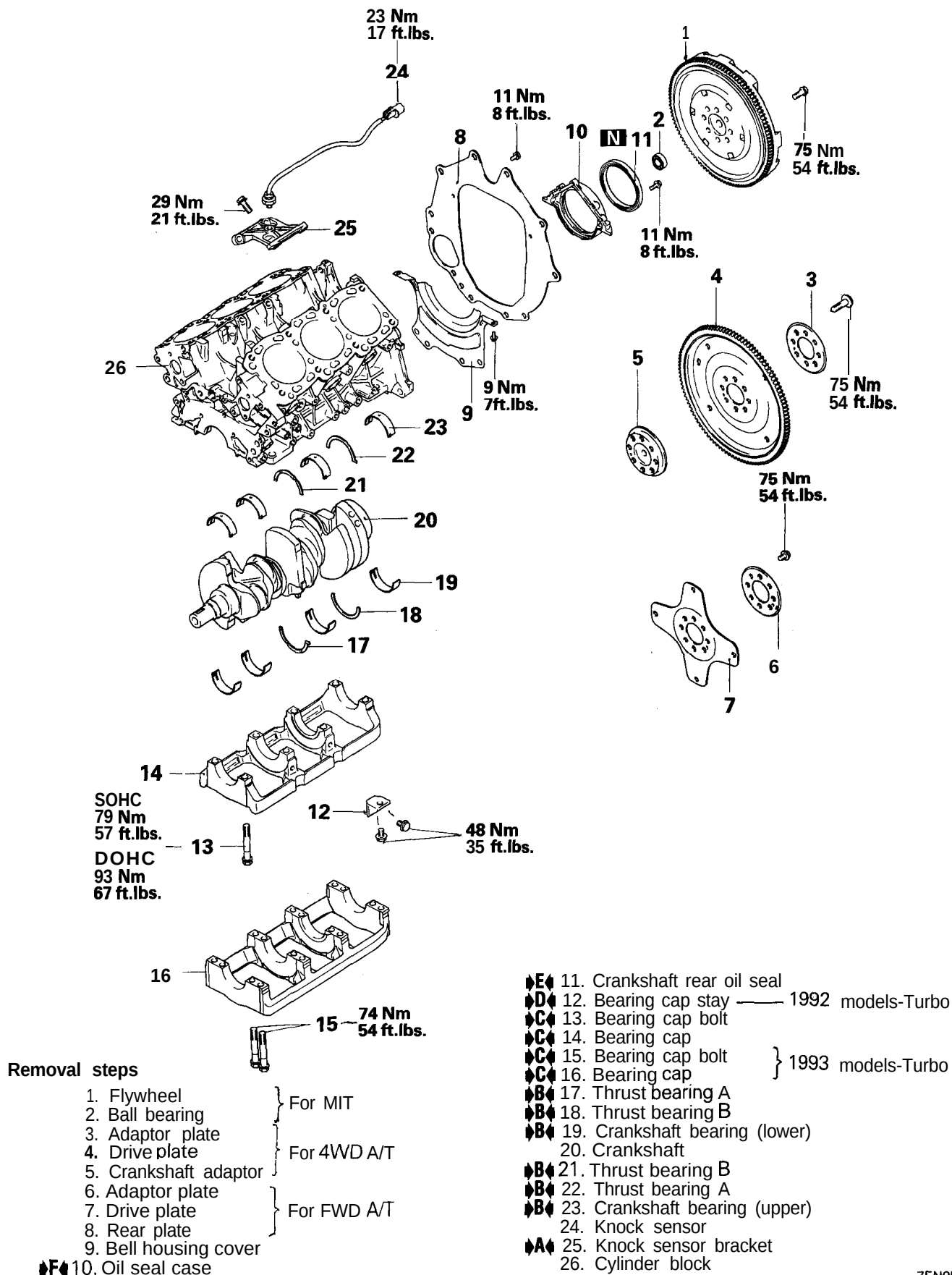
Standard value: 0.10 – 0.25 mm (.0039 – .0098 in.)

Limit: 0.4 mm (.0157 in.)



CRANKSHAFT, FLYWHEEL AND DRIVE PLATE

REMOVAL AND INSTALLATION



INSPECTION**CRANKSHAFT**

If the oil clearance exceeds the limit, replace the bearing, and crankshaft if necessary.

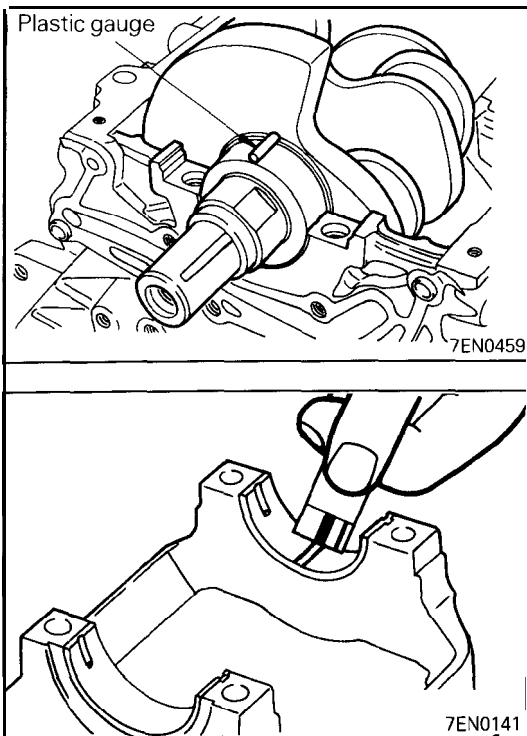
- (1) Measure the outside diameter of the journals and the inside diameter of the crankshaft bearings. If the difference between them (oil clearance) exceeds the limit, replace the crankshaft bearing and, if necessary, crankshaft.

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

Limit: 0.1 mm (.004 in.)

Caution

Do not attempt an undersize machining of the crankshaft with special **surface treatment. This crankshaft can be identified by its dull gray appearance.**

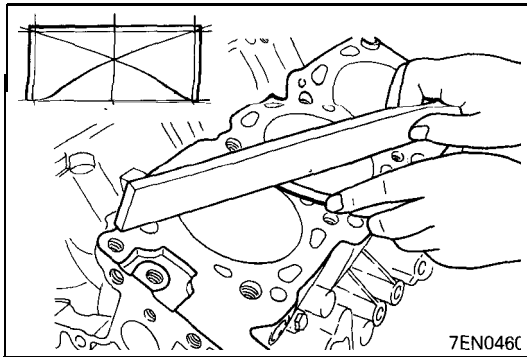
**CRANKSHAFT JOURNAL OIL CLEARANCE (PLASTIC GAUGE METHOD)**

The crankshaft oil clearance can be measured easily by using a plastic gauge, as follows:

- (1) Remove oil and grease and any other foreign matters from the crankshaft journal and bearing inner surface.
- (2) Install the crankshaft.
- (3) Cut the plastic gauge to the same length as the width of the bearing and place it on the journal in parallel with its axis.
- (4) Gently place the crankshaft bearing cap over it and tighten the bolts to the specified torque.
- (5) Remove the bolts and gently remove the crankshaft bearing cap.
- (6) Measure the width of the smashed plastic gauge at its widest section by using a scale printed on the plastic gauge bag.

CRANKSHAFT REAR OIL SEAL

- (1) Check the oil seal lip for wear and damage.
- (2) Check rubber for deterioration or hardening.
- (3) Check the oil seal case for cracks and damage.



INSPECTION

CYLINDER BLOCK

- (1) Visually check for scratches, rust, and corrosion. Use also a flaw detecting agent for the check. If defects are evident, correct, or replace.
- (2) Using a straightedge and feeler 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 (.0020 in.)

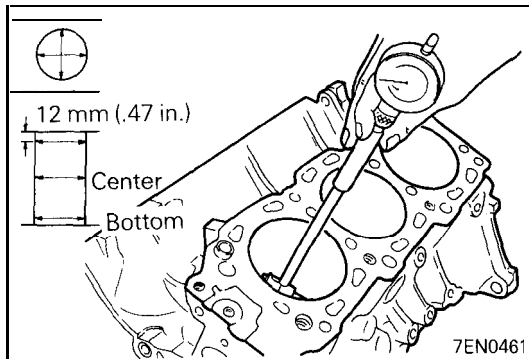
Limit: 0.1 mm (.0039 in.)

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

Grinding limit: 0.2 mm (.008 in.)

The total thickness of the stock allowed to be removed from cylinder block and mating cylinder head is 0.2 mm (.008 in.) at maximum.

Cylinder block height (when new): 210.5 mm (8.29 in.)

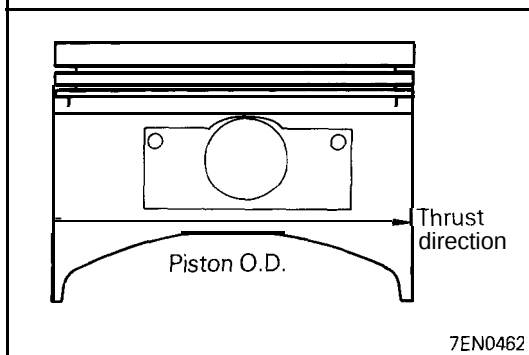


- (4) Check the cylinder walls for scratches and seizure. If defects are evident, correct (rebore to an oversize) or replace.
- (5) Using a cylinder gauge, measure the cylinder bore and cylindricity. If worn badly, correct by boring the cylinders to an oversize and replace pistons and piston rings. Measure at the points shown in the illustration.

Standard value:

Cylinder I.D.: 91.10 – 91.13 mm (3.5866 – 3.5878 in.)

Cylindricity: 0.01 (.0004 in.)



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
0.25 mm (.01 in.) O.S.	0.25
0.50 mm (.02 in.) O.S.	0.50
0.75 mm (.03 in.) O.S.	0.75
1.00 mm (.04 in.) O.S.	1.00

NOTE

Size mark is stamped on the piston top.

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

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

- (4) Bore 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.6, No.1, No.3 and No.5.

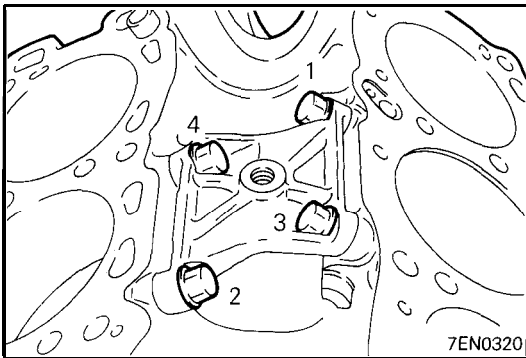
- (5) Hone to the final finish dimension (piston O.D. + clearance between piston O.D. and cylinder).
(6) Check the clearance between the piston and cylinder.

Clearance between piston and cylinder:

0.01 – 0.04 mm (.0004 – .0016 in.)

NOTE

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



INSTALLATION SERVICE POINTS

**◆◆ DETONATION SENSOR BRACKET
INSTALLATION**

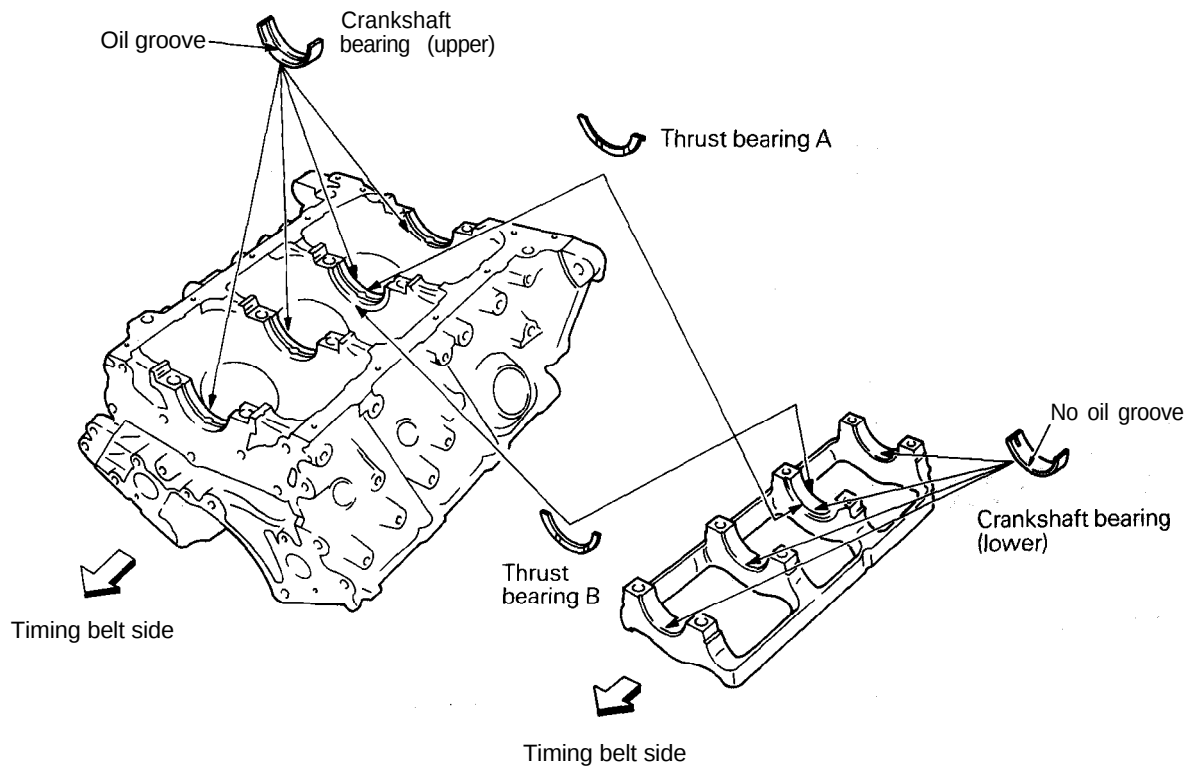
- (1) Check that the bracket is in intimate contact with the cylinder block boss and tighten to specified torque in the order shown.

**⚠ B ⚠ CRANKSHAFT BEARING (UPPER) /
THRUST BEARING A / THRUST BEARING B /
CRANKSHAFT BEARING (LOWER) INSTALLATION**

- (1) Classify the crankshaft bearings (upper and lower) by whether there is an oil groove or not. Then, assemble as shown in the illustration.
- (2) Assemble the thrust bearings (A and B) on the No.3 journal area as shown.

Caution

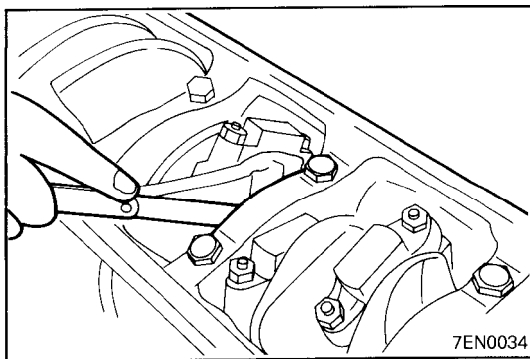
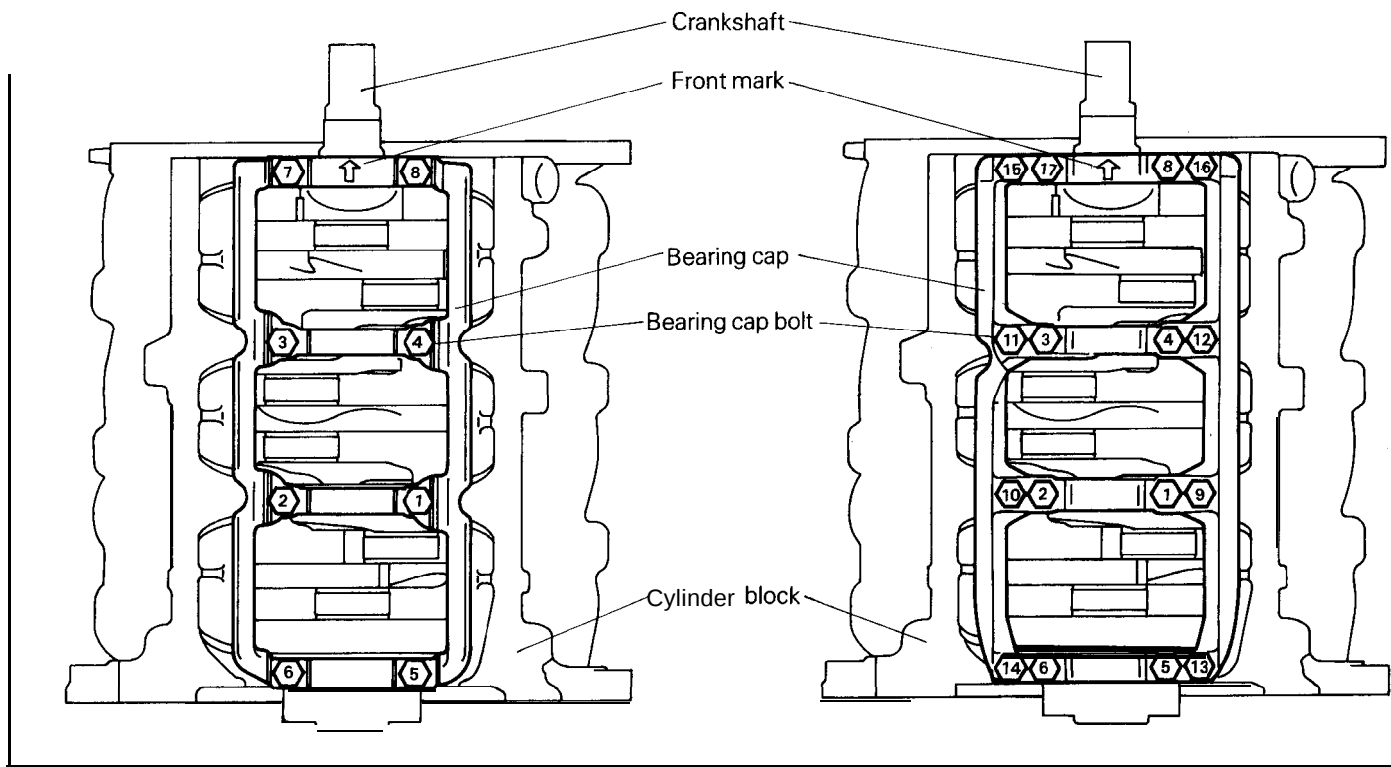
Install them with the groove side facing outward.



7EN0463

❖C❖ BEARING CAP / BEARING BOLT INSTALLATION

- (1) Attach the bearing cap on the cylinder block as shown in the illustration.
- (2) Tighten the bearing cap bolts to the specified torque in the sequence shown in the illustration.
- (3) Check that the crankshaft rotates smoothly.



- (4) Check the end plate. If it exceeds the limit value, replace the thrust bearing.

Standard value : 0.05 – 0.25 mm (.0020 – .0098 in.)

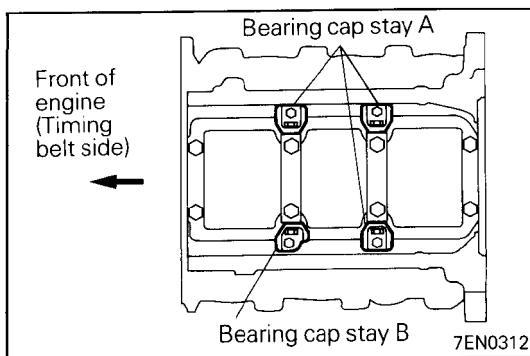
Limit: 0.3 mm (.012 in.)

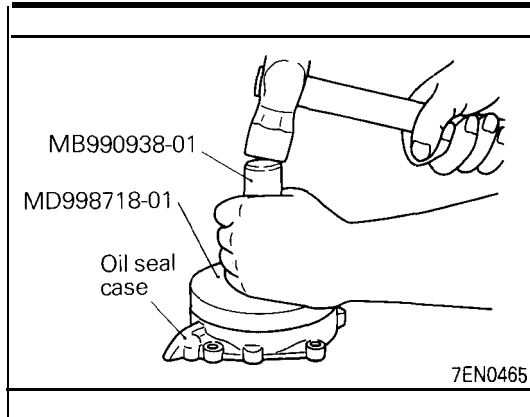
❖D❖ BEARING CAP STAY INSTALLATION – DOHC TURBO

- (1) Apply engine oil to the thread and bearing surface of each bolt.
- (2) Temporarily tighten the bolts on the cylinder block side.
- (3) Tighten the bolts on the bearing cap side to the specified torque.
- (4) Finally, tighten the bolts on the cylinder block side to the specified torque.

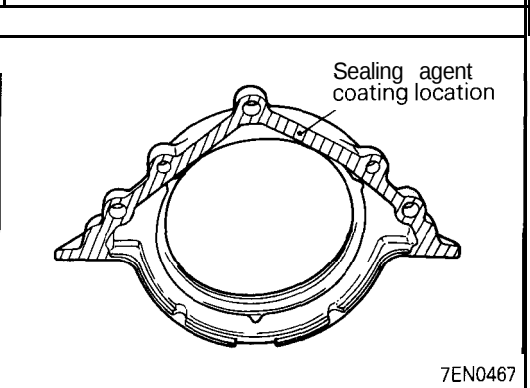
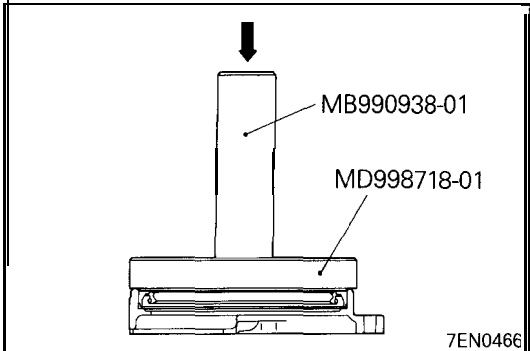
NOTE

The bearing cap stays A and B differ in shape. Install correct ones on correct sides.



**◆E◆ CRANKSHAFT REAR OIL SEAL INSTALLATION**

- (1) Using the special tool, press-fit a new crankshaft rear oil seal into the oil seal case.

**◆F◆ OIL SEAL CASE INSTALLATION**

- (1) Apply specified sealant to the area shown in the illustration.

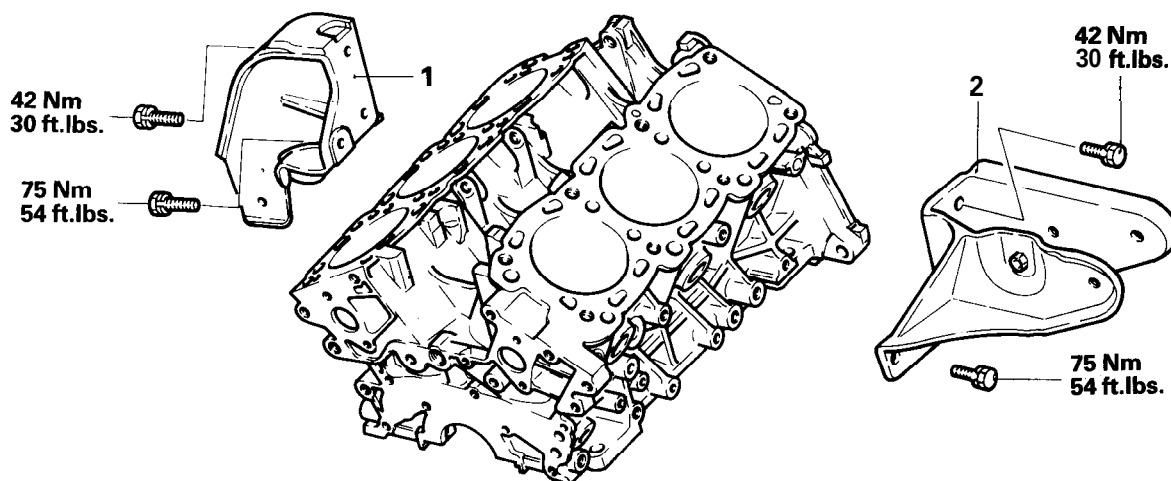
Specified sealant:

MITSUBISHI GENUINE Part No. MD970389 or equivalent

- (2) Apply a small amount of engine oil to the entire circumference of the oil seal lip section, and place the oil seal on the cylinder block.

BRACKET

REMOVAL AND INSTALLATION – DIAMANTE and 3000GT

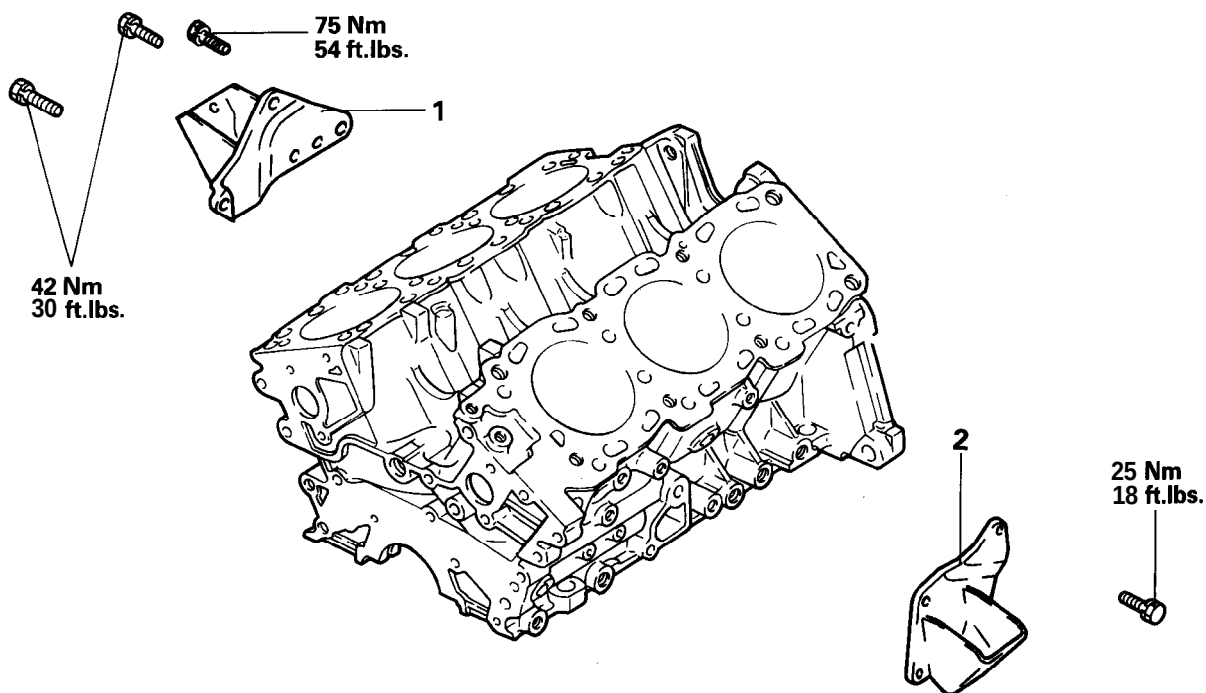


Removal steps

1. Engine support bracket, right
2. Engine support bracket, left

7EN0521

REMOVAL AND INSTALLATION – MONTERO and TRUCK



Removal steps

1. Roll stopper bracket, front
2. Roll stopper bracket, rear

7EN0133

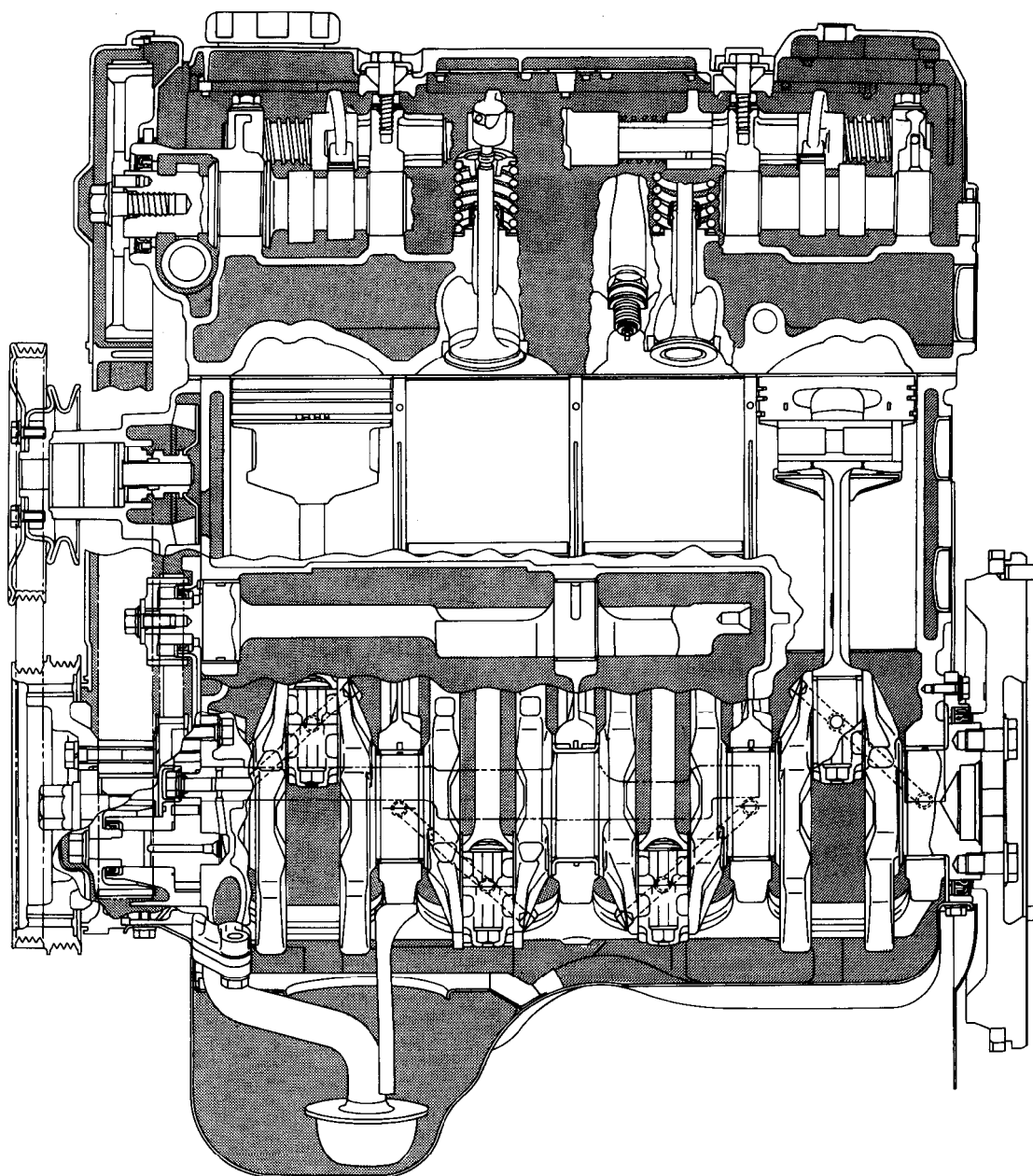
ENGINE

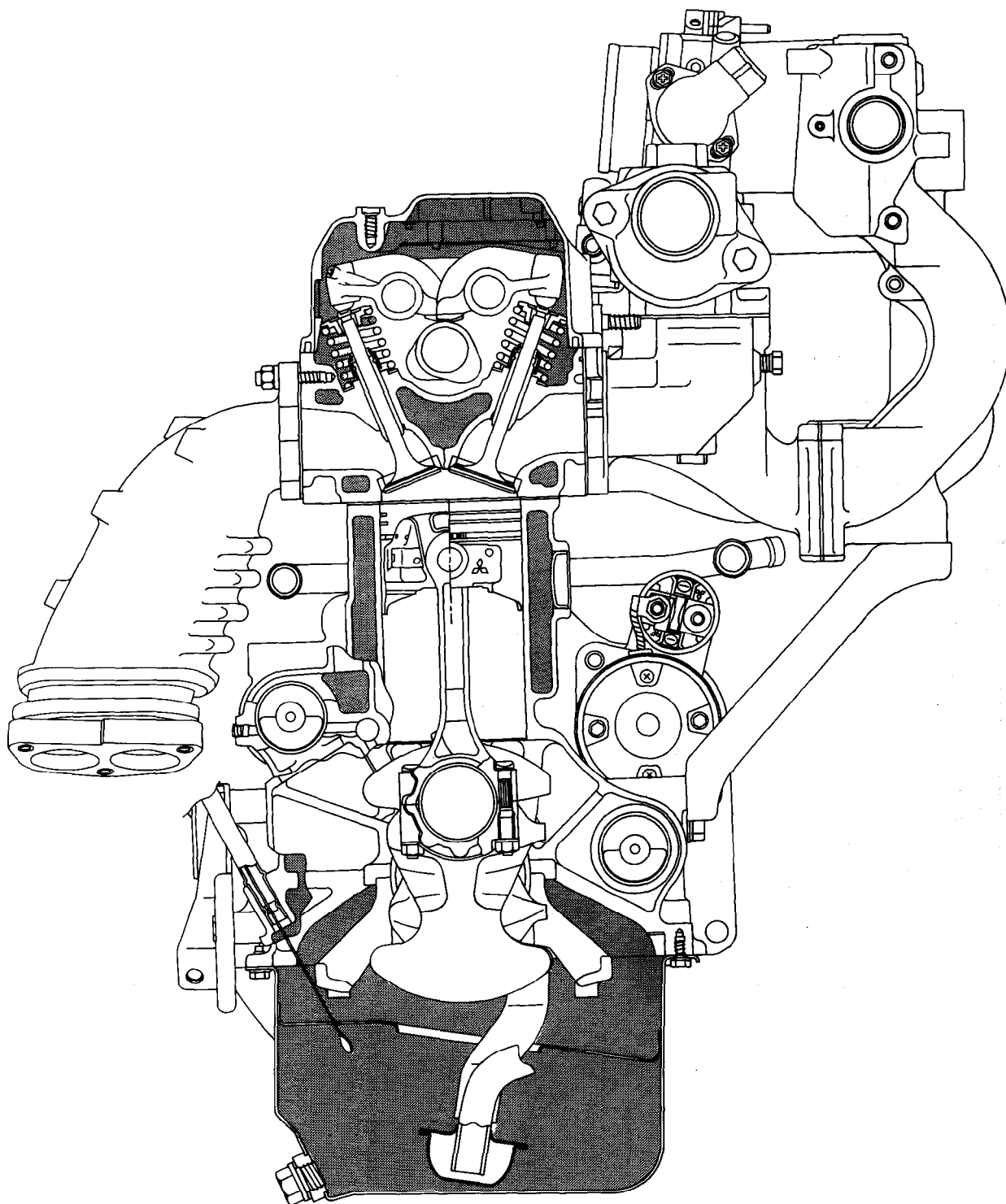
4G63, 4G64

<1993>

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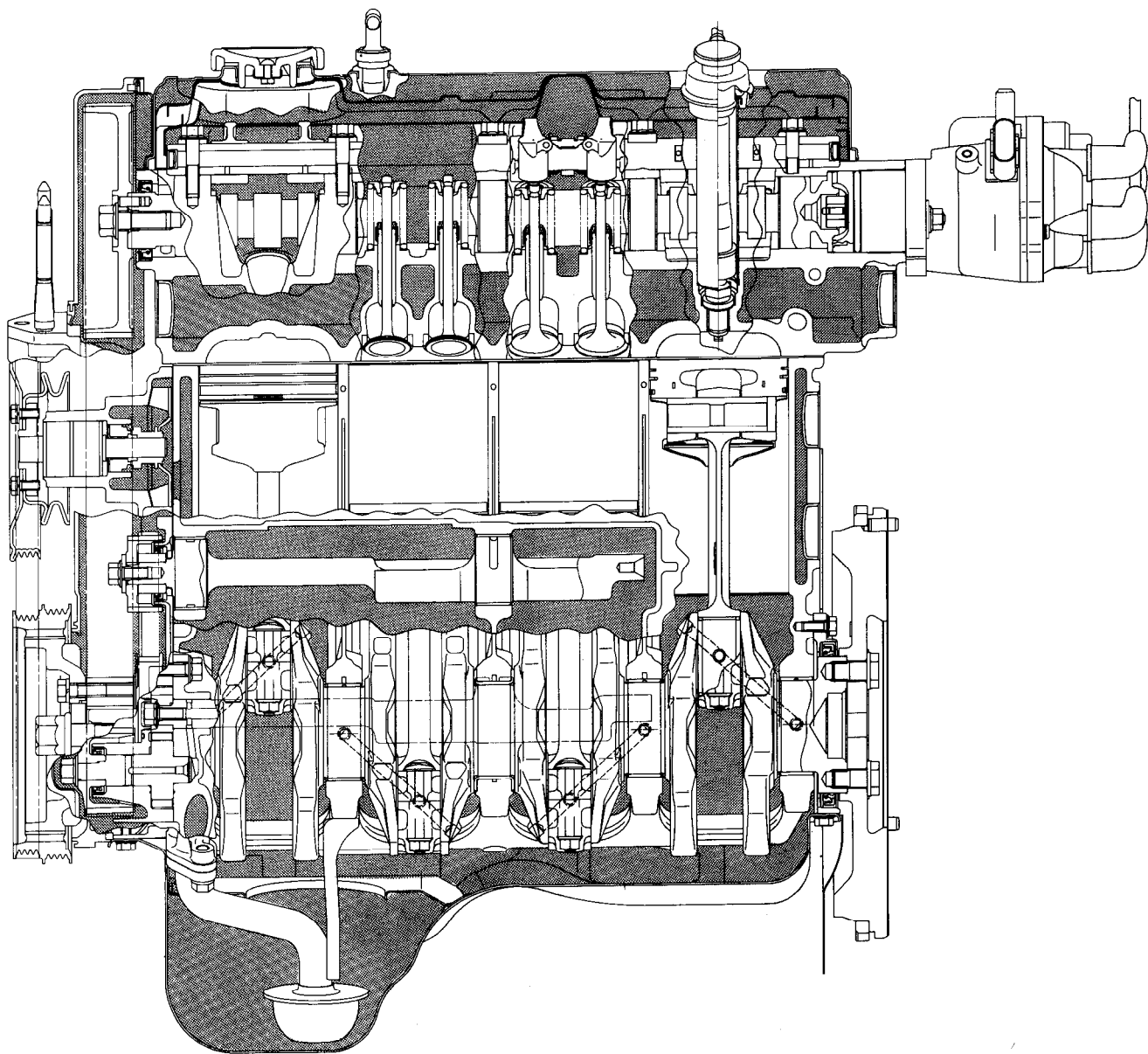
GENERAL INFORMATION**ENGINE SECTIONAL VIEW – SOHC 8 VALVE**



