ENGINE
6G7 SERIES

CONTENTS

 Dec. 1996 PWEE9615

NOTES

GENERAL INFORMATION

GENERAL SPECIFICATIONS

Descriptions			6G72
Type			60° OHV, SOHC
Number of cylinders			6
Combustion chamber			Compact type
Total displacement dm^3			2.972
Cylinder bore mm			91.1
Piston stroke mm			76.0
Compression ratio			8.9
Valve timing	Intake valve	Opens (BTDC)	15°
		Closes (ABDC)	53°
	Exhaust valve	Opens (BBDC)	53°
		Closes (ATDC)	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

Descriptions			6G74
Type			60° OHV, SOHC
Number of cylinders			6
Combustion chamber			Pentroof type
Total displacement dm^3			3.497
Cylinder bore mm			93.0
Piston stroke mm			85.5
Compression ratio			9.0
Valve timing	Intake valve	Opens (BTDC)	15°
		Closes (ABDC)	49°
	Exhaust valve	Opens (BBDC)	45°
		Closes (ATDC)	19°
Lubrication system			Pressure feed, full-flow filtration
Oil pump type			Trochoid type
Cooling system			Water-cooled forced circulation
Water pump type			Centrifugal impeller type

1. SPECIFICATIONS

SERVICE SPECIFICATIONS

Items		Standard	Limit
Timing belt			
Auto-tensioner rod length mm		3.8 - 5.0	-
Auto-tensioner rod projection length mm		12	-
Auto-tensioner rod pushed-in amount (when pushed with a force of 98 - 196 N) mm		1.0 or less	-
Rocker arms and camshaft			
Camshaft cam height mm (Identification mark: 1)	Intake	37.71	37.21
	Exhaust	37.14	36.64
Camshaft journal outside diameter mm		45	-
Lash adjuster leak down time [diesel fuel at 15 - 20°C] seconds/mm		4 - 20/1.0	-
Cylinder head and valves			
Cylinder head flatness of gasket surface mm		Less than 0.03	0.2
Cylinder head grinding limit of gasket surface mm (Total resurfacing depth of both cylinder head and cylinder block)		-	0.2
Cylinder head overall height mm		120	-
Valve thickness of valve head (margin) mm	Intake	1.0	0.5
	Exhaust	1.2	0.7
Valve overall height mm	Intake	112.30	111.80
	Exhaust	114.11	113.61
Valve stem outside diameter mm	Intake	6.0	-
	Exhaust	6.0	-
Valve thickness to valve guide clearance mm	Intake	0.02 - 0.04	0.10
	Exhaust	0.04 - 0.06	0.15
Valve face angle mm		45° - 45.5°	-
Valve spring free length mm		51.0	50.0
Valve spring load/installed height N/mm		267/44.2	-
Valve spring out-of-squareness		2° or less	Maximum 4°
Valve seat valve contact width mm		0.9 - 1.3	-
Valve guide inside diameter mm		6.0	-
Valve guide projection from cylinder head upper surface mm		14	-
Valve stem projection mm		49.3	49.8
Oil pan and oil pump			
Oil pump tip clearance mm		0.06 - 0.18	-

Items			Standard	Limit
Oil pump side clearance mm			0.04 –0.10	–
Oil pump body clearance mm			0.10 – 0.18	0.35
Piston and connecting rod				
Piston outside diameter mm			91.1	–
Piston ring to ring groove clearance mm	No. 1		0.03 – 0.07	0.1
	No. 2		0.02 – 0.06	0.1
Piston ring end gap mm	No. 1		0.30 – 0.45	0.8
	No. 2		0.45 – 0.60	0.8
	Oil ring side rail	6G72	0.20 – 0.60	1.0
		6G74	0.10 – 0.35	1.0
Piston pin outside diameter mm			22.0	–
Piston pin press-in load N (at room temperature)			7,350 – 17,200	–
Crankshaft pin oil clearance mm			0.02 – 0.05	0.1
Connecting rod big end side clearance mm			0.10 – 0.25	0.4
Crankshaft, flywheel and drive plate				
Crankshaft end play mm			0.05 – 0.25	0.3
Crankshaft journal outside diameter mm			60	–
Crankshaft pin outside diameter mm			50	–
Crankshaft journal oil clearance mm			0.02 – 0.04	0.1
Piston to cylinder clearance mm			0.02 – 0.04	–
Cylinder block flatness of gasket surface mm			0.05	0.1
Cylinder block grinding limit on gasket surface mm (Total resurfacing depth of both cylinder head and cylinder block)			–	0.2
Cylinder block overall height mm			210.5	–
Cylinder bore inside diameter mm	6G72		91.1	–
	6G74		93.0	–
Cylindricity mm			0.01	–

REWORK DIMENSIONS

Items		Standard value	Limit
Oversize rework dimensions of valve guide hole mm	0.05 oversize diameter	11.05 – 11.07	–
	0.25 oversize diameter	11.25 – 11.27	–
	0.50 oversize diameter	11.50 – 11.52	–
Oversize rework dimensions of intake valve seat hole mm	0.3 oversize diameter	34.30 – 34.33	–
	0.6 oversize diameter	34.60 – 34.63	–
Oversize rework dimensions of exhaust valve seat hole mm	0.3 oversize diameter	31.80 – 31.83	–
	0.6 oversize diameter	32.10 – 32.13	–

TORQUE SPECIFICATIONS

Items	Nm
Alternator	
Drive belt tensioner pulley nut	49
Crankshaft bolt	185 ± 5
Alternator pivot nut	44
Alternator bolt M8	21
Alternator bolt M10	48
Oil level gauge guide bolt	22
Air intake plenum	
Air intake plenum stay bolt M8	17
Air intake plenum stay bolt M10	36
Accelerator cable bracket	9
Bracket	10
Throttle body bolt	11
Air intake plenum bolt and nut	17
Exhaust gas recirculation valve bolt	21
Exhaust gas recirculation pipe bolt	17
Exhaust gas recirculation pipe flare nut	56
Ignition system	
Spark plugs	25
Distributor	23
Timing belt	
Timing belt cover bolt M6	11
Timing belt cover bolt M8	13
Engine support bracket	45
Crankshaft angle sensor bolt	8
Auto tensioner bolt	23
Tensioner pulley bolt	48
Tensioner arm bolt	44
Idler pulley bolt	44
Camshaft sprocket bolt	88
Bracket	23
Timing belt rear cover bolt	13

Items	Nm
Intake manifold	
Engine coolant temperature gauge unit	10
Engine coolant temperature sensor	29
Heater pipe bolt	18
Water outlet fitting bolt	18
Water inlet fitting bolt	18
Thermostat housing bolt	18
Water pipe bolt	13
Delivery pipe	11
Intake manifold bolt	20
Fuel pipe bolt	8.8
Fuel pressure regulator bolt	8.8
Exhaust manifold	
Heat protector bolt	13
Exhaust manifold bolt	49
Engine hanger	35
Water pump bolt M8	23
Water pump bolt M10	41
Rocker arms and camshaft	
Rocker cover bolt	3.4
Rocker shaft bolt	31
Thrust case bolt	12
Cylinder head and valve	
Cylinder head bolt	108 ± 5
Oil pan and oil pump	
Oil pressure switch	9.8
Oil filter bracket bolt M8	23
Oil filter bracket bolt M10	41
Drain plug	39
Oil pan lower bolt	11
Cover bolt	11
Oil pan upper bolt	5.9

Items		Nm
Baffle plate bolt (oil pan side)		11
Baffle plate bolt (cylinder block side)		9.8
Oil screen bolt		18
Relief plug		44
Oil pump case bolt		13
Oil pump cover bolt		9.8
Piston and connecting rod		
Connecting rod cap	6G72	49
	6G74	34 + 90°
Crankshaft, flywheel and drive plate		
Flywheel bolt		74
Drive plate bolt		74
Rear plate bolt		11
Oil seal case bolt		11
Bearing cap bolt	6G72	89
	6G74	71

SEALANTS

Description	Specified sealant	Quantity
Engine coolant temperature gauge unit	3M ATD Part No. 8660	As required
Engine coolant temperature sensor	3M Nut Locking Part No. 4171	As required
Oil pressure switch	3M ATD Part No. 8660	As required
Oil pan	MITSUBISHI GENUINE Part No. MD970389	As required
Oil pump case	MITSUBISHI GENUINE Part No. MD970389	As required
Oil seal case	MITSUBISHI GENUINE Part No. MD970389	As required

FORM-IN-PLACE GASKET

The engine has several areas where the form-in-place gasket (FIPG) is in use. To ensure that the gasket fully serves its purpose, it is necessary to observe some precautions when applying the gasket. Bead size, continuity and location are of paramount importance. Too thin a bead could cause leaks. Too thick a bead, on the other hand, could be squeezed out of location, causing blocking or narrowing of the fluid feed line. To eliminate the possibility of leaks from a joint, therefore, it is absolutely necessary to apply the gasket evenly without a break, while observing the correct bead size.
The FIPG used in the engine is a room temperature vulcanisation (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. MD997110 can only be used for engine oil sealing.

Disassembly

The parts assembled with the FIPG can be easily disassembled without use of a special method. In some cases, however, the sealant between the joined surfaces may have to be broken by lightly striking with a mallet or similar tool. A flat and thin gasket scraper may be lightly hammered in between the joined surfaces. In this case, however, care must be taken to prevent damage to the joined surfaces.

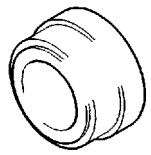
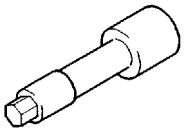
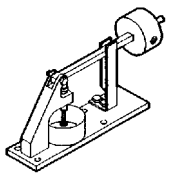
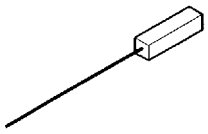
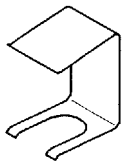
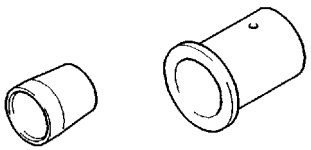
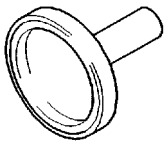
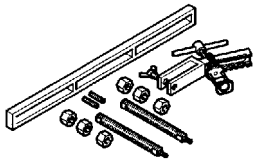
Surface Preparation

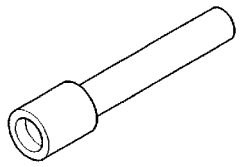
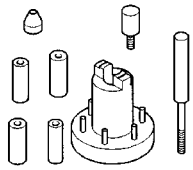
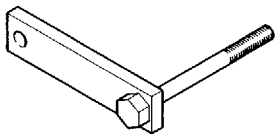
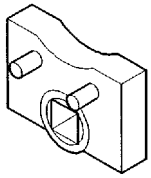
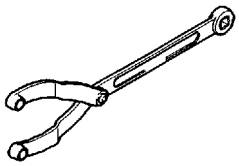
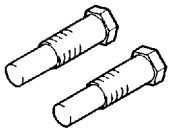
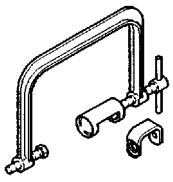
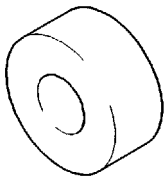
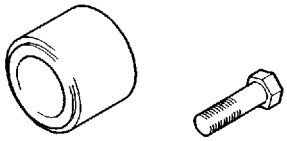
Thoroughly remove all substances deposited on the gasket application surfaces, using a gasket scraper or wire brush. Check to ensure that the surfaces to which the FIPG is to be applied is flat. Make sure that there are no oils, greases and foreign substances deposited on the application surfaces. Do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

Form-in-Place Gasket Application (FIPG)

When assembling parts with the FIPG, you must observe some precautions, but the procedure is very simple as in the case of a conventional pre-cut 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.

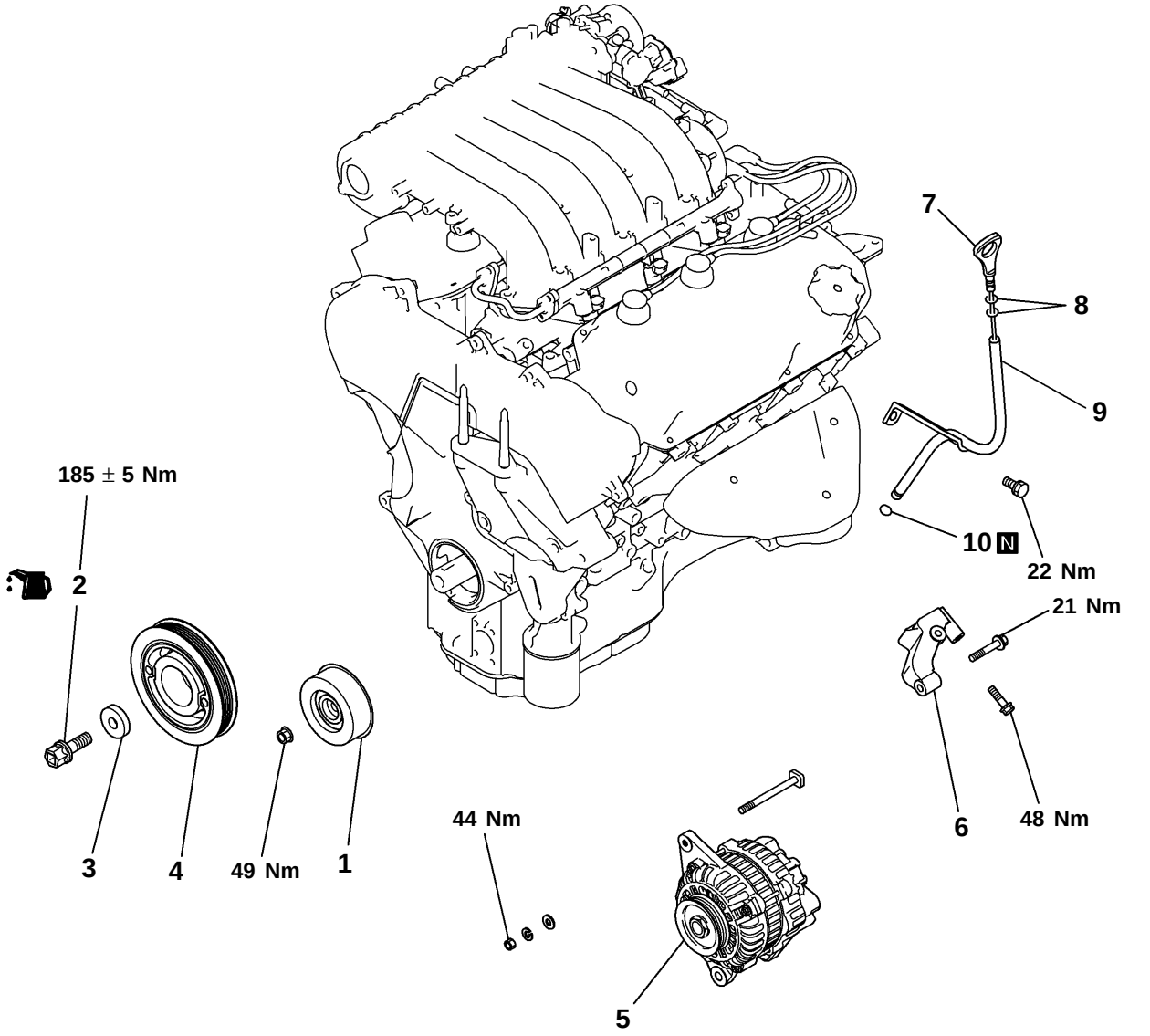
2. SPECIAL TOOLS

Tool	Number	Name	Use
	MB991559	Camshaft oil seal installer adaptor	Installation of camshaft oil seal (on left bank) (Used in combination with MD998713)
	MD998051	Cylinder head bolt wrench	Loosening and tightening of cylinder head bolt
	MD998440	Leak-down tester	Leak-down test of lash adjuster
	MD998441	Lash adjuster	Air bleeding of lash adjuster retainer
	MD998442	Air bleed wire	Air bleeding of lash adjuster
	MD998443	Auto-lash adjuster holder	Holding of the lash adjuster to prevent it from falling when rocker shaft assembly is removed or installed
	MD998717	Crankshaft front oil seal	Installation of crankshaft front oil seal installer
	MD998718	Crankshaft rear oil seal installer	Press fitting crankshaft rear oil
	MD998772	Valve spring compressor	Compressing of the valve springs

Tool	Number	Name	Use
	MD998774	Valve stem seal installer	Installation of valve stem seal
	MD998780	Piston pin setting tool	Removal and installation of piston pin
	MD998781	Flywheel stopper	Holding flywheel or drive plate
	MD998767	Tensioner pulley	Adjustment of timing belt tension
	MB990767	End yoke holder	Holding camshaft sprocket (Used in combination with MD998715)
	MD998715	Pulley holder pin	Holding camshaft sprocket (Used in combination with MB990767)
	MD998735	Valve spring compressor adaptor	Compressing the valve springs
	MD998769	Crank pulley spacer	Cranking the crankshaft to install timing belt
	MD998713	Camshaft oil seal installer	Installation of camshaft oil seal

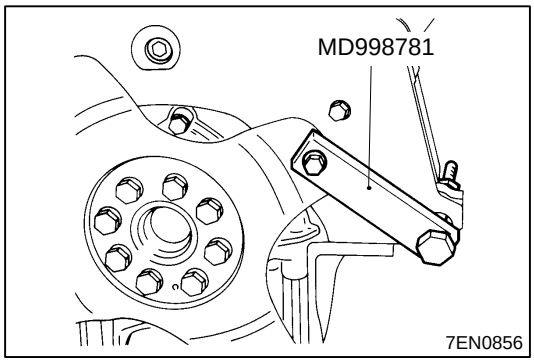
3. ALTERNATOR

REMOVAL AND INSTALLATION



Removal steps

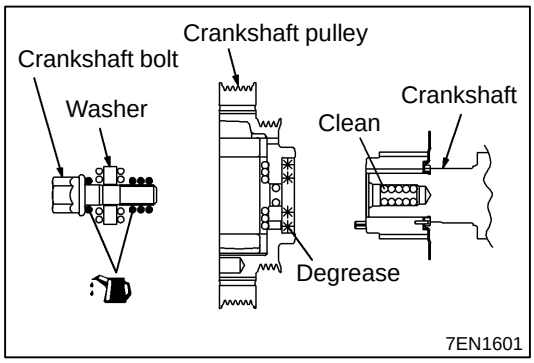
◀A▶ ▶A◀ 1. Tensioner pulley
◀A▶ ▶A◀ 2. Crankshaft bolt
▶A◀ 3. Washer
▶A◀ 4. Crankshaft pulley
5. Alternator
6. Alternator bracket
7. Dipstick
8. O-ring
9. Dipstick tube
10. O-ring



REMOVAL SERVICE POINTS

◀A▶ CRANKSHAFT BOLT

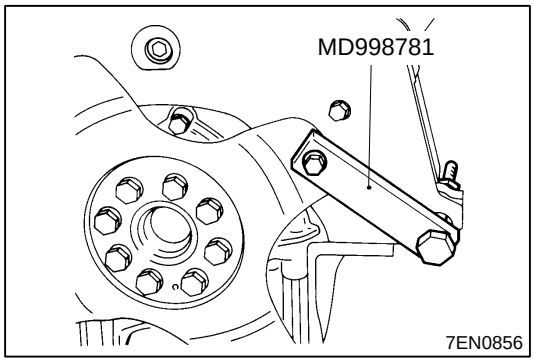
(1) With the Special Tool fixed to the drive plate or flywheel, remove the crankshaft bolt.



INSTALLATION SERVICE POINTS

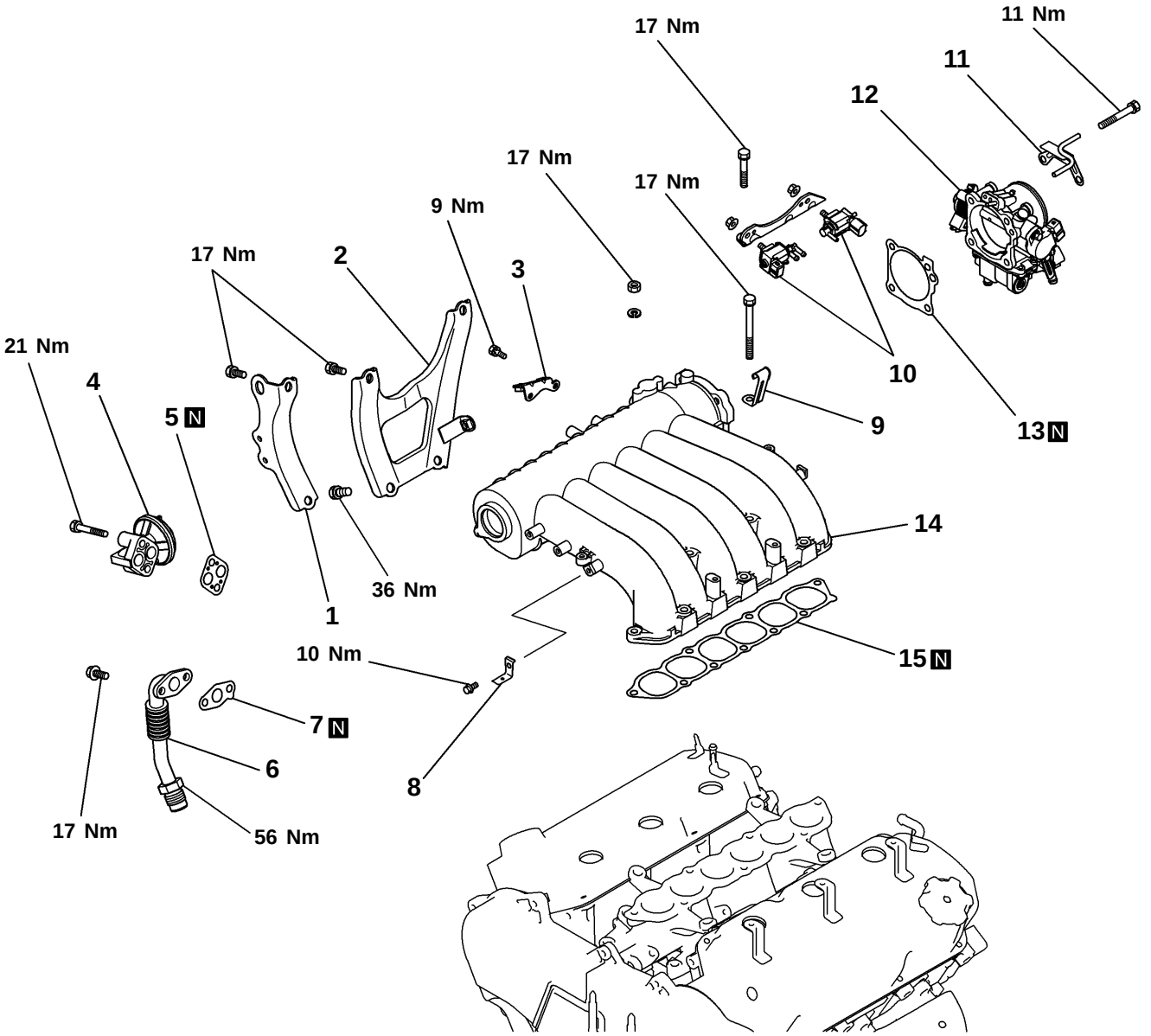
▶A◀ CRANKSHAFT BOLT / WASHER / CRANKSHAFT PULLEY

(1) Clean and degrease the crankshaft sprocket fitting surface of the crankshaft pulley, then install the crankshaft pulley on the crankshaft.
(2) Clean the threaded hole in the crankshaft, the crankshaft fitting surface of the crankshaft pulley, the washer fitting surface of the crankshaft and both surfaces of the washer.
(3) Apply necessary minimum amount of engine oil on the threads and washer fitting surface of the crankshaft bolt.
(4) With the Special Tool fixed to the drive plate or flywheel, install the crankshaft bolt.



