
GENERAL

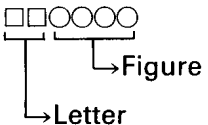
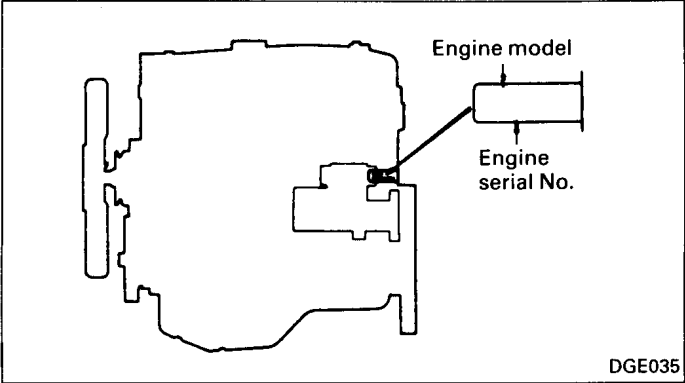
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1. ENGINE-TRANSMISSION MODEL TABLE

Engine – Transmission	Transmission	Vehicle model	Remarks
4D55 – 0 – 90U	M1S5	FB433	EUROPE

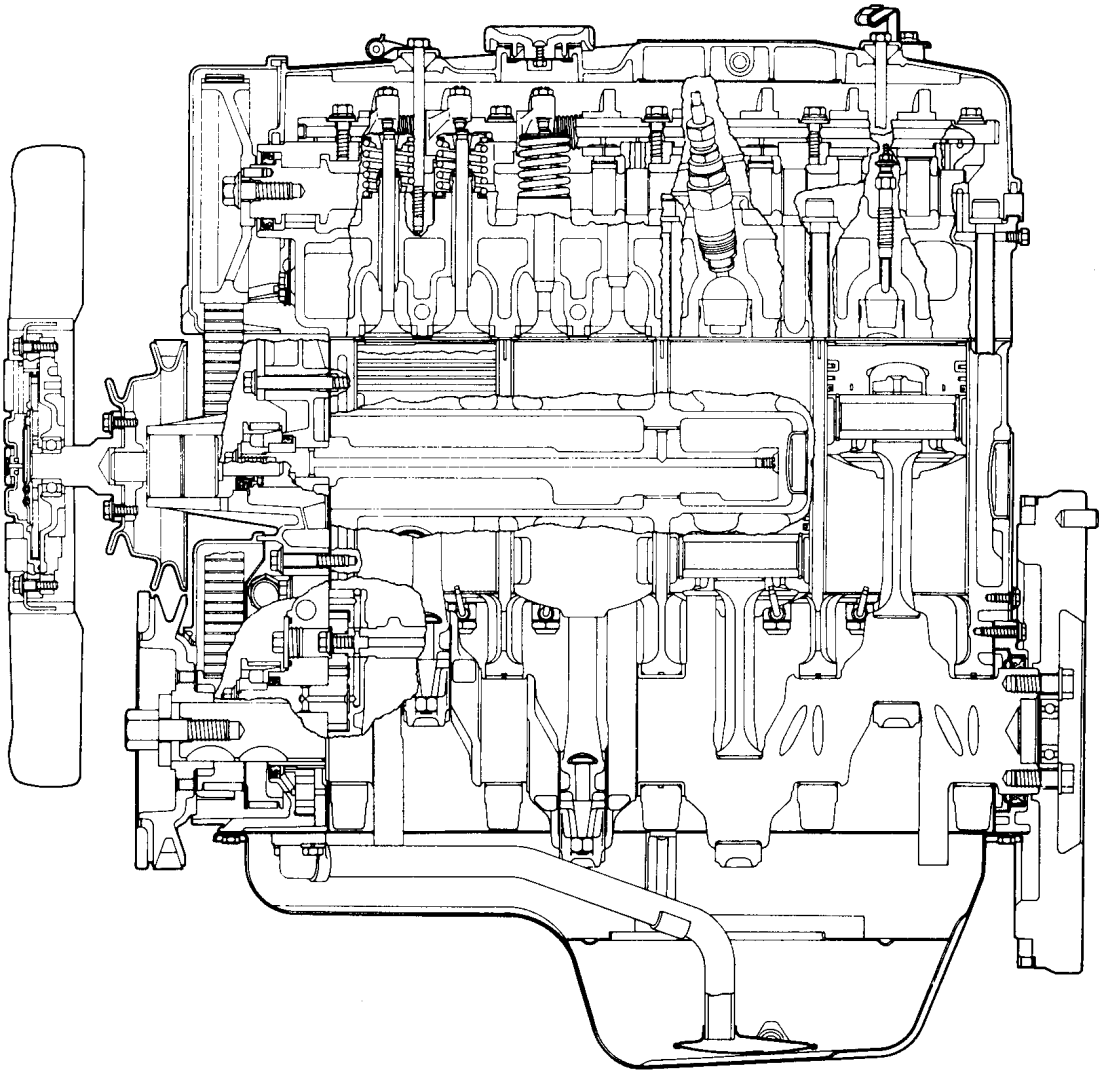
2. ENGINE MODEL AND SERIAL NUMBER LOCATION



Example: AA0101 to AA9999
↓
AB0001
⋮
AY9999
↓
BA0001

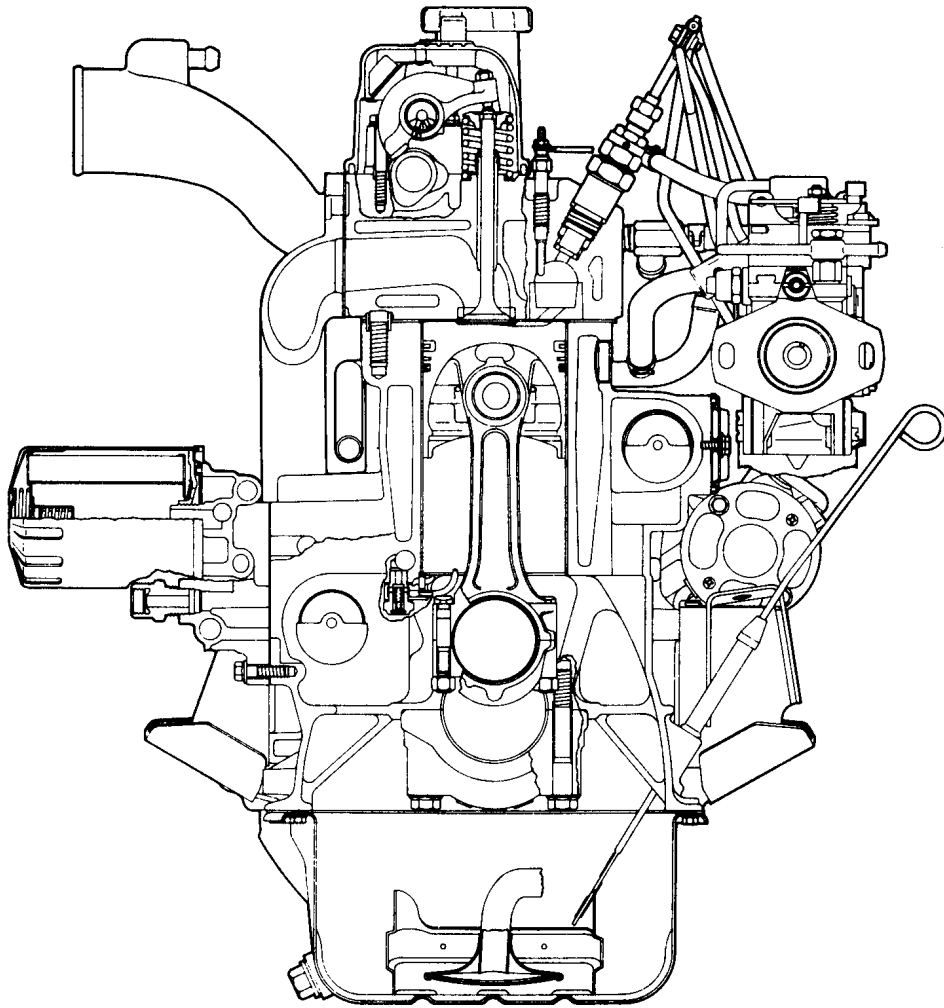
3. ENGINE SECTION

Longitudinal Section of Engine



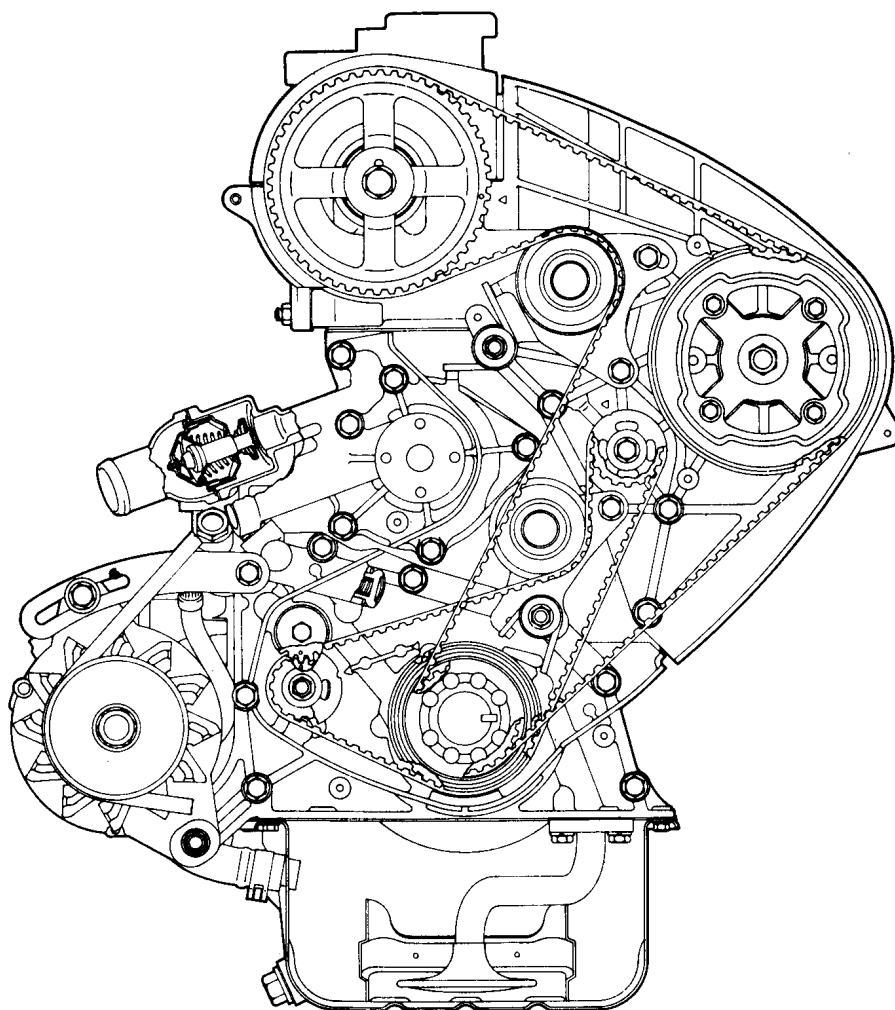
DGE002

Cross Section of Engine



DGE003

Timing Belt Train



DGE004

4. MAJOR SPECIFICATIONS

Description	Specifications	Remarks
Type	4 cycle, diesel engine	
No. of cylinders, arrangement	4-in line, longitudinal	
Type of combustion chamber	Swirl chamber	
Valve mechanism	Overhead valve, single overhead camshaft (SOHC), belt drive	
Cylinder liner type	Dry type	
Bore x stroke	91.1 x 90.0 mm	
Total displacement	2.346 lit.	
Compression ratio	21.0	
Compression pressure	2 256 kPa (23 kg/cm ²) or more – 250 rpm	
Valve timing		
Intake valve		
Opens/Closes	BTDC 20°/ABDC 48°	
Exhaust valve		
Opens/Closes	BBDC 54°/ATDC 22°	
Valve clearance (hot)		
Intake valve	0.25 mm	
Exhaust valve	0.25 mm	
Idling speed	750 ± 50 rpm	
Blow-by gas recirculation system	Sealed type	
Lubrication system	Pressure-feed type	
Oil pump type	Gear type	
Oil filter type	Full flow filtration, filter paper type	
Engine oil quantity	6.5 lit. (including 0.6 lit. oil filter and 0.4 lit. oil cooler)	
Fuel feed pump type	Vane type	
Fuel injection pump type	Distribution type	
Injection timing	ATDC 5°	
Nozzle holder type	Screw type	
Nozzle type	Throttle type	
Injection pressure	11 768 kPa (120 kg/cm ²)	
