
FUEL AND ENGINE CONTROL

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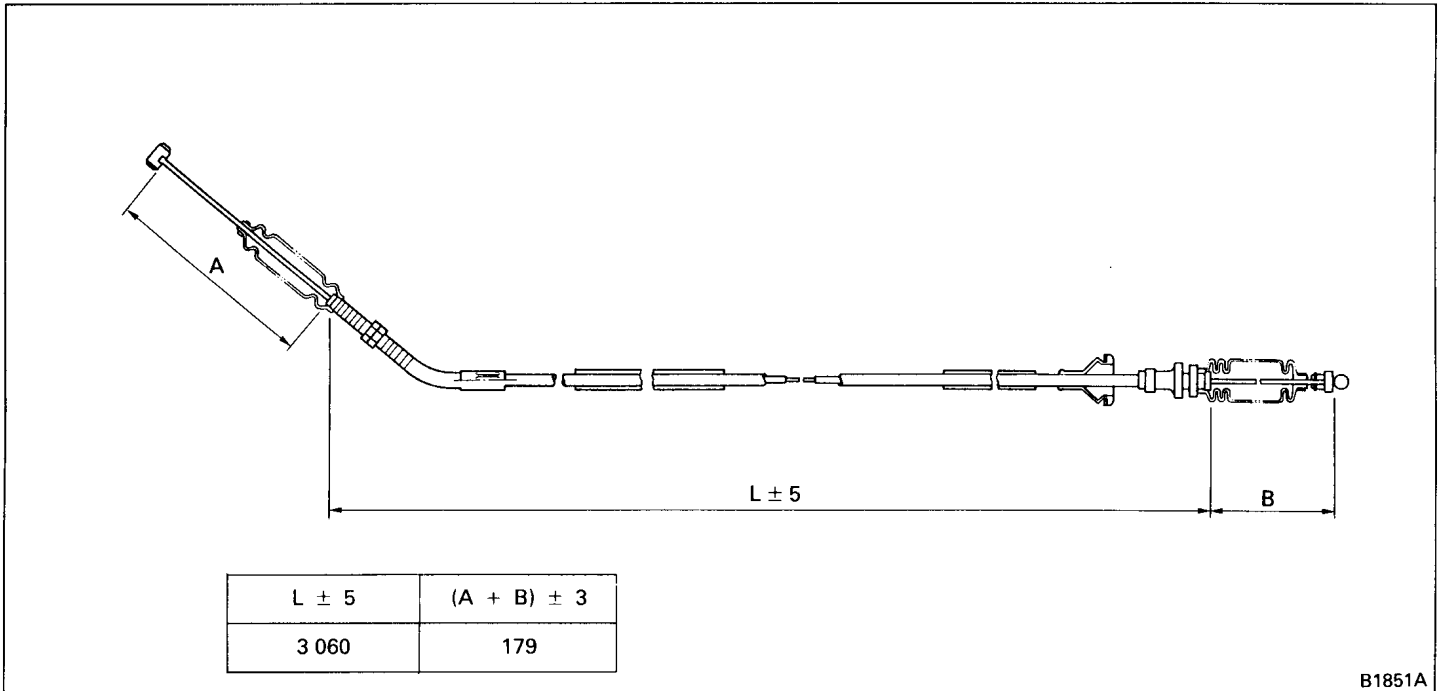
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1. SPECIFICATIONS**1.1 GENERAL SPECIFICATIONS**

Description	Specifications	Remarks
Fuel injection pump		
Injection pump		
Type	Distribution type (Diesel Kiki)	
Turning direction	Clockwise as viewed from drive side	
Injection sequence	1 – 3 – 4 – 2	
Injection timing	5° ATDC (when pluger lift 1 mm)	
Cam lift	2.2 mm	
Plunger diameter	10 mm	
Delivery valve opening pressure	2 108 kPa (21.5 kg/cm ²)	
Governor type	Centrifugal type	
Timer type	Hydraulic	
Feed pump type	Vane type	
Control equipment		
Fuel cut solenoid	Rated voltage: 12V; Resistance: 8Ω	
Injection nozzle		
Type	Screw type	
Nozzle		
Type	Throttle type	
Injection orifice (Number – diameter)	1 – 1.02 mm	
Injection pressure	11 768 kPa (120 kg/cm ²)	
Engine control system		
	Pedal-operated cable type, incorporating electric engine stop mechanism interlocked with starter switch	
	Throttle button type	
Throttle knob stroke	25 or more	

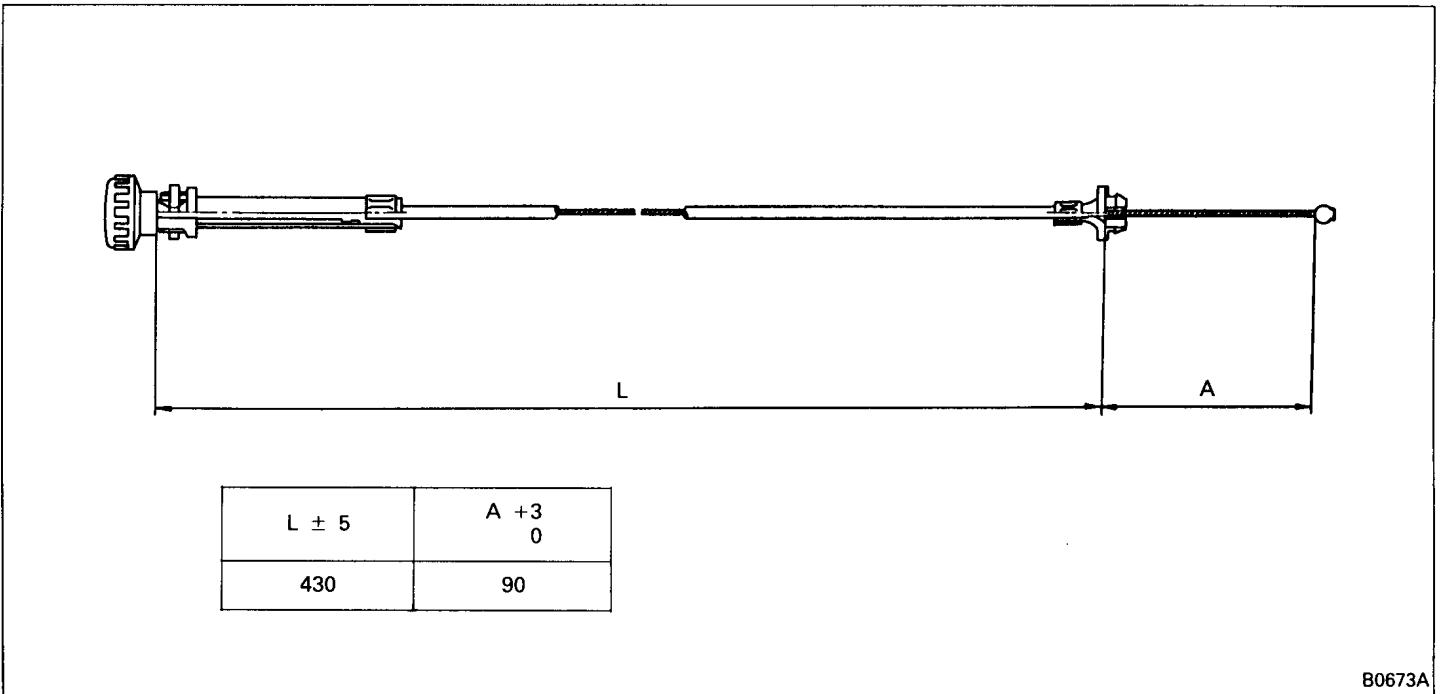
1.2 CABLE SPECIFICATIONS

Accelerator Control Cable




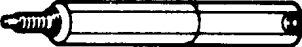
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Throttle Cable

