

ENGINE

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NOTES

SPECIFICATIONS

GENERAL SPECIFICATIONS

E11CA--

Items		4G13	4G92	4G93	4D68
Number and arrangement of cylinder		4, in-line	4, in-line	4, in-line	4, in-line
Total displacement	ml (cu.in.)	1,299 (79.3)	1,597 (97.5)	1,834 (111.9)	1,998 (121.9)
Bore × Stroke	mm (in.)	71.0 × 82.0 (2.80 × 3.23)	81.0 × 77.5 (3.19 × 3.05)	81.0 × 89.0 (3.19 × 3.50)	82.7 × 93.0 (3.26 × 3.66)
Compression ratio		9.5	10.0	10.5	22.4
Firing order		1-3-4-2	1-3-4-2	1-3-4-2	—
Injection order		—	—	—	1-3-4-2
Combustion chamber		Pentroof type	Pentroof type	Pentroof type	Swirl type
Camshaft arrangement		Single overhead camshaft	Single overhead camshaft	Double overhead camshaft	Single overhead camshaft
Valve timing					
Intake	Open	BTDC 15°	BTDC 14° BTDC 16°*	BTDC 20°	BTDC 20°
	Close	ABDC 53°	ABDC 58° ABDC 42°*	ABDC 60°	ABDC 48°
Exhaust	Open	BBDC 57°	BBDC 52° BBDC 54°*	BBDC 60°	BBDC 54°
	Closed	ATDC 15°	ATDC 16° ATDC 6°*	ATDC 16°	ATDC 22°
Rocker arm		Roller follower type	Roller follower type	Roller follower type	Roller follower type
Lash adjuster		Not equipped	Not equipped	Equipped	Not equipped

NOTE

*: indicates specifications for MVV engines.

SERVICE SPECIFICATIONS

E11CB-

Items	4G13	4G92	4G93	4D68
Standard value				
Drive belt deflection mm (in.)				
Alternator V-ribbed type				
When checked	7.0-9.0 (0.28-0.35)	8.5-12.0 (0.33-0.47)	8.5-12.0 (0.33-0.47)	7.0-10.0 (0.28-0.39)
When a new belt is installed	5.5-7.0 (0.21-0.28)	7.0-8.5 (0.28-0.33)	7.0-8.5 (0.28-0.33)	6.0-7.0 (0.24-0.28)
When a used belt is installed	8.0 (0.31)	9.5 (0.37)	9.5 (0.37)	8.0-9.0 (0.31-0.35)
Power steering oil pump				
When checked	5.5-7.5 (0.22-0.30)	9.5-11.5 (0.374-0.453)* ¹	9.5-11.5 (0.374-0.453)* ¹	5.5-8.0 (0.22-0.39)
When a new belt is installed	4.0-5.5 (0.16-0.22)	7.5-9.0 (0.295-0.354)* ¹	7.5-9.0 (0.295-0.354)* ¹	4.5-5.5 (0.18-0.22)
When a used belt is installed	5.5-7.5 (0.22-0.30)	9.5-11.5 (0.374-0.453)* ¹	9.5-11.5 (0.374-0.453)* ¹	6.0-7.0 (0.24-0.28)
Air conditioner compressor				
When checked	6.0-7.0 (0.24-0.28)	—	—	7.0-8.0 (0.28-0.31)
When a new belt is installed	5.0-6.0 (0.20-0.24)	—	—	5.0-6.0 (0.20-0.24)
When a used belt is installed	6.0-7.0 (0.24-0.28)	—	—	7.0-8.0 (0.28-0.31)
Power steering oil pump and air conditioner compressor				
When checked	—	6.8-7.6 (0.268-0.299)	6.8-7.6 (0.268-0.299)	—
When a new belt is installed	—	5.5-6.0 (0.217-0.236)	5.5-6.0 (0.217-0.236)	—
When a used belt is installed	—	6.8-7.6 (0.268-0.299)	6.8-7.6 (0.268-0.299)	—
Basic ignition timing	5°BTDC ± 2°	5°BTDC ± 2°	5°BTDC ± 2°	—
Injection timing	—	—	—	9°ATDC
Idle speed r/min.	750 ± 100	800 ± 100 700 ± 100* ²	800 ± 100	750 ± 100
CO concentration and HC concentration at idle				
CO concentration %	0.5 or less	0.5 or less	0.5 or less	—
HC concentration ppm	100 or less	100 or less	100 or less	—
Compression pressure kPa (kg/cm ² , psi) (250-400 r/min.)	1400 (14.0, 199)	1450 (14.5, 206)	1500 (15.0, 213)	3500 (35.0, 49.8)
Intake manifold vacuum kPa (kg/cm ² , in.Hg)	Approx. 71 (530, 21)	Approx. 67 (500, 20)	Approx. 67 (500, 20)	—
Valve clearance (at hot) mm (in.)				
Intake	0.20 (0.008)	0.20 (0.008)	—	0.25 (0.010)
Exhaust	0.25 (0.010)	0.30 (0.012)	—	0.25 (0.010)
Timing belt tension mm (in.)	—	33 (1.30)	—	4-5 (0.16-0.20)

Items	4G13	4G92	4G93	4D68
Limit				
Compression pressure kPa (kg/cm ² , psi) (250-400 r/min.)	min. 1000 (10.0, 142)	min. 1100 (11.0, 156)	min. 1150 (11.5, 164)	min. 2560 (25.6, 364)
Compression pressure difference of all cylinder kPa (kg/cm ² , psi)	max. 100 (1.0, 14)	max. 100 (1.0, 14)	max. 100 (1.0, 14)	max. 300 (3.0, 43)

NOTE

*1: indicates specifications for vehicles without air conditioner.

*2: indicates specifications for MWV engines.


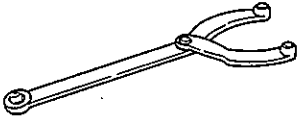
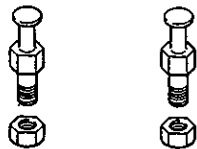

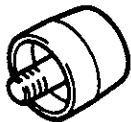
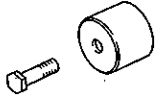
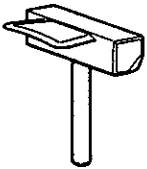

SEALANTS

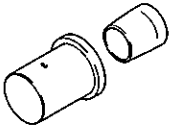


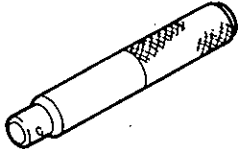
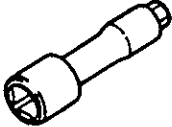


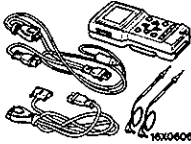

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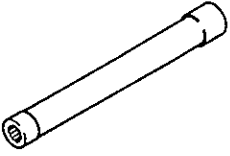
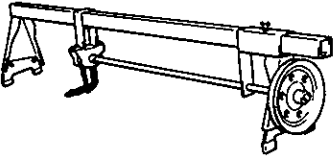
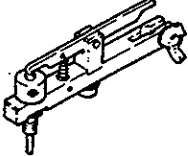



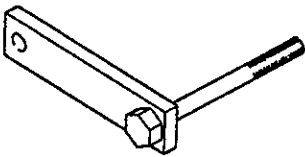
Engine	Items	Specified sealant	Remarks
4G1	Oil pan and cylinder block	MITSUBISHI GENUINE PART MD997110 or equivalent	Semi-drying sealant
4G9	Semi-circular packing and rocker cover seal, and cylinder head seal	3M ATD Part No. 8660 or equiv- alent	
	Oil pan and cylinder block	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant
	Flywheel assembly <M/T> or drive plate <A/T> mounting bolt threads	3M Stud locking 4170 or equiva- lent	
	Thermostat case assembly and cylinder block seal	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant
4D6	Semi-circular packing and rocker cover seal, and cylinder head seal	3M ATD Part No. 8660 or equiv- alent	
	Oil pan and cylinder block	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant
	Thermostat case assembly and cylinder block seal	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant

SPECIAL TOOLS

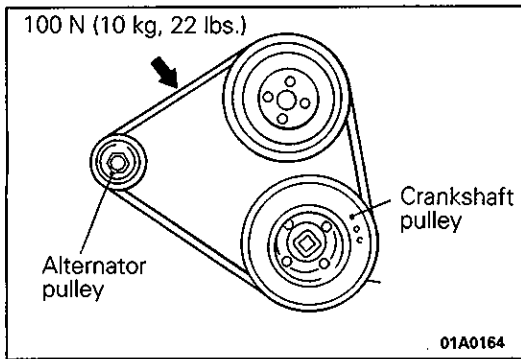
E11DA--

Tool	Number	Name	Use	Application		
				4G1	4G9	4D6
	MD998747	Crankshaft pulley holder	Supporting crankshaft pulley	<input type="radio"/>		
	MB990767	End yoke holder	Supporting camshaft pulley Supporting crankshaft pulley	<input type="radio"/>	<input type="radio"/> <input type="radio"/>	<input type="radio"/>
	MD998719 or MD998754	Crankshaft pulley holder pin				
	MD998306	Camshaft oil seal installer	Installation of camshaft oil seal	<input type="radio"/>		
	MD998307	Camshaft oil seal installer				
	MD998713	Camshaft oil seal installer	Installation of camshaft oil seal		<input type="radio"/>	
	MD998727	Oil pan remover	Removal of oil pan	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	MD998716	Crankshaft wrench	Rotation of crankshaft when installing timing belt		<input type="radio"/>	

Tool	Number	Name	Use	Application		
				4G1	4G9	4D6
	MD998717	Crankshaft front oil seal installer	Installation of crankshaft front oil seal	○	○	
	MD998011	Crankshaft rear oil seal installer	Installation of crankshaft rear oil seal	○		
	MD998776	Crankshaft rear oil seal installer	Installation of crankshaft rear oil seal		○	○
	MB990938	Handle				
	MD998360	Cylinder head bolt wrench	Removal and installation of cylinder head assembly	○		
	MB991341	Multi-use tester sub assembly	<Up to 1993 models> Reading of engine rpm	○	○	
	ROM pack (for multi-use tester) (For the number, refer to GROUP 00 – Precautions Before Service)					
	MB991502	MUT-II sub assembly	<All models> Reading of engine rpm	○	○	
 16X0607	ROM pack					

Tool	Number	Name	Use	Application		
				4G1	4G9	4D6
	GENERAL SERVICE TOOL	Cylinder head bolt wrench	Loosening and tightening of cylinder head bolt		○	
	GENERAL SERVICE TOOL MZ203827	Mechanic hanger, engine	Supporting engine assembly when removing and installing transmission	○	○	○
	MD998389	Pre-stroke measuring adapter	Adjusting injection timing			○
	MD998364	Camshaft oil seal installer	Installation of camshaft oil seal			○
	MD998383	Crankshaft front oil seal guide	Installation of crankshaft front oil seal			○
	MD998382	Crankshaft front oil seal installer				
	MD998781	Flywheel stopper	Securing the flywheel <M/T> or drive plate <A/T>	○	○	○

NOTES



ENGINE<4G1>

SERVICE ADJUSTMENT PROCEDURES

ALTERNATOR DRIVE BELT TENSION INSPECTION AND ADJUSTMENT

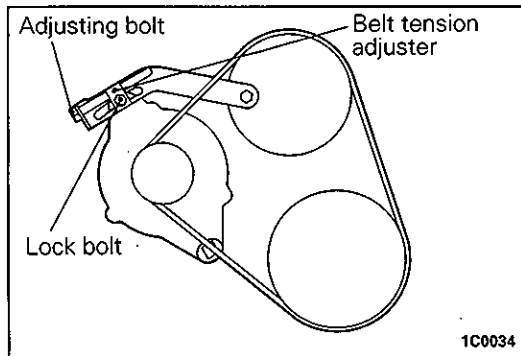
E11FQBM

ALTERNATOR DRIVE BELT TENSION INSPECTION

Check the tension by pulling or pushing at the centre of the belt between pulleys with a force of 100 N (10 kg, 22 lbs.) as shown in the figure.

Measure drive belt deflection amount.

Standard value: 7.0–9.0 mm (0.28–0.35 in.)



ALTERNATOR DRIVE BELT TENSION ADJUSTMENT

- (1) Loosen the nut of the alternator pivot bolt.
- (2) Loosen the lock bolt.
- (3) Turn the adjusting bolt to adjust the amount of belt deflection to the standard value.

Standard value:

If used belt (with correct tension) is used;

8.0 mm (0.31 in.)

If a new belt is used; 5.5–7.0 mm (0.22–0.28 in.)

- (4) Tighten the lock bolt.

Tightening torque:

12–15 Nm (1.2–1.5 kgm, 9–11 ft.lbs.)

- (5) Tighten the nut of the alternator pivot bolt.

Tightening torque:

20–25 Nm (2.0–2.5 kgm, 14–18 ft.lbs.)

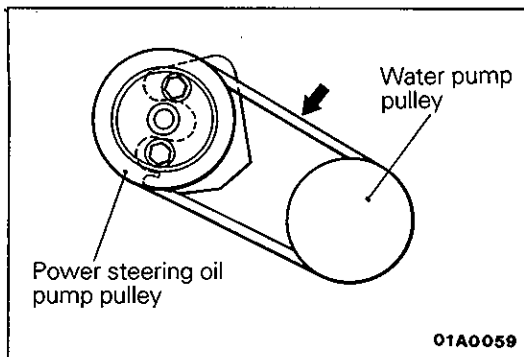
POWER STEERING OIL PUMP DRIVE BELT TENSION INSPECTION AND ADJUSTMENT

POWER STEERING OIL PUMP DRIVE BELT TENSION INSPECTION

Check the tension by pulling or pushing at the centre of the belt between pulleys with a force of 100 N (10 kg, 22 lbs.).

Measure drive belt deflection amount.

Standard value: 5.5–7.5 mm (0.22–0.30 in.)



POWER STEERING OIL PUMP DRIVE BELT TENSION ADJUSTMENT

- (1) Loosen power steering oil pump fixing bolt.
- (2) Move power steering oil pump, tension belt moderately and adjust tension.

Standard value:

If used belt (with correct tension) is used;
5.5–7.5 mm (0.22–0.30 in.)

If a new belt is used; 4.0–5.5 mm (0.16–0.22 in.)

- (3) Tighten fixing bolt.

Tightening torque: 40 Nm (4.0 kgm, 29 ft.lbs.)

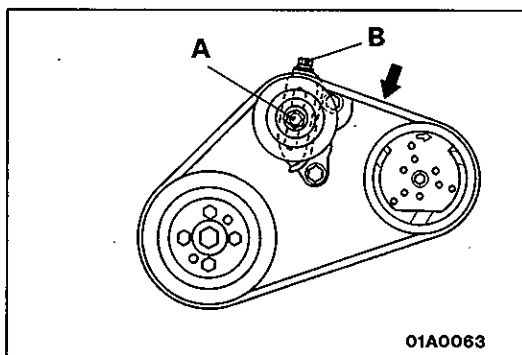
- (4) Check belt tension and adjust if necessary.

AIR CONDITIONER COMPRESSOR DRIVE BELT TENSION INSPECTION AND ADJUSTMENT

AIR CONDITIONER COMPRESSOR DRIVE BELT TENSION INSPECTION

Check the tension by pulling or pushing at the centre of the belt between pulleys with a force of 100 N (10 kg, 22 lbs.). Measure drive belt deflection amount.

Standard value: 6.0–7.0 mm (0.24–0.28 in.)



AIR CONDITIONER COMPRESSOR DRIVE BELT TENSION ADJUSTMENT

- (1) Loosen tension pulley fixing nut A.
- (2) Adjust belt tension with adjusting bolt B.

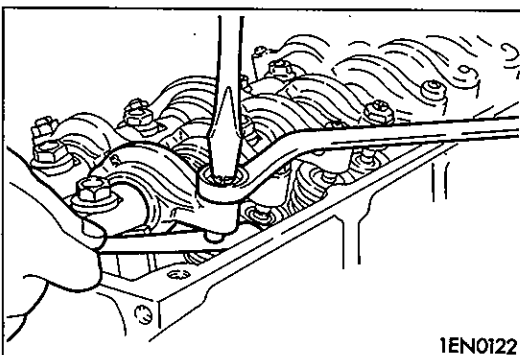
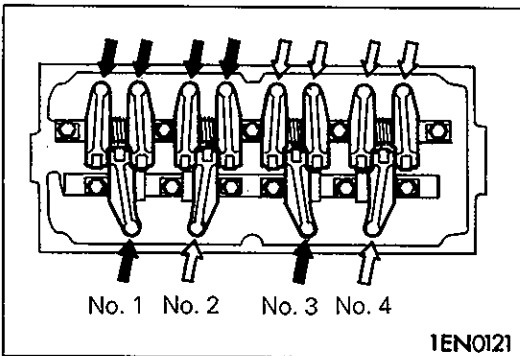
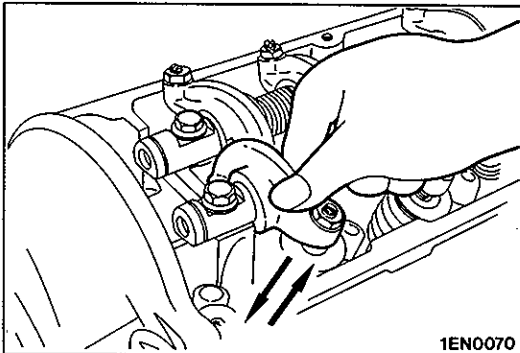
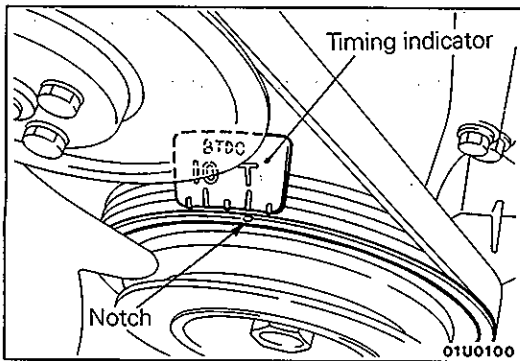
Standard value:

If used belt (with correct tension) is used;
6.0–7.0 mm (0.24–0.28 in.)

If a new belt is used; 5.0–6.0 mm (0.20–0.24 in.)

- (3) Tighten fixing nut A.
- (4) Check the belt tension after driving.

Standard value: 6.0–7.0 mm (0.24–0.28 in.)



VALVE CLEARANCE INSPECTION AND ADJUSTMENT

E11FDAW

- (1) Start the engine and allow it to warm up until the engine coolant temperature reaches 80 to 95°C (176 to 203°F).
- (2) Remove all spark plugs from the cylinder head for easy inspection.
- (3) Remove the rocker cover.
- (4) Turn the crankshaft clockwise until the notch on the pulley is lined up with the "T" mark on the timing indicator.

- (5) Move the rocker arms on the No. 1 and No. 4 cylinders up and down by hand to determine which cylinder has its piston at the top dead centre on the compression stroke. If both intake and exhaust valve rocker arms have a valve lash, the piston in the cylinder corresponding to these rocker arms is at the top dead centre on the compression stroke.

- (6) Valve clearance inspection and adjustment can be performed on rocker arms indicated by white arrow ↓ when the No. 1 cylinder piston is at the top dead centre on the compression stroke, and on rocker arms indicated by solid arrows ↓ when the No. 4 cylinder piston is at the top dead centre on the compression stroke.

- (7) Measure the valve clearance.
If the valve clearance is not as specified, loosen the rocker arm lock nut and adjust the clearance using a feeler gauge while turning the adjusting screw.

Standard value (hot engine):

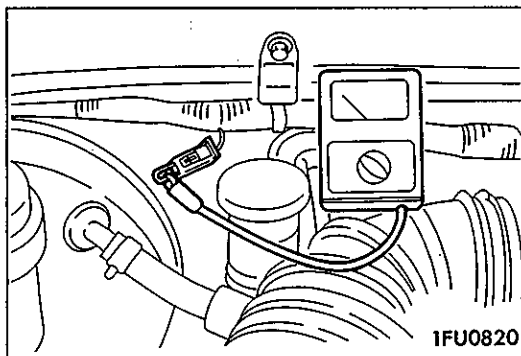
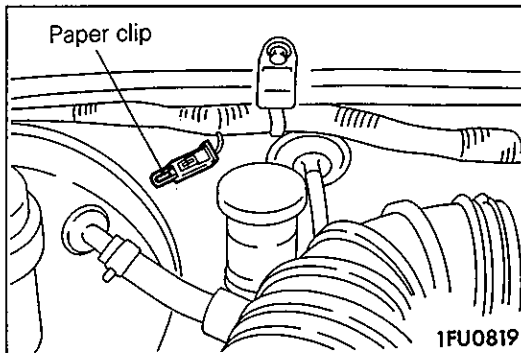
Intake valve 0.20 mm (0.008 in.)

Exhaust valve 0.25 mm (0.010 in.)

- (8) While holding the adjusting screw with a screwdriver to prevent it from turning, tighten the lock nut securely.

- (9) Turn the crankshaft through 360° to line up the notch on the crankshaft pulley with the "T" mark on the timing indicator.
- (10) Repeat steps (7) and (8) on other valves for clearance adjustment.
- (11) Install the rocker cover.
- (12) Install the spark plugs and tighten to the specified torque.

Tightening torque: 25 Nm (2.5 kgm, 18 ft.lbs.)



IGNITION TIMING INSPECTION AND ADJUSTMENT

E11FU8G

- (1) Before inspection and adjustment set vehicle in the following condition.
 - Engine coolant temperature: 80–95°C (176–203°F)
 - Lamps, electric cooling fan and all accessories: OFF
 - Transmission: Neutral
- (2) Insert a paper clip into the 1 pin connector (blue) as shown in the illustration at left.

- (3) Connect a primary-voltage-detection type of tachometer to the paper clip.

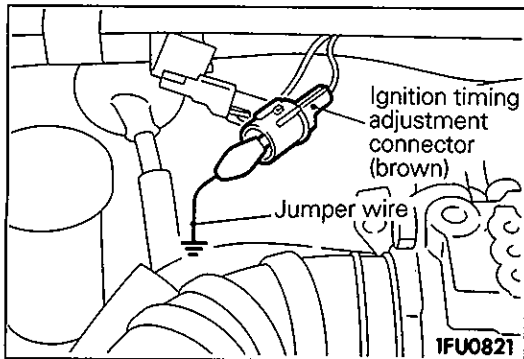
NOTE

Do not use the multi-use tester (MUT) or MUT-II.

If tested with the MUT or MUT-II connected to the diagnosis connector, the ignition timing will not be the basic timing but be ordinary timing.

- (4) Set up a timing light.
- (5) Start the engine and run at idle.
- (6) Check that engine idle speed is within the standard value.

Standard value: 750 ± 100 r/min.



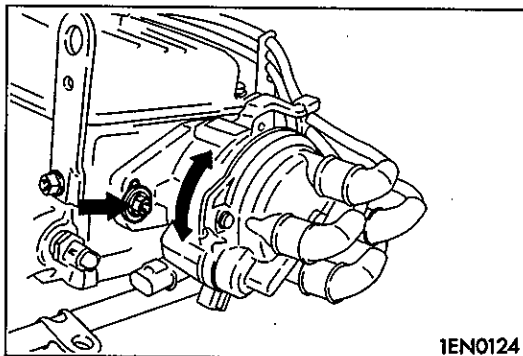
- (7) Turn the ignition switch to OFF.
- (8) Remove the waterproof connector from the ignition timing adjustment connector (brown).
- (9) Connect the jumper wire with the clip to the ignition timing adjustment terminal, and earth this to the body as illustrated.

NOTE

Grounding this terminal sets the engine to the basic ignition timing.

- (10) Start the engine and run it at idle.
- (11) Check that basic ignition timing is within the standard value.

Standard value: 5° BTDC ± 2°



- (12) If not within the standard value, loosen distributor fixing nut and adjust by rotating distributor body.
- (13) Tighten mounting nut after adjusting.

Tightening torque: 12 Nm (1.2 kg, 9 ft.lbs.)

- (14) Stop the engine, remove the jumper wire from the ignition timing adjustment connector (brown), and return the connector to its original condition.
- (15) Start the engine and check that ignition timing at the standard value.

Standard value: Approx. 10° BTDC

NOTE

1. Ignition timing is variable within about $\pm 7^\circ$, even under normal operating.
 2. And it is automatically further advanced by about 5° from 10° BTDC at higher altitudes.
- (16) Sealing tape is to be attached to the fixing nut only for vehicles for Switzerland.

NOTE

Sealing tape is attached to all vehicles when new.

IDLE SPEED INSPECTION

E13FXDB

- (1) Before inspection and adjustment set vehicles in the following condition.
 - Engine coolant temperature: 80–95°C (176–203°F)
 - Lamps, electric cooling fan and all accessories: OFF
 - Transmission: Neutral
- (2) Check the basic ignition timing. Adjust if necessary.

Standard value: 5° BTDC ± 2°

- (3) After turning the ignition switch to OFF, connect the multi-use tester (MUT) or MUT-II to the diagnosis connector.
- (4) Start the engine and run it at idle.
- (5) Run the engine at idle for 2 minutes.
- (6) Check the idle speed.

Curb idle speed: 750±100 r/min.**NOTE**

The idle speed is adjusted automatically by the idle speed control (ISC) system.

- (7) If there is a deviation from the standard value, refer to GROUP 13 – Check Chart Classified by Problem Symptoms, and check the MPI components.

IDLE MIXTURE INSPECTION

- (1) Before inspection, set vehicles in the following condition:
 - Engine coolant temperature: 80–95°C (176–203°F)
 - Lamps, electric cooling fan and all accessories: OFF
 - Transmission: Neutral
- (2) Check that the basic ignition timing is within the standard value.

Standard value: 5° BTDC ± 2°

- (3) After turning the ignition switch to OFF, connect the multi-use tester (MUT) or MUT-II to the diagnosis connector.
- (4) Start the engine and run it at 2,500 r/min. for 2 minutes.
- (5) Set the CO, HC tester.
- (6) Check the CO concentration and the HC concentration at idle.

Standard value**CO concentration: 0.5% or less****HC concentration: 100 ppm or less**

- (7) If there is a deviation from the standard value, check the following items:
- Diagnosis output
 - Closed-loop control (When the closed-loop control is carried out normally, the output signal of the oxygen sensor changes between 0–400mV and 600–1,000mV at idle.)
 - Combustion pressure
 - Injector
 - Ignition coil, spark plug cable, spark plug
 - Evaporative emission control system
 - Compression pressure

NOTE

Replace the three way catalyst when the CO and HC concentrations do not remain inside the standard value, even though the result of the inspection is normal on all items.

COMPRESSION PRESSURE INSPECTION

E11FGAO

- (1) Before inspection, check that the engine oil, starter and battery are normal. Also, set the vehicle to the following condition:
- Engine coolant temperature: 80–95°C (176–203°F)
 - Lamps, electric cooling fan and all accessories: OFF
 - Transmission: Neutral
- (2) Disconnect the spark plug cables.
- (3) Remove all of the spark plugs.
- (4) Disconnect the distributor 6 pin connector.

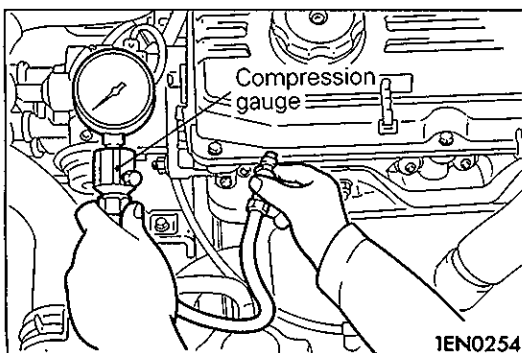
NOTE

Doing this will prevent the engine control unit from carrying out ignition and fuel injection.

- (5) Cover the spark plug hole with a rag etc., and after the engine has been cranked, check that no foreign material is adhering to the rag.

Caution

1. **Keep away from the spark plug hole when cranking.**
2. **If compression is measured with water, oil, fuel, etc., that has come from cracks inside the cylinder, these materials will become heated and will gush out from the spark plug hole, which is dangerous.**



- (6) Set compression gauge to one of the spark plug holes.
- (7) Crank the engine with the throttle valve fully open and measure the compression pressure.

Standard value (at engine speed of 250–400 r/min.):

1400 kPa (14.0 kg/cm², 199 psi)

Limit (at engine speed of 250–400 r/min.):

min. 1000 kPa (10.0 kg/cm², 142 psi)

- (8) Measure the compression pressure for all the cylinders, and check that the pressure differences of the cylinders are below the limit.

Limit: max. 100 kPa (1.0 kg/cm², 14 psi)

- (9) If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the spark plug hole, and repeat the operations in steps (7) and (8).

① If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.

② If the compression does not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.

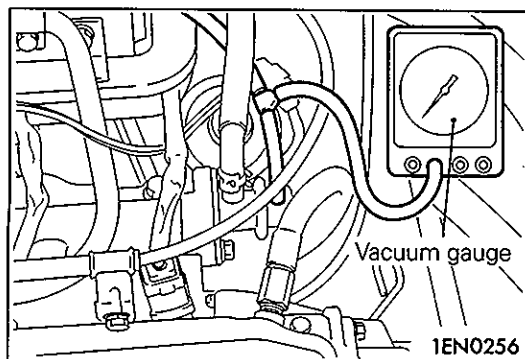
(10) Connect the distributor connector.

(11) Install the spark plugs and spark plug cables.

(12) Use the multi-use tester (MUT) or MUT-II to erase the self-diagnosis codes.

NOTE

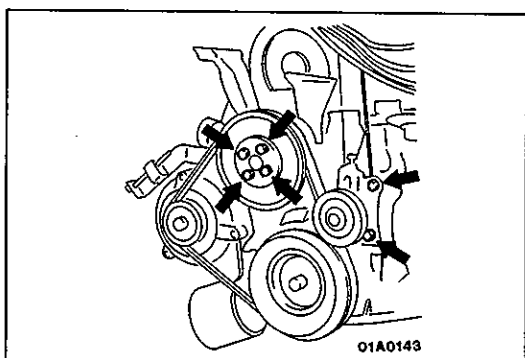
This will erase the problem code resulting from the distributor connector being disconnected.

**MANIFOLD VACUUM INSPECTION**

E11FWBD

- (1) The vehicle should be repaired as follows before the inspection.
 - Engine coolant temperature: 80–95°C (176–203°F)
 - Lamps, electric cooling fan, and accessories: OFF
 - Transmission: Neutral
- (2) Connect the multi-use tester (MUT) or MUT-II.
- (3) Disconnect the vacuum hose from the nipple for taking off fuel pressure regulator vacuum from the air intake plenum.
- (4) Connect a three-way joint between the removed vacuum hose and the nipple and connect a vacuum gauge to the joint.
- (5) Start the engine and check that idle speed is within the standard value range.
- (6) Check the manifold vacuum.

Standard value: Approx. 71 kPa (530 mmHg, 21 in.Hg)

**TIMING BELT TENSION ADJUSTMENT**

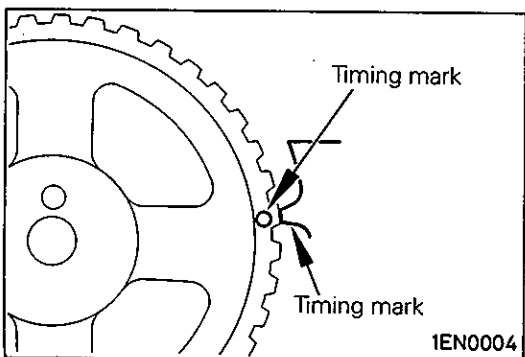
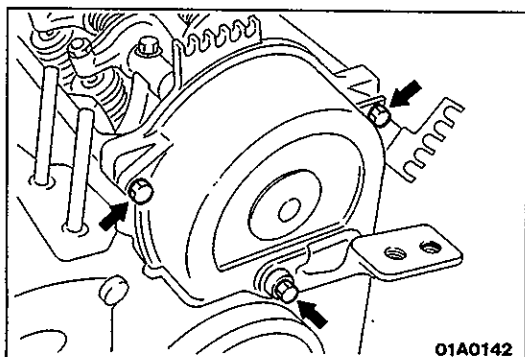
E11FFAP

The timing belt has an automatic tension adjusting mechanism. Adjustment can be made by the following procedure.

- (1) Remove the water pump pulley.
- (2) Remove the air conditioner pulley bracket.
- (3) Remove the timing belt upper cover.
- (4) Remove the timing belt lower cover.
- (5) Remove the spark plugs.
- (6) Turn the crankshaft clockwise to check that the timing belt is okay over its entire length.

Caution

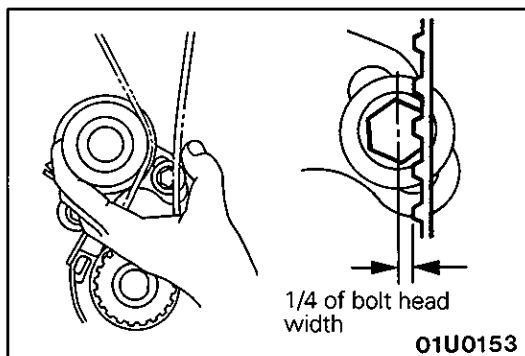
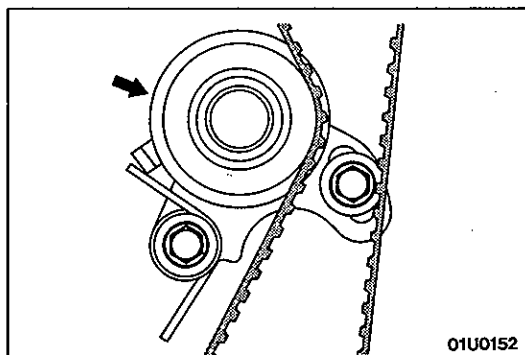
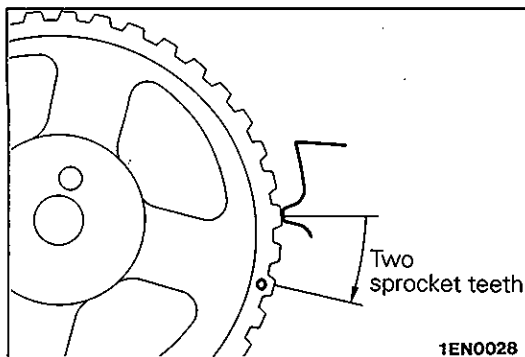
Always turn the crankshaft clockwise.



- (7) Turn the crankshaft clockwise to bring the No. 1 cylinder piston to the top dead centre on the compression stroke.

Caution

For aligning the timing marks, never turn the crankshaft counterclockwise as it could cause inadequate belt tensioning.



- (8) Loosen both pivot side and slot side tensioner bolts and tension the belt, making use of the tensioner spring force.
- (9) Turn the crankshaft clockwise by two sprocket teeth (18°).

- (10) Push the timing belt tensioner in the direction of the arrow to check that each sprocket is kept in firm and complete engagement with the belt cogs.
After this check, release hand pressure so that only the tensioner spring acts on belt and tighten the slot side bolt and then the pivot side bolt to fix the tensioner in position.

- (11) Check the timing belt tension.
Hold the timing belt tensioner and timing belt together by hand and give the belt a slight thumb pressure at a point level with tensioner centre. Make sure that the belt cog crest deflects approximately 1/4 of the tensioner attaching bolt head width.

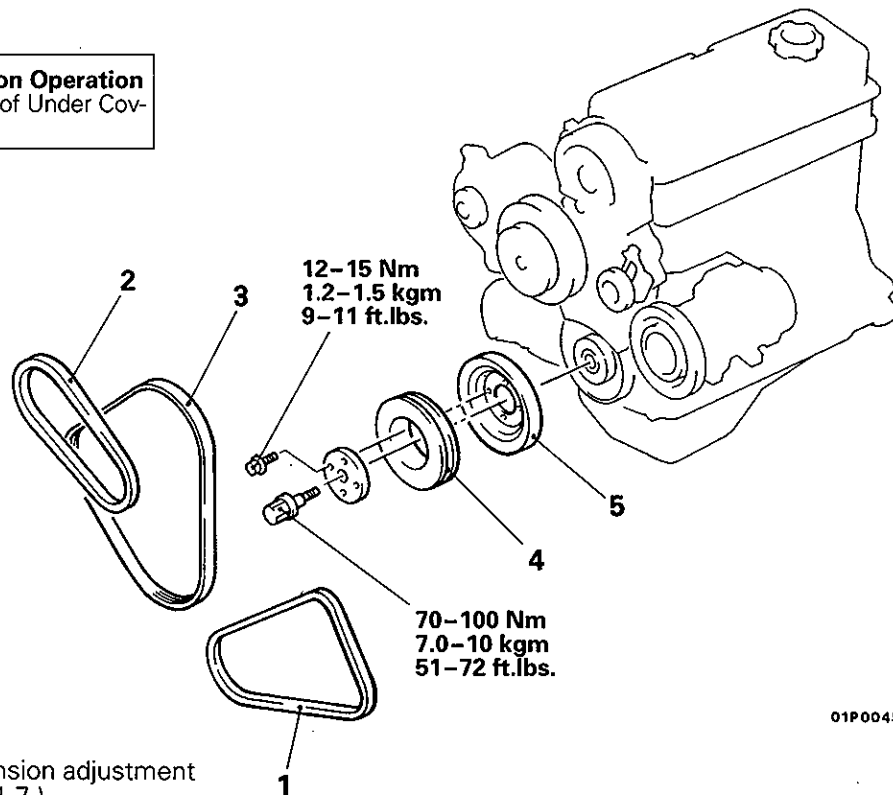
- (12) Install the spark plugs.
- (13) Install the timing belt lower cover.
- (14) Install the timing belt upper cover.
- (15) Install the air conditioner pulley bracket.
- (16) Install the water pump pulley and adjust the drive belt deflection.

CRANKSHAFT PULLEY REMOVAL AND INSTALLATION

E11LA--

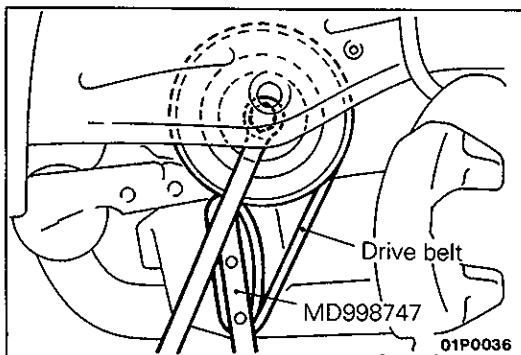
Pre-removal and Installation Operation

- Removal and Installation of Under Cover



Removal steps

- Drive belt tension adjustment (Refer to P.11-7.)
1. Drive belt (Air conditioner)
 2. Drive belt (Power steering)
 3. Drive belt (Alternator)
- ◀▶▶▶ 4. Crankshaft compressor pulley (Air conditioner)
- ◀▶▶▶ 5. Crankshaft pulley.



SERVICE POINTS OF REMOVAL AND INSTALLATION

E11LEAA

4. REMOVAL AND INSTALLATION OF CRANKSHAFT COMPRESSOR PULLEY / 5. CRANKSHAFT PULLEY

Caution

1. This drive belt will get damaged. Do Not use the engine's drive belt.
2. Never use a damaged drive belt.

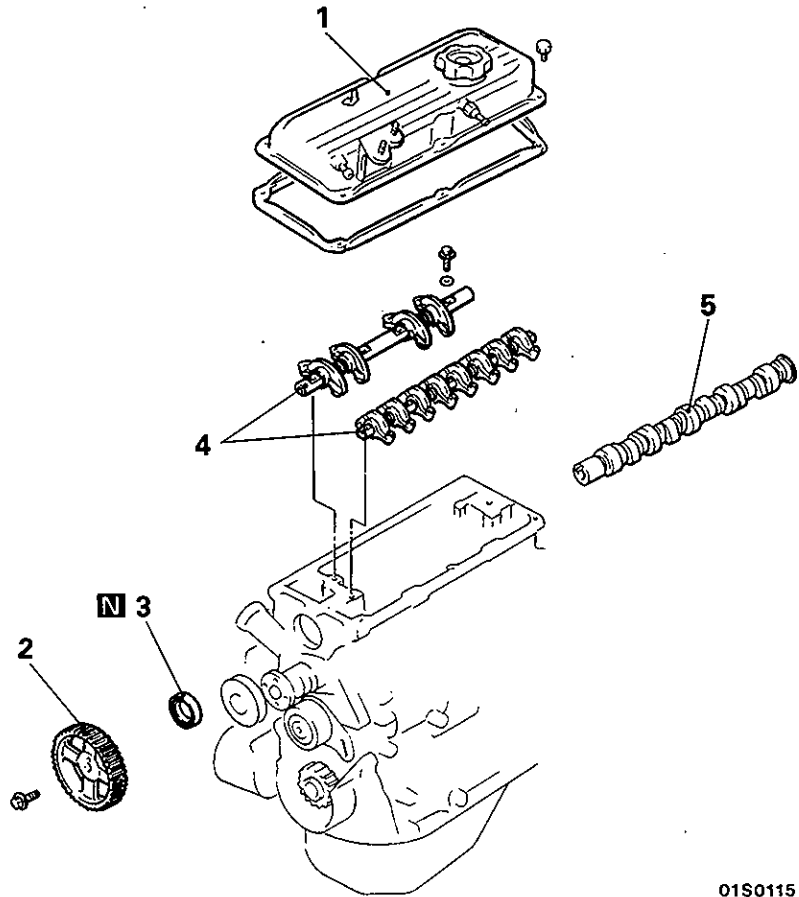
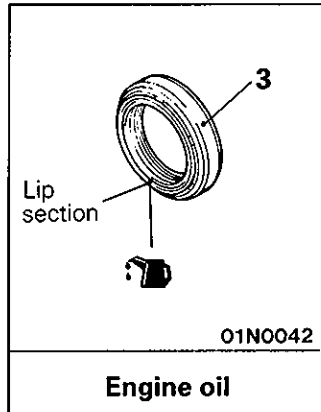
CAMSHAFT AND CAMSHAFT OIL SEAL

E11HA--

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

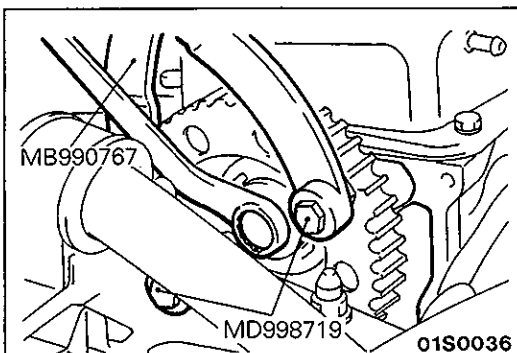
- Removal and Installation of Timing Belt (Refer to P.11-28.)
- Removal and Installation of Distributor (Refer to GROUP 16 - Distributor)



01S0115

Removal steps

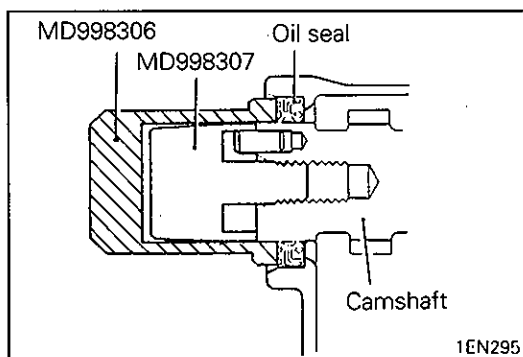
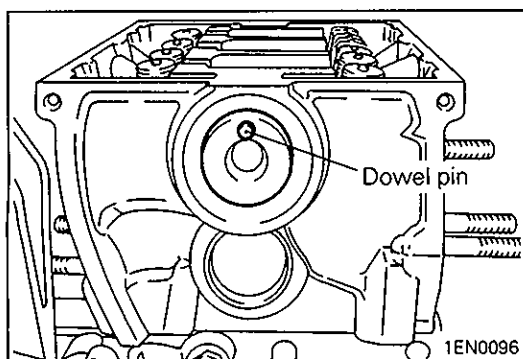
1. Rocker cover
2. Camshaft sprocket
3. Oil seal
 - Valve clearance inspection and adjustment (Refer to P.11-9.)
4. Rocker arm assembly
5. Camshaft



SERVICE POINTS OF REMOVAL

E11HBAO

2. REMOVAL OF CAMSHAFT SPROCKET



SERVICE POINTS OF INSTALLATION

E11HCAP

5. INSTALLATION OF CAMSHAFT

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

3. INSTALLATION OF OIL SEAL

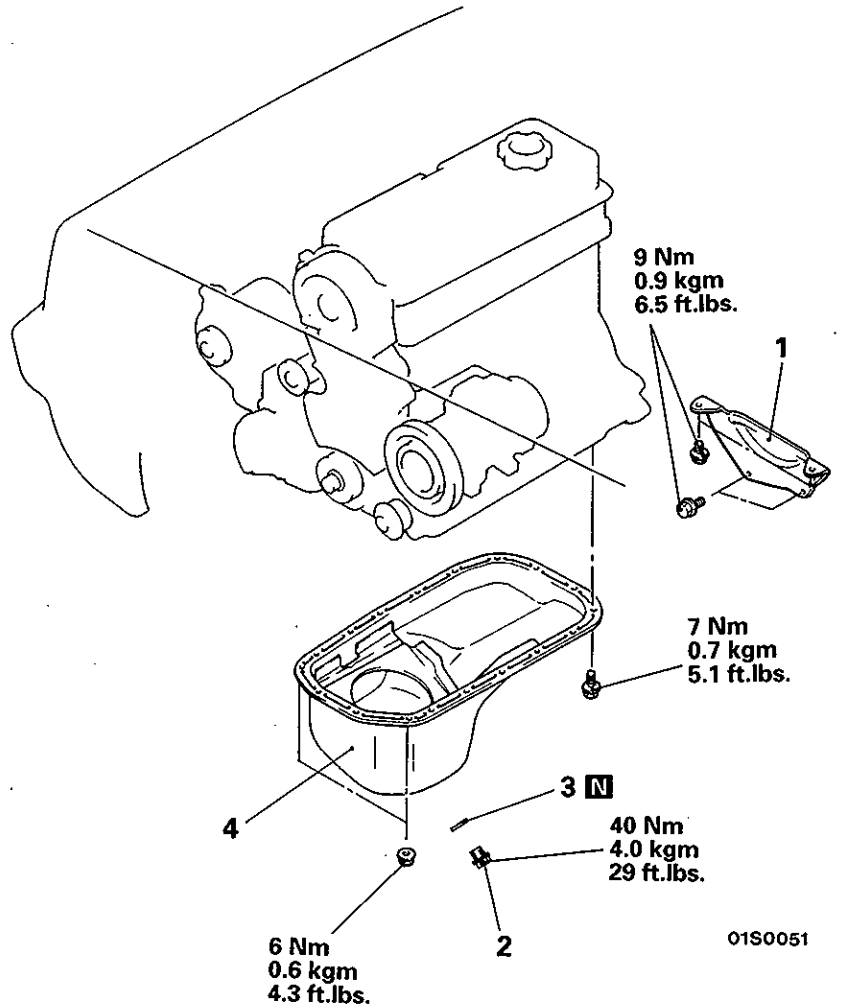
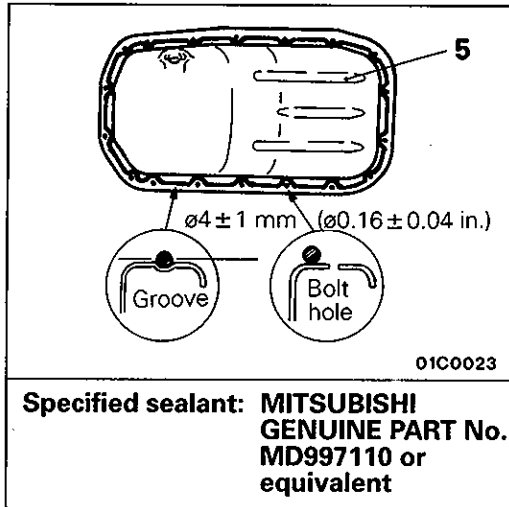
- (1) Install the special tool, Guide on the camshaft.
- (2) Apply oil to the oil seal and insert the oil seal along the Guide until it contacts the cylinder head.
- (3) Using the special tool, Installer, press-fit the oil seal into the cylinder head.

