
ENGINE

6G7 SERIES

<From 2002>

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NOTES

GENERAL INFORMATION**6G72**

Descriptions			6G72 12-valve	6G72 24-valve
Type			60° OHV, SOHC	60° OHV, DOHC
Number of cylinders			6	6
Combustion chamber			Compact type	Pentroof type
Total displacement dm ³			2,972	2,972
Cylinder bore mm			91.1	91.1
Piston stroke mm			76.0	76.0
Compression ratio			8.9	9.0
Valve timing	Intake valve	Opens (BTDC)	19°	19°
		Closes (ABDC)	59°	45°
	Exhaust valve	Opens (BBDC)	59°	49°
		Closes (ATDC)	19°	15°
Lubrication system			Pressure feed, full-flow filtration	Pressure feed, full-flow filtration
Oil pump type			Trochoid type	Trochoid type
Cooling system			Water-cooled forced circulation	Water-cooled forced circulation
Water pump type			Centrifugal impeller type	Centrifugal impeller type

6G74

Descriptions			6G74 24-valve	6G74 24-valve-GDI
Type			60° OHV, SOHC	60° OHV, DOHC
Number of cylinders			6	6
Combustion chamber			Pentroof type	Pentroof+curved top piston type
Total displacement dm ³			3,497	3,497
Cylinder bore mm			93.0	93.0
Piston stroke mm			85.8	85.8
Compression ratio			9.0	10.4
Valve timing	Intake valve	Opens (BTDC)	13°	8°*1, 12°*2
		Closes (ABDC)	55°	52°*1, 48°*2
	Exhaust valve	Opens (BBDC)	51°	52°*1, 48°*2
		Closes (ATDC)	17°	8°*1, 12°*2
Lubrication system			Pressure feed, full-flow filtration	Pressure feed, full-flow filtration
Oil pump type			Trochoid type	Trochoid type
Cooling system			Water-cooled forced circulation	Water-cooled forced circulation
Water pump type			Centrifugal impeller type	Centrifugal impeller type

*1: For Europe

*2: For Hong Kong

1. SPECIFICATIONS

SERVICE SPECIFICATIONS

Item		Standard	Limit	
Timing belt				
Auto-tensioner rod length mm	Except PAJERO (V63W, V73W)	3.8–4.5	–	
	PAJERO (V63W, V73W)	4.8–5.5	–	
Auto-tensioner rod projection length mm		12	–	
Auto-tensioner rod pushed-in amount (when pushed with a force of 98–196N) mm		1.0 or less	–	
Rocker arms and camshaft				
Camshaft cam height mm	SOHC	Intake	37.58	37.08
		Exhaust	36.95	36.45
	GDI	Intake	35.20* ¹ , 34.85* ²	34.70* ¹ , 34.35* ²
		Exhaust	34.91	34.41
Camshaft journal outside diameter mm	12-valve	34.5	–	
	24-valve	45	–	
	GDI	26	–	
Cylinder head and valves				
Cylinder head Flatness of gasket surface mm	12-valve	Less than 0.05	0.2	
	24-valve, GDI	Less than 0.03	0.2	
Cylinder head grinding limit of gasket surface (including grinding of cylinder block gasket surface) mm		–	0.2	
Cylinder head overall height mm	12-valve	84	–	
	24-valve	120	–	
	GDI	132	–	
Valve thickness of valve head (margin) mm	12-valve	Intake	1.2	0.7
		Exhaust	2.0	1.5
	24-valve	Intake	1.0	0.5
		Exhaust	1.2	0.7
	GDI	Intake	1.0	0.5
		Exhaust	1.5	1.0
Valve overall height mm	12-valve	Intake	102.97	102.47
		Exhaust	102.67	102.17
	24-valve	Intake	112.30	111.80
		Exhaust	114.11	113.61
	GDI	Intake	102.28	101.78
		Exhaust	101.40	100.90
Valve stem outside diameter mm	12-valve, GDI	6.6	–	
	24-valve	6.0	–	

*1: For Europe

*2: For Hong Kong

Item			Standard	Limit
Valve stem to guide clearance mm	12-valve	Intake	0.03–0.06	0.10
		Exhaust	0.05–0.09	0.15
	24-valve	Intake	0.02–0.05	0.10
		Exhaust	0.04–0.06	0.15
	GDI	Intake	0.02–0.05	0.10
Exhaust		0.04–0.07	0.15	
Valve face angle			43.5°–44°	–
Valve spring free height mm	12-valve		49.8	48.8
	24-valve		51.0	50.0
	GDI		47.2	46.2
Valve spring load/installed height N/mm	12-valve		323/40.4	–
	24-valve		216/44.2	–
	GDI		230/37.9	–
Valve spring out of squareness			2° or less	4°
Valve seat contact width mm			0.9–1.3	–
Valve guide internal diameter mm	12-valve, GDI		6.6	–
	24-valve		6.0	–
Valve guide projection mm			14.0	–
Valve stem projection mm	12-valve		41.65	42.15
	24-valve		49.30	49.80
	GDI	Intake	47.10	47.60
		Exhaust	46.60	47.10
Oil pump and oil pan				
Oil pump tip clearance mm			0.03–0.08	–
Oil pump side clearance mm			0.04–0.10	–
Oil pump body clearance mm			0.10–0.18	0.35
Pistons and connecting rods				
Piston outside diameter mm	6G72		91.1	–
	6G74		93.0	–
Piston ring side clearance mm	No.1 ring		0.03–0.07	–
	No. 2 ring		0.02–0.06	–
Piston ring out gap clearance mm	No.1 ring		0.30–0.45	0.8
	No. 2 ring		0.45–0.60	0.8
	Oil ring		0.10–0.35	1.0
Piston pin O.D. mm			22.0	–
Piston pin press-in load (at room temperature) N			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

Item		Standard	Limit
Crankshaft, flywheel and drive plate			
Crankshaft end play mm		0.05–0.25	0.4
Crankshaft journal outside diameter mm	6G72	60.0	–
	6G74	64.0	–
Crankshaft pin outside diameter mm	6G72	50.0	–
	6G74	55.0	–
Crankshaft journal oil clearance mm		0.02–0.05	0.1
Piston to cylinder clearance mm	6G72	0.02–0.04	0.1
	6G74	0.03–0.05	0.1
Cylinder block flatness of gasket surface mm		0.05	0.1
Cylinder block grinding limit of gasket surface mm (Total resurfacing depth of both cylinder head and cylinder block)		–	0.2
Cylinder block overall height mm	6G72	210	–
	6G74	228	–
Cylinder bore inside diameter mm	6G72	91.1	–
	6G74	93.0	–
Cylinder block cylindricality mm		0.01	–

REWORK DIMENSIONS

Item			Standard	Limit	
Cylinder head and valves					
Cylinder head oversize valve guide hole diameter mm	12-valve		0.05 O.S.	13.05–13.07	–
			0.25 O.S.	13.25–13.27	–
			0.50 O.S.	13.50–13.52	–
	24-valve		0.05 O.S.	11.05–11.07	–
			0.25 O.S.	11.25–11.27	–
			0.50 O.S.	11.50–11.52	–
	GDI		0.05 O.S.	12.05–12.07	–
			0.25 O.S.	12.25–12.27	–
			0.50 O.S.	12.50–12.52	–
Oversize valve seat ring hole diameter mm	12-valve	Intake	0.3 O.S.	44.30–44.33	–
			0.6 O.S.	44.60–44.63	–
		Exhaust	0.3 O.S.	38.30–38.33	–
			0.6 O.S.	38.60–38.63	–
	24-valve	Intake	0.3 O.S.	34.30–34.33	–
			0.6 O.S.	34.60–34.63	–
		Exhaust	0.3 O.S.	31.80–31.83	–
			0.6 O.S.	32.10–32.13	–
	GDI	Intake	0.3 O.S.	36.30–36.33	–
			0.6 O.S.	36.60–36.63	–
		Exhaust	0.3 O.S.	33.30–33.33	–
			0.6 O.S.	33.60–33.63	–

TORQUE SPECIFICATIONS

Item	Nm
Alternator	
Accessory mount bolt (M10 x 1.25)	44 ± 10
Accessory mount bolt (M10 x 1.5)	41 ± 8
Accessory mount bolt (M12)	74 ± 9
Accessory mount stay bolt (M8)	24 ± 4
Accessory mount stay bolt (M10)	49 ± 9
Alternator bolt <12-valve>	14 ± 1
Alternator bolt <24-valve> (M8)	23 ± 3
Alternator bolt <24-valve> (M10)	49 ± 5
Alternator nut	23 ± 2
Alternator cover bolt (M6)	10 ± 2
Alternator cover bolt (M8)	13 ± 2
Auto tensioner bolt (Flange)	24 ± 4
Auto tensioner bolt (Washer)	44 ± 10
Cooling fan bolt	11 ± 1
Cooling fan bracket bolt <12-valve> (M8)	42 ± 8
Cooling fan bracket bolt <12-valve> (M10)	75 ± 10
Cooling fan bracket bolt <24-valve>	41 ± 8
Cooling fan pulley bolt	11 ± 1
Crankshaft bolt	185 ± 5
Drive belt tensioner pulley nut	49 ± 10
Engine hanger bolt	17 ± 2
Fan clutch bolt	11 ± 1
Idler pulley bolt	44 ± 10
Tensioner pulley bolt	44 ± 10
Tensioner bracket bolt (Flange)	24 ± 3
Tensioner bracket bolt (M8 washer)	19 ± 3
Tensioner bracket bolt (M10 washer)	42 ± 8
Tensioner bracket stay bolt	24 ± 3
Timing indicator bolt	11 ± 1
Oil filler bolt <12-valve>	9 ± 1
Oil filler bolt <24-valve>	22 ± 4
Power steering pump bracket bolt	44 ± 10
Control and EGR system	
EGR valve bolt <12-valve>	22 ± 4
EGR valve bolt <24-valve>	21 ± 4
EGR pipe bolt	18 ± 2
EGR pipe flare nut	18 ± 2

Item	Nm
Vacuum pipe and hose bolt	10±2
Vacuum pipe and hose bolt	10±2
Solenoid valve bolt	9±1
Intake and ignition system	
Air intake fitting bolt	18±2
Air intake plenum bolt, nut	18±2
Air intake plenum stay bolt (M8)	18±2
Air intake plenum stay bolt (M10)	36±6
Bracket bolt	24±3
Center cover bolt	3.0±0.5
Distributor nut	14±1
Engine hanger bolt	17±2
Ignition coil assembly bolt <12-valve>	24±5
Ignition coil assembly bolt <24-valve for L200>	24±5
Ignition coil assembly bolt <24-valve for except L200>	11±1
Ignition coil bolt <GDI>	10±2
Ignition failure sensor bolt	5±1
Intake manifold nut	22±1
MDP sensor bolt	5±1
Power transistor bolt	18±2
Spark plug	25±5
Throttle body bolt	12±1
Throttle body stay bolt	18±2
Water outlet fitting bracket bolt	14±1
Timing belt	
Alternator stay bolt	25±4
Auto tensioner bolt	23±3
Cam position sensor bolt	11±1
Cam position sensor support bolt	14±1
Cam position sensing cylinder bolt	22±4
Camshaft sprocket bolt	88±10
Crank angle sensor bolt	8.5±0.5
Idler pulley bolt	44±5
Tensioner arm bolt	23±3
Tensioner pulley bolt	48±6
Timing belt cover bolt (M6)	11±1
Timing belt cover bolt (M8)	14±1
Timing belt cover nut	5±1
Timing belt tensioner bolt	26±3

Item	Nm
Water pipe and water hose	
Engine coolant temperature gauge unit	10.8±1.0
Engine coolant temperature sensor	29±10
Fitting bolt	19±3
Heat pipe bolt	14±1
Thermo switch	8±1
Thermostat case bolt	19±1
Water inlet fitting bolt	24±4
Water outlet fitting bolt <12-valve>	19±1
Water outlet fitting bolt <24-valve>	12±1
Water outlet pipe bolt	14±1
Water passage bolt	19±1
Water pipe bolt (M6)	5±1
Water pipe bolt (M8)	14±1
Water pipe assembly B bolt	5±1
Water pump fitting bolt (M6)	9±1
Water pump fitting bolt (M8)	12±1
Fuel system	
Injector and delivery pipe bolt	12±2
Intake manifold nut <12-valve>	18±2
Intake manifold nut <24-valve>	22±1
Flange bolt	24±2
Fuel center pipe bolt	19±3
Fuel feed pipe bolt	19±3
Fuel pipe bolt	9±1
Fuel pressure regulator bolt	9±2
Fuel pump bolt	5→17±2
Water pump bracket bolt	24±3
Injector holder bolt	23±2
Exhaust manifold	
Bracket bolt	18±2
Bracket nut	19±3
Oil level gauge guide bolt	14±1
Engine hanger bolt	19±3
Exhaust manifold bolt <12-valve>	19±3
Exhaust manifold bolt <24-valve>	44±5
Exhaust manifold bolt <GDI>	49±5
Heat protector bolt	14±1
Water inlet fitting bolt	12±1

Item	Nm
Water pump bolt	24 ± 3
Rocker arms and camshaft	
Distributor adaptor bolt	14 ± 1
Rocker arms, rocker arm shaft bolt <12-valve>	20 ± 1
Rocker arms, rocker arm shaft bolt <24-valve>	31 ± 3
Rocker cover bolt <12-valve>	9 ± 1
Rocker cover bolt <24-valve>	3.5 ± 0.5
Thrust case bolt	13 ± 2
Rocker arms and camshaft <GDI>	
Beam camshaft cap bolt (M6)	11 ± 1
Beam camshaft cap bolt (M8)	24 ± 2
Rocker cover bolt	3.5 ± 0.5
Cylinder head and valves	
Cylinder head bolt	108 ± 5 → Back off → 108 ± 5
Oil pan and oil pump	
Baffle plate bolt	11 ± 1
Cover bolt	11 ± 1
Drain plug	39 ± 5
Oil cooler by-pass valve	54 ± 5
Oil filter bracket bolt <12-valve>	25 ± 2
Oil filter bracket bolt <24-valve for PAJERO> (M8)	24 ± 4
Oil filter bracket bolt <24-valve for except PAJERO> (M8)	23 ± 3
Oil filter bracket bolt <24-valve> (M10)	25 ± 2
Oil level sensor bolt <GDI>	23 ± 3
Oil pan bolt	9 ± 3
Oil pan lower bolt	11 ± 1
Oil pressure switch	10 ± 2
Oil pump case bolt	14 ± 1
Oil pump cover screw	10 ± 2
Oil screen bolt <GDI> (Flange)	5 ± 1
Oil screen bolt <Except GDI> (Flange)	14 ± 1
Oil screen bolt (Washer)	19 ± 3
Relief valve	44 ± 5
Pistons and connecting rod	
Connecting rod cap nut <12-valve>	51 ± 1
Connecting rod cap bolt <24-valve>	34 ± 2 + 90°
Crankshaft flywheel and drive plate	
Bearing cap bolt <12-valve>	93 ± 4
Bearing cap bolt <24-valve>	74 ± 4

Item	Nm
Bell housing cover bolt	11 ± 2
Detonation sensor bracket bolt	28 ± 2
Drive plate bolt	74 ± 2
Flywheel bolt	74 ± 2
Knock sensor	23 ± 2
Oil seal case bolt	11 ± 2
Rear plate bolt	11 ± 2

SEALANTS

Item	Specified sealant	Quantity
Cam position sensor support	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
Thermo switch	3M Nut Locking Part No. 4171 or equivalent	As required
Rocker arms, rocker arm shaft	3M Nut Locking Part No. 4171 or equivalent	As required
Rocker cover	3M ATD Part No. 8660 or equivalent	As required
Beam bearing cap	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 pressure switch	3M ATD Part No. 8660 or equivalent	As required
Oil seal case	Mitsubishi Genuine Part No. MD970389 or equivalent	As required

FORM-IN-PLACE GASKET

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

The FIPG used in the engine is a room temperature 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.

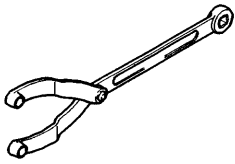

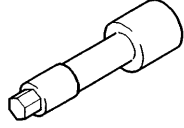
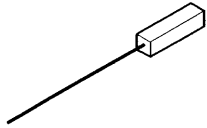
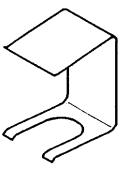
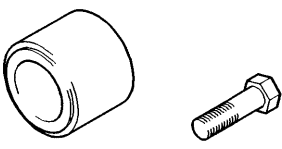
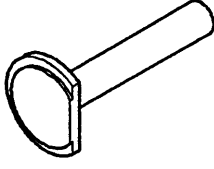
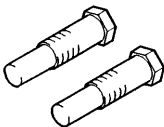
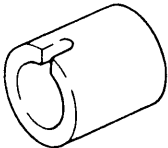
Form-in-Place Gasket Application (FIPG)

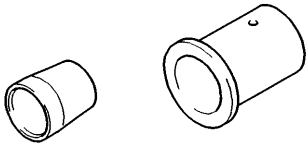
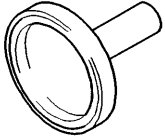
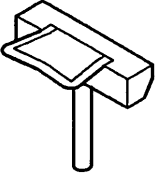
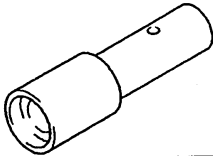
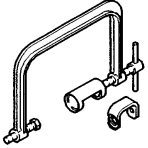

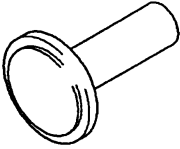
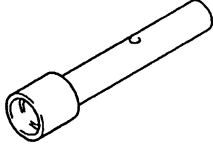
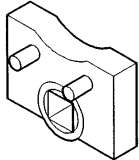
When assembling parts with the FIPG, you must observe some precautions, but the procedure is very simple as in the case of a conventional pre-cut gasket.

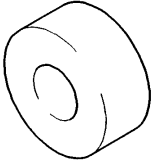
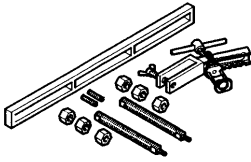
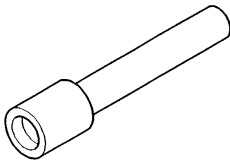
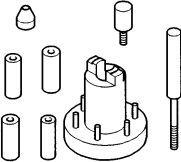
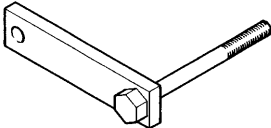
Applied FIPG bead should be of the specified size and without breaks. Also be sure to encircle the bolt hole circumference with a completely continuous bead. The FIPG can be wiped away unless it is hardened. While the FIPG is still moist (in less than 15 minutes), mount the parts in position. When the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

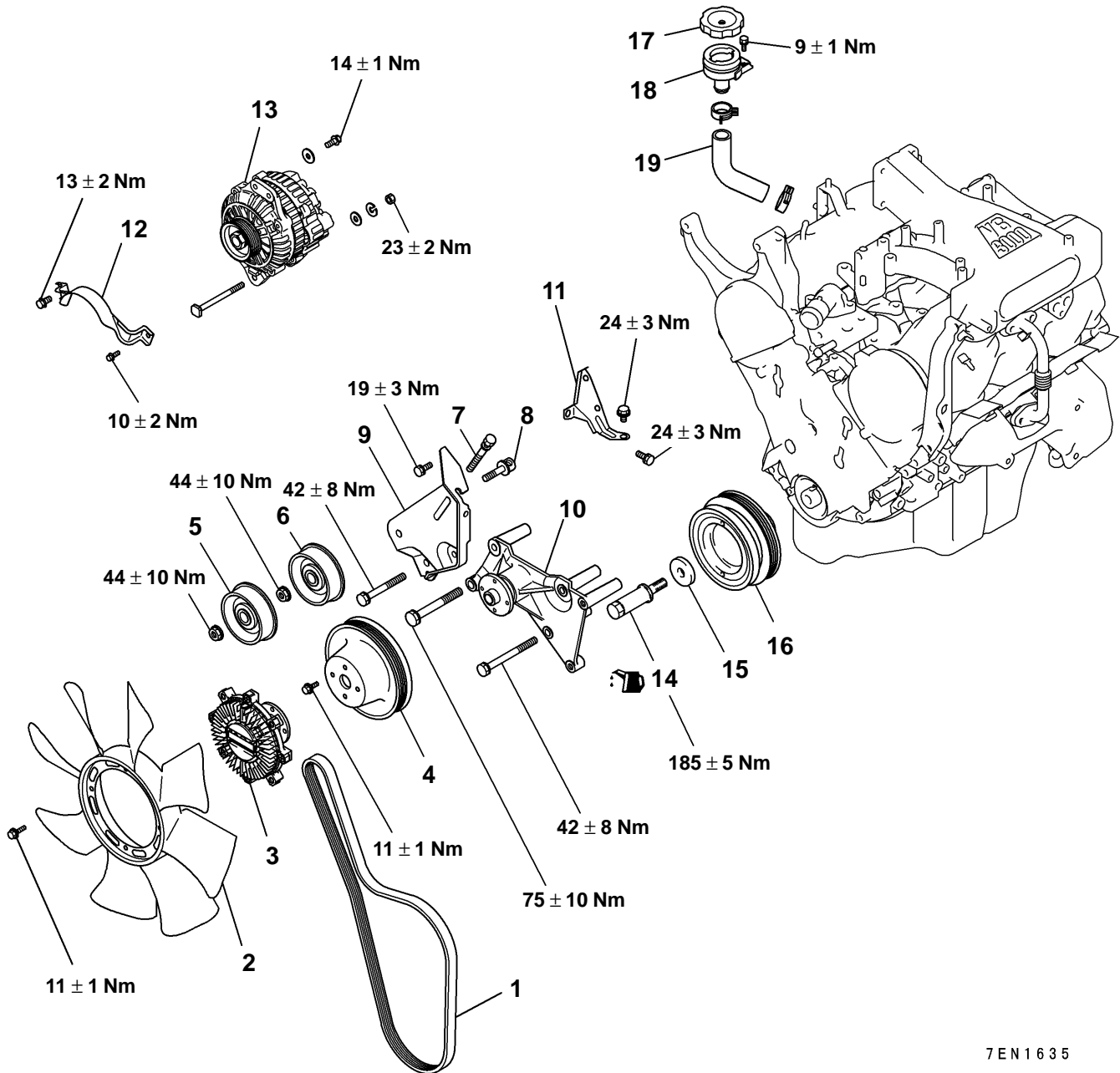
Tool	Number	Name	Use
	MB990767	End yoke holder	Holding camshaft sprocket (Used in combination with MD998715)
	MB991559	Camshaft oil seal installer adaptor	Installation of camshaft oil seal (on left bank) (Used in combination with MD998713) <SOHC 24-valve>
	MD998051	Cylinder head bolt wrench	Loosening and tightening of cylinder head bolt
	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 <SOHC 24-valve>
	MD998713	Camshaft oil seal installer	Installation of camshaft oil seal
	MD998714	Circular packing installer	Installation of circular packing <6G72 12-valve>
	MD998715	Pulley holder pin	Holding camshaft sprocket (Used in combination with MB990767)
	MD998716	Crankshaft wrench	Rotation of crankshaft

Tool	Number	Name	Use
	MD998717	Crankshaft front oil seal installer	Installation of crankshaft front oil seal
	MD998718	Crankshaft rear oil seal installer	Press fitting crankshaft rear oil seal
	MD998727	Oil pan remover	Removal of oil pan
	MD998729	Valve stem seal installer <6G72 12-valve>	Installation of valve stem seal <6G72 12-valve>
	MD998735	Valve spring compressor	Compressing the valve springs
	MD998761	Camshaft oil seal installer	Installation of camshaft oil seal <6G74 GDI>
	MD998762	Circular packing installer	Installation of circular packing <6G74 GDI>
	MD998763	Valve stem seal installer <6G74 GDI>	Installation of valve stem seal <6G74 GDI>
	MD998767	Tensioner pulley	Adjustment of timing belt tension

Tool	Number	Name	Use
	MD998769	Crank pulley spacer	Cranking the crankshaft to install timing belt
	MD998772	Valve spring compressor	Compressing of the valve springs
	MD998774	Valve stem seal installer	Installation of valve stem seal <SOHC 24-valve>
	MD998780	Piston pin setting tool	Removal and installation of piston pin
	MD998781	Flywheel stopper	Holding flywheel or drive plate

3. ALTERNATOR

<12-VALVE>



7EN1635

Removal steps

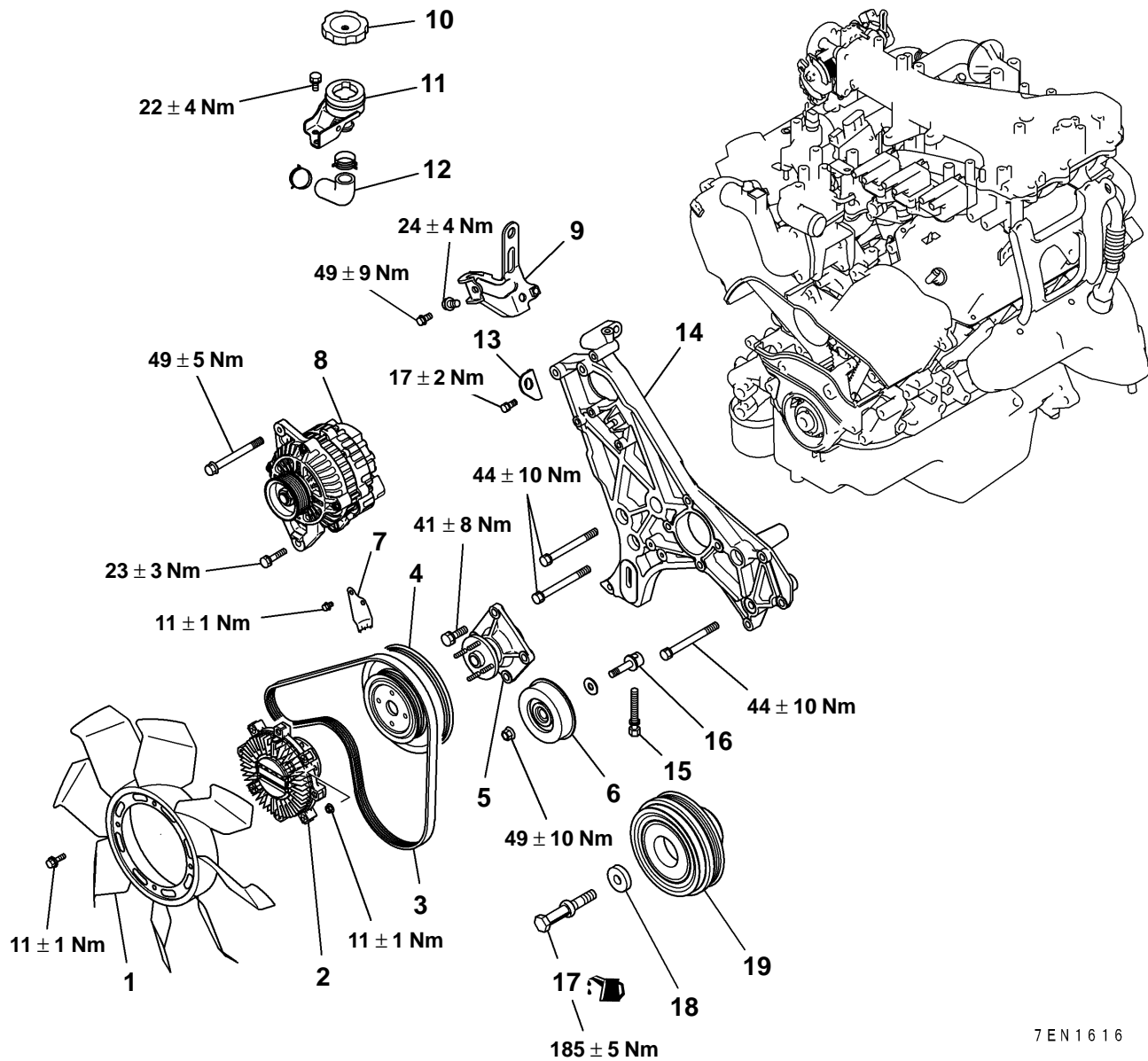
1. Drive belt
2. Cooling fan
3. Fan clutch
4. Cooling fan pulley
5. Idler pulley
6. Tensioner pulley
7. Adjusting bolt
8. Adjusting stud
9. Tensioner bracket
10. Cooling fan bracket

11. Tensioner bracket stay
12. Alternator cover
13. Alternator
14. Crankshaft bolt
15. Special washer
16. Crankshaft pulley
17. Oil filler cap
18. Oil filler
19. Tube



REMOVAL AND INSTALLATION

<24-VALVE FOR PAJERO (V33V), CHALLENGER, L200>



7EN1616

Removal steps

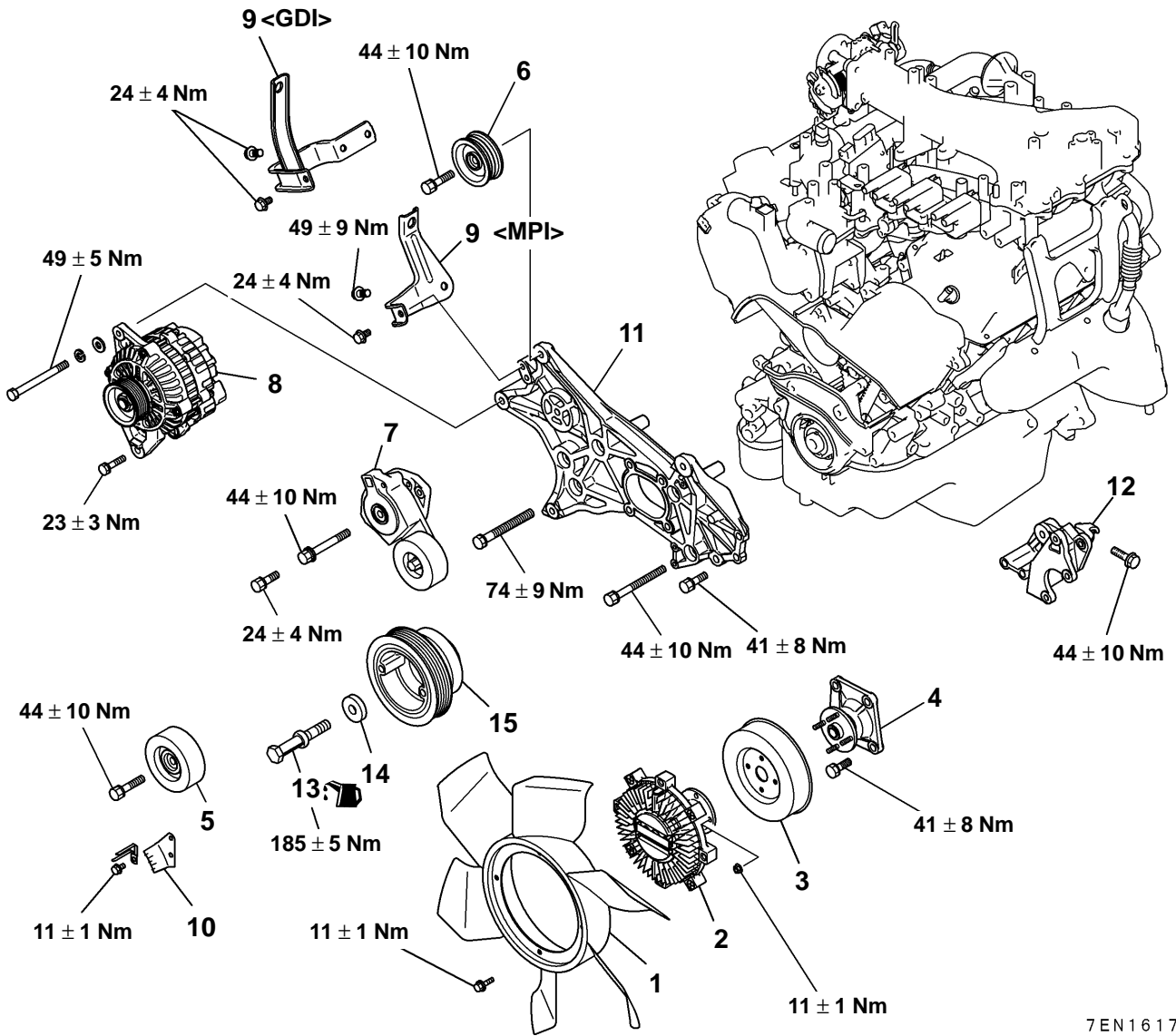
- 1. Cooling fan
- 2. Fan clutch
- 3. Drive belt
- 4. Cooling fan pulley
- 5. Cooling fan bracket
- 6. Drive belt tensioner pulley
- 7. Timing indicator
- 8. Alternator
- 9. Accessory mount stay
- 10. Oil filler cap

- 11. Oil filler
- 12. Tube
- 13. Engine hanger
- 14. Accessory mount
- 15. Adjusting bolt
- 16. Adjusting stud
- 17. Crankshaft bolt
- 18. Special washer
- 19. Damper pulley



REMOVAL AND INSTALLATION

<24-VALVE FOR PAJERO (V63W, V73W), GDI>



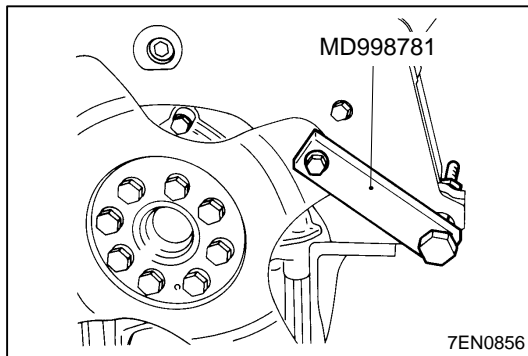
7EN1617

Removal steps

1. Cooling fan
2. Fan clutch
3. Cooling fan pulley
4. Cooling fan bracket
5. Idler pulley
6. Idler pulley
7. Auto tensioner
8. Alternator

9. Accessory mount stay
10. Timing indicator bracket
11. Accessory mount
12. Power steering pump bracket
13. Crankshaft bolt
14. Crankshaft pulley washer
15. Damper pulley

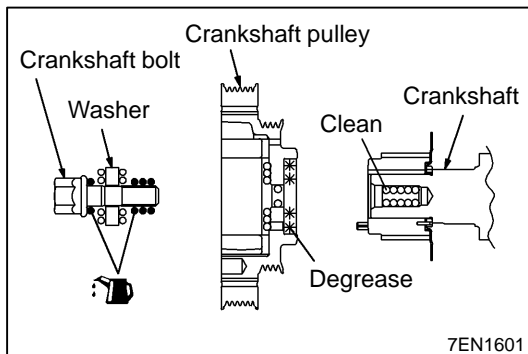




REMOVAL SERVICE POINTS

◀A▶ CRANKSHAFT BOLT REMOVAL

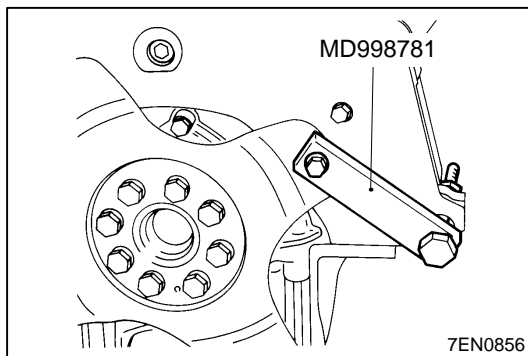
With the Special Tool fixed to the drive plate or flywheel, remove the crankshaft bolt.



INSTALLATION SERVICE POINTS

▶A◀ CRANKSHAFT BOLT / WASHER / CRANKSHAFT PULLEY INSTALLATION

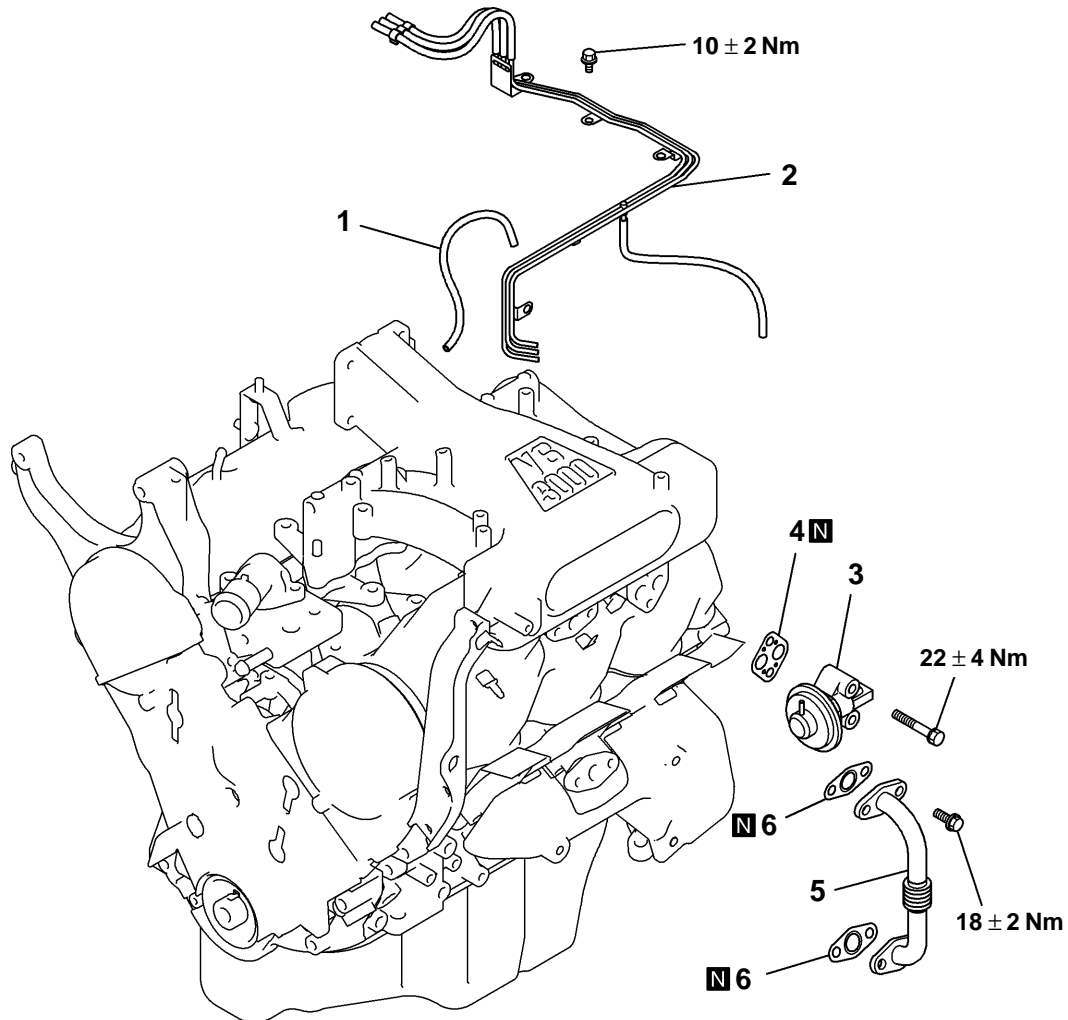
1. Clean and degrease the crankshaft sprocket fitting surface of the crankshaft pulley, then install the crankshaft pulley on the crankshaft.
2. Clean the threaded hole in the crankshaft, the crankshaft fitting surface of the crankshaft pulley, the washer fitting surface of the crankshaft and both surfaces 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 to the specified torque of 185 ± 5 Nm.



4. CONTROL AND EGR SYSTEM

REMOVAL AND INSTALLATION

<12-VALVE>



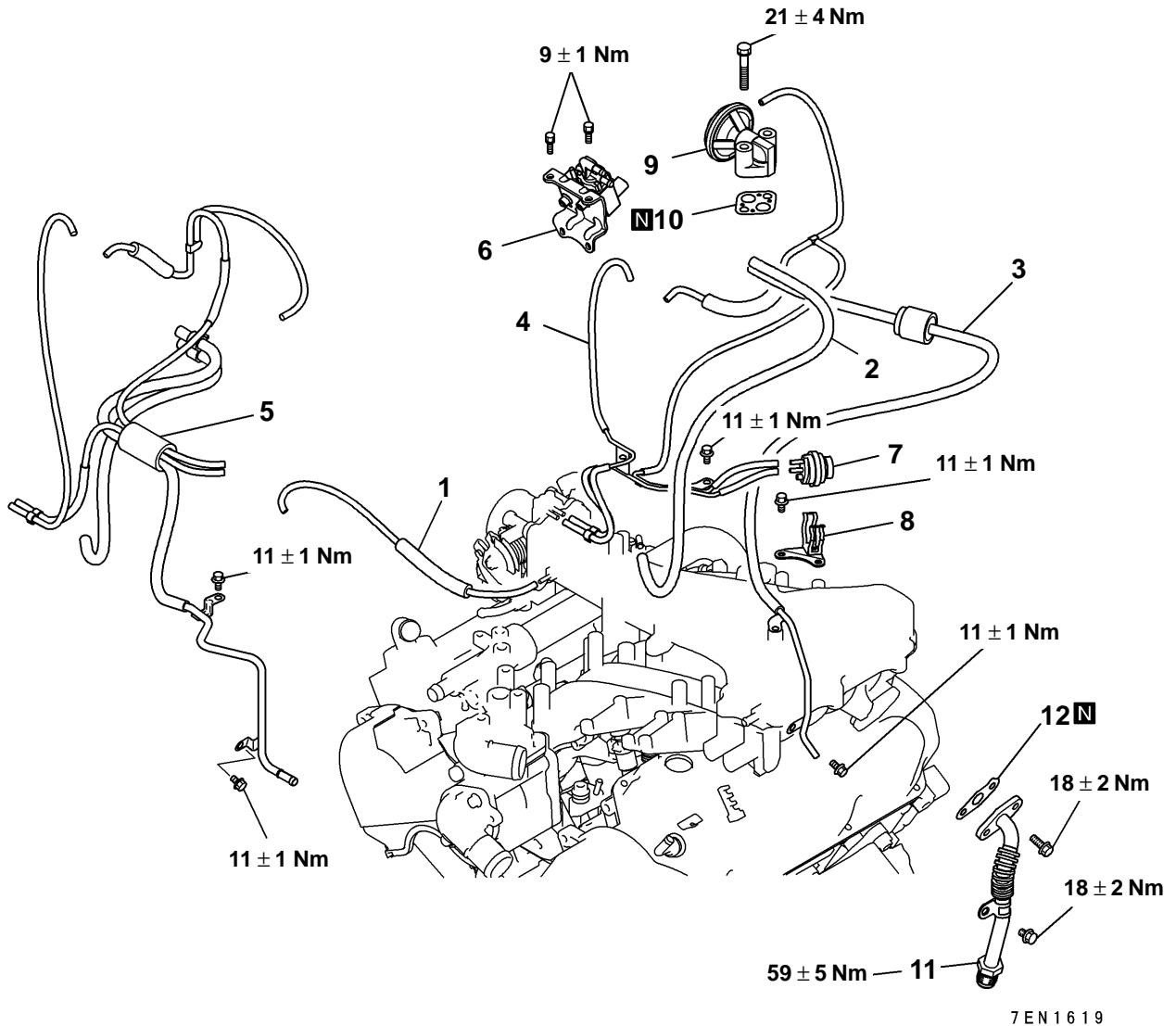
7EN1618

Removal steps

1. Vacuum pipe
2. Vacuum pipe and hose
3. EGR valve
4. EGR valve gasket
5. EGR pipe
6. EGR pipe gasket

REMOVAL AND INSTALLATION

<24-VALVE WITH VACUUM CONTROL VALVE>



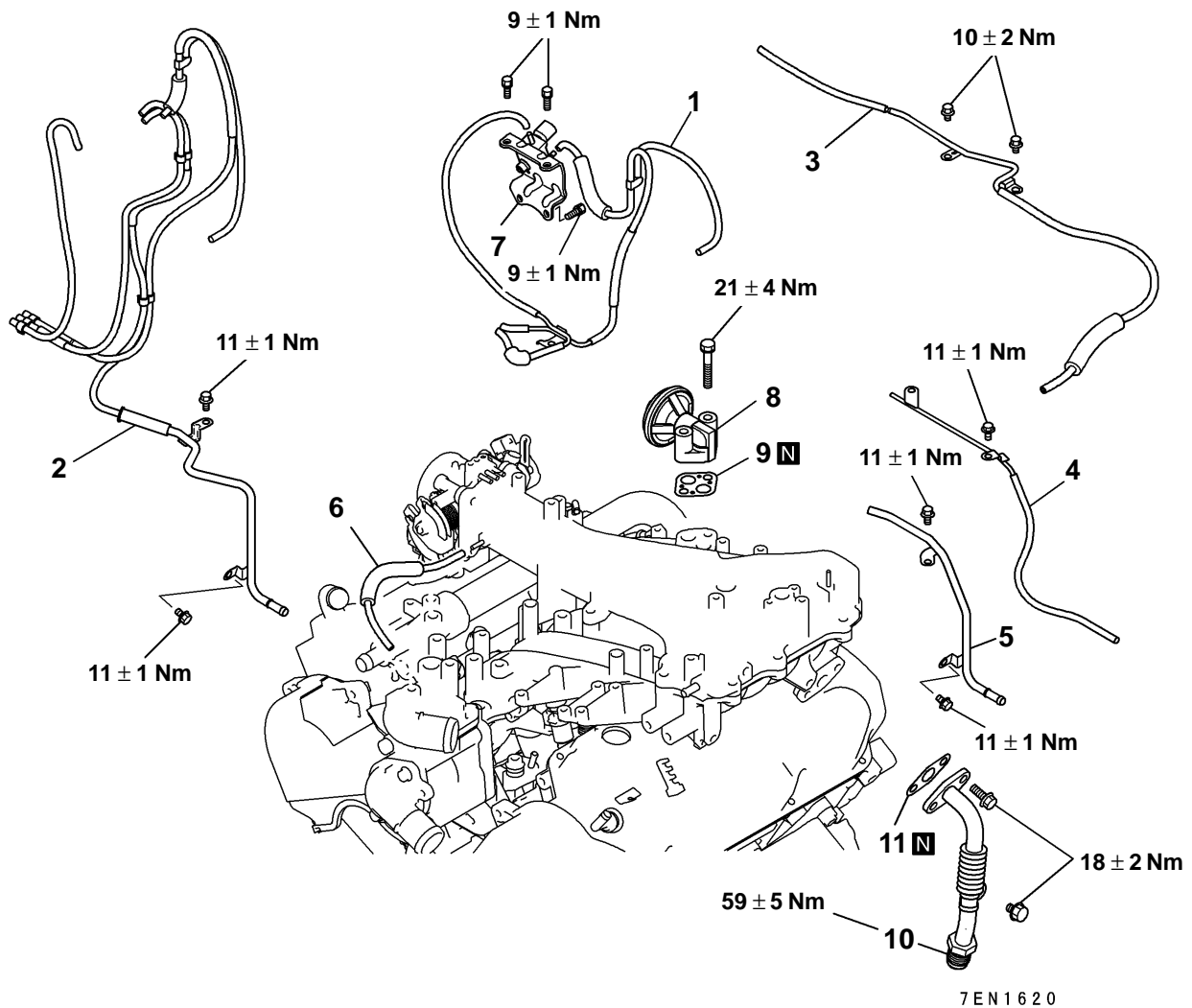
7EN1619

Removal steps

- | | |
|--------------------------------------|---------------------------------|
| 1. Vacuum hose | 6. Solenoid valve |
| 2. Hose <CHALLENGER> | 7. Vacuum control valve |
| 3. Vacuum pipe and hose <CHALLENGER> | 8. Vacuum control valve bracket |
| 4. Vacuum pipe and hose <CHALLENGER> | 9. EGR valve |
| 5. Vacuum pipe and hose <PAJERO> | 10. EGR valve gasket |
| | 11. EGR pipe |
| | 12. EGR pipe gasket |