Cooling system	Water cooling system	
Glow plug type	Sheathed type	
Starting motor type	Reduction drive	
Alternater type	AC type with vacuum motor	

5. STANDARD PARTS TIGHTENING TORQUE

Tightening Torque of Bolt or Nut with Spring Washer

Classification Torque	Head mark 4		Head mark 7		Head mark 10	
	Nm	kgm	Nm	kgm	Nm	kgm
Thread size mm (dia. x pitch)						
5 x 0.8	–	–	4 – 5	0.4 – 0.6	–	–
6 x 1.0	–	–	8 – 9	0.8 – 1	10 – 12	1 – 1.3
8 x 1.25	10 – 12	1 – 1.3	15 – 21	1.5 – 2.2	25 – 34	2.5 – 3.5
10 x 1.25	18 – 24	1.8 – 2.5	30 – 41	3 – 4.2	49 – 68	5 – 7
12 x 1.25	30 – 41	3 – 4.2	54 – 73	5.5 – 7.5	94 – 117	9.5 – 12
14 x 1.5	49 – 68	5 – 7	79 – 107	8 – 11	157 – 186	16 – 19

Tightening Torque of Flange Bolt or Nut

Classification Torque	Head mark 4		Head mark 7	
	Nm	kgm	Nm	kgm
Thread size mm (dia. x pitch)				
5 x 0.8	–	–	5 – 6	0.5 – 0.7
6 x 1.0	–	–	8 – 11	1 – 1.2
8 x 1.25	12 – 14	1.2 – 1.5	20 – 26	2 – 2.7
10 x 1.25	27 – 33	2.7 – 3.4	43 – 53	4.3 – 5.5
12 x 1.25	47 – 58	4.8 – 6	79 – 98	8 – 10

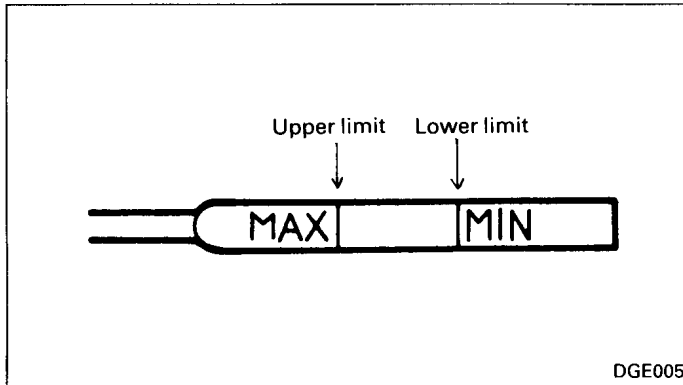
Tightening Torque of Taper Thread

Classification Torque	Aluminium alloy		Cast iron or steel	
	Nm	kgm	Nm	kgm
Thread size				
NPTF 1/16	5 – 7	0.5 – 0.8	8 – 11	0.8 – 1.2
PT 1/8	8 – 11	0.8 – 1.2	15 – 21	1.5 – 2.2
PT 1/4, NPTF 1/4	20 – 29	2 – 3	35 – 44	3.5 – 4.5
PT 3/8	40 – 53	4 – 5.5	54 – 73	5.5 – 7.5
PT 1/2	69 – 98	7 – 10	118 – 156	12 – 16

6. MAINTENANCE

6.1 ENGINE OIL AND OIL FILTER

Checking Engine Oil Level and Replenishing Engine Oil



1. Position the vehicle on a flat level.
2. Check the engine oil level with an oil level gauge. If the oil level is found to have fallen to the lower limit as indicated by the MIN mark, replenish 1 liter of engine oil.