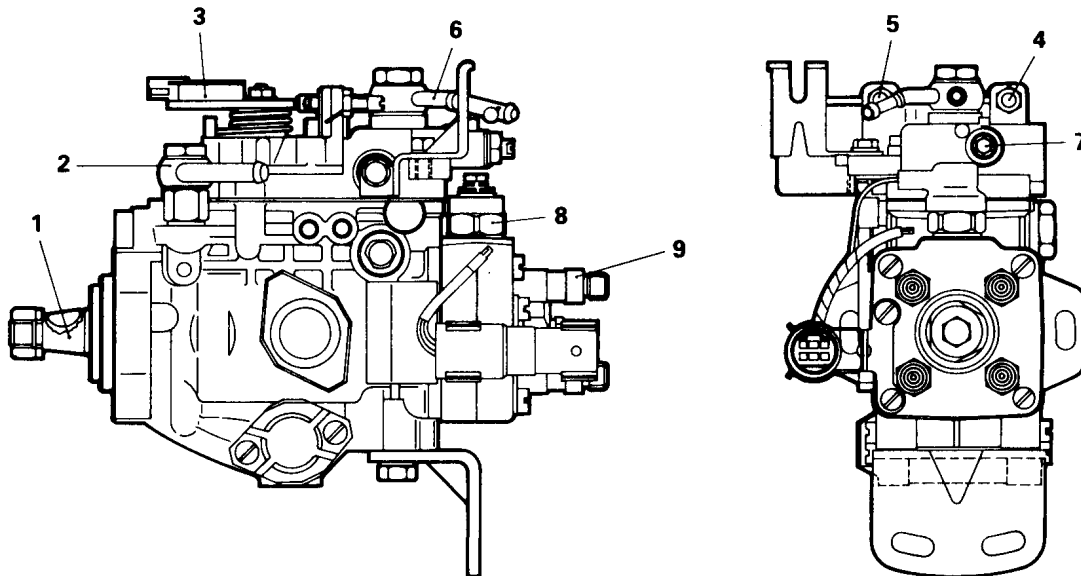


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2. SPECIAL TOOLS

Tool name	Part No.	Shape	Use
Nozzle Holder Socket Wrench	MD998387		Removing or installing nozzle holder assembly
Prestroke Measuring Adaptor	MD998384		Adjusting injection timing

3. FUEL INJECTION PUMP



- 1 Drive shaft
- 2 Fuel inlet
- 3 Accelerator lever
- 4 Idle adjust screw
- 5 Maximum speed adjust screw
- 6 Fuel return
- 7 Full load adjusting screw
- 8 Fuel cut solenoid
- 9 Delivery valve holder

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3.1 INSPECTION ON VEHICLE

If found defective, replace the injection pump as assembly.

NOTE:

Limit the injection pump adjustment to the idle adjustment

Description	Check procedure	Criteria
Idling run	<ul style="list-style-type: none"> • Measure rpm 	750 ± 50 rpm (See "Adjusting Idling".)
Color of exhaust gas	<ul style="list-style-type: none"> • Give fast acceleration under no load and check color of exhaust gas. (Measure smoke value.) 	Voluminous black smoke is unacceptable. (Smoke ref. value: within 50%.)
Timer	<ul style="list-style-type: none"> • Operate accelerator lever to maintain an engine speed of approx. 1 500 rpm. In this condition, manually operate accelerator switch knob to see how engine speed changes. 	Engine noise changes.
Fuel cut solenoid	<ul style="list-style-type: none"> • Turn on and off ignition switch. 	Actuating sound (click) is heard.

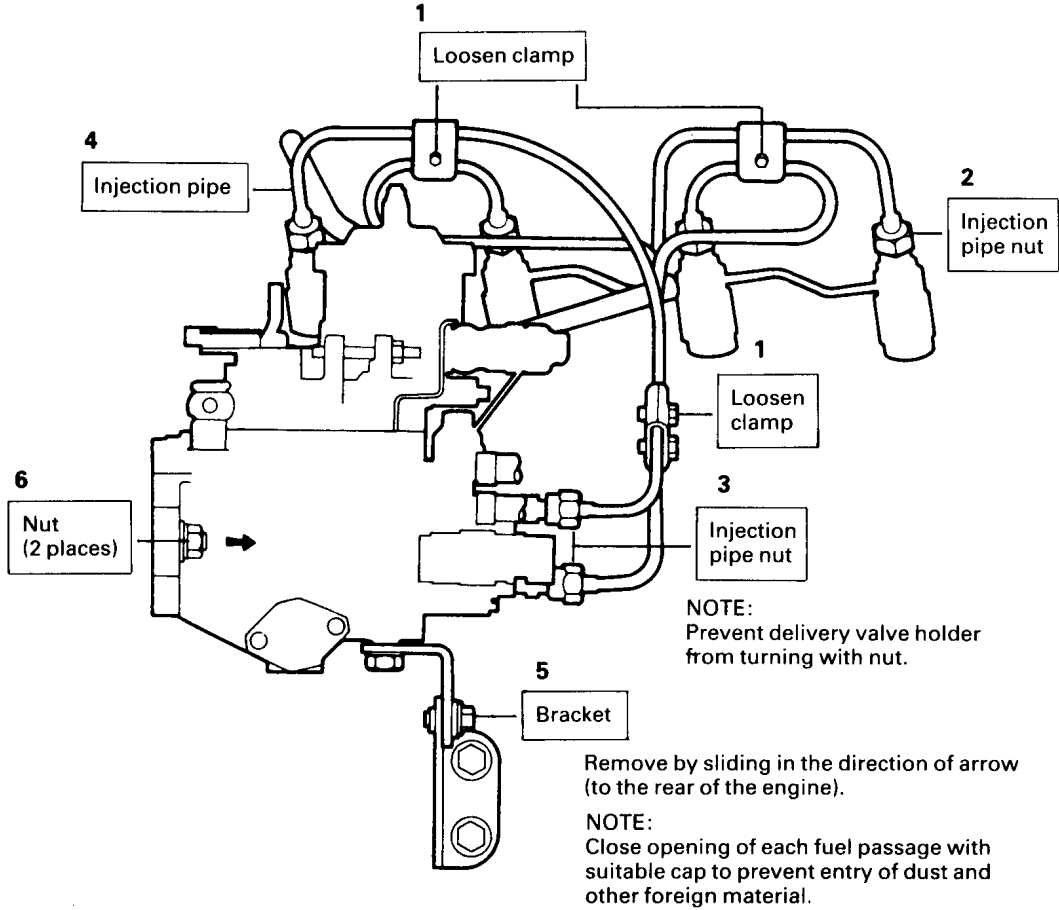
3.2 REMOVAL

1. Remove the timing belt upper cover.
2. Remove the nut and washer securing the injection pump sprocket. Take care not to drop the nut and washer in the lower cover.
3. Turn the crankshaft to bring the piston in No. 1 cylinder to the top dead center on the compression stroke.
4. Using a puller (commercially available), disengage the sprocket from the taper section of the drive shaft. Do not remove the sprocket but accommodate it in the timing belt lower cover with the belt engaged.