REMOVAL AND INSTALLATION

<24-VALVE WITHOUT VACUUM CONTROL VALVE>

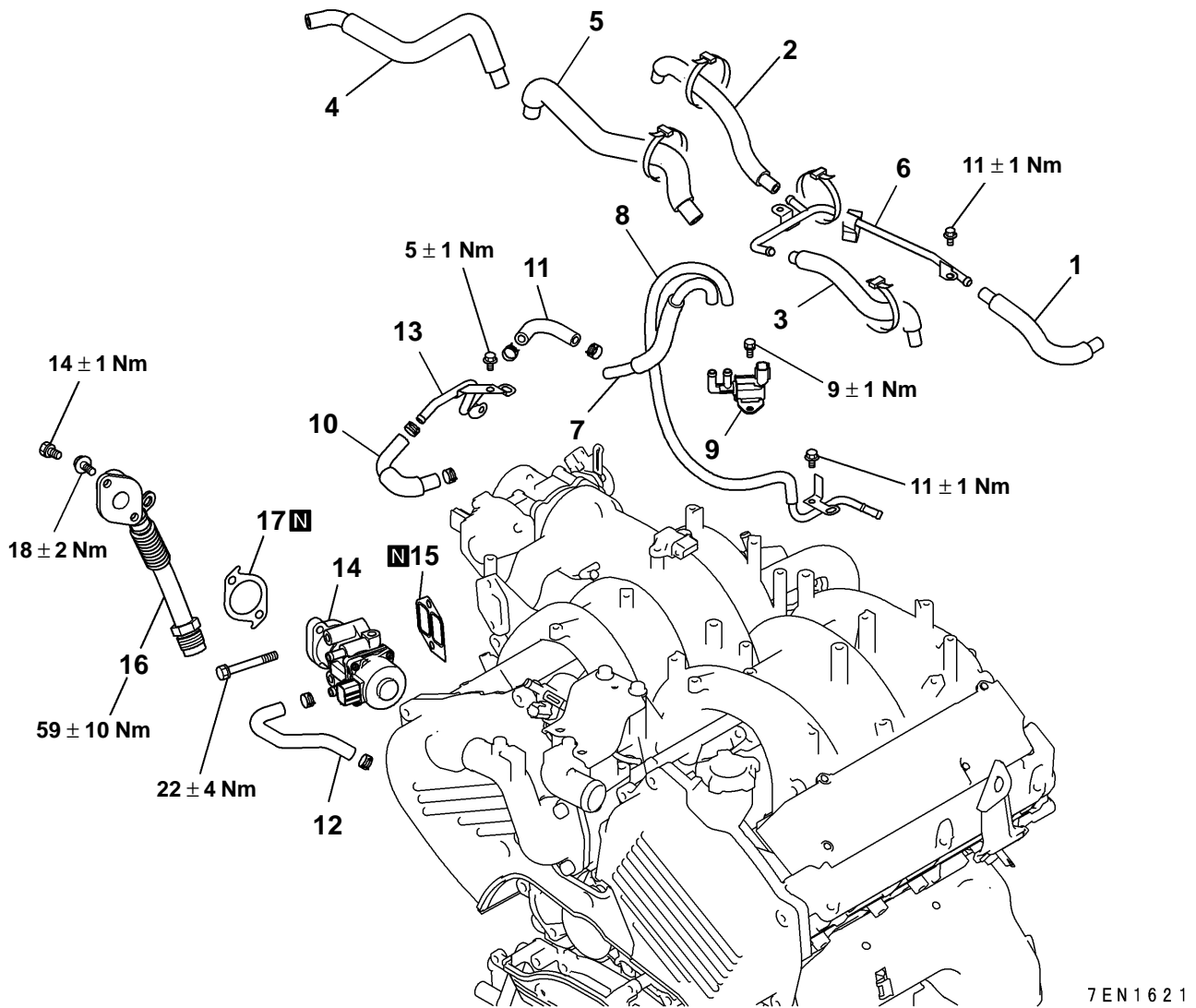


Removal steps

1. Vacuum pipe and hose <PAJERO for General Export, GCC-6G72, Australia, CHALLENGER for Export, Australia>
2. Vacuum pipe and Hose <PAJERO for Export, Brazil, GCC-6G74>
3. Vacuum pipe and hose <L200>
4. Vacuum pipe and hose <PAJERO (V33V) for GCC, CHALLENGER for Europe, Australia>
5. Vacuum pipe <PAJERO (V63W, V73W) for GCC-6G72>
6. Vacuum pipe
7. Solenoid valve <Except for L200>
8. EGR valve <Except for L200>
9. EGR valve gasket <Except for L200>
10. EGR pipe <Except for L200>
11. EGR pipe gasket <Except for L200>

REMOVAL AND INSTALLATION

<GDI>



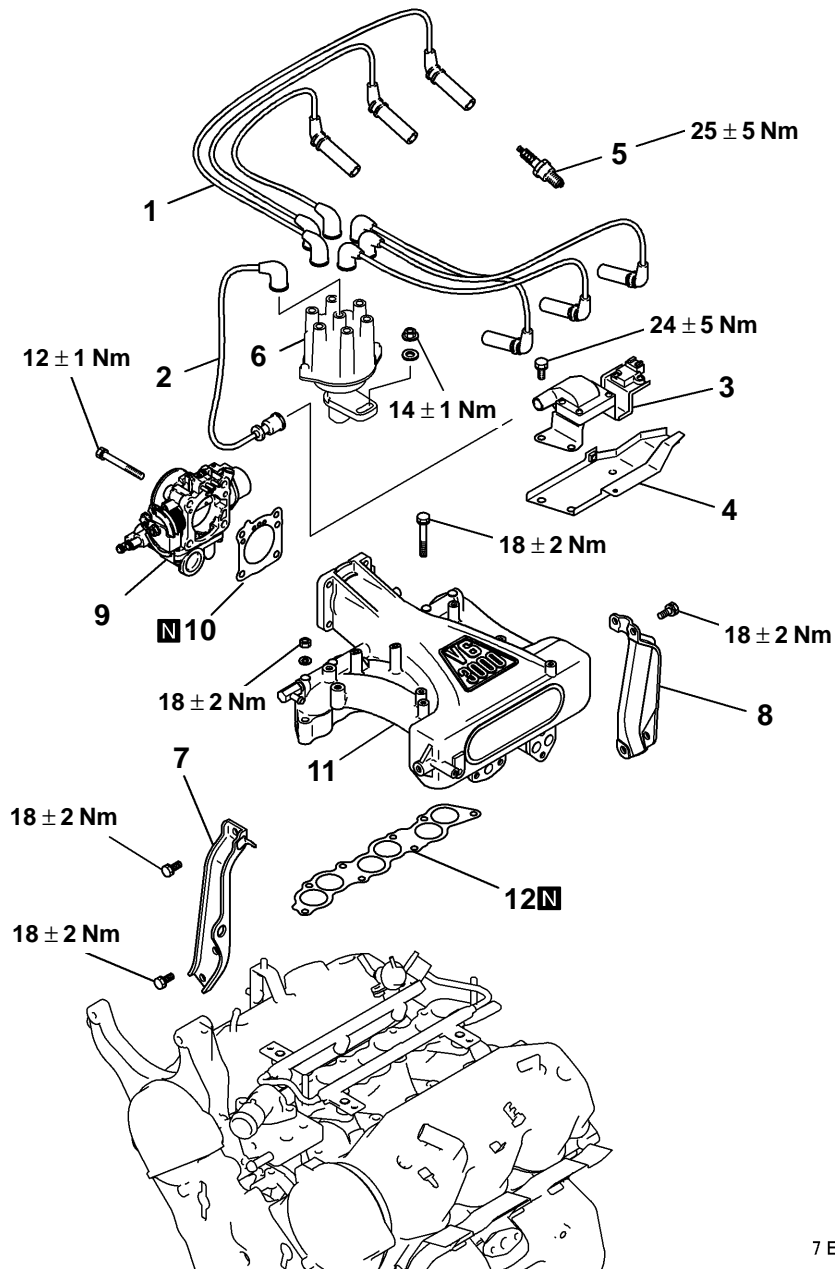
Removal steps

- | | |
|-------------------------|---------------------------|
| 1. PCV hose A | 10. Water hose |
| 2. PCV hose B | 11. Water hose |
| 3. PCV hose C | 12. Water hose |
| 4. Breather hose | 13. Water pipe assembly A |
| 5. Blow-by hose | 14. EGR valve |
| 6. PCV pipe | 15. EGR valve gasket |
| 7. Purge hose | 16. EGR pipe |
| 8. Vacuum pipe and hose | 17. EGR pipe gasket |
| 9. Solenoid valve | |

5. INTAKE AND IGNITION SYSTEM

REMOVAL AND INSTALLATION

<12-VALVE>



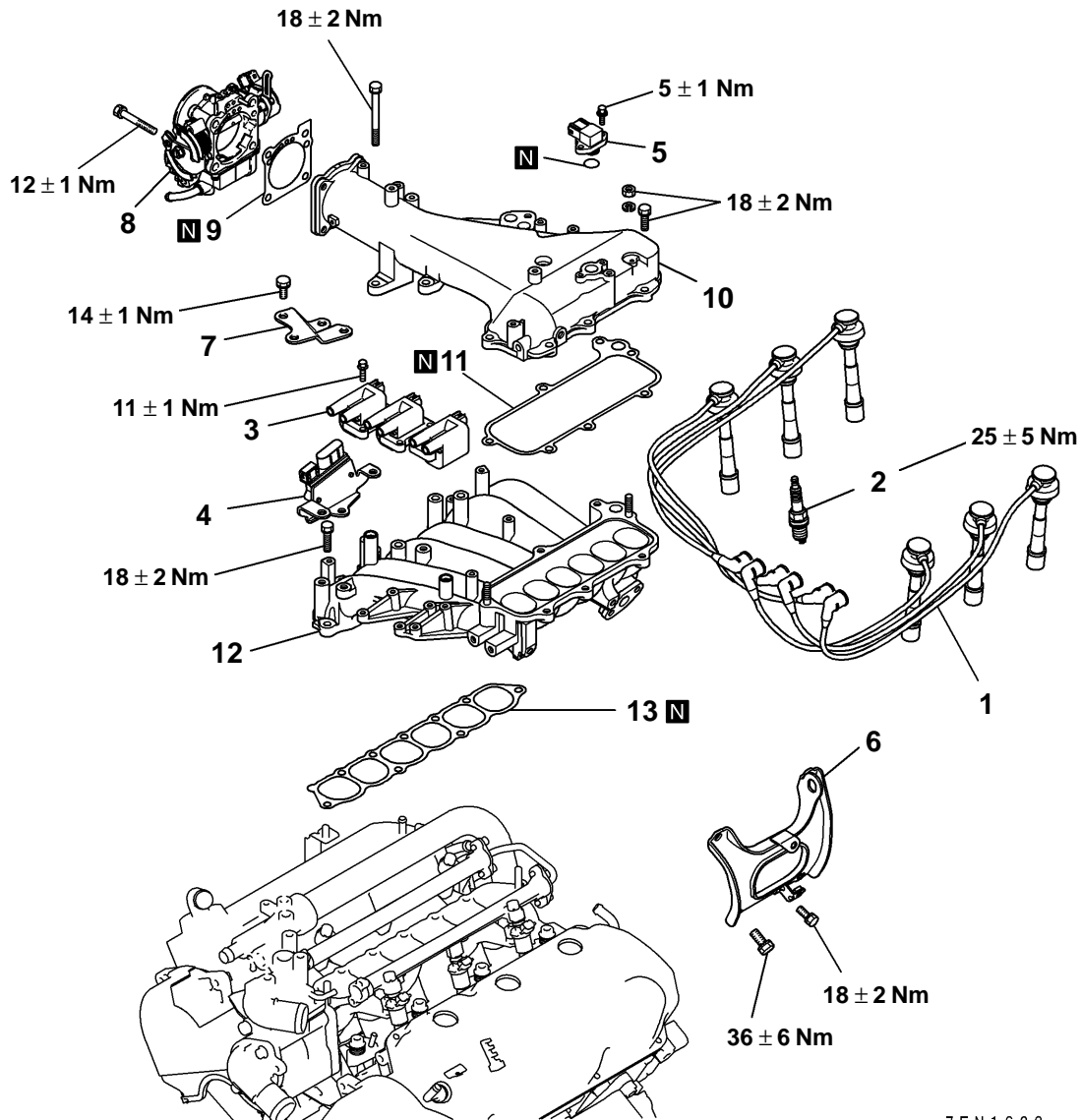
7EN1622

Removal steps

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Spark plug cable 2. High tension cable 3. Ignition coil assembly 4. Stay B 5. Spark plug 6. Distributor | <ol style="list-style-type: none"> 7. Air intake plenum stay, front 8. Air intake plenum stay, rear 9. Throttle body ▶◀ B ◀▶ 10. Throttle body gasket 11. Air intake plenum 12. Air intake plenum gasket |
|---|--|

REMOVAL AND INSTALLATION

<24-VALVE FOR PAJERO, CHALLENGER>



7EN1623

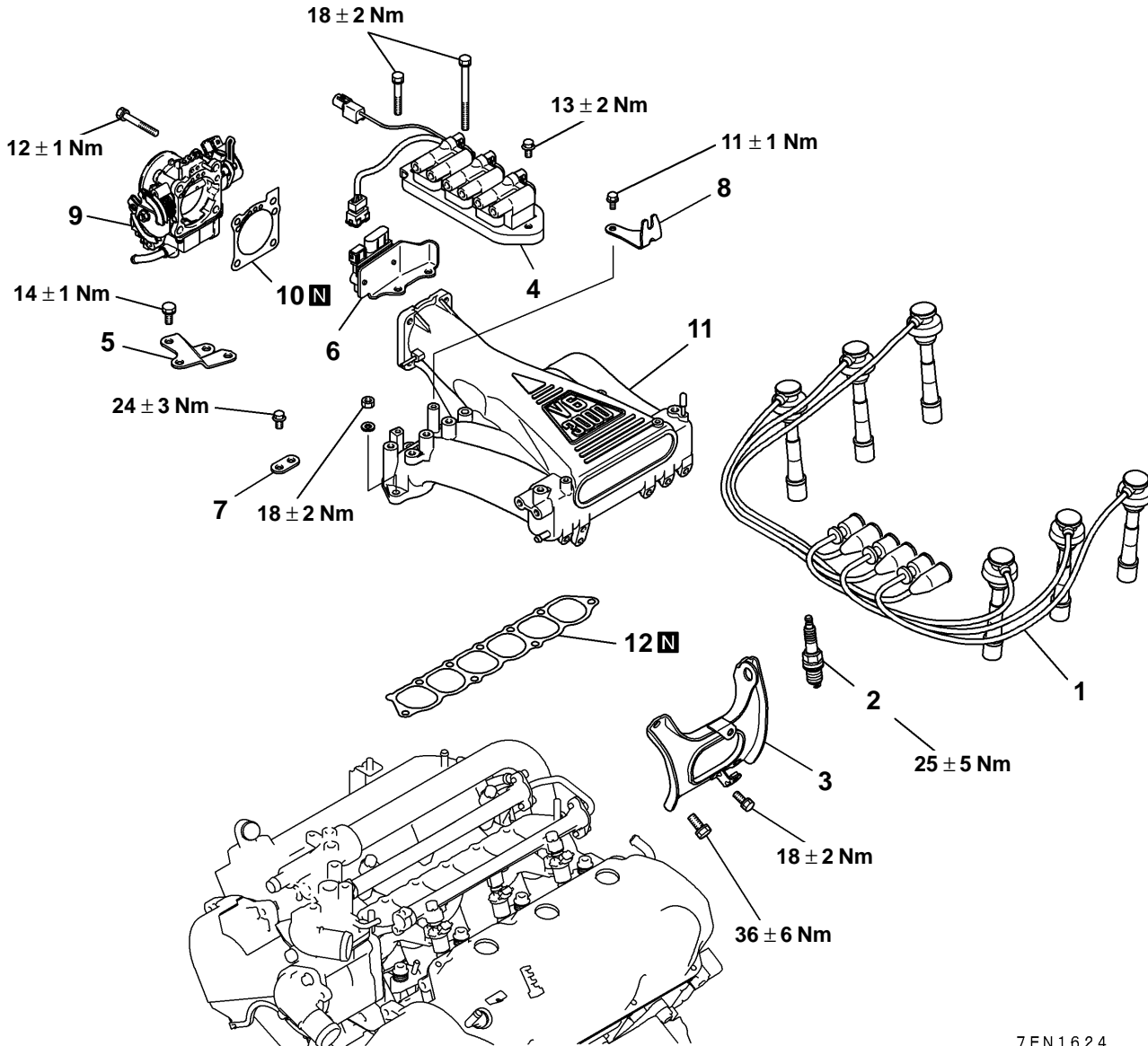
Removal steps

1. Spark plug cable
2. Spark plug
3. Ignition coil assembly
4. Ignition power transistor
5. MDP sensor <For Taiwan>
6. Air intake plenum stay
7. Water outlet fitting bracket

- B◄
8. Throttle body
 9. Throttle body gasket
 10. Air intake fitting
 11. Intake fitting gasket
 12. Intake upper manifold
 13. Air intake plenum gasket

REMOVAL AND INSTALLATION

<24-VALVE FOR L200>



7EN1624

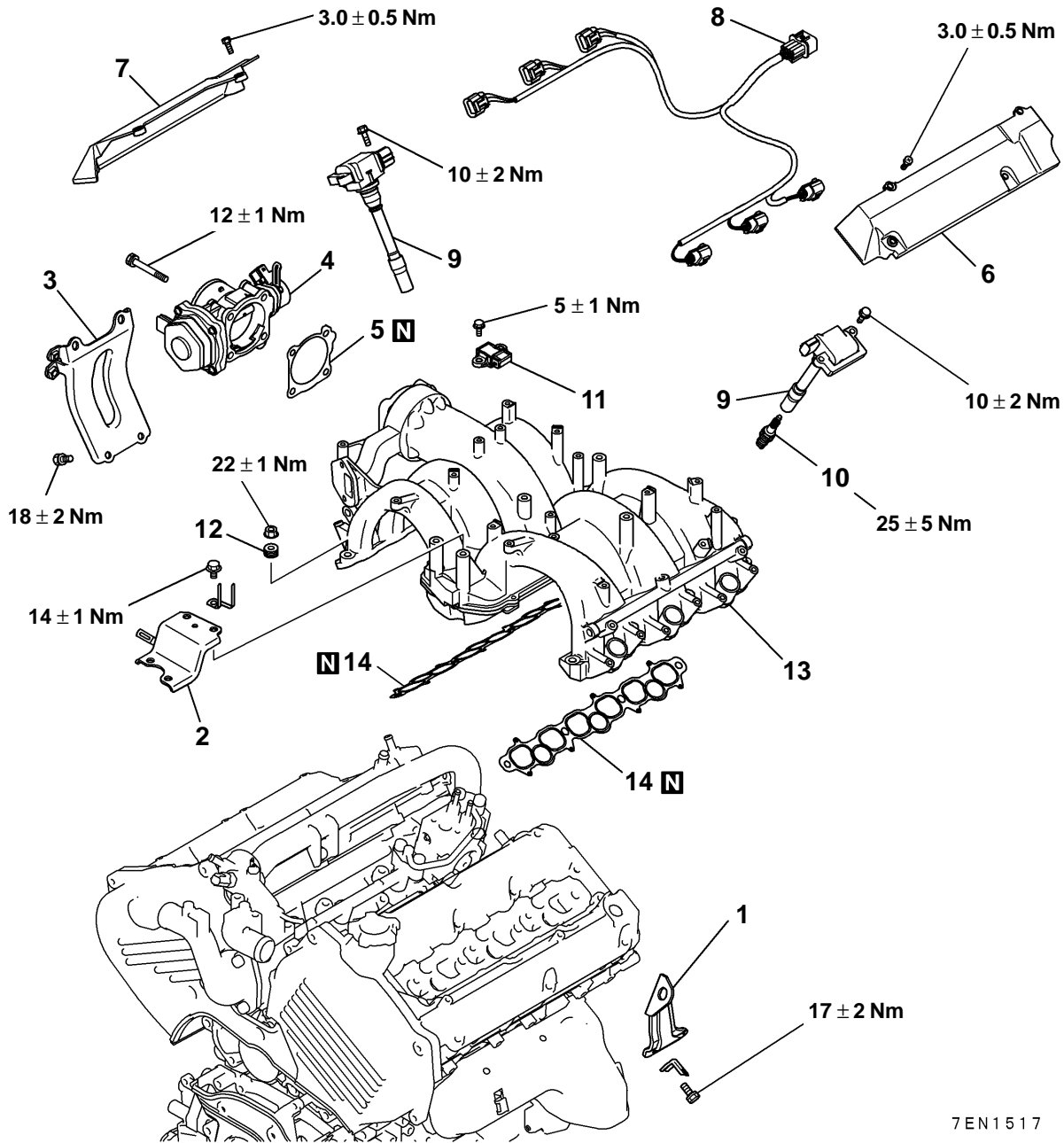
Removal steps

1. Spark plug cable
2. Spark plug
3. Air intake plenum stay
4. Ignition coil assembly
5. Water outlet fitting bracket
6. Power transistor

7. Bracket
8. Accel cable bracket
9. Throttle body
- ▶ B ◀ 10. Throttle body gasket
11. Air intake plenum
12. Air intake plenum gasket

REMOVAL AND INSTALLATION

<GDI>

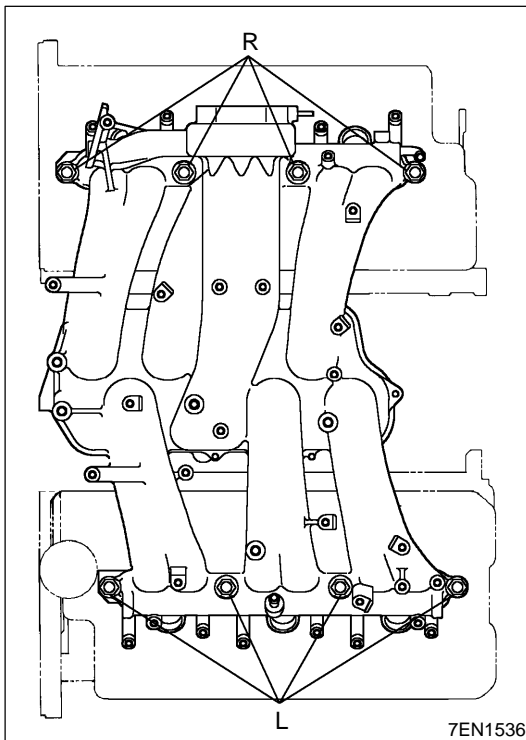


7EN1517

Removal steps

- 1. Engine hanger
- 2. Water outlet fitting bracket
- 3. Throttle body stay
- 4. Throttle body
- ▶B◀ 5. Throttle body gasket
- 6. Center cover, left
- 7. Center cover, right

- 8. Ignition coil harness
- 9. Ignition coil
- 10. Spark plug
- 11. Ignition failure sensor
- 12. Cone disc spring
- ▶A◀ 13. Intake manifold
- 14. Intake manifold gasket

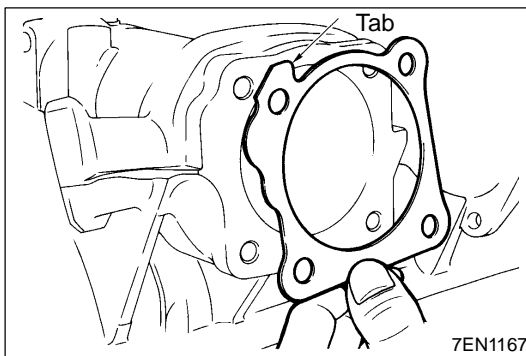


INSTALLATION SERVICE POINTS

▶A◀ INTAKE MANIFOLD INSTALLATION

Tighten the intake manifold mounting nuts in the following order.

1. Tighten nut (L) on the left bank side to 7 Nm.
2. Tighten nut (R) on the right bank side to the specified torque.
3. Tighten (L) to the specified torque.
4. Tighten (R) to the specified torque.
5. Tighten (L) to the specified torque.



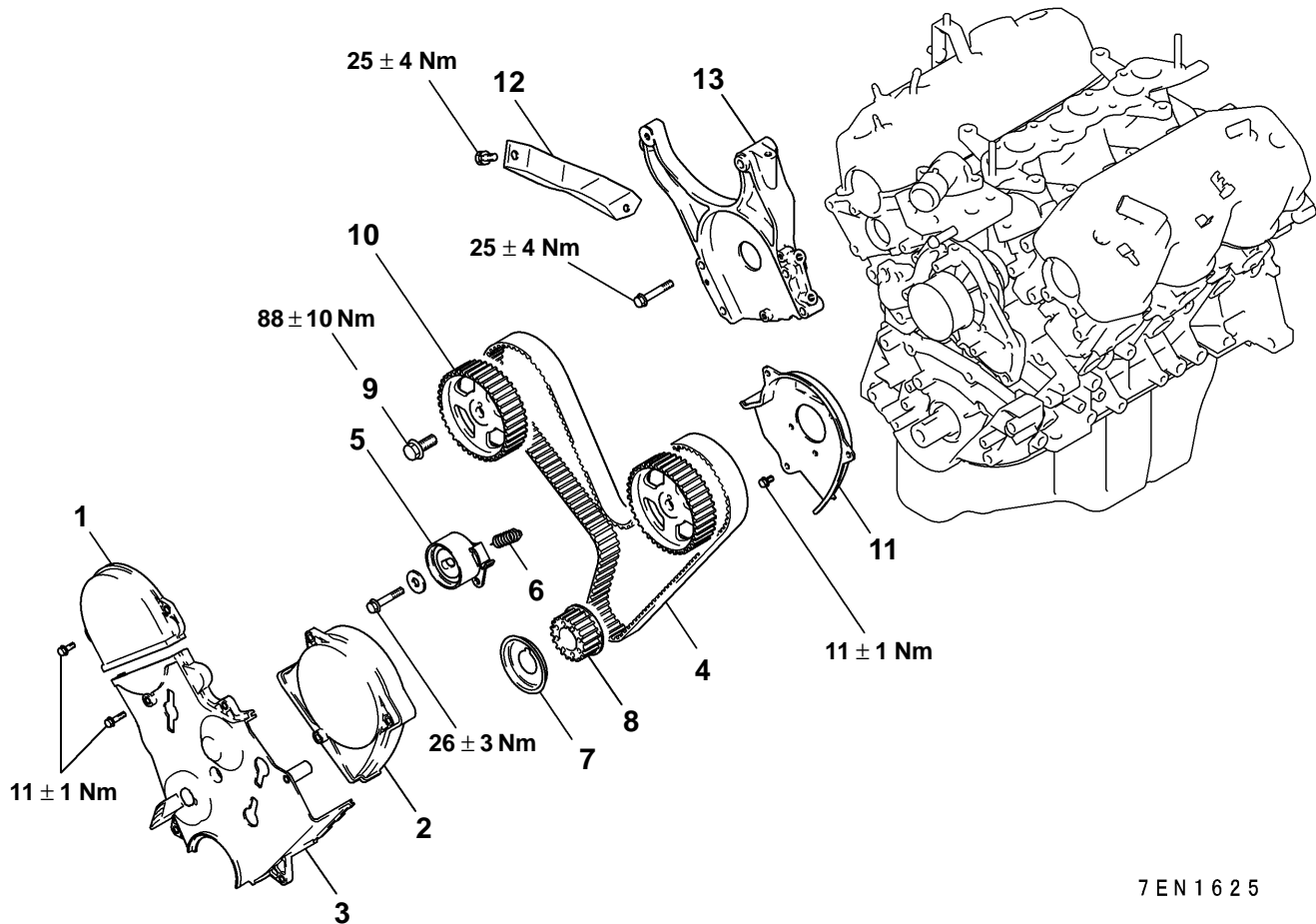
▶B◀ THROTTLE BODY GASKET INSTALLATION

Install the throttle body gasket so that its tab is located at the position shown.

6. TIMING BELT

REMOVAL AND INSTALLATION

<12-VALVE>

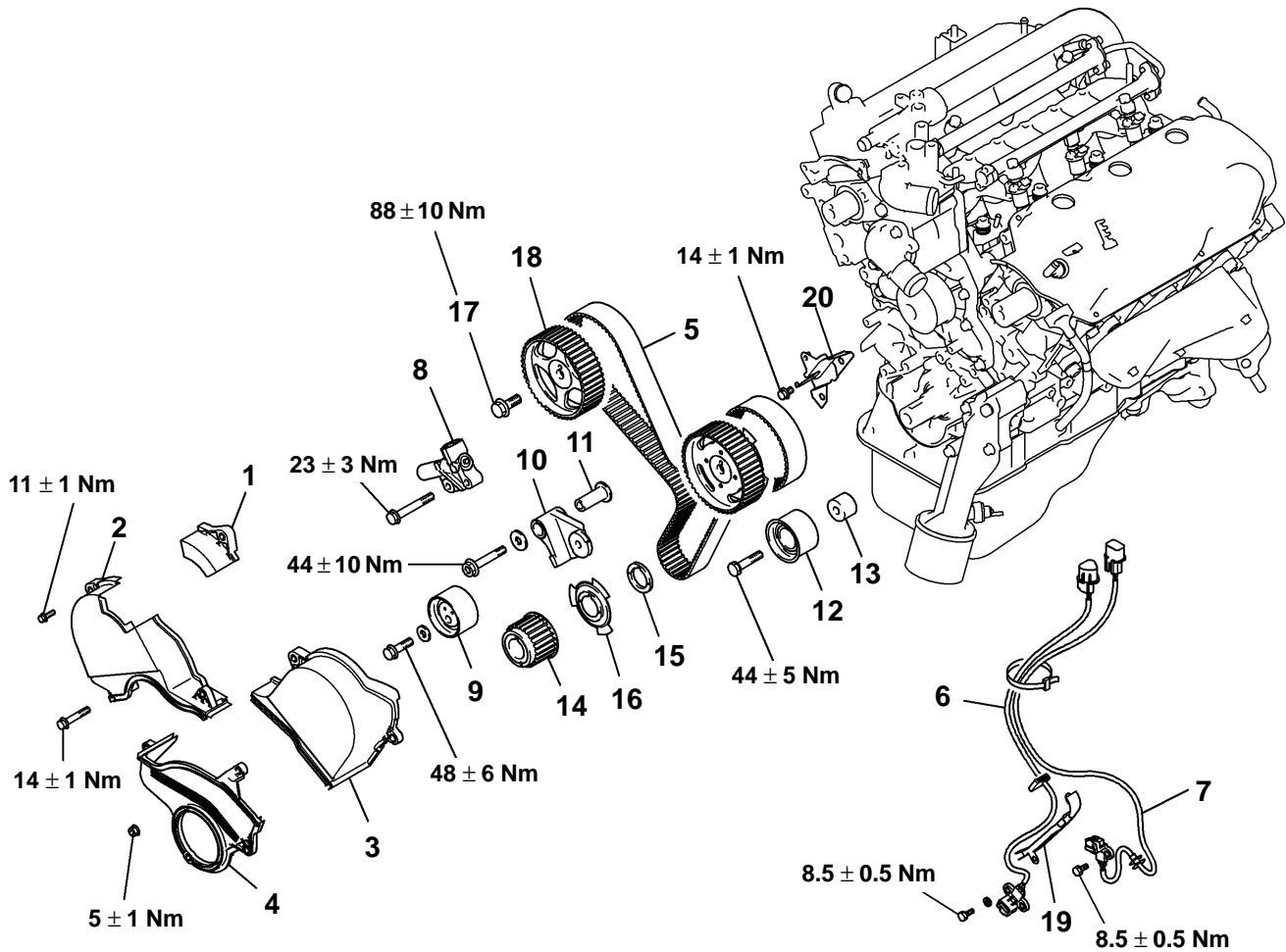


Removal steps

- | | | | |
|---------------------------|---|---------------------------|---|
| <p>◀A▶ ▶H▶</p> <p>▶F▶</p> | <ol style="list-style-type: none"> 1. Timing belt front upper cover, right 2. Timing belt front upper cover, left 3. Timing belt front lower cover 4. Timing belt 5. Timing belt tensioner 6. Tensioner spring 7. Front flange | <p>◀D▶ ▶F▶</p> <p>▶A▶</p> | <ol style="list-style-type: none"> 8. Crankshaft sprocket 9. Camshaft sprocket bolt 10. Camshaft sprocket 11. Timing belt rear upper cover, left 12. Alternator stay 13. Alternator bracket |
|---------------------------|---|---------------------------|---|

REMOVAL AND INSTALLATION

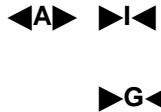
<24-VALVE FOR PAJERO (V33V), CHALLENGER, L200>



7 EN 1626

Removal steps

1. Timing belt cover cap
2. Timing belt front upper cover, right
3. Timing belt front upper cover, left
4. Timing belt front lower cover
5. Timing belt
6. Crankshaft position sensor
7. Camshaft position sensor
8. Auto tensioner
9. Tensioner pulley
10. Tensioner arm

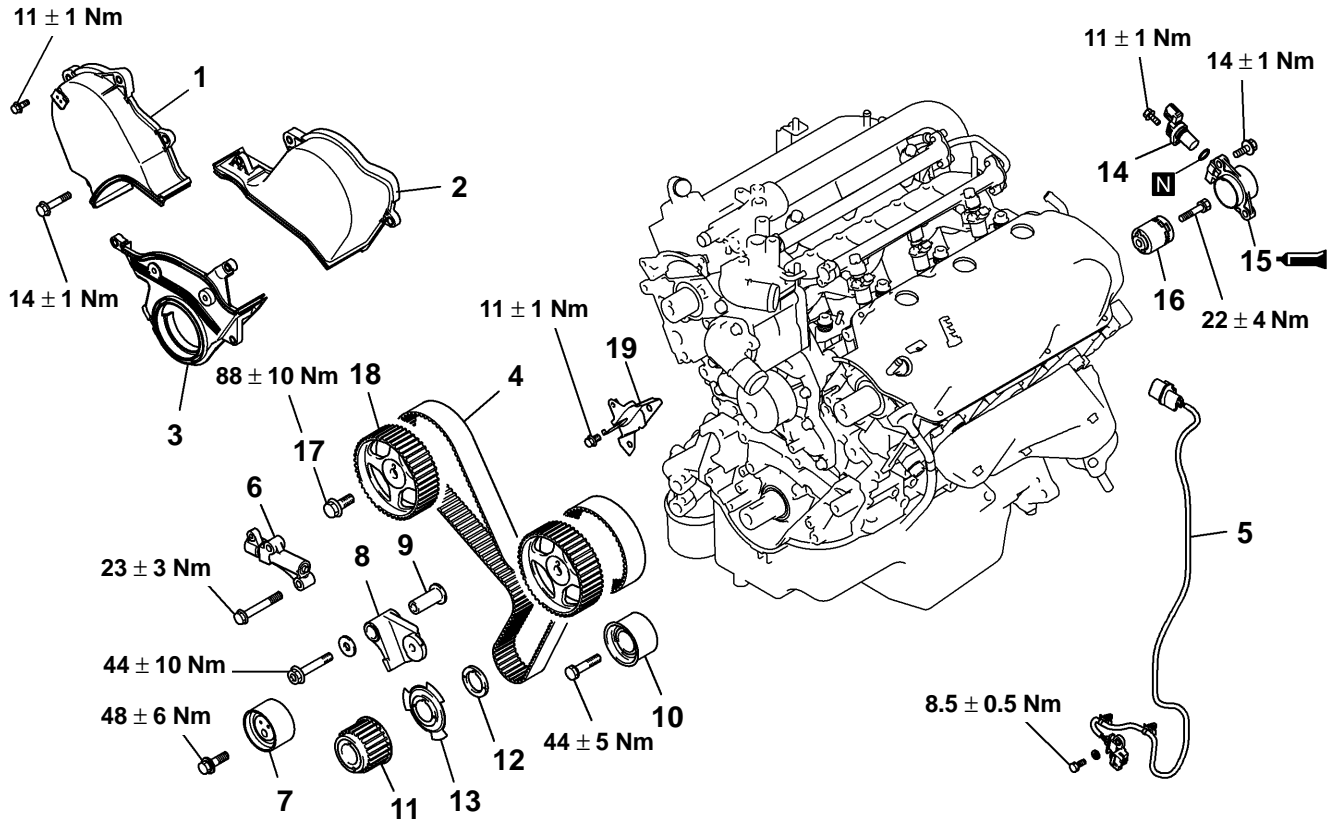


11. Shaft
12. Idler pulley
13. Idler pulley spacer
14. Crankshaft sprocket
15. Crankshaft spacer
16. Crankshaft sensing blade
17. Camshaft sprocket bolt
18. Camshaft sprocket
19. Harness protector
20. Timing belt rear cover



REMOVAL AND INSTALLATION

<24-VALVE FOR PAJERO (V63W, V73W)>



7EN1627

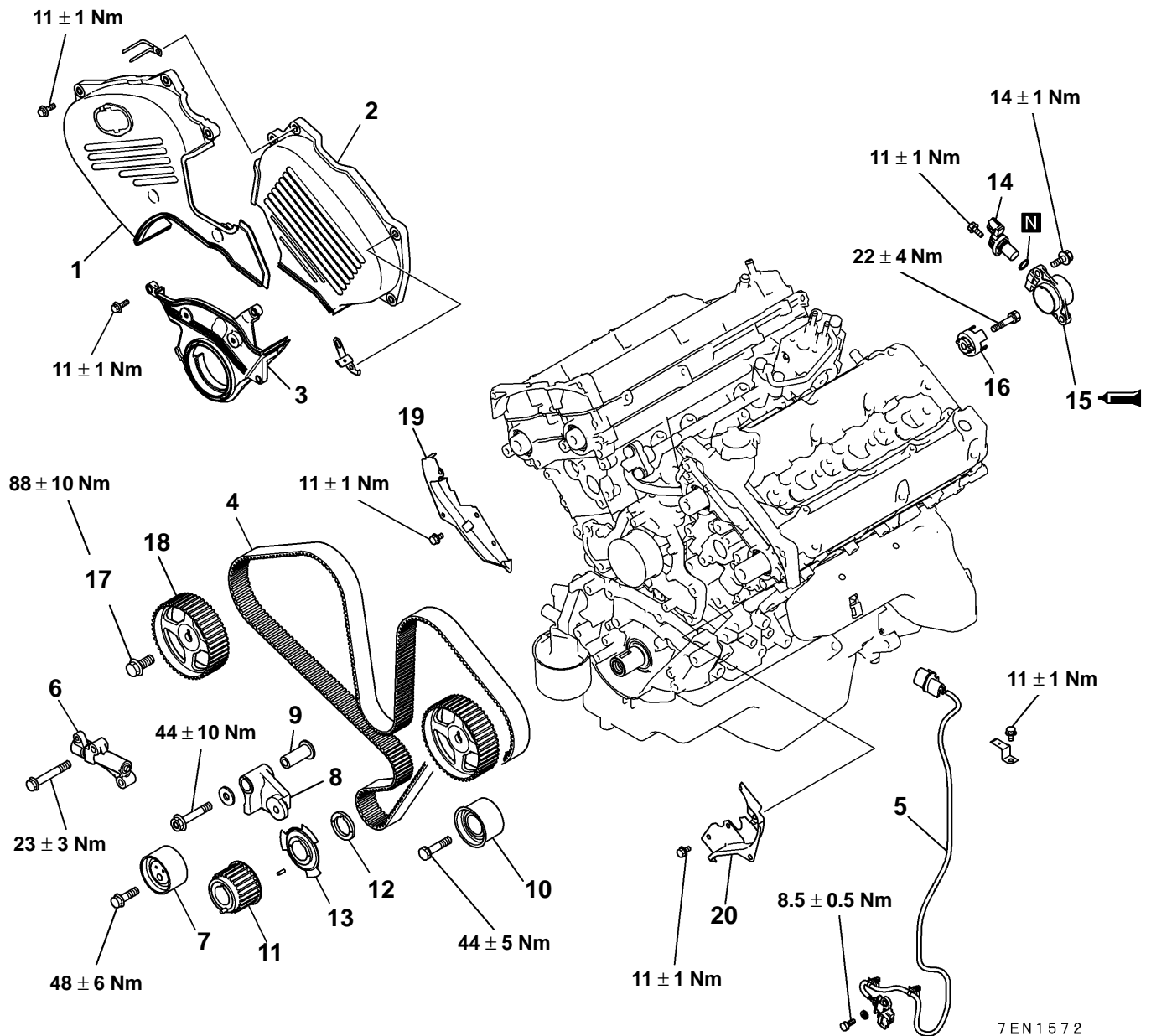
Removal steps

- 1. Timing belt front upper cover, right
- 2. Timing belt front upper cover, left
- 3. Timing belt front lower cover
- ◀A▶ ▶I▶ 4. Timing belt
- ▶G▶ 5. Crankshaft position sensor
- 6. Auto tensioner
- 7. Tensioner pulley
- 8. Tensioner arm
- 9. Shaft
- 10. Idler pulley

- ▶E▶ 11. Crankshaft sprocket
- ▶E▶ 12. Crankshaft spacer
- ▶E▶ 13. Crankshaft sensing blade
- ▶D▶ 14. Cam position sensor
- ▶C▶ 15. Cam position sensor support
- ▶C▶ 16. Cam position sensing cylinder
- ▶A▶ 17. Camshaft sprocket bolt
- 18. Camshaft sprocket
- 19. Timing belt rear cover

REMOVAL AND INSTALLATION

<GDI>

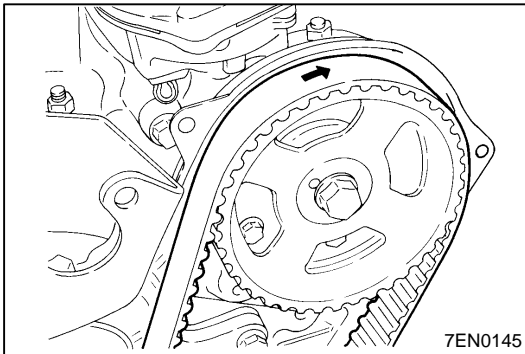


7EN1572

Removal steps

- 1. Timing belt front upper cover, right
- 2. Timing belt front upper cover, left
- 3. Timing belt front lower cover
- 4. Timing belt
- 5. Crankshaft position sensor
- 6. Auto tensioner
- 7. Tensioner pulley
- 8. Tensioner arm
- 9. Shaft
- 10. Idler pulley

- ▶E◀ 11. Crankshaft sprocket
- ▶E◀ 12. Camshaft spacer
- ▶E◀ 13. Camshaft sensing blade
- ▶D◀ 14. Cam position sensor
- ▶C◀ 15. Cam position sensor support
- ▶B◀ 16. Cam position sensing cylinder
- ▶B◀ 17. Camshaft sprocket bolt
- ▶B◀ 18. Camshaft sprocket
- ▶B◀ 19. Timing belt rear cover, right
- ▶B◀ 20. Timing belt rear cover, left



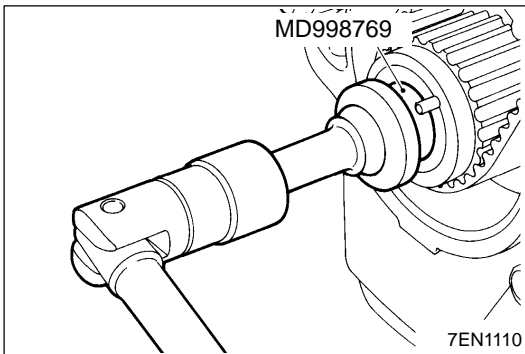
REMOVAL SERVICE POINTS

◀A▶ TIMING BELT REMOVAL

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.

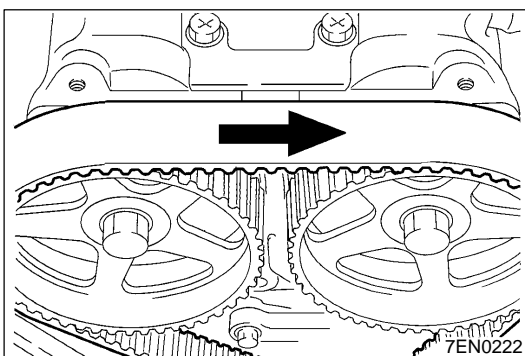
Caution

- (1) 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.
- (2) 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▶ TIMING BELT REMOVAL

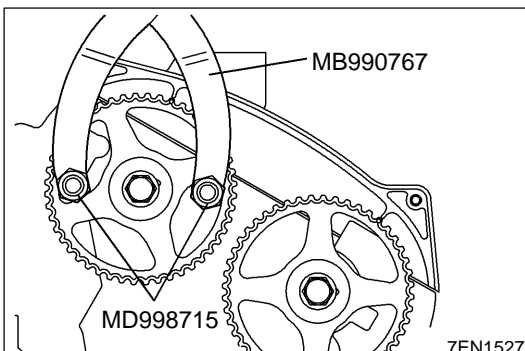
1. Turn the crankshaft to bring the piston in No. 1 cylinder to its TDC on the compression stroke.



2. If reusing the timing belt, use a chalk to draw an arrow on back of the timing belt to indicate rotation direction.

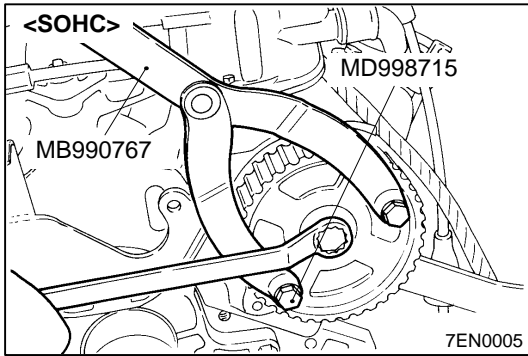
NOTE

- (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.



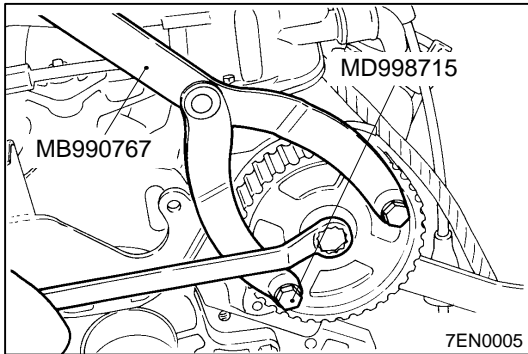
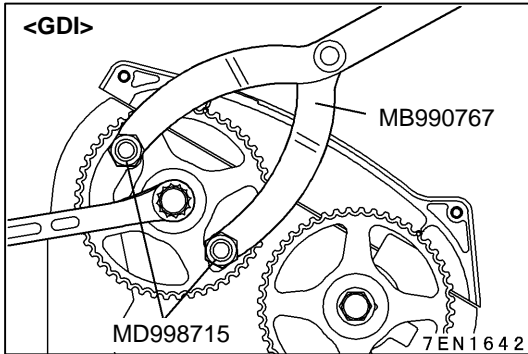
◀C▶ CAM POSITION SENSING CYLINDER REMOVAL

With the camshaft sprocket locked in position using the special tool, remove the cam position sensing cylinder.



◀D▶ CAMSHAFT SPROCKET BOLT REMOVAL

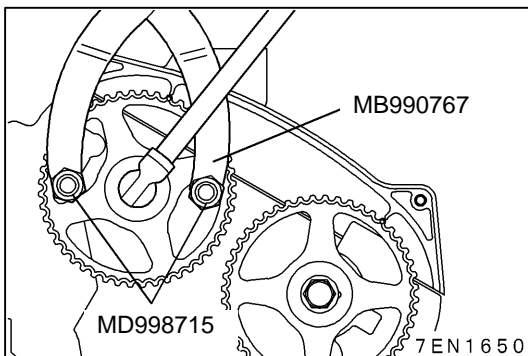
1. Using the Special Tool, hold the camshaft sprocket.
2. Remove the camshaft sprocket bolt.



INSTALLATION SERVICE POINTS

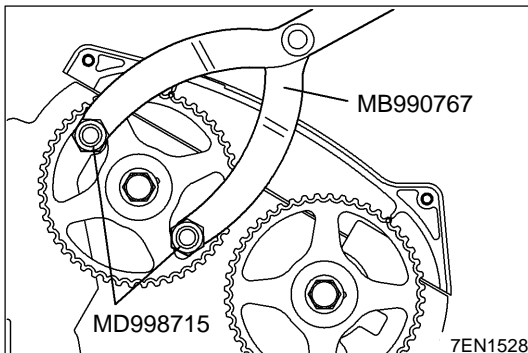
▶A▶ CAMSHAFT SPROCKET BOLT INSTALLATION

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



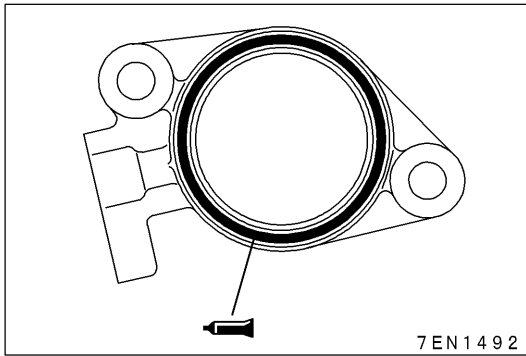
▶B▶ CAMSHAFT SPROCKET BOLT INSTALLATION

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



▶C▶ CAM POSITION SENSING CYLINDER INSTALLATION

With the camshaft sprocket locked in position using the special tool, install the cam position sensing cylinder.