4. AIR INTAKE PLENUM

REMOVAL AND INSTALLATION



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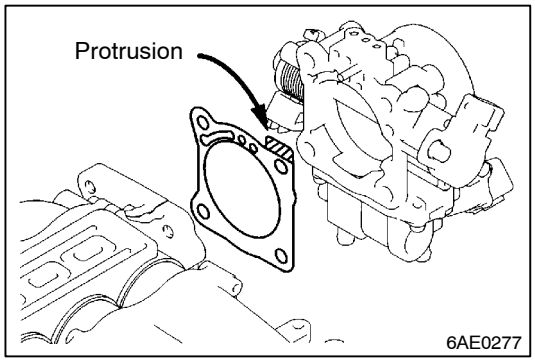
Removal steps

1. Air intake plenum stay, front
2. Air intake plenum stay, rear
3. Throttle cable bracket
4. EGR valve
5. EGR valve gasket
6. EGR pipe
7. EGR pipe gasket
8. Connector bracket
9. Throttle cable clamp
10. Solenoid valve
11. Vacuum pipe
12. Throttle body

▶A◀ 13. Throttle body gasket

14. Air intake plenum
15. Air intake plenum gasket



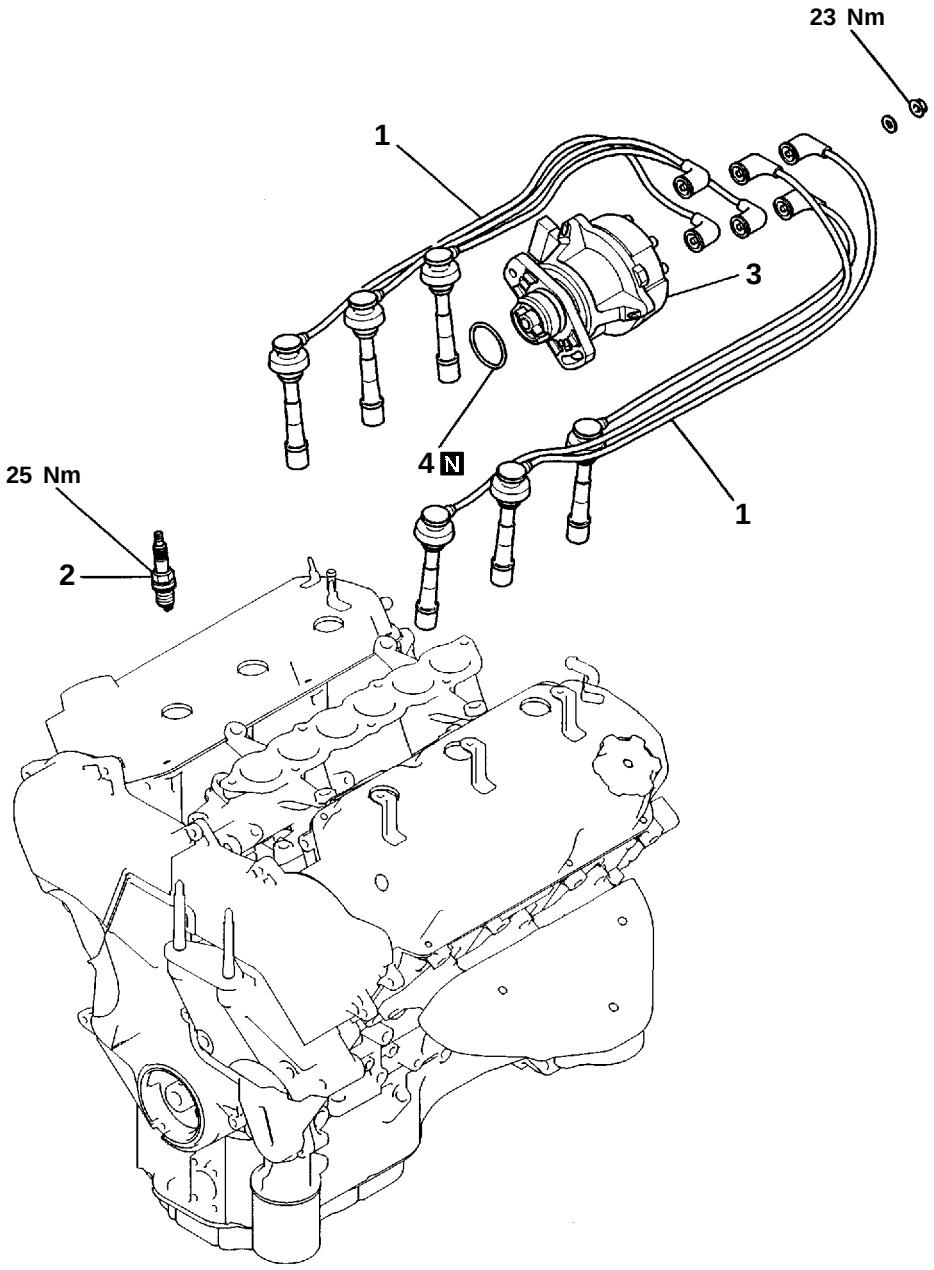
INSTALLATION SERVICE POINTS

▶A◀ THROTTLE BODY GASKET

(1) Install gasket with protrusion as illustrated.

5. IGNITION SYSTEM

REMOVAL AND INSTALLATION



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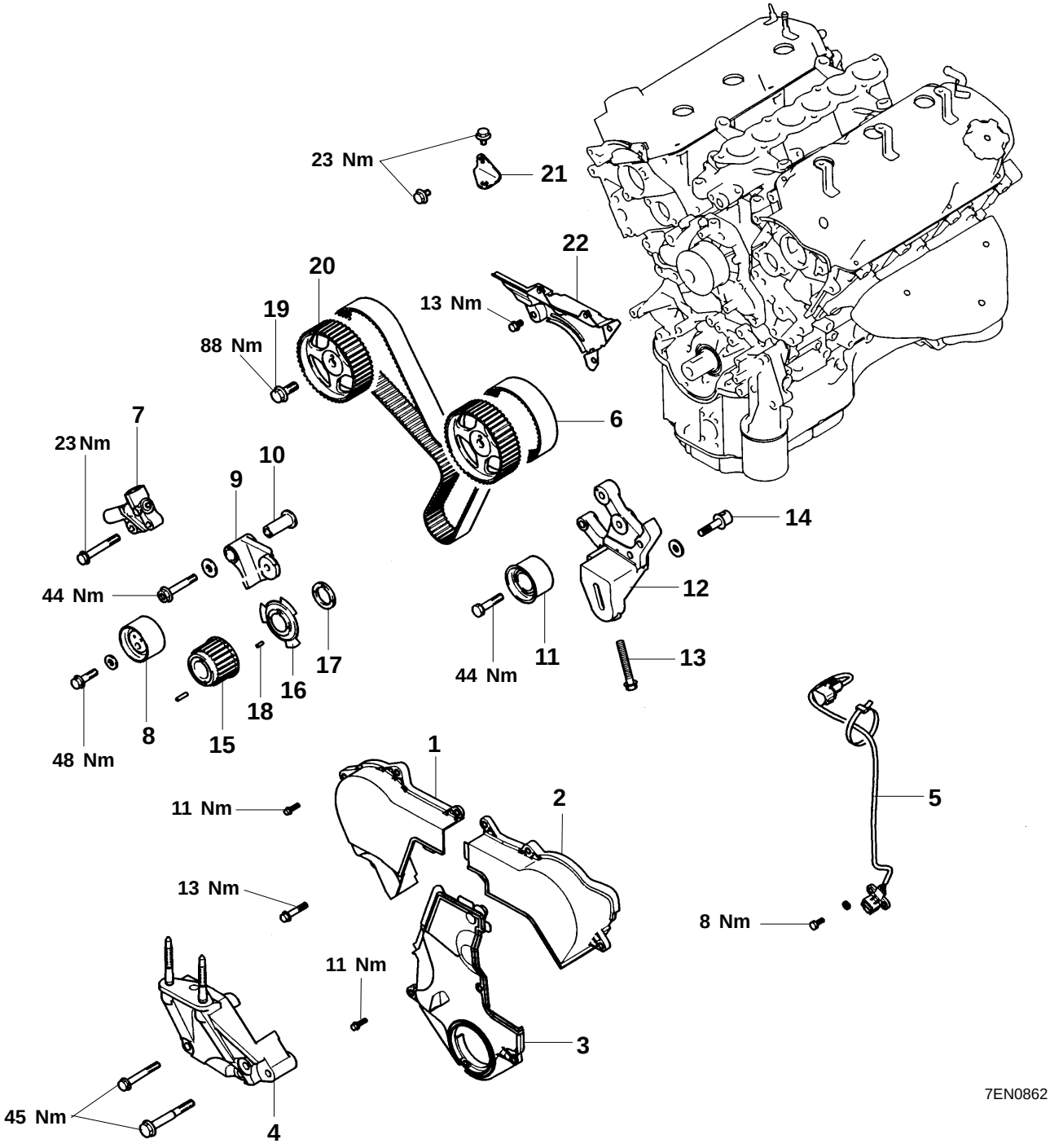
Removal steps

1. Spark plug cable
2. Spark plug
3. Distributor
4. O-ring

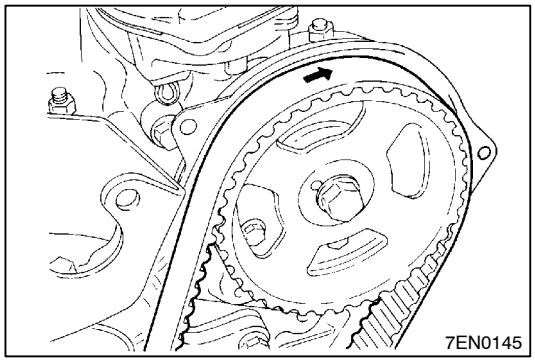
6. TIMING BELT

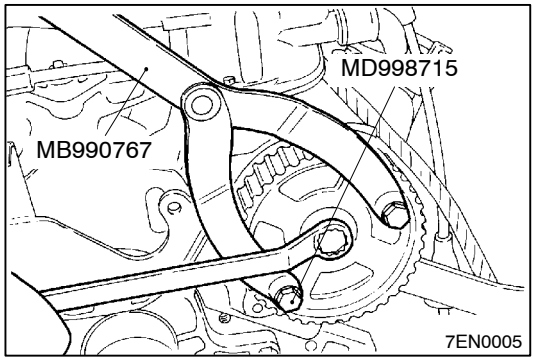
REMOVAL AND INSTALLATION



Removal steps

1. Timing belt front upper cover, rear
2. Timing belt front upper cover, front
3. Timing belt front lower cover
4. ▶E◀ Engine support bracket
5. Crank angle sensor
6. ◀A▶ ▶D◀ ▶C◀ Timing belt
7. Automatic tensioner
8. Tensioner pulley
9. Tensioner arm
10. Shaft
11. Idler pulley
12. Idler pulley adjusting bracket
13. Adjusting bolt
14. Adjusting stud
15. ▶B◀ Crankshaft sprocket
16. ▶B◀ Sensing blade
17. ▶B◀ Crankshaft spacer
18. Crankshaft key
19. ◀B▶ ▶A◀ Camshaft sprocket bolt
20. Camshaft sprocket
21. Bracket
22. Timing belt rear cover





REMOVAL SERVICE POINTS

◀A▶ TIMING BELT

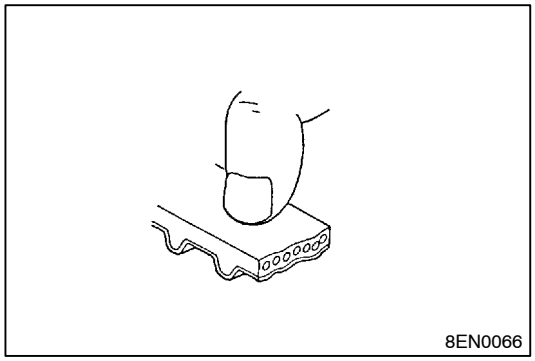
(1) When the timing belt is to be reused, in order to allow re-installation of the belt so that it travels in the same direction as before it was removed, mark the direction of travel with an arrow before removing it.

Caution

- **As water or oil on the belt can seriously reduce its usable life, ensure that the timing belt, sprocket, and tensioner stay clean and dry while removed, and never wash them. Parts that have become too dirty should be replaced.**
- **When any of the parts are oily, check to see whether there are any oil leaks in any of the oil seals or the camshaft oil seal on the front of the engine.**

◀B▶ CAMSHAFT SPROCKET BOLT

(1) Using the Special Tool, hold the camshaft sprocket.
(2) Remove the camshaft sprocket bolt.

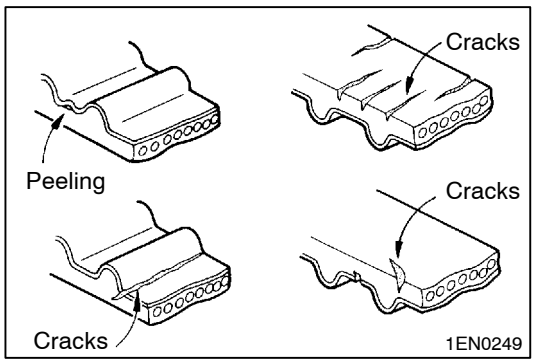


INSPECTION

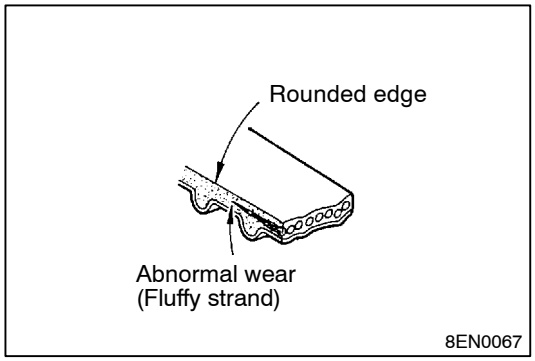
TIMING BELT

Check the belt in detail. If the following is evident, replace the belt.

(1) Hardened back surface rubber.
Back surface glossy, non-elastic and so hard that even if a finger nail is forced into it, no mark is produced.

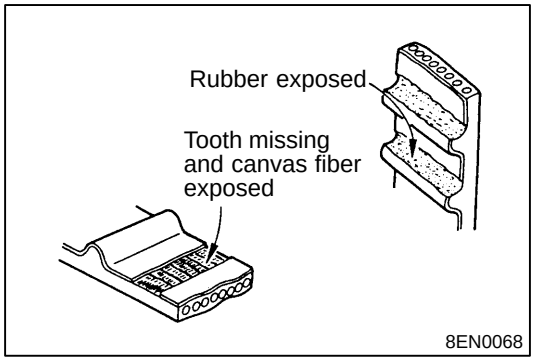


(2) Cracked back surface rubber.
(3) Cracked or separated canvas.
(4) Cracked tooth bottom.
(5) Cracked side of belt.

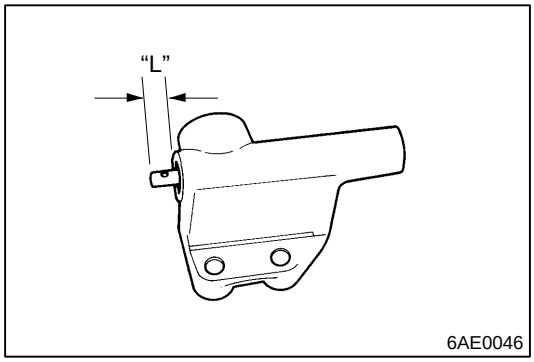


(6) Side of belt badly worn.

NOTE
Normal belt should have clear-cut sides as if cut with a sharp knife.



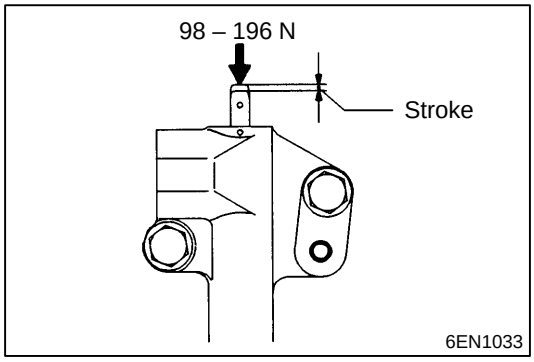
(7) Badly worn teeth.
Initial stage:
Canvas is worn (fluffy canvas fibres are visible, rubber is gone and colour has changed to white. Canvas texture is not clear).
Last stage:
Canvas is worn out and rubber exposed and its width is reduced.
(8) Missing tooth.



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 "L". If the reading is outside the standard value, replace the auto-tensioner.

Standard value "L": 12 mm

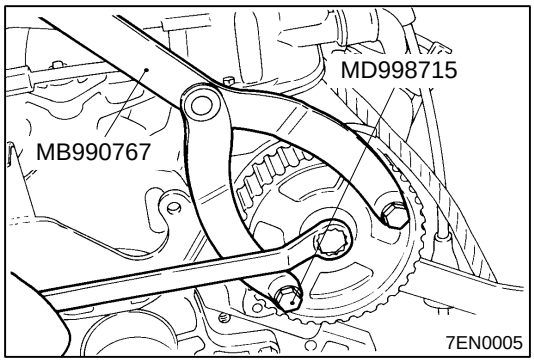


(4) Press the rod by a force of 98 to 196 N and measure the rod stroke. If the measured value exceeds the standard value, replace the tensioner.

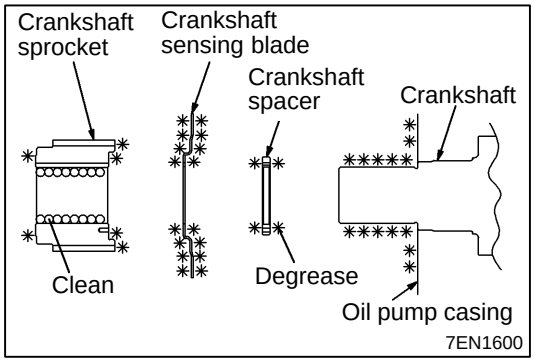
Standard value "L": 1 mm or less

INSTALLATION SERVICE POINTS

▶A◀ CAMSHAFT SPROCKET BOLT

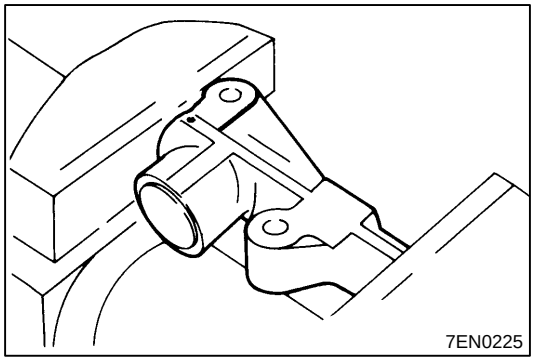


(1) Using the Special Tool, hold the camshaft sprocket.
(2) Torque the camshaft sprocket bolt to the specified torque.



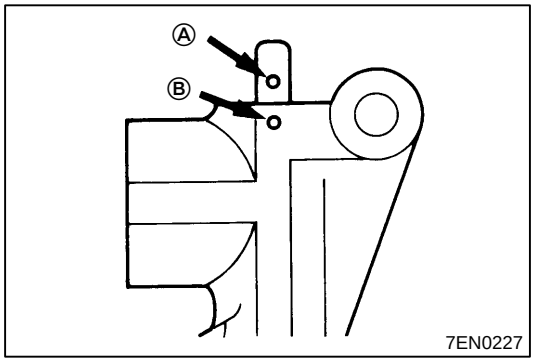
▶B◀ CRANKSHAFT SPROCKET / CRANKSHAFT SENSING BLADE / CRANKSHAFT SPACER

(1) Wipe clean the crankshaft fitting surface of the crankshaft sprocket.
(2) Clean and degrease the crankshaft sprocket, the crankshaft sprocket fitting surface of the crankshaft, the sensing blade and the crankshaft spacer. Then, install the crankshaft sprocket, crankshaft sensing blade and crankshaft spacer on the crankshaft.



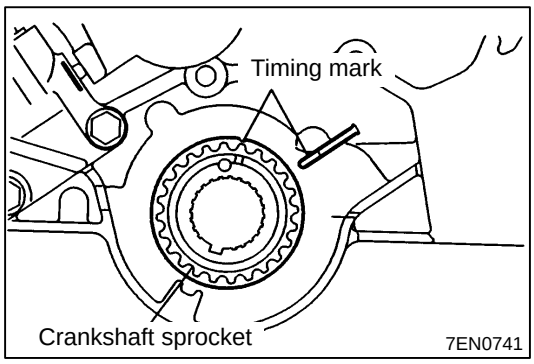
▶C◀ AUTO-TENSIONER

(1) If the auto-tensioner rod is fully extended, set it in the retracted position by the following procedure.
   ① Set the auto-tensioner in a vice, making sure it is not tilted.



   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 metal wire (1.4 mm in diameter) into the set holes.
   ④ Remove the auto-tensioner from the vice.

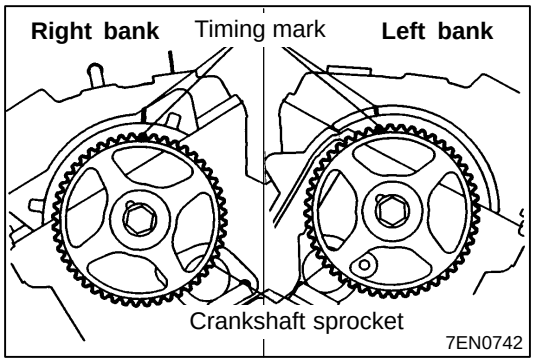
(2) Install the auto tensioner on the cylinder block through the oil pump case.



▶D◀ TIMING BELT

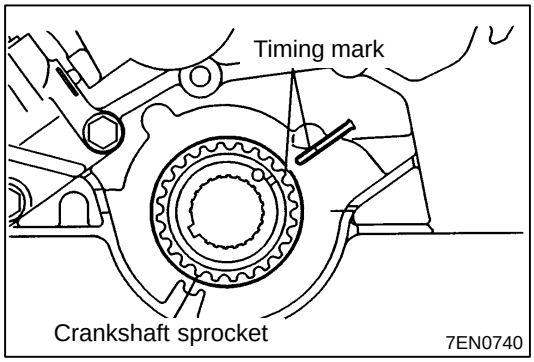
(1) Turn the crankshaft sprocket to position its timing mark 3 teeth away from the timing mark on the crankcase. (That is, slightly lower the No. 1 piston from the top dead centre on the compression stroke.)

