Group 10
DIESEL FUEL SYSTEM

FUEL SUPPLY PUMP

"D" Engines

Removal

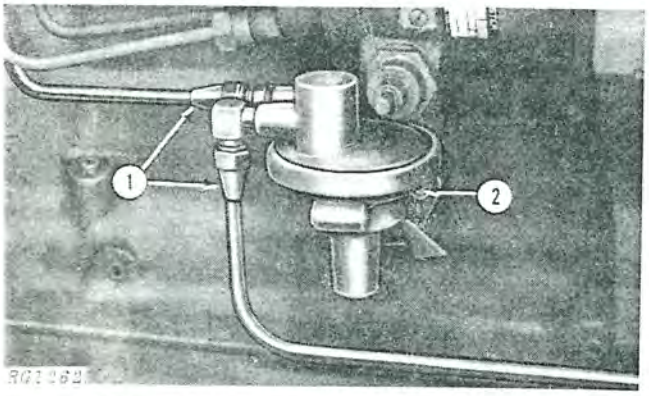


Fig. 1-Fuel Pump Removal (6404D Shown)

1. Disconnect pump inlet and outlet pipes. Cap exposed fittings.

2. Remove mounting nuts.

Lift pump from engine block.

Repair

The fuel pump is not serviceable. If found defective, install a new pump.

Installation

Be sure engine mounting pad is clean. Install pump, using a new packing seal.

Connect fuel inlet and outlet pipes.

Bleed fuel system (see page 30-10-4).

"T" and "A" Engines

Removal

Referring to Figure 2:

1. Disconnect pump inlet and outlet line fittings. Do not disconnect banjo fittings.

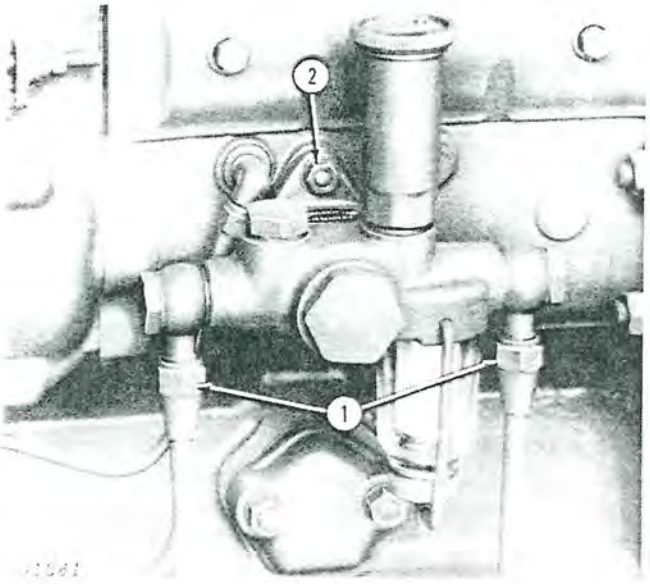


Fig. 2-Fuel Pump Removal (6404T Shown)

2. Remove mounting nuts.

Lift pump from injection pump housing.

Repair

Refer to Section 40, TM-1065 "Fuel Injection Equipment - Robert Bosch" for repair and testing instructions.

Installation

Remove all old gasket material. Position a new gasket over mounting studs.

Install pump. Tighten nuts to 5 ft-lbs (7 Nm) (0.7 kgm).

Connect fuel inlet and outlet pipes to pump.

Bleed fuel system (see page 30-10-4).

FUEL CHECK VALVE
"T" and "A" Engines

General Information

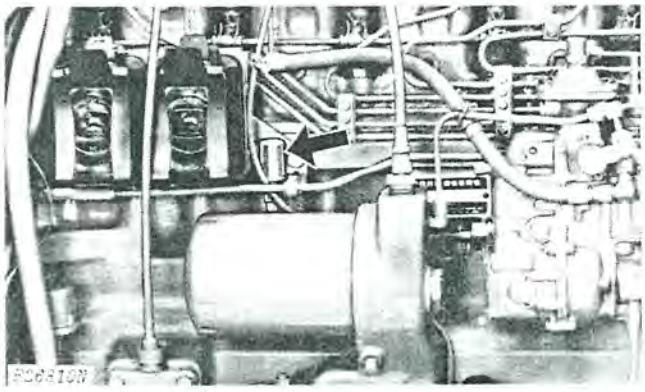
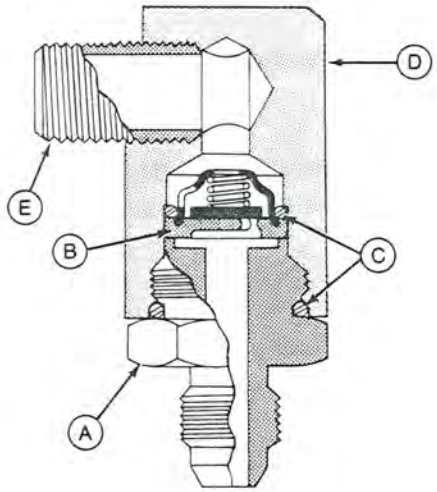


Fig. 3-Fuel Check Valve

A fuel check valve assembly (Fig. 3) located at the fuel inlet on filter body, is used to prevent fuel in filters, injection pump housing, and lines from draining back into the fuel tank when the fuel level is low. Fuel drain-back can be a prime cause of hard starting.

Removal



R 26811N

A—Connector
B—Check Valve
C—O-Rings
D—Valve Body
E—Pipe Nipple

Fig. 4-Cross-Sectional View of Fuel Check Valve Assembly

Disconnect the fuel inlet pipe and unscrew connector (A, Fig. 4). Check valve (B) will fall out of housing when connector is removed.

To remove valve body (D), take off the fuel filter elements. Separate the filter body (11, Fig. 8) from its support (1). Unscrew valve body from filter body.

Repair

The check valve (B, Fig. 4) cannot be repaired. Before replacing valve, inspect to make sure that there is no foreign material which may be keeping valve open. Use compressed air to remove foreign material from valve and valve body.

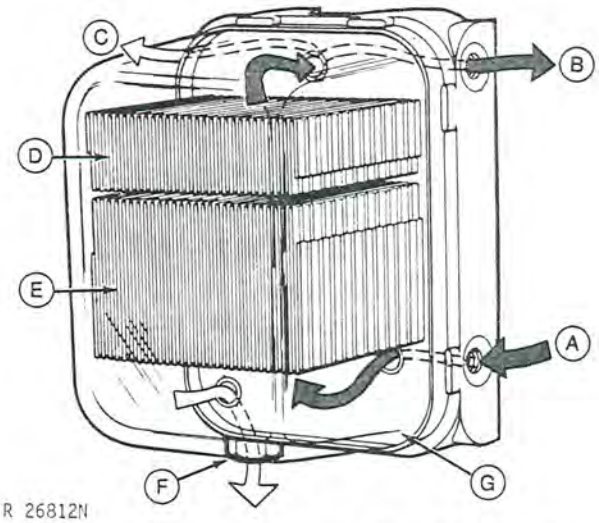
Installation

Apply a light coating of Permatex to pipe nipple threads (E), and attach valve body to filter body. Mount filter body on its support. Install filter elements.

Position new O-rings (C) on check valve and connector. Install valve and connector in valve body. Connect fuel pipe, and bleed the fuel system (page 10-6).

FUEL FILTER

General Information



R 26812N

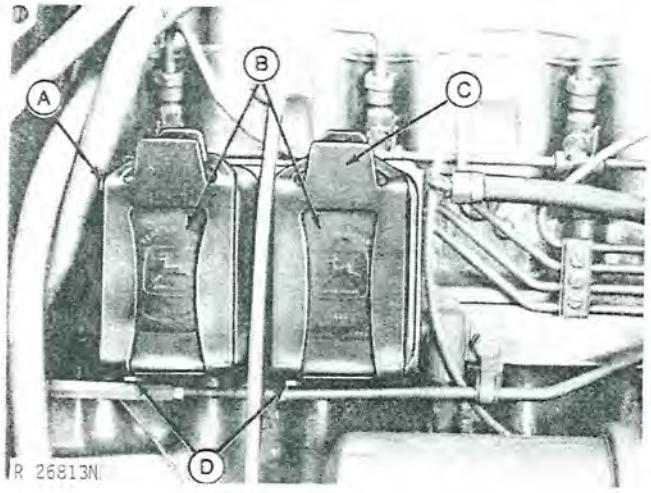
A—Inlet
B—Outlet
C—Air Vent
D—Second Stage Filtering Media
E—First Stage Filtering Media
F—Drain
G—Sediment Bowl
Supply Pump Pressure

Fig. 5-Fuel Flow Through Filter

One fuel filter element is used on "D" engines and two elements are used on "T" and "A" engines. These filters prevent dirty fuel from reaching the injection pump and nozzles. The twin filter elements are mounted in parallel on a common filter body.

The filter element(s) will require occasional replacement (in pairs on dual filter engines) to maintain an adequate flow of fuel to the injection pump. The frequency of this service will vary according to the cleanliness of available fuel and the care used in fuel storage.

Replacing Filter Element(s)



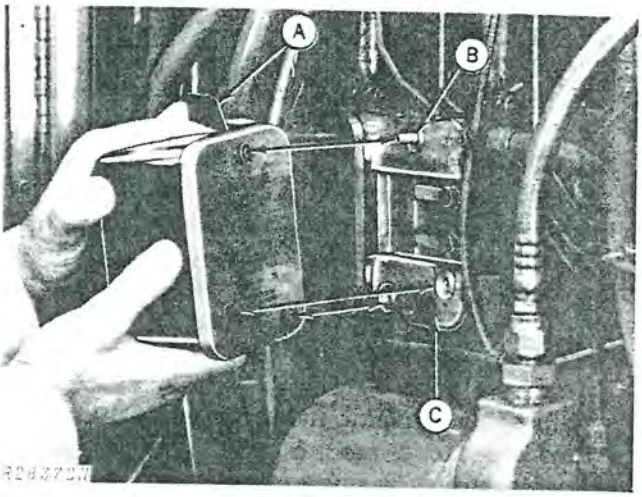
A—Bleed Plug
B—Filter Elements
C—Retaining Spring
D—Drain Plugs

Fig. 6-Fuel Filter (6466A Shown)

To change the filter element(s) (B, Fig. 6), remove drain plug(s) and drain filter(s).

Release the filter element retaining spring (C) and pull off element.

NOTE: The spring may be released by pressing inward on the outside finger tab (A, Fig. 7) until the top hook of the spring can be disengaged. Disengage the top hook by pulling upward on the inside finger tab.



A—Finger Tabs
B—Spring
C—Fuel Filter Body

Fig. 7-Installing Fuel Filter

Before installing new filter elements, inspect the filter body where elements make contact. These locations must be completely void of dirt or other contaminants. If contaminants are found, clean carefully.

IMPORTANT: Any dirt lodged in the spring pin groove or at the end of the spring pin by cleaning efforts will be washed into the injection system and may result in severe damage to the injection pump or nozzles.

Push new element over the spring pin (B, Fig. 7). Hook the bottom end of retaining spring first, then hook the top end.

After changing both elements, install drain plugs in filter body.

Open the fuel shut-off valve and bleed the filters. (See "Bleeding Fuel System" on next page.)

BLEEDING FUEL SYSTEM

CAUTION: Escaping diesel fuel under pressure can have sufficient force to penetrate the skin, causing serious personal injury. Before disconnecting lines be sure to relieve all pressure. Before applying pressure to the system, be sure all connections are tight and that lines, pipes and hoses are not damaged. Fuel escaping from a very small hole can be almost invisible. Use a piece of cardboard or wood, rather than hands, to search for suspected leaks.

If injured by escaping fuel, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

Whenever the fuel system has been opened up for service (lines disconnected or filters removed), it will be necessary to bleed the air from system.

To bleed the fuel system on "D" engines, loosen the bleed plug on the fuel filter base (A, Fig. 6) and operate the hand primer on the fuel pump until most of the air bubbles are expelled from the filter.

Push the hand primer back (toward engine) as far as possible and tighten filter bleed plug.

To bleed the fuel system on "T" and "A" engines, loosen the bleed plug (A, Fig. 6). Unscrew the hand primer knurled knob on the fuel pump, and loosen until it can be pulled up by hand. Operate the hand primer until most of the air bubbles are expelled from the glass bowl on the pump.

Push hand primer down and tighten. Tighten bleed plug.

NOTE: If the engine will not start, it may be necessary to loosen the fuel pipes at the injection nozzles to bleed air from the system. With the hand throttle pushed all the way in, turn the engine over with the starter until fuel without air flows from the loose fuel pipe connections. Tighten the connections.

FUEL INJECTION PUMP

4270D

Removal

Clean the injection pump, pipes, and area around the pump with cleaning solvent or a steam cleaner.

IMPORTANT: Never steam clean or pour cold water on an injection pump while the pump is running or while it is warm. To do so may cause seizure of pump parts.

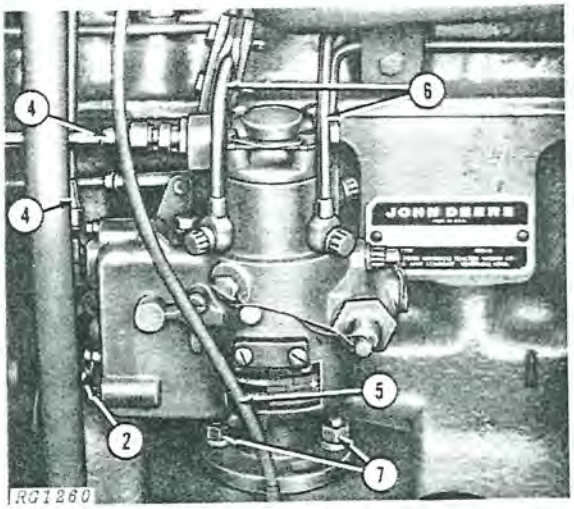


Fig. 8-Removing 4270D Fuel Injection Pump

1. Set engine to No. 1 TDC compression (see page 10-05-03).

2. Disconnect electrical fuel shut-off lead.

3. Disconnect speed control linkage (not shown).

4. Disconnect fuel inlet and return lines.

5. Disconnect tachometer drive cable.

6. Remove fuel lines. Cap fittings on nozzles and on injection pump.

7. Remove hold-down nuts and lift injection pump from engine.

Repair

For injection pump repair information and specifications, refer to SM-2045 - "Testing and Servicing Fuel Injection Pumps and Nozzles".