Caution:

- **Protect the timing belt against undue stress (torsion, bending, etc.).**
- **After the removal, do not turn the crankshaft.**

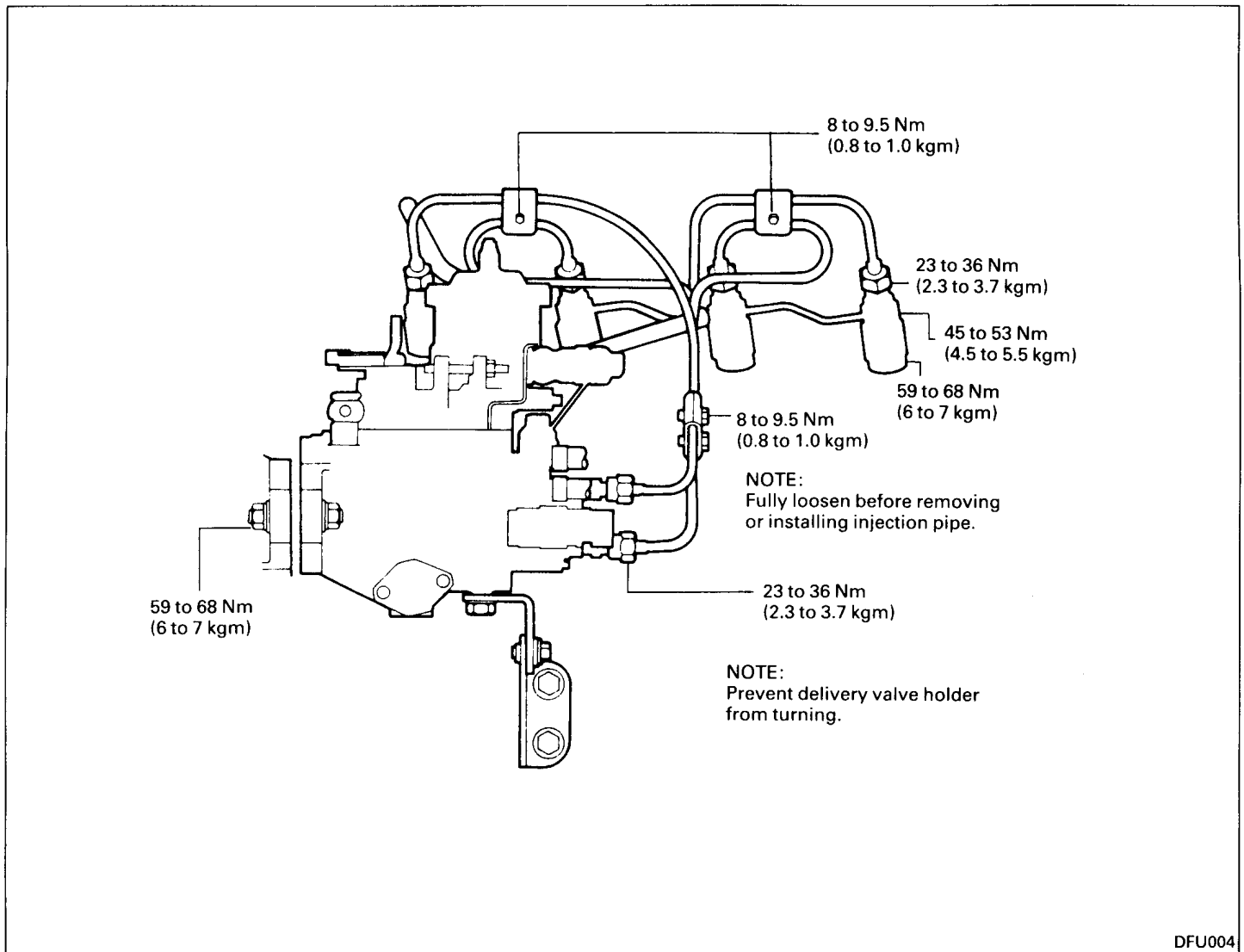
5. To remove, proceed as follows (in numerical order).



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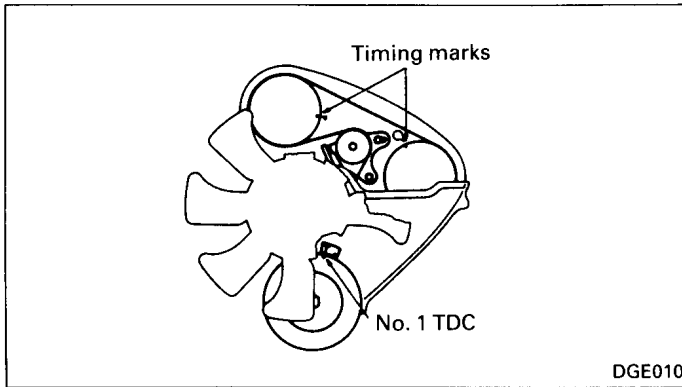
3.3 INSTALLATION

Install in reverse order of the removal, paying attention to the following.



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Installing Injection Pump Sprocket



1. Make sure that the timing marks on the camshaft sprocket and the crankshaft pulley are aligned. (Piston in No. 1 cylinder at the top dead center on the compression stroke.)
2. With the injection pump sprocket (carrying the belt) lifted up, install the injection pump inserting the injection pump drive shaft in the sprocket taper hole.

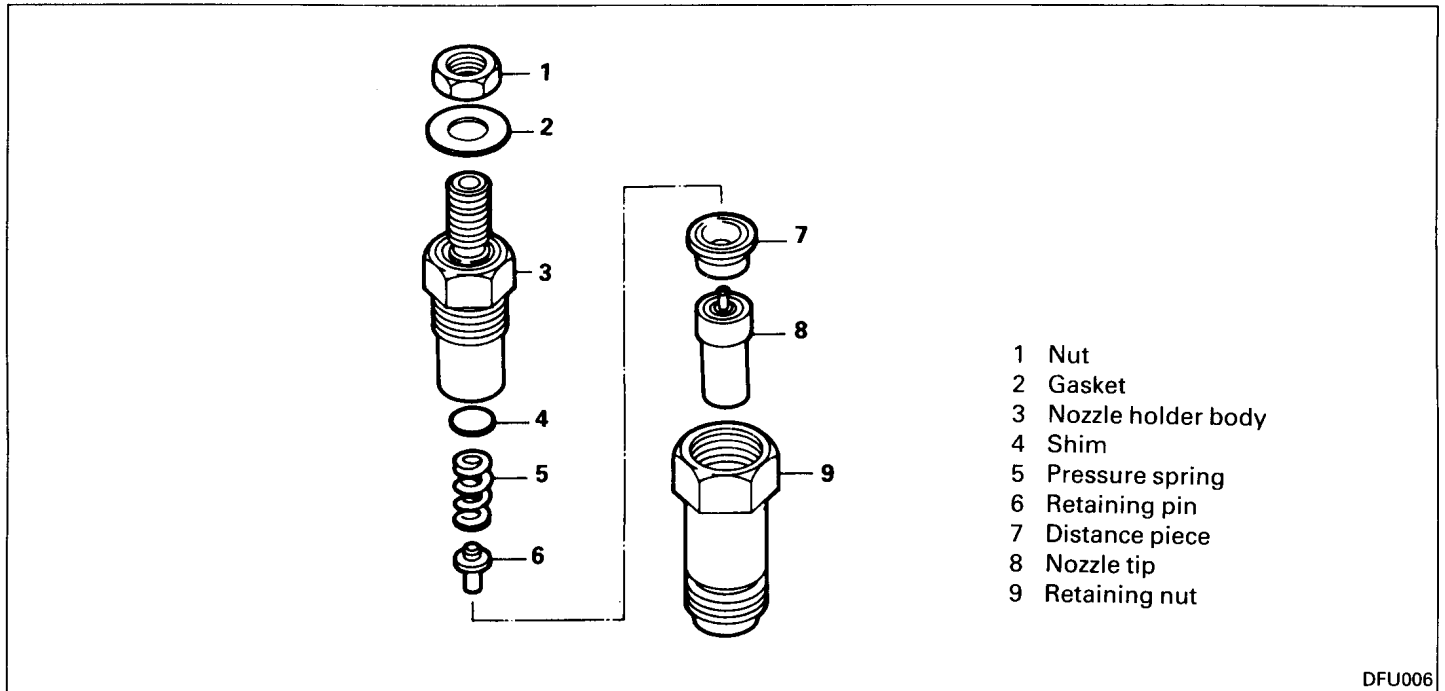
Caution:

- **Make sure that the injection pump drive shaft key is not displaced or dropped.**
3. Tighten temporarily the two nuts and two bolts securing the injection pump.
 4. Tighten the nut securing the sprocket to specified torque.