Caution
- **If the camshaft sprocket is turned with the piston at the top dead centre on the compression stroke, valves may interfere with the piston.**

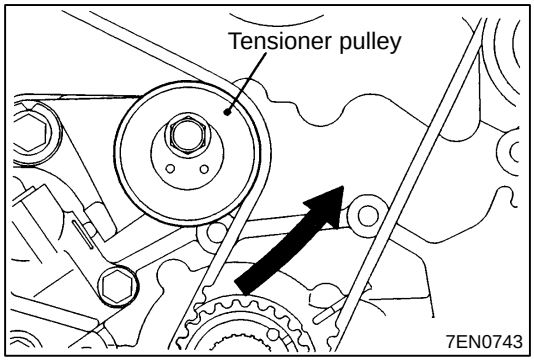


(2) Align the timing marks for the left bank camshaft sprocket.
(3) Align the timing marks for the right bank camshaft sprocket.

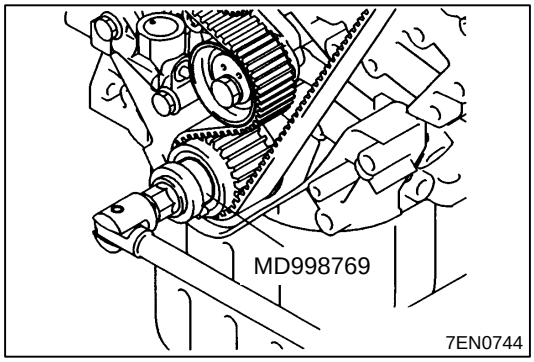
Caution
- **The camshaft sprocket may turn unintentionally due to the valve spring tension. Take care not to injure your fingers.**



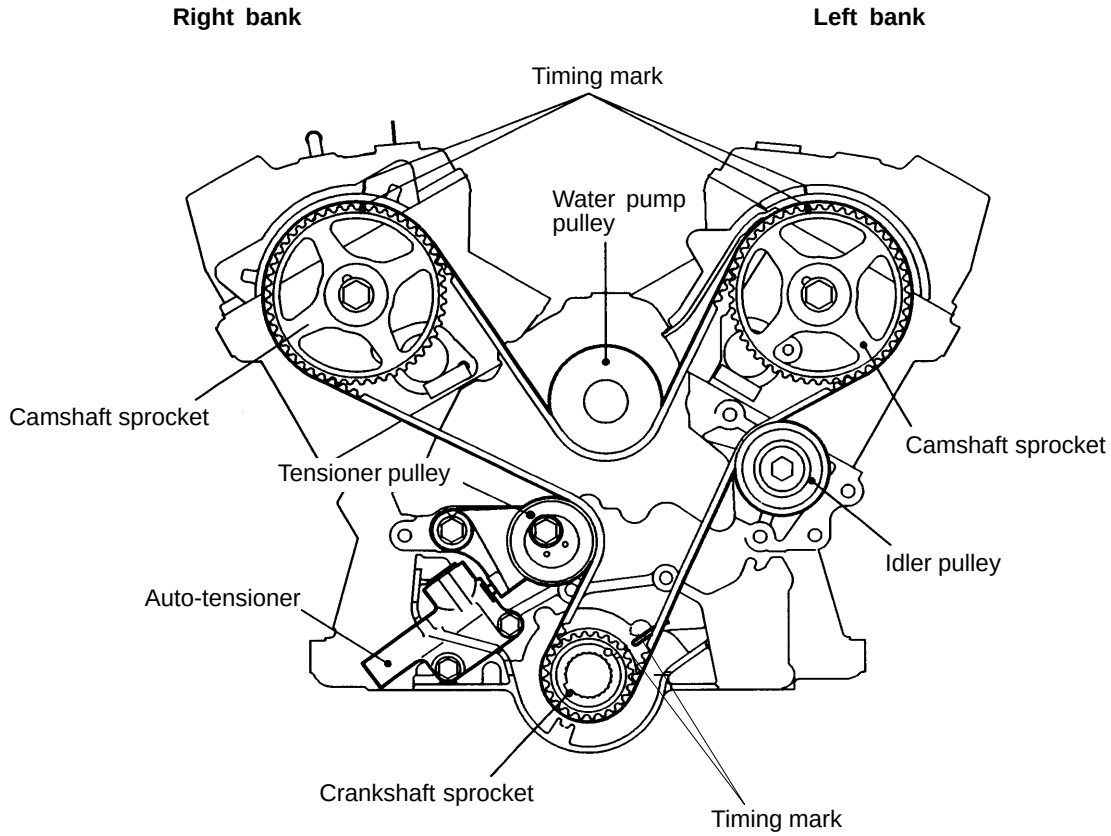
(4) Align timing marks for the crankshaft sprocket.
(5) Install the timing belt over the sprockets in the following sequence.
   ① Place the timing belt over the crankshaft. While applying tension to the belt, set it over the idler pulley.
   ② Place the belt over the left bank camshaft sprocket.
   ③ While applying tension to the belt, place it over the water pump pulley.
   ④ Place the belt over the right bank camshaft sprocket.
   ⑤ Place the belt over the tensioner pulley.

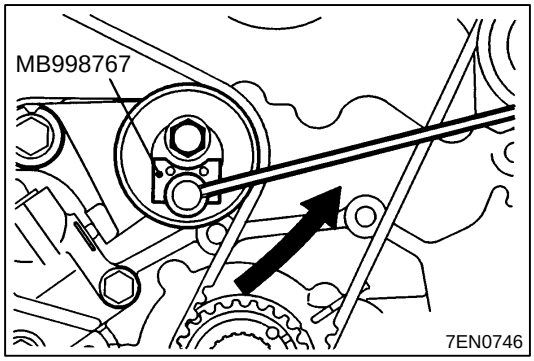


(6) While pressing the tensioner pulley lightly against the timing belt, temporarily tighten its centre bolt.
(7) Check that all timing marks are in alignment.



(8) Using the Special Tool, turn the crankshaft counter-clockwise a quarter turn, then turn it clockwise and align the timing marks. Make sure that all timing marks are in alignment.

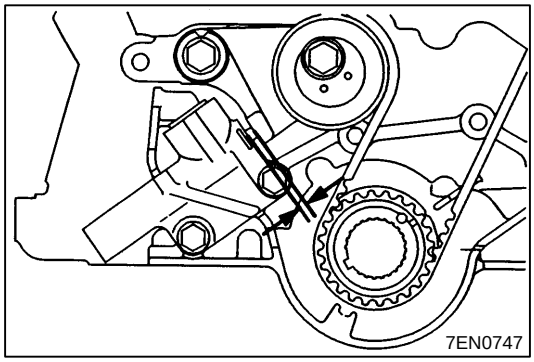


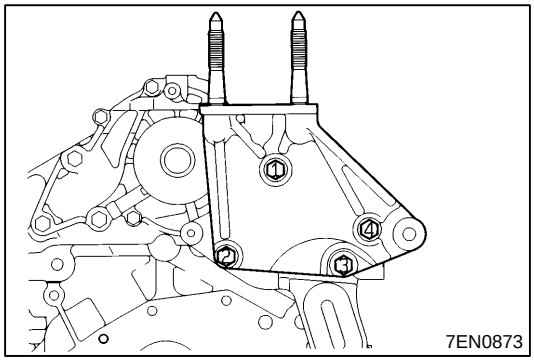


(9) Set the Special Tool and a torque wrench on the tensioner pulley.
(10) Torque the tensioner pulley to 4.4 Nm.
(11) While holding the tensioner pulley, tighten its centre bolt to the specified torque.
(12) Turn the crankshaft 2 turns clockwise and let it stand for approx. 5 minutes.
(13) Remove the wire, which was inserted when installing the tensioner, from the auto tensioner. If it can be removed easily, the timing belt tension is correct. Make sure that the auto tensioner rod projection is within specification.

Standard value: 3.8 – 5.0 mm

(14) If the wire cannot be removed easily or the rod protrusion is not to specification, repeat steps 9 through 12 to obtain the correct tension.



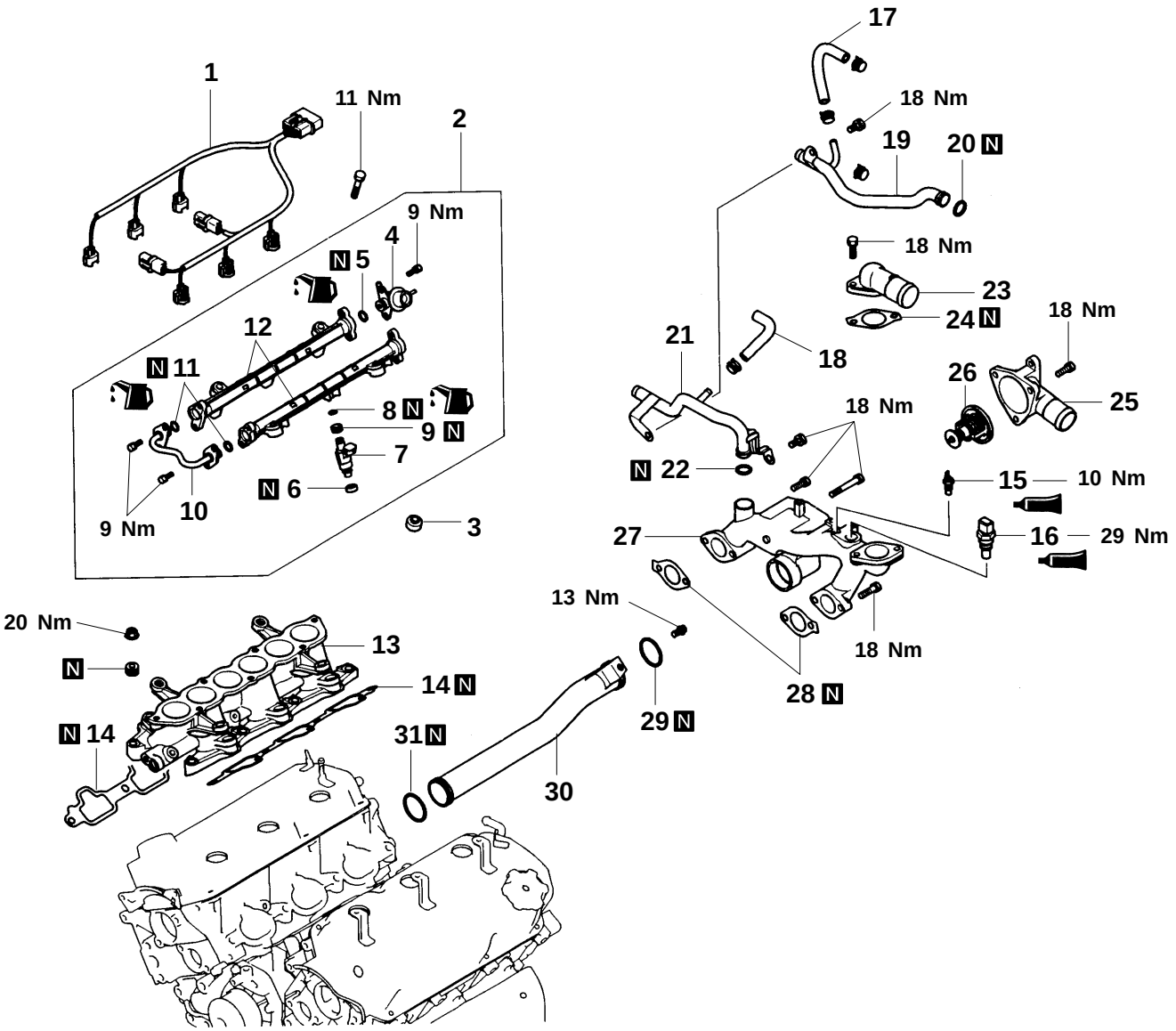


▶E◀ ENGINE SUPPORT BRACKET

(1) Tighten bolts to specified torque in the sequence shown.

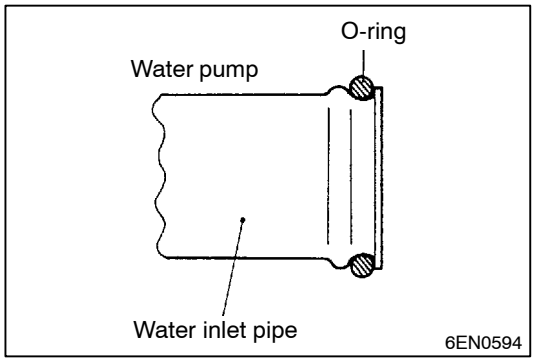
7. INTAKE MANIFOLD

REMOVAL AND INSTALLATION



Removal steps

1. Engine harness
2. Injector and delivery pipe
3. Insulator
- ▶H◀ 4. Fuel pressure regulator
5. O-ring
6. Insulator
- ▶G◀ 7. Injector
8. O-ring
9. Grommet
10. Fuel pipe
11. O-ring
12. Delivery pipe
- ▶F◀ 13. Intake manifold
14. Intake manifold gasket
- ▶E◀ 15. Engine coolant temperature gauge unit
- ▶D◀ 16. Engine coolant temperature sensor
17. Water hose
18. Water hose
- ▶C◀ 19. Heater inlet pipe
- ▶A◀ 20. O-ring
- ▶C◀ 21. Heater inlet pipe
- ▶A◀ 22. O-ring
23. Water outlet fitting
24. Water outlet fitting gasket
25. Water inlet fitting
- ▶B◀ 26. Thermostat
27. Thermostat housing
28. Thermostat housing gasket
- ▶A◀ 29. O-ring
30. Water pipe
- ▶A◀ 31. O-ring



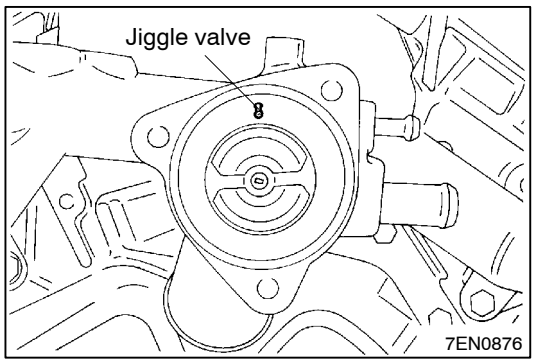
INSTALLATION SERVICE POINTS

▶A◀ O-RING / WATER PIPE

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

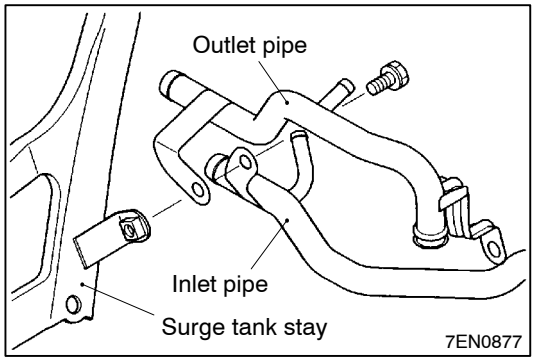
Caution

- **Keep the O-ring of oil or grease.**



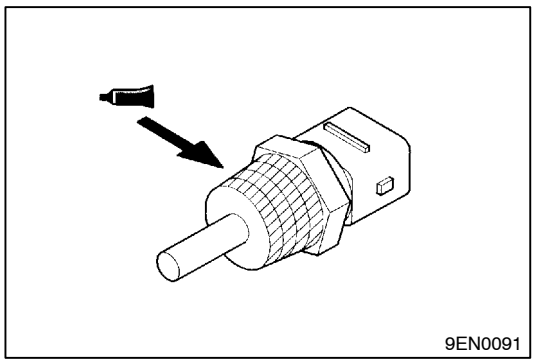
▶B◀ THERMOSTAT

(1) Install the thermostat in the thermostat case with its jiggle valve located at the top position.



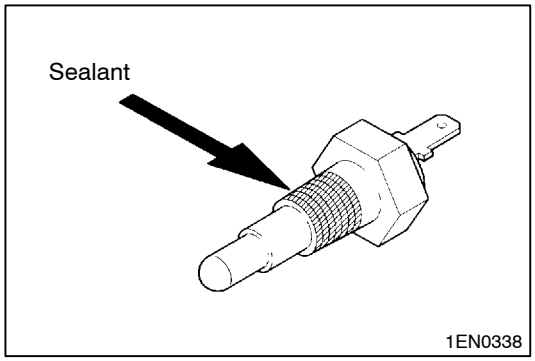
▶C◀ HEATER INLET AND OUTLET PIPES

(1) Attach the outlet and inlet pipes in this order, one on the top of the other.



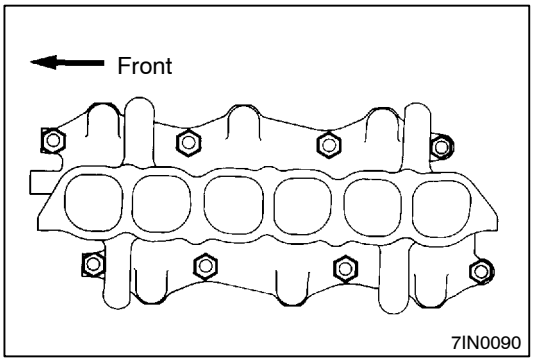
▶D◀ APPLICATION OF SEALANT TO ENGINE COOLANT TEMPERATURE SENSOR

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



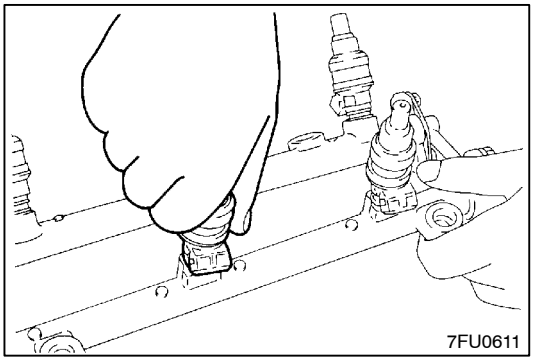
▶E◀ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE GAUGE UNIT

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



▶F◀ INTAKE MANIFOLD

(1) Tighten the nuts on the right bank to 5 - 8 Nm.
(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.

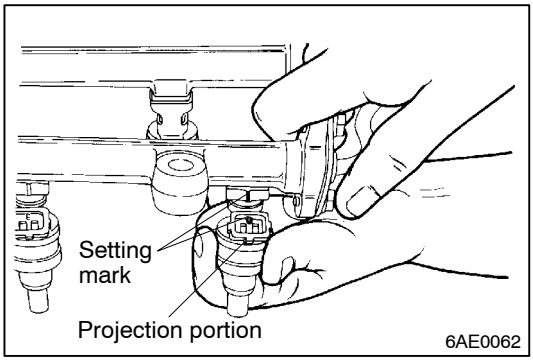


▶G◀INJECTOR

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

Caution
- **Take care to prevent the engine oil from entering the delivery pipe.**

(2) Install the injector into the delivery pipe and turn it right and left.
(3) Make sure the injector turns smoothly. If not, the O-ring may be caught. Remove the injector and check for damage to the O-ring, then re-insert it and confirm that it turns smoothly.
(4) When installing the injector, set the delivery pipe setting mark and the injector projecting portion.



▶H◀ FUEL PRESSURE REGULATOR

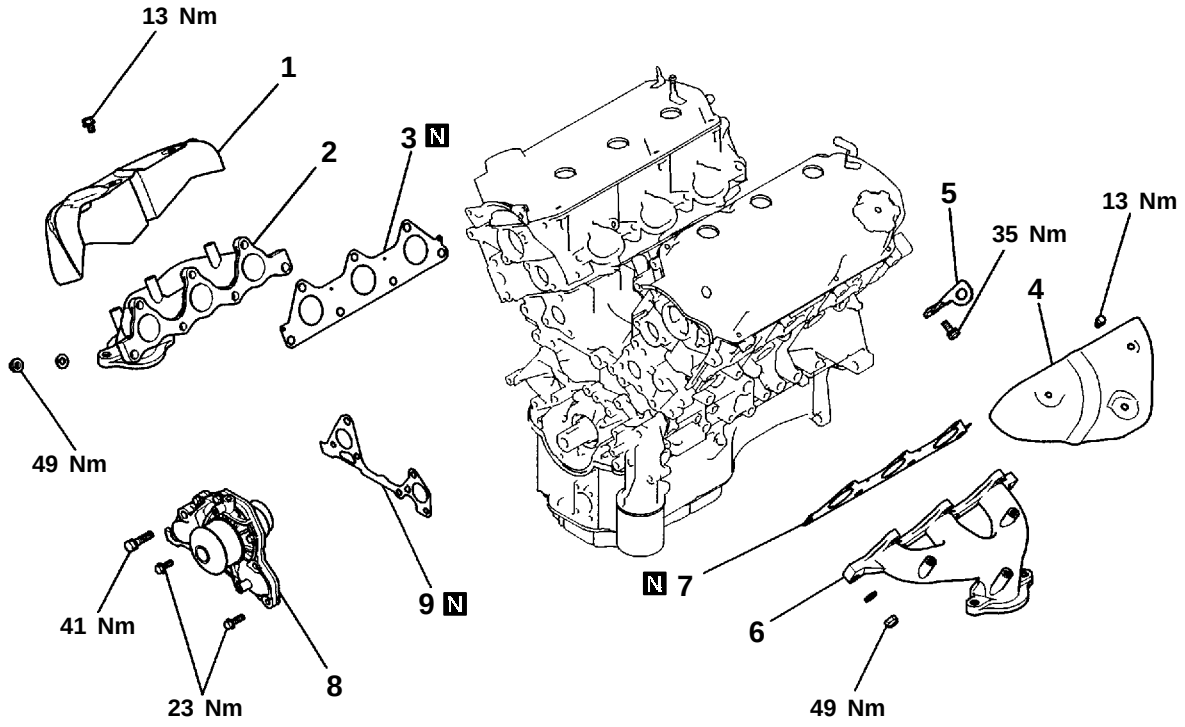
(1) Apply a small amount of new engine oil to the O-ring, then insert the fuel pressure regulator into the delivery pipe, taking care not to damage the O-ring.

Caution
- **Take care to prevent engine oil from entering the delivery pipe.**

(2) Make sure the regulator turns smoothly. If not, the O-ring may be caught. Remove the regulator and check for damage to the O-ring, then re-insert it into the delivery pipe and confirm that it turns smoothly.