Installation

Inspect injection pump mounting hole in cylinder block. If I.D. of the mounting hole has a sharp edge, bevel the edge slightly with emery cloth. Remove all metal chips and dust.

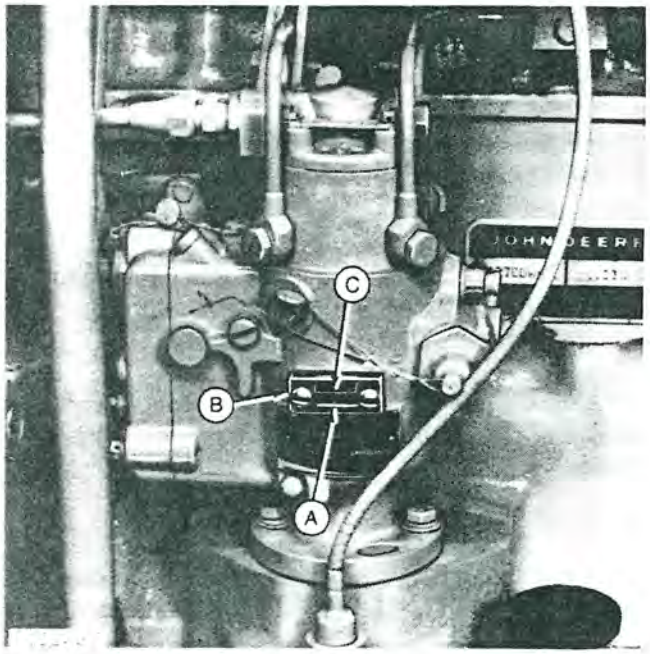
Verify that engine is set to No. 1 TDC compression. If not, set to No. 1 TDC compression.

Place thrust spring over tang on pump drive shaft.

Install injection pump in cylinder block, making sure that tang on pump drive shaft engages slot in oil pump drive gear.

Pump should sit squarely and solidly on mounting pad when a slight downward pressure is applied.

Install mounting nuts with washers but do not tighten.



A—Weight Retainer Timing Line
B—Timing Window
C—Cam Timing Line

Fig. 9-Injection Pump Timing Lines

Turn pump to align timing marks (Fig. 9). Tighten mounting nuts securely.

Rotate engine backward 1/4 revolution.

Turn engine in direction or rotation until injection pump timing marks line up. The flywheel timing marks should now be aligned. If not, remove and reinstall injection pump.

IMPORTANT: The normal backlash of gears is enough to throw the injection pump timing off by several degrees, resulting in poor engine performance. Therefore, it is very important that the timing of the pump be rechecked after installation.

Install fuel ines. Tighten fittings at injection nozzles to 20 ft-lbs (27 Nm) (2.7 kgm). Tighten hollow screws at injection pump to 35 ft-lbs (47 Nm) (4.7 kgm).

Connect electrical fuel shut-off lead.

Connect fuel inlet and return lines. Tighten fittings to 20 ft-lbs (27 Nm) (2.7 kgm).

Connect speed control linkage.

Do not remove timing window or connect tachometer drive cable.

Bleed fuel system (see page 30-10-04).

Adjust automatic speed advance. Refer to Section 230, Group 10.

FUEL INJECTION PUMP—Continued

6404D; 6466D

Removal

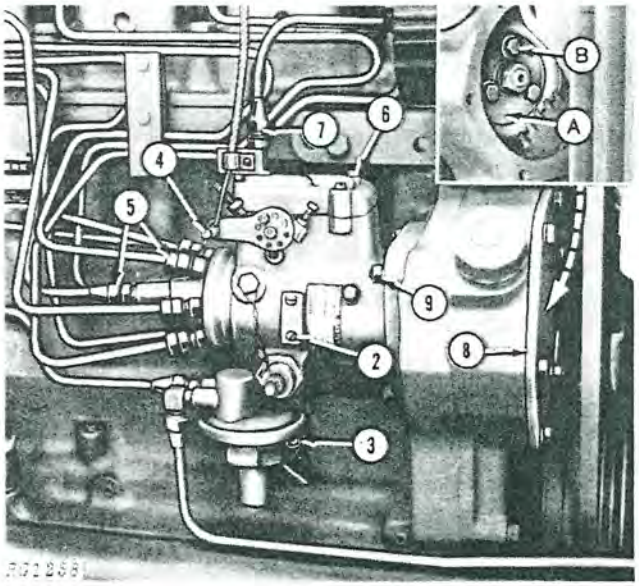
Clean the injection pump, pipes, and area around the pump with cleaning solvent or a steam cleaner.

IMPORTANT: Never steam clean or pour cold water on an injection pump while the pump is running or while it is warm. To do so may cause seizure of pump parts.

Use the following method to remove the fuel injection pump:

1. Position engine at TDC, with No. 1 piston on the compression stroke. (See page 10-05-04.)

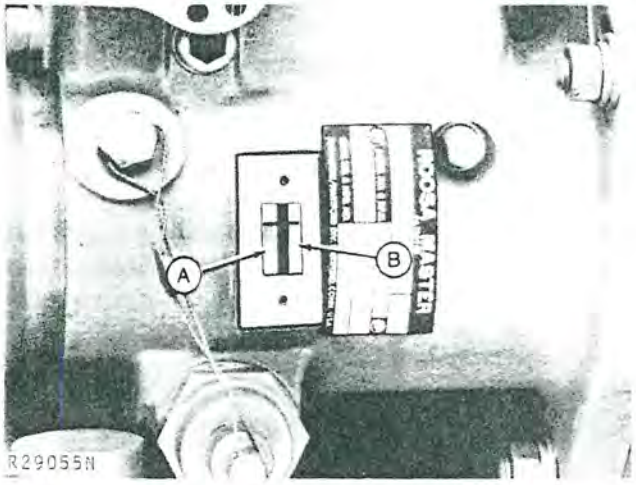
NOTE: Obtaining TDC (No. 1 piston on compression stroke) is not required for removing the injection pump. However, it is required when installing back on the engine. If the engine is to be disassembled or rotated after the pump has been removed, disregard this step and proceed to Step 2.



A—Pump Gear **B—Cap Screw**

Fig. 10-Injection Pump Removal Steps

2. Remove the timing hole cover (Fig. 10). Rotate the engine until timing mark on governor weight retainer (B, Fig. 11) is in line with timing mark on cam ring (A).



A—Cam Ring **B—Weight Retainer**

Fig. 11-Injection Pump Timing Marks

3. Remove fuel pump (page 30-10-1).

4. Disconnect the speed control linkage.

5. Disconnect injection pump inlet and pump-to-nozzle fuel pipes.

6. Disconnect electrical shut-off lead.

7. Disconnect fuel return pipe.

8. Clean area around timing gear cover and remove cover. Remove the three cap screws (B, Fig. 10) from pump drive gear (A).

9. Remove mounting bolt nuts. The pump mounting flange on 6466D engine is secured with four nuts, whereas the 6404D engine uses three.

Remove pump. Be sure to cap all injection pump and fuel pipe openings to prevent entry of contaminants.

Repair

For injection pump repair information and specifications, refer to TM-1064 "Fuel Injection Equipment-Roosa Master".

Installation

Check engine timing to make sure that No. 1 piston is at TDC on the compression stroke. If the engine was rotated after the injection pump was removed, crank the engine until No. 1 piston is starting the compression stroke. Install timing pin in cylinder block.

FUEL INJECTION PUMP—Continued

Installation—Continued

The compression stroke can be determined by removing the rocker arm cover and turning the engine until both valves are closed on No. 1 cylinder, and increased turning effort is noted. Continue turning the engine until timing pin engages the timing hole in flywheel.

Remove injection pump timing hole cover (Fig. 10). Rotate pump drive shaft and align the timing mark on governor weight carrier with the timing mark on the cam ring (Fig. 11).

Check pump mounting flange packing for damage or wear. Replace if necessary.

Install injection pump on the engine so the top edge of the pump flange is parallel to the edge of the mating flange on the cylinder block. Tighten the mounting bolt nuts to 20 ft-lb (27 Nm) (2.7 kgm) torque.

Install the injection pump gear on hub ("dish" in gear facing outward toward front of engine), with the elongated holes in gear approximately centered with holes in hub. Recheck pump timing mark alignment. If correct, install the timing gear-to-hub cap screws, and tighten to 35 ft-lb (47 Nm) (4.7 kgm) torque.

Remove the timing pin from cylinder block. Rotate the engine 1-1/2 revolutions in direction of rotation, then install timing pin in cylinder block. Continue to turn the engine until timing pin engages the timing hole in flywheel. Recheck the alignment of injection pump timing marks. If marks are not in line, loosen the pump gear cap screws, and bring marks into alignment. Retighten cap screws to 35 ft-lb (47 Nm) (4.7 kgm) torque.

IMPORTANT: The normal backlash of gears is enough to throw the pump timing off by several degrees, resulting in poor engine performance. Therefore, it is very important that the timing of the pump be rechecked after it has been installed.

Remove caps from injection pump and fuel pipe openings.

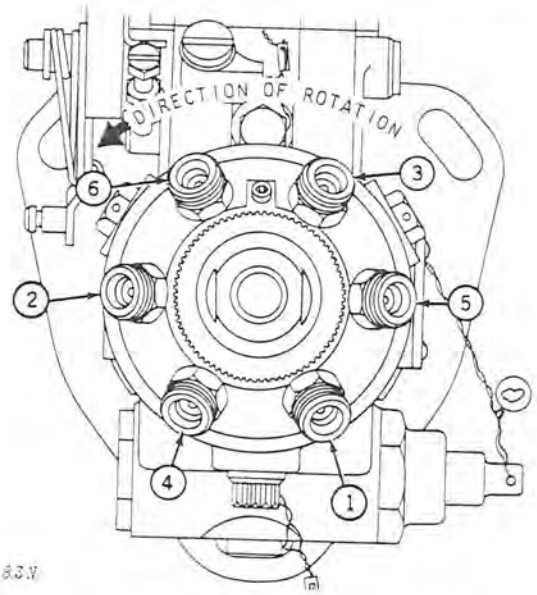


Fig. 12-Injection Pump-To-Nozzle Pipe Connections

Connect the Injection pump-to-nozzle pipes. Refering to Fig. 12, connect No. 1 outlet first and continue around the pump head in a counterclockwise direction, attaching pipes in order of engine firing (1-5-3-6-2-4).

Tighten fuel pipe connectors to 20 ft-lbs (27 Nm) (2.7 kgm) torque.

Connect the speed control rod, fuel inlet pipe, return pipe to the injection pump, and electrical shut-off lead wire.

Install fuel pump (page 30-10-1), and open the fuel shut-off valve.

Remove timing pin and rotation tool from engine, and plug openings. Connect crankcase vent hose to lower vent tube.

Install injection pump timing hole cover, and engine timing gear cover. Use new gaskets when necessary.

Bleed the fuel system (page 30-10-4).

After bleeding the fuel system, the automatic speed advance should be checked for proper adjustment. Refer to Section 230, Group 10.

FUEL INJECTION PUMP—Continued

6404T and A; 6466T and A

Removal

Clean the injection pump, pipes, and area around the pump with cleaning solvent or a steam cleaner.

IMPORTANT: Never steam clean or pour cold water on an injection pump while the pump is running or while it is warm. To do so may cause seizure of pump parts.

Use the following method to remove the fuel injection pump:

1. Position engine at TDC, with No. 1 piston on the compression stroke (see page 10-05-04).

NOTE: Obtaining TDC (No. 1 piston on compression stroke) is not required for removing the injection pump. However, it is required when installing back on the engine. If the engine is to be disassembled or rotated after the pump has been removed, disregard this step and proceed to Step 2.

Disconnect the crankcase vent hose and lower vent tube from engine. Remove two plastic cover plugs from flywheel housing next to oil pressure sending unit.

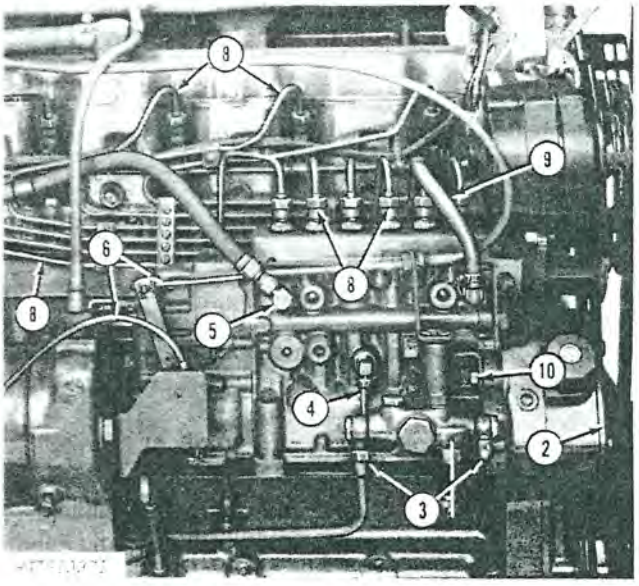
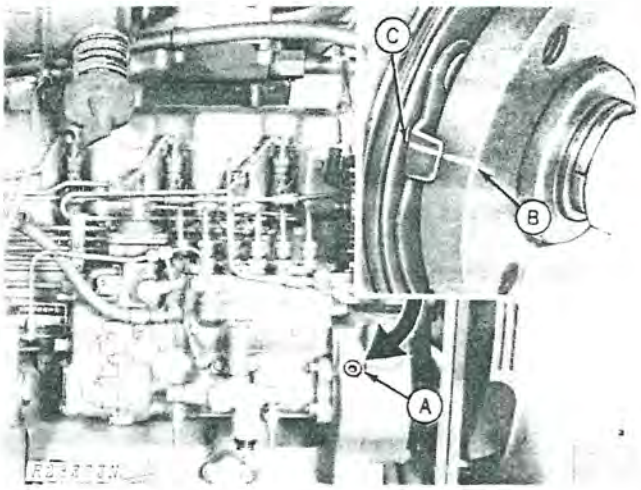


Fig. 13-Injection Pump Removal Steps (6466A Engine Without Aneroid Shown)

2. Remove timing gear cover (Fig. 13) from engine. Take out three cap screws (four on 6466A engines) that fasten injection pump drive gear to pump drive hub.