Adjusting after Installation of Injection Pump

1. Adjust the timing belt tension.
2. Adjust the injection timing.
3. Bleed.

4. INJECTION NOZZLE



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4.1 REMOVAL

1. Remove the injection pipe and the fuel return pipe.
2. Remove the injection nozzle and pull out the nozzle tip gasket from the cylinder head.

Caution:

- **Attach a tag indicating No. to the removed injection nozzle.**
- **Put suitable caps to the respective openings to prevent entry of dust, water and other foreign material into the fuel passage and combustion chamber.**

4.2 DISASSEMBLY

If found defective in the inspection, correct or replace defective part.

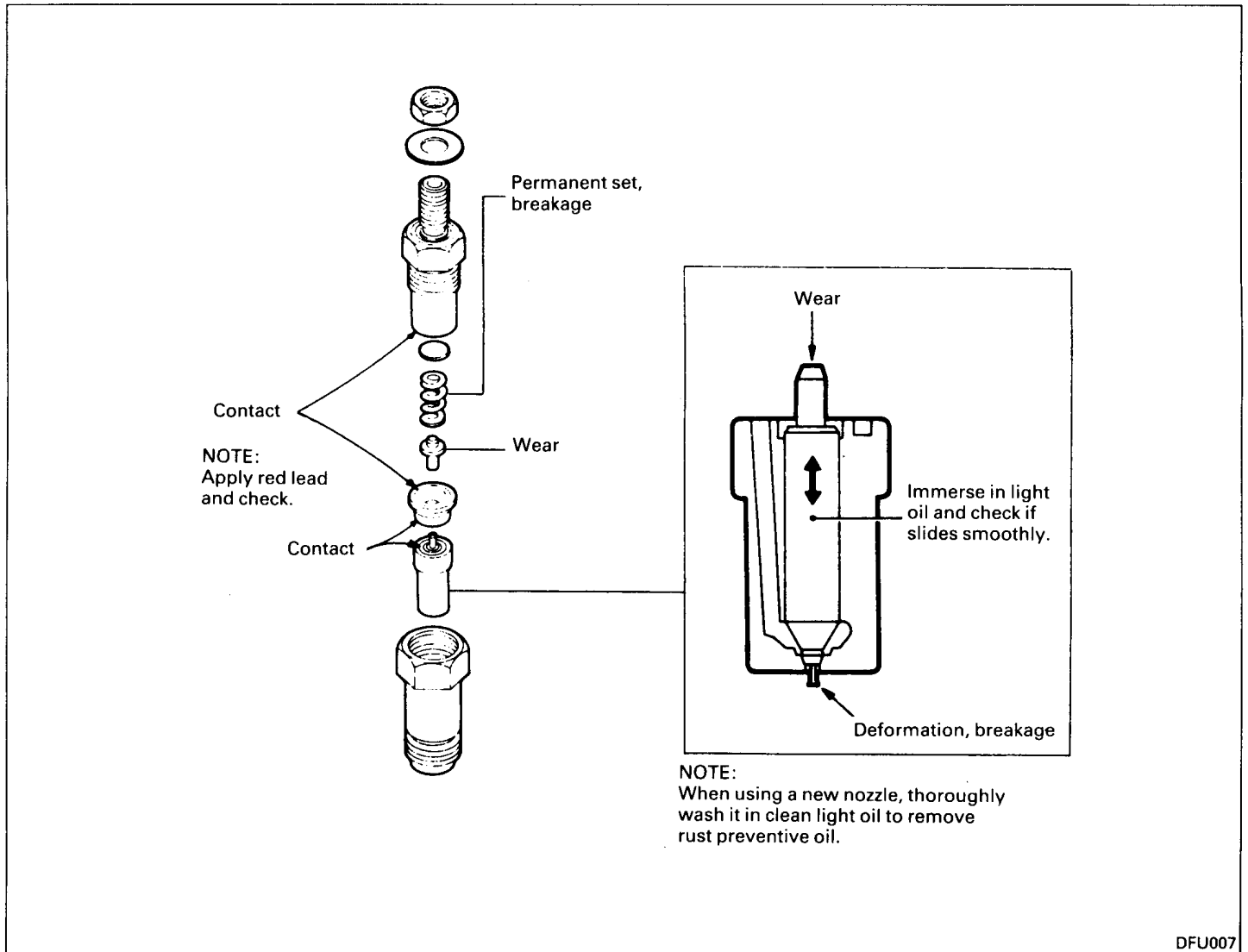
1. Holding the nozzle holder body in a vice or the like, remove the retainer nut with the special tool Nozzle Holder Socket Wrench (MD998387). Do not hold the retaining nut in a vice, etc. as it could result in deformation of the nut.
2. Remove the pressure spring, retaining pin, distance piece and nozzle tip.

Caution:

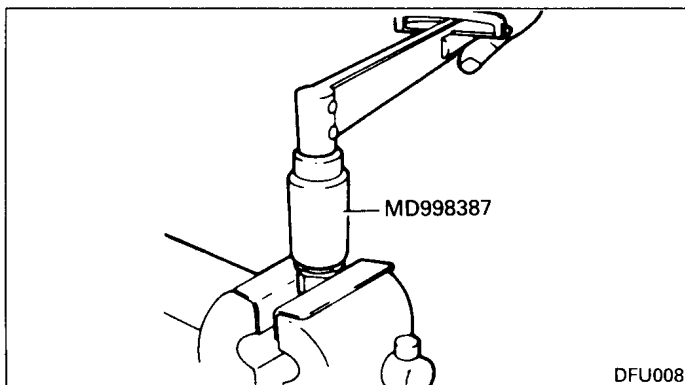
- **Scrape off carbon deposit with a piece of wood and clean each part with cleaning oil (gasoline). Then, keep the parts immersed in light oil. Take particular care to protect the nozzle tip needle valve against damage.**

4.3 INSPECTION

Check and replace if defective.