8. EXHAUST MANIFOLD & WATER PUMP

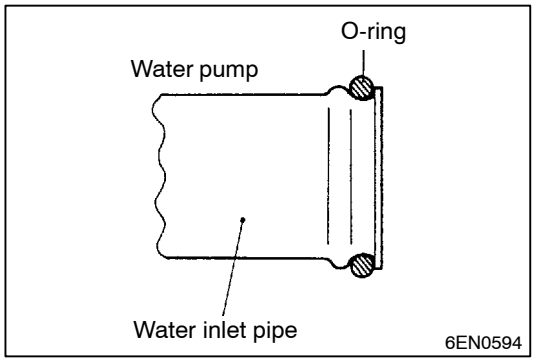
REMOVAL AND INSTALLATION



7EN0966

Removal steps

1. Heat protector, rear
2. Exhaust manifold, rear
▶B◀ 3. Exhaust manifold gasket, rear
4. Heat protector, front
5. Engine lift bracket
6. Exhaust manifold, front
▶B◀ 7. Exhaust manifold gasket, front
▶A◀ 8. Water pump
9. Water pump gasket



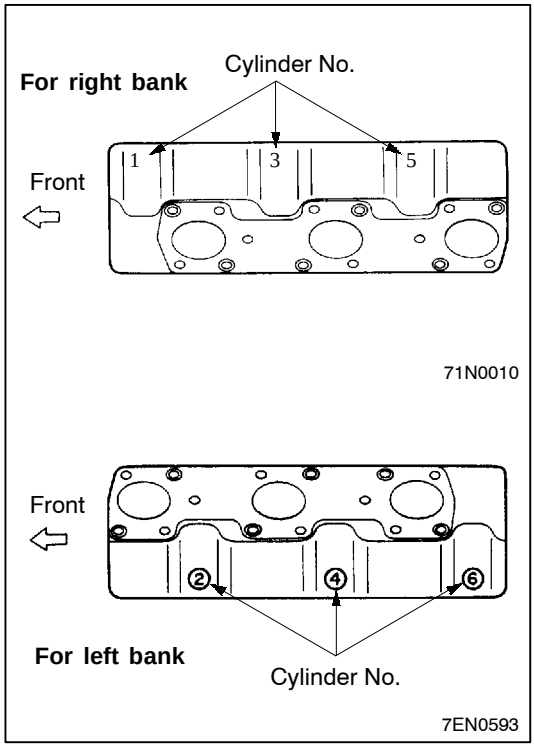
INSTALLATION SERVICE POINTS

▶A◀ O-RING / WATER PIPE

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

Caution

- **Keep the O-ring free of oil grease.**



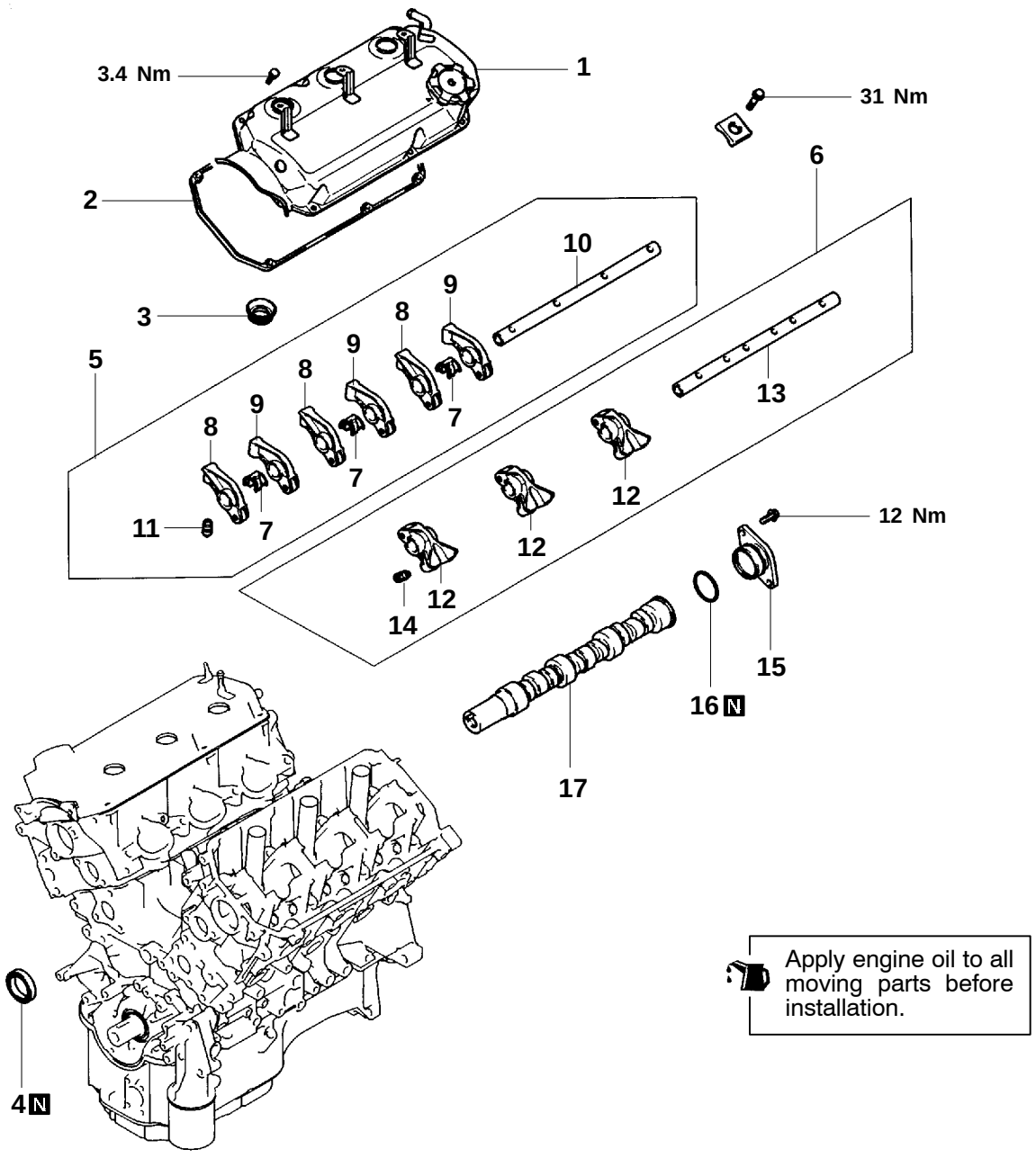
▶B◀ EXHAUST MANIFOLD GASKET

(1) Install gaskets with number 1, 3 and 5 embossed on their top side to the right bank (exhaust manifold (B) side) and install those with number 2, 4 and 6 to the left bank (exhaust manifold (A) side).

(2) Torque the nuts to 30 Nm.

9. ROCKER ARMS AND CAMSHAFT

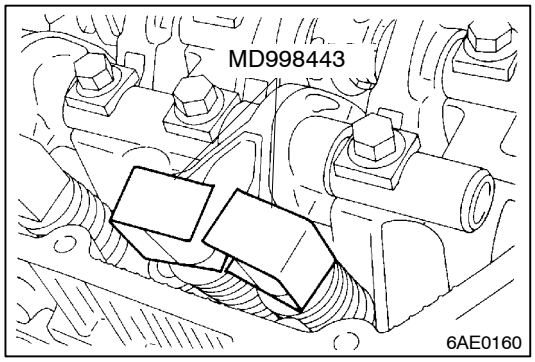
REMOVAL AND INSTALLATION



7EN0879

Removal steps

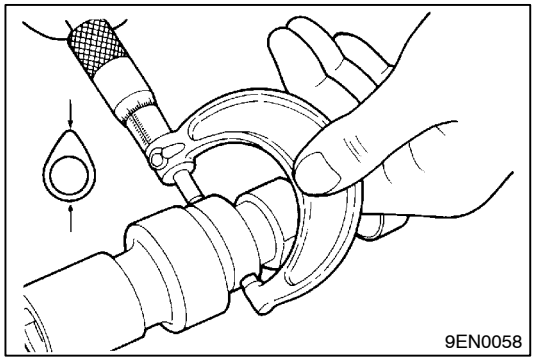
1. Rocker cover
2. Gasket
3. Oil seal
▶E◀ 4. Oil seal
◀A▶ 5. Rocker arms, Rocker arm shaft
◀A▶ 6. Rocker arms, Rocker arm shaft
▶D◀ 7. Rocker shaft spring
8. Rocker arm “A”
9. Rocker arm “B”
▶C◀ 10. Rocker arm shaft
▶B◀ 11. Lash adjuster
12. Rocker arm “C”
▶C◀ 13. Rocker arm shaft
▶B◀ 14. Lash adjuster
15. Thrust case (left bank)
16. O-ring (left bank)
▶A◀ 17. Camshaft



REMOVAL SERVICE POINTS

◀A▶ LASH ADJUSTER

(1) Before removing the rocker arms and rocker arm shafts, install the Special Tools to prevent the lash adjusters from falling off.



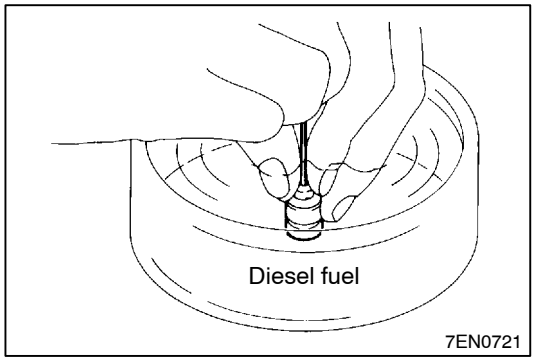
INSPECTION

CAMSHAFT

(1) Measure the cam height.

Standard value:
IN: 37.71 mm
EX: 37.14 mm

Limit:
IN: 37.21 mm
EX: 36.64 mm

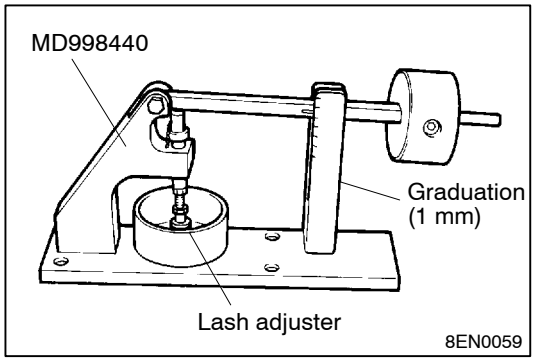


LASH ADJUSTER LEAK DOWN TEST

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

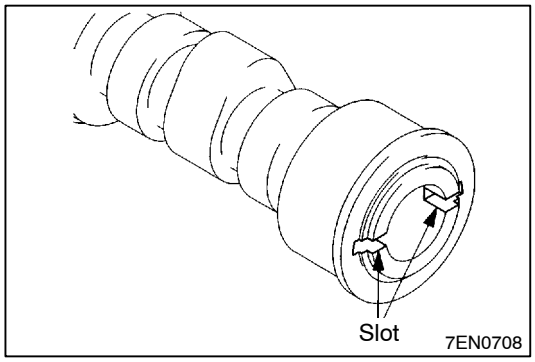
(1) Immerse the lash adjuster in clean diesel fuel.
(2) While lightly pushing down inner steel ball using the Special Tool (Air bleed wire MD998442), move the plunger up and down four or five times to bleed air.
Use of the Special Tool (Retainer MD998441) helps facilitate the air bleeding of the rocker arm mounted type lash adjuster.
(3) Remove the Special Tool (Air bleed wire MD998442) 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.**



(4) After air bleeding, set lash adjuster on the Special Tool (Leak down tester MD998440).
(5) After plunger has gone down between 0.20 to 0.50 mm, measure time taken for it to go down a further 1 mm. Replace if measured time is out of specification.

Standard value: 4 - 20 seconds/1 mm
<Diesel fuel at 15 - 20°C>

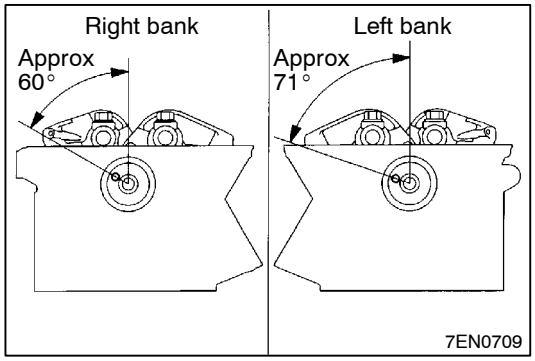


INSTALLATION SERVICE POINTS

▶A◀ CAMSHAFT

(1) Before attaching the camshafts, apply engine oil to the journals and cams.
Take care not to confuse the right bank and left bank camshafts.

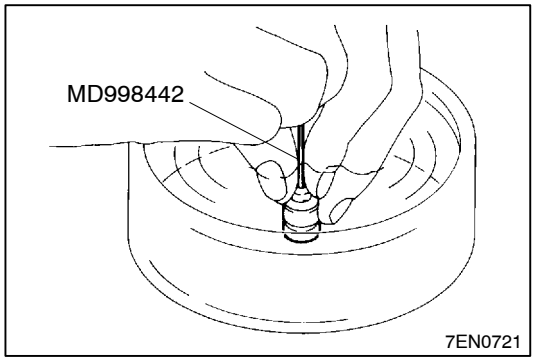
NOTE
The right bank camshaft has 4-mm-wide slits in the rear end surface.

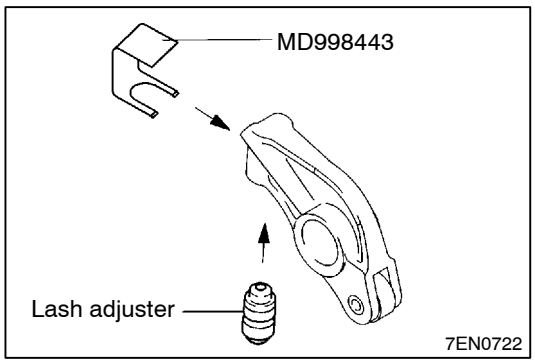


(2) Make sure the camshaft dowel pin is at the location shown.

▶B◀ LASH ADJUSTER

(1) Immerse the lash adjuster in clean diesel fuel No. 2.
(2) While pushing down the inside steel ball with the special air bleeding wire tool, move the plunger up and down four or five times to evacuate air from the lash adjuster.





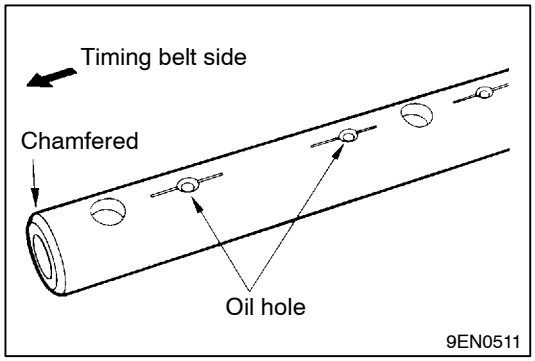
(3) Taking care not to spill the diesel fuel, install the lash adjuster into the rocker arm and attach a special tool to prevent it from falling out.

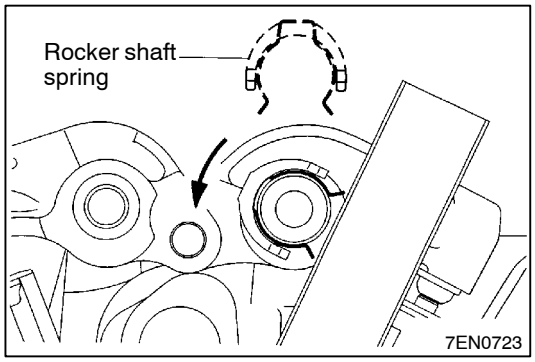
▶C◀ ROCKER ARM SHAFT

(1) The end with the larger chamfer is at the right on the front bank and at the left on the rear bank.

NOTE
The side with the four bolt holes is on the intake side.

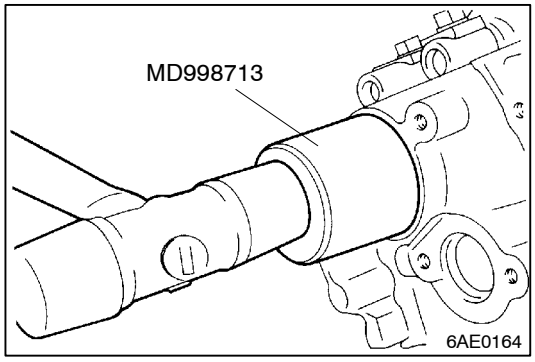
(2) The side with the oil holes is on the lower side (cylinder head side).



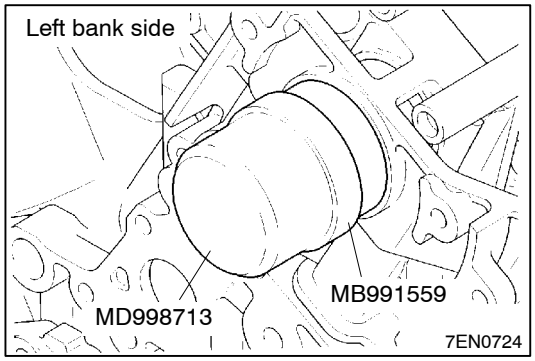


▶D◀ ROCKER SHAFT SPRING

(1) Insert the rocker shaft spring at a slant with respect to the spark plug guide and install it normal to the guide.

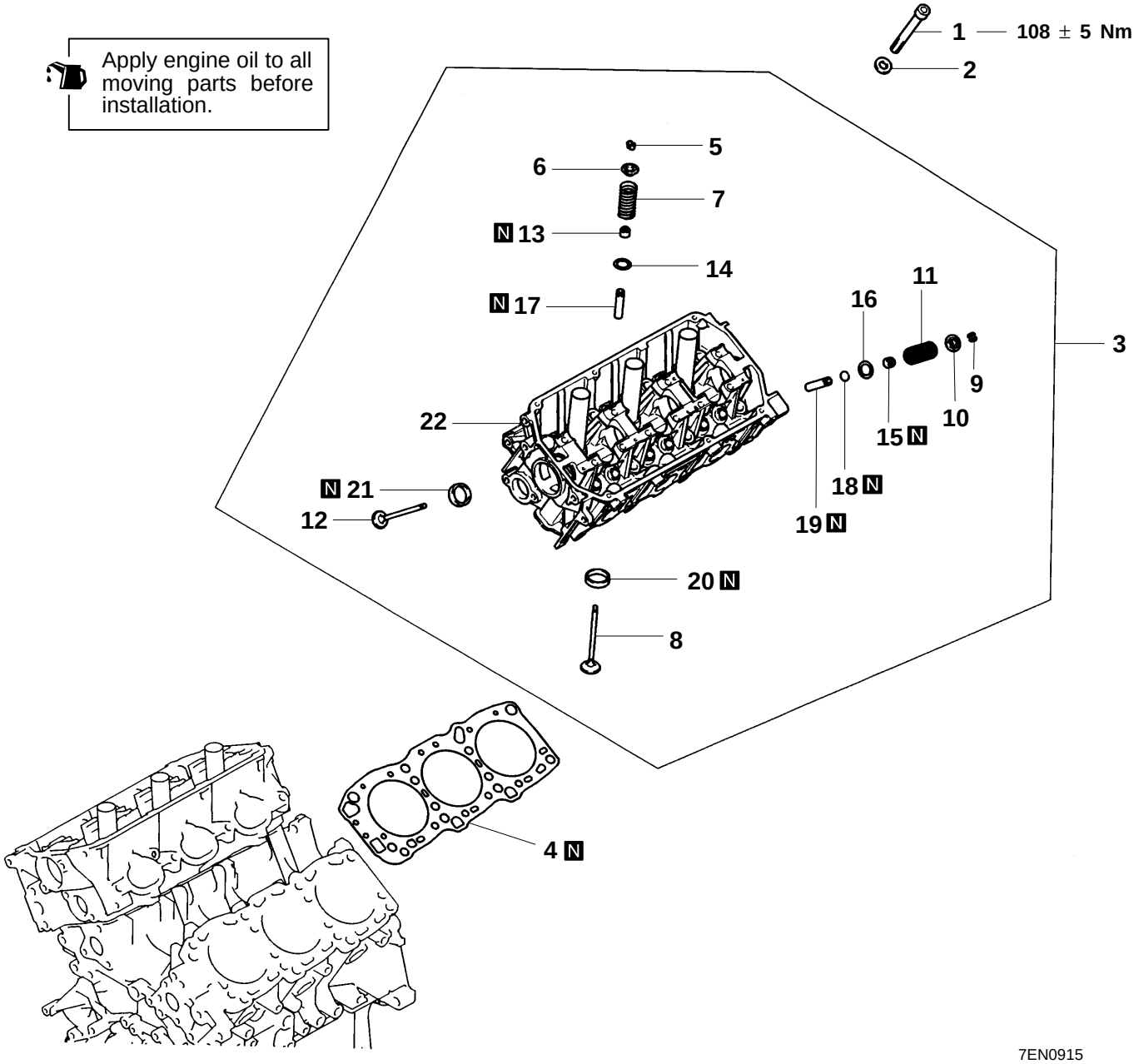


▶E◀ OIL SEAL



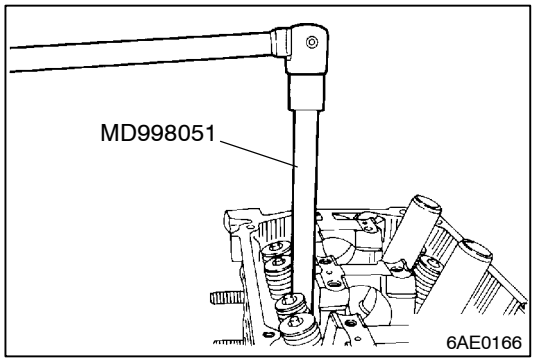
10. CYLINDER HEAD AND VALVES

REMOVAL AND INSTALLATION



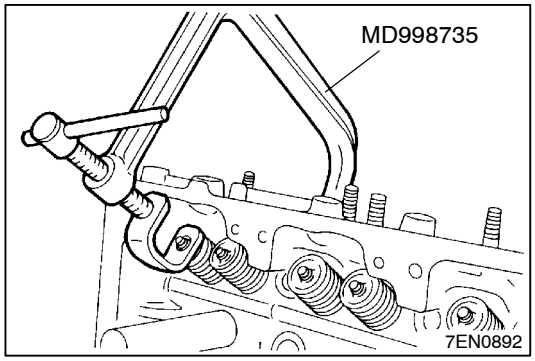
Removal steps

◀A▶ ▶D◀ 1. Cylinder head bolt
2. Washer
3. Cylinder head assembly
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. Snap ring
19. Exhaust valve guide
20. Intake valve seat
21. Exhaust valve seat
22. Cylinder head



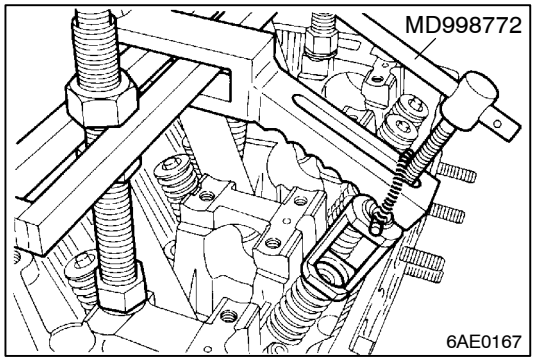
REMOVAL SERVICE POINTS

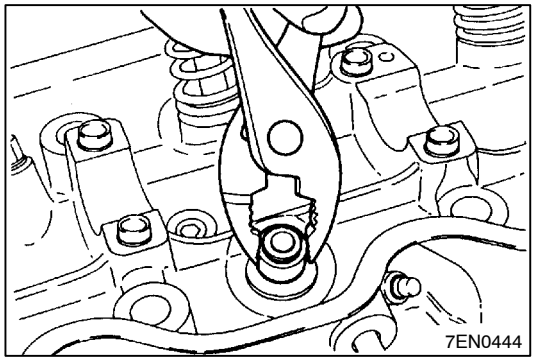
◀A▶ CYLINDER HEAD BOLT



◀B▶ RETAINER LOCK

(1) Attach a tag with the cylinder No. and mounting location to the detached valves, springs and other parts and store them for reassembly.