3. Disconnect supply pump inlet and outlet pipes. Cap all exposed fittings.

4. Disconnect and remove lubrication pipe. The pipe connects oil filter base to aneroid activator.



A—Timing Hole Plug B—Drive Hub Mark C—Pointer Mark

Fig. 14-Injection Pump Timing Marks (6466T Shown)

Install JDE-81-1 Engine Rotation Tool. Remove timing hole plug (A, Fig. 14) and by looking into hole, observe when pump drive hub mark (B) comes in alignment with pointer mark (C) as engine is turned. At this point, the JDE-81-4 Timing Pin should enter the hole in flywheel. Rotate engine slightly in either direction until pin can be pushed into hole.

5. Disconnect injection pump fuel inlet line.

6. Disconnect fuel shut-off cable and speed control rod.

7. Disconnect intake manifold-to-aneroid pipe (not shown).

8. Disconnect fuel delivery pipes using CS-2428 Line Wrench. (Figs. 15 and 16). On 6404T and A and 6466T engines, it is advisable to hold the hex portion of pump delivery valve holder with another wrench while loosening the fuel pipes.

On 6466A engines, hold the pump outlet fitting stationary with JDE-90 Wrench while loosening fuel pipes with CS-2428 Wrench.

9. Disconnect fuel return line.

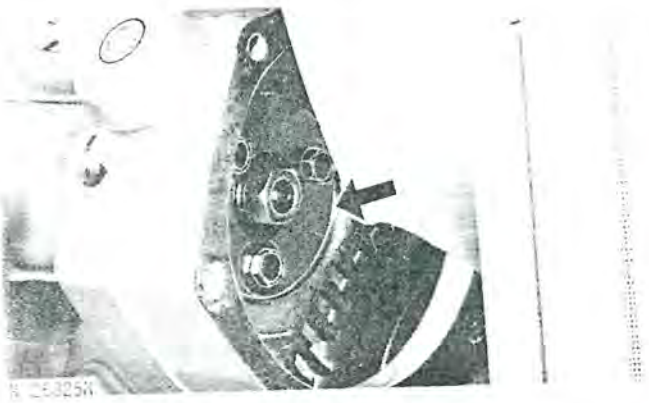


Fig. 20-Injection Pump Drive Gear Installation

Install the drive gear on pump drive hub, positioning gear so that the cap screws which secure the gear to the drive hub will be in the approximate center of gear slots. Doing so, will permit the pump timing to be changed, should the need arise.

Rotate the engine 1-1/2 revolutions in direction of rotation. Continue to turn the engine until the timing pin drops in flywheel hole for TDC.

Recheck the alignment of the injection pump timing marks. If the marks are not in line, loosen the pump gear cap screws, and bring marks into alignment.

IMPORTANT: The normal backlash of gears is enough to throw the pump timing off by several degrees, resulting in poor engine performance. Therefore, it is very important that the timing of the pump be rechecked after it has been installed. To avoid backlash, always approach the timing mark on pointer by turning engine in direction of rotation.

Tighten drive gear cap screws and pump mounting stud nuts to 35 ft-lbs (47 Nm) (4.7 kgm) torque. Install timing hole plug (E, Fig. 14) and cover plate (2, Fig. 13).

Remove all protective caps from pipe and hose connections.

Reverse the numbered removal steps found on page 10-8 except for Step 6. Leave the speed control rod and fuel shut-off cable disconnected until the pump idle speeds have been checked. (See "Adjustments", Section 230.)

Open the fuel shut-off valve, and bleed the fuel system.

Start engine and check for leaks. Especially check for leaks at pump lubrication pipe connections to prevent loss of engine lubricating oil. Repair as required, to stop leakage of fuel and lubricating oil.

ANEROID ("T" and "A" Engines)

General Information

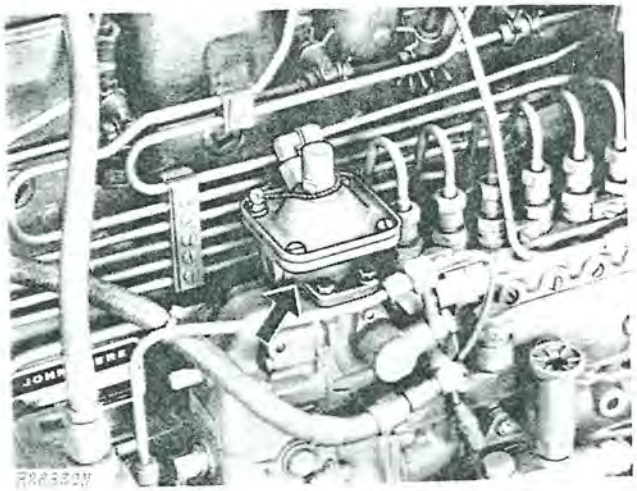


Fig. 21-Aneroid

Some 6404T and A and 6466T and A engines are equipped with an aneroid (Fig. 21), which is a diaphragm-type control unit that mounts on top of injection pump governor housing.

Its purpose is to limit the black smoke produced during acceleration under two conditions:

(1) When load is moderate to heavy with engine speeds from 800 to approximately 1000 rpm.

(2) When load is light at any engine speed.

Repair

Refer to TM-1065 "Fuel Injection Equipment - Robert Bosch", Section 30, Group 10 and 15 for instructions on how to repair and adjust the aneroid.

The aneroid controls fuel delivery when intake manifold pressure is about 10 psi (1 bar) (1 kg/cm²) or less. Therefore, all final adjustments are to be made on the test stand with aneroid mounted on injection pump.

IMPORTANT: Correct aneroid adjustments are essential for satisfactory engine performance. Whenever the aneroid has been disassembled or the adjustments have been altered, the injection pump (including aneroid) must be calibrated on the test stand before releasing the pump for service.

HYDRAULIC ANEROID ACTIVATOR

Removal

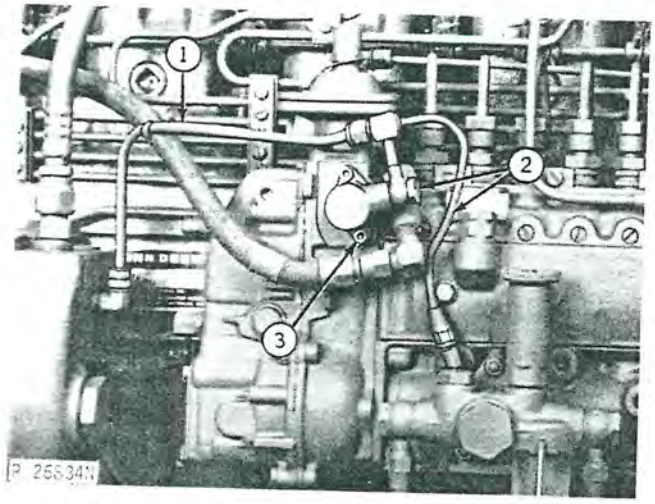


Fig. 22-Hydraulic Aneroid Activator Removal Procedures (6466T Engine)

NOTE: The hydraulic aneroid activator used on P-110 injection pump (6466A Engine) is located on the back side of the governor housing (Fig. 23), next to the engine block. It is in the same relative position on the housing as the one illustrated above. There is no difference in the individual component activator parts between the two models of pumps.

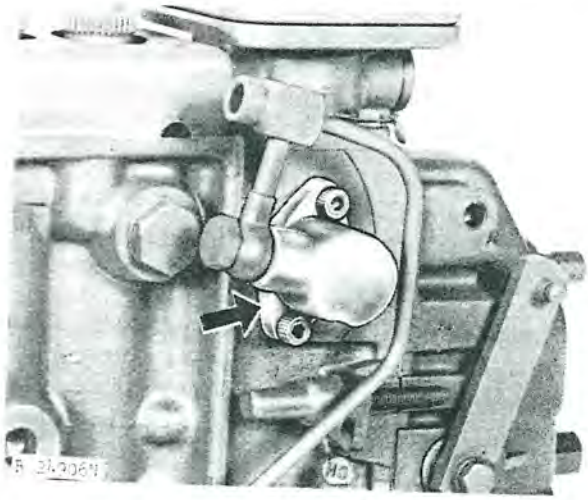


Fig. 23-Hydraulic Aneroid Activator On P-110 Pump (6466A Engine)

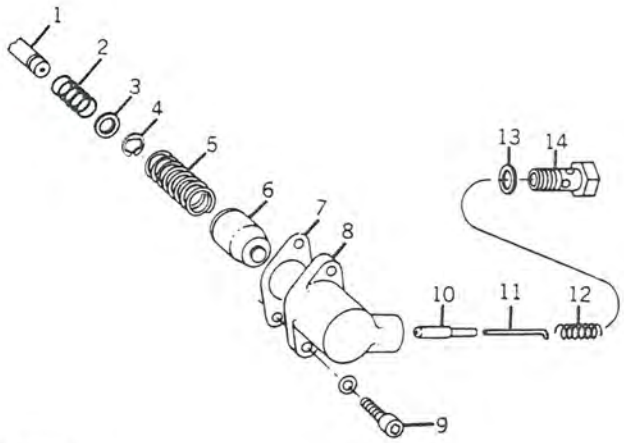
To remove the activator (Fig. 22 or 23):

1. Disconnect lube pipe connecting oil filter body-to-aneroid activator.

2. Disconnect lube pipe connecting aneroid activator-to-pump housing. Note two copper washers used with special screw to secure lube pipe banjo fitting to activator housing.

3. Take out two socket head attaching screws. Remove activator housing, gasket, piston, and spring. Be careful not to lose restrictor wire and other activator parts. (See Fig. 24).

Repair



1—Starting Fuel Control Shaft
2—Return Spring
3—Washer
4—Retaining Ring
5—Piston Spring
6—Piston
7—Gasket
8—Activator Housing
9—Mounting Screws
10—Capillary Valve
11—Restrictor Wire
12—Capillary Valve Spring
13—Washers
14—Special Screw

Fig. 24-Exploded View Of Activator Parts

Wash parts in solvent and dry with compressed air. Blow out all passages to make sure that they are open.

Check piston (6, Fig. 24) and activator housing (8) for general condition. Piston must move freely in its bore.

Check piston spring (5) and capillary valve spring (12). Replace if weak or broken.

Inspect condition of restrictor wire (11). Wire must not be bent or broken, and must fit loose in capillary valve (10).

Check condition and installation of return spring (2), washer (3), and retaining ring (4) on starting fuel control shaft (1).

Replace spring if weak or broken. Be sure retaining ring is secure on shaft.

Move starting fuel control shaft back and forth. If shaft binds, return spring can't function correctly. Free-up shaft if binding occurs.

Installation

To install the activator (Fig. 24):

1. Insert piston spring (5) into piston (6). Place these parts in activator housing (8).

2. Assemble a new gasket (7) and activator assembly on governor housing. Tighten mounting screws (9).

3. Assemble capillary valve (10), restrictor wire (11), and spring (12) in activator housing.

4. Install activator-to-pump lube pipe (2, Fig. 22). Use two new copper washers (13, Fig. 24), one on each side of banjo fitting. Secure with special screw (14).

5. Install filter body-to-activator lube pipe (1, Fig. 22).

6. Start engine and check for leaks.

9.5 MM FUEL INJECTION NOZZLES

Removal

IMPORTANT: Disconnect battery ground cable before working on nozzles close to the alternator to prevent accidental shorts through tools.

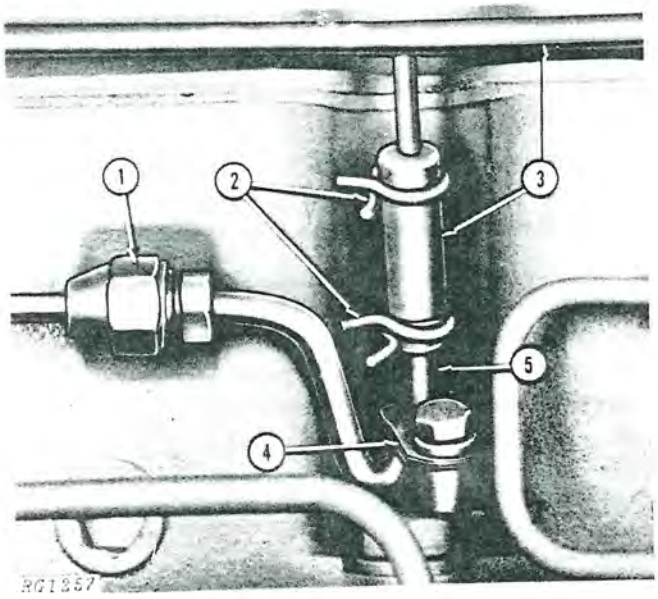


Fig. 25-9.5 mm Nozzle Removal Steps

Referring to Fig. 25:

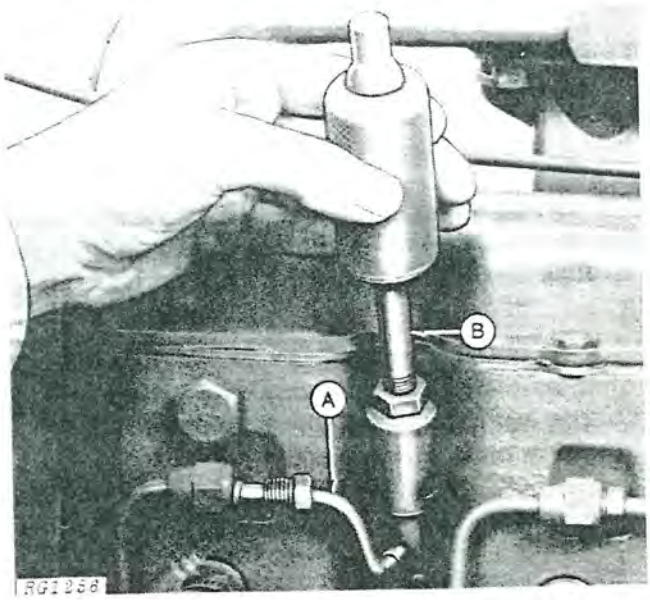
1. Disconnect nozzle from fuel pipe at connector, using two wrenches.