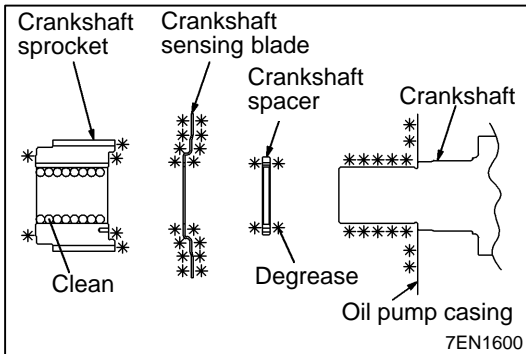


►D◄ CAM POSITION SENSOR SUPPORT INSTALLATION

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

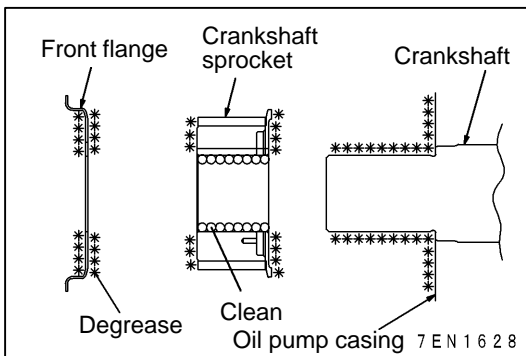
Specified sealant:

Mitsubishi Genuine Part No. MD970389 or equivalent



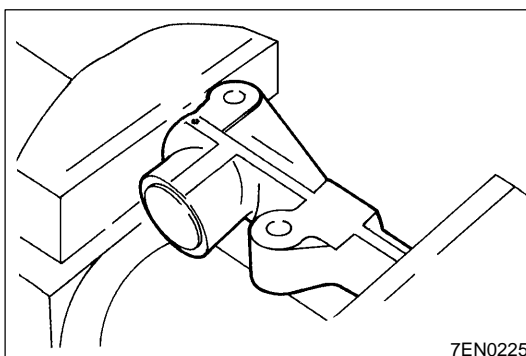
►E◄ CRANKSHAFT SPROCKET / CRANKSHAFT SENSING BLADE / CRANKSHAFT SPACER INSTALLATION

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.



►F◄ CRANKSHAFT SPROCKET / FRONT FLANGE INSTALLATION

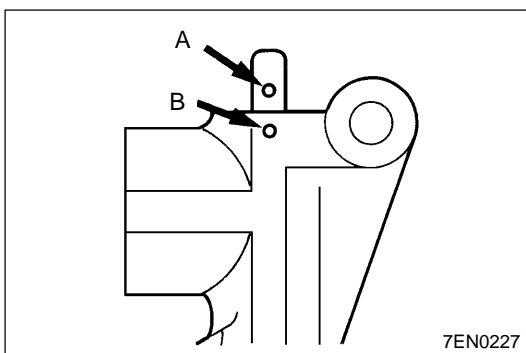
1. Wipe clean the crankshaft fitting surface of the crankshaft sprocket.
2. Clean and degrease the crankshaft sprocket, the crankshaft sprocket fitting surface of the crankshaft, front flange. Then, install the crankshaft sprocket, front flange on the crankshaft.



►G◄ AUTO TENSIONER INSTALLATION

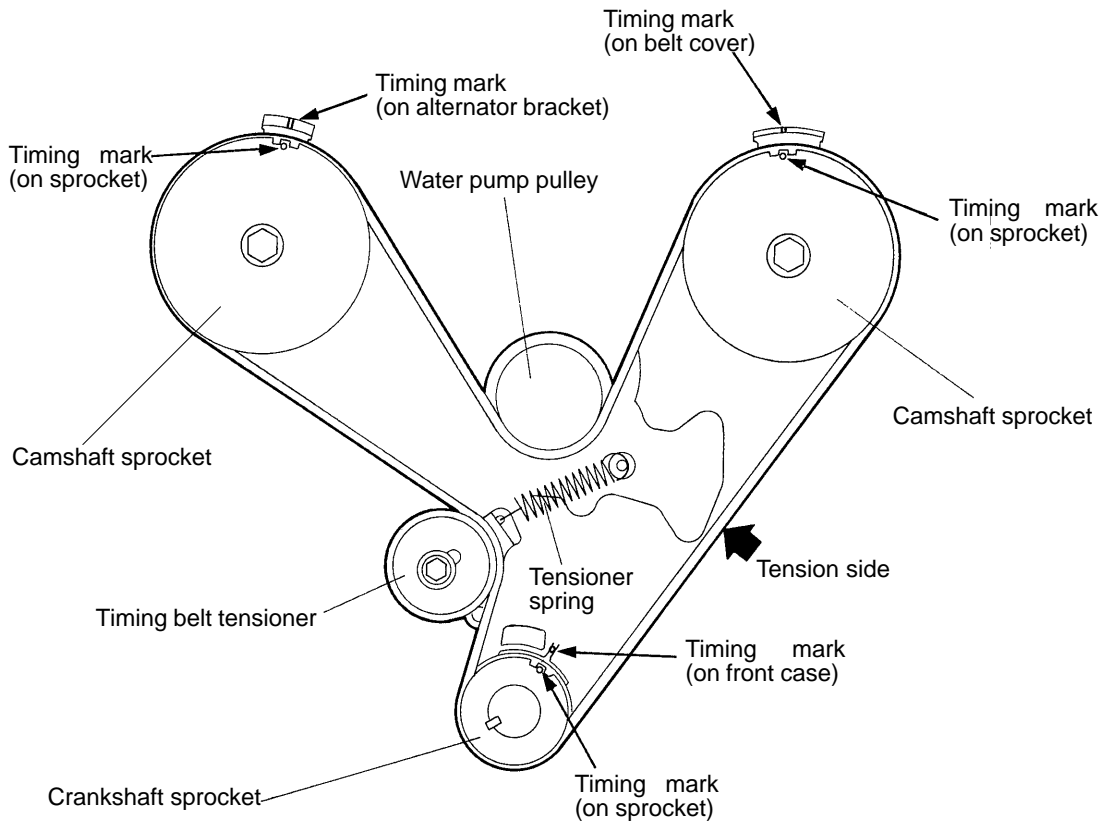
1. If the auto tensioner rod is fully extended, set it in the retracted position with the following procedure.
 - (1) Set the auto tensioner in a vice, while making sure it is not tilted.
 - (2) Slowly close the vice to force the rod in until the set hole (A) of the rod is lined up with the set hole (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. On engines with turbocharger, apply sealant to the threads of the auto tensioner mounting bolt.
3. Install the auto tensioner on the cylinder block through the oil pump case.

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

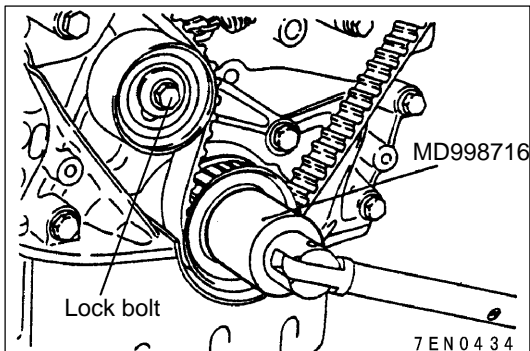


▶H◀ TIMING BELT INSTALLATION

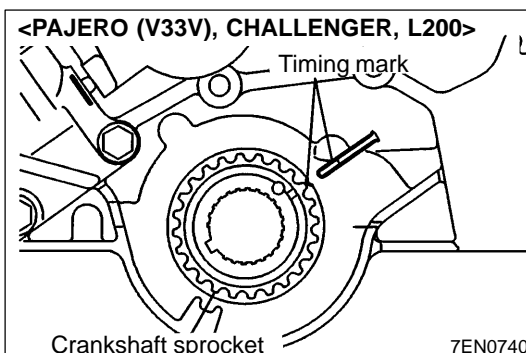
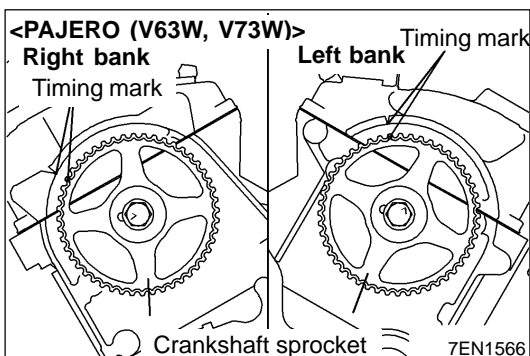
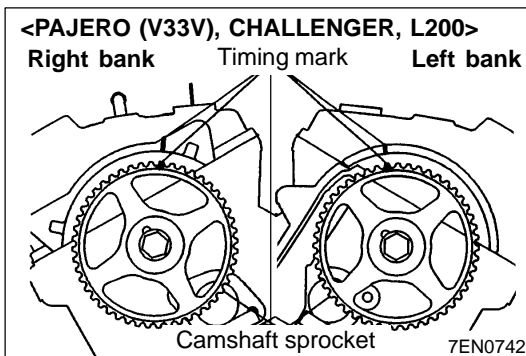
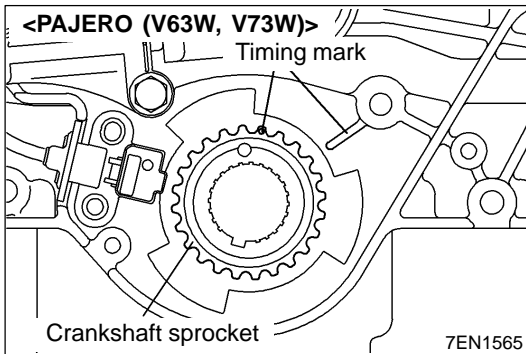
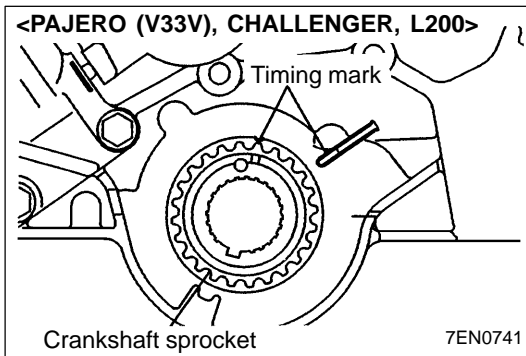
1. Align the timing marks of the camshaft sprockets and the crankshaft sprocket.
2. First, route the timing belt on the crankshaft sprocket, then on the camshaft sprocket of the left bank side without slackness in the tension side.
3. Next, run the timing belt onto the water pump pulley, the camshaft sprocket on the right bank side, and the timing belt tensioner.



7EN0007



4. Back off the tensioner lock bolt one or two turns.
5. Install the flange onto the front end of crankshaft.
6. Install the special tool onto the crankshaft.
7. Turn the crankshaft clockwise smoothly two turns.
8. Tighten the tensioner lock nut to specified torque.



▶◀ TIMING BELT INSTALLATION

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 center on the compression stroke.)

Caution

If the camshaft sprocket is turned with the piston at the top dead center on the compression stroke, valves may interfere with the piston.

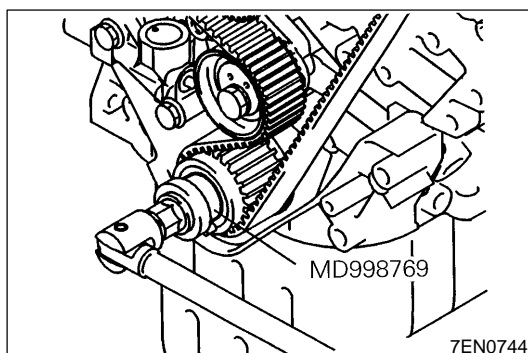
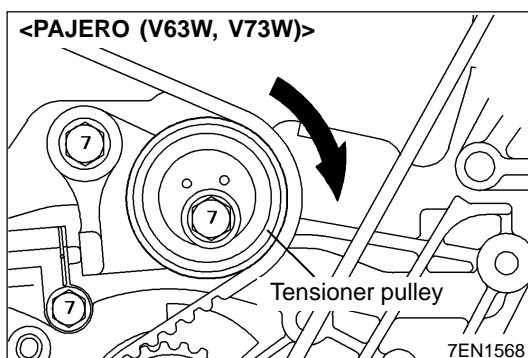
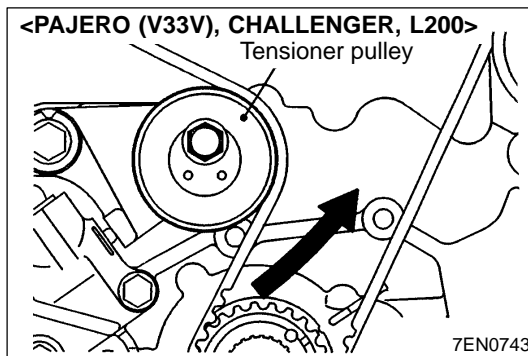
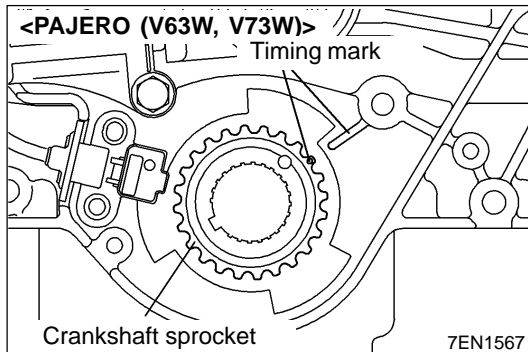
2. Align the timing marks for the left bank camshaft sprocket.
3. Align the timing marks for the right bank camshaft sprocket.

Caution

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

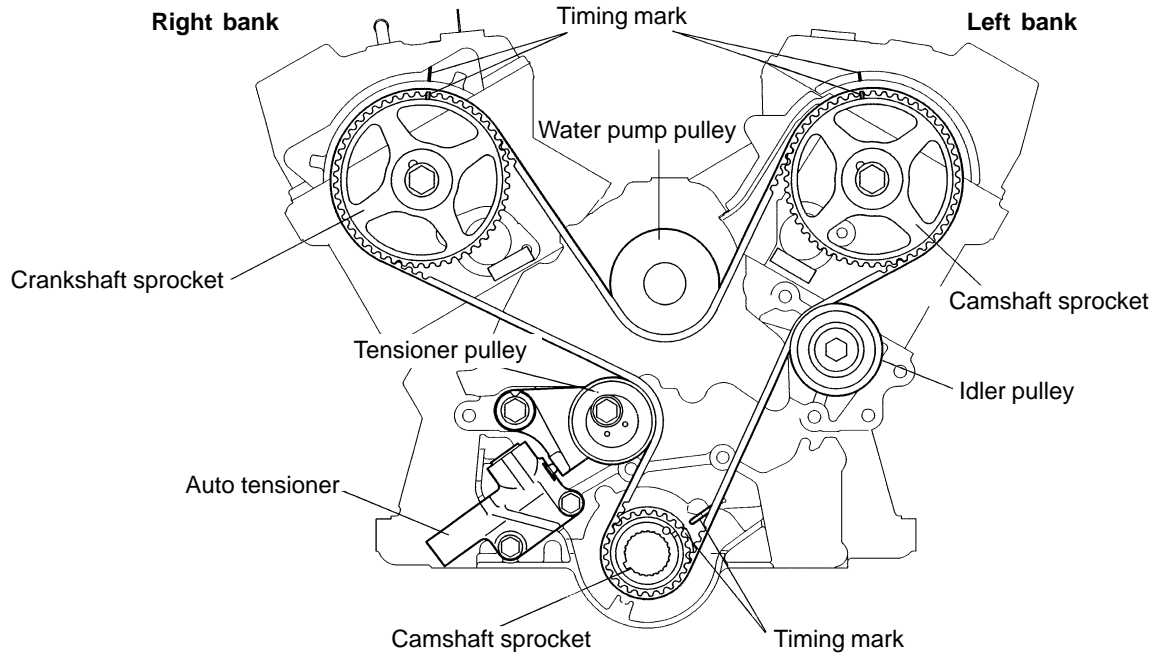
4. Align timing marks for the crankshaft sprocket.
5. Install the timing belt over the sprockets in the following procedure.
 - (1) Place the timing belt over the crankshaft. While giving tension to the belt, set it over the idler pulley.
 - (2) Place the belt over the left bank camshaft sprocket.
 - (3) While giving 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 center bolt.
7. Check that all timing marks are in alignment.



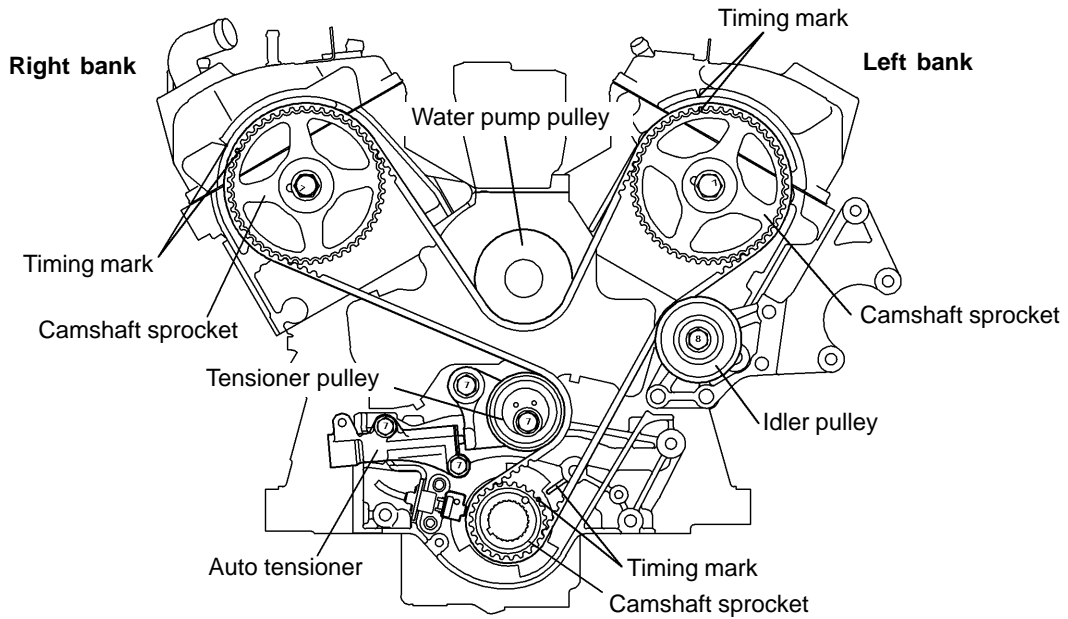
8. Using the special tool, turn the crankshaft counter-clockwise a quarter turn, then turn it clockwise and align the timing marks. Make sure that all timing marks are in alignment.

<PAJERO (V33V), CHALLENGER, L200>

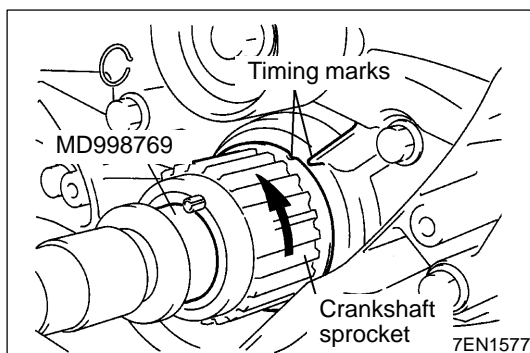
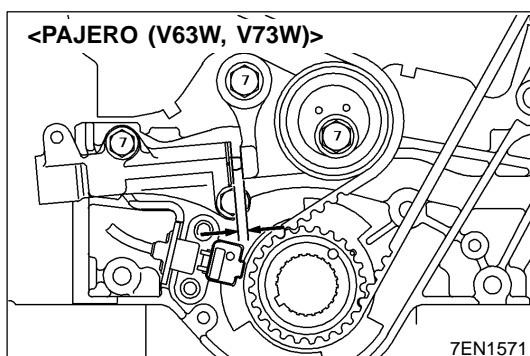
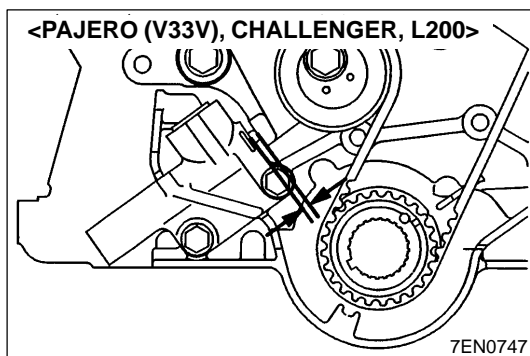
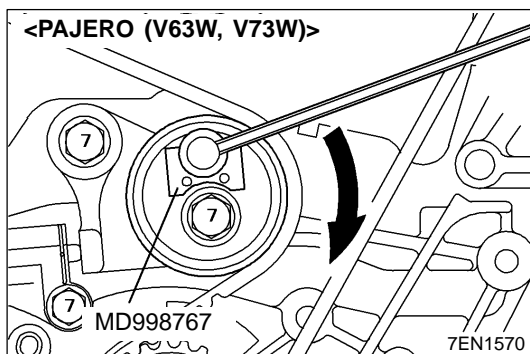
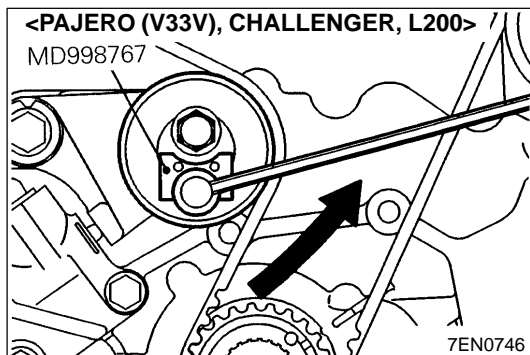


7EN0745

<PAJERO (V63W, V73W)>



7EN1569



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 center 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 has been inserted when installing the tensioner, from the auto tensioner. If it is removed easily, the timing belt tension is correct. Make sure that the auto tensioner rod projection is within specification.

Standard value:

3.8 – 4.5 mm

<PAJERO (V33V), CHALLENGER, L200>

4.8 – 5.5 mm

<PAJERO (V63W, V73W)>

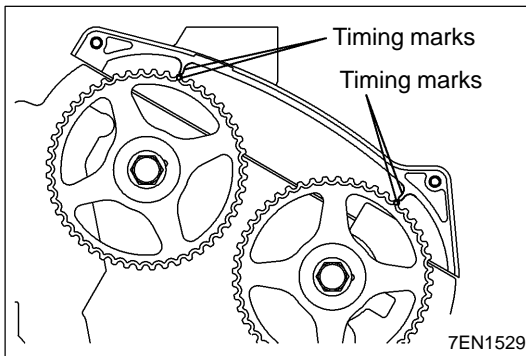
14. If the wire cannot be removed easily or the rod protrusion is not up to specification, repeat steps 9. through 12. to obtain the correct tension.

▶◀ TIMING BELT INSTALLATION

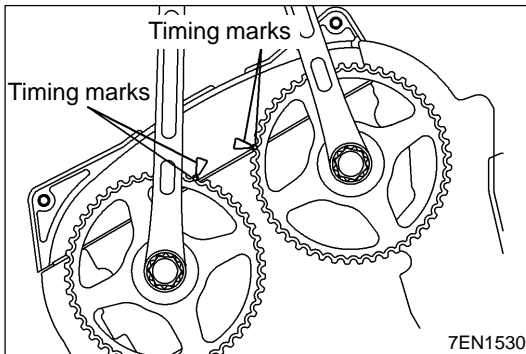
1. Turn the crankshaft sprocket so that its timing mark is off three teeth to slightly lower the piston in No. 1 cylinder from its TDC on the compression stroke.

Caution

There can be an interference between the valve and piston when the camshaft sprocket is turned with the piston in No. 1 cylinder at its TDC on the compression stroke.



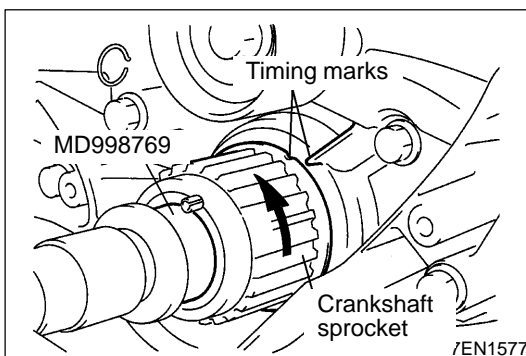
- Align the timing mark of the camshaft sprocket on the left bank side.



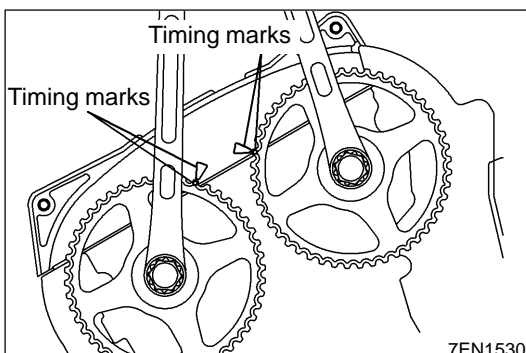
- Align the timing marks of the camshaft sprockets on the right bank side. When the special tool is removed, the sprocket turns by itself, letting the timing mark to deviate. Make necessary corrections, therefore, in step 5. to align the timing mark before installing the belt.

Caution

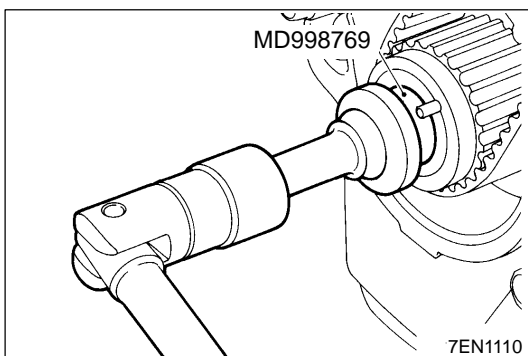
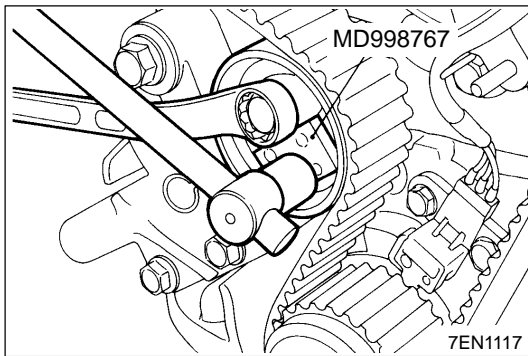
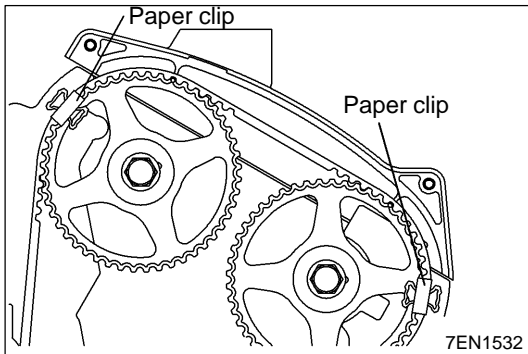
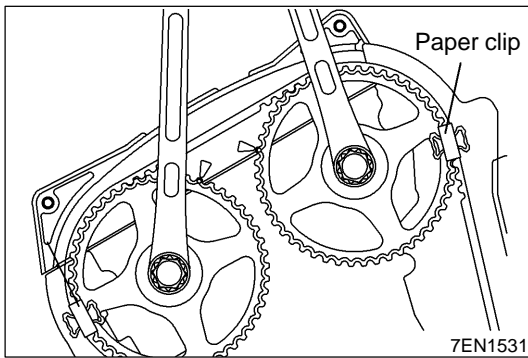
- The camshaft sprockets on the right bank side are easy to turn because of the spring tension involved. Be careful not to allow your finger to be pinched in the mechanism.
- Do not attempt to turn one of the sprockets on the right side one turn with the timing mark of another one aligned. It may cause the intake and exhaust valves to interfere with each other.



- Align the timing mark of the crankshaft sprocket. Then, turn the crankshaft sprocket one tooth counterclockwise.



- Align the timing marks of the camshaft sprockets on the right bank side and lock them in position with box wrenches.

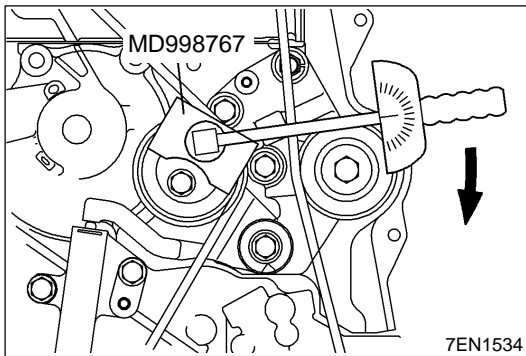
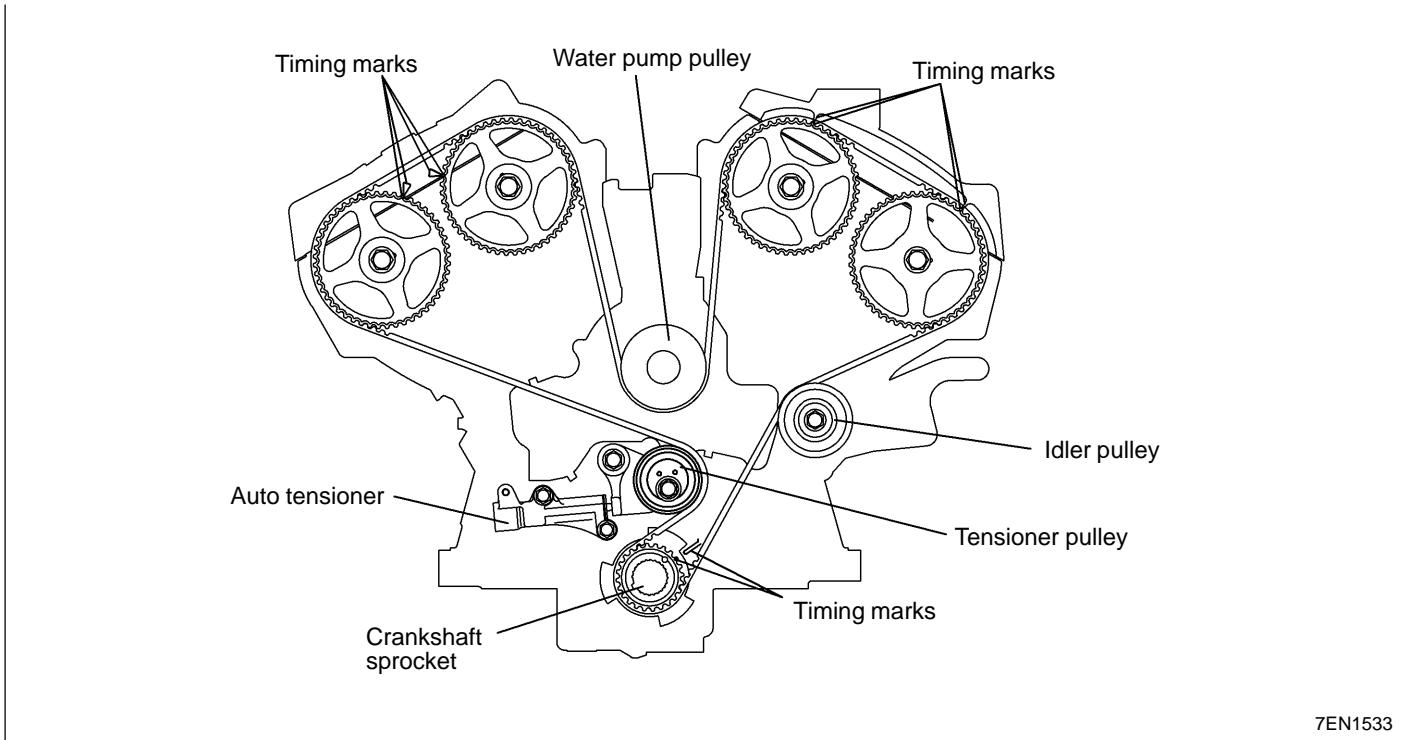


6. Make sure that the timing mark of the exhaust camshaft sprocket on the right bank side is in alignment. Then install the timing belt over the sprocket and secure it with a paper clip.

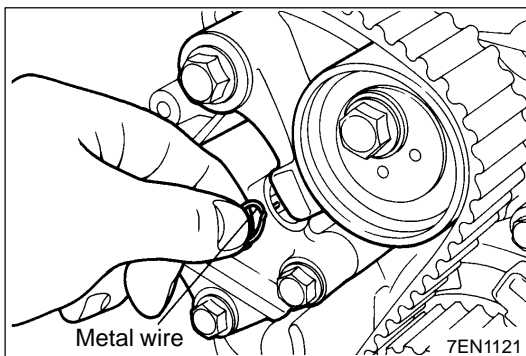
Caution

If the old timing belt is to be reused, install it so that the arrow marked during removal procedures points in the turning direction.

7. Check that the timing mark is aligned on the intake camshaft sprocket. Then install the timing belt and secure it with a paper clip.
8. Place the timing belt around the water pump pulley.
9. Check that the timing marks of the camshaft sprockets on the left bank side are in alignment. Then install the timing belt over the sprockets and secure it with paper clips.
10. Place the timing belt around the idler pulley.
11. Place the timing belt around the crankshaft sprocket.
12. Place the timing belt around the tensioner pulley.
13. Make sure that the tensioner pulley is positioned so that its pinhole is on the upper side. Then, lightly press the tensioner pulley against the timing belt and temporarily tighten the fixing bolt.
14. Remove all four paper clips.
15. Turn the crankshaft one tooth clockwise.
16. Check that the timing mark of each sprocket is properly aligned.
17. Turn the crankshaft 1/4 turns counter-clockwise. Then, turn it clockwise and check that the timing marks are properly aligned.

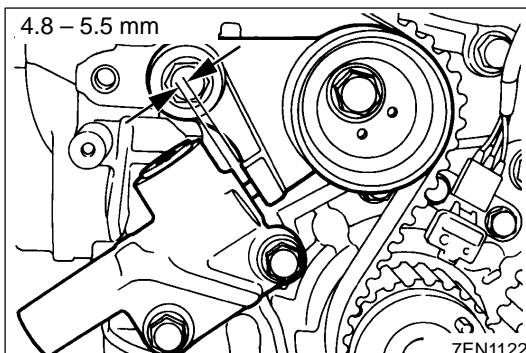


18. Loosen the center bolt of the tensioner pulley and install the special tool and torque wrench. Apply a torque of 4.4 Nm to prevent the tensioner pulley from turning together, tighten the center bolt to the specified torque.

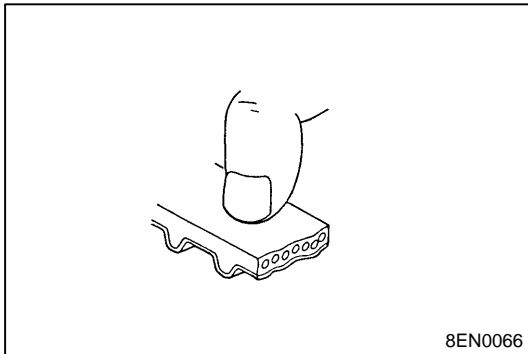


19. Turn the crankshaft two complete turns clockwise and leave it to stand for about 5 minutes.
20. Check to see if the metal wire, which has been inserted during installation procedures, can be removed easily from the auto tensioner.
If it can be removed with a light force, it indicates that the belt tension is appropriate. Now, remove the metal wire. Another indication of an adequate belt tension is that the protrusion of the rod of the auto tensioner falls within the standard value range.

Standard value: 4.8 – 5.5 mm



21. If the metal wire cannot be pulled out easily, repeat steps 18. and 19. until an adequate tension is obtained.

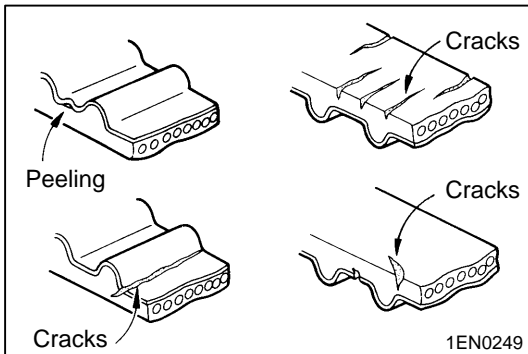


INSPECTION

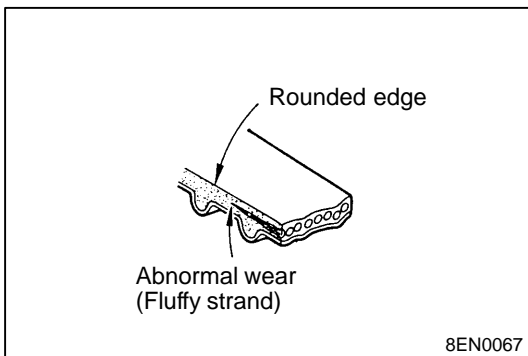
1. TIMING BELT

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.



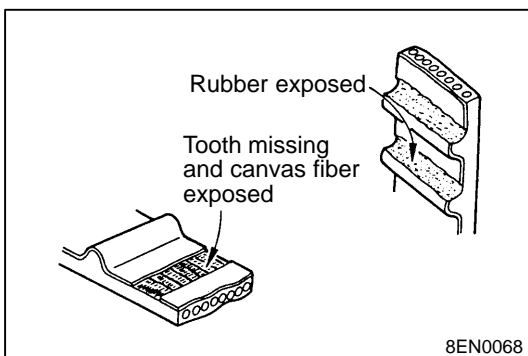
- (2) Cracked back surface rubber.
- (3) Cracked or separated canvas.
- (4) Cracked tooth bottom.
- (5) Cracked side of belt.



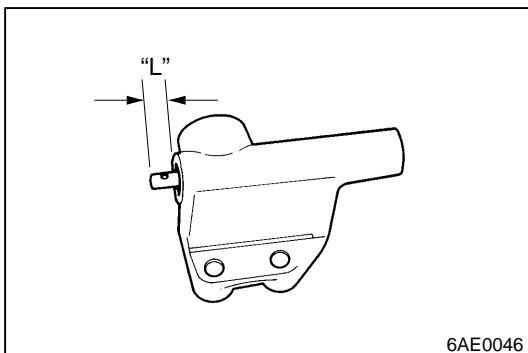
- (6) Side of belt badly worn.

NOTE

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



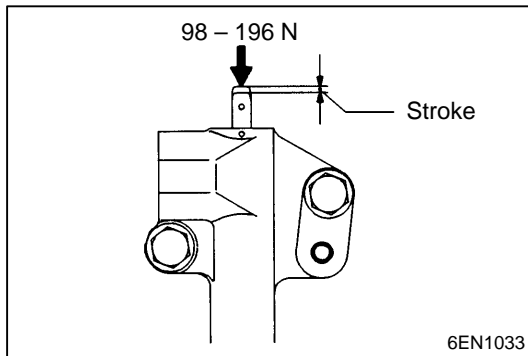
- (7) Badly worn teeth.
Initial stage:
Canvas is worn (fluffy canvas fibres are visible, rubber is gone and colour has changed to white. Canvas texture is not clear).
Last stage:
Canvas is worn out and rubber exposed and its width is reduced.
- (8) Missing tooth.



2. 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



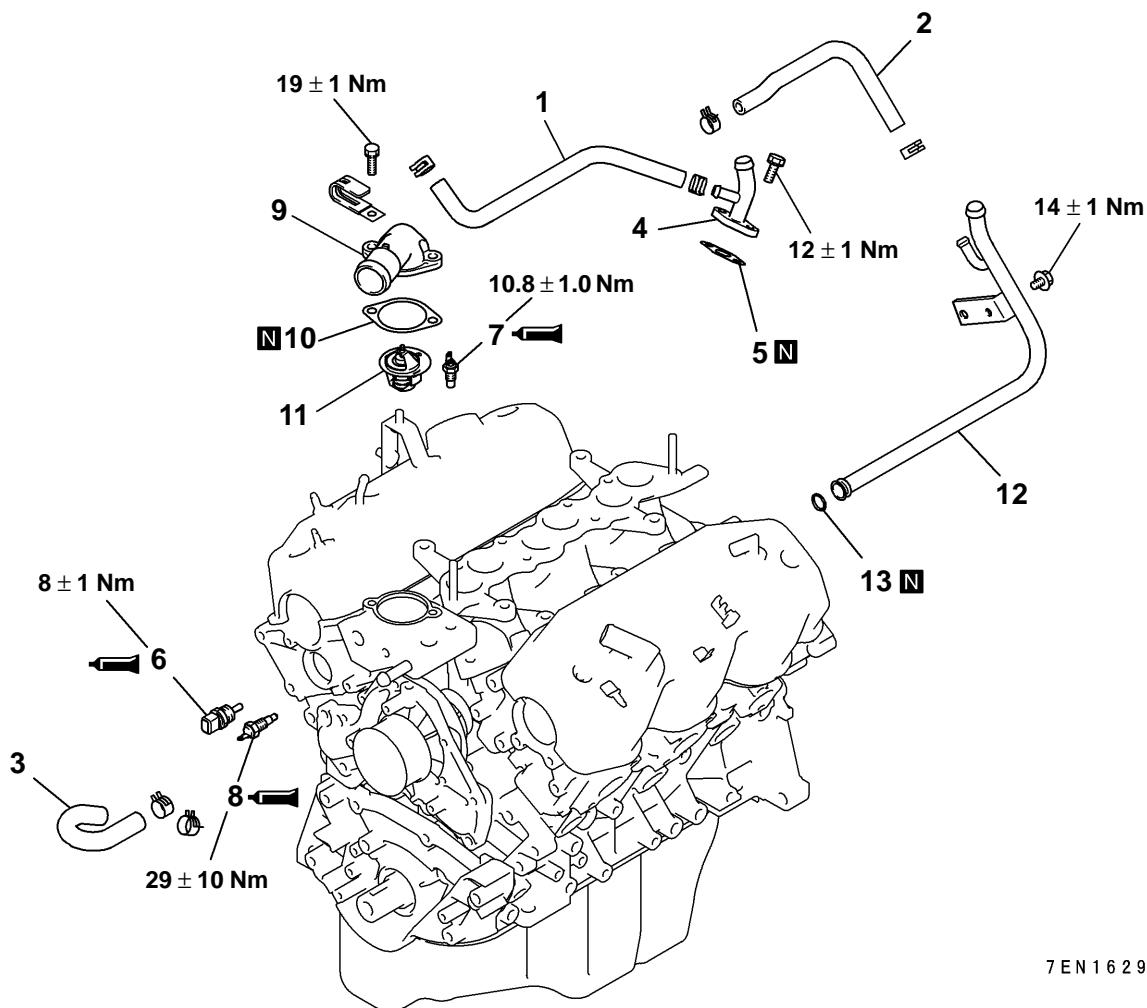
- (4) Press the rod by a force of 98 to 196 N and measure the rod stroke. If the measured value exceeds the standard value, replace the tensioner.