OIL PAN

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Draining and Supplying of Engine Oil
- Removal and Installation of Oil Level Gauge
- Removal and Installation of Front Exhaust Pipe (Refer to GROUP 15 – Exhaust Pipe and Muffler.)

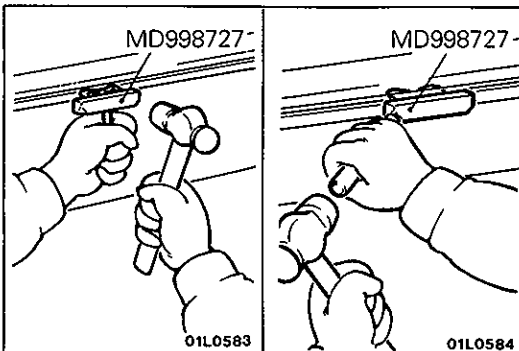


Removal steps

1. Bell housing cover
2. Drain plug
3. Gasket
4. Oil pan



01S0051



SERVICE POINTS OF REMOVAL

E11KBBP

4. REMOVAL OF OIL PAN

After removing the oil pan mounting bolts, remove the oil pan with the special tool and a brass bar.

Caution

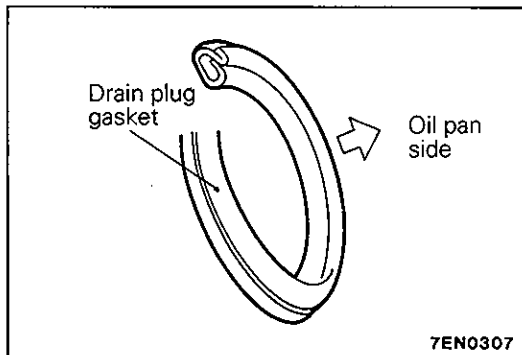
Perform this slowly to avoid deformation of the oil pan flange.

SERVICE POINTS OF INSTALLATION

E11KDBN

4. INSTALLATION OF OIL PAN**Caution**

After cleaning the oil pan mounting bolt holes in the oil seal case, the oil pan should be installed.

**2. INSTALLATION OF GASKET**

Replace the gasket with a new gasket, and install it in the direction shown in the illustration.

CRANKSHAFT OIL SEAL

REMOVAL AND INSTALLATION

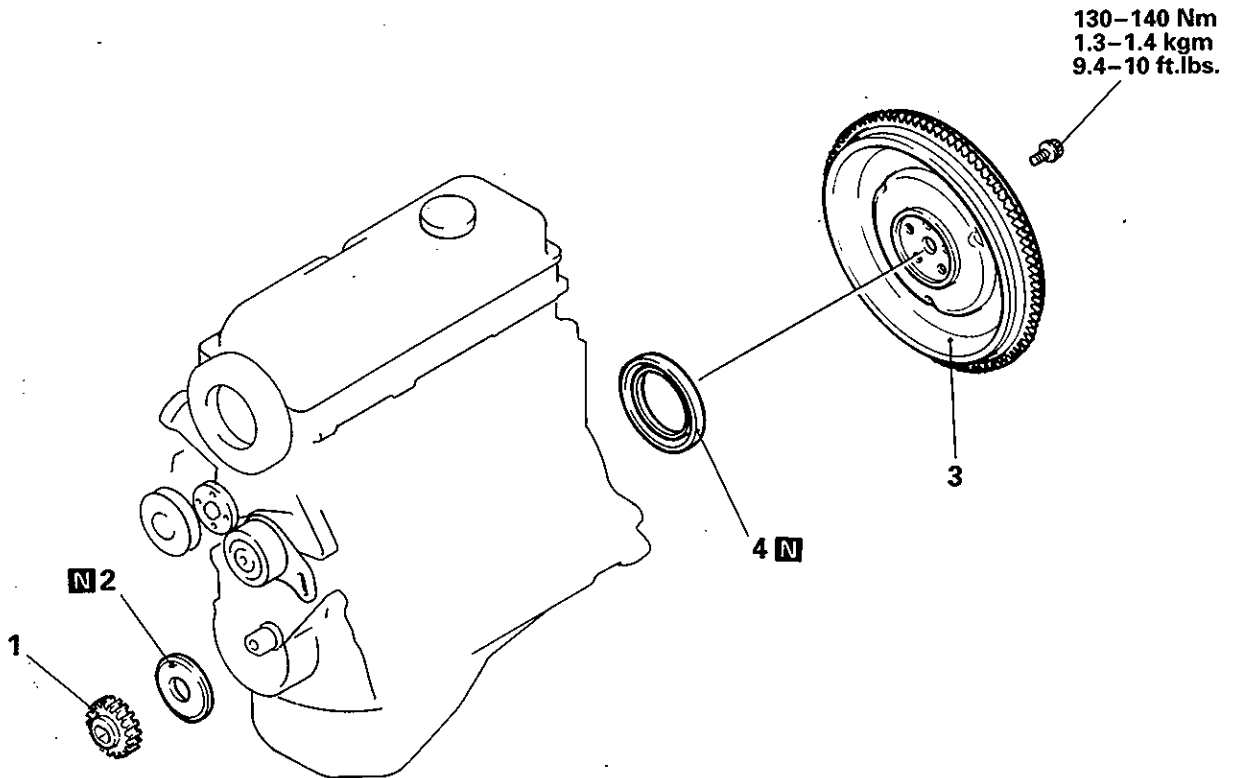
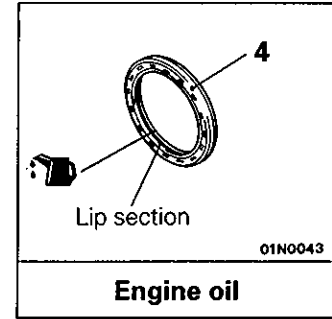
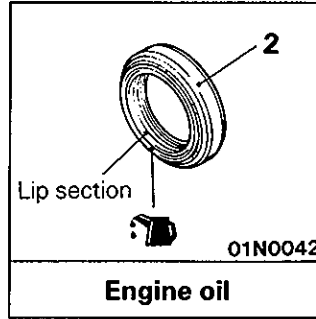
Pre-removal and Post-installation Operation

<Crankshaft Oil Seal>

- Removal and Installation of Timing Belt (Refer to P.11-28.)

<Crankshaft Rear Oil Seal>

- Removal and Installation of Oil Pan (Refer to P.11-20.)
- Removal and Installation of Transmission Assembly (Refer to GROUP 22 or 23 – Transmission Assembly.)
- Removal and Installation of Clutch Cover and Disc <M/T>



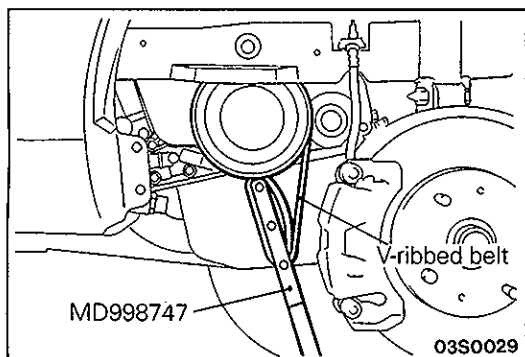
01S0110

Removal steps of crankshaft front oil seal

1. Crankshaft sprocket
2. Crankshaft front oil seal

Removal steps of crankshaft rear oil seal

3. Flywheel assembly <M/T> or drive plate <A/T>
4. Crankshaft rear oil seal

**SERVICE POINTS OF REMOVAL**

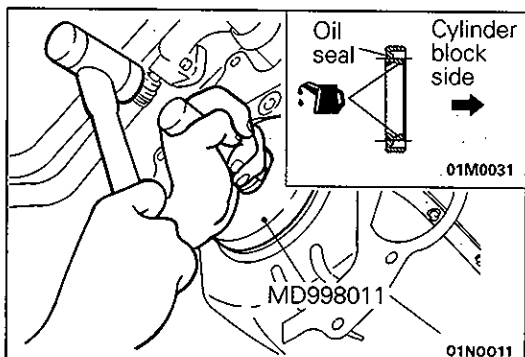
E11UBAF

3. REMOVAL OF FLYWHEEL ASSEMBLY <M/T> OR DRIVE PLATE <A/T>

- (1) Fix the crank shaft pulley by using the V-ribbed belt and the special tool.

Caution

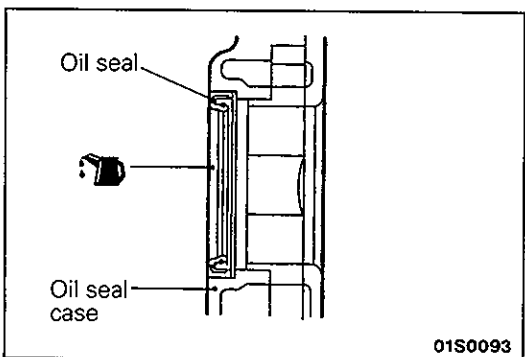
- (1) **Because the V-ribbed belt installed in the vehicle may be damaged, use a disused V-ribbed belt.**
- (2) **Do not use a damaged V-ribbed belt.**
- (2) Remove the flywheel assembly <M/T> or the drive plate <A/T>.

**SERVICE POINTS OF INSTALLATION**

E11UCAL

4. INSTALLATION OF CRANKSHAFT REAR OIL SEAL

- (1) Apply a small amount of engine oil to the entire circumference of the oil seal lip.
- (2) Tap the oil seal as shown in the illustration until it is flush with the oil seal case.

**2. INSTALLATION OF CRANKSHAFT FRONT OIL SEAL**

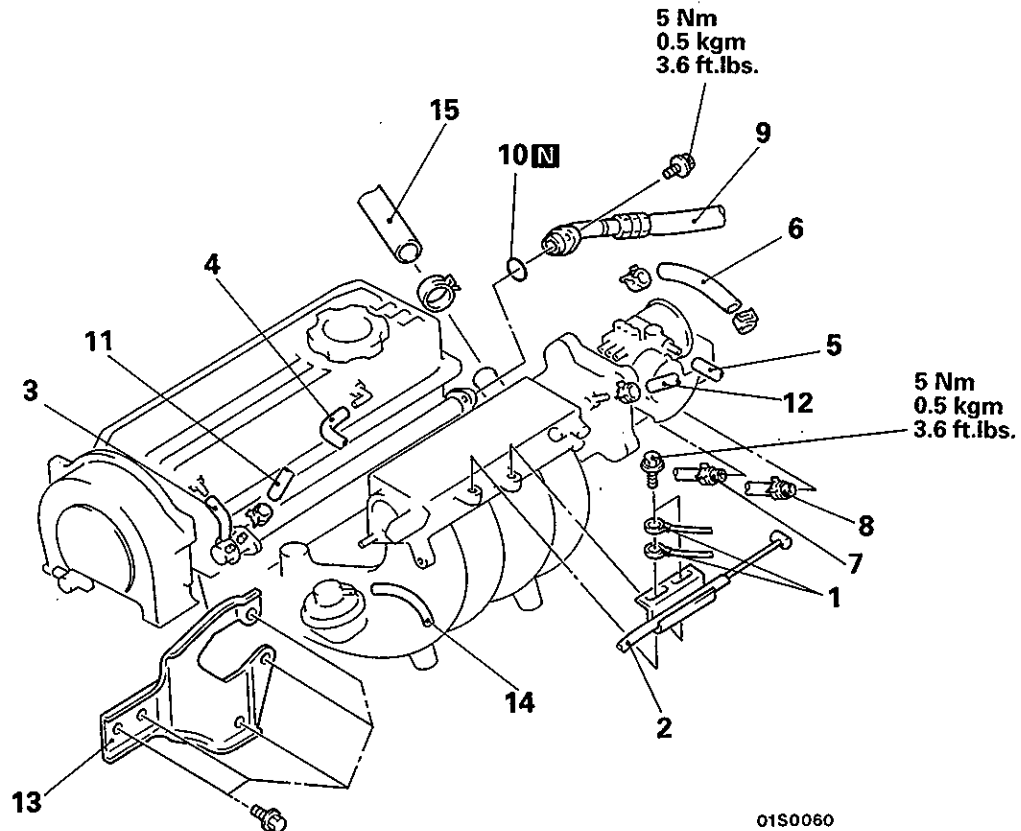
- (1) Apply a small amount of engine oil to the entire circumference of the oil seal lip.
- (2) Tap the oil seal until it is flush with the oil seal case.

CYLINDER HEAD GASKET**REMOVAL AND INSTALLATION****Pre-removal Operation**

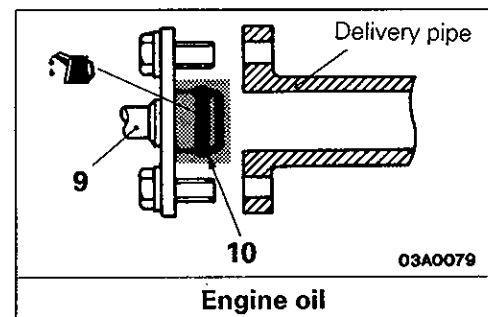
- Reduce the Inner Pressure of Fuel Line and Hose (Refer to GROUP 13 - Service Adjustment Procedures.)
- Draining the Engine Coolant
- Draining the Engine Oil
- Removal of Air Intake Hose (Refer to GROUP 15 - Air Cleaner.)

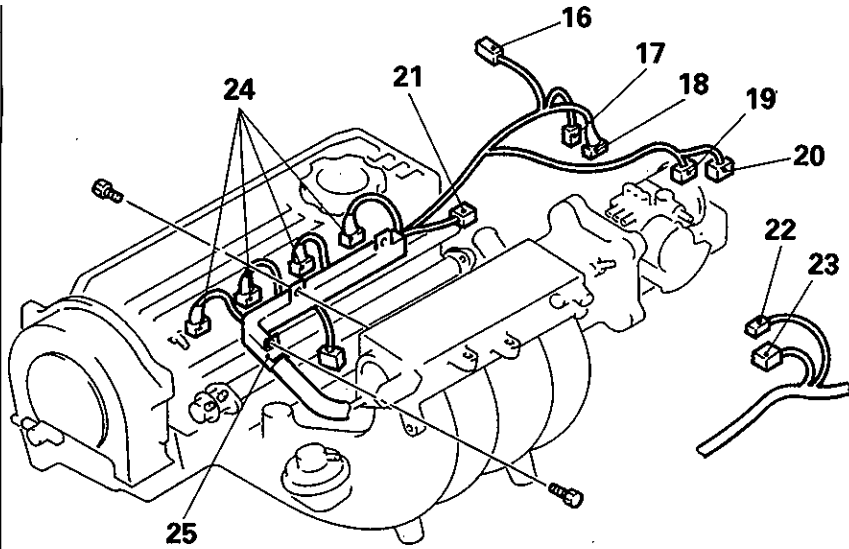
Post-installation Operation

- Installation of Air Intake Hose (Refer to GROUP 15 - Air Cleaner.)
- Refilling the Engine Oil
- Refilling the Engine Coolant
- Adjusting the Accelerator Cable (Refer to GROUP 13 - Service Adjustment Procedures.)

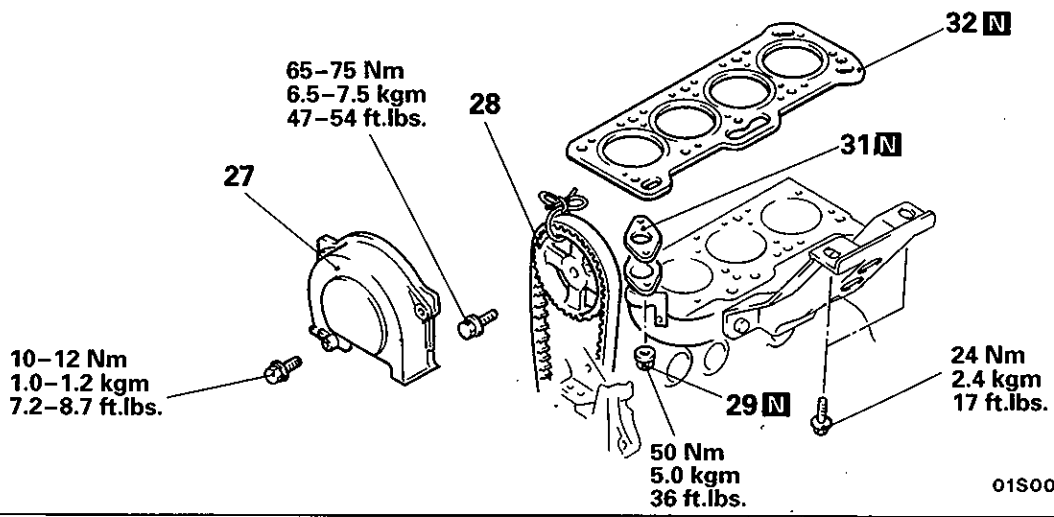
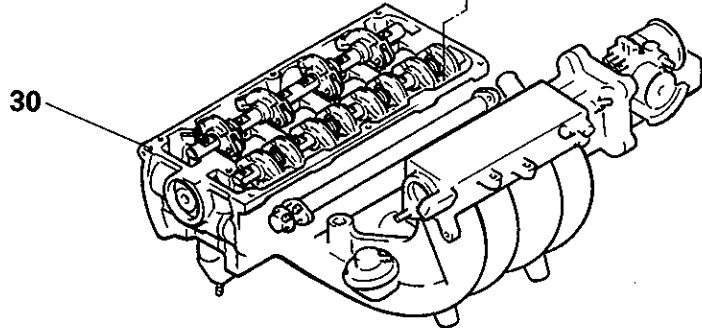
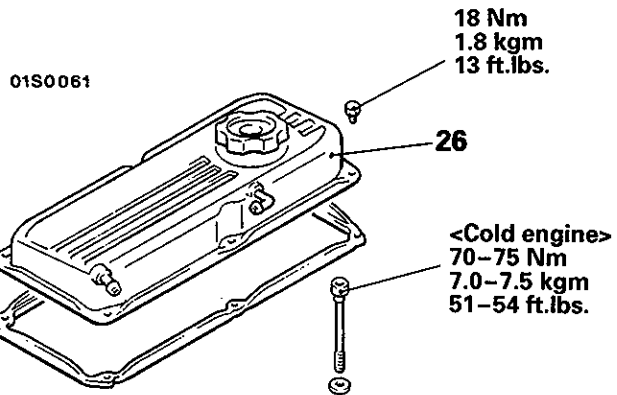
**Removal steps**

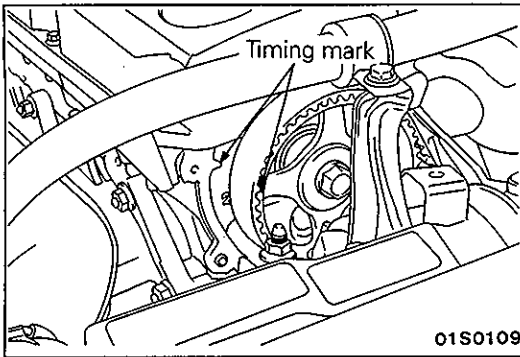
1. Earth cable connection
2. Accelerator cable connection
3. PCV hose connection
4. Breather hose connection
5. Vacuum hose connection
6. Water hose connection (Throttle body → thermostat housing)
7. Water hose connection (Throttle body → water inlet pipe)
8. Water hose connection (Heater unit → thermostat housing)
9. High-pressure hose connection
10. O-ring
11. Return hose connection
12. Brake booster vacuum hose connection
13. Engine mounting stay
14. Vacuum hose
15. Radiator upper hose





- 16. Oxygen sensor connector
- 17. Ignition coil connector
- 18. Crank angle sensor and top dead center sensor connector
- 19. Engine coolant temperature sensor connector
- 20. Water temperature gauge unit connector
- 21. Throttle position sensor connector
- 22. Idle switch connector
- 23. Idle speed control connector
- 24. Injector connector
- 25. Control harness
- 26. Rocker cover
- 27. Timing belt upper cover
- 28. Camshaft sprocket
- 29. Self-locking nuts
- 30. Cylinder head assembly
- 31. Gasket
- 32. Cylinder head gasket





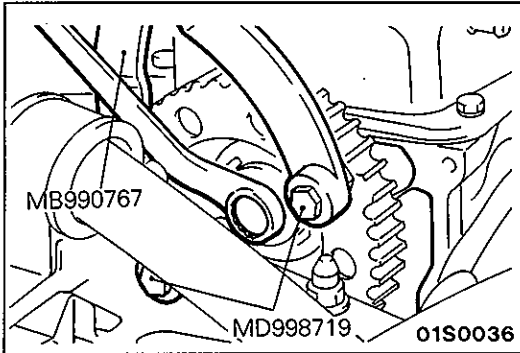
SERVICE POINTS OF REMOVAL

27. REMOVAL OF TIMING BELT UPPER COVER

After removing the timing belt upper cover, rotate the crankshaft clockwise and align the timing marks.

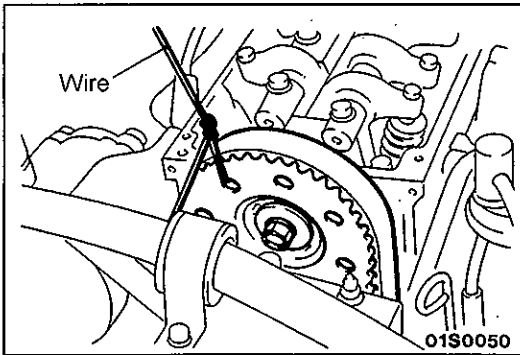
Caution

The crankshaft must always be rotated clockwise.

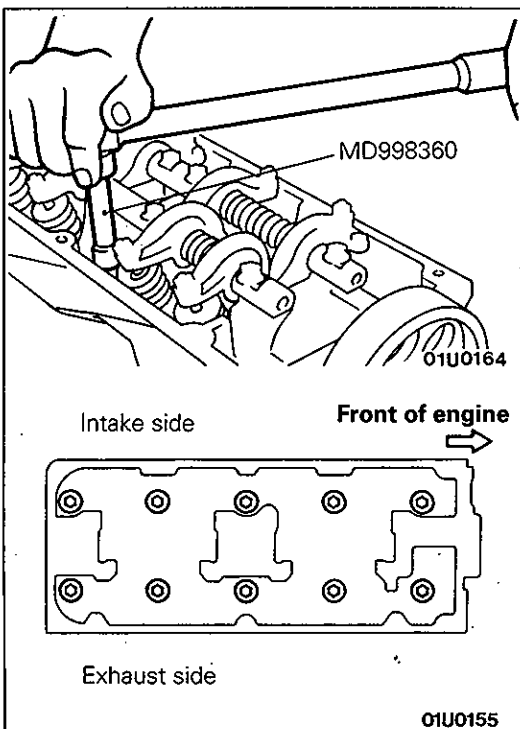


28. REMOVAL OF CAMSHAFT SPROCKET

(1) Use the special tool to remove the camshaft sprocket with the timing belt attached.

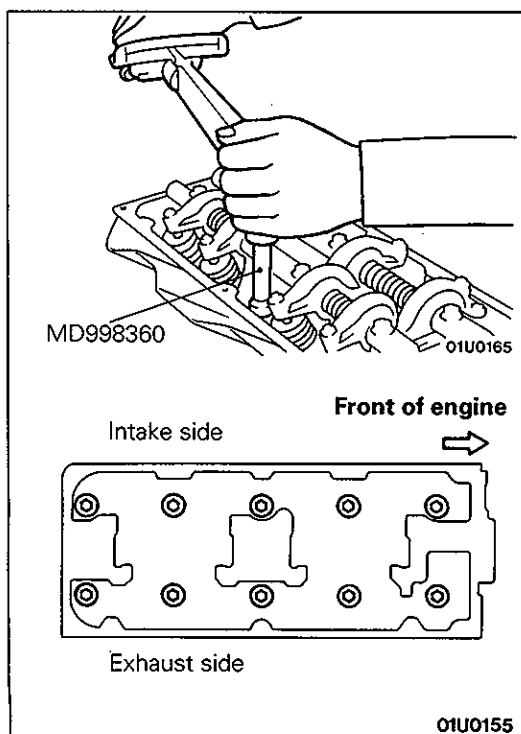
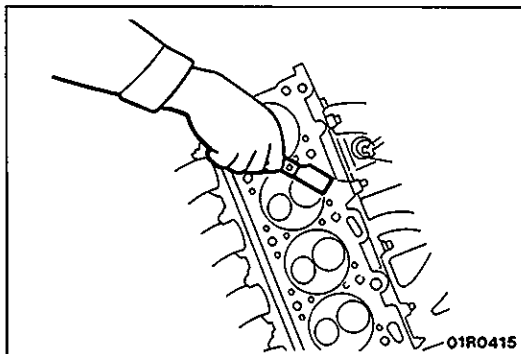
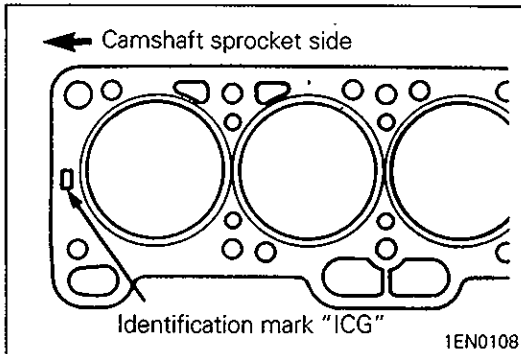
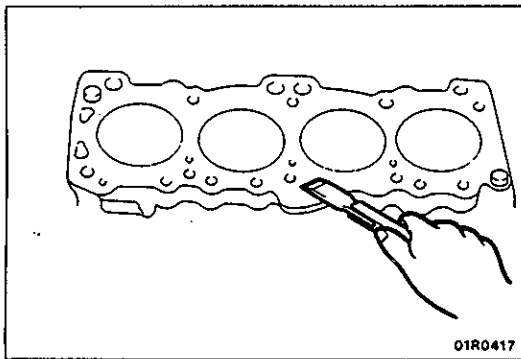


(2) Tie the camshaft sprocket and timing belt with a wire so that the position of the camshaft sprocket will not move with respect to the timing belt.



30. REMOVAL OF CYLINDER HEAD ASSEMBLY

Using the special tool, loosen the bolts in the order shown in the illustration (in 2 or 3 cycles), remove them and then remove the cylinder head assembly.

**SERVICE POINTS OF INSTALLATION**

E11JDCY

32. INSTALLATION OF CYLINDER HEAD GASKET

- (1) Use a scraper to remove the cylinder head gasket from the cylinder block.

Caution

Take care that no foreign material gets into the cylinder, or into the engine coolant or oil passages.

- (2) Place the cylinder head gasket on the cylinder block with the marks facing upward.

30. INSTALLATION OF CYLINDER HEAD ASSEMBLY

- (1) Use a scraper to remove the cylinder head gasket from the cylinder head assembly.

Caution

Take care that no foreign material gets into the engine coolant or oil passages.

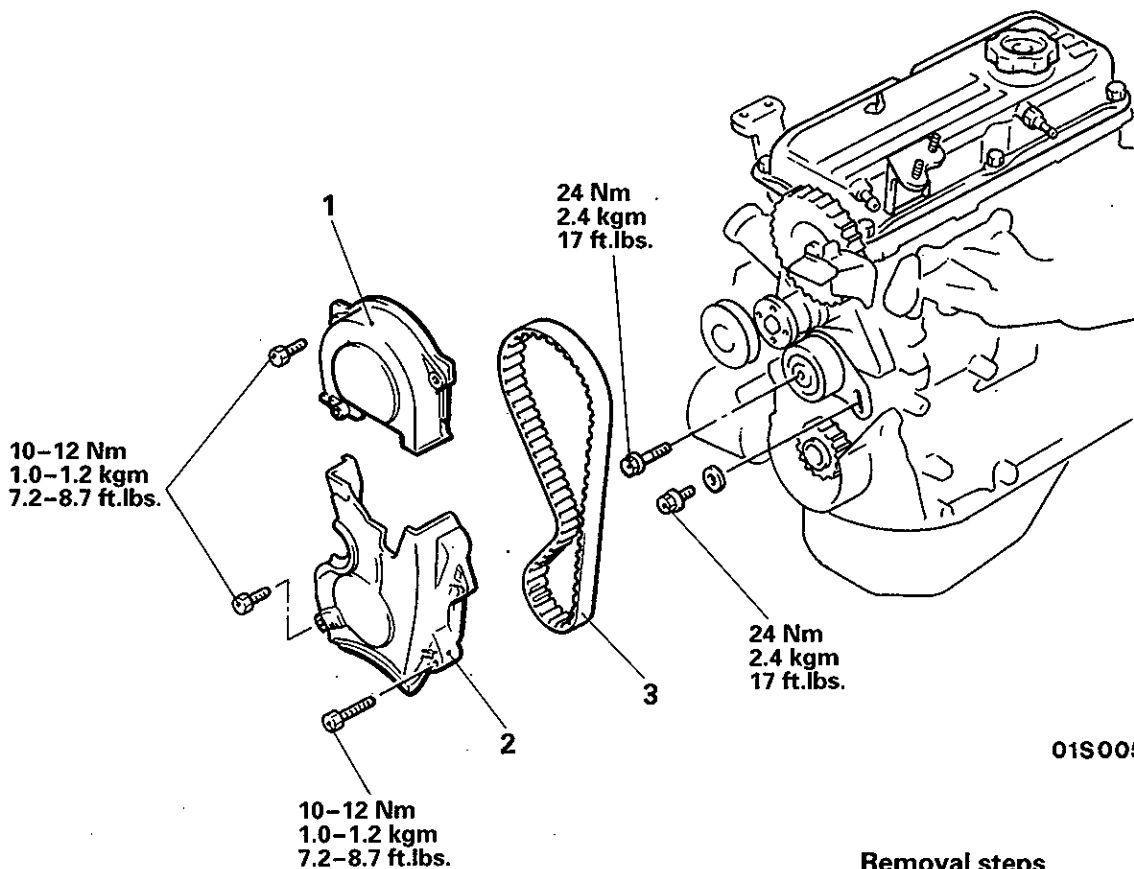
- (2) Using the special tool, tighten the bolts in the order shown repeating the sequence once or twice.

TIMING BELT

REMOVAL AND INSTALLATION

Pre-removal and post-installation Operation

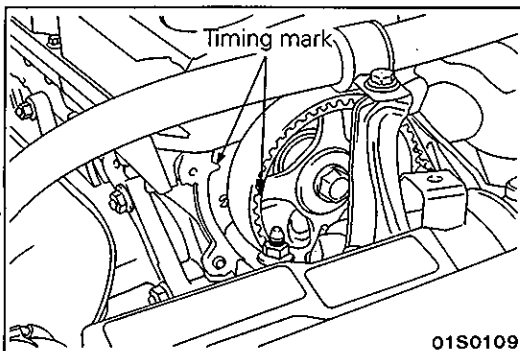
- Removal and Installation of Under Cover
- Removal and Installation of Crankshaft Pulley (Refer to P.11-17.)
- Removal and Installation of Engine Mount (Refer to GROUP 32 - Engine Mount.)



01S0058

Removal steps

- ◀▶▶▶ 1. Timing belt upper cover
- ▶▶▶▶ 2. Timing belt lower cover
- ◀▶▶▶ 3. Timing belt



SERVICE POINTS OF REMOVAL

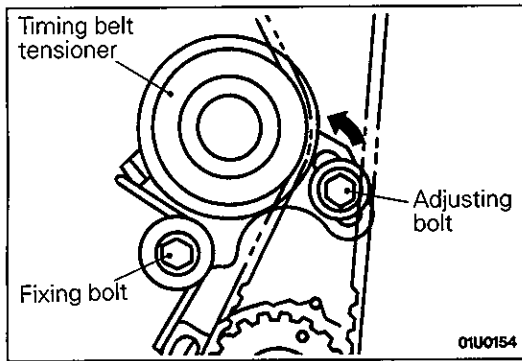
E11GBGC

1. REMOVAL OF TIMING BELT UPPER COVER

After removing the timing belt upper cover, rotate the crankshaft clockwise and align the timing marks.

Caution

The crankshaft should always be turned only clockwise.



3. REMOVAL OF TIMING BELT

- (1) Loosen the timing belt tensioner bolts.
- (2) Move the timing belt tensioner to the water pump side and temporarily tighten the bolt so that the tensioner doesn't return.
- (3) Remove the timing belt.

Caution

If the timing belt is to be re-used, use chalk to mark (on its flat side) an arrow indicating the clockwise direction.

SERVICE POINTS OF INSTALLATION

E11GDGC

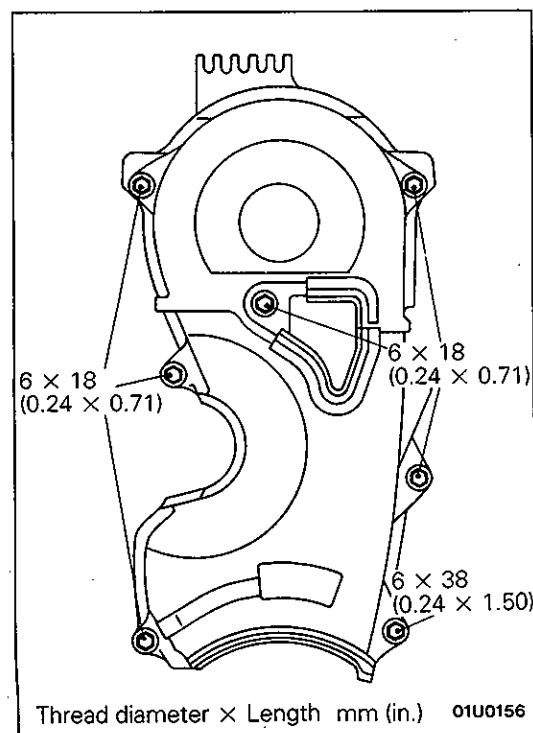
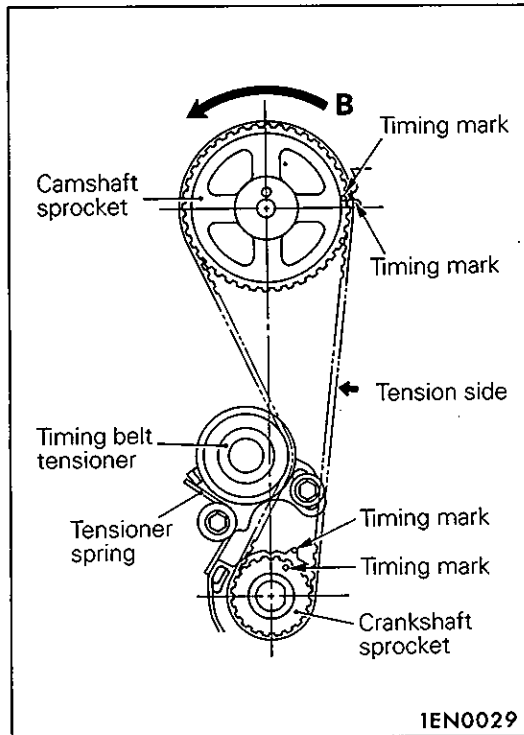
3. INSTALLATION OF TIMING BELT

- (1) Align the timing marks on the camshaft sprocket and crankshaft sprocket. (Now the piston in No. 1 cylinder is at the top dead centre on the compression stroke.)
- (2) Set the timing belt first on crankshaft sprocket and then keeping the tension side of belt tight, set on the camshaft sprocket.

Caution

If the timing belt is re-used, install so that the arrow marked on it at time of removal is pointing in the clockwise direction.

- (3) Apply counterclockwise force (in the direction B) to the camshaft sprocket to give tension to the belt on tension side and make sure that all timing marks are lined up.
- (4) Install the crankshaft pulley temporarily. This is to prevent the belt from coming off when crankshaft is turned.



2. INSTALLATION OF TIMING BELT LOWER COVER/ 1. TIMING BELT UPPER COVER

Note that the timing belt lower and upper cover attaching bolts differ in size from one place to another.

ENGINE ASSEMBLY

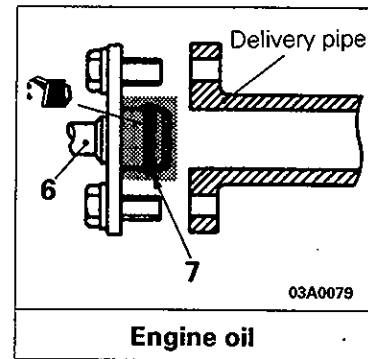
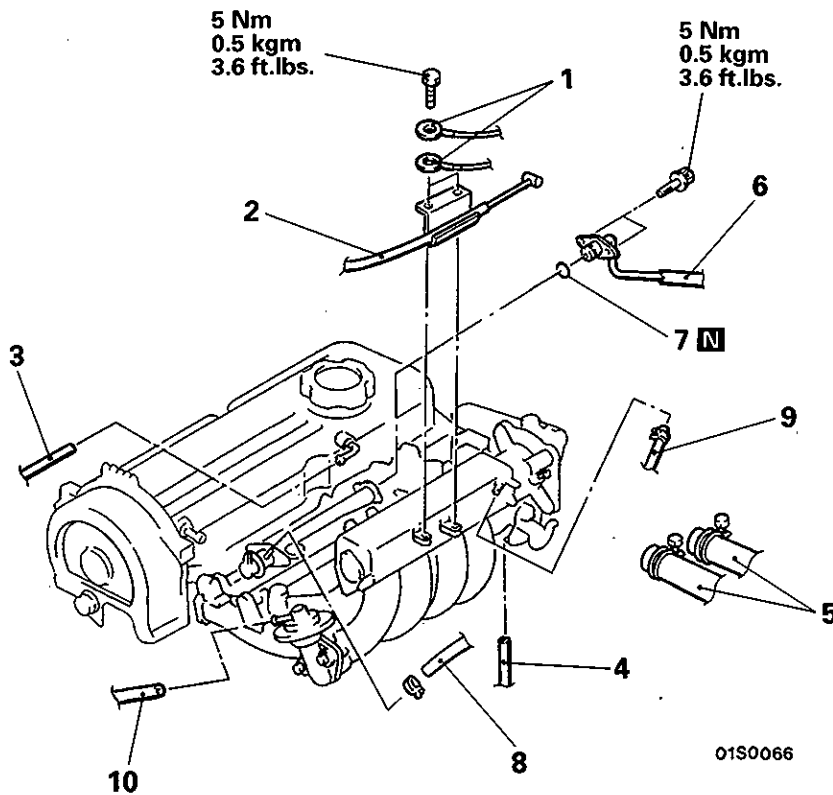
REMOVAL AND INSTALLATION

Pre-removal Operation

- Releasing of Fuel Line Pressure (Refer to GROUP 13 – Service Adjustment Procedures.)
- Removal of the Hood
- Draining of the Coolant (Refer to GROUP 14 – Service Adjustment Procedures.)
- Removal of the Transmission Assembly (Refer to GROUP 22, 23 – Transmission Assembly.)
- Removal of the Radiator (Refer to GROUP 14 – Radiator.)

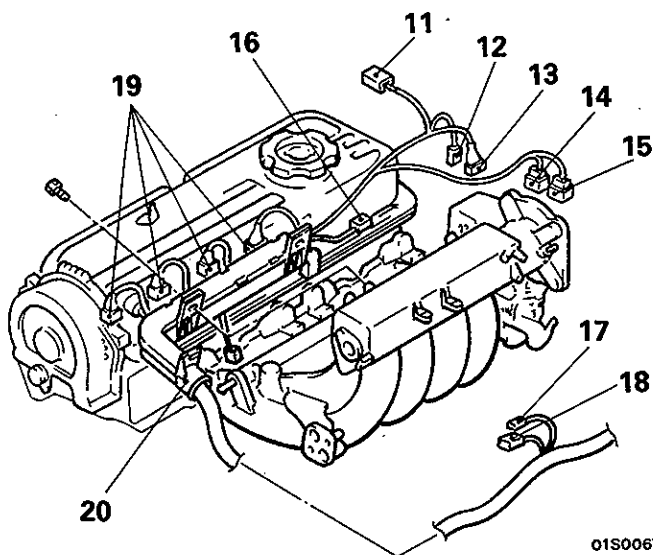
Post-installation Operation

- Installation of the Radiator (Refer to GROUP 14 – Radiator.)
- Installation of the Transmission Assembly (Refer to GROUP 22, 23 – Transmission Assembly.)
- Supplying of the Coolant (Refer to GROUP 14 – Service Adjustment Procedures.)
- Installation of the Hood
- Accelerator Cable Adjustment (Refer to GROUP 13 – Service Adjustment Procedures.)