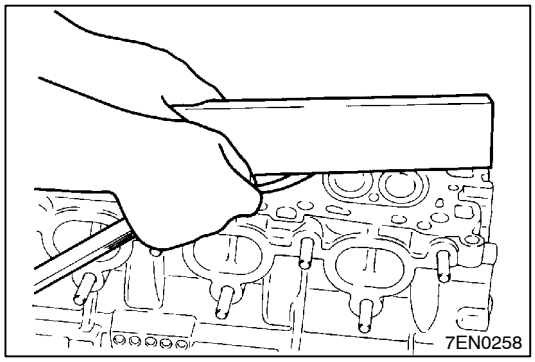




◀C▶ VALVE STEM SEAL

Caution

- **Do not reuse the stem seal.**



INSPECTION

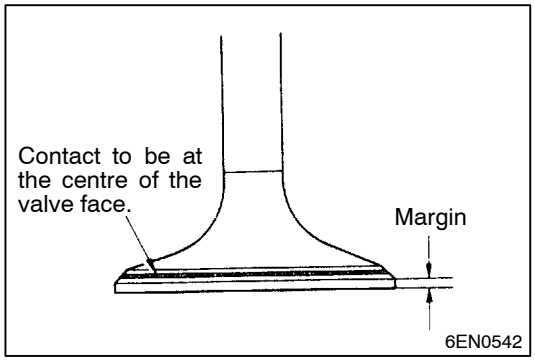
CYLINDER HEAD

(1) Check the cylinder head for water leaks, gas leaks, damage or cracks before washing it.
(2) Completely remove oil, fur, sealer, carbon and the like. After washing the oil passages, blow air through them to make sure they are not clogged.
(3) To ensure flatness of the cylinder head bottom surface, measure the distortion of the surface using a straight edge and a thickness gauge. When the distortion exceeds the specifications, correct by grinding the surface.

Standard values of bottom surface distortion:
Within 0.03 mm

Limit: 0.2 mm
Grinding limit: 0.2 mm
Height of the cylinder head: 120 mm

Caution
- **The cylinder head bottom surface may be ground to within 0.2 mm of the mating cylinder block.**



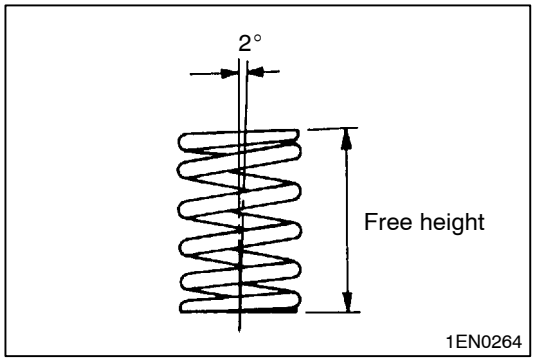
VALVES

(1) When contact between the valve and the valve seat is improper, unbalanced or nonexistent, correct the valve seat.
(2) Change the valve when the margin doesn't meet the specifications.

Standard value:	**Intake 1.0 mm**
	Exhaust 1.2 mm
Limit:	**Intake 0.5 mm**
	Exhaust 0.7 mm

(3) Measure the total length of the valve. If the measured value is below the limit, change the valve.

Standard value:	**Intake 112.30 mm**
	Exhaust 114.11 mm
Limit:	**Intake 111.80 mm**
	Exhaust 113.61 mm



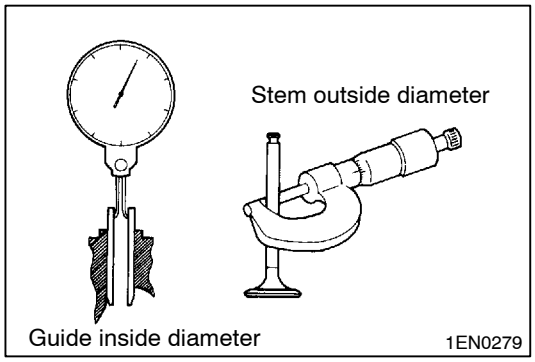
VALVE SPRING

(1) Measure the free height of the valve spring. When the measured value exceeds the specified limit, change the valve spring.

Standard value: 51.0 mm
Limit: 50.0 mm

(2) Measure the perpendicularity of the valve spring. When the measured value exceeds the specified limit, change the valve spring.

Standard value: 2° max.
Limit: 4°

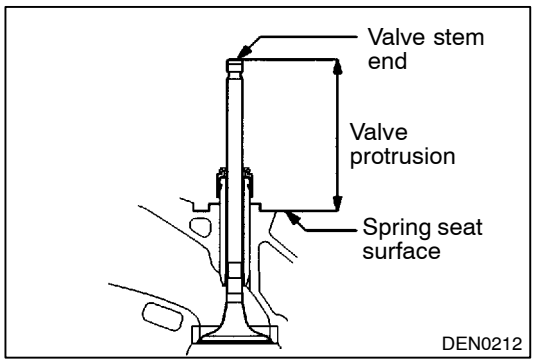


VALVE GUIDE

(1) Measure the clearance between the valve guide and the valve stem. When the clearance exceeds the specified limit, change the valve guide or the valve or both.

Standard value: **Intake 0.02 - 0.04 mm**
Exhaust 0.04 - 0.06 mm

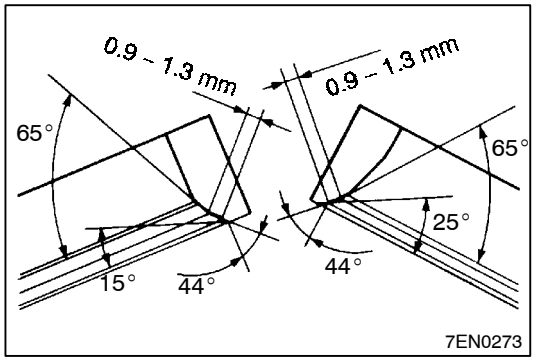
Limit: **Intake 0.10 mm**
Exhaust 0.15 mm



VALVE SEAT

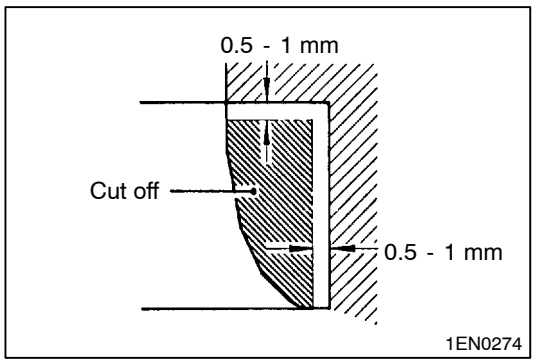
(1) Assemble the valve, and with it pressed down on the valve seat measure the part of the valve which protrudes from the spring seat surface. The length measured should be between the spring seat surface and the valve stem end. If the measured value exceeds the limit, change the valve.

Standard value: 49.3 mm
Limit: 49.8 mm



VALVE SEAT RECONDITIONING PROCEDURE

(1) Check the clearance between the valve guide and the valve, and if necessary, change the valve guide before correcting the valve seat.
(2) Correct so that the valve seat width and angle are as specified in the figure at left.
(3) After making the corrections, apply lapping compound and adjust the valve and valve seat.



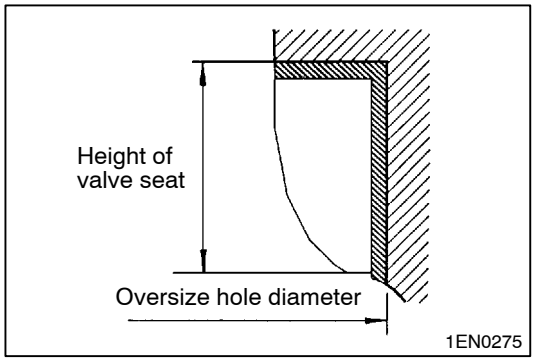
VALVE SEAT REPLACEMENT PROCEDURE

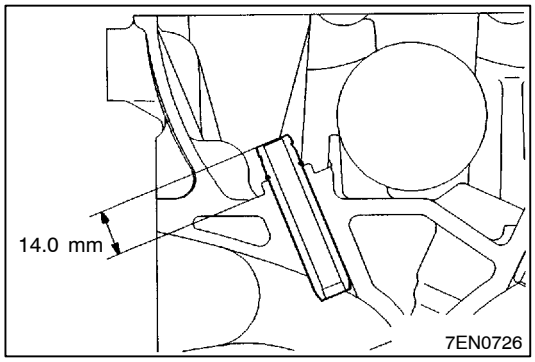
(1) Cut off the inside of the valve seat to reduce its thickness before pulling out the valve seat.
(2) Adjust the valve cylinder hole in the cylinder head to the diameter of the oversize valve seat to be press fitted.

Intake valve seat hole diameter
0.30 O.S. 34.30 - 34.33 mm
0.60 O.S. 34.60 - 34.63 mm

Exhaust valve seat hole diameter
0.30 O.S. 31.80 - 31.83 mm
0.60 O.S. 32.10 - 32.13 mm

(3) When press fitting a valve seat, cool it using liquid nitrogen so as not to gall the cylinder head inside diameter.
(4) Machine the valve seat.
(5) See “Valve seat reconditioning procedure.”





VALVE GUIDE REPLACEMENT PROCEDURE

(1) Remove the snap ring from the exhaust valve guide.
(2) Pull out to the cylinder block side using a press.
(3) Machine the valve guide hole in the cylinder head to match the oversize valve guide to be press fitted.

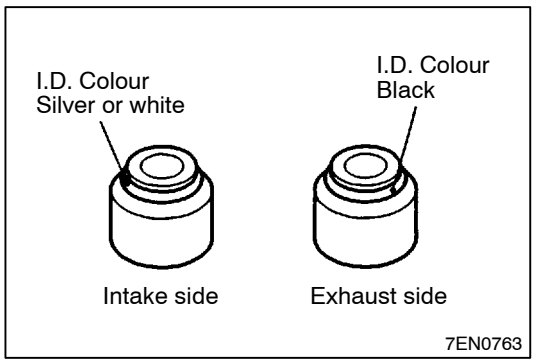
Caution
- **Do not press fit another valve guide of the same size.**

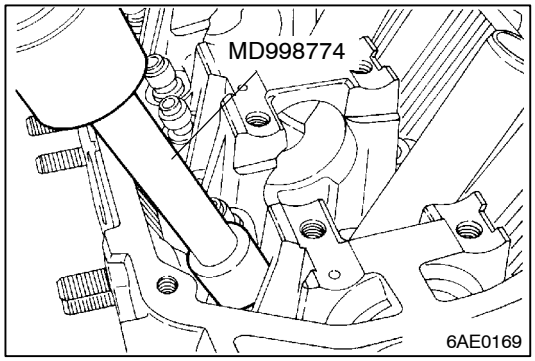
Diameter of the valve guide hole

0.05 O.S.	**11.05 - 11.07 mm**
0.25 O.S.	**11.25 - 11.27 mm**
0.50 O.S.	**11.50 - 11.52 mm**

(4) Press fit the valve guide until the projection is 14.0 mm, as shown.

NOTE
- Press fit the valve guide from the top surface of the cylinder head.
- Pay attention to the difference in the valve guide length (45.5 mm for the intake side valve guide and 50.5 mm for the exhaust side valve guide).
- After press fitting the valve guide, insert a new valve and check the contact between the valve guide and the valve.





INSTALLATION SERVICE POINTS

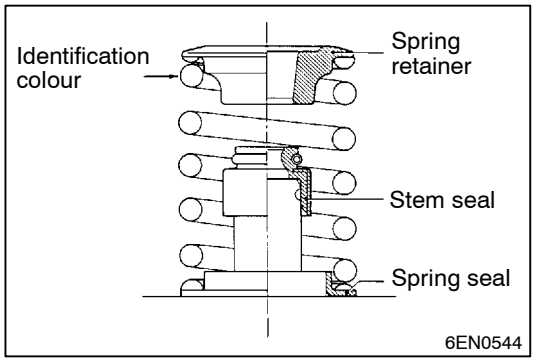
▶A◀ VALVE STEM SEAL

(1) Attach a valve spring seat.
(2) Attach a new stem seal to the valve guide with the Special Tool.

NOTE
Pay attention to the difference between the intake side and exhaust side valve stem seals.

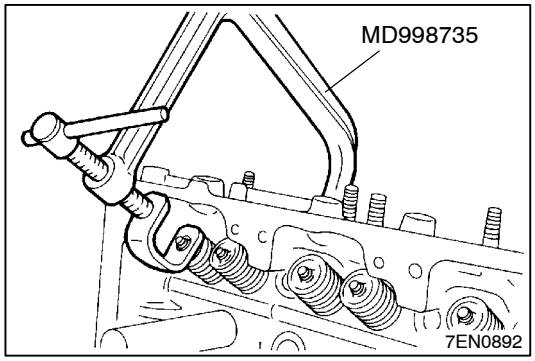
Identifying colour at the valve stem seal portion
Intake side: Silver or white
Exhaust side: Black

Caution
- **Do not reuse valve stem seals.**
- **Always use the Special Tool to install valve stem seals. Improper installation will cause oil leaks.**



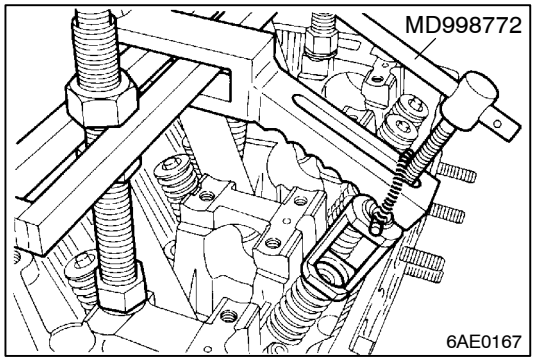
▶B◀ VALVE SPRING

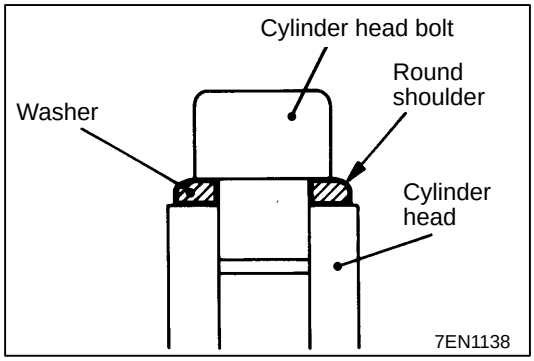
(1) Install the valve spring painted red side up.



▶C◀ VALVE RETAINER LOCK

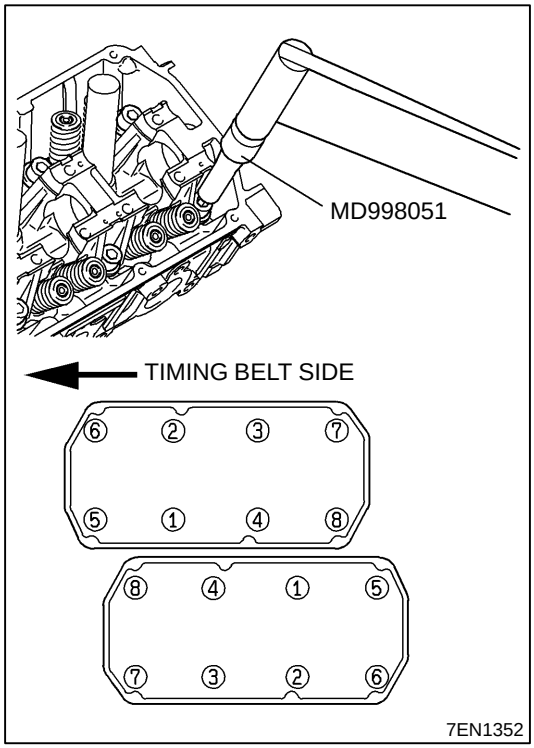
(1) Using Special Tool install the valve retainer lock.





▶D◀ WASHER / CYLINDER HEAD BOLT

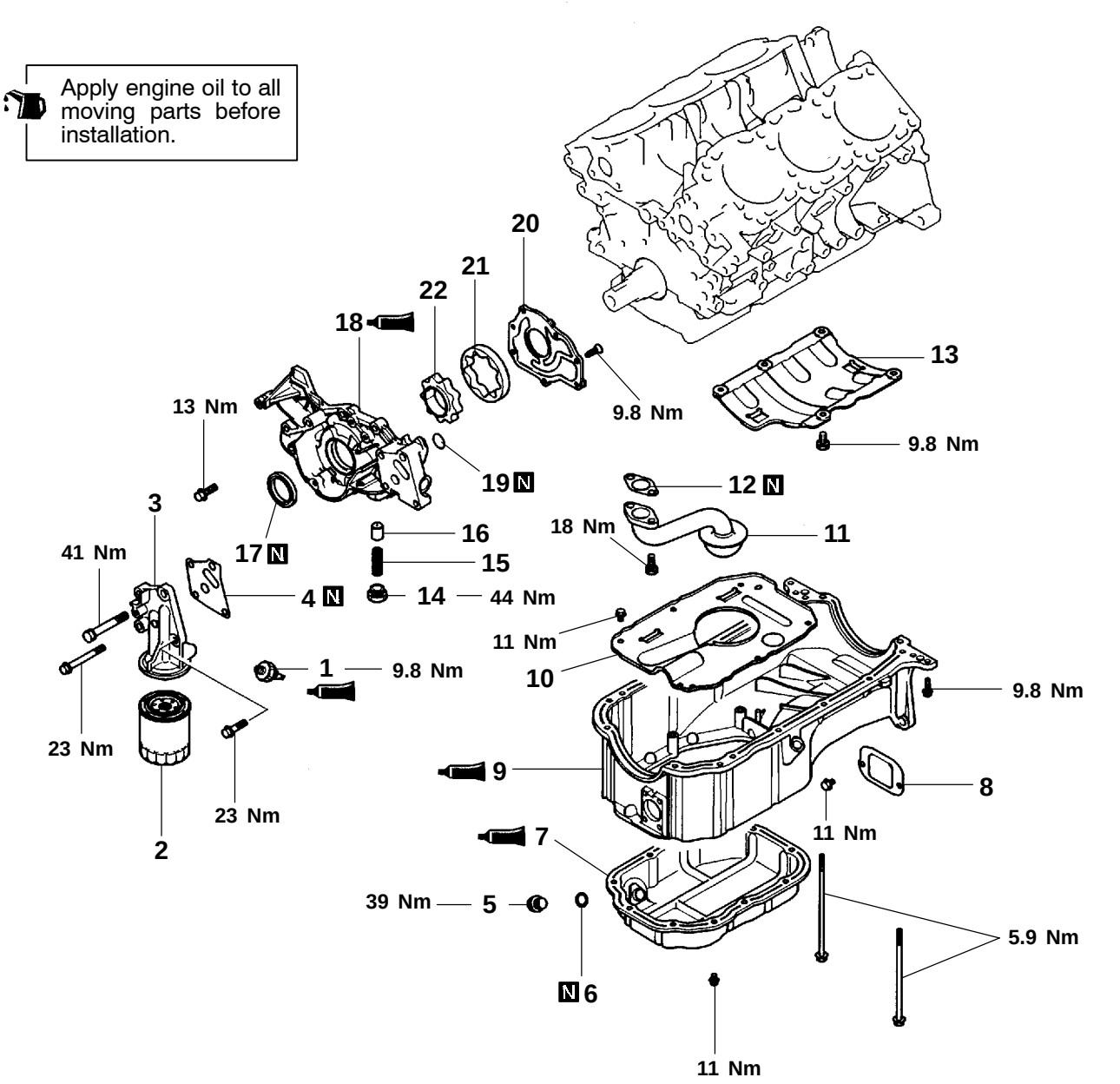
(1) Fit the washer onto each cylinder head bolt with its round edge toward the bolt head. Then install the cylinder head bolts into the bolt holes.



(2) Tighten the cylinder head bolts to the specified torque in the order shown in the illustration.
(3) Loosen all the cylinder head bolts.
(4) Retighten the cylinder head bolts to the specified torque in the order shown in the illustration.

11. OIL PAN AND OIL PUMP

REMOVAL AND INSTALLATION



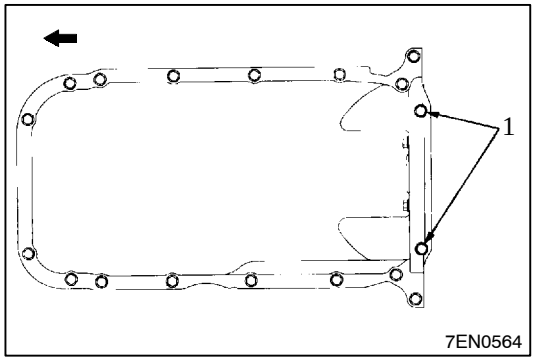
Removal steps

- ▶G◀ 1. Oil pressure switch
- ▶F◀ 2. Oil filter
- 3. Oil filter bracket
- 4. Oil filter bracket gasket
- 5. Drain plug
- 6. Drain plug gasket
- ◀A▶ ▶E◀ 7. Oil pan, lower
- 8. Cover
- ◀B▶ ▶D◀ 9. Oil pan, upper
- 10. Baffle plate
- 11. Oil screen
- 12. Oil screen gasket
- 13. Baffle plate
- 14. Plug
- 15. Relief spring
- 16. Relief plunger
- ▶C◀ 17. Oil seal
- ▶B◀ 18. Oil pump case
- 19. O-ring
- 20. Oil pump cover
- ◀C▶ ▶A◀ 21. Oil pump outer rotor
- ◀C▶ ▶A◀ 22. Oil pump inner rotor

REMOVAL SERVICE POINTS

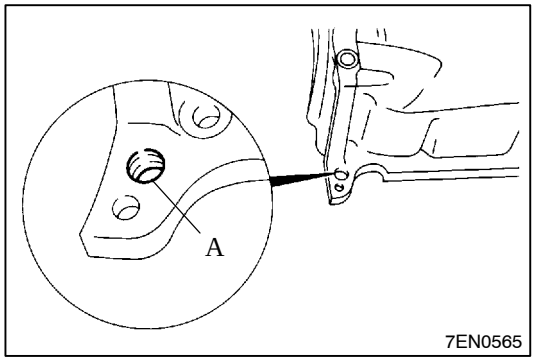
◀A▶ OIL PAN (LOWER)

(1) Apply wood to the oil pan side and remove the oil pan lower with a plastic hammer.



