

DIAGNOSIS OF FUEL INJECTION SYSTEM (CONT.)

PROBLEM	POSSIBLE CAUSE	CORRECTION
Low Power	<ol style="list-style-type: none"> 1. Fuel filter plugged. 2. Injection lines restricted/leakage. 3. Incorrect pump-to-engine timing. 4. Injection nozzle not working. 5. Air filter restricted. 6. Incorrect firing order. 7. Fuel pump timing assembly gear not working. 8. Engine valves out of adjustment. 9. Injection pump not working. 10. Accelerator linkage not adjusted. 	<ol style="list-style-type: none"> 1. Replace fuel filter 2. Replace injection lines. 3. Time the engine. 4. Replace nozzle. 5. Replace air filter. 6. Correct firing order. 7. Replace timing assembly. 8. Adjust the valves. 9. Remove pump and take to authorized service dealer. 10. Adjust linkage.
Excessive Fuel Consumption	<ol style="list-style-type: none"> 1. Incorrect pump-to-engine timing. 2. Injection to nozzle/line leaking. 3. Air filter restricted. 4. Low idle. 5. Fuel pump timing assembly not working. 6. Governor not adjusted. 	<ol style="list-style-type: none"> 1. Time the engine. 2. Replace line/test nozzle. 3. Replace air filter. 4. Adjust low idle. 5. Replace timing gear. 6. Remove pump and take to authorized service dealer.
Black Smoke	<ol style="list-style-type: none"> 1. Air in the fuel system. 2. Injection line restricted/leaking. 3. Incorrect pump-to-engine timing. 4. Injection nozzle leaking. 5. Air filter restricted. 6. Incorrect firing order. 7. Timing gear in full advance. 8. Low compression. 9. Fuel injection pump or governor not adjusted properly. 10. Misadjusted engine valves. 	<ol style="list-style-type: none"> 1. Bleed the fuel system. 2. Replace injection line. 3. Time the engine. 4. Test and replace if necessary. 5. Replace air filter. 6. Correct firing order. 7. Replace gear. 8. Perform a compression test. 9. Remove pump and take to authorized service dealer. 10. Adjust valves.
White or Blue Smoke	<ol style="list-style-type: none"> 1. Air in the fuel system. 2. Fuel filter plugged. 3. Injection lines restricted/leaking. 4. Incorrect pump-to-engine timing. 5. Incorrect firing order. 6. Fuel pump timing gear assembly. 7. Injection pump or governor not adjusted properly. 8. Misadjusted engine valves. 	<ol style="list-style-type: none"> 1. Bleed the fuel system. 2. Replace fuel filter. 3. Replace injection line. 4. Time the engine. 5. Set firing order. 6. Replace gear. 7. Remove pump and take to authorized Bosch service dealer. 8. Adjust valves.

6C3-8 FUEL INJECTION SYSTEM

FUEL INJECTION NOZZLE TEST

If diagnosis shows that the injection nozzle is not working. The injection nozzle must be removed from the engine and mounted on a nozzle tester and checked for:

1. Opening pressure
2. Spray pattern
3. Leakage
4. Chatter

To check for the mentioned areas, follow the instructions on the tester.

Leakage

Hold the tester handle to about 2070 kPa (300 psi) below the opening pressure. If no drops of fuel fall from the nozzle tip within 10 seconds, the nozzle is not leaking (figure 6).

Opening Pressure

Opening pressure is the point where the nozzle opens and starts to spray. Read the gage pressure and compare the reading with the specifications at the end of this section.

Spray Pattern

Spray pattern is the way the atomized fuel comes out of the injection nozzle. Check for proper spray angle (figure 7).

Chatter

An easily audible chatter at all pump lever speeds should be heard.