Removal steps

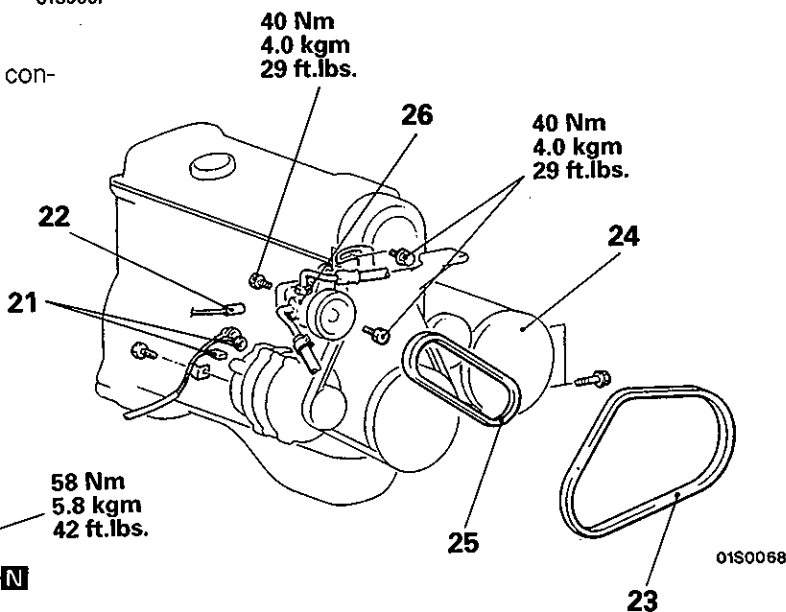
1. Earth cable connection
2. Accelerator cable connection
3. Breather hose connection
4. Vacuum hose connection
5. Heater hose connection
6. High-pressure hose connection
7. O-ring
8. Return hose connection
9. Brake booster vacuum hose connection
10. Vacuum hose connection



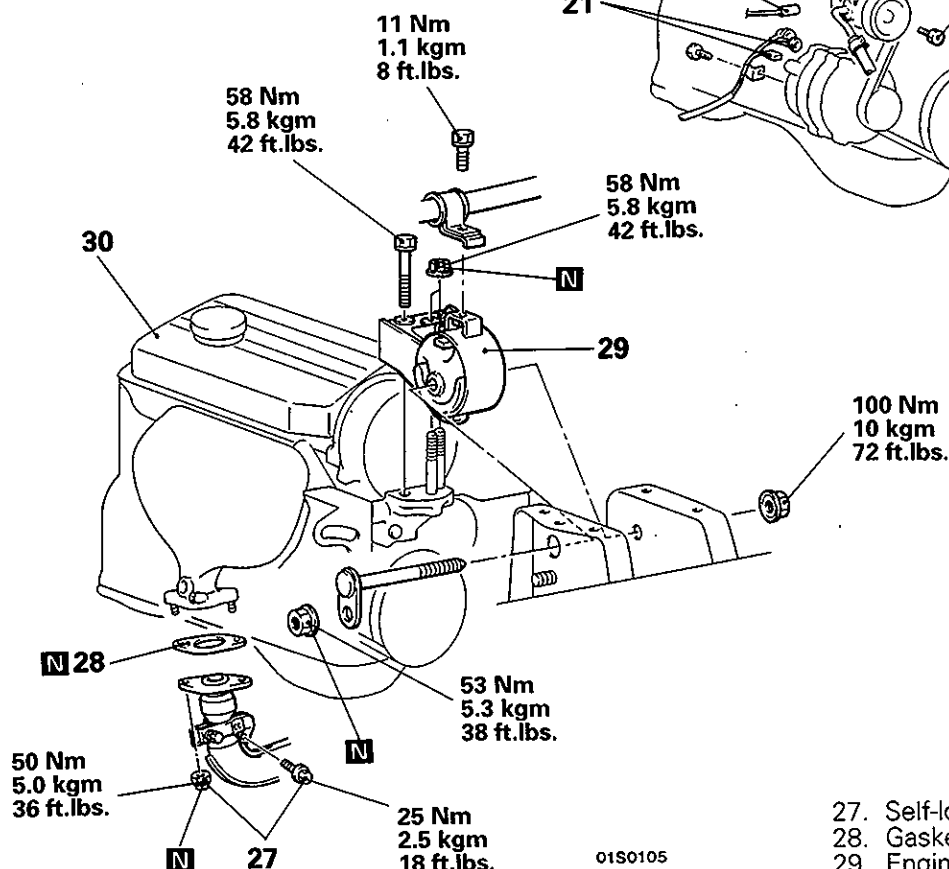
- 11. Oxygen sensor connector
- 12. Ignition coil connector
- 13. Crank angle sensor and top dead center sensor connector
- 14. Engine coolant temperature sensor connector
- 15. Water temperature gauge unit connector
- 16. Throttle position sensor connector
- 17. Idle switch connector
- 18. Idle speed control connector
- 19. Injector connector
- 20. Control harness

01S0067

- 21. Alternator connector
- 22. Power steering oil pressure switch connector
- Adjustment of V-ribbed belts (Refer to P.11-7.)
- 23. V-ribbed belt for air conditioner
- 24. Air conditioner compressor
- 25. V-ribbed belt for power steering
- 26. Power steering oil pump

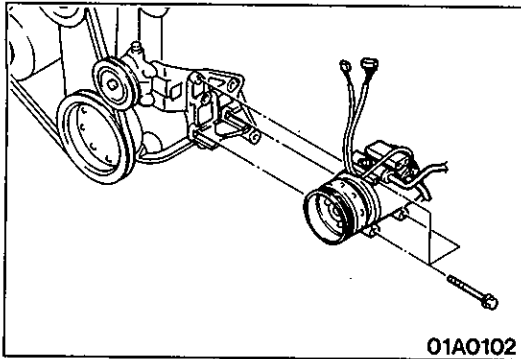


01S0068



01S0105

- 27. Self-locking nuts and bolts
- 28. Gasket
- 29. Engine mount bracket (Refer to GROUP 32 - Engine Mounting.)
- 30. Engine assembly



SERVICE POINTS OF REMOVAL

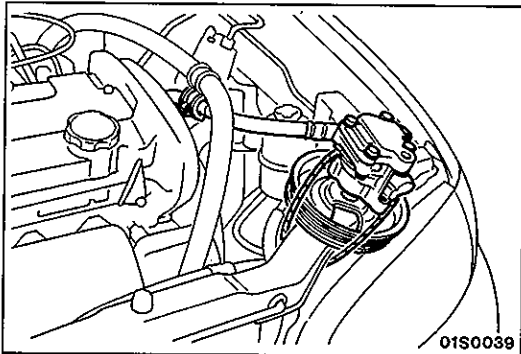
E11TBAQ

24. REMOVAL OF AIR CONDITIONER COMPRESSOR <VEHICLES WITH AIR CONDITIONER>

Disconnect the air conditioner compressor connector and remove the compressor from the compressor bracket with the hose still attached.

NOTE

Place the removed air conditioner compressor in a place where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.



26. REMOVAL OF POWER STEERING OIL PUMP

Remove the power steering oil pump from the bracket with the hose attached.

NOTE

Place the removed power steering oil pump in a place where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

30. REMOVAL OF ENGINE ASSEMBLY

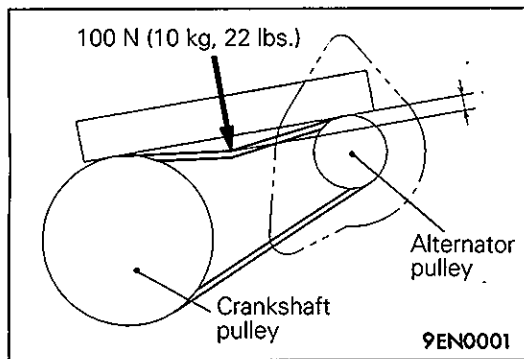
After checking that all cables, hoses and harness connectors, etc., are disconnected from the engine, lift the chain block slowly to remove the engine assembly upward from the engine compartment.

SERVICE POINTS OF INSTALLATION

E11TDAS

30. INSTALLATION OF ENGINE ASSEMBLY

Install the engine assembly while checking to be sure that the cables, hoses, and harness connectors are not clamped.



ENGINE <4G9>

SERVICE ADJUSTMENT PROCEDURES

ALTERNATOR DRIVE BELT TENSION INSPECTION AND ADJUSTMENT

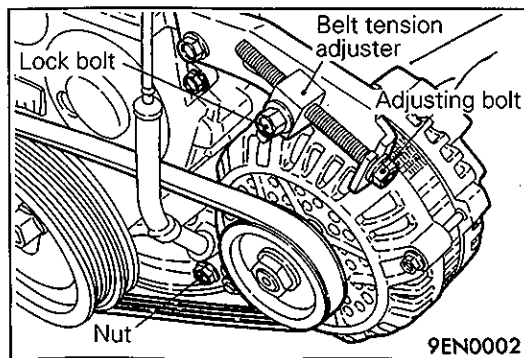
E11FQBN

ALTERNATOR DRIVE BELT TENSION INSPECTION

Check the tension by pulling or pushing at the centre of the belt between pulleys with a force of 100 N (10 kg, 22 lbs.) as shown in the figure.

Measure drive belt deflection amount.

Standard value: 8.5–12 mm (0.34–0.47 in.)



ALTERNATOR DRIVE BELT TENSION ADJUSTMENT

- (1) Loosen the nut of the alternator pivot bolt.
- (2) Loosen the lock bolt.
- (3) Turn the adjusting bolt to adjust the amount of belt deflection to the standard value.

Standard value:

If used belt (with correct tension) is used **9.5 mm (0.37 in.)**

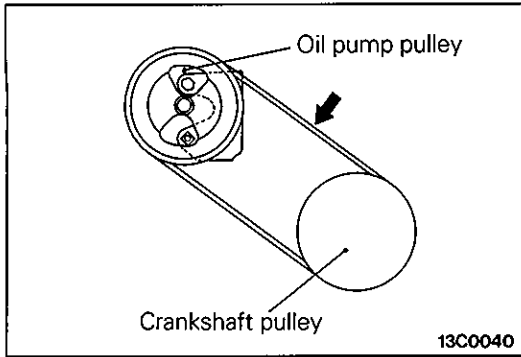
If a new belt is used **7.0–8.5 mm (0.28–0.34 in.)**

- (4) Tighten the lock bolt.

Tightening torque: 20–25 Nm
(2.0–2.5 kgm, 14–18 ft.lbs.)

- (5) Tighten the nut of the alternator pivot bolt.

Tightening torque: 45 Nm (4.5 kgm, 33 ft.lbs.)

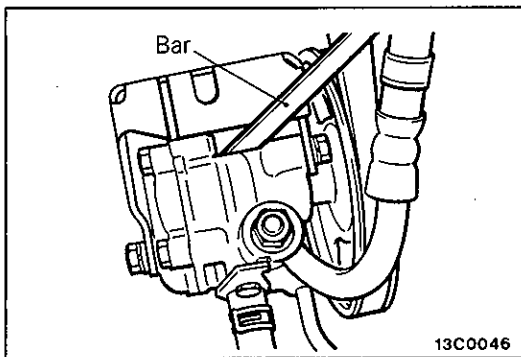
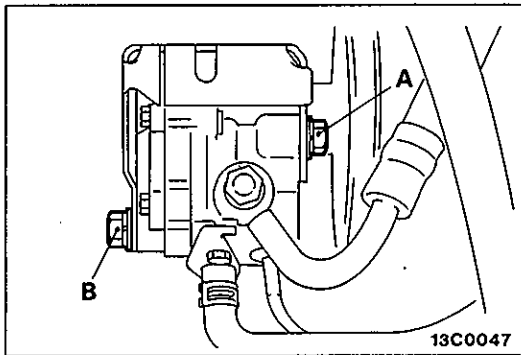


POWER STEERING OIL PUMP DRIVE BELT TENSION INSPECTION AND ADJUSTMENT
<Vehicles without Air Conditioner>

1. Press in the V-ribbed belt at the illustrated position with about 100 N (10 kg, 22 lbs.) and measure deflection. Use a belt tension gauge to check that the belt tension is at the standard value.

Standard value:

	Deflection mm (in.)	Tension N (kg, lbs.)
When belt tension is readjusted	9.5–11.5 (0.374–0.453)	400–600 (40–60, 88–132)
When new belt is installed	7.5–9.0 (0.295–0.354)	650–850 (65–85, 143–187)



2. If the deflection is out of the standard values, adjust the belt tension using the following procedures.

(1) Loosen bolts A and B (for holding the oil pump).

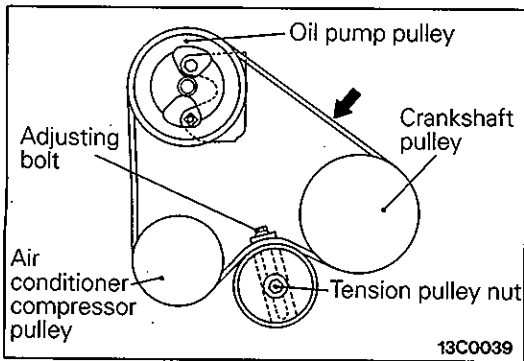
(2) Place a bar or similar object against the body of the oil pump, and, while manually providing the suitable amount of tension, adjust the amount of flexion of the belt.

(3) Tighten bolts A and B in that order.

(4) Check the amount of flexion of the belt; readjust if necessary.

Caution

The check should be made after turning the engine one time or more in the regular direction of rotation (to the right).



POWER STEERING OIL PUMP AND AIR CONDITIONER COMPRESSOR DRIVE BELT TENSION INSPECTION AND ADJUSTMENT
<Vehicles with Air Conditioner>

1. Press in the V-ribbed belt at the illustrated position with about 100 N (10 kg, 22 lbs.) and measure deflection. Use a belt tension gauge to check that the belt tension is at the standard value.

Standard value:

	Deflection mm (in.)	Tension N (kg, lbs.)
When belt tension is readjusted	6.8–7.6 (0.268–0.299)	500–630 (50–63, 110–139)
When new belt is installed	5.5–6.0 (0.217–0.236)	750–800 (75–80, 165–176)

2. If the deflection is out of the standard values, loosen the tension pulley nut and adjust the belt tension with adjusting bolt.

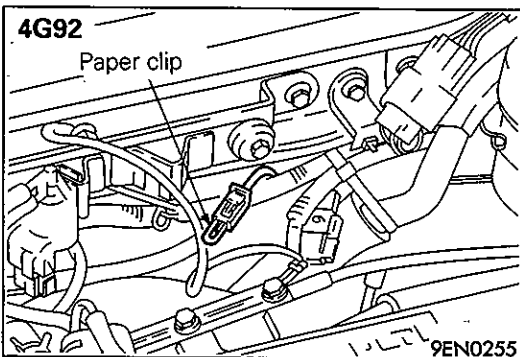
VALVE CLEARANCE INSPECTION AND ADJUSTMENT <4G92>

E11FDBZ

Refer to P.11-9.

Standard value (hot engine):

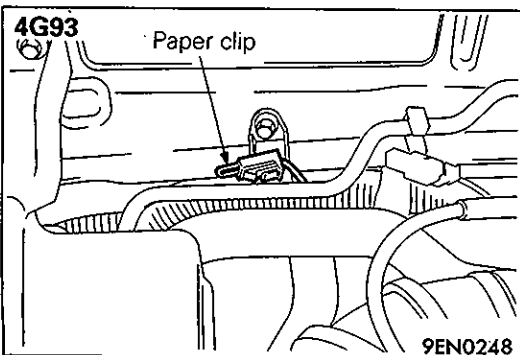
Intake valve	0.20 mm (0.008 in.)
Exhaust valve	0.30 mm (0.012 in.)

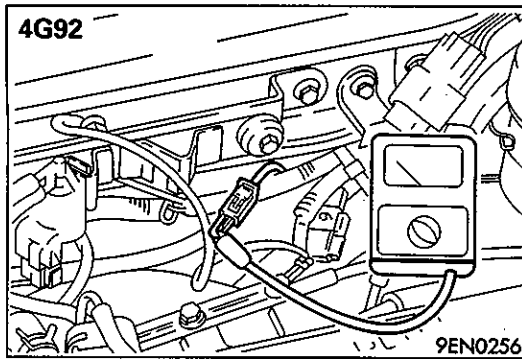


IGNITION TIMING INSPECTION AND ADJUSTMENT

E11FUBK

- (1) Before inspection and adjustment set vehicle in the following condition.
 - Engine coolant temperature: 80–95°C (176–203°F)
 - Lamps, electric cooling fan and all accessories: OFF
 - Transmission: Neutral (P range on vehicles with A/T)
- (2) Insert a paper clip into the 1 pin connector (blue) as shown in the illustration at left.





- (3) Connect a primary-voltage-detection type of tachometer to the paper clip.

NOTE

Do not use the multi-use tester (MUT) or MUT-II.

If tested with the MUT or MUT-II connected to the diagnosis connector, the ignition timing will not be the basic ignition timing but be ordinary timing.

- (4) Set up a timing light.
- (5) Start the engine and run at idle.
- (6) Check that engine idle speed is within the standard value.

Standard value:

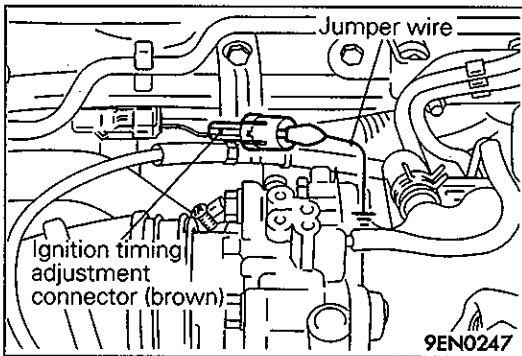
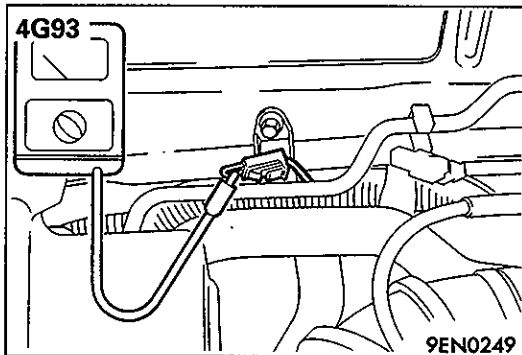
4G92 (Except MVV), 4G93	800 ± 100 r/min
4G92-MVV	700 ± 100 r/min

NOTE

<4G93>

The tachometer indication is a half of actual engine speed.

Therefore, multiply the reading by 2 to know actual engine speed.



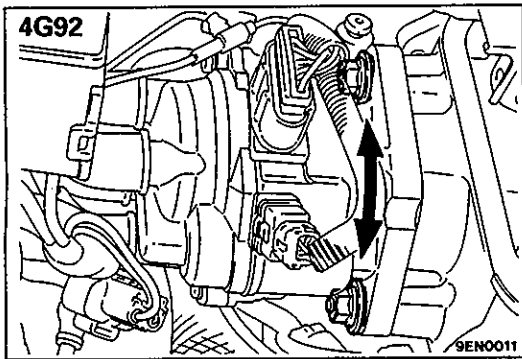
- (7) Turn the ignition switch to OFF.
- (8) Remove the waterproof connector from the ignition timing adjustment connector (brown).
- (9) Connect the jumper wire with the clip to the ignition timing adjustment terminal, and earth this to the body as illustrated.

NOTE

Grounding this terminal sets the engine to the basic ignition timing.

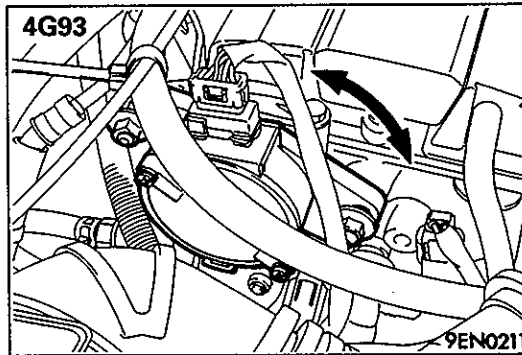
- (10) Start the engine and run it at idle.
- (11) Check that basic ignition timing is within the standard value.

Standard value: 5° BTDC ± 2°



- (12) If not within the standard value, loosen distributor <4G92> or crank angle sensor <4G93> fixing nut and adjust by rotating distributor <4G92> or crank angle sensor <4G93> body.
 (13) Tighten mounting nut after adjusting.

Tightening torque: 12 Nm (1.2 kg, 9 ft.lbs.)



- (14) Stop the engine, remove the jumper wire from the ignition timing adjustment connector, (brown), and return the connector to its original condition.
 (15) Start the engine and check that ignition timing at the standard value.

Standard value:

4G92 (Except MVV), 4G93	Approx. 8° BTDC
4G92-MVV	Approx. 12° BTDC

NOTE

1. Ignition timing is variable within about $\pm 7^\circ$, even under normal operating.
 2. And it is automatically further advanced by about 5° from 8° BTDC (12° BTDC for 4G92-MVV) at higher altitudes.
- (16) Sealing tape is to attached to the fixing nut only for vehicles for Switzerland.

NOTE

Sealing tape is attached to all vehicles when new.

IDLE SPEED INSPECTION

E11FXDB

- (1) Before inspection and adjustment set vehicles in the following condition.
 - Engine coolant temperature: 80–95°C (176–203°F)
 - Lamps, electric cooling fan and all accessories: OFF
 - Transmission: Neutral (P range on vehicles with A/T)
- (2) Check the basic ignition timing. Adjust if necessary.

Standard value: 5° BTDC ±2°

- (3) After turning the ignition switch to OFF, connect the multi-use tester (MUT) <up to 1993 models> or MUT-II <all models> to the diagnosis connector.
For the procedures for connecting the MUT and MUT-II, refer to GROUP 13–Troubleshooting.
- (4) Start the engine and run it at idle.
- (5) Run the engine at idle for 2 minutes.
- (6) Check the idle speed.

Curb idle speed:

4G92 (Except MVV), 4G93	800 ± 100 r/min
4G92–MVV	700 ± 100 r/min

NOTE

The idle speed is adjusted automatically by the idle speed control (ISC) system.

- (7) If there is a deviation from the standard value, refer to GROUP 13 – Check Chart Classified by Problem Symptoms, and check the MPI components.

IDLE MIXTURE INSPECTION

- (1) Before inspection, set vehicles in the following condition:
 - Engine coolant temperature: 80–95°C (176–203°F)
 - Lamps, electric cooling fan and all accessories: OFF
 - Transmission: Neutral (P range on vehicles with A/T)
- (2) Check that the basic ignition timing is within the standard value.

Standard value: 5° BTDC ±2°

- (3) After turning the ignition switch to OFF, connect the multi-use tester (MUT) <up to 1993 models> or MUT-II <all models> to the diagnosis connector.
For the procedures for connecting the MUT and MUT-II, refer to GROUP 13 – Troubleshooting.
- (4) Start the engine and run it at 2,500 r/min for 2 minutes.
- (5) Set the CO, HC tester
- (6) Check the CO concentration and the HC concentration at idle.

Standard value**CO concentration: 0.5% or less****HC concentration: 100 ppm or less**

- (7) If there is a deviation from the standard value, check the following items:
 - Diagnosis output
 - Closed-loop control (When the closed-loop control is carried out normally, the output signal of the oxygen sensor changes between 0–400mV and 600–1,000mV at idle.)
 - Combustion pressure
 - Injector
 - Ignition coil, spark plug cable, spark plug
 - Leak in the EGR system and in the EGR valve
 - Evaporative emission control system
 - Compression pressure

NOTE

Replace the three way catalyst when the CO and HC concentrations do not remain inside the standard value, even though the result of the inspection is normal on all items.

COMPRESSION PRESSURE INSPECTION

E11FGAT

Refer to P.11-13.

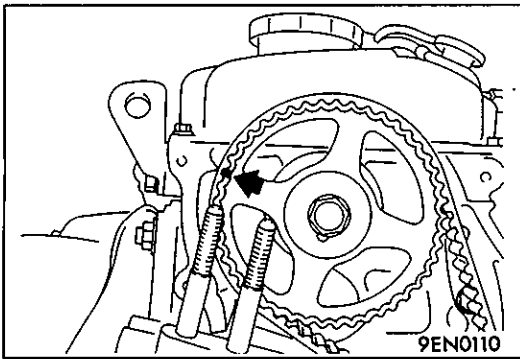
Standard value (at engine speed of 250–400 r/min.):**4G92 1,450 kPa (14.5 kg/cm², 206 psi)****4G93 1,500 kPa (15.0 kg/cm², 213 psi)****Limit (at engine speed of 250–400 r/min.):****4G92 min. 1100 kPa (11.0 kg/cm², 156 psi)****4G93 min. 1150 kPa (11.5 kg/cm², 164 psi)****MANIFOLD VACUUM INSPECTION**

E11PWBE

Refer to P.11-15.

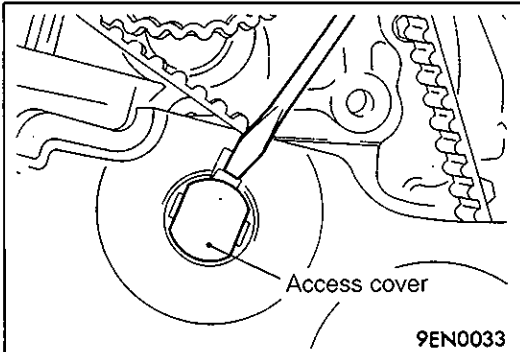
Standard value:**Approx. 67 kPa (500 mmHg, 20 in.Hg)**

NOTE

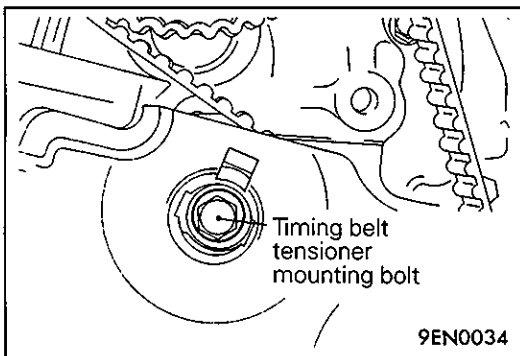
**TIMING BELT TENSION ADJUSTMENT**

E11FFDL

- (1) Remove the timing belt upper cover. <4G92>
- (2) Turn the crankshaft clockwise for one turn or more to set the No. 1 cylinder to top dead compression center.



- (3) Remove the access cover.

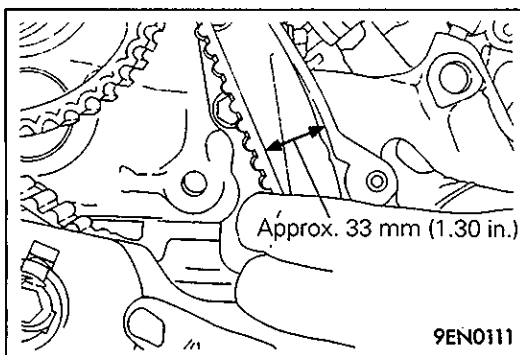


- (4) Loosen the timing belt tensioner fixing bolt to apply tension to the belt by means of the force of the tensioner spring.

Caution

The bolt can be loosened 80° – 200°.

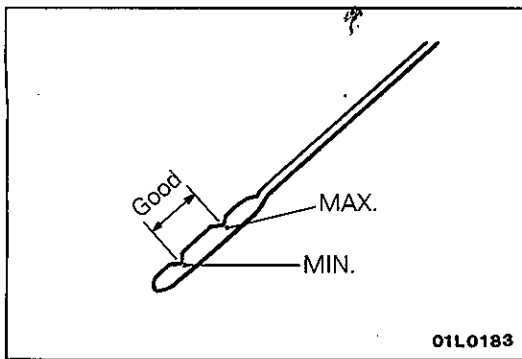
If the bolt is loosened more than necessary, the bolt may fall inside the cover.



- (5) Tighten the timing belt tensioner fixing bolt.
- (6) Check that the clearance between the timing belt and the under cover is at the standard value as shown in the illustration.

Standard value: Approx. 33 mm (1.30 in.)

- (7) Install the access cover.
- (8) Install the timing belt upper cover.

**LASH ADJUSTERS CHECK <4G93>**

E11FBAO

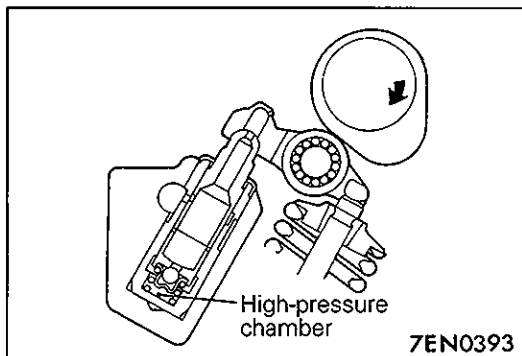
NOTE

Soon after the engine is started or while it is running, abnormal noise (clattering) which may be attributed to the adjuster sounds but does not stop. In this case, check the following.

- (1) Check the engine oil, and refill or replace oil if necessary.

NOTE

1. If the oil amount is small, air will be sucked from the oil strainer and mixed in the oil passage.
2. If the oil amount is excessive, the oil will be stirred by the crank and mixed with a large amount of air.
3. Air and oil can not be separated easily in the deteriorated oil, and the amount of air mixed in the oil increases.



If such mixed-in air enters the high pressure chamber in the lash adjuster, the air in the high-pressure chamber will be compressed while the valve is opened, the lash adjuster will be excessively compressed and abnormal noise will be produced when the valve is closed.

This is the same phenomenon which occurs when the valve clearance is improperly adjusted to be excessively large.

However, it will return to be normal if the air entrapped in the adjuster is released in this case.

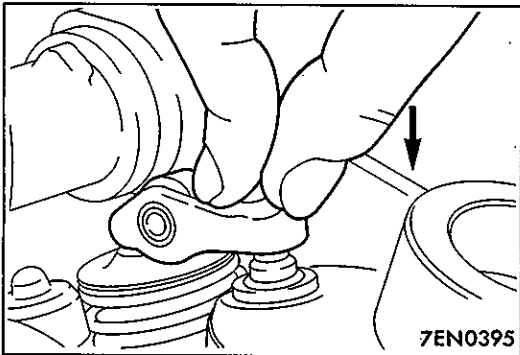
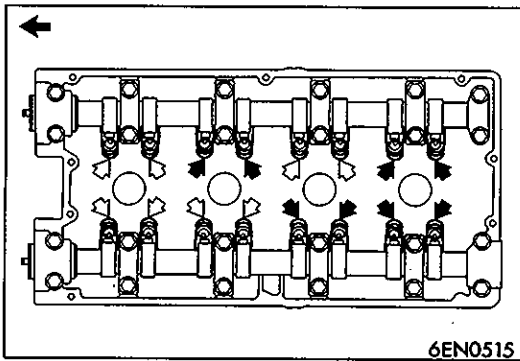
- (2) Start the engine, and slowly race* it several times (10 times or less).

If the abnormal noise is eliminated by racing the engine, it means that the air is released from the high-pressure chamber of the lash adjuster and the function of the lash adjuster is returned to normal.

* Gradually increase the engine speed from the idle speed to 3,000 r/min. (for 30 seconds), and then gradually slow down the engine to the idling speed (for 30 seconds).

NOTE

1. If the vehicle is parked on a slope for a long time, the oil will be sometimes reduced in the lash adjuster, and air will enter the high-pressure chamber when the engine is started.
2. After the vehicle is parked for a long time, the oil will go out of the oil passage. Since it takes a little time to supply oil to the lash adjuster, air sometimes enters the high-pressure chamber.



(3) If any abnormal noise is not eliminated by racing, check the lash adjuster.

- ① Stop the engine.
- ② Set the engine so that cylinder No. 1 is positioned at the top dead centre of the compression.
- ③ Press the rocker arm at the area indicated by the ⇐ arrow mark to check whether the rocker arm is lowered or not.
- ④ Slowly turn the crankshaft 360 degrees clockwise.
- ⑤ In the same procedure as Step ③, check the rocker arm at the area indicated by the ← arrow mark.

⑥ If the rocker arm can be lowered easily when the part of the rocker arm which is directly above the top of the lash adjuster is pressed, the lash adjuster is defective and should be replaced with a new part.

Furthermore, when replacing the lash adjuster, bleed all of the air from the lash adjuster and then install. After this, check to be sure that there is no abnormality by carrying out the inspection in steps (1) to (5).

NOTE

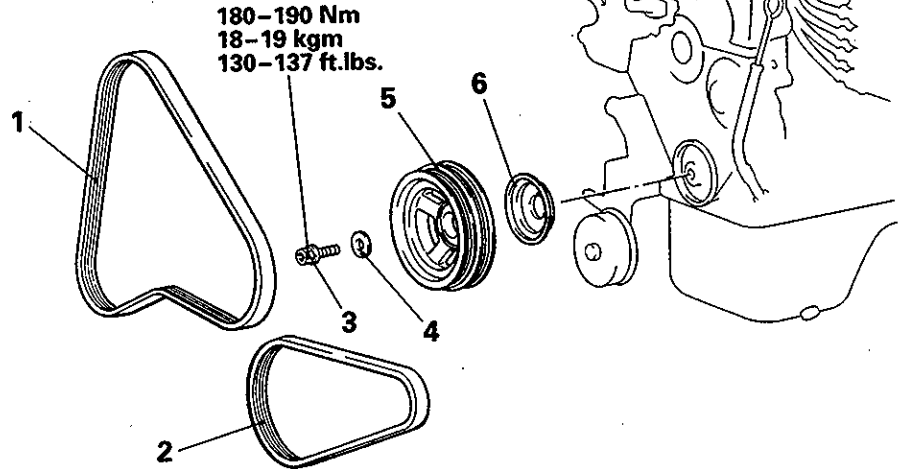
1. A leak-down test can be carried out to accurately determine whether the lash adjuster is defective or not.
2. For the procedures for the leak-down test and air bleeding of the lash adjuster, refer to the Engine Workshop Manual.
3. Furthermore, if the rocker arm feels extremely stiff and cannot be lowered when it is pressed, the lash adjuster is normal, so investigate for some other cause of the abnormality.

**CRANKSHAFT PULLEY
REMOVAL AND INSTALLATION**

E11LA-

**Pre-removal and Post-installation
Operation**

- Removal and Installation of Under Cover (L.H.)



01S0072

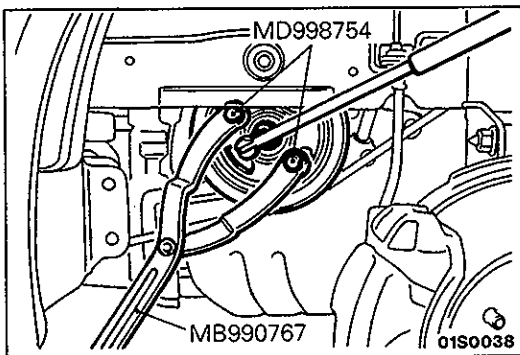
Removal steps

- Drive belt tension adjustment
- 1. Drive belt (Air conditioner)
- 2. Drive belt (Alternator)
- ◄◄ 3. Crankshaft pulley bolt
- ◄◄ 4. Crankshaft pulley washer
- 5. Crankshaft pulley
- 6. Dust cover

SERVICE POINTS OF REMOVAL

E11LBBD

3. REMOVAL OF CRANKSHAFT PULLEY BOLT



SERVICE POINTS OF INSTALLATION

E11LDBE

4. INSTALLATION OF CRANKSHAFT PULLEY WASHER/3. CRANKSHAFT PULLEY BOLT

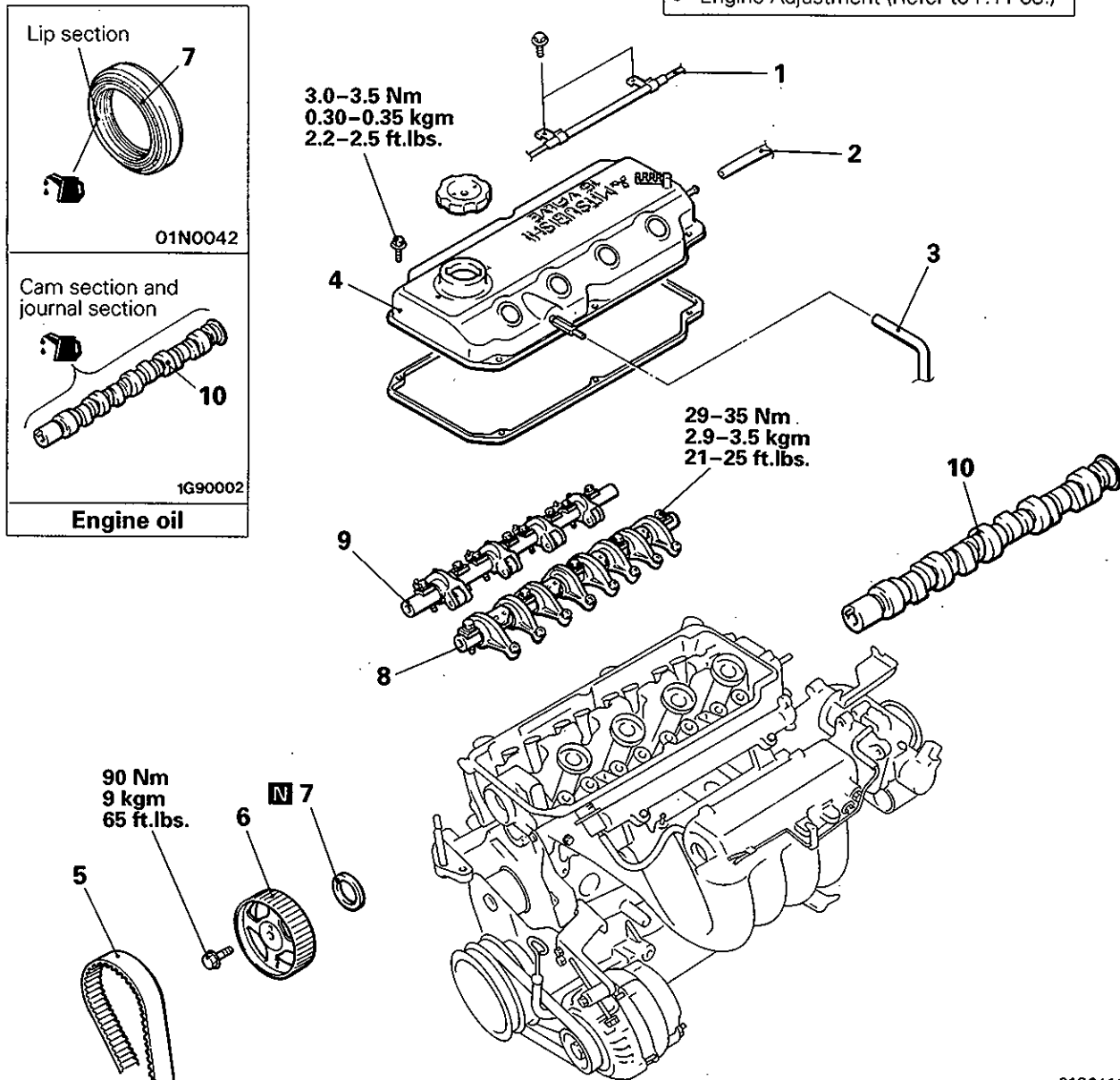
When installing the crankshaft pulley bolt, install so that the burred side of the crankshaft pulley washer is at the bolt side.

CAMSHAFT AND CAMSHAFT OIL SEAL <4G92>**REMOVAL AND INSTALLATION****Pre-removal Operation**

- Removal of Distributor (Refer to GROUP 16 – Distributor)
- Removal of Timing Belt Cover (Refer to P.11-64.)

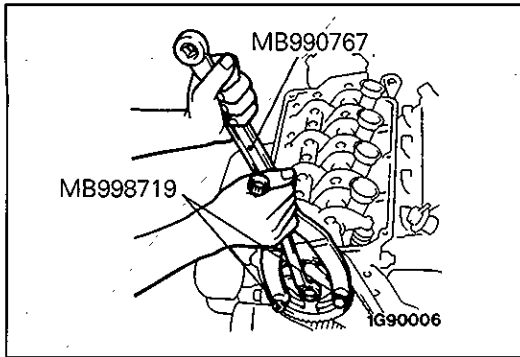
Post-installation Operation

- Installation of Distributor (Refer to GROUP 16 – Distributor)
- Installation of Timing Belt Cover (Refer to P.11-64.)
- Engine Adjustment (Refer to P.11-33.)

**Removal steps**

1. Accelerator cable connection
2. Breather hose connection
3. PCV hose connection
4. Rocker cover
 - Valve clearance adjustment (Refer to P.11-35.)
5. Timing belt (Refer to P.11-64.)
6. Camshaft sprocket
7. Camshaft oil seal
8. Rocker arms and rocker arm shaft assembly (Intake side)
9. Rocker arms and rocker arm shaft assembly (Exhaust side)
10. Camshaft

01S0111

**SERVICE POINTS OF REMOVAL**

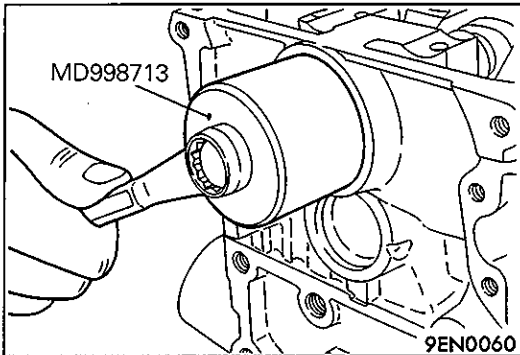
E11HBAL

6. REMOVAL OF CAMSHAFT SPROCKET

8. REMOVAL OF ROCKER ARMS AND ROCKER ARM SHAFT ASSEMBLY (INTAKE SIDE)/9. ROCKER ARMS AND ROCKER ARM SHAFT ASSEMBLY (EXHAUST SIDE)

Caution

Do not disassemble the rocker arms and rocker arm shaft assembly.

**SERVICE POINTS OF INSTALLATION**

E11HCAM

7. INSTALLATION OF CAMSHAFT OIL SEAL

CAMSHAFT AND CAMSHAFT OIL SEAL <4G93>

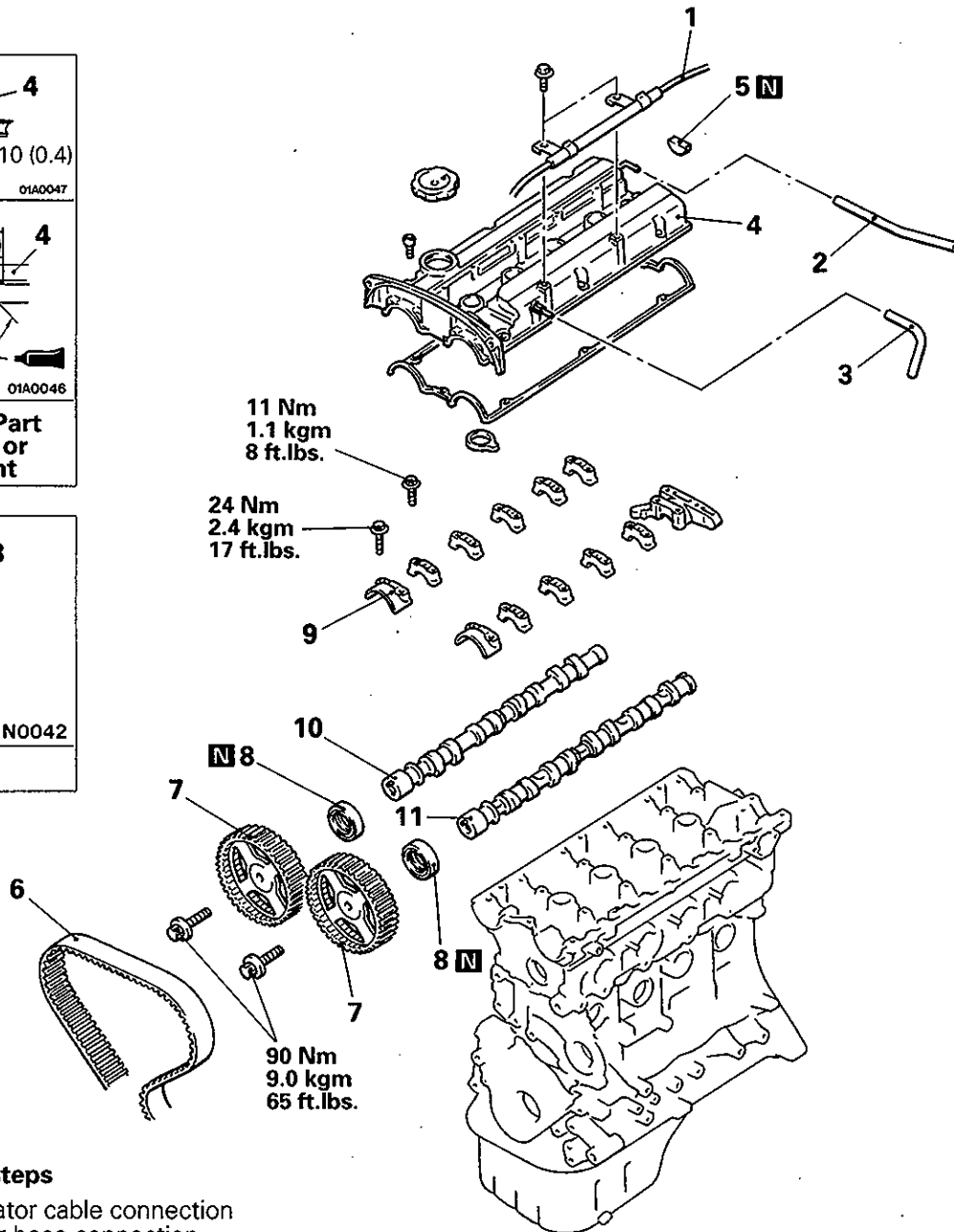
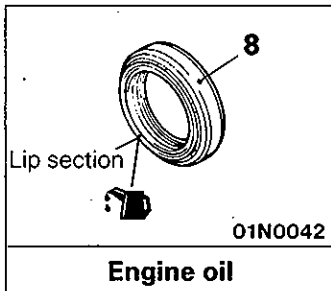
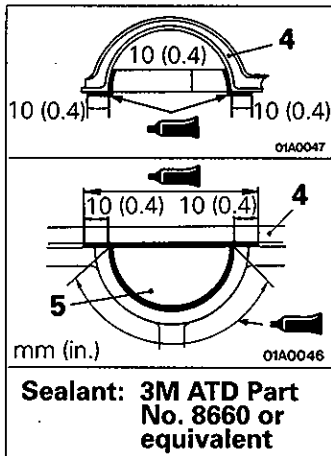
REMOVAL AND INSTALLATION

Pre-removal Operation

- Removal of Crank Angle Sensor (Refer to GROUP 16 – Crank Angle Sensor.)
- Removal of Timing Belt Cover (Refer to P.11-69.)

Post-installation Operation

- Installation of Crank Angle Sensor (Refer to GROUP 16 – Crank Angle Sensor.)
- Installation of Timing Belt Cover (Refer to P.11-69.)
- Engine Adjustment (Refer to P.11-33.)