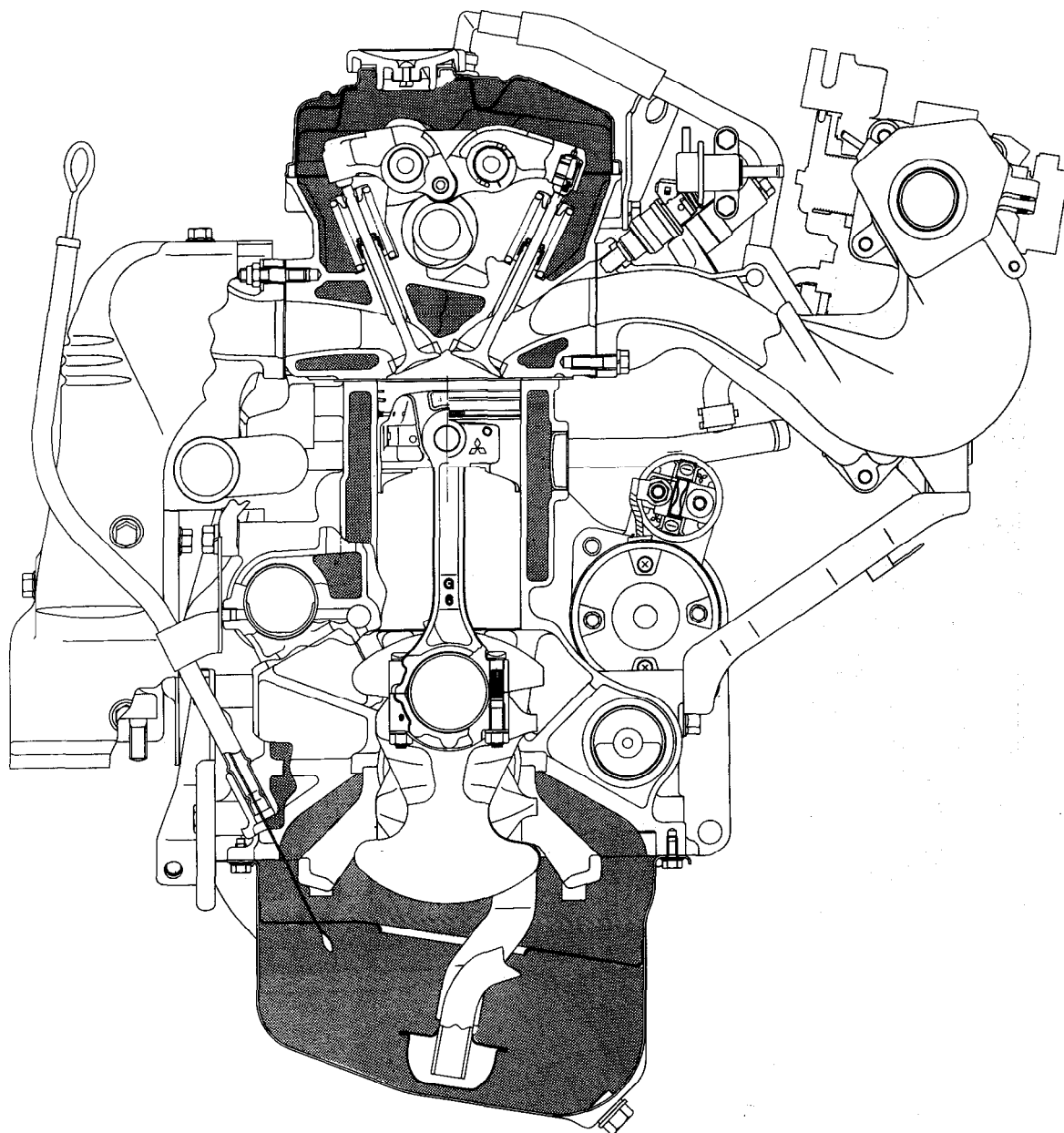
6EN0630

TSB Revision

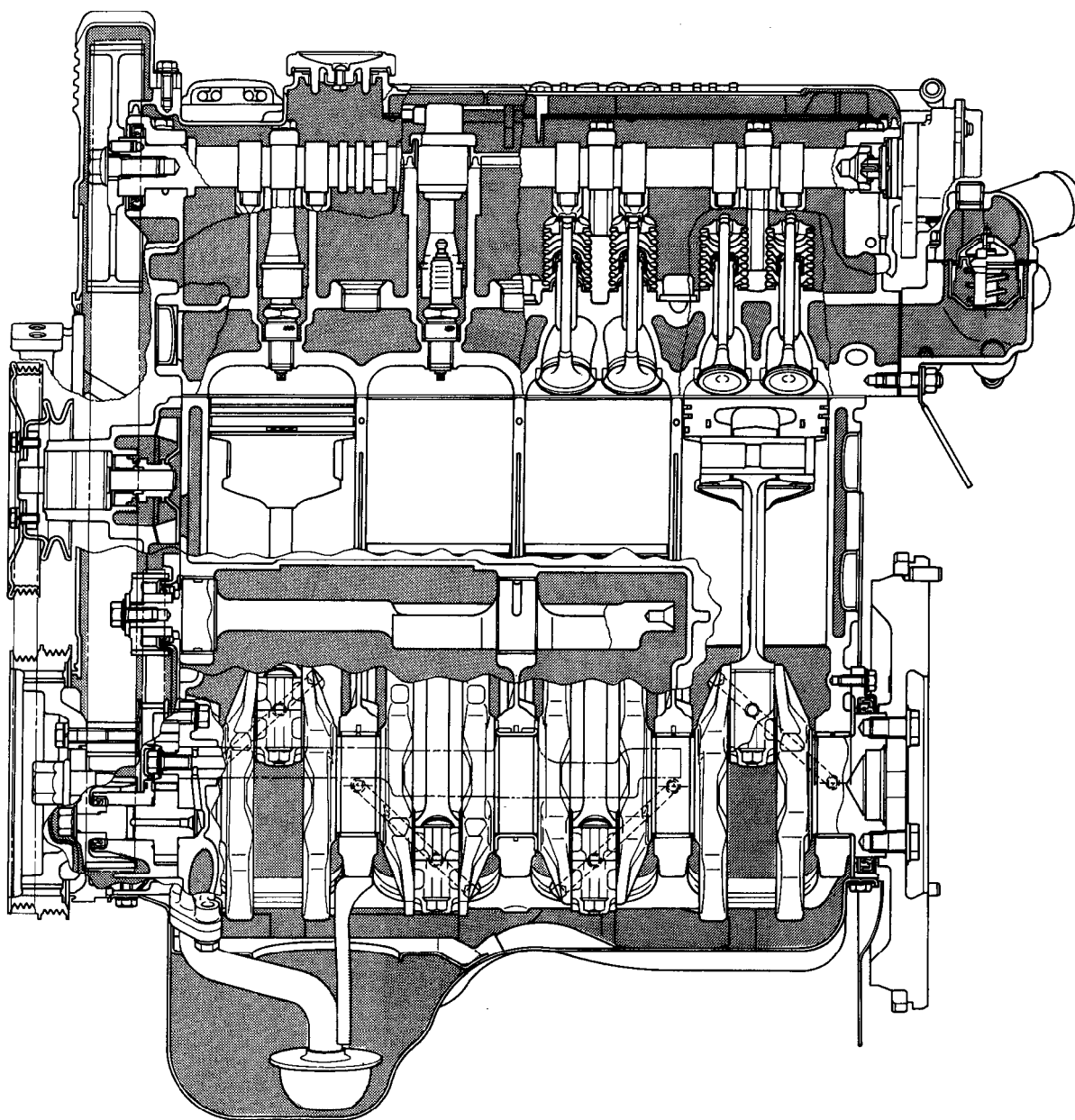
ENGINE SECTIONAL VIEW – SOHC 16 VALVE

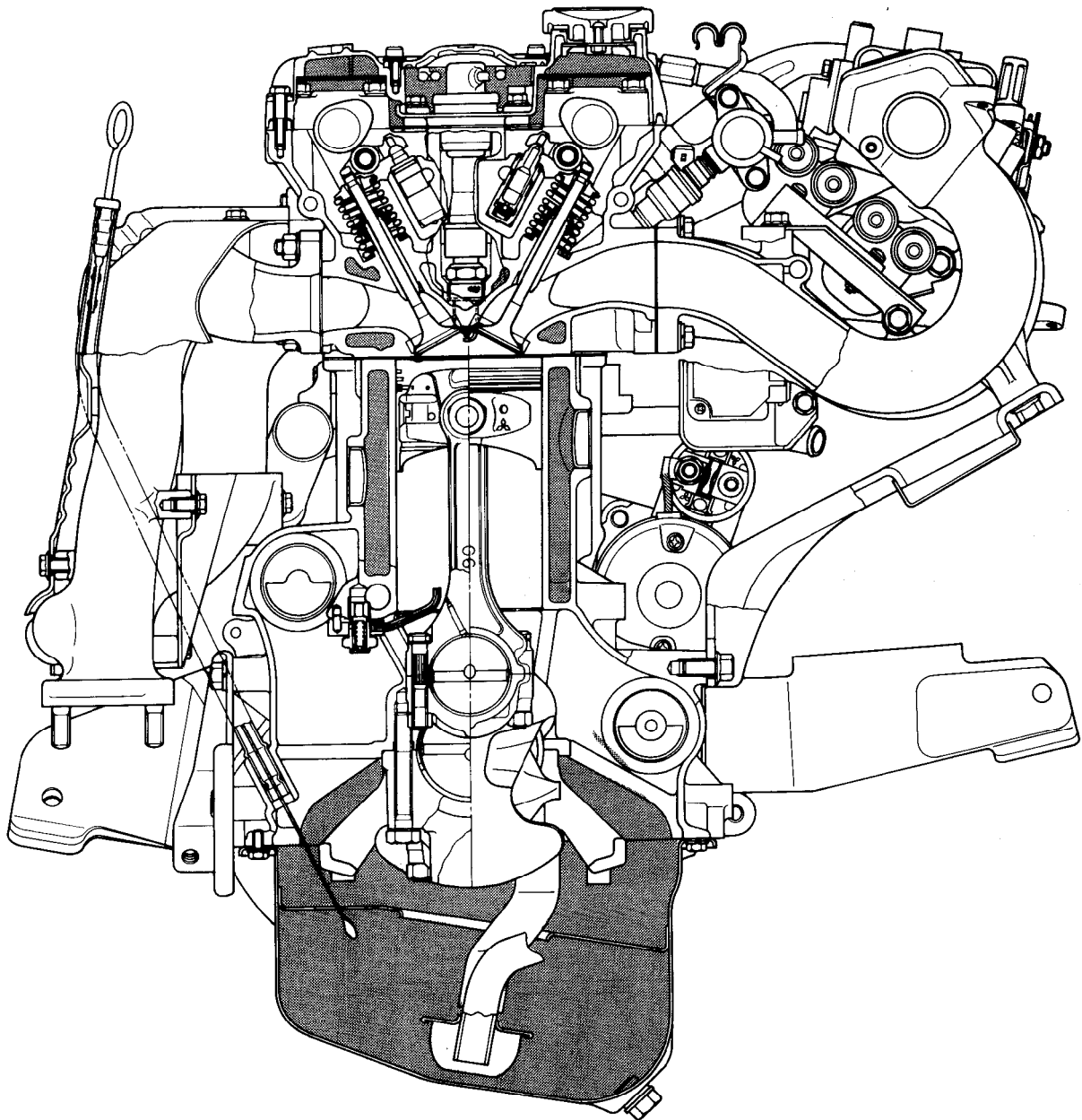


4G60 1.6L 16V



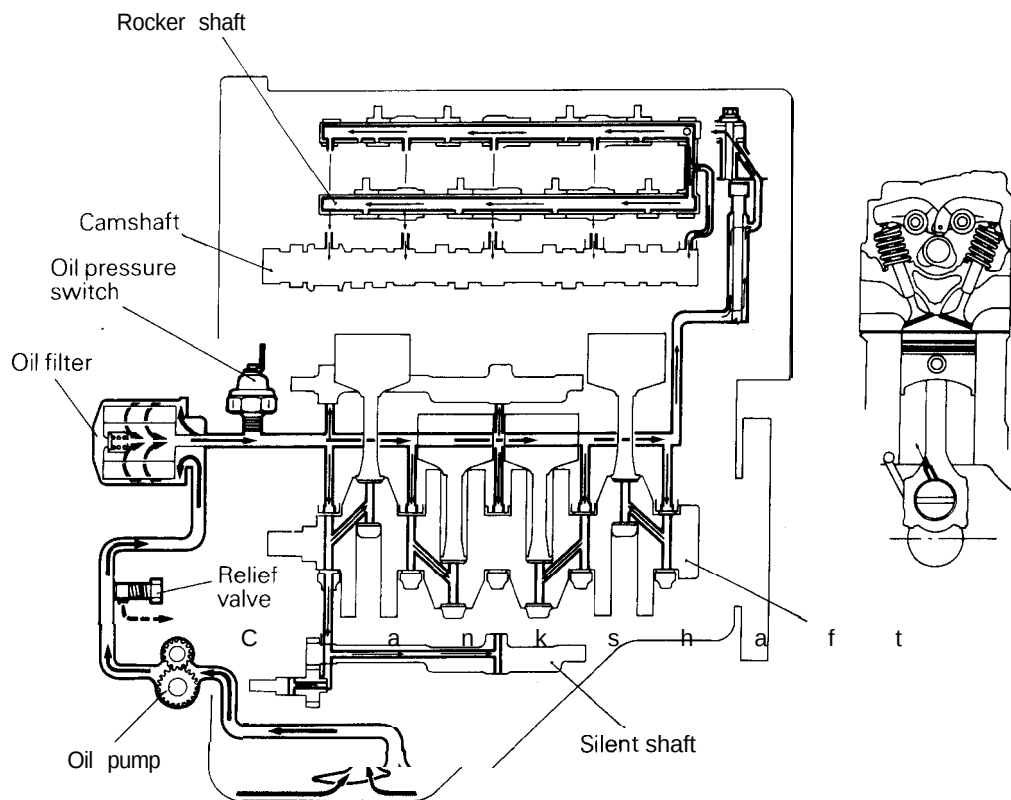
ENGINE SECTIONAL VIEW – DOHC





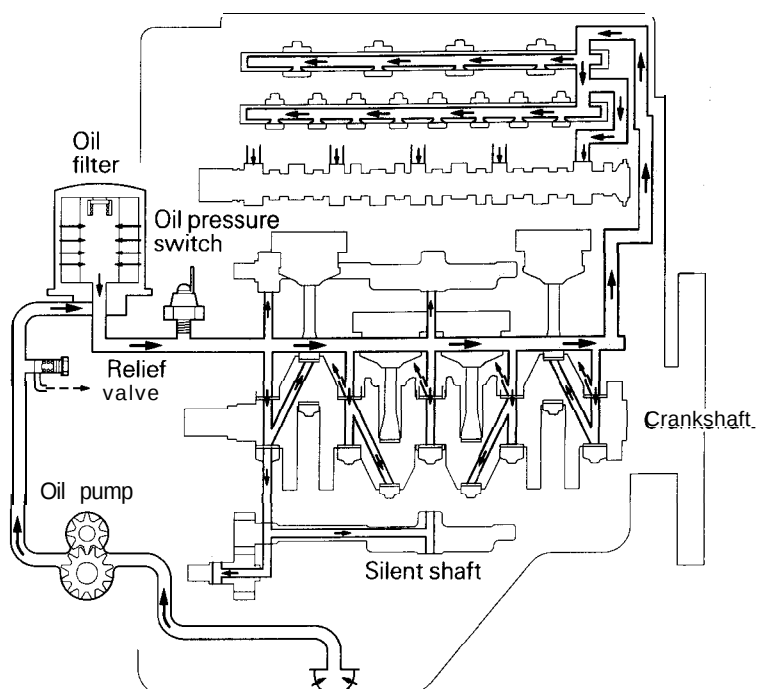
6EN0620

ENGINE LUBRICATION SYSTEM – SOHC 8 VALVE



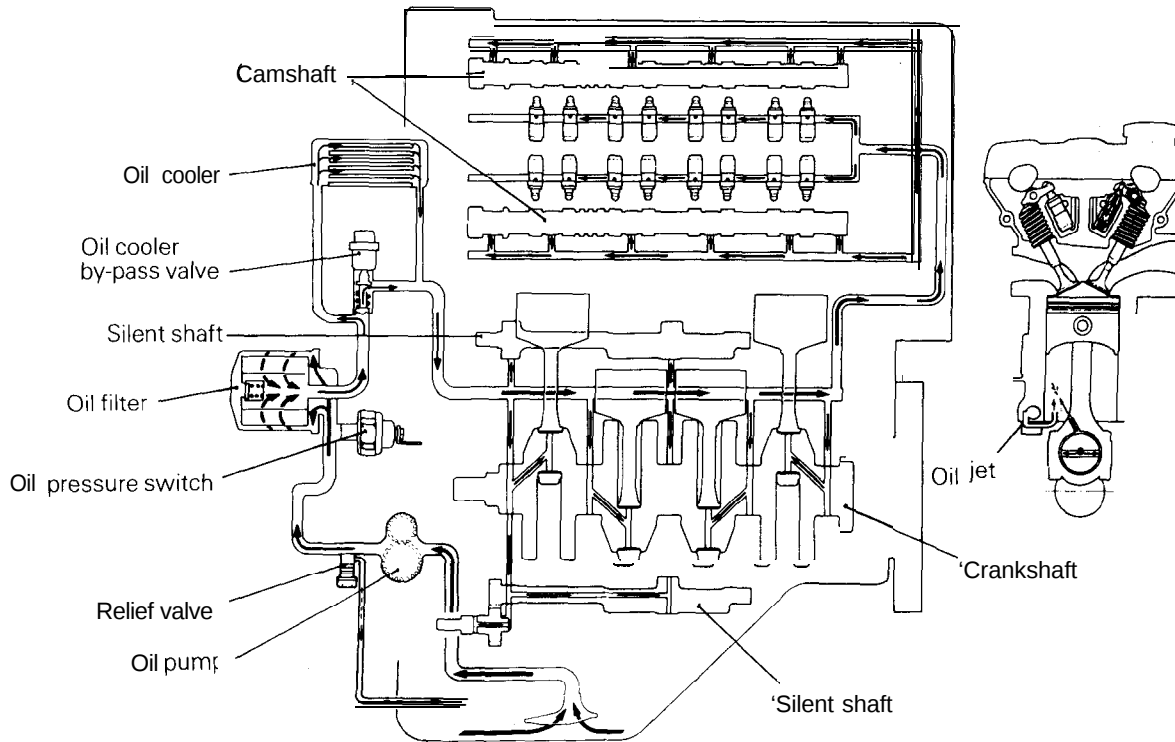
6LU0039

ENGINE LUBRICATION SYSTEM – SOHC 16 VALVE



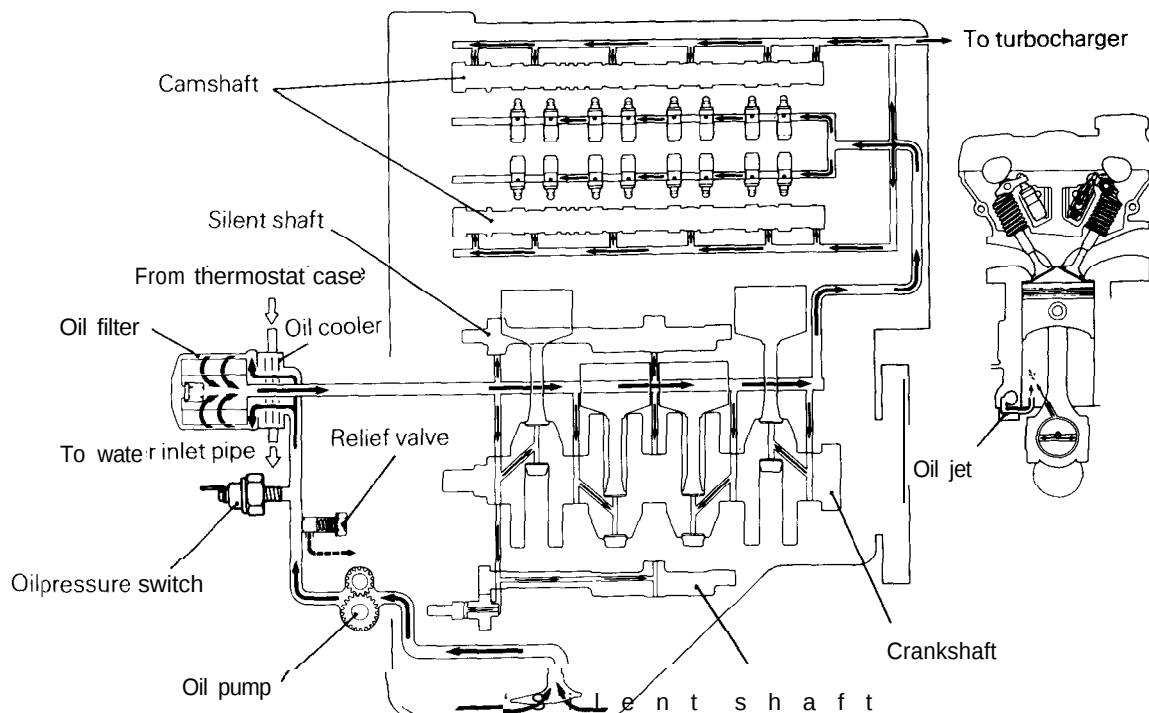
6EN0734

ENGINE LUBRICATION SYSTEM – DOHC



6LU0055

ENGINE LUBRICATION SYSTEM – DOHC-TURBO



6LU0056

TSB Revision

GENERAL SPECIFICATIONS

4G63 SOHC 16 VALVE

Items	Specifications
Type	In-line OHV, SOHC
Number of cylinders	4
Combustion chamber	Pentroof type
Total displacement cm ³ (cu. in.)	1,997 (121.9)
Cylinder bore mm (in.)	85 (3.35)
Piston stroke mm (in.)	88 (3.46)
Compression ratio	9.5
Valve timing	
Intake valve	
Opens BTDC	11°
Closes ABDC	53°
Exhaust valve	
Opens BBDC	63°
Closes ATDC	21°
Lubrication system	Pressure feed, full-flow filtration
Oil pump type	Involute gear type
Cooling system	Water-cooled forced circulation
Water pump type	Centrifugal impeller type
EGR valve	Single type
Injector type and number	Electromagnetic, 4
Injector identification No.	MDH240
Fuel regulated pressure kpa (psi)	335 (47.6)
Throttle bore mm (in.)	54 (2.13)
Throttle position sensor	Variable resistor type
Closed throttle position switch	Movable contact type within throttle position sensor

4G64 SOHC 8 VALVE

Items	Specifications
Type	In-line OHV, SOHC
Number of cylinders	4
Combustion chamber	Pentroof type
Total displacement cm ³ (cu. in.)	2,350 (143.4)
Cylinder bore mm (in.)	86.5 (3.41)
Piston stroke mm (in.)	100 (3.94)
Compression ratio	8.5
Valve timing	
Intake valve	
Opens BTDC	20°
Closes ABDC	64°
Exhaust valve	
Opens BBDC	64°
Closes ATDC	20°
Lubrication system	Pressure feed, full-flow filtration
Oil pump type	Involute gear type
Cooling system	Water-cooled forced circulation
Water pump type	Centrifugal impeller type
EGR valve	Single type
Injector type and number	Electromagnetic, 4
Injector identification No.	N275H
Fuel regulated pressure kpa (psi)	335 (47.6)
Throttle bore mm (in.)	50 (1.97)
Throttle position sensor	Variable resistor type
Closed throttle position switch	Contact type within idle speed control motor

4G64 SOHC 16 VALVE

Items	Specifications
Type	In-line OHV, SOHC
Number of cylinders	4
Combustion chamber	Pentroof type
Total displacement cm ³ (cu. in.)	2,350 (143.4)
Cylinder bore mm (in.)	86.5 (3.41)
Piston stroke mm (in.)	100 (3.94)
Compression ratio	9.5
Valve timing	
intake valve	
Opens BTDC	18°
Closes ABDC	58°
Exhaust valve	
Opens BBDC	58°
Closes ATDC	18°
Lubrication system	Pressure feed, full-flow filtration
Oil pump type	Involute gear type
Cooling system	Water-cooled forced circulation
Water pump type	Centrifugal impeller type
EGR valve	Single type
Injector type and number	Electromagnetic, 4
Injector identification No.	MDH275
Fuel regulated pressure kpa (psi)	335 (47.6)
Throttle bore mm (in.)	60 (2.36)
Throttle position sensor	Variable resistor type
Closed throttle position switch	Movable contact type within throttle position sensor

4G63 DOHC

Items	Specifications			
Type	In-line OHV, OHC			
Number of cylinders	4			
Combustion chamber	Pentroof type			
Total displacement cm ³ (cu. in.)	1,997 (121.9)			
Cylinder bore mm (in.)	85 (3.35)			
Piston stroke mm (in.)	88 (3.46)			
Compression ratio				
GALANT	9.8			
ECLIPSE-Non-turbo	9.0			
ECLIPSE-Turbo	7.8			
Valve timing				
(): camshaft identification mark	(B,C)	(A,A)	(D,C)	(E,A)
Intake valve				
Opens BTDC	21"	26"	21"	16"
Closes ABDC	43"	46"	51"	48"
Exhaust valve				
Opens BBDC	57"	55"	57"	55"
Closes ATDC	18"	9"	15"	9"
Lubrication system	Pressure feed, full-flow filtration			
Oil pump type	Involute gear type			
Cooling system	Water-cooled forced circulation			
Water pump type	Centrifugal impeller type			
EGR valve	Single type			
Injector type and number	Electromagnetic, 4			
Injector identification No.				
Non-turbo	N24OH			
Turbo	B450L			
Fuel regulated pressure kpa (psi)				
Non-turbo	335 (47.6)			
Turbo	255 (36.6)			
Throttle bore mm (in.)	60 (2.36)			
Throttle position sensor	Variable resistor type			
Closed throttle position switch	Contact type			

SERVICE SPECIFICATIONS

mm (in.)

	Standard	L i m i t
Cylinder head – SOHC 8 VALVE Flatness of gasket surface Grinding limit of gasket surface * Total resurfacing depth of both cylinder head and cylinder block. Overall height Oversize rework dimensions of valve guide hole (both intake and exhaust) 0.05 (.002) 0.25 (.010) 0.50 (.020) Oversize rework dimensions of intake valve seat ring hole 0.30 (.012) 0.60 (.024) Oversize rework dimensions of exhaust valve seat ring hole 0.30 (.012) 0.60 (.024)	0.05 (.0020) 89.9 – 90.1 (3.508 – 3.547) 13.05 – 13.07 (.5138 – .5146) 13.25 – 13.27 (.5217 – .5224) 13.50 – 13.52 (.5315 – .5323) 47.30 – 47.33 (1.8622 – 1.8634) 47.60 – 47.63 (1.8740 – 1.8752) 40.30 – 40.33 (1.5866 – 1.5878) 40.60 – 40.63 (1.5984 – 1.5996)	0.2 (.008) *0.2 (.008)
Cylinder head – SOHC 16 VALVE Flatness of gasket surface Grinding limit of gasket surface * Total resurfacing depth of both cylinder head and cylinder block. □ Flatness of manifold mounting surface Overall height Oversize rework dimensions of valve guide hole (both intake and exhaust) 0.05 (.002) 0.25 (.010) 0.50 (.020) Oversize rework dimensions of intake valve seat ring hole 0.30 (.012) 0.60 (.024) Oversize rework dimensions of exhaust valve seat ring hole 0.30 (.012) 0.60 (.024)	0.05 (.0020) 0.15 (.0059) 119.9 – 120.1 (4.720 – 4.728) 11.05 – 11.07 (.435 – .436) 11.25 – 11.27 (.443 – .444) 11.50 – 11.52 (.453 – .454) 34.30 – 34.33 (1.3504 – 1.3516) 34.60 – 34.63 (1.3622 – 1.3634) 31.80 – 31.83 (1.2520 – 1.2531) 32.10 – 32.13 (1.2638 – 1.2650)	0.2 (.008) *0.2 (.008) 0.3 (.012)

mm (in.)

	Standard	Limit
Cylinder head – DOHC		
Flatness of gasket surface	0.05 (.0020)	0.2 (.008)
Grinding limit of gasket surface		*0.2 (.008)
* Total resurfacing depth of both cylinder head and cylinder block		
Flatness of manifold mounting surface	0.15 (.0059)	0.3 (.012)
Overall height	131.9-132.1 (5.193 – 5.201)	
Oversize rework dimensions of valve guide hole (both intake and exhaust)		
0.05 (.002)	12.05 – 12.07 (.4744 – .4752)	
0.25 (.010)	12.25 – 12.27 (.4823 – .4831)	
0.50 (.020)	12.50 – 12.52 (.4921 – .4929)	
Oversize rework dimensions of intake valve seat ring hole		
0.30 (.012)	35.30 – 35.33 (1.3898 – 1.3909)	
0.60 (.024)	35.60 – 35.63 (1.4016 – 1.4028)	
Oversize rework dimensions of exhaust valve seat ring hole		
0.30 (.012)	33.30 – 33.33 (1.3110 – 1.3122)	
0.60 (.024)	33.60 – 33.63 (1.3228 – 1.3240)	
Camshaft – SOHC 8 VALVE		
Cam height		
Intake	42.40 (1.6693)	41.90 (1.6496)
Exhaust	42.40 (1.6693)	41.90 (1.6496)
Journal diameter	33.94 – 33.95 (1.3362 – 1.3366)	
Oil clearance	0.05 – 0.09 (.0020 – .0035)	
Camshaft – SOHC 16 VALVE		
Cam height		
Intake	37.39 (1.4720)	36.89 (1.4524)
Exhaust	37.47 (1.4752)	36.97 (1.4555)
Journal diameter	44.93 – 44.94 (1.7689 – 1.7693)	
Oil clearance	0.05 – 0.09 (.0020 – .0035)	
Camshaft – DOHC		
Intake		
Identification mark: A, D		
Cam height	35.49 (1.3972)	34.99 (1.3776)
Identification mark: B, E		
Cam height	35.20 (1.3858)	34.70 (1.3661)
Exhaust		
Identification mark: A		
Cam height	35.20 (1.3858)	34.70 (1.3661)
Identification mark: C		
Cam height	35.49 (1.3972)	34.99 (1.3776)
NOTE: The camshaft identification mark is stamped on the rear end of the camshaft.		
Journal diameter	25.95-25.97 (1.0217 – 1.0224)	
Oil clearance	0.05 – 0.09 (.0020 – .0035)	

mm (in.)

	Standard	Limit
Rocker arm – SOHC 8 VALVE I.D. Rocker arm-to-shaft clearance	18.91 – 18.93 (.7445 – .7453) 0.01 – 0.04 (.0004 – .0016)	0.1 (.004)
Rocker arm – SOHC 16 VALVE I.D. Rocker arm-to-shaft clearance	20.02 – 20.04 (.7882 – .7890) 0.02 – 0.05 (.0008 – .0020)	0.1 (.004)
Lash adjuster Leak down test Remarks: Diesel fuel at 15 – 20°C (59 – 68°F)	4 – 20 seconds/l mm (.04 in.)	
Rocker shaft – SOHC 8 VALVE O.D. Overall length Intake Exhaust	18.89 – 18.90 (.7437 – .7441) 385.5 (15.177) 372.5 (14.665)	
Rocker shaft – SOHC 16 VALVE O.D. Overall length Intake Exhaust	19.99 – 20.00 (.7870 – .7874) 417.25 (16.427) 417.25 (16.427)	
Valve – SOHC 8 VALVE Overall length Intake Exhaust Stem diameter Intake Exhaust Face angle Thickness of valve head (margin) Intake Exhaust Stem-to-guide clearance Intake Exhaust	 106.6 (4.197) 105.2 (4.142) 7.96-7.98 (.3134 – .3142) 7.93 – 7.95 (.3122 – .3130) 45° – 45°30' 1.2 (.047) 2.0 (.079) 0.02 – 0.06 (.0008 – .0024) 0.05 – 0.09 (.0020 – .0035)	 0.7 (.028) 1.5 (.059) 0.10 (.0039) 0.15 (.0059)

mm (in.)

	Standard	Limit
Valve – SOHC 16 VALVE		
Overall length		
Intake	112.3 (4.421)	
Exhaust	114.1 (4.492)	
Stem diameter		
Intake	5.97 – 5.98 (.2350 – .2354)	
Exhaust	5.95 – 5.97 (.2343 – .2350)	
Face angle	45° – 45°30'	
Thickness of valve head (margin)		
Intake	1.0 (.039)	0.5 (.020)
Exhaust	1.2 (.047)	0.7 (.028)
Stem-to-guide clearance		
Intake	0.02 – 0.05 (.0008 – .0020)	0.10 (.004)
Exhaust	0.03 – 0.07 (.0012 – .0028)	0.15 (.006)
Valve – DOHC		
Overall length		
Intake	109.5 (4.311)	
Exhaust	109.7 (4.319)	
Stem diameter		
Intake	6.57 – 6.58 (.2587 – .2591)	
Exhaust	6.53 – 6.55 (.2571 – .2579)	
Face angle	45° – 45°30'	
Thickness of valve head (margin)		
Intake	1.0 (.039)	0.7 (.028)
Exhaust	1.5 (.059)	1.0 (.039)
Stem-to guide clearance		
Intake	0.02 – 0.05 (.0008 – .0020)	0.10 (.004)
Exhaust	0.05 – 0.09 (.0020 – .0035)	0.15 (.006)
Valve spring – SOHC 8 VALVE		
Free height	49.8 (1.961)	48.8 (1.921)
Load/installed height N/mm (lbs./in.)	329/40.4 (73/1.591)	
Out-of-squareness	2" or less	Max. 4°
Valve spring – SOHC 16 VALVE		
Free height	51.0 (2.008)	50.0 (1.969)
Load/installed height N/mm (lbs./in.)	272/44.2 (60/1.740)	
Out-of-squareness	2" or less	Max. 4"
Valve spring – DOHC		
Free height	48.3 (1.902)	47.3 (1.862)
Load/installed height N/mm (lbs./in.)	300/40.0 (66/1.575)	
Out-of-squareness	1.5" or less	Max. 4"

mm (in.)

	Standard	Limit
Valve guide- SOHC 8 VALVE Overall length Intake Exhaust I.D. O.D. Service size Press-in temperature	 47 (1.85) 52 (2.05) 8.00 – 8.02 (.3150 – .3157) 13.06 – 13.07 (.5142 – .5146) 0.05 (.002), 0.25 (.010), 0.50 (.020) oversize Room temperature	
Valve guide – SOHC 16 VALVE Overall length Intake Exhaust I.D. O.D. Service size Press-in temperature	 45.5 (1.79) 50.5 (1.99) 6.00 – 6.02 (.236 – .237) 11.06 – 11.07 (.4354 – .4358) 0.05 (.002), 0.25 (.01), 0.50 (.02) over size Room temperature	
Valve guide – DOHC Overall length Intake Exhaust I.D. O.D. Service size Press-in temperature	 45.5 (1.791) 50.5 (1.988) 6.60 – 6.62 (.2598 – .2606) 12.06 – 12.07 (.4748 – .4752) 0.05 (.002), 0.25 (.010), 0.50 (.020) over size Room temperature	
Valve seat Seat angle Valve contact width Sinkage Service size	 43°30' – 44" 0.9 – 1.3 (.035 – .051) 0.3 (.012), 0.6 (.024) over size	 0.2 (.008)
Silent shaft Journal diameter Right (front) (rear) Left (front) (rear) Oil clearance Right (front) (rear) Left (front) (rear)	 41.96 – 41.98 (1.6520 – 1.6528) 10.95 – 40.97 (1.6122 – 1.6130) 18.47 – 18.48 (.7272 – .7276) 10.95 – 40.97 (1.6122 – 1.6130) 0.03 – 0.06 (.0012 – .0024) 0.05 – 0.09 (.0020 – .0036) 0.02 – 0.05 (.0008 – .0020) 0.05 – 0.09 (.0020 – .0036)	
Piston – SOHC I.D. 4G63 4G64 Piston to cylinder clearance Service size	 84.97 – 85.00 (3.3453 – 3.3465) 86.47 – 86.50 (3.404 – 3.4055) 0.02 – 0.04 (.0008 – .0016) 0.25 (.010), 0.50 (.020), 0.75 (.030), 1.00 (.039) over size	

mm (in.)

	Standard	Limit
Piston – DOHC		
O.D.		
Non-turbo	84.97 – 85.00 (3.3453 – 3.3465)	
Turbo	84.96 – 84.99 (3.3449 – 3.3461)	
Piston to cylinder clearance		
Non-turbo	0.02 -0.04 (.0008 – .0016)	
Turbo	0.03 -0.05 (.0012 – .0020)	
Service size	0.25 (.010), 0.50 (.020), 0.75 (.030), 1.00 (.039) over size	
Piston ring – SOHC		
End gap		
No. 1 ring	0.25 – 0.35 (.0098 – .0138)	0.8 (.031)
No. 2 ring		
8 VALVE	0.45 – 0.60 (.0177 – .0236)	0.8 (.031)
16 VALVE	0.40 -0.55 (.0157 – .0217)	0.8 (.031)
Oil ring		
8 VALVE	0.20 -0.60 (.0079 – .0236)	1.0 (.039)
16 VALVE	0.10 – 0.40 (.0039 – .0157)	1.0 (.039)
Ring-to-ring groove clearance		
4G63	0.02 -0.06 (.0008 – .0024)	0.1 (.004)
4G64	0.03 – 0.07 (.0012 – .0028)	0.1 (.004)
Service size	0.25 (.010), 0.50 (.020), 0.75 (.030), 1.00 (.039) over size	
Piston ring – DOHC		
End gap		
No. 1 ring	0.25 -0.40 (.0098 – .0157)	0.8 (.031)
No. 2 ring	0.45 – 0.60 (.0177 – .0236)	0.8 (.031)
Oil ring	0.13 – 0.38 (.0051 – .0150)	1.0 (.039)
Ring-to-ring groove clearance		
No. 1 ring Non-turbo	0.02 – 0.06 (.0008 – .0024)	0.1 (.004)
Turbo	0.03 – 0.07 (.0012 – .0028)	0.1 (.004)
No. 2 ring	0.02 – 0.06 (.0008 – .0024)	0.1 (.004)
Service size	0.25 (.010), 0.50 (.020), 0.75 (.030), 1.00 (.039) over size	
Piston pin		
O.D.	22.00 – 22.01 (.8661 – .8665)	
Press-in load N (lbs.)	7,500 – 17,500 (1,653 – 3,858)	
Press-in temperature	Room temperature	
Connecting rod		
Big end center-to-small end center length	149.9 – 150.0 (5.902 – 5.906)	
Big end	0.05 (.0020)	
Twist	0.1 (.004)	
Big end side clearance	0.10 – 0.25 (.0039 – .0098)	0.4 (.016)

mm (in.)

	Standard	Limit
Crankshaft		
End play	0.05 – 0.25 (.0020 – .0098)	0.4 (.016)
Journal O.D.	56.98 – 57.00 (2.2433 – 2.2441)	
Pin O.D.	44.98 – 45.00 (1.7709 – 1.7717)	
Out-of-roundness and taper of journal and pin	Max. 0.01 (.0004)	
Concentricity of journal	Max. 0.02 (.0008)	
Oil clearance of journal	0.02 – 0.05 (.0008 – .0020)	0.1 (.004)
Oil clearance of pin	0.02 – 0.05 (.0008 – .0020)	0.1 (.004)
Cylinder block		
Cylinder I.D.		
4G63	85.00 – 85.03 (3.3465 – 3.3476)	
4G64	86.50 – 86.53 (3.4055 – 3.4067)	
Flatness of gasket surface	0.05 (.0020)	0.1 (.004)
Grinding limit		“0.2 (.008)
* Total resurfacing depth of both cylinder block and cylinder head.		
Overall height		
4G63	283.9-284.1 (11.177 – 11.185)	
4G64	289.9 – 290.1 (11.413 – 11.421)	
Oil pump		
Side clearance		
Drive gear	0.08 – 0.14 (.0031 – .0055)	
Driven gear	0.06 – 0.12 (.0024 – .0047)	
Drive belt		
Deflection		
V-ribbed type belt	New belt	7.5 – 9.0 (.30 – .35)
	Used belt	8.0 (.32)
V type belt		7.0 – 10.0 (.28 – .39)
Tension		
V-ribbed type belt	New belt N (lbs.)	500 – 700 (110 – 154)
	Used belt N (lbs.)	400 (88)
Oil cooler by-pass valve		
Dimension (L)	34.5 (1.358) – normal temperature	
By-pass hole closing temperature	[97 – 103°C (207 – 217°F) or more]	
Injector		
Coil resistance		
	Non-turbo Ω	13 – 16 at 20°C (68°F)
	Turbo Ω	2 – 3 at 20°C (68°F)
Throttle position sensor		
Resistance Ω	28 – 33 at 20°C (68°F)	
Idle speed control motor position sensor		
- SOHC engine for TRUCK		
Resistance kΩ	4 - 6	

NOTE

O.D.: Outer Diameter

I.D.: Inner Diameter

U.S.: Undersize Diameter

TSB Revision

TORQUE SPECIFICATIONS

	Nm	ft.lbs.
Generator and ignition system		
Cooling fan	11	8
Fan clutch	11	8
Water pump pulley	11	8
Generator mounting bolt	23	17
Generator brace bolt	24	17
Generator pivot nut	14	10
Crankshaft pulley bolt	25	18
Spark plug	25	18
Ignition coil bolt		
M6	14	10
M8	24	17
Distributor nut	11	8
Center cover bolt	3	2
Power transistor bolt	11	8
Crank angle sensor nut	19	14
Timing belt		
Tensioner spring bolt	49	35
Tensioner pulley bolt	49	35
Tensioner arm bolt	22	16
Auto tensioner bolt	24	17
Idler pulley bolt – SOHC	36	26
Idler pulley bolt – DOHC	38	27
Oil pump sprocket nut	55	40
Crankshaft bolt	120	87
Tensioner “B” bolt	19	14
Silent shaft sprocket bolt	46	33
Camshaft sprocket bolt	90	65
Timing belt rear cover – SOHC 16 VALVE		
M8	14	10
M10	31	22
Engine support bracket bolt	45	33
Fuel and emission parts		
IGR valve -bolt	22	16
Throttle body stay bolt – DOHC	19	14
Throttle body bolt	19	14
Fuel pressure regulator bolt	9	7
Throttle body		
Throttle position sensor bolt	2	1.4
Idle speed control servo bolt	3.5	2.5

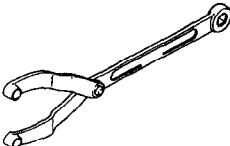
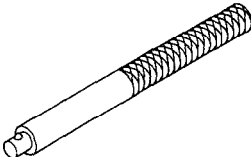
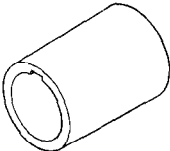
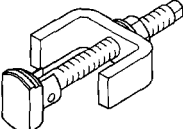
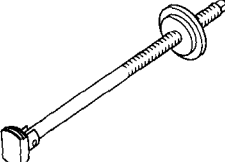
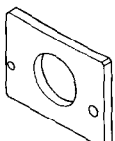
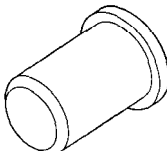
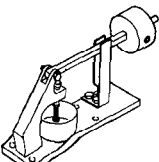
	Nm	ft.lbs.
Intake manifold		
Intake manifold bolt and nut	18	13
Intake manifold bolt (MI 0) and nut (MI 0)– DOHC	36	26
Intake manifold stay bolt – SOHC	22	16
Intake manifold stay bolt – DOHC	28	20
Intake manifold plenum bolt and nut	18	13
Intake manifold plenum stay bolt	18	13
Water outlet fitting bolt	19	14
Engine coolant temperature gauge unit	11	8
Engine coolant temperature sensor	30	22
Thermostat case nut	18	13
Exhaust manifold and water pump		
Oil level gauge guide bolt		
M8	14	10
M10	60	43
Heat protector bolt		
M6	9	7
M8	14	10
M10	30	22
Exhaust manifold nut – SOHC	18	13
Exhaust manifold nut – DOHC	28	20
Air outlet fitting bolt	19	14
Turbocharger bolt and nut	60	43
Exhaust fitting bolt	60	43
Water inlet pipe bolt	14	10
Water pump bolt	14	10
Water pipe “A” and “B” eye bolt	43	31
Water pipe “A” bolt	11	8
Water pipe “B” flare nut	45	33
Water pipe bolt		
M8	14	10
M6	11	8
Oil return pipe bolt	9	7
Oil pipe		
Cylinder head side	17	12
Turbocharger side	31	22
Turbocharger		
turbocharger waste gate actuator bolt	12	9

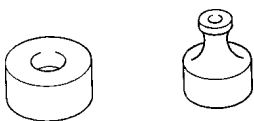
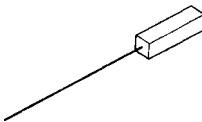
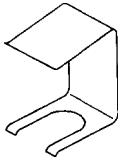
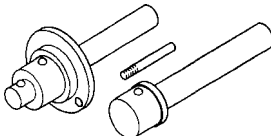
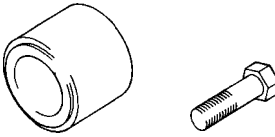
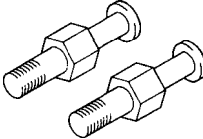
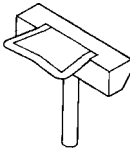
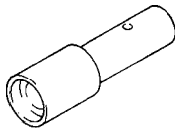
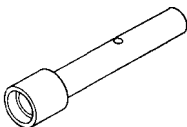
	Nm	ft.lbs.
Rocker arms and camshaft		
Rocker cover bolt – SOHC	6	4
Rocker cover bolt – DOHC	3	2.2
Bearing cap bolt – SOHC		
M8 x 25	24	17
M8 x 65	20	14
Bearing cap bolt – DOHC	20	14
Rocker shaft bolt	32	23
Oil delivery body	11	8
Cylinder head and valves		
Cylinder head bolt	20 + 1/4 turns + 1/4 turns	14.5 + 114 turr + 1/4 turns
Front case, silent shaft and oil pan		
Drain plug	40	29
Oil pan bolt	7	5
Oil screen bolt and nut	19	14
Check valve	33	24
Oil cooler bolt	43	31
Oil filter bracket bolt	19	14
Plug	24	17
Left silent shaft flange bolt	37	27
Front case bolt		
M8	24	17
M10	31	22
Oil pressure switch	10	7
Oil cooler by-pass valve	55	40
Relief plug	45	33
Oil pump cover bolt	17	12
Oil pressure gauge unit	55	40
Piston and connecting rod		
Connecting rod cap nut	20 + 1/4 turns	14.5 + 1/4 turn:
Crankshaft, flywheel and drive plate		
Flywheel bolt	135	98
Drive plate bolt	135	98
Oil seal case bolt	11	8
Bearing cap bolt – SOHC	53	3 8
Bearing cap bolt – DOHC	68	49
Bracket		
Left and right engine support bracket bolt	45	33
Front roll stopper bracket bolt	65	47
Rear roll stopper bracket bolt	120	87
Front engine support bracket bolt	60	43
Exhaust pipe support bracket bolt	36	26

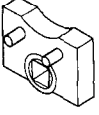
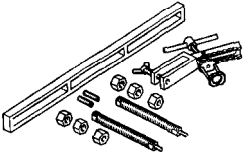
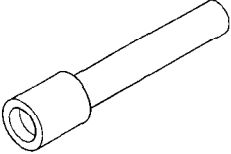
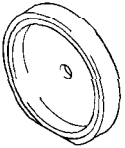
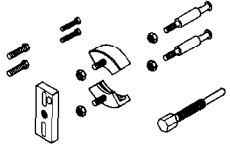
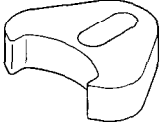
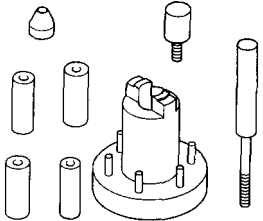
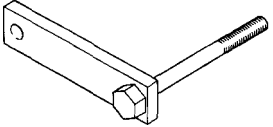
SEALANT

	Specified sealant	Quantity
Rocker cover	3M ATD Part No. 8660 or equivalent	As required
Semi-circular packing	3M ATD Part No. 8660 or equivalent	As required
Engine support bracket bolt	3M ATD Part No. 8660 or equivalent	As required
Oil pan gasket	MITSUBISHI GENUINE PART MD970389 or equivalent	As required
Water outlet fitting	MITSUBISHI GENUINE PART MD970389 or equivalent	As required
Engine coolant temperature gauge unit	3M ATD Part No. 8660 or equivalent	As required
Engine coolant temperature sensor	3M Nut Locking Part No. 4171 or equivalent	As required
Oil pressure switch	3M ATD Part No. 8660 or equivalent	As required
Oil pressure gauge unit	3M ATD Part No. 8660 or equivalent	As required
Rear oil seal case	MITSUBISHI GENUINE PART MD970389 or equivalent	As required

SPECIAL TOOLS

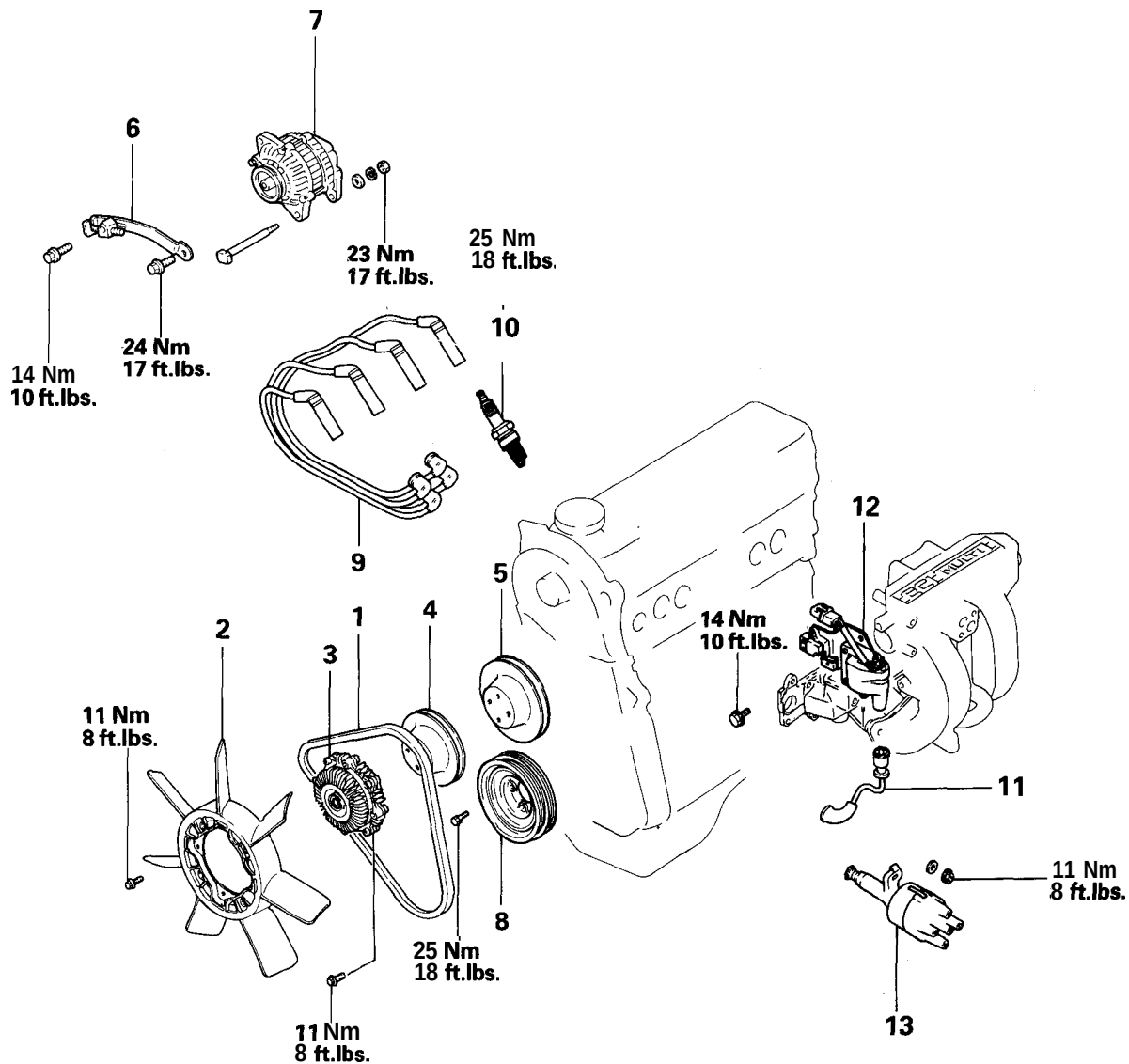
Tool	Number and tool name	Supersession	Application
	MB990767 End yoke holder Use with MD998719	MB990767-01 Use with MIT308239	Holding camshaft sprocket when loosening or torquing bolt. For SOHC engine only
	MB990938 Handle Use with MD998776	MB990938-01	Installation of crankshaft rear oil seal
	MD998162 Plug wrench	MD998162-01	Removal and installation of front case cap plug
	MD998285 Crankshaft front oil seal guide	MD998285-01	Installation of crankshaft front oil seal
	MD998371 Silent shaft bearing puller	MD998371-01 Use with MIT304204	Removal of silent shaft rear
	MD998372 Silent shaft bearing puller	MD998372-01 Use with MIT304204	Removal of silent shaft rear
	MD998374 Bearing installer stopper	MD998374-01	Removal and installation of rear bearing
	MD998375 Crankshaft front oil seal installer	MD998375-01	Installation of crankshaft front oil seal
	MD998440 Leak-down tester		Leak-down test of lash adjuster

Tool	Number and tool name	Supersession	Application
	MD998441 Lash adjuster retainer		Air bleeding of lash adjuster For SOHC engine only
	MD998442 Air bleed wire		Air bleed of lash adjuster
	MD998443 Lash adjuster holder (8)	MD998443-01	Supporting of the lash adjuster to prevent it from falling when rocker shaft assembly is removed or installed For SOHC engine only
	MD998705 Silent shaft bearing installer	MD998373-01	Installation of silent shaft bearing
	MD998713 Camshaft oil seal installer	MD998713-01	Installation of camshaft oil seal
	MD998719 Pulley holding pins (2)	MIT308239	Holding camshaft sprocket when loosening or torquing bolt For SOHC engine only
	MD998727 Oil pan remover		Removal of oil pan
	MD998729 Valve stem seal installer	MD998729-01	Installation of valve stem seal For SOHC 8 valve engine only
	MD998737 Valve stem seal installer	MD998737-01	Installation of valve stem seal For DOHC engine only

Tool	Number and tool name	Supersession	Application
	MD998767 Tension pulley wrench	MD998752-01	Installation of auto tensioner
	MD998772 Valve spring compressor		Compression of valve spring
	MD998774 Valve steam seal installer		Installation of valve steam seal For SOHC 16 valve engine only
	MD998776 Crankshaft rear oil seal installer Use with MB990938	MD998376-01 Use with MB990938-01	Installation of crankshaft rear oil seal
	MD998778 Crankshaft sprocket puller		Removal of crankshaft sprocket
	MD998779 Sprocket stopper		Supporting silent shaft sprocket
	MD998780 Piston pin setting tool	MIT21 6941	Removal and installation of piston pin
	MD998781 Flywheel stopper		Supporting flywheel and drive plate

GENERATOR AND IGNITION SYSTEM

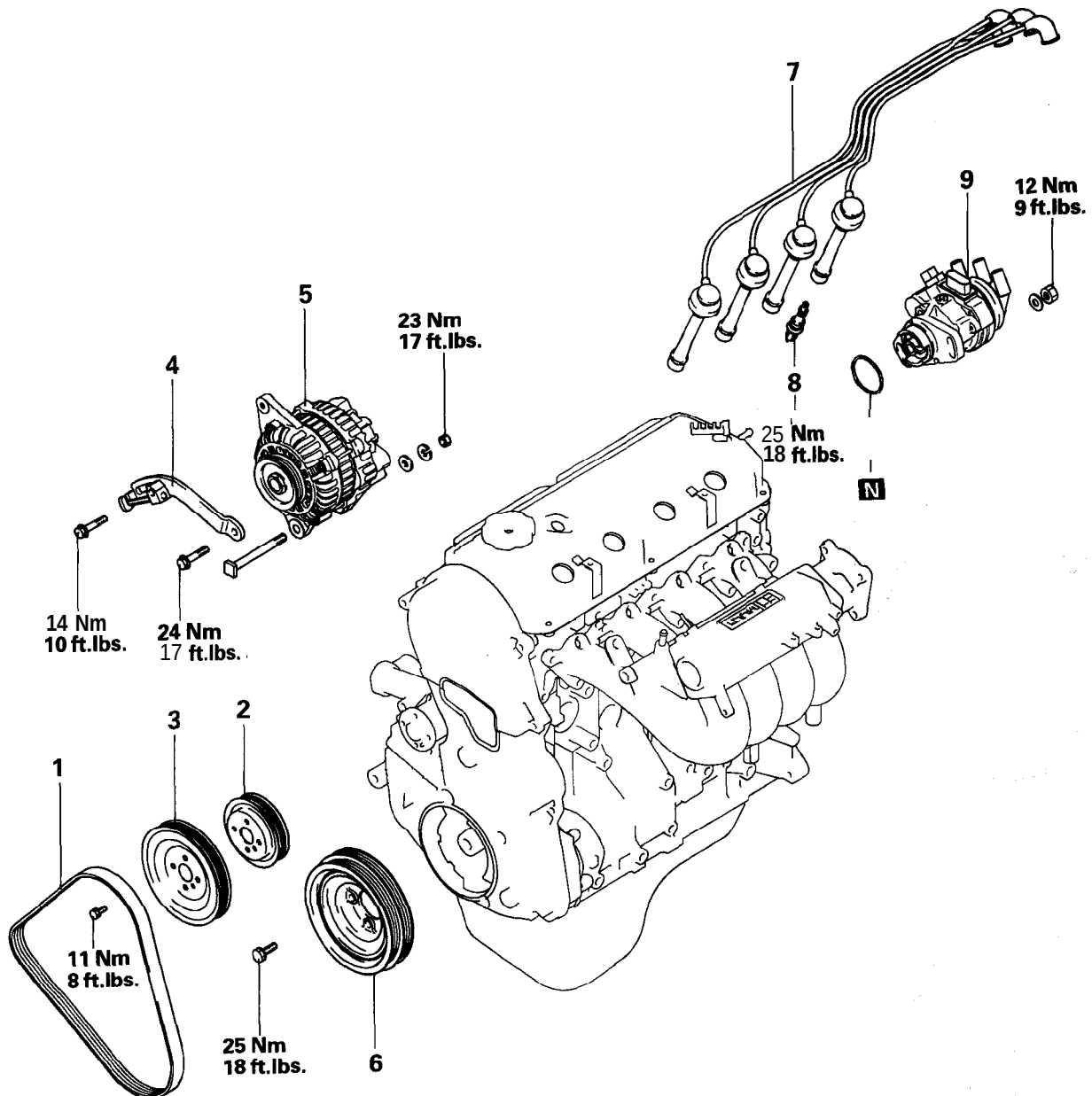
REMOVAL AND INSTALLATION – SOHC 8 VALVE



Removal steps

- ◆◆ 1. Drive belt
- 2. Cooling fan
- 3. Fan clutch
- 4. Water pump pulley
- 5. Power steering pump pulley
- 6. Generator brace
- 7. Generator
- 8. Crankshaft pulley
- 9. Spark plug cable
- 10. Spark plug
- 11. High tension cable
- 12. Ignition coil and ignition power transistor
- ◆◆ 13. Distributor

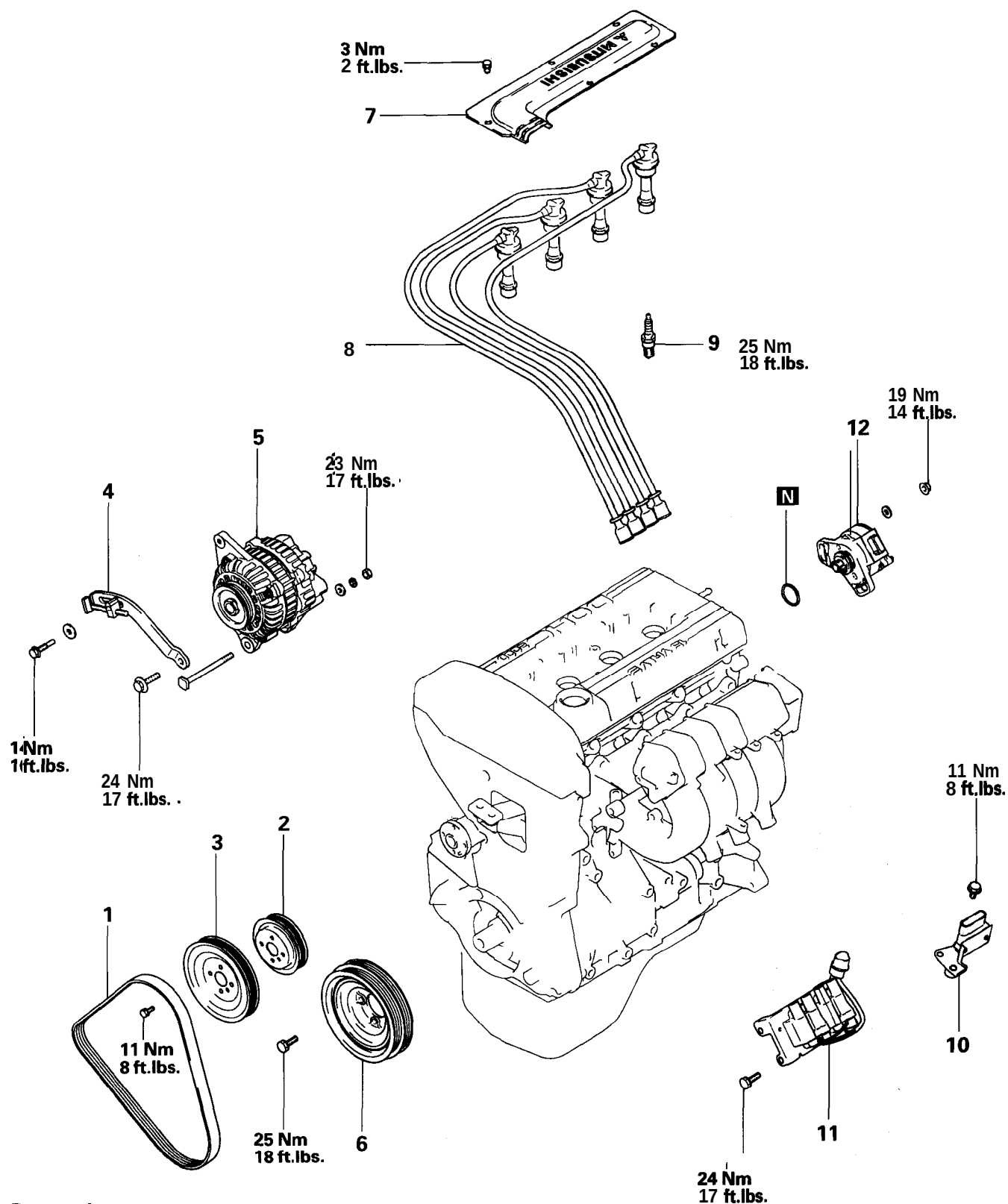
REMOVAL AND INSTALLATION — SOHC 16 VALVE



Removal steps

- ◆◆ 1. Drive belt
- 2. Water pump pulley
- 3. Power steering pump pulley
- 4. Generator brace
- 5. Generator
- 6. Crankshaft pulley
- 7. Spark plug cable
- 8. Spark plug
- ◆◆ 9. Distributor

REMOVAL AND INSTALLATION - DOHC



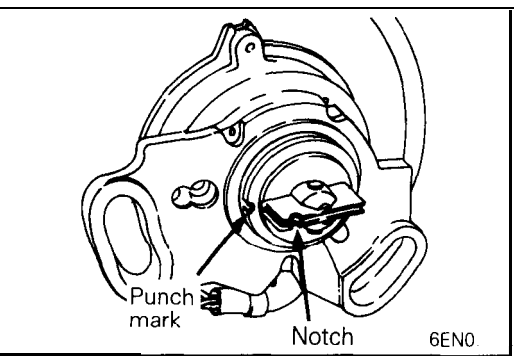
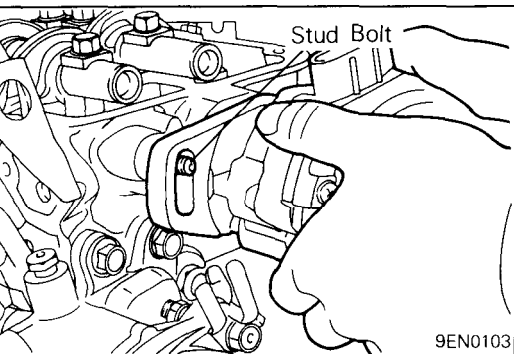
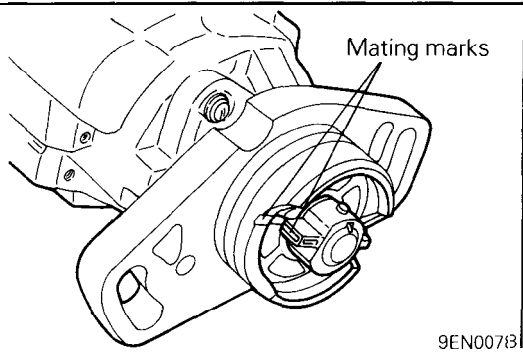
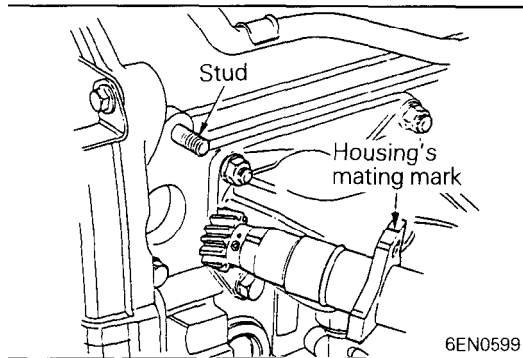
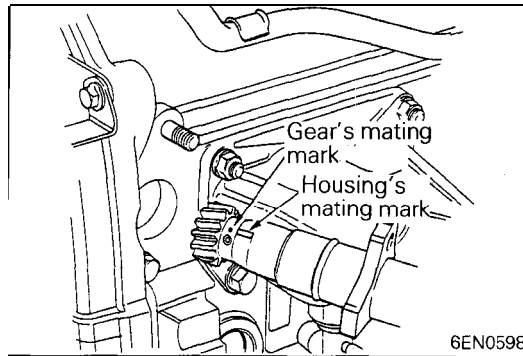
Removal steps



1. Drive belt
2. Water pump pulley
3. Power steering pump pulley
4. Generator brace
5. Generator
6. Crankshaft pulley



7. Center cover
8. Spark plug cable
9. Spark plug
10. Ignition power transistor
11. Ignition coil
12. Crankshaft position sensor



INSTALLATION SERVICE POINTS

◆A◆ DISTRIBUTOR INSTALLATION

- (1) Turn the crankshaft so that the No. 1 cylinder is at top dead center.
- (2) Align the distributor housing and gear mating marks.