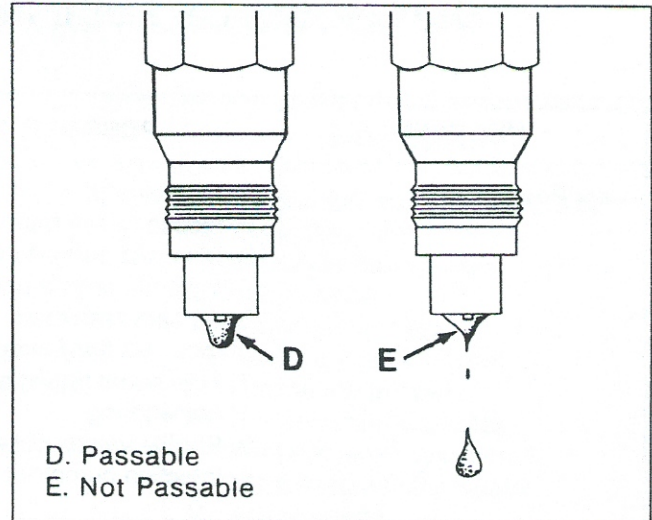


Figure 6. Fuel Injection Nozzle Leakage

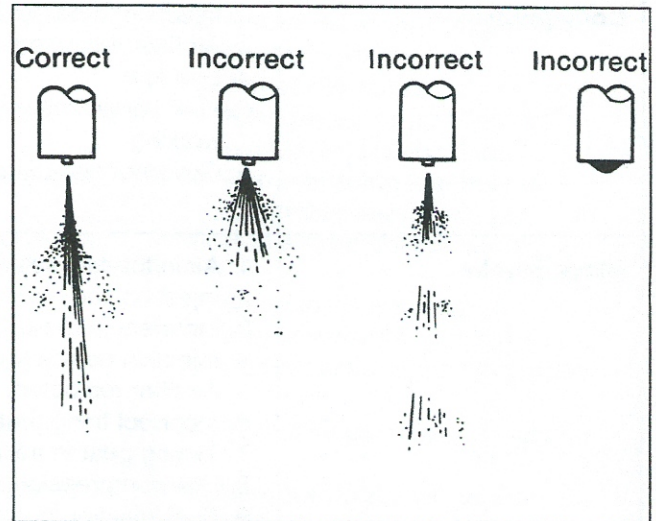


Figure 7. Fuel Injection Nozzle Spray Pattern

ON-VEHICLE SERVICE

FUEL PUMP

The fuel pump is mounted on the side of the fuel injection pump. A primer pump for fuel system bleeding is also located on top of the pump (figure 8).

FUEL PUMP REPLACEMENT

Remove or Disconnect (Figure 8)

- Tilt the cab.
 1. Fuel line from the fuel pump.
 2. Mounting stud nuts.
 3. Fuel pump and gasket.

Install or Connect (Figure 8)

1. New gasket to the fuel pump.
2. Fuel pump to the side of injection pump.
3. Fuel line.
4. Bleed the fuel system.

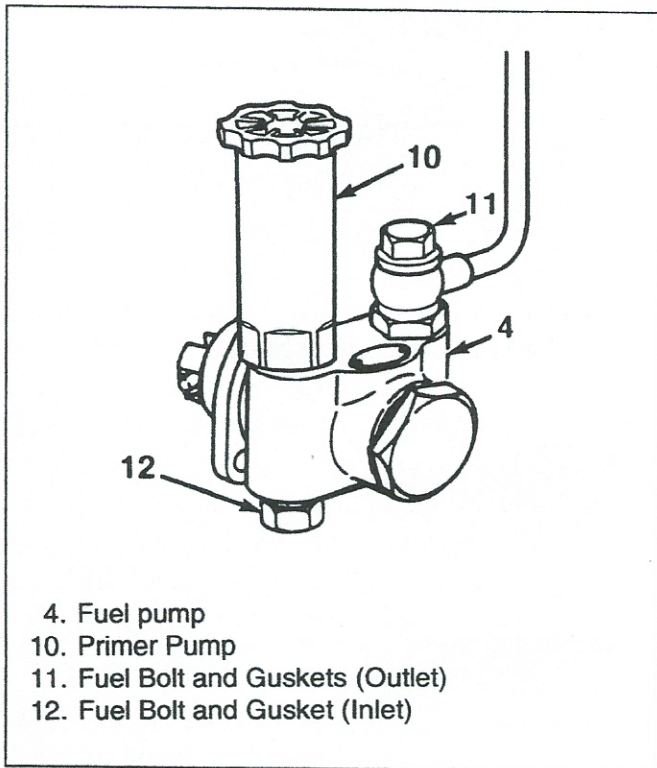


Figure 8. Fuel Pump

FUEL INJECTION NOZZLE

CAUTION: Do not bend injection lines in any shape or form to ease nozzle replacement.