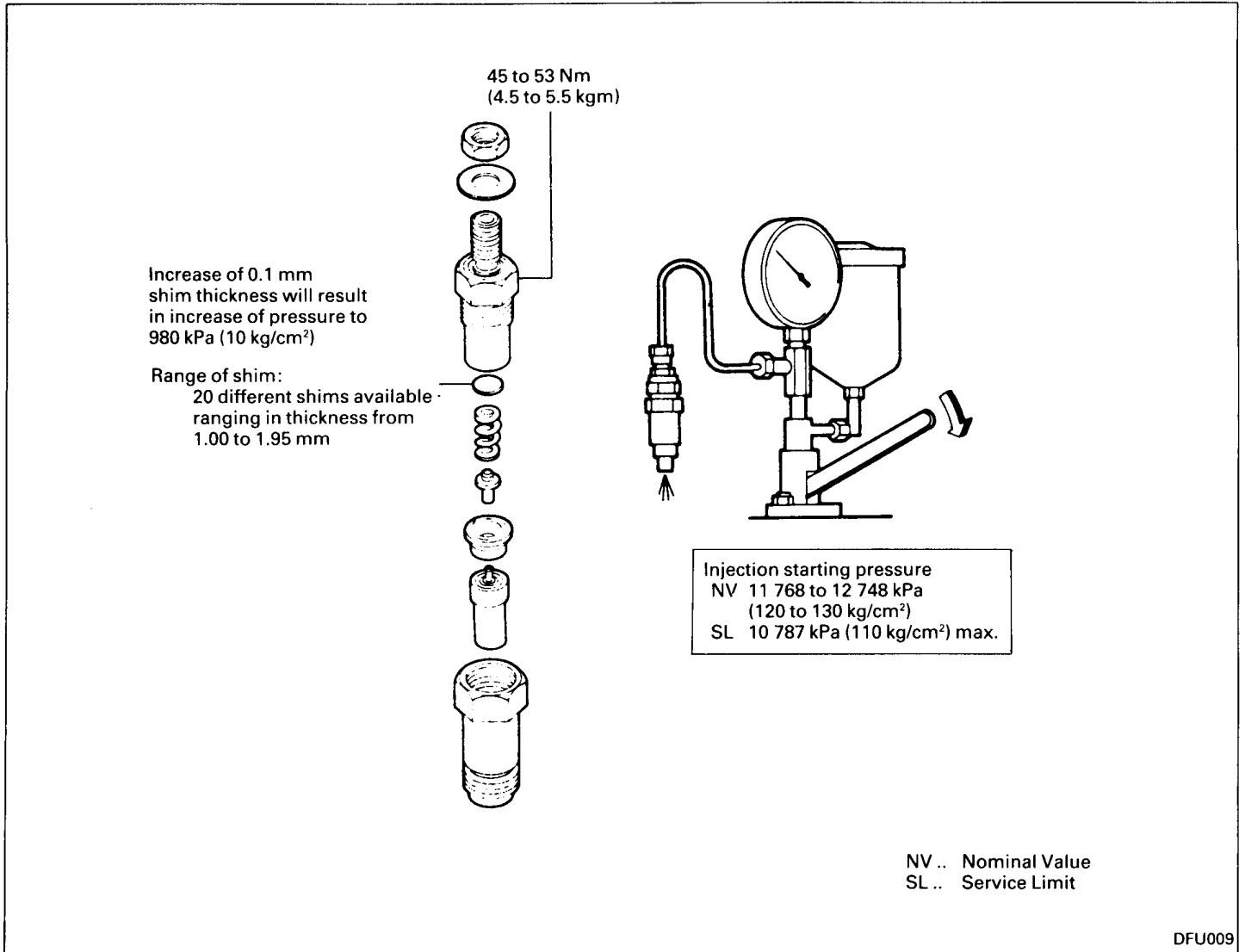
4.4 ASSEMBLY



1. Insert the nozzle tip into the retaining nut until it is fully seated.
2. Place the distance piece, retaining pin, pressure spring and the shim (removed during disassembly) on the nozzle tip.
3. Finger tighten the nozzle holder body.
4. Hold the nozzle holder in a vice and using the special tool Nozzle Holder Wrench (MD998387), tighten the retaining nut to specified torque.

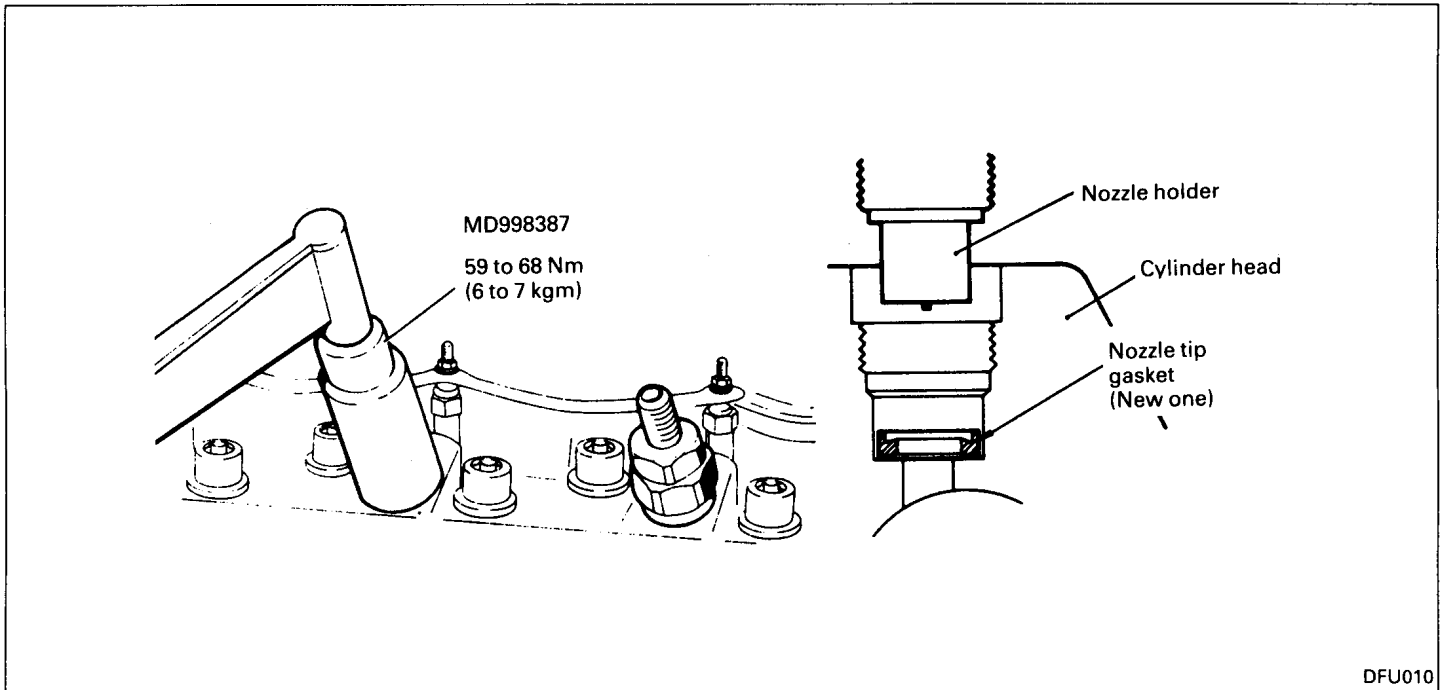
4.5 ADJUSTMENT

Adjust the injection starting pressure as follows.
After adjustment, check the spray condition.