2. Remove spring clamps from boot.

3. Disconnect and remove leak-off pipe and boots.

4. Remove hold-down screw and washer, clamp and spacer.

5. Remove injection nozzle. If nozzle cannot be easily removed, use JDE-38 Nozzle Puller (Fig. 26).



A—Injection Nozzle **B—JDE-38 Nozzle Puller**

Fig. 26-Removing Injection Nozzle

IMPORTANT: Do not use a screwdriver or similar tool to pry injection nozzles from head. Doing so may cause distortion and permanent damage to the nozzles.

9.5 MM FUEL INJECTION NOZZLES—Continued

Testing

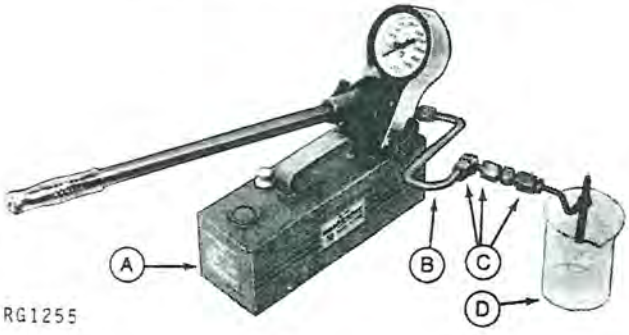
Test the injection nozzle before disassembling to determine its condition. Test for: Opening Pressure, Leakage, Chatter and Spray Pattern.

⚠ CAUTION: The nozzle tip should always be directed away from the operator. Fuel from the spray orifices can penetrate clothing and skin, causing serious personal injury. Enclosing the nozzle in a transparent cover, as shown, is recommended.

Before applying pressure to the nozzle tester, be sure that all connections are tight, and that the fittings are not damaged. Fuel escaping from a very small hole can be almost invisible. Use a piece of cardboard or wood, rather than hands, to search for suspected leaks.

If injured by escaping fuel, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

IMPORTANT: Always use clean, filtered fuel when testing injection nozzle performance. Testing nozzles with dirty fuel will severely damage the precision parts of the nozzle.



A—Nozzle Tester
B—Fuel Line
C—Adapters
D—Beaker

Fig. 27-Nozzle Connected to Tester

Use Y-900-3, Y-900-5 and Y-900-9 adapters (C, Fig. 27) and Y-900-2 fuel line (B) from D-01110AA Adapter Set (Y-901A) to connect nozzles to D-01109AA Nozzle Tester (Y-900) (A).

Position tip of nozzle below top of beaker and back out 30 degrees from vertical. This is necessary to contain all spray in beaker, as nozzle spray pattern is at an angle to nozzle centerline. Check all connections for leakage that could cause false readings.

Opening Pressure Test

Pump the handle several times to flush out nozzle fittings. Tighten all fittings.

Expel air from the nozzle by operating the pump handle for several strokes. Then raise the pressure to a point where the gauge needle falls rapidly. This is the nozzle opening pressure.

On a new nozzle, this pressure should be 3150 to 3250 psi (217 to 224 bar) (221 to 229 kg/cm²). On a used nozzle, opening pressure should be 2950 to 3050 psi (203 to 210 bar) (207 to 214 kg/cm²).

Leakage Test

Check valve seat leakage by positioning nozzle on tester with nozzle tip down. Operate test pump rapidly to seat valve firmly.

Dry nozzle tip thorougly. Slowly raise nozzle pressure to 200 to 300 psi (14 to 21 bar) (14 to 21 kg/cm²) below opening pressure.

A slight dampness is permissable, but no fuel drops should form within 10 seconds.

Check nozzle leak-off by positioning nozzle with tip slightly above horizontal and covered.

Raise gauge pressure to 1500 psi (103 bar) (105 kg/cm²) and observe leakage at return end of nozzle.

After one drop, back leakage should be 3 to 10 drops within 30 seconds.

Chatter Test and Spray Pattern

The injection nozzle should chatter very distinctly as the pump is operated at 60 strokes per minute. Failure to chatter may be caused by a bent or binding nozzle valve.

Until the chattering range is reached, fuel will emerge in streams. When pump lever movement is accelerated, the spray should be finely atomized.

The spray cone, although usually inclined from the centerline of the nozzle, should be evenly distributed. A partially clogged or erroded orifice will usually cause the spray to deviate from the correct angle and be streaky rather than finely atomized.

If spray pattern, leakage and leak-off tests are good, but opening pressure is incorrect, adjust opening pressure as directed in "Repair".

NOTE: If the nozzle performs properly in all tests, no further service is necessary and it can be installed in the engine. Nozzles which do not operate properly must be cleaned or reconditioned. See "Repair".

Repair

General Information

Since dirt and water are the worst contaminants in the fuel injection system, the working area, tools and cleaning materials must be kept spotlessly clean. Whenever possible, work in an isolated, dust-free area.

Cover the work bench with clean paper before beginning disassembly of injection nozzles.

As parts are disassembled, place them in a pan of clean diesel fuel and leave them there until needed. Do not permit these parts to strike each other.

Use a separate pan of clean fuel for washing parts before assembly.

Disassembly

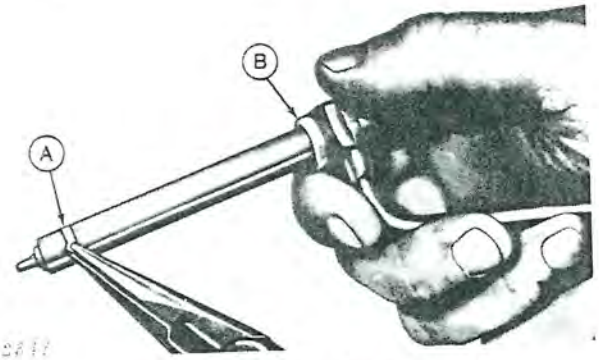


Fig. 28-Removing Seals

Using a needle-nose pliers, remove carbon stop seal and upper sealing washer (Fig. 28). Discard both pieces.

IMPORTANT: Do not scrape or otherwise damage the Teflon coating on nozzle body above carbon stop seal groove. This coating will become discolored during normal service. Do not use a motor-driven brush to clean nozzle body.

NOTE: Disassembly of nozzles is not recommended unless servicing is indicated by nozzle operation and testing.

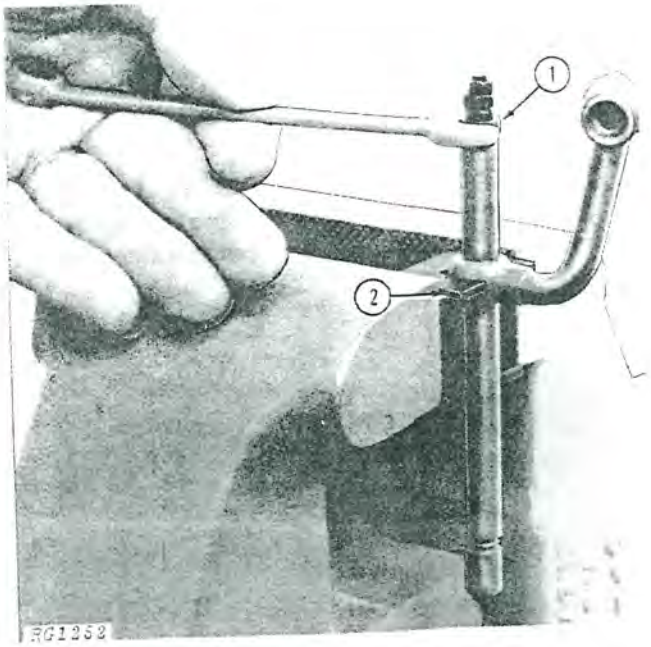


Fig. 29-Nozzle Disassembly Procedure

1. Place nozzle in No. 16475 Holding Fixture and secure in a vise.

2. Loosen lock nut. Back out pressure adjusting screw and lift assembly.

Invert nozzle and allow pressure adjusting spring seat and adjusting assembly to fall into your hand. Do not bend stem during removal.

Fig. 30-Using Nozzle Valve Retractor

If valve does not slide freely from body, use No. 16481 Retractor to remove valve (Fig. 30).

Remove locating clamp from nozzle body.

9.5 MM FUEL INJECTION NOZZLES —Continued

Cleaning

Nozzle Body

Clean carbon stop seal groove and nozzle tip with No. 16488 Brass Wire Brush. Inspect tip for cracks and spray orifices for chipping and erosion.

Fig. 31-Cleaning Nozzle Tip Orifices

To clean carbon from spray orifices (Fig. 31):

1. Begin with cleaning wire 0.003 to 0.004 inch (0.07 to 0.10 mm) smaller than the nominal orifice size of 0.012 in. (0.30 mm).

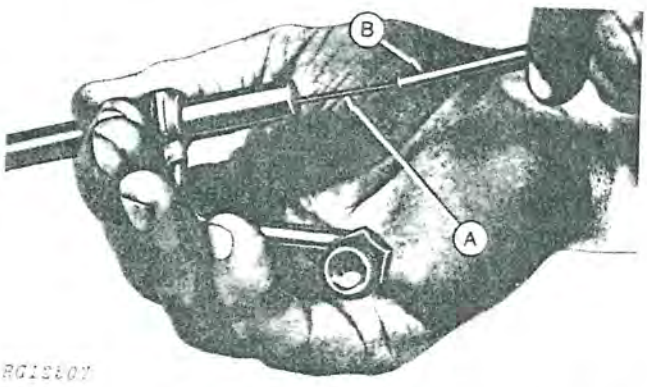
NOTE: Stoning the wire to provide a flat surface on one side will help in reaming carbon from a clogged hole.

2. Clamp the cleaning wire in a pin vise. Wire should not protrude from vise more than 1/32 in. (0.8 mm).

3. Insert wire in orifice and rotate.

4. For final cleaning, use cleaning wire 0.001 in. (0.03 mm) smaller than orifice size. Follow steps given above.

Use No. 16482 Scraper to clean deposits from valve seating area.



A—Sac Hole Drill **B—Valve Retractor**

Fig. 32-Cleaning Sac Hole

Insert No. 16476 Sac Hole Drill into nozzle body and rotate it to ream carbon and deposits from the sac hole (Fig. 32).

Valve and Valve Seat

IMPORTANT: Never use a steel wire brush on nozzle parts.

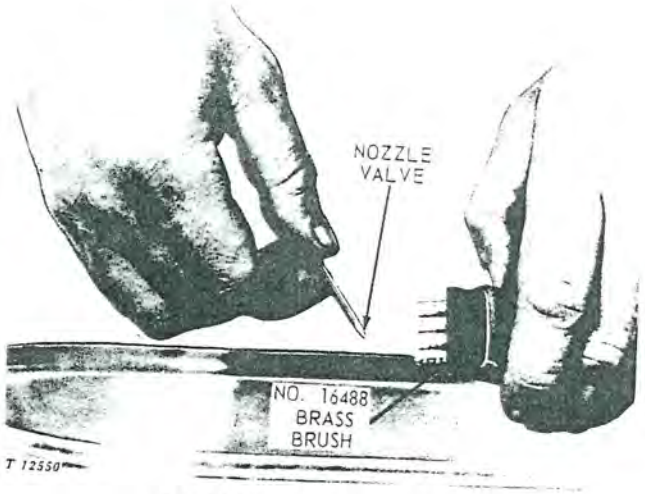


Fig. 33-Cleaning Nozzle Valve Tip

Use No. 16488 Brass Wire Brush to remove deposits from seating area on tip of nozzle valve (Fig. 33). Use a felt pad to remove varnish deposits.

Inspect guide area of valve for scratches. Polishing and vertical marks are normal.

A nozzle which, during test, had spotty chatter or showed signs of sticking accompanied by low return leakage may be corrected by polishing the valve guide area as follows:

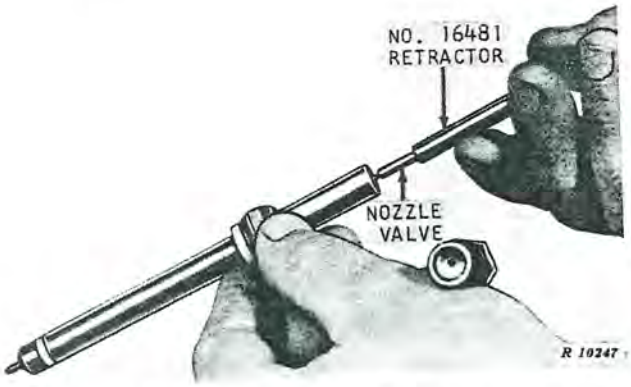


Fig. 34-Polishing Valve Guide Area

1. Apply a small amount of No. 16489 Lapping Compound on valve in guide area only (Fig. 34). Do not use any other compound.

2. Slide valve into body.

3. Grip top of valve with No. 16481 Retractor and rotate valve in guide.

Lap approximately 10 to 20 turns, moving valve up and down and reversing direction of rotation every 3 or 4 turns.

IMPORTANT: Never attempt lapping by rotating valve in a motor-driven chuck.