Remove or Disconnect (figures 9 and 10)

- Tilt the cab.
 1. Fuel line fitting at the injection nozzle assembly (1).
 2. Fuel return line nut (16), gasket and fitting.
 3. Injection nozzle assembly (1) from the cylinder head.
 - Cap the fuel lines.
 - Plug the hole in the cylinder head with a clean shop rag.
 4. Nozzle washer (14) and corrugated washer (13).
 5. Check nozzle opening pressure, spray pattern, chatter and oil leakage. Refer to FUEL INJECTION NOZZLE TEST in this service manual.

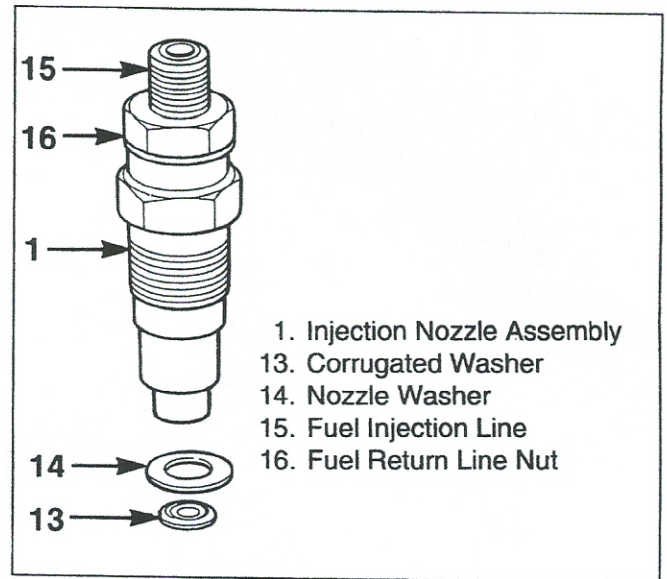
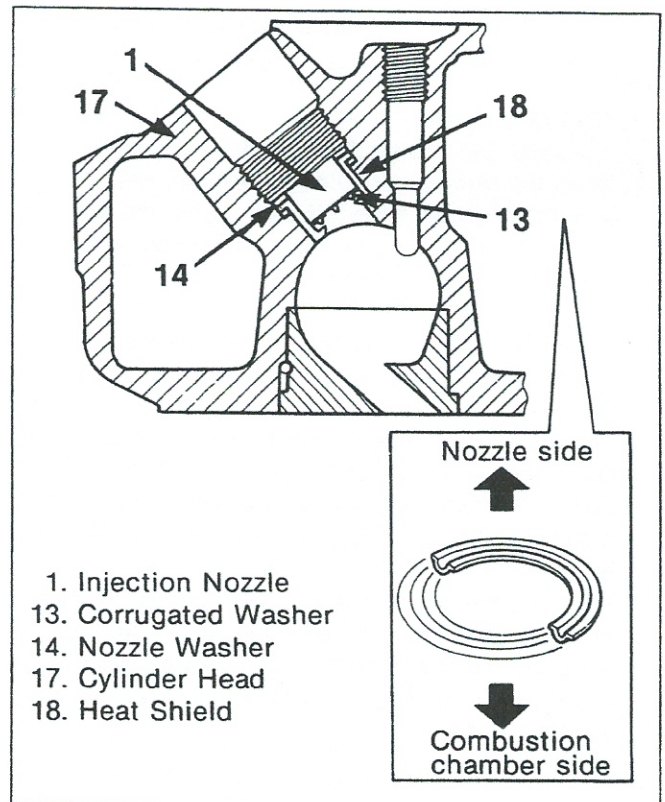


Figure 9. Injection Nozzle Assembly

Disassemble (Figure 11)

1. Clamp the nozzle holder assembly into a vise.
2. Nozzle retaining nut (43).
3. Nozzle (45).
4. Spacer (46).
5. Push rod (47).
6. Nozzle spring (48).
7. Shim (49).
8. Nozzle holder (44).