Caution:

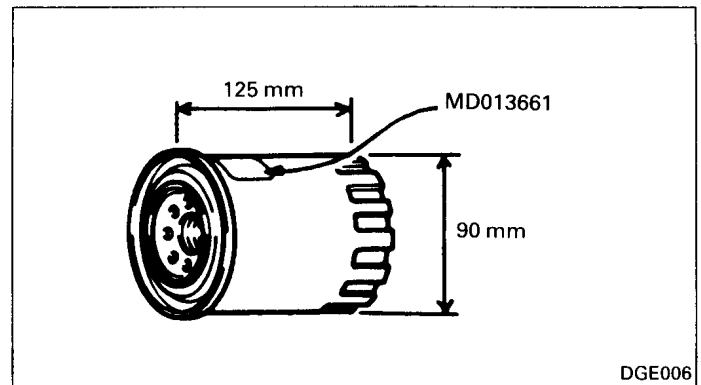
- **Check the oil level approximately one minute after replenishment**
- **For replenishment, use the same type of engine oil as one currently used.**
- **In the case of a vehicle that has been out of service for a prolonged period, run the engine for several minutes and then stop for some time before attempting to check the oil level.**
- **If the oil cooler and hose have been removed or replaced, check the oil level with the engine fully warmed up or at a coolant temperature of 80 to 90°C.**

Engine Oil

Be sure to use engine oil equivalent or superior to the specified grade, and of the viscosity suitable for the atmospheric temperature as shown at the right.

API classification	Temperature	Viscosity (SAE)
Class CC or higher	0 to 40°C	30
	Above -10°C	20W - 40
	Above -15°C	15W - 40
	-20 to 40°C	10W - 30
	Below 10°C	5W - 30

Oil Filter



Use the oil filter of the size shown in figure. Do not use the oil filter for other models.

Replacing Engine Oil

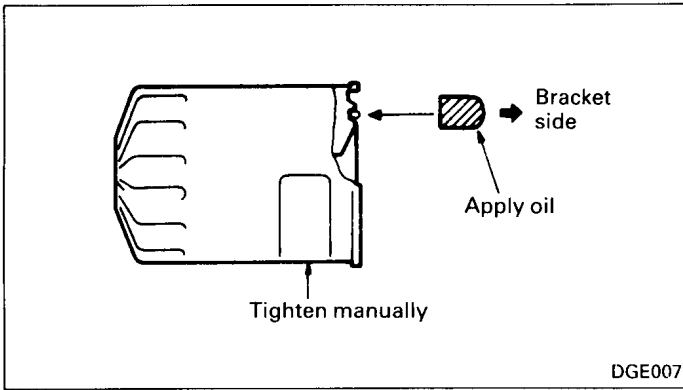
After warming up the engine, remove the drain plug from the oil pan to drain off the old oil. Then, tighten the drain plug and pour new engine oil through the oil filler.

- Drain plug tightening torque:
59 to 78 Nm (6 to 8 kgm)
- Oil quantity:
Approximately 6.5 lit. (including 0.6 lit. in oil filter and 0.4 lit. in oil cooler).

Caution:

- **When draining the engine oil, most of the oil in the oil cooler (including pipe) and the oil filter remain undrained. When filling oil, therefore, make allowance for that quantity.**
- **If the oil cooler and hose have been removed or replaced, check the oil level with the engine fully warmed up or at a coolant temperature of 80 to 90°C.**

Replacing Oil Filter

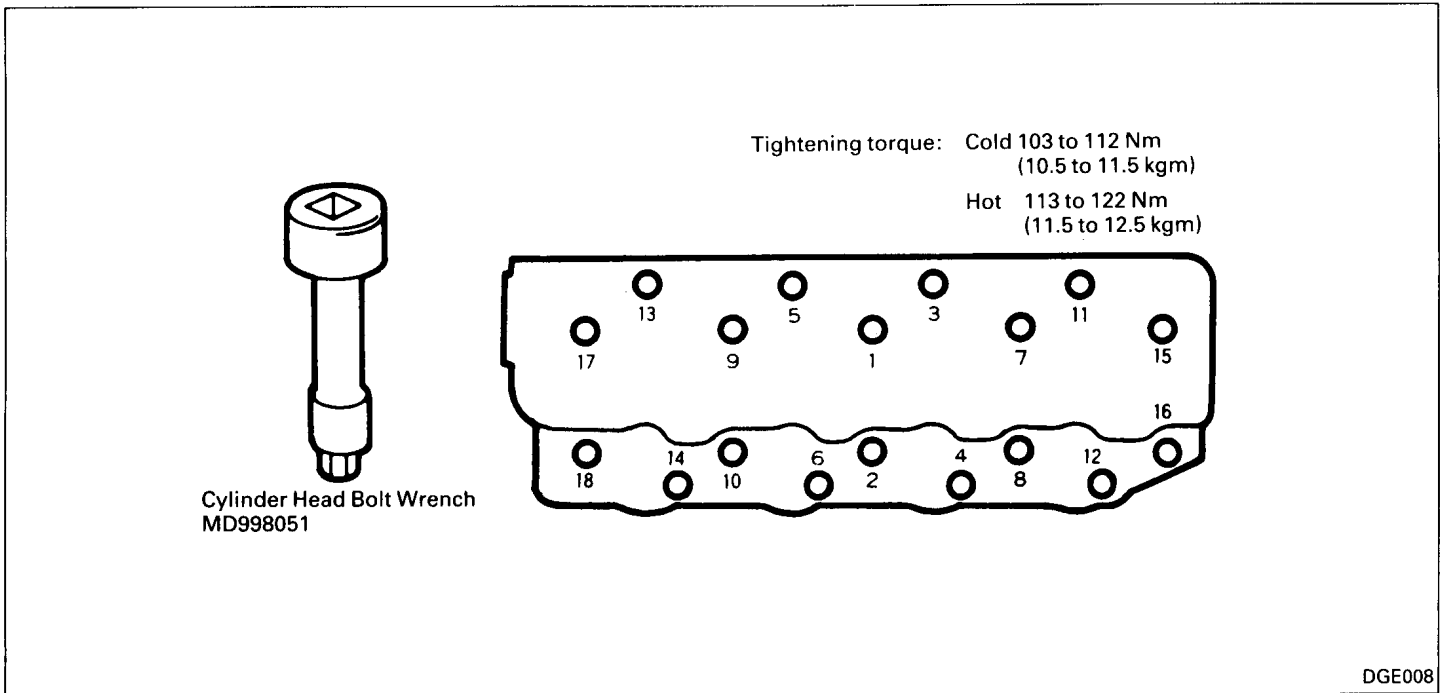


1. Use filter wrench or the like to remove the oil filter.
2. When installing the oil filter, clean the filter mounting surface of the filter bracket and lightly apply engine oil to the filter O-ring. Finger tighten the oil filter. [Tightening torque: 11 to 12 Nm (1.1 to 1.3 kgm)]

Caution:

- **Protect O-ring against twist and bending.**
3. Run the engine for several minutes to check for engine oil leaks.
 4. After stopping the engine, check the oil level and replenish as necessary.