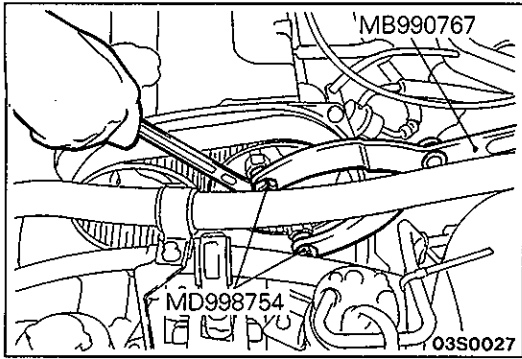


Removal steps

1. Accelerator cable connection
2. Breather hose connection
3. PCV valve hose connection
4. Rocker cover
5. Semi-circular packing
 - Valve clearance adjustment (Refer to P.11-35.)
6. Timing belt (Refer to P.11-69.)
7. Camshaft sprocket

- ◆◆ 8. Camshaft oil seal
- ◆◆ 9. Bearing cap
- ◆◆ 10. Camshaft
- ◆◆ 11. Camshaft

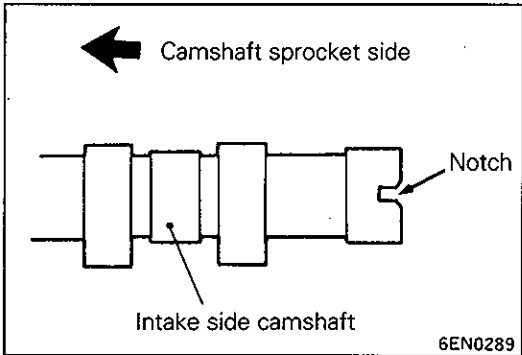
01S0117



SERVICE POINTS OF REMOVAL

E11HBAO

7. REMOVAL OF CAMSHAFT SPROCKET

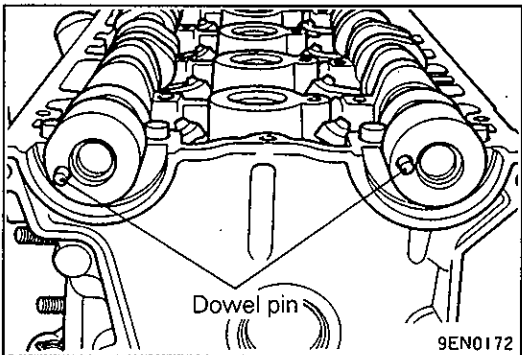


SERVICE POINTS OF INSTALLATION

E11HCAQ

11. INSTALLATION OF CAMSHAFT

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

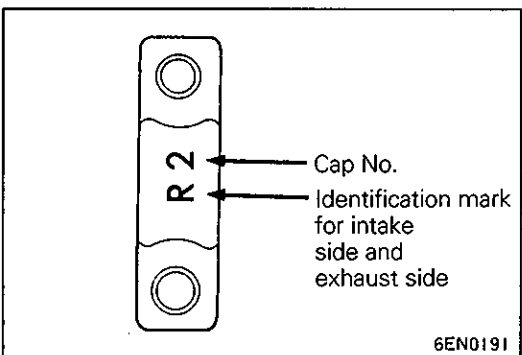


9. INSTALLATION OF BEARING CAP

- (1) Set the camshaft dowel pins in the positions shown in the illustration.

NOTE

Place the notch for tightening the cam shaft head bolt in the correct position.

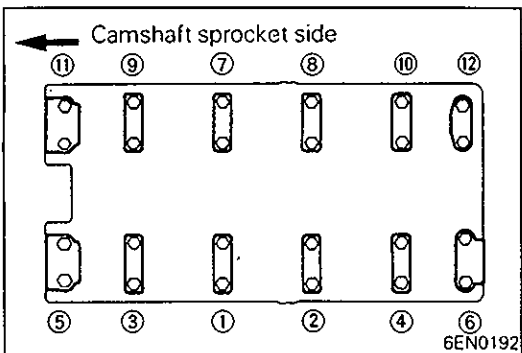


- (2) Because bearing caps No. 2 - 5 have the same shape, check the identification mark when installing so as not to mistake the cap number and the intake or exhaust side.

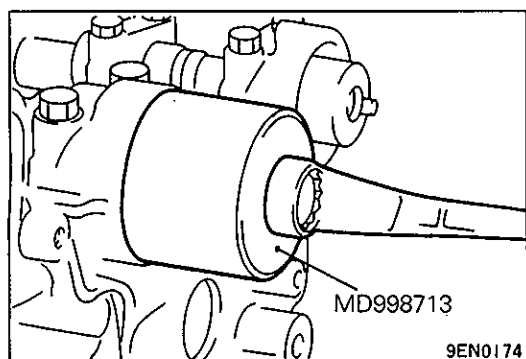
Identification marks (embossed on the front and bearing caps nos. 2 - 5.)

L.....Intake side

R.....Exhaust side



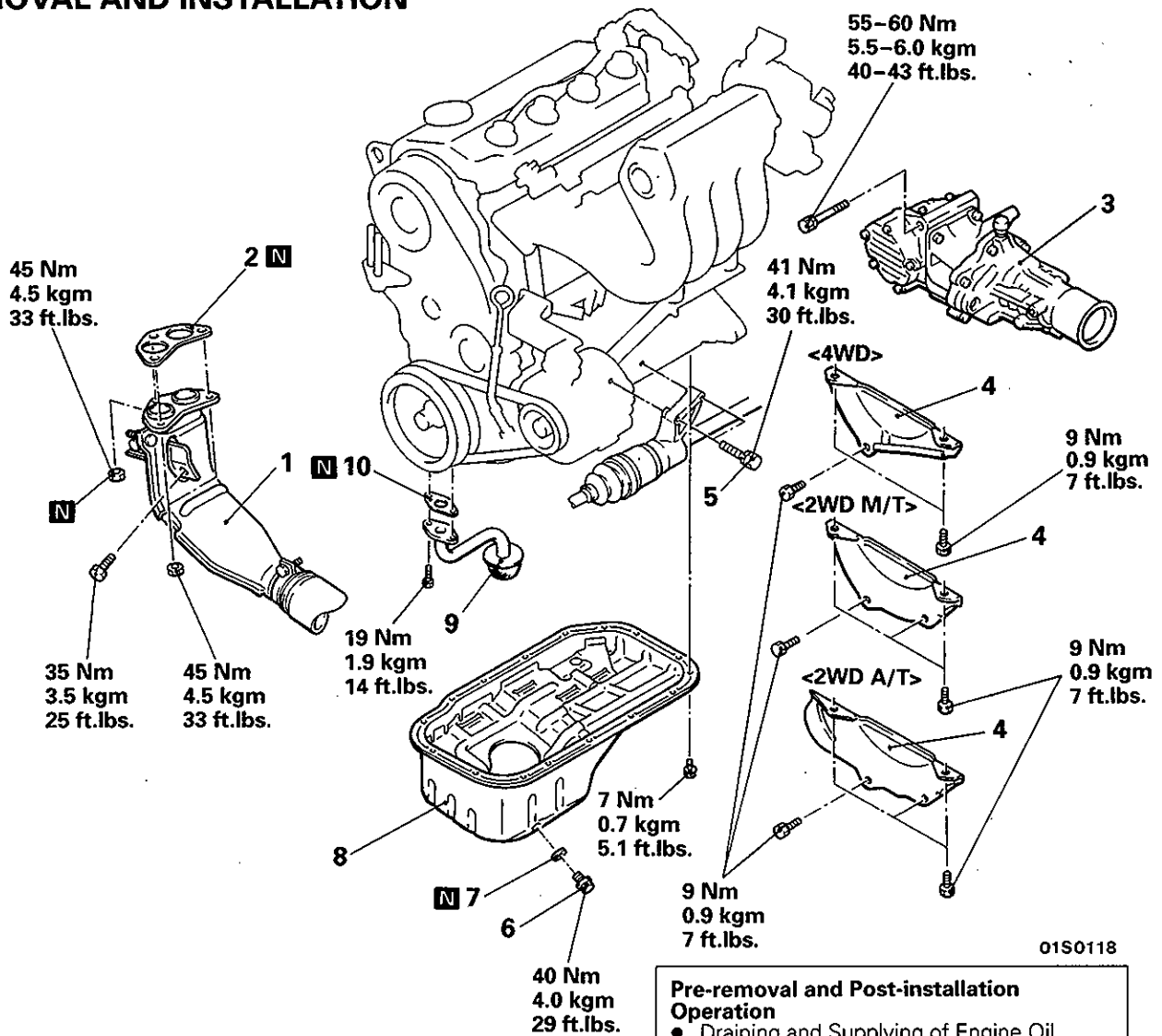
- (3) Tighten the bearing caps in the order shown two to three times by torquing progressively. Tighten to specification in the final sequence.
- (4) Check to ensure that the rocker arm is held in position on the lash adjuster and valve stem end.



8. INSTALLATION OF CAMSHAFT OIL SEAL

OIL PAN

REMOVAL AND INSTALLATION



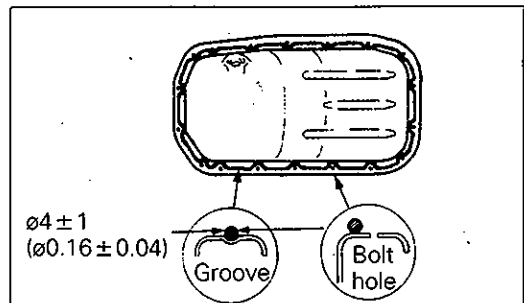
01S0118

Pre-removal and Post-installation Operation

- Draining and Supplying of Engine Oil (Refer to GROUP 12 - Service Adjustment Procedures.)
- Removal and Installation of Oil Level Gauge

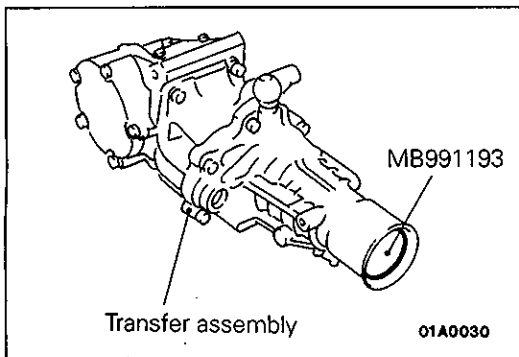
Removal steps

- 1. Front exhaust pipe
- 2. Gasket
- 3. Transfer assembly
- 4. Bell housing cover
- 5. Drive shaft center bearing mounting bolt
- 6. Drain plug
- 7. Drain plug gasket
- 8. Oil pan
- 9. Oil screen assembly
- 10. Gasket



01C0023

Specified sealant:
MITSUBISHI GENUINE PART
MD970389 or equivalent

**SERVICE POINTS OF REMOVAL**

E11KBBM

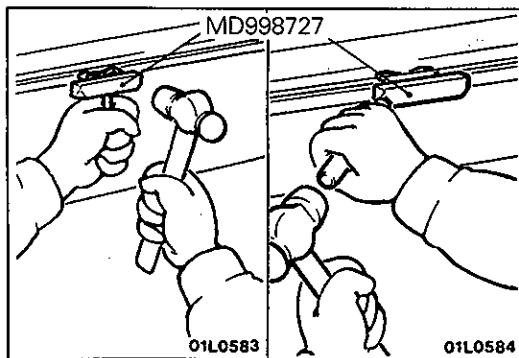
3. REMOVAL OF TRANSFER ASSEMBLY

- (1) With the propeller shaft still installed, remove the transfer mounting bolt.
- (2) Insert a flat-tipped screwdriver between the transfer and transmission to remove the transfer from the center shaft.
- (3) Remove the transfer from the propeller shaft.

Caution

Do not lower the rear end of the transfer, as this will cause the transfer oil to flow out.

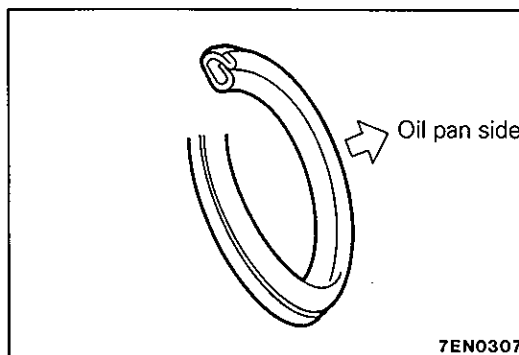
- (4) After removing the transfer assembly, insert the special tool to prevent transfer oil from flowing out.
- (5) Suspend the propeller shaft from the vehicle body with wire, etc.

**8. REMOVAL OF OIL PAN**

After removing the oil pan mounting bolts and nuts, remove the oil pan with the special tool and a brass bar.

Caution

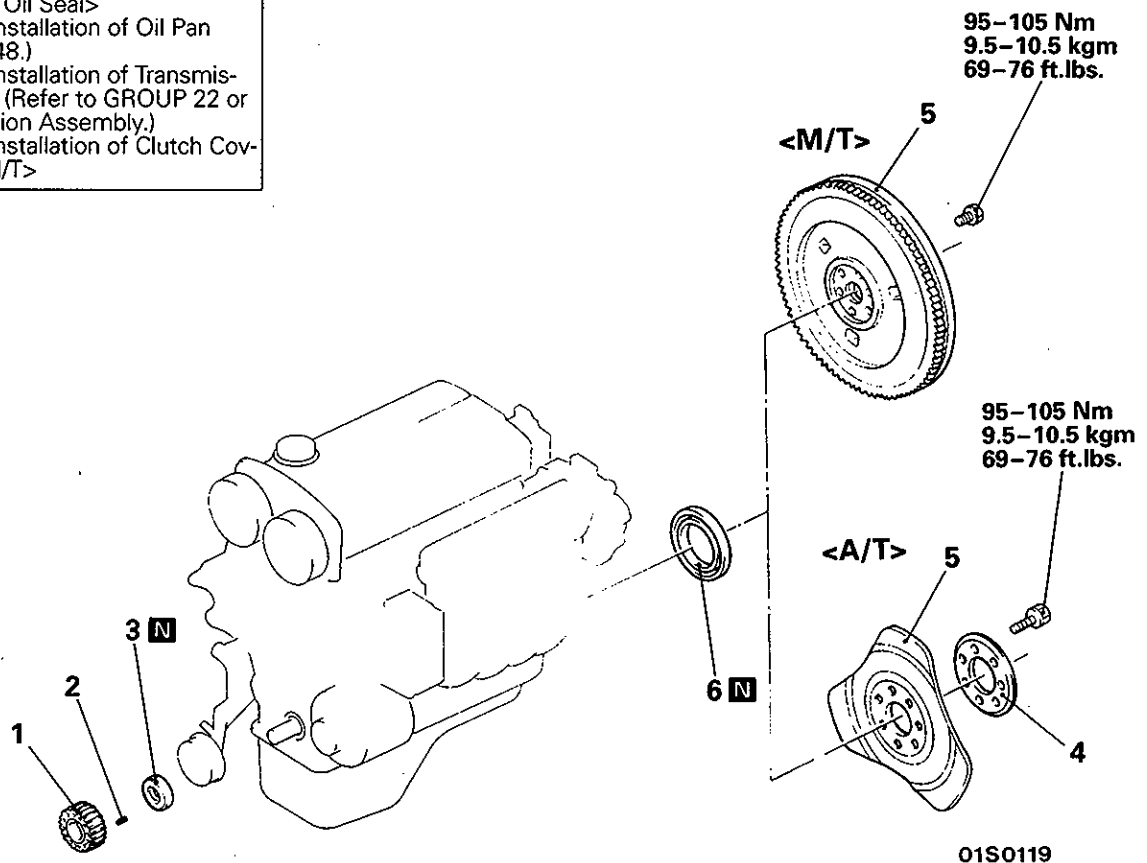
Perform this slowly to avoid deformation of the oil pan flange.

**SERVICE POINTS OF INSTALLATION****7. INSTALLATION OF DRAIN PLUG GASKET**

Install the drain plug gasket in the direction so that it faces as shown in the illustration.

CRANKSHAFT OIL SEAL**REMOVAL AND INSTALLATION****Pre-removal and Post-installation Operation**

- <Crankshaft Front Oil Seal>
- Removal and Installation of Timing Belt (Refer to P.11-64, 69.)
- <Crankshaft Rear Oil Seal>
- Removal and Installation of Oil Pan (Refer to P.11-48.)
 - Removal and Installation of Transmission Assembly (Refer to GROUP 22 or 23 - Transmission Assembly.)
 - Removal and Installation of Clutch Cover and disc <M/T>

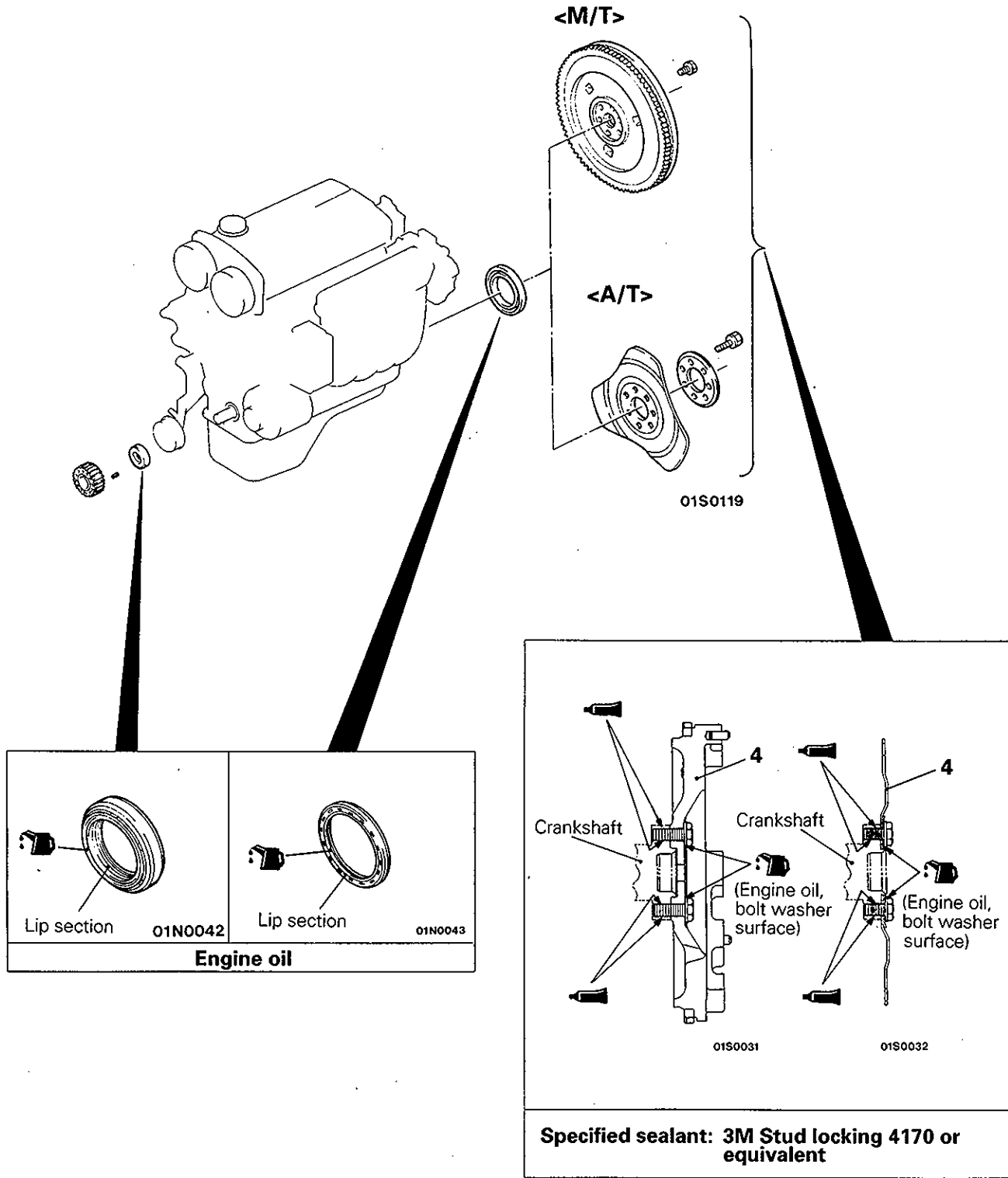
**Crankshaft front oil seal removal steps**

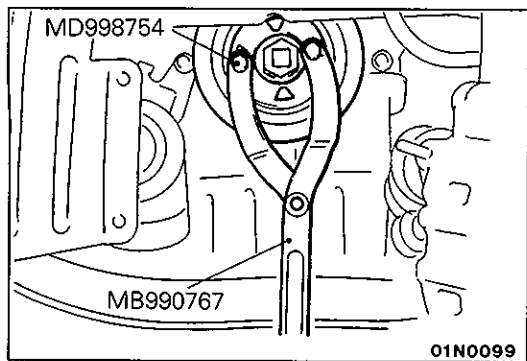
1. Crankshaft sprocket
2. Key
- ◆◆ 3. Crankshaft front oil seal

Crankshaft rear oil seal removal steps

- ◆◆◆ 4. Adapter plate
- ◆◆◆ 5. Flywheel assembly <M/T> or drive plate <A/T>
- ◆◆ 6. Crankshaft rear oil seal

SEALANT AND LUBRICATION POINTS



**SERVICE POINTS OF REMOVAL**

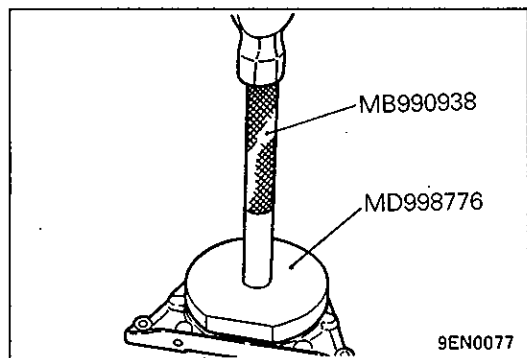
E11UBAG

5. REMOVAL OF FLYWHEEL ASSEMBLY <M/T> OR DRIVE PLATE <A/T>

Stop the crankshaft pulley from turning, and remove the flywheel assembly <M/T> or drive plate <A/T>.

Caution

- (1) Use only the specified special tools, otherwise the damper section of the crankshaft pulley could be damaged.
- (2) In order not to damage the timing belt lower cover and front flange, hold the special tool securely so that it doesn't move.

**SERVICE POINTS OF INSTALLATION**

E11UCAM

6. INSTALLATION OF CRANKSHAFT REAR OIL SEAL

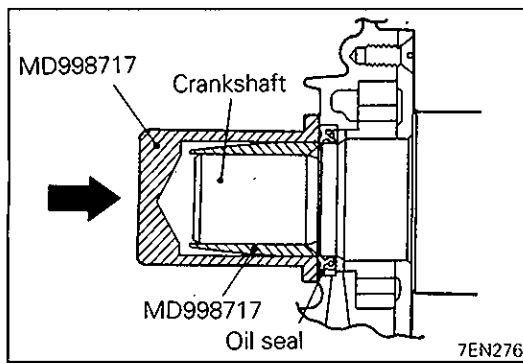
- (1) Apply a small amount of engine oil to the entire circumference of the oil seal lip.
- (2) Install the oil seal by tapping it as far as the chamfered position of the oil seal case as shown in the illustration.

5. INSTALLATION OF FLYWHEEL ASSEMBLY <M/T> OR DRIVE PLATE <A/T>

- (1) Clean the sealant, oil and other particles that are adhering to the mounting bolts, the thread sections of the crankshaft, and the flywheel assembly <M/T> or drive plate <A/T>.
- (2) Apply oil to the washer surfaces of the flywheel assembly <M/T> bolts or the drive plate <A/T> bolts.
- (3) Apply specified sealant to the thread sections of the mounting bolts.

Specified sealant: 3M Stud locking 4170 or equivalent

- (4) Tighten the mounting bolts to the specified torque.
- (5) After installation, clean off any sealant adhering to the ends of the flywheel assembly <M/T> mounting bolts or the drive plate <A/T> mounting bolts of the crankshaft.



3. INSTALLATION OF CRANKSHAFT FRONT OIL SEAL

- (1) Apply a small amount of engine oil to the entire circumference of the oil seal lip.
- (2) Tap the oil seal until it is flush with the oil seal case.

CYLINDER HEAD GASKET <4G92>

REMOVAL AND INSTALLATION

Pre-removal Operation

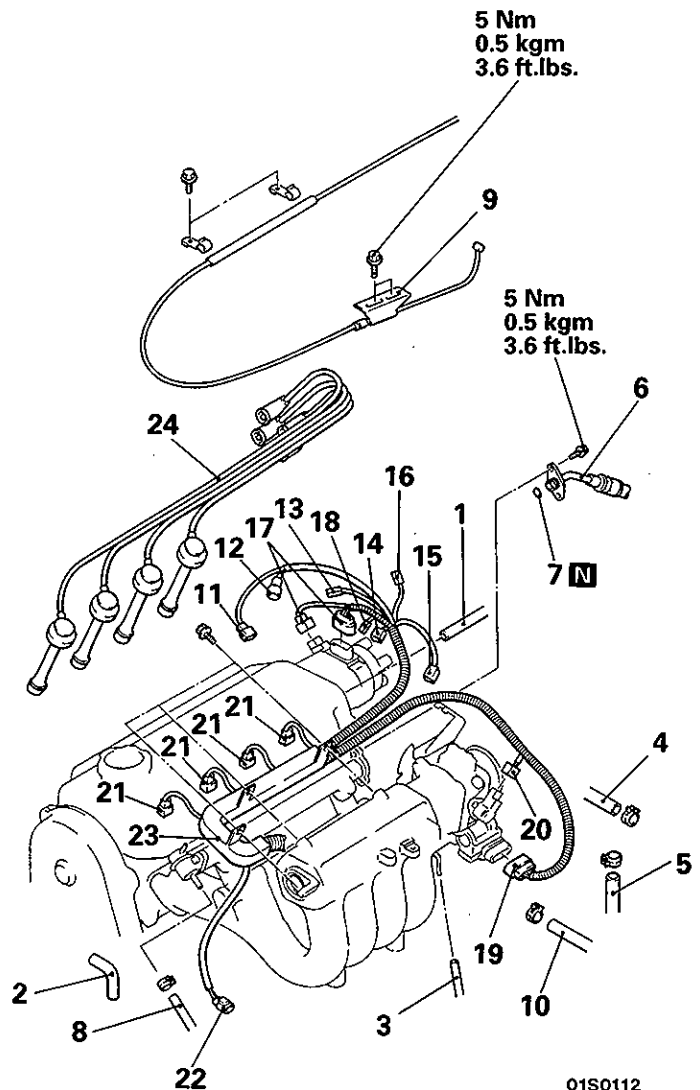
- Releasing of Fuel Line Pressure (Refer to GROUP 13 - Service Adjustment Procedures.)
- Draining of the Coolant (Refer to GROUP 14 - Service Adjustment Procedures.)
- Draining of the Engine Oil
- Removal of the Air Intake Hose (Refer to GROUP 15 - Air Cleaner.)

Post-installation Operation

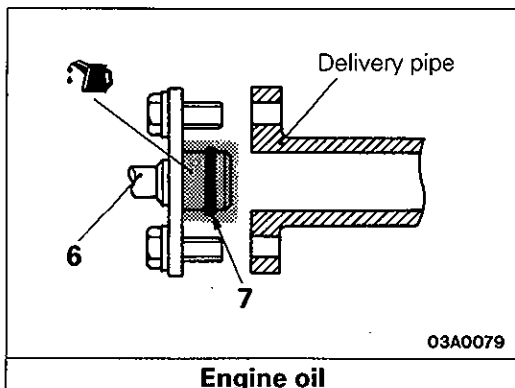
- Installation of the Air Intake Hose (Refer to GROUP 15 - Air Cleaner.)
- Supplying of the Coolant (Refer to GROUP 14 - Service Adjustment Procedures.)
- Supplying of the Engine Oil
- Accelerator Cable Adjustment (Refer to GROUP 13 - Service Adjustment Procedures.)

Removal steps

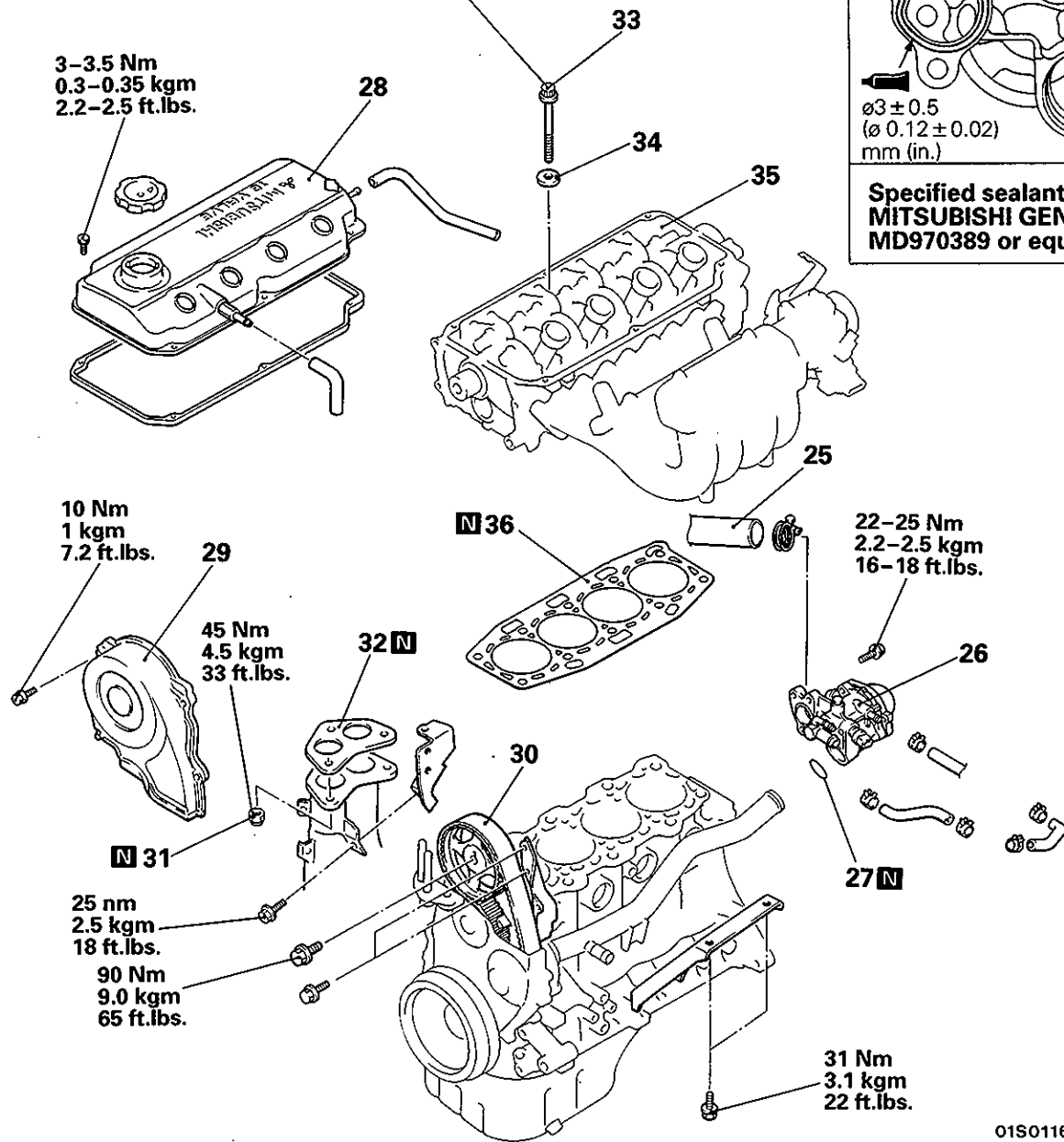
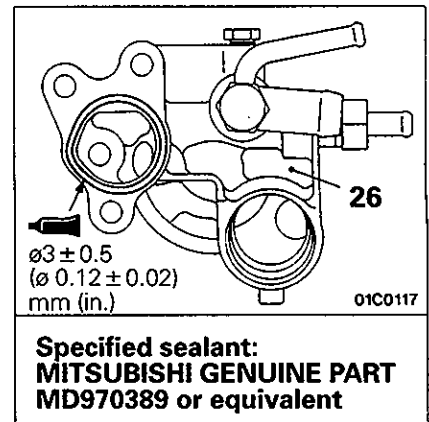
1. Breather hose connection
2. PCV hose
3. Vacuum hose connection
4. Water hose connection (Thermostat case → throttle body)
5. Water hose connection (Throttle body → water inlet fitting)
6. Fuel high pressure hose connection
7. O-ring
8. Fuel return hose connection
9. Accelerator cable connection
10. Brake booster vacuum hose connection
11. Engine coolant temperature switch connector
12. Oxygen sensor connector
13. Oil pressure switch connector
14. Water temperature gauge unit connector
15. Engine coolant temperature sensor connector
16. Engine coolant temperature switch connector <for condenser fan>
17. Distributor connector
18. Condenser connector
19. Idle speed control connector
20. TPS connector
21. Injector connector.
22. Detonation sensor connector
23. Control harness assembly
24. Spark plug cable



01S0112



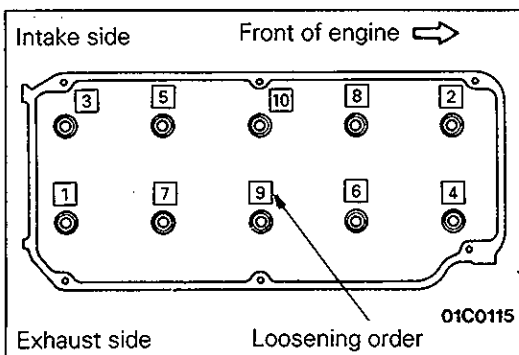
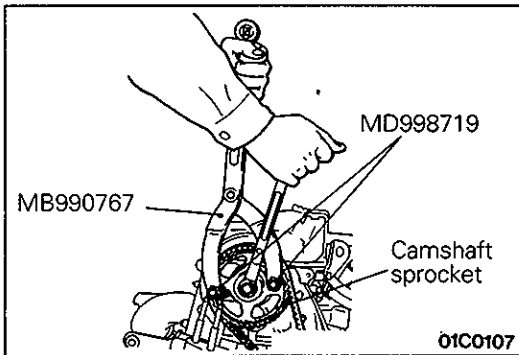
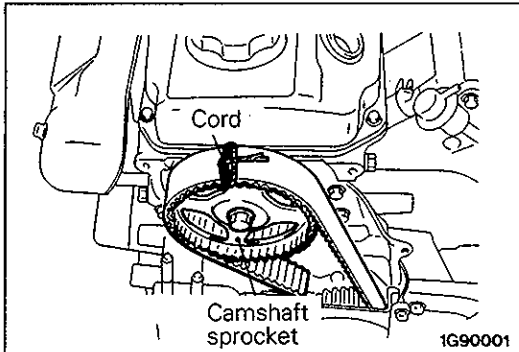
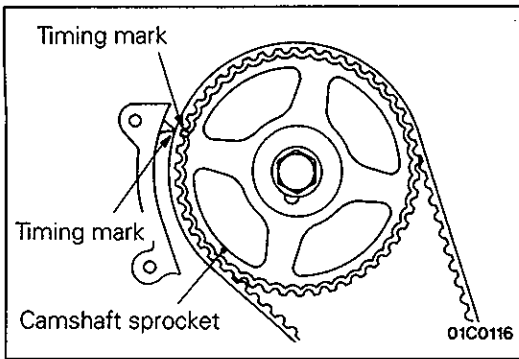
Cold Engine
 75 Nm → 0 Nm → 20 Nm → +90° → +90°
 7.5 kgm → 0 kgm → 2.0 kgm → +90° → +90°
 54 ft.lbs. → 0 ft.lbs. → 14 ft.lbs. → +90° → +90°



Removal steps

- 25. Connection for radiator upper hose
- ◀▶ 26. Water inlet fitting, thermostat and thermostat case assembly
- ▶▶ 27. O-ring
- 28. Rocker cover
- 29. Timing belt upper cover
- ◀▶ 30. Camshaft sprocket
- ▶▶ 31. Self-locking nuts
- ▶▶ 32. Gasket
- ▶▶ 33. Cylinder head bolt
- ▶▶ 34. Washer
- ◀▶ ▶▶ 35. Cylinder head assembly
- ▶▶ 36. Cylinder head gasket

01S0116



SERVICE POINTS OF REMOVAL

E11JBAZ

30. REMOVAL OF CAMSHAFT SPROCKET

- (1) Rotate the crankshaft in the forward (right) direction and align the timing mark.

Caution

The crankshaft must always be rotated in the forward direction only.

- (2) Tie the camshaft sprocket and timing belt with a cord so that the position of the camshaft sprocket will not move with respect to the timing belt.

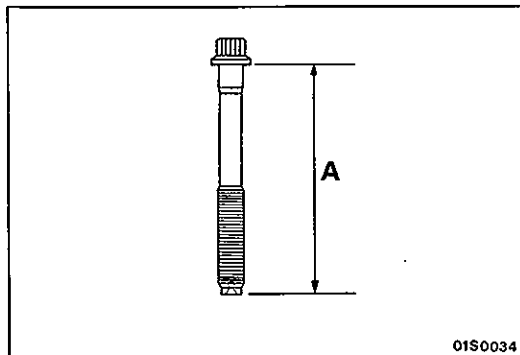
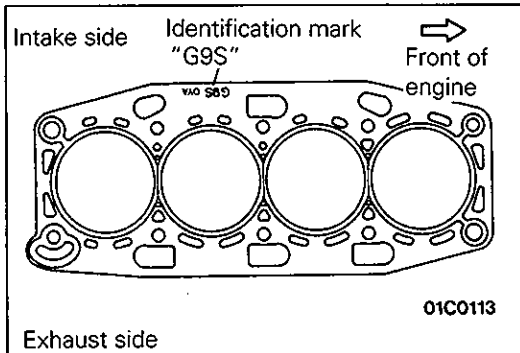
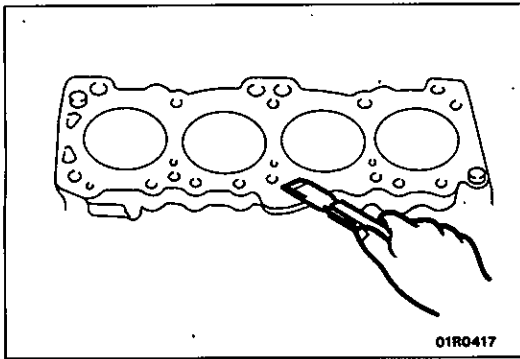
- (3) Use the special tool to remove the camshaft sprocket with the timing belt attached.

Caution

After removing the camshaft sprocket, be sure not to rotate the crankshaft.

35. REMOVAL OF CYLINDER HEAD ASSEMBLY

Loosen the bolts in 2 or 3 steps in order of the numbers shown in the illustration, and remove the cylinder head assembly.



SERVICE POINTS OF INSTALLATION

E11JDCV

36. INSTALLATION OF CYLINDER HEAD GASKET

- (1) Use a scraper or gasket remover to remove the gasket adhering to the cylinder block.

Caution

When doing this, be careful not to let any foreign substances such as gasket scraps enter the cylinder or the coolant and oil passages.

- (2) Place the cylinder head gasket on top of the cylinder block so that the identification mark is facing upwards as in the illustration.

Caution

The cylinder head gasket is easy to mis-install, so be sure to check it. If it is mis-installed, malfunctions such as no oil rising to the cylinder head will occur.

35. INSTALLATION OF CYLINDER HEAD ASSEMBLY/34. WASHER/33. CYLINDER HEAD BOLT

- (1) Use a scraper or gasket remover to remove the gasket adhering to the cylinder head assembly.

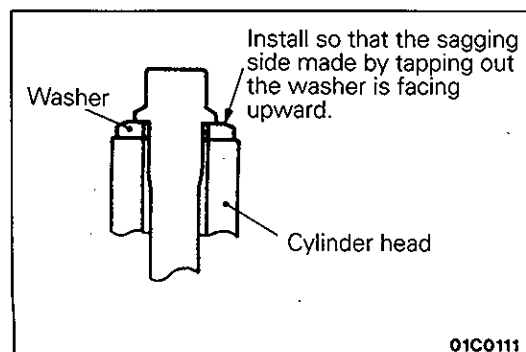
Caution

When doing this, be careful not to let any foreign substances such as gasket scraps enter the cylinder or the coolant and oil passages.

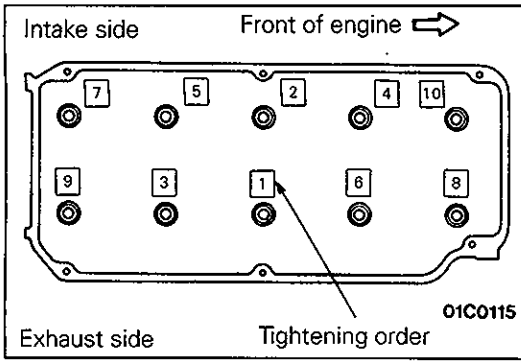
- (2) When installing the cylinder head bolts, the length below the head of the bolts should be within the standard value. If it is outside the standard value, replace the bolts.

Limit: Within 96.4 mm (3.795 in.)

- (3) Apply a small amount of engine oil to the thread section and the washer of the cylinder head bolt.

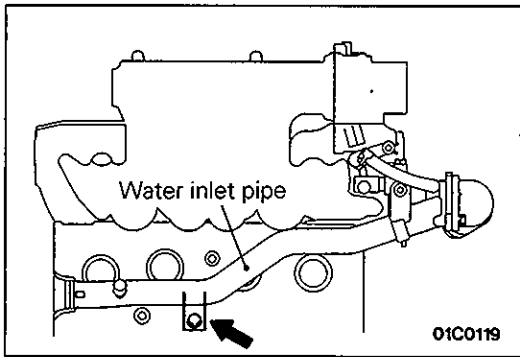


- (4) Install so that the sagging side made by tapping out the washer is facing upward.



(5) Tighten using the angular tightening method.

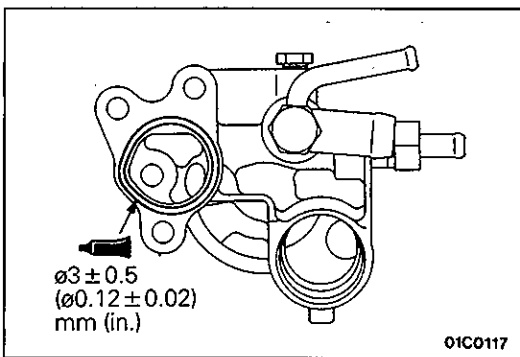
Procedure	Operation contents	Remarks
①	Tighten to 75 Nm (7.5 kgm, 54 ft.lbs.)	Carry out in the order shown in the illustration.
②	Fully loosen.	Carry out in the reverse order to that shown in the illustration.
③	Tighten to 20 Nm (2 kgm, 14 ft.lbs.)	Carry out in the order shown in the illustration.
④	Tighten by 1/4 turn (90°)	Carry out in the order shown in the illustration.
⑤	Tighten by 1/4 turn (90°)	Carry out in the order shown in the illustration.



26. INSTALLATION OF WATER INLET FITTING, THERMOSTAT AND THERMOSTAT CASE ASSEMBLY

- (1) Loosen the water inlet pipe bolt shown in the illustration.
- (2) Apply specified sealant to the thermostat case assembly as shown in the illustration.

Specified sealant: MITSUBISHI GENUINE PART MD970389 or equivalent



- (3) Apply a small amount of water to the O-ring of the water inlet pipe, and press the thermostat case assembly onto the water inlet pipe.
- (4) Install the thermostat case assembly mounting bolt.
- (5) Tighten the water inlet pipe bolt.

CYLINDER HEAD GASKET <4G93>**REMOVAL AND INSTALLATION****Pre-removal Operation**

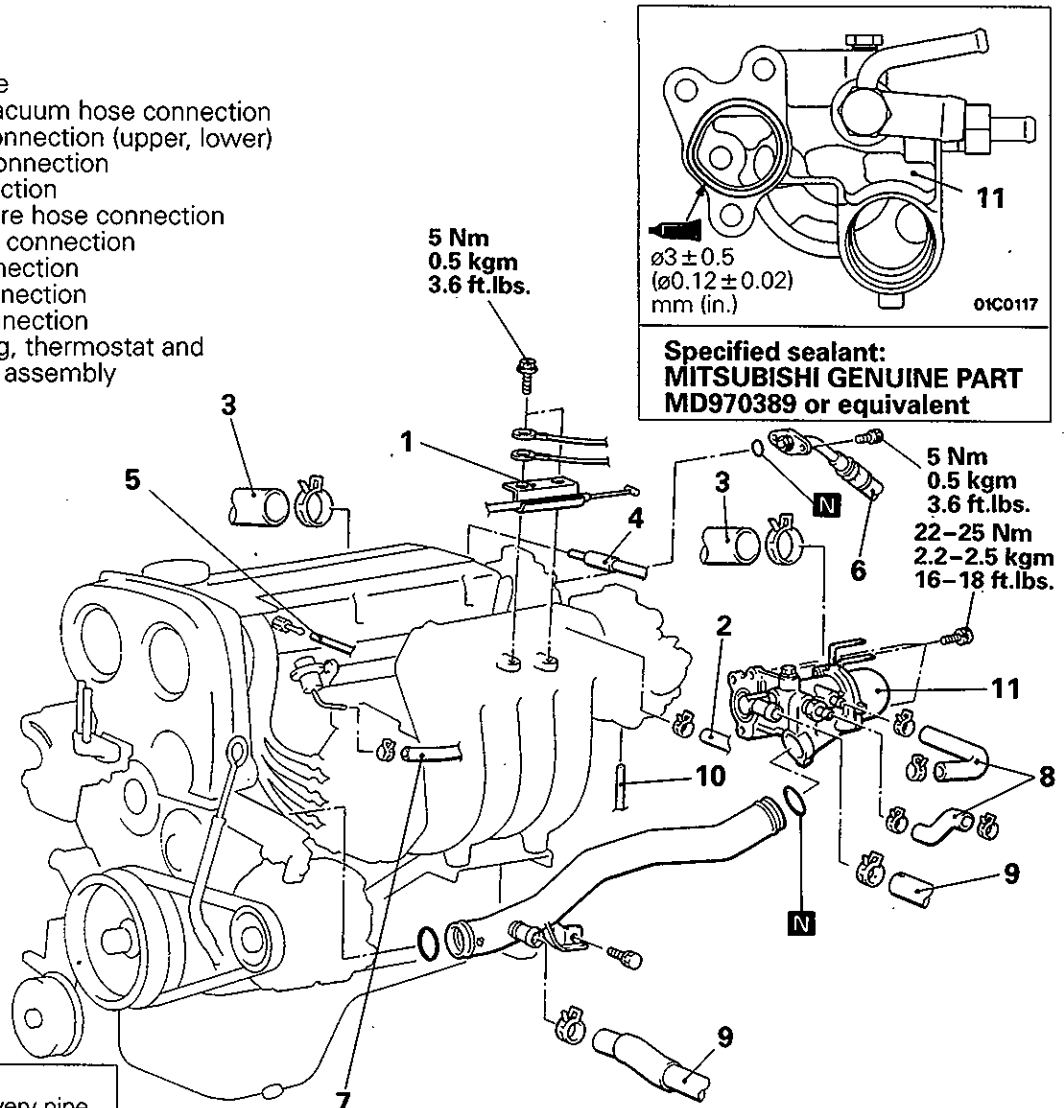
- Releasing of Fuel Line Pressure (Refer to GROUP 13 - Service adjustment Procedures.)
- Draining of the Coolant (Refer to GROUP 14 - Service Adjustment Procedures.)
- Draining of the Engine Oil
- Removal of the Air Intake Hose (Refer to GROUP 15 - Air Cleaner.)
- Removal of the Timing Belt (Refer to P.11-69.)