1. Injection Nozzle
13. Corrugated Washer
14. Nozzle Washer
17. Cylinder Head
18. Heat Shield

6C3-10 FUEL INJECTION SYSTEM

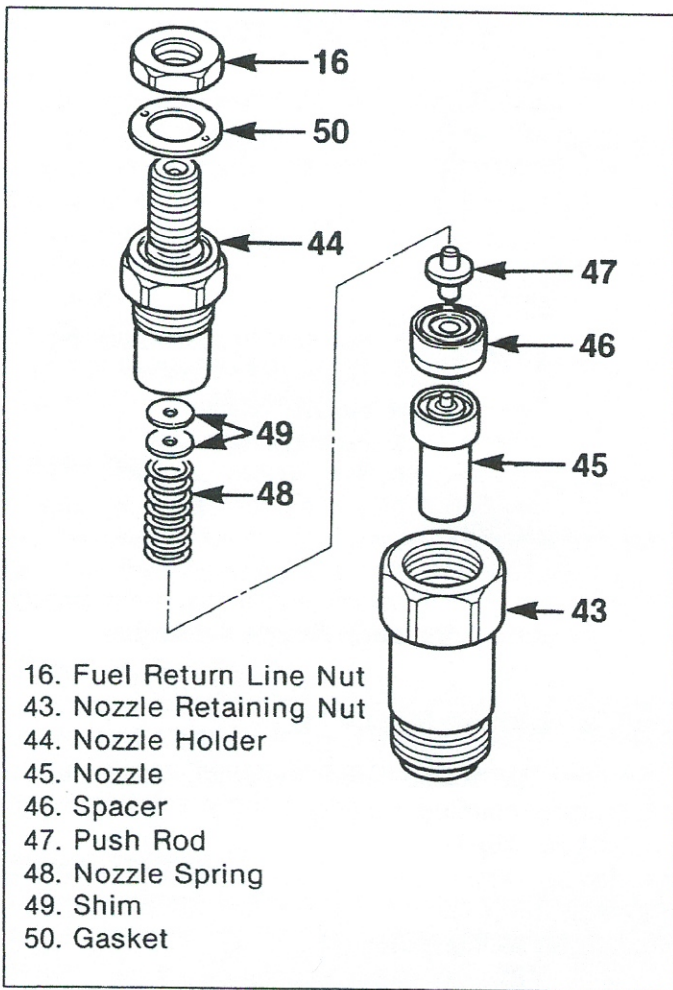


Figure 11. Injection Nozzle Assembly

Clean (Figures 12, 13, 14 and 15)

Tool Required:

J-39531 Nozzle Cleaning Kit

1. Soak all parts other than the nozzle in a cleaning oil and wipe off all excess residue with a soft cloth or the like. Use the wire brush to clean excessively dirty parts.

CAUTION: Clean the nozzle holder mating surface and both sides of the spacer with a hardwood piece or a soft cloth.

Do not use a metal brush since scars on these surfaces cause oil leakage.

Carefully remove carbon residues sticking to inside of the retaining nut with the appropriate scraper.

Remove carbon residues and dirt on the seat surface, inside surface of the body sliding section, sac cone and spray hole inside of the nozzle body using the cleaning tools (figures 12, 13 and 14).