6.2 ADDITIONAL TIGHTENING OF HEAD BOLTS



When giving additional tightening to the cylinder head bolts, back off the bolts slightly and then tighten to the specified torque. The tightening sequence of the bolts is as shown in illustration.

6.3 VALVE CLEARANCE ADJUSTMENT

Nut
12 to 17 Nm
(1.2 to 1.8 kgm)

Valve whose clearance is adjustable when the piston in No. 1 cylinder is at top dead center on compression stroke

Valve whose clearance is adjustable when the piston in No. 4 cylinder is at top dead center on compression stroke

Valve clearance

	When hot	When cold (ref.)
In.	0.25 mm	0.15 mm
Ex.	0.25 mm	0.15 mm

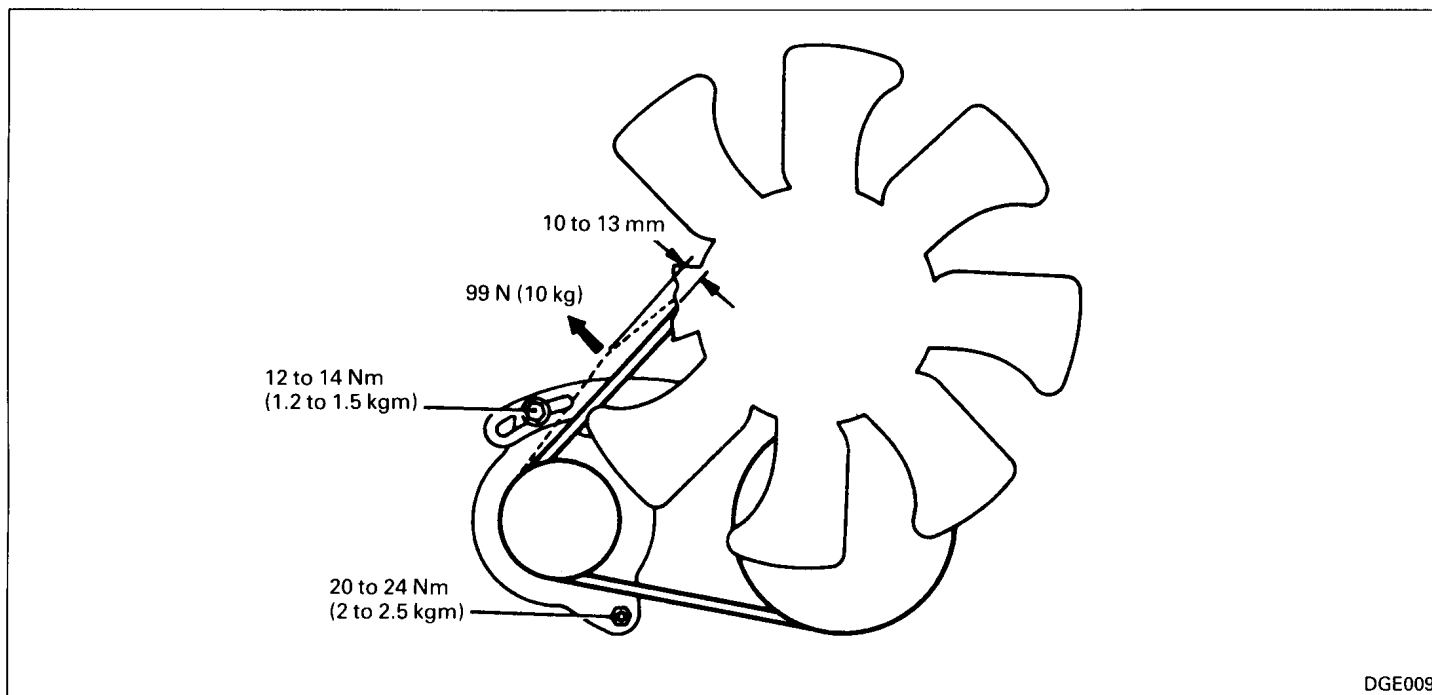
DGE032

Caution

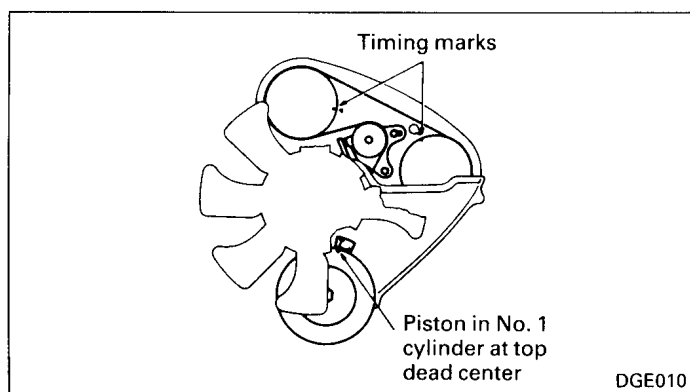
- **The valve clearance adjustment shall be preceded by additional tightening of the cylinder head bolts.**

1. Warm up the engine until the coolant is heated to 80 to 90°C.
2. Loosen the rocker arm nut and turn the adjust screw to measure and adjust the valve clearance with a thickness gauge.
3. Tighten the nut while holding the adjust screw to prevent it from turning.

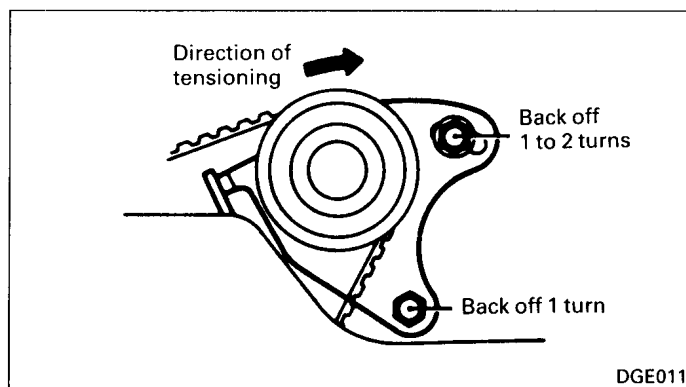
The valves shown in illustration can have their clearance adjusted when the piston in No. 1 cylinder is at the top dead center on compression stroke or the piston in No. 4 cylinder at the top dead center on compression stroke.

6.4 ADJUSTING FAN BELT TENSION

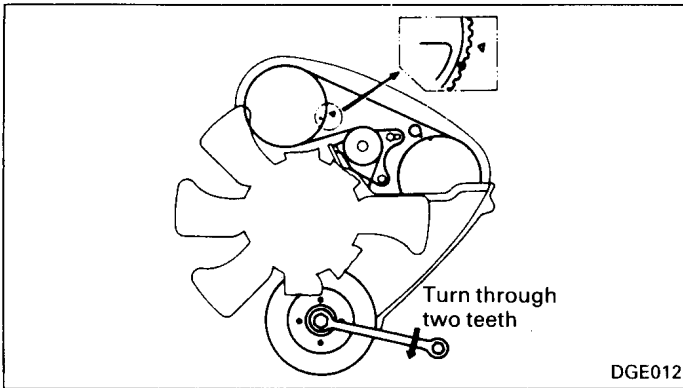
Adjust the position of the alternator so that the belt deflects 10 to 13 mm when it is pulled in the direction normal to the belt with a force of approximately 99 N (10 kg) at a point halfway between the water pump pulley and the alternator pulley.