- (2) Install the distributor to the engine while aligning the fine cut (groove or projection) of the distributor's installation flange with the center of the distributor installation stud.

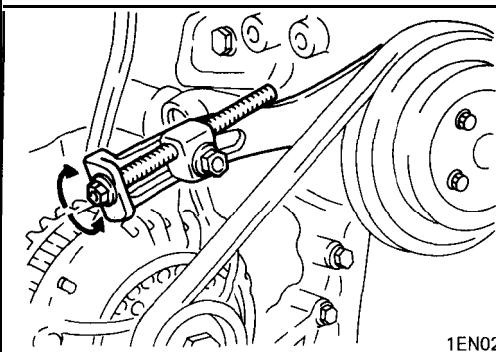
◆B◆ DISTRIBUTOR ASSEMBLY INSTALLATION

- (1) Turn the crankshaft to bring No. 1 cylinder to the top dead center on compression stroke.
- (2) Align the mating marks on the distributor housing with that of the coupling key.

- (3) Install the distributor assembly on the engine while aligning the stud bolt used for securing the distributor with the slot in the mounting flange of the distributor.

◆C◆ CRANKSHAFT POSITION SENSOR INSTALLATION

- (1) Turn the crankshaft so that the No. 1 cylinder is at top dead center.
- (2) Align the punch mark on the crankshaft position sensor housing with the notch in plate.
- (3) Install the crankshaft position sensor on the cylinder head.



DRIVE BELT TENSION ADJUSTMENT

ADJUSTER TYPE

- (1) Adjust belt deflection to standard value. Turn adjusting bolt clockwise to increase the belt tension and turn adjusting bolt counterclockwise to decrease the belt tension.

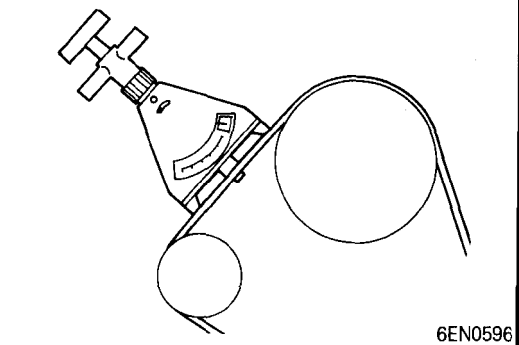
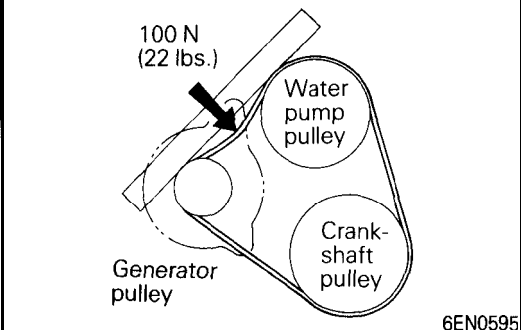
Standard value:

V-ribbed type belt

New belt 7.5 – 9.0 mm (.30 – .35 in.)

Used belt 8.0 mm (.32 in.)

V-type belt 7.0 – 10.0 mm (.28 – .39 in.)



When using tension gauge for V-ribbed belt only.

Standard value:

New belt 500 – 700 N (110 – 154 lbs.)

Used belt 400 N (88 lbs.)

- (2) Tighten the lock bolt to the specified torque.
- (3) Tighten the nut for the pivot bolt to the specified torque.

BRACE BOLT TYPE

- (1) Move generator to adjust belt deflection to standard value.

Standard value:

V-ribbed type belt

New belt 7.5 – 9.0 mm (.30 – .35 in.)

Used belt 8.0 mm (.32 in.)

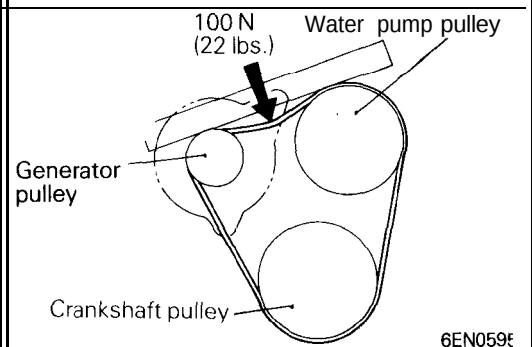
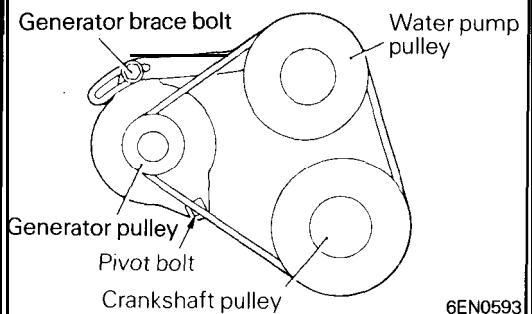
V-type belt 7.0 – 10.0 mm (.28 – .39 in.)

When using tension gauge for V-ribbed belt only.

Standard value:

New belt 500 – 700 N (110 – 154 lbs.)

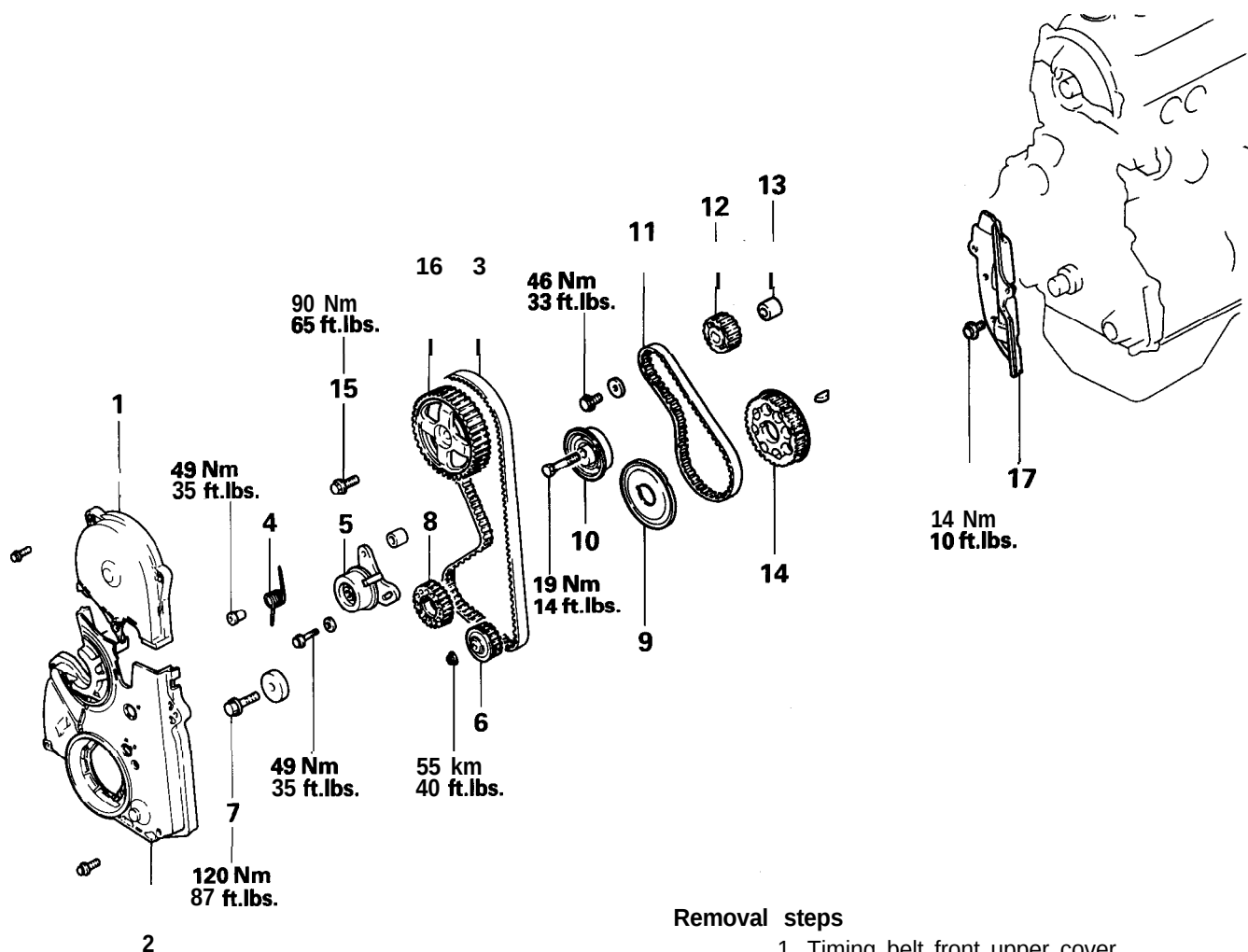
Used belt 400 N (88 lbs.)



- (2) Tighten the brace bolt to the specified torque.
- (3) Tighten the nut for the pivot bolt to the specified torque.

TIMING BELT

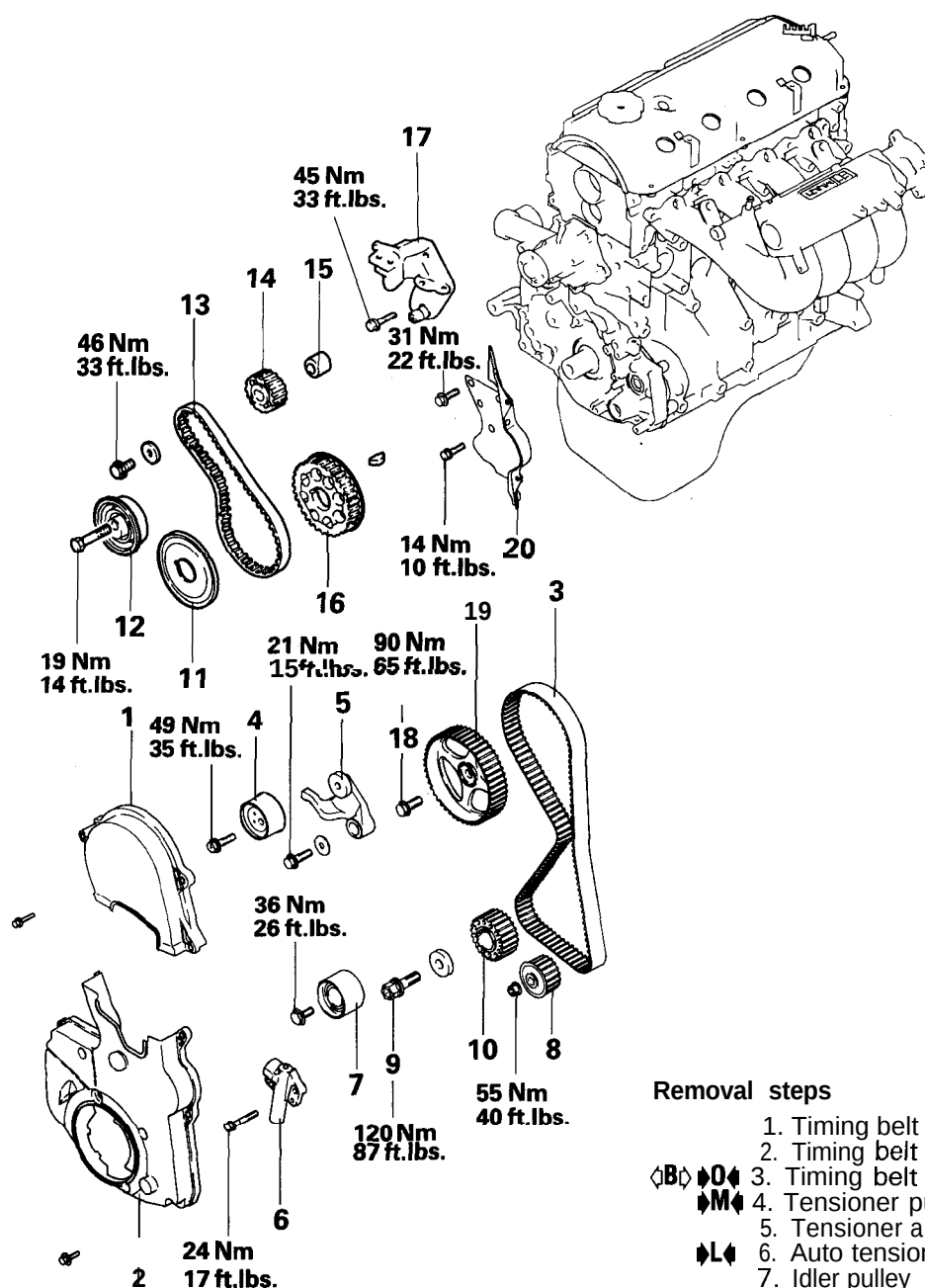
REMOVAL AND INSTALLATION – SOHC 8 VALVE



Removal steps

1. Timing belt front upper cover
2. Timing belt front lower cover
3. Timing belt
4. Tensioner spring
5. Tensioner pulley
6. Oil pump sprocket
7. Crankshaft bolt
8. Crankshaft sprocket
9. Flange
10. Tensioner "B"
11. Timing belt "B"
12. Silent shaft sprocket
13. Spacer
14. Crankshaft sprocket "B"
15. Camshaft sprocket bolt
16. Camshaft sprocket
17. Timing belt rear cover

REMOVAL AND INSTALLATION – SOHC 16 VALVE

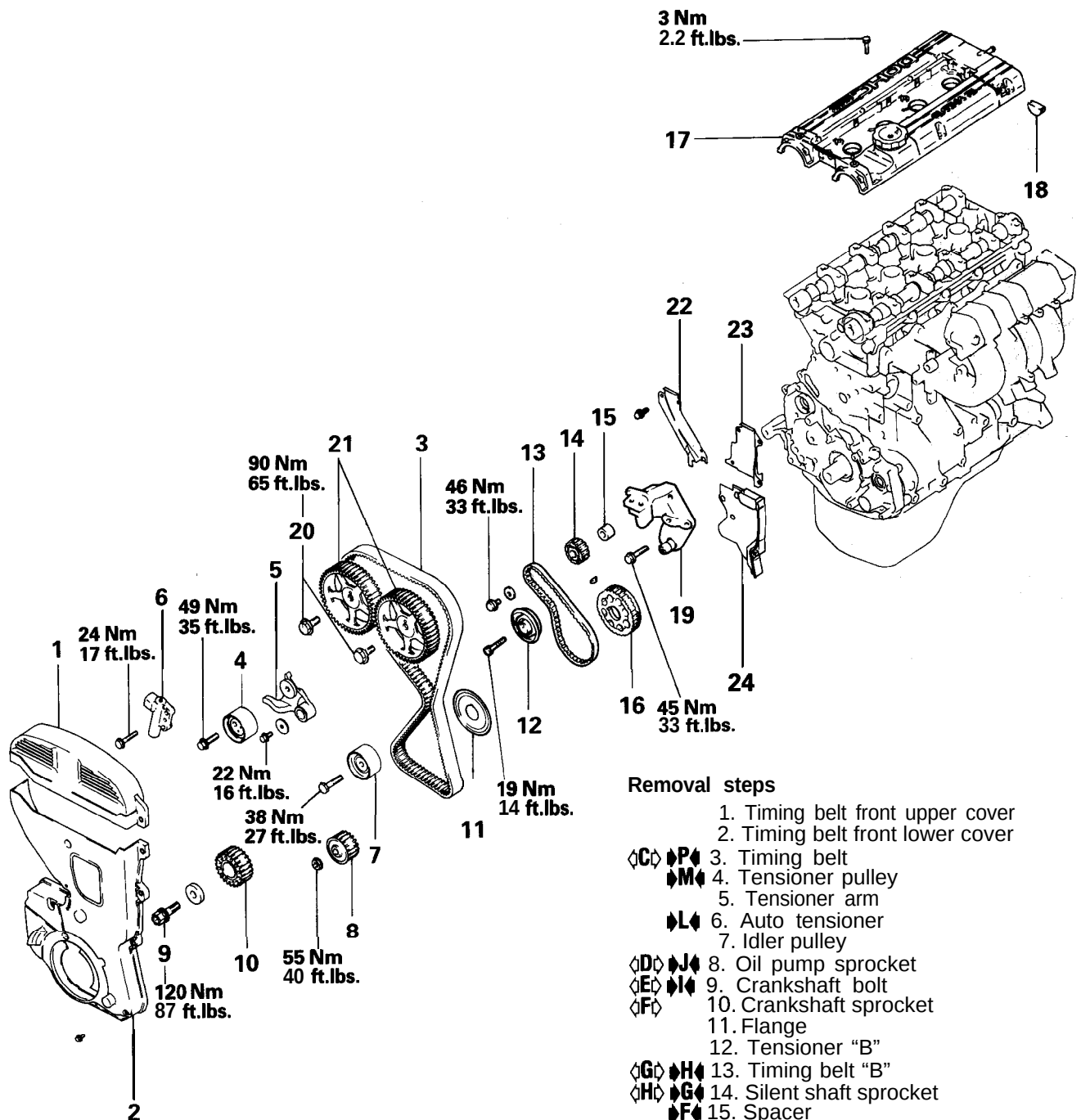


Removal steps

1. Timing belt front upper cover
2. Timing belt front lower cover
3. Timing belt
4. Tensioner pulley
5. Tensioner arm
6. Auto tensioner
7. Idler pulley
8. Oil pump sprocket
9. Crankshaft sprocket
10. Crankshaft sprocket bolt
11. Flange
12. Tensioner "B"
13. Timing belt "B"
14. Silent shaft sprocket
15. Spacer
16. Crankshaft sprocket "B"
17. Engine support bracket
18. Camshaft sprocket bolt
19. Camshaft sprocket
20. Timing belt rear cover

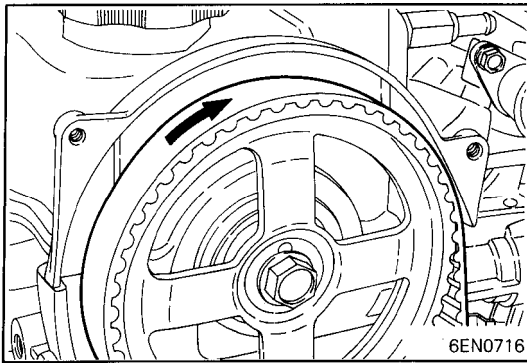
6EN0658

REMOVAL AND INSTALLATION - DOHC



Removal steps

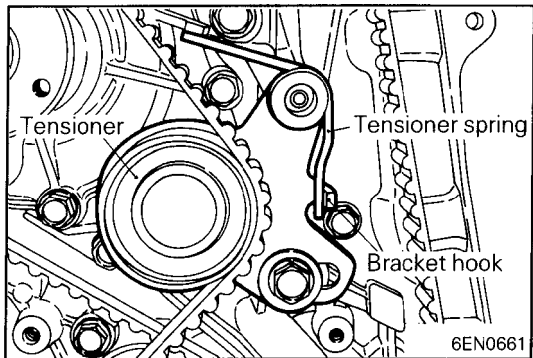
1. Timing belt front upper cover
2. Timing belt front lower cover
3. Timing belt
4. Tensioner pulley
5. Tensioner arm
6. Auto tensioner
7. Idler pulley
8. Oil pump sprocket
9. Crankshaft bolt
10. Crankshaft sprocket
11. Flange
12. Tensioner "B"
13. Timing belt "B"
14. Silent shaft sprocket
15. Spacer
16. Crankshaft sprocket "B"
17. Rocker cover
18. Semi-circular packing
19. Engine support bracket
20. Camshaft sprocket bolt
21. Camshaft sprocket
22. Timing belt rear right cover
23. Timing belt rear left upper cover
24. Timing belt rear left lower cover

**REMOVAL SERVICE POINTS****◊A◊ TIMING BELT REMOVAL**

- (1) Mark the belt running direction for reference in reinstallation.

NOTE

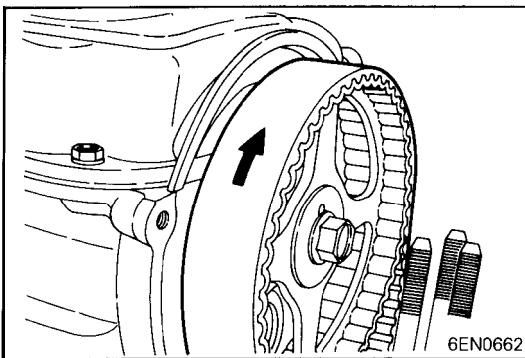
- (1) Water or oil on the belt shorten its life drastically, so the removed timing belt, sprocket, and tensioner must be free from oil and water. These parts should not be washed. Replace parts if seriously contaminated.
- (2) If there is oil or water on each part check front case oil seals, camshaft oil seal and water pump for leaks.
- (2) Back off the tensioner spring mounting bolt three turns.
- (3) Pinching the end of the tensioner spring on the tensioner side with pliers, unhook it from the bracket hook on the tensioner to free the tensioner spring.
- (4) Loosen the tensioner mounting bolt and remove the timing belt.

**◊B◊ TIMING BELT REMOVAL**

- (1) Mark belt running direction for reinstallation.

NOTE

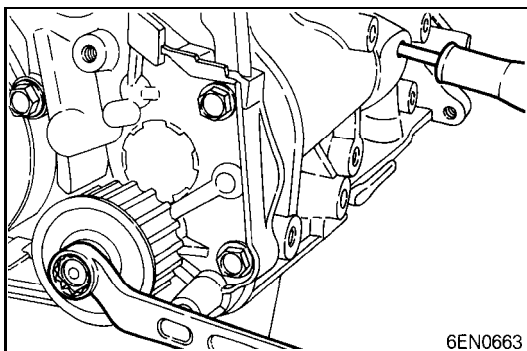
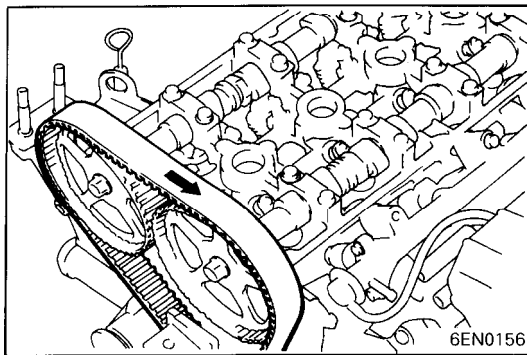
- (1) Water or oil on the belt shorten its life drastically, so the removed timing belt, sprocket, and tensioner must be free from oil and water. These parts should not be washed. Replace parts if seriously contaminated.
- (2) If there is oil or water on each part check front case oil seals, camshaft oil seal and water pump for leaks.

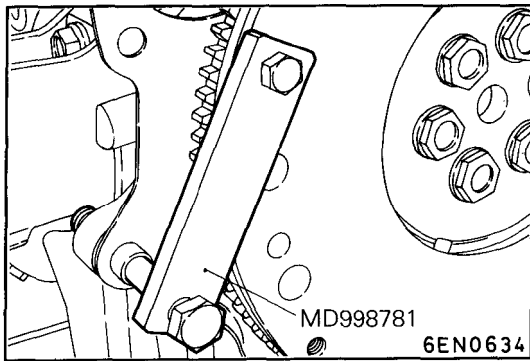
**◊C◊ TIMING BELT REMOVAL**

- (1) Mark the belt running direction for reference in reinstallation.

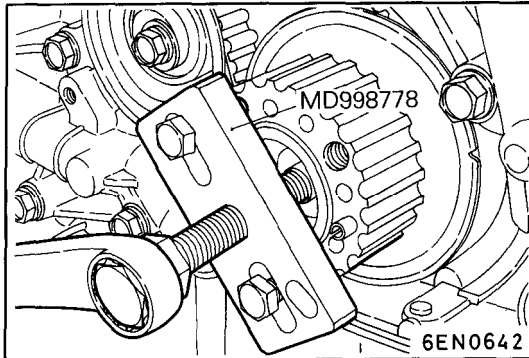
NOTE

- (1) Water or oil on the belt shorten its life drastically, so the removed timing belt, sprocket, and tensioner must be free from oil and water. These parts should not be washed. Replace parts if seriously contaminated.
- (2) If there is oil or water on each part check front case oil seals, camshaft oil seal and water pump for leaks.

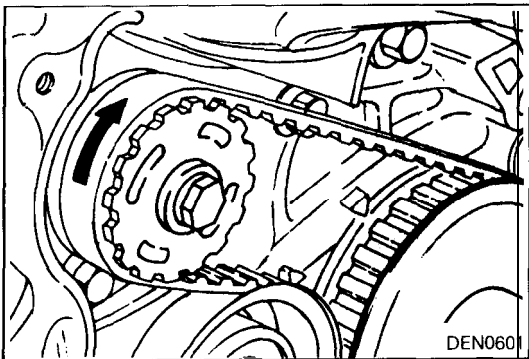
**◊D◊ OIL PUMP SPROCKET REMOVAL**



⇧E⇧ CRANKSHAFT BOLT LOOSENING



⇧F⇧ CRANKSHAFT SPROCKET REMOVAL

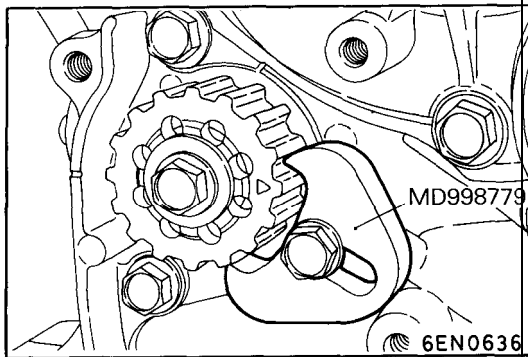


⇧G⇧ TIMING BELT "B" REMOVAL

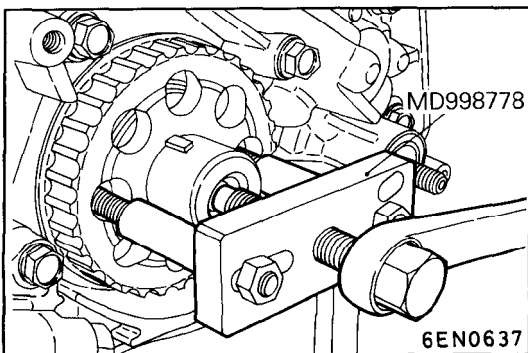
- (1) Make a mark on the back of the timing belt indicating the direction of rotation so it may be reassembled in the same direction if it is to be reused.

NOTE

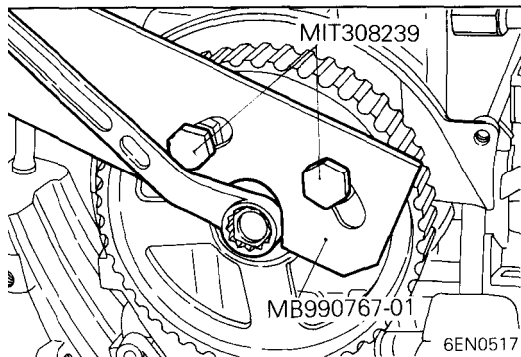
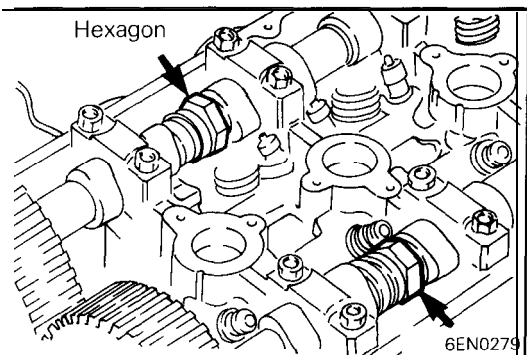
- (1) Water or oil on the belt shortens its life drastically, so the removed timing belt, sprocket, and tensioner must be free from oil and water. These parts should not be washed. Replace parts if seriously contaminated.
- (2) If there is oil or water on each part check front case oil seals, camshaft oil seal and water pump for leaks.



⇧H⇧ SILENT SHAFT SPROCKET REMOVAL



⇧I⇧ CRANKSHAFT SPROCKET "B" REMOVAL

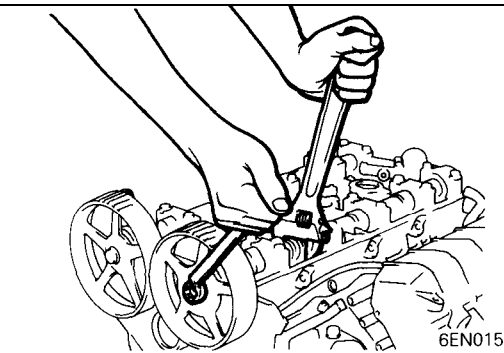
**CAMSHAFT SPROCKET BOLT LOOSENING****CAMSHAFT SPROCKET BOLT LOOSENING**

- (1) Using a wrench, hold the camshaft at its hexagon (between the No. 2 and No. 3 journals) and remove the camshaft sprocket bolt.

Caution

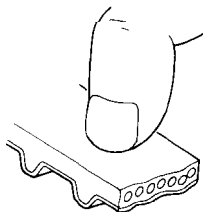
Locking the camshaft sprocket with a tool damages the sprocket.

- (2) Remove the camshaft sprockets.

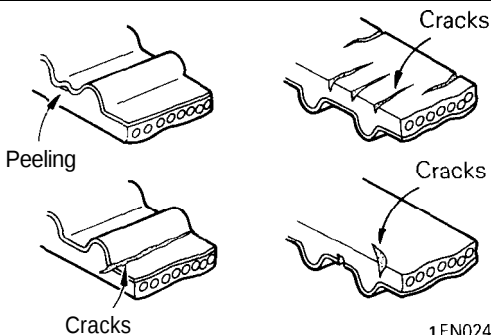
**INSPECTION****TIMING BELT**

Replace belt if any of the following conditions exist.

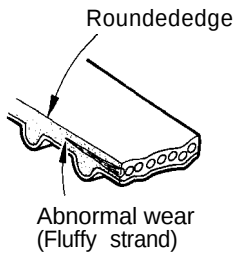
- (1) Hardening of back rubber.
Back side is glossy without resilience and leaves no indent when pressed with fingernail.



8EN006

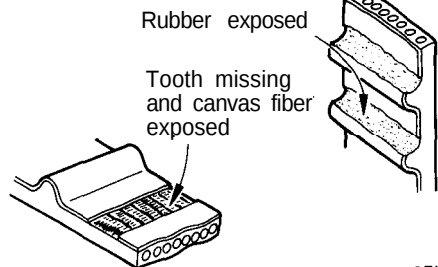


- (2) Cracks on rubber back.
- (3) Cracks or peeling of canvas.
- (4) Cracks on rib root.
- (5) Cracks on belt sides.



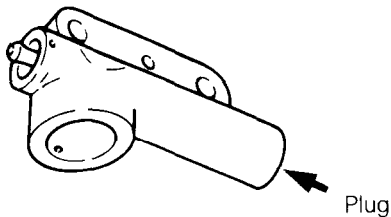
8EN0067

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



8EN0068

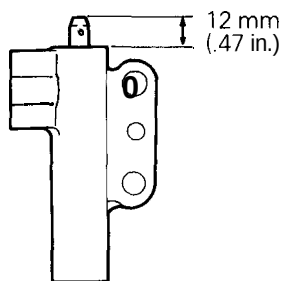
- (7) Abnormal wear on teeth.
(8) Missing tooth.



6EN0280

AUTO TENSIONER

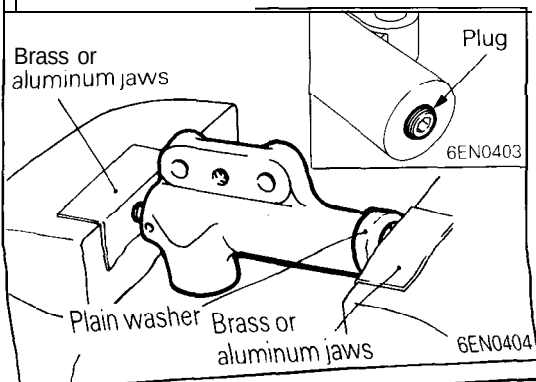
- (1) Check the auto tensioner for possible leaks and replace as necessary.
- (2) Check the rod end for wear or damage and replace as necessary.



6EN016

- (3) Measure the rod protrusion. If it is out of specification, replace the auto tensioner.

Standard value: 12 mm (.47 in.)

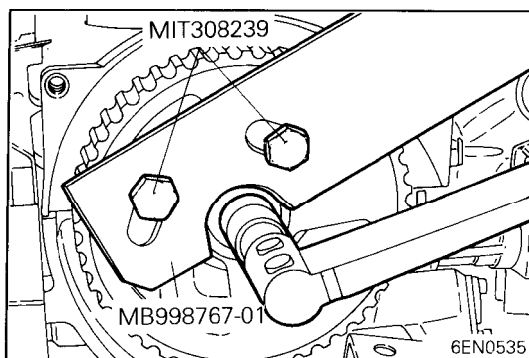


- (4) Clamp the auto tensioner in a vise with soft jaws.

Caution

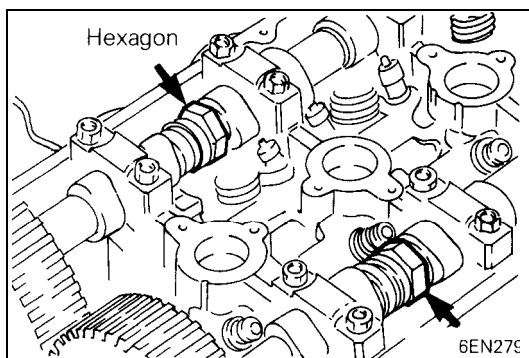
The plug at the bottom of the auto tensioner protrudes. **Insert a plain washer as illustrated to prevent the plug from being in direct contact with the vise.**

- (5) Turning the vise handle, push in the auto tensioner rod. If the rod can be easily retracted, replace the auto tensioner. You should feel a fair amount of resistance when pushing the rod in.



INSTALLATION SERVICE POINTS

▶▶ CAMSHAFT SPROCKET TIGHTENING

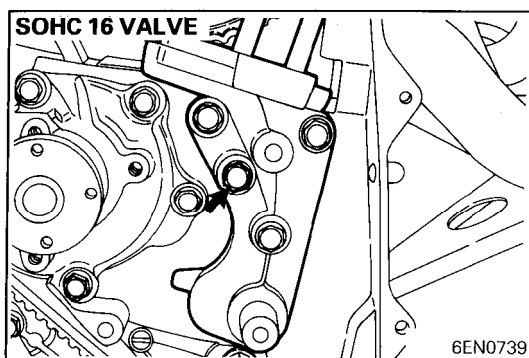
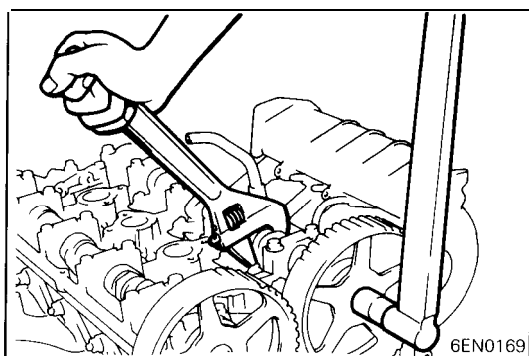


▶▶ CAMSHAFT SPROCKETS TIGHTENING

- (1) Using a wrench, hold the camshaft at its hexagon (between the No. 2 and No. 3 journals) and tighten the bolt to the specification.

Caution

Locking the camshaft sprocket with a tool damages the sprocket.

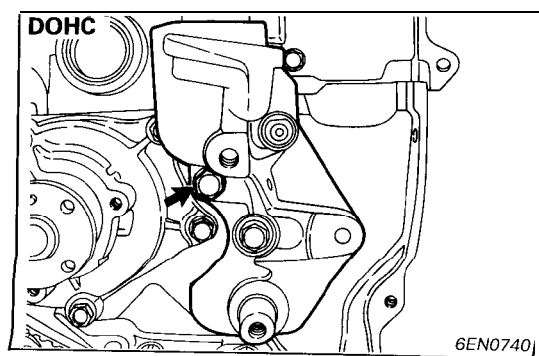


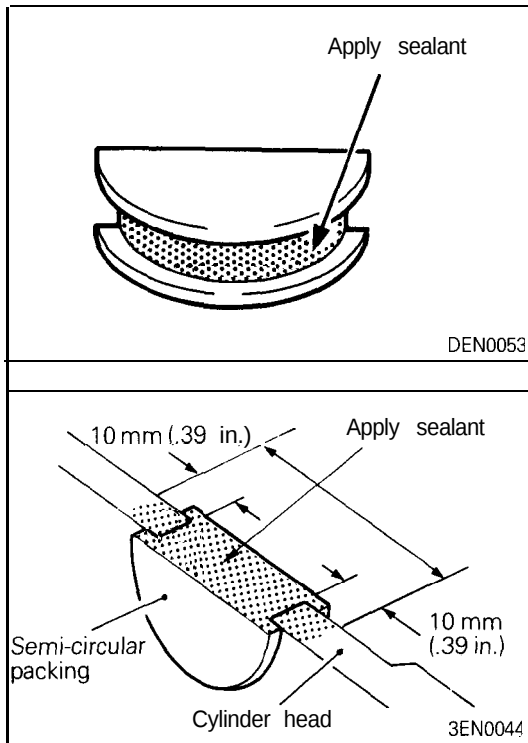
▶▶ ENGINE SUPPORT BRACKET INSTALLATION

- (1) Coat the bolts illustrated with sealant before tightening.

Specified sealant:

3M ATD Part No. 8660 or equivalent



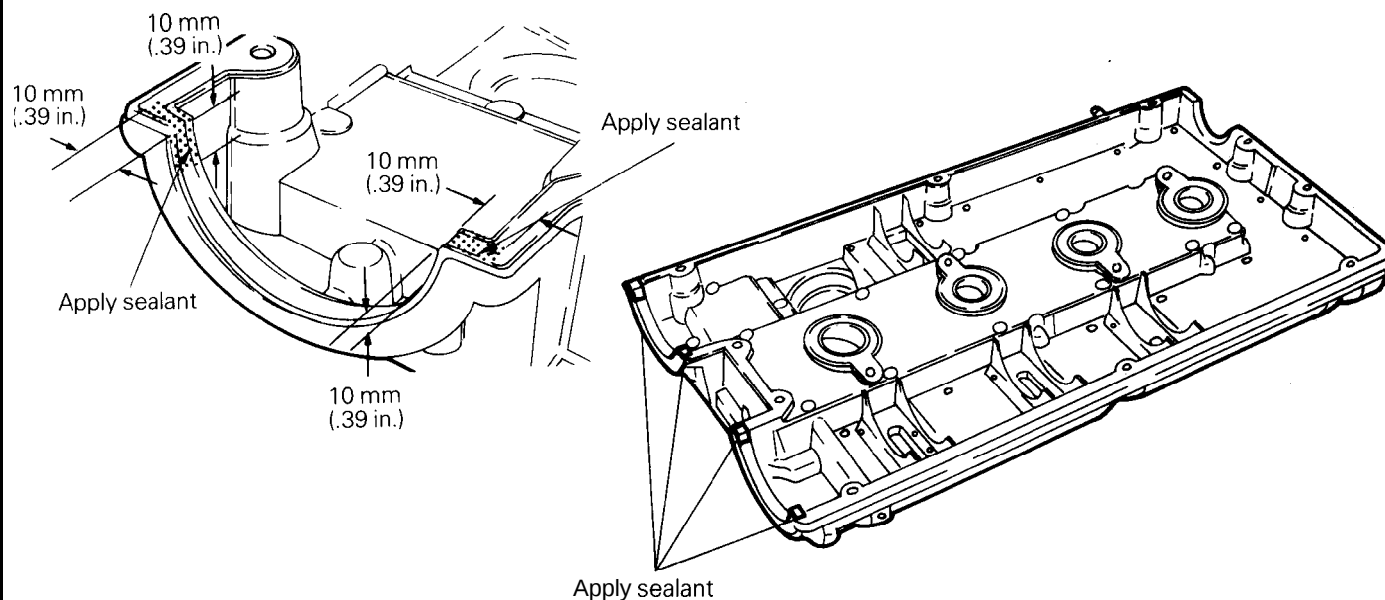
**◆D◆ SEALANT APPLICATION ON SEMI-CIRCULAR PACKING**

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

SEALANT APPLICATION ON ROCKER COVER

Apply sealant to the areas indicated in the illustration.

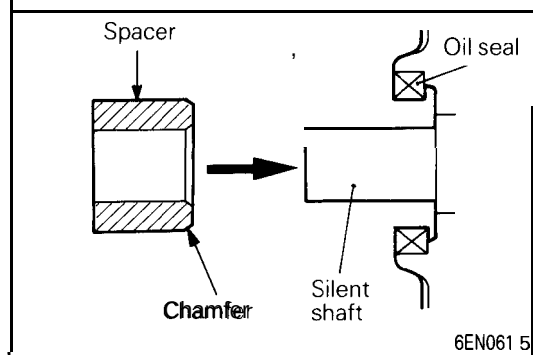
Specified sealant: **3M ATD Part No. 8660** or equivalent



6EN0396

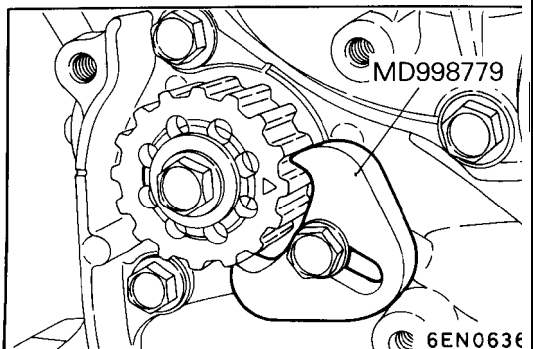
SPACER INSTALLATION

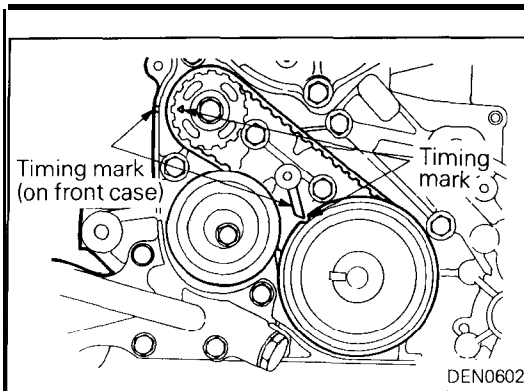
- (1) Install the spacer with the chamfered end toward the oil seal.



6EN0615

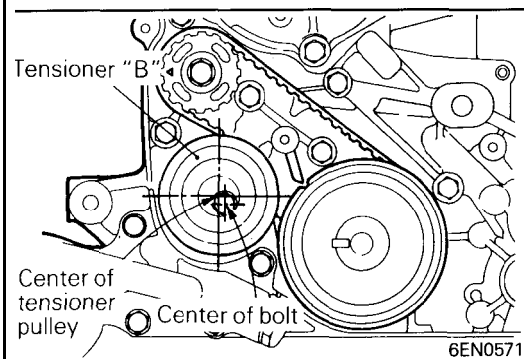
SILENT SHAFT SPROCKET INSTALLATION



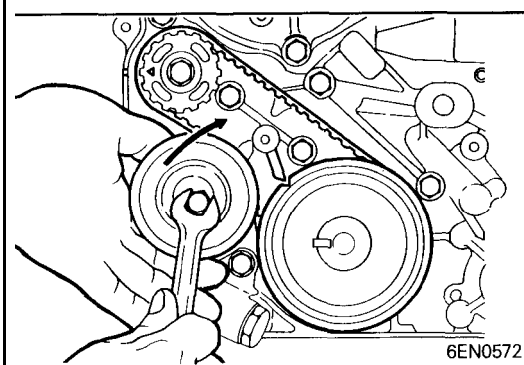


◆◆ TIMING, BELT "B" INSTALLATION

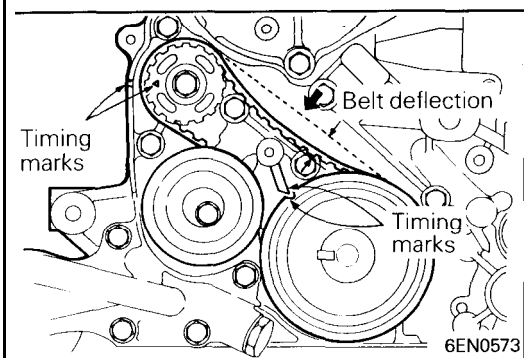
- (1) Align timing marks on the crankshaft sprocket "B" and silent shaft sprocket with the marks on the front case respectively.
- (2) Install the timing belt "B" on the crankshaft sprocket "B" and silent shaft sprocket. There should be no slack on the tension side.