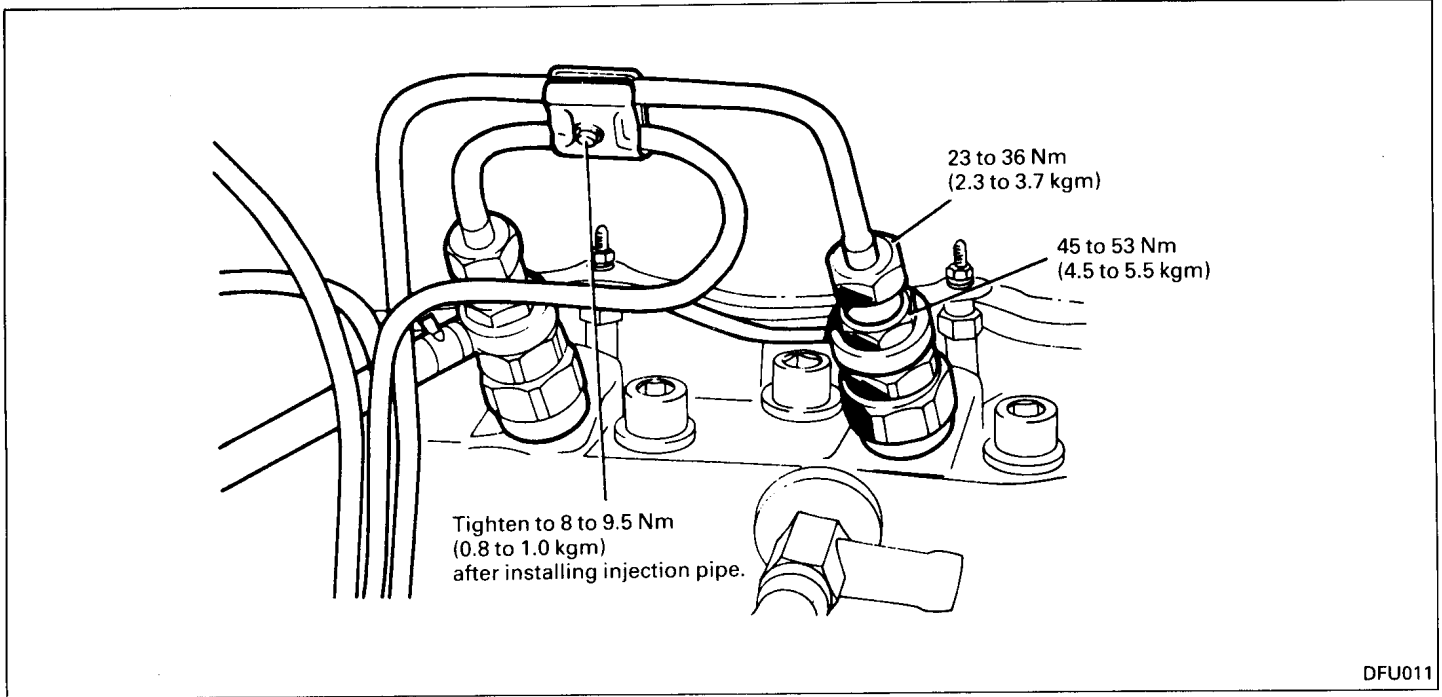


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4.6 INSTALLATION



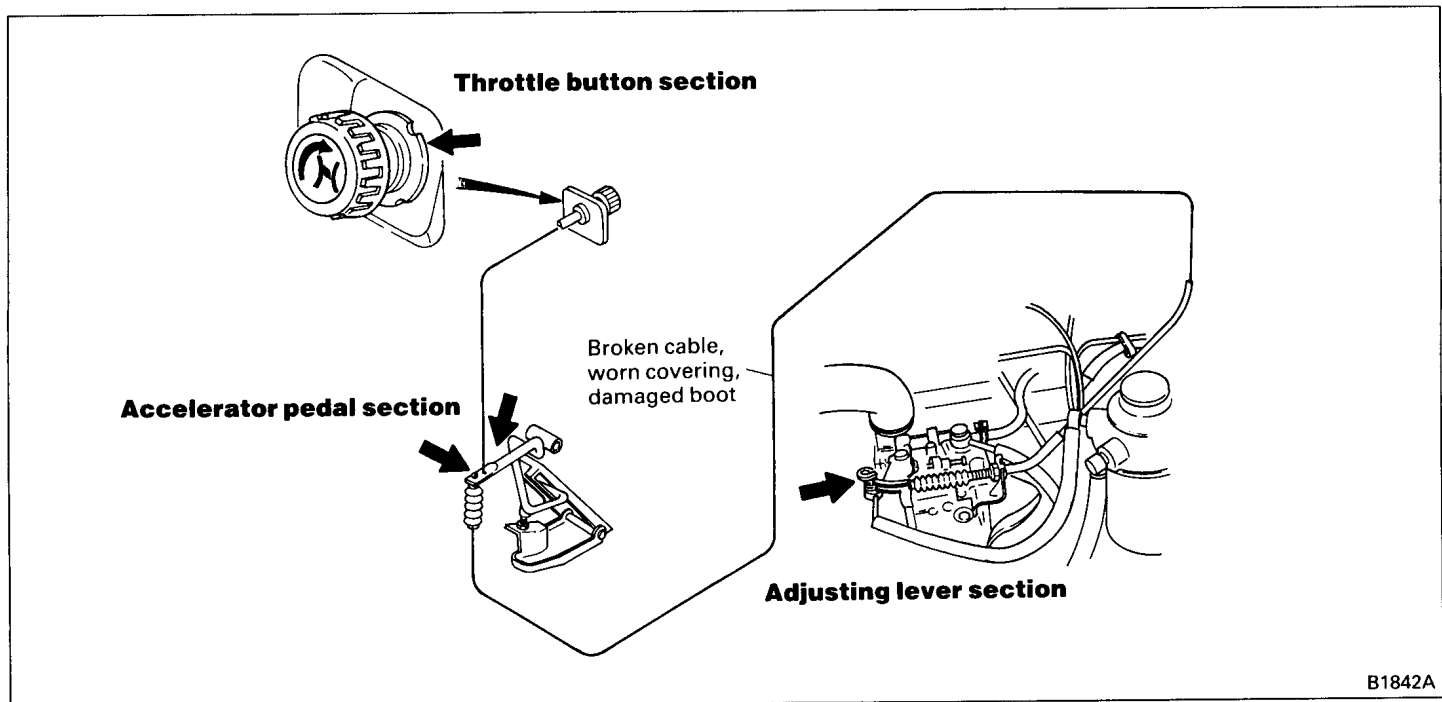
1. Clean the nozzle holder mounting area of the cylinder head. Then, fit a new nozzle tip gasket to the nozzle tip and tighten to the cylinder head to specified torque, using the special tool Nozzle Holder Wrench (MD998387).



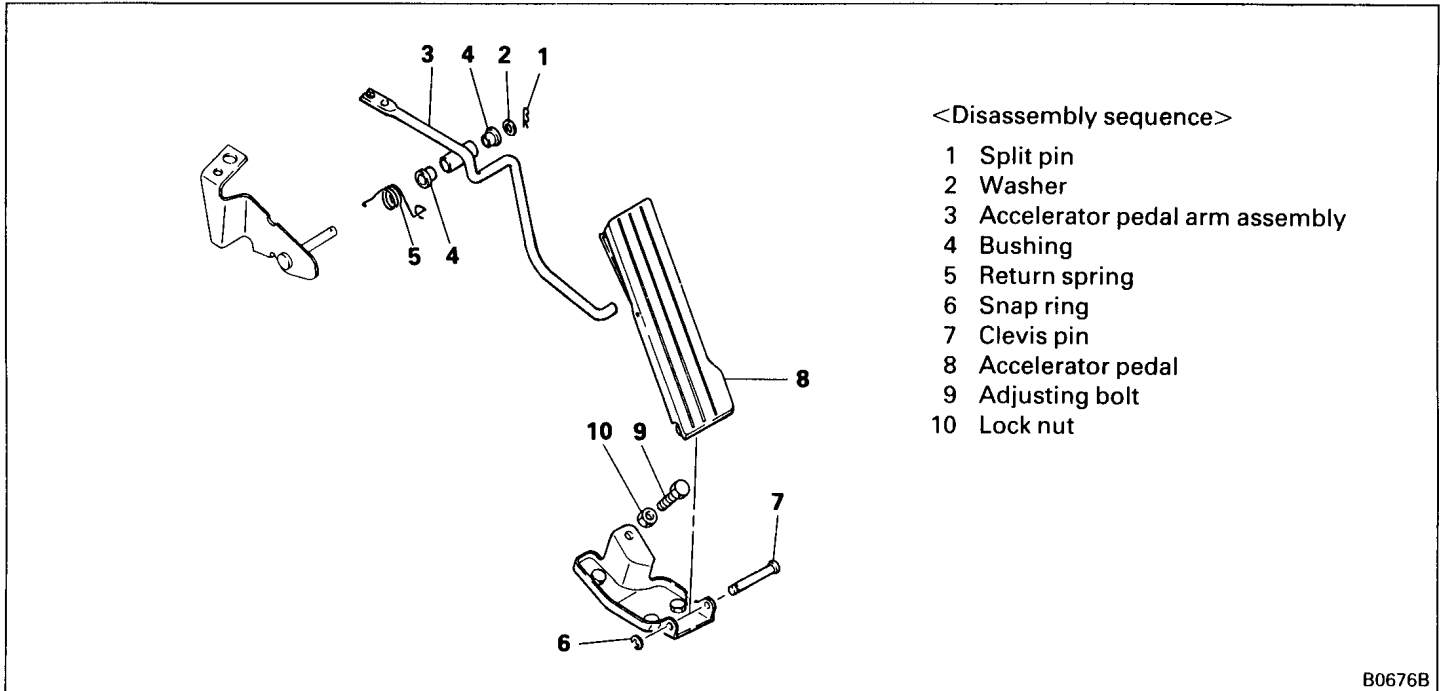
2. Install the fuel return pipe and the injection pipe.