4. Wash nozzle body and valve thoroughly in clean fuel before reassembly.

Seat leakage may be caused by dirt, carbon or fuel deposits in valve area. Inspect valve seat and clean as follows:

1. Apply a small amount of No. 16489 Lapping Compound to valve tip and insert valve in nozzle body.

2. Gripping valve with No. 16481 Retractor, rotate valve 3 to 5 turns to clean up seat.

3. Wash valve and nozzle body thoroughly in clean fuel.

Valve Coding

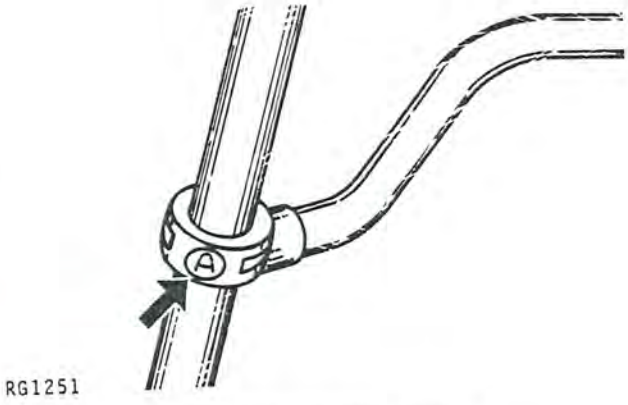


Fig. 35-Nozzle Code Marking

All nozzles are marked on the banjo inlet fitting with a code letter (Fig. 35). This letter is used in manufacturing to mate a sized valve to a sized nozzle body.

Since individual valves are not available for service parts, disregard this code marking.

Valve Adjusting Mechanism

Referring to Fig. 36 on following page:

1. Inspect lift adjusting screw (8). Replace if bent or otherwise damaged.

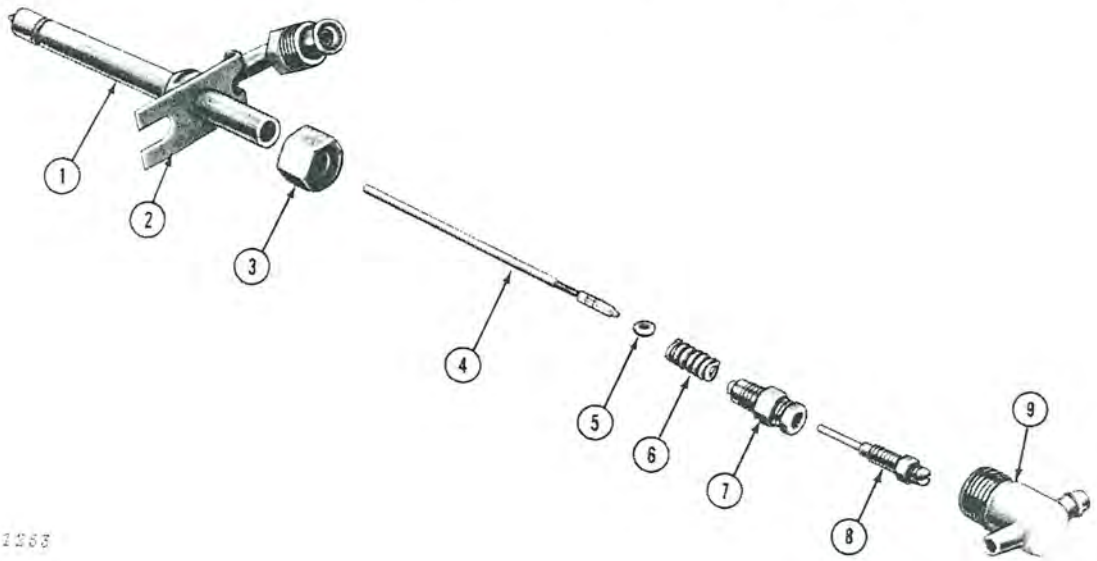
2. Inspect pressure adjusting screw (7). Replace if worn or damaged.

3. Inspect pressure adjusting spring (6). Replace if broken or distorted.

4. Inspect spring seat (5) for wear and replace as necessary.

5. Replace nozzle clamp (2) if bent.

9.5 MM FUEL INJECTION NOZZLES—Continued



1—Nozzle Body
2—Nozzle Locating Clamp
3—Lock Nut
4—Valve
5—Spring Seat
6—Spring
7—Pressure Adjusting Screw
8—Lift Adjusting Screw
9—Leak-off Cap

Fig. 36-Exploded View of 9.5 mm Injection Nozzle

Assembly

Fig. 37-Assembling Nozzle

Referring to Fig. 37:

1. Position nozzle locating clamp over upper nozzle body with flanges pointing downward.
2. Wet valve with clean fuel and insert into nozzle body.
3. Thread lift adjusting screw into pressure adjusting screw until top just enters screw (not shown).
4. Invert adjusting screw assembly and assemble spring seat and spring to adjusting screw (not shown).
5. Tilt body, not allowing valve to fall out, and install spring adjusting screw in body. Be careful not to dislodge spring or seat during initial assembly.

Turn pressure adjusting screw down as far as possible by hand; usually about ten full turns.

Adjustment

Connect nozzle to nozzle tester (Fig. 27).

CAUTION: The nozzle tip should always be directed away from the operator. Fuel from the spray orifices can penetrate clothing and skin causing serious personal injury. Enclosing the nozzle in a transparent cover is recommended.

Before applying pressure to the nozzle tester, be sure that all connections are tight, and that the fittings are not damaged. Fluid escaping from a very small hole can be almost invisible. Use a piece of cardboard or wood, rather than hands, to search for suspected leaks.

If injured by escaping fluid, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

Opening Pressure

Close pressure gauge valve and flush nozzle by operating pump rapidly.

Raise pressure on pump until nozzle opens (gauge drops sharply).

Correct opening pressure is 3150 to 3250 psi (217 to 224 bar) (221 to 229 kg/cm²) on new nozzles or nozzles that have a new spring. Opening pressure for used nozzles is 2950 to 3050 psi (203 to 210 bar) (207 to 214 kg/cm²).

If opening pressure is incorrect:

1. Remove nozzle from tester and install in No. 16475 Holding Fixture (Fig. 29).

2. Loosen pressure adjusting screw lock nut.

3. Reconnect nozzle to tester with tip pointing downward.

4. Carefully turn lift adjusting screw in until it bottoms, then back lift adjusting screw out far enough to prevent bottoming when pressure adjusting screw is turned.

5. Turn pressure adjusting screw clockwise to increase, or counterclockwise to decrease opening pressure. Do not tighten lock nut.

NOTE: It is desirable to set opening pressure to the high limit.

Valve Lift

While pumping fuel through nozzle, hold pressure adjusting screw and slowly turn lift adjusting screw clockwise so valve will not open.

Check for valve bottoming by raising pressure to 200 to 500 psi (14 to 34 bar) (14 to 35 kg/cm²) above nozzle opening pressure.

Although some fuel may collect at nozzle tip, a rapid dribble should not occur.

Referring to Fig. 38:

1. Remove nozzle from tester and install in No. 16475 Holding Fixture.

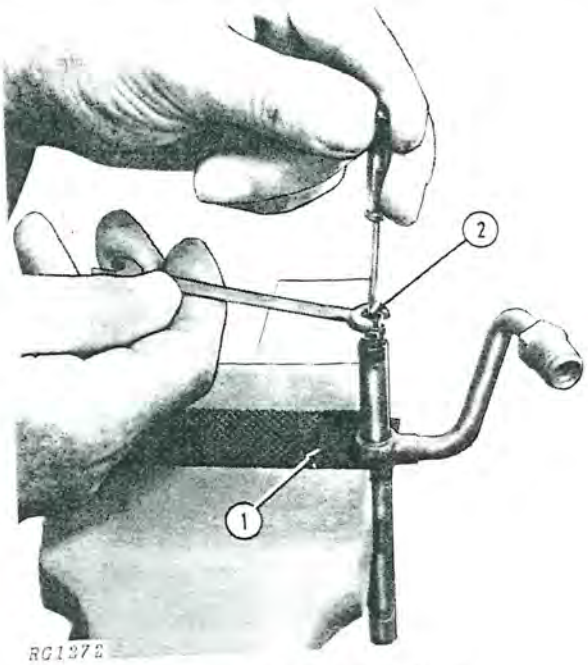


Fig. 38-Adjusting Lift Screw

2. Carefully turn lift adjusting screw in until it bottoms, then back screw out 3/4 turn. (A tolerance of 1/8 turn is permissable.

Fig. 39-Tightening Locknut

Using No. 16478 Torque Wrench Adapter, tighter pressure adjusting screw locknut to 5.8 to 6.7 ft-lbs (7.9 to 9.1 Nm) (0.8 to 0.9 kgm) (Fig. 39).

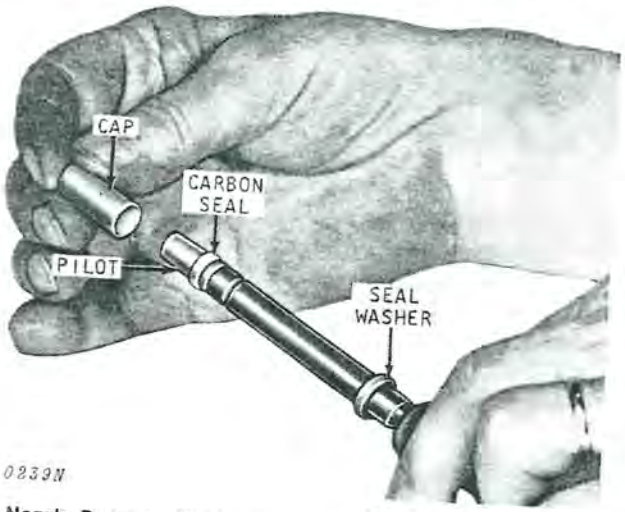
9.5 MM FUEL INJECTION NOZZLES —Continued

The pressure adjusting screw must be held stationary while tightening the locknut.

Recheck nozzle opening pressure.

If, after servicing, nozzle chatter is incorrect, valve parts may be misaligned. To correct, screw pressure adjusting screw through its range of adjustment several times and reset valve lift. Recheck nozzle for chatter.

Clean nozzle with No. 16488 Brass Wire Brush.



A—Nozzle Protector Cap
B—Pilot Tool
C—Carbon Stop Seal
D—Upper Seal Washer

Fig. 40-Installing Seals

Referring to Fig. 40, install No. 16477 Pilot Tool over nozzle tip.

Slide a new upper seal washer on to nozzle body.

Position a new carbon stop seal on pilot tool and push on to nozzle body using No. 16189 Nozzle Protector Cap (found on all repair nozzles). Work seal into groove on nozzle body.

Installation

Clean nozzle bore in head using JDE-39 Reamer.

Insert nozzle in head, using a twisting motion.

Install spacer, clamp, cap screw and washer. Tighten finger tight.

Connect fuel pipe to inlet and hand-tighten.

Tighten nozzle hold-down cap screw to 20 ft-lbs (27 Nm) (2.7 kgm).

Tighten fuel inlet connector to 20 ft-lbs (27 Nm) (2.7 kgm).

Install boots and leak-off pipe.

Bleed fuel system (see page 30-10-4).

KDL FUEL INJECTION NOZZLES

General Information

Robert Bosch Model KDL fuel injection nozzles are used on the following engines:

Part No.	Engine	Serial No.
AR53091	6404T	(-445569)
	6404A	(-357083)
AR62986	6404A	(357084-445569)

Engines after the above serial numbers use Model KDEL injection nozzles (see page 30-10-29).

Removal

IMPORTANT: Disconnect battery ground cable before working on nozzles close to alternator to prevent accidental short circuits through tools.

Disconnect fuel inlet line at injection pump.

Disconnect fuel return line at injection pump.

Using CS-2428 Line Wrench (Fig. 15), disconnect and remove fuel delivery lines as an assembly.

Remove leak-off screw from injection nozzles using a 12 mm wrench.

Remove leak-off line.

Using JDE-69A Wrench (Fig. 41), loosen injection nozzle gland nut. Remove injection nozzle.

NOTE: The gland nut will act as a jack screw to raise the nozzle out of the cylinder head.

If nozzle is difficult to remove, screw JDE-95 Nozzle Puller Adapter into leak-off fitting at top of nozzle. Attach JDE-38 Nozzle Puller to adapter and remove nozzle.

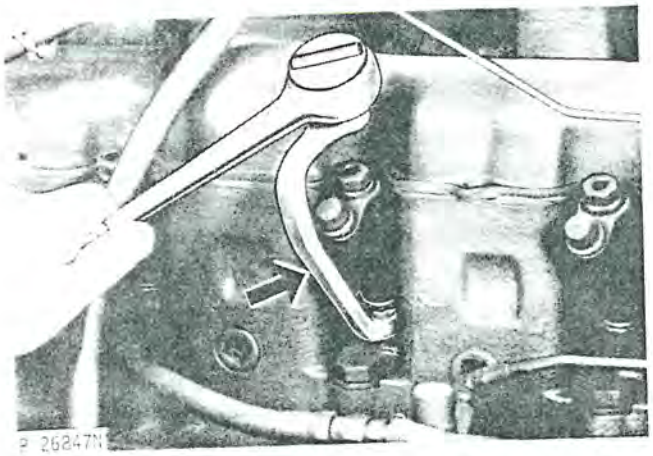


Fig. 41-Using JDE-69A Wrench

Testing

Test the injection nozzle before disassembling to determine its condition. Test for: Opening Pressure, Leakage, Chatter and Spray Pattern.