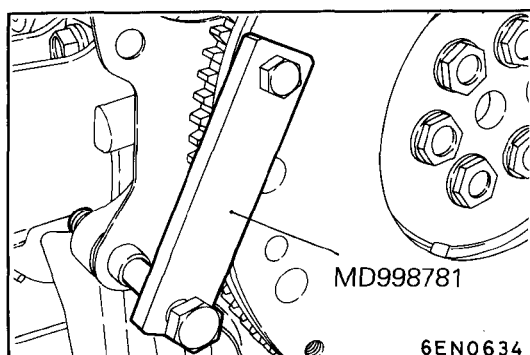
- (3) Make sure that the relationship between the tensioner pulley center and the bolt center is as shown in the illustration.



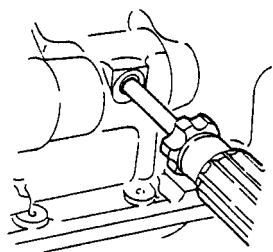
- (4) Move the tensioner "B" in the direction of arrow while lifting with a finger to give a sufficient tension to the tension side of timing belt. In this condition, tighten bolt to secure tensioner "B". When the bolt is tightened, use care to prevent shaft from turning together. If shaft is turned together, belt will be overtensioned.



- (5) Check to ensure that timing marks on sprockets and front case are in alignment.
- (6) Press with index finger the center of span on tension side of timing belt "B". The bolt must deflect 5 – 7 mm (.20 – .28 in.).



◆◆ CRANKSHAFT BOLT TIGHTENING



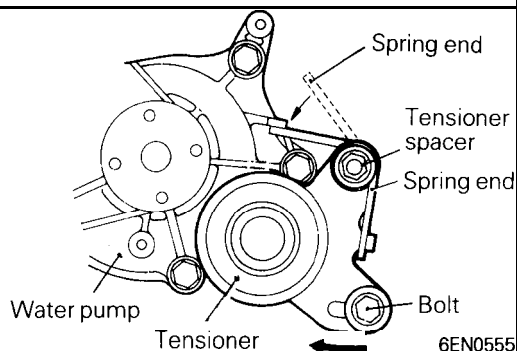
6EN0564

◆◆ OIL PUMP SPROCKET INSTALLATION

- (1) Insert a Phillips screwdriver [shank diameter 8 mm (.31 in.) shaft] through the plug hole on the left side of the cylinder block to block the left silent shaft.
- (2) Install the oil pump sprocket.
- (3) Apply a proper amount of engine oil to the bearing surfaces of the nuts.
- (4) Tighten the nuts to the specified torque.

◆◆ TENSIONER INSTALLATION

- (1) Hook the tensioner spring ends to the water pump body projection and tensioner bracket.
- (2) Move tensioner fully toward water pump and tighten the bolt and tensioner spacer.



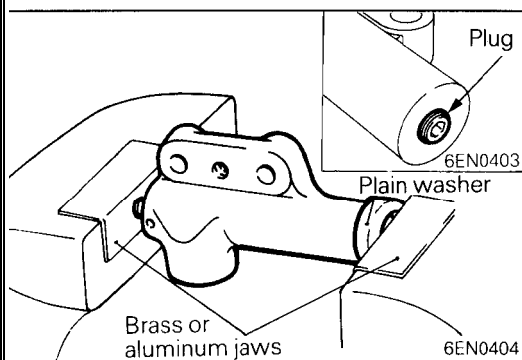
6EN0555

◆◆ AUTO TENSIONER INSTALLATION

- (1) If the auto tensioner rod is in its fully extended position, reset it as follows.
- (2) Clamp the auto-tensioner in the vise with soft jaws.

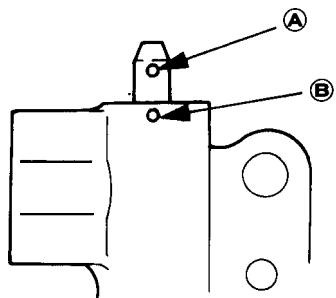
Caution

The plug at the bottom of the auto tensioner protrudes. Insert a plain washer as illustrated to prevent the plug from being in direct contact with the vise.



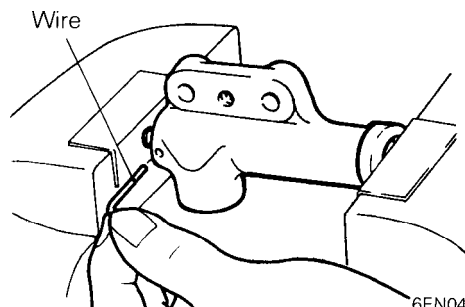
6EN0404

- (3) Push in the rod little by little with the vise until the set hole (A) in the rod is aligned with the hole (B) in the cylinder.

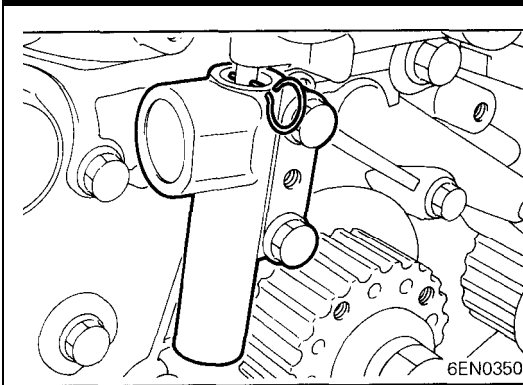


6EN0154

- (4) Insert a wire [1.4 mm (.055 in.) in diameter] into the set holes.
- (5) Unclamp the auto tensioner from the vise.



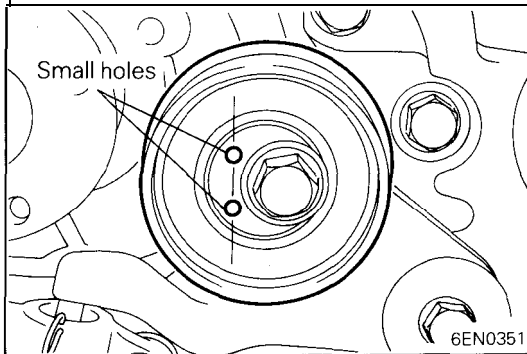
6EN0404



- (6) Install the auto tensioner to front case and tighten to the specified torque.

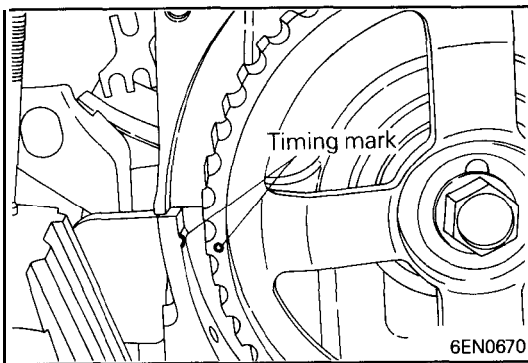
Caution

Leave the wire installed in the auto tensioner.



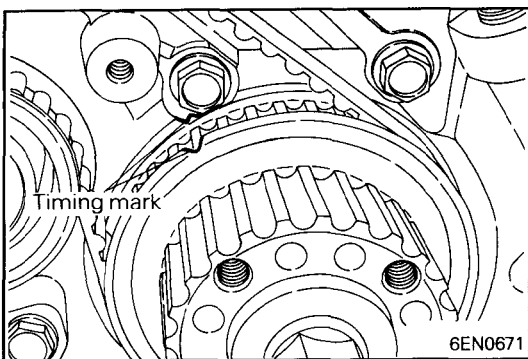
◆M◆ TENSIONER PULLEY INSTALLATION

- (1) Install the tensioner pulley in such direction that its two small holes are arranged vertically.

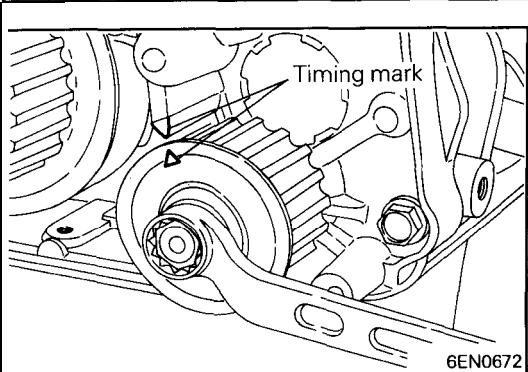


◆N◆ TIMING BELT INSTALLATION

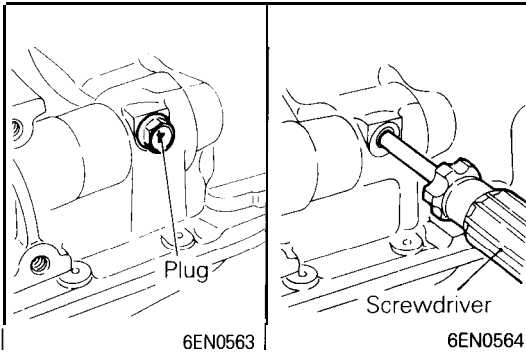
- (1) Check that the timing belt tensioner has been installed in position. (See ◆K◆)
 (2) Align timing mark on camshaft sprocket with timing mark on cylinder head.



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



- (4) Align the timing mark on oil pump sprocket with its mating mark.

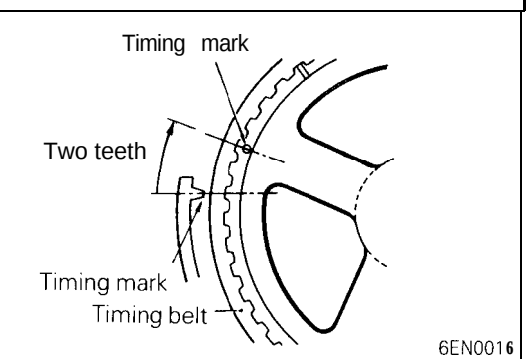
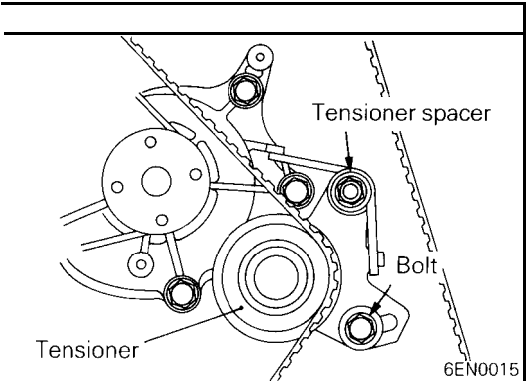


- (5) Remove the plug on cylinder block and insert a Phillips screwdriver [shank diameter 8 mm (.31 in.)] through the hole (Engine with silent shafts).

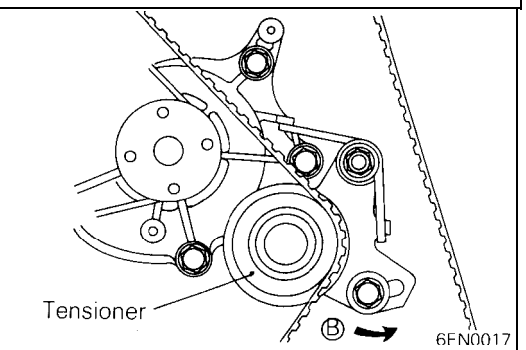
If it can be inserted as deep as 60 mm (2.4 in.) or more, the timing marks are correctly aligned. If the inserted depth is only 20 – 25 mm (.8 – 1.0 in.), turn the oil pump sprocket one turn and realign timing marks. Then check to ensure that the screwdriver can be inserted 60 mm (2.4 in.) or more. Keep the screwdriver inserted until installation of timing belt is finished.

- (6) Install the timing belt on the crankshaft sprocket, oil pump sprocket and camshaft sprocket in that order. There should be no slack on the tension side.

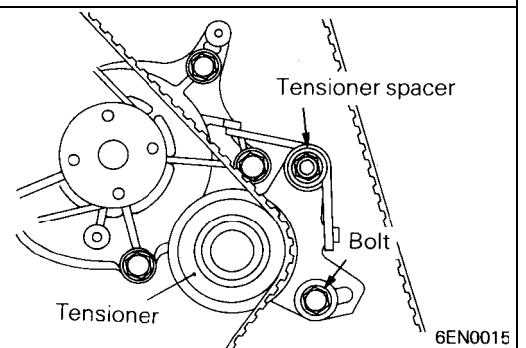
- (7) Loosen the tensioner mounting bolt and tensioner spacer.



- (8) Turn the crankshaft clockwise by two teeth of camshaft sprocket (or crankshaft sprocket).



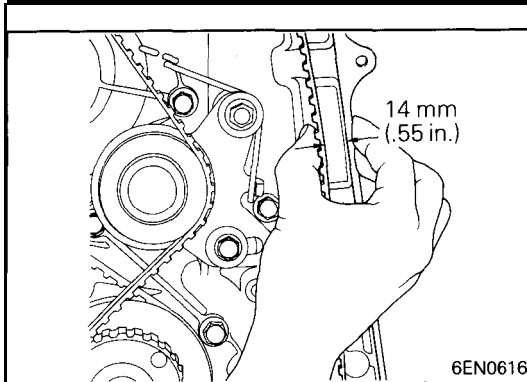
- (9) Apply force to the tensioner in the direction shown by arrow **B** to make the belt engage completely with each sprocket.



- (10) Tighten the tensioner attaching bolt, then tighten the tensioner spacer.

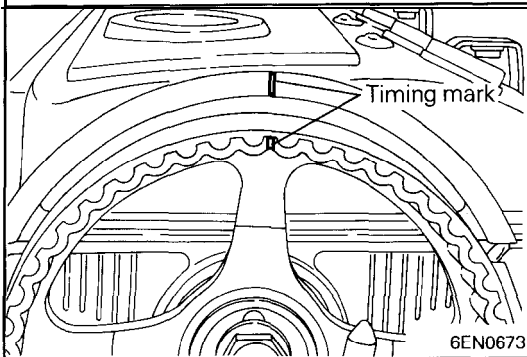
Caution

If the tensioner spacer is tightened first, tensioner turns as the tensioner spacer is tightened, resulting in an excessive belt tension.



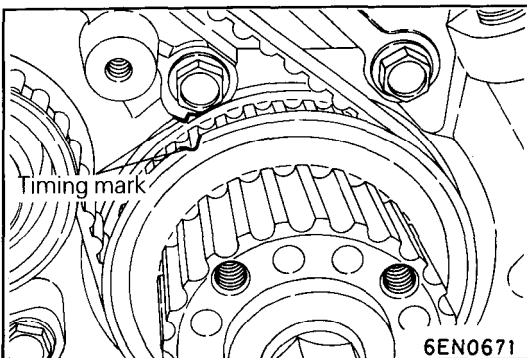
- (11) Hold the center of the tension side span of the timing belt (between the camshaft and oil pump sprockets) between your thumb and index finger as shown. Then, make sure that the clearance between the belt back surface and cover is standard value.

Standard value: 14 mm (.55 in.)

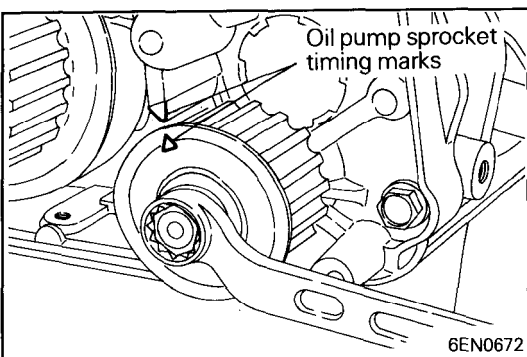


◆0◆ TIMING BELT INSTALLATION

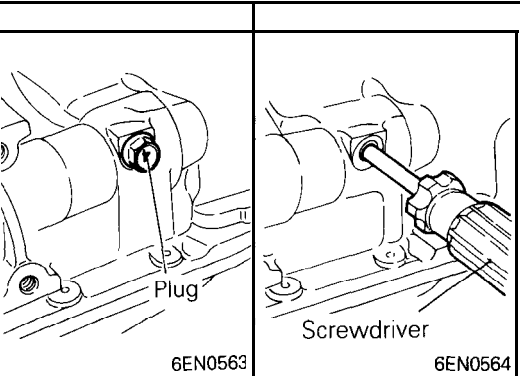
- (1) Check that the timing belt tensioner and spring have been installed in position. (See ◆B◆)
- (2) Align timing mark on camshaft sprocket with timing mark on cylinder head.



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

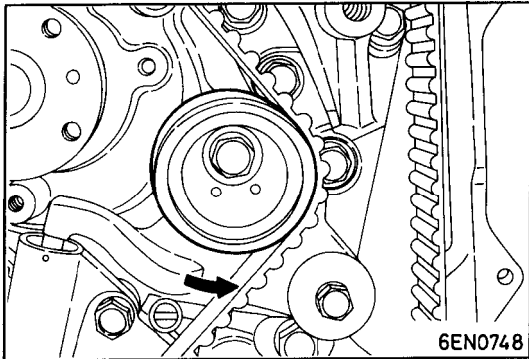


- (4) Align the timing mark on oil pump sprocket with its mating mark.

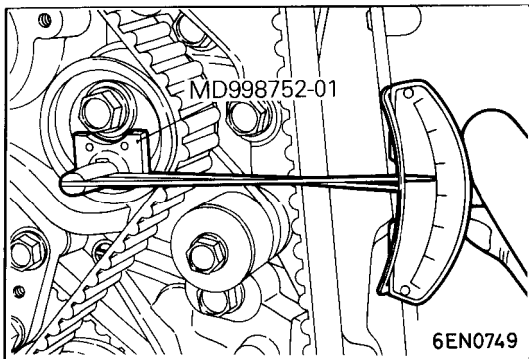


- (5) Remove the plug on cylinder block and insert a Phillips screwdriver [shank diameter 8 mm (.31 in.)] through the hole (Engine with silent shafts). If it can be inserted as deep as 60 mm (2.4 in.) or more, the timing marks are correctly aligned. If the inserted depth is only 20 – 25 mm (.8 – 1.0 in.), turn the oil pump sprocket one turn and realign timing marks. Then check to ensure that the screwdriver can be inserted 60 mm (2.4 in.) -or more. Keep the screwdriver inserted until installation of timing belt is finished.

- (6) Install the timing belt on the crankshaft sprocket, idler pulley, camshaft sprocket, and tensioner pulley in that order.



- (7) Lift up the tensioner pulley in the direction of arrow and tighten the center bolt.
 (8) Check to see that all timing marks are lined up.
 (9) Remove the screwdriver inserted in step (5) and fit the plug.
 (10) Give the crankshaft a quarter counter-clockwise turn. Then, turn it clockwise until the timing marks are lined up again.



- (11) Install the special tools, Socket Wrench and Torque Wrench, on the tensioner pulley, and loosen the tensioner pulley center bolt.

NOTE

If the special tool is not available, use a commercially available torque wrench that is capable of measuring 0 – 3 Nm (0 – 2.2 ft.lbs.).

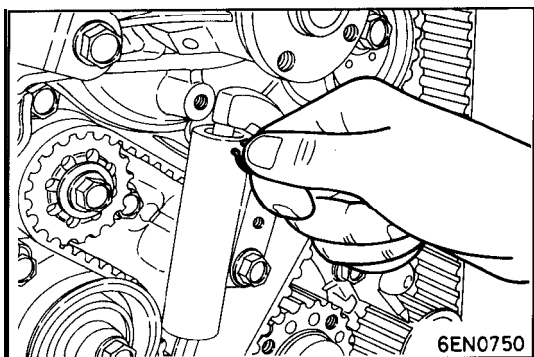
- (12) Torque to 2.6 – 2.8 Nm (1.88 – 2.03 ft.lbs.) with the torque wrench.
 (13) Holding the tensioner pulley with the special tool and torque wrench, tighten the center bolt to specification.

- (14) After giving two clockwise turns to the crankshaft, let it alone for approx. 15 minutes. Then, make sure that the auto tensioner setting wire moves freely.

NOTE

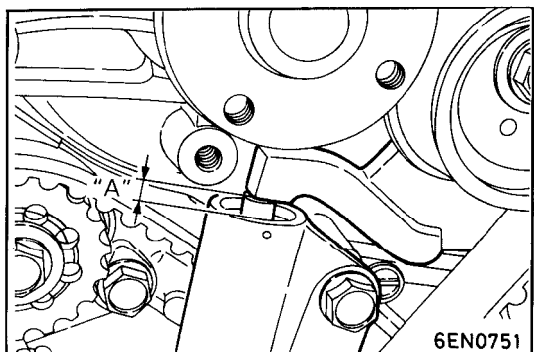
If the wire does not move freely, repeat step (10) above until it moves freely.

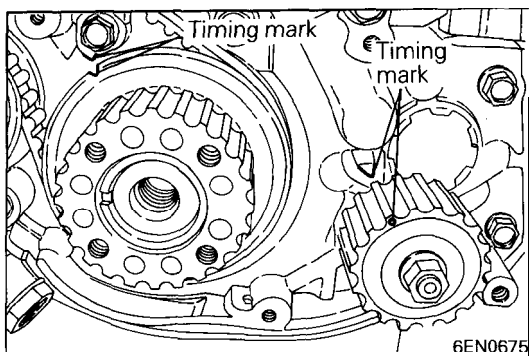
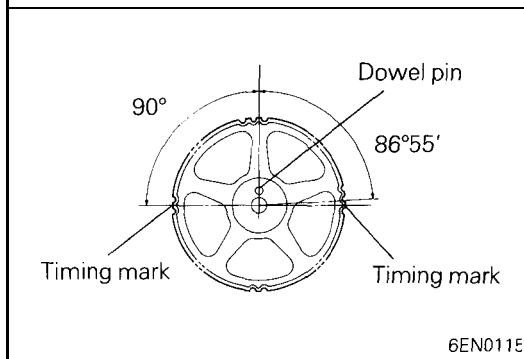
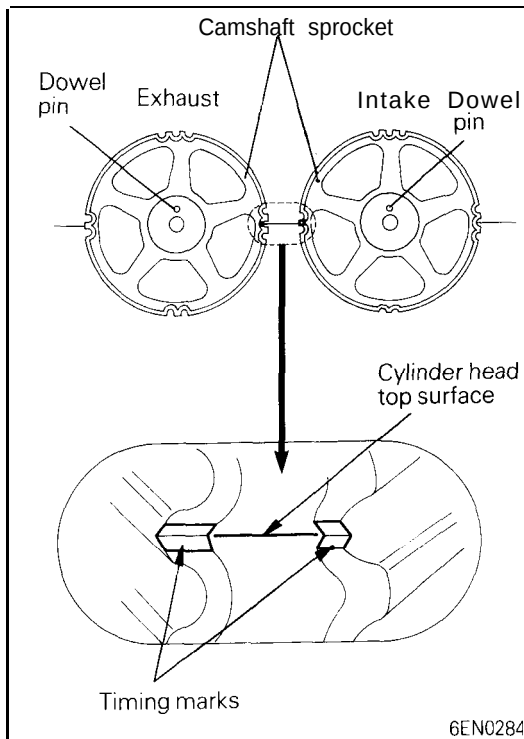
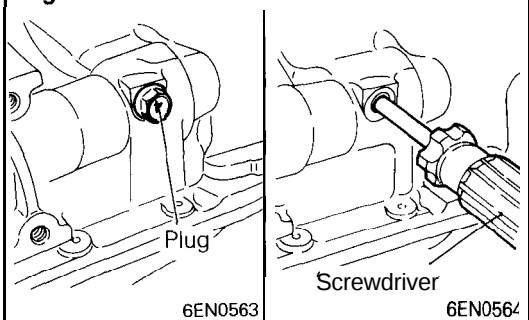
- (15) Remove the auto tensioner setting wire.



- (16) Measure the distance "A" (between the tensioner arm and auto tensioner body).

Standard value: 3.8 – 4.5 mm (.15 – .18 in.)



**Engine with silent shafts****⚙️ TIMING BELT INSTALLATION**

- (1) Turn the two sprockets so that their dowel pins are located on top. Then, align the timing marks facing each other with the top surface of the cylinder head. When you let go of the exhaust camshaft sprocket, it will rotate one tooth in the counterclockwise direction. This should be taken into account when installing the timing belt on the sprockets.

NOTE

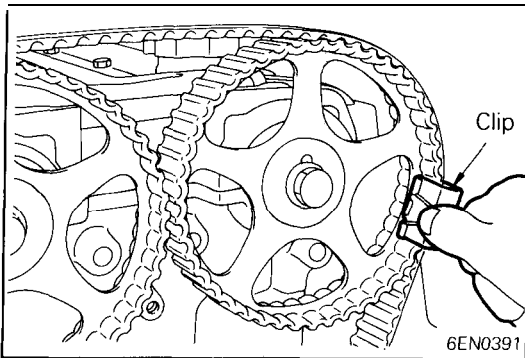
The same camshaft sprocket is used for the intake and exhaust camshafts and is provided with two timing marks. When the sprocket is mounted on the exhaust camshaft, use the timing mark on the right with the dowel pin hole on top. For the intake camshaft sprocket, use the one on the left with the dowel pin hole on top.

- (2) Align the crankshaft sprocket timing mark.
- (3) Align the oil pump sprocket timing mark (Engine with silent shafts).

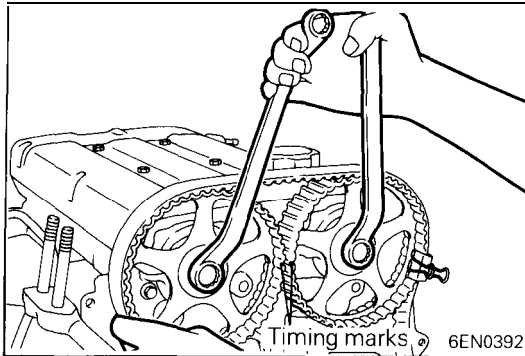
- (4) Insert a Phillips screwdriver [shank diameter 8 mm (.31 in.)] through the 'hole (Engine with silent shafts). If it can be inserted as deep as 60 mm (2.4 in.) or more, the timing marks are correctly aligned. If the inserted depth is only 20 – 25 mm (.8 – 1.0 in.), turn the oil pump sprocket one turn and realign timing marks. Then check to ensure that the screwdriver can be inserted 60 mm (2.4 in.) or more. Keep the screwdriver inserted until the installation of the timing belt is finished.

NOTE

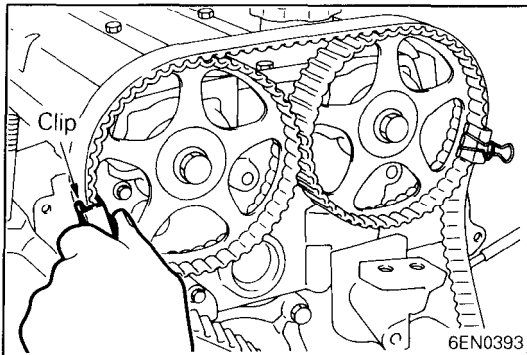
Step (4) is performed to ensure that the oil pump sprocket is correctly positioned with reference to the silent shafts.



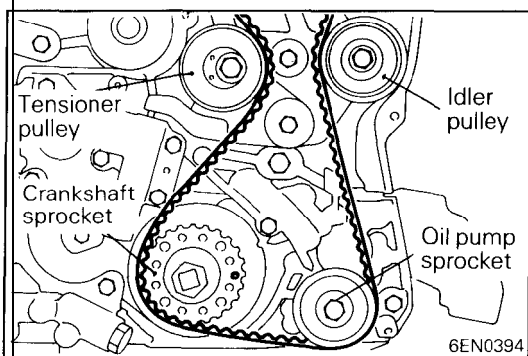
- (5) Thread the timing belt over the intake side camshaft sprocket and fix it at indicated position by a clip.



- (6) Thread the timing belt over the exhaust side sprocket, aligning the timing marks with the cylinder head top surface using two wrenches.

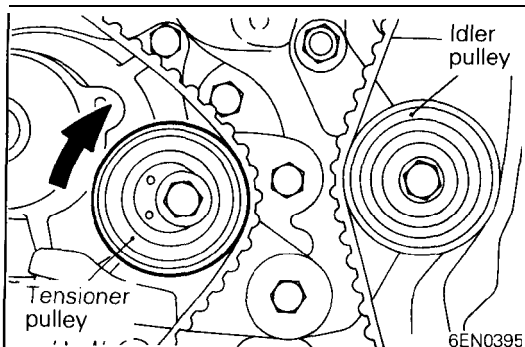


- (7) Fix the belt at indicated position by a clip.



- (8) Thread the timing belt over the idler pulley, the oil pump sprocket, the crankshaft sprocket and the tensioner pulley in the order shown.

- (9) Remove the two clips.

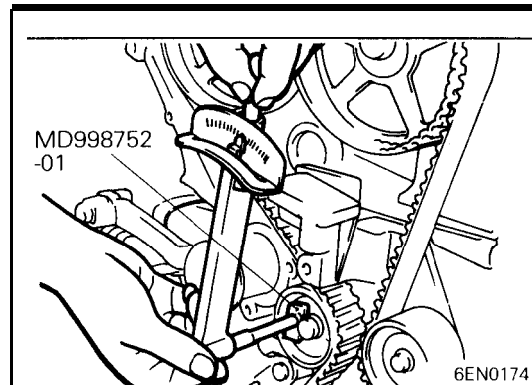


- (10) Lift up the tensioner pulley in the direction of arrow and tighten the center bolt.

- (11) Check to see that all timing marks are lined up.

- (12) Remove the screwdriver inserted in step (4) and fit the plug.
(Engine with silent shafts)

- (13) Give the crankshaft a quarter counter-clockwise turn. Then, turn it clockwise until the timing marks are lined up again.



- (14) Install the special tools, Socket Wrench and Torque Wrench, on the tensioner pulley, and loosen the tensioner pulley center bolt.

NOTE

If the special tool is not available, use a commercially available torque wrench that is capable of measuring 0 – 3 Nm (0 – 2.2 ft.lbs.).

- (15) Torque to 2.6 – 2.8 Nm (1.88 – 2.03 ft.lbs.) with the torque wrench.

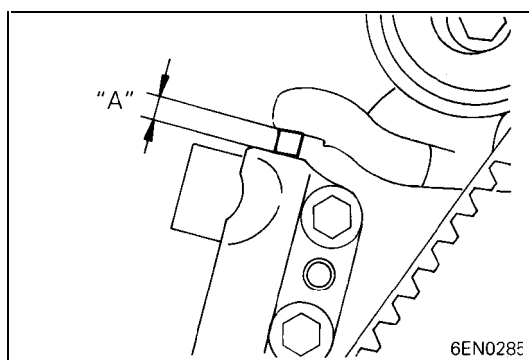
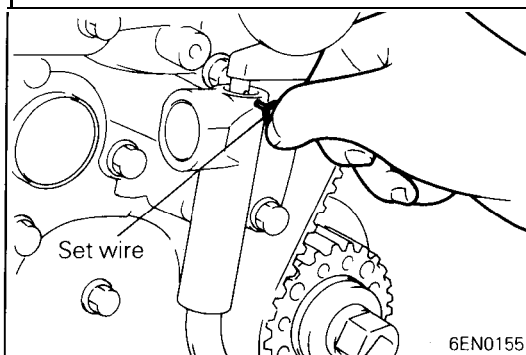
- (16) Holding the tensioner pulley with the special tool and torque wrench, tighten the center bolt to specification.

- (17) After giving two clockwise turns to the crankshaft, let it alone for approx. 15 minutes. Then, make sure that the auto tensioner setting wire moves freely.

NOTE

If the wire does not move freely, repeat step (13) above until it moves freely.

- (18) Remove the auto tensioner setting wire.

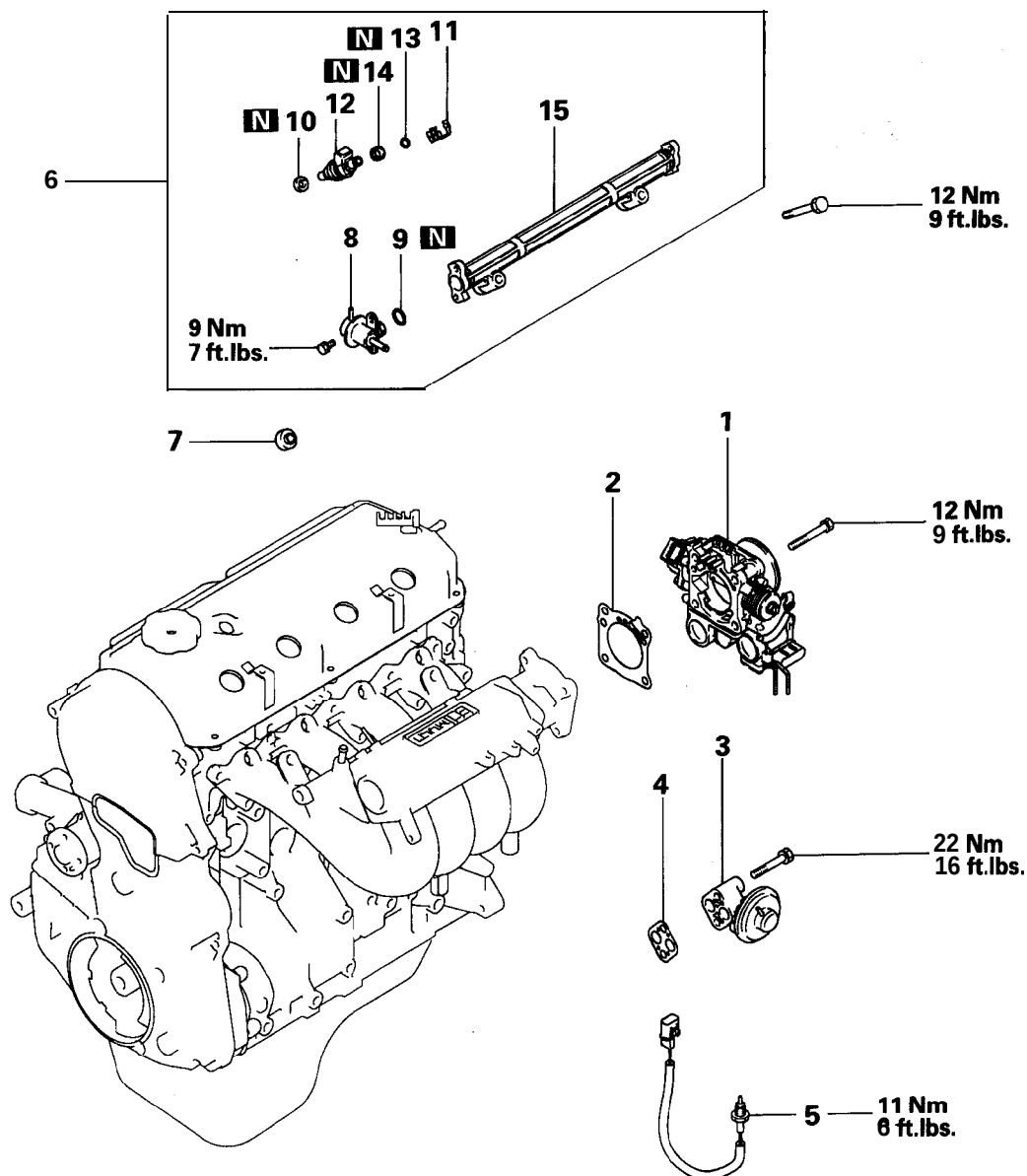


- (19) Measure the distance "A" (between the tensioner arm and auto tensioner body).

Standard value: 3.8 – 4.5 mm (.15 – .18 in.)

FUEL AND EMISSION CONTROL PARTS

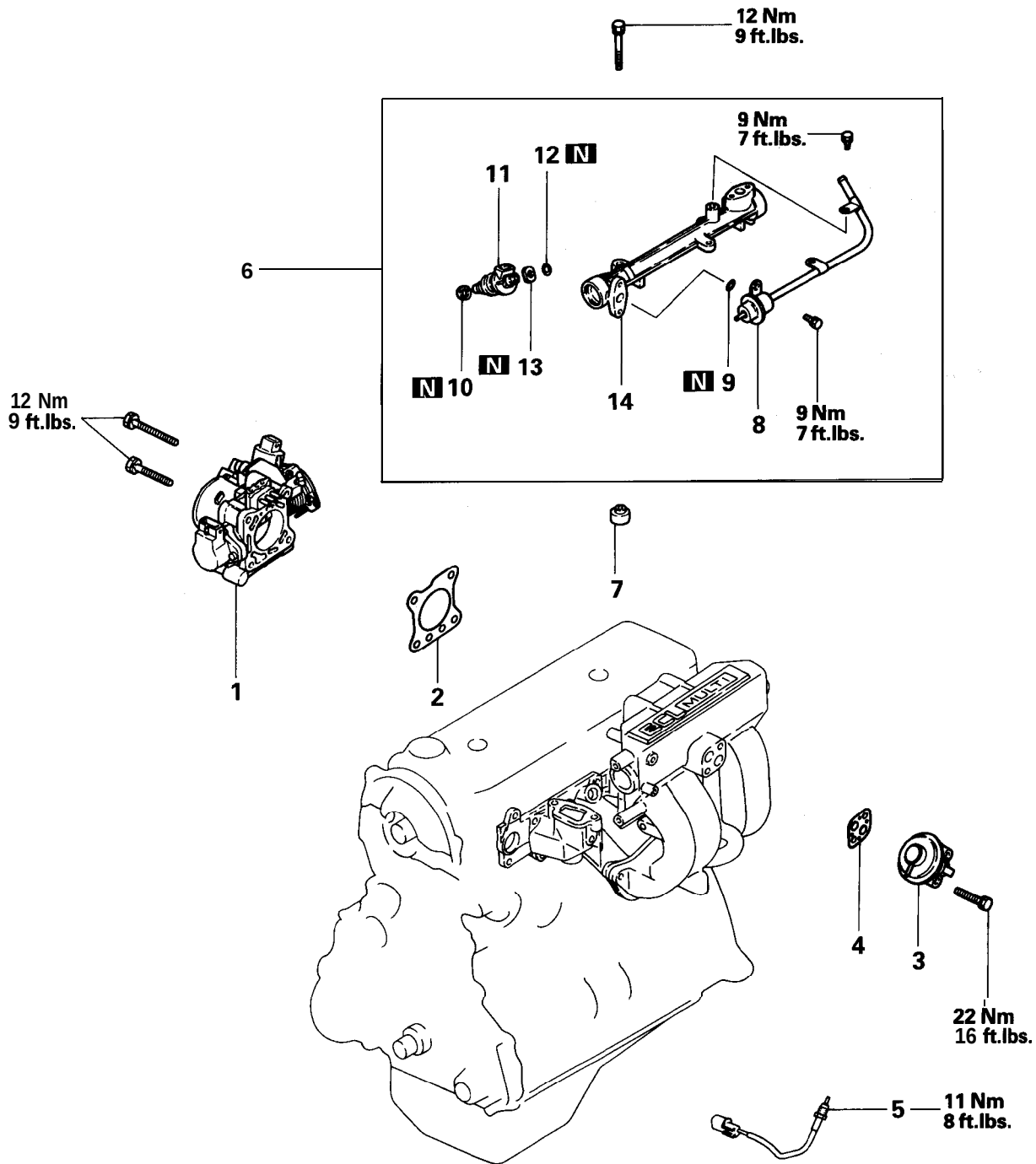
REMOVAL AND INSTALLATION – SOHC for GALANT/EXPO/EXP LRV



Removal steps

1. Throttle body
2. Throttle body gasket
3. EGR valve
4. EGR valve gasket
5. EGR temp sensor – For California
6. Injectors and delivery pipe
7. Insulator
8. Fuel pressure regulator
9. O-ring
10. Insulator
11. Injector clip
12. Injectors
13. O-ring
14. Grommet
15. Fuel rail

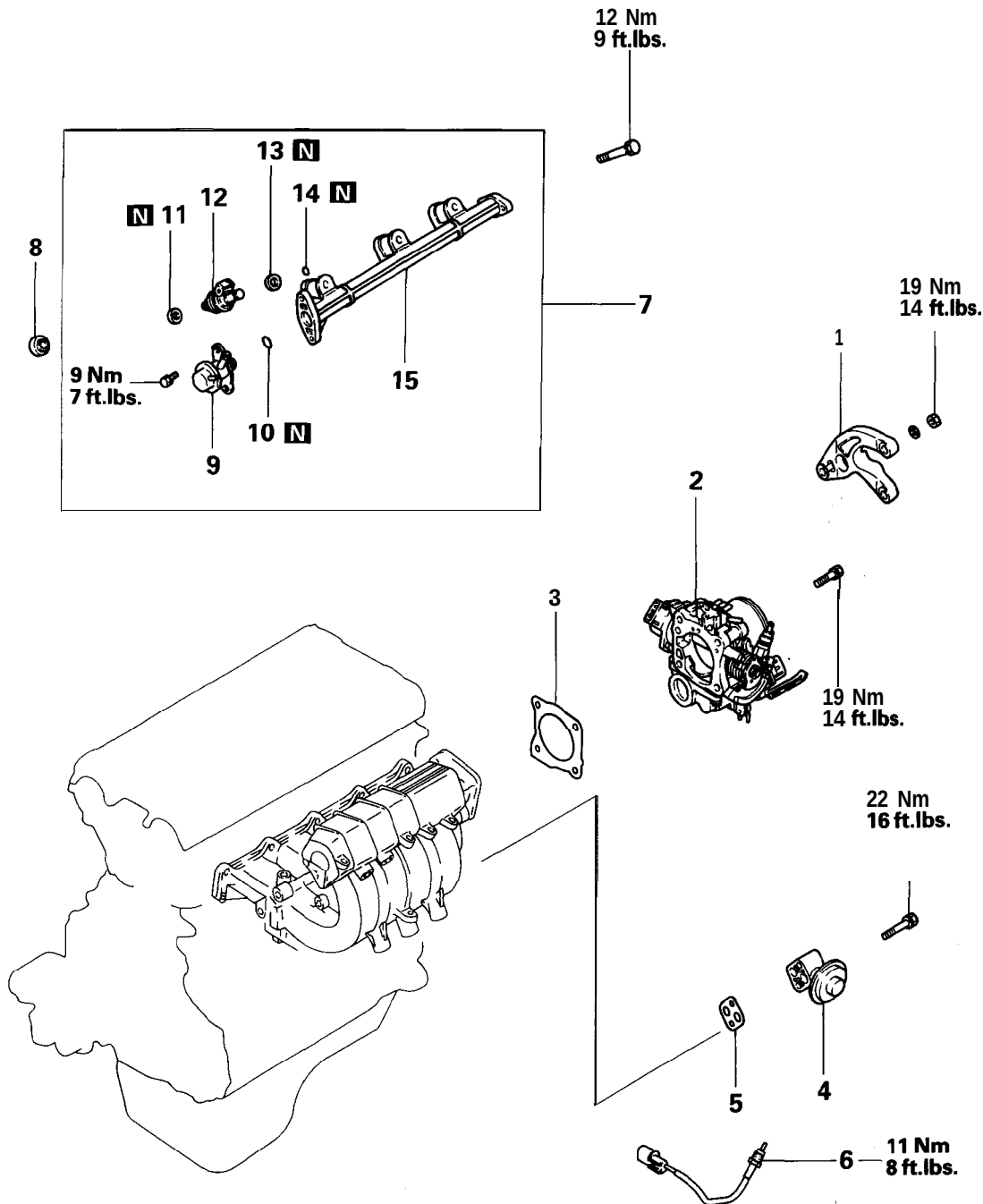
REMOVAL AND INSTALLATION – SOHC for TRUCK



Removal steps

1. Throttle body
2. Throttle body gasket
3. EGR valve
4. EGR valve gasket
5. EGR temp sensor- For California
6. Injectors and fuel rail
7. Insulator
8. Fuel pressure regulator
9. O-ring
10. Insulator
11. Injectors
12. O-ring
13. Grommet
14. Fuel rail

REMOVAL AND INSTALLATION – DOHC

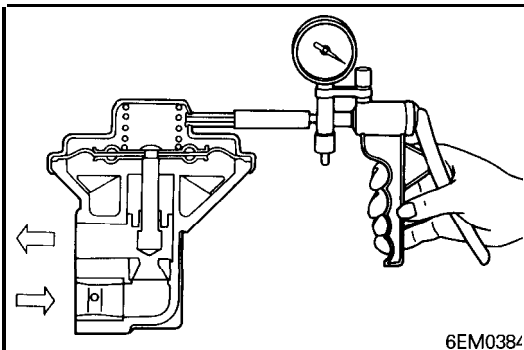


Removal steps

1. Throttle body stay
2. Throttle body
3. Throttle body gasket
4. EGR valve
5. EGR valve gasket
6. EGR temp sensor – For California
7. Injectors and fuel rail
8. Insulator
9. Fuel pressure regulator
10. O-ring
11. Insulator
12. Injectors
13. O-ring
14. Grommet
15. Fuel rail

C

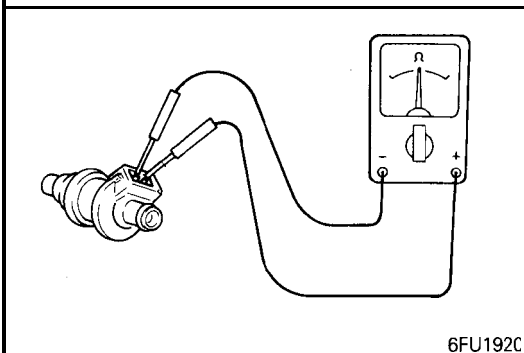
B



INSPECTION

EGR VALVE

- (1) Check EGR valve for sticking or carbon deposits. If such conditions exist, clean or replace EGR valve.
- (2) Connect a hand vacuum pump to the nipple of EGR valve and plug other nipple.
- (3) Apply a vacuum of 500 mmHg (19.7 in. Hg) to make sure that a vacuum is maintained. If there is a leak, replace the EGR valve. In addition, check the valve for its opening and closing by applying and removing a vacuum.



INJECTORS

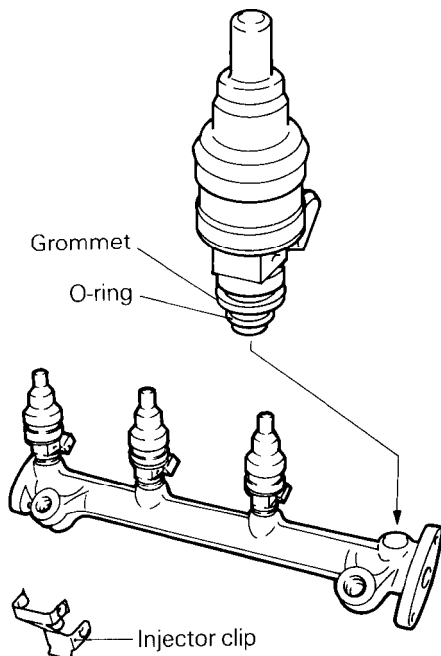
- (1) Using an ohmmeter (circuit tester), test for continuity between terminals of injector; the circuit should be closed. If failure is detected, replace the injector.

Standard value:

Non-turbo 13 – 16 Ω [at 20°C (68°F)]

Turbo 2 – 3 Ω [at 20°C (68°F)]

SOHC – 16VALVE

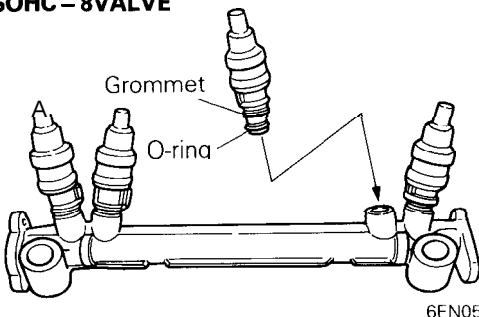


INSTALLATION SERVICE POINTS

◆A◆ INJECTORS / INJECTOR CLIP INSTALLATION

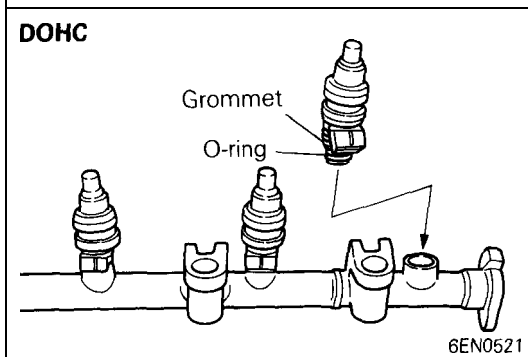
- (1) Before installing an injector the rubber O-ring must be lubricated with a drop of clean engine oil to aid in installation.
- (2) Install injector top end into fuel rail. Be careful not to damage O-ring during installation.
- (3) Install injector clip by sliding open end onto injector and onto the fuel rail.

SOHC – 8VALVE



◆B◆ INJECTOR INSTALLATION

- (1) Before installing an injector the rubber O-ring must be lubricated with a drop of clean engine oil to aid in installation.



- (2) Install injector top end into fuel rail.
Be careful not to damage the O-ring during installation.