◀B▶ OIL PAN (UPPER)

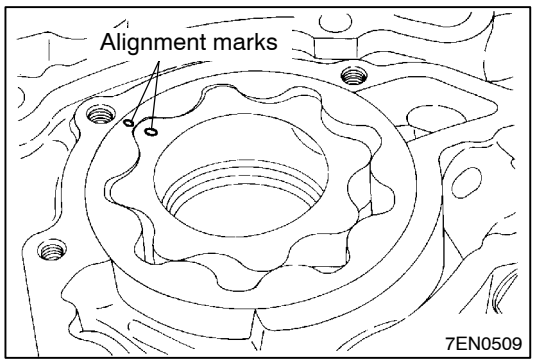
(1) Detach the bolt (1) shown at left.
(2) Detach all other bolts.



(3) Screw a bolt into bolt hole A shown (at both ends) to remove the oil pan.

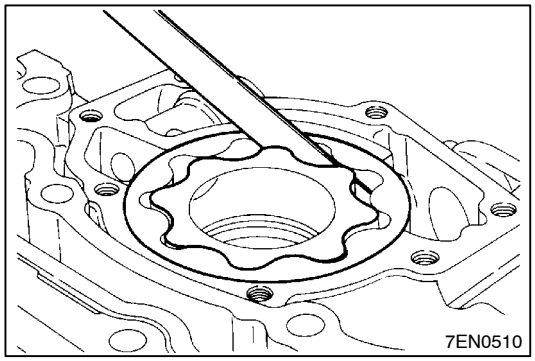
Caution

- **Do not use a scraper or special tool to remove the oil pan.**



◀C▶ OIL PUMP OUTER AND INNER ROTORS

(1) Draw a setting mark on the oil pump outer and inner rotors to facilitate reassembly.

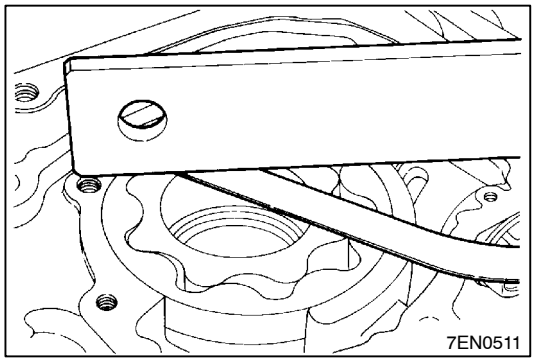


INSPECTION

OIL PUMP

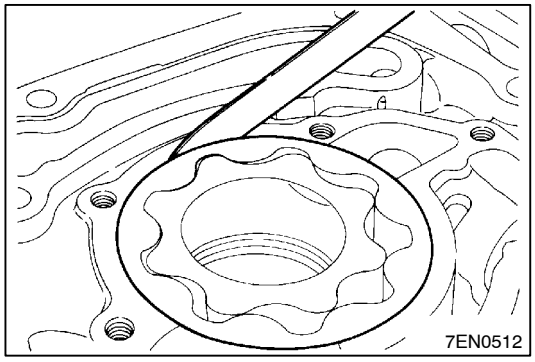
(1) Check for tip clearance.

Standard value: 0.06 - 0.18 mm



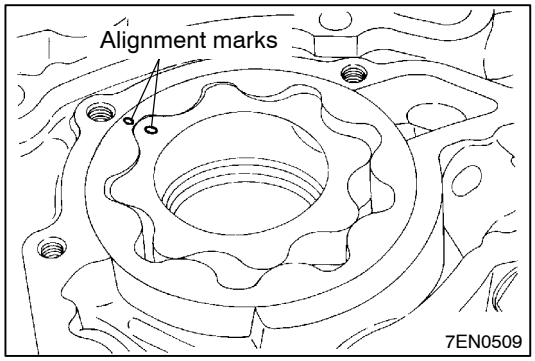
(2) Check for side clearance.

Standard value: 0.04 - 0.10 mm



(3) Check for body clearance.

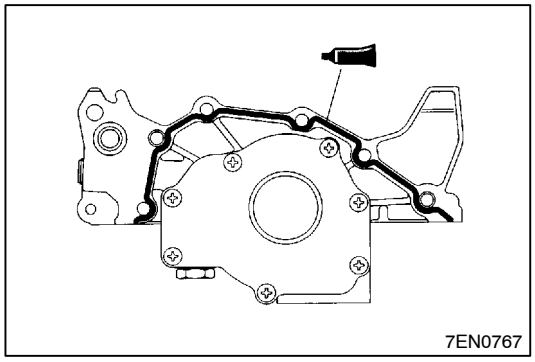
Standard value: 0.10 - 0.18 mm
Limit: 0.35 mm



INSTALLATION SERVICE POINTS

▶A◀ OIL PUMP INNER AND OUTER ROTORS

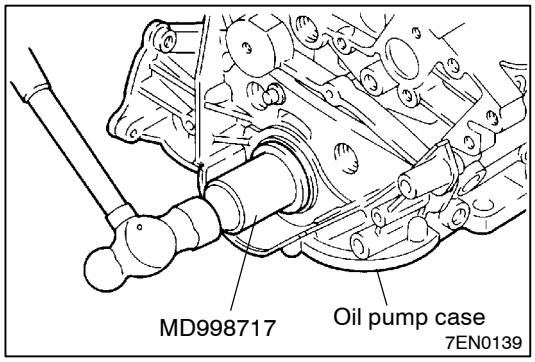
(1) Install the oil pump outer rotor in the proper direction using the setting mark drawn on it before disassembly. Apply engine oil over the entire rotor surface.

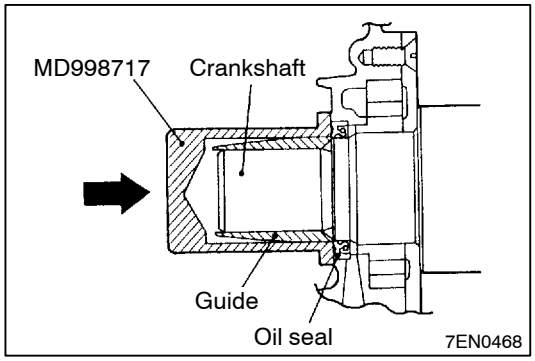


▶B◀ OIL PUMP CASE

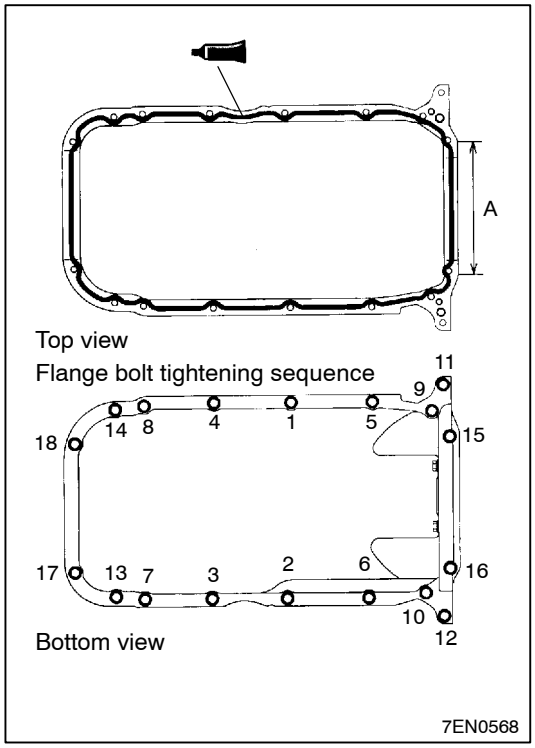
(1) Remove the old liquid gasket from the cylinder block (oil pump mounting surface) and from the oil pump.
(2) Squeeze out about 3 mm of liquid gasket (FIPG) and coat the coating surface with it.

Specified sealant:
MITSUBISHI GENUINE Part No. MD970389 or equivalent





▶C◀ OIL SEAL



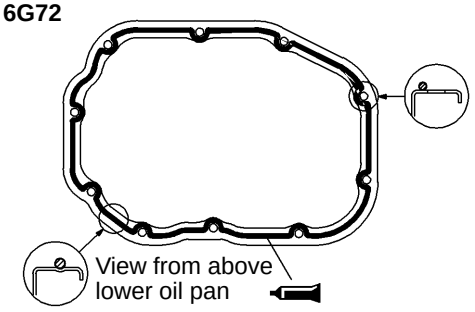
▶D◀ OIL PAN (UPPER)

(1) Clean the gasket coating surfaces of the cylinder block and the oil pan upper.
(2) Squeeze out a 4 mm bead of liquid gasket and coat the coating surface with it.

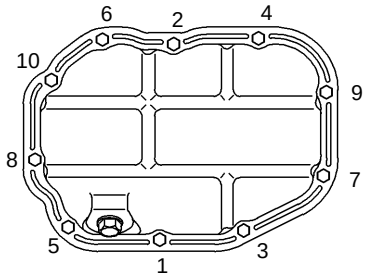
NOTE
During attachment of the oil pan upper, the sealer must not be expelled from the flange portion of the oil pan for distance A as shown.

Liquid gasket:
MITSUBISHI GENUINE Part No. MD970389 or equivalent

6G72



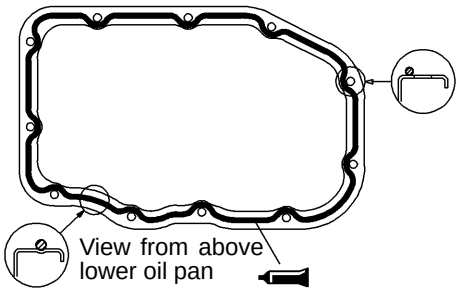
Flange bolt tightening sequence



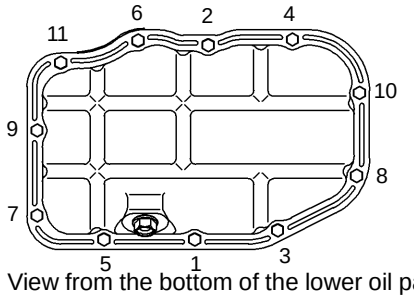
View from the bottom of the lower oil pan

7EN1205

6G74



Flange bolt tightening sequence



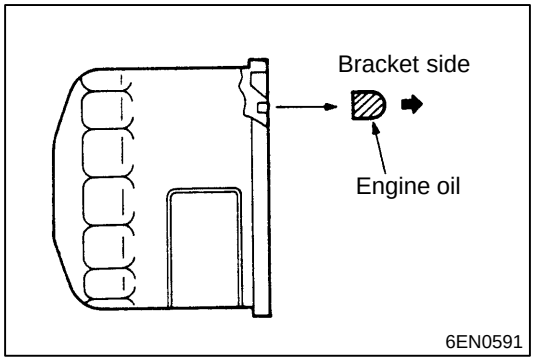
View from the bottom of the lower oil pan

7EN1598

▶E◀ OIL PAN (LOWER)

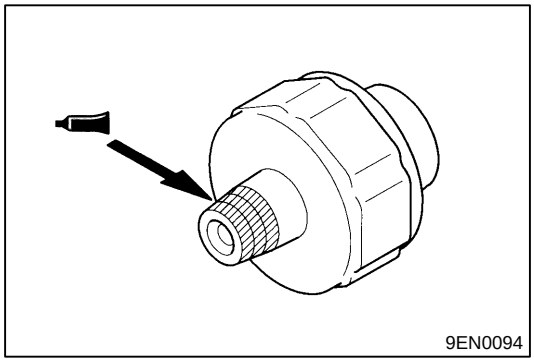
(1) Clean the gasket coating surfaces of the oil pan upper and the oil pan lower.
(2) Squeeze out a 4 mm bead of liquid gasket on the coating surfaces.

Liquid gasket:
MITSUBISHI GENUINE Part No. MD970389 or equivalent



▶F◀ OIL FILTER

(1) Clean the oil filter attaching surface on the side of the cylinder block.
(2) Apply engine oil to the O-ring for the oil filter.
(3) Screw in the oil filter until its O-ring contacts the oil filter attaching surface. Then tighten it further by about one turn (at approx. 14 Nm).



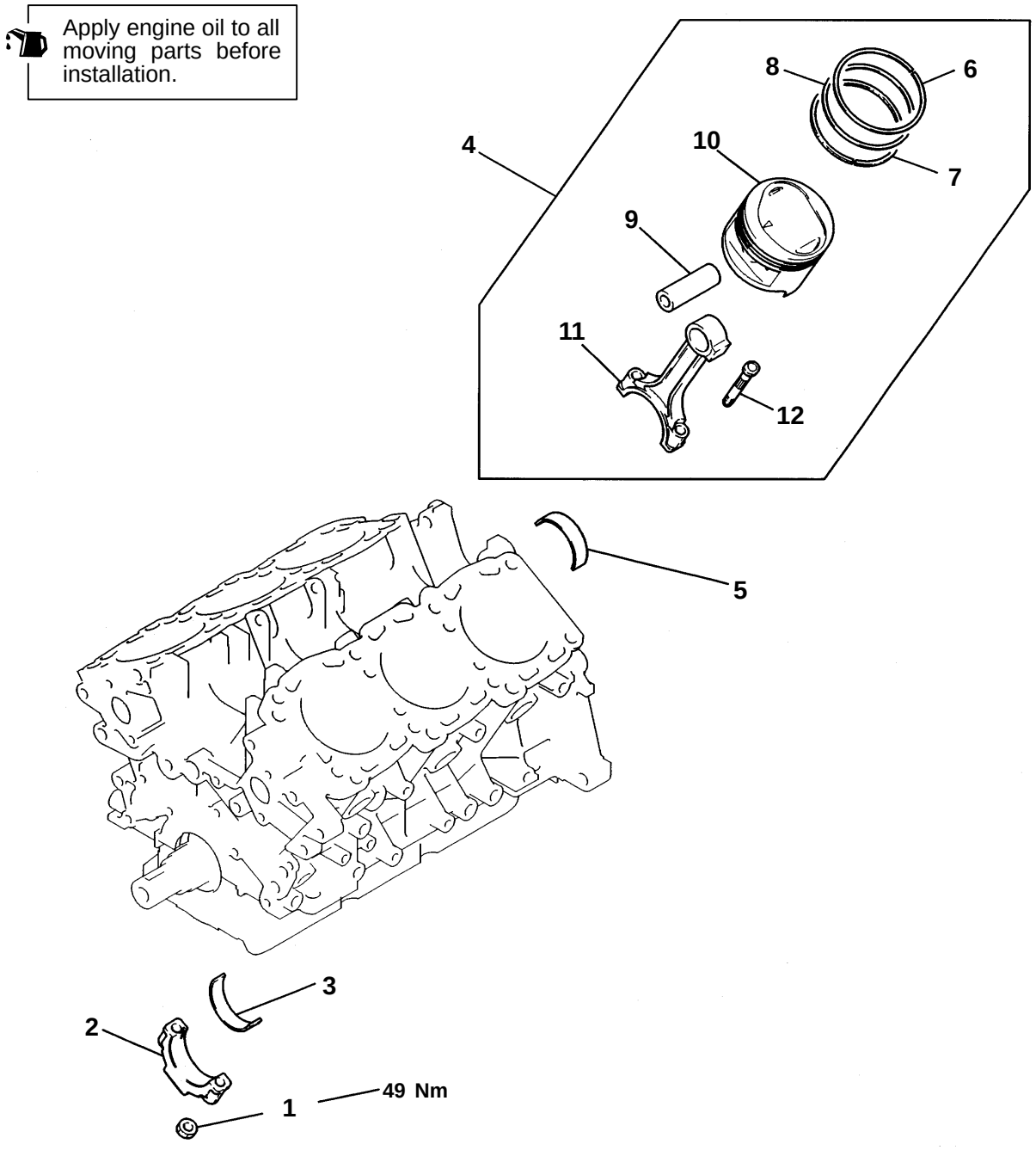
▶G◀ OIL PRESSURE SWITCH

Sealant: 3M ATD Part No. 8660 or equivalent

NOTE
- Sealant must not extend beyond the tip of the thread portion.
- Do not overtighten the switch.

12. PISTON AND CONNECTING ROD

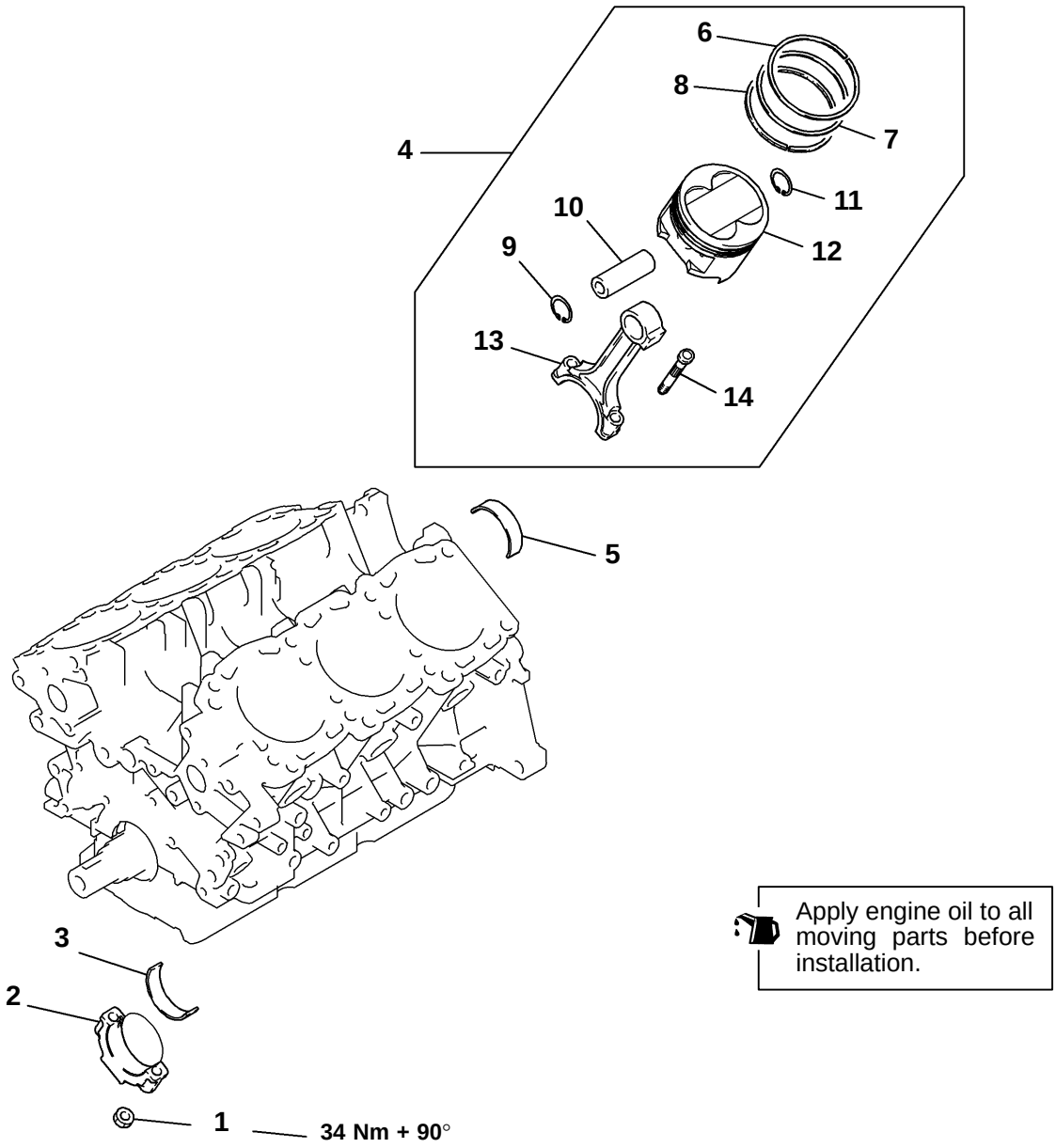
REMOVAL AND INSTALLATION (6G72)



Removal steps

- 1. Connecting rod cap nut
- ◀A▶ ▶G◀ 2. Connecting rod cap
- ▶E◀ 3. Connecting rod bearing, lower
- ▶F◀ 4. Piston and connecting rod assembly
- ▶E◀ 5. Connecting rod bearing, upper
- ▶D◀ 6. Piston ring No. 1
- ▶D◀ 7. Piston ring No. 2
- ▶C◀ 8. Oil ring
- ◀B▶ ▶A◀ 9. Piston pin
- 10. Piston
- 11. Connecting rod
- 12. Connecting rod cap bolt

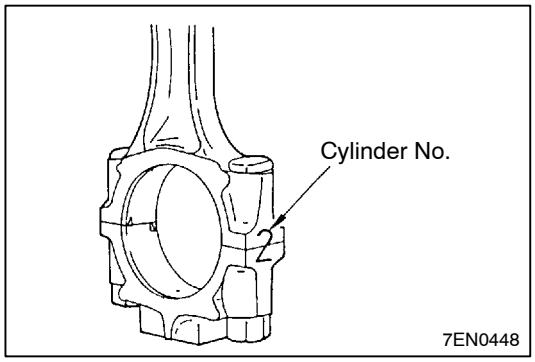
REMOVAL AND INSTALLATION (6G74)



Removal steps

◀A▶ ▶H◀ 1. Connecting rod cap nut
▶G◀ 2. Connecting rod cap
▶E◀ 3. Connecting rod bearing, lower
▶F◀ 4. Piston and connecting rod assembly
▶E◀ 5. Connecting rod bearing, upper
▶D◀ 6. Piston ring No. 1
▶D◀ 7. Piston ring No. 2
▶C◀ 8. Oil ring
▶B◀ 9. Snap ring
◀C▶ ▶B◀ 10. Piston pin
▶B◀ 11. Snap ring
12. Piston
13. Connecting rod
14. Bolt

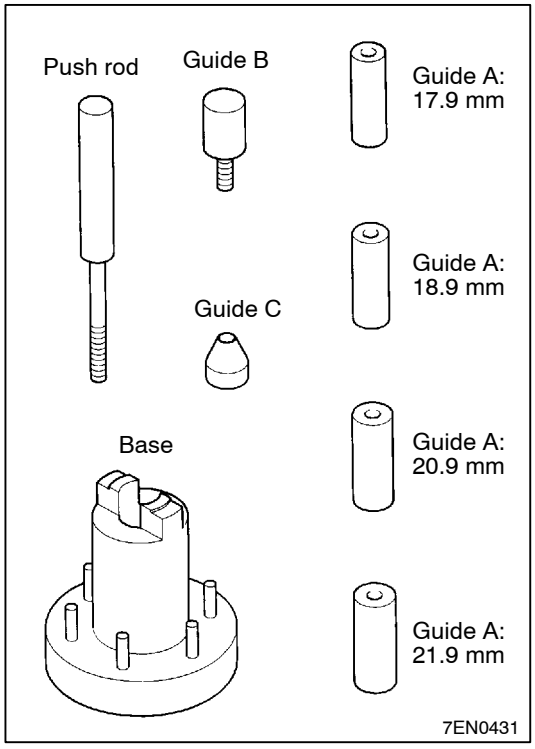
Intentionally blank



REMOVAL SERVICE POINTS

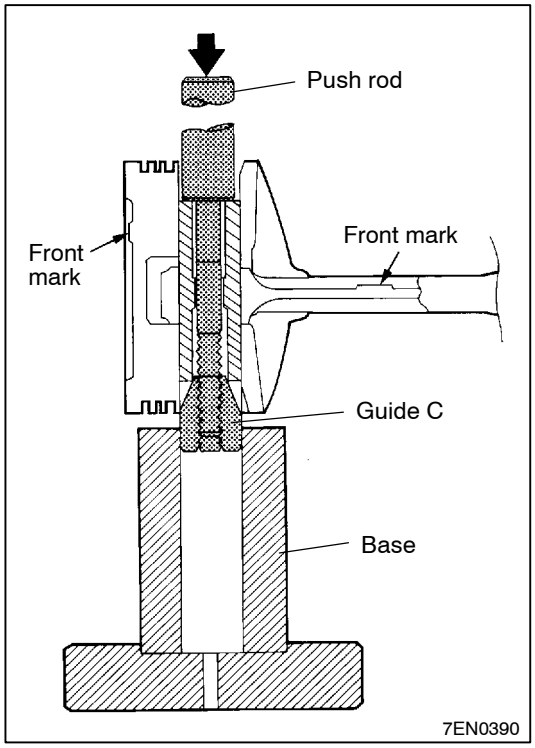
◀A▶ CONNECTING ROD CAP

(1) Enter the cylinder No. on the side of the large end of the connecting rod to facilitate reassembly.