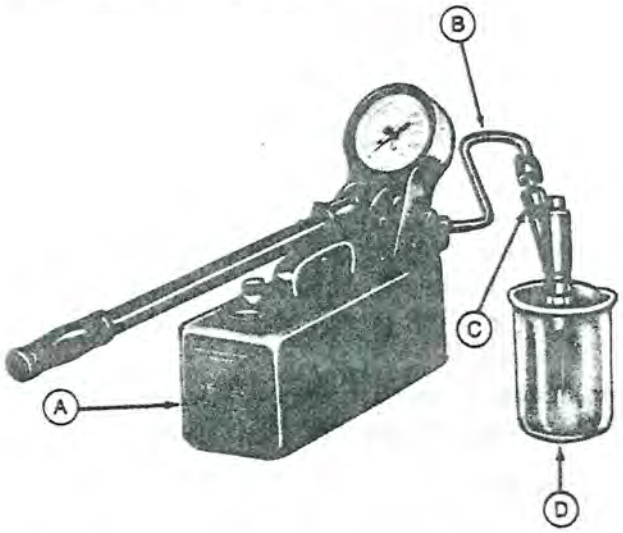
CAUTION: The nozzle tip should always be directed away from the operator. Fuel from the spray orifices can penetrate clothing and skin, causing serious personal injury. Enclosing the nozzle in a transparent cover, as shown, is recommended.

Before applying pressure to the nozzle tester, be sure that all connections are tight, and that the fittings are not damaged. Fuel escaping from a very small hole can be almost invisible. Use a piece of cardboard or wood, rather than hands, to search for suspected leaks.

If injured by escaping fuel, see a doctor at once. Serious infection or reaction can develop if proper medical treatement is not administered immediately.

IMPORTANT: Always use clean, filtered fuel when testing injection nozzle performance. Testing nozzles with dirty fuel will severely damage the precision parts of the nozzle.

Opening Pressure Test



R 26848N

A—Nozzle Tester
B—Fuel Line
C—Adapter
D—Beaker

Fig. 42-Testing Nozzle Opening Pressure

To make the opening pressure test, connect the injection nozzle to the D-01109AA Nozzle Tester (Y-900) (A, Fig. 42) using Y-900-2 Fuel Line (B) and Y-900-3 90° Adapter (C) from the D-01110AA Adapter Set (Y-910A). Place a glass beaker (D) under nozzle.

Pump the handle several times to flush out nozzle fittings. Tighten the fittings.

Expel air from the nozzle by operating the pump handle for several strokes. Then raise the pressure slowly and steadily. Observe the gauge pressure at which the valve opens. Recheck by completely releasing the pressure, and gradually building pressure until the valve opens.

A new nozzle or a used nozzle with a new pressure spring should open at approximately 3200 to 3350 psi (221-231 bar) (225-236 kg/cm²). In nozzles which have been in service, the spring and pin will have taken a normal set. In this case, a satisfactory opening pressure should be at least 3100 psi (214 bar) (218 kg/cm²).

KDL INJECTION NOZZLES—Continued

Opening Pressure Test—Continued

Shims are available for changing the opening pressure adjustment. Each shim changes the opening pressure approximately 75 psi (5 bar) (5 kg/cm²).

If the opening pressure is not correct, remove the screw plug (11, Fig. 43) and change shims (10) until nozzle opens at the proper pressure. The difference in opening pressure of nozzles in any one engine should not exceed 50 psi (3.5 bar) (3.5 kg/cm²).

IMPORTANT: Always use John Deere nozzle adjusting shims, which are specially hardened. Other shims will not be satisfactory.

Leakage Test

To check for a leaking nozzle, wipe the nozzle dry. Bring the pressure up slowly to 285 psi (20 bar) (20 kg/cm²) below the opening pressure, and watch for an accumulation of fuel from the spray orifice, indicating a bad seat. If the nozzle drips within 10 seconds, replace the nozzle assembly (3 and 4, Fig. 43).

Check for leakage around the nozzle thread fitting, indicating a bad seat between the nozzle (3) and nozzle holder (7). If leakage is observed, tighten the nozzle retaining nut (2) to a maximum of 58 ft-lbs (79 Nm) (7.9 kgm) torque. Replace the injection nozzle if leakage continues.

Chatter and Spray Pattern Test

The injection nozzle should chatter very softly, and only when the hand lever movement is very rapid (4-6 downward movements per second). Failure to chatter may be caused by a binding or bent nozzle valve (4, Fig. 43).

Until the chattering range is reached, the test oil emerges as non-atomized streams. When the lever movement is accelerated, the sprays should be very broad and finely atomized.

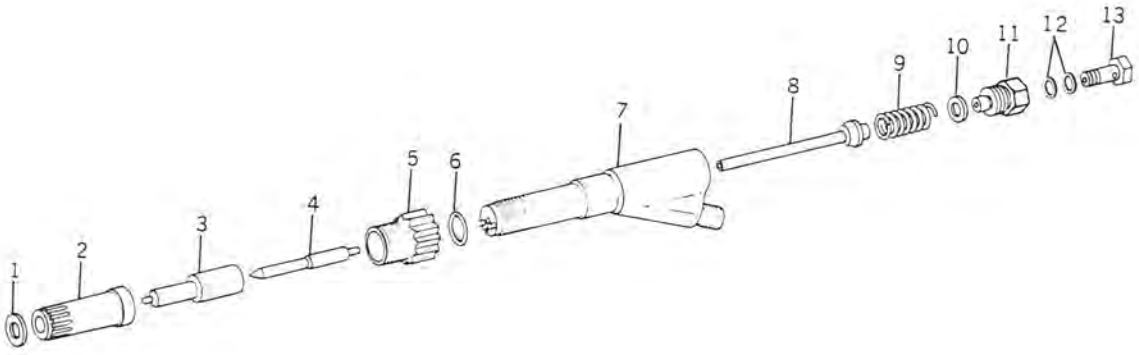
A partially clogged or eroded orifice will usually cause the spray to deviate from the correct angle. The spray will also be streaky rather than finely atomized.

Disassemble the nozzle for cleaning or reconditioning if it fails to chatter or spray properly.

REPAIR

General Information

Since dirt and water are the worst contaminants in the fuel injection system, the working area, tools, and cleaning materials must be kept spotlessly clean. Whenever possible, work in an isolated, dust-free area.



1—Aluminum Washer
2—Nozzle Retaining Nut
3—Nozzle
4—Nozzle Valve
5—Gland Nut
6—Gland Nut O-ring
7—Nozzle Holder Body
8—Spindle
9—Spring
10—Adjusting Shim
11—Screw Plug
12—Washers
13—Leak-Off Screw

Fig. 43-Exploded View of KDL-21 mm Injection Nozzle

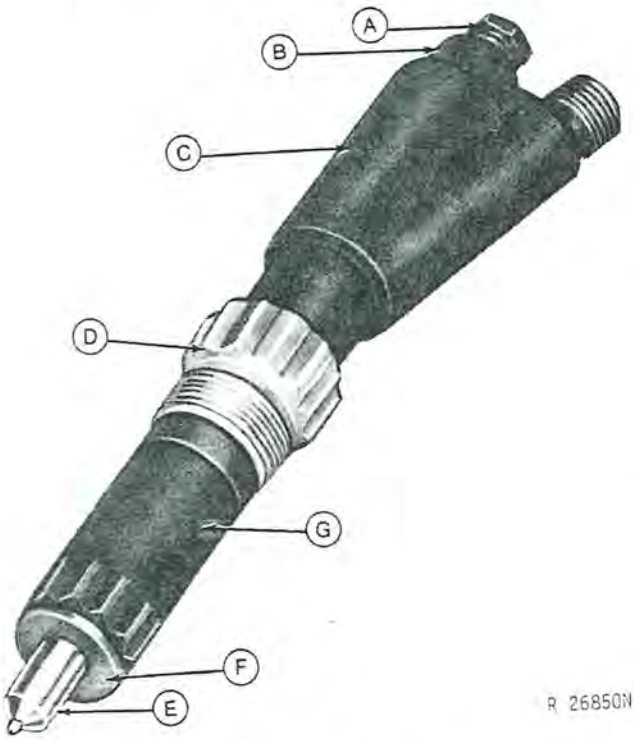
Cover the work bench with clean paper before beginning disassembly of injection nozzle.

As parts are disassembled, place them in a pan of clean diesel fuel and leave them there until needed. Do not permit these parts to strike each other.

Use a separate pan of clean diesel fuel for washing parts just before assembly.

Disassembly

IMPORTANT: Disassembly of the KDL injection nozzle requires metric tools. The following sizes of box-end wrenches and/or sockets are required: 12 mm, 17 mm, and 19 mm (3/4-in.).



A—Leak-Off Screw
B—Screw Plug
C—Nozzle Holder
D—Gland Nut
E—Nozzle
F—Washer
G—Nozzle Retaining Nut

Fig. 44-Assembled KDL-21 mm Nozzle

Clamp the nozzle holder (C) in a soft-jawed vise and do the following:

1. Loosen the screw plug (B) to relieve pressure on the nozzle valve spring (9, Fig. 43).

2. Remove the nozzle retaining nut (G). Remove nozzle assembly (3 and 4, Fig. 43). Install retaining nut on nozzle holder to protect the lapped end of holder.

3. Remove screw plug from holder body and withdraw shims (11), spring (10), and spindle (9).

Withdraw nozzle valve from nozzle. If valve is stuck, it may be necessary to soak the nozzle assembly in Bendix cleaner, acetone, or other commercial cleaners sold especially for freeing stuck valves.

⚠ CAUTION: Use these nozzle cleaning fluids in accordance with the manufacturer's instructions.

The valve and nozzle are individually fitted and hand lapped. Keep these mated parts together, and do not permit the lapped surfaces to come in contact with any hard substance. Do not touch the valve unless hands are wet with fuel.

Cleaning and Inspection

Nozzle Assembly

Remove anti-corrosive grease from new or reconditioned nozzles by washing them thoroughly in diesel fuel.

Remove carbon from used nozzles, and clean by washing in diesel fuel. If parts are coated with hardened carbon or lacquer, it may be necessary to use a brass wire brush.

IMPORTANT: Never use a steel brush to clean nozzles as this will distort the spray orifices.

After removing carbon or lacquer from the exterior of nozzle, inspect the lapped machined surface (B, Fig. 45) for nicks or scratches.

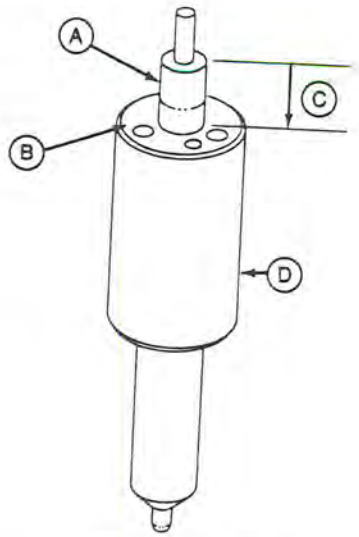
Inspect the piston (large) part of nozzle valve to see that it is not scratched or scored. If any of these conditions are present, replace the nozzle assembly (see Figs. 45 and 46).

Inspect condition of seat for nozzle valve and nozzle. Contact area of seat (both parts) must not be scored or pitted. Use the inspection magnifier provided in the JDE-105 Nozzle Cleaning Kit to aid making the inspection.

NOTE: A bad nozzle valve seat will cause fuel to drip from the nozzle. This condition usually will be noted when making "Leakage Test" described on page 10-22.

KDL INJECTION NOZZLES—Continued

Nozzle Assembly—Continued



A—Nozzle Valve
B—Lapped Surface
C—Free-Fall Distance
D—Nozzle

Fig. 45-Nozzle Assembly Slide Test

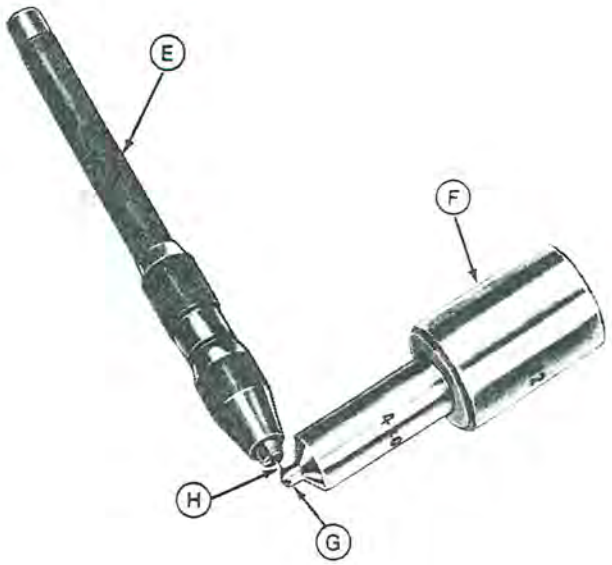
Further inspect the nozzle assembly by performing a side test (Fig. 45). Use the following procedure:

1. Dip the nozzle valve (A) in clean diesel fuel. Insert valve in nozzle (D).

2. Hold nozzle vertical, and pull valve out about 1/3 of its engaged length (C).

3. Release valve. Valve should slide down to its seat by its own weight.

Always replace a nozzle assembly if the valve does not fall freely to its seat.



E—Pin Vise
F—Nozzle
G—Orifice
H—Cleaning Wire

Fig. 46-Cleaning Nozzle Orifices

Remove any carbon that may be present in the spray orifices of the nozzle assembly before reassembling on nozzle holder.

To clean carbon from the spray orifices (Fig. 46):

1. Begin with cleaning wire 0.003-0.004 in. (0.07-0.10 mm) smaller than the nominal orifice size given on page 30-10-27.

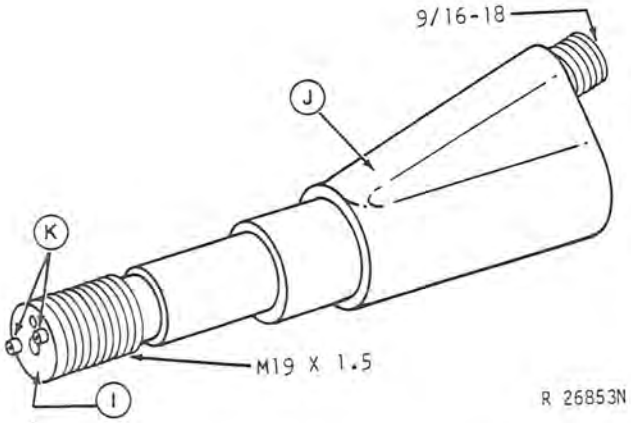
NOTE: Stoning the wire to provide a flat surface on one side will help in reaming carbon from a clogged hole.