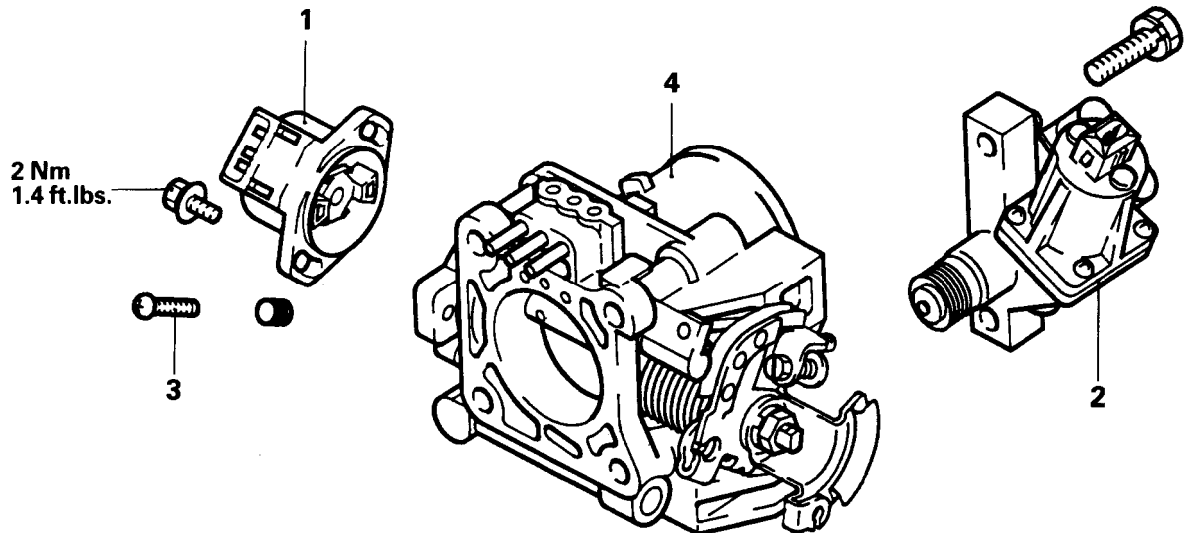
❖C❖ FUEL PRESSURE REGULATOR INSTALLATION

- (1) Before installing pressure regulator the O-ring must be lubricated with a drop of clean engine O-ring to aid in installation.

THROTTLE BODY

DISASSEMBLY AND REASSEMBLY

SOHC – TRUCK – Federal

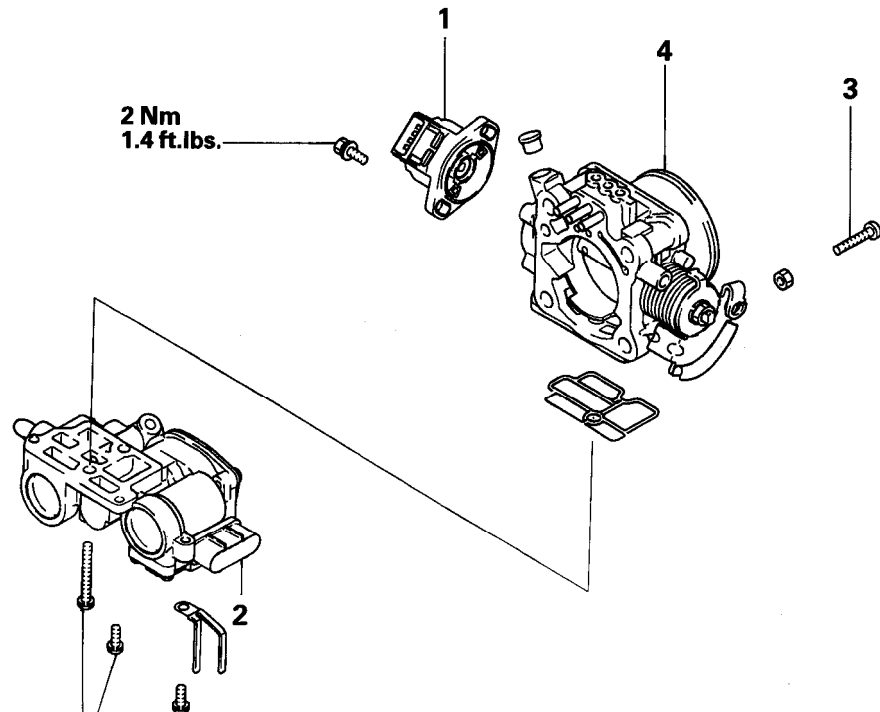


Disassembly steps

- ◊A◊▶▶ 1. Throttle position sensor
- ◊A◊ 2. Speed control motor
- ▶B◊ 3. Throttle valve set screw
- ▶B◊ 4. Throttle body

6FU1292

SOHC – TRUCK – California
SOHC – GALANT



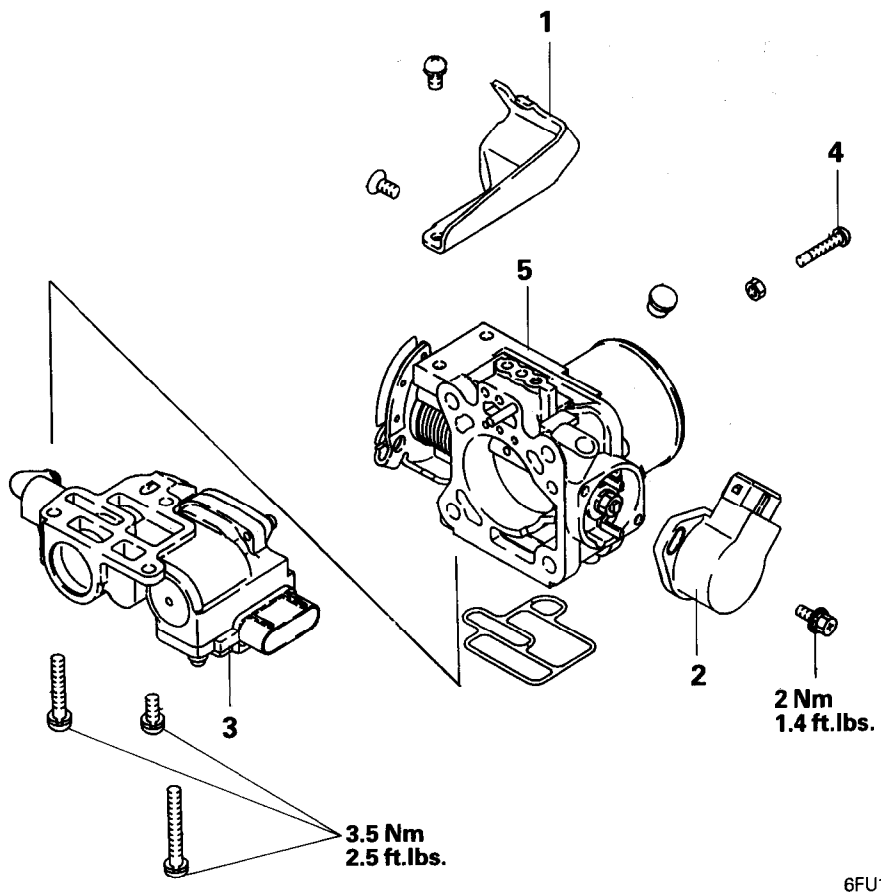
Disassembly steps

- ◊A◊▶▶ 1. Throttle position sensor
- ◊A◊ 2. Idle air control motor
- ◊B◊ 3. Throttle valve set screw
- ◊B◊ 4. Throttle body

3.5 Nm
2.5 ft.lbs.

6EN0711

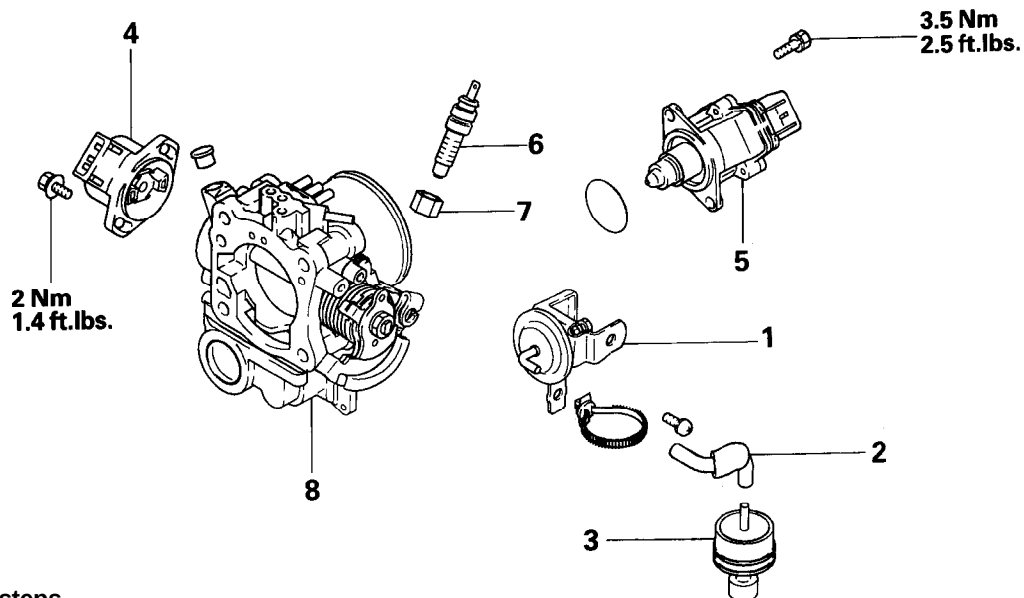
SOHC – EXPO/EXPO LRV



Disassembly steps

1. Accelerator wire bracket
-EXPO/EXP LRV
2. Throttle position sensor
3. Idle air control motor
4. Throttle valve set screw
5. Throttle body

6FU1857



Disassembly steps

1. Dash pot
2. Hose
3. Vacuum valve
4. Throttle position sensor
5. Idle air control motor
6. Idle position switch
7. Adjusting nut
8. Throttle body

6EN0712

DISASSEMBLY SERVICE POINTS**Ⓐ THROTTLE POSITION SENSOR AND IDLE AIR CONTROL MOTOR REMOVAL**

- (1) Do not disassemble the sensor and motor.
- (2) Do not immerse solvent to clean the sensor and motor. Clean them with shop towel.

Ⓑ THROTTLE BODY REMOVAL

- (1) Do not remove the throttle valve.
- (2) Check if the vacuum port or passage is clogged. Use compressed air to clean the vacuum passage.

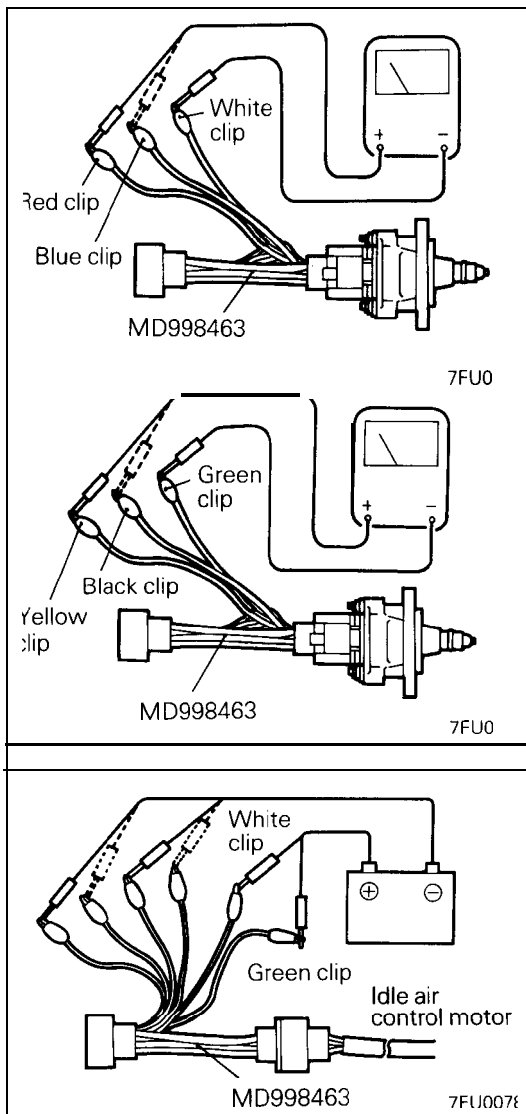
INSPECTION**IDLE AIR CONTROL MOTOR – DOHC****Checking the Coil Resistance**

- (1) Connect Test Harness to the motor connector.
- (2) Measure the resistance between white clip of Test Harness and red clip or blue clip.

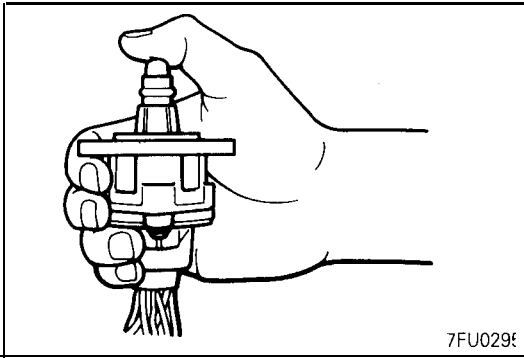
Standard value: 28 – 33 Ω at 20°C (68°F)

- (3) Measure the resistance between green clip of the Test Harness and yellow clip or black clip.

Standard value: 28 – 33 Ω at 20°C (68°F)

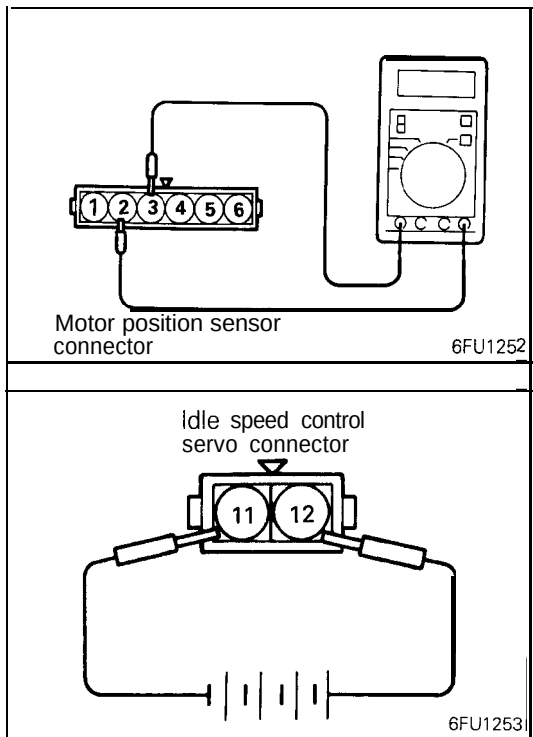
**Operational Check**

- (1) Connect Test Harness to the idle air control motor connector.
- (2) Connect the positive ⊕ terminal of 6 volt battery to white clip and green clip of Test Harness.



(3) Holding the idle air control motor as shown in the illustration, connect the negative $\ominus$ terminal of the power supply to each clip as described in the following steps, and check whether or not a vibrating feeling (a feeling of very slight vibration of the stepper motor) is generated as a result of the activation of the stepper motor.

- ① Connect the negative $\ominus$ terminal of the power supply to the red and black clip.
 - ② Connect the negative $\ominus$ terminal of the power supply to the blue and black clip.
 - ③ Connect the negative $\ominus$ terminal of the power supply to the blue and yellow clip.
 - ④ Connect the negative $\ominus$ terminal of the power supply to the red and yellow clip.
 - ⑤ Connect the negative $\ominus$ terminal of the power supply to the red and black clip.
 - ⑥ Repeat the tests in sequence from ⑤ to ①.
- (4) If, as a result of these tests, vibration is detected, the stepper motor can be considered to be normal.



MOTOR POSITION SENSOR – SOHC for TRUCK

- (1) Measure the resistance between terminals ② and ③

Standard value: 4 – 6 k Ω

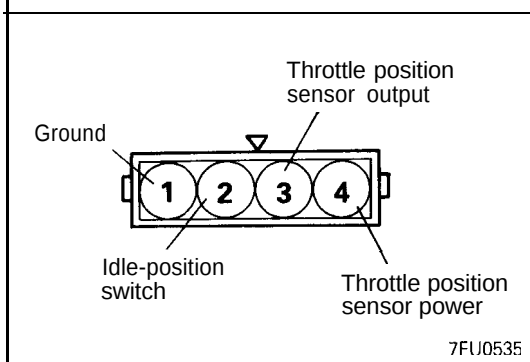
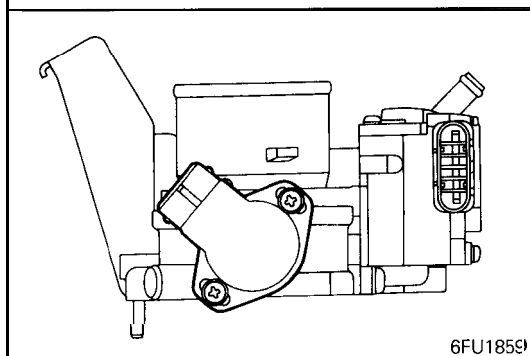
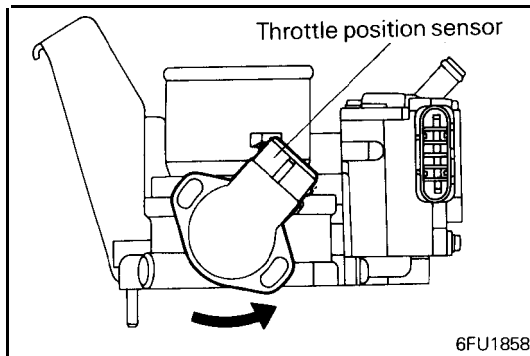
- (2) Disconnect the idle-speed control motor connector.
- (3) Connect 6V DC between terminals ⑪ and ⑫ of the idle-speed control motor connector, and then measure the resistance between terminals ③ and ⑤ of the motor position sensor connector when the idle-speed control motor is activated (caused to expand and contract).

Standard value: It should decrease smoothly as the idle speed control motor plunger contracts.

Caution

Apply only a 6V DC or lower voltage. Application of higher voltage could cause locking of the motor gears.

- (4) If there is a deviation from the standard value, or if the change is now smooth, replace the idle speed control motor assembly.

**REASSEMBLY SERVICE POINTS****◆◆ THROTTLE POSITION SENSOR INSTALLATION – SOHC FOR EXPO**

- (1) Install the throttle position sensor to the throttle body as shown in the illustration.

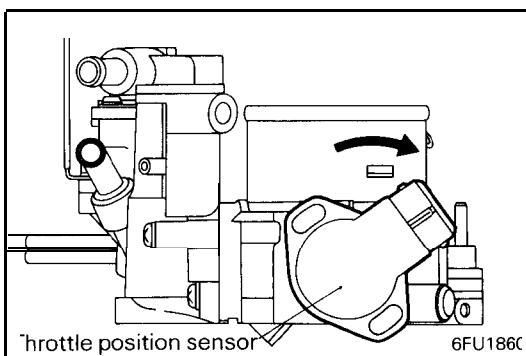
- (2) Turn the throttle position sensor 90° counterclockwise to set it in position and tighten the screws.

- (3) Connect the circuit tester between ① (ground) and ③ (output), or between ③ (output) and ④ (power). Then make sure that the resistance changes smoothly when the throttle valve is slowly moved to the fully open position.
- (4) Check for continuity between terminals ② (closed throttle position switch) and ① (ground) with the throttle valve both fully closed and fully open.

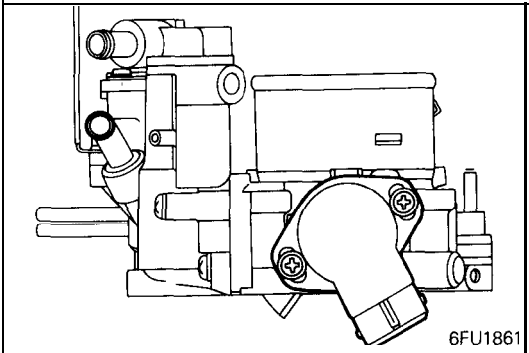
Throttle valve position	Continuity
Fully closed	Conductive
Fully open	Non-conductive

If there is not continuity with the throttle valve fully closed, turn the throttle position sensor clockwise direction, and then check again.

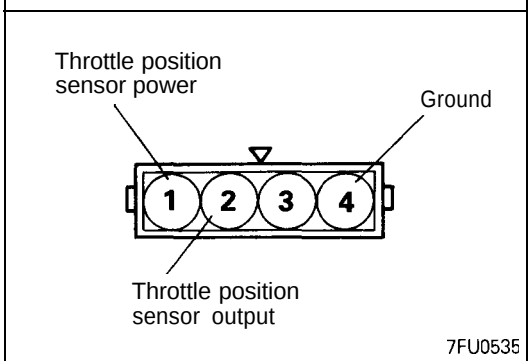
- (5) If the above specifications are not met, replace TPS.

**◆◆ THROTTLE POSITION SENSOR INSTALLATION – GALANT, ECLIPSE, TRUCK**

- (1) Install the throttle position sensor to the throttle body as shown in the illustration.



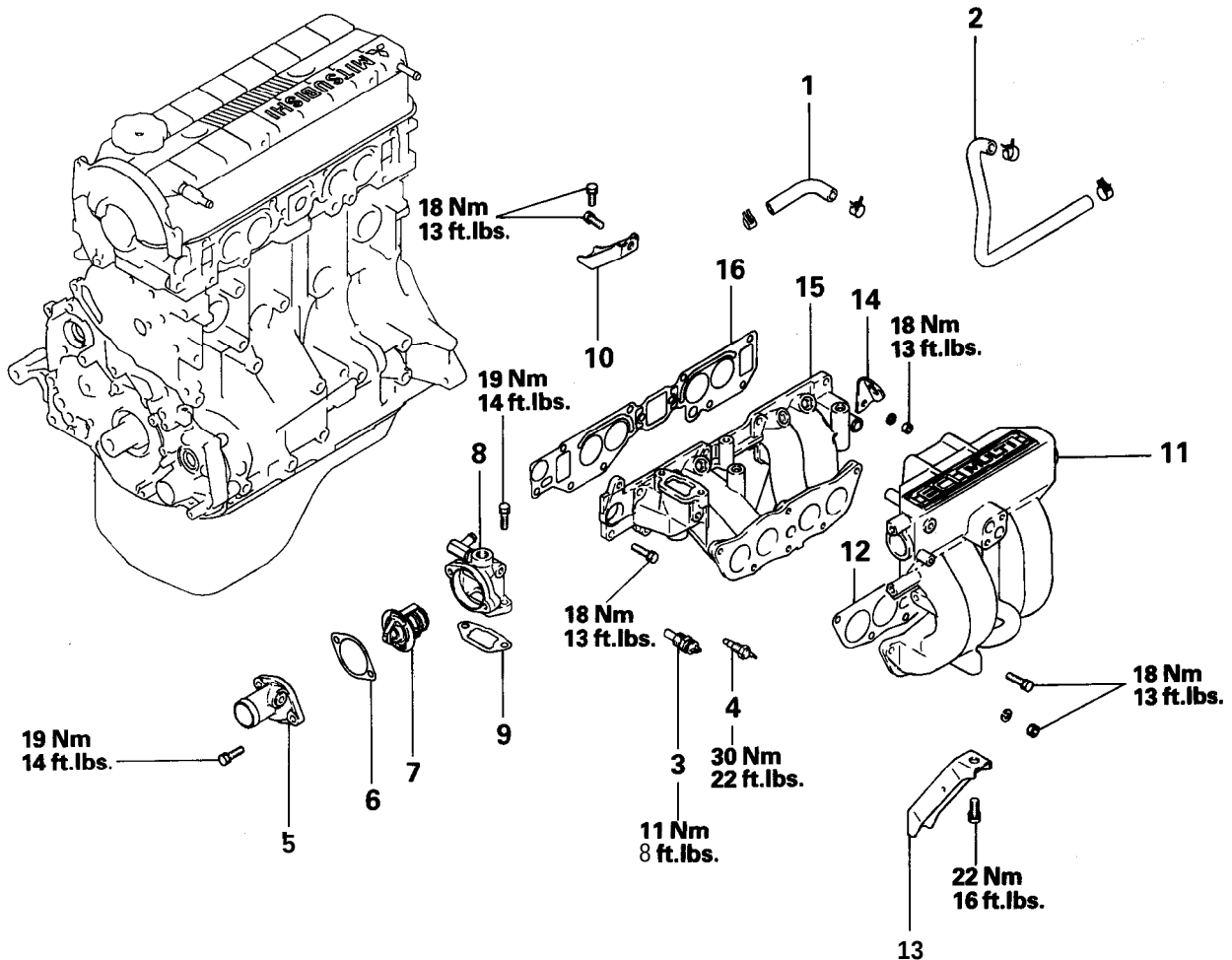
- (2) Turn the throttle position sensor 90° in the clockwise direction to set it and tighten the screws.



- (3) Connect the circuit tester between ④ (ground) and ② (output), or between ② (output) and ① (power). Then, make sure that the resistance changes smoothly when the throttle valve is slowly moved to the fully open position.

INTAKE MANIFOLD

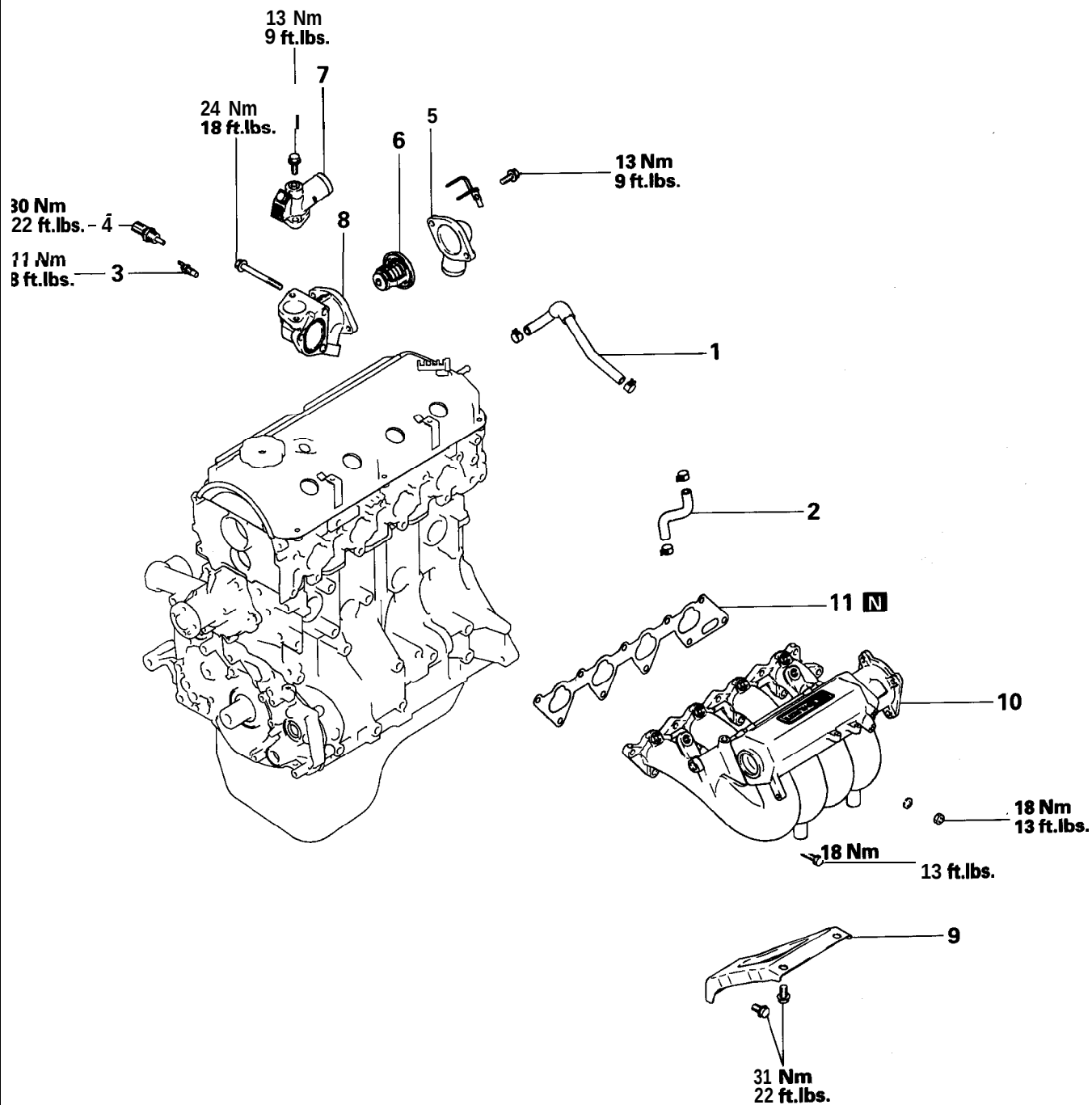
REMOVAL AND INSTALLATION – SOHC – 8 VALVE



Removal steps

1. Water hose
2. Water hose
- F 3. Engine coolant temperature gauge unit
- E 4. Engine coolant temperature sensor
- B 5. Water outlet fitting
6. Gasket
7. Thermostat
8. Thermostat housing
9. Gasket
10. Intake manifold plenum stay
11. Intake manifold plenum
12. Intake manifold plenum gasket
13. Intake manifold stay
14. Engine hanger
15. Intake manifold
16. Intake manifold gasket

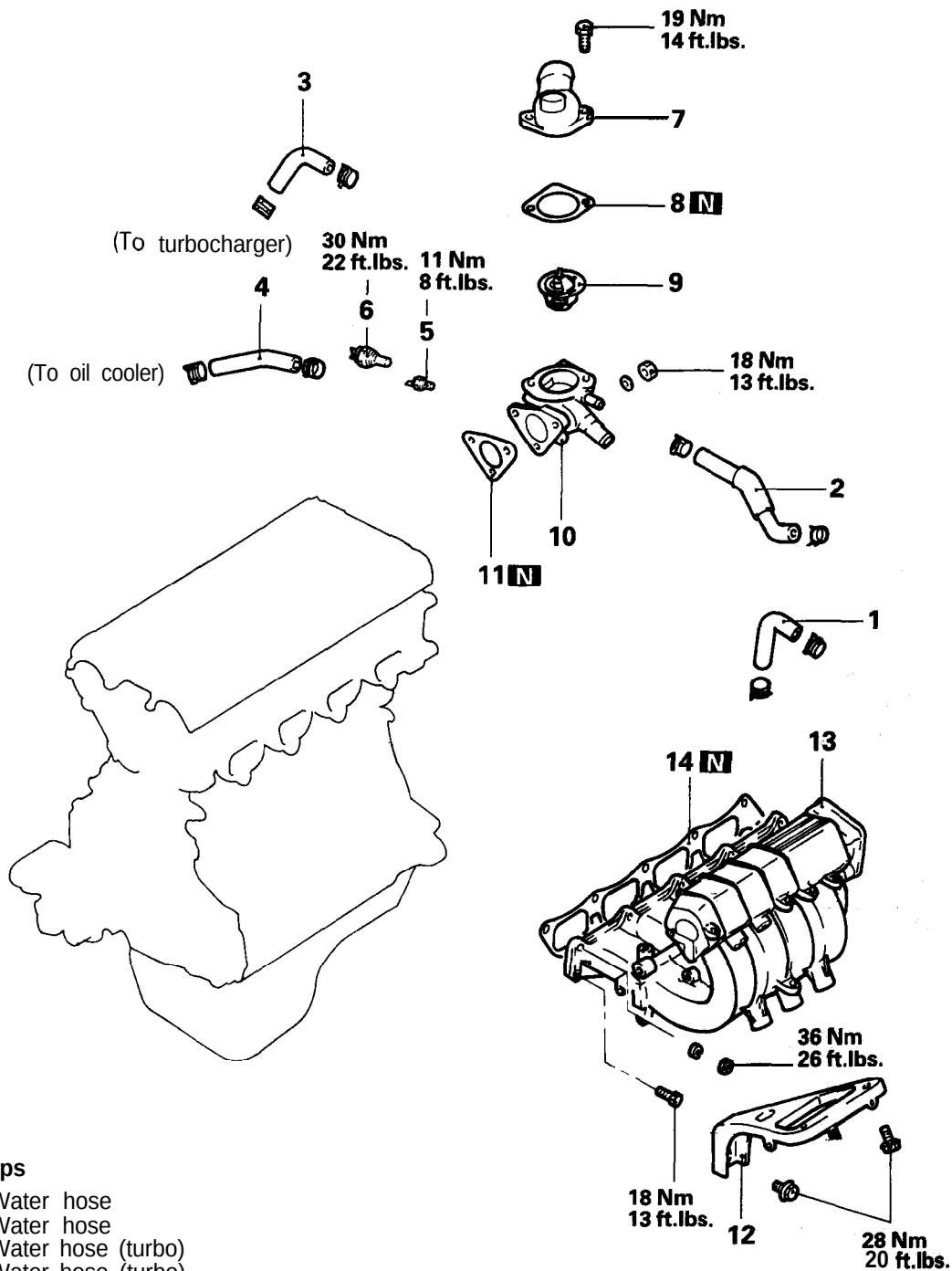
REMOVAL AND INSTALLATION - SOHC - 16 VALVE



Removal steps

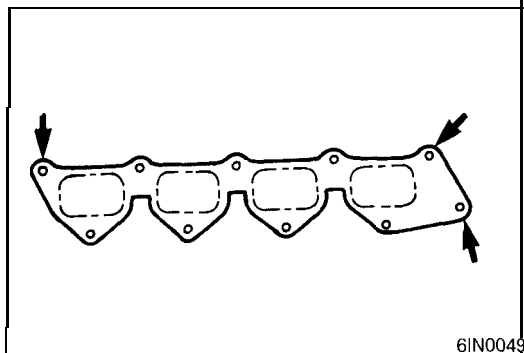
1. Water hose
2. Water hose
- ▶F▶ 3. Engine coolant temperature sensor
- ▶E▶ 4. Engine coolant temperature gauge unit
- ▶D▶ 5. Water inlet fitting
6. Thermostat
7. Water outlet fitting
- ▶C▶ 8. Thermostat housing
9. Intake manifold stay
10. Intake manifold
11. Intake manifold gasket

REMOVAL AND INSTALLATION – DOHC

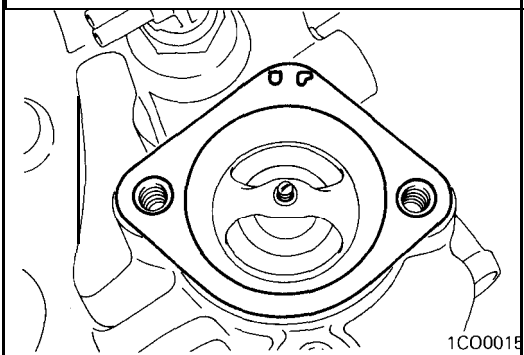


Removal steps

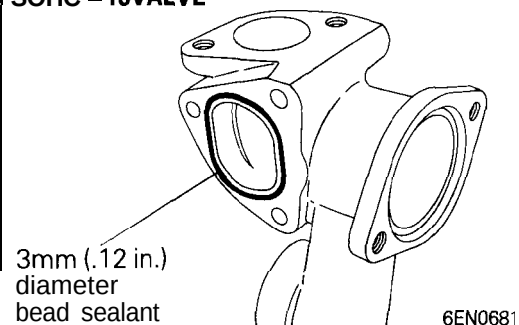
1. Water hose
2. Water hose
3. Water hose (turbo)
4. Water hose (turbo)
- ♦F♦ 5. Engine coolant temperature gauge unit
- ♦E♦ 6. Engine coolant temperature sensor
7. Water outlet fitting
8. Gasket
9. Thermostat
- ♦C♦ 10. Thermostat case
11. Gasket
12. Intake manifold stay
- ♦A♦ 13. Intake manifold
14. Intake manifold gasket

**INSTALLATION SERVICE POINTS****◆A◆ INTAKE MANIFOLD INSTALLATION – DOHC**

- (1) Tighten the intake manifold bolts, noting that the bolts installed at the locations indicated in the illustration are tightened to a different torque.

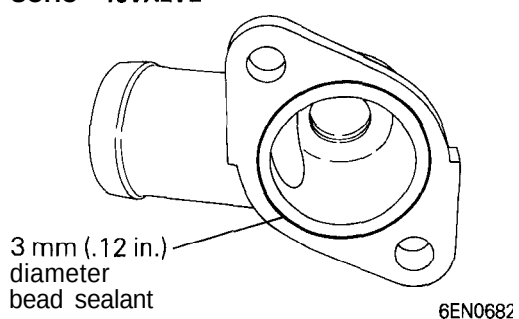
**◆B◆ WATER OUTLET FITTING GASKET INSTALLATION (FOR RUBBER COATED METAL GASKET ONLY)**

- (1) install the water outlet fitting gasket with its “UP” mark facing up (toward the water outlet fitting side).

SOHC – 16VALVE**◆C◆ SEALANT APPLICATION TO THERMOSTAT HOUSING**

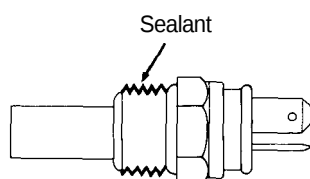
Specified sealant:

Mitsubishi Genuine Part No. MD970389 or equivalent

SOHC – 16VALVE**◆D◆ SEALANT APPLICATION TO WATER OUTLET FITTING**

Specified sealant:

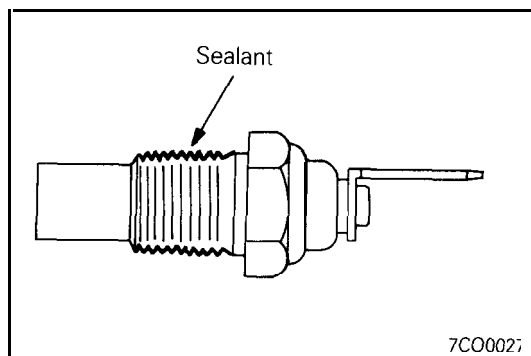
Mitsubishi Genuine Part No. MD970389 or equivalent

**◆E◆ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE SENSOR**

Specified sealant:

3M Nut Locking Part No. 4171 or equivalent

8CO0012

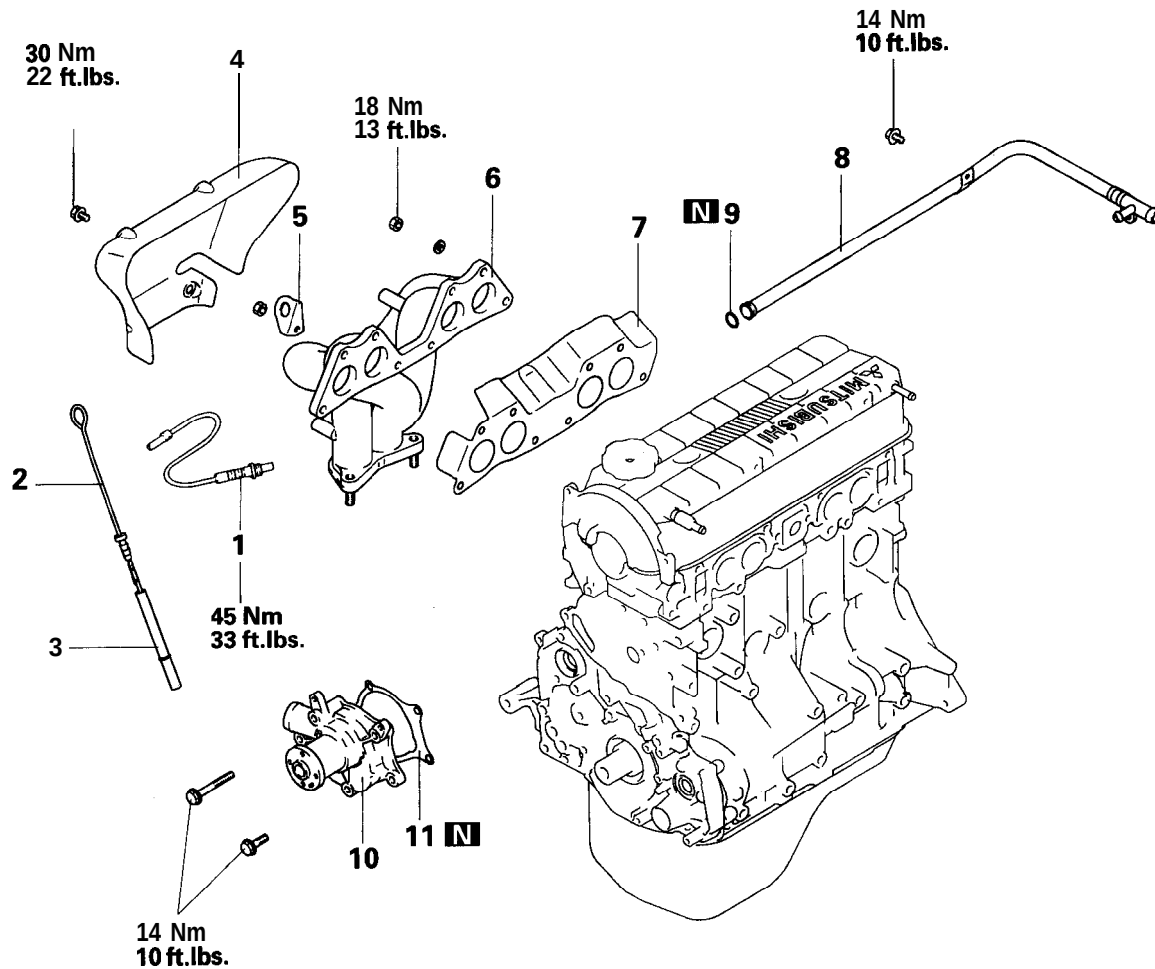


◆F◆ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE GAUGE UNIT

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

EXHAUST MANIFOLD AND WATER PUMP

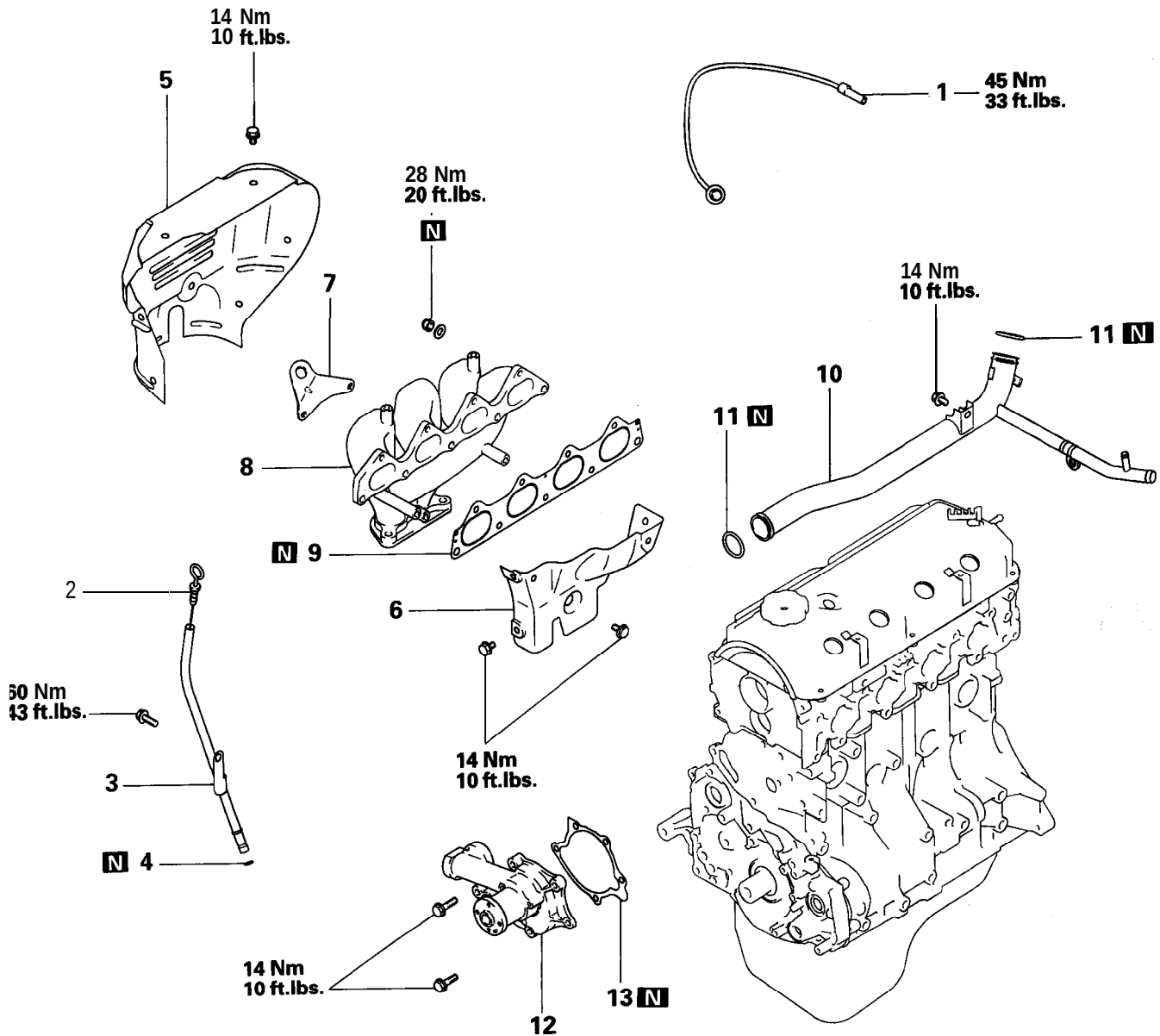
REMOVAL AND INSTALLATION – SOHC 8 VALVE



Removal steps

1. Oxygen sensor-Federal
2. Oil level gauge
3. Oil level gauge guide
4. Heat protector
5. Engine hanger
6. Exhaust manifold
7. Exhaust manifold gasket
8. Water inlet pipe
9. O-ring
10. Water pump
11. Water pump gasket

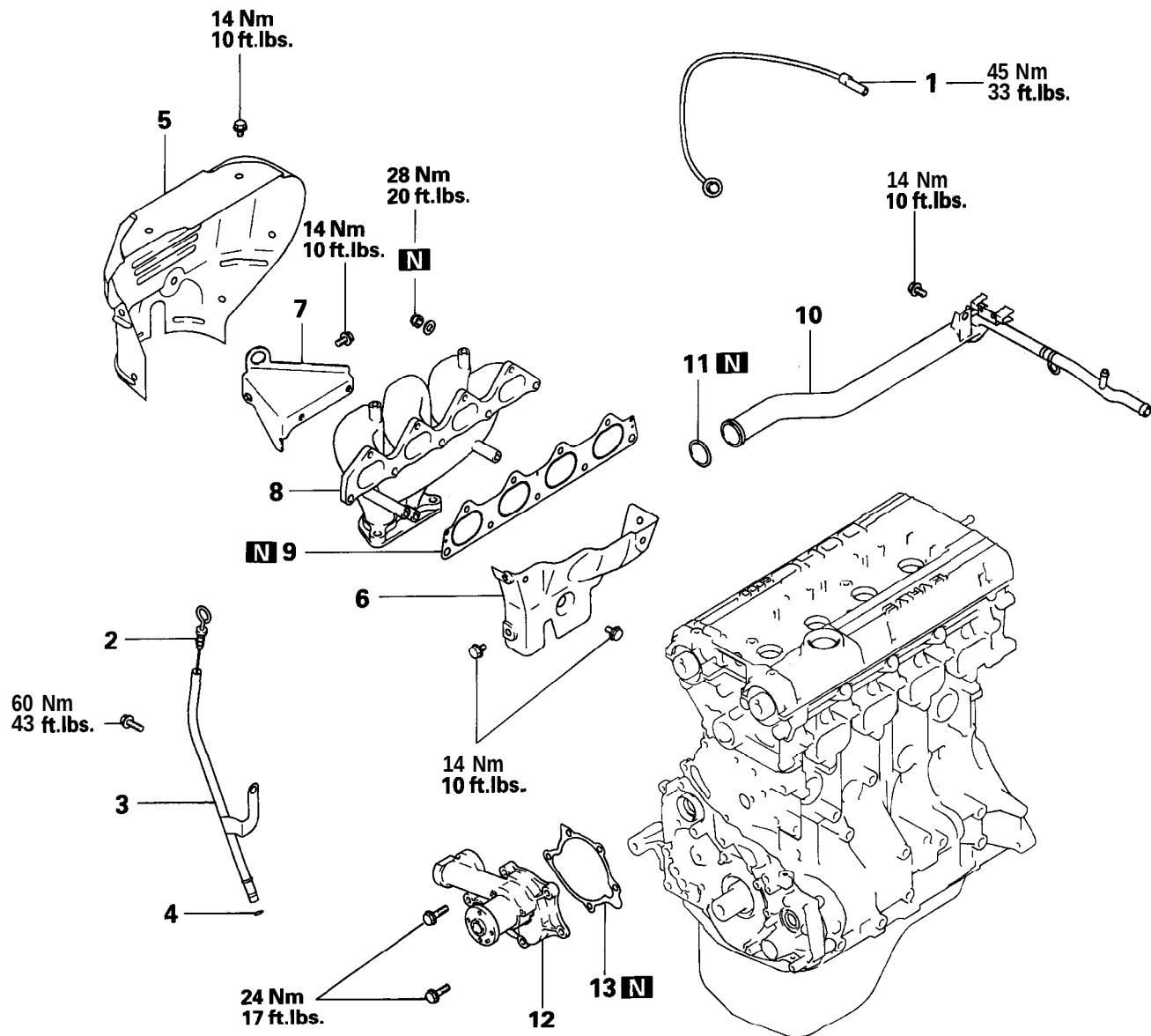
REMOVAL AND INSTALLATION – SOHC – 16 VALVE



Removal steps

1. Oxygen sensor-GALANT/EXPO Federal
2. Oil level gauge
3. Oil level gauge guide
4. O-ring
5. Heat protector
6. Heat protector
7. Engine hanger
8. Exhaust manifold
9. Exhaust manifold gasket
10. Water inlet pipe
11. O-ring
12. Water pump
13. Water pump gasket