Post-installation Operation

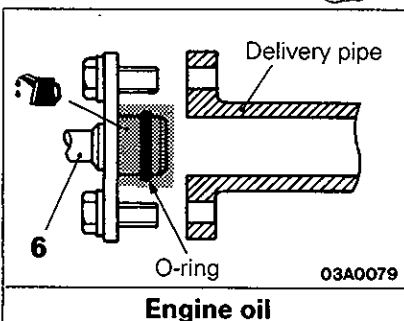
- Installation of the Timing Belt (Refer to P.11-69.)
- Installation of the Air Intake Hose (Refer to GROUP 15 - Air Cleaner.)
- Supplying of the Coolant (Refer to GROUP 14 - Service Adjustment Procedures.)
- Supplying of the Engine Oil
- Accelerator Cable Adjustment (Refer to GROUP 13 - Service Adjustment Procedures.)

Removal steps

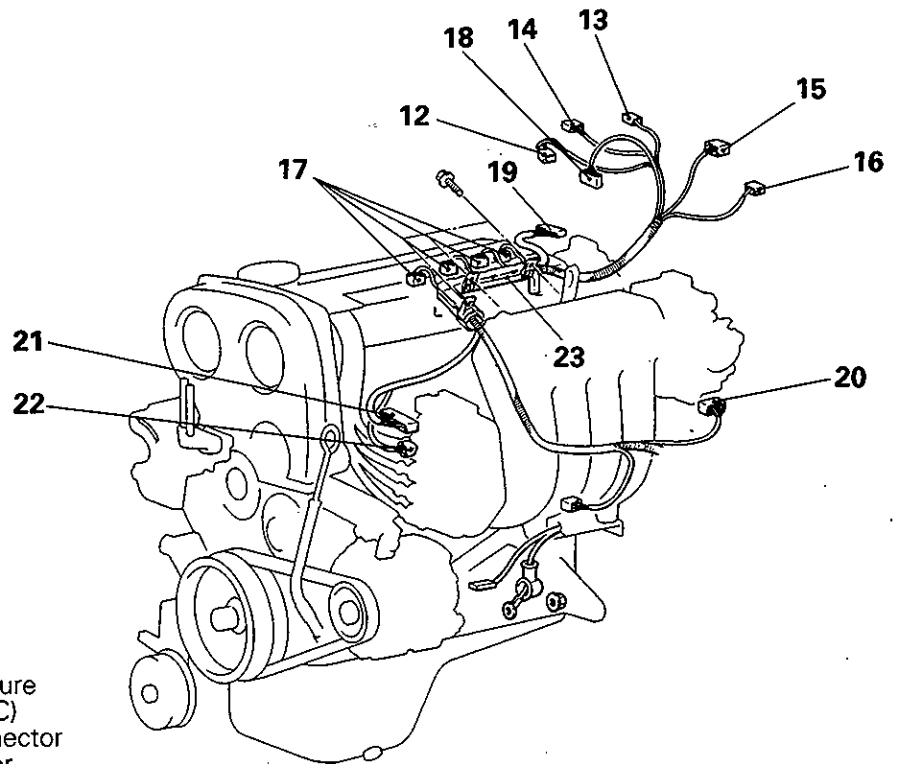
1. Accelerator cable
2. Brake booster vacuum hose connection
3. Radiator hose connection (upper, lower)
4. Breather hose connection
5. PCV hose connection
6. Fuel high pressure hose connection
7. Fuel return hose connection
8. Water hose connection
9. Heater hose connection
10. Vapour hose connection
- ▶◀ 11. Water inlet fitting, thermostat and thermostat case assembly



Specified sealant:
MITSUBISHI GENUINE PART
MD970389 or equivalent

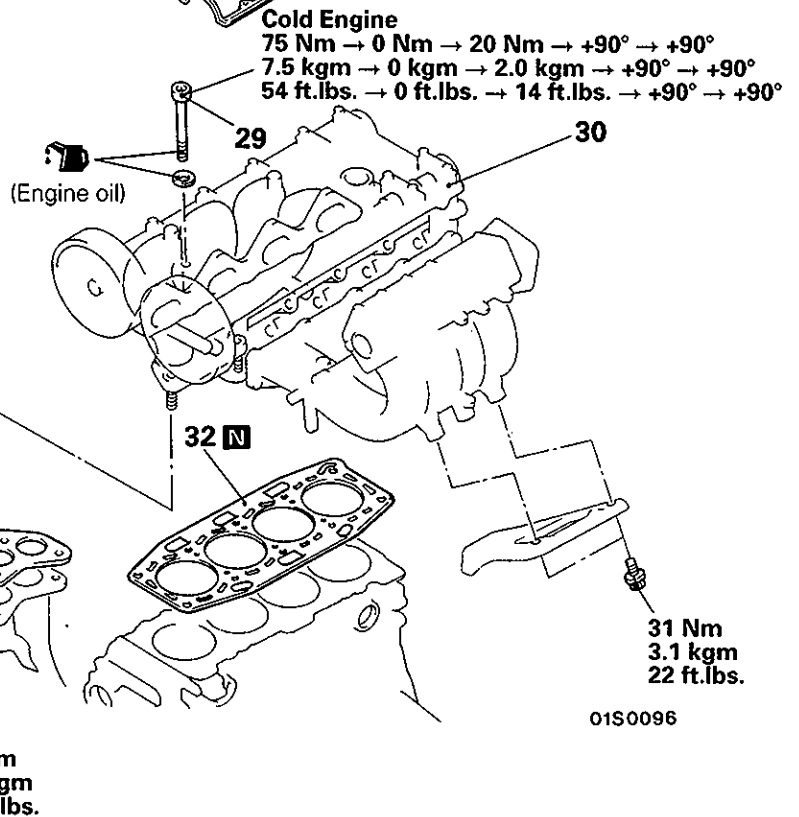
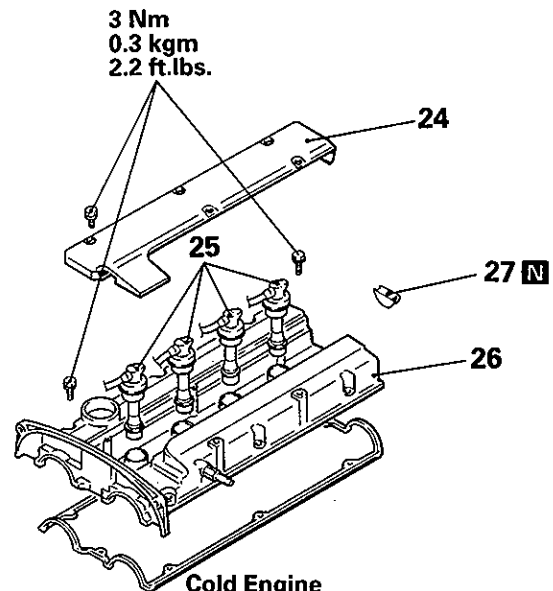
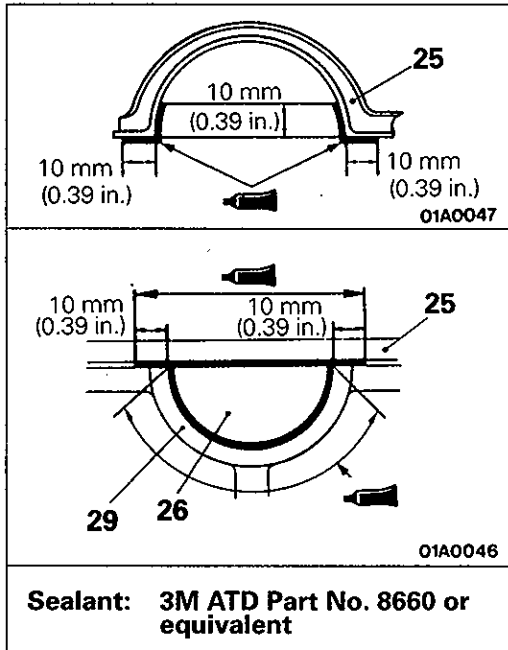


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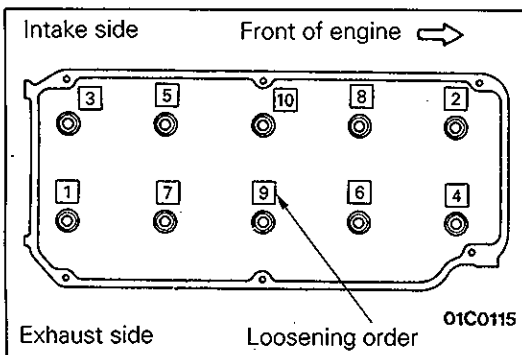


- 12. Engine coolant temperature switch connector (for A/C)
- 13. Oil pressure switch connector
- 14. Oxygen sensor connector
- 15. Engine coolant temperature switch connector
- 16. Water temperature gauge unit connector
- 17. Injector connector
- 18. Crank angle sensor connector
- 19. Throttle position sensor connector
- 20. Idle speed control connector
- 21. Power transistor connector
- 22. Ignition coil connector
- 23. Control harness

01S0090



- 24. Center cover
- 25. Spark plug cable connection
- 26. Rocker cover
- 27. Semi-circular packing
- 28. Self-locking nuts
- 29. Cylinder head bolt
- 30. Cylinder head
- 31. Gasket
- 32. Cylinder head gasket

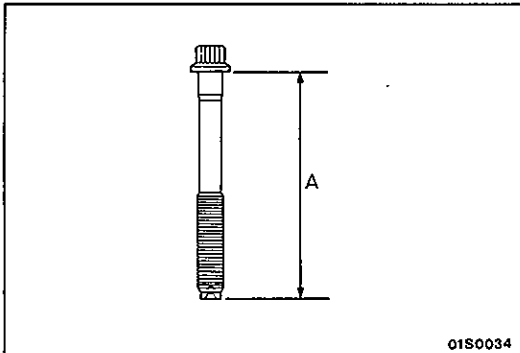
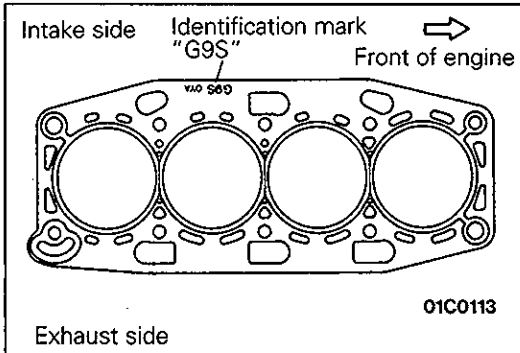
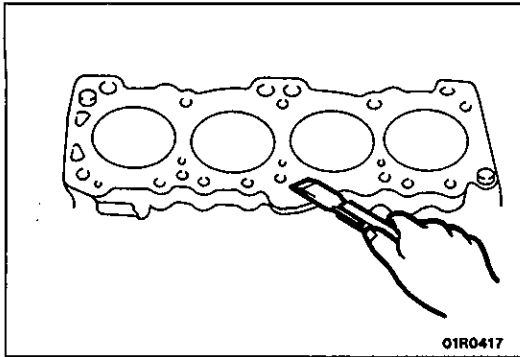


SERVICE POINTS OF REMOVAL

E11JBAZ

30. REMOVAL OF CYLINDER HEAD ASSEMBLY

Loosen the bolts in 2 or 3 steps in order of the numbers shown in the illustration, and remove the cylinder head assembly.



SERVICE POINTS OF INSTALLATION

E11JDCV

32. INSTALLATION OF CYLINDER HEAD GASKET

- (1) Use a scraper or gasket remover to remove the gasket adhering to the cylinder block.

Caution

When doing this, be careful not to let any foreign substances such as gasket scraps enter the cylinder or the coolant and oil passages.

- (2) Place the cylinder head gasket on top of the cylinder block so that the identification mark is facing upwards as in the illustration.

Caution

The cylinder head gasket is easy to mis-install, so be sure to check it. If it is mis-installed, malfunctions such as no oil rising to the cylinder head will occur.

✓ 30. INSTALLATION OF CYLINDER HEAD ASSEMBLY/29. CYLINDER HEAD BOLT

- (1) Use a scraper or gasket remover to remove the gasket adhering to the cylinder head assembly.

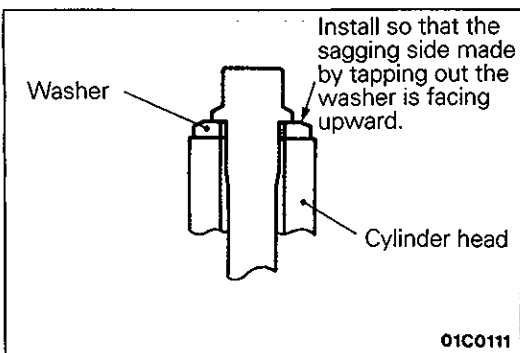
Caution

When doing this, be careful not to let any foreign substances such as gasket scraps enter the cylinder or the coolant and oil passages.

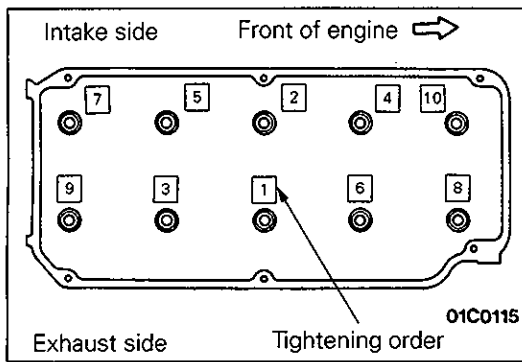
- (2) When installing the cylinder head bolts, the length below the head of the bolts should be within the standard value. If it is outside the standard value, replace the bolts.

Limit: Within 96.4 mm (3.795 in.)

- (3) Apply a small amount of engine oil to the thread section and the washer of the cylinder head bolt.

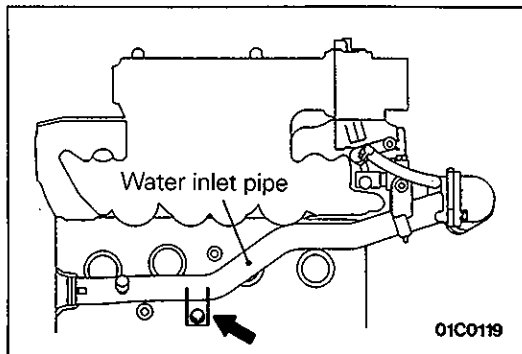


- (4) Install so that the sagging side made by tapping out the washer is facing upward.



(5) Tighten using the angular tightening method.

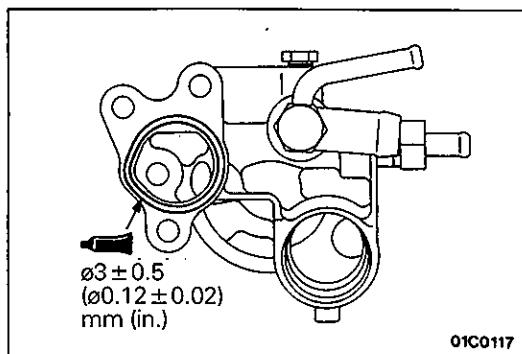
Procedure	Operation contents	Remarks
①	Tighten to 75 Nm (7.5 kgm, 54 ft.lbs.)	Carry out in the order shown in the illustration.
②	Fully loosen.	Carry out in the reverse order to that shown in the illustration.
③	Tighten to 20 Nm (2 kgm, 14 ft.lbs.)	Carry out in the order shown in the illustration.
④	Tighten by 1/4 turn (90°)	Carry out in the order shown in the illustration.
⑤	Tighten by 1/4 turn (90°)	Carry out in the order shown in the illustration.



11. INSTALLATION OF WATER INLET FITTING, THERMOSTAT AND THERMOSTAT CASE ASSEMBLY

- (1) Loosen the water inlet pipe bolt shown in the illustration.
- (2) Apply specified sealant to the thermostat case assembly as shown in the illustration.

Specified sealant: MITSUBISHI GENUINE PART MD970389 or equivalent



- (3) Apply a small amount of water to the O-ring of the water inlet pipe, and press the thermostat case assembly onto the water inlet pipe.
- (4) Install the thermostat case assembly mounting bolt.
- (5) Tighten the water inlet pipe bolt.

TIMING BELT <4G92>

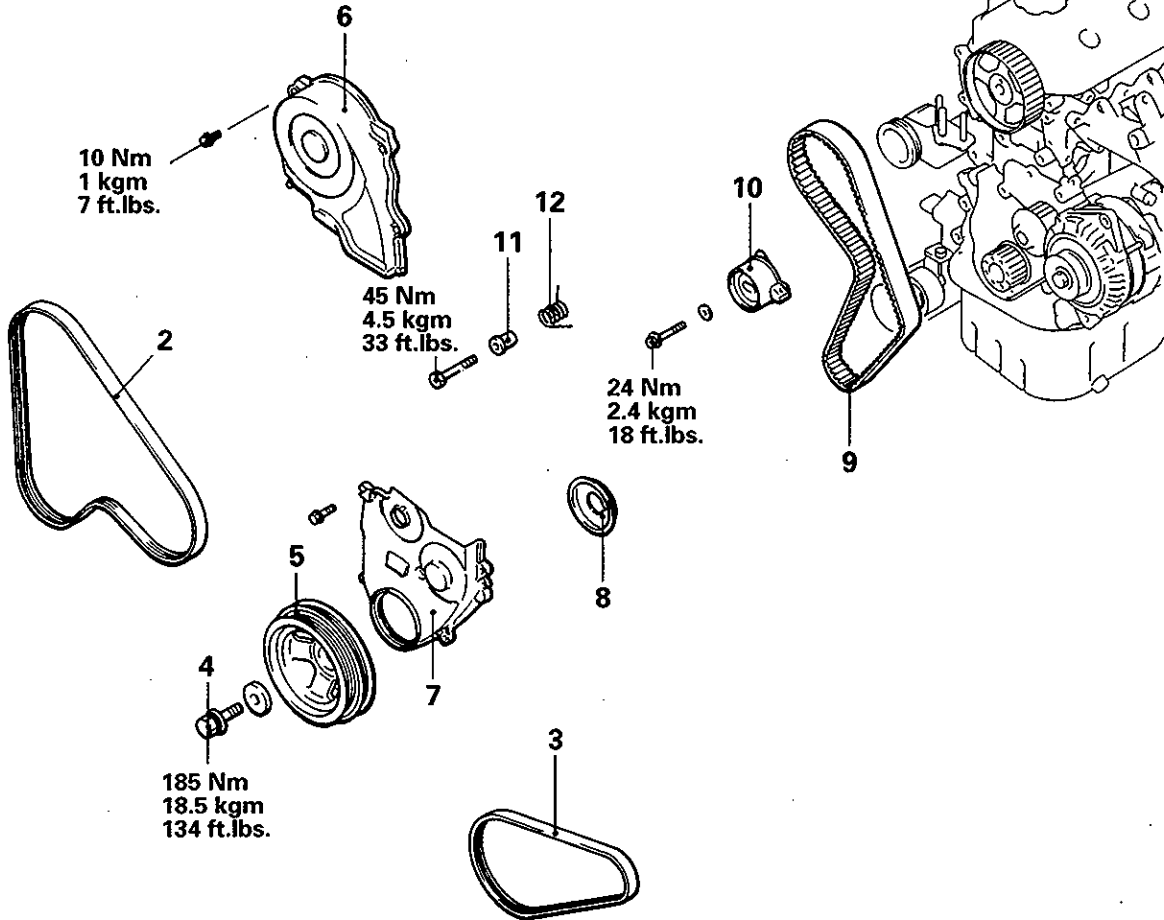
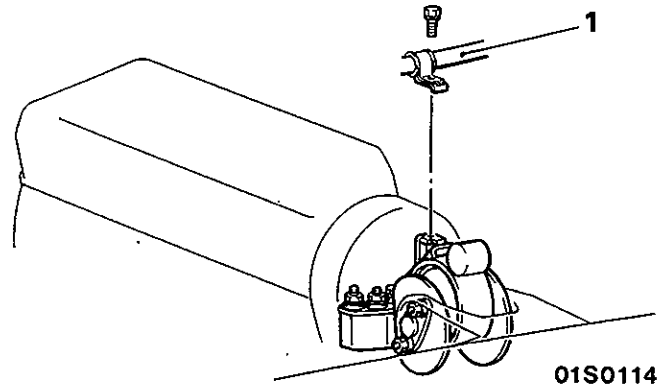
REMOVAL AND INSTALLATION

Pre-removal Operation

- Removal of the Under Cover

Post-installation Operation

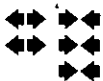
- Adjustment of Drive Belt Tension (Refer to P.11-33.)
- Installation of the Under Cover



1G90017

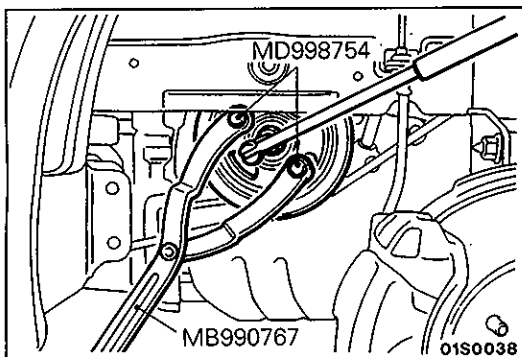
Removal steps

1. Clamp section of Air conditioner
2. Drive belt (Power steering, Air conditioner)
3. Drive belt (Alternator)
4. Crankshaft bolt
5. Crankshaft pulley
6. Timing belt upper cover



7. Timing belt lower cover
8. Flange
- Adjustment of timing belt tension
9. Timing belt
10. Timing belt tensioner
11. Tensioner spacer
12. Tensioner spring



**SERVICE POINTS OF REMOVAL**

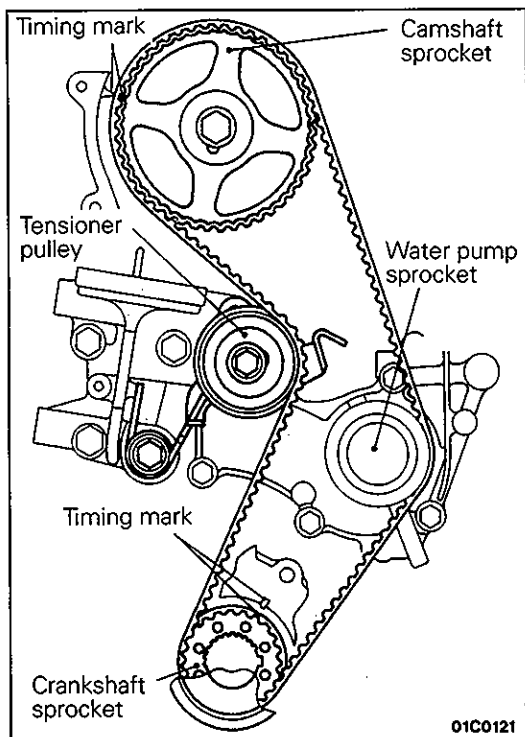
E11GBHA

4. REMOVAL OF CRANKSHAFT BOLT/5. CRANKSHAFT PULLEY

Use the special tool to stop the crankshaft pulley from turning, and remove the crankshaft bolt.

Caution

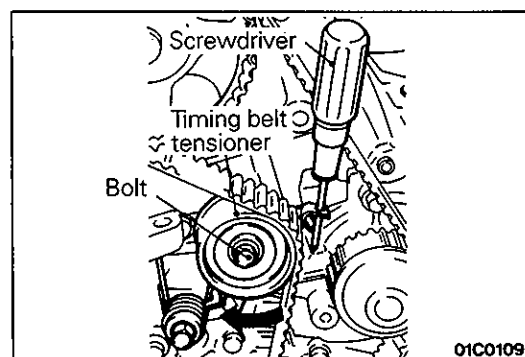
Hold the special tool securely so that it doesn't move.

**9. REMOVAL OF TIMING BELT**

- (1) Turn the crankshaft clockwise (right turn) to align each timing mark and to set the No. 1 cylinder at compression top dead centre.

Caution

The crankshaft should always be turned only clockwise.



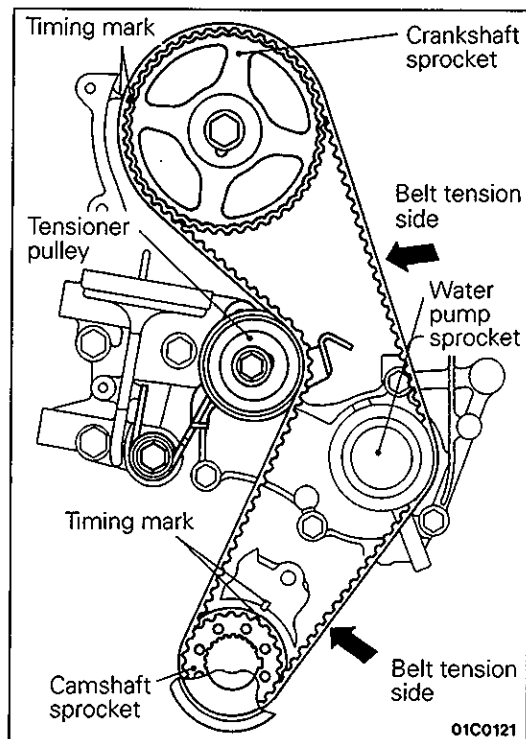
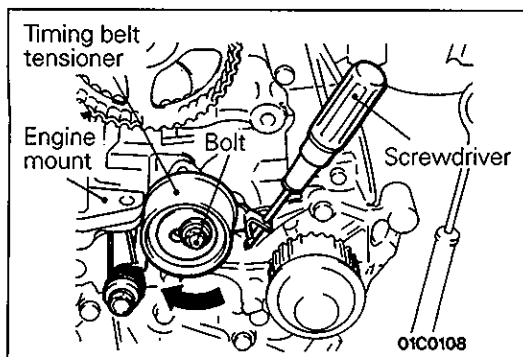
- (2) Loosen the timing belt tensioner bolt.
- (3) Set a screwdriver to the timing belt tensioner and press it fully back in the direction of the arrow.
- (4) Provisionally tighten the timing belt tensioner bolt.
- (5) Remove the timing belt.

Caution

If the timing belt is to be re-used, use chalk to mark the flat side of the belt with an arrow indicating the direction of rotation (right turn).

SERVICE POINTS OF INSTALLATION**9. INSTALLATION OF TIMING BELT**

- (1) With the timing belt tensioner bolt loosened, use a screwdriver to fully turn the timing belt tensioner as close to the engine mount as possible, and then provisionally tighten the tensioner bolt.



- (2) Align each of the camshaft sprocket and the crankshaft sprocket timing marks.
- (3) Install the timing belt in the following order, while making sure that the tension side of the belt is not slackened.

- ① Crankshaft sprocket
- ② Water pump sprocket
- ③ Camshaft sprocket
- ④ Tensioner pulley

Caution

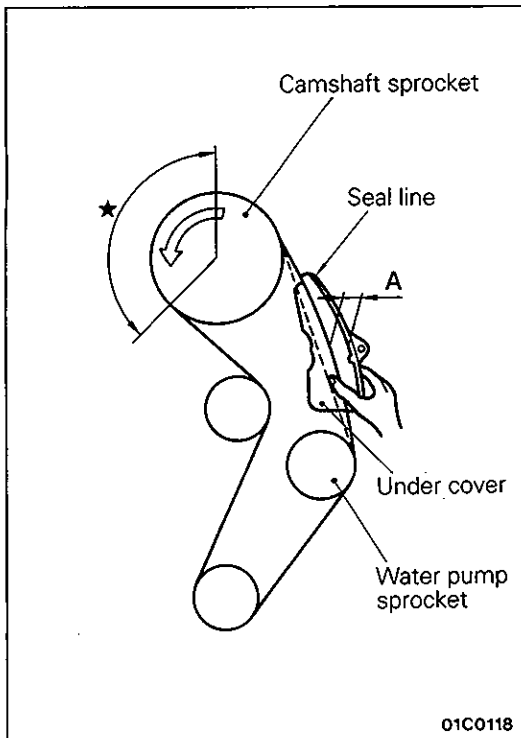
After installing the timing belt, apply force to turn the camshaft sprocket in the reverse direction, and recheck to be sure that the belt is fully tensioned and that each timing mark is in the proper position.

● ADJUSTMENT OF TIMING BELT TENSION

- (1) Initially loosen the fixing bolt of the tensioner pulley fixed to the engine mount side by 1/2-1/4 turn, and use the force of the tensioner spring to apply tension to the belt.
- (2) Turn the crankshaft in the proper rotation direction (right turn) for two rotations, and recheck to be sure that the timing marks on each sprocket are aligned.

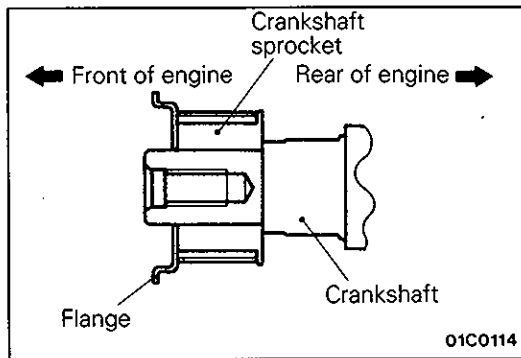
Caution

As the purpose of this procedure is to apply the proper amount of tension to the tension side of the timing belt by using the cam driving torque, turn the crankshaft only by the amount given above. Be sure not to turn the crankshaft in the opposite direction (left turn).



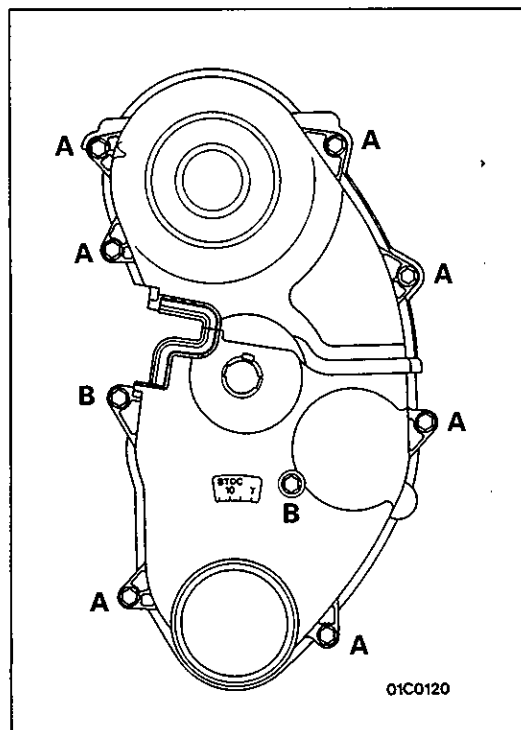
- (3) After checking to be sure that no belt teeth in the section marked with ★ are lifted up and that the teeth in each sprocket are engaged, secure the tensioner pulley.
- (4) Lastly, lightly clamp the centre of the span between the camshaft sprocket and the water pump sprocket on the belt tension side with your thumb and forefinger as shown in the illustration, and check to be sure that the clearance A between the reverse surface of the belt and the inside of the under cover seal line is at the standard value.

Standard value: Approx. 30 mm (1.18 in.)



8. INSTALLATION OF FLANGE

Install the flange as shown in the illustration.



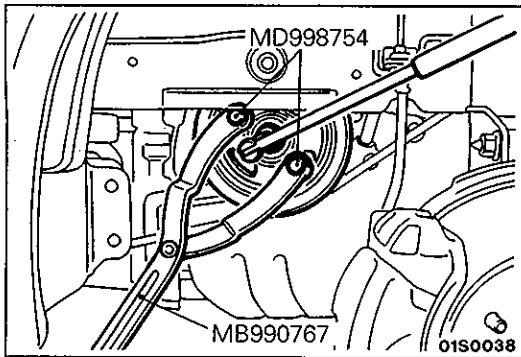
7. INSTALLATION OF TIMING BELT LOWER COVER/6. TIMING BELT UPPER COVER

Install the bolts, being careful not to mistake the bolt sizes.

A bolt: 6 × 18 (0.24 × 0.72)

B bolt: 6 × 30 (0.24 × 1.18)

[diameter × length mm (in.)]



5. INSTALLATION OF CRANKSHAFT PULLEY/4. CRANKSHAFT BOLT

- (1) Apply engine oil to the bearing surface and to the thread section of the crankshaft bolt.
- (2) Use the special tool to stop the crankshaft pulley from turning, and install the crankshaft bolt.

Caution

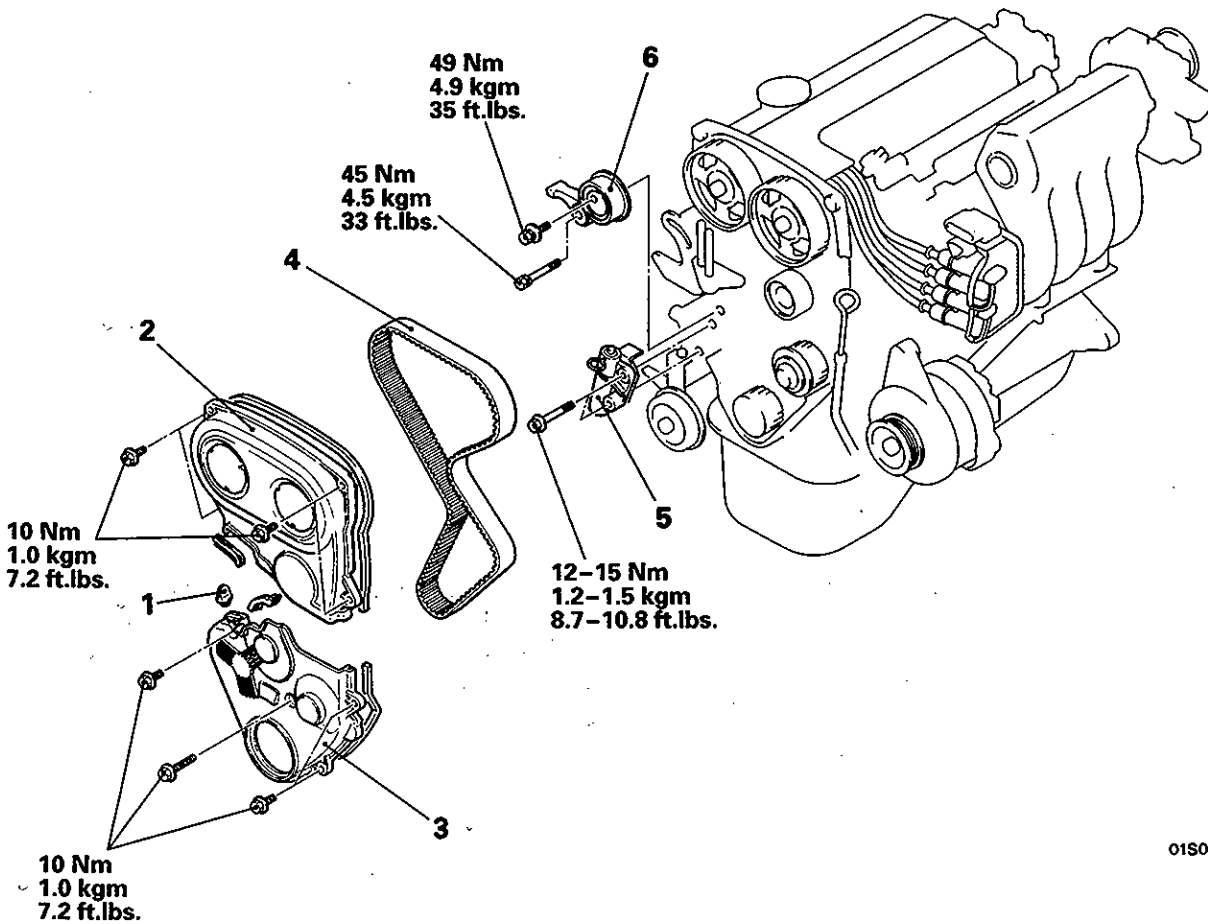
Hold the special tool securely so that it doesn't move.

TIMING BELT <4G93>

E11GA-2

REMOVAL AND INSTALLATION

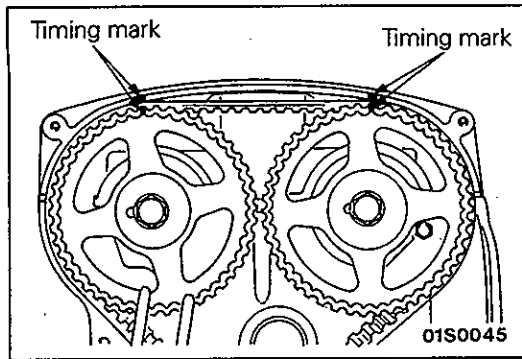
- Pre-removal and Post-installation Operation**
- Removal and Installation of Under Cover
 - Removal and Installation of Crankshaft Pulley (Refer to P.11-42.)



01S0089

Removal steps

- ◆◆◆ 1. Rubber plug
- ◆◆◆ 2. Timing belt upper cover
- ◆◆◆ 3. Timing belt lower cover
- Adjustment of timing belt tension
- ◆◆◆◆ 4. Timing belt
- ◆◆◆ 5. Auto tensioner
- ◆◆◆ 6. Tension pulley and arm assembly



SERVICE POINTS OF REMOVAL

E11GBGD

4. REMOVAL OF TIMING BELT

- (1) Turn the crankshaft clockwise to align each timing mark.

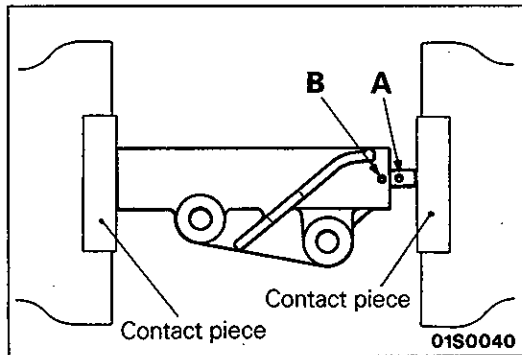
Caution

The crankshaft must always be turned clockwise.

- (2) Loosen the tensioner pulley center bolt and remove the timing belt.

Caution

If the timing belt is to be re-used, use chalk to mark (on its flat side) an arrow indicating the clockwise direction.



SERVICE POINTS OF INSTALLATION

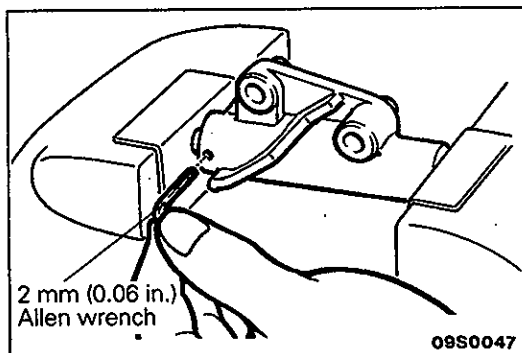
E11GDGE

5. INSTALLATION OF AUTO TENSIONER

- (1) Using a press or vise, compress the push rod of the auto tensioner as slowly as possible and align pin hole A of the push rod and pin hole B of the tensioner cylinder.

Caution

- (1) **The auto tensioner must be placed at a right angle to the pressing surface of the press or vise.**
- (2) **If the compression speed is too fast, the push rod may become bent, so carry out this operation slowly.**



- (2) Insert a 2.0 mm (0.06 in.) Allen wrench into the aligned pin holes.

NOTE

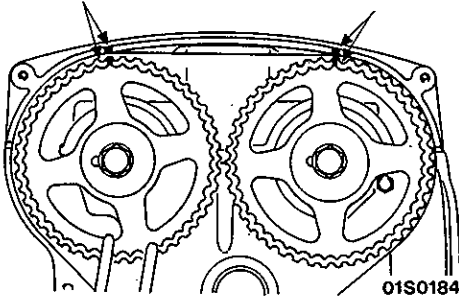
If the auto tensioner has been replaced, the pins are set in the auto tensioner.

- (3) Install the tensioner to engine.

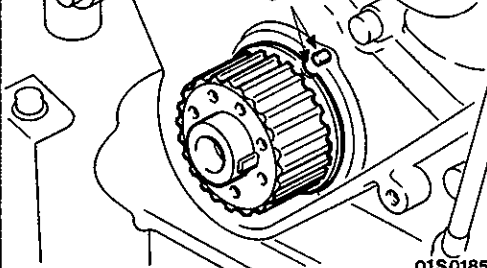
Camshaft sprocket

Timing mark

Timing mark

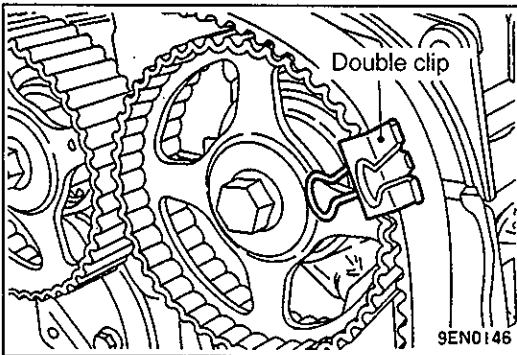
**Crankshaft sprocket**

Timing mark

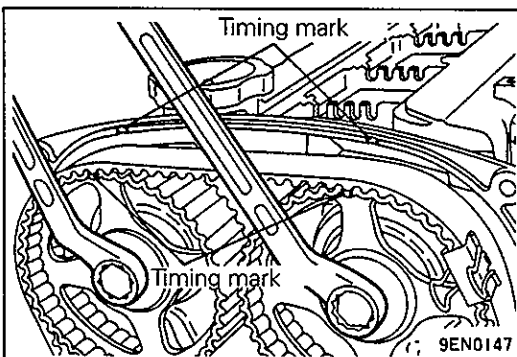
**4. INSTALLATION OF TIMING BELT**

- (1) Align the timing marks of each camshaft sprocket and the crankshaft sprocket.
- (2) Loosen the tensioner pulley center bolt.
- (3) Move the crankshaft sprocket half a tooth width in the anti-clockwise direction.

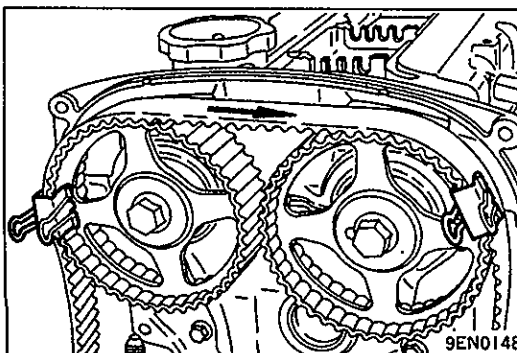
- (4) Place the timing belt on the intake-side camshaft sprocket, and hold it in the position shown in the illustration with a double clip.

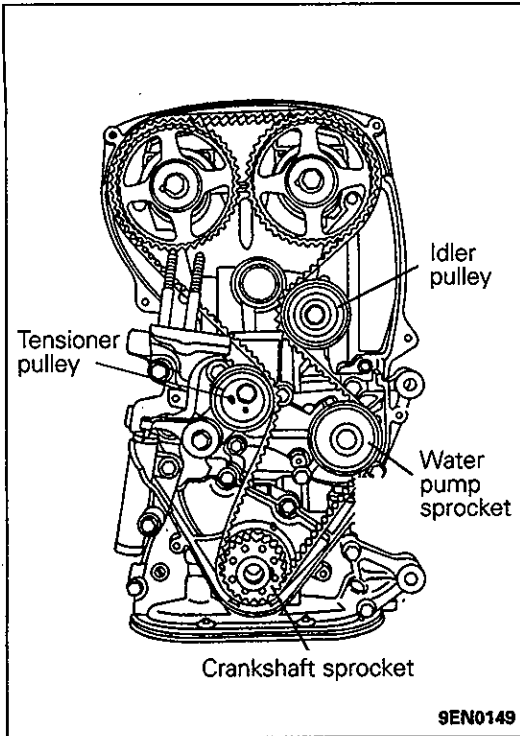


- (5) Place the timing belt on the exhaust-side sprocket while using two wrenches to align the timing marks.

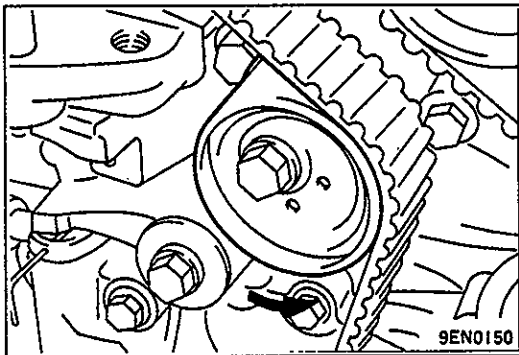


- (6) Hold the belt in the position shown in the illustration with another double clip.