2. Clamp the cleaning wire in pin vise (E). Wire should not protrude from vise more than 1/32 in. (0.8 mm).

3. Insert wire into orifice (G), and rotate.

4. For final cleaning, use cleaning wire 0.001 in. (0.03 mm) smaller than orifice size. Follow steps given above.

Nozzle Holder



I—Lapped Surface
J—Nozzle Holder
K—Locating Pin

Fig. 47-KDL Nozzle Holder

Inspect the lapped machined surface (I, Fig. 47) on bottom end of nozzle holder (J) for nicks or scratches. Replace holder if not in good condition.

Inspect threads (sizes shown in Fig. 47) on nozzle holder for general condition. Threads that are nicked slightly may be "dressed-up." Replace holder if threads cannot be restored to a serviceable condition.

IMPORTANT: Do not lap machined surface of nozzle holder in an attempt to stop fuel leakage at this location. The locating pin (K) in holder has to be removed before the machined surface can be lapped.

Removing this pin is not recommended as removal is likely to damage it, and a replacement pin is not available as a service part.

Nozzle Retaining Nut

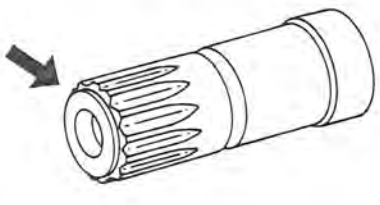


Fig. 48-Nozzle Retaining Nut

Remove carbon deposits on both inner and outer surfaces of the nozzle retaining nut (Fig. 48).

Inspect the retaining nut for cracks caused by overtightening or a damaged lower seating surface. A seating surface may be restored by rubbing the surface on emory cloth.

Any nozzle retaining nut which cannot be reconditioned, must be replaced with a new one.

Spindle

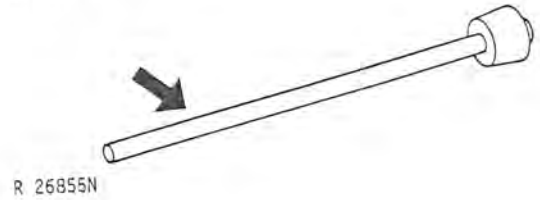


Fig. 49-Spindle

The spindle (Fig. 49) has a spring seat (which is a separate piece) pressed on it. Do not separate parts.

Inspect the spindle for:

1. Cracked or broken lower portion which contacts the nozzle valve stem.

2. Bent condition.

3. Excessive spring seat wear.

If any of the above conditions are present, replace the spindle.

NOTE: Robert Bosch spindles are magnetized to trap small metal particles which may be produced by normal wear.

Nozzle Valve Spring and Upper Seat

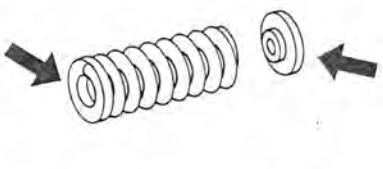


Fig. 50-Nozzle Valve Spring and Upper Seat

Examine spring and seat (Fig. 50) for general condition. They must not be cracked, broken, pitted, or show excessive wear. Replace, if any of these conditions exist.

KDL INJECTION NOZZLES—Continued

Cleaning and Inspection—Continued

Screw Plug

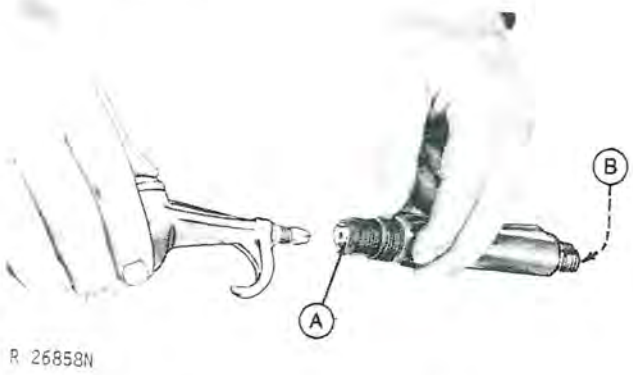
Fig. 51-Screw Plug

Inspect spring seat on screw plug (Fig. 51) for wear. Use a metal polishing cloth to touch-up spring seat if slightly worn.

Inspect condition of threads (both M16 x 1.5 male and M8 x 1 female). Threads not severely nicked may be "dressed-up".

Replace screw plug when it cannot be restored to a serviceable condition.

Edge-Type Filter



A—Fuel Passage **B—Edge-Type Filter**

Fig. 52-Cleaning Edge-Type Filter

The edge-type filter (B, Fig. 52) is pressed into the nozzle holder, and is not removable for service.

Clean the filter by applying compressed air to the nozzle holder fuel passage (A) at nozzle end. Applying compressed air in a direction opposite to fuel flow will expell foreign particles from the nozzle holder.

Gland Nut

Inspect the nozzle holder gland nut (D, Fig. 52) for general condition, especially to be sure that it is not cracked or split.

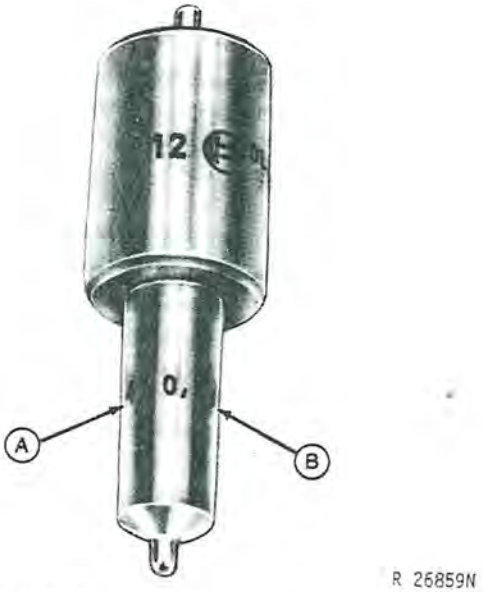
Also check condition of threads (M24 x 1.5). Threads which are slightly nicked or damaged may be "dressed-up".

Replace gland nut if unable to restore to a serviceable condition.

Assembly

KDL injection nozzles used on 6404T and A engines are identical except for the number and diameter of orifices in the tip end of nozzle.

IMPORTANT: Be sure to install the correct nozzle assembly on nozzle holder. Do not intermix different size nozzle assemblies.



A—Number of Orifices **B—Orifice Size**

Fig. 53-Nozzle Markings

To help determine the right nozzle assembly for each application, note that markings (Fig. 53) appear on the lower part of nozzle.

For example, the illustration shows a nozzle marked 4 x 0.33. The number "4" indicates the number of orifices (A), and "0.33" indicates the orifice size (B) in millimeters.

The engine-nozzle size relationship for engines using the KDL injection nozzle are listed below.

Engine	Engine Serial No.	Nozzle Size
6404T	(-445569)	4 x 0.33
6404A	(-357083)	4 x 0.33
6404A	(357084-445569)	3 x 0.40

IMPORTANT: Immerse parts in clean fuel before assembly. Do not dry parts with towels or compressed air, as dust particles might collect and stay on pressure faces of nozzle valve and nozzle holder.

To assemble the injection nozzle, refer to Fig. 43 and:

1. Lightly lubricate a new gland nut O-ring (6) and install on nozzle holder (7). O-ring is positioned against the first stepped face on holder (from nozzle end).

2. Coat bore and bottom end of gland nut (5) liberally with an anti-seize compound (such as Never-Seez) to help prevent gland nut from seizing on holder body. Slide gland nut on holder, up against O-ring.

3. Insert the nozzle valve (4) into the nozzle (3) while holding parts below the fuel level in pan.

4. Install the nozzle assembly on holder and secure with the nozzle retaining nut (2).

NOTE: The locating pin (K, Fig. 47) will assure correct alignment of nozzle with holder.

5. Insert spindle (8), spring (9), and shims (10) in nozzle holder. Retain with screw plug (11).

6. Thread leak-off screw (13) with washers (12) into screw plug to prevent entry of dirt, water, or other contaminants.

7. Tighten the following connections:

   a. Nozzle retaining nut - 44-58 ft-lbs (60-79 Nm) (6.0-7.9 kgm).

   b. Screw plug - 36-44 ft-lbs (49-60 Nm) (4.9-6.0 kgm).

8. Perform opening pressure, leakage, chatter and spray pattern tests (page 10-21 and 22).

If test results are not satisfactory, disassemble the injection nozzle to locate the problem. Reassemble and retest to assure correct operation before installing on engine.

Installation

Before installing the KDL injection nozzle, check engine cylinder for:

a. Condition of threads for nozzle gland nut. Threads are metric (M24 x 1.5).

b. Condition of machined surface to seat nozzle.

Cylinder head threads and nozzle seating surface must be free of rust and carbon deposits.

IMPORTANT: If the injection nozzle gland nut threads are clean, a false reading on the torque wrench may be obtained when the injection nozzle is installed. This may prevent the injection nozzle from seating properly in the cylinder head.

To clean threads which have light or moderate foreign deposits, connect the D-17029BR Thread Cleaning Brush to an electric drill. Work brush up and down several times to thoroughly clean threads.

To clean threads with heavy foreign deposits, or to reclaim damaged threads, use the JDF-4 Tap as shown in Fig. 75, page 30-10-37. Be sure to start tap straight to avoid possible cross-threading. A light coating of grease on tap will help to collect foreign deposits on tap and prevent them from falling into nozzle bore.

After cleaning threads, insert a 1/2-inch (13 mm) tapered hardwood dowel into nozzle bore. Blow out debris from nozzle cavity. Remove wood dowel.

Fig. 54-JDE-99 Nozzle Seat Reamer

KDL INJECTION NOZZLES—Continued

Installation—Continued

Inspect the nozzle seating surface in cylinder head for carbon deposits. If seat is not clean, use the JDE-99 Nozzle Seat Reamer (Fig. 54) to remove carbon. Stop using tool when seat comes clean.

Insert wood dowel in nozzle bore and blow out debris with compressed air. Remove wood dowel.

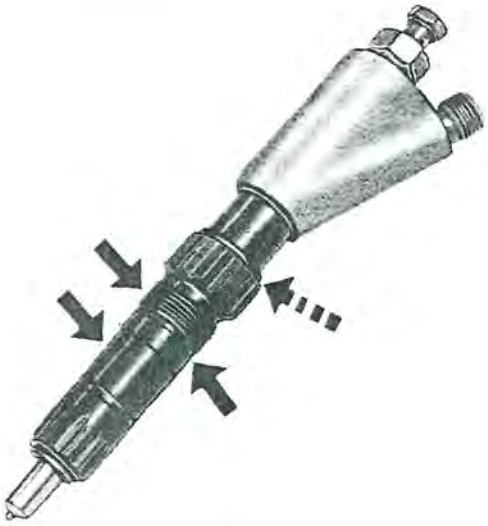


Fig. 55-Locations To Apply Anti-Seize Compound

Apply anti-seize compound (such as Never-Seez) to the gland nut threads and nozzle barrel (Fig. 55). Be sure that anti-seize compound was also applied on inside (bore) and bottom end of gland nut during assembly. See Step 2 on previous page.

NOTE: Applying an anti-seize compound at these locations will help prevent possible seizure of the gland nut to the holder body. Future removal of the injection nozzle will be much easier when an anti-seize compound is used.

Install a new aluminum washer (F, Fig. 44) on tip end of injection nozzle.

Insert the injection nozzle into cylinder head, and using JDE-69A wrench (Fig. 41), tighten gland nut to 35 ft-lbs (47 Nm) (4.7 kgm) torque. Be sure that the injection nozzle is "square" with engine when fully tightened.

IMPORTANT: Interference of the JDE-69A wrench with wall of cylinder head when tightening gland nut may over-stress the wrench and possibly break it. Do not stress wrench against cylinder head.

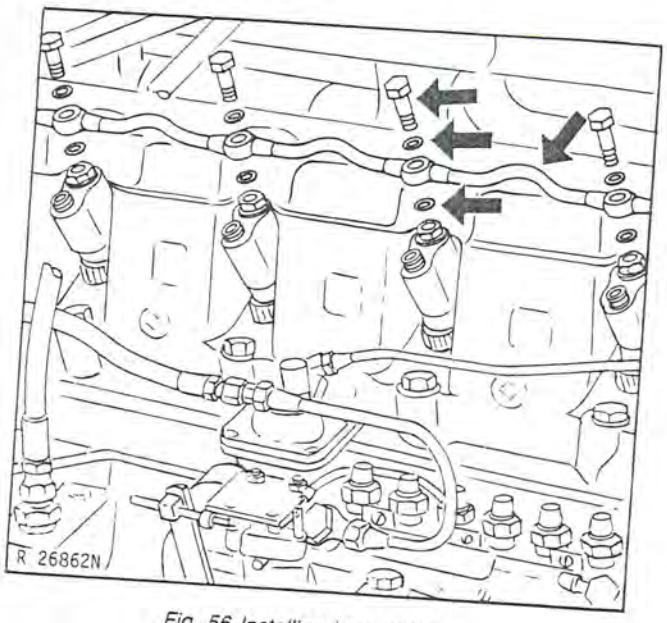


Fig. 56-Installing Leak-Off Pipe

Remove all caps and plugs from injection nozzles, fuel lines and pipes.

Install leak-off pipe on injection nozzles (Fig. 56). Use copper sealing washer on both top and bottom of pipe banjo. Retain with leak-off screw (tighten with 12 mm wrench).

NOTE: Use care when tightening leak-off screw as it is easily broken.

Install fuel delivery pipes. Tighten connectors to 20 ft-lbs (27 Nm) (2.7 kgm) torque.

Connect injection pump-to-leak-off return line and fuel inlet line to pump.

Bleed the fuel system (see page 10-4).

Start the engine and check for leaks.