6.5 ADJUSTING TIMING BELT TENSION

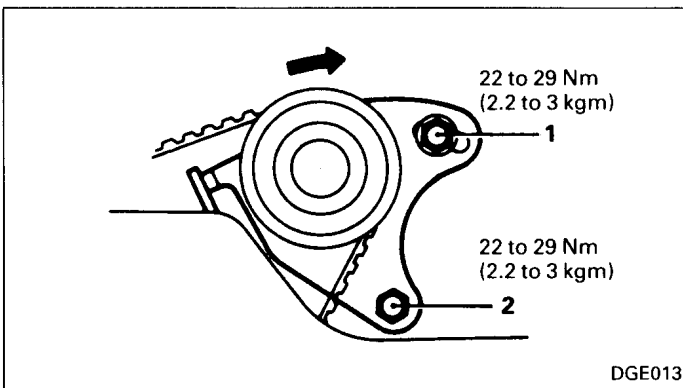
1. Remove the timing belt upper cover and bring the piston in No. 1 cylinder to the top dead center on the compression stroke. Check that the timing marks of the chain and sprockets are aligned. (If not, see "Timing Belt".)



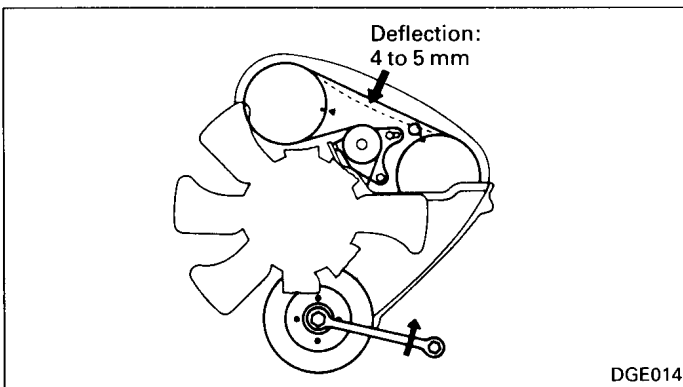
2. Loosen the timing belt tensioner mounting bolts. This causes the tensioner spring to work for automatic tensioning of the timing belt.



- Turn the crankshaft in the normal direction through two teeth of the camshaft sprocket and hold in this position. Be sure to turn smoothly by the specified amount as this operation is necessary to give a fixed tension to the tension side of the belt.

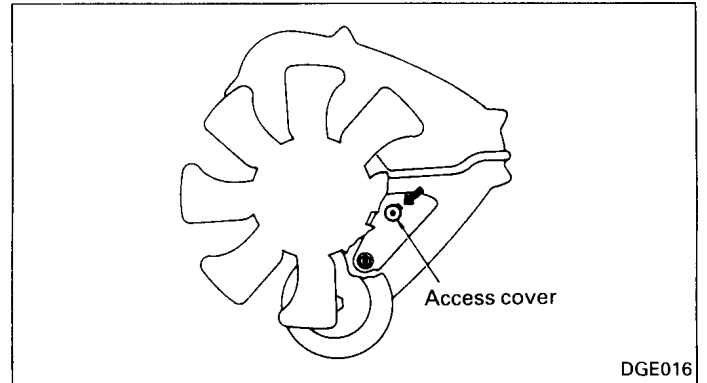


- Tighten the two tensioner mounting bolts. In order to prevent free rotation of the tensioner bracket, first tighten the bolt (on oblong hole side) and then tighten the other bolt.

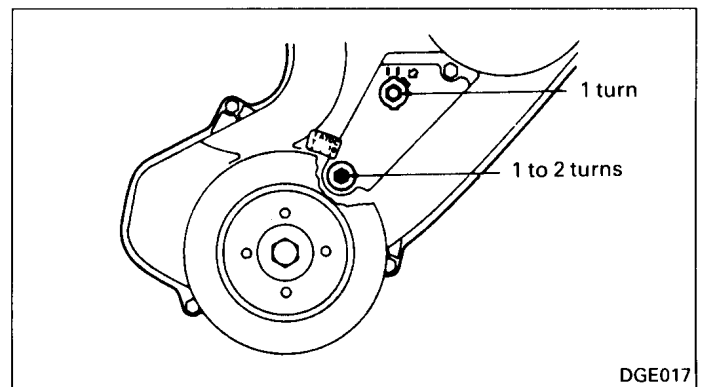


- Turn the crankshaft in reverse direction until the timing marks are aligned. Then, check the belt tension by pushing down the belt with a forefinger at a point halfway between the cam sprocket and the injection pump sprocket.

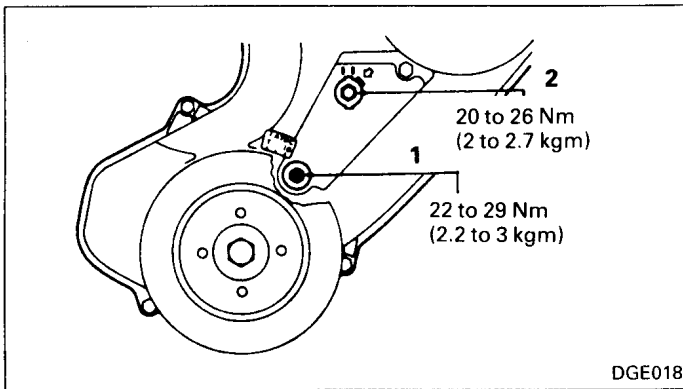
6.6 ADJUSTING TENSION OF TIMING BELT "B" (SILENT SHAFT DRIVE BELT)



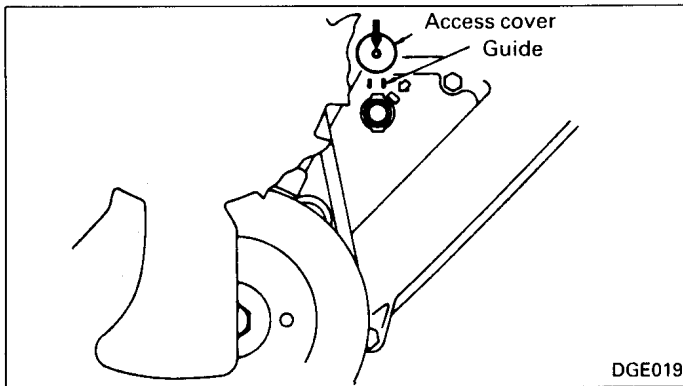
- Turn the crankshaft to bring the piston in No. 1 cylinder to the top dead center on the compression stroke, and remove the access cover. Inserting a screwdriver tip through the position indicated by the arrow and prying up the cover will facilitate its removal.



- Loosen the tensioner mounting bolts and nuts. This will result in proper tensioning of the belt "B".



3. Tighten the tensioner mounting nuts and bolts. In order to prevent rotation of the tensioner bracket, be sure to tighten the nut (lower side) first.