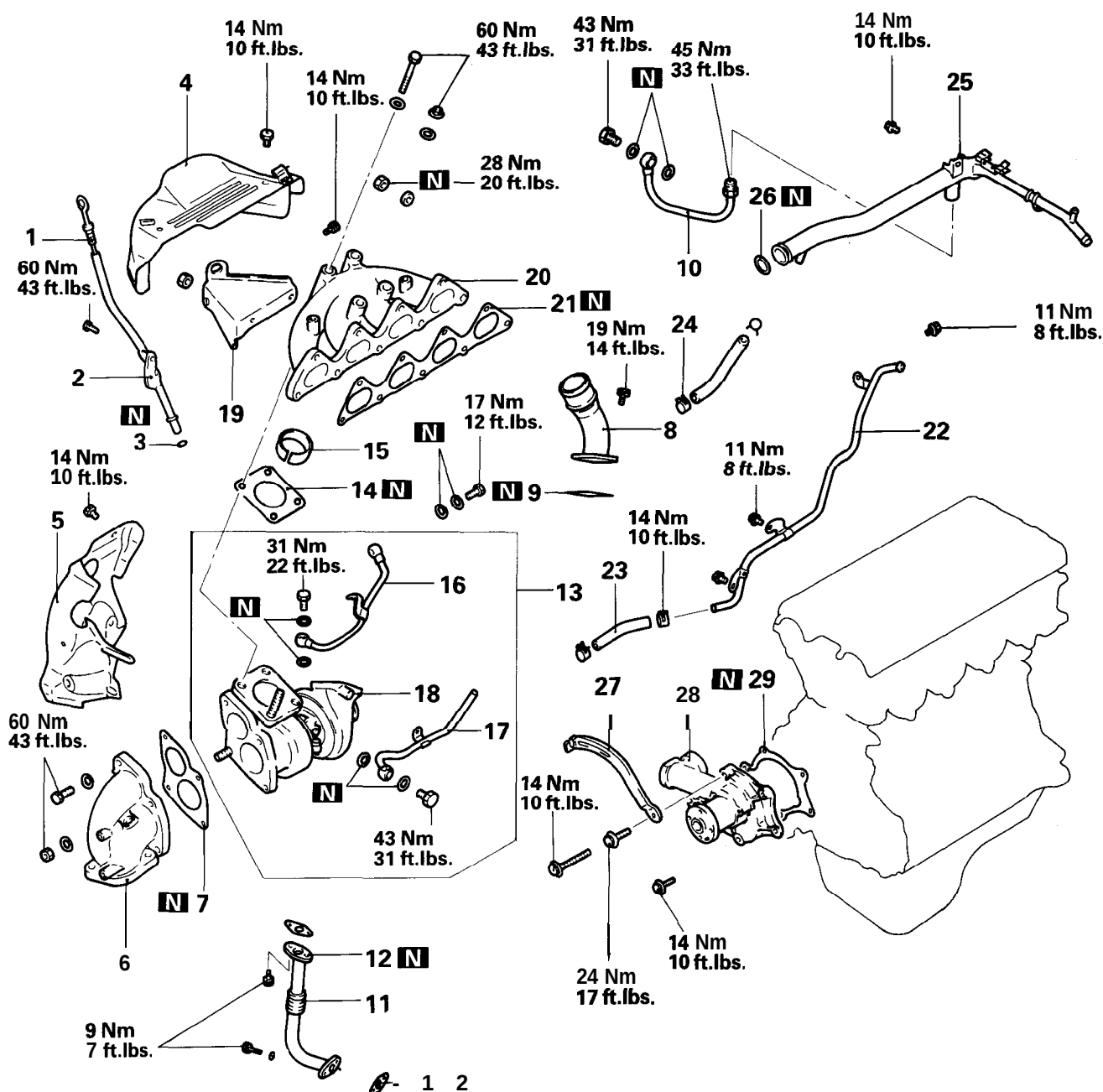
REMOVAL AND INSTALLATION — DOHC FOR NON-TURBO



Removal steps

1. Oxygen sensor
2. Oil level gauge
3. Oil level gauge guide
4. O-ring
5. Heat protector "A"
6. Heat protector "B"
7. Engine hanger
8. Exhaust manifold
9. Exhaust manifold gasket
- ▶▶ 10. Water inlet pipe
- ▶▶ 11. O-ring
12. Water pump
13. Gasket

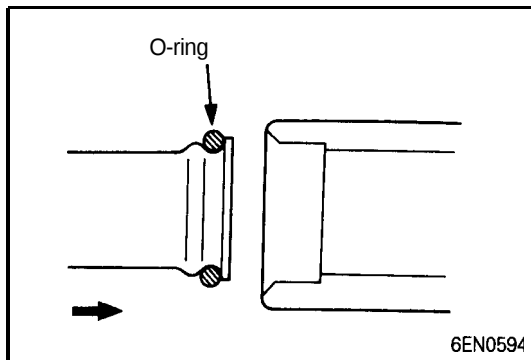
REMOVAL AND INSTALLATION – DOHC TURBO



Removal steps

1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Heat protector "A"
5. Heat protector "B"
6. Exhaust fitting
7. Gasket
8. Air outlet fitting
9. Gasket
10. Water pipe "B"
11. Oil return pipe
12. Gasket
13. Turbocharger assembly
14. Gasket
15. Ring

16. Oil pipe
17. Water pipe "A"
18. Turbocharger
19. Engine hanger
20. Exhaust manifold
21. Exhaust manifold gasket
22. Water pipe
23. Water hose
24. Water hose
25. Water inlet pipe
26. O-ring
27. Generator brace
28. Water pump
29. Gasket

**INSTALLATION SERVICE POINT****▶A▶ WATER PIPE/O-RING INSTALLATION**

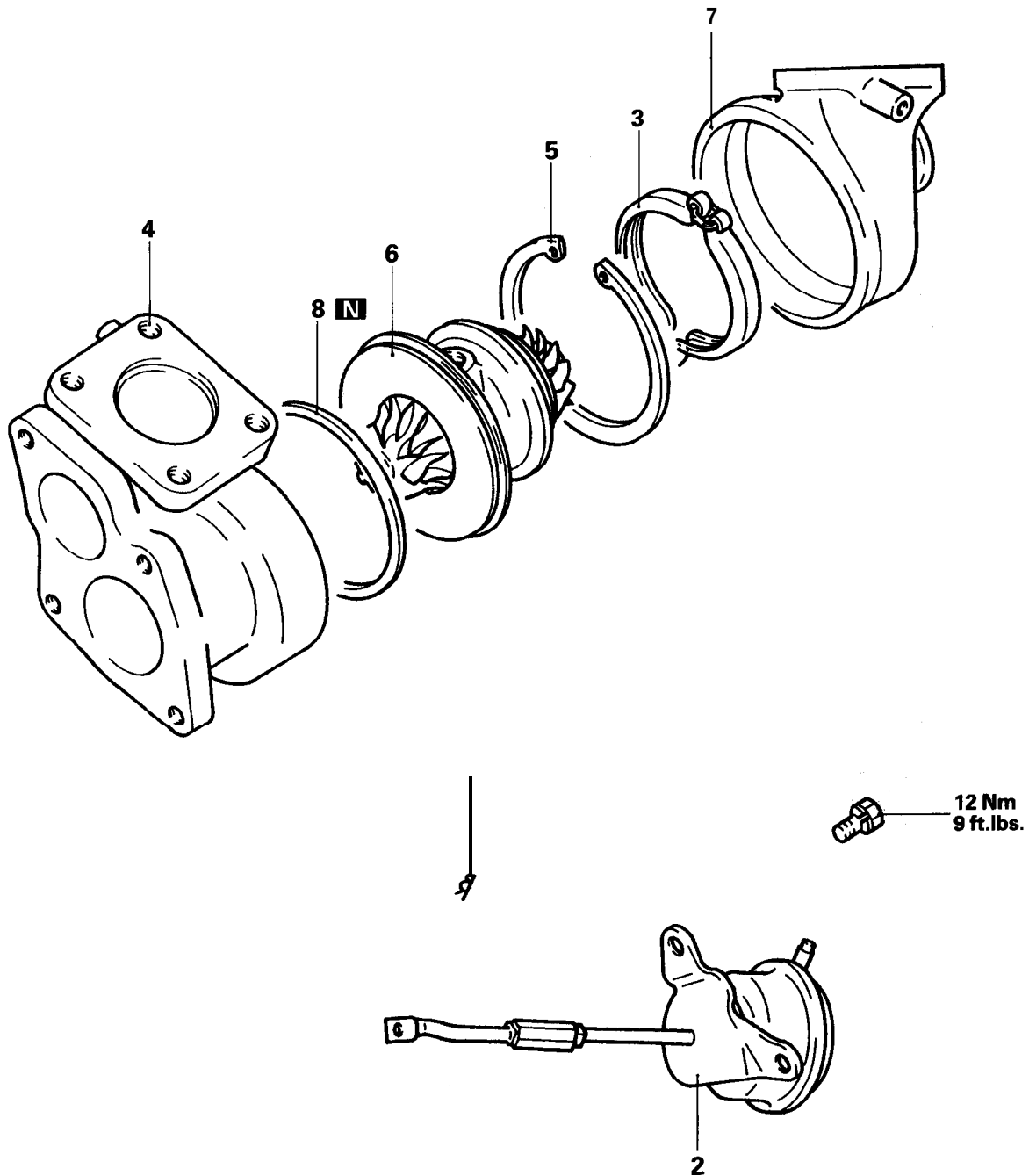
(1) Wet the O-ring (with water) to facilitate assembly.

Caution

Keep the O-ring free of oil or grease.

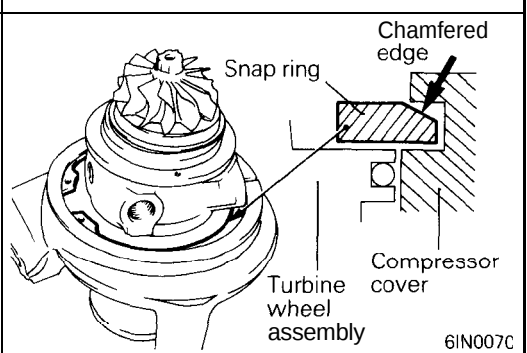
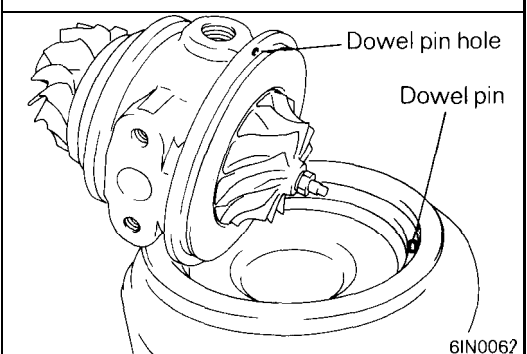
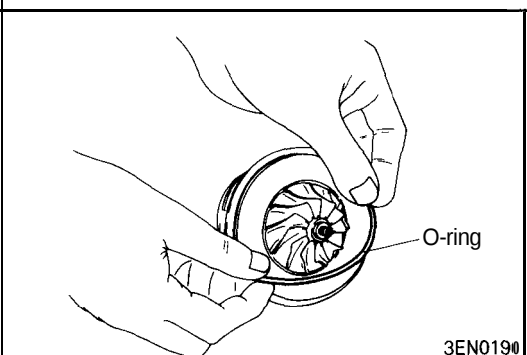
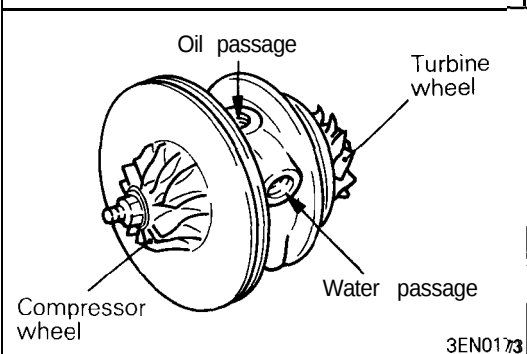
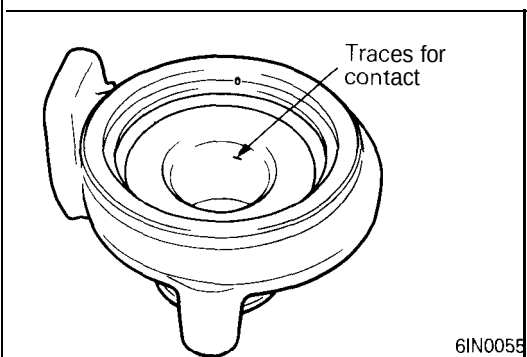
TURBOCHARGER

DISASSEMBLY AND REASSEMBLY



Disassembly steps

- ◆F◆ Inspection of turbocharger waste gate actuator operation
- 1. Snap pin
- 2. Turbocharger waste gate actuator
- ◆E◆ 3. Coupling
- ◆D◆ 4. Turbine housing
- ◆C◆ 5. Snap ring
- ◆B◆ 6. Turbine wheel assembly
- 7. Compressor cover
- ◆A◆ 8. O-ring



INSPECTION

TURBINE HOUSING

- (1) Check the housing for traces of contact with the turbine wheel, cracks due to overheating, pitching, deformation and other damage. Replace with a new turbine housing if cracked.
- (2) Operate the turbocharger waste gate valve lever manually to check that the gate can be opened and closed smoothly.

COMPRESSOR COVER

- (1) Check the compressor cover for traces of contact with the compressor wheel and other damage.

TURBINE WHEEL ASSEMBLY

- (1) Check the turbine and compressor wheel blades for bend, burr, damage, corrosion and traces of contact on the back side and replace if defective.
- (2) Check the oil passage of the turbine wheel assembly for deposit and clogging.
- (3) In the case of water cooled type, check also the water passage for deposit and clogging.
- (4) Check the turbine wheel and compressor wheel for light and smooth turning.

REASSEMBLY SERVICE POINTS

◆A◆ O-RING INSTALLATION

- (1) Apply a light coat of engine oil to a new O-ring and fit in the turbine wheel assembly groove.

◆B◆ TURBINE WHEEL ASSEMBLY INSTALLATION

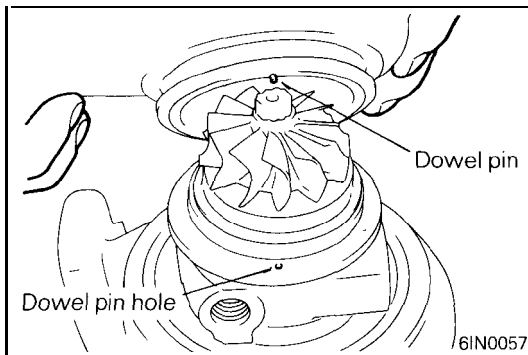
- (1) Install the turbine wheel assembly to the compressor cover in relation to the dowel pin.

Caution

Use care not to damage the blades of turbine wheel and compressor wheel.

◆C◆ SNAP RING INSTALLATION

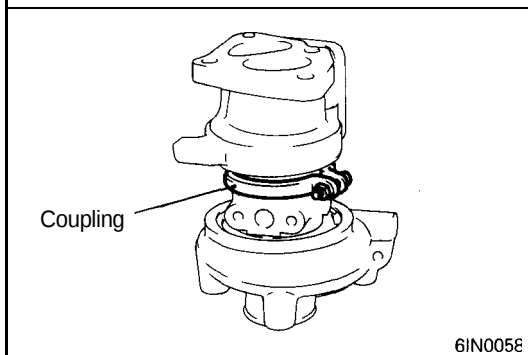
- (1) Fit the snap ring with its chamfered side facing up.

**◆D◆ TURBINE HOUSING INSTALLATION**

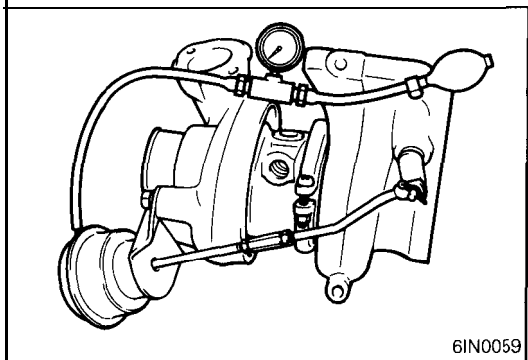
- (1) Install the turbine housing in relation to the dowel pin.

Caution

Use care not to damage the blades of turbine wheel.

**◆E◆ COUPLING INSTALLATION**

- (1) Install the coupling and tighten to specified torque.

**◆F◆ TURBOCHARGER WASTE GATE ACTUATOR OPERATION INSPECTION**

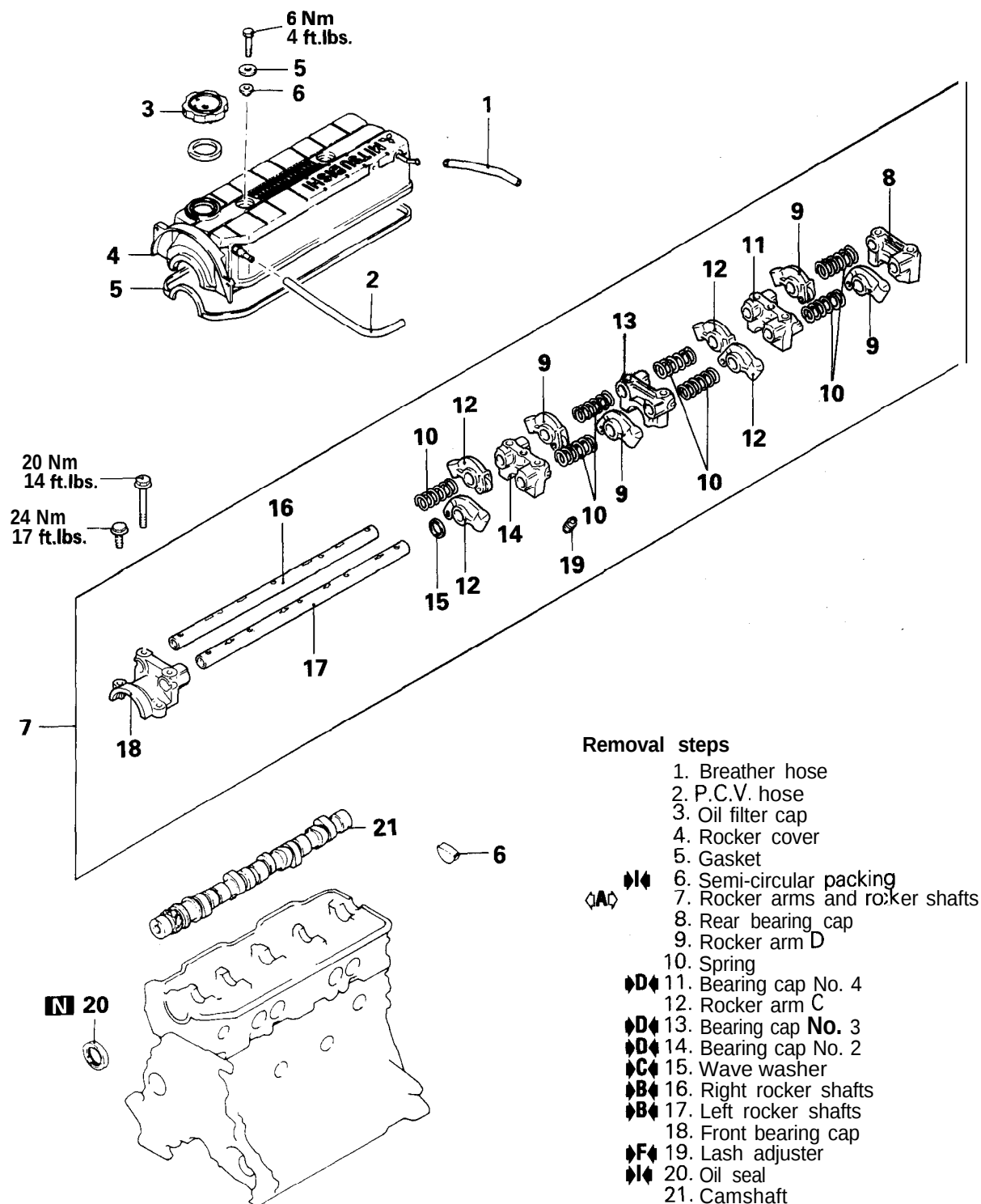
- (1) Using a tester, apply a pressure of approx. 72 kPa (10.3 psi) to the actuator and make sure that the rod moves.

Caution

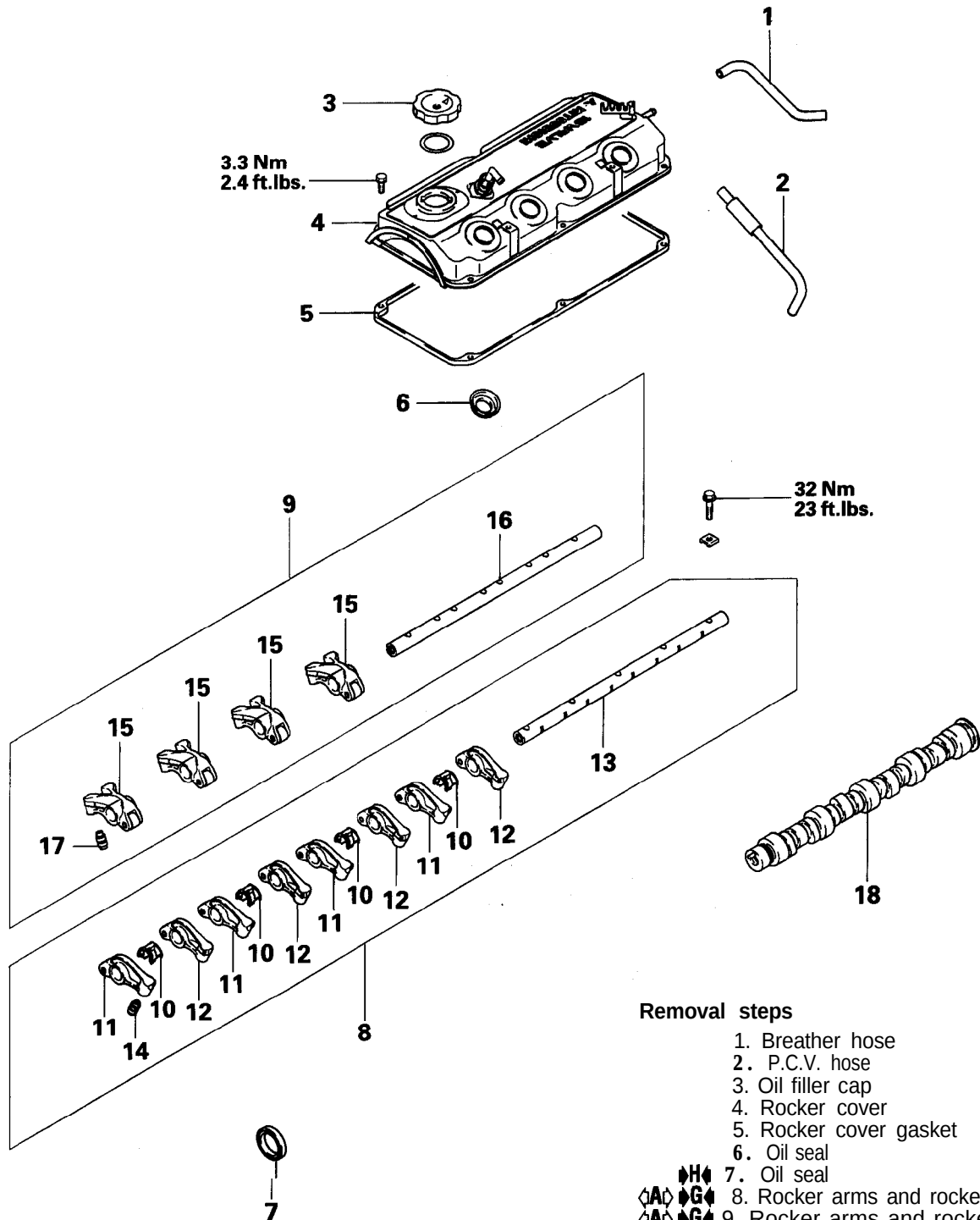
Do not apply a pressure of more than 85 kPa (12.4 psi) to the actuator. Otherwise, the diaphragm may be damaged. Never attempt to adjust the turbocharger waste gate valve.

ROCKER ARMS AND CAMSHAFT

REMOVAL AND INSTALLATION – SOHC 8 VALVE



REMOVAL AND INSTALLATION – SOHC 16 VALVE

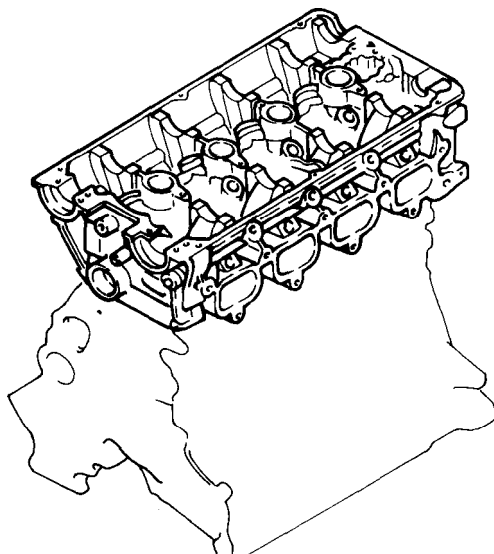
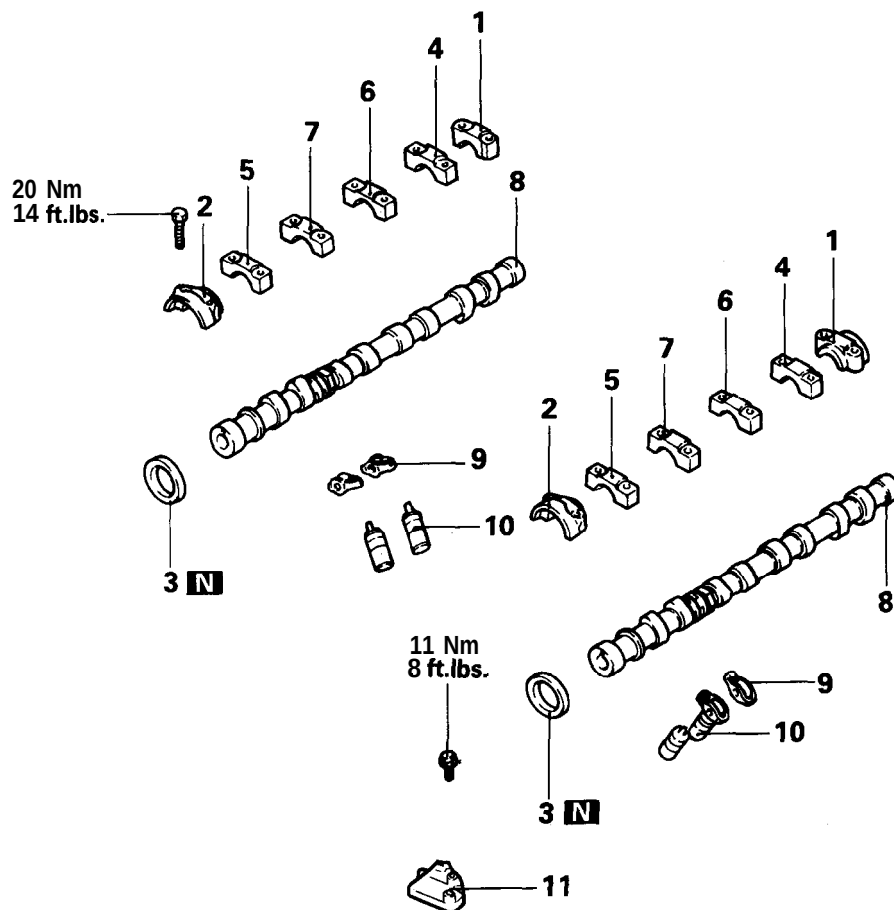


Removal steps

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 arms and rocker arm shaft
9. Rocker arms and rocker arm shaft
10. Rocker shaft spring
11. Rocker arm A
12. Rocker arm B
13. Rocker arm shaft (Intake side)
14. Lash adjuster
15. Rocker arm C
16. Rocker arm shaft (Exhaust side)
17. Lash adjuster
18. Camshaft

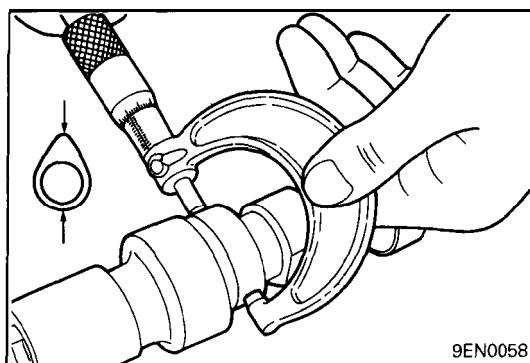
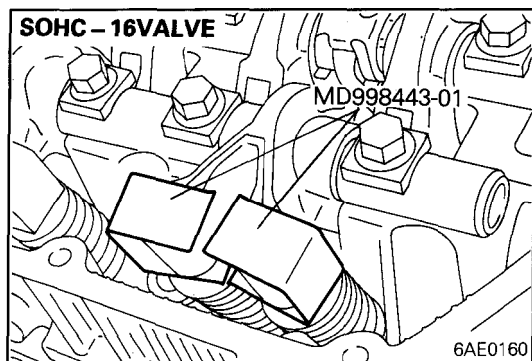
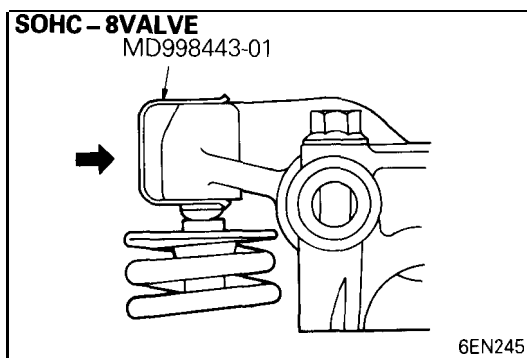
6EN0686

REMOVAL AND INSTALLATION – DOHC



Removal steps

- ♦E♦ 1. Bearing cap rear
- ♦E♦ 2. Bearing cap front
- ♦H♦ 3. Camshaft oil seal
- ♦E♦ 4. Bearing cap No. 5
- ♦E♦ 5. Bearing cap No. 2
- ♦E♦ 6. Bearing cap No. 4
- ♦E♦ 7. Bearing cap No. 3
- ♦A♦ 8. Camshaft
- ♦A♦ 9. Rocker arm
- ♦F♦ 10. Lash adjuster
- 11. Oil delivery body



REMOVAL SERVICE POINT

ROCKER ARMS AND ROCKER ARM SHAFTS REMOVAL

- (1) Before removing rocker arms and shafts assembly, install the special tool as illustrated to prevent adjuster from dropping.

INSPECTION

CAMSHAFT

- (1) Measure the cam height.

SOHC

mm (in.)

Identification mark	Standard value	Limit
Intake		
D	42.40 (1.6693)	41.90 (1.6496)
1.2	37.39 (1.4720)	36.89 (1.4524)
Exhaust		
D	42.40 (1.6693)	41.90 (1.6496)
1.2	37.47 (1.4752)	36.97 (1.4555)

DOHC

mm (in.)

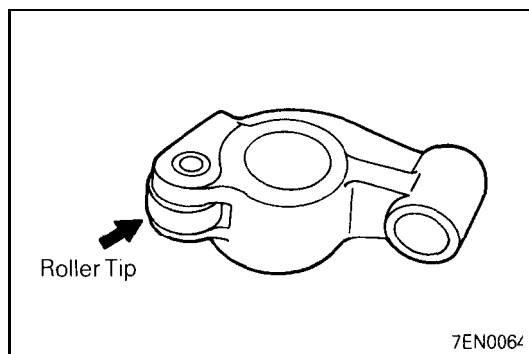
Identification mark	Standard value	Limit
Intake		
A, D	35.49 (1.3972)	34.99 (1.3776)
B, E	35.20 (1.3858)	34.70 (1.3661)
Exhaust		
A	35.20 (1.3858)	34.70 (1.3661)
C	35.49 (1.3972)	34.99 (1.3776)

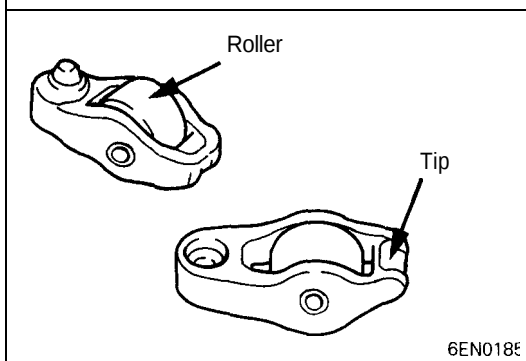
NOTE

The camshaft identification mark is stamped on the opposite end of the camshaft sprocket side.

ROCKER ARM

- (1) Check the roller surface. If any dents, damage or seizure is evident, replace the rocker arm.
- (2) Check rotation of the roller. If it does not rotate smoothly or if looseness is evident, replace the rocker arm.
- (3) Check the inside diameter. If damage or seizure is evident, replace the rocker arm.



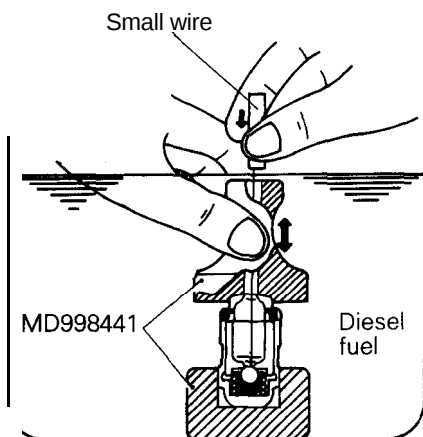


LASH ADJUSTER LEAK DOWN TEST

Caution

1. The lash adjuster is a precision part. Keep it free from dust and other foreign matter.
2. Do not disassemble lash adjuster.
3. When cleaning lash adjuster, use clean diesel fuel only.

SOHC



6EN057C

- (1) immerse the lash adjuster in clean diesel fuel.
- (2) While lightly pushing down inner steel ball using the small wire, move the plunger up and down four or five times to bleed air.

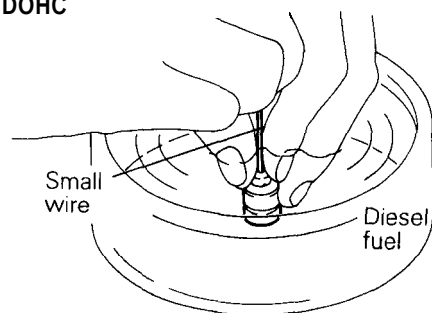
Use of the retainer helps facilitate the air bleeding of the rocker arm mounted type lash adjuster.

- (3) Remove the small wire and press the plunger. If the plunger is hard to be pushed in, the lash adjuster is normal. If the plunger can be pushed in all the way readily, bleed the lash adjuster again and test again. If the plunger is still loose, replace the lash adjuster.

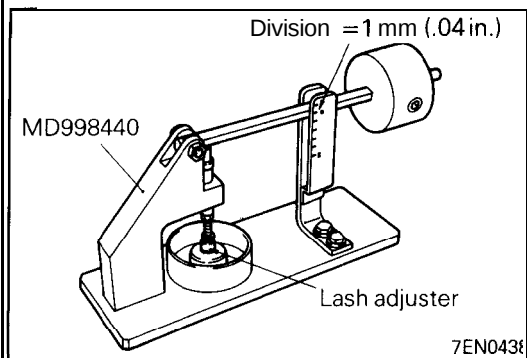
Caution

Upon completion of air bleeding, hold lash adjuster upright to prevent inside diesel fuel from spilling.

DOHC

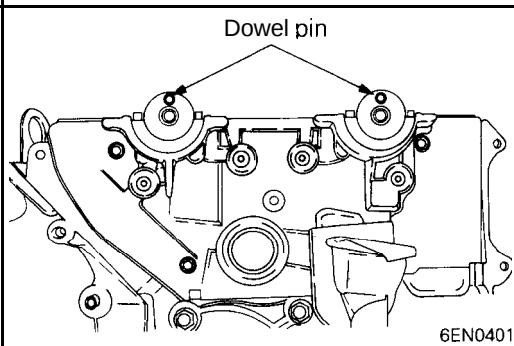
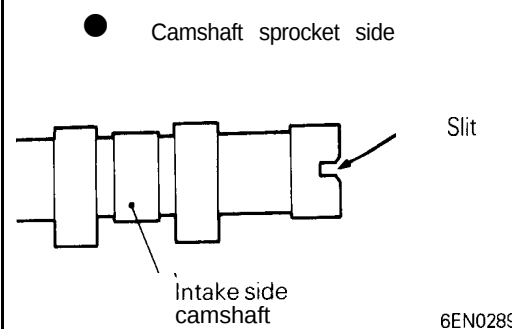
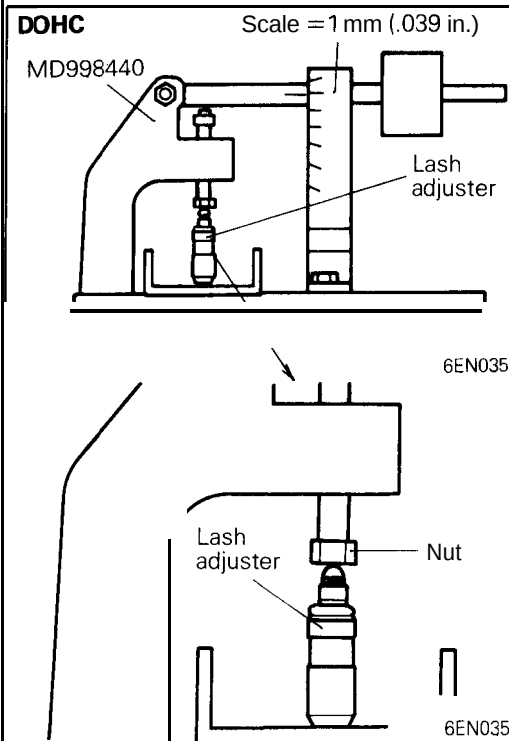


6EN0421



- (4) After air bleeding, set lash adjuster on the special tool (Leak down tester MD998440).
- (5) After plunger has gone down somewhat (.2 – .5 mm), measure time taken for it to go down 1 mm. Replace if measured time is out of specification.

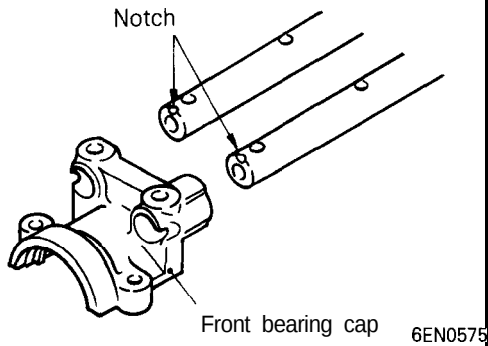
Standard value: 4 – 20 seconds / 1 mm (.04 in.)
[Diesel fuel at 15 – 20°C (59 – 68°F)]



REASSEMBLY SERVICE POINTS

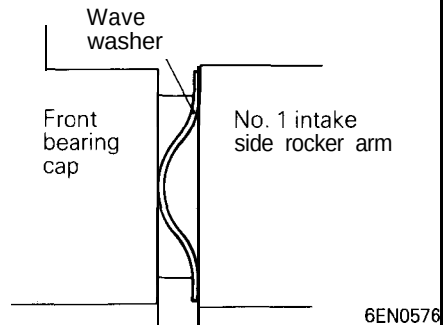
▲ CAMSHAFT INSTALLATION

- (1) Apply engine oil to journals and cams of the camshafts.
- (2) Install the camshafts on the cylinder head.
 Use care not to confuse the intake camshaft with the exhaust one. The intake camshaft has a slit on its rear end for driving the crankshaft position sensor.
- (3) Install the crankshaft sprocket B or spacer and flange to an end of the crankshaft, and turn the crankshaft until the timing marks are lined up, setting No. 1 cylinder to the TDC.
- (4) Set the camshafts so that their dowel pins are positioned at top.



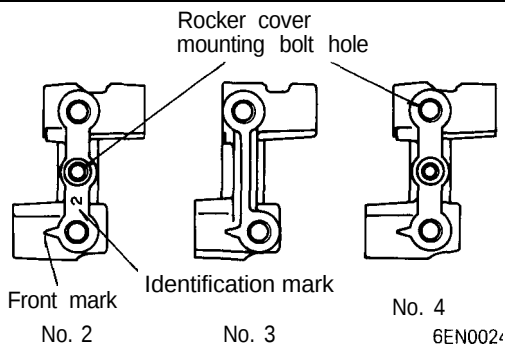
◆B◆ ROCKER SHAFTS INSTALLATION

- (1) Insert the rocker arm shaft into the front bearing cap so that the notch on the shaft faces up, and insert the installation bolt without tightening it.



◆C◆ WAVE WASHER INSTALLATION

- (1) Install the wave washer in correct direction as shown.



◆D◆ CAMSHAFT BEARING CAPS IDENTIFICATION

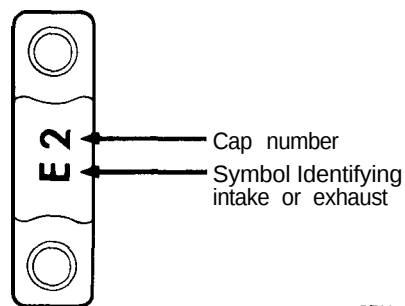
- (1) No. 3 bearing cap looks very similar to No. 2 and No. 4 bearing caps.

Use the identification marks shown at left for identification.

NOTE

No. 2 bearing cap is the same as No. 4 bearing cap.

- (2) Install the bearing caps with their front marks pointing to camshaft sprocket side.

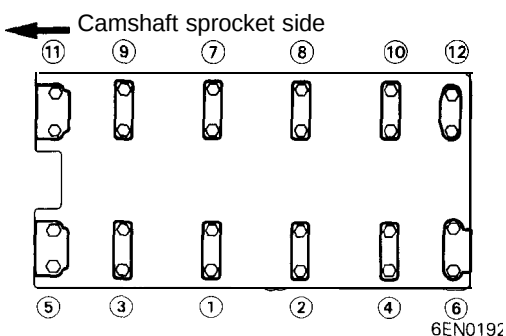


◆E◆ BEARING CAPS INSTALLATION

- (1) According to the identification mark stamped on top of each bearing cap, install the caps to the cylinder head. Only "L" or "R" is stamped on No. 1 bearing cap. Cap No. is stamped on No. 2 to No. 5 bearing caps. No. 6 bearing cap has no stamping.

I: For intake camshaft side

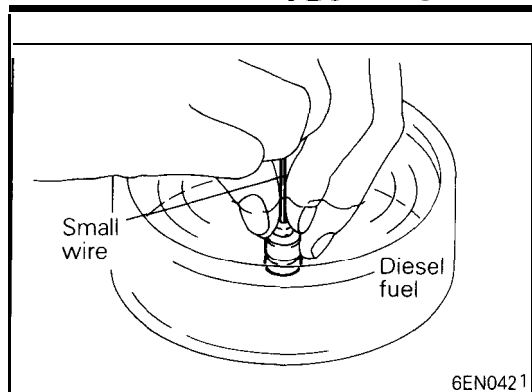
E: For exhaust camshaft side



- (2) Tighten the bearing caps in the order shown two to three times by torquing progressively.

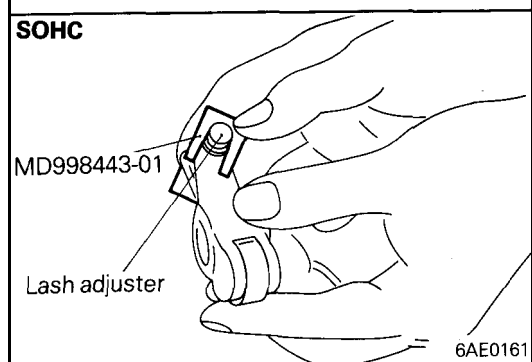
Tighten to specification in the final sequence.

- (3) Check to ensure that the rocker arm is held in position on the lash adjuster and valve stem end.

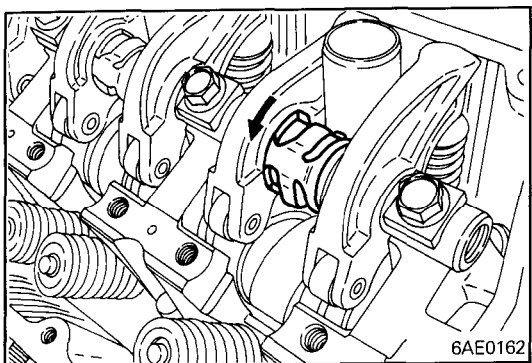


◆F◆ LASH ADJUSTER INSTALLATION

- (1) Immerse the lash adjuster in clean diesel fuel.
- (2) Using a small wire, move the plunger up and down 4 or 5 times while pushing down lightly on the check ball in order to bleed out the air.



- (3) Insert the lash adjuster to rocker arm, being careful not to spill the diesel fuel. Then use the special tool to prevent adjuster from falling while installing it.

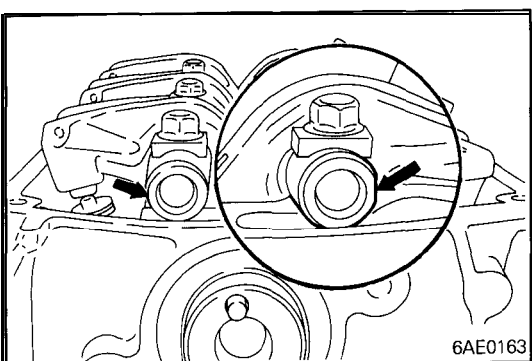


◆G◆ ROCKER SHAFT SPRING INSTALLATION ROCKER ARMS AND ROCKER ARM **SHAFT**

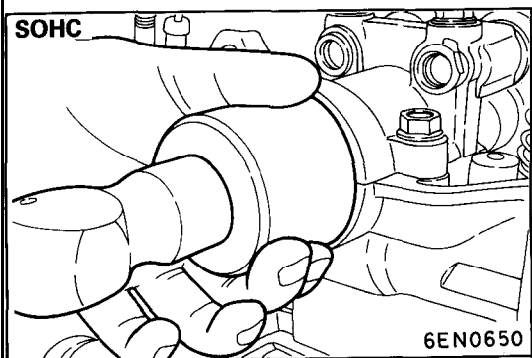
- (1) Temporarily tighten the rocker shaft with the bolt so that all rocker arms on the inlet valve side do not push the valves.
- (2) Fit the rocker shaft spring from the above and position it so that it is right angles to the plug guide.

NOTE

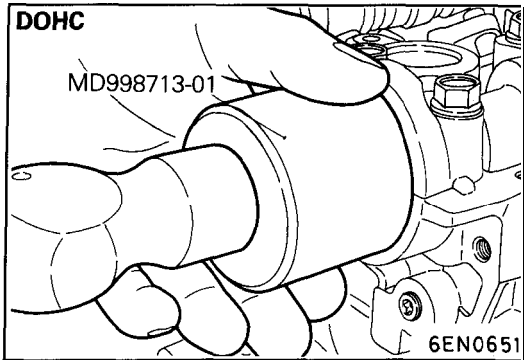
Install the rocker shaft spring before installing the exhaust side rocker arms and rocker arm shaft.



- (3) Remove the special tool for securing the lash adjuster.
- (4) Make sure that the notch in the rocker arm shaft is in the direction as illustrated.