5. ENGINE CONTROL

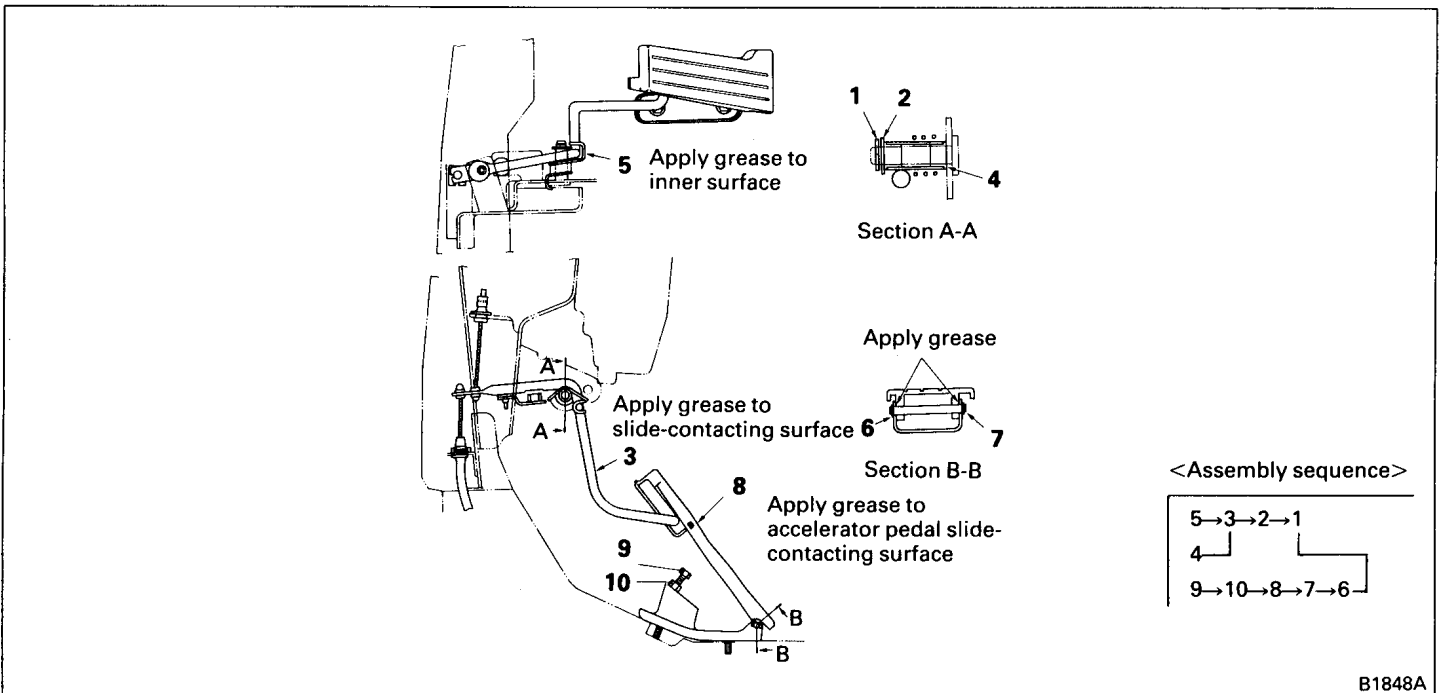
5.1 REMOVAL AND INSPECTION



5.2 DISASSEMBLY

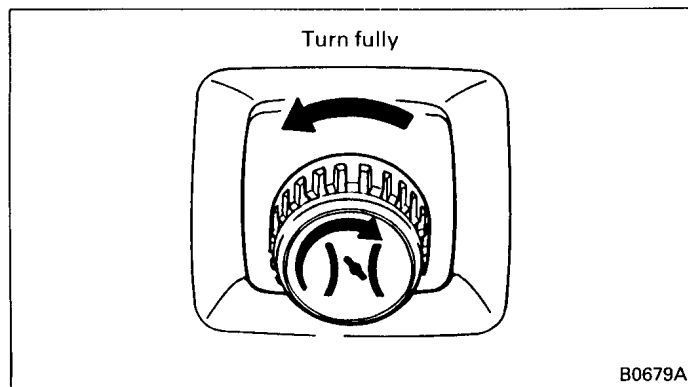


5.3 ASSEMBLY



Cable Installation and Adjustment Procedures

1. Throttle Cable

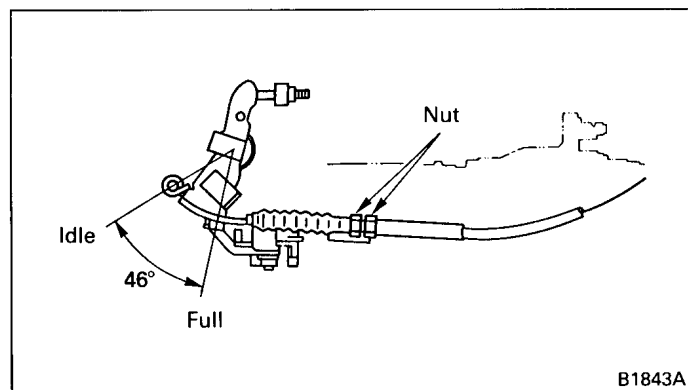


NOTE:

1. Make this adjustment with the cab tilt and tilt handle down.
2. Route each cable so that it may not come in contact with the edge of sheet metal.
3. The routing radius of each cable shall be 150 mm or more.

Turn the throttle button fully in the opposite direction to that of arrow indicated on the button. With the inner cable most protruded, install the accelerator pedal arm or accelerator lever. At that time, make sure that when the engine speed reaches the lowest speed, the inner cable is in the most protruded state.

2. Accelerator Control Cable

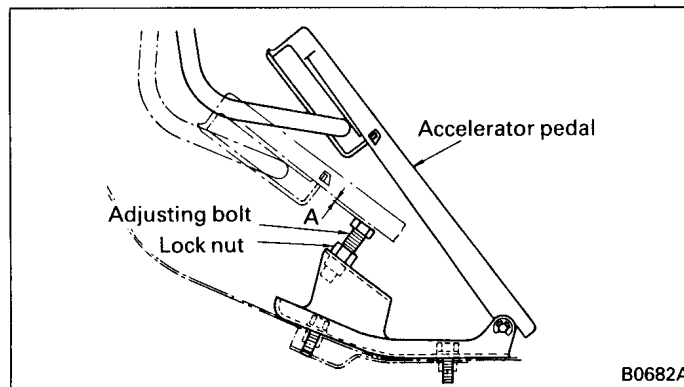


Turn the throttle button in the opposite direction to that of arrow indicated on the button and make sure that the accelerator pedal does not move. Install the accelerator control cable to the adjusting lever and secure the engine side of the cable by tightening the nut.

NOTE:

Do not move the engine side adjusting lever when the accelerator control cable is installed.