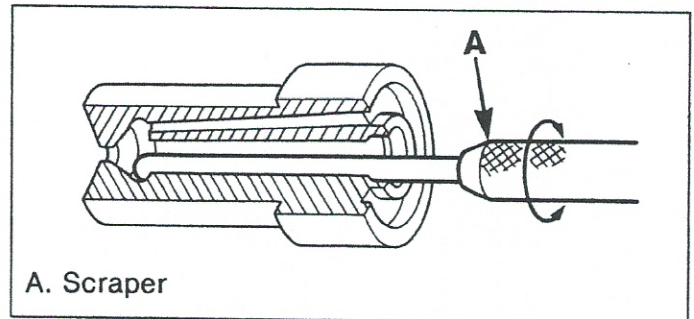


Figure 12. Cleaning of Nozzle Sac Cone

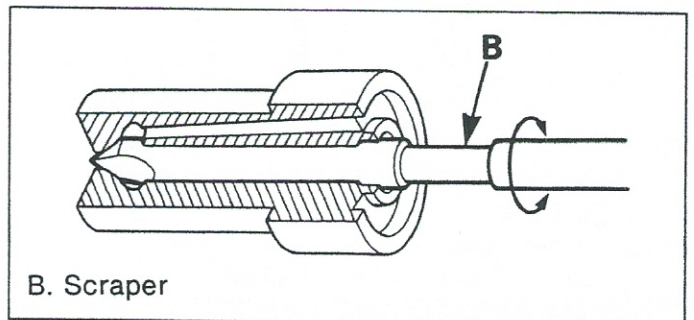


Figure 13. Cleaning of Seat Section

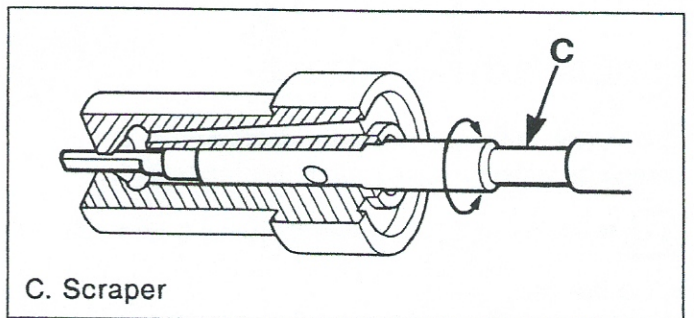


Figure 14. Cleaning of Spray Hole

2. Pull out the needle valve from the nozzle body and clean both of them to clean the nozzle. First, Holding the needle by the stem only clean the shaft section and seat surface of the needle valve using a hardwood dipped in oil or a clean soft cloth (figure 15). If a large amount of carbon residue remains and the nozzle cannot be cleaned well enough, dip the nozzle in carbon cleaner, and repeat the cleaning process.

CAUTION: Never use sand paper, metal scraper, or other abrasive materials to clean the nozzle body and needle valve.

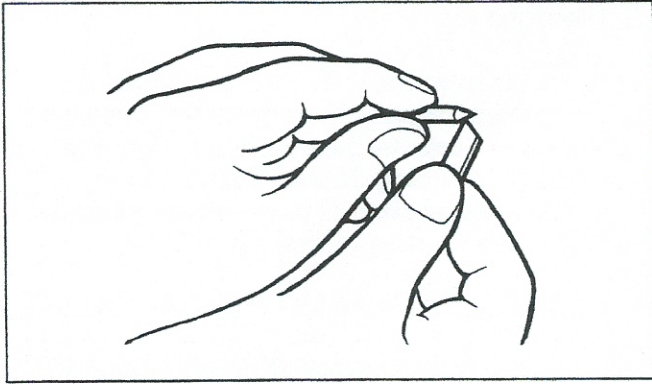


Figure 15. Needle Seat Cleaning with a Wooden Piece

3. Wash all parts in a clean oil and place them on a clean work table. For best results compressed air should be applied to them after the oil cleaning.

CAUTION: After cleaning, all parts must be coated with a light oil to prevent rust.

 **Inspect (Figures 11 and 16)**

- The following items should be checked on all parts (figure 11):
Abrasion, corrosion, impact marks, scars, breaks, cracks, cavitation erosion, damages caused by foreign material in the fuel, or excessive.
Replace any worn, corroded or damaged parts.

Nozzle slide test (Figure 16)

Dip the nozzle and needle in light oil and assemble. Insert the needle all the way into the body. Raise the needle 1/3 (one-third) of the way out and release. The needle must slide all the way back into the body by its own weight. If the needle sticks, reclean and repeat the slide test. Any nozzle that fails must be replaced.