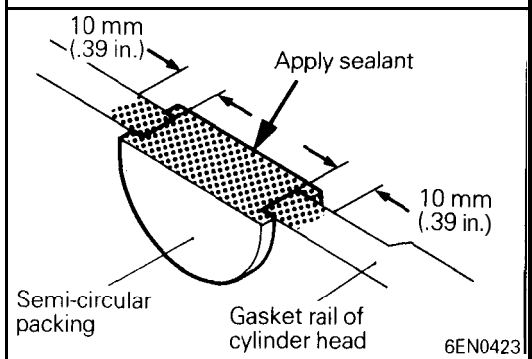
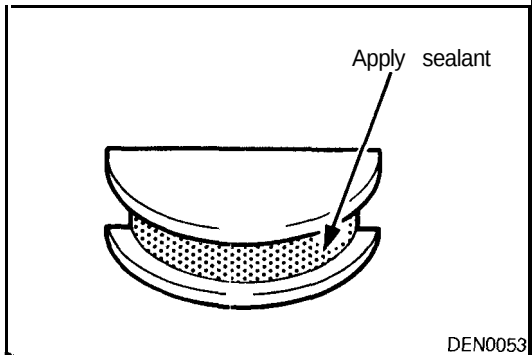
◆H◆ CAMSHAFT OIL SEAL INSTALLATION



SEMI-CIRCULAR PACKING INSTALLATION

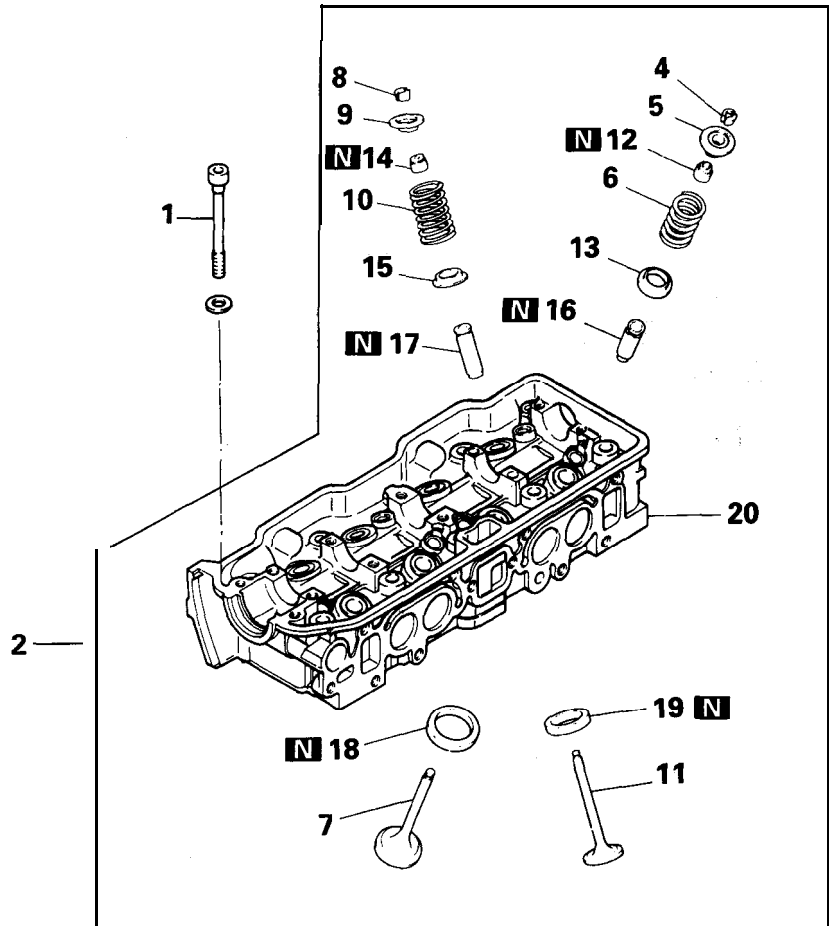
Specified sealant:

3M ATD Part No. 8660 or equivalent



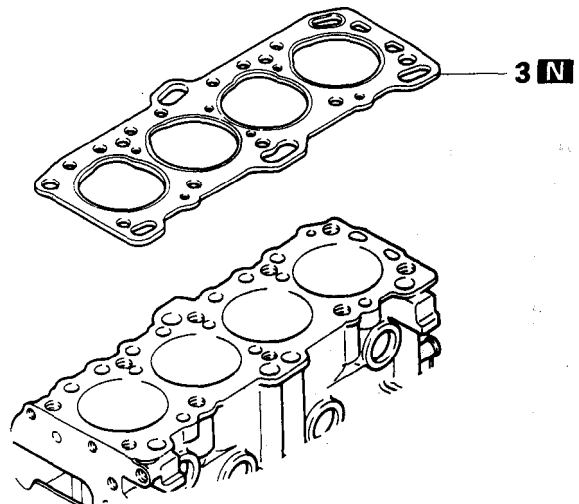
CYLINDER HEAD AND VALVES

REMOVAL AND INSTALLATION – SOHC – 8VALVE



Removal steps

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



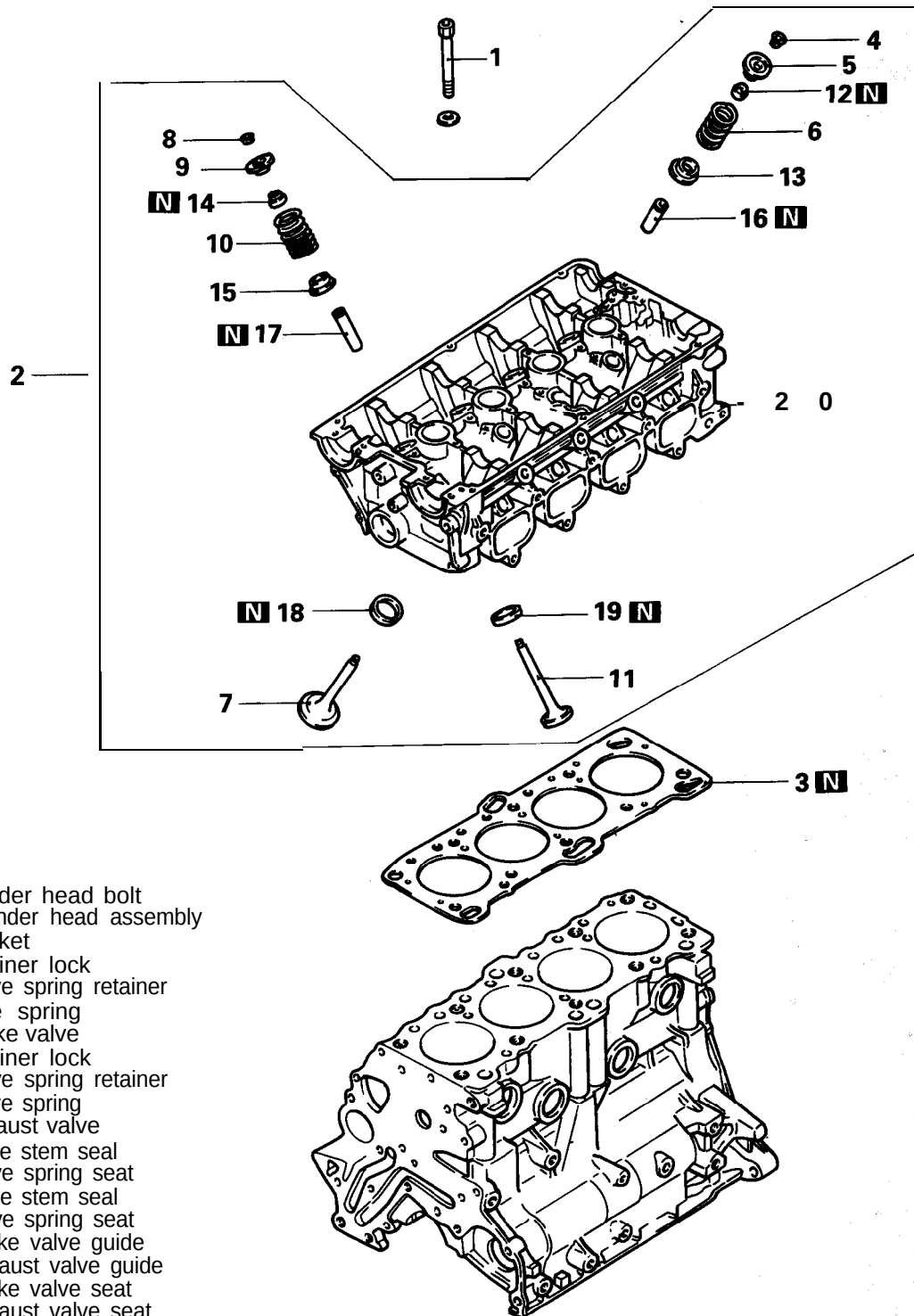
The diagram illustrates the removal of a cylinder head assembly. It shows the cylinder head (20) being lifted away from the engine block. Various components are labeled with numbers and letters in boxes, indicating their removal steps. The components include: 1. Cylinder head bolt, 2. Cylinder head assembly, 3. Cylinder head gasket, 4. Retainer lock, 5. Valve spring retainer, 6. Valve spring, 7. Retainer lock, 8. Retainer lock, 9. Retainer lock, 10. Retainer lock, 11. Retainer lock, 12. Retainer lock, 13. Retainer lock, 14. Retainer lock, 15. Retainer lock, 16. Retainer lock, 17. Retainer lock, 18. Retainer lock, 19. Retainer lock, 20. Cylinder head assembly.

Removal steps

- 1. Cylinder head bolt
- 2. Cylinder head assembly
- 3. Cylinder head gasket
- 4. Retainer lock
- 5. Valve spring retainer
- 6. Valve spring

1. Cylinder head bolt
2. Cylinder head assembly
3. Cylinder head gasket
4. Retainer lock
5. Valve spring retainer
6. Valve spring
7. Intake valve
8. Retainer lock
9. Valve spring retainer
10. Valve spring
11. Exhaust valve
12. Valve stem seal
13. Valve spring seat
14. Valve stem seal
15. Valve spring seat
16. Intake valve guide
17. Exhaust valve guide
18. Intake valve seat
19. Exhaust valve seat
20. Cylinder head

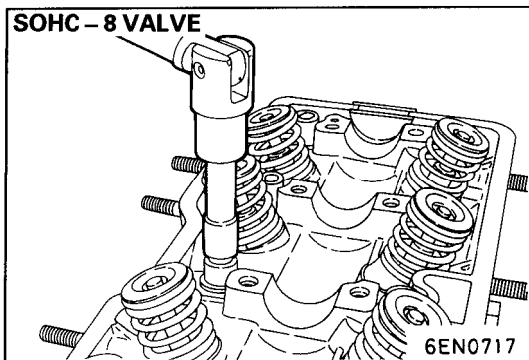
REMOVAL AND INSTALLATION – DOHC



Removal steps

- ◆A◆◆E◆ 1. Cylinder head bolt
- ◆A◆◆E◆ 2. Cylinder head assembly
- ◆D◆ 3. Gasket
- ◆B◆◆C◆ 4. Retainer lock
- ◆B◆◆C◆ 5. Valve spring retainer
- ◆B◆ 6. Valve spring
- ◆B◆◆C◆ 7. Intake valve
- ◆B◆◆C◆ 8. Retainer lock
- ◆B◆◆C◆ 9. Valve spring retainer
- ◆B◆ 10. Valve spring
- ◆B◆◆C◆ 11. Exhaust 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. Intake valve guide
- ◆C◆◆A◆ 17. Exhaust valve guide
- ◆C◆◆A◆ 18. Intake valve seat
- ◆C◆◆A◆ 19. Exhaust valve seat
- ◆C◆◆A◆ 20. Cylinder head

SOHC – 8 VALVE

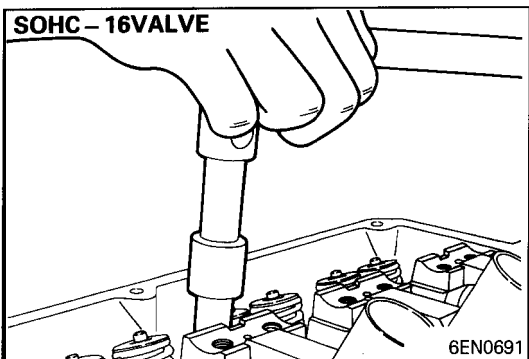
**REMOVAL SERVICE POINTS****PRECAUTION FOR REMOVED PARTS**

- (1) Keep removed parts in order according to the cylinder number and intake/exhaust.

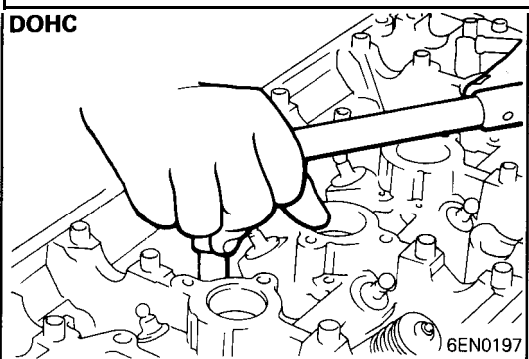
◀A▶ CYLINDER HEAD BOLTS REMOVAL

- (1) Using the 12 mm – 12 points socket wrench, loosen the cylinder head bolts. Loosen evenly, little by little.

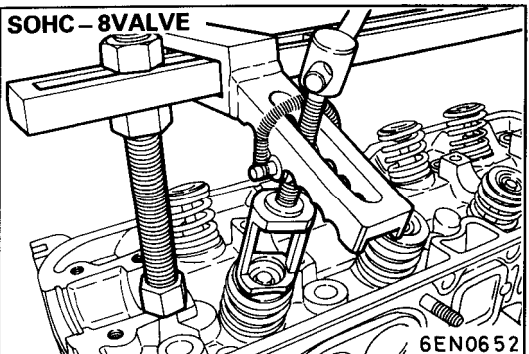
SOHC – 16 VALVE



DOHC

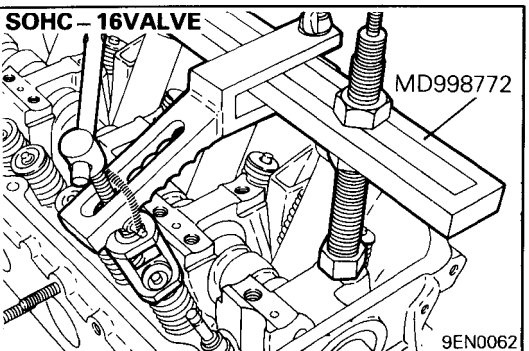


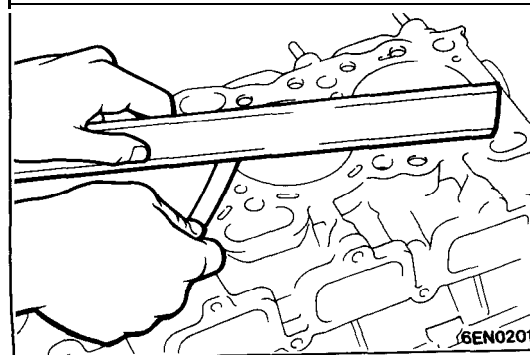
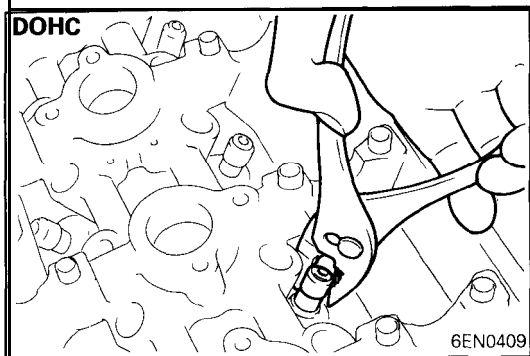
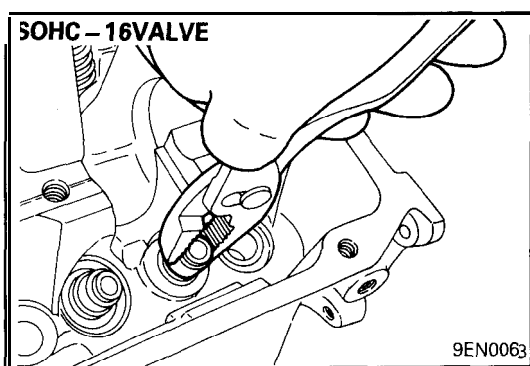
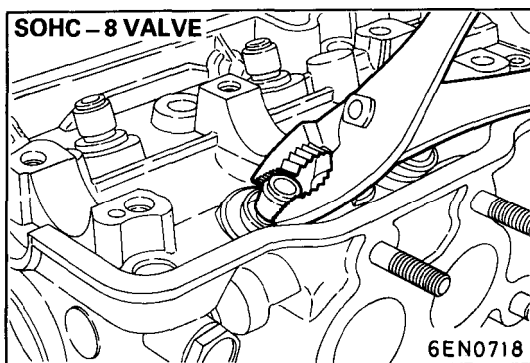
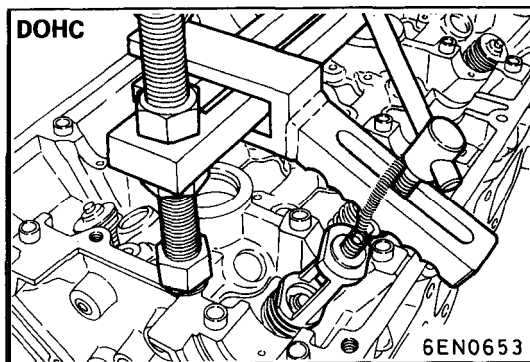
SOHC – 8 VALVE

**◀B▶ RETAINER LOCK REMOVAL**

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

SOHC – 16 VALVE





⚠ VALVE STEM SEAL REMOVAL

(1) Do not reuse valve stem seal.

INSPECTION CYLINDER HEAD

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

Standard value: 0.05 mm (.0020 in.)

Limit: 0.2 mm (.008 in.)

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

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

* Includes combined with cylinder block grinding.

Cylinder head height (Specification when new):

SOHC – **8VALVE**

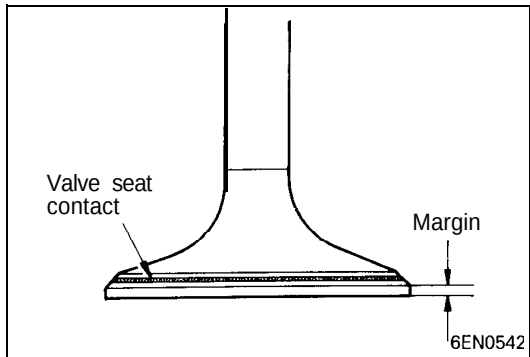
89.9 – 90.1 mm (3.539 – 3.547 in.)

SOHC – **16VALVE**

119.9 – 120.1 mm (4.720 – 4.728 in.)

DOHC

131.9 – 132.1 mm (5.193 – 5.201 in.)



VALVE

- (1) Check the valve face for correct contact. If incorrect, reface using valve refacer. Valve seat contact should be maintained uniform at the center of valve face.
- (2) If the margin exceeds the service limit, replace the valve.

Standard value:

SOHC – **8VALVE**

Intake 1.2 mm (.047 in.)

Exhaust 2.0 mm (.079 in.)

SOHC – **16VALVE**

Intake 1.0 mm (.039 in.)

Exhaust 1.2 mm (.047 in.)

DOHC

Intake 1.0 mm (.039 in.)

Exhaust 1.5 mm (.059 in.)

Limit:

SOHC – **8VALVE**

Intake 0.7 mm (.028 in.)

Exhaust 1.5 mm (.059 in.)

SOHC – **16VALVE**

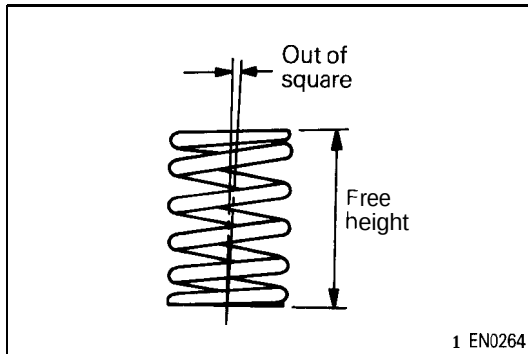
Intake 0.5 mm (.020 in.)

Exhaust 0.7 mm (.028 in.)

DOHC

Intake 0.7 mm (.028 in.)

Exhaust 1.0 mm (.039 in.)



VALVE SPRING

- (1) Measure the free height of spring and, if it is smaller than the limit, replace.

SOHC – **8VALVE**

Identification color: White

Standard value: 49.8 mm (1.961 in.)

Limit: 48.8 mm (1.921 in.)

SOHC – **16VALVE**

Identification color: White

Standard value: 51.0 mm (2.008 in.)

Limit 50.0 mm (1.969 in.)

DOHC

Identification color: Blue

Standard value: 48.3 mm (1.902 in.)

Limit: 47.3 (1.862 in.)

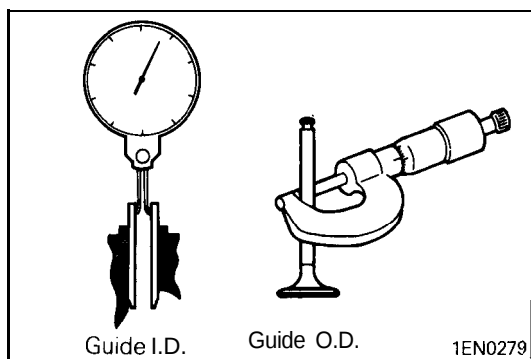
- (2) Measure the squareness of the spring and, if the limit is exceeded, replace.

Standard value:

SOHC 2° or less

DOHC 1.5° or less

Limit: Max. 4°



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:

SOHC – 8VALVE

Intake 0.02 – 0.06 mm (.0008 – .0024 in.)

Exhaust 0.05 – 0.09 mm (.0020 – .0035 in.)

SOHC – 16VALVE

Intake 0.02 – 0.05 mm (.0008 – .0020 in.)

Exhaust 0.03 – 0.07 mm (.0012 – .0028 in.)

DOHC

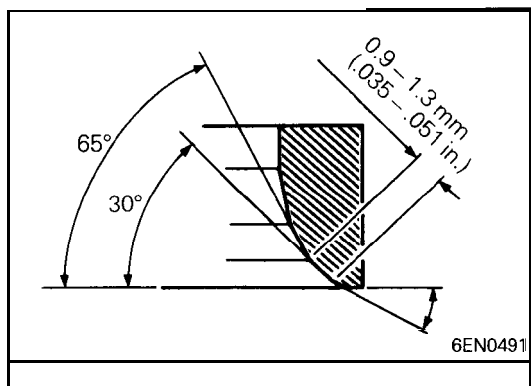
Intake 0.02 – 0.05 mm (.0008 – .0020 in.)

Exhaust 0.05 – 0.09 mm (.0020 – .0035 in.)

Limit:

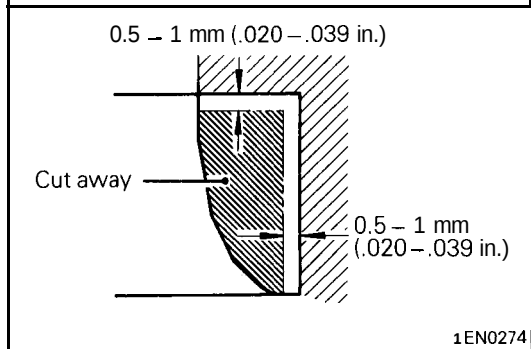
Intake 0.10 mm (.004 in.)

Exhaust 0.15 mm (.006 in.)



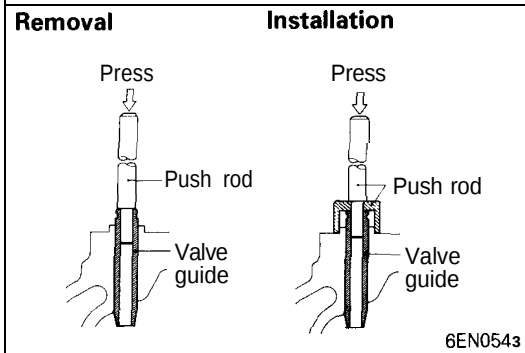
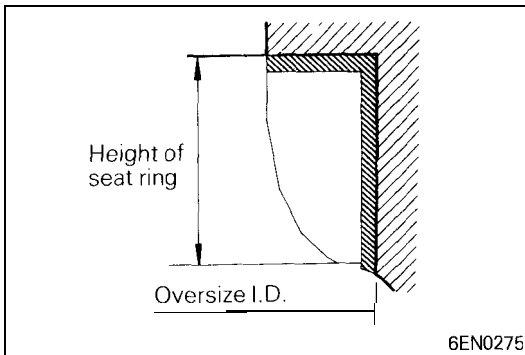
VALVE SEAT RECONDITIONING PROCEDURE

- (1) Before correcting the valve seat, check for clearance between the valve guide and valve and, if necessary, replace the valve guide.
- (2) Using the special tool or seat grinder, correct to obtain the specified seat width and angle.
- (3) After correction, valve and valve seat should be lapped with a lapping compound.



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.

Seat ring hole diameter: See “Service Specifications” on page 11F-14.

- (3) Before fitting the valve seat, either heat the cylinder head up to approximately 250°C (482°F) or cool the valve seat in liquid nitrogen, to prevent the cylinder head bore from galling.
- (4) Using a valve seat cutter, correct the valve seat to the specified width and angle.
See “VALVE SEAT RECONDITIONING PROCEDURE”.

VALVE GUIDE REPLACEMENT PROCEDURE

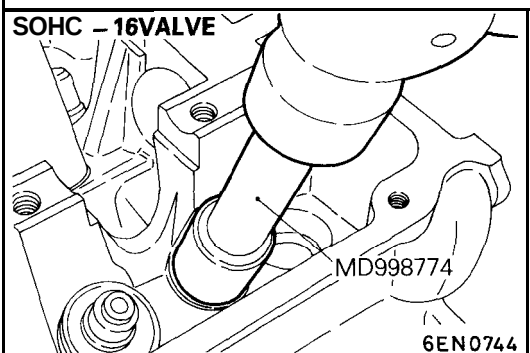
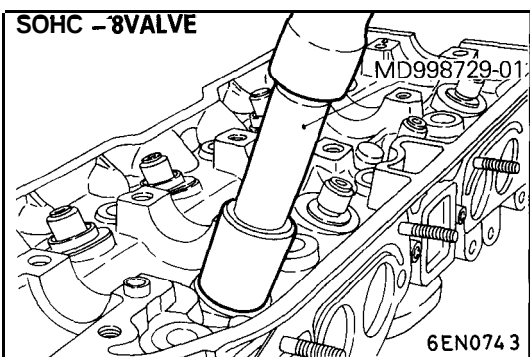
- (1) Using the special tool and a press, remove the valve guide toward cylinder head gasket surface.
- (2) Rebore valve guide hole to the new oversize valve guide outside diameter.

Valve guide hole diameter: See “Service Specifications” on page 11F-14.

NOTE

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

- (3) Using the special tool, press-fit the valve guide, working from the cylinder head top surface.
- (4) After installing valve guides, insert new valves in them to check for sliding condition.
- (5) When valve guides have been replaced, check for valve contact and correct valve seats as necessary.



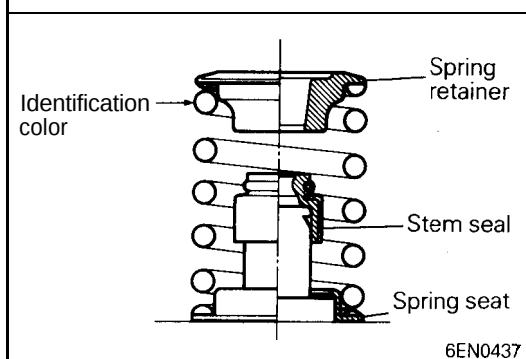
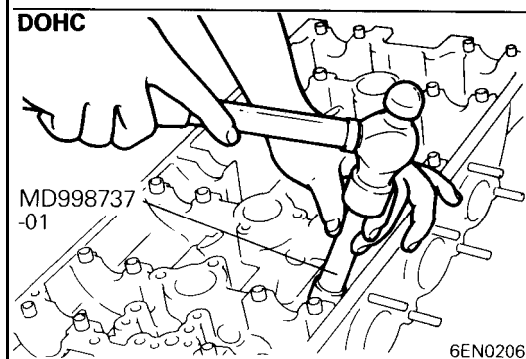
INSTALLATION SERVICE POINTS

◆A◆ VALVE STEM SEAL INSTALLATION

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

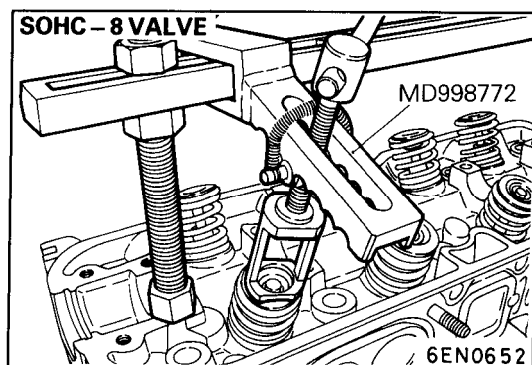
Caution

Do not reuse the valve stem seal.



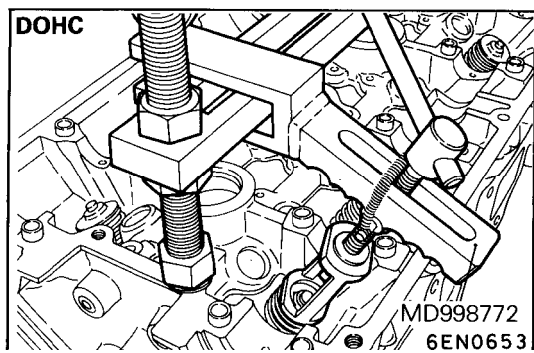
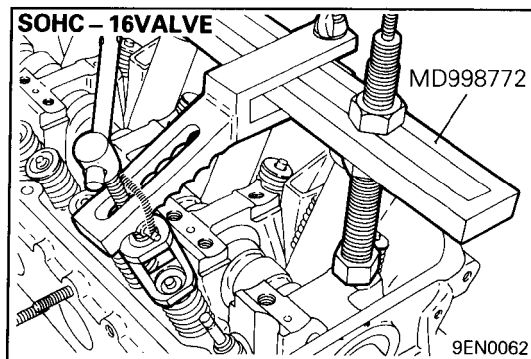
◆B◆ VALVE SPRINGS INSTALLATION

- (1) Direct the valve spring end with identification color end toward the spring retainer.

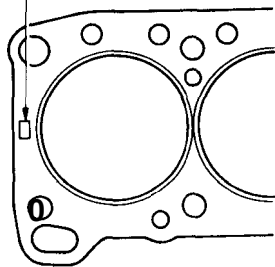


◆C◆ RETAINER LOCK INSTALLATION

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



Identification mark



6EN0545

◆D◆ CYLINDER HEAD GASKET IDENTIFICATION

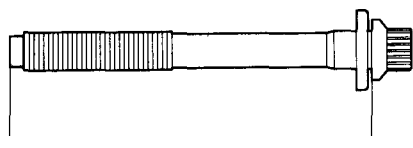
Identification mark:

4G63		63
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4G64		64
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Caution

Do not apply sealant to cylinder head gasket.



9EN0782

◆E◆ 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 bolt.

Limit: Max.

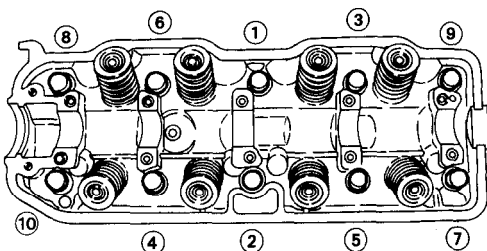
SOHC – 8VALVE 120.4 mm (4.74 in.)

SOHC – 16VALVE 99.4 mm (3.91 in.)

DOHC 99.4 mm (3.91 in.)

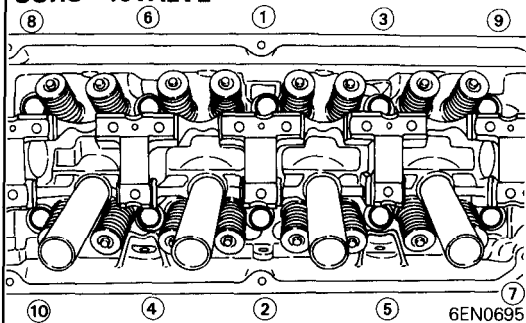
- (2) Apply engine oil to the threaded portions of bolts and to the washers.
- (3) According to the tightening sequence, tighten the bolts to the specified torque 80 Nm (58 ft.lbs.) use with 12 mm – 12 points socket wrench.
- (4) Loosen bolts completely.
- (5) Torque bolts to 20 Nm (14.5 ft.lbs.)
- (6) Tighten bolts 1/4 turns (90°) more.
- (7) Tighten bolts 1/4 turns (90°) additionally.

SOHC – 8VALVE



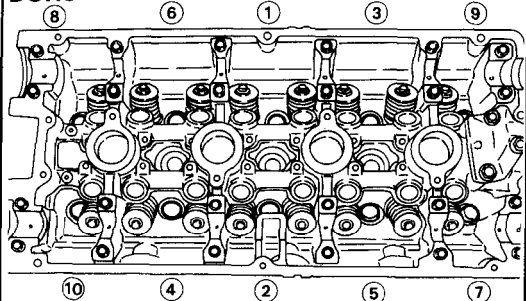
6EN0694

SOHC – 16VALVE



6EN0695

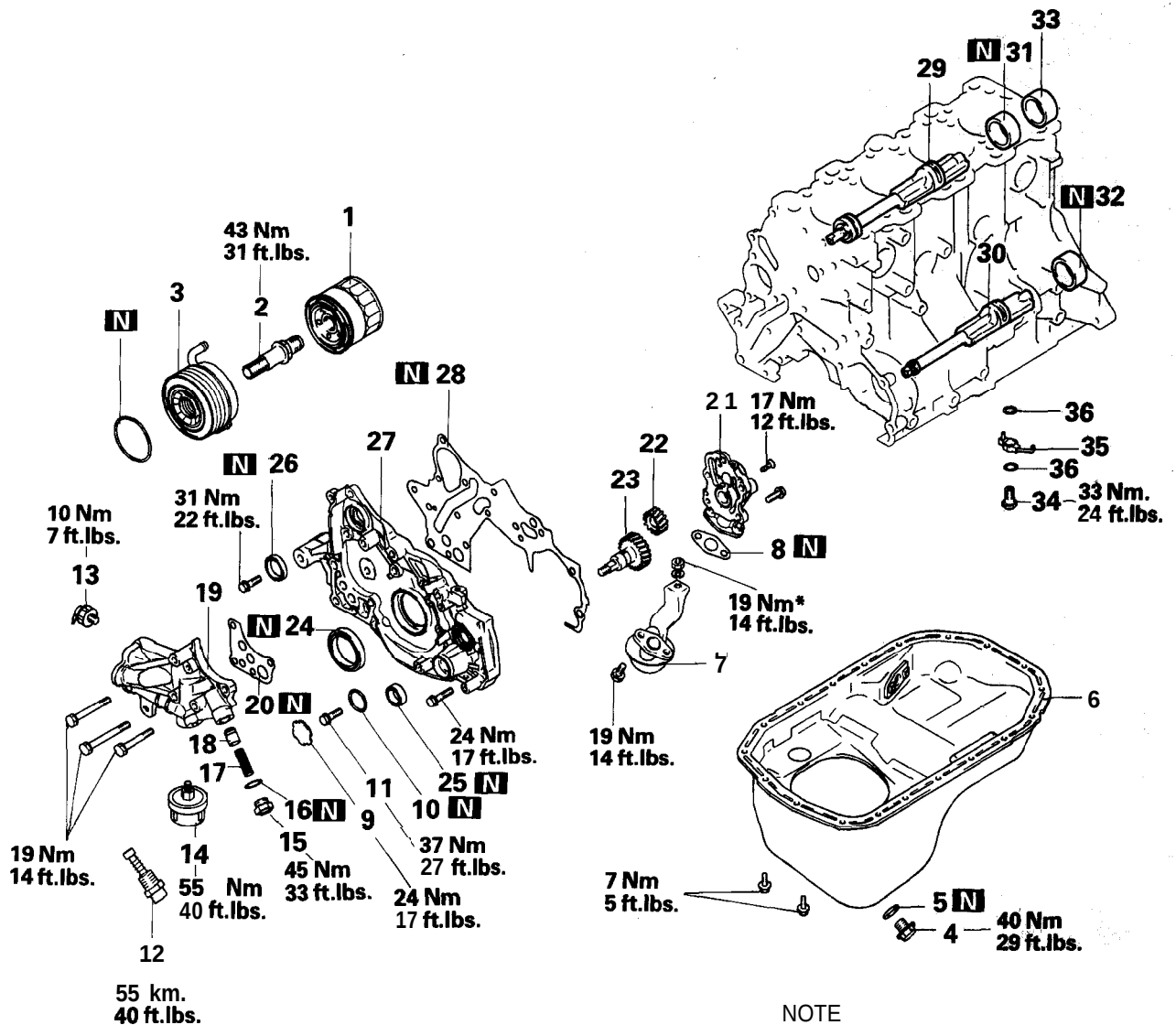
DOHC



6EN0696

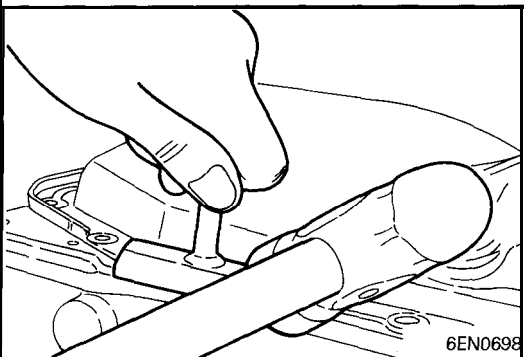
FRONT CASE, SILENT SHAFT AND OIL PAN

REMOVAL AND INSTALLATION



Removal steps

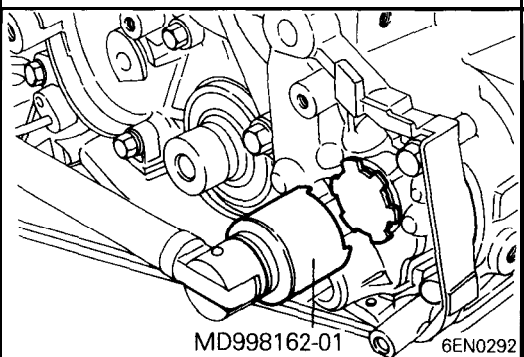
1. Oil filter
2. Oil cooler bolt**
3. Oil cooler**
4. Drain plug
5. Drain plug gasket
7. Oil screen
8. Oil screen gasket
9. Plug
10. O-ring
11. Flange bolt
12. Oil cooler by-pass valve
13. Oil pressure switch
14. Oil pressure gauge unit
15. Relief plug
16. Gasket
17. Relief plunger
18. Relief plunger
19. Oil filter bracket
20. Oil filter bracket gasket
21. Oil pump cover
22. Oil pump driven gear
23. Oil pump drive gear
24. Crankshaft front oil seal
25. Oil pump oil seal
26. Silent shaft oil seal
27. Front case
28. Front case gasket
29. Silent shaft, left
30. Silent shaft, right
31. Silent shaft, front bearing
32. Silent shaft, rear bearing, left
33. Silent shaft, rear bearing, right
34. Check valve*
35. Oil jet*
36. Gasket*

**REMOVAL SERVICE POINTS****◊A◊ OIL PAN REMOVAL**

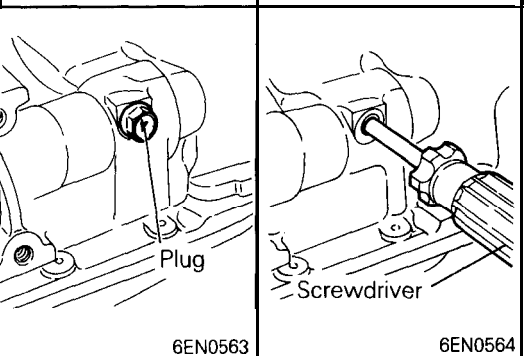
- (1) Remove all oil pan bolts.
- (2) Drive in the service tool between the cylinder block and oil pan.

NOTE

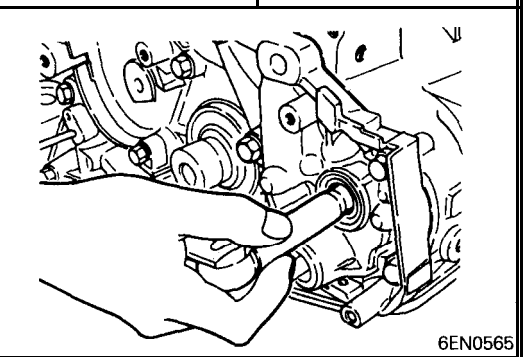
Never use a screwdriver or chisel, instead of the service tool, as a deformed oil pan flange will result in oil leakage.

**◊B◊ PLUG REMOVAL**

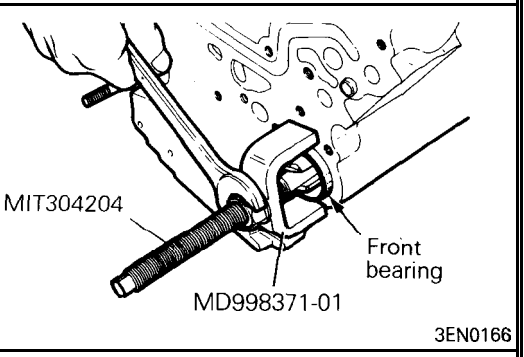
- (1) If the plug is too tight, hit the plug head with a hammer two to three times, and the plug will be easily loosened.

**◊C◊ FLANGE BOLT REMOVAL**

- (1) Remove the plug on the side of cylinder block.
- (2) Insert a Phillips screwdriver [shank diameter 8 mm (.32 in.)] into the plug hole to lock the silent shaft.



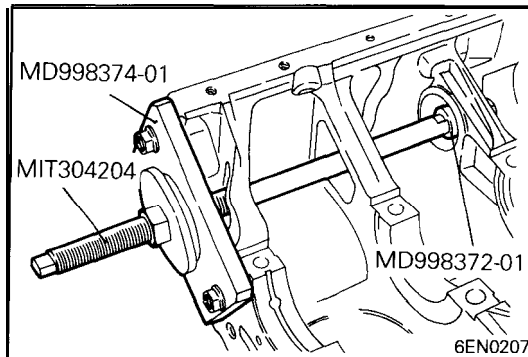
- (3) Loosen the flange bolt.

**◊D◊ SILENT SHAFT FRONT BEARING REMOVAL**

Using the special tool, remove the silent shaft front bearing from the cylinder block.

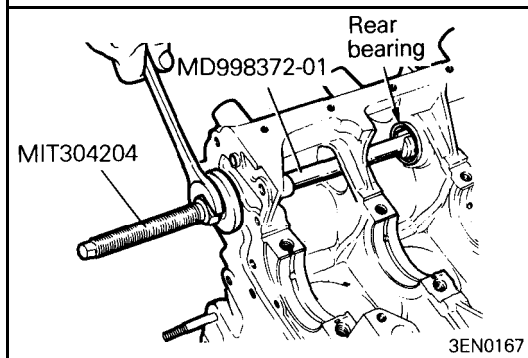
NOTE

Be sure to remove the front bearing first. If it has not been removed, the Rear Bearing Puller cannot be used.



◊E◊ LEFT SILENT SHAFT REAR BEARING REMOVAL

Using the special tool, remove the left silent shaft rear bearing from the cylinder block.



◊F◊ REAR BEARING REMOVAL

Using the special tool, remove the right silent shaft rear bearing from the cylinder block.

INSPECTION

FRONT CASE

- (1) Check oil holes for clogging and clean if necessary.
- (2) Check left silent shaft front bearing section for wear, damage and seizure. If there is anything wrong with the section, replace the front case.
- (3) Check the front case for cracks and other damage. Replace cracked or damaged front case.

OIL SEAL

- (1) Check the oil seal lip for wear and damage. Replace oil seal if necessary.
- (2) Check the oil seal lip for deterioration. Replace oil seal if necessary.

SILENT SHAFT

- (1) Check oil holes for clogging.
- (2) Check journal for seizure, damage and contact with bearing. If there is anything wrong with the journal, replace silent shaft, bearing or front case assembly.
- (3) Check the silent shaft oil clearance. If the clearance is excessively due to wear, replace the silent shaft bearing, silent shaft or front case assembly.

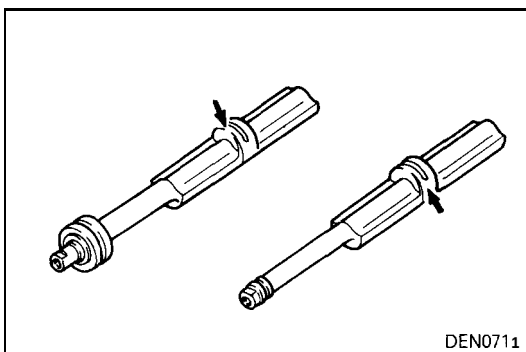
Standard value:

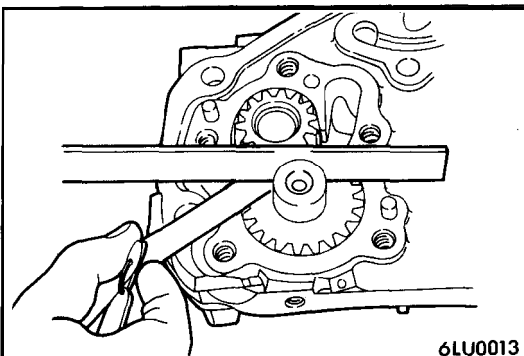
Front

Right	0.03 – 0.06 mm (.0012 – .0024 in.)
Left	0.02 – 0.05 mm (.0008 – .0020 in.)

Rear

Right	0.05 – 0.09 mm (.0020 – .0036 in.)
Left	0.05 – 0.09 mm (.0020 – .0036 in.)



**OIL PUMP**

- (1) Assemble the oil pump gear to the front case and rotate it to ensure smooth rotation with no looseness.
- (2) Ensure that there is no ridge wear on the contact surface between the front case and the gear surface of the oil pump cover.
- (3) Check the side clearance

Standard value:

Drive gear	0.06 – 0.14 mm (.0031 – .0055 in.)
Driven gear	0.06 – 0.12 mm (.0024 – .0047 in.)

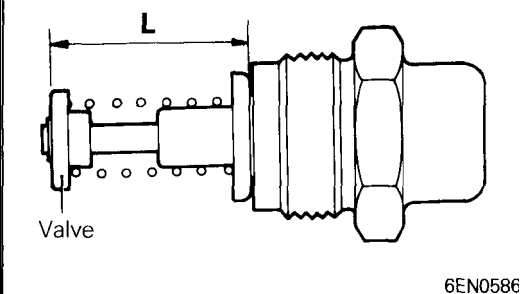
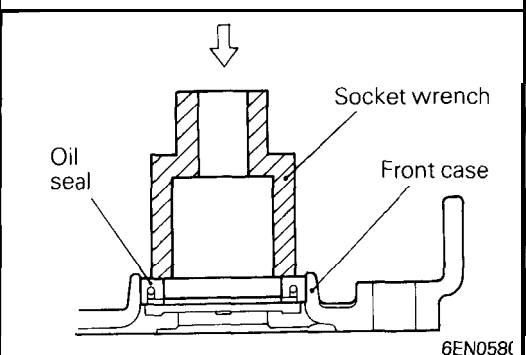
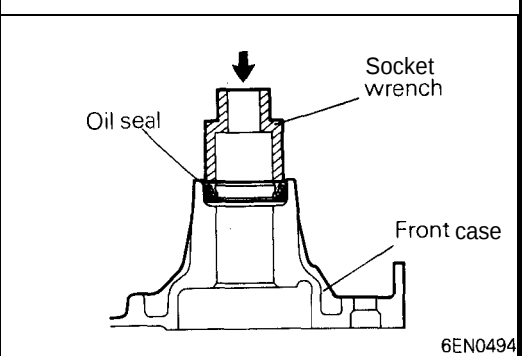
OIL COOLER BYPASS VALVE**(ENGINE WITH AIR COOLING TYPE OIL COOLER)**

- (1) Make sure that the valve moves smoothly.
- (2) Ensure that the dimension (L) measures the standard value under normal temperature and humidity.

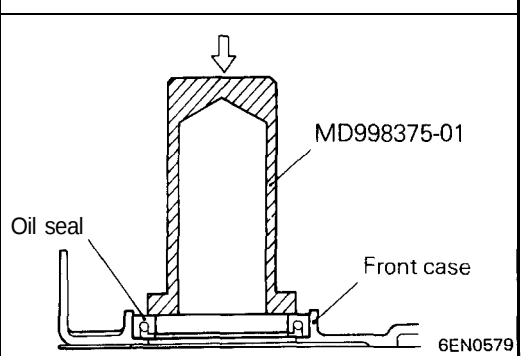
Standard value (L): 34.5 (1.356 in.)

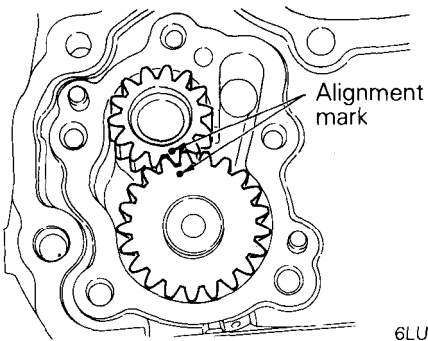
- (3) The dimension must be the standard value when measured after the valve has been dipped in 100°C (212°F) oil.

Standard value (L): 40 mm (1.57 in.) or more

**INSTALLATION SERVICE POINTS****◆A◆ SILENT SHAFT OIL SEAL INSTALLATION****◆B◆ OIL PUMP OIL SEAL INSTALLATION****◆C◆ CRANKSHAFT FRONT OIL SEAL INSTALLATION**

- (1) Using the special tool, install the crankshaft front oil seal into the front case.

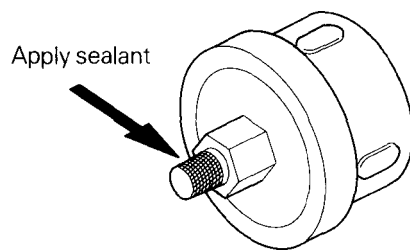




6LU0015

◆D◆ OIL PUMP DRIVEN GEAR / OIL PUMP DRIVE GEAR INSTALLATION

- (1) Apply engine oil to the gears and line up the alignment marks.



3EN022

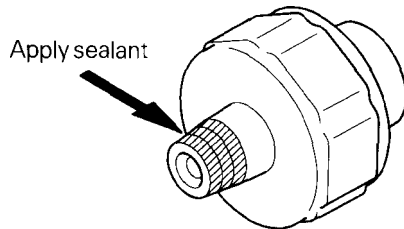
◆E◆ SEALANT APPLICATION TO OIL PRESSURE GAUGE UNIT

- (1) Coat the threads of switch with sealant and install the switch using the special tool.

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

Caution

1. Keep the end of threaded portion clear of sealant.
2. Avoid an overtightening.



9EN0094

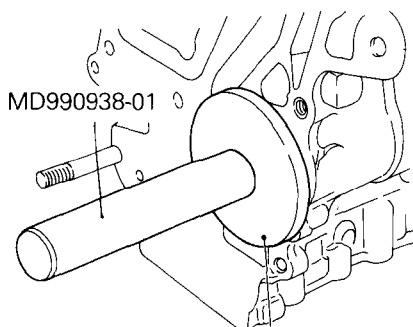
◆F◆ SEALANT APPLICATION TO OIL PRESSURE SWITCH

- (1) Coat the threads of switch with sealant and install the switch using the special tool.

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

Caution

1. Keep the end of threaded portion clear of sealant.
2. Avoid an overtightening.

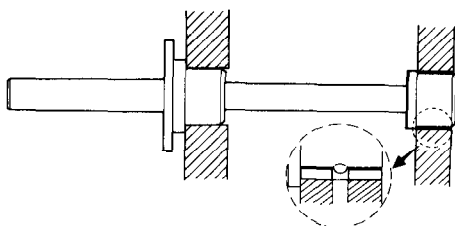


MD998373-01

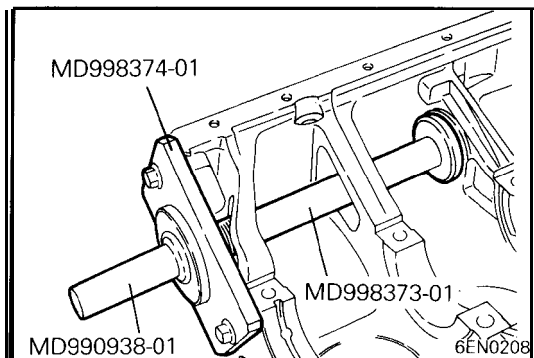
6EN0586

◆G◆ RIGHT SILENT SHAFT REAR BEARING INSTALLATION

- (1) Apply engine oil to the outer surface of bearing.
- (2) Using special tools, install right rear bearing. Make sure that oil hole of bearing is aligned with oil hole of cylinder block.