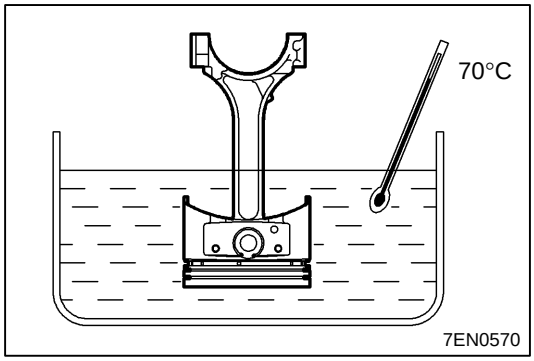
◀B▶ PISTON PIN

The special piston pin setting tool (MD998780) consists of the parts shown at left.



(1) Insert the special push rod tool from the front marked (arrow) side of the piston side and attach guide C.
(2) Set the piston and connecting rod assembly to the special tool piston pin setting base such that the front mark on the piston faces upward.
(3) Pull out the piston pin with a press.

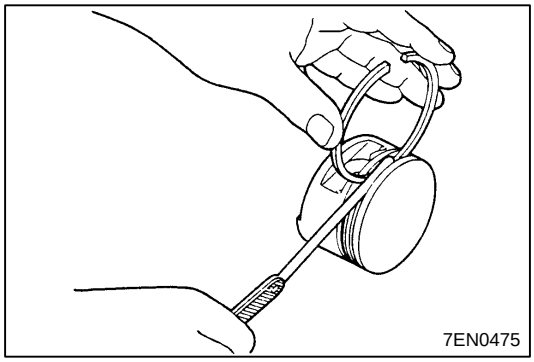
NOTE
After pulling out the piston pin, place the piston, the piston pin, and the connecting rod in order for each cylinder number.



◀C▶ PISTON PIN

(1) Remove the snap rings.
(2) Heat the piston to approximately 70°C and remove the piston pin.

Caution
- **The piston pin fits tightly in the piston at normal temperature. Be sure to heat the piston to remove the piston pin. Be careful not to get scalded.**



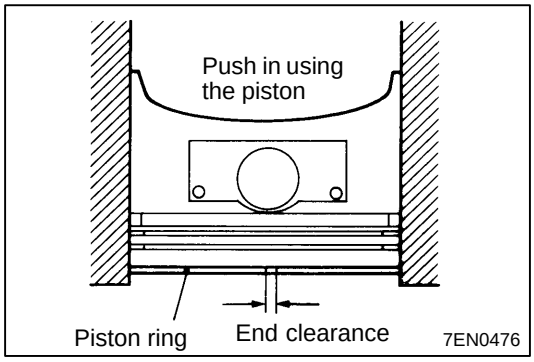
INSPECTION

PISTON RING

(1) Check the clearance between the piston ring and the ring groove. If it exceeds the specified limit, change the ring or the piston and piston ring.

Standard values:
No. 1 0.03 – 0.07 mm
No. 2 0.02 – 0.06 mm

Limit: 0.1 mm



(2) Place the piston ring in the cylinder bore, push it in by the piston head, and make sure it is square against the cylinder wall.
Then measure the clearance at the ring ends with a thickness gauge.
Change the piston ring if the clearance is excessive.

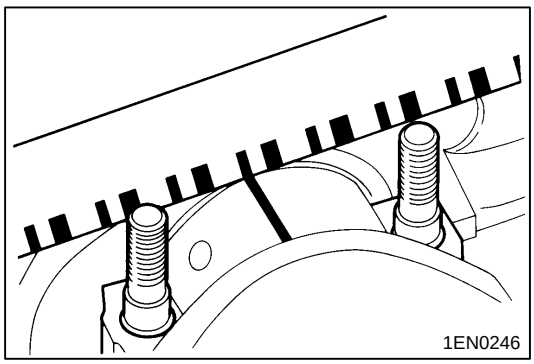
Standard values:
No. 1 0.30 – 0.45 mm
No. 2 0.45 – 0.60 mm
Oil 0.20 – 0.60 mm (6G72)
0.10 – 0.35 mm (6G74)

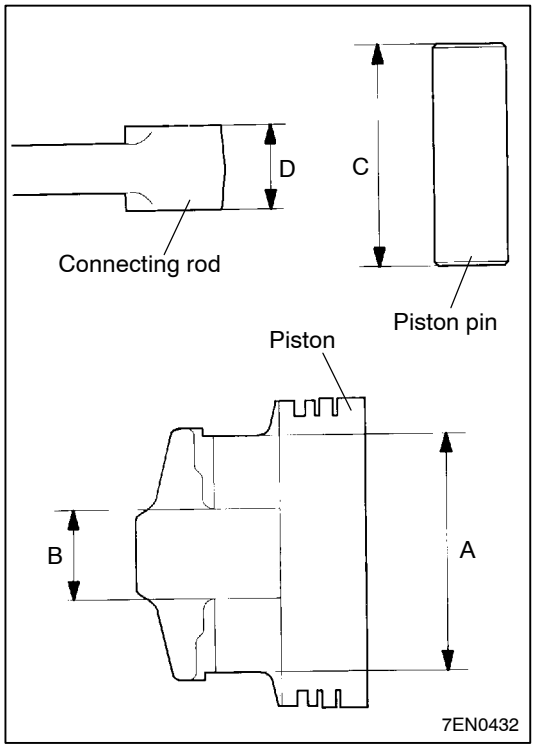
Limit: No. 1 0.8 mm
No. 2 0.8 mm
Oil 1.0 mm

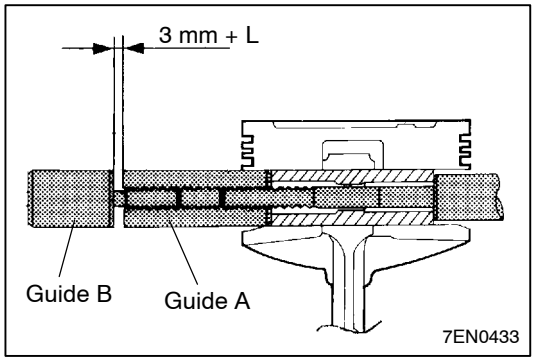
CRANKSHAFT PIN OIL CLEARANCE (PLASTIGAGE METHOD)

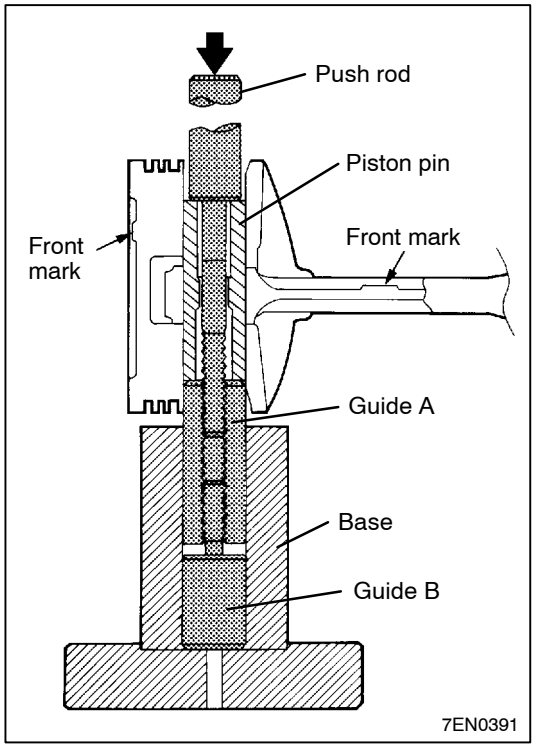
(1) Drain oil from the crankshaft pin and the connecting rod bearing.
(2) Place a piece of Plastigage with the length of the bearing width on the crankshaft pin straight along the pin centre.
(3) Gently place the connecting rod cap on top and tighten the bolt to the specified torque.
(4) Detach the bolt and gently remove the connecting rod cap.
(5) Measure the width of the crushed Plastigage (at the widest point) using the scale printed on the Plastigage package.

Standard value: 0.02 – 0.05 mm
Limit: 0.1 mm









INSTALLATION SERVICE POINTS

▶A◀ PISTON PIN

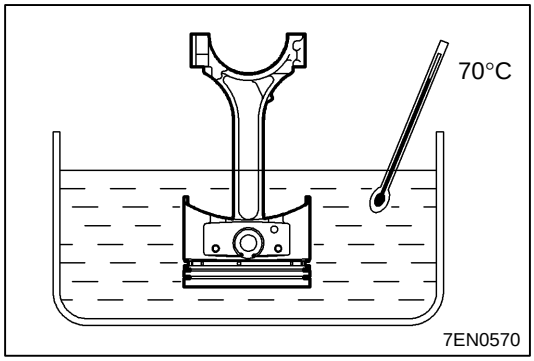
(1) Measure the dimensions of the following parts and portions:
- A: Piston pin mounting portion
- B: Distance between piston bosses
- C: Piston pin
- D: Connecting rod

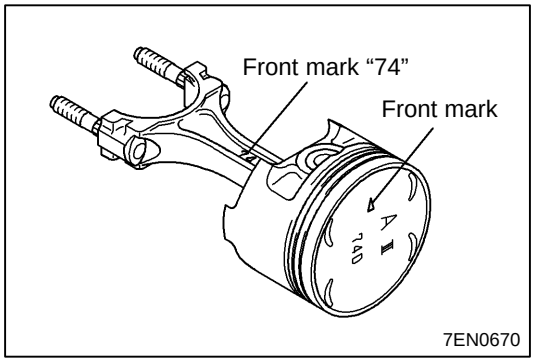
(2) Calculate by substituting each measured value into the following equation:

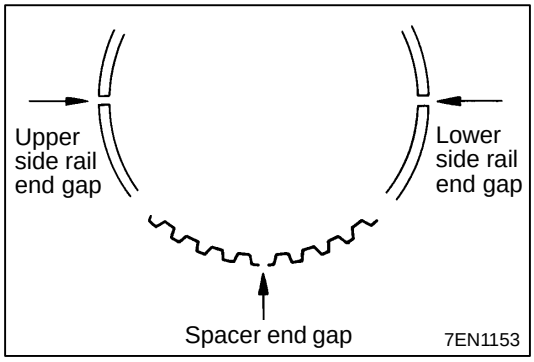
$$L = \frac{(A - C) - (B - D)}{2}$$

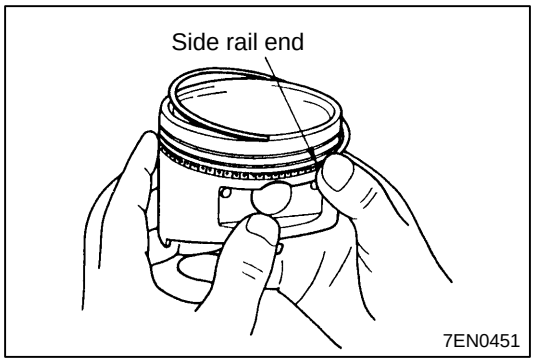
(3) Insert the special push rod tool into the piston pin and attach guide A to it.
(4) Combine the piston and the connecting rod, matching their front marks.
(5) Apply engine oil to the outer periphery of the piston pin.
(6) Insert the side of the piston pin guide A attached per Step (3) into the pin hole from the side of the piston containing the front mark.
(7) Screw guide B into guide A until they are distance L (obtained per Step (2) above) plus 3 mm apart as shown.
(8) Use special tools to set the piston pin to a special tool piston setting base with the front mark of the piston facing up.
(9) Press fit the piston pin with a press. When the load required for press fitting the piston pin is below the standard value, change the piston pin (piston assembly) or the connecting rod or both.

Standard values: 7,350 - 17,200 N









▶B◀ SNAP RING / PISTON PIN

(1) Fit one snap ring with its shear droop end toward inside.
(2) Heat the piston to approximately 70°C.
(3) Align the front marks on the connecting rod and piston on the same side. Then, fit the piston pin in through the connecting rod and piston.
(4) After the piston pin is fitted, install the other snap ring with its shear droop end toward inside.

Caution
- **Apply a sufficient amount of engine oil to the outer surface of the piston pin and the small end hole of the connecting rod.**
- **The piston pin fits tightly in the piston at normal temperature. Be sure to heat the piston to insert the piston pin. Be careful not to get scalded.**

▶C◀ OIL RING

(1) Fit the oil ring spacer in the piston ring groove. Fit the upper side rail, then the lower side rail.

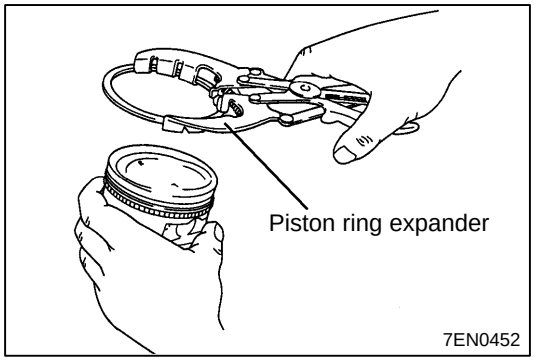
NOTE
- Be sure to locate the end gaps of the side rails and spacer as shown in the illustration.
- New spacer and side rails have size identification colors.

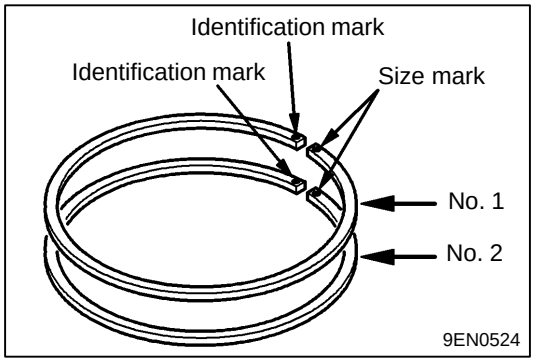
Size	Identification color
S.T.D.	None
0.50 mm O.S.	Blue
1.00 mm O.S.	Yellow

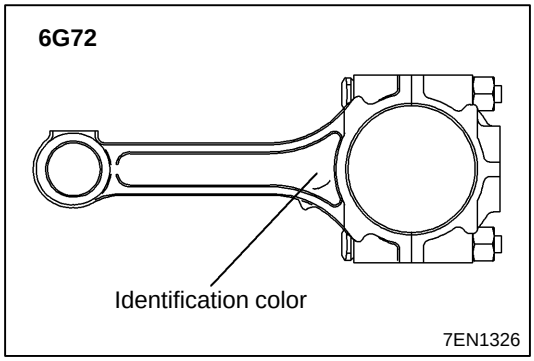
(2) The side rail can be inserted easily into the piston groove by first inserting one end and then pushing the rail into place while turning it by hand as shown.

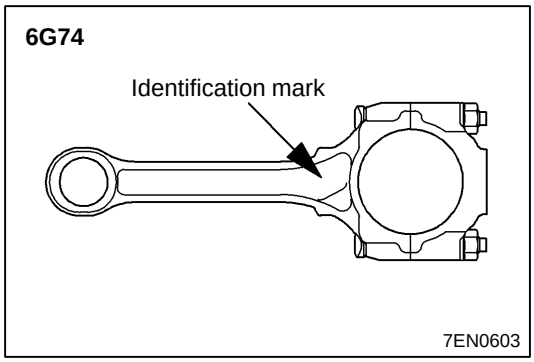
Caution
- **The side rail may break if a ring expander is used.**

(3) After installation into the piston, make sure the side rail turns smoothly in either direction.









▶D◀ PISTON RING NO. 2 / PISTON RING NO. 1

(1) Using a piston ring expander, install the piston rings with their identification marks facing upward.

	Piston ring No.1 identification mark	Piston ring No.2 identification mark
6G72	T	T2
6G74	1T	2T

NOTE
The piston rings have stamped size marks.

Size	Size mark
S.T.D.	(None)
0.50 mm O.S.	50
1.00 mm O.S.	100

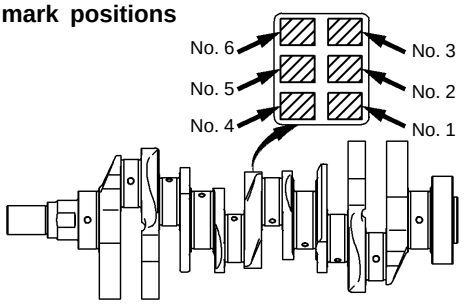
▶E◀ CONNECTING ROD BEARINGS, UPPER AND LOWER

(1) When connecting rod bearings, connecting rod or crankshaft is to be replaced, select the proper connecting rod bearings according to the crankshaft and connecting rod identification marks/colors.

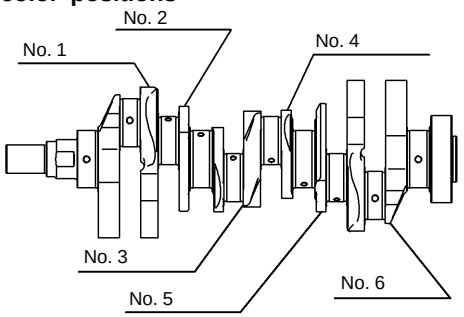
6G72

Crankshaft			Connecting rod identification color	Bearing identification color
Identification mark		Pin O.D. mm		
Production part	Service part			
None	I	49.995 – 50.000	White	Yellow
			None	Yellow
			Yellow	None
None	II	49.985 – 49.995	White	Yellow
			None	None
			Yellow	Blue
None	III	49.980 – 49.986	White	None
			None	Blue
			Yellow	Blue

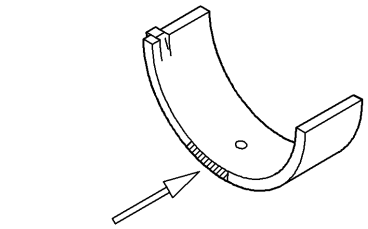
6G72 crankshaft identification mark positions



6G74 crankshaft identification color positions



7EN1400



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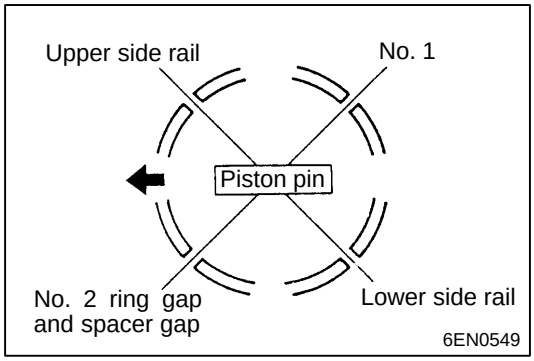
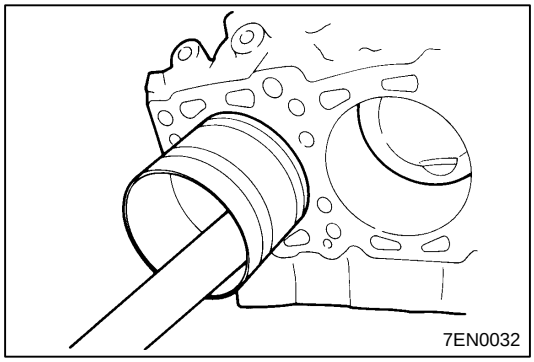
6G74

Crankshaft			Connecting rod identification color	Bearing identification color
Identification color		Pin O.D. mm		
Production part	Service part			
None	Yellow	54.994 – 55.000	0	Pink
			1	Red
			2	Green
None	None	54.988 – 54.994	0	Red
			1	Green
			2	Black
None	White	54.982 – 54.988	0	Green
			1	Black
			2	Brown

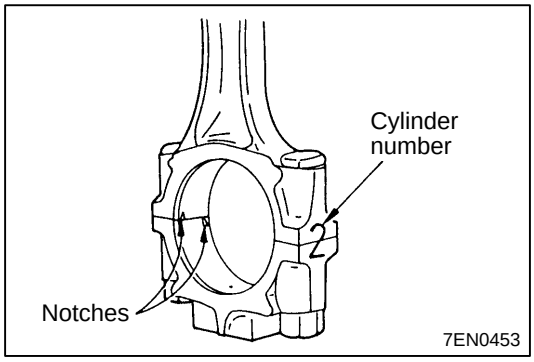




▶F◀ PISTON AND CONNECTING ROD

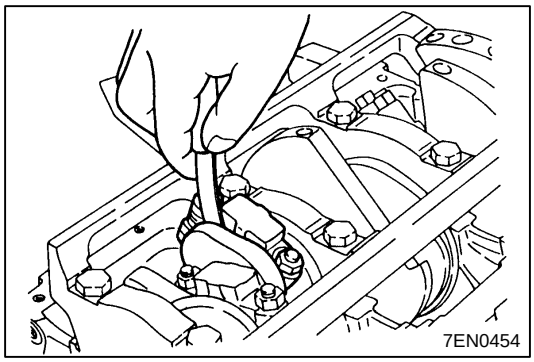
(1) Liberally coat the circumference of the piston, piston ring, and oil ring with engine oil.
(2) Arrange the piston ring and oil ring gaps (side rail and spacer) as shown in the figure.
(3) Rotate the crankshaft so that the crank pin is positioned at the centre line of the cylinder bore.
(4) Use suitable thread protectors on connecting rod bolts before inserting piston and connecting rod assembly into cylinder block.
Care must be taken not to nick crank pin.
(5) Using a suitable piston ring compressor, install piston and connecting rod assembly into cylinder block.

Caution
- **Install the piston with the front mark (arrow mark) on the top of the piston facing towards the engine front (timing belt side).**



▶G◀ CONNECTING ROD CAP

(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.