3. Accelerator Pedal Stopper



Make adjustment so that when the engine side adjusting lever is in contact with the full stopper, clearance between accelerator pedal and adjusting bolt is equal to dimension A.

Dimension A: 0 to 5

6. TROUBLESHOOTING

6.1 GENERAL INFORMATION

Because the diesel engine's operation and efficiency are highly dependent on cylinder compression, many operating problems that seem to be injection troubles can also be caused by engine mechanical faults. Valves that are badly out of adjustment, valves that are leaking, and a leaking cylinder head gasket are three mechanical faults that can cause poor running, hard starting, or inefficient operation. Worn cylinders or pistons, worn-out or stuck piston rings, and broken pistons can cause similar troubles. Lubricating oil that finds its way past worn piston rings or worn valve stem seals sometimes produces exhaust smoke that is mistaken for the smoke caused by a misadjusted fuel injection system.

It is therefore wise to make certain routine checks of the fuel injection system when operating problems are encountered, but a compression test is an indispensable part of diesel troubleshooting. Table "Fuel Injection System Troubleshooting" lists five possible problems along with their probable causes and applicable remedies. Check each item in the order that it appears in the table. The numbers in the Remedy column refer to headings in this section of the Manual where the suggested tests and repairs are described.

6.2 FUEL INJECTION SYSTEM

Problem	Probable cause	Remedy
1. Engine does not start	<ul style="list-style-type: none"> a. Cranking speed too low b. No voltage at fuel cut-off solenoid on injection pump c. Fuel cut-off solenoid on injection pump loose or faulty d. No voltage at glow plug bus e. Glow plug faulty f. Air in fuel system g. Injection pump not delivering fuel h. Injection pipes misconnected i. Injection timing incorrect j. Faulty injection nozzles k. Engine mechanical faults, as described earlier under this heading l. Faulty injection pump 	<ul style="list-style-type: none"> a. Repair starting system or charge or replace battery so that engine cranks at a minimum of 150 rpm. b. Check for voltage with test light. If necessary, replace fuse or faulty wires. c. Tighten solenoid. Check that solenoid clicks when key is turned off and on. Replace faulty solenoid. d. If test light shows no voltage at bus with key at "ON" position, test relay and wiring. e. Test and, if necessary, replace glow plug. f. Bleed fuel system. See "Maintenance". g. If no fuel emerges from a loosened injection pipe during cranking, check timing belt and fuel supply from filter. h. Connect pipes in correct location. i. Adjust injection timing. See "Maintenance". j. Check and, if necessary, repair or replace nozzles. See "Injection Nozzles". k. Test compression and, if necessary, repair engine. l. Try to start engine with new pump installed. If necessary, replace pump permanently. See "Fuel Injection Pump" in this group.

Problem	Probable cause	Remedy
<p>2. Idle speed incorrect or idle rough or irregular</p>	<ul style="list-style-type: none"> a. Idle speed incorrectly adjusted b. Accelerator control binding c. Loose fuel hose between filter and injection pump d. Air in fuel system e. Inadequate fuel supply owing to clogged fuel filter, or fuel return line and injection pipes leaking, dirty, kinked, or squeezed at connections f. Faulty injection nozzles g. Injection timing incorrect h. Engine mechanical faults, as described earlier under this heading i. Faulty injection pump 	<ul style="list-style-type: none"> a. Check and, if necessary, adjust the idle speed. See "Maintenance". b. Check that accelerator lever on pump is not loose, then adjust accelerator cable. See "Chassis Workshop Manual". c. Replace hose or secure with clamps, bleed air from system. See "Maintenance". d. Bleed fuel system. See "Maintenance". e. Inspect and, if necessary, replace lines and hoses or replace fuel filter. f. Check and, if necessary, repair or replace injection nozzles. g. Adjust injection timing. See "Maintenance". h. Test compression and, if necessary, repair engine. i. Try engine at idle with new pump installed. If necessary, replace pump permanently. See "Fuel Injection Pump" in this group.
<p>3. Smoky exhaust (black, blue or white)</p>	<ul style="list-style-type: none"> a. Engine lugging in too high a gear b. Engine not reaching correct operating temperature c. Maximum rpm incorrect d. Faulty injection nozzles e. Injection timing incorrect f. Restricted exhaust system g. Engine mechanical faults, as described earlier under this heading h. Faulty injection pump 	<ul style="list-style-type: none"> a. Observe correct shift speeds as given in Owner's Handbook. b. Check and, if necessary, replace cooling system thermostat. See "Cooling System". c. Check and, if necessary, replace injection pump. See "Injection Pump". d. Check and, if necessary, repair or replace injection nozzles. e. Adjust injection timing. See "Maintenance". f. Check exhaust system for dents and obstructions. g. Test compression and, if necessary, repair engine. h. Observe exhaust with new pump installed. If necessary, replace pump permanently. See "Fuel Injection Pump" in this group.
<p>4. Poor power output, slow acceleration (speedometer accurate, clutch not slipping)</p>	<ul style="list-style-type: none"> a. Injection pump accelerator lever loose or not reaching maximum rpm adjusting screw b. Maximum rpm incorrect c. Air cleaner filter dirty 	<ul style="list-style-type: none"> a. Tighten lever, check that accelerator pedal travel is not restricted, then adjust accelerator cable. b. Check and, if necessary, replace injection pump. See "Injection Pump". c. Clean or replace air cleaner filter. See "Intake and Exhaust".

Problem	Probable cause	Remedy
<p>4. Poor power output, slow acceleration (speedometer accurate, clutch not slipping) (continued)</p>	<p>d. Inadequate fuel supply owing to clogged fuel filter, or fuel return line and injection pipes leaking, dirty, kinked, or squeezed at connections</p> <p>e. Air in fuel system</p> <p>f. Ice or solidified wax in fuel lines. (winter time only)</p> <p>g. Faulty injection nozzles</p> <p>h. Injection timing incorrect</p> <p>i. Engine mechanical faults, as described earlier under this heading</p> <p>j. Faulty injection pump</p>	<p>d. Inspect and, if necessary, replace lines and hoses, replace fuel filter.</p> <p>e. Bleed fuel system. See "Maintenance".</p> <p>f. Move car to a warm garage until ice or wax has become liquid, then bleed fuel system.</p> <p>g. Check and, if necessary, repair or replace injection nozzles.</p> <p>h. Adjust injection timing. See "Maintenance"</p> <p>i. Test compression and, if necessary, repair engine.</p> <p>j. Check acceleration and speed with new pump installed. If necessary, replace pump permanently. See "Fuel Injection Pump" in this group.</p>
<p>5. Excessive fuel consumption</p>	<p>a. Air cleaner filter dirty</p> <p>b. Fuel leaks</p> <p>c. Return pipe and hose blocked</p> <p>d. Idle speed too fast or maximum rpm too high</p> <p>e. Faulty injection nozzles</p> <p>f. Injection timing incorrect</p> <p>g. Engine mechanical faults, as described earlier under this heading</p> <p>h. Faulty injection pump</p>	<p>a. Clean or replace air cleaner filter. See "Intake and Exhaust".</p> <p>b. Check and, if necessary, replace or tighten all pipes, hoses and connections.</p> <p>c. Check return line for kinks and dents. Replace faulty lines. If line is clogged, blow it out with compressed air, then bleed fuel system. See "Maintenance".</p> <p>d. Check and, if necessary, adjust idle speed or replace injection pump. See "Maintenance".</p> <p>e. Check and, if necessary, repair or replace injection nozzles.</p> <p>f. Adjust injection timing. See "Maintenance".</p> <p>g. Test compression and, if necessary, repair engine.</p> <p>h. Check fuel consumption with new pump installed. If necessary, replace pump permanently.</p>

6.3 ENGINE CONTROL