4. Mount the access cover, sliding down along the two embossed lines of the front lower cover.

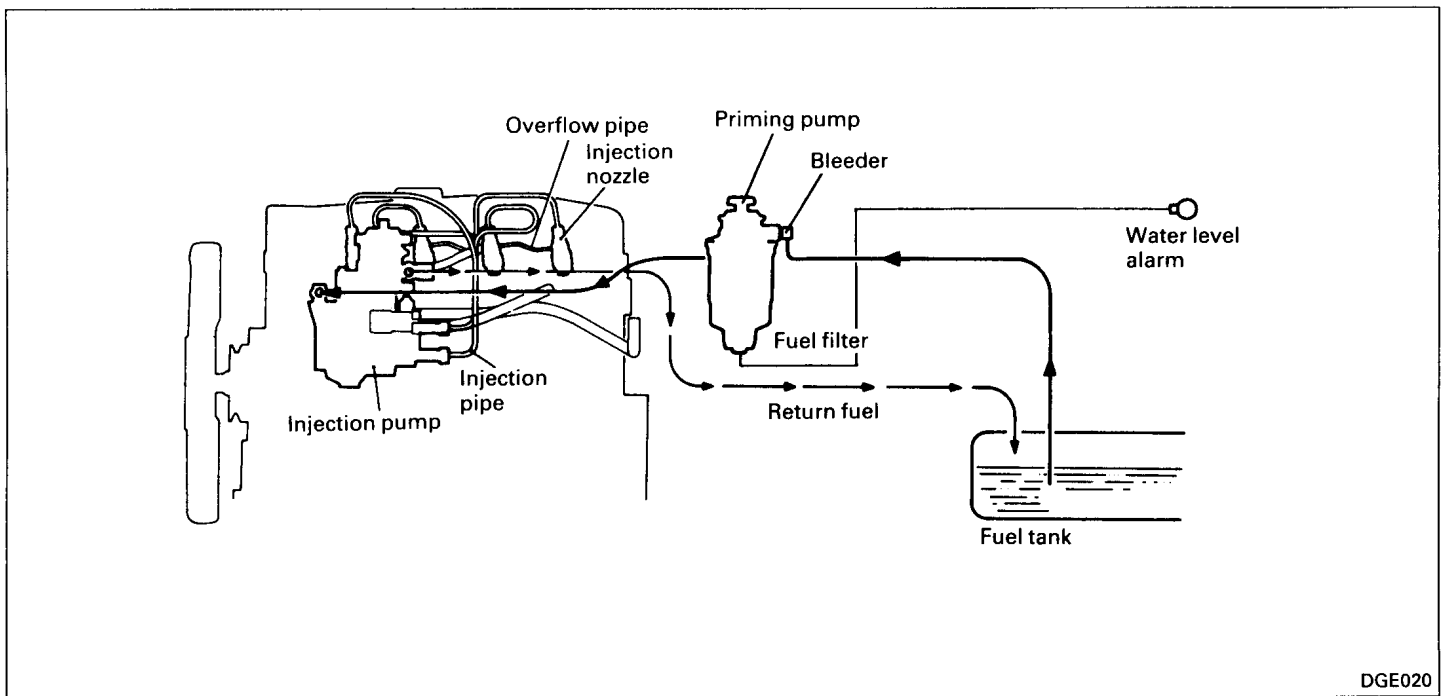
6.7 BLEEDING FUEL SYSTEM

Whenever the fuel piping is disconnected or the fuel filter is replaced, bleed the fuel system in the following procedure:

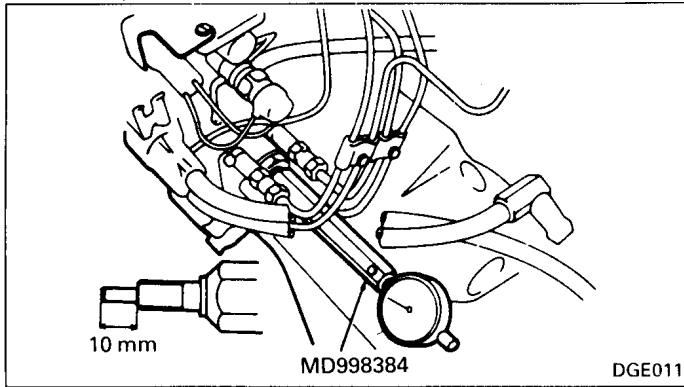
1. Cover the bleeder plug at the fuel filter top with a cloth.
2. Loosen the bleeder plug.
3. Operate the priming pump until bubble-free flowing is seen.
4. Firmly tighten the bleeder plug and wipe the spilled fuel with a cloth.

Caution:

- **Be sure to completely remove the spilled fuel. If the fuel is left unremoved, it could get fire.**
5. Operate the priming pump until it becomes hard to operate.



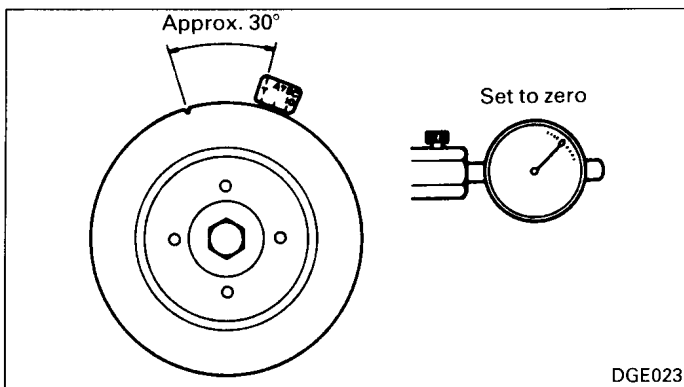
6.8 ADJUSTING INJECTION TIMING



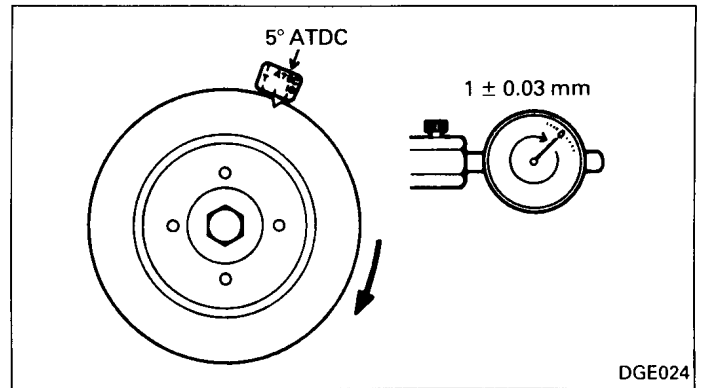
1. Remove the plug from the rear of the injection pump and attach the prestroke measuring adapter (MD998384) and a dial indicator.

Caution

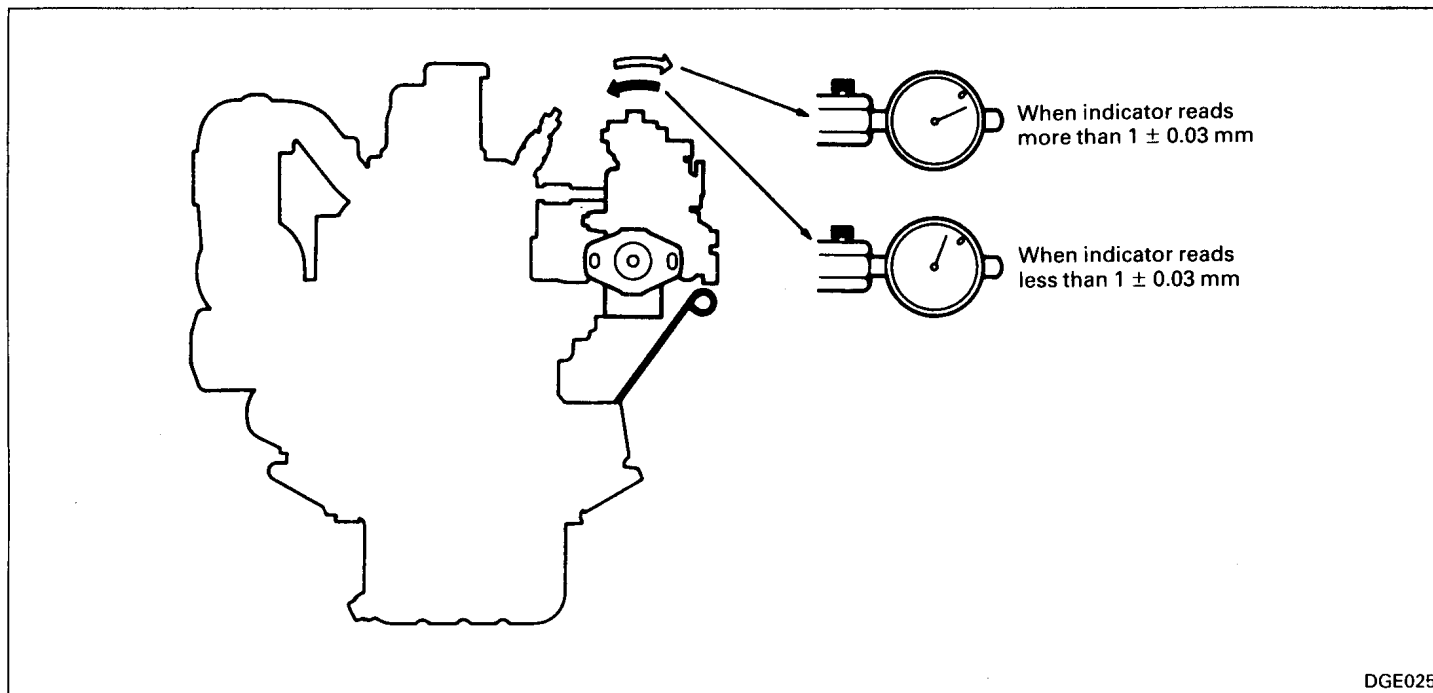
- Before installation of adapter, make sure that the push rod is protruding by 10 mm.
- Protrusion of push rod can be adjusted with an inner nut.