Standard value: 1 mm or less

7. WATER PIPE AND WATER HOSE

REMOVAL AND INSTALLATION

<12-VALVE>



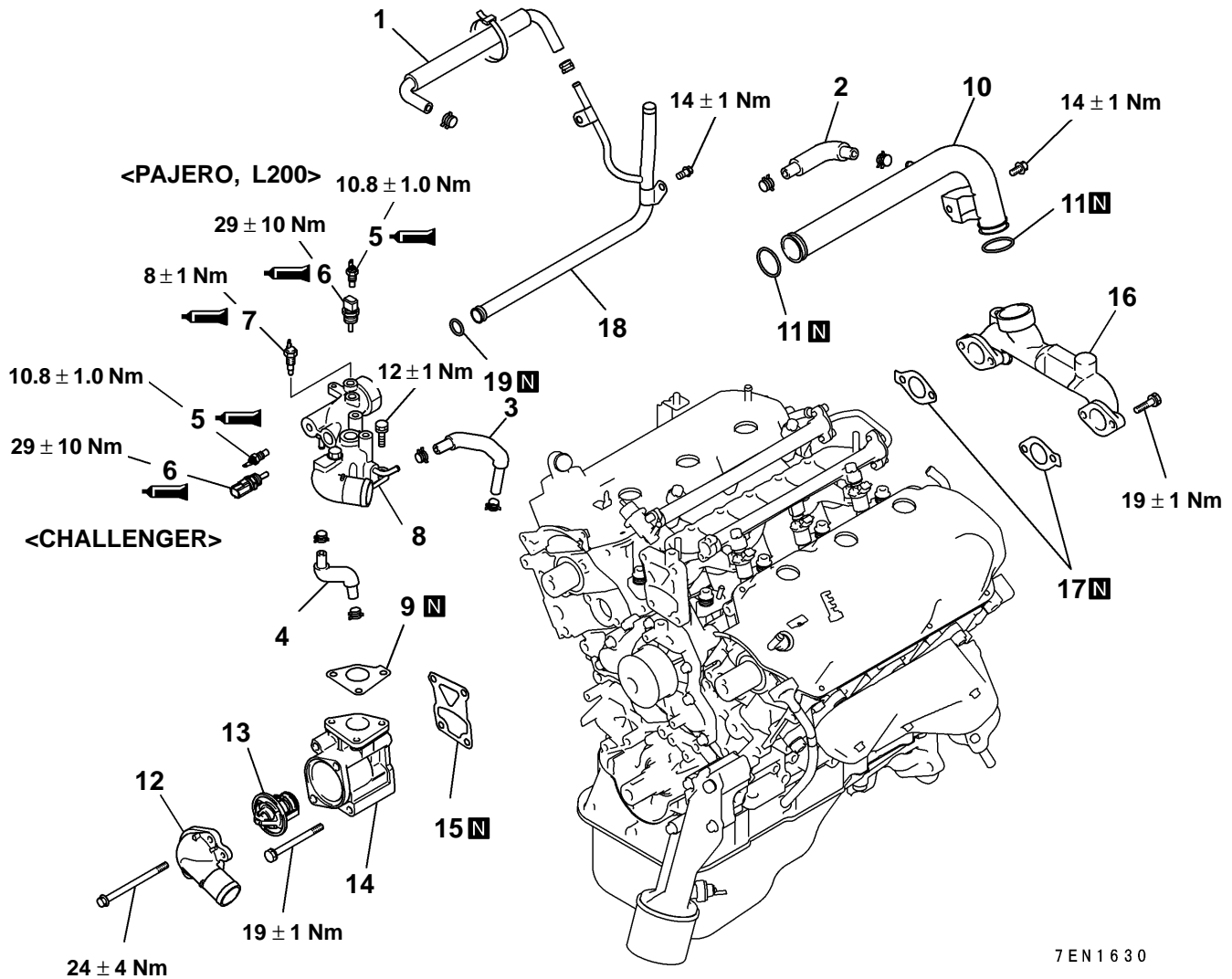
7EN1629

Removal steps

- | | |
|--|--|
| <ul style="list-style-type: none"> 1. Water hose 2. Water hose 3. Water by-pass hose 4. Heat pipe 5. Heat pipe gasket >F< 6. Thermo switch <for A/T> >E< 7. Engine coolant temperature gauge unit | <ul style="list-style-type: none"> >D< 8. Engine coolant temperature sensor 9. Water outlet fitting 10. Water outlet fitting gasket 11. Thermostat >A< 12. Water pipe >A< 13. O-ring |
|--|--|

REMOVAL AND INSTALLATION

<24-VALVE FOR PAJERO (V33V), CHALLENGER, L200>



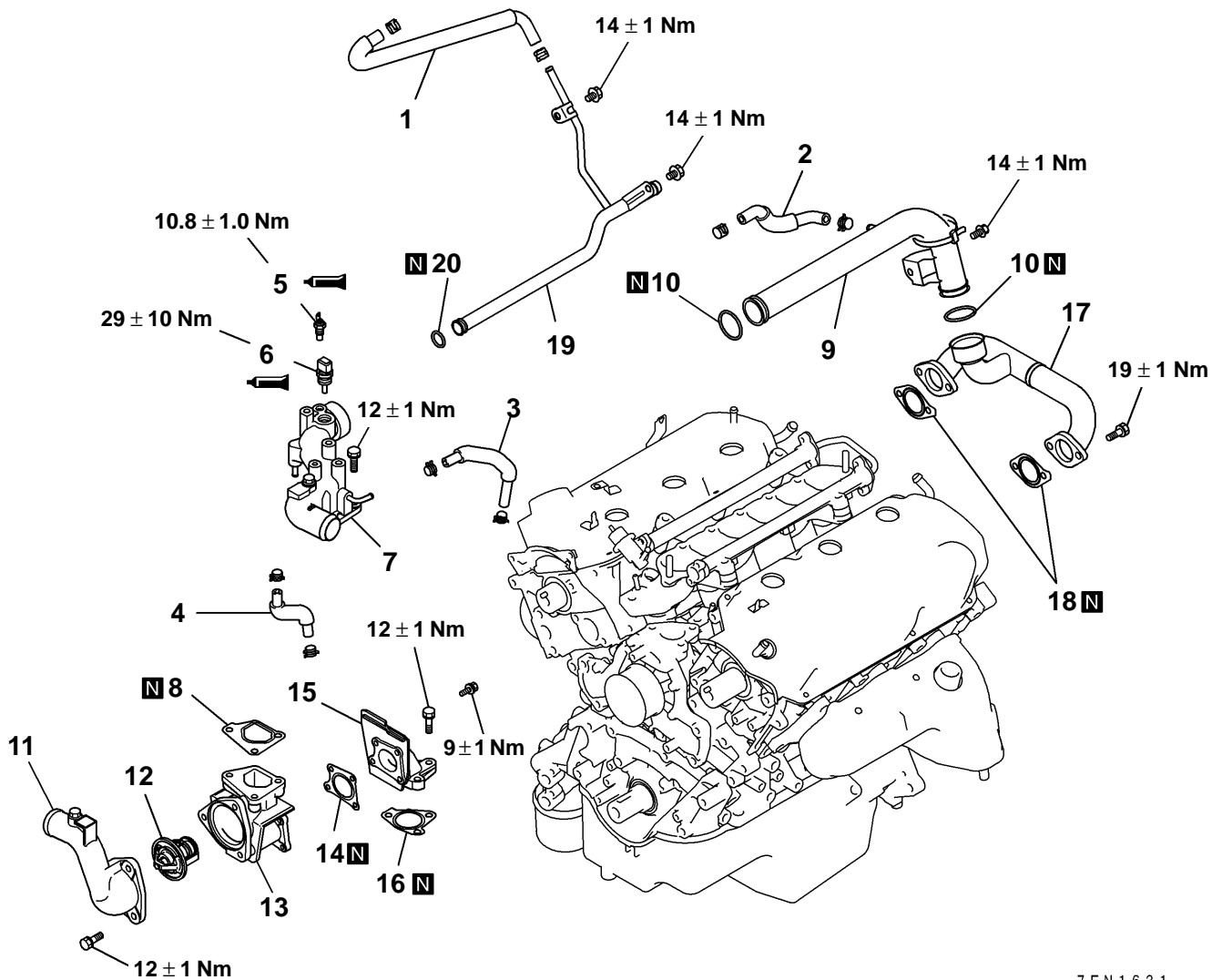
7EN1630

Removal steps

- 1. Water hose
- 2. Water hose
- 3. Water hose
- 4. Water hose
- ▶E◀ 5. Engine coolant temperature gauge unit
- ▶D◀ 6. Engine coolant temperature sensor
- ▶F◀ 7. Thermo switch (For PAJERO-A/T)
- 8. Water outlet fitting
- 9. Water outlet fitting gasket

- ▶C◀ 10. Water outlet pipe
- ▶C◀ 11. O-ring
- 12. Water inlet fitting
- ▶B◀ 13. Thermostat
- 14. Thermostat case
- 15. Gasket
- 16. Water passage
- 17. Gasket
- ▶A◀ 18. Water pipe
- ▶A◀ 19. O-ring

<24-VALVE FOR PAJERO (V63W, V73W)>



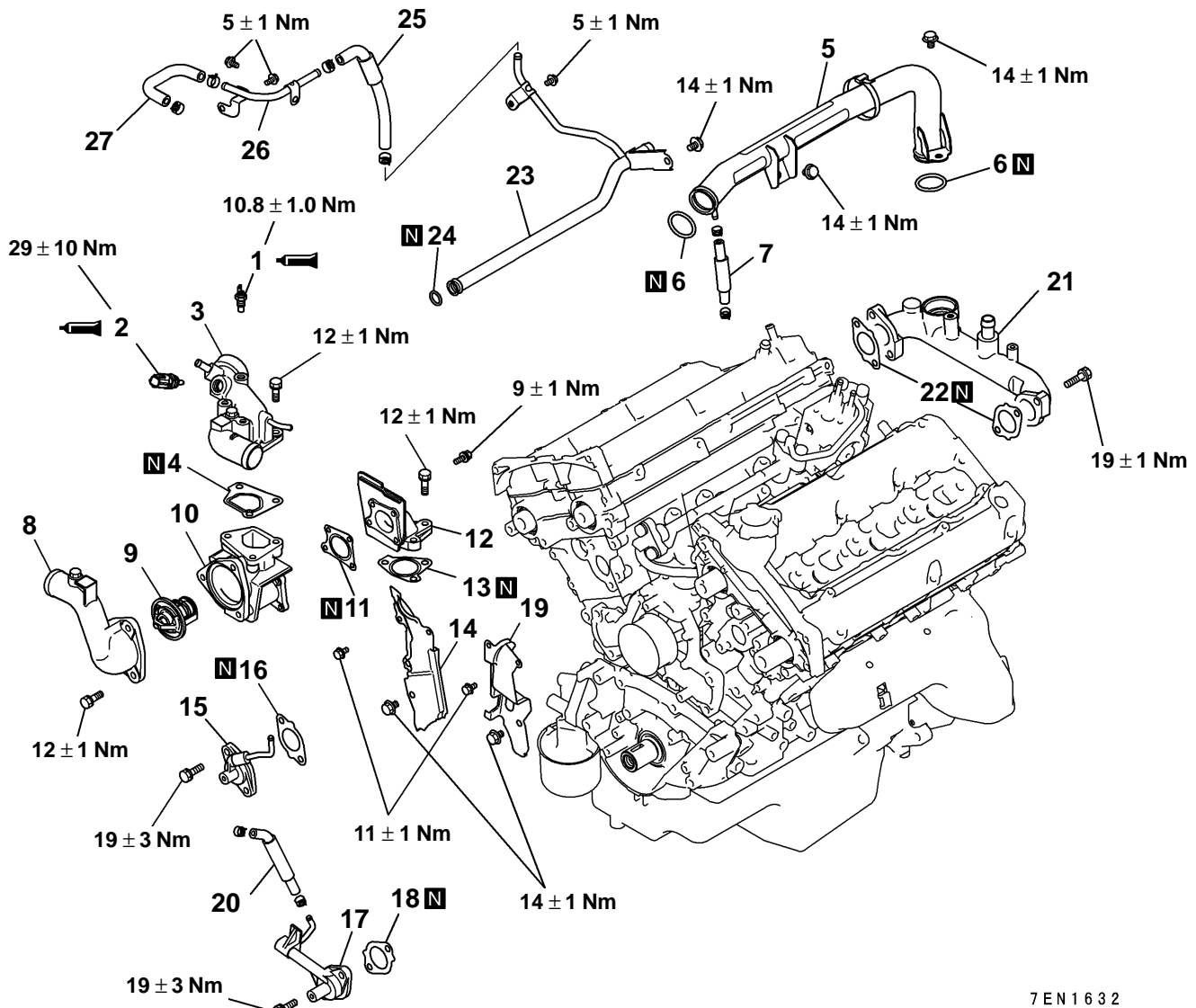
7EN1631

Removal steps

- | | | | |
|-----|--|-----|-------------------------|
| | 1. Water hose | | 11. Water inlet fitting |
| | 2. Water hose | ▶B◀ | 12. Thermostat |
| | 3. Water hose | | 13. Thermostat case |
| | 4. Water hose | | 14. Gasket |
| ▶E◀ | 5. Engine coolant temperature gauge unit | | 15. Water pump fitting |
| ▶D◀ | 6. Engine coolant temperature sensor | | 16. Gasket |
| | 7. Water outlet fitting | | 17. Water passage |
| | 8. Gasket | | 18. Gasket |
| ▶C◀ | 9. Water outlet pipe | ▶A◀ | 19. Water pipe |
| ▶C◀ | 10. O-ring | ▶A◀ | 20. O-ring |

REMOVAL AND INSTALLATION

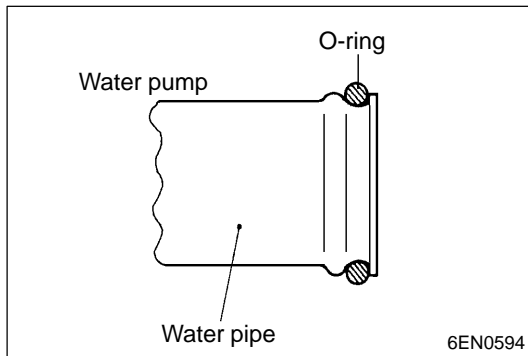
<GDI>



7EN1632

Removal steps

- ▶E◀ 1. Engine coolant temperature gauge unit
- ▶D◀ 2. Engine coolant temperature sensor
- ▶C◀ 3. Water outlet fitting
- ▶C◀ 4. Gasket
- ▶B◀ 5. Water outlet pipe
- ▶B◀ 6. O-ring
- ▶B◀ 7. Water hose
- ▶B◀ 8. Water inlet fitting
- ▶B◀ 9. Thermostat
- ▶B◀ 10. Thermostat case
- ▶B◀ 11. Gasket
- ▶B◀ 12. Water pump fitting
- ▶B◀ 13. Gasket
- ▶A◀ 14. Timing belt rear center cover, right
- ▶A◀ 15. Fitting, right
- ▶A◀ 16. Gasket
- ▶A◀ 17. Fitting, left
- ▶A◀ 18. Gasket
- ▶A◀ 19. Timing belt rear center cover, left
- ▶A◀ 20. Water hose
- ▶A◀ 21. Water passage
- ▶A◀ 22. Gasket
- ▶A◀ 23. Water pipe
- ▶A◀ 24. O-ring
- ▶A◀ 25. Water hose
- ▶A◀ 26. Water pipe assembly B
- ▶A◀ 27. Water hose

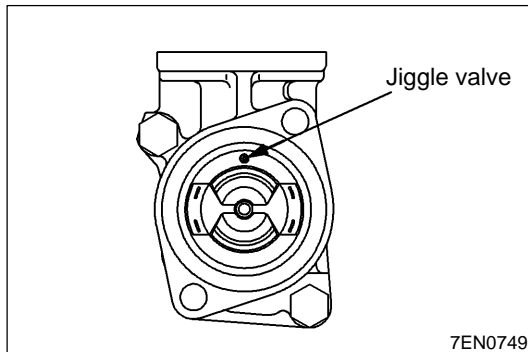
**INSTALLATION SERVICE POINTS****▶A◀ O-RING / WATER PIPE INSTALLATION**

1. Fit a new O-ring in the groove at the front end of the water pipe.
2. Coat the O-ring with water or soapsuds.

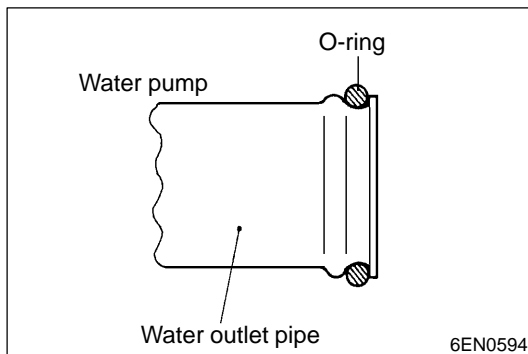
Caution

Never apply engine oil or any other grease to the O-ring.

3. Insert the front end of the water pipe in the water pump.

**▶B◀ THERMOSTAT INSTALLATION**

Install the thermostat so that the jiggle valve is on the top end.

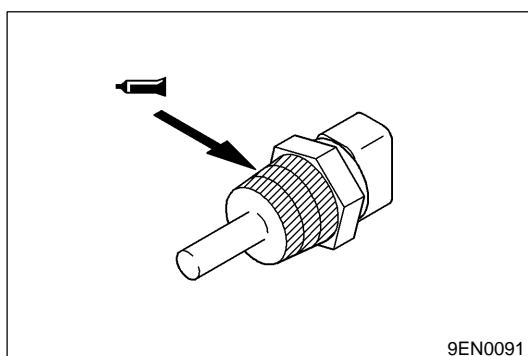
**▶C◀ O-RING / WATER OUTLET PIPE INSTALLATION**

1. Fit new O-rings in the grooves at the front and rear ends of the water pipe.
2. Coat the O-rings with water or soapsuds.

Caution

Never apply engine oil or any other grease to the O-rings.

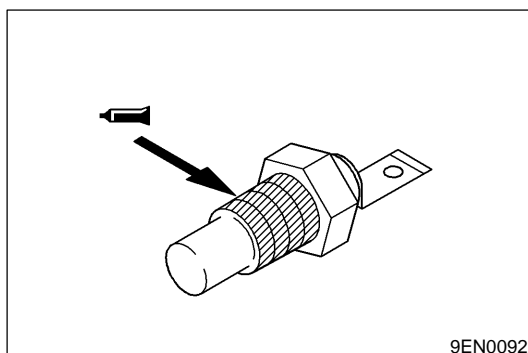
3. Insert the front end of the pipe into the water outlet pipe and rear end into the water passage.

**▶D◀ ENGINE COOLANT TEMPERATURE SENSOR INSTALLATION**

If the engine coolant temperature sensor is to be reused, apply the specified sealant to its threads.

Specified sealant:

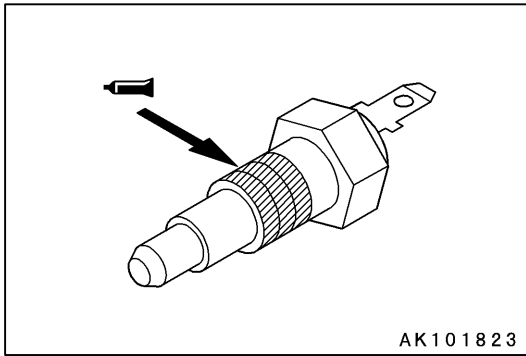
3M Nut Locking Part No. 4171 or equivalent

**▶E◀ ENGINE COOLANT TEMPERATURE GAUGE UNIT INSTALLATION**

If the engine coolant temperature gauge unit is to be reused, apply the specified sealant to its threads.

Specified sealant:

3M ATD Part No. 8660 or equivalent

**►F◄ THERMO SWITCH INSTALLATION**

If the thermo switch is to be reused, apply the specified sealant to its threads.

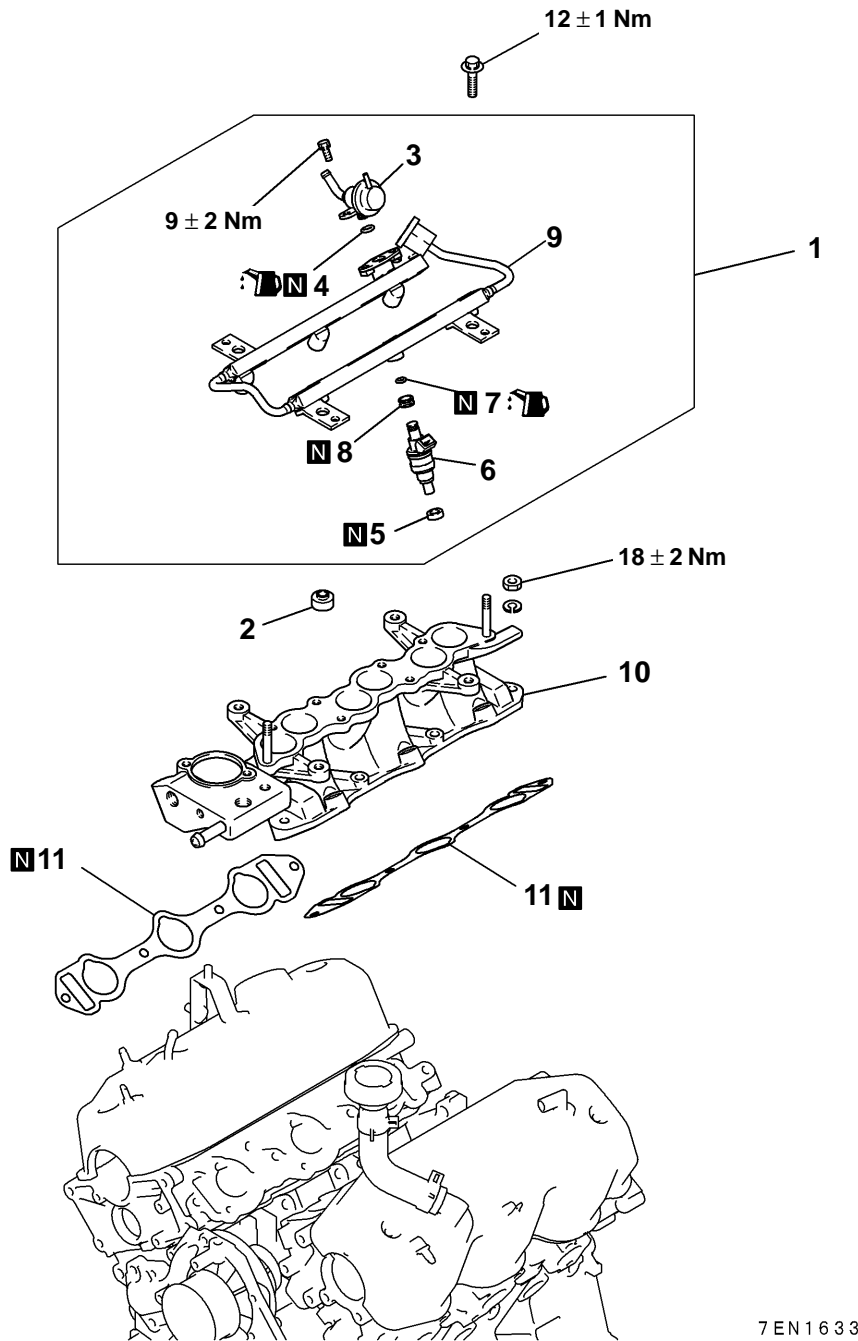
Specified sealant:

3M Nut Locking Part No. 4171 or equivalent

8. FUEL SYSTEM

REMOVAL AND INSTALLATION

<12-VALVE>



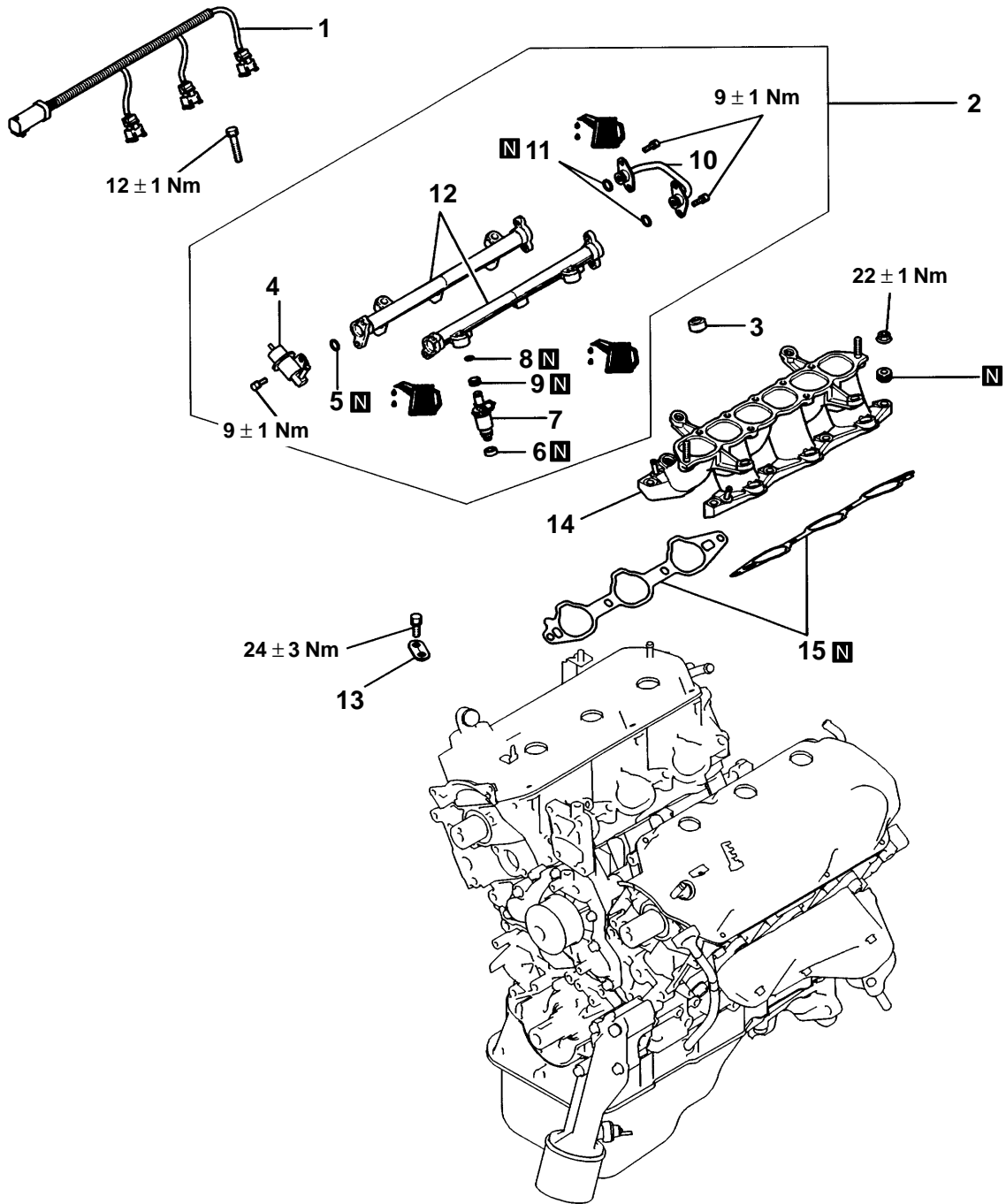
7 EN1633

Removal steps

- | | |
|--|---|
| <p>►B◄</p> <ol style="list-style-type: none"> 1. Injector and delivery pipe 2. Insulator 3. Fuel pressure regulator 4. O-ring 5. Insulator 6. Injector | <p>►A◄</p> <ol style="list-style-type: none"> 7. O-ring 8. Grommet 9. Delivery pipe 10. Intake manifold 11. Intake manifold gasket |
|--|---|

REMOVAL AND INSTALLATION

<24-VALVE>



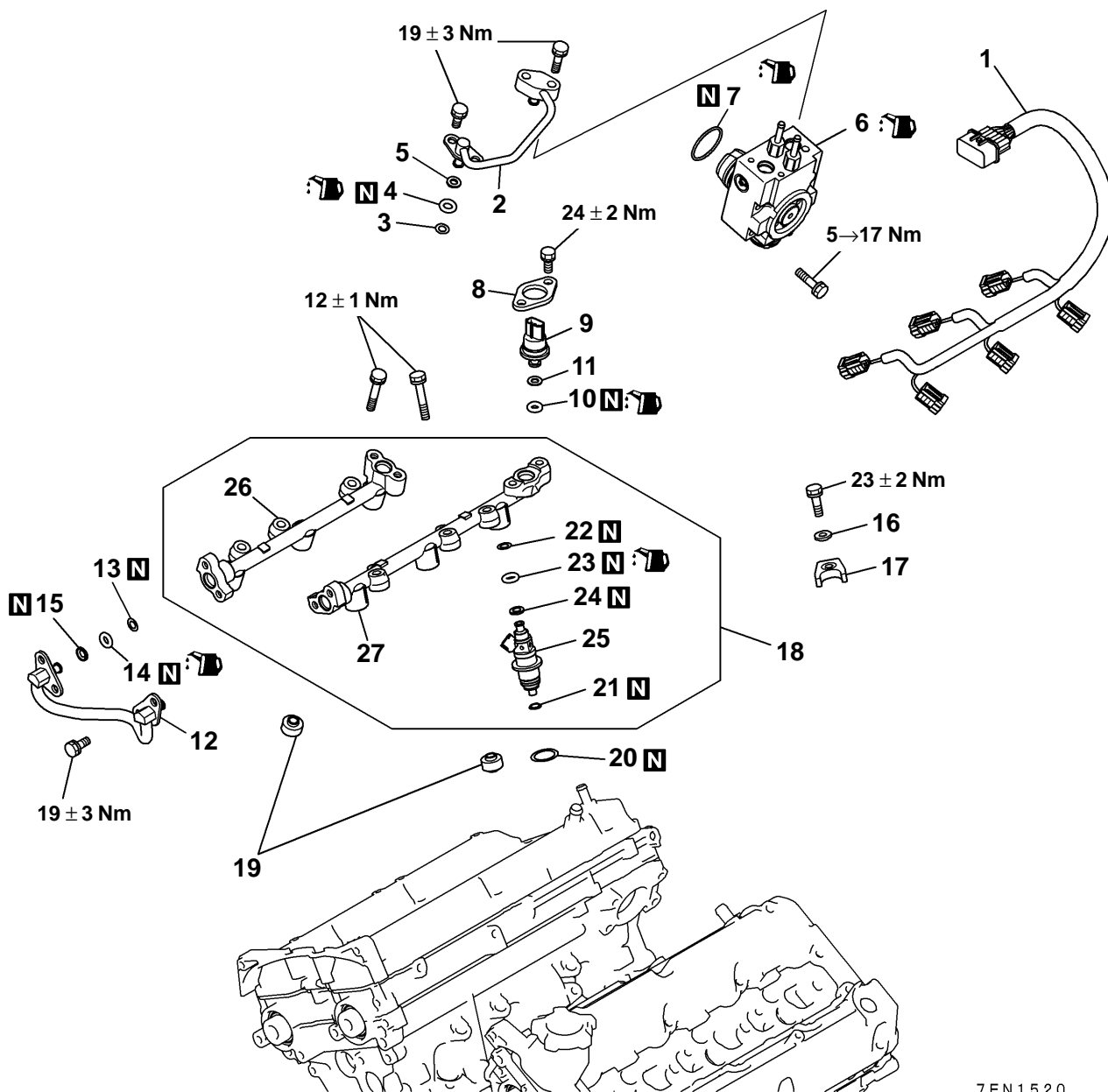
7EN1372

Removal steps

- | | |
|--|---|
| <p>►B◄</p> <ol style="list-style-type: none"> 1. Injector harness 2. Injector and delivery pipe 3. Insulator 4. Fuel pressure regulator 5. O-ring 6. Insulator 7. Injector 8. O-ring | <p>►A◄</p> <ol style="list-style-type: none"> 9. Grommet 10. Fuel pipe 11. O-ring 12. Delivery pipe 13. Water pump bracket
<Except PAJERO (V63W, V73W)> 14. Intake manifold 15. Intake manifold gasket |
|--|---|

REMOVAL AND INSTALLATION

<GDI>

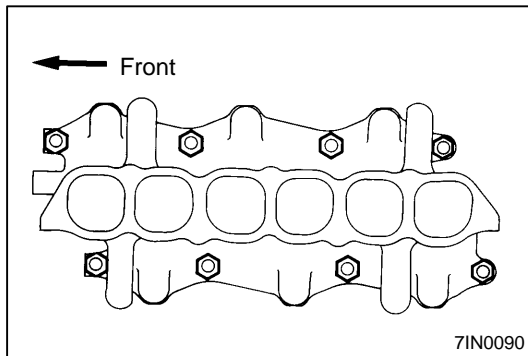


7EN1520

Removal steps

- ▶H▶ 1. Injector harness
- ▶H▶ 2. Fuel feed pipe
- ▶H▶ 3. Backup ring
- ▶H▶ 4. O-ring
- ▶H▶ 5. Backup ring
- ▶H▶ 6. Fuel pump
- ▶H▶ 7. O-ring
- ▶G▶ 8. Flange
- ▶G▶ 9. Fuel pressure sensor
- ▶G▶ 10. O-ring
- ▶G▶ 11. Backup ring
- ▶F▶ 12. Fuel center pipe
- ▶F▶ 13. Backup ring
- ▶F▶ 14. O-ring

- ▶F▶ 15. Backup ring
- ▶F▶ 16. Washer
- ▶F▶ 17. Injector holder
- ▶E▶ 18. injector and delivery pipe
- ▶E▶ 19. Insulator
- ▶D▶ 20. Injector gasket
- ▶D▶ 21. Corrugated washer
- ▶C▶ 22. Backup ring
- ▶C▶ 23. O-ring
- ▶C▶ 24. Backup ring
- ▶C▶ 25. Injector
- ▶C▶ 26. Delivery pipe, right
- ▶C▶ 27. Delivery pipe, left



INSTALLATION SERVICE POINTS

►A◄ INTAKE MANIFOLD INSTALLATION

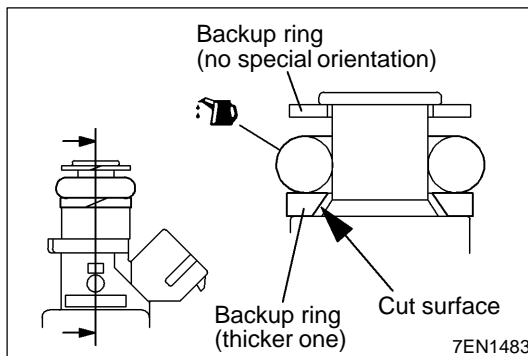
1. Tighten the nuts on the right bank to 7 ± 1 Nm.
2. Tighten the nuts on the left bank to the specified torque. Then tighten the nuts on right bank to the specified torque.
3. Tighten the nuts on the left bank and those on the right bank again in that order.

►B◄ FUEL PRESSURE REGULATOR INSTALLATION

Before installing the pressure regulator, the O-ring must be lubricated with a drop of new engine oil for easy installation.

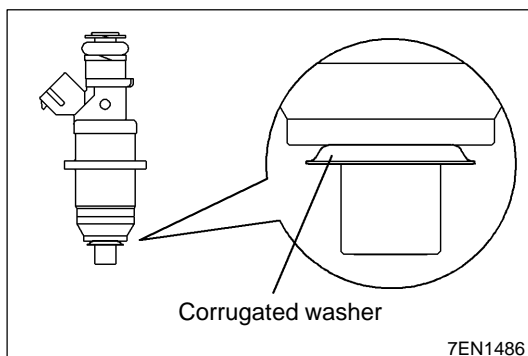
Caution

Use care not to let the engine oil enter the delivery pipe.



►C◄ BACKUP RING / O-RING INSTALLATION

Install the backup rings and O-ring to the injector. Install the backup ring (thicker one) in the injector so that its inner cut surface faces in the direction shown.

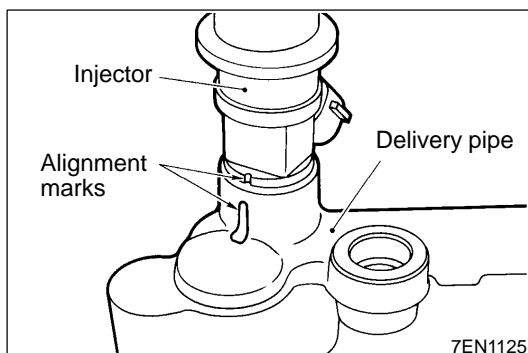


►D◄ CORRUGATED WASHER INSTALLATION

Coat the corrugated washer with white vaseline and install it to the injector as shown.

Caution

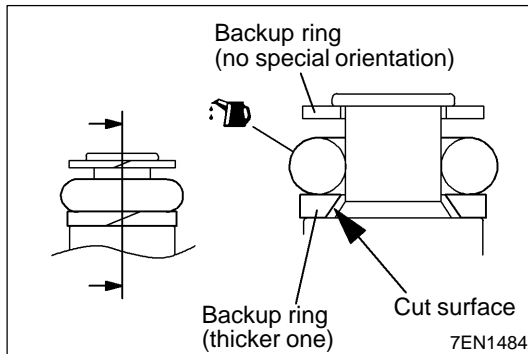
Always replace the corrugated washer with new one. Reused corrugated washer can cause fuel or gas leaks.



►E◄ INJECTOR AND DELIVERY PIPE INSTALLATION

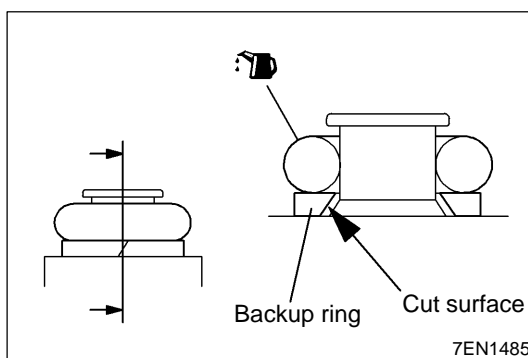
1. Apply spindle oil or gasoline to the O-ring in the injector.
2. Insert the injectors straight into the injector mounting holes in the delivery pipe.
3. Turn each injector. If it does not turn smoothly, remove it and check the O-ring for damage. If the O-ring is damaged, replace it with a new one; then, reinstall the injector and check to see if it turns smoothly.

4. Align the alignment mark on each injector with that on the delivery pipe.
5. Install the injector and delivery pipe into the cylinder head.
6. Tighten the bolt at the center of each delivery pipe to the specified torque. Then tighten bolts on both ends to the specified torque.



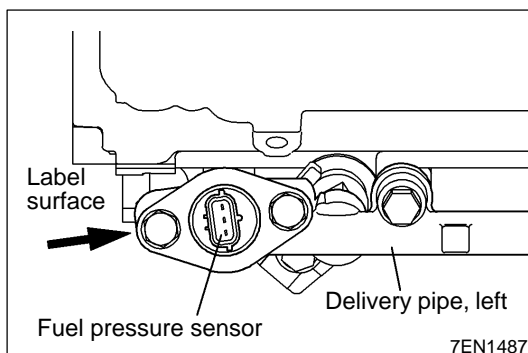
▶F◀ BACKUP RING / O-RING / FUEL CENTER PIPE INSTALLATION

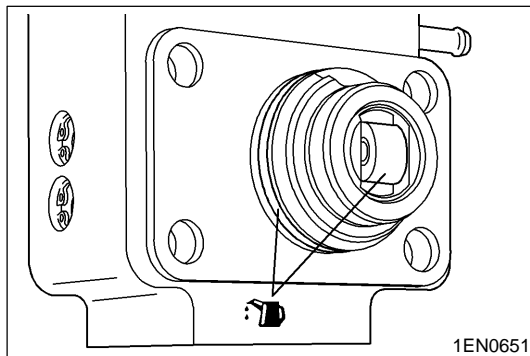
1. Fit the backup rings and O-ring to both ends of the fuel center pipe. Mount the backup ring (thicker one) so that its inner cut surface faces in the direction shown.
2. Coat the O-rings on both ends of the pipe with spindle oil or gasoline.
3. Insert the fuel center pipe straight into the mounting hole in the delivery pipe. Insert it all the way into the hole, ensuring that it does not twist.
4. Tighten the bolts on both ends of the fuel center pipe to the specified torque.



▶G◀ BACKUP RING / O-RING / FUEL PRESSURE SENSOR INSTALLATION

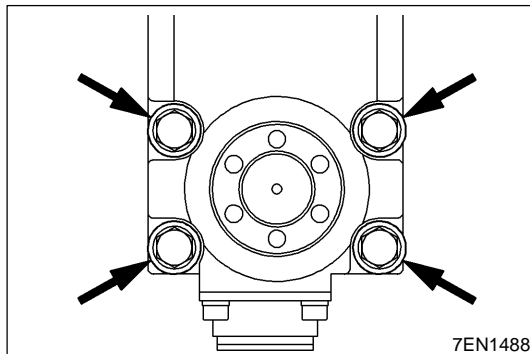
1. Fit the backup ring to the fuel pressure sensor so that its inner cut surface faces in the direction shown.
2. Being attentive to the shape of the connector and label surface of the fuel pressure sensor, install the fuel pressure sensor in the direction shown.



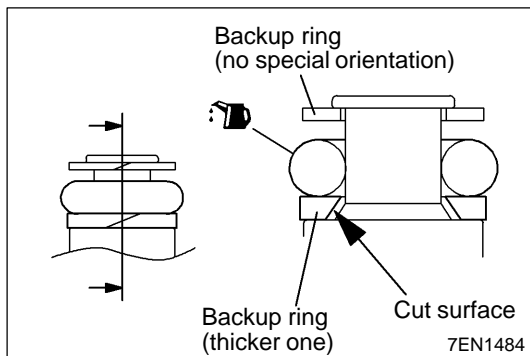


►H◄ FUEL PUMP / BACKUP RING / O-RING / FUEL FEED PIPE INSTALLATION

1. Apply engine oil to the roller of the fuel pump and O-ring.



2. Insert the fuel pump into the mounting hole in the cylinder head and lightly tighten the four bolts (slightly tighter than finger-tight).

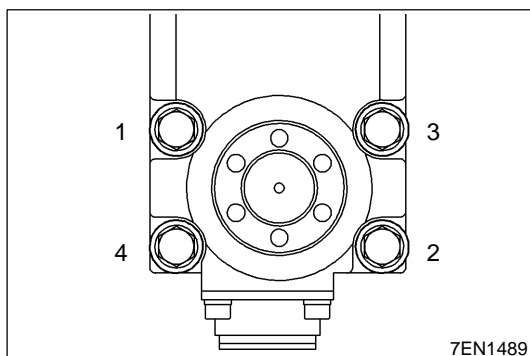


3. Fit the backup rings and O-ring to both ends of the fuel feed pipe. Mount the backup ring (thicker one) so that its inner cut surface faces in the direction shown.

4. Coat the O-rings on both ends of the pipe with spindle oil or gasoline.

5. Insert the fuel feed pipe straight into the mounting hole in the fuel pump. Insert it all the way into the hole, ensuring that it does not twist.

6. Tighten the bolts on both ends of the pipe to the specified torque.



7. Using a torque wrench (minimum graduations), follow these steps to tighten the fuel pump mounting bolts.

(1) Tighten the bolts to 5 Nm in the order shown.

(2) Tighten the bolts to 17 Nm in the order shown.

Variations in torque among the four bolts should be within 2 Nm.

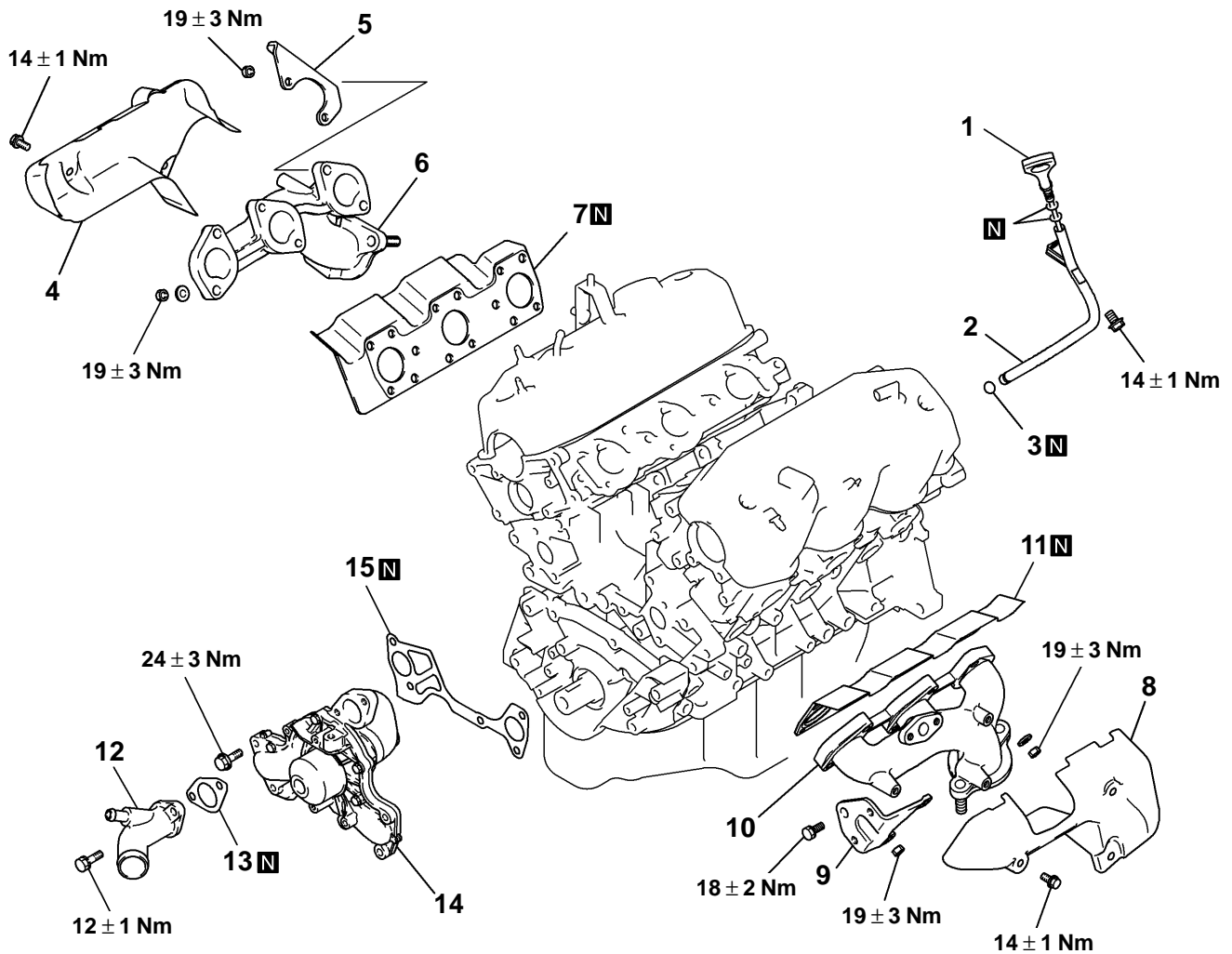
Caution

Strictly observe the tightening order. A leak and other problem could result if the torque specifications and torquing order are not met.

9. EXHAUST MANIFOLD

REMOVAL AND INSTALLATION

<12-VALVE>



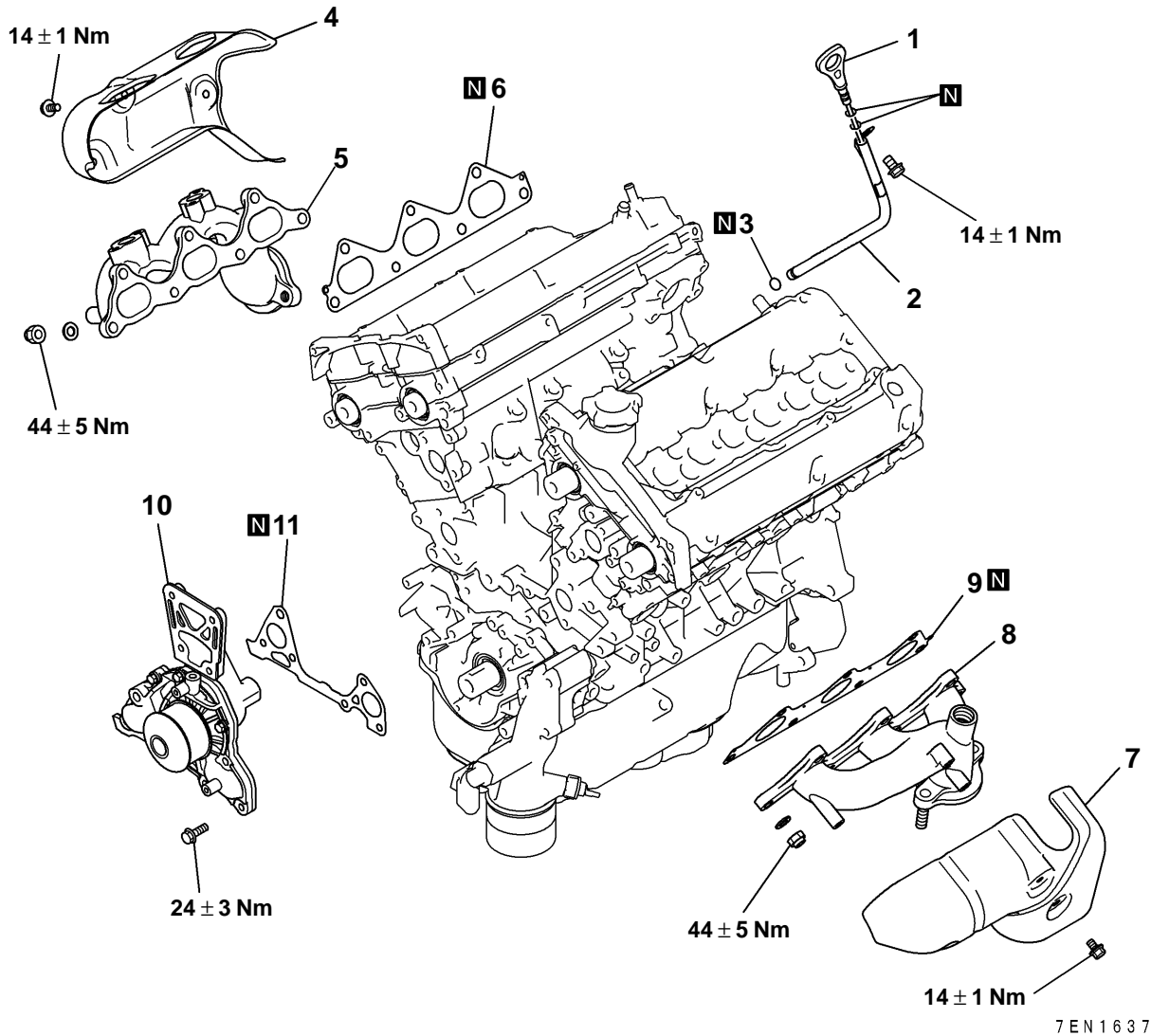
7EN1636

Removal steps

- | | |
|--|---|
| <ul style="list-style-type: none"> 1. Oil level gauge 2. Oil level gauge guide 3. O-ring 4. Heat protector, right 5. Engine hanger ▶A◀ 6. Exhaust manifold, right 7. Exhaust manifold gasket 8. Heat protector, left | <ul style="list-style-type: none"> 9. Bracket 10. Exhaust manifold, left ▶A◀ 11. Exhaust manifold gasket 12. Water inlet fitting 13. Water inlet fitting gasket 14. Water pump 15. Water pump gasket |
|--|---|

REMOVAL AND INSTALLATION

<24-VALVE>



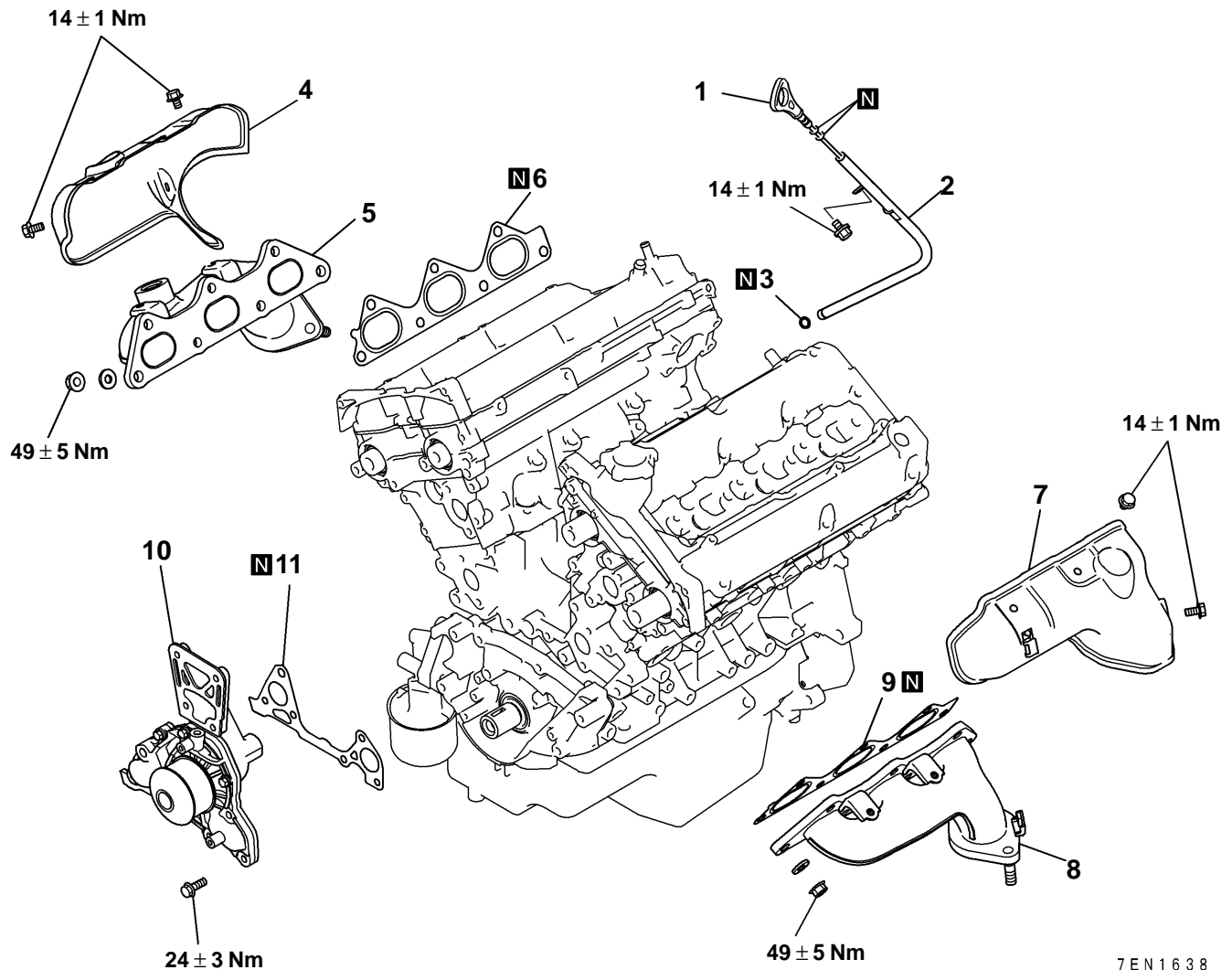
Removal steps

- | | |
|----------------------------|----------------------------|
| 1. Oil level gauge | 7. Heat protector, left |
| 2. Oil level gauge guide | 8. Exhaust manifold, left |
| 3. O-ring | 9. Exhaust manifold gasket |
| 4. Heat protector, right | 10. Water pump |
| 5. Exhaust manifold, right | 11. Gasket |
| 6. Exhaust manifold gasket | |