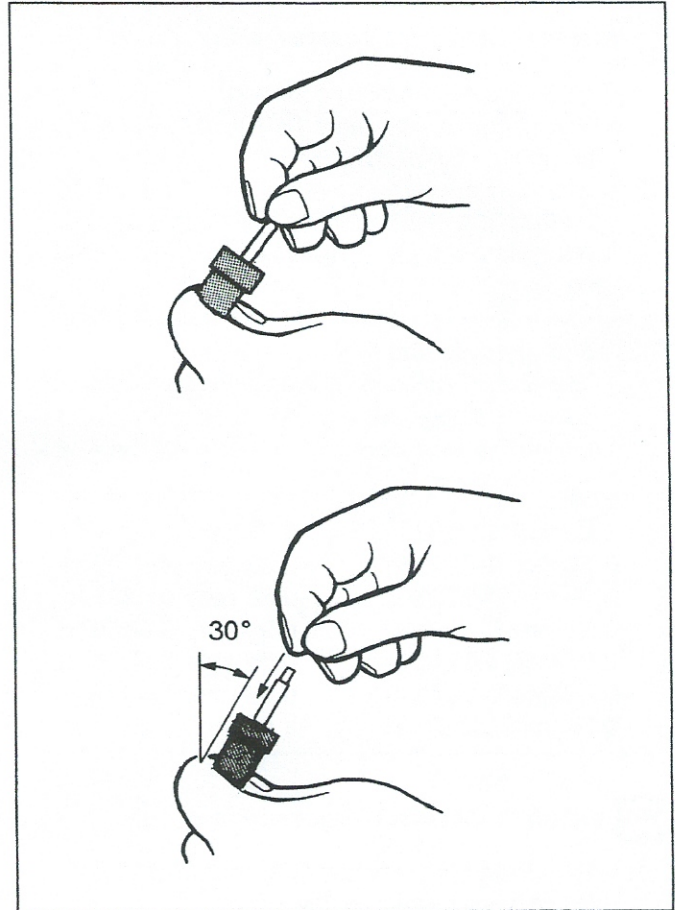


Figure 16. Nozzle Slide test

 **Assemble (Figure 11)**

CAUTION: New nozzle must be cleaned in a solvent to remove protective coating. The nozzle body and needle must always be replaced as an assembly.

Tool Required:

J-39543 Nozzle guide

1. Clamp the nozzle holder to a vise.
2. Shim (49).
3. Nozzle spring (48).
4. Push rod (47).
5. Spacer (46).
6. Nozzle (45).
7. Nozzle retaining nut (43).
8. Insert the nozzle guide to center the nozzle in the retaining nut.

 **Tighten**

- Retaining nut to 88 N·m (65 lb·ft).

9. Check nozzle opening pressure, spray pattern, chatter and oil leakage. Refer to FUEL INJECTION TEST in this service manual.

6C3-12 FUEL INJECTION SYSTEM

Nozzle Opening Pressure Adjustment

1. Check nozzle opening pressure.
 - The gage should read 13 700 to 14 500 kPa (2 000 to 2 100 psi).
 2. If the nozzle opening pressure does not meet specification, disassemble the nozzle and holder assembly and replace the shim with a new one.
 - Use a thicker shim, if the pressure is lower than the specification.
 - Use a thinner shim, if the pressure is higher than the specification.
- The shim is available in the following thickness.

0.50 mm 0.0197 in	0.78 mm 0.0307 in
0.54 mm 0.0213 in	0.82 mm 0.0323 in
0.58 mm 0.0228 in	0.86 mm 0.0339 in
0.62 mm 0.0244 in	0.90 mm 0.0354 in
0.66 mm 0.0260 in	0.94 mm 0.0370 in
0.70 mm 0.0276 in	0.98 mm 0.0386 in
0.74 mm 0.0291 in	1.00 mm 0.0394 in

Install or Connect (Figures 9 and 10)

1. New corrugated washer (13) with blue color painted side turned to the nozzle.
2. New nozzle washer (14).
3. Injection nozzle assembly (1).

Tighten

- Injection nozzle assembly to 64 N·m (47 lb·ft).

4. Gasket, fuel return line and nut (16).

Tighten

- Fuel return line nut to 35 N·m (26 lb·ft).

5. Fuel line (15).

Tighten

- Fuel line sleeve nut (15) to 30 N·m (22 lb·ft).

6. Bleed the fuel system.

NOTICE: After the Cleaning Procedure is completed, be sure to perform the Opening Pressure Test, the Spray Pattern Test, the Leakage Test and Chatter Test. Refer to appropriate section in to the Service Manual for details on these tests.

FUEL INJECTION PUMP REPLACEMENT

Remove or Disconnect (Figures 17 and 18)

- Tilt the cab.
 1. Battery positive cable.
 2. Engine stop cable (25).
 3. fuel injection lines (28).
 4. Injector return line (21).
 5. Intake manifold.
 6. Accelerator cable (27).
 7. Fuel lines between the secondary fuel filter and the pump (22).
 8. Hole cover from timer housing (23).
 - For ease in reinstalling the injection pump, align the timing mark on the automatic timer with the pointer on the timer housing (figure 17).
 9. Injection pump mounting bolts (24).
- 10. Injection pump.