2. Turn the crank pulley to such a position that the notch on the pulley is at approximately 30° before the top dead center on the compression stroke of the piston in No. 1 cylinder. Then, set the dial indicator to zero. Slightly turn the crank pulley clockwise and counterclockwise to make sure that the dial indicator pointer does not deviate from the zero position. If it does, readjust the pulley position so that the notch on the pulley is at 30° before the top dead center.

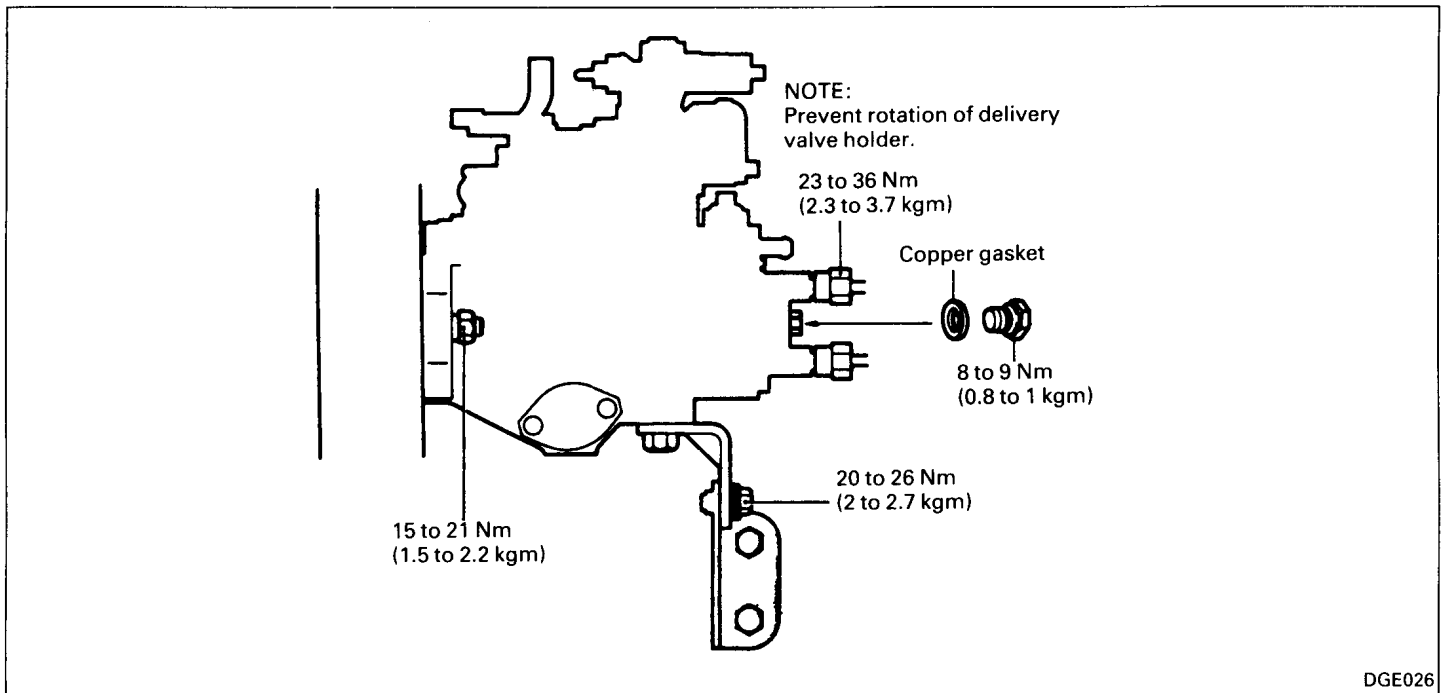


3. Turn the crankshaft in the normal direction to bring the notch to 5° ATDC, and check that the dial indicator reads 1 ± 0.03 mm.

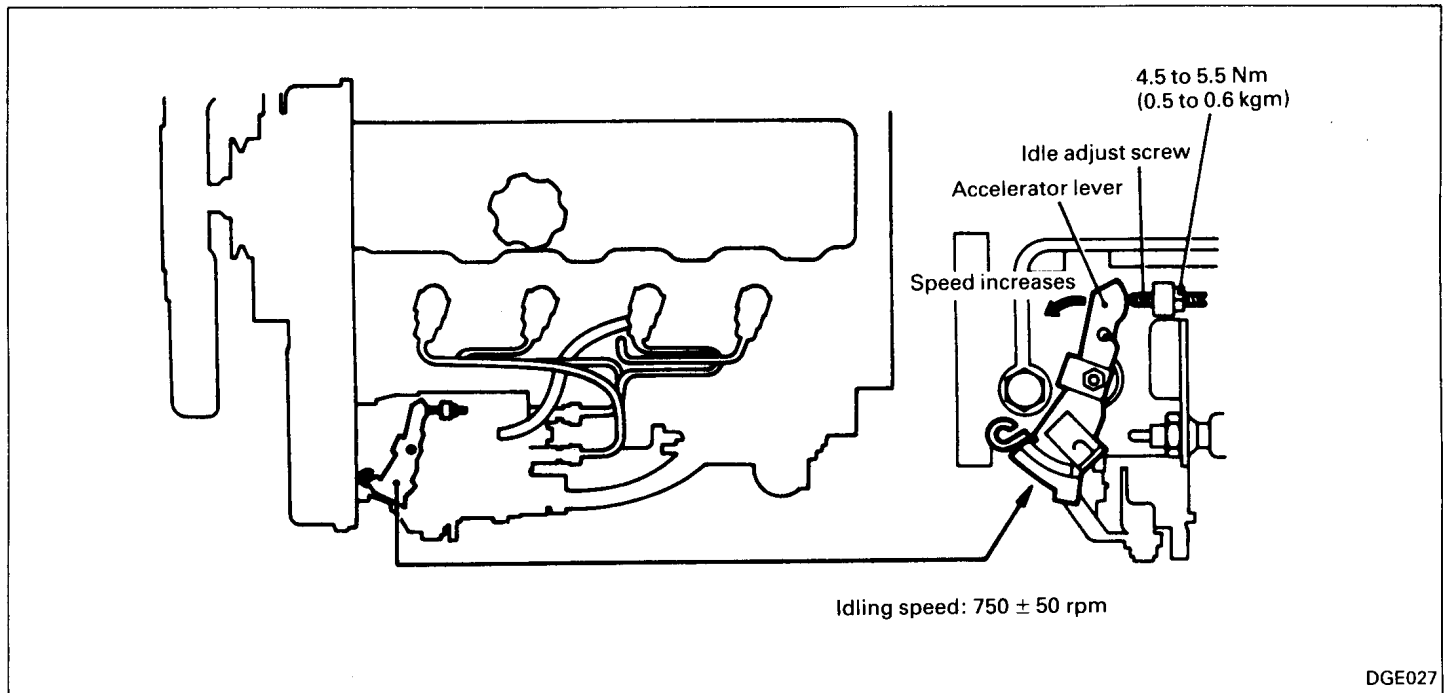


DGE025

4. If the dial indicator does not indicate the specified value, tilt the injection pump body to the right or left until the dial indicator reads 1 ± 0.03 mm. Then, provisionally tighten the bolts securing the injection pump.
5. Repeat Steps 2. thru 4. to check that the adjustment has been made correctly.