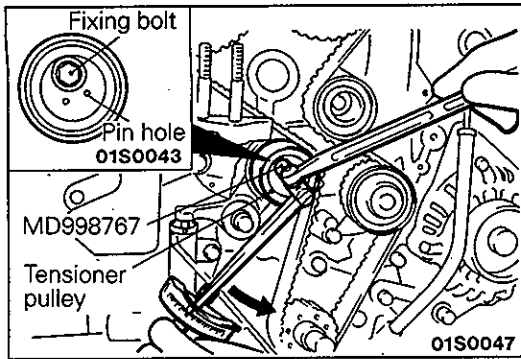


- (7) Place the belt onto the idler pulley, water pump sprocket, crankshaft sprocket and tensioner pulley in that order.
- (8) Remove the two double clips.



- (9) Lift the tensioner pulley in the direction of the arrow and tighten the tensioner pulley bolt.
- (10) Check to be sure that all timing marks are aligned.
- (11) Adjust the timing belt tension.

NOTES



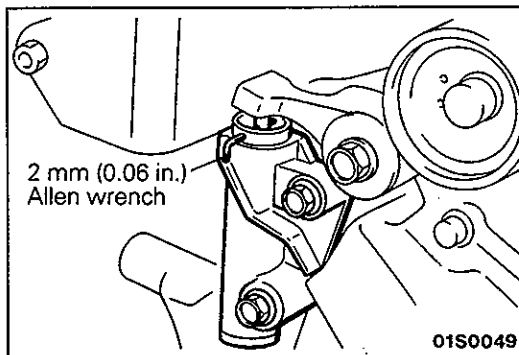
● ADJUSTMENT OF TIMING BELT TENSION

- (1) After turning the crankshaft a 1/4 turn anti-clockwise, turn it clockwise to the position where the timing marks are aligned.
- (2) Loosen the fixing bolt of the tensioner pulley and using the special tool and a torque wrench, apply tension to the timing belt; then tighten the fixing bolt at the specified torque.

Standard value: 0.26 kgm (timing belt tension torque)

Caution

When tightening the fixing bolt, ensure that the tensioner pulley shaft doesn't rotate with the bolt.



- (3) Take out the 2mm (0.06 in) Allen wrench from the auto tensioner. At this time, check to be sure that the 2mm (0.06 in) Allen wrench can be pulled out easily. Turn the crankshaft clockwise 2 turns, and after leaving it in this position for 5 minutes or more, check again to be sure that the auto tensioner 2mm (0.06 in) Allen wrench can be pulled out or inserted easily.

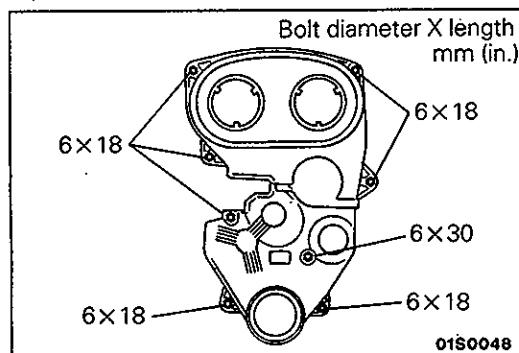
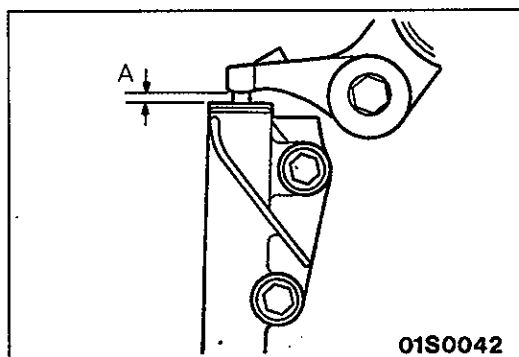
NOTE

Even if the 2mm (0.06 in) Allen wrench cannot be easily inserted, then it is satisfactory if the amount of protrusion of the auto tensioner rod is within the standard value.

Standard value: 3.8–4.5 mm (0.15–0.17 in)

If it is outside the standard value, repeat the operations in steps (1) to (4).

- (4) Check to be sure that the timing marks on all sprockets are aligned

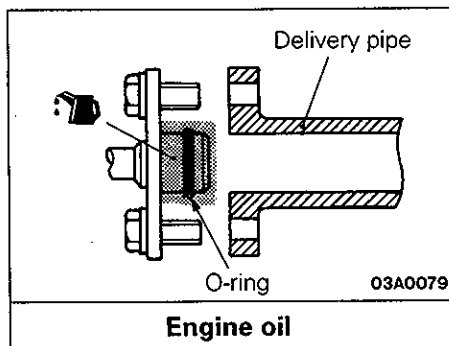
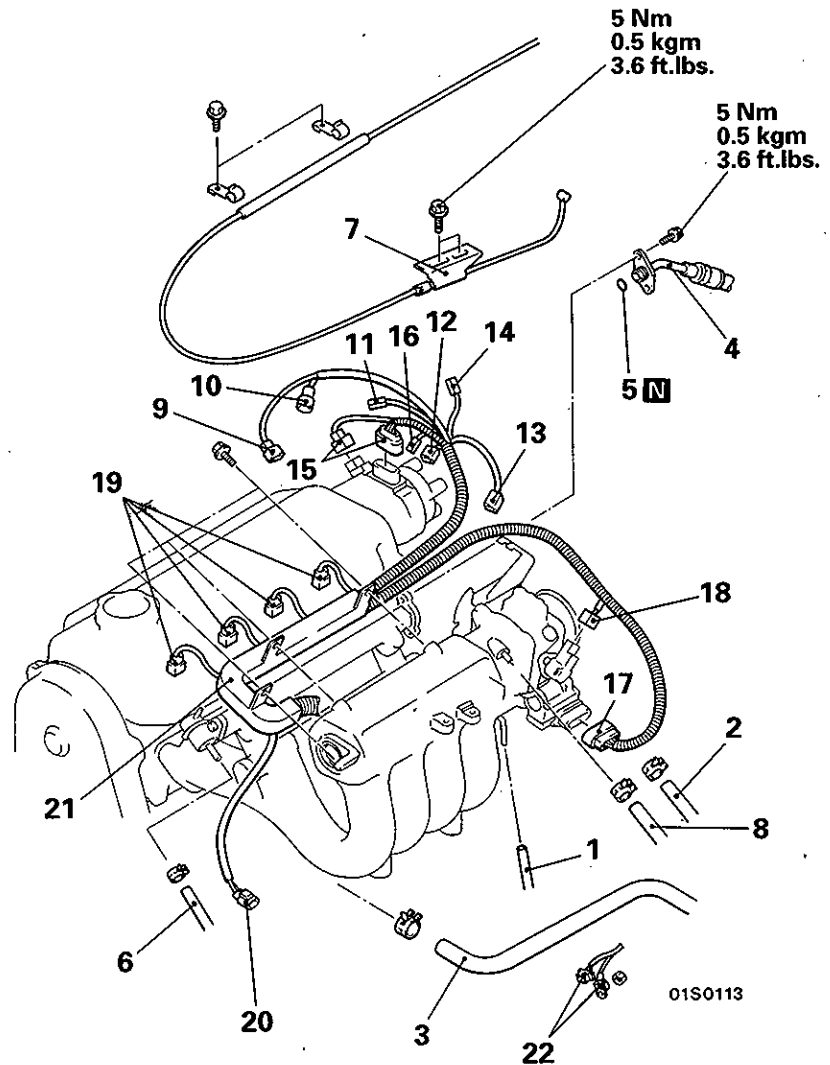


3. INSTALLATION OF TIMING BELT LOWER COVER/2. TIMING BELT UPPER COVER

The dimensions of the installation bolts for the timing belt covers differ according to the installation location, so be sure not to install the bolts in the incorrect locations.

ENGINE ASSEMBLY <4G92>**REMOVAL AND INSTALLATION****Pre-removal Operation**

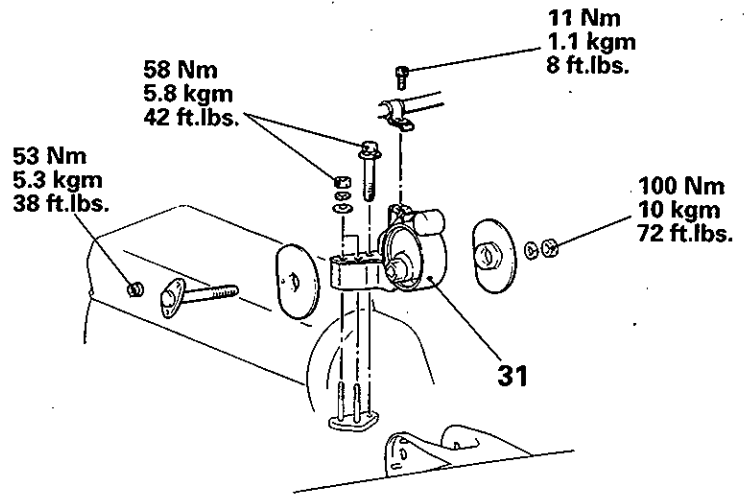
- Releasing of Fuel Line Pressure (Refer to GROUP 13 – Service Adjustment Procedures.)
- Removal of the Hood
- Draining of the Coolant (Refer to GROUP 14 – Service Adjustment Procedures.)
- Removal of the Transmission Assembly (Refer to GROUP 22, 23 – Transmission Assembly.)
- Removal of the Radiator (Refer to GROUP 14 – Radiator.)

**Removal steps**

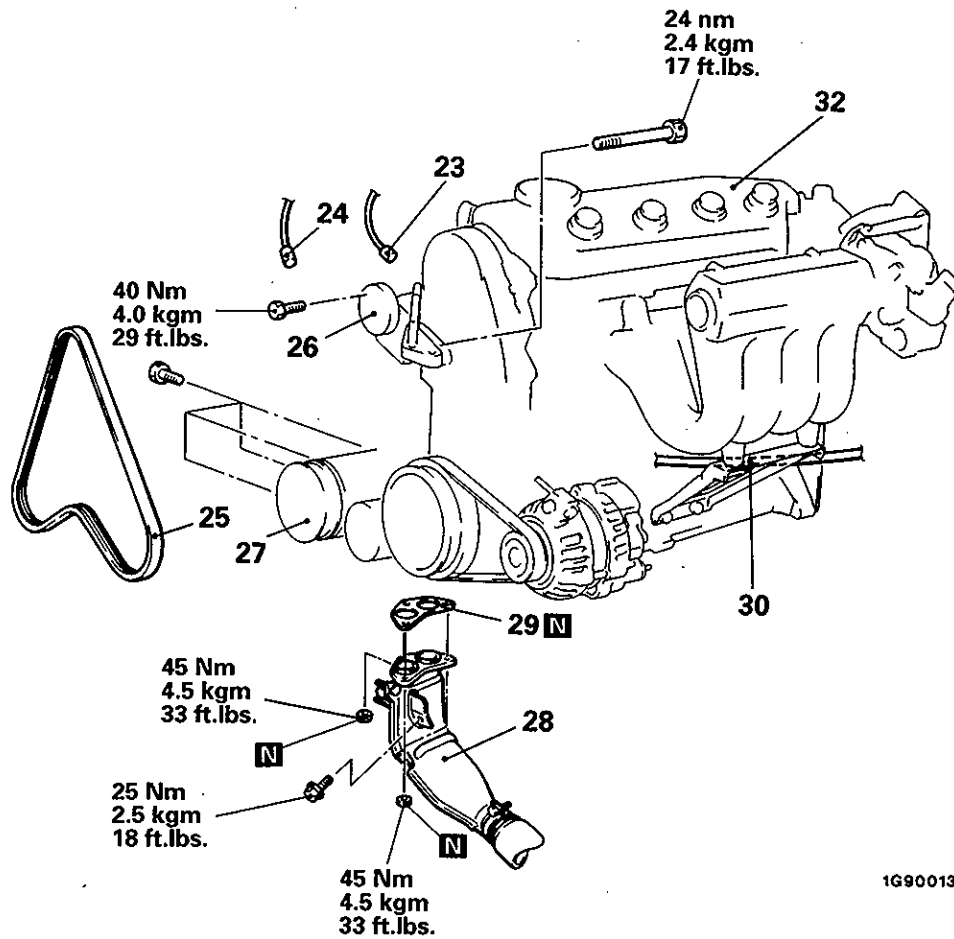
1. Vacuum hose connection
2. Heater hose connection (Thermostat housing → heater unit)
3. Heater hose connection (Heater unit → Water inlet pipe)
4. Fuel high pressure hose connection
5. O-ring
6. Fuel return hose connection
7. Accelerator cable connection
8. Brake booster vacuum hose connection
9. Engine coolant temperature switch connector
10. Oxygen sensor connector
11. Oil pressure switch connector
12. Water temperature gauge unit connector
13. Engine coolant temperature sensor connector
14. Engine coolant temperature switch connector (for condenser fan)
15. Distributor connector
16. Condenser connector
17. Idle speed control connector
18. TPS connector
19. Injector connector
20. Detonation sensor connector
21. Control harness assembly
22. Alternator harness connection

Post-installation Operation

- Installation of the Radiator (Refer to GROUP 14 - Radiator.)
- Installation of the Transmission Assembly (Refer to GROUP 22, 23 - Transmission Assembly.)
- Supplying of the Coolant (Refer to GROUP 14 - Service Adjustment Procedures.)
- Installation of the Hood
- Accelerator Cable Adjustment (Refer to GROUP 13 - Service Adjustment Procedures.)
- V-ribbed Belt Tension Adjustment of Power Steering Oil Pump and Air Conditioner Compressor (Refer to P.11-35.)



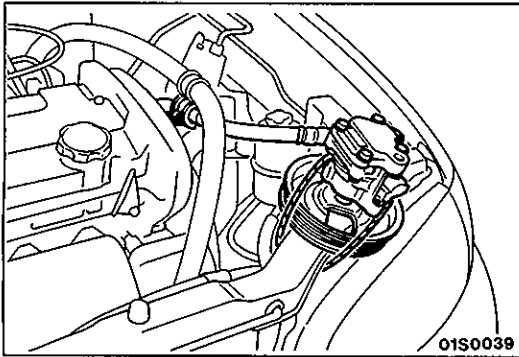
01S0200



1G90013

Removal steps

- 23. Power steering oil pressure switch connector
- 24. Air conditioner compressor connector
- 25. V-ribbed belt
- ↔ 26. Power steering oil pump connection
- ↔ 27. Air conditioner compressor connection
- 28. Front exhaust pipe connection
- 29. Gasket
- 30. Starter and alternator harness clamp
- ↔↔↔↔ 31. Engine mount bracket
- ↔↔↔↔ 32. Engine assembly

**SERVICE POINTS OF REMOVAL**

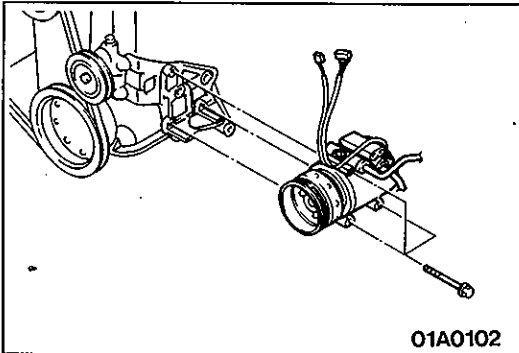
E11TBAN

26. REMOVAL OF POWER STEERING OIL PUMP

Remove the power steering oil pump from the bracket with the hose attached.

NOTE

Place the removed power steering oil pump in a place where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

**27. REMOVAL OF AIR CONDITIONER COMPRESSOR <VEHICLES WITH AIR CONDITIONER>**

Disconnect the air conditioner compressor connector and remove the compressor from the compressor bracket with the hose still attached.

NOTE

Place the removed air conditioner compressor in a place where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

31. REMOVAL OF ENGINE MOUNT BRACKET

- (1) Support the engine with a garage jack.
- (2) Hold the engine assembly with a chain block, etc.
- (3) Place the garage jack against the engine oil pan with a piece of wood in between, and after raising the engine until there is no weight on the engine mount brackets, remove the engine mount brackets.

32. REMOVAL OF ENGINE ASSEMBLY

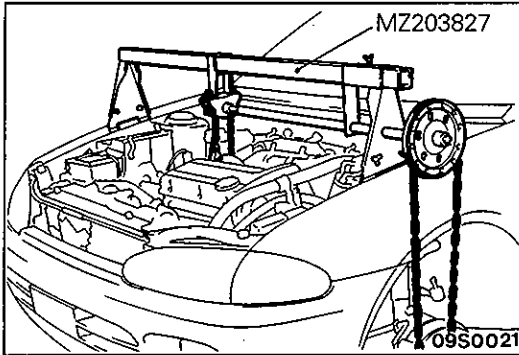
After checking that all cables, hoses and harness connectors, etc., are disconnected from the engine; lift the chain block slowly to remove the engine assembly upward from the engine compartment.

SERVICE POINTS OF INSTALLATION

E11TDAQ

32. INSTALLATION OF ENGINE ASSEMBLY

Install the engine assembly while checking to be sure that the cables, hoses, and harness connectors are not clamped.

**31. INSTALLATION OF ENGINE MOUNT BRACKET**

- (1) Place a garage jack against the engine oil pan with a piece of wood in between, and install the engine mount bracket while adjusting the position of the engine.
- (2) Support the engine with a garage jack.
- (3) Remove the chain block and support the engine assembly with the special tool.

ENGINE ASSEMBLY <4G93>

E11TA-2

REMOVAL AND INSTALLATION

Pre-removal Operation

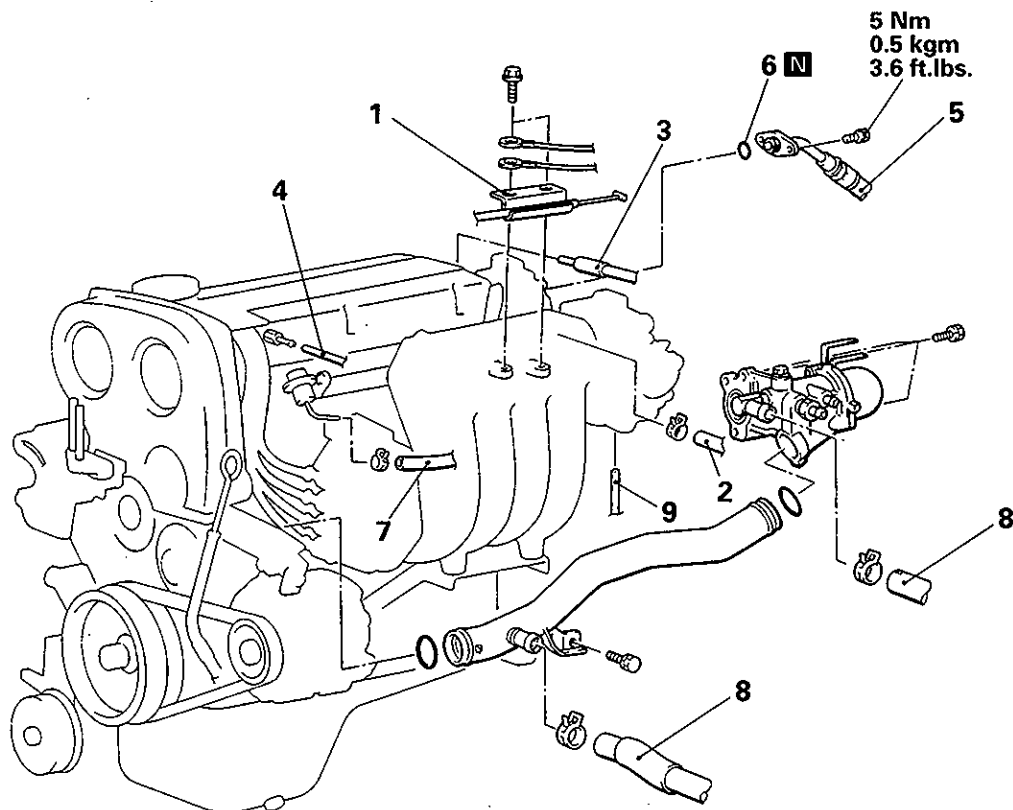
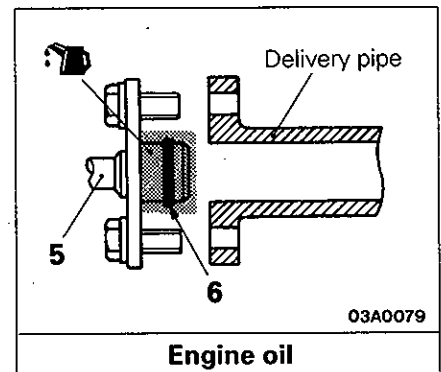
- Releasing of Fuel Line Pressure (Refer to GROUP 13 – Service Adjustment Procedures.)
- Removal of the Hood
- Draining of the Coolant (Refer to GROUP 14 – Service Adjustment Procedures.)
- Removal of the Transmission Assembly (Refer to GROUP 22, 23 – Transmission Assembly.)
- Removal of the Radiator (Refer to GROUP 14 – Radiator.)

Post-installation Operation

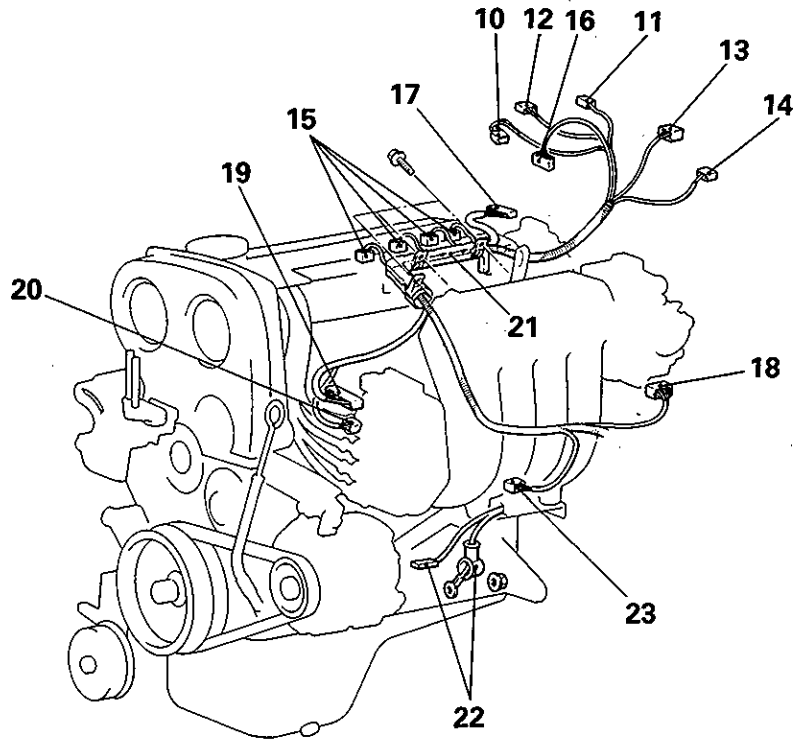
- Installation of the Radiator (Refer to GROUP 14 – Radiator.)
- Installation of the Transmission Assembly (Refer to GROUP 22, 23 – Transmission Assembly.)
- Supplying of the Coolant (Refer to GROUP 14 – Service Adjustment Procedures.)
- Installation of the Hood
- Accelerator Cable Adjustment (Refer to GROUP 13 – Service Adjustment Procedures.)
- V-ribbed Belt Tension Adjustment of Power Steering Oil Pump and Air Conditioner Compressor (Refer to P.11-35.)

Removal steps

1. Accelerator cable connection
2. Brake booster vacuum hose connection
3. Breather hose connection
4. Positive crankcase ventilation hose connection
5. High-pressure hose connection
6. O-ring
7. Return hose connection
8. Heater hose connection
9. Vapour hose connection

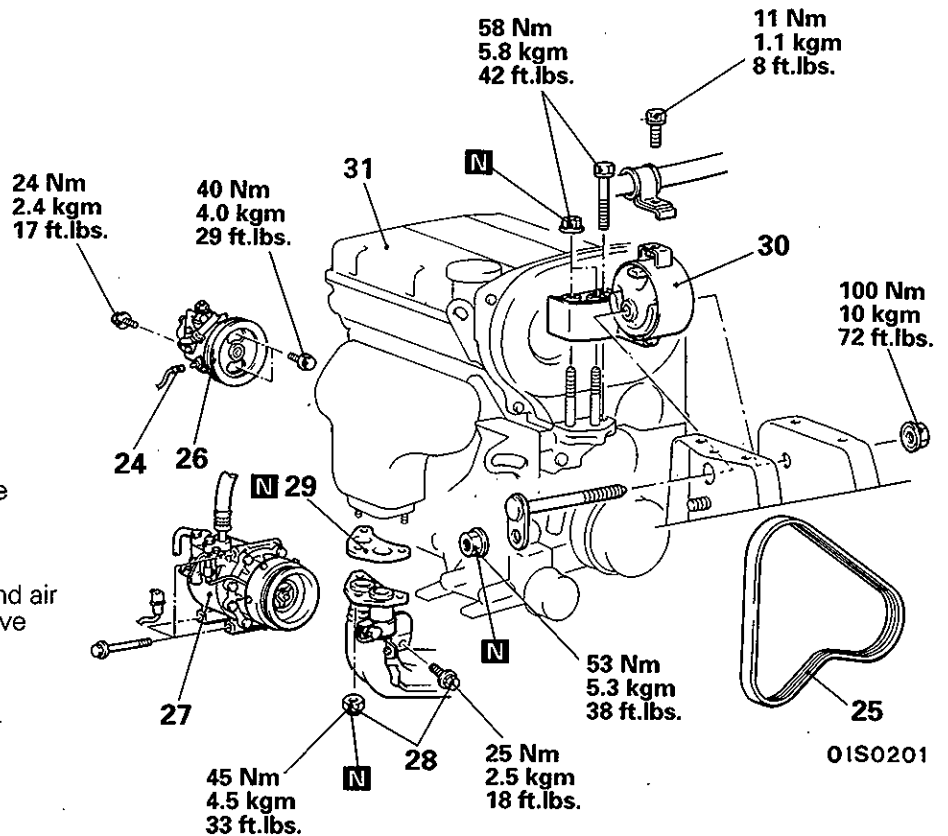


01S0080



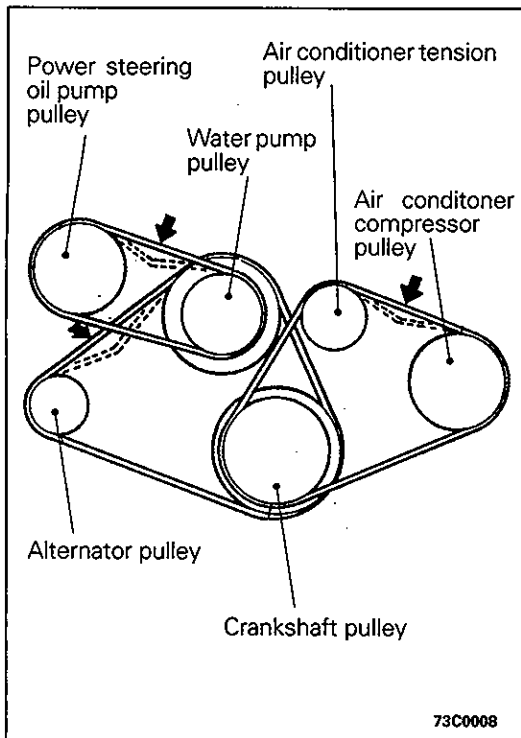
- 10. Engine coolant temperature switch connector (for A/C)
- 11. Oil pressure switch connector
- 12. Oxygen sensor connector
- 13. Engine coolant temperature switch connector
- 14. Water temperature gauge unit connector
- 15. Injector connector
- 16. Crank angle sensor connector
- 17. Throttle position sensor connector
- 18. Idle speed control connector
- 19. Power transistor connector
- 20. Ignition coil connector
- 21. Control harness
- 22. Alternator connector
- 23. Detonation sensor connector

01S0090



- 24. Power steering oil pressure switch connector
 - Adjustment of drive belts (Refer to P.11-8.)
- 25. Power steering oil pump and air conditioner compressor drive belt
- 26. Power steering oil pump (Refer to P.11-75.)
- 27. Air conditioner compressor (Refer to P.11-75.)
- 28. Self-locking nuts and bolts
- 29. Gasket
- 30. Engine mount bracket (Refer to P.11-75, 76.)
- 31. Engine assembly (Refer to P.11-75, 76.)

01S0201



ENGINE <4D68>

SERVICE ADJUSTMENT PROCEDURES

DRIVE BELT TENSION INSPECTION AND ADJUSTMENT

E11F0BQ

DRIVE BELT TENSION INSPECTION

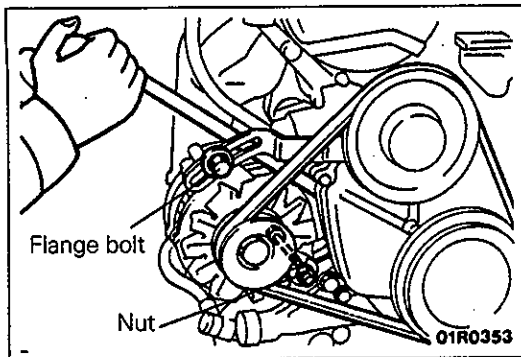
Check the tension by pulling or pushing at the centre of the belt between pulleys with a force of 98 N (10 kg, 22 lbs.) as shown in the figure.

Measure drive belt deflection amount.

Standard value:

mm (in.)

Items	During inspection	When retightening used belt	When fitting new belt
Alternator drive belt	7.0 – 10.0 (0.28 – 0.39)	8.0 – 9.0 (0.31 – 0.35)	6.0 – 7.0 (0.24 – 0.28)
Power steering oil pump drive belt	5.5 – 8.0 (0.22 – 0.31)	6.0 – 7.0 (0.24 – 0.28)	4.5 – 5.5 (0.18 – 0.22)
Air conditioner compressor drive belt	7.0 – 8.0 (0.28 – 0.31)	7.0 – 8.0 (0.28 – 0.31)	5.0 – 6.0 (0.20 – 0.24)



DRIVE BELT TENSION ADJUSTMENT

ALTERNATOR DRIVE BELT

- (1) Loosen the flange bolt and nut that are securing the alternator.
- (2) Apply a bar to the stator section of the alternator and lever it to adjust the belt deflection amount so that it is at the standard value.
- (3) Tighten the flange bolt and nut that were previously loosened to the specified torque.

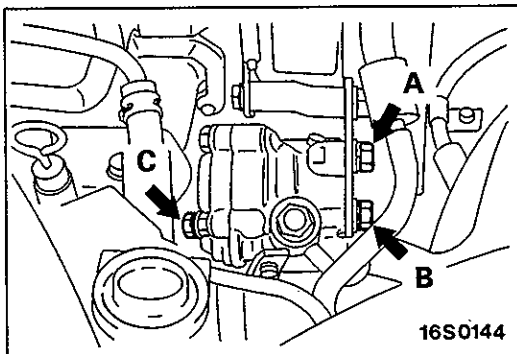
Tightening torque

Flange bolt:	12 – 15 Nm
	1.2 – 1.5 kgm
	10 – 11 ft.lbs.
Nut:	20 – 25 Nm
	2.0 – 2.5 kgm
	14 – 18 ft.lbs.

- (4) Turn the crankshaft one full rotation or more in the forward direction (rotation to the right) to turn over the engine, and then recheck the belt deflection amount and readjust if necessary.

NOTE

The crankshaft should always be turned in the forward direction of rotation.

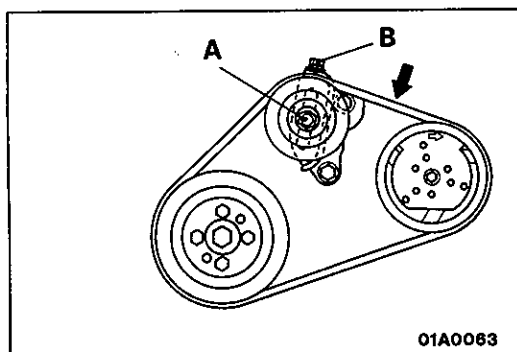


POWER STEERING OIL PUMP DRIVE BELT

- (1) Loosen power steering oil pump fixing bolt.
- (2) Move power steering oil pump, tension belt moderately and adjust tension.
- (3) Tighten the fixing bolts in the order A, B and C.

Tightening torque: 39 Nm (4.0 kgm, 29 ft.lbs.)

- (4) Check belt tension after driving.



AIR CONDITIONER COMPRESSOR DRIVE BELT TENSION ADJUSTMENT

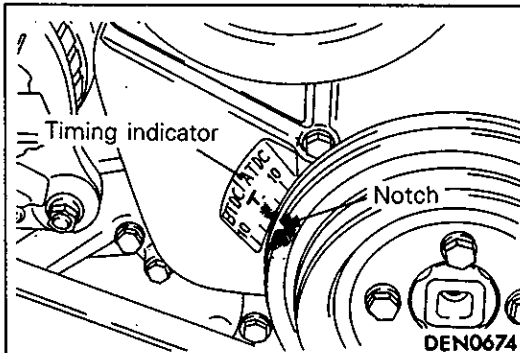
- (1) Loosen tension pulley fixing bolt A.
- (2) Adjust belt tension with adjusting bolt B.
- (3) Tighten fixing bolt A.
- (4) Check the belt tension after driving.

VALVE CLEARANCE INSPECTION AND ADJUSTMENT

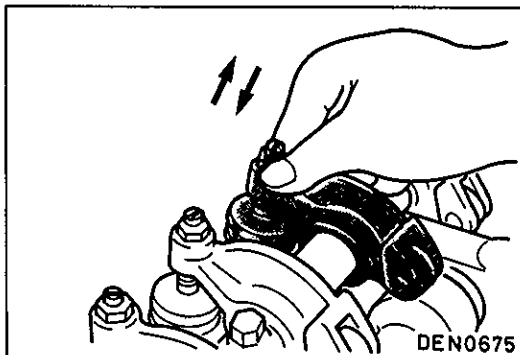
E11FDAX

- (1) Start the engine and allow it to warm up until the engine coolant temperature reaches 80 to 95°C (176 to 203°F).
- (2) Remove all glow plugs from the cylinder heads for easy inspection. (Refer to GROUP 16 – Glow System.)
- (3) Remove the rocker cover.

- (4) Turn the crankshaft clockwise until the notch on the pulley is lined up with the "T" mark on the timing indicator.

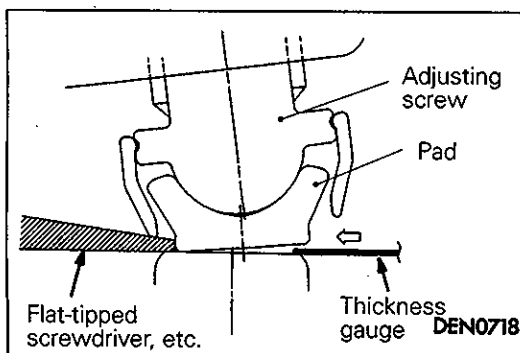
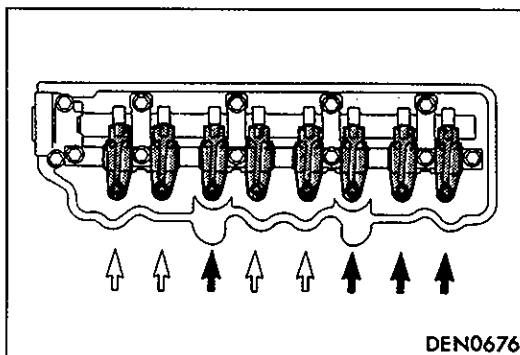


- (5) Move the rocker arms on the No. 1 and No. 4 cylinders up and down by hand to determine which cylinder has its piston at the top dead centre on the compression stroke. If both intake and exhaust valve rocker arms have a valve lash, the piston in the cylinder corresponding to these rocker arms is at the top dead centre on the compression stroke.

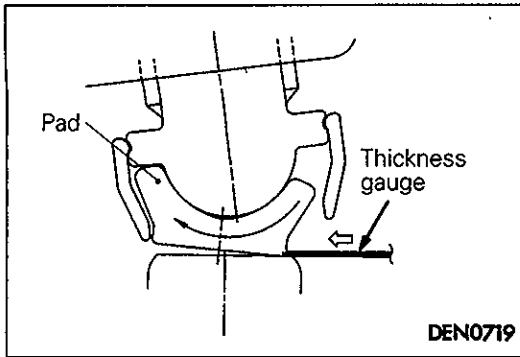


- (6) Valve clearance inspection and adjustment can be performed on rocker arms indicated by white arrows ⇐ when the No. 1 cylinder piston is at the top dead centre on the compression stroke, and on rocker arms indicated by solid arrows ⇨ when the No. 4 cylinder piston is at the top dead centre on the compression stroke.

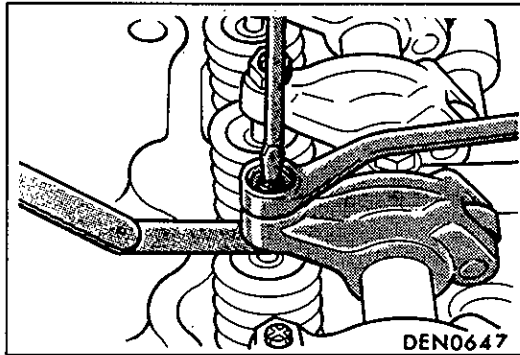
- (7) Measure the valve clearance.

**NOTE**

When inserting the thickness gauge, push the pad from the opposite side from the thickness gauge insertion side with a flat-tipped screwdriver or similar tool to make a gap, and then insert the thickness gauge.



When you try to insert the thickness gauge, if the pad is not pushed with a flat-tipped screwdriver or similar tool and no gap is made, the pad will tilt as shown in the illustration and the thickness gauge will not be able to be inserted.

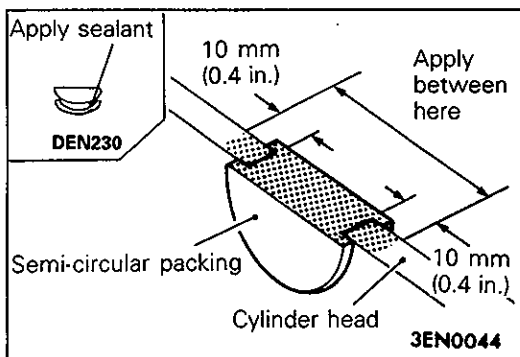


- (8) If the valve clearance is not as specified, loosen the rocker arm lock nut and adjust the clearance using a thickness gauge while turning the adjusting screw.

Standard value (hot engine):

Intake valve	0.25 mm (0.010 in.)
Exhaust valve	0.25 mm (0.010 in.)

- (9) While holding the adjusting screw with a screwdriver to prevent it from turning, tighten the lock nut securely.
 (10) Turn the crankshaft through 360° to line up the notch on the crankshaft pulley with the "T" mark on the timing indicator.
 (11) Repeat steps (6) and (7) on other valves for clearance adjustment.

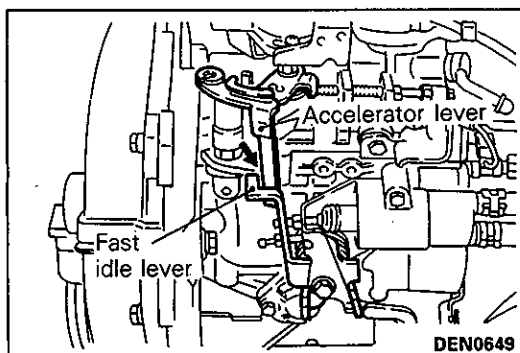


- (12) Apply a coating of the specified sealant to the semi-circular packing and cylinder head to surfaces.

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

- (13) Install the rocker cover.
 (14) Install the glow plugs and tighten to the specified torque.

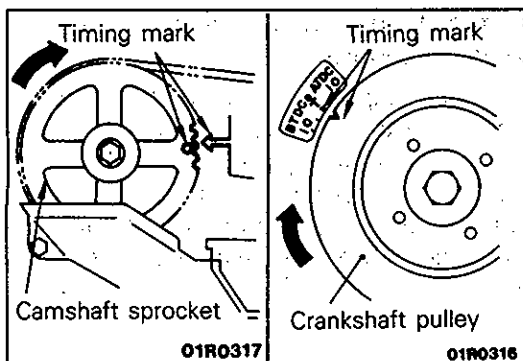
Tightening torque: 18 Nm (1.8 kgm, 13 ft.lbs.)



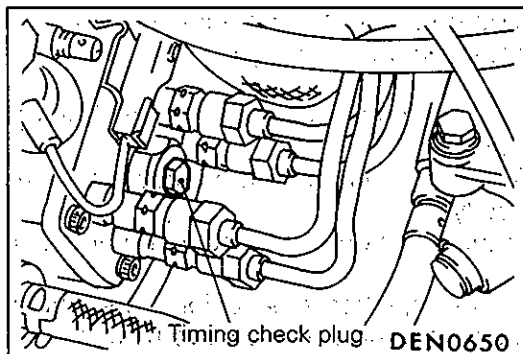
INJECTION TIMING ADJUSTMENT

E11FVAK

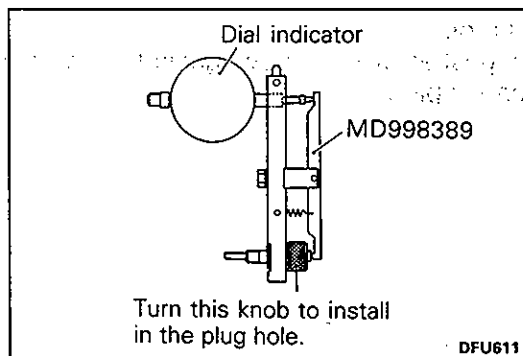
- (1) After warming up the engine, check to be sure that the fast idle lever is separated from the accelerator lever.
 (2) To make the crankshaft turn more easily, remove the four glow plugs.



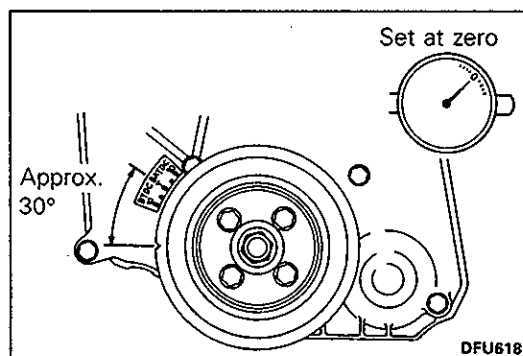
- (3) Turn the crankshaft clockwise (right turn) to align each timing mark and to set the NO. 1 cylinder at compression top dead centre.



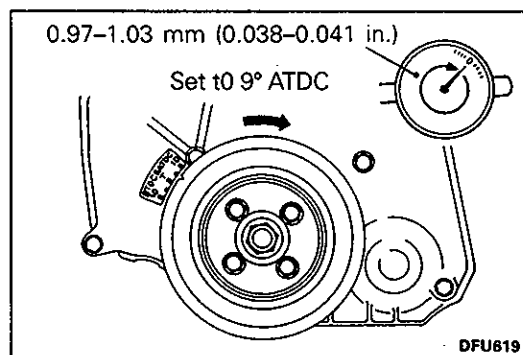
- (4) Remove the timing check plug installed at the rear of the injection pump.



- (5) Install the special tool to the rear of the injection pump.
(6) Install a dial gauge to the special tool.

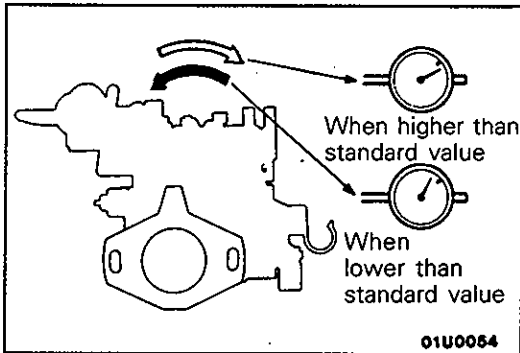
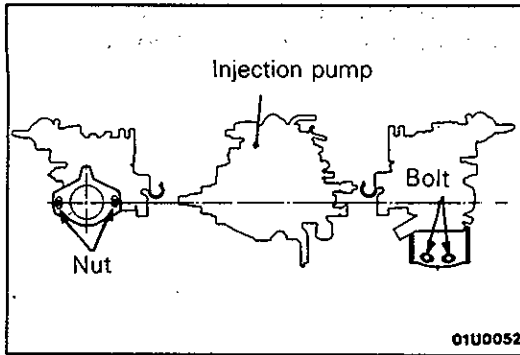


- (7) Turn the crankshaft clockwise to move the No. 1 cylinder approximately 30° before compression top dead centre.
(8) Set the needle of the dial gauge to 0.
(9) Check to be sure that the needle doesn't move even if the crankshaft is turned slightly (2–3°) both clockwise and anti-counter clockwise.
(10) If the needle moves, the injection pump plunger is lifted, so reset it by turning the crankshaft to a position where the needle doesn't move.



- (11) Turn the crankshaft pulley clockwise to align the crankshaft pulley notch to 9° ATDC.
(12) Take a reading of the value displayed on the dial gauge.

Standard value: 0.97–1.03 mm (0.038–0.041 in.)



(13) If the value is outside the standard value, adjust the injection timing by the following procedure.