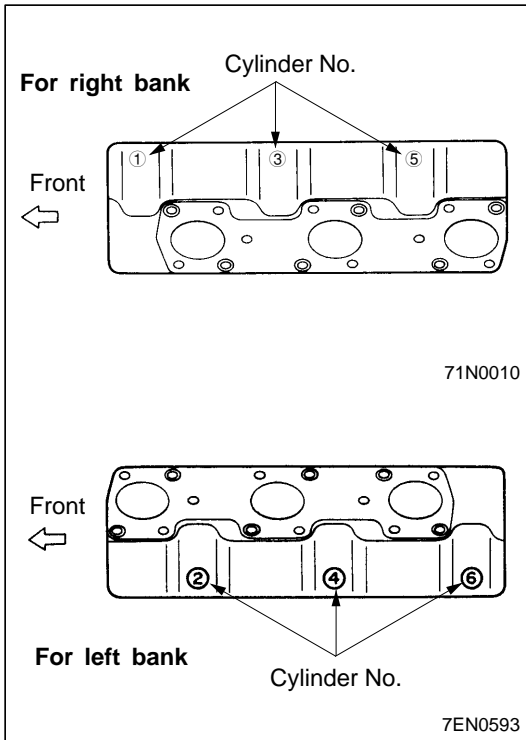
7EN1637

REMOVAL AND INSTALLATION

<GDI>

**Removal steps**

1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Heat protector, right
5. Exhaust manifold, right
6. Exhaust manifold gasket
7. Heat protector, left
8. Exhaust manifold, left
9. Exhaust manifold gasket
10. Water pump
11. Gasket



INSTALLATION SERVICE POINTS

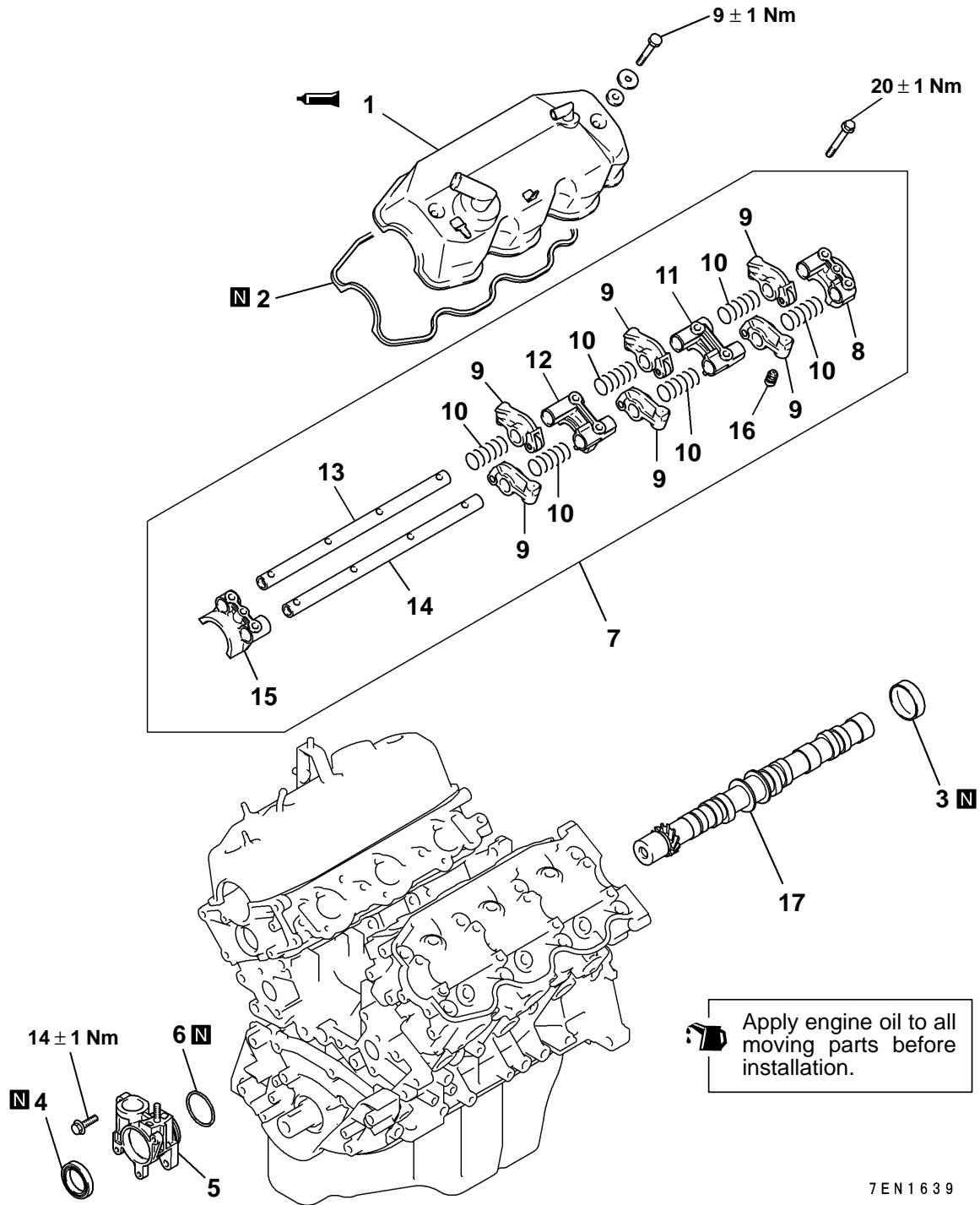
▶A◀ EXHAUST MANIFOLD GASKET INSTALLATION

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

10. ROCKER ARMS AND CAMSHAFT

REMOVAL AND INSTALLATION

<12-VALVE>



- Removal steps**
- ▶I◀ 1. Rocker cover
 - ▶H◀ 2. Rocker cover gasket
 - ▶G◀ 3. Circular packing
 - ▶F◀ 4. Oil seal
 - ▶E◀ 5. Distributor adaptor
 - ▶D◀ 6. O-ring
 - ▶C◀ 7. Rocker arms, rocker arm shaft
 - ▶B◀ 8. Bearing cap No. 4
 - ▶A◀ 9. Rocker arms

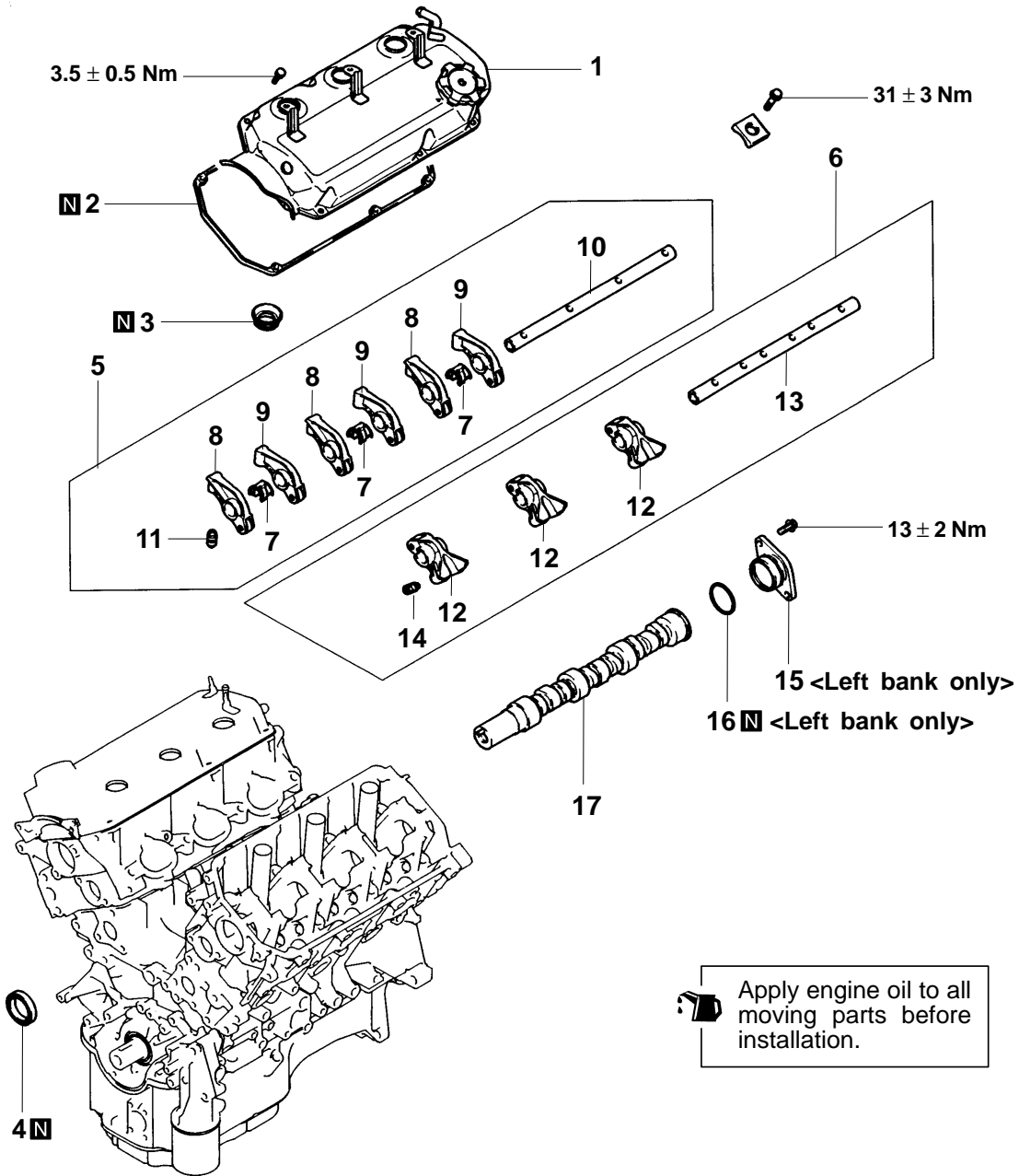
- ▶D◀ 10. Rocker shaft spring
- ▶D◀ 11. Bearing cap No. 3
- ▶D◀ 12. Bearing cap No. 2
- ▶D◀ 13. Rocker arm shaft "B"
- ▶D◀ 14. Rocker arm shaft "A"
- ▶B◀ 15. Lash adjuster
- ▶B◀ 16. Bearing cap No. 1
- ▶B◀ 17. Camshaft

Apply engine oil to all moving parts before installation.

7EN1639

REMOVAL AND INSTALLATION

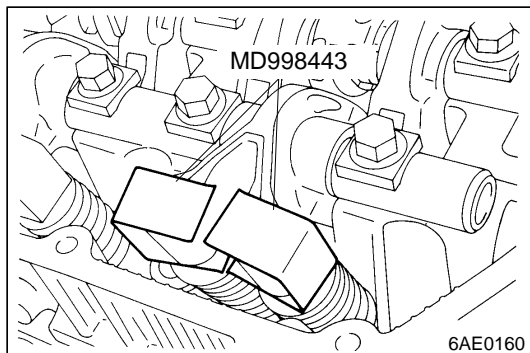
<24-VALVE>



7EN0879

Removal steps

- | | |
|---|--|
| <p>▶G◀ 4. Oil seal</p> <p>▶F◀ 7. Rocker shaft spring</p> <p>▶C◀ 9. Rocker arm "B"</p> <p>▶C◀ 10. Rocker arm shaft</p> | <p>▶A▶ ▶B◀ 11. Lash adjuster</p> <p>▶C◀ ▶B◀ 12. Rocker arm "C"</p> <p>▶C◀ ▶B◀ 13. Rocker arm shaft</p> <p>▶B◀ ▶B◀ 14. Lash adjuster</p> <p>▶B◀ ▶B◀ 15. Thrust case
<Except PAJERO (V63W, V73W)></p> <p>▶A▶ ▶B◀ 16. O-ring
<Except PAJERO (V63W, V73W)></p> <p>▶A▶ ▶B◀ 17. Camshaft</p> |
|---|--|



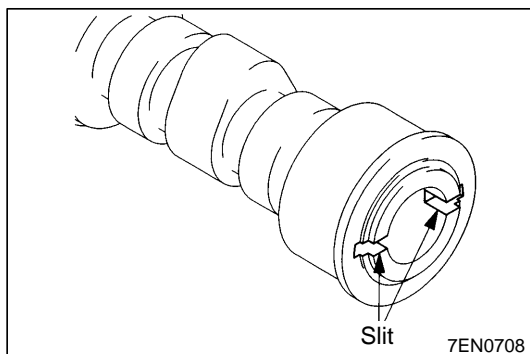
REMOVAL SERVICE POINTS

◀A▶ LASH ADJUSTER REMOVAL

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

Caution

If the lash adjuster is re-used, clean the lash adjuster. (Refer to LASH ADJUSTER INSPECTION)



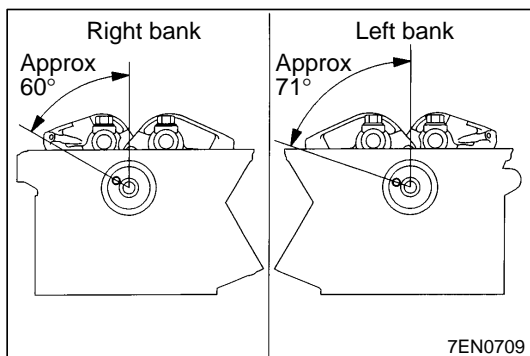
INSTALLATION SERVICE POINTS

▶A◀ CAMSHAFT INSTALLATION

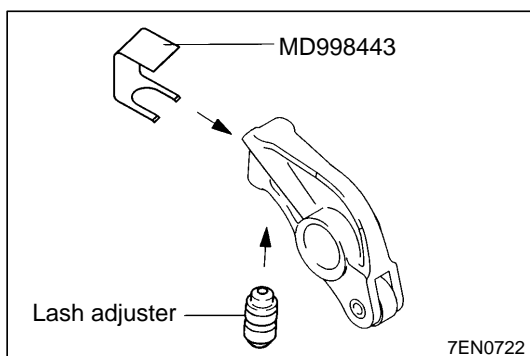
1. Before attaching the camshafts, apply engine oil to the journals and cams.
Take care not to confuse the right bank and left bank camshafts.

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.

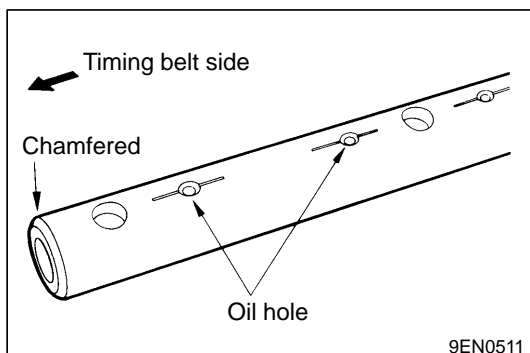


▶B◀ LASH ADJUSTER INSTALLATION

Caution

If the lash adjuster is re-used, clean the lash adjuster. (Refer to LASH ADJUSTER INSPECTION)

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.



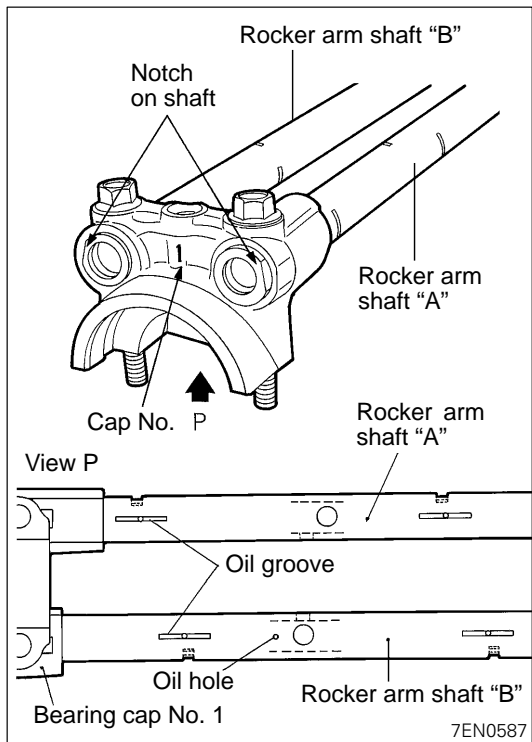
▶C◀ ROCKER ARM SHAFT INSTALLATION

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

NOTE

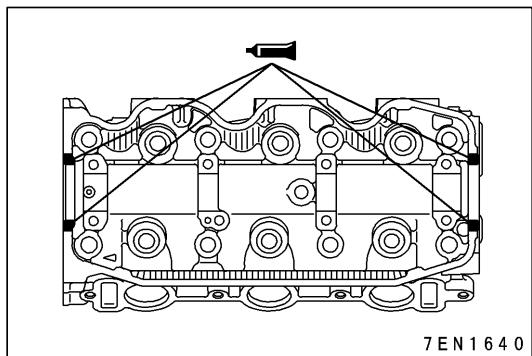
The side with the four bolt holes is on the intake side.

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



►D◄ ROCKER ARM SHAFTS 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 bearing cap and shafts.
2. Install 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".



►E◄ ROCKER ARMS, ROCKER ARM SHAFTS INSTALLATION

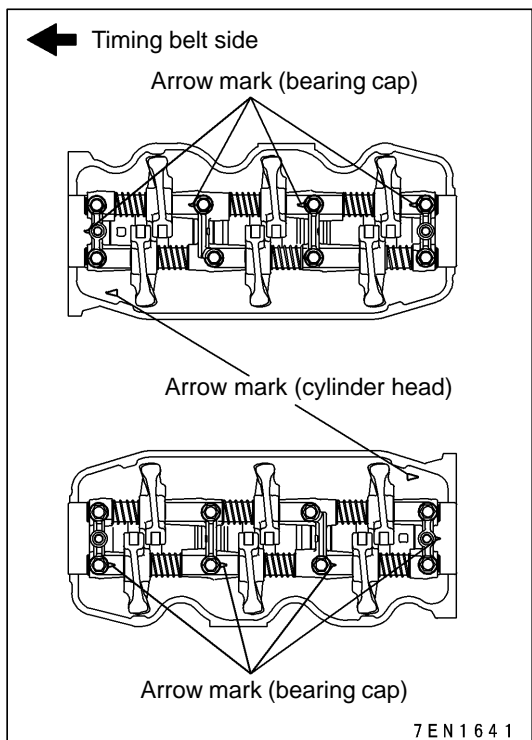
1. Apply a minimum amount of specified sealant on the four places of cylinder head.

NOTE

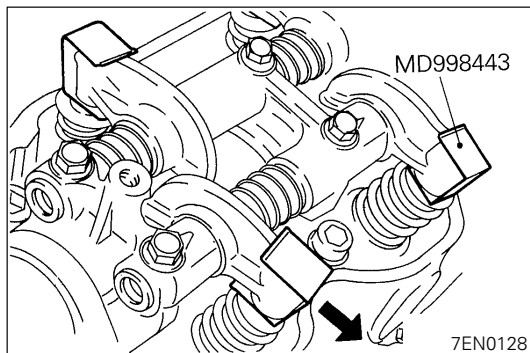
Be sure the sealing agent does not swell out onto the cam journal surface of the cylinder head. If it swells out, immediately wipe it off before it can dry.

Specified sealant:

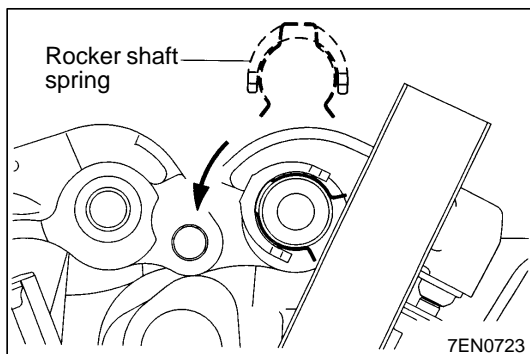
3M NUT Locking No. 4171 or equivalent



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.

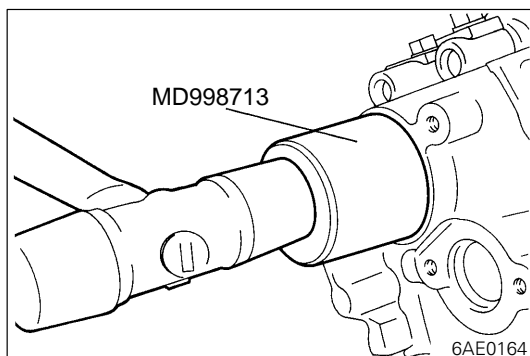


3. Tighten the bearing cap bolts to the specified torque.
4. Remove the special tools from all rocker arms.



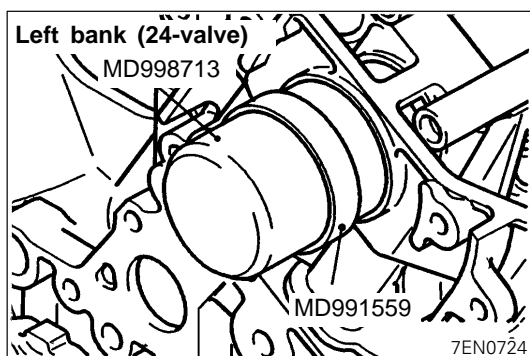
►F◄ ROCKER SHAFT SPRING INSTALLATION

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



►G◄ CAMSHAFT OIL SEAL INSTALLATION

Using the special tool, install the oil seal.

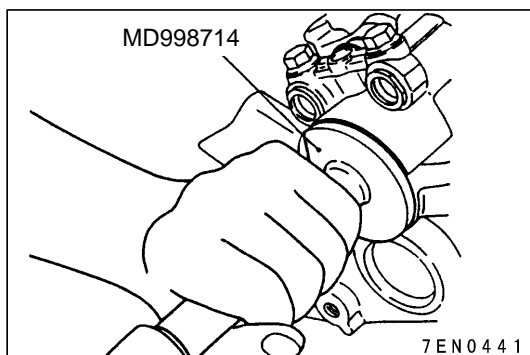


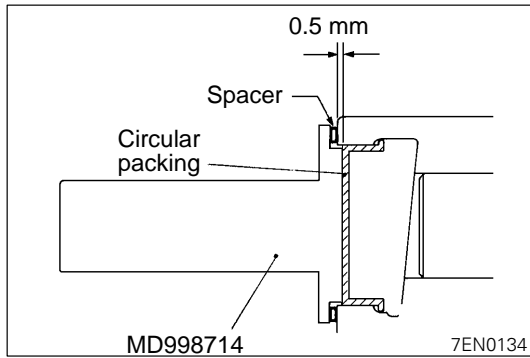
►H◄ CIRCULAR PACKING INSTALLATION

Install a 1.3 to 1.5 mm thick spacer to the special tool and drive in the circular packing.

NOTE

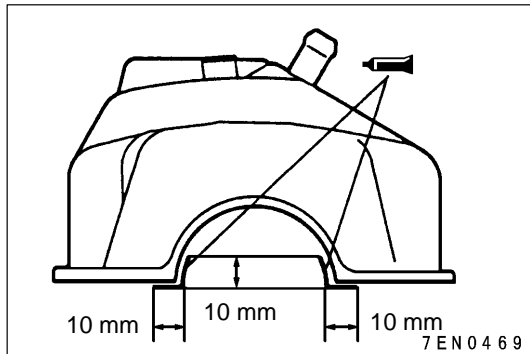
Use of MD724328 spacer for transmission is recommended.





Caution

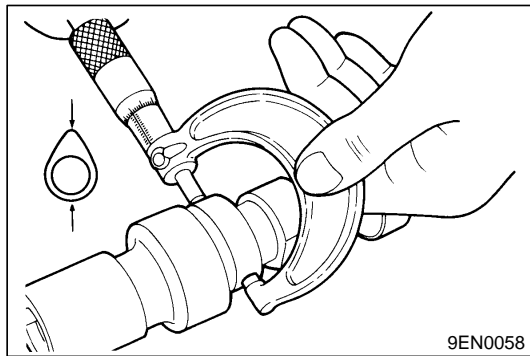
The packing is overdriven if no spacer is fitted to the special tool.



▶◀ ROCKER COVER INSTALLATION

Apply specified sealant on the area specified in the figure.

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



INSPECTION

1. CAMSHAFT

Measure the cam height.

Standard value:

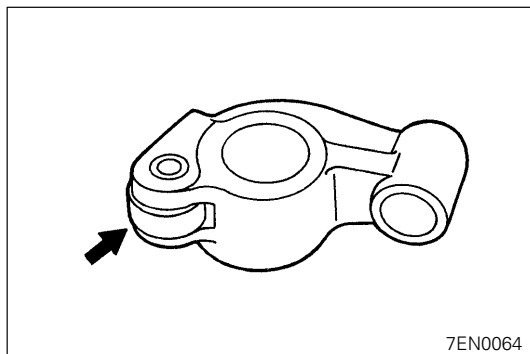
IN: 37.58 mm

EX: 36.95 mm

Limit:

IN: 37.08 mm

EX: 36.45 mm



2. 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.

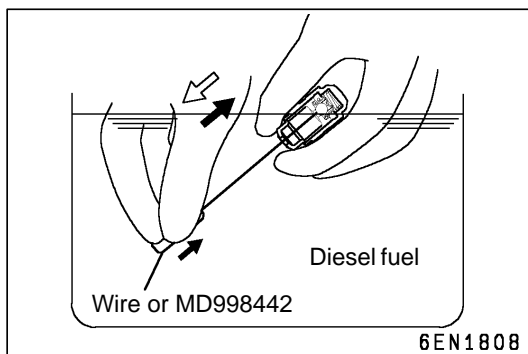
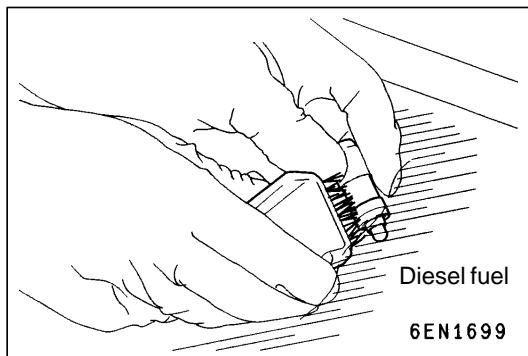
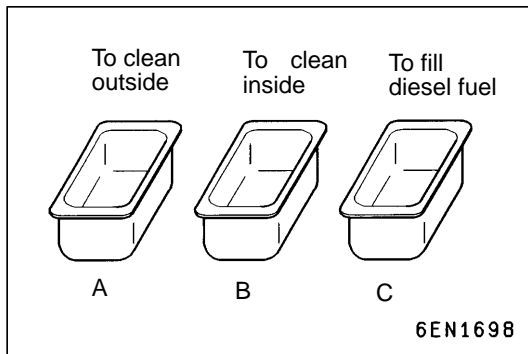
3. ROCKER ARM SHAFT

- (1) Check rocker arm mounting portions of rocker arm shaft for wear or damage. Replace as necessary.
- (2) Check to ensure that oil holes are clear.

4. LASH ADJUSTERS

Caution

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



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

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

NOTE

Use a nylon brush if deposits are hard to remove.

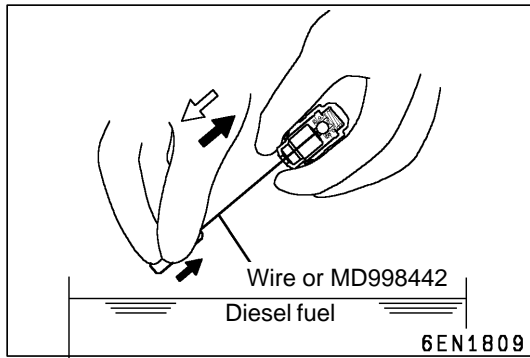
- (3) While gently pushing down the internal steel ball using special tool MD998442, move the plunger through 5 to 10 strokes until it slides smoothly. In addition to eliminating stiffness in the plunger, this operation will remove dirty oil.

Caution

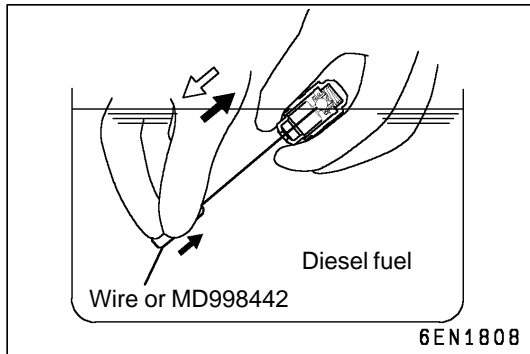
The steel ball spring is extremely weak, so the lash adjuster's functionality may be lost if the air bleed wire is pushed in hard.

NOTE

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



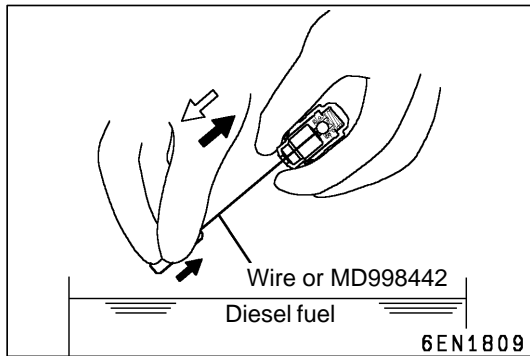
- (4) Remove the lash adjuster from the container. Then, push down the steel ball gently and push the plunger to eliminate diesel fuel from the pressure chamber.



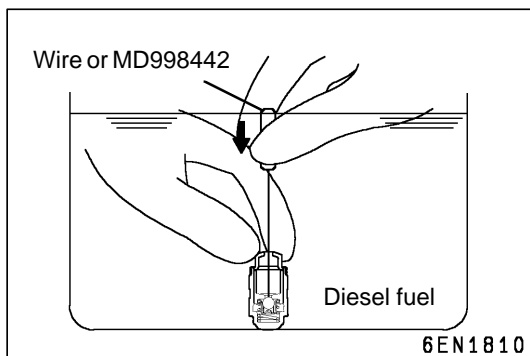
- (5) Place the lash adjuster in container B. Then, gently push down the internal steel ball using special tool MD998442 and move the plunger through 5 to 10 strokes until it slides smoothly. This operation will clean the lash adjuster's pressure chamber.

Caution

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



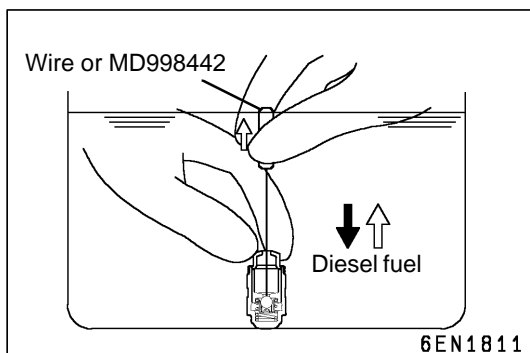
- (6) Remove the lash adjuster from the container. Then, push down the steel ball gently and push the plunger to eliminate diesel fuel from the pressure chamber.



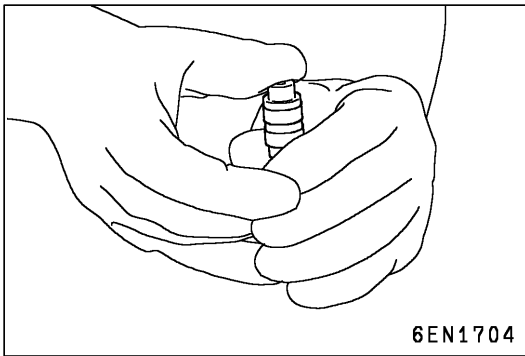
- (7) Place the lash adjuster in container C. Then, gently push down the internal steel ball using special tool MD998442.

Caution

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



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



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

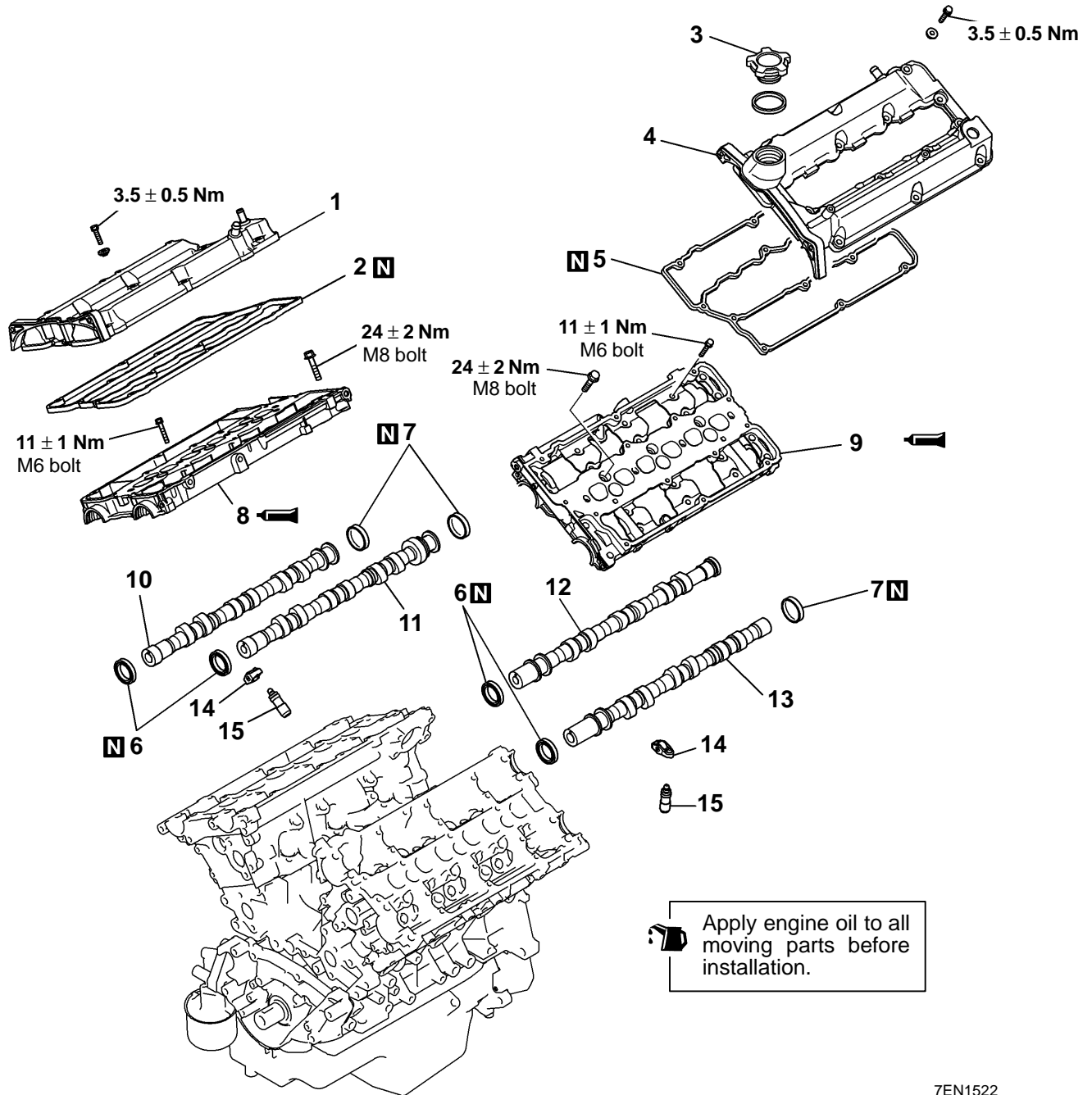
NOTE

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

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

11. ROCKER ARMS AND CAMSHAFT <GDI>

REMOVAL AND INSTALLATION



7EN1522

Removal steps

- | | | | |
|----------------------------------|---|-----------------------|---|
| <p>▶D◀</p> <p>▶C◀</p> <p>▶B◀</p> | <ol style="list-style-type: none"> 1. Rocker cover, right 2. Rocker cover gasket 3. Oil filler cap 4. Rocker cover, left 5. Rocker cover gasket 6. Oil seal 7. Circular packing 8. Beam camshaft cap, right | <p>▶B◀</p> <p>▶A◀</p> | <ol style="list-style-type: none"> 9. Beam camshaft cap, left 10. Exhaust camshaft, right 11. Intake camshaft, right 12. Intake camshaft, left 13. Exhaust camshaft, left 14. Rocker arm 15. Lash adjuster |
|----------------------------------|---|-----------------------|---|

REMOVAL SERVICE POINT

◀A▶ LASH ADJUSTER REMOVAL

Caution

If the lash adjuster is re-used, clean the lash adjuster. (Refer to LASH ADJUSTER INSPECTION)

INSTALLATION SERVICE POINTS

▶A▶ LASH ADJUSTER INSTALLATION

Caution

If the lash adjuster is re-used, clean the lash adjuster. (Refer to LASH ADJUSTER INSPECTION)

Fit the lash adjuster onto the rocker arm without allowing diesel fuel to spill out.

▶B▶ BEAM CAMSHAFT CAP, LEFT / BEAM CAMSHAFT CAP, RIGHT INSTALLATION

1. Remove deposits from the surfaces of the beam camshaft caps and cylinder head, to which sealant is to be applied.
2. Squeeze a 3-mm-thick bead of sealant from the tube out into the groove in the bottom surface of the beam camshaft caps. Fit the caps before the sealant hardens.

Specified sealant:

MITSUBISHI GENUINE Part No. MD970389 or equivalent

3. Apply an adequate amount of sealant to the top surface of the cylinder head. Mount the beam bearing caps before the sealant hardens.

Specified sealant:

MITSUBISHI GENUINE Part No. MD970389 or equivalent

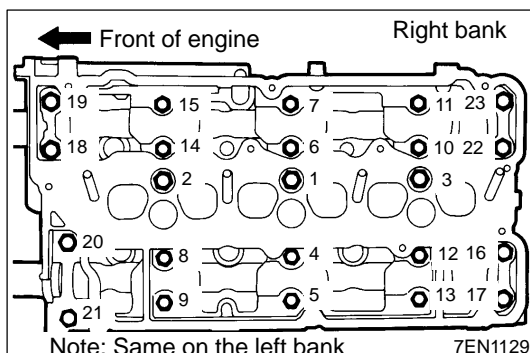
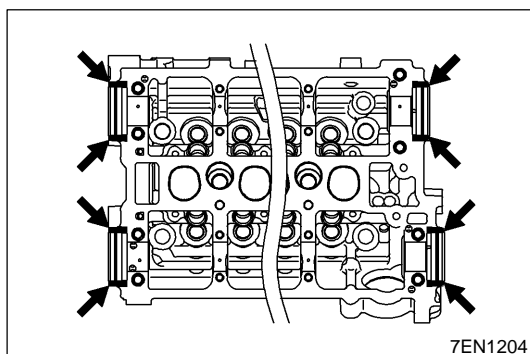
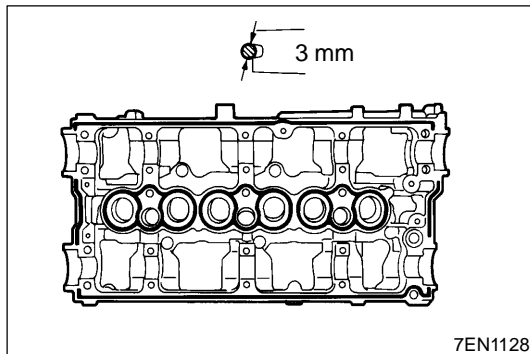
4. Mount the beam camshaft caps and tighten them in the order shown to the specified torque.

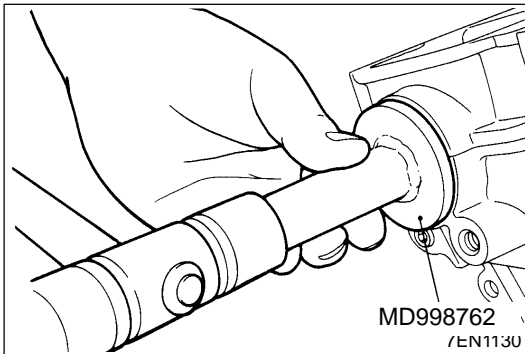
Specified torque:

M6 bolt: 11 ± 1 Nm

M8 bolt: 24 ± 2 Nm

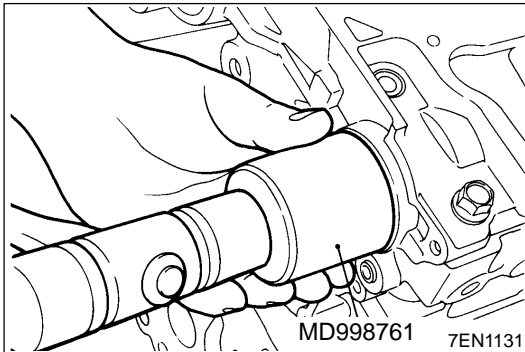
5. After the caps have been tightened, wipe the portion of the sealant that is squeezed out at the intake port before it hardens.





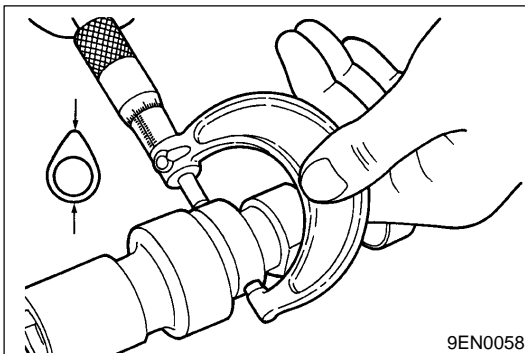
►◀ CIRCULAR PACKING INSTALLATION

Using the special tool, install the oil seal.



►◀ OIL SEAL INSTALLATION

Using the special tool, install the oil seal.



INSPECTION

1. CAMSHAFT

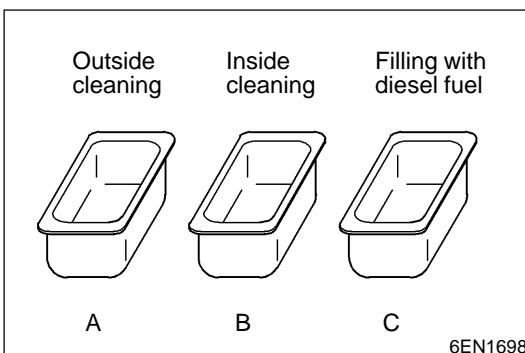
Measure the cam height.

Item		Standard value mm	Limit mm
Intake	Europe	35.20	34.70
	Hong Kong	34.85	34.35
Exhaust		34.91	34.41

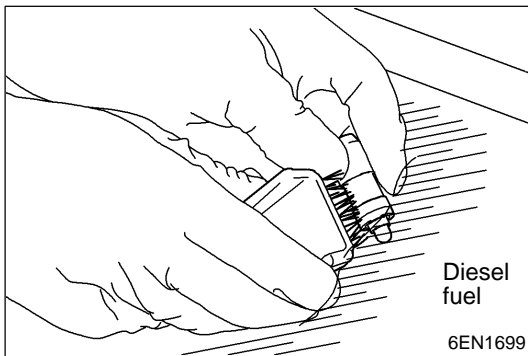
2. LASH ADJUSTER

Caution

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



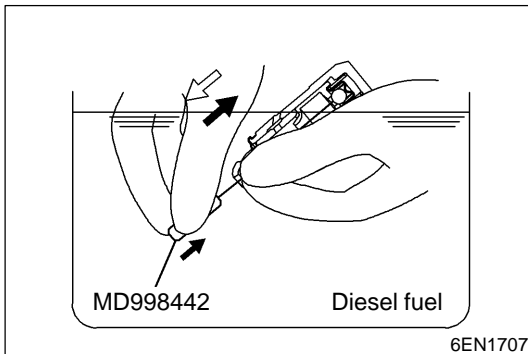
- (1) Prepare three containers and approximately five liters of diesel fuel. Into each container, pour enough diesel fuel to completely cover a lash adjuster when it is standing upright. Then, perform the following steps with each lash adjuster.



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

NOTE

Use a nylon brush if deposits are hard to remove.



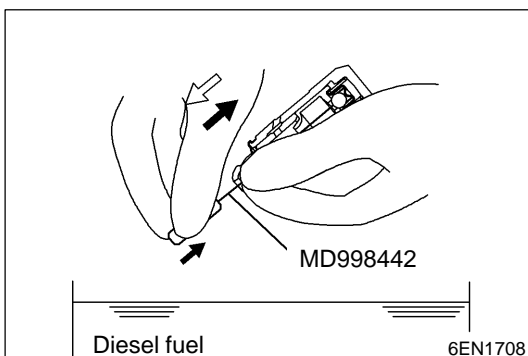
- (3) While gently pushing down the internal steel ball using special tool MD998442, move the plunger through 5 to 10 strokes until it slides smoothly. In addition to eliminating stiffness in the plunger, this operation will remove dirty oil.

Caution

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

NOTE

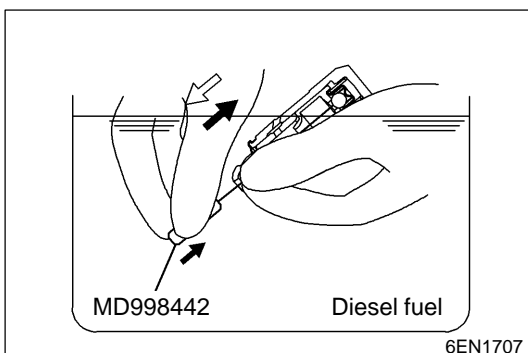
If the plunger remains stiff or the mechanism appears otherwise abnormal, replace the lash adjuster.



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

Caution

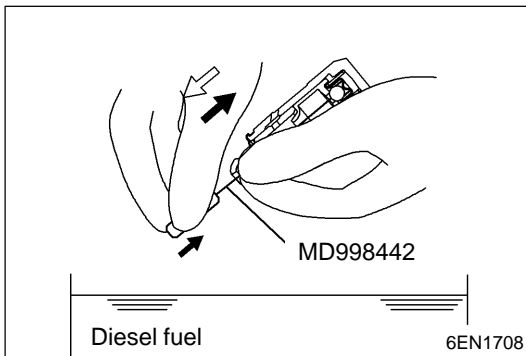
Make sure the oil hole in the side of the body is pointing toward container A. Do not point the oil hole at yourself or other people.



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

Caution

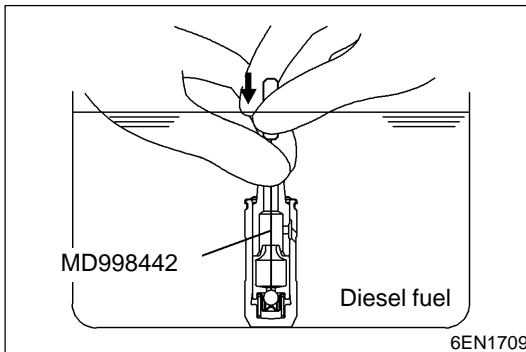
The steel ball spring is extremely weak, so the lash adjuster's functionality may be lost if the air bleed wire is pushed in hard.



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

Caution

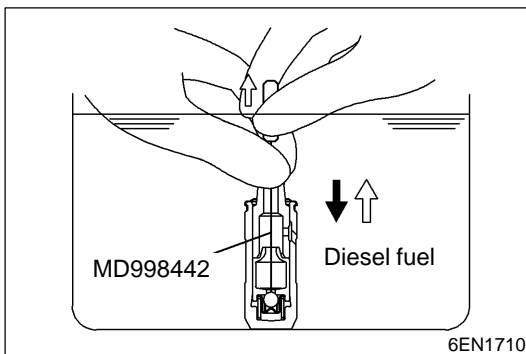
Make sure the oil hole in the side of the body is pointing toward container A. Do not point the oil hole at yourself or other people.



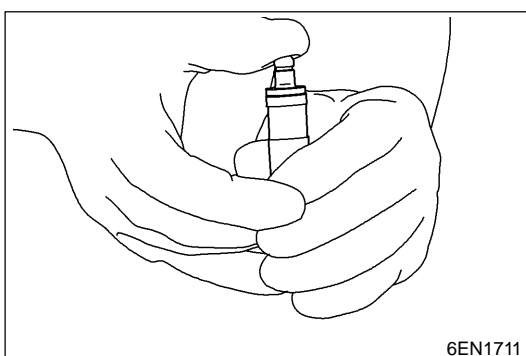
- (7) Place the lash adjuster in container C. Then, gently push down the internal steel ball using special tool MD998442.