6EN0587



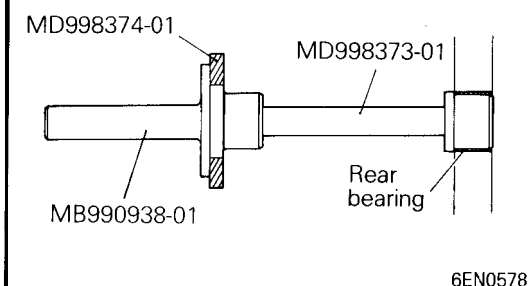
LEFT SILENT SHAFT REAR BEARING INSTALLATION

- (1) Install the special tool (GUIDE PLATE) tool to the cylinder block.
- (2) Apply engine oil to the rear bearing outer circumference and bearing hole in cylinder block.

- (3) Using the special tool, install the rear bearing.

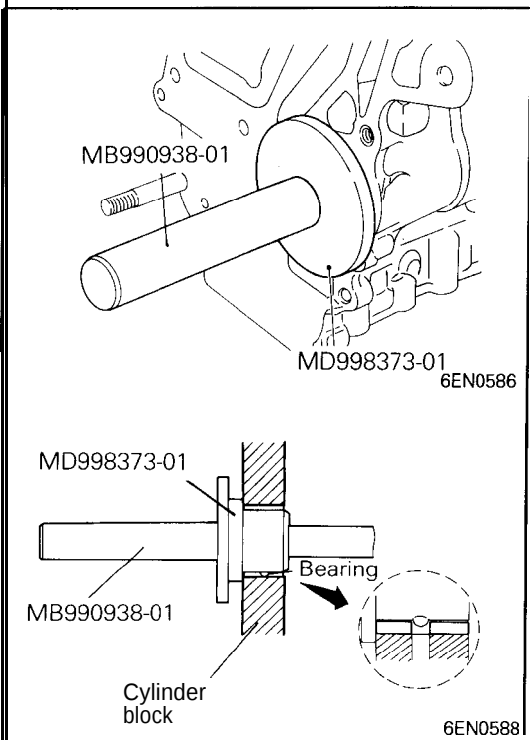
NOTE

The left rear bearing has no oil holes.



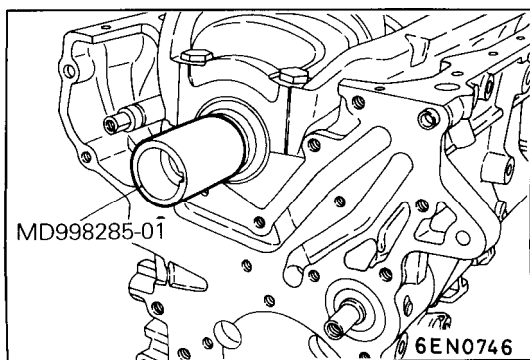
SILENT SHAFT FRONT BEARING INSTALLATION

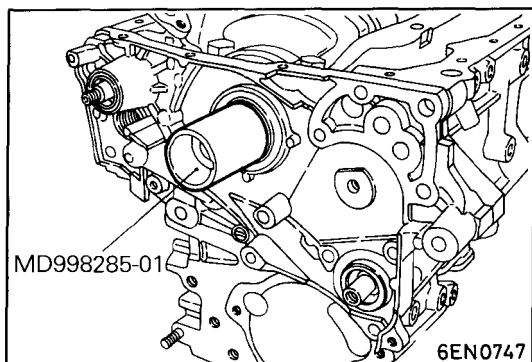
- (1) Using special tools, install front bearing.



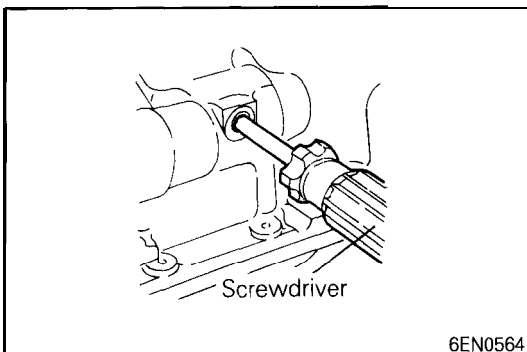
FRONT CASE INSTALLATION

- (1) Set the special tool on the front end of crankshaft and apply a thin coat of engine oil to the outer circumference of the special tool to install the front case.



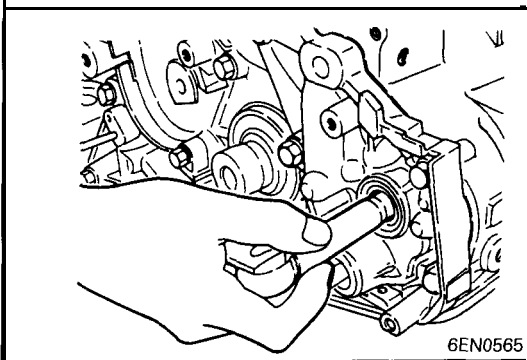


- (2) Install the front case assembly through a new front case gasket and temporarily tighten the flange bolts (other than those for tightening the filter bracket).

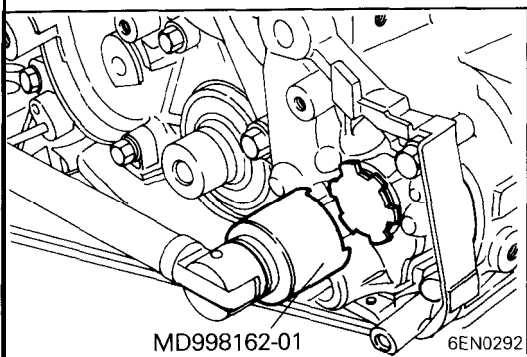


◆K◆ FLANGE BOLT INSTALLATION

- (1) Insert a Phillips screwdriver into a hole in the left side of the cylinder block to lock the silent shaft.



- (2) Secure the oil pump driven gear onto the left silent shaft by tightening the flange bolt to specified torque.



◆L◆ PLUG INSTALLATION

- (1) Install a new O-ring to the groove of front case.
- (2) Using the special tool, install the plug and tighten to specified torque.

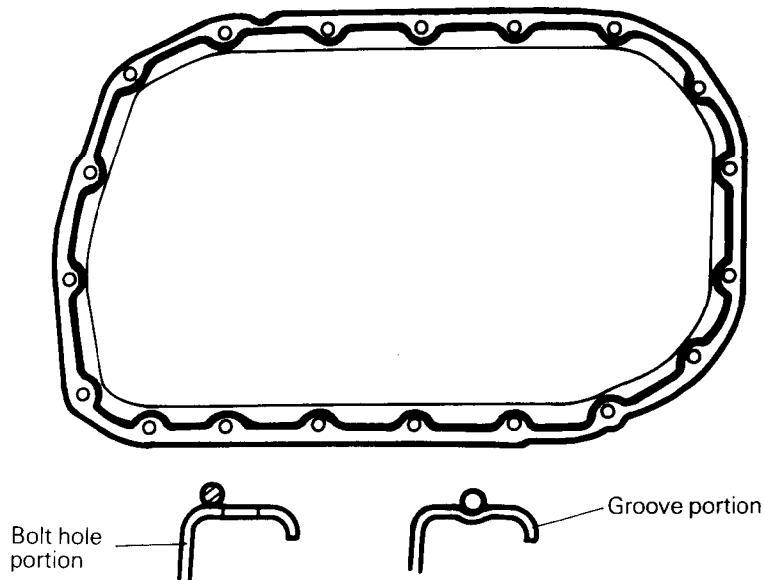
◆M◆ OIL PAN INSTALLATION

- (1) Clean both mating surfaces of oil pan and cylinder block.
- (2) Apply a 4 mm (.16 in.) wide bead of sealant to the entire circumference of the oil pan flange.

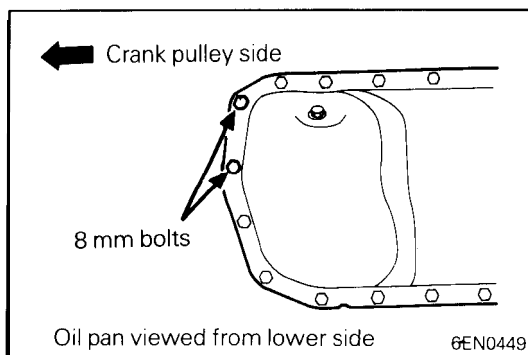
Specified sealant:

MITSUBISHI GENUINE PART No. MD997110 or equivalent

- (3) The oil pan should be installed in 15 minutes after the application of sealant.



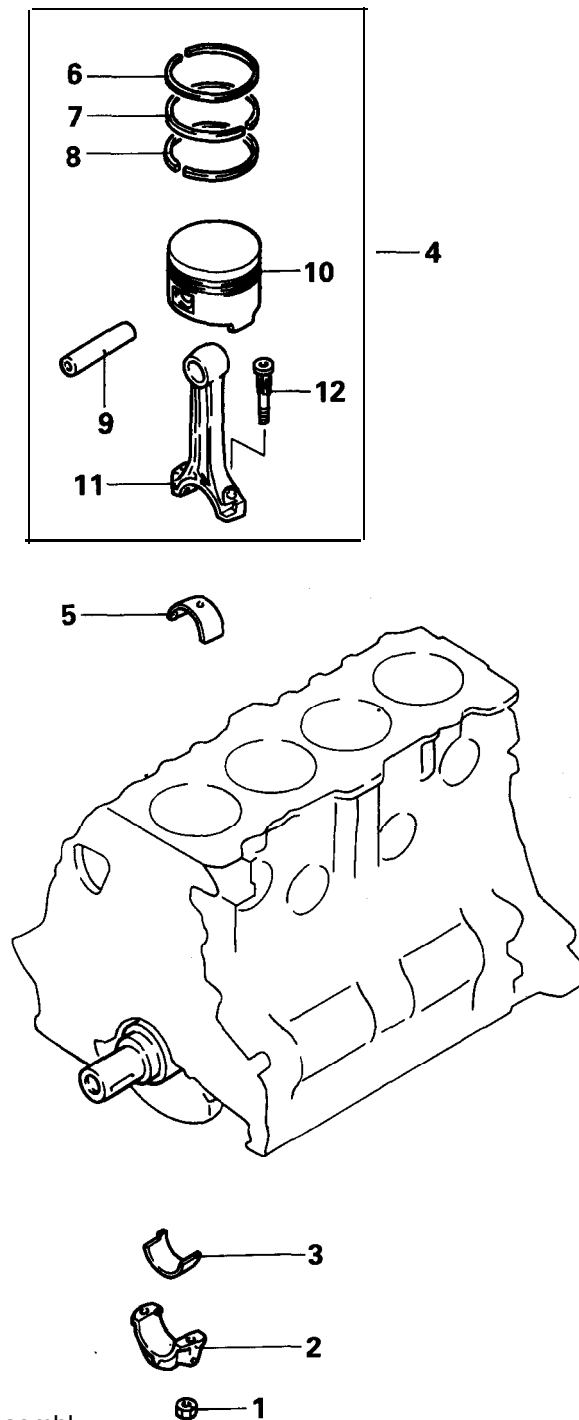
6EN0213



- (4) Note the difference in bolt lengths at the location shown.

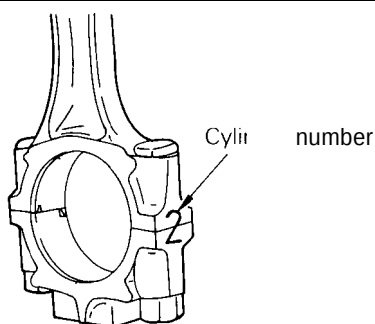
PISTON AND CONNECTING ROD

REMOVAL AND INSTALLATION



Removal steps

- ▶G▶ 1. Nut
- ◀A▶ ▶F▶ 2. Connecting rod cap
- ▶E▶ 3. Connecting rod bearing
- ▶D▶ 4. Piston and connecting rod assembly
- ▶E▶ 5. Connecting rod bearing
- ▶C▶ 6. Piston ring No. 1
- ▶C▶ 7. Piston ring No. 2
- ▶B▶ 8. Oil ring
- ◀B▶ ▶A▶ 9. Piston pin
- 10. Piston
- 11. Connecting rod
- 12. Bolt



7EN0448

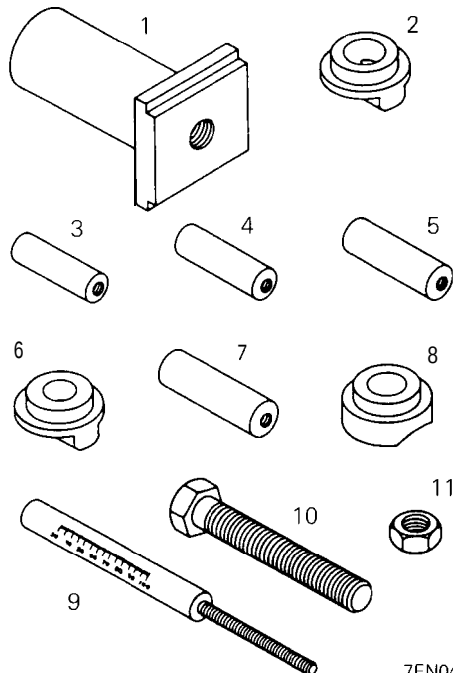
REMOVAL SERVICE POINTS

⚠️ A ⚠️ CONNECTING ROD CAP REMOVAL

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

⚠️ B ⚠️ PISTON PIN REMOVAL

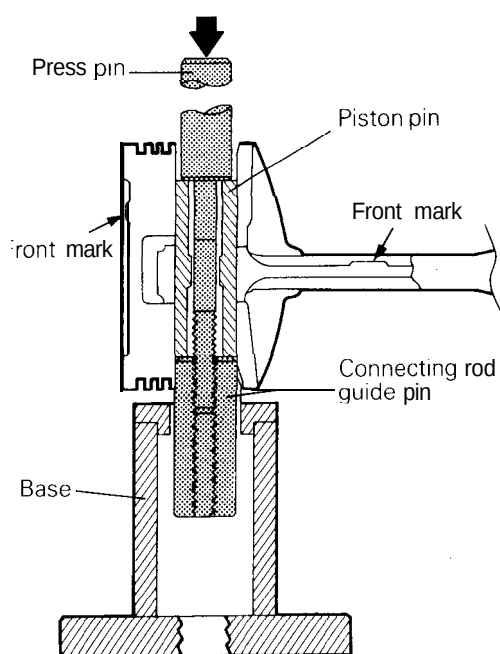
Piston pinsetting
tool MIT216941



7EN0425

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

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



7EN0421

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

IMPORTANT: To avoid piston damage,

- 1. The piston support must seat squarely against the piston.**
- 2. Verify that the piston pin will slide through the hole in the piston support.**

- (6) Remove the piston pin from the press pin.

INSPECTION**PISTON**

- (1) Replace the piston if scratches or seizure is evident on its surfaces (especially the thrust surface). Replace the piston if it is cracked.

PISTON PIN

- (1) Insert the piston pin into the piston pin hole with a thumb. You should feel a slight resistance. Replace the piston pin if it can be easily inserted or there is an excessive play.
- (2) The piston and piston pin must be replaced as an assembly.

PISTON RING

- (1) Check the piston ring for damage, excessive wear, and breakage and replace if defects are evident. If the piston has been replaced with a new one, the piston rings must also be replaced with new ones.
- (2) Check for 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****SOHC 4G63, DOHC Non-turbo**

0.02 – 0.06 mm (.0008 – .0024 in.)

SOHC 4G64, DOHC Turbo

0.03 – 0.07 mm (.0017 – .0028 in.)

No. 2**SOHC 4G63, DOHC**

0.02 – 0.06 mm (.0008 – .0024 in.)

SOHC 4G64

0.03 – 0.07 mm (.0017 – .0028 in.)

Limit: 0.1 mm (.004 in.)

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

Standard value:**No. 1****SOHC**

0.25 – 0.35 mm (.0098 – .0138 in.)

DOHC

0.25 – 0.40 mm (.0098 – .0157 in.)

No. 2**SOHC – 8VALVE, DOHC**

0.45 – 0.60 mm (.0177 – .0236 in.)

SOHC – 16VALVE

0.40 – 0.55 mm (.0157 – .0217 in.)

Oil ring**SOHC – 8VALVE**

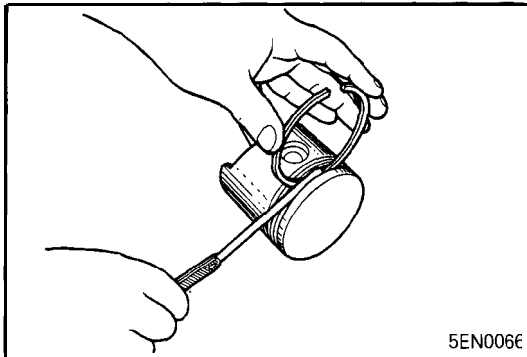
0.20 – 0.60 mm (.0079 – .0236 in.)

SOHC – 16VALVE

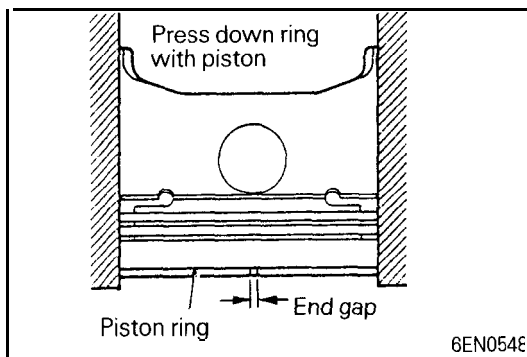
0.10 – 0.40 mm (.0039 – .0157 in.)

DOHC

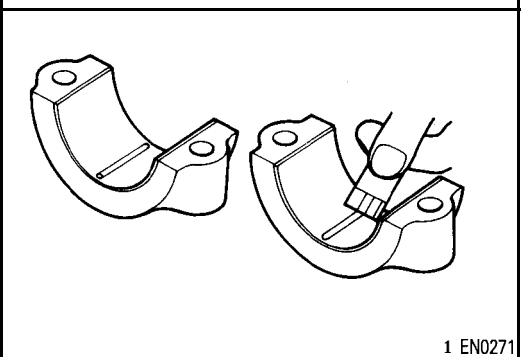
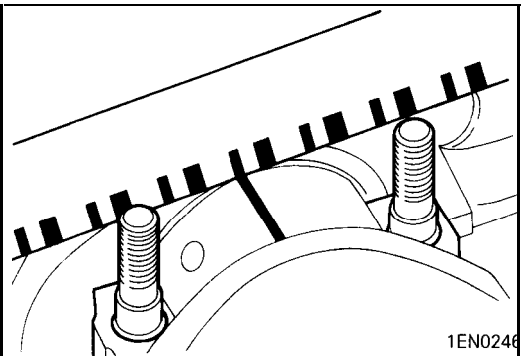
0.13 – 0.38 mm (.0051 – .0150 in.)

Limit:**No. 1, No. 2 0.8 mm (.031 in.)****Oil 1.0 mm (.039 in.)**

5EN006E



6EN054E



CRANKSHAFT PIN OIL CLEARANCE (PLASTIC GAUGE METHOD)

- (1) Remove oil from crankshaft pin and connecting rod bearing.
- (2) Cut the plastic gauge 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 plastic gauge at its widest part by using a scale printed on the plastic gauge package.

Standard value: 0.02 – 0.05 mm (.0008 – .0020 in.)
Limit: 0.1 mm (.004 in.)

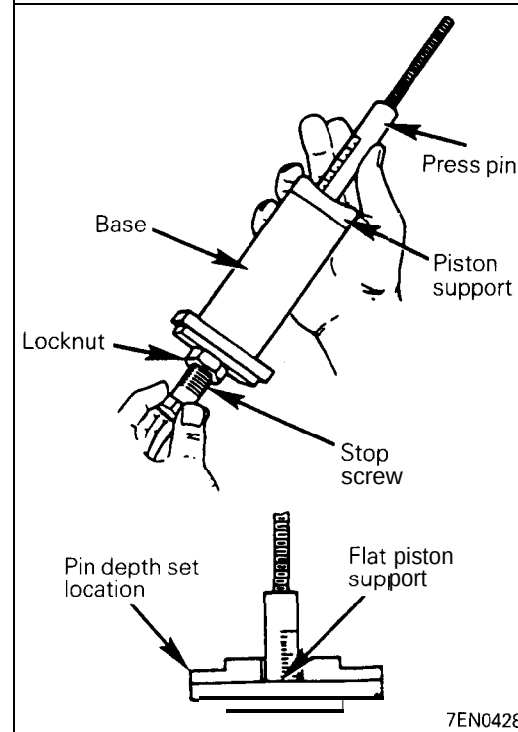
INSTALLATION SERVICE POINTS

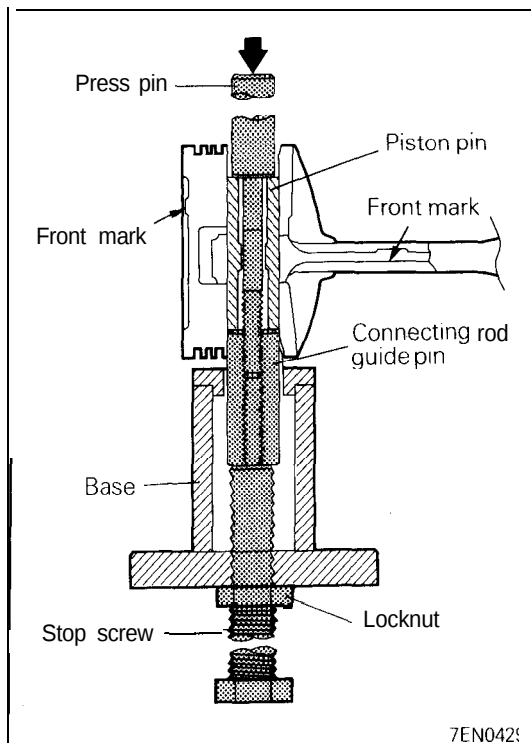
◆A◆ PISTON PIN INSTALLATION

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

Depth:

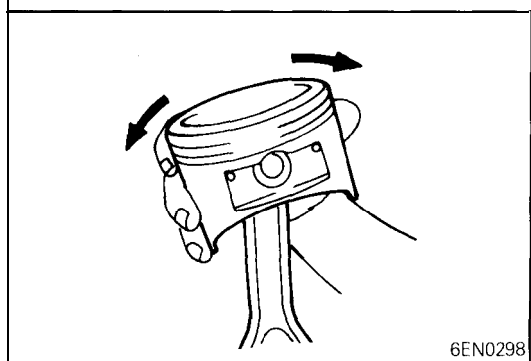
Refer to the operating instructions on the special tool.



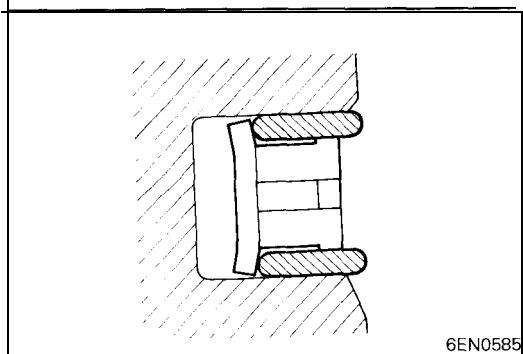


- (3) Place the base on press support blocks.
- (4) Slide the piston pin over the threaded end of the press pin, and thread the correct guide pin up against it.
- (5) Coat the piston pin with oil, and with the connecting rod held in position, slide the guide pin through the piston and connecting rod.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

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



- (8) Check that the piston moves smoothly.

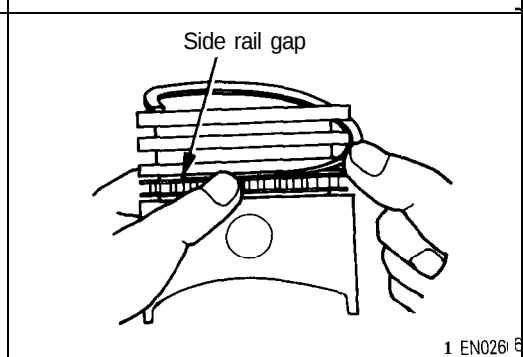


◆B◆ OIL RING INSTALLATION

- (1) Fit the oil ring spacer into the piston ring groove.

NOTE

The side rails and spacer may be installed in either direction.

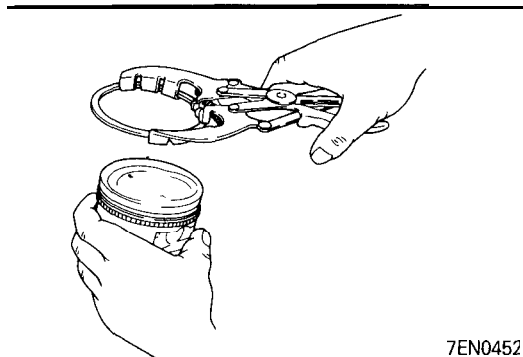


- (2) Install the upper side rail.
To install the side rail, first fit one end of the rail into the piston groove, then press the remaining portion into position by finger. See illustration.

Caution

Do not use piston ring expander when installing side rail.

- (3) Install the lower side rail in the same procedure as described in step (2).
- (4) Make sure that the side rails move smoothly in either direction.



7EN0452



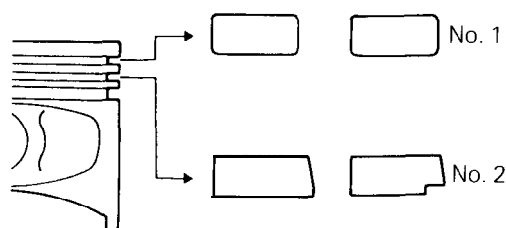
PISTON RING NO. 2 / PISTON RING NO. 1 INSTALLATION

- (1) Using piston ring expander, fit No. 2 and then No. 1 piston ring into position.

NOTE

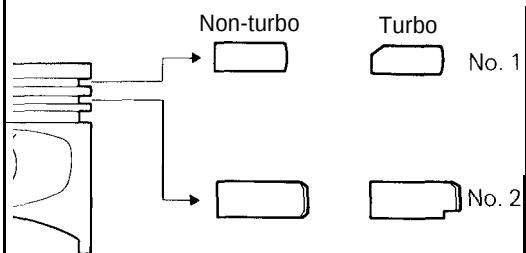
- (1) Note the difference in shape between No. 1 and No. 2 piston rings.
- (2) Install piston rings No. 1 and No. 2 with their side having marks facing up (on the piston crown side).

SOHC



6EN0527

DOHC

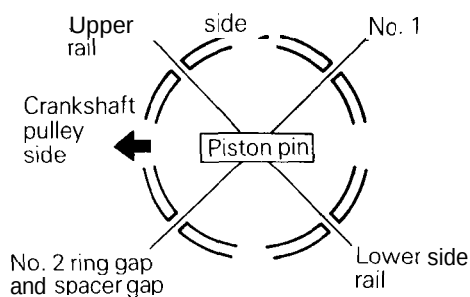


6EN0497

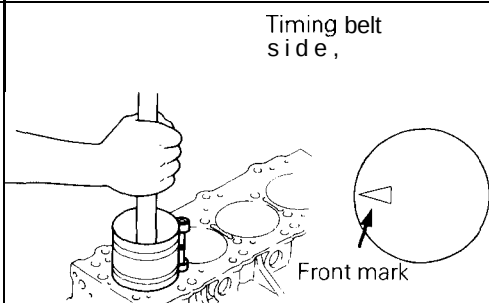


PISTON AND CONNECTING ROD INSTALLATION

- (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 figure.
- (3) Rotate crankshaft so that crank pin is on center of cylinder bore.

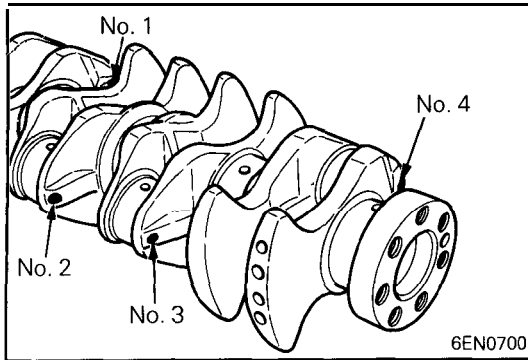


6EN0549



1 EN0247

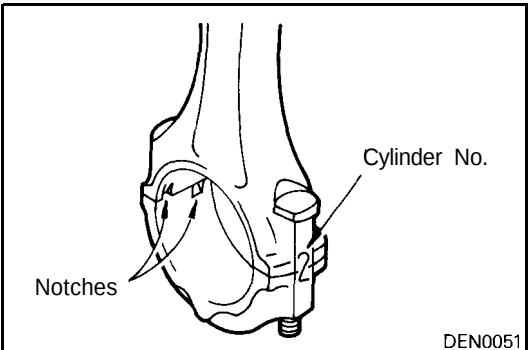
- (4) Rotate crankshaft so that the crank pin is on the center of the cylinder bore.
- (5) Use suitable thread protectors on the connecting rod bolts before inserting piston and connecting rod assembly into the cylinder block.
Care must be taken not to nick the crank pin.
- (6) Using a suitable piston ring compressor tool, install the piston and connecting rod assembly into the cylinder block.



◆E◆ CONNECTING ROD BEARINGS INSTALLATION

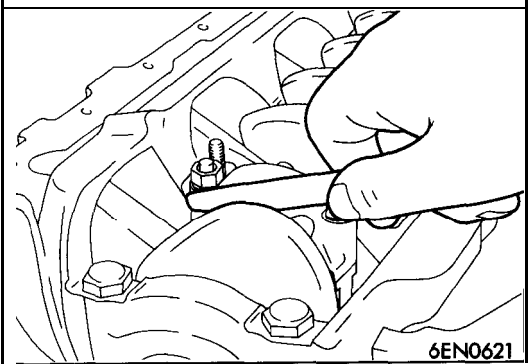
- (1) When the bearings are to be replaced, select appropriate bearings for assembly according to identification colors for the crankshaft.

Crank pin O.D. identification color	Connecting rod bearing identification mark
Yellow	1
None	2
White	3



◆F◆ CONNECTING ROD CAP INSTALLATION

- (1) Verifying the mark made during disassembly, install the bearing cap to the connecting rod. If the connecting rod is new with no index mark, make sure that the bearing locking notches come on the same side as shown.



- (2) Make sure that the connecting rod big end side clearance meets the specification.

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

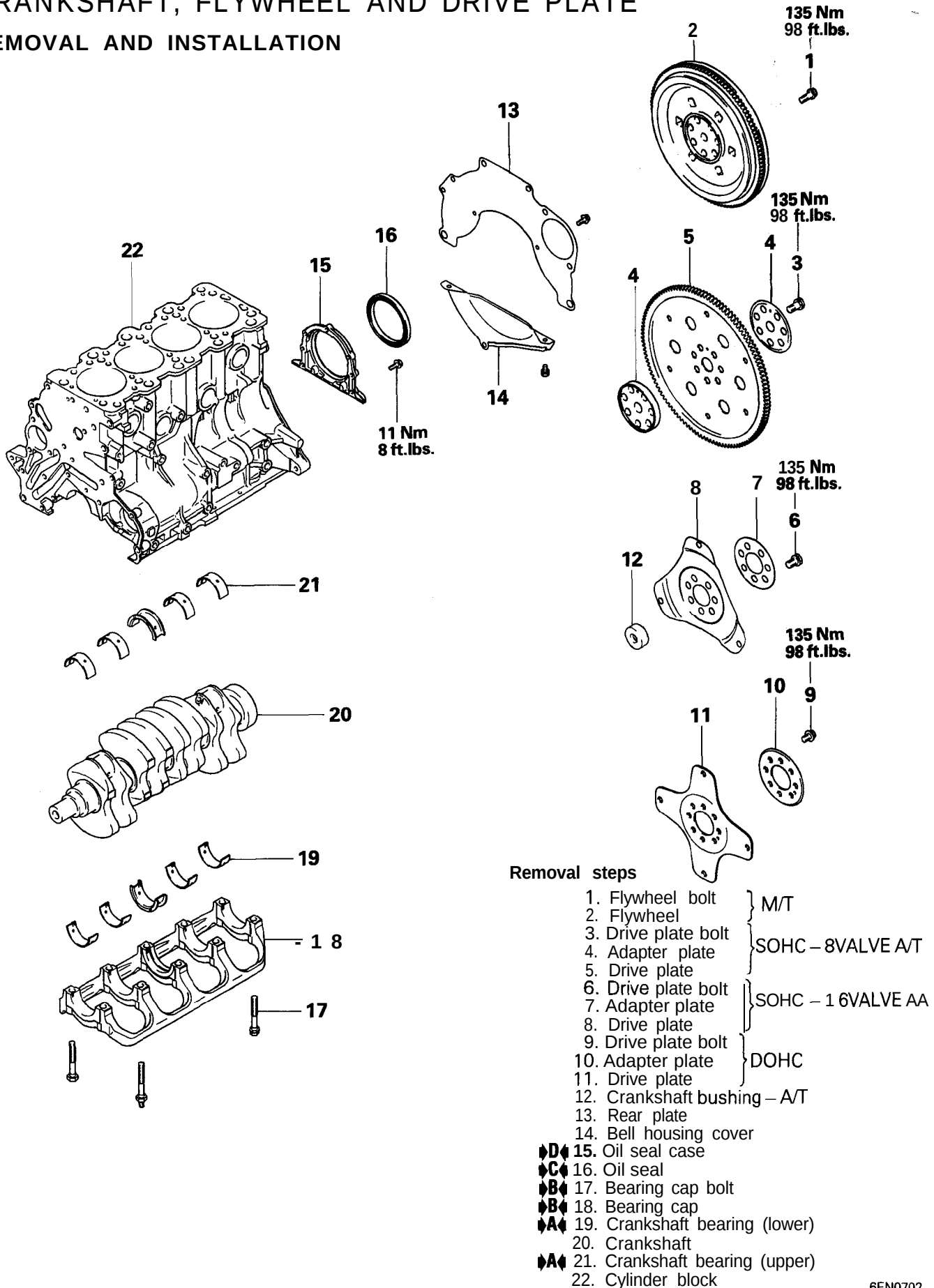
Limit: 0.4 mm (.016 in.)

◆G◆ CONNECTING ROD CAP NUT INSTALLATION

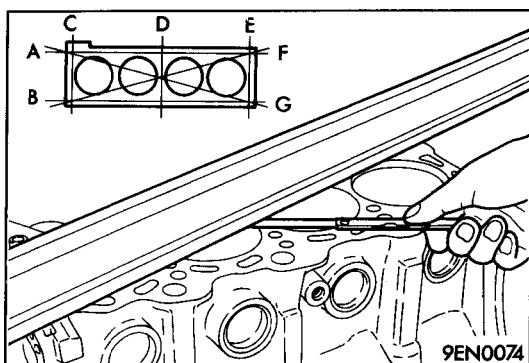
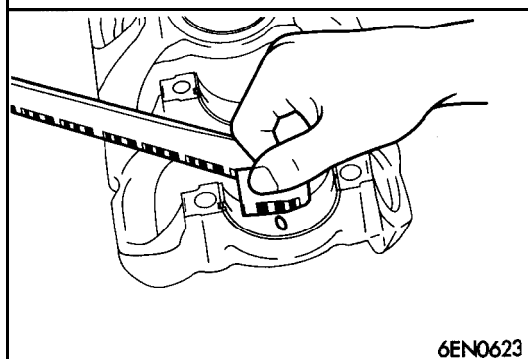
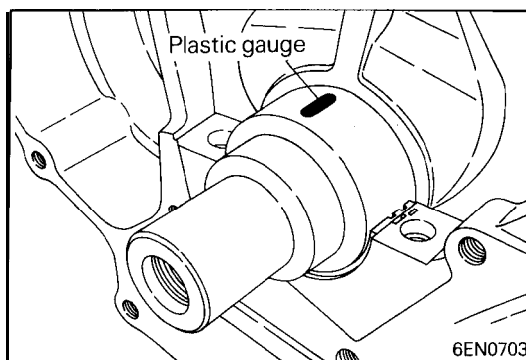
- (1) Since the connecting rod bolts and nuts are torqued using a new procedure they should be examined BEFORE reuse. If the bolt threads are “necked down” the bolts should be replaced.
Necking can be checked by running a nut with fingers to the full length of the bolt’s thread. If the nut does not run down smoothly the bolt should be replaced.
- (2) Install the connecting rod cap on the big end of connecting rod.
- (3) Before installing the nuts the threads should be oiled with engine oil.
- (4) Install both nuts on each bolt finger tight, then alternately torque each nut to assemble the cap properly.
- (5) Tighten the nuts to 20 Nm (2 kgm, 14.5 ft.lbs.) and plus 1/4 (90°) turn.

CRANKSHAFT, FLYWHEEL AND DRIVE PLATE

REMOVAL AND INSTALLATION



6EN0702



INSPECTION

CRANKSHAFT OIL CLEARANCE (PLASTIC GAUGE METHOD)

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

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

Limit: 0.1 mm (.004 in.)

CYLINDER BLOCK

- (1) Visually check for scratches, rust, and corrosion. Use also a flaw detecting agent for the check. If defects are evident, correct, or replace.
- (2) Using a straightedge and feeler 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 (.0020 in.)

Limit: 0.1 mm (.004 in.)

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

Grinding limit: 0.2 mm (.008 in.)

The total thickness of the stock allowed to be removed from cylinder block and mating cylinder head is 0.2 mm (.008 in.) at maximum.

Cylinder block height (when new):

4G63 283.9 – 284.1 mm
(11.177 – 11.185 in.)

4G64 289.9 – 290.1 mm
(11.413 – 11.421 in.)

- (4) Check cylinder walls for scratches and seizure. If defects are evident, correct (bored to oversize) or replace.
- (5) Using cylinder gauge, measure the cylinder bore and cylindricity. If worn badly, correct cylinder to an oversize and replace piston and piston rings. Measure at the points shown in illustration.

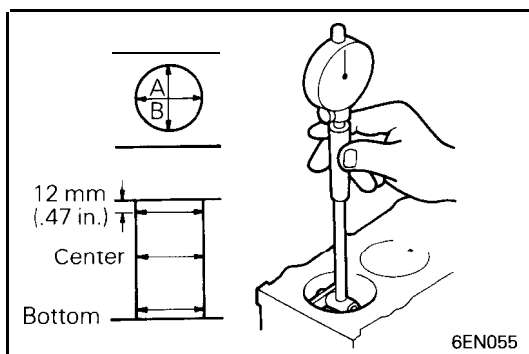
Standard value:

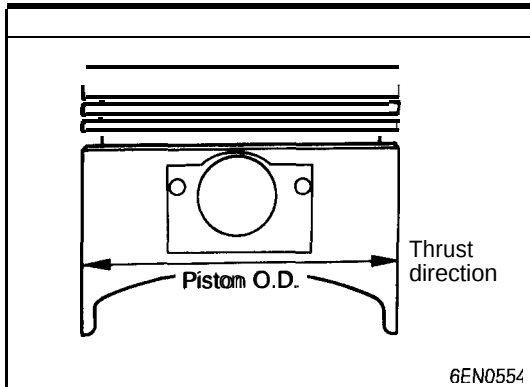
Cylinder I.D.

4G63 85.00 – 85.03 mm (3.3465 – 3.3476 in.)

4G64 86.50 – 86.53 mm (3.4055 – 3.4067 in.)

Cylindricity 0.01 mm (.0004 in.)



**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
0.25 mm (0.01 in.) O.S.	0.25
0.50 mm (0.02 in.) O.S.	0.50
0.75 mm (0.03 in.) O.S.	0.75
1.00 mm (0.04 in.) O.S.	1.00

NOTE

Size mark is stamped on piston top.

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

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

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

Caution

To prevent distortion that may result from temperature rise during honing, bore cylinders, working from No. 2 to No. 4 to No. 1 to No. 3.

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

Clearance between piston and cylinder:**Non-T/C**

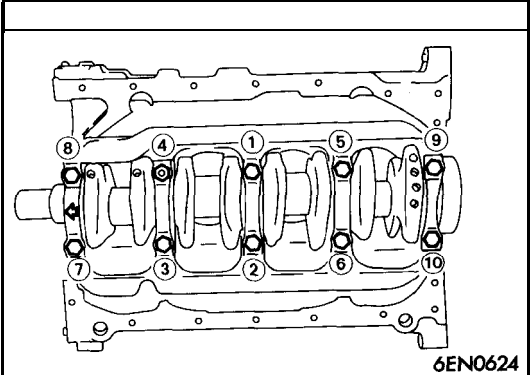
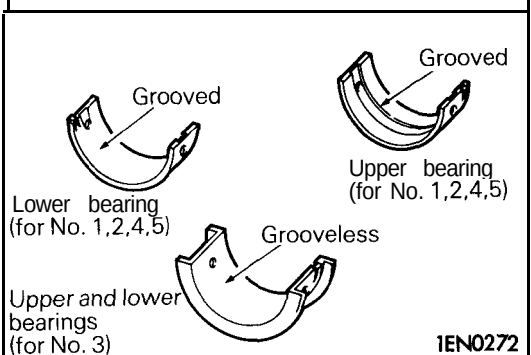
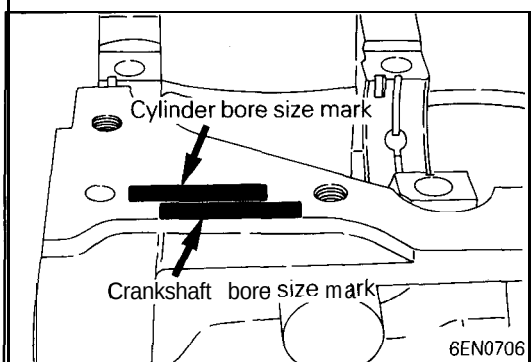
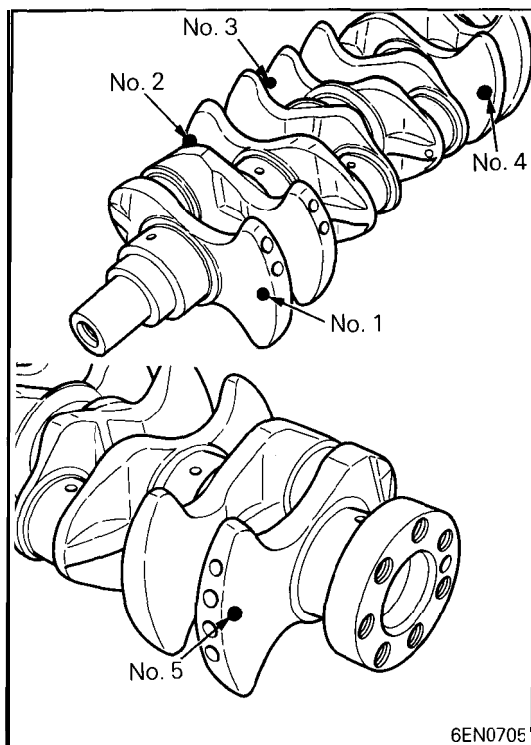
0.02 – 0.04 mm (.0008 – .0016 in.)

T/C

0.03 – 0.05 mm (.0012 – .0020 in.)

NOTE

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



REASSEMBLY SERVICE POINTS

◆◆ CRANKSHAFT BEARING INSTALLATION

- (1) When the bearing is to be replaced, select the appropriate bearing for assembly according to the identification color for the crankshaft and the identification mark stamped on the cylinder block.

Journal OD identification color	Identification mark for cylinder block bearing support section ID	Crankshaft bearing identification mark
Yellow	0	1
	1	2
	2	3
None	0	2
	1	3
	2	4
White	0	3
	1	4
	2	5

- (2) Install the upper crankshaft bearings to the cylinder block. There is an oil groove in the upper crankshaft bearing. There is no difference between upper and lower bearings for the center (with flange).
- (3) Install the lower crankshaft bearings to bearing cap and apply engine oil to bearing surface.

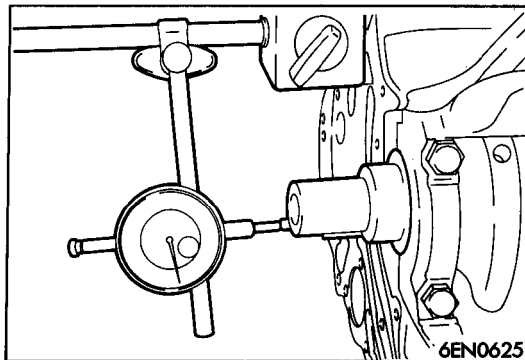
◆◆ BEARING CAP / BEARING CAP BOLT INSTALLATION

- (1) Install the bearing caps so that their arrows are positioned on the timing 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 (2.79 in.)

- (3) Torque the bearing cap bolts to 25 Nm (18 ft.lbs.) and, from that position, retighten them 1/4 (90°) turns more.

1 1F-114 4G6 ENGINE <1993> – Crankshaft, Flywheel and Drive Plate

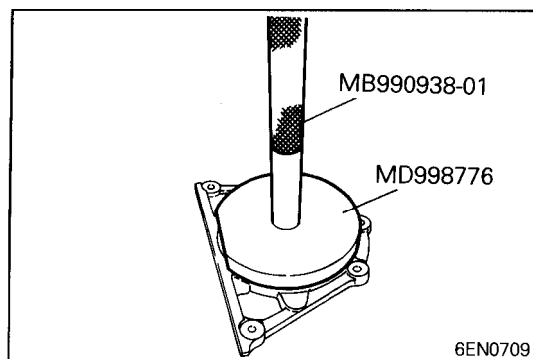


- (4) After installing the bearing caps, make sure that the crankshaft turns smoothly and the end play is correct. If the end play exceeds the limit, replace crankshaft bearings.

Standard value: 0.05 – 0.25 mm (.0020 – .0098 in.)

Limit: 0.4 mm (.016 in.)

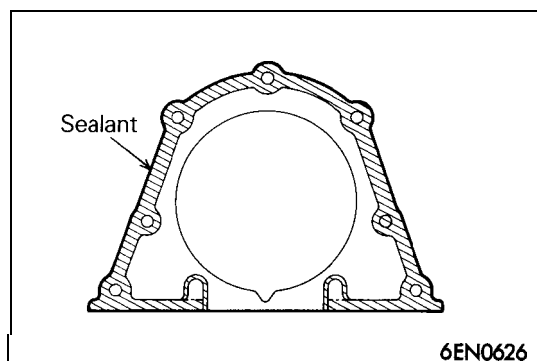
▶◀ OIL SEAL INSTALLATION



▶◀ SEALANT APPLICATION TO OIL SEAL CASE

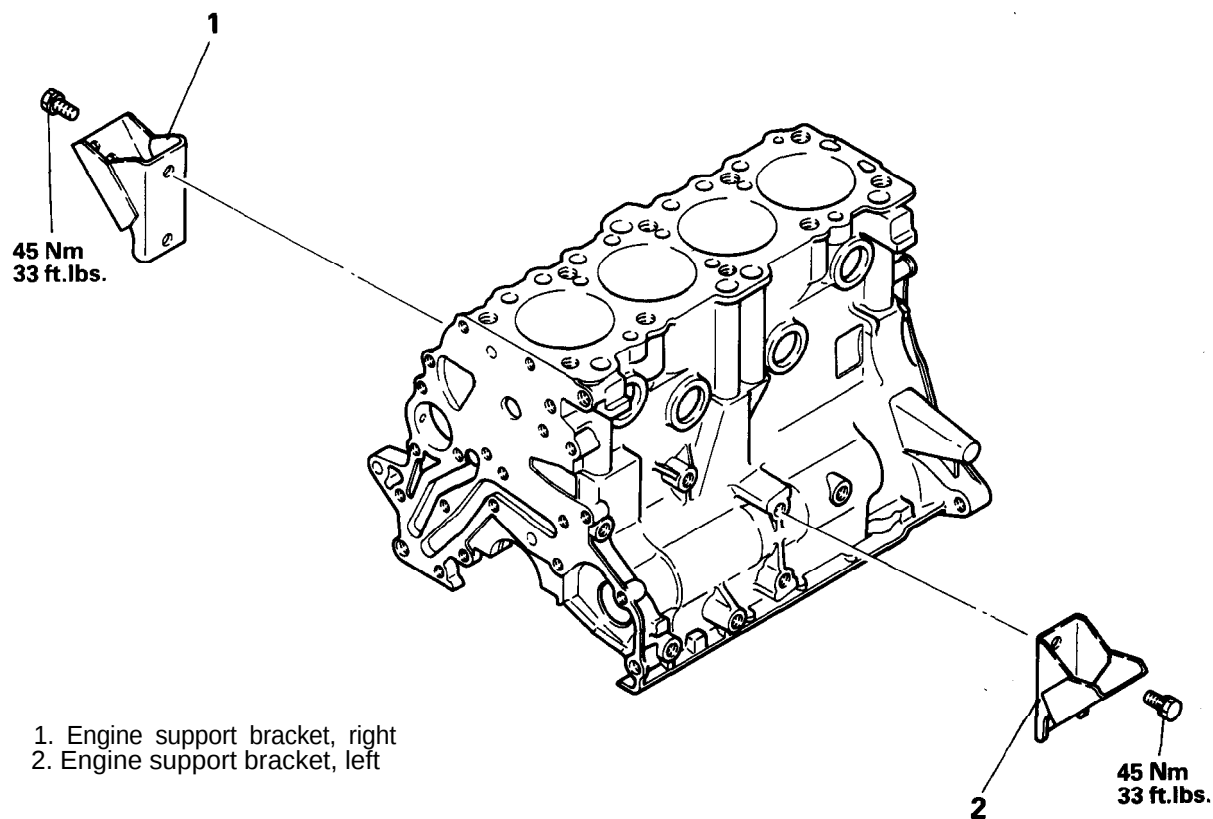
Specified sealant:

Mitsubishi Genuine Part No. MD970389 or equivalent



BRACKET

Rear wheel drive and four wheel drive



Front wheel drive and all wheel drive