- ① Loosen the four injection pipe union nuts on the injection pump side. (Do not remove the union nuts.) When loosening the nuts, hold the delivery valve holders with a spanner so that they don't turn at the same time.
- ② Loosen the two injection pump mounting nuts and the two injection pump mounting bolts. (Do not remove the nuts and bolts.)
- ③ Tilt the injection pump to the left and right and adjust so that the value displayed on the dial gauge is at the standard value.
- ④ Temporarily tighten the two mounting nuts and bolts of the injection pump.
- ⑤ Repeat steps (7) – (12) to check if the adjustment has been made correctly.
- ⑥ Securely tighten the injection pump mounting nuts and bolts.
- ⑦ Securely tighten the injection pipe union nuts. When tightening the nuts, hold the delivery valve holders with a spanner so that they don't turn at the same time.

(14) Remove the special tool.

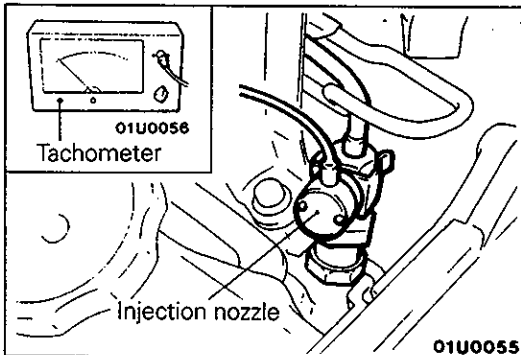
(15) After replacing the gasket with a new gasket, securely tighten the timing check plug.

ENGINE IDLE SPEED INSPECTION AND ADJUSTMENT**NOTE**

Carry out inspection and adjustment of the idle speed after checking that the injection timing is normal.

(1) Before inspection and adjustment set vehicle in the following condition.

- Engine coolant temperature: 80–95°C (176–203°F)
- Lamps, electric cooling fan and all accessories: OFF
- Transmission: Neutral



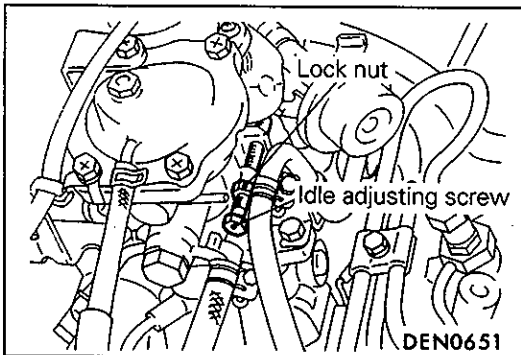
(2) Connect a tachometer to the injection nozzle or the injection pipe.

Caution

When the tachometer is connected to the injection pipe, the pipe mounting clamps should all be removed.

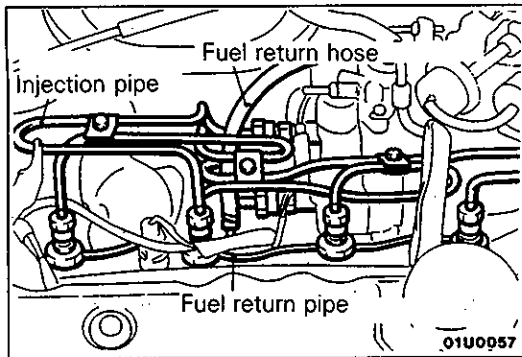
(3) Check the idle speed.

Standard value: 750 ± 100 r/min.



(4) If the idle speed is outside the standard value, loosen the lock nut on the idle adjusting screw and adjust by turning the idle adjusting screw..

After adjustment, securely tighten the lock nut.

**COMPRESSION PRESSURE INSPECTION**

E11FGAP

- (1) Check to be sure that the engine oil, starting motor and battery are in the normal condition.
- (2) Start the engine and allow it to warm up until the temperature of the engine coolant reaches 80 to 95°C (176 to 203°F).
- (3) Remove the injection pipes.
- (4) Remove the fuel return hose.
- (5) Hold the hexagonal section of the fuel return pipe with a wrench, and remove the nut that fastens the pipe to each injection nozzle.

- (6) Remove the fuel return pipe and gasket.
- (7) Using a deep socket wrench, remove all the injection nozzles.

NOTE

Attach a tag indicating the cylinder number to each nozzle that has been removed.

- (8) Remove the holder gasket and nozzle gasket from the injection nozzle hole in the cylinder head.
- (9) Disconnect the fuel cut solenoid valve connector.

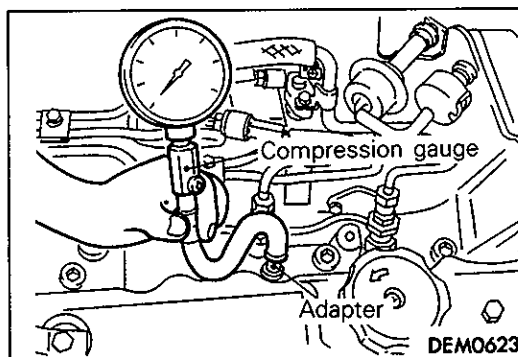
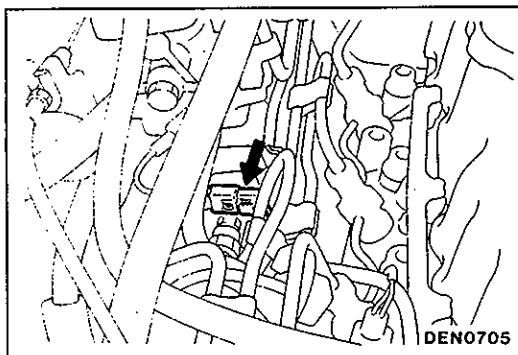
NOTE

This will stop fuel injection from being carried out.

- (10) Cover the injection nozzle mounting hole with a rag, and after the engine has been cranked, check that no foreign material is adhering to the rag.

Caution

1. **Keep away from the injection nozzle mounting hole when cranking.**
2. **If compression is measure while water, oil, fuel, etc., that has come from cracks is inside the cylinder, these materials will become heated and will gush out from the injection nozzle mounting hole, which is dangerous.**



- (11) Attach the adapter to the injection nozzle hole and connect a compression gauge to the adapter.
- (12) Crank the engine and measure the compression pressure.

Standard value (at engine speed of 250 r/min.):

3,500 kPa (35.0 kg/cm, 498 psi)

Limit (at engine speed of 250 r/min.):

min. 2,560 kPa (25.6 kg/cm, 364 psi)

- (13) Measure the compression of all the cylinders, and check that the pressure differences between each cylinder are below the limit.

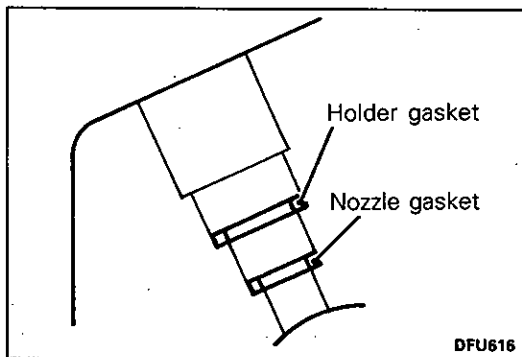
Limit: max. 300 kPa (3.0 kg/cm, 43 psi)

- (14) If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the injection nozzle mounting hole, and repeat the operations in steps (11) to (13).

- ① If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.
- ② If the compression does not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.

- (15) Connect the fuel cut solenoid valve connector.

For information regarding the servicing procedures for these causes of malfunction, refer to the ENGINE AND TRANSMISSION MANUAL.

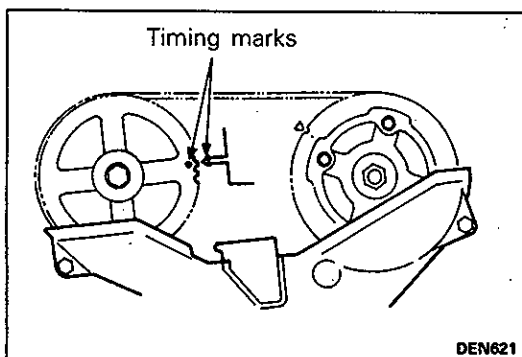


- (16) Clean nozzle holder installation area of the cylinder head.
 (17) Fit a new nozzle gasket and holder gasket into the nozzle holder hole in the cylinder head.

- (18) Install the injection nozzles in their correct position referring to the cylinder numbers indicated on the tags that were attached to each nozzle at the time of removal. Tighten the nozzles to specified torque.

Tightening torque: 55 Nm (5.5 kgm, 40 ft.lbs.)

- (19) Install the gaskets and fuel return pipe.
 (20) Install the injection pipes.



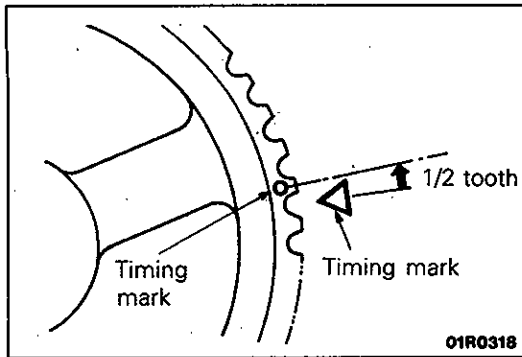
TIMING BELT ADJUSTMENT

E11FFD1

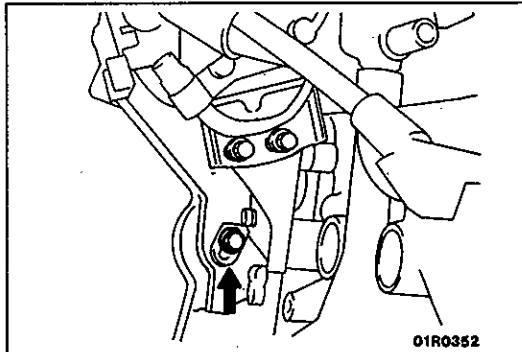
- (1) Turn crankshaft clockwise to bring No. 1 cylinder piston to top dead centre on compression stroke.

Caution

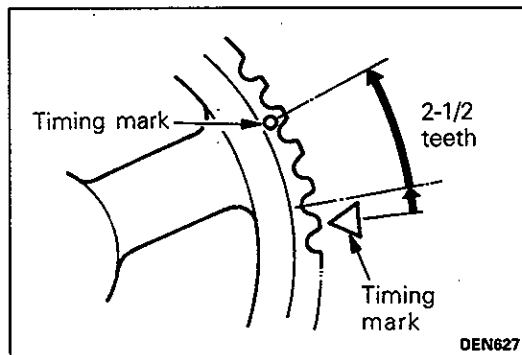
For aligning the timing marks, never turn the crankshaft anticlockwise as it could cause inadequate belt tension.



- (2) Turn the crankshaft anticlockwise by a distance equivalent to 1/2 tooth of the camshaft sprocket in order to correct looseness of the belt at the idler side.



- (3) Using a long extension, loosen the installation bolt of the timing belt tension (from the engine rear) by 1/6 to 1/2 turn, taking advantage of the force of the tensioner spring to provide tension to the belt.



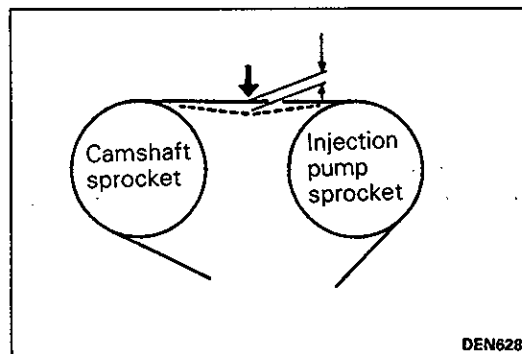
- (4) In addition, turn the crankshaft anticlockwise by a distance equivalent to 2-1/2 teeth.

NOTE

When the setting is as described above, the camshaft will be slightly past compression top dead centre of the No. 1 cylinder, and the looseness of the timing belt will be at the tension side.

Caution

Do not rotate the crankshaft clockwise, because the tensioner side will become stretched and the adjustment will be unsuitable.



- (5) Tighten the timing belt tensioner at the specified torque.
 (6) Turn the crankshaft clockwise and align the timing mark.
 (7) Using the index finger, press between the camshaft sprocket and the injection pump and sprocket, and check whether or not the amount of flexion is within the standard value range or not.

Standard value range: 4.0–5.0 mm (0.16–0.20 in.)

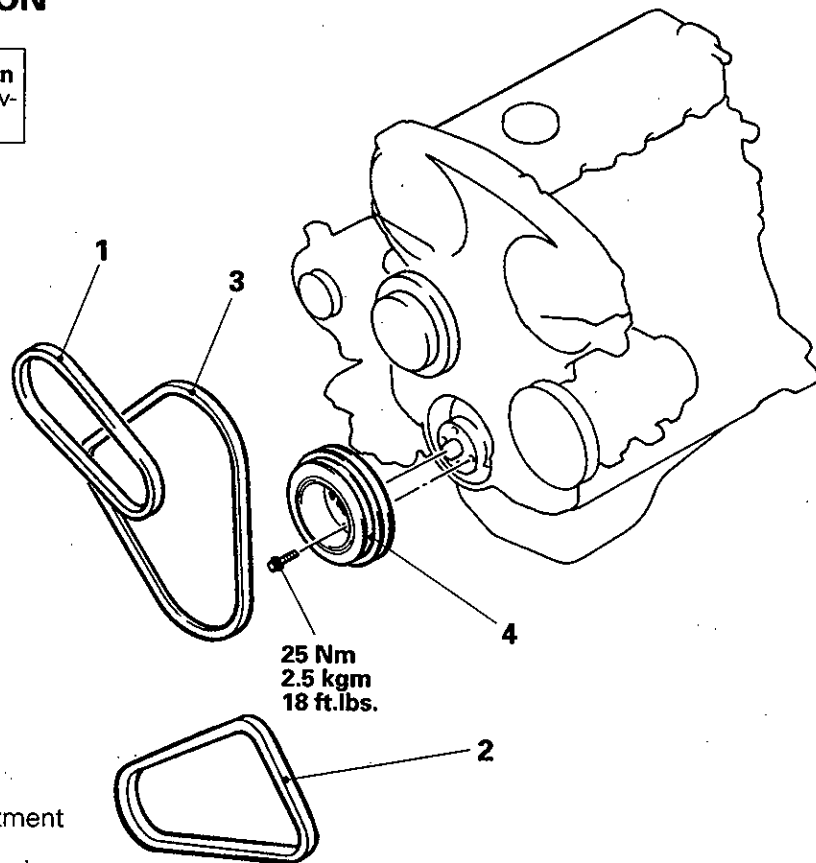
If there is a deviation from the standard value range, repeat steps (2) to (5).

CRANKSHAFT PULLEY

E11LA-

REMOVAL AND INSTALLATION**Pre-removal and Installation Operation**

- Removal and Installation of Under Cover

**Removal steps**

- Drive belt tension adjustment (Refer to P.11-79)
1. Drive belt (Power steering)
 2. Drive belt (Air conditioner)
 3. Drive belt (Alternator)
 4. Crankshaft pulley

01X0020

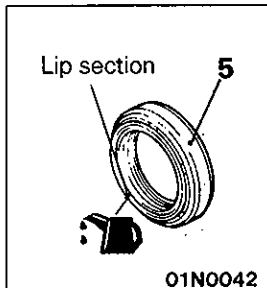
CAMSHAFT AND CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

E11HA-

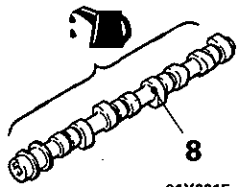
Pre-removal and Post-installation Operation

- Removal and Installation of Timing Belt (Refer to P.11-103.)



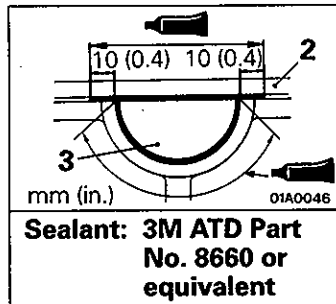
01N0042

Cam section and journal section



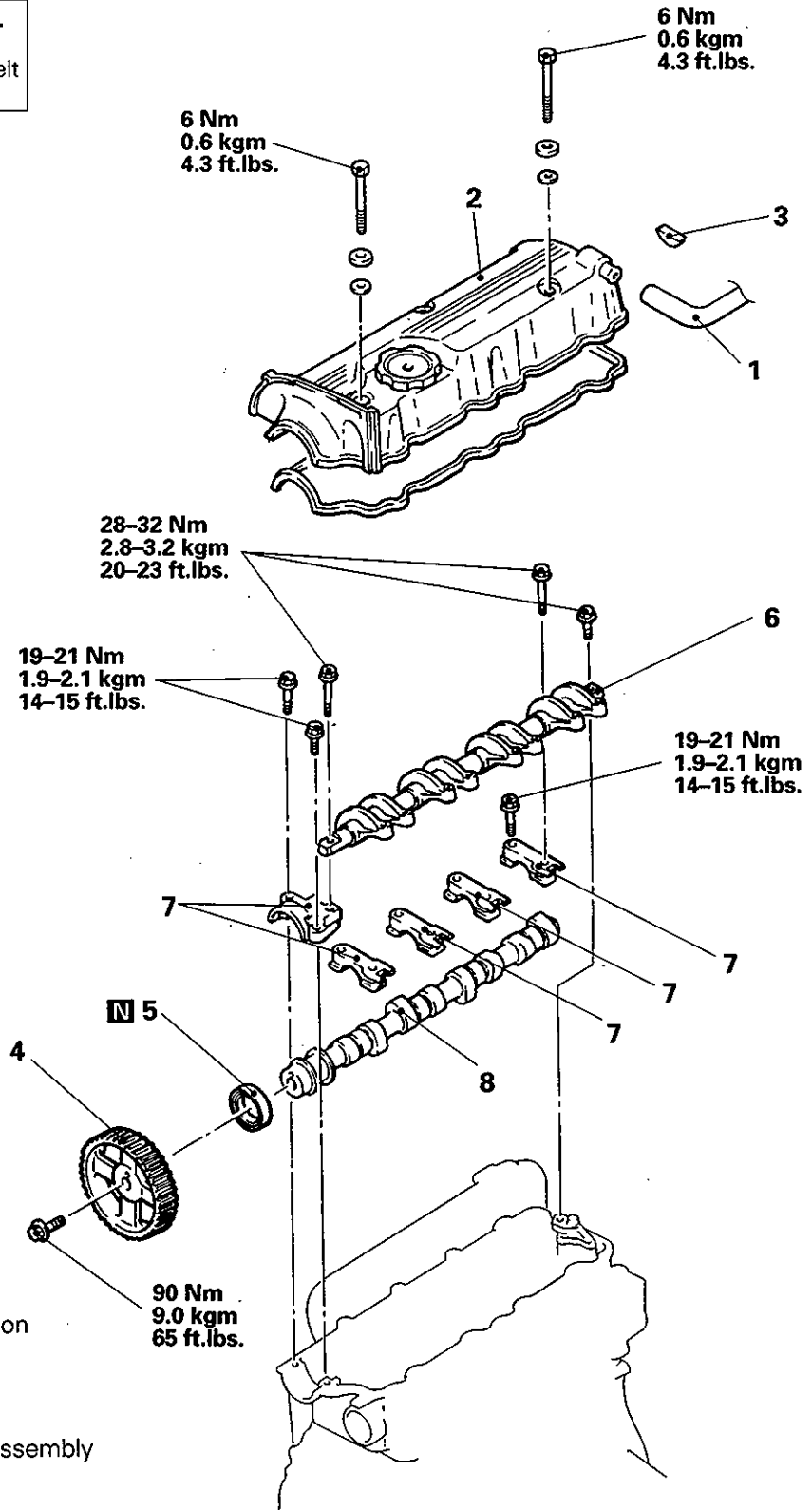
01X0015

Engine oil

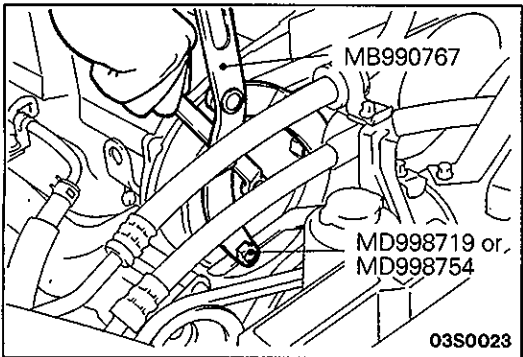


Removal steps

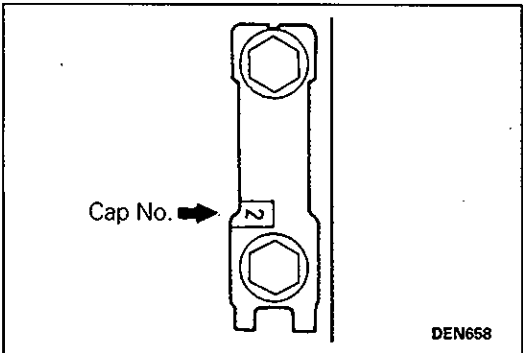
1. Breather hose connection
2. Rocker cover
3. Semi-circular packing
4. Camshaft sprocket
5. Camshaft oil seal
6. Rocker arm and shaft assembly
7. Camshaft bearing cap
8. Camshaft



01S0183

**SERVICE POINTS OF REMOVAL**

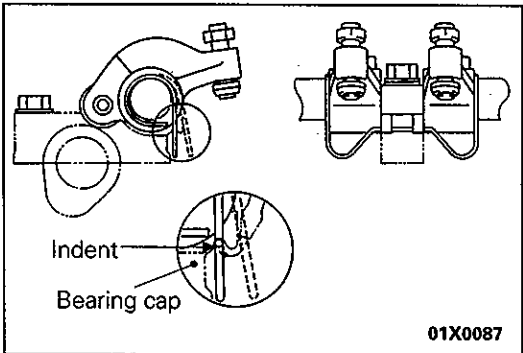
E11HBA0

4. REMOVAL OF CAMSHAFT SPROCKET**SERVICE POINTS OF INSTALLATION**

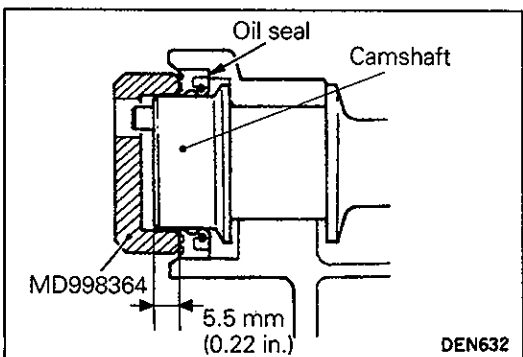
E11HCA0

7. INSTALLATION OF CAMSHAFT BEARING CAP

The cap numbers are embossed on the top surface of the bearing caps, so install in the order of the numbers. However, no numbers are embossed on bearing caps 1 and 5.

**6. INSTALLATION OF ROCKER ARM AND SHAFT ASSEMBLY**

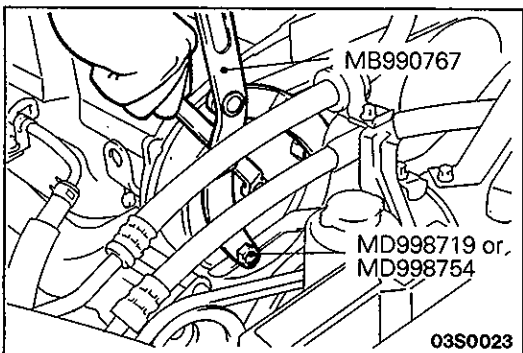
- (1) Install the rocker arm and shaft assembly to the bearing caps.
- (2) Set the rocker arm springs into the bearing cap indents.
- (3) Check the valve clearance and adjust if necessary. (Refer to P.11-81.)

**5. INSTALLATION OF CAMSHAFT OIL SEAL**

- (1) Apply a small amount of engine oil to the entire circumference of the oil seal lip and camshaft.
- (2) Use the special tool to tap in the oil seal.

NOTE

The oil seal should be tapped in until the distance from the end of the camshaft to the end of the oil seal is as shown in the illustration.

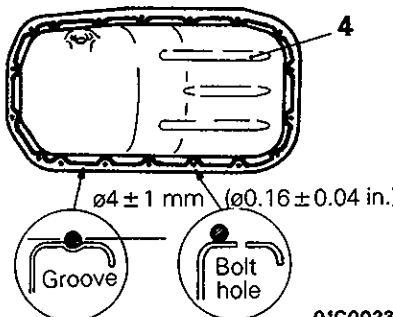
**4. INSTALLATION OF CAMSHAFT SPROCKET**

OIL PAN

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Draining and Supplying of Engine Oil
- Removal and Installation of Oil Level Gauge
- Removal and Installation of Front Exhaust Pipe (Refer to GROUP 15-Exhaust Pipe and Muffler.)

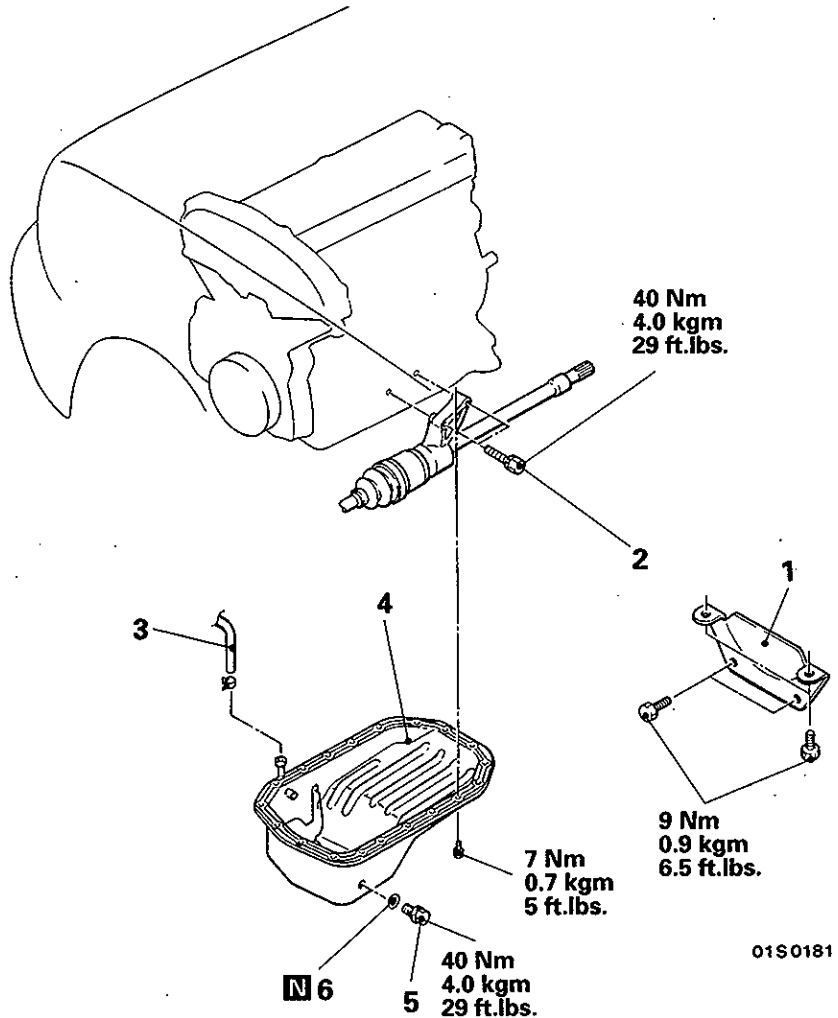


ø4 ± 1 mm (ø0.16 ± 0.04 in.)

Groove Bolt hole

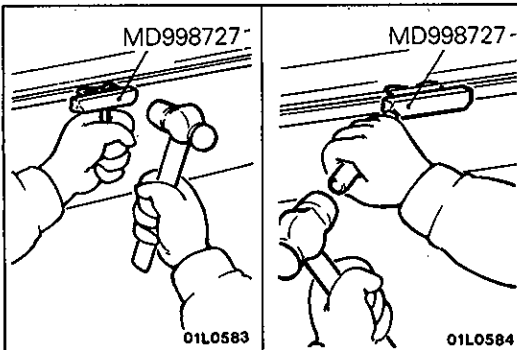
01C0023

Specified sealant: MITSUBISHI GENUINE PART No. MD970389 or equivalent



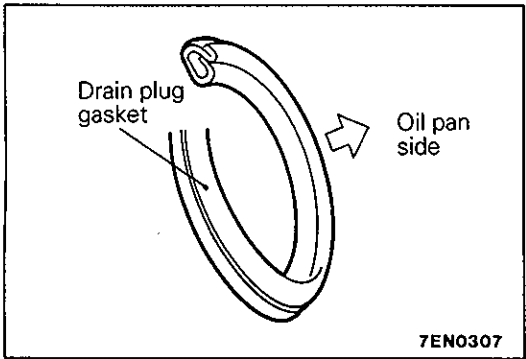
Removal steps

1. Bell housing cover
2. Drive shaft center bearing mounting bolt
3. Oil return hose
4. Oil pan
5. Drain plug
6. Gasket



SERVICE POINTS OF REMOVAL

4. REMOVAL OF OIL PAN

**SERVICE POINTS OF INSTALLATION**

E11KDBN

6. INSTALLATION OF GASKET

Replace the gasket with a new gasket, and install it in the direction shown in the illustration.

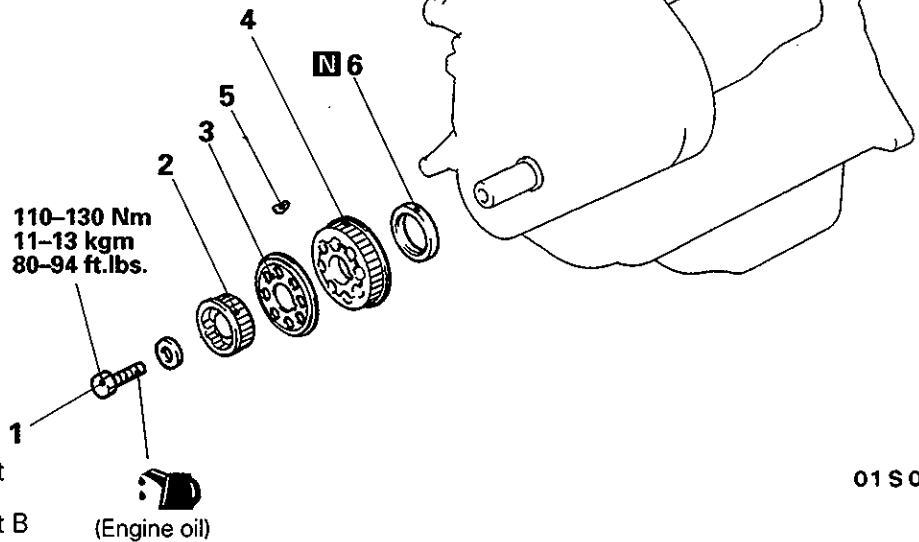
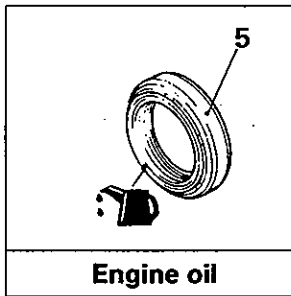
CRANKSHAFT FRONT OIL SEAL

E11UA-1

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

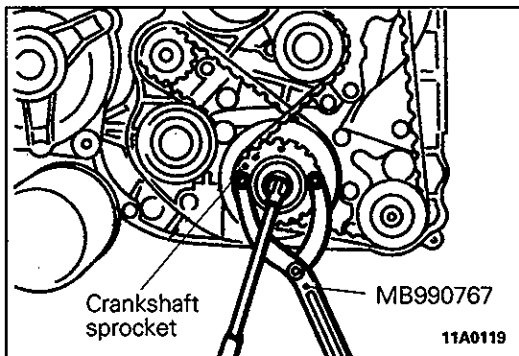
- Removal and Installation of Timing Belt (Refer to P.11-103.)



Removal steps

- ↔ ↔ 1. Crankshaft bolt
- ↔ ↔ 2. Crankshaft sprocket
- ↔ ↔ 3. Flange
- ↔ ↔ 4. Crankshaft sprocket B
- ↔ ↔ 5. Key
- ↔ ↔ 1. Crankshaft bolt

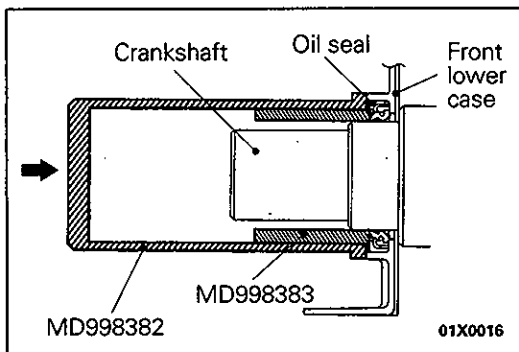
01S0177



SERVICE POINTS OF REMOVAL

E11UBAI

1. REMOVAL OF CRANKSHAFT BOLT/2. CRANKSHAFT SPROCKET

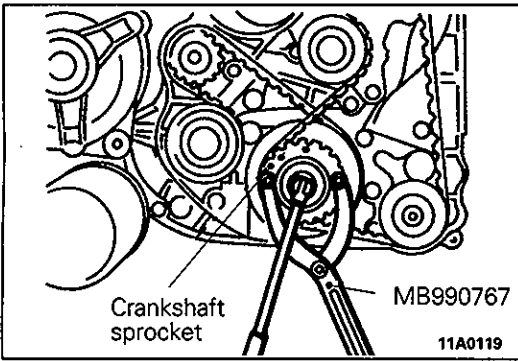


SERVICE POINTS OF INSTALLATION

E11UCAO

6. INSTALLATION OF CRANKSHAFT FRONT OIL SEAL

Apply engine oil to the entire circumference of the oil seal lip, and then tap in the oil seal until it is flush with the front lower case.



2. INSTALLATION OF CRANKSHAFT SPROCKET/1. CRANKSHAFT BOLT

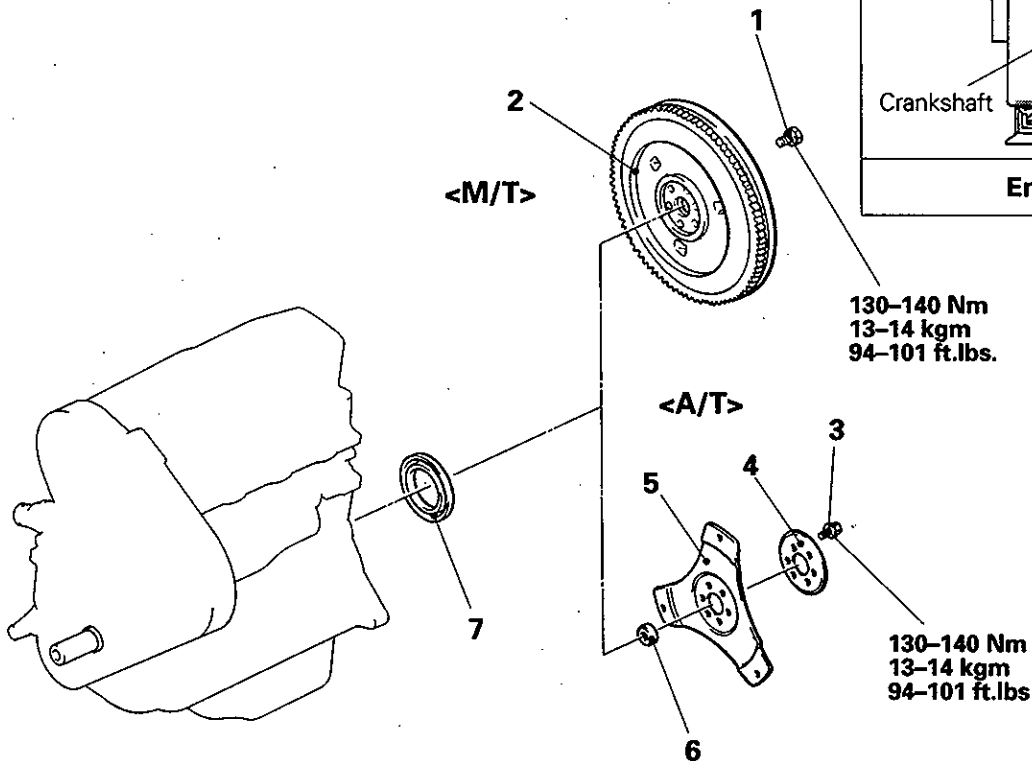
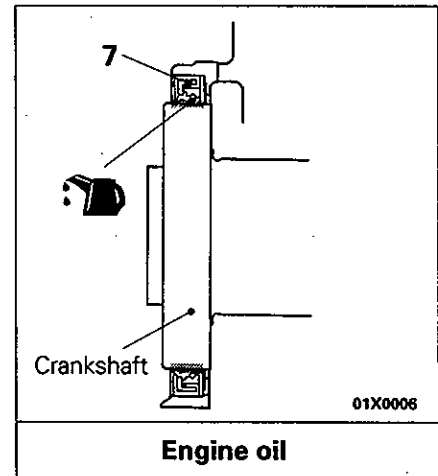
CRANKSHAFT REAR OIL SEAL

E11UA-2

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations

- Removal and Installation of Transmission Assembly (Refer to GROUPS 22 and 23 – Transmission Assembly)
- Removal and Installation of Clutch Cover and Disk <M/T>
- Removal and Installation of Oil Pan (Refer to P.11-92.)

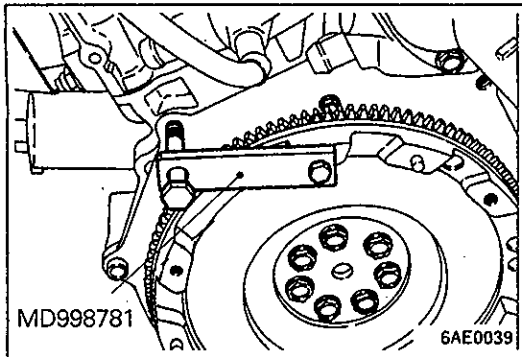


01X0017

Removal steps

- ◆◆ 1. Flywheel bolt } <M/T>
- ◆◆ 2. Flywheel
- ◆◆ 3. Drive plate bolt } <A/T>
- ◆◆ 4. Adapter plate
- ◆◆ 5. Drive plate
- ◆◆ 6. Crankshaft bushing
- ◆◆ 7. Crankshaft rear oil seal

11-96 ENGINE <4D68> – Crankshaft Front Oil Seal and Crankshaft Rear Oil Seal

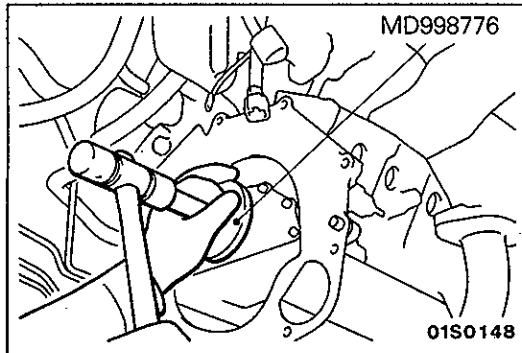


SERVICE POINTS OF REMOVAL

E11UBAJ

1. REMOVAL OF FLYWHEEL BOLT <M/T>/3. DRIVE PLATE BOLT <A/T>

Use the special tool to secure the flywheel or drive plate, and remove the bolt.

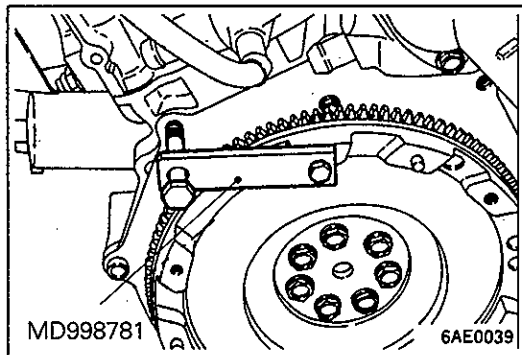


SERVICE POINTS OF INSTALLATION

E11UCAP

7. INSTALLATION OF CRANKSHAFT REAR OIL SEAL

- (1) Apply a small amount of engine oil to the entire circumference of the oil seal lip.
- (2) Tap in the oil seal as shown in the illustration.



3. INSTALLATION OF DRIVE PLATE BOLT <A/T>/1. FLYWHEEL BOLT <M/T>

Use the special tool to secure the flywheel or drive plate, and install the bolt.

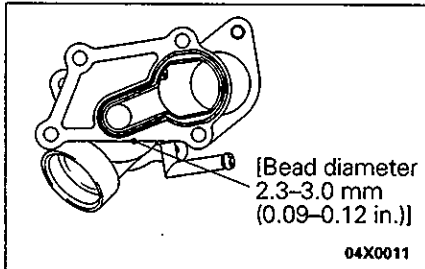
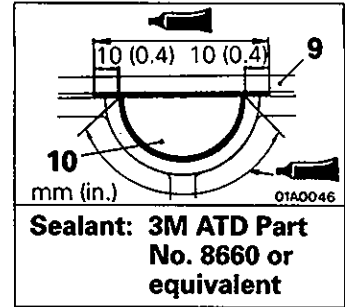
CYLINDER HEAD GASKET

E11JA--

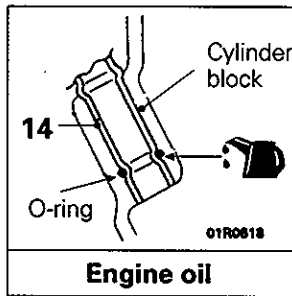
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations

- Draining and Supplying of the Coolant (Refer to GROUP 14 – Service Adjustment Procedures.)
- Draining and Supplying of the Engine Oil
- Removal and Installation of the Air Intake Hose and Air Cleaner Assembly.