Caution

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



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



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

NOTE


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

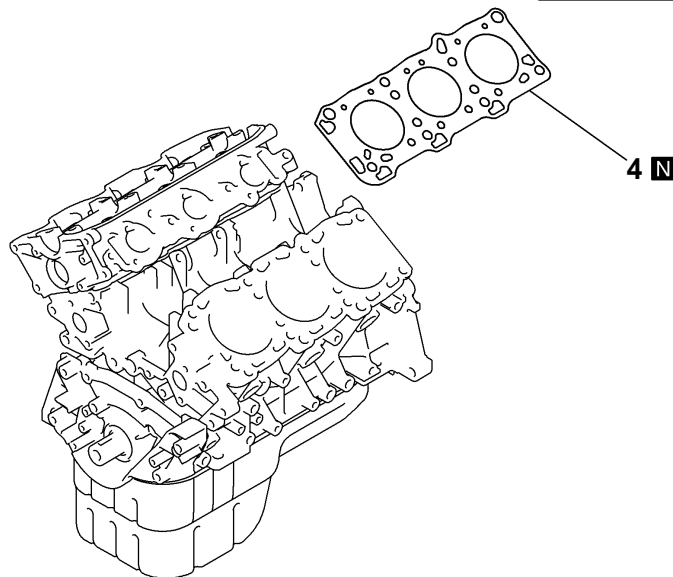
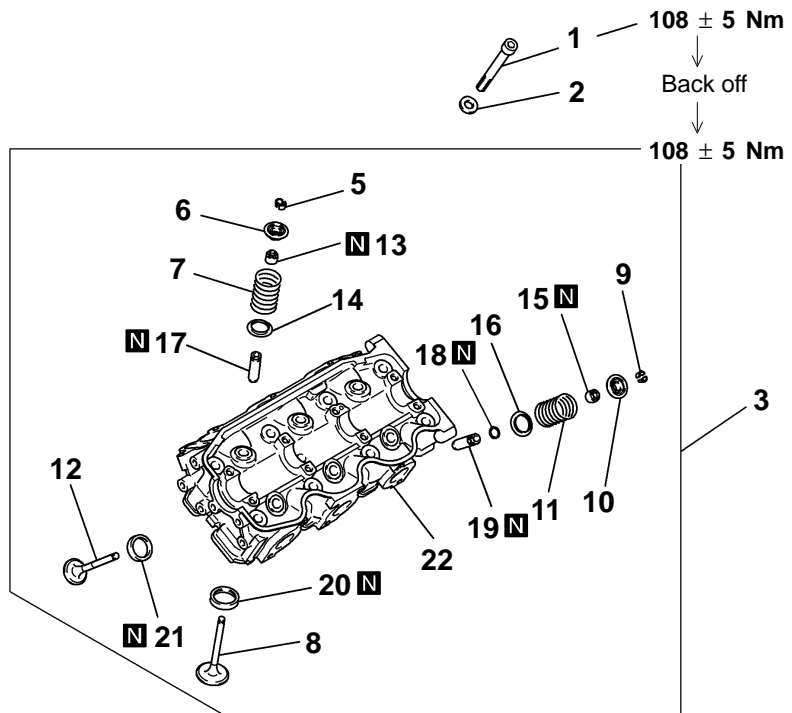
- (10) Stand the lash adjuster upright to prevent diesel fuel from spilling out. Do not allow the lash adjuster to become contaminated by dirt or other foreign matter. Fit the lash adjuster onto the engine as soon as possible.

12. CYLINDER HEAD AND VALVES

REMOVAL AND INSTALLATION

<12-VALVE>

 Apply engine oil to all moving parts before installation.



7EN0522

Removal steps

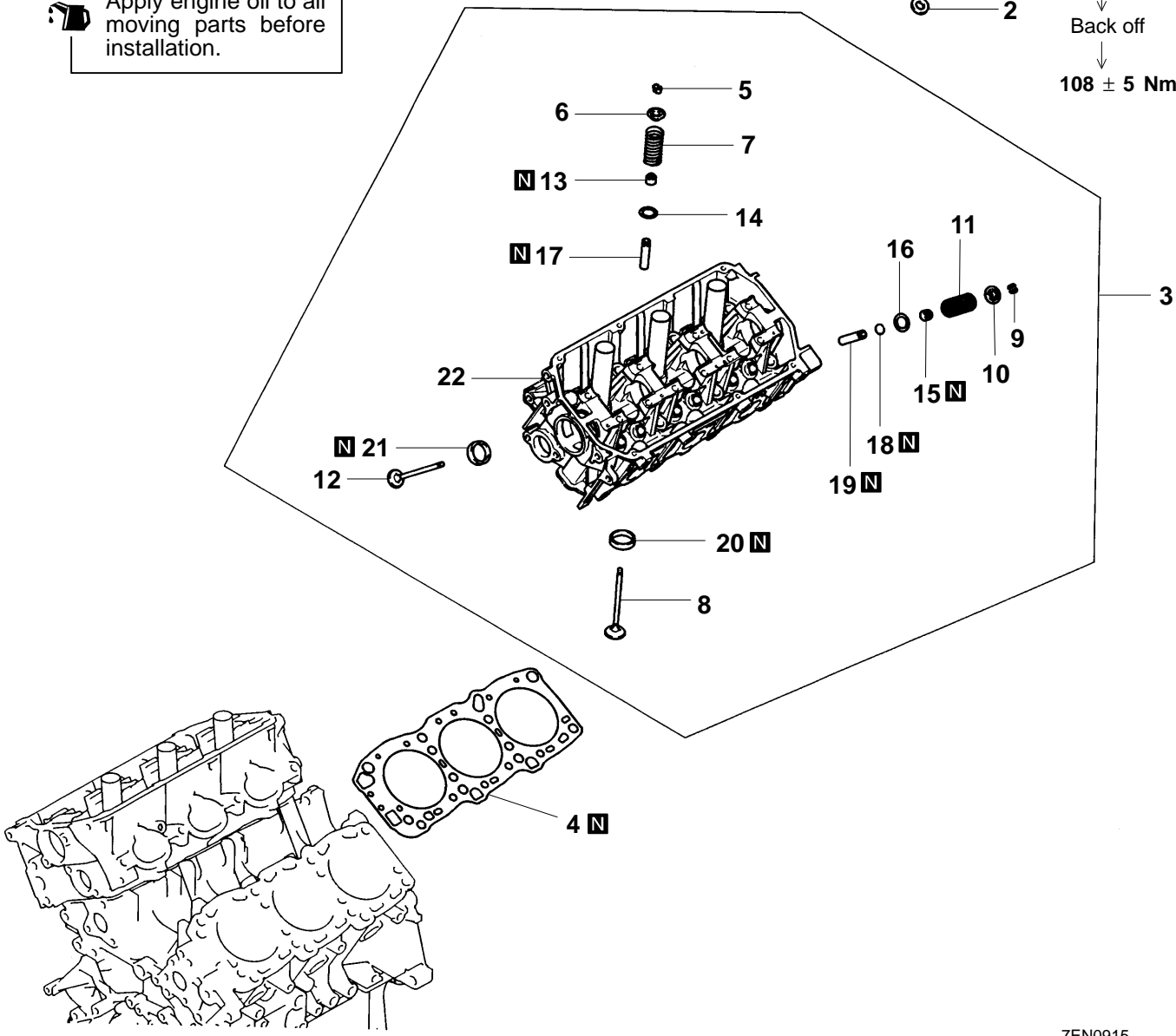
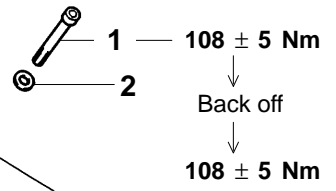
- ◀A▶ ▶D▶ 1. Cylinder head bolt
- ▶B▶ ▶C▶ 2. Washer
- ▶B▶ ▶C▶ 3. Cylinder head assembly
- ▶B▶ ▶C▶ 4. Cylinder head gasket
- ▶B▶ ▶C▶ 5. Retainer lock
- ▶B▶ ▶C▶ 6. Valve spring retainer
- ▶B▶ ▶C▶ 7. Valve spring
- ▶B▶ ▶C▶ 8. Intake valve
- ▶B▶ ▶C▶ 9. Retainer lock
- ▶B▶ ▶C▶ 10. Valve spring retainer
- ▶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. Snap ring
- ▶C▶ ▶A▶ 19. Exhaust valve guide
- ▶C▶ ▶A▶ 20. Intake valve seat
- ▶C▶ ▶A▶ 21. Exhaust valve seat
- ▶C▶ ▶A▶ 22. Cylinder head

REMOVAL AND INSTALLATION

<24-VALVE>

Apply engine oil to all moving parts before installation.



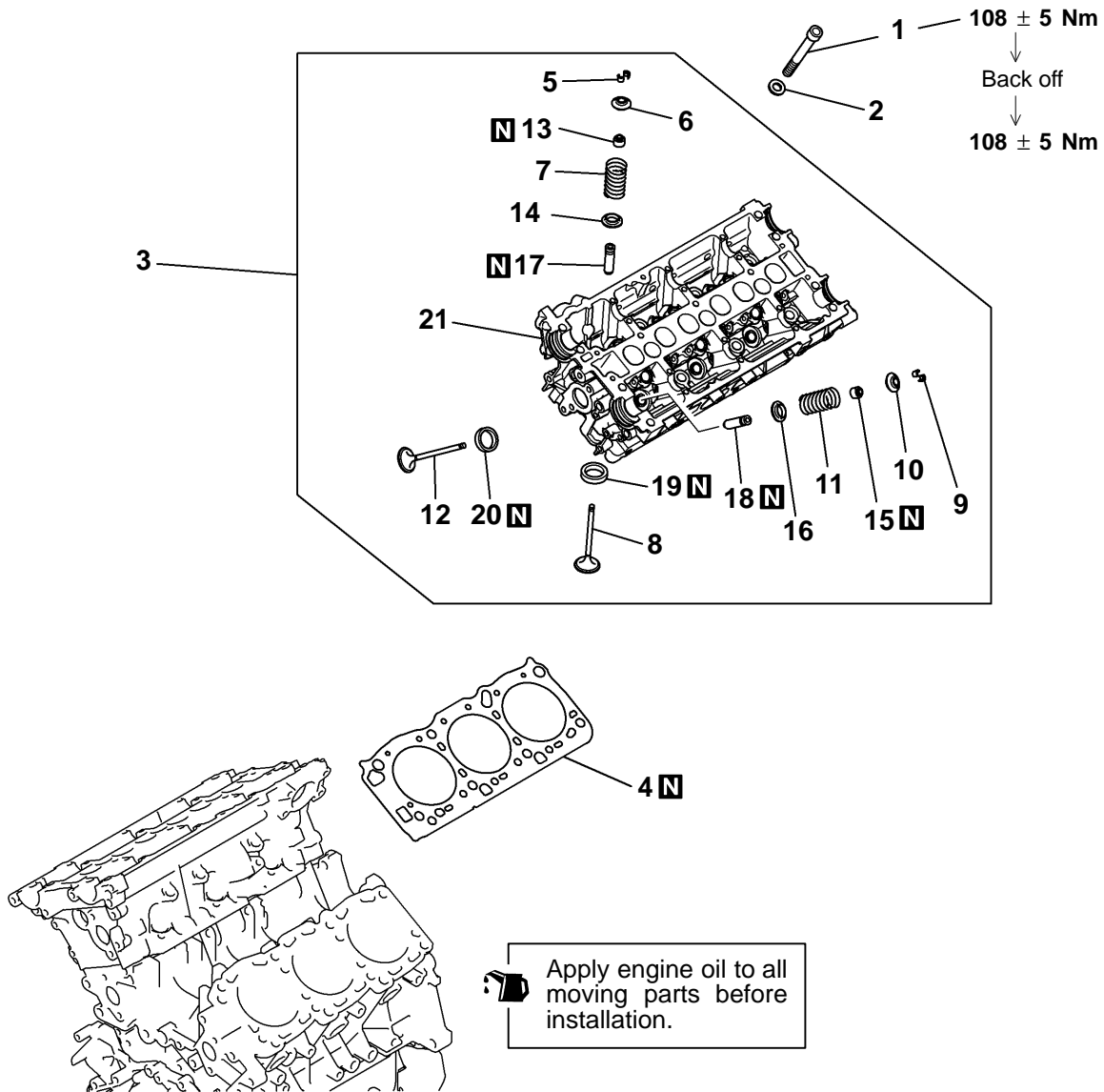
7EN0915

Removal steps

- | | | | |
|---------|---------------------------|---------|-------------------------|
| ◀A▶ ▶D▶ | 1. Cylinder head bolt | | |
| | 2. Washer | | |
| | 3. Cylinder head assembly | ▶C▶ ▶A▶ | 12. Exhaust valve |
| | 4. Cylinder head gasket | | 13. Valve stem seal |
| ▶B▶ ▶C▶ | 5. Retainer lock | ▶C▶ ▶A▶ | 14. Valve spring seat |
| | 6. Valve spring retainer | | 15. Valve stem seal |
| ▶B▶ | 7. Valve spring | | 16. Valve spring seat |
| | 8. Intake valve | | 17. Intake valve guide |
| ▶B▶ ▶C▶ | 9. Retainer lock | | 18. Snap ring |
| | 10. Valve spring retainer | | 19. Exhaust valve guide |
| ▶B▶ | 11. Valve spring | | 20. Intake valve seat |
| | | | 21. Exhaust valve seat |
| | | | 22. Cylinder head |

REMOVAL AND INSTALLATION

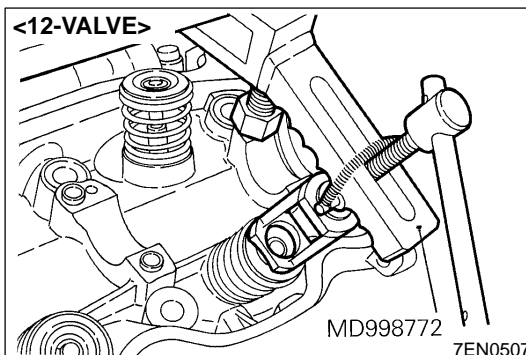
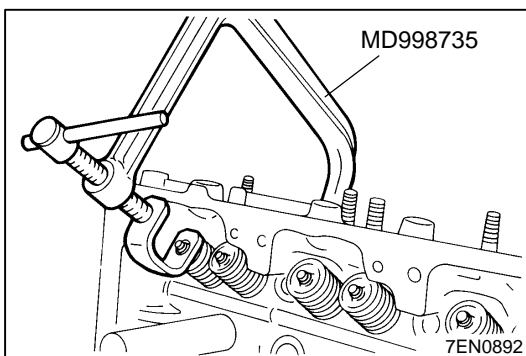
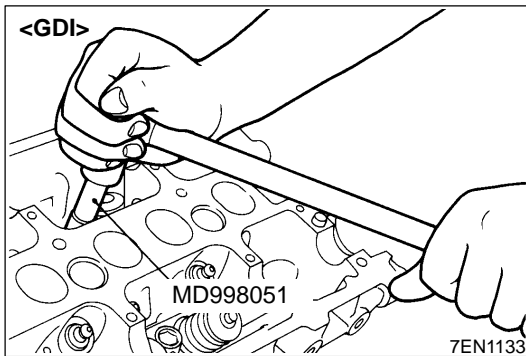
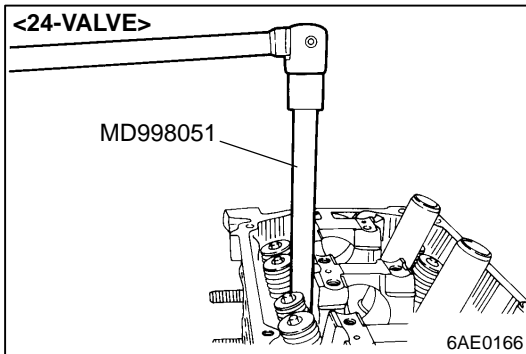
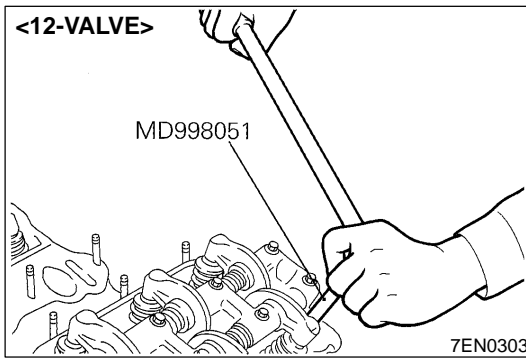
<GDI>



7EN1132

Removal steps

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



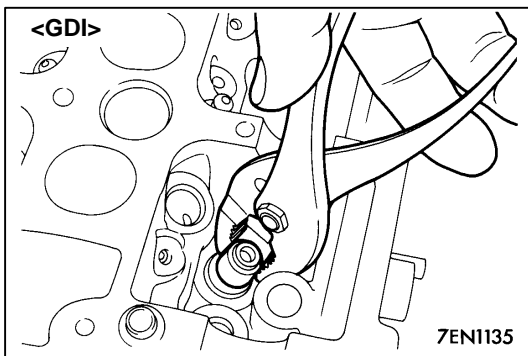
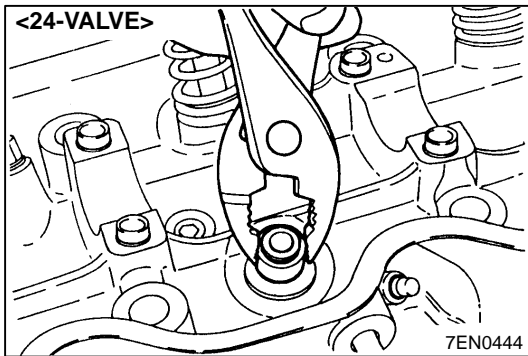
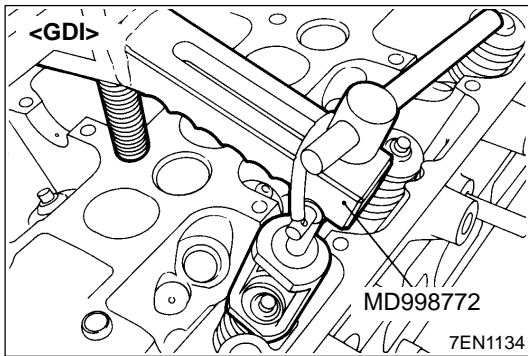
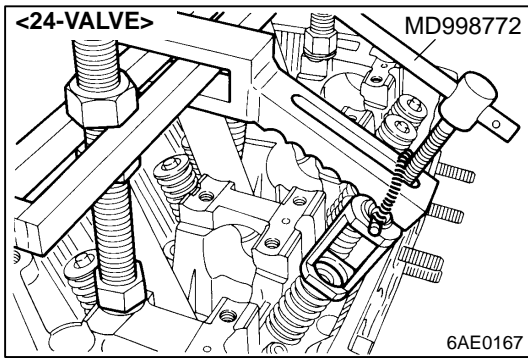
REMOVAL SERVICE POINTS

◀A▶ CYLINDER HEAD BOLT REMOVAL

Using the special tool, loosen the cylinder head bolts. Loosen evenly, little by little.

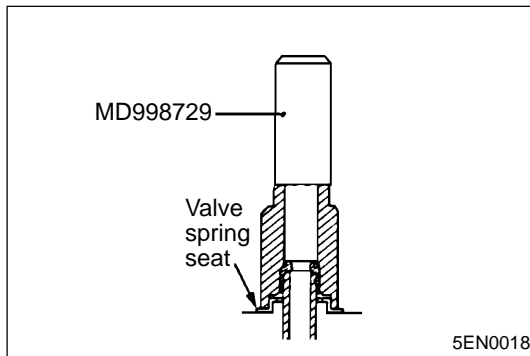
◀B▶ RETAINER LOCK REMOVAL

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 REMOVAL

Caution
Remove the valve stem seals with pliers and discard them.
Do not reuse the stem seal.

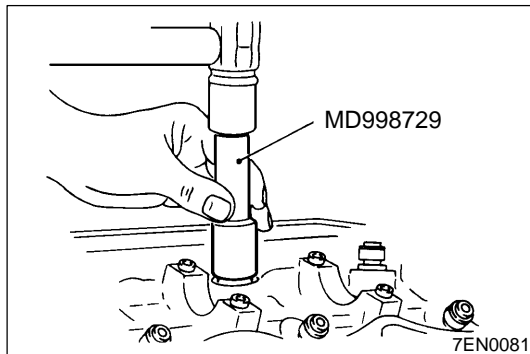


INSTALLATION SERVICE POINTS

▶A◀ VALVE STEM SEAL INSTALLATION

<12-VALVE>

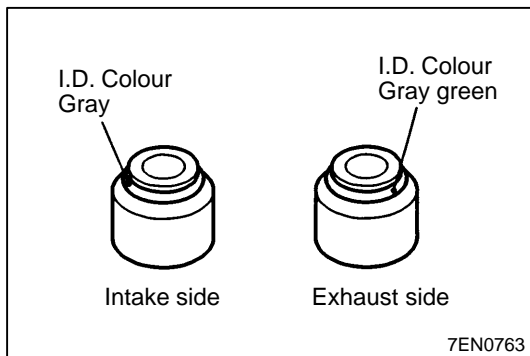
1. Install the valve spring seat.



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

Caution

Do not reuse the valve stem seal.



<24-VALVE, GDI>

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.

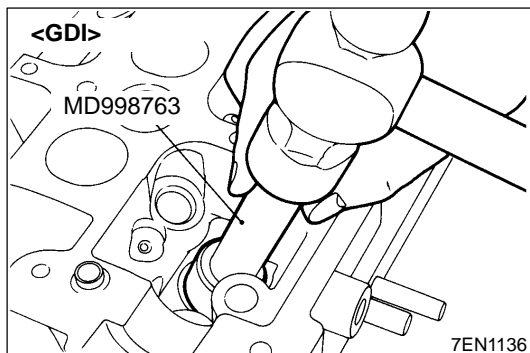
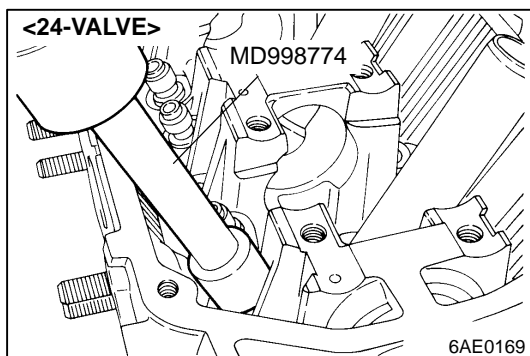
Identifying colour at the valve stem seal portion

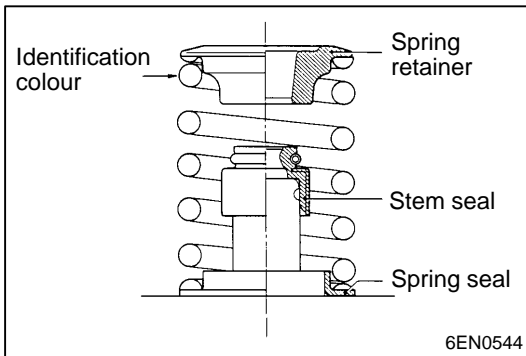
Intake side: Gray

Exhaust side: Gray green

Caution

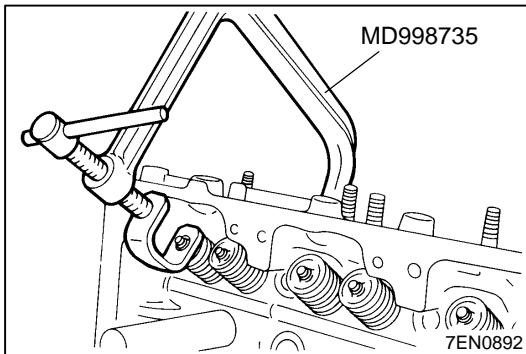
- (1) Do not reuse valve stem seals.
- (2) Always use the Special Tool to install valve stem seals. Improper installation will cause oil leaks.





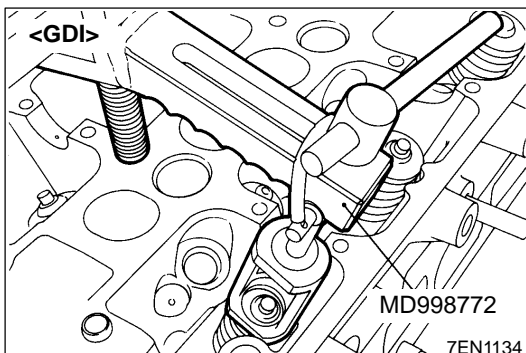
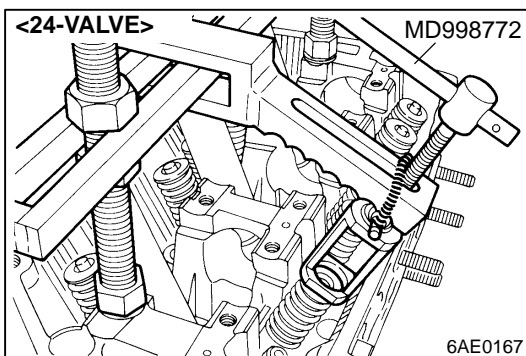
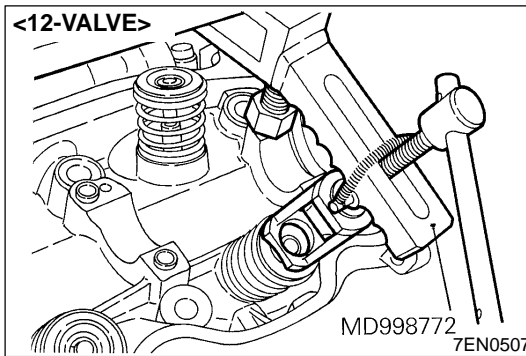
▶B◀ VALVE SPRING INSTALLATION

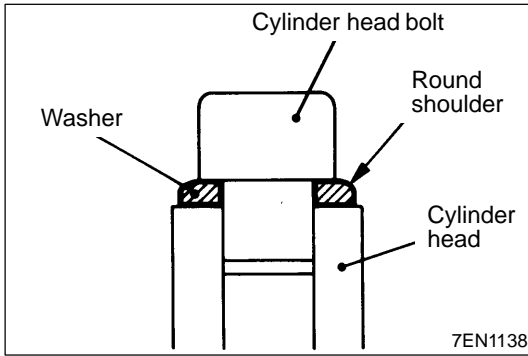
- (1) Install the valve spring with the painted end on the rocker arm side.



▶C◀ VALVE RETAINER LOCK INSTALLATION

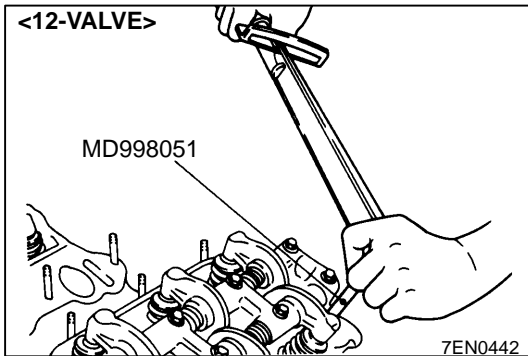
Using Special Tool install the valve retainer lock.





▶D◀ CYLINDER HEAD BOLT INSTALLATION

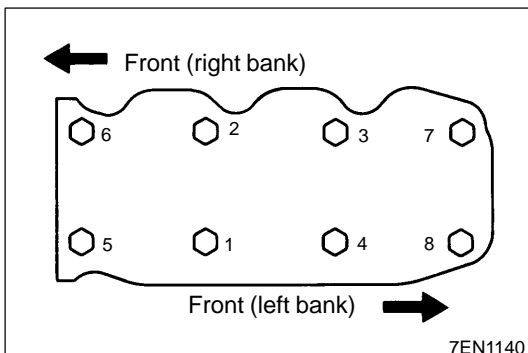
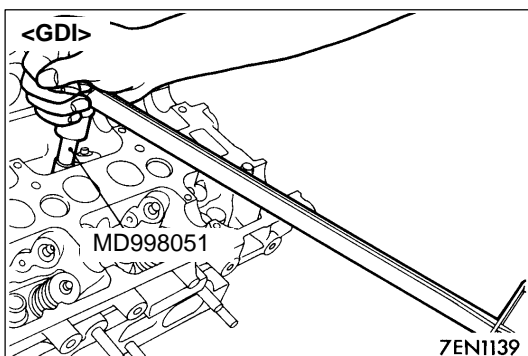
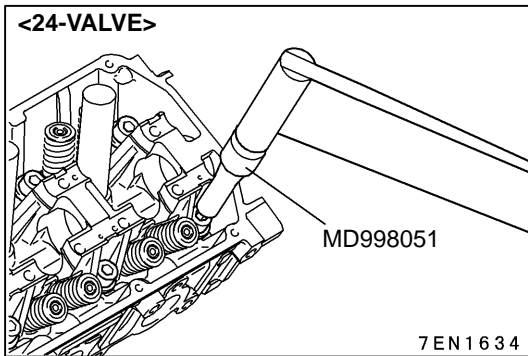
1. Fit washers to the cylinder head bolts and install the bolts in the bolt holes in the cylinder head. Make sure of the correct orientation of the washer when installed.

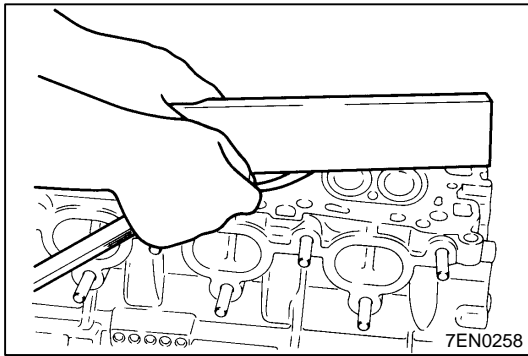


2. Tighten the cylinder head bolts to the specified torque in the order shown.

3. Loosen all bolts.

4. Tighten the cylinder head bolts to the specified torque in the order shown.





INSPECTION

1. 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:

12-valve engine: 0.05 mm

24-valve, GDI engine: 0.03 mm

Limit: 0.2 mm

Grinding limit: 0.2 mm

Height of the cylinder head:

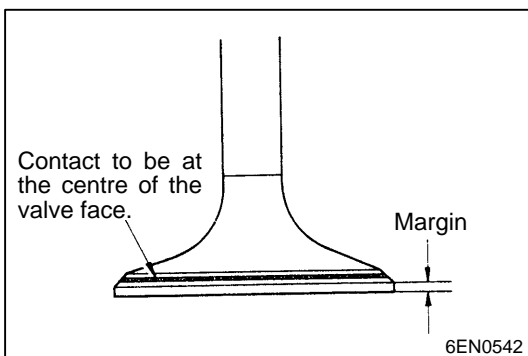
12-valve engine: 84 mm

24-valve engine: 120 mm

GDI engine: 132 mm

Caution

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



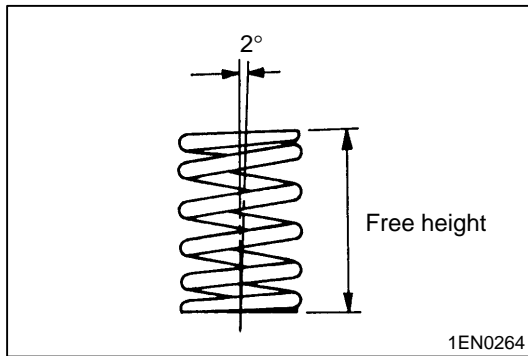
2. VALVES

- (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.

Item		Standard value mm	Limit mm
12-valve	Intake	1.2	0.7
	Exhaust	2.0	1.5
24-valve	Intake	1.0	0.5
	Exhaust	1.2	0.7
GDI	Intake	1.0	0.5
	Exhaust	1.5	1.0

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

Item		Standard value mm	Limit mm
12-valve	Intake	102.97	102.47
	Exhaust	102.67	102.17
24-valve	Intake	112.30	111.80
	Exhaust	114.11	113.61
GDI	Intake	102.28	101.78
	Exhaust	101.40	100.90



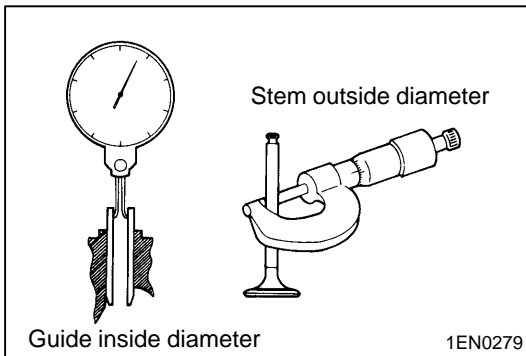
3. VALVE SPRING

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

Item	Standard value mm	Limit mm
12-valve	49.8	48.8
24-valve	51.0	50.0
GDI	47.2	46.2

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

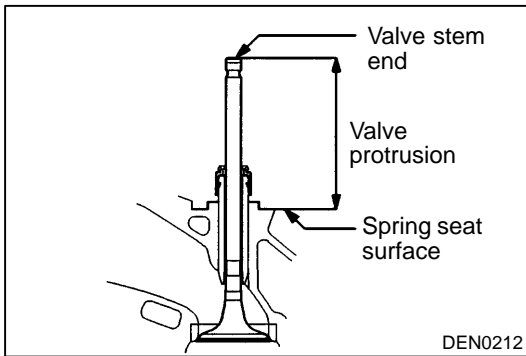
Standard value: 2° max.
Limit: 4°



4. VALVE GUIDE

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.

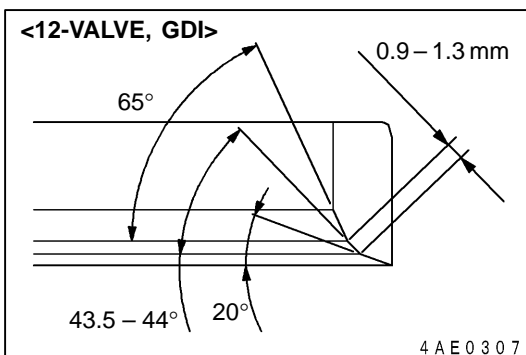
Item		Standard value mm	Limit mm
12-valve	Intake	0.03–0.06	0.10
	Exhaust	0.05–0.09	0.15
24-valve	Intake	0.02–0.05	0.10
	Exhaust	0.04–0.06	0.15
GDI	Intake	0.02–0.05	0.10
	Exhaust	0.04–0.07	0.15



5. VALVE SEAT

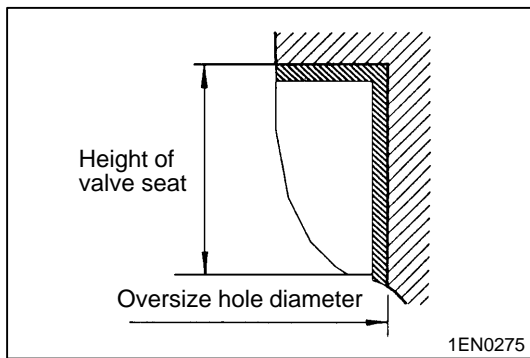
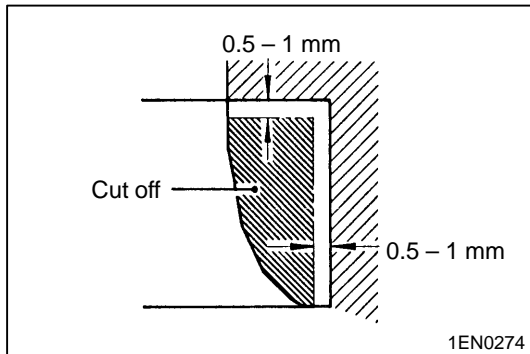
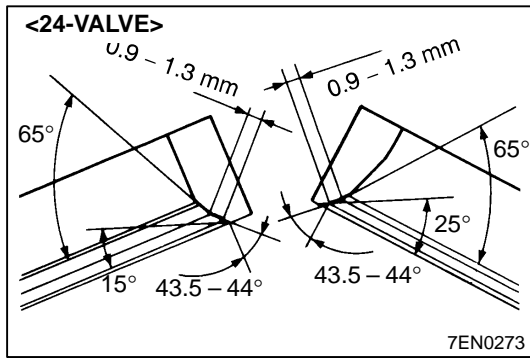
Assemble the valve, and with it pressed down on the valve seat measure the part of the valve which protrudes from the spring seat surface. The length measured should be between the spring seat surface and the valve stem end. If the measured value exceeds the limit, change the valve.

Item		Standard value mm	Limit mm
12-valve	Intake	41.65	42.15
	Exhaust	41.65	42.15
24-valve	Intake	49.30	49.80
	Exhaust	49.30	49.80
GDI	Intake	47.10	47.60
	Exhaust	46.60	47.10



6. 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.

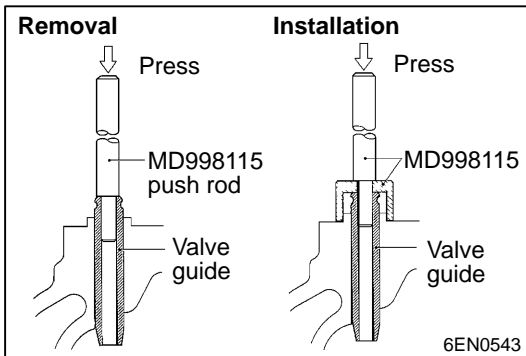


7. VALVE SEAT REPLACEMENT PROCEDURE

- (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.

Item			Standard value mm
12-valve	Intake	0.30 O.S.	44.30–44.33
		0.60 O.S.	44.60–44.63
	Exhaust	0.30 O.S.	38.30–38.33
		0.60 O.S.	38.60–38.63
24-valve	Intake	0.30 O.S.	34.30–34.33
		0.60 O.S.	34.60–34.63
	Exhaust	0.30 O.S.	31.80–31.83
		0.60 O.S.	32.10–32.13
GDI	Intake	0.30 O.S.	36.30–36.33
		0.60 O.S.	36.60–36.63
	Exhaust	0.30 O.S.	33.30–33.33
		0.60 O.S.	33.60–33.63

- (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.”



8. VALVE GUIDE REPLACEMENT PROCEDURE

<12-VALVE>

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

Valve guide hole diameter

0.05 O.S.: 13.05 – 13.07 mm

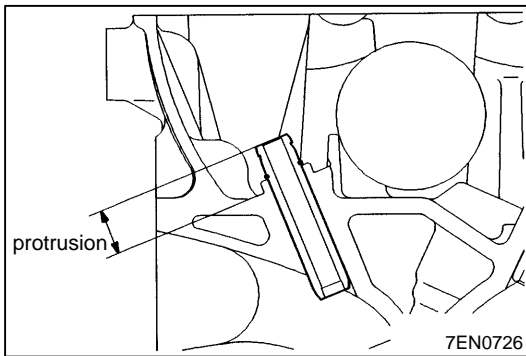
0.25 O.S.: 13.25 – 13.27 mm

0.50 O.S.: 13.50 – 13.52 mm

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 valve seats as necessary.



<24-VALVE, GDI>

- (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.

Item		Standard value mm
24-valve	0.05 O.S.	11.05–11.07
	0.25 O.S.	11.25–11.27
	0.50 O.S.	11.50–11.52
GDI	0.05 O.S.	12.05–12.07
	0.25 O.S.	12.25–12.27
	0.50 O.S.	12.50–12.52

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

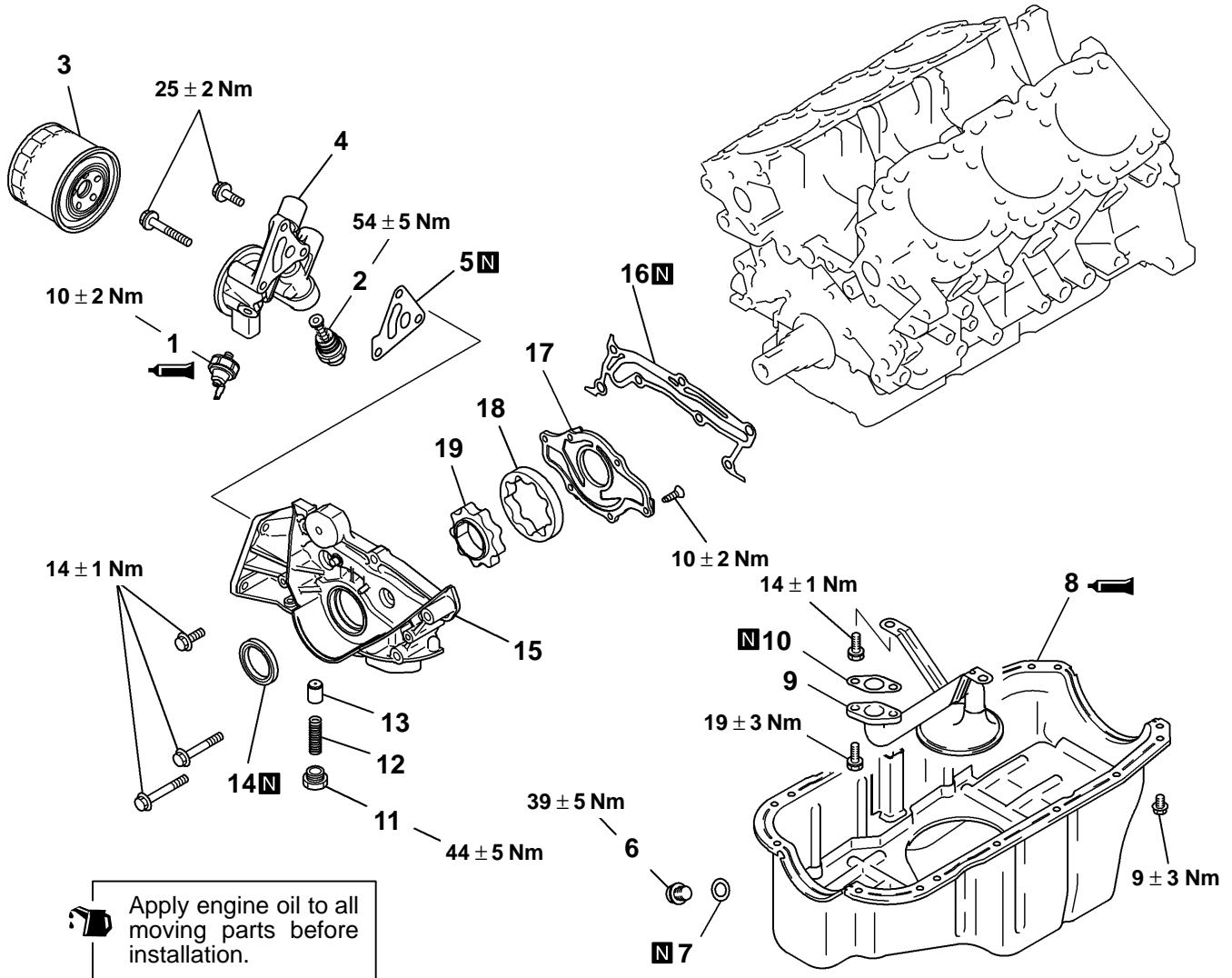
NOTE

- (1) Press fit the valve guide from the top surface of the cylinder head.
- (2) 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).
- (3) After press fitting the valve guide, insert a new valve and check the contact between the valve guide and the valve.

13. OIL PAN AND OIL PUMP

REMOVAL AND INSTALLATION

<12-VALVE>



Apply engine oil to all moving parts before installation.

7EN1643

Removal steps

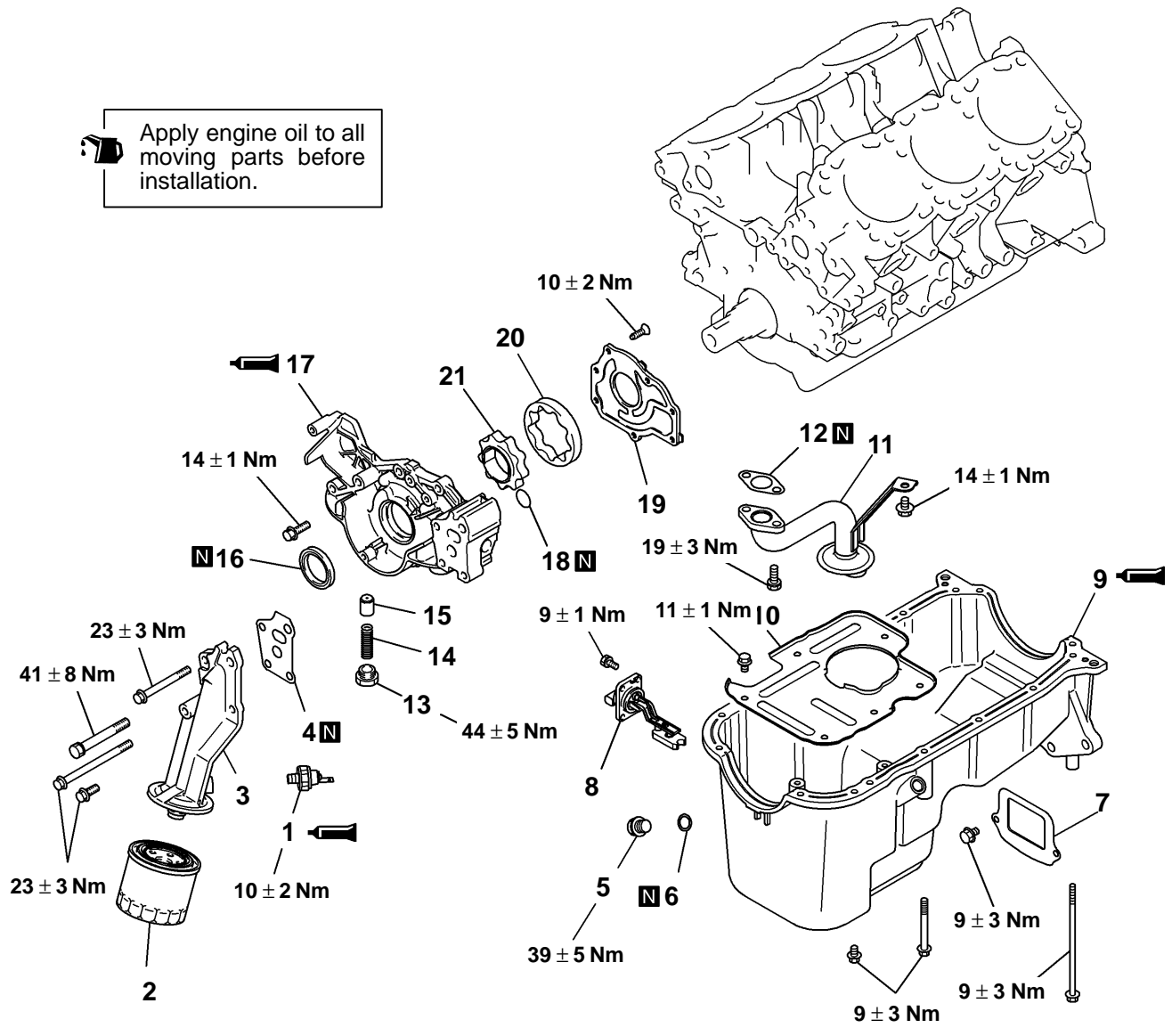
- ▶| 1. Oil pressure switch
- ▶| 2. Oil cooler by-pass valve
- ▶H 3. Oil filter
- ▶H 4. Oil filter bracket
- ▶H 5. Oil filter bracket gasket
- ▶H 6. Drain plug
- ▶G 7. Drain plug gasket
- ◀A ▶D 8. Oil pan
- ▶D ▶A 9. Oil screen
- ▶D ▶A 10. Oil screen gasket

- ▶C 11. Plug
- ▶C 12. Relief spring
- ▶C 13. Relief plunger
- ▶C 14. Oil seal
- ▶C 15. Oil pump case
- ▶C 16. Oil pump gasket
- ▶C 17. Oil pump cover
- ▶D ▶A 18. Oil pump outer rotor
- ▶D ▶A 19. Oil pump inner rotor

REMOVAL AND INSTALLATION

<24-VALVE FOR L200, CHALLENGER>

Apply engine oil to all moving parts before installation.