6. Remove the prestroke measuring adapter, fit the plug and tighten each part.

6.9 ADJUSTING IDLING SPEED

Check the following before attempting to adjust the idling.

1. The engine has been warmed up sufficiently to heat the coolant to 80 to 90°C.
2. The valve clearance has been adjusted correctly. Adjust as necessary.
3. The injection timing is as specified (5° ATDC).
4. The fast idle is released.
5. The injection nozzle operates normally.

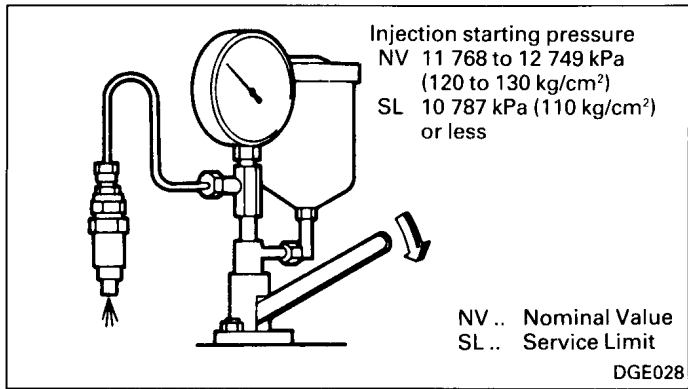
Adjust the idling as follows.

1. Loosen the lock nut of the idle adjust screw and turn the screw clockwise or counterclockwise to obtain an idling speed of 750 ± 50 rpm. After adjustment, tighten the lock nut.

Caution:

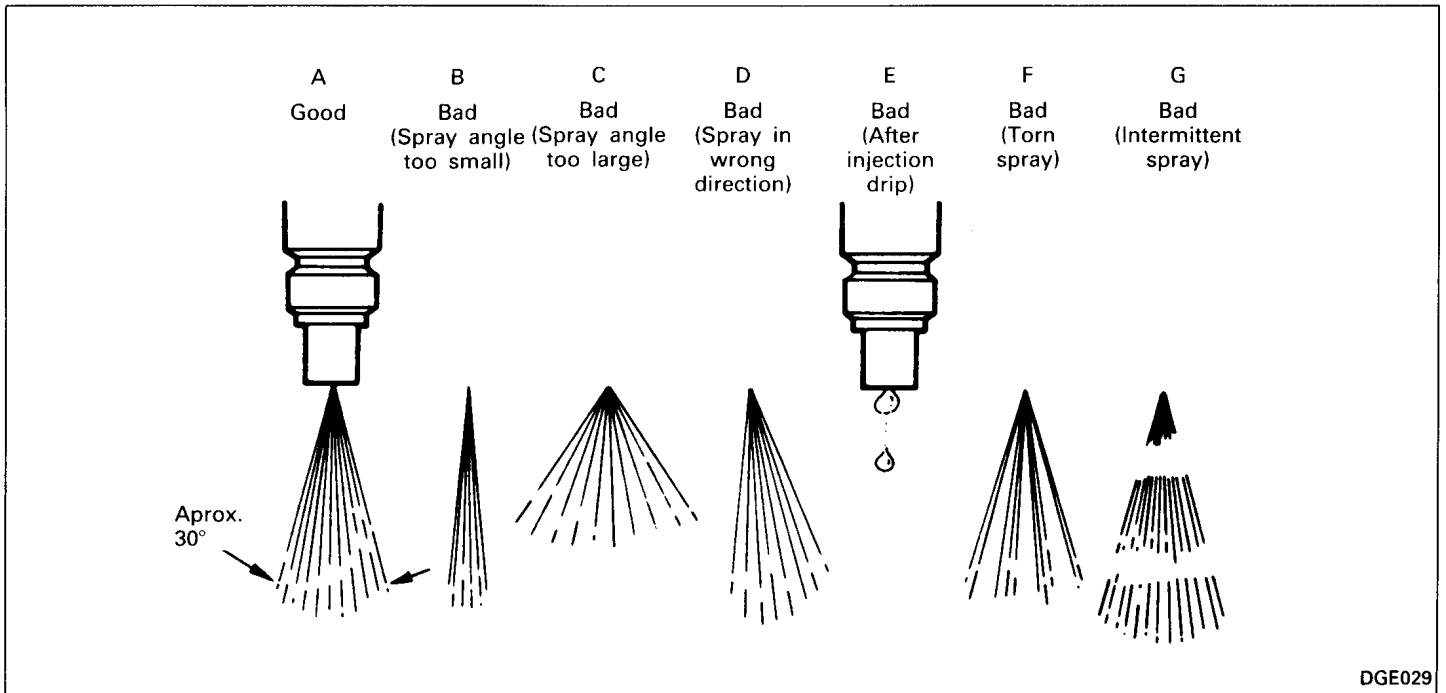
- **Do not disturb other screws.**

6.10 CHECKING NOZZLE



Check the nozzles for the following items and correct or replace defective nozzle.

Checking Spray Condition



1. Operate the tester handle at a rate of approximately one stroke/min.
 - Vibrating condition of needle valve
 When the tester handle is stroked, the nozzle should inject, producing characteristic intermittent noises (Schnarre), and the vibration of the needle valve should be felt at the tester handle.

- Spraying condition
 The spray pattern A shown in above figure is normal, all other patterns being abnormal. Sometimes, the fuel may be injected in a straight stream of coarse particles, leaving fuel oil in the orifice after injection. This phenomenon occurs only during the check and does not mean abnormal nozzle function.

2. Operate the tester handle at a rate of approximately 4 to 6 strokes/second.
 - A normal spray pattern obtained should be a circular cone with a vertical angle of approx. 30° and made of uniform and fine mist. Patterns other than pattern A represent abnormal conditions.

Checking Oil Tightness of Nozzle

Operate the nozzle tester to maintain the nozzle inside pressure at 9 807 to 10 787 kPa (100 to 110 kg/cm²) as indicated by the pressure gauge, and check for fuel leaks from the nozzle tip.

6.11 CHECKING COMPRESSION PRESSURE

Prior to checking the compression pressure, ensure that:

1. The engine oil, air cleaner, starting motor and batteries are all in normal condition.
2. The engine is warmed up [coolant temperature: 80 to 90°C].

Check the compression pressure as follows.

1. Loosen the injection pipe nut on the nozzle side and remove the pipe from the nozzle holder.

Caution:

- **Keep the nozzle capped to prevent entry of foreign matter.**
2. Remove the glow plugs from all cylinders and attach the compression gauge adapter and the compression gauge to the cylinder under test.
 3. Turn on the starting motor to start the engine and read the compression gauge after its pointer has stabilized.

Description	Nominal value
Engine speed	250 rpm
Compression pressure	2 256 kPa (23 kg/cm ²) or more
Pressure difference among cylinders	294 kPa (3 kg/cm ²) or less

Caution:

- **When checking the pressure, remember that the fuel will gush out from the injection pipe.**
4. After measurement, remove the compression gauge and the compression gauge adapter and attach the glow plugs and the injection pipe.

Part to be tightened	Torque
Injection pipe nut	23 to 36 Nm (2.3 to 3.7 kgm)
Pipe clamp nut	8 to 9 Nm (0.8 to 1.0 kgm)
Glow plug	15 to 19 Nm (1.5 to 2.0 kgm)