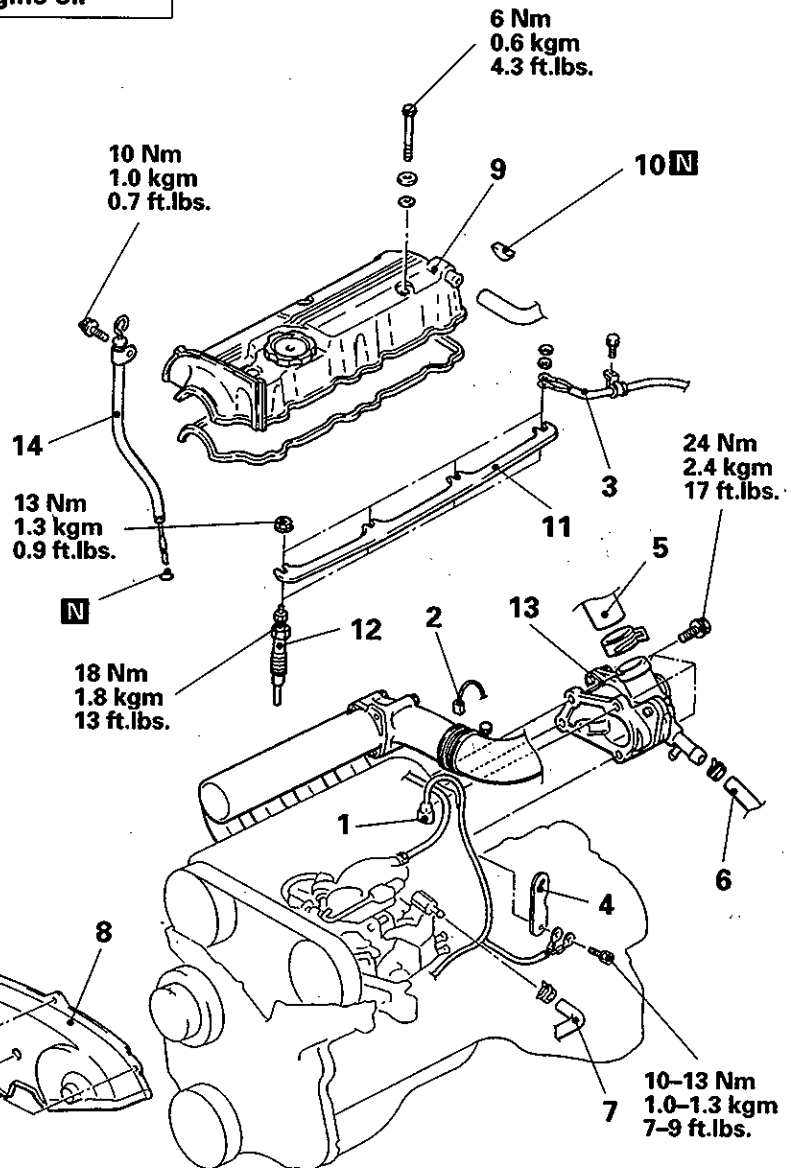


Specified sealant:
MITSUBISHI GENUINE PART
MD970389 or equivalent

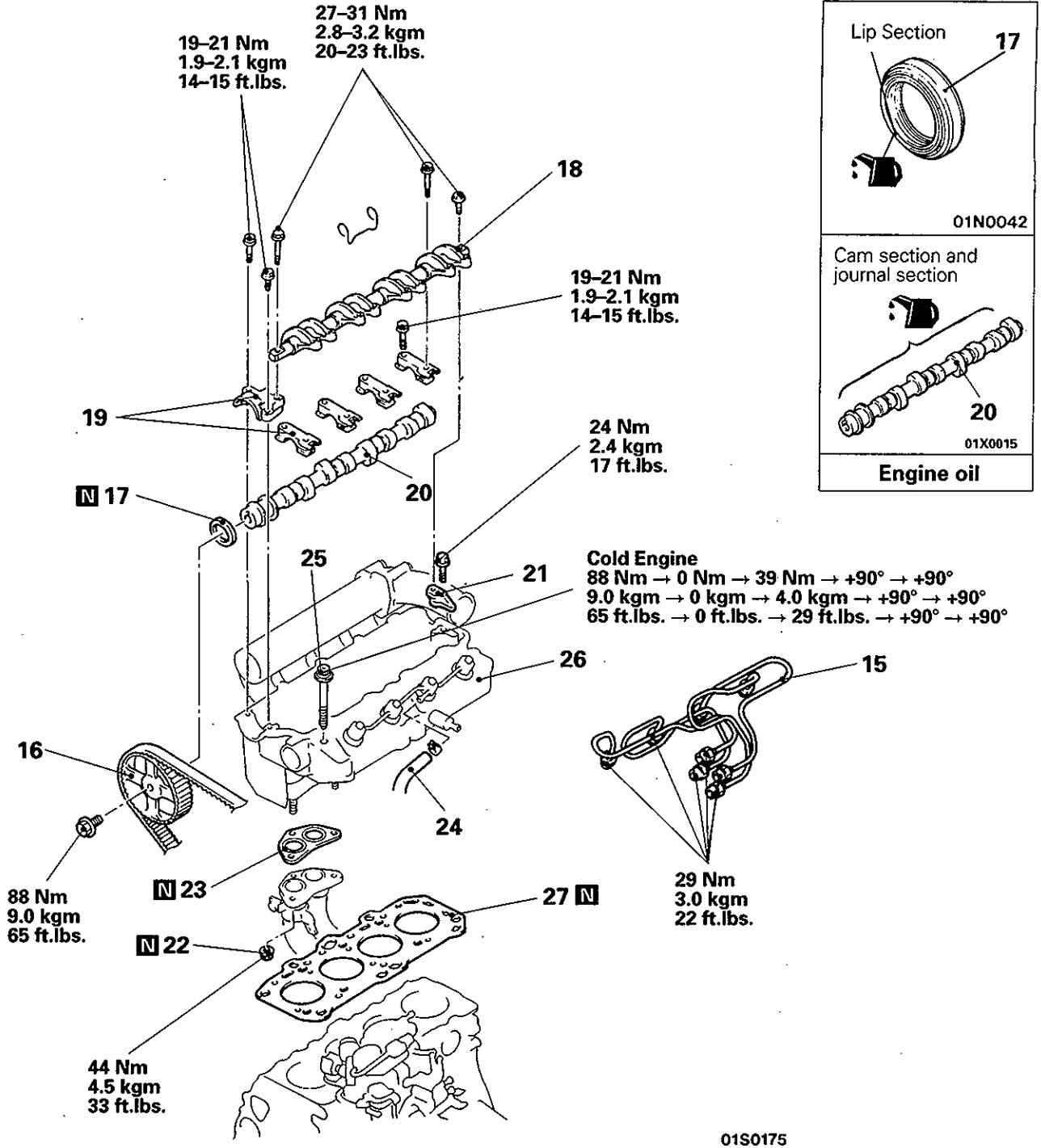


Removal steps

1. Engine coolant temperature sensor and engine coolant temperature gauge unit
2. Engine coolant temperature switch connector (A/C)
3. Glow plug connector
4. Engine hanger
5. Radiator upper hose connection
6. Heater hose connection
7. Water hose connection
8. Timing belt upper cover
9. Rocker cover
10. Semi-circular packing
11. Glow plug plate
12. Glow plug
13. Thermostat case assembly
14. Oil level gauge

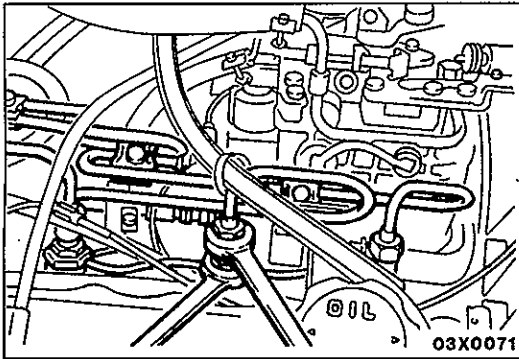


01S0178



Removal steps

- ◆◆ ◆◆ 15. Fuel injection pipe
- ◆◆ ◆◆ 16. Camshaft sprocket
- ◆◆ ◆◆ 17. Oil seal
- ◆◆ ◆◆ 18. Rocker arm and shaft assembly
- ◆◆ ◆◆ 19. Camshaft bearing cap
- ◆◆ ◆◆ 20. Camshaft
- ◆◆ ◆◆ 21. Rocker shaft support
- ◆◆ ◆◆ 22. Self-locking nut
- ◆◆ ◆◆ 23. Gasket
- ◆◆ ◆◆ 24. Fuel return hose
- ◆◆ ◆◆ 25. Cylinder head bolt
- ◆◆ ◆◆ 26. Cylinder head assembly
- ◆◆ ◆◆ 27. Cylinder head gasket



SERVICE POINTS OF REMOVAL

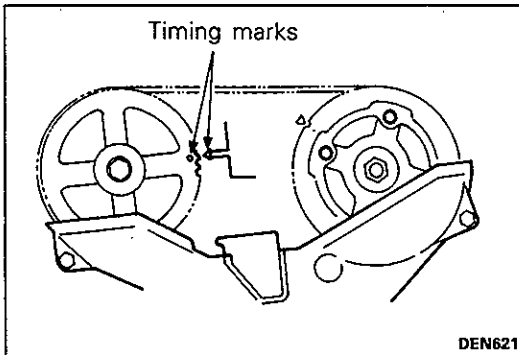
E11JBBH

15. DISCONNECTION OF INJECTION PIPE

When loosening nuts at both ends of injection pipe, hold the other side (pump side-delivery holder, nozzle side-nozzle holder) with wrench and loosen nut.

Caution

After disconnecting the injection pipe, plug the opening so that no foreign particles get inside the pump or into the injection nozzle.

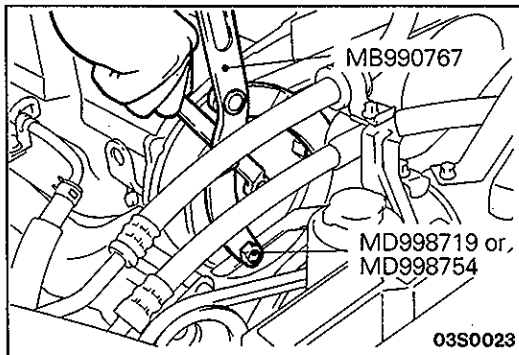


16. REMOVAL OF CAMSHAFT SPROCKET

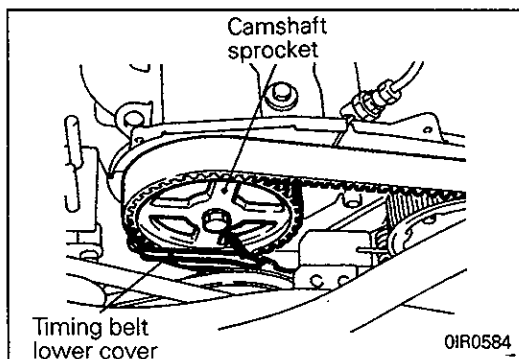
(1) Rotate the crankshaft clockwise and check that the camshaft sprocket's timing mark and the injection sprocket's timing mark are aligned.

Caution

The crankshaft should always be turned in a clockwise direction.



(2) Use the special tool to loosen the camshaft sprocket bolt.



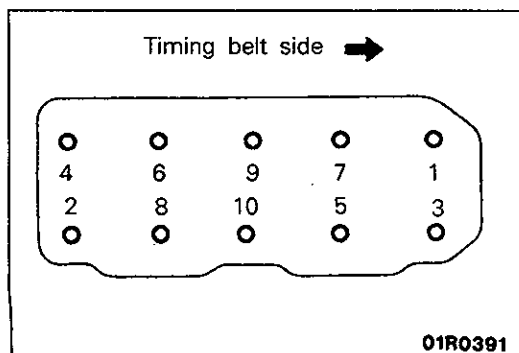
(3) Remove the camshaft sprocket with the timing belt still attached, and place it on the timing belt lower cover.

NOTE

At this time, tie the timing belt and camshaft sprocket and also the timing belt and injection pump sprocket together with cord or similar so that they do not become unmeshed.

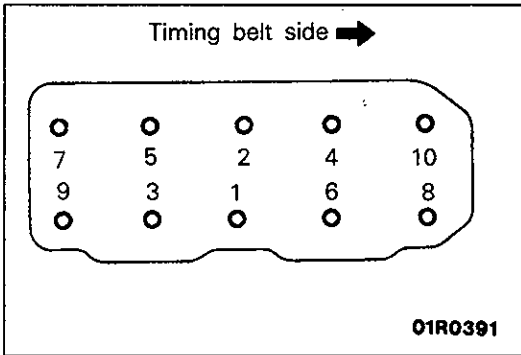
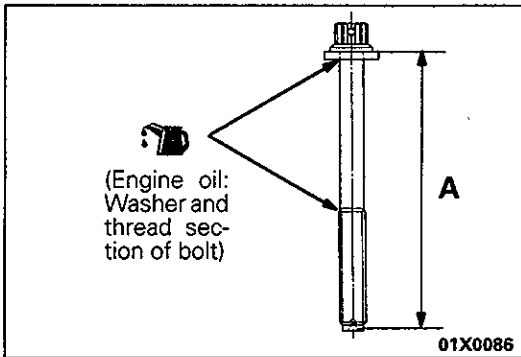
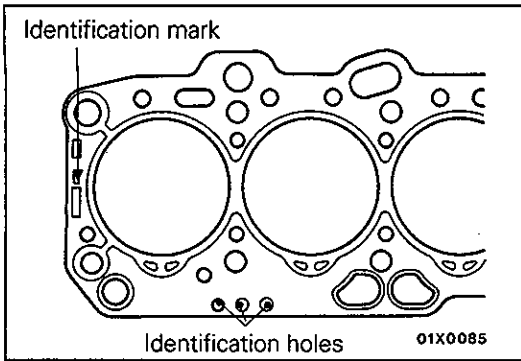
Caution

The crankshaft should not be turned after the camshaft sprocket has been removed.



25. REMOVAL OF CYLINDER HEAD BOLT

Loosen each of the bolts in 2 or 3 steps (in the order shown in the illustration), and then remove the cylinder head assembly.



SERVICE POINTS OF INSTALLATION

27. INSTALLATION OF CYLINDER HEAD GASKET

- (1) Wipe off any oil or grease from the gasket mounting surface.
- (2) Check the number of identification holes on the cylinder head gasket that was removed, and select a cylinder head gasket with the same number of identification holes.
- (3) Place the cylinder head gasket on top of the cylinder block so that the identification mark is facing upwards as in the illustration.

25. INSTALLATION OF CYLINDER HEAD BOLT

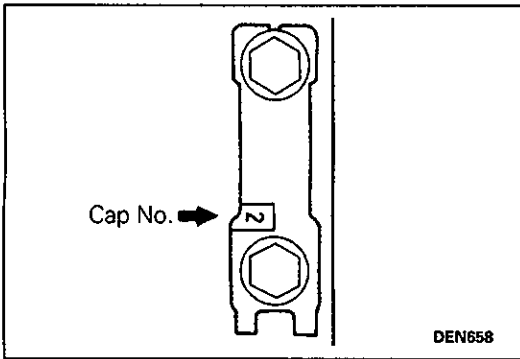
- (1) When installing the cylinder head bolts, the length below the head of the bolts should be within the standard value. If it is outside the standard value, replace the bolts.

Limit: Within 119.7 mm (4.713 in.)

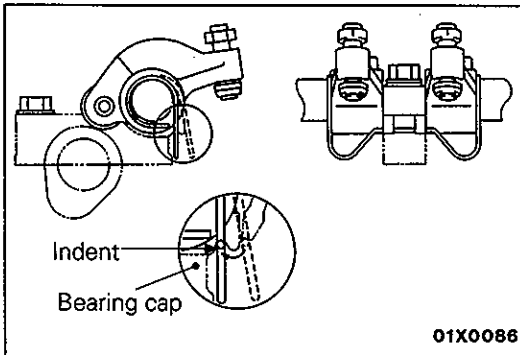
- (2) Apply a small amount of engine oil to the thread section and the washer of the cylinder head bolt.

- (3) Tighten the bolts in order by the following procedure.

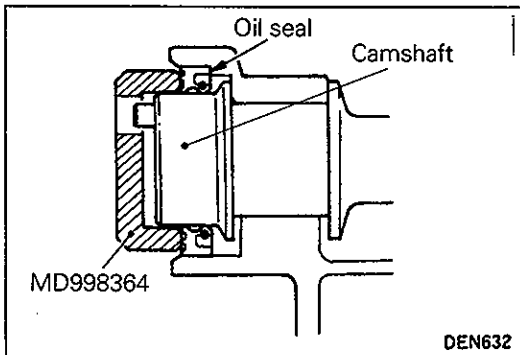
Procedure	Operation contents	Remarks
①	Tighten to 90 Nm (9.0 kgm, 65 ft.lbs.)	Carry out in the order shown in the illustration
↓		
②	Fully loosen.	Carry out in the reverse order to that shown in the illustration
↓		
③	Tighten to 40 Nm (4.0 kgm, 29 ft.lbs.)	Carry out in the order shown in the illustration
↓		
④	Tighten by 1/4 turn (90°)	Carry out in the order shown in the illustration
↓		
⑤	Tighten by 1/4 turn (90°)	Carry out in the order shown in the illustration

**19. INSTALLATION OF CAMSHAFT BEARING CAP**

The cap numbers are embossed on the top surface of the bearing caps, so install in the order of the numbers. However, no numbers are embossed on bearing caps 1 and 5.

**18. INSTALLATION OF ROCKER ARM AND SHAFT ASSEMBLY**

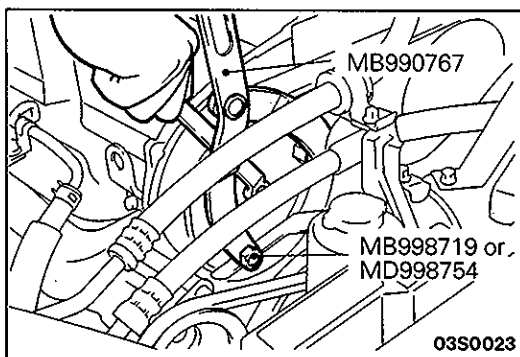
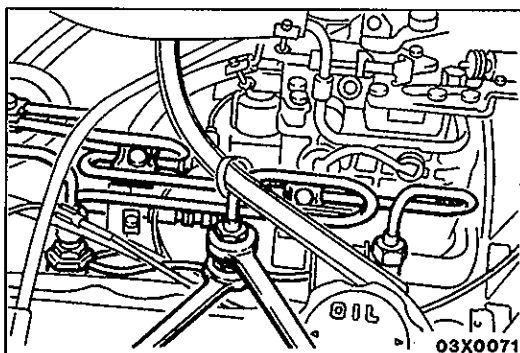
- (1) Install the rocker arm and shaft assembly to the bearing caps.
- (2) Set the rocker arm springs into the bearing cap indents.
- (3) Check the valve clearance and adjust if necessary. (Refer to P.11-xx.)

**17. INSTALLATION OF CAMSHAFT OIL SEAL**

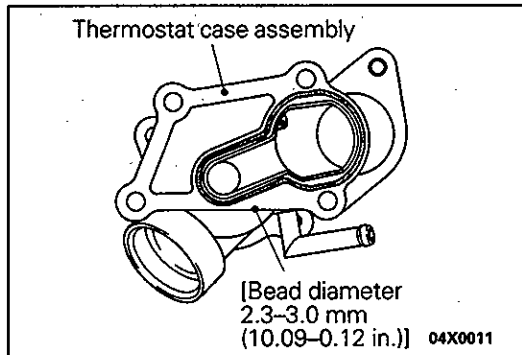
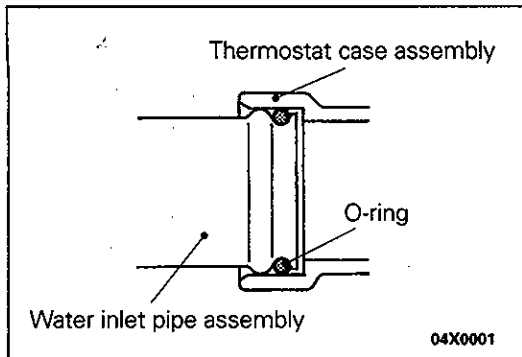
- (1) Apply a small amount of engine oil to the entire circumference of the oil seal lip and camshaft.
- (2) Use the special tool to tap in the oil seal.

NOTE

The oil seal should be tapped in until the distance from the end of the camshaft to the end of the oil seal is as shown in the illustration.

**16. INSTALLATION OF CAMSHAFT SPROCKET****15. INSTALLATION OF FUEL INJECTION PIPE**

When tightening the nuts at both ends of the fuel injection pipe, hold the other side (pump-side delivery holder, nozzle-side nozzle holder) with a wrench, and tighten the nuts to the specified torque.



13. INSTALLATION OF THERMOSTAT CASE ASSEMBLY

- (1) Insert the O-ring into the groove of the water inlet pipe assembly and rinse the outside of the O-ring with water.

- (2) Apply specified sealant to the sections of the thermostat case assembly shown in the illustration.

Semi-dry sealant: Three bond 1207F

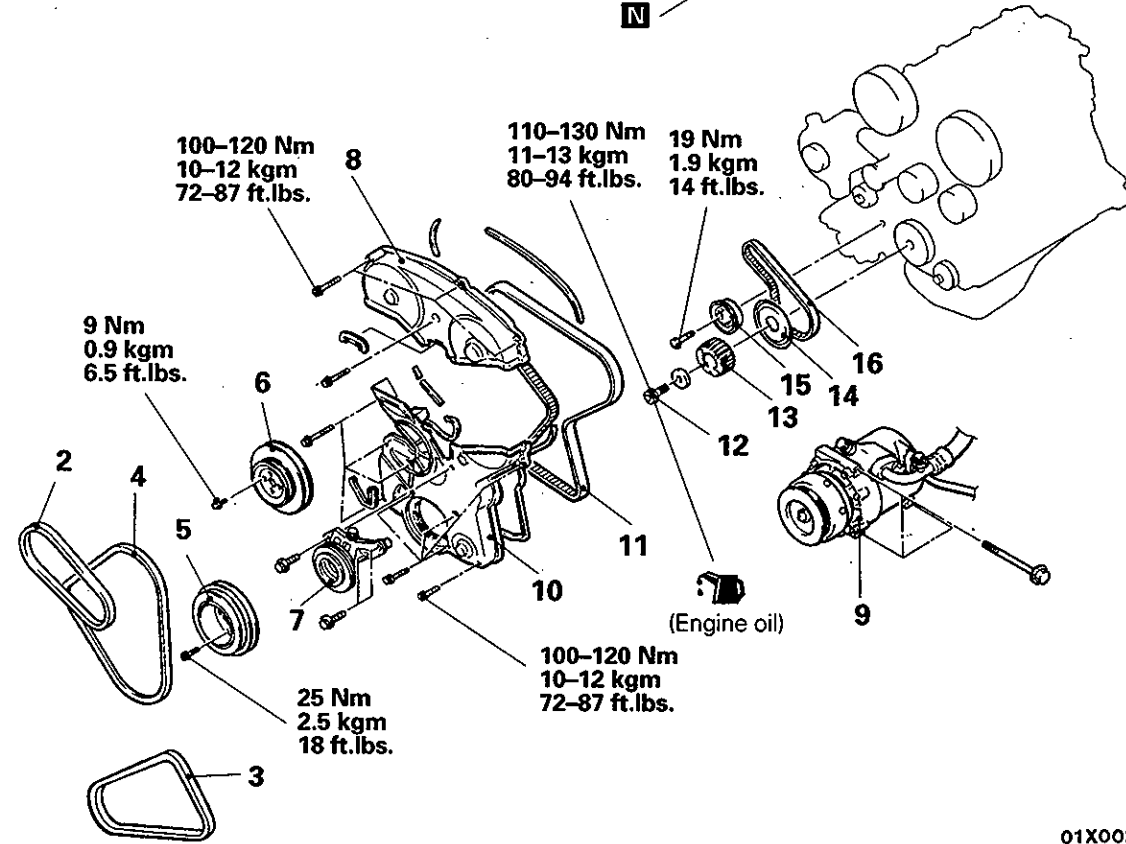
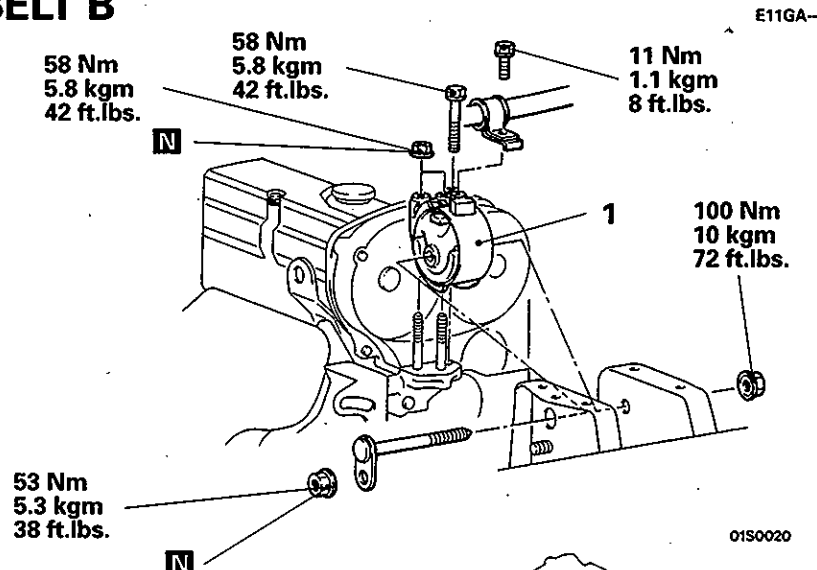
- (3) After rinsing the inside of the thermostat case assembly with water, install the thermostat case assembly hole and the water inlet pipe.
- (4) Tighten the thermostat case assembly mounting bolts.

TIMING BELT AND TIMING BELT B

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations

- Removal and Installation of Left-side Under Cover



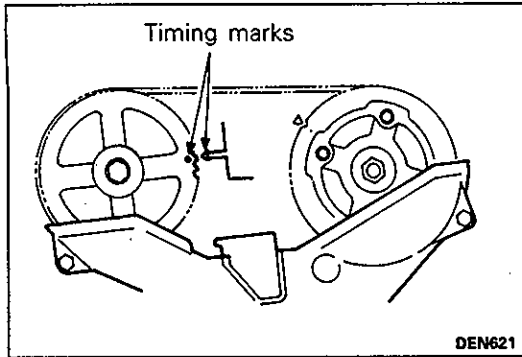
Timing belt removal steps

1. Engine mount bracket
 - Adjustment of drive belt tensions (Refer to P.11-79.)
2. Power steering drive belt
3. Air conditioner drive belt
4. Alternator drive belt
5. Crankshaft pulley
6. Water pump pulley
7. Air conditioner tensioner pulley assembly
8. Timing belt upper cover
9. Air conditioner compressor connection

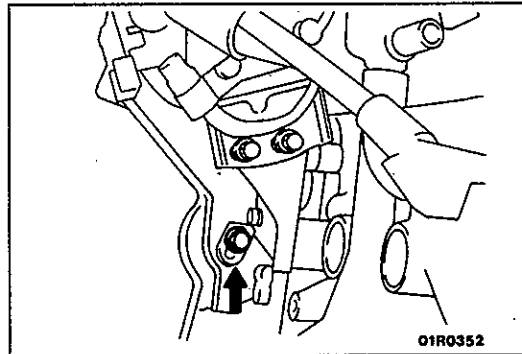
10. Timing belt lower cover
 - Adjustment of timing belt tension
11. Timing belt

Timing belt B removal steps

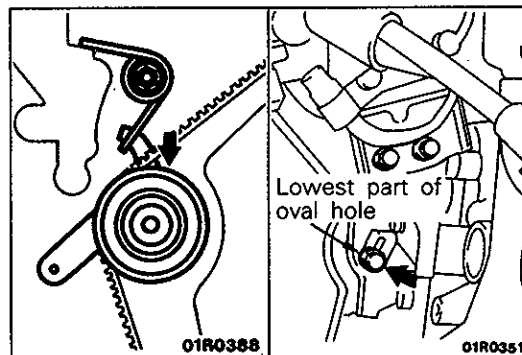
11. Timing belt
12. Crankshaft bolt
13. Crankshaft sprocket
14. Flange
15. Timing belt B tensioner
 - Adjustment of timing belt B tension
16. Timing belt B

**SERVICE POINTS OF REMOVAL****11. REMOVAL OF TIMING BELT**

(1) Align the timing marks.



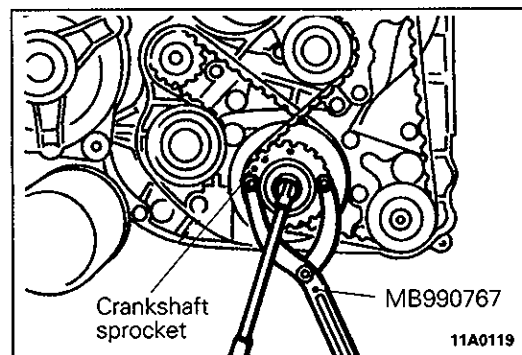
(2) Using a long extension, loosen the installation bolt of the timing belt tensioner (from the engine rear).



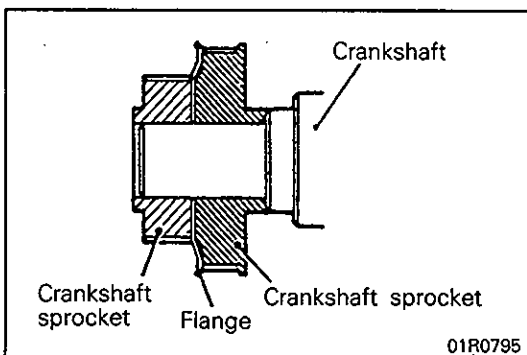
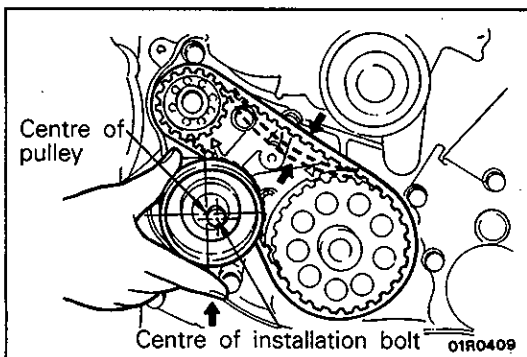
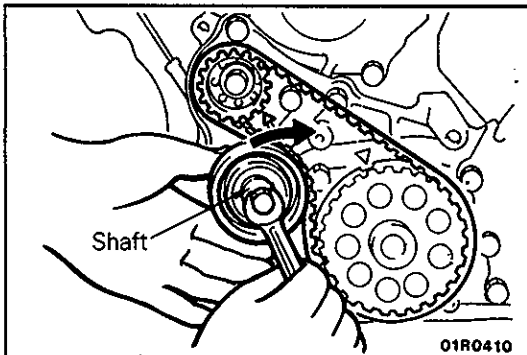
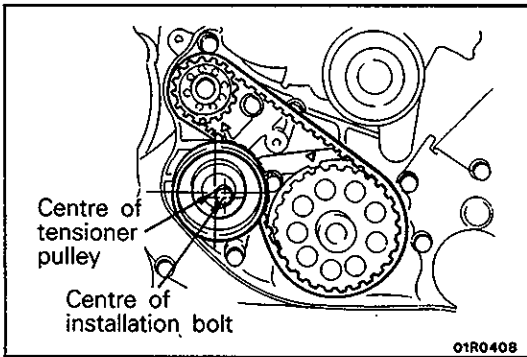
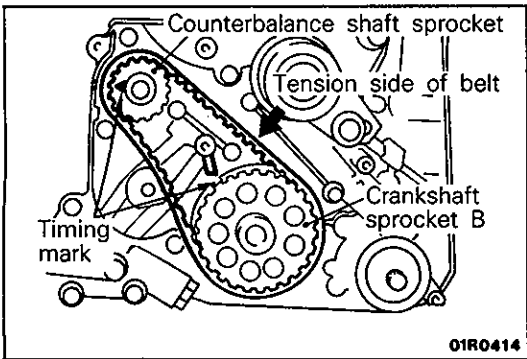
(3) Move the timing belt tensioner downward and loosely tighten the bolt so that the tensioner doesn't return; then remove the timing belt.

Caution

If the timing belt is to be re-used, use chalk to mark (on its flat side) an arrow indicating the clockwise direction.

**12./13. REMOVAL OF CRANKSHAFT SPROCKET AND CRANKSHAFT BOLT****16. REMOVAL OF TIMING BELT "B"****Caution**

If the timing belt "B" is to be re-used, use chalk to mark (on its flat side) an arrow indicating the clockwise direction.

**SERVICE POINTS OF INSTALLATION**

E111DAH

16. INSTALLATION OF TIMING BELT "B"

- (1) Ensure that crankshaft sprocket "B" timing mark and the counterbalance shaft sprocket timing mark are aligned.
- (2) Fit timing belt "B" over crankshaft sprocket "B" and the counterbalance shaft sprocket. Ensure that there is no slack in the belt.

- **ADJUSTMENT OF TIMING BELT "B" TENSION**

- (1) Temporarily fix the timing belt "B" tensioner such that the centre of the tensioner pulley is to the left and above the centre of the installation bolt, and temporarily attach the tensioner pulley so that the flange is toward the front of the engine.

- (2) Holding the timing belt "B" tensioner up with your finger in the direction of the arrow, place pressure on the timing belt so that the tension side of the belt is taut. Now tighten the bolt to fix the tensioner.

Caution

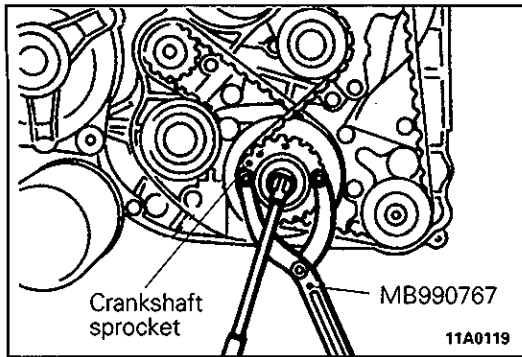
When tightening the bolt, ensure that the tensioner pulley shaft does not rotate with the bolt. Allowing it to rotate with the bolt can cause excessive tension of the belt.

- (3) Check to ensure that when centre of span on tension side is depressed with index finger in direction of arrow, tension of belt is up to specification.

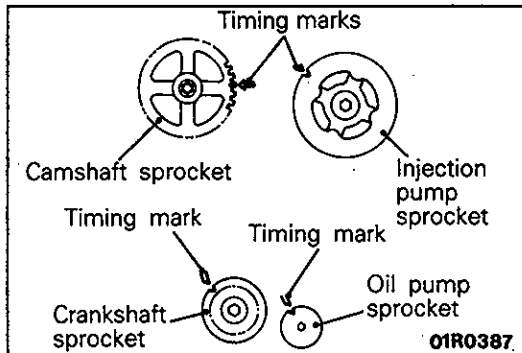
Standard value: 5–7 mm (0.20–0.28 in.)

14./13./12. INSTALLATION OF FLANGE, CRANKSHAFT SPROCKET AND CRANKSHAFT BOLT

- (1) When installing, be sure the direction is correct.

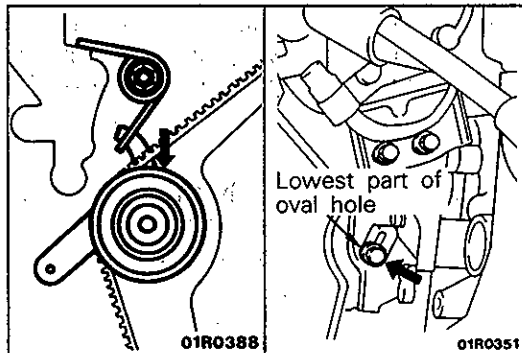


- (2) Install the crankshaft sprocket by using the special tool.



11. INSTALLATION OF TIMING BELT

- (1) Ensure that the timing marks of the camshaft sprocket, the injection pump sprocket, the crankshaft sprocket, and the oil pump sprocket are all aligned.



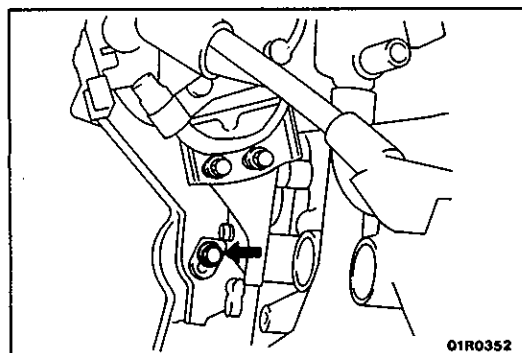
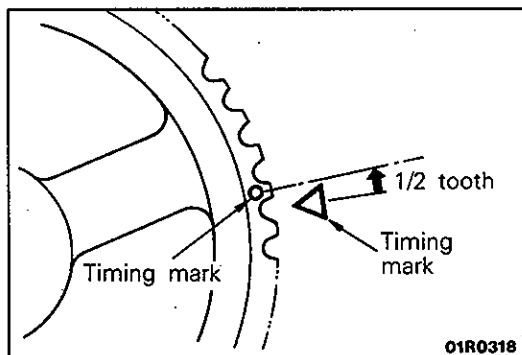
- (2) Move the timing belt tensioner downward and loosely tighten the bolt so that the tensioner doesn't return.
- (3) Install the timing belt onto the crankshaft sprocket, the timing belt idler, the camshaft sprocket, the injection pump sprocket, and the oil pump sprocket in that order.

Caution

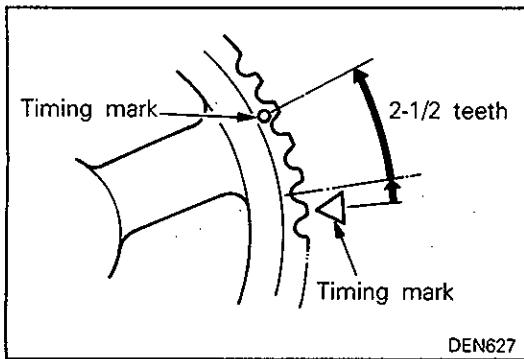
If the timing belt is reused, install so that the arrow marked on it at the time of removal is pointing in the clockwise direction.

• ADJUSTMENT OF TIMING BELT TENSION

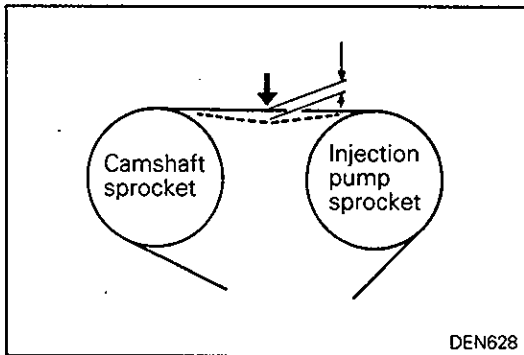
- (1) Turn the crankshaft anticlockwise by a distance equivalent to 1/2 tooth of the camshaft sprocket in order to correct looseness at the timing belt idler side.



- (2) Loosen (by 1/6 to 1/2 turn) the tensioner installation bolt previously secured provisionally, taking advantage of the force of the tensioner spring to provide tension to the belt.



- (3) In addition, turn the crankshaft anticlockwise by a distance equivalent to 2-1/2 teeth.
- (4) Tighten the timing belt tensioner at the specified torque.
- (5) Turn the crankshaft clockwise and align the timing mark.



- (6) Using the index finger, press between the camshaft sprocket and the injection pump and sprocket, and check whether or not the amount of flexion is within the standard value range or not.

Standard value range: 4-5 mm (0.16-0.20 in.)

ENGINE ASSEMBLY

E11TA-

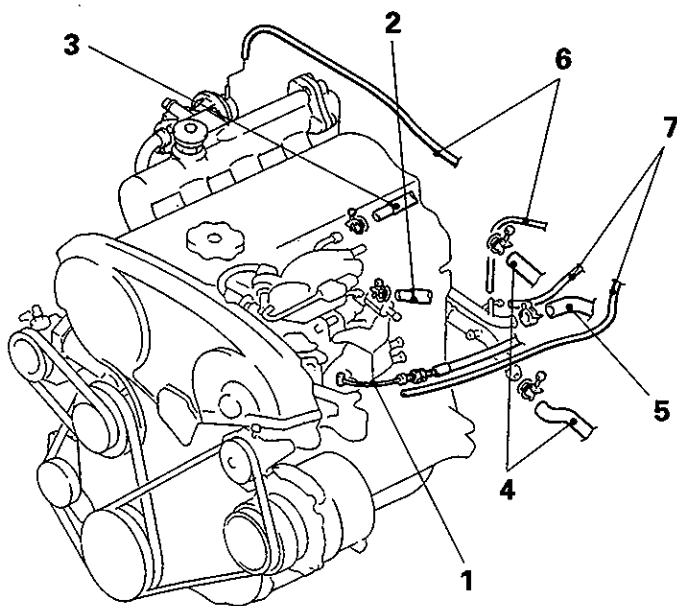
REMOVAL AND INSTALLATION

Pre-removal Operations

- (1) Removal of Hood (Refer to GROUP 42 - Hood)
- (2) Prevention of Fuel Flow (Refer to GROUP 13 – Service Adjustment Procedures)
- (3) Draining of Engine Coolant
- (4) Removal of Transmission Assembly (Refer to GROUPS 22 and 23 – Transmission Assembly)
- (5) Removal of Radiator Assembly (Refer to GROUP 14 – Radiator)

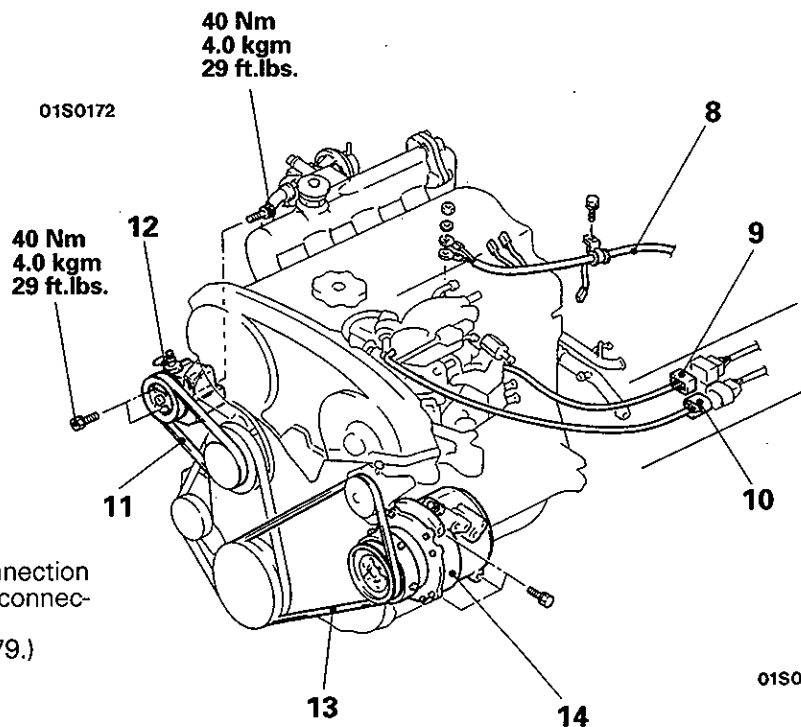
Post-installation Operations

- (1) Installation of Radiator Assembly (Refer to Group 14 – Radiator)
- (2) Installation of Transmission Assembly (Refer to GROUPS 22 and 23 – Transmission Assembly)
- (3) Supplying of Engine Coolant
- (4) Adjustment of Accelerator Cable (Refer to GROUP 13 – Service Adjustment Procedures.)
- (5) Air Bleeding of Fuel Line (Refer to GROUP 13 – Service Adjustment Procedures)
- (6) Installation of Hood (Refer to GROUP 42 – Hood)



Removal steps

1. Accelerator cable connection
2. Fuel hose (return) connection
3. Fuel hose (main) connection
4. Heater hose connection
5. Brake booster vacuum hose connection
6. EGR vacuum hose connection <T/C>
7. Vacuum hose connection for air conditioner idle-up solenoid valve

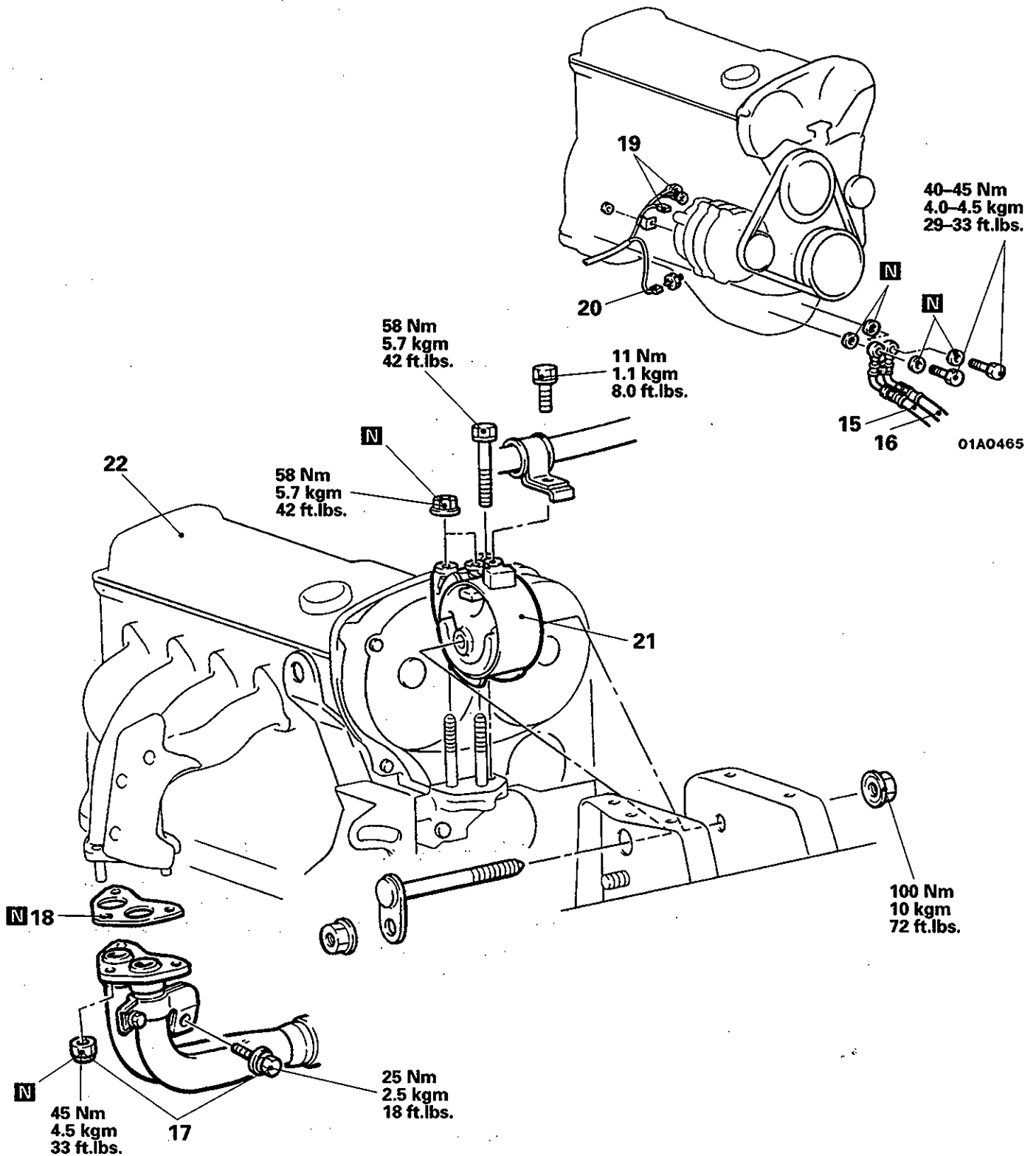


8. Control harness connection
9. Fuel injection pump harness connection
10. Lever (throttle) position sensor connector

● Adjustment of drive belts (P.11-79.)

11. Power steering drive belt
12. Power steering oil pump
13. Air conditioner drive belt
14. Air conditioner compressor

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- 15. Engine oil feed hose connection
- 16. Engine oil return hose connection
- 17. Self-locking nut and bolt
- 18. Gasket
- 19. Alternator connector
- 20. Oil pressure switch connector
- 21. Engine mount bracket
- 22. Engine assembly



SERVICE POINTS OF REMOVAL

E11TBAN

12. REMOVAL OF POWER STEERING OIL PUMP

Remove the power steering oil pump from the bracket with the hose attached.

NOTE

Place the removed power steering oil pump in a place where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

14. REMOVAL OF AIR CONDITIONER COMPRESSOR <VEHICLES WITH AIR CONDITIONER>

Disconnect the air conditioner compressor connector and remove the compressor from the compressor bracket with the hose still attached.

NOTE

Place the removed air conditioner compressor in a place where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

21. REMOVAL OF ENGINE MOUNT BRACKET

- (1) Support the engine with a garage jack.
- (2) Hold the engine assembly with a chain block, etc.
- (3) Place the garage jack against the engine oil pan with a piece of wood in between, and after raising the engine until there is no weight on the engine mount brackets, remove the engine mount brackets.

22. REMOVAL OF ENGINE ASSEMBLY

After checking that all cables, hoses and harness connectors, etc., are disconnected from the engine, lift the chain block slowly to remove the engine assembly upward from the engine compartment.

SERVICE POINTS OF INSTALLATION

E11TDAQ

21. INSTALLATION OF ENGINE MOUNT BRACKET

- (1) Place a garage jack against the engine oil pan with a piece of wood in between, and install the engine mount bracket while adjusting the position of the engine.
- (2) Support the engine with a garage jack.
- (3) Remove the chain block and support the engine assembly with the special tool.