7EN1644

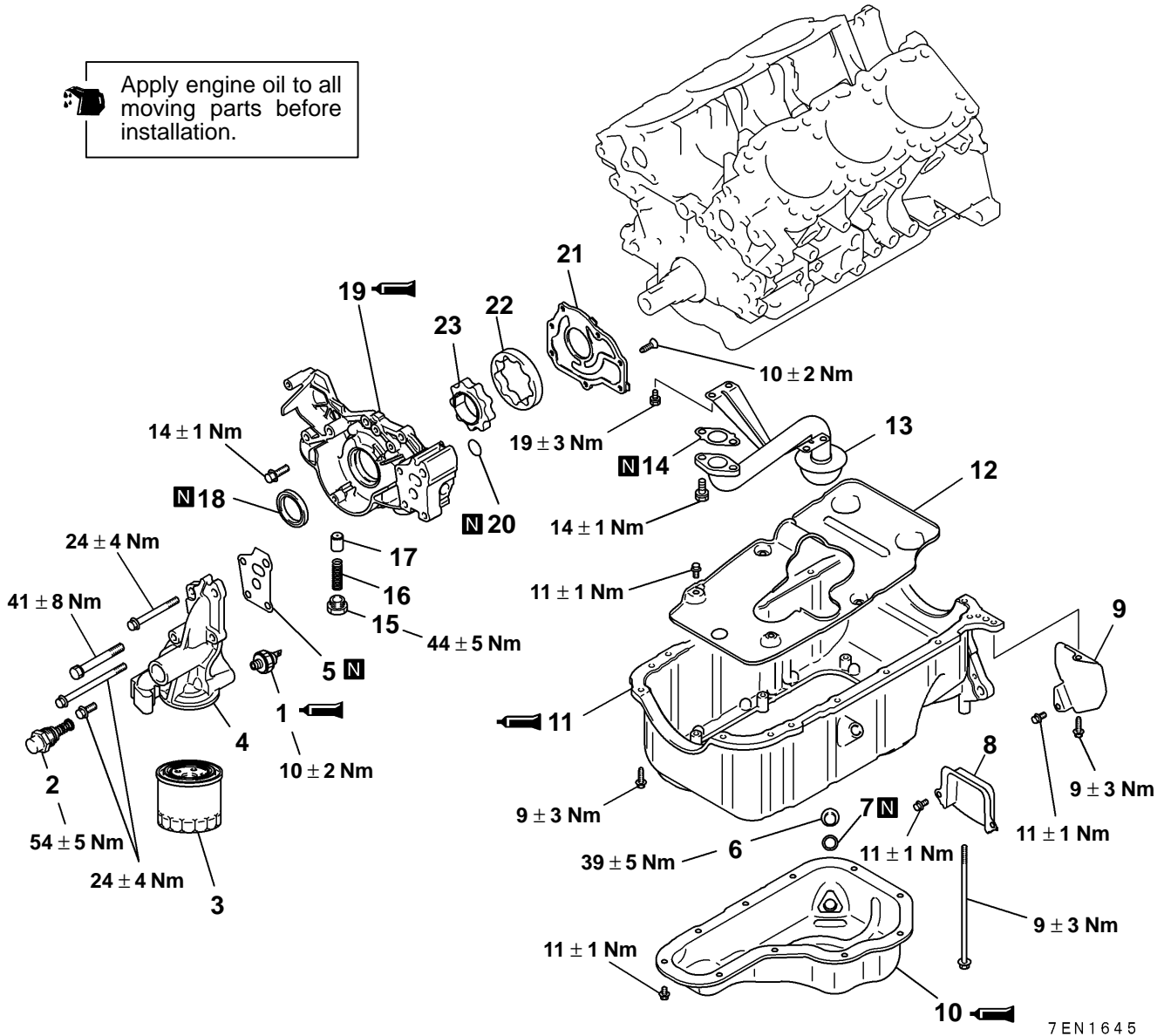
Removal steps

- | | | | |
|--------|----------------------------------|--------|-----------------------|
| ▶I◀ | 1. Oil pressure switch | ▶C▶▶A▶ | 12. Oil screen gasket |
| ▶H▶ | 2. Oil filter | ▶B▶ | 13. Plug |
| | 3. Oil filter bracket | | 14. Relief spring |
| | 4. Oil filter bracket gasket | | 15. Relief plunger |
| | 5. Drain plug | | ▶C▶▶A▶ |
| ▶G▶ | 6. Drain plug gasket | | ▶B▶ |
| | 7. Cover | | ▶C▶▶A▶ |
| | 8. Oil level sensor <For Europe> | | ▶D▶▶A▶ |
| ▶C▶▶D▶ | 9. Oil pan | | ▶D▶▶A▶ |
| | 10. Baffle plate | | |
| | 11. Oil screen | | |

REMOVAL AND INSTALLATION

<24-VALVE FOR PAJERO (V33V)>

Apply engine oil to all moving parts before installation.



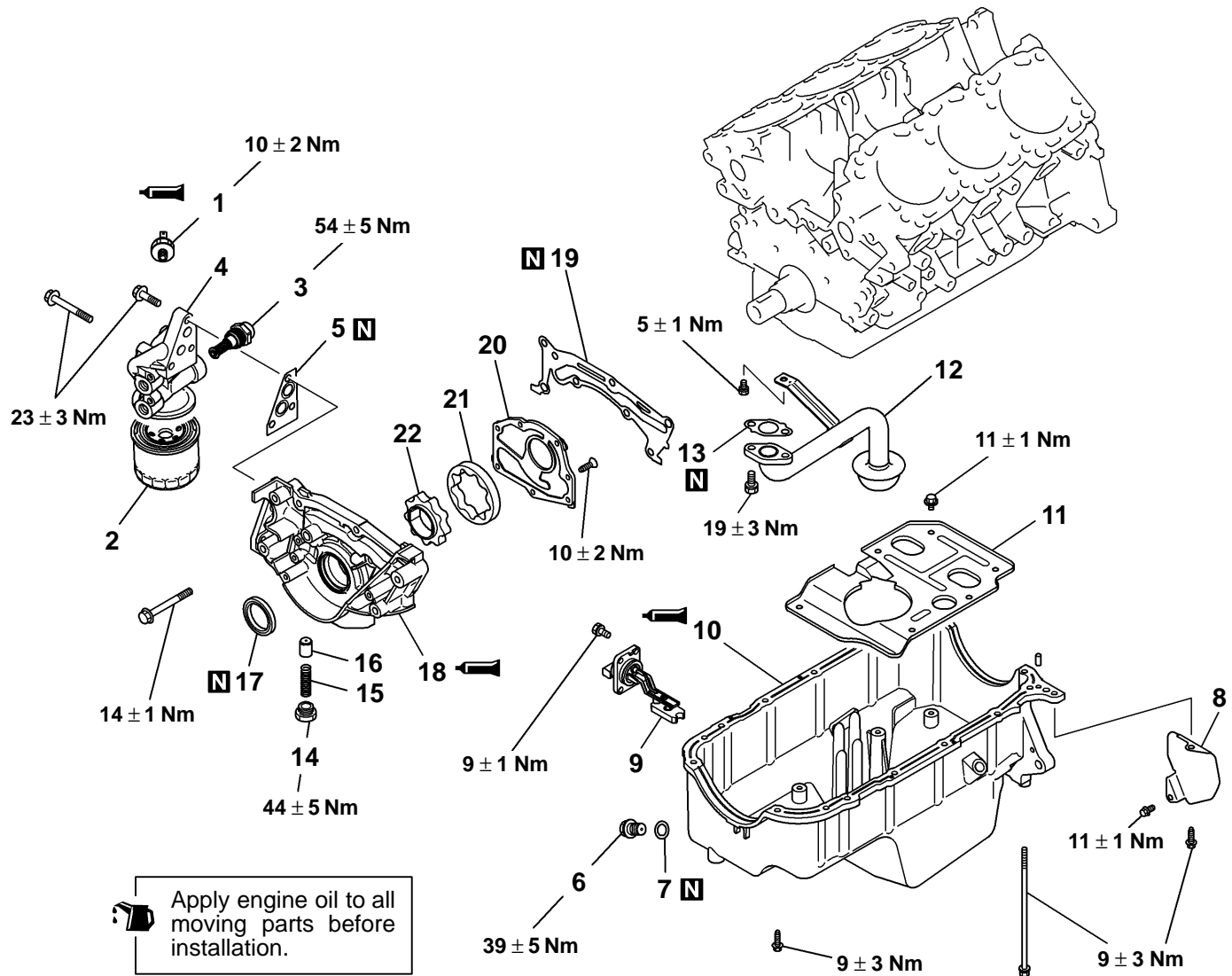
7EN1645

Removal steps

- | | | | |
|-----|------------------------------|-----|--------------------------|
| ▶ ◀ | 1. Oil pressure switch | ▶ ◀ | 13. Oil screen |
| ▶ ◀ | 2. Oil cooler by-pass valve | ▶ ◀ | 14. Oil screen gasket |
| ▶ ◀ | 3. Oil filter | ▶ ◀ | 15. Plug |
| ▶ ◀ | 4. Oil filter bracket | ▶ ◀ | 16. Relief spring |
| ▶ ◀ | 5. Oil filter bracket gasket | ▶ ◀ | 17. Relief plunger |
| ▶ ◀ | 6. Drain plug | ▶ ◀ | 18. Oil seal |
| ▶ ◀ | 7. Drain plug gasket | ▶ ◀ | 19. Oil pump case |
| ▶ ◀ | 8. Cover | ▶ ◀ | 20. O-ring |
| ▶ ◀ | 9. Cover | ▶ ◀ | 21. Oil pump cover |
| ▶ ◀ | 10. Oil pan, lower | ▶ ◀ | 22. Oil pump outer rotor |
| ▶ ◀ | 11. Oil pan, upper | ▶ ◀ | 23. Oil pump inner rotor |
| ▶ ◀ | 12. Baffle plate | | |

REMOVAL AND INSTALLATION

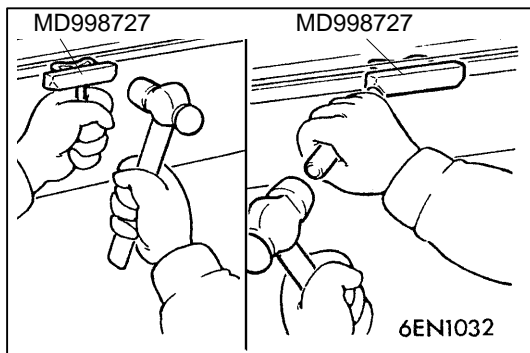
<24-VALVE FOR PAJERO (V63W, V73W), GDI>



7EN1573

Removal steps

- | | | |
|--|--|---|
| <p>▶I▶
▶H▶</p> <p>▶G▶</p> <p>◀C▶ ▶F▶</p> | <p>1. Oil pressure switch</p> <p>2. Oil filter</p> <p>3. Oil cooler by-pass valve
<Except for Taiwan></p> <p>4. Oil filter bracket</p> <p>5. Oil filter bracket gasket</p> <p>6. Drain plug</p> <p>7. Drain plug gasket</p> <p>8. Cover</p> <p>9. Oil level sensor <For Europe></p> <p>10. Oil pan</p> <p>11. Baffle plate</p> | <p>12. Oil screen</p> <p>13. Oil screen gasket</p> <p>14. Relief plug</p> <p>15. Relief spring</p> <p>16. Relief plunger</p> <p>▶C▶ 17. Oil seal</p> <p>18. Oil pump case</p> <p>19. Oil pump case gasket</p> <p>20. Oil pump cover</p> <p>▶D▶ ▶A▶ 21. Oil pump outer rotor</p> <p>▶D▶ ▶A▶ 22. Oil pump inner rotor</p> |
|--|--|---|



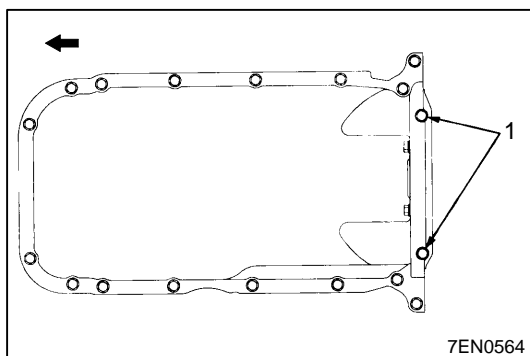
REMOVAL SERVICE POINTS

◀A▶ OIL PAN REMOVAL

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

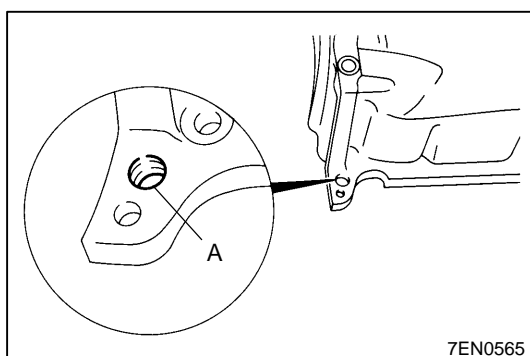
◀B▶ OIL PAN LOWER REMOVAL

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



◀C▶ OIL PAN UPPER REMOVAL

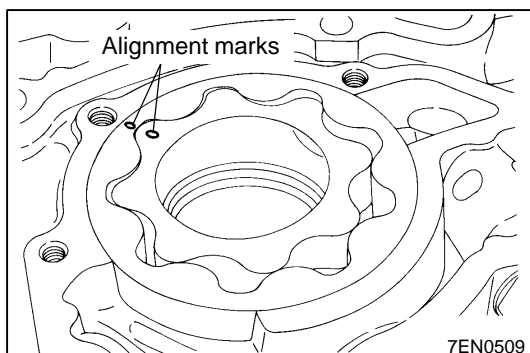
1. Detach the bolt (1) shown at left.
2. Detach all other bolts.



3. Screw a M10 bolt into bolt hole (A) shown (at both ends) to remove the oil pan.

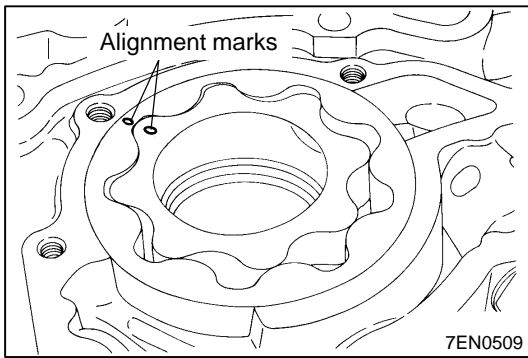
Caution

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



◀D▶ OIL PUMP OUTER AND INNER ROTORS REMOVAL

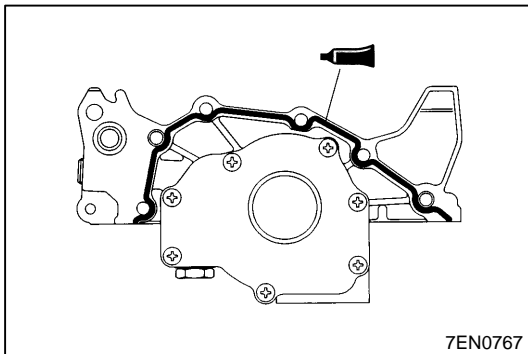
Draw a setting mark on the oil pump outer and inner rotors to facilitate reassembly.



INSTALLATION SERVICE POINTS

▶A◀ OIL PUMP INNER AND OUTER ROTORS INSTALLATION

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.

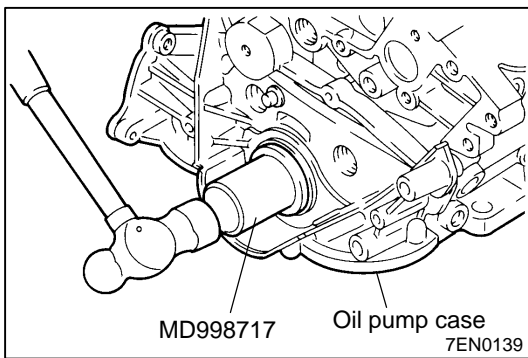


▶B◀ OIL PUMP CASE INSTALLATION

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 (FIG) and coat the coating surface with it.

Specified sealant:

mitsubishi GENUINE Part No. MD970389 or equivalent

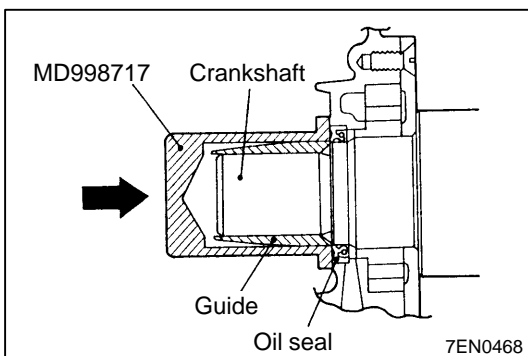


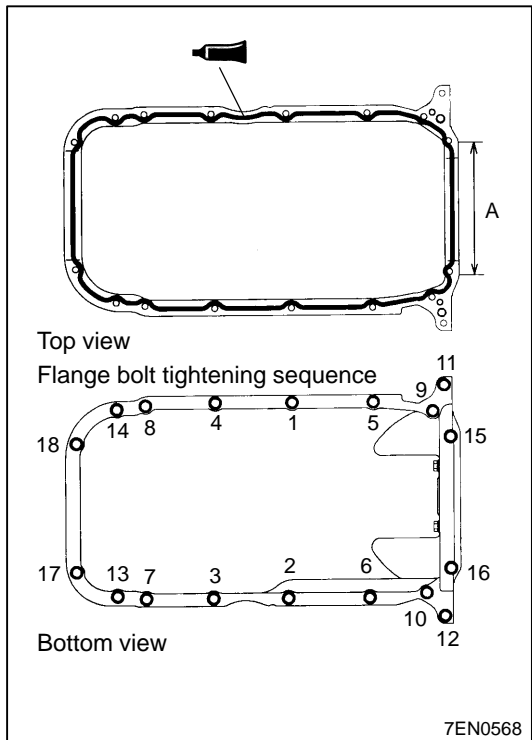
▶C◀ OIL SEAL INSTALLATION

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

NOTE

Knock it as far as the surface.





►D◄ OIL PAN UPPER INSTALLATION

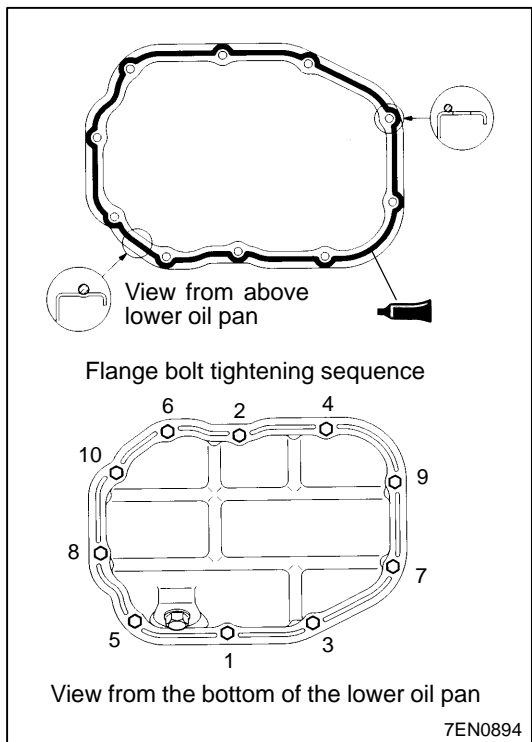
1. Clean the gasket coating surfaces of the cylinder block and the oil pan upper.
2. Squeeze out a 4 mm bead of liquid gasket and coat the coating surface with it.

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

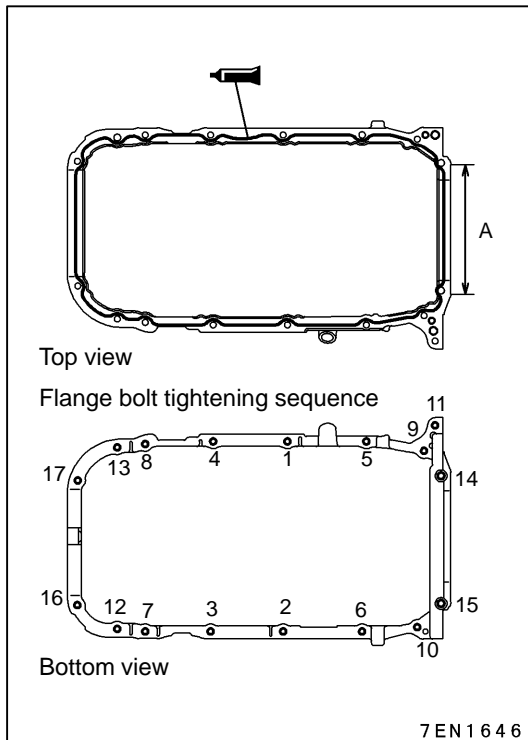


►E◄ OIL PAN LOWER INSTALLATION

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 and coat the coating surfaces.

Liquid gasket:

MITSUBISHI GENUINE Part No. MD970389 or equivalent



►F◄ OIL PAN

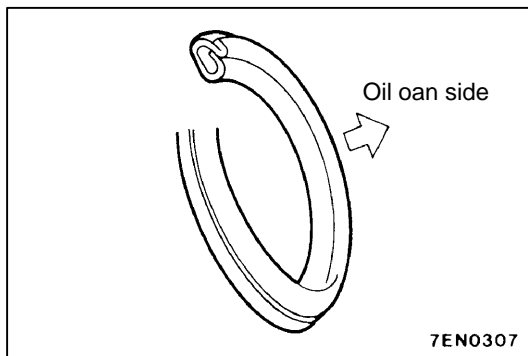
1. Clean the gasket coating surfaces of the cylinder block and the oil pan upper.
2. Squeeze out a 4 mm bead of liquid gasket and coat the coating surface with it.

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

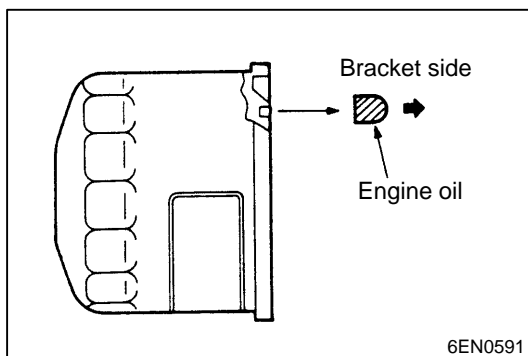


►G◄ DRAIN PLUG GASKET INSTALLATION

Replace the drain plug gasket with a new one. Fit the new gasket as shown.

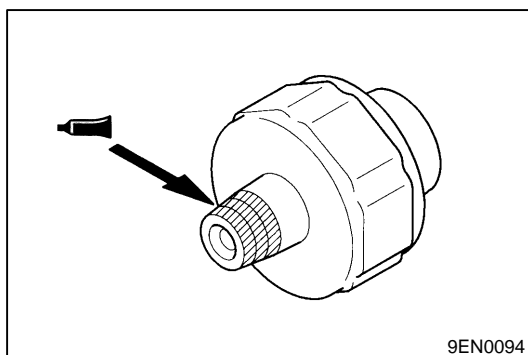
Caution

If the gasket is installed in the wrong direction, oil leaks will occur.



►H◄ 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).

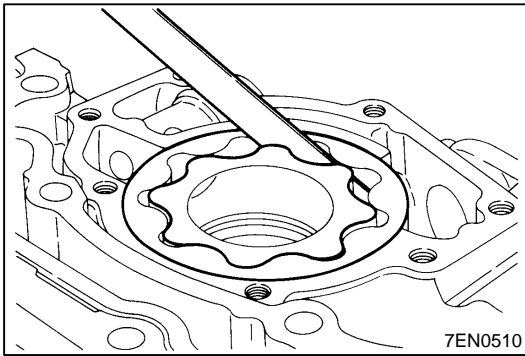


►I◄ OIL PRESSURE SWITCH

Sealant: 3M ATD Part No. 8660 or equivalent

NOTE

- (1) Sealant must not extend beyond the tip of the thread portion.
- (2) Do not overtighten the switch.

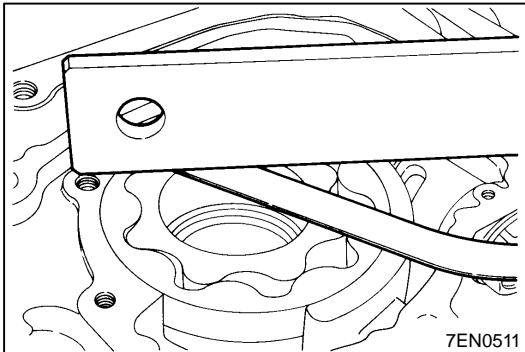


INSPECTION

1. OIL PUMP

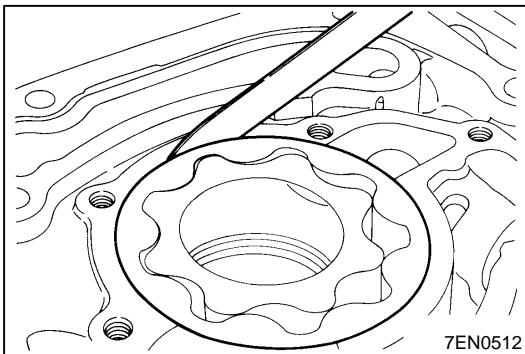
- (1) Check for tip clearance.

Standard value: 0.03 – 0.08 mm



- (2) Check for side clearance.

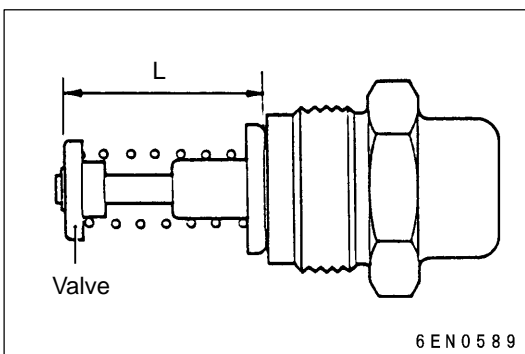
Standard value: 0.04 – 0.10 mm



- (3) Check for body clearance.

Standard value: 0.10 – 0.18 mm

Limit: 0.35 mm



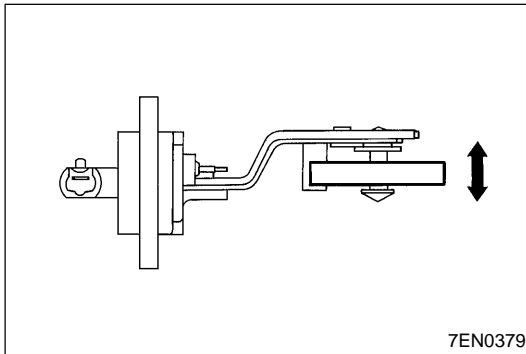
2. OIL COOLER BY-PASS VALVE

- (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

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

Dimension L: 40 mm or more



3. OIL LEVEL SENSOR

Put the oil level sensor in the oil, then move the float up and down with the oil at a temperature either lower than 40°C or higher than 80°C, and check for continuity.

40°C

Float position	Switch ON/OFF
Condition when down	ON (continuity)
Condition when up	ON (continuity)

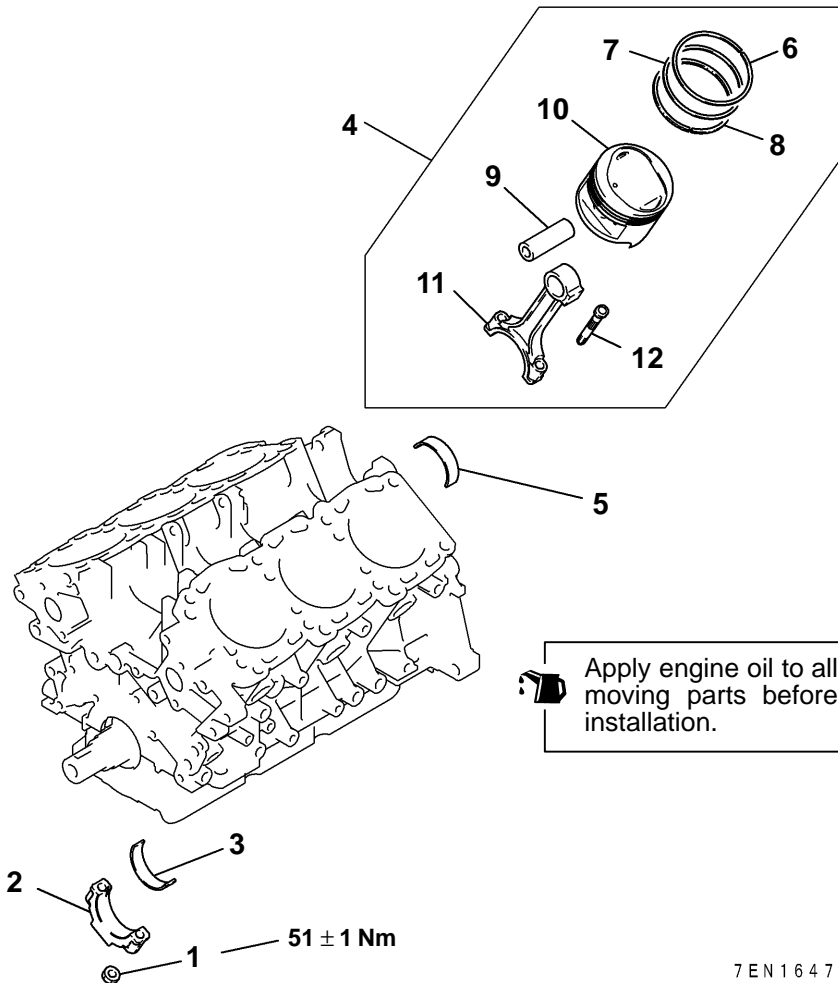
80°C

Float position	Switch ON/OFF
Condition when down	OFF (no continuity)
Condition when up	ON (continuity)

14. PISTON AND CONNECTING ROD

REMOVAL AND INSTALLATION

<12-VALVE, 6G72-24-VALVE>



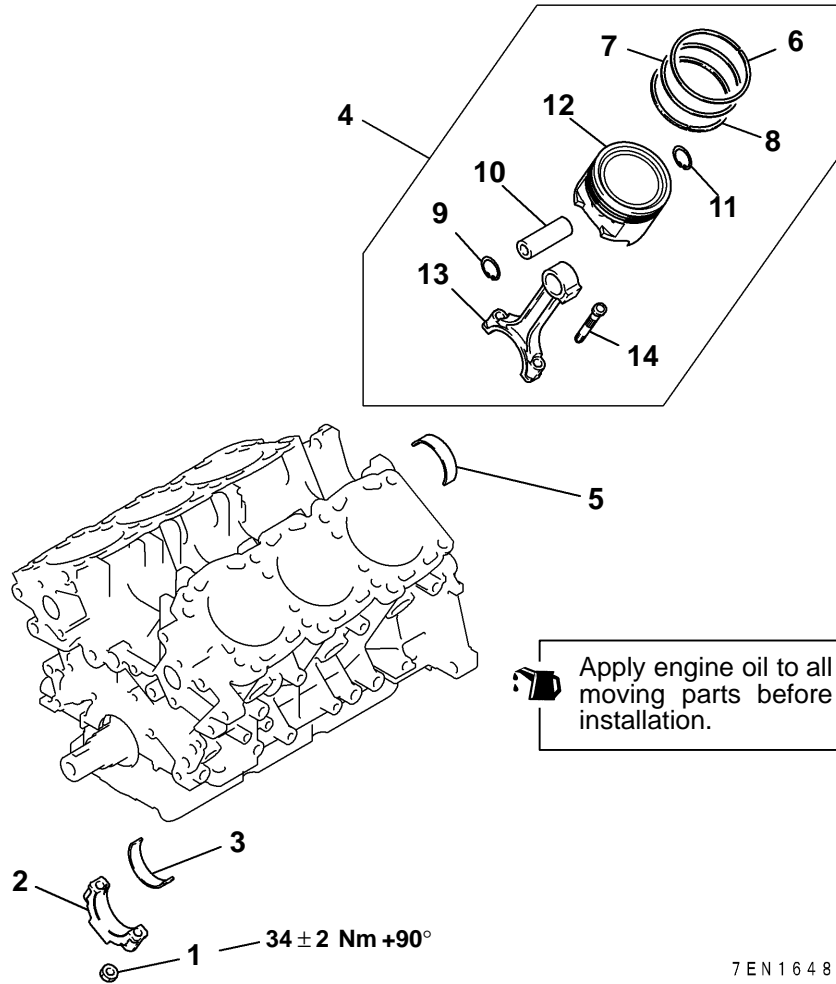
7 EN 16 4 7

Removal steps

- | | | | |
|--------------------------------------|---|----------------------------------|---|
| <p>◀A▶ ▶G▶</p> <p>▶F▶</p> <p>▶D▶</p> | <ol style="list-style-type: none"> 1. Connecting rod cap nut 2. Connecting rod cap 3. Connecting rod bearing, lower 4. Piston, connecting rod assembly 5. Connecting rod bearing, upper 6. Piston ring No.1 | <p>▶D▶</p> <p>▶C▶</p> <p>▶A▶</p> | <ol style="list-style-type: none"> 7. Piston ring No.2 8. Oil ring 9. Piston pin 10. Piston 11. Connecting rod 12. Bolt |
|--------------------------------------|---|----------------------------------|---|

REMOVAL AND INSTALLATION

<6G74-24-VALVE>



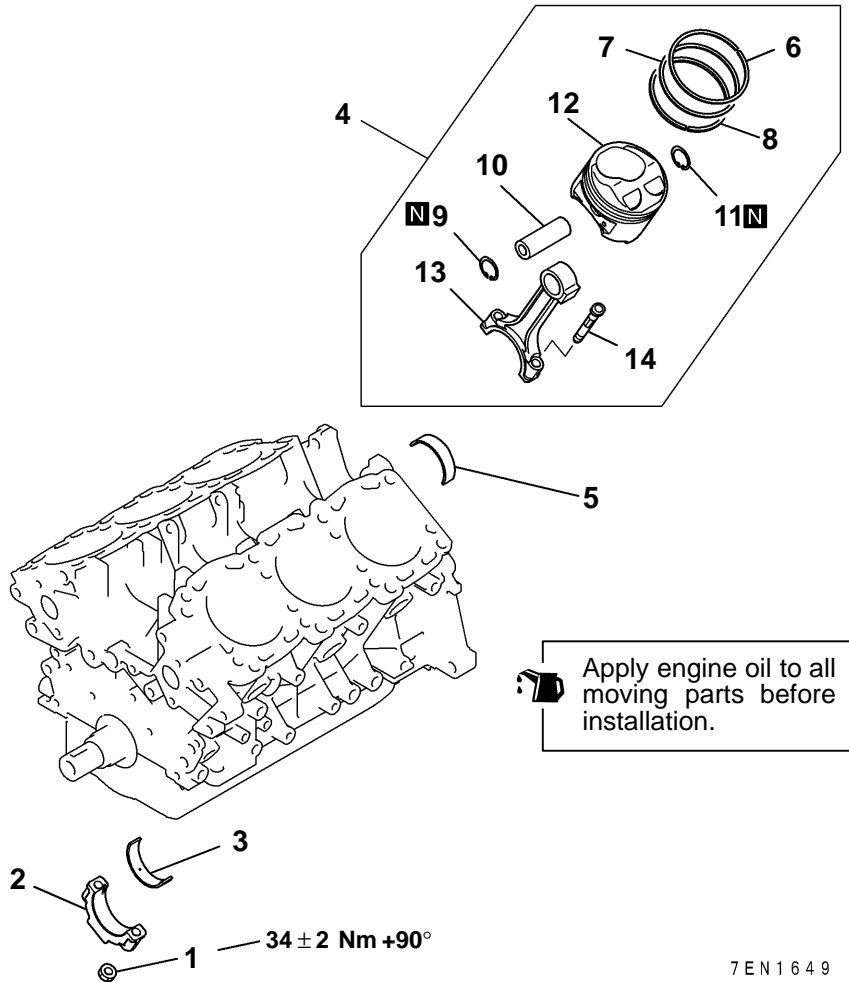
7EN1648

Removal steps

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

REMOVAL AND INSTALLATION

<GDI>

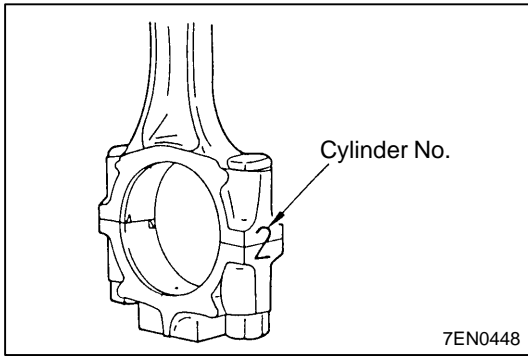


Apply engine oil to all moving parts before installation.

7EN1649

Removal steps

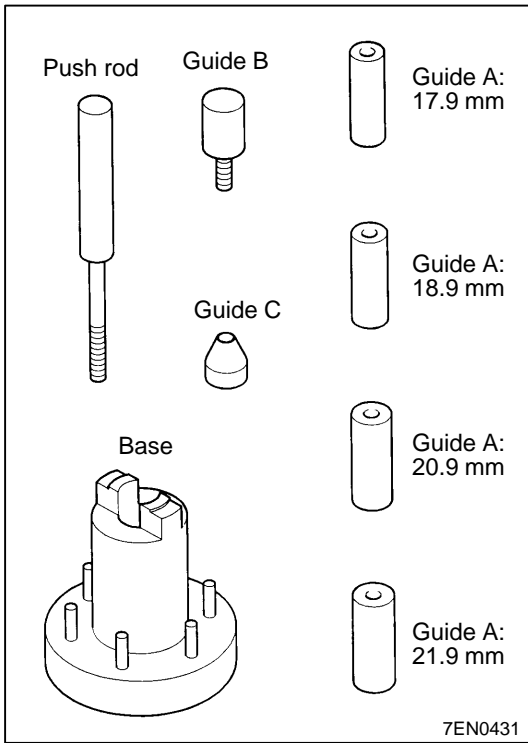
- | | | | | |
|-----|-----|------------------------------------|---------|--------------------|
| ◀A▶ | ▶H▶ | 1. Connecting rod cap nut | ▶C▶ | 8. Oil ring |
| | ▶G▶ | 2. Connecting rod cap | | 9. Snap ring |
| | ▶E▶ | 3. Connecting rod bearing, lower | ◀C▶ ▶B▶ | 10. Piston pin |
| | ▶F▶ | 4. Piston,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



REMOVAL SERVICE POINTS

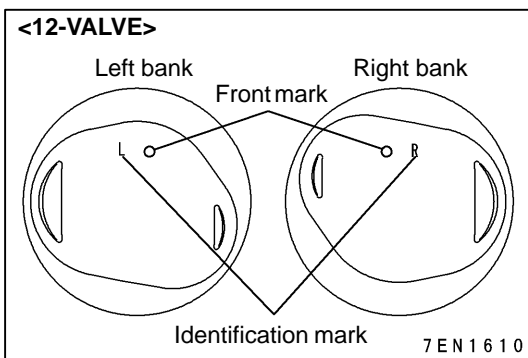
◀A▶ CONNECTING ROD CAP REMOVAL

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

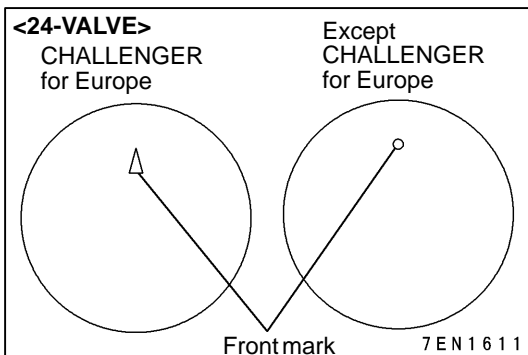


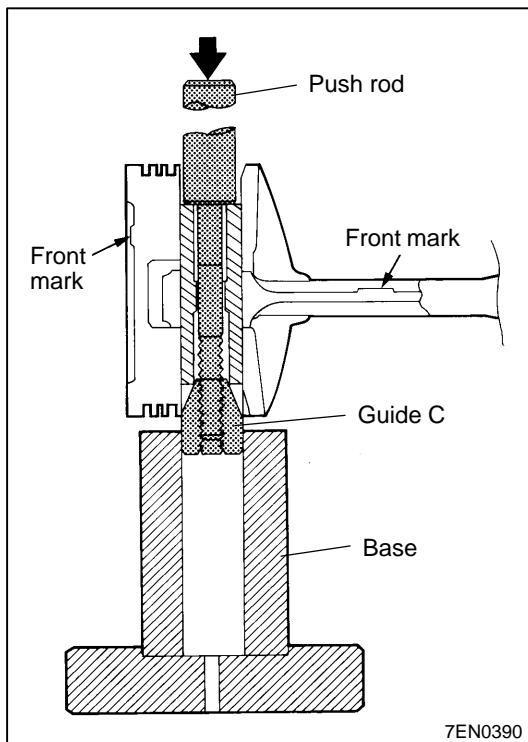
◀B▶ PISTON PIN REMOVAL <6G72>

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 side of the piston side and attach guide C.

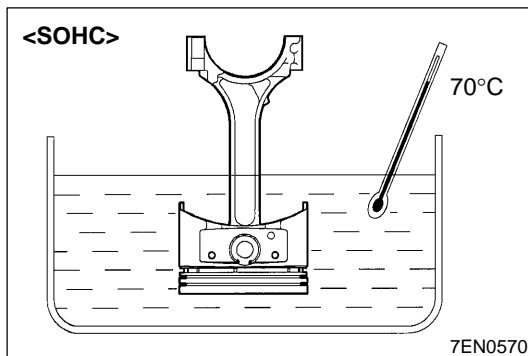




2. Set the piston and connecting rod assembly to the special tool piston pin setting base such that the front mark on the piston faces upward.
3. Pull out the piston pin with a press.

NOTE

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

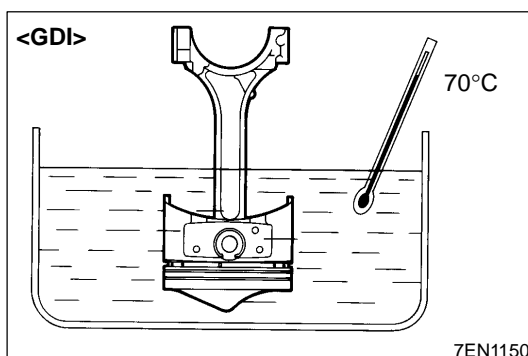


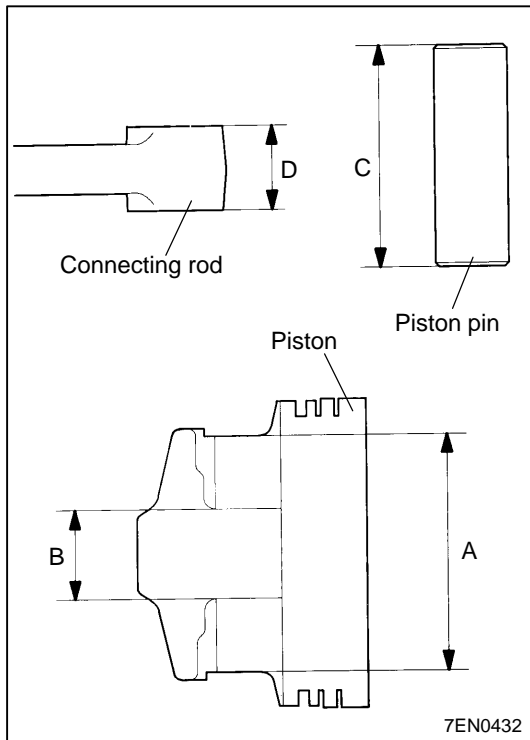
◀C▶ PISTON PIN REMOVAL <6G74>

1. Remove the snap rings.
2. Heat the piston to approximately 70°C and pull out the piston pin.

Caution

The clearance between the piston and the piston pin is an almost tight fit at normal temperature. Therefore, be sure to heat the piston before pulling out the piston pin. In addition, note that the piston is hot after heating.





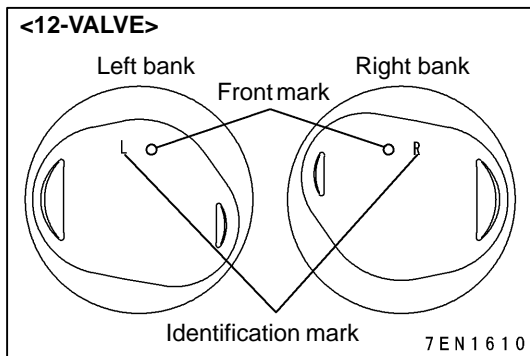
INSTALLATION SERVICE POINTS

▶A◀ PISTON PIN INSTALLATION

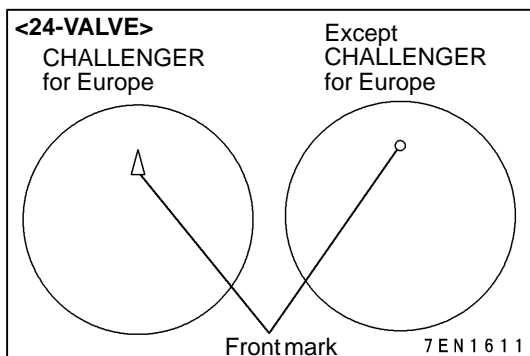
1. Measure the dimensions of the following parts and portions:
 A: Piston pin mounting portion
 B: Distance between piston bosses
 C: Piston pin
 D: Connecting rod
2. Calculate by substituting each measured value into the following equation:

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

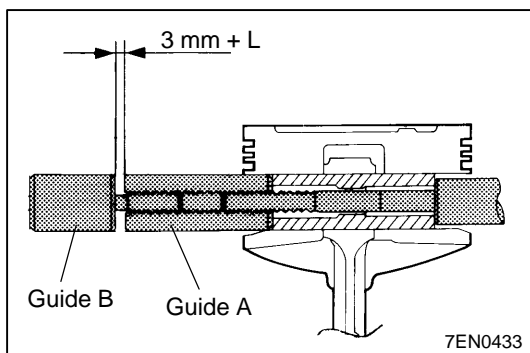
3. Insert the special push rod tool into the piston pin and attach guide A to it.
4. Combine the piston and the connecting rod, matching their front marks.
5. Apply engine oil to the outer periphery of the piston pin.

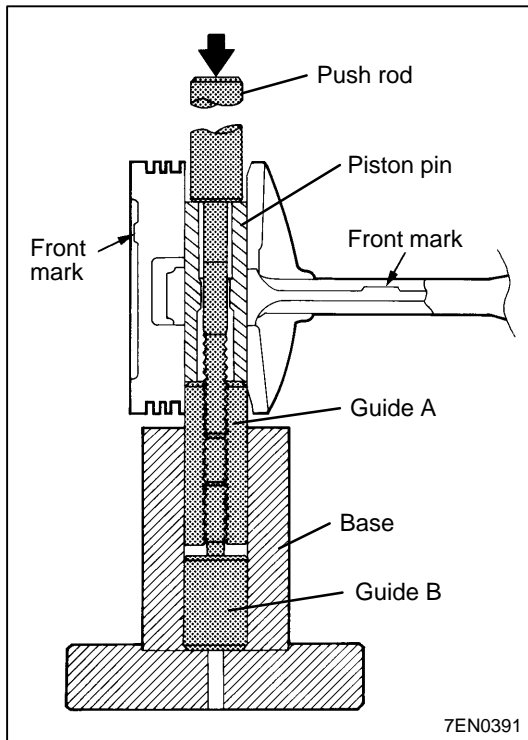


6. Insert the side of the piston pin guide A attached per Step 3. into the pin hole from the side of the piston containing the front mark.



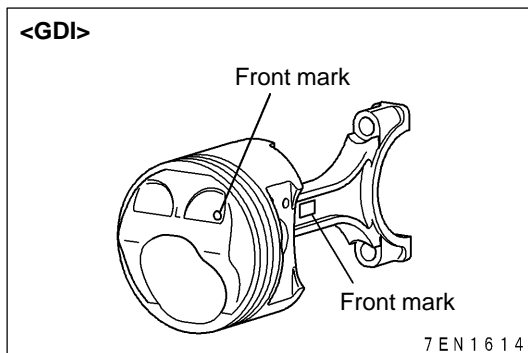
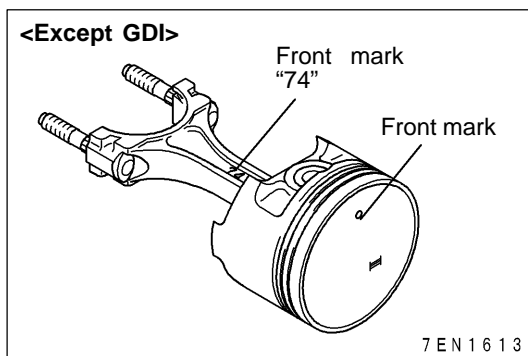
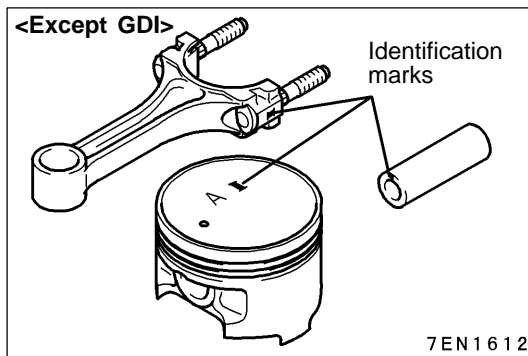
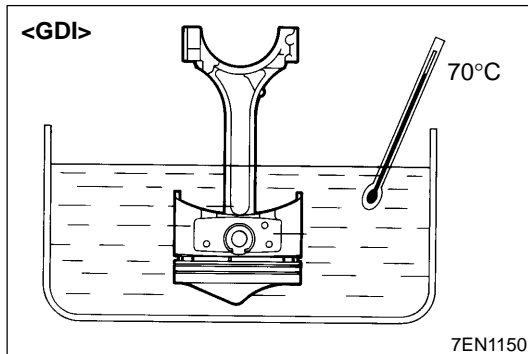
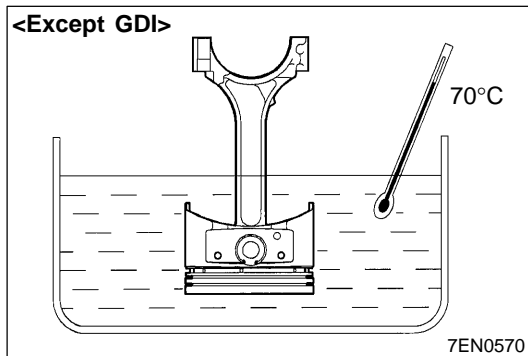
7. Screw guide B into guide A until they are distance L (obtained per Step 2. above) plus 3 mm apart as shown.