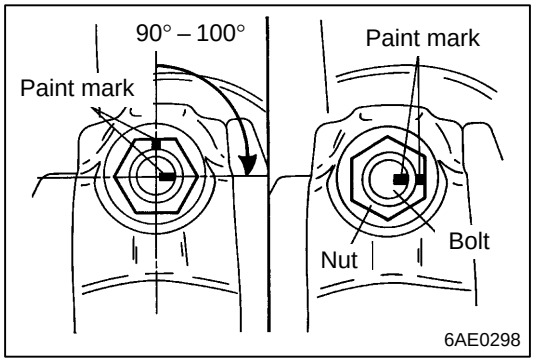


(2) Check if the thrust clearance in the connecting rod big end is correct.

Standard value: 0.10 – 0.25 mm
Limit: 0.4 mm

▶H◀ CONNECTING ROD CAP NUT

(1) The plastic area tightening method is used for tightening connecting rod bolts and nuts. If a bolt is reused, check the bolt for elongation by screwing the nut down through the bolt. If the nut does not reach the last thread of the bolt, replace the bolt.
(2) Before installing the nut, apply a thin coat of engine oil to its threads and bearing surface.
(3) Install the nut on each bolt finger-tight.

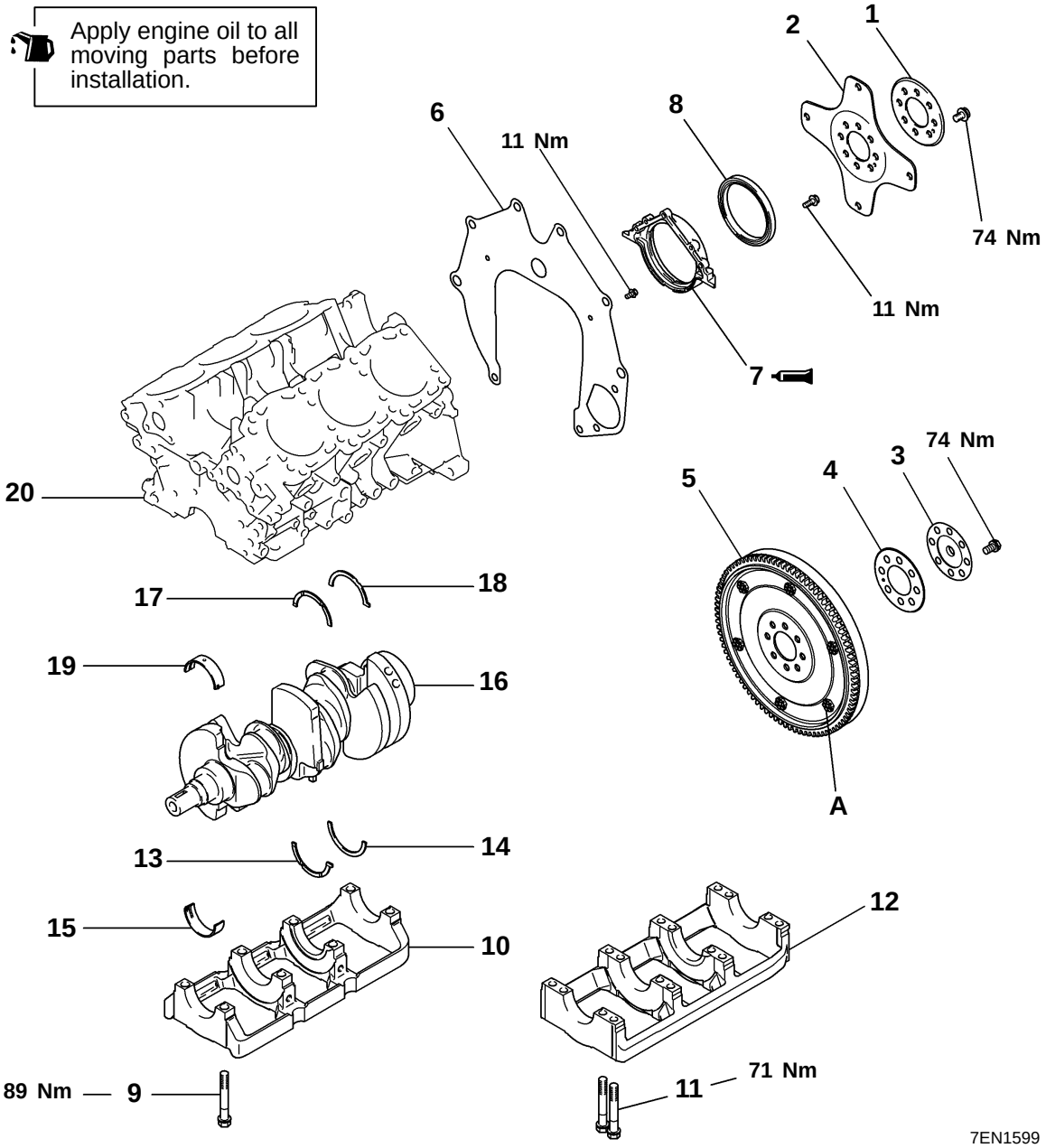


(4) To fit the bearing cap properly, tighten the nuts alternately step by step to a torque of 34 Nm.
(5) Provide a paint mark on the head of each nut.
(6) Using the paint mark on the nut as reference point, provide a paint mark on the bolt in the position corresponding to a 90° turn of the nut.
(7) Turn the nut through 90° to align the paint marks on the bolt and nut.

Caution
- **If the tightening angle is shorter than 90°, sufficient clamping force cannot be obtained.**
- **If the tightening angle exceeds 100°, loosen the nut completely and repeat the above procedure from the beginning.**

13. CRANKSHAFT, FLYWHEEL AND DRIVE PLATE

REMOVAL AND INSTALLATION



Removal steps

1. Adaptor plate
2. Drive plate
3. Plate
4. Adaptor plate
5. Flywheel
6. Rear plate
- ▶D◀ 7. Oil seal case
- ▶C◀ 8. Oil seal
- ▶B◀ 9. Bearing cap bolt (6G72)
- ▶B◀ 10. Bearing cap (6G72)
- ▶B◀ 11. Bearing cap bolt (6G74)
- ▶B◀ 12. Bearing cap (6G74)
- ▶A◀ 13. Thrust bearing (A)
- ▶A◀ 14. Thrust bearing (B)
- ▶A◀ 15. Crankshaft bearing (lower)

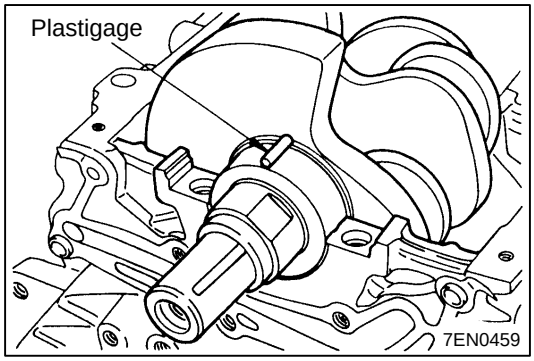
16. Crankshaft
- ▶A◀ 17. Thrust bearing (B)

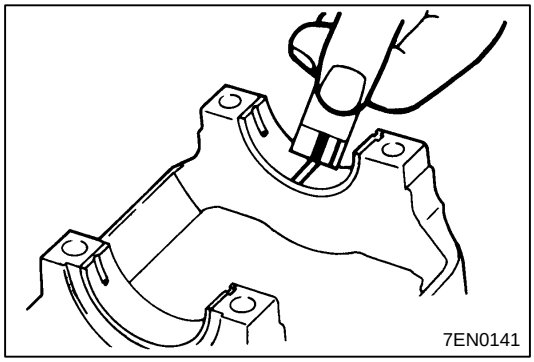
18. Thrust bearing (A)
19. Crankshaft bearing (upper)
20. Cylinder block

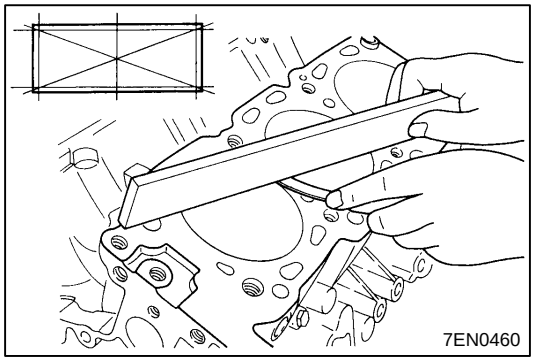
Caution

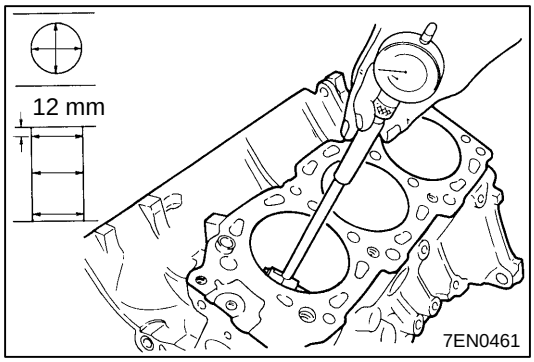
On the flexible wheel equipped engines, do not remove any of the bolts "A" of the flywheel shown in the illustration.

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









INSPECTION

CRANKSHAFT OIL CLEARANCE (PLASTIGAGE METHOD)

NOTE
If the oil clearance exceeds the limit, replace the bearing, and crankshaft if necessary.

This crankshaft oil clearance can be measured easily by using a plastic gauge, as follows:

① Remove oil, grease and any other foreign material from crankshaft journal and bearing inner surface.
② Install the crankshaft.
③ Cut the Plastigage to the same length as the width of bearing and place it on 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 crushed Plastigage at its widest section by using a scale printed on the Plastigage package.

Standard values: 0.02 – 0.04 mm
Limit: 0.1 mm

CYLINDER BLOCK

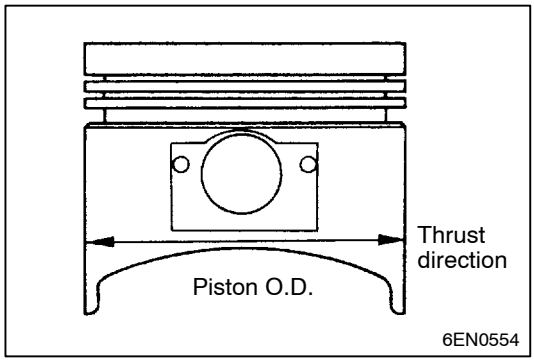
(1) Visually check for scratches, rust and corrosion. Also use flaw detecting agents and the like to check for cracks. If there are any defects, rectify the cylinder block.
(2) Measure the flatness of the cylinder block top surface with a straight edge and a thickness gauge. During measurement, the cylinder block top surface must be free from gasket pieces and the like.

Standard values: 0.05 mm
Limit: 0.1 mm

(3) Check for scratches or seizure of the cylinder wall. If there are any defects, correct (bore it a oversize) or change the cylinder block.
(4) Measure the inside diameter and the ovality of the cylinder. If the cylinder is overly worn, correct it to a larger size and change the pistons and the piston rings.

Standard value:

Cylinder inside diameter	**91.1 mm (6G72)**
Ovality: 0.01 mm	**93.0 mm (6G74)**



BORING CYLINDER

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

Piston size identification

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

NOTE
Size mark is stamped on the piston top.

(2) Measure outside diameter of piston to be used. Measure it in thrust direction as shown.

(3) Based on the measured piston O.D., calculate the boring finish dimension.

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

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

Caution

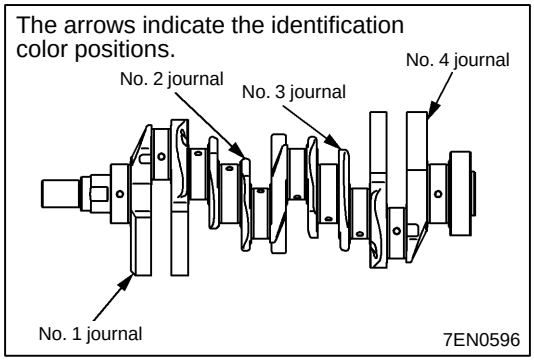
- **To prevent distortion that may result from temperature rise during honing, bore cylinders, in the order of No. 1, No. 2, No. 3, No. 4, No. 5 and No. 6.**

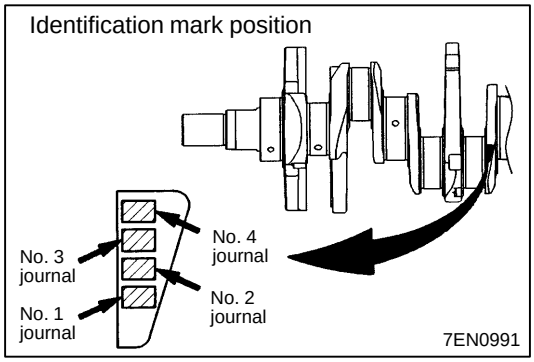
(5) Hone to the final finish dimension (Piston O.D. + clearance between piston O.D. and cylinder.)

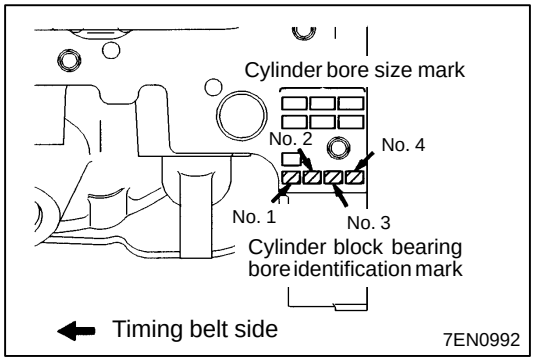
(6) Check the clearance between piston and cylinder.

Clearance between piston and cylinder:
0.02 - 0.04 mm

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







INSTALLATION SERVICE POINTS

▶A◀ CRANKSHAFT BEARING

When bearing replacement is required, select and install the correct bearing by the following procedure.

(1) Measure the crankshaft journal diameter and confirm its classification from the following table. In the case of a crankshaft supplied as a service part, identification colours/marks of its journals are painted/stamped at the positions shown in the illustration.

(2) The cylinder block bearing bore diameter identification marks are stamped at the position shown in the illustration from left to right, beginning at No. 1.

6G72

Combination of crankshaft journal diameter and cylinder block bearing bore diameter					Bearing identification color or identification mark (for service part)
Crankshaft journal				Cylinder block bearing bore diameter identification mark	
Classification	Identification color or identification mark		O.D. mm		
	Production part	Service part			
1	None	Yellow, 0	59.994 – 60.000	I	Pink, 1
				II	Red, 2
				III	Green, 3
2	None	None, 1	59.988 – 59.994	I	Red, 2
				II	Green, 3
				III	Black, 4
3	None	White, 2	59.982 – 59.988	I	Green, 3
				II	Black, 4
				III	Brown, 5

6G74

Combination of crankshaft journal diameter and cylinder block bearing bore diameter					Bearing identification color (for service part)
Crankshaft journal				Cylinder block bearing bore diameter identification mark	
Classification	Identification color		O.D. mm		
	Production part	Service part			
1	None	Yellow	63.994 – 64.000	I	Pink
				II	Red
				III	Green
2	None	None	63.998 – 63.994	I	Red
				II	Green
				III	Black
3	None	White	63.982 – 63.988	I	Green
				II	Black
				III	Brown

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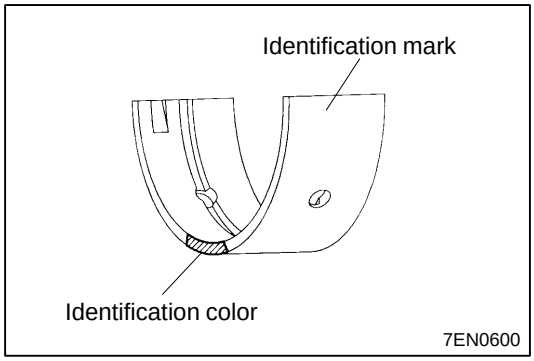
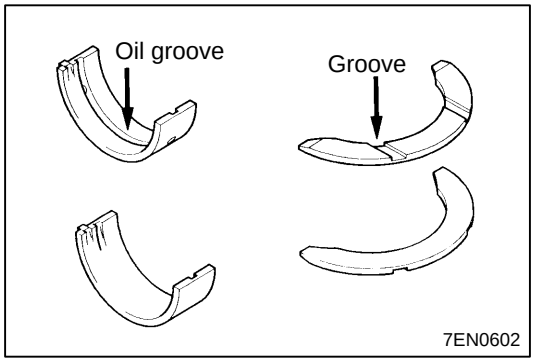




(3) Select the correct bearing from the above table on the basis of the identification data confirmed at steps 1 and 2.

(Example of bearing selection – 6G72)

① If the measured diameter of a crankshaft journal is 59.996 mm, Classification 1 applies.

② Then, if the cylinder block bearing bore diameter identification mark is I, select the bearing with identification mark “1” or identification color “Pink”.

(4) Install the bearing halves with oil groove on the cylinder block side.

(5) Install the bearing halves without oil groove on the bearing cap side.

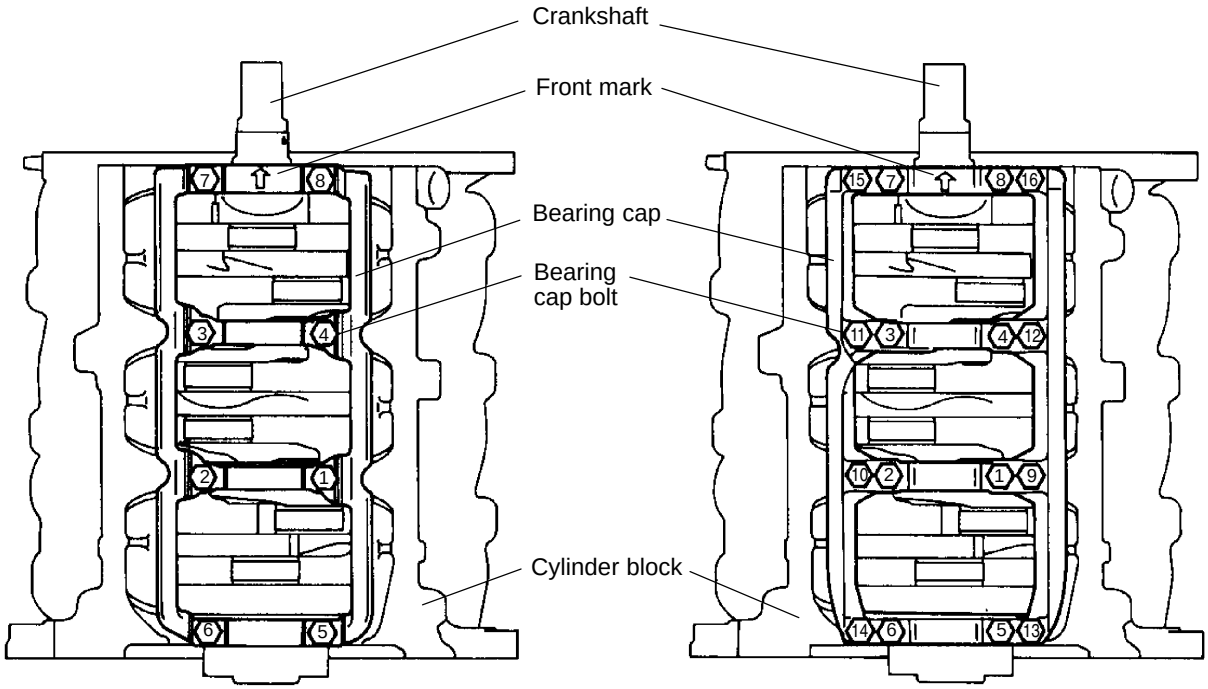
(6) Install the thrust bearings on both sides of the No. 3 bearing with the grooves facing outward.

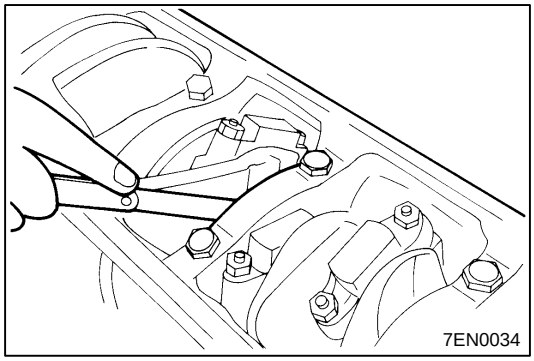
▶B◀ BEARING CAP / BEARING BOLT

(1) Attach the bearing cap on the cylinder block as shown in the figure.

(2) Tighten the bearing cap bolts to the specified torque in the sequence shown in the figure.

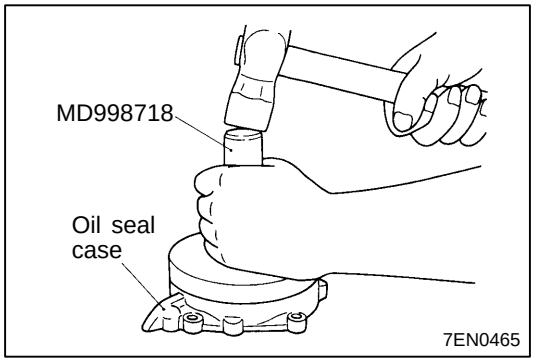
(3) Check that the crankshaft rotates smoothly.





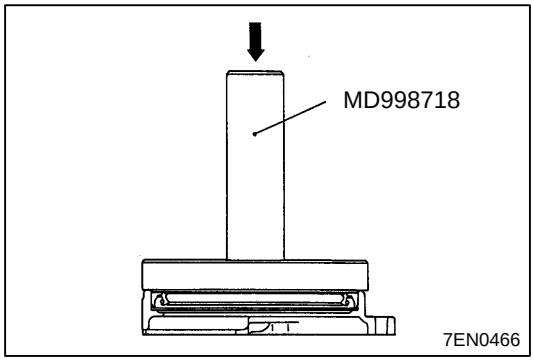
(4) Check the end play. If it exceeds the limit, replace the thrust bearing.

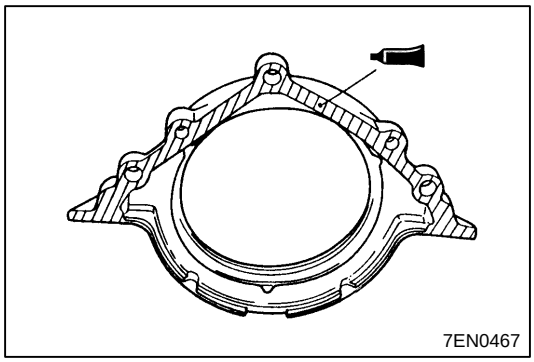
Standard value: 0.05 – 0.25 mm
Limit: 0.3 mm



▶C◀ CRANKSHAFT REAR OIL SEAL

(1) Using the Special Tool, press-fit a new crankshaft rear oil seal into the seal case.





▶D◀ OIL SEAL CASE

(1) Squeeze out a 3 mm bead of liquid gasket (FIPG) and apply it to the coating surface.

Liquid gasket:
MITSUBISHI GENUINE Part No. MD970389

NOTES