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◄ PISTON PIN INSTALLATION

1. Heat the piston pin to approximately 70°C and set the snap ring on one side first. Be sure to install the snap ring with the shear droop directed toward the inside.
2. Make sure that the identification marks of the piston, piston pin and connecting rod small end are of the appropriate class. <Except GDI>

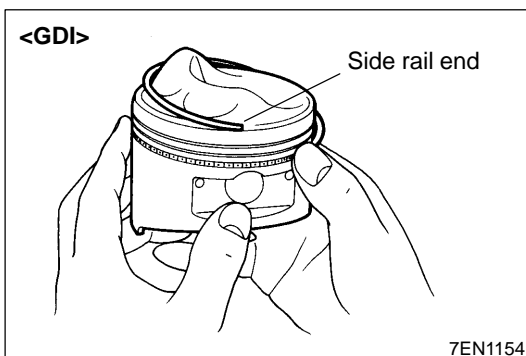
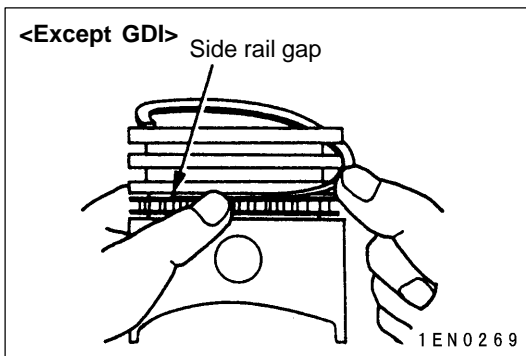
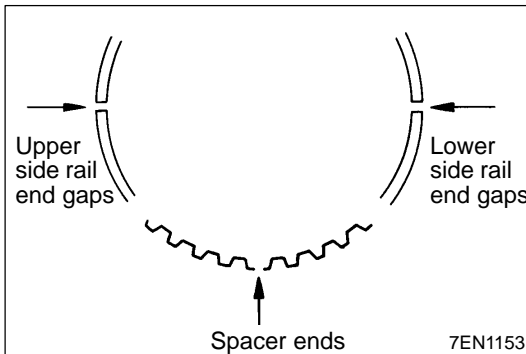
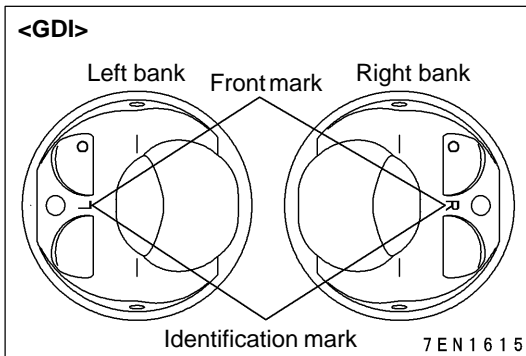
mm

		Class		
		I	II	III
Piston pin	Identification mark	I	No mark	III
	O.D.	22.005 – 22.007	22.003 – 22.005	22.001 – 22.003
Piston	Identification	I	No mark	III
	I.D.	22.003 – 22.005	22.001 – 22.003	21.999 – 22.001
	Clearance (at normal temperature)	-0.04 – 0	-0.04 – 0	-0.04 – 0
Connecting rod small end	Identification	I	No mark	III
	I.D.	22.012 – 22.020	22.010 – 22.018	22.008 – 22.016
	Clearance (at normal temperature)	0.005 – 0.015	0.005 – 0.015	0.005 – 0.015

3. With the front mark of the connecting rod and that of the piston located on the same side, insert the piston pin.
4. After insertion of the piston pin, set the other snap ring.

Caution

- (1) Apply ample coat of engine oil to the periphery of the piston pin and the hole of the connecting rod small end.
- (2) The clearance between the piston and the piston pin is an almost tight fit at normale temperature. Therefore, be sure to heat the piston before inserting the piston pin.
- (3) In addition, note that the piston is hot after heating.



▶C◀ OIL RING INSTALLATION

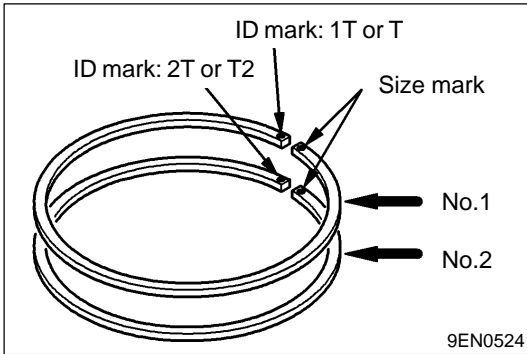
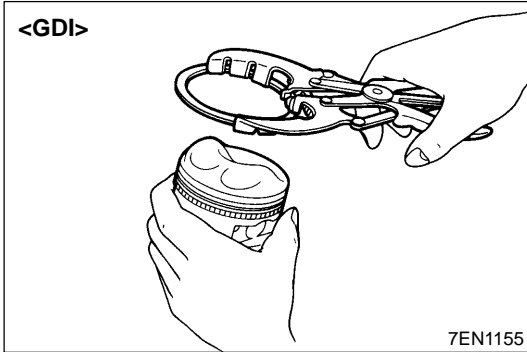
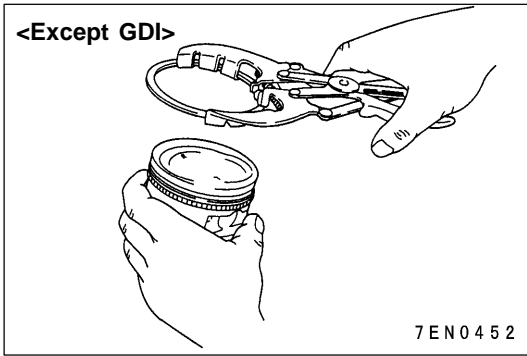
1. Fit the oil ring spacer into the piston ring groove.

NOTE

- (1) Ensure that the end gaps of the side rails and spacer are located as shown.
- (2) The spacer and side rails (new) are color-coded as detailed below according to their sizes.

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

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.
Use of ring expander to expand the side rail end gap can break the side rail, unlike other piston rings.
- Caution**
Unlike other piston rings, the side rail can break if it is expanded with a ring expander.
3. Mount the lower side rail.
4. A three-piece oil ring, if installed correctly, should turn smoothly in either direction. Check this.



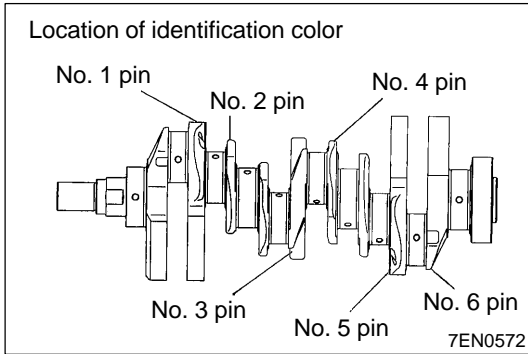
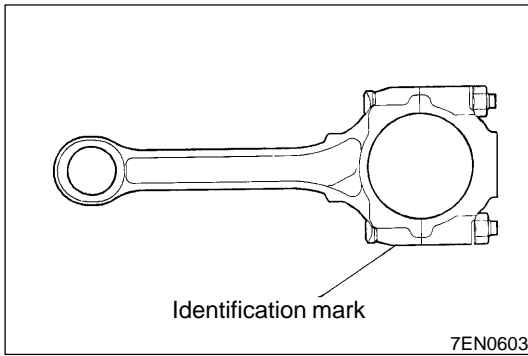
▶D◀ PISTON RING NO.2 / PISTON RING NO.1 INSTALLATION

Using a piston ring expander, fit the piston rings into position with the ring ID mark facing up.

NOTE

Each piston ring is stamped with the following size mark as appropriately.

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



►E◄ CONNECTING ROD BEARING INSTALLATION

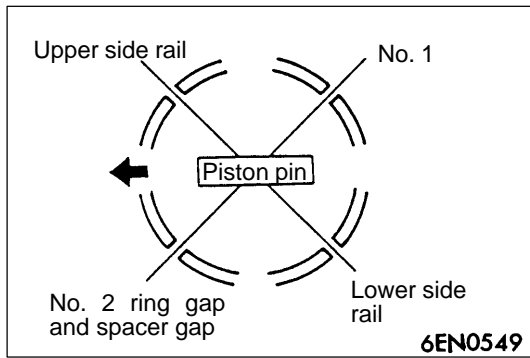
NOTE

The replacement connecting rod bearings for the 6G72 and 6G73 engines are supplied in the unit of a package containing all necessary number of bearings for the engine.

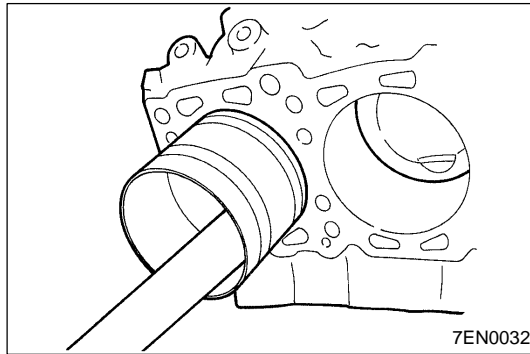
When replacing the bearing, select the proper bearing according to the crankshaft identification color and the connecting rod identification mark and install it.

<6G74 only>

Crankshaft			Connecting rod			
Identification mark (color)		Pin O.D. mm	Big end		Bearing	
Production part	Spare part		Identification mark	I.D. mm	Identification color	Thickness mm
None	Yellow	54.994 – 55.000	0	58.000 – 58.006	Pink	1.483 – 1.486
			1	58.006 – 58.012	Red	1.486 – 1.489
			2	58.012 – 58.018	Green	1.489 – 1.492
None	None	54.988 – 54.994	0	58.000 – 58.006	Red	1.486 – 1.489
			1	58.006 – 58.012	Green	1.489 – 1.492
			2	58.012 – 58.018	Black	1.492 – 1.495
None	White	54.982 – 54.988	0	58.000 – 58.006	Green	1.489 – 1.492
			1	58.006 – 58.012	Black	1.492 – 1.495
			2	58.012 – 58.018	Brown	1.495 – 1.498



- F◄ 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 figure.
 3. Rotate crankshaft so that crank pin is on center of cylinder bore.



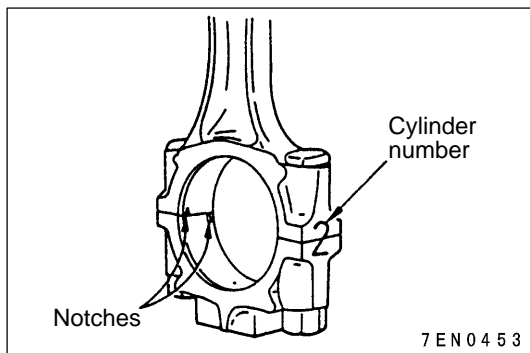
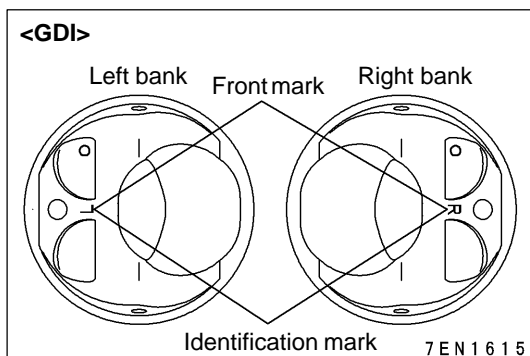
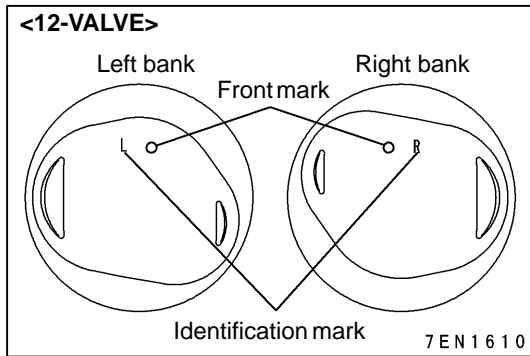
4. Use suitable thread protectors on connecting rod bolts before inserting piston and connecting rod assembly into cylinder block.
Care must be taken not to nick crank pin.
5. Using a suitable piston ring compressor tool, install piston and connecting rod assembly into cylinder block.

Caution

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

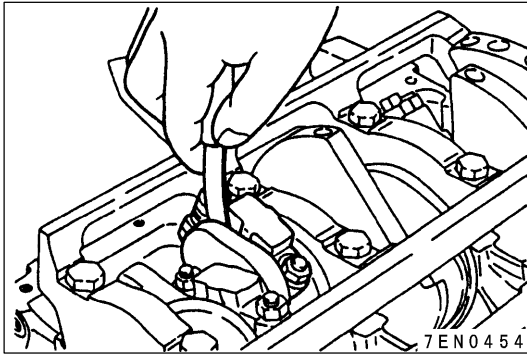
NOTE

6G72–12-valve or 6G74–GDI engine for rear wheel drive vehicle, 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



►G◄ 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.



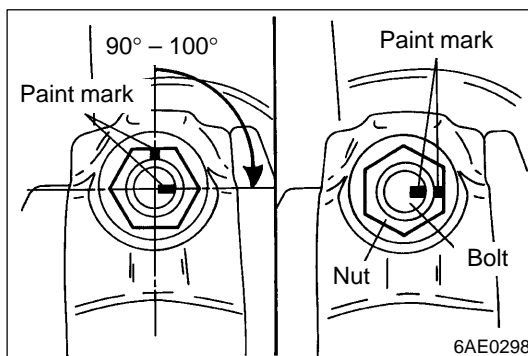
2. Check if the thrust clearance in the connecting rod big end is correct.

Standard value: 0.10 – 0.25 mm

Limit: 0.4 mm

▶H◀CONNECTING ROD CAP NUT INSTALLATION

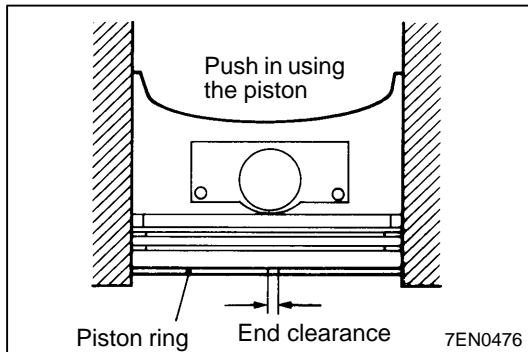
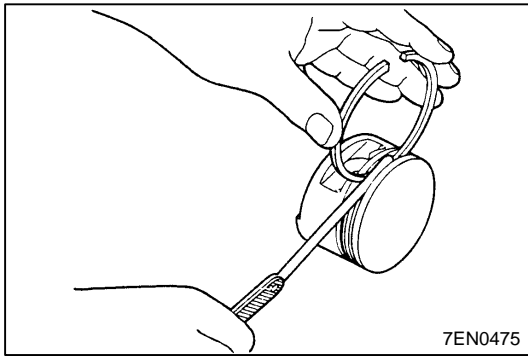
1. Since the plastic region tightening method has been employed for the connecting rod bolts and nuts, be sure to check the bolts for elongation before reuse. Bolts can be checked for elongation by finger-screwing the nut to the end of the bolt threads. If the nut cannot be screwed to the end smoothly, it indicates that the bolt threads have elongated. In this case, replace the bolt with a new one.
2. Before mounting the nut, coat the nut threads and seating surface with engine oil.
3. After the nut has been mounted to each bolt and tightened finger-tight, alternately tighten nuts as follows to install caps properly.
4. Tighten nuts to 34 Nm.



5. Put a paint mark to the head of the nut.
6. With reference to the paint mark on the nut, mark the bolt with a paint mark at the position angled 90° in the nut tightening direction.
7. Tighten the nut 90° and check that the paint marks on the nut and bolt are aligned with each other.

Caution

- (1) If the tightening angle is less than 90°, poor tightening performance could result. Make sure of the correct tightening angle.
- (2) If the tightening angle exceeds 100°, completely back off the nut and start the procedure over.



INSPECTION

1. 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

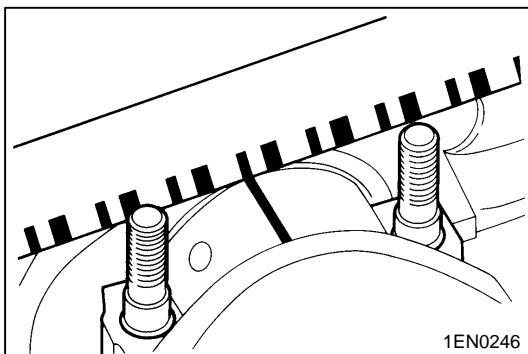
- (2) Place the piston ring in the cylinder bore, push it in by applying the piston head side, and make sure it is square.

Then measure the clearance at the ring ends with a thickness gauge.

Change the piston ring if the clearance at the ring end is excessive.

Standard values: No. 1 0.30 – 0.45 mm
No. 2 0.45 – 0.60 mm
Oil 0.10 – 0.35 mm

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



2. CRANKSHAFT PIN OIL CLEARANCE (PLASTIGAUGE METHOD)

- (1) Drain oil from the crankshaft pin and the connecting rod bearing.
- (2) Place a piece of Plastigauge 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 Plastigauge (at the widest point) using the scale printed on the Plastigauge package.

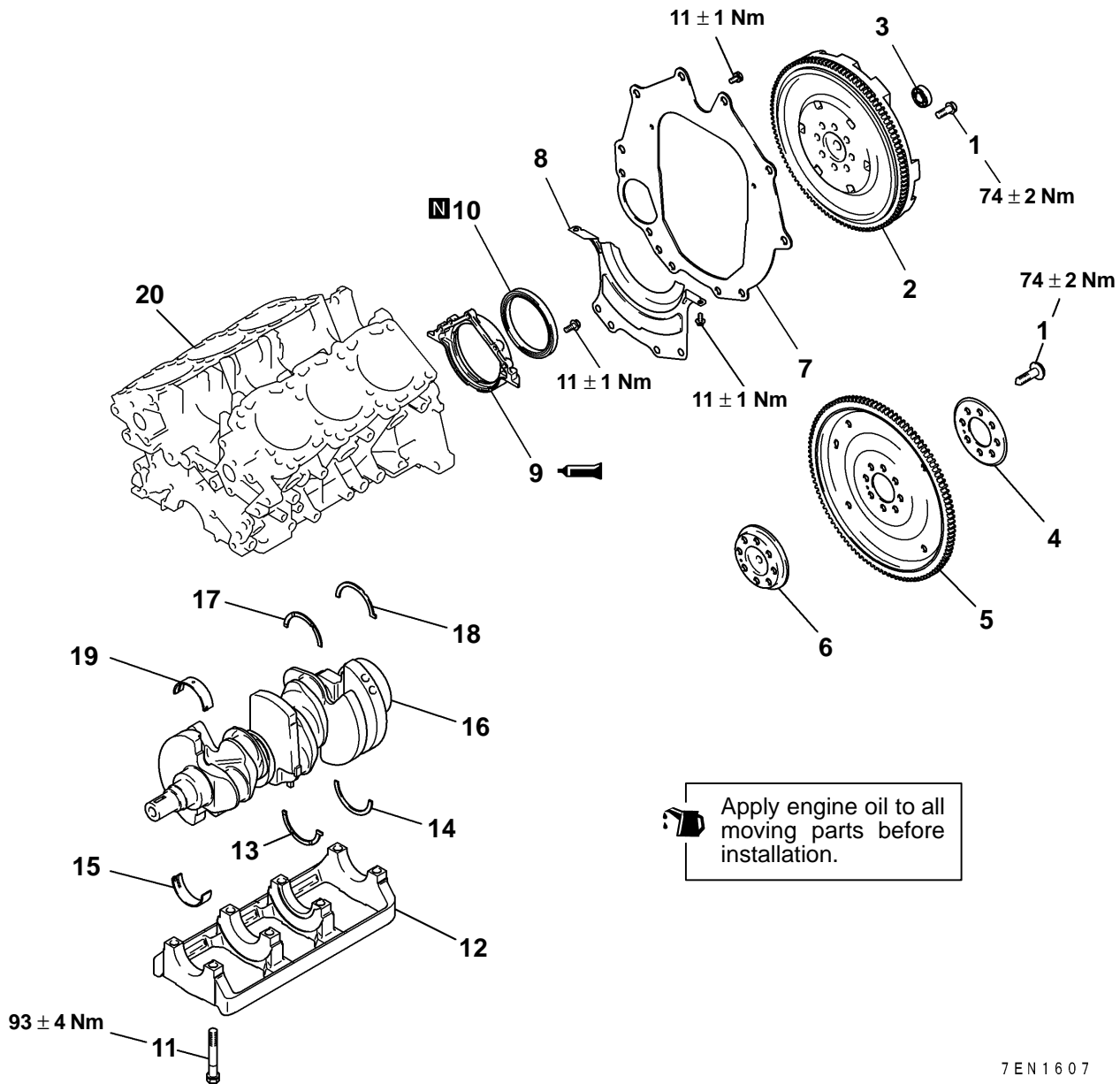
Standard value: 0.02 – 0.05 mm

Limit: 0.1 mm

15. CRANKSHAFT, FLYWHEEL AND DRIVE PLATE

REMOVAL AND INSTALLATION

<6G72-12-VALVE>



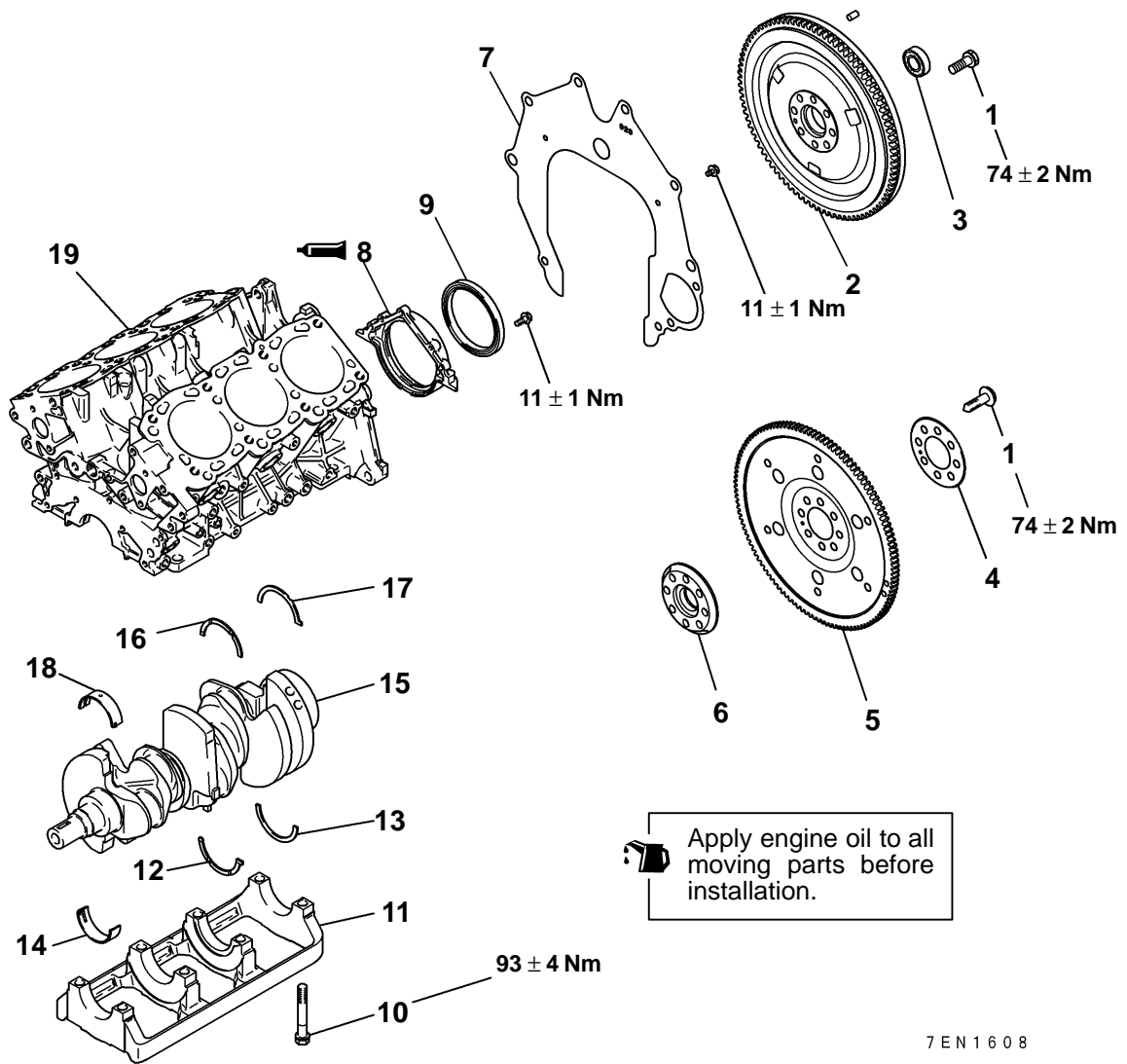
Apply engine oil to all moving parts before installation.

7EN1607

Removal steps

- 1. Flywheel bolt
- 2. Flywheel
- 3. Ball bearing
- 4. Adaptor plate
- 5. Drive plate
- 6. Crankshaft adaptor
- 7. Rear plate
- 8. Ball bearing cover
- 9. Oil seal case
- 10. Oil seal
- 11. Bearing cap bolt
- 12. Bearing cap
- 13. Thrust bearing (A)
- 14. Thrust bearing (B)
- 15. Crankshaft bearing lower
- 16. Crankshaft
- 17. Thrust bearing (B)
- 18. Thrust bearing (A)
- 19. Crankshaft bearing upper
- 20. Cylinder block

<6G72-24-VALVE>



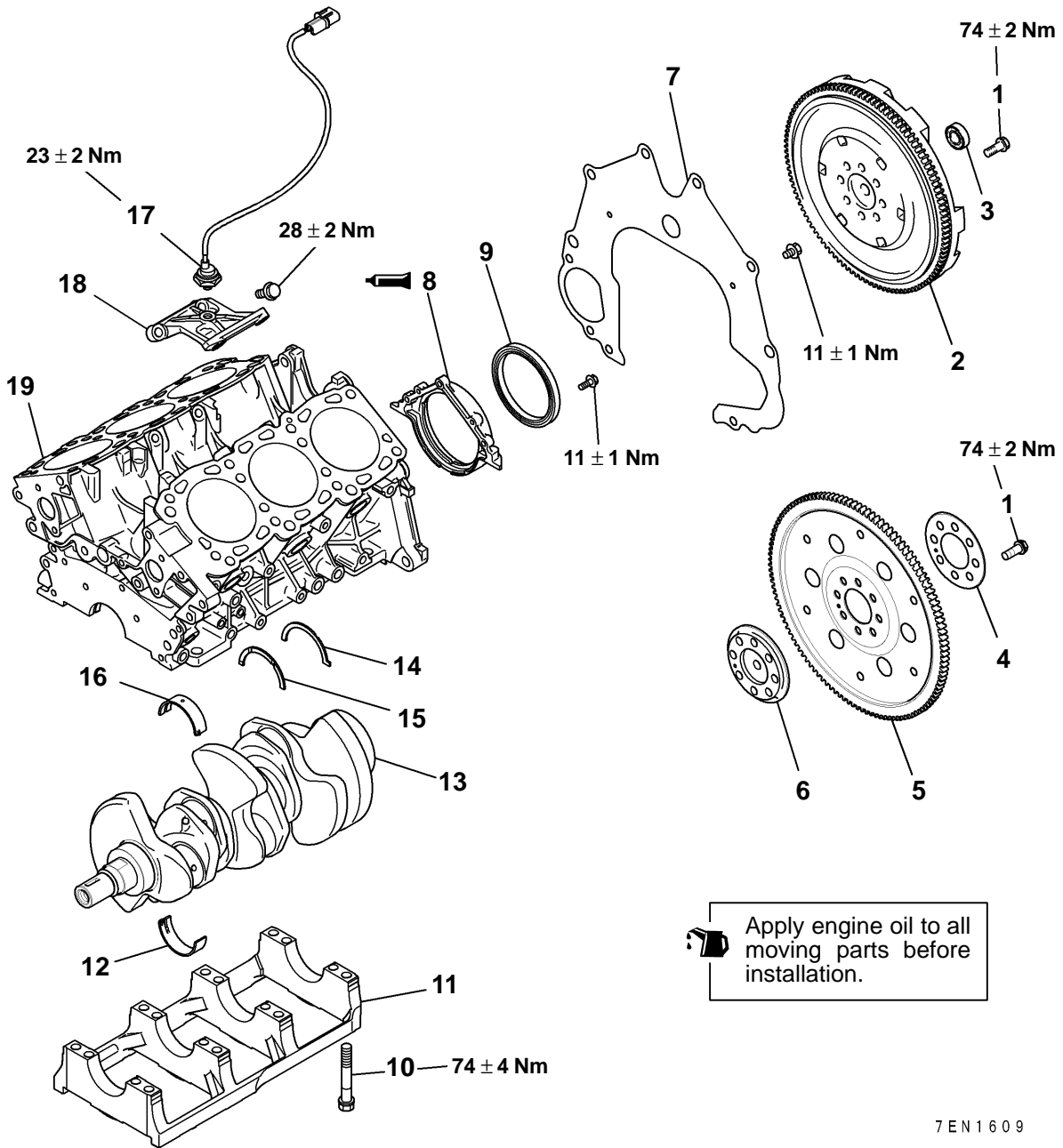
Apply engine oil to all moving parts before installation.

7EN1608

Removal steps

- | | |
|--------------------------|----------------------------------|
| 1. Flywheel bolt | ▶C◀ 11. Bearing cap |
| 2. Flywheel | ▶B◀ 12. Thrust bearing (A) |
| 3. Ball bearing | ▶B◀ 13. Thrust bearing (B) |
| 4. Adaptor plate | ▶B◀ 14. Crankshaft bearing lower |
| 5. Drive plate | ▶B◀ 15. Crankshaft |
| 6. Crankshaft adaptor | ▶B◀ 16. Thrust bearing (B) |
| 7. Rear plate | ▶B◀ 17. Thrust bearing (A) |
| ▶E◀ 8. Oil seal case | ▶B◀ 18. Crankshaft bearing upper |
| ▶D◀ 9. Oil seal | ▶B◀ 19. Cylinder block |
| ▶C◀ 10. Bearing cap bolt | |

<6G74>

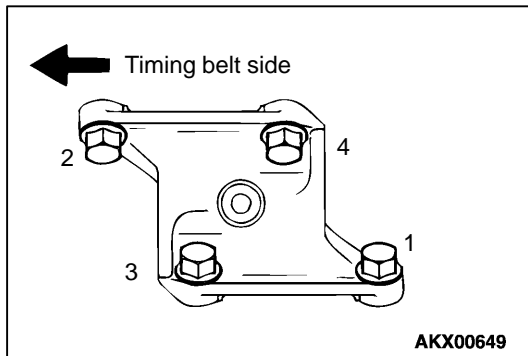


Apply engine oil to all moving parts before installation.

7EN1609

Removal steps

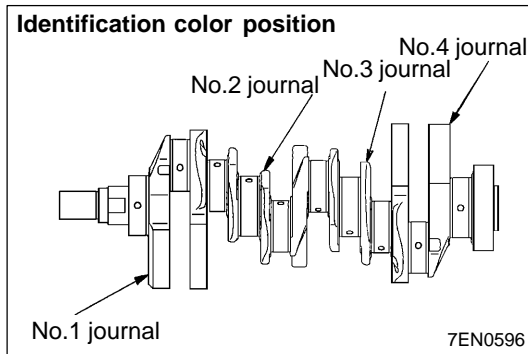
- | | | | |
|-----|-----------------------|-----|---|
| ▶E◀ | 1. Flywheel bolt | ▶C◀ | 11. Bearing cap |
| ▶D◀ | 2. Flywheel | ▶B◀ | 12. Crankshaft bearing lower |
| ▶C◀ | 3. Ball bearing | ▶B◀ | 13. Crankshaft |
| | 4. Adaptor plate | ▶B◀ | 14. Thrust bearing (A) |
| | 5. Drive plate | ▶B◀ | 15. Thrust bearing (B) |
| | 6. Rear plate | ▶B◀ | 16. Crankshaft bearing upper |
| | 7. Crankshaft adaptor | ▶A◀ | 17. Knock sensor <For Taiwan, GDI> |
| | 8. Oil seal case | | 18. Detonation sensor bracket <For Taiwan, GDI> |
| | 9. Oil seal | | 19. Cylinder block |
| | 10. Bearing cap bolt | | |



INSTALLATION SERVICE POINTS

▶A◀ DETONATION SENSOR BRACKET INSTALLATION

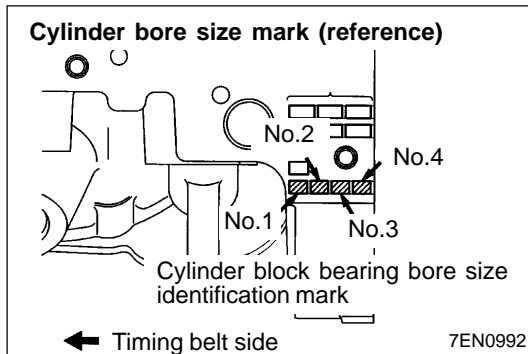
Check that the bracket is in proper contact with the cylinder block bores and tighten to the specified torque in the order shown.



▶B◀ CRANKSHAFT BEARING INSTALLATION

When the bearing needs replacing, select and install a proper 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 colors of its journals are painted 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 front to back, beginning at No. 1.



<6G72-12-VALVE>

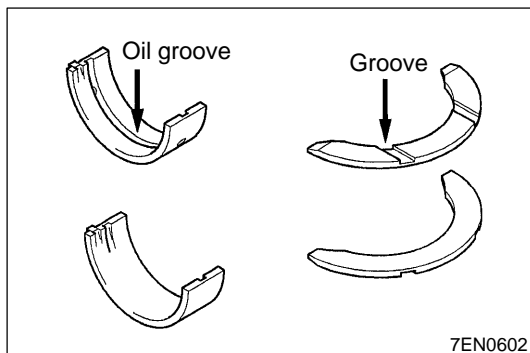
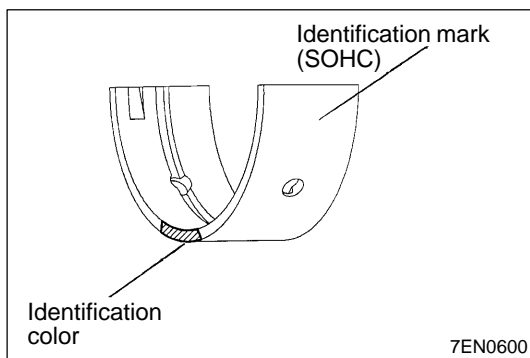
Combination of crankshaft journal diameter and cylinder block bearing bore diameter					Cylinder block bearing bore diameter identification mark	Bearing identification color or identification mark (for service part)
Crankshaft journal						
Classification	Identification color		O.D. mm			
	Production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

<6G72-24-VALVE>

Combination of crankshaft journal diameter and cylinder block bearing bore diameter					Cylinder block bearing bore diameter identification mark	Bearing identification color (for service part)
Crankshaft journal						
Classification	Identification color		O.D. mm			
	Production part	Service part				
1	None	Yellow	59.990 – 59.996	I	Pink	
				II	Red	
				III	Green	
2	None	None	59.984 – 59.990	I	Red	
				II	Green	
				III	Green	
3	None	White	59.978 – 59.984	I	Green	
				II	Black	
				III	Brown	

<6G74>

Combination of crankshaft journal diameter and cylinder block bearing bore diameter				Cylinder block bearing bore diameter identification mark	Bearing identification color (for service part)
Crankshaft journal					
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	63.988 – 63.994	I	Red
				II	Green
				III	Black
3	None	White	63.982 – 63.988	I	Green
				II	Black
				III	Brown



3. Select a proper bearing from the above table on the basis of the identification data confirmed under Items 1. and 2..

[Example – Two-camshaft engine]

(1) If the measured value of a crankshaft journal outer diameter is 59.996 mm, the journal is classified as "1" in the table.

In case the crankshaft is also replaced by a spare part, check the identification colors of the journals painted on the new crankshaft. If the color is yellow, for example, the journal is classified as "1".

(2) Next, check the cylinder block bearing bore identification mark stamped on the cylinder block. If it is "I", read the "Bearing identification color" column to find the identification color of the bearing to be used. In this case, it is "pink".

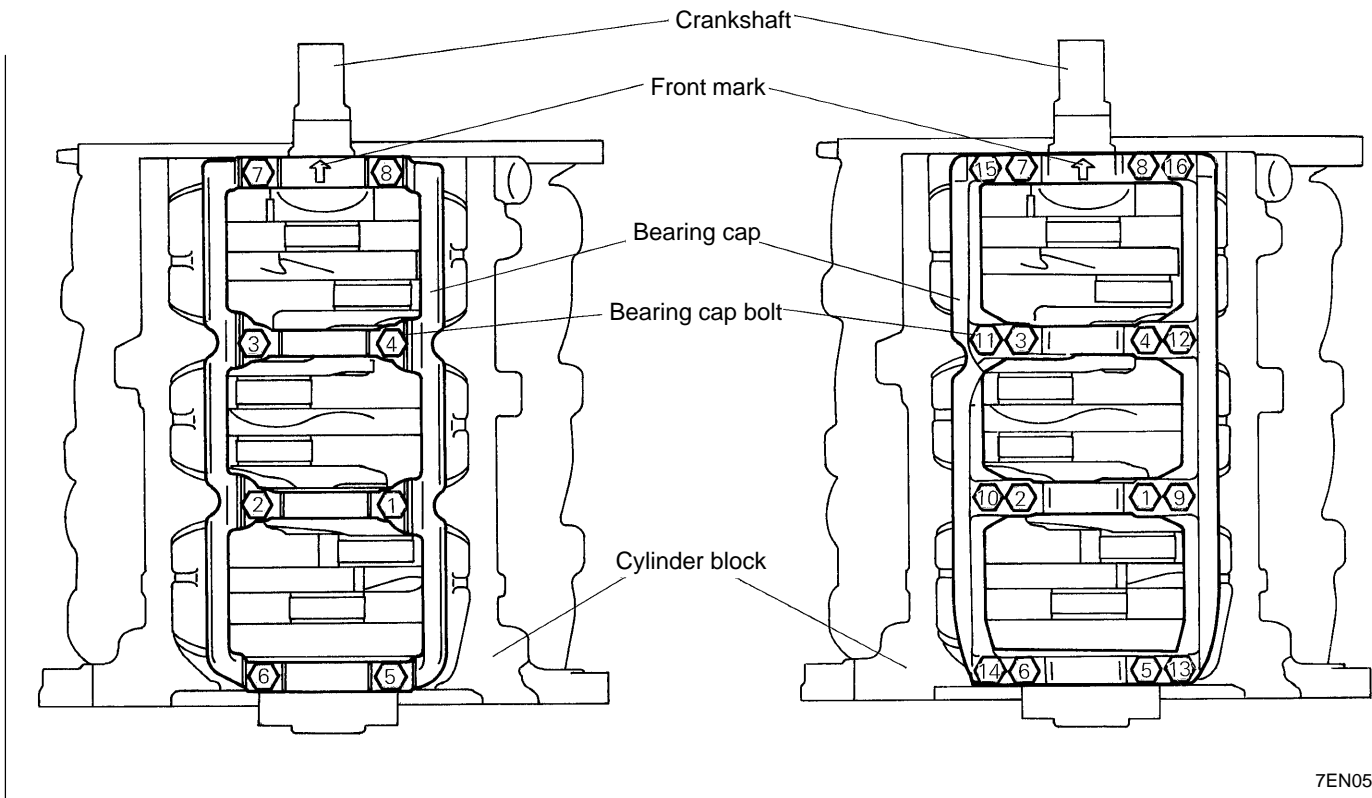
(3) Install the bearing halves with oil groove on the cylinder block side.

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

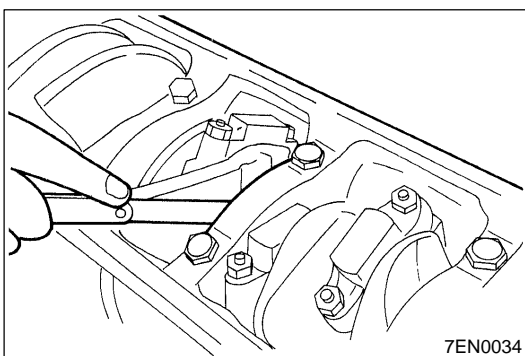
(5) Install the thrust bearings on both sides of the No.3 bearing with the grooves facing outward.

►C◄ BEARING CAP / BEARING BOLT INSTALLATION

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.



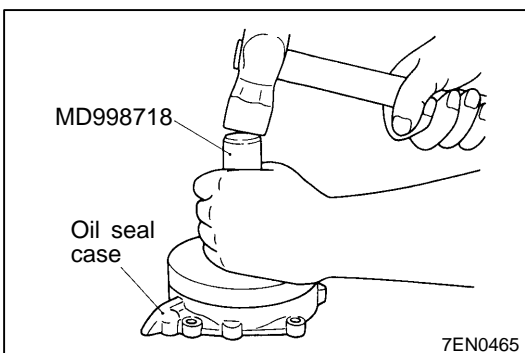
7EN0524



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

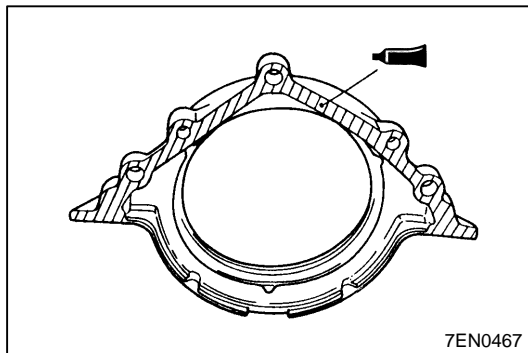
Standard value : 0.05 – 0.25 mm

Limit: 0.4 mm



►D◄ CRANKSHAFT REAR OIL SEAL INSTALLATION

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



▶◀ OIL SEAL CASE INSTALLATION

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

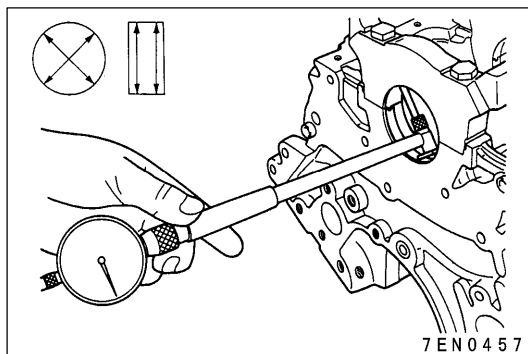
Liquid gasket:

MITSUBISHI genuine Part No. MD970389

INSPECTION

1. CRANKSHAFT

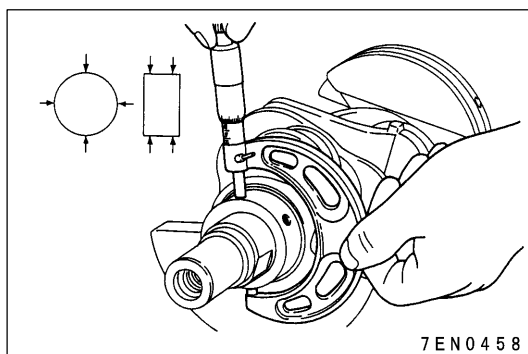
If the oil clearance exceeds the limit, replace the bearing, and crankshaft if necessary.



Measure the outside diameter of journal and inside diameter of crankshaft bearing. If the difference between them (oil clearance) exceeds the limit, replace the crankshaft bearing and, if necessary, crankshaft.

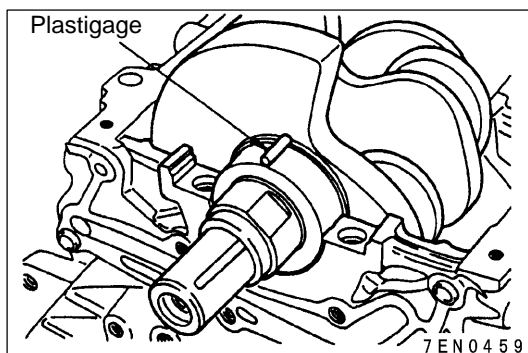
Standard value: 0.02 – 0.05 mm

Limit: 0.1 mm



Caution

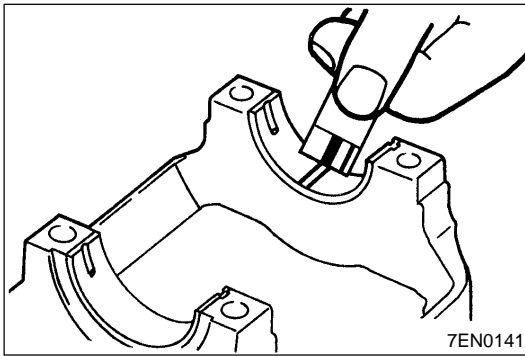
Do not attempt an undersize machining on the crankshaft with special surface treatment. This crankshaft can be identified by its dull gray appearance.



2. CRANKSHAFT OIL CLEARANCE (PLASTIC GAUGE METHOD)

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

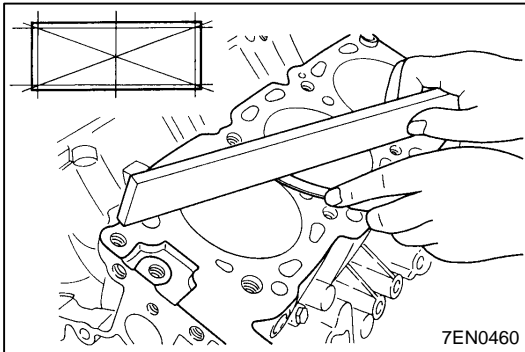
- (1) Remove oil and grease and any other foreign matters from crankshaft journal and bearing inner surface.
- (2) Install the crankshaft.
- (3) Cut the plastic gauge to the same length as the width of bearing and place it on journal in parallel with its axis.



- (4) 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 – 0.04 mm

Limit: 0.1 mm

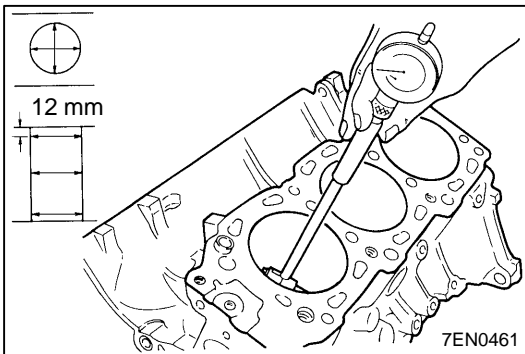


3. CYLINDER BLOCK

- (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.

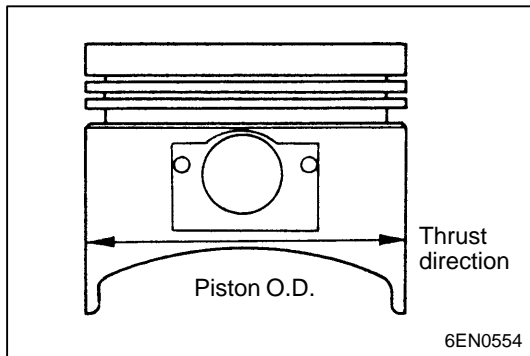
Standard value:

Cylinder inside diameter:

6G72 91.1 mm

6G74 93.0 mm

Ovality: 0.01 mm



4. 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:

- 6G72 0.02 – 0.04 mm**
- 6G74 0.03 – 0.05 mm**

NOTE

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