KDEL FUEL INJECTION NOZZLES

General Information

Robert Bosch Model KDEL fuel injection nozzles are used on the following engines:

Part No.	Engine	Serial No.
AR79686	6404D	(500000-)
AR74665	6404T	(445570-)
AR74664	6404A	(445570-)
AR85541	6466D	All
AR74665	6466T	All
AR73847	6466A	All

6404D engines before the above serial number use 9.5 mm injection nozzles. See page 30-10-13. 6404T and A engines before the above serial numbers use Robert Bosch Model KDL injection nozzles. See page 30-10-20.

Removal

IMPORTANT: Disconnect battery ground cable before working on nozzles close to alternator to prevent accidental short circuits through tools.

To remove KDEL injection nozzle illustrated in Figs. 57, 58 and 59:

1. Thoroughly clean area around injection pump and nozzles, including all pipe and line connections, using compressed air (not illustrated).

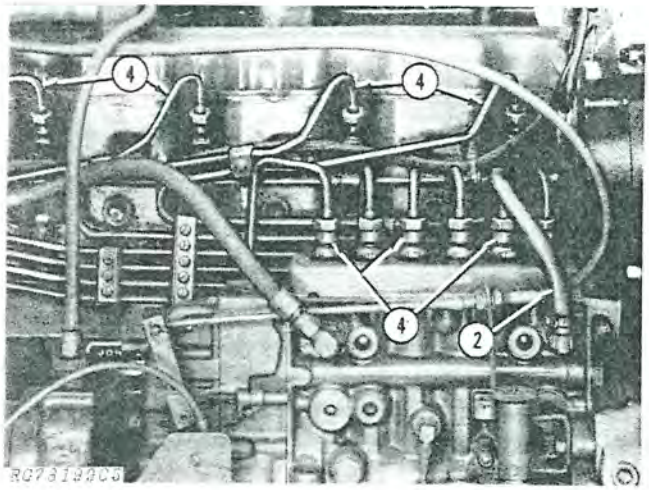


Fig. 57-Removal Steps (6466A Shown)

2. Remove fuel return pipe (injection pump-to-leak-off line).

3. Disconnect manifold pressure pipe at aneroid if equipped.

4. Disconnect and remove fuel delivery pipes as an assembly. It is not necessary to remove each pipe separately.

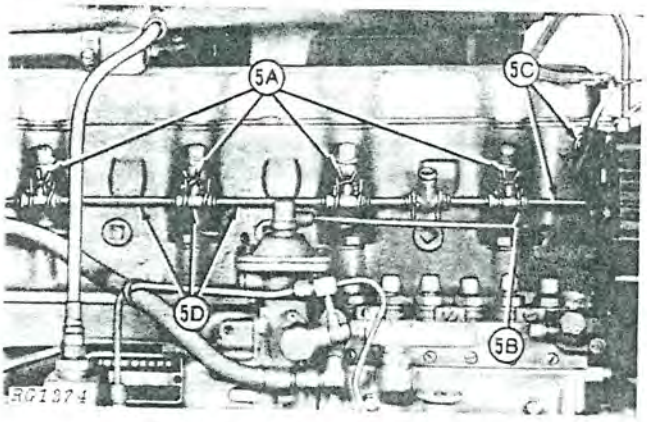


Fig. 58-Pipe Connections at Nozzles

5. Remove leak-off line assembly.

   a. Disconnect spring clamp (next to nozzle) from leak-off boot at each nozzle.
   b. Disconnect return line that goes to fuel tank.
   c. On 6466 engines with one-piece leak-off line, disconnect injection pump leak-off line at pump fitting.
   d. Remove leak-off boots and line as an assembly.

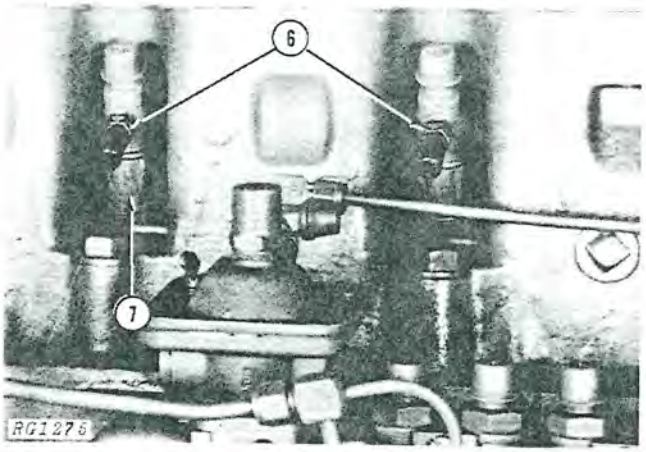


Fig. 59-Leak-off Connectors

6. Using an 11 mm wrench, remove leak-off connector from each nozzle.

7. Remove nozzles from head, using outer part of JDE-92 Socket to loosen gland nut.

Reinstall leak-off connectors on nozzles.

KDEL FUEL INJECTION NOZZLES—Continued

Testing

Test the injection nozzle before disassembling to determine its condition. Test for: Opening Pressure, Leakage, Chatter and Spray Pattern.

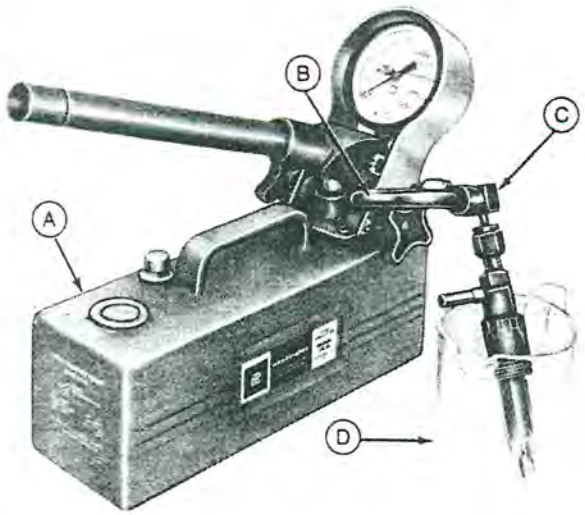
CAUTION: The nozzle tip should always be directed away from the operator. Fuel from the spray orifices can penetrate clothing and skin, causing serious personal injury. Enclosing the nozzle in a transparent cover, as shown, is recommended.

Before applying pressure to the nozzle tester, be sure that all connections are tight, and that the fittings are not damaged. Fuel escaping from a very small hole can be almost invisible. Use a piece of cardboard or wood, rather than hands, to search for suspected leaks.

If injured by escaping fuel, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

IMPORTANT: Always use clean, filtered fuel when testing injection nozzle performance. Testing nozzles with dirty fuel will severely damage the precision parts of the nozzle.

Opening Pressure Test



R 26866N

A—Nozzle Tester
B—Fuel Line
C—Adapter
D—Breaker

Fig. 60-Testing Nozzle Opening Pressure

To make the opening pressure test, connect the injection nozzle to the D-01109AA Nozzle Tester (Y-900) (A, Fig. 60), using Y-900-2 Fuel Line (B) and Y-900-7 and Y-900-15 Straight Adapters (C). A Y-900-11 90° Adapter may also be used. These adapters can be found in the D-01110AA Adapter Kit (Y-910A).

Place a glass beaker (D) under nozzle.

Pump the handle several times to flush out nozzle fittings. Tighten the fittings.

Expel air from the nozzle by operating the pump handle for several strokes. Then raise the pressure slowly and steadily. Observe the gauge pressure at which the valve opens. Recheck by completely releasing the pressure, and gradually building pressure until the valve opens.

A new nozzle or a used nozzle with a new spring (7, Fig. 61) should open at approximately 4050 psi (279 bar) (285 kg/cm²). In nozzles which have been in service, the spring and spring seat (8) will have taken a normal set. In this case, a satisfactory opening pressure should be at least 3800 psi (262 bar) (267 kg/cm²).

Shims (6) are available for changing the opening pressure adjustment. Each shim changes the opening pressure approximately 100 psi (7 bar) (7 kg/cm²).

If the opening pressure is not correct, disassemble the injection nozzle (Fig. 30) and change shims until nozzle opens at the proper pressure. The difference in opening pressure of nozzles in any one engine should not exceed 50 psi (3.5 bar) (3.5 kg/cm²).

IMPORTANT: Always use John Deere nozzle adjusting shims, which are specially hardened. Other shims will not be satisfactory.

Leakage Test

To check for a leaking nozzle, wipe the nozzle dry. Bring the pressure up slowly to 285 psi (20 bar) (20 kg/cm²) below the opening pressure, and watch for an accumulation of fuel from the spray orifice, indicating a bad seat. If the nozzle drips within 10 seconds, replace the nozzle assembly (10 and 11, Fig. 61).

Check for leakage around the nozzle retaining nut (12) thread connection with nozzle holder (5).

Leakage indicates a bad seat either between the nozzle (11) and intermediate plate (9), or between nozzle holder and intermediate plate.

IMPORTANT: Do not lap the machined surfaces of the intermediate plate in an attempt to stop fuel leakage at these locations. The dowels (spring pins) in plate have to be removed before the surfaces can be lapped. Removing these dowels is not recommended as removal is likely to damage them, and replacement dowels are not available as service parts.

If leakage is observed, tighten the nozzle retaining nut to a maximum of 58 ft-lbs (79 Nm) (7.9 kgm) torque. Replace the injection nozzle if leakage continues.

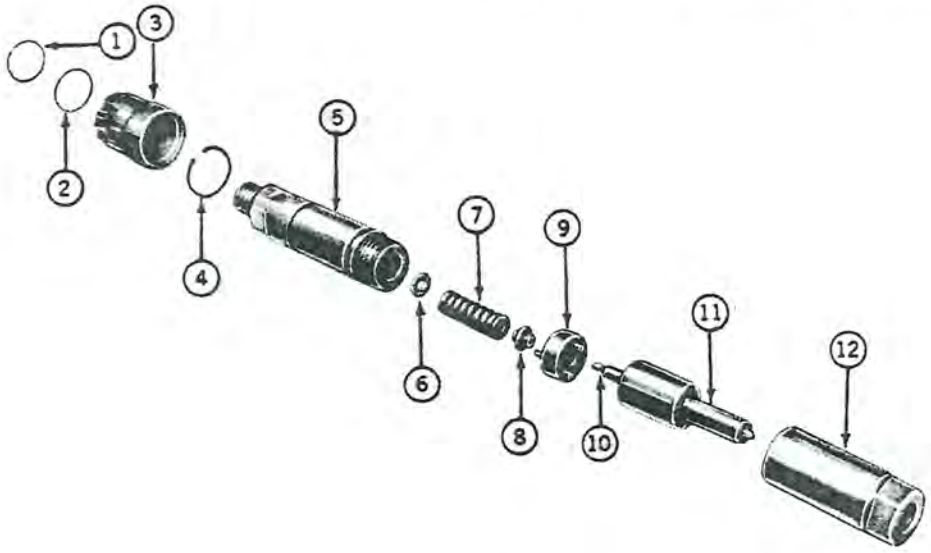
Chatter and Spray Pattern Test

The injection nozzle should chatter very softly, and only when the hand lever movement is very rapid (4-6 downward movements per second). Failure to chatter may be caused by a binding or bent nozzle valve.

Until the chattering range is reached, the test oil emerges as non-atomized streams. When the lever movement is accelerated, the sprays should be very broad and finely atomized.

A partially clogged or eroded orifice will usually cause the spray to deviate from the correct angle. The spray will also be streaky rather than finely atomized.

Disassemble the nozzle for cleaning or reconditioning if it fails to chatter or spray properly.



R 26867N

1—Snap Ring (upper)
2—Gland Nut O-Ring
3—Gland Nut
4—Snap Ring (Lower)
5—Nozzle Holder
6—Shim
7—Nozzle Valve Spring
8—Spring Seat
9—Intermediate Plate
10—Nozzle Valve
11—Nozzle
12—Nozzle Retaining Nut

Fig. 61-Exploded View of KDEL Injection Nozzle

KDEL FUEL INJECTION NOZZLES—Continued

REPAIR

General Information

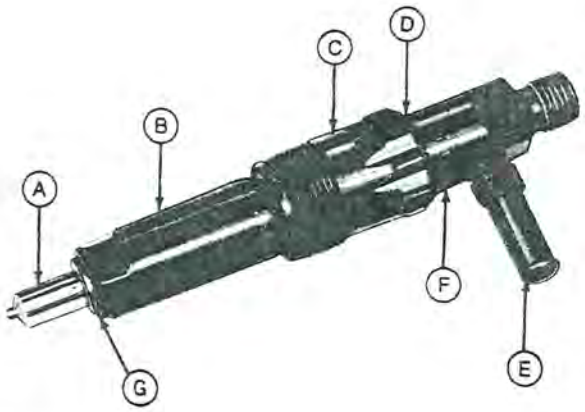
Since dirt and water are the worst contaminants in the fuel injection system, the working area, tools, and cleaning materials must be kept spotlessly clean. Whenever possible, work in an isolated, dust-free area.

Cover the work bench with clean paper before beginning disassembly of injection nozzle.

As parts are disassembled, place them in a pan of clean diesel fuel and leave them there until needed. Do not permit these parts to strike each other.

Use a separate pan of clean diesel fuel for washing parts just before assembly.

Disassembly



R 26868N

A—Nozzle
B—Nozzle Retaining Nut
C—Gland Nut
D—O-Ring and Upper Snap Ring
E—Leak-Off Connector
F—Nozzle Holder
G—Washer

Fig. 62-Assembled KDEL-21 mm Injection Nozzle

NOTE: While the KDEL injection nozzle is a metric unit, only one size metric wrench is required for disassembly (a 11 mm box-end or open-end for use on leak-off connector).

Unscrew the leak-off connector (E, Fig. 62) out of nozzle holder (F).

Remove the O-ring and upper snap ring (D) from nozzle holder. Also see 1 and 2, Fig. 61.

Slip gland nut (C) off nozzle holder.

Remove lower snap ring (4, Fig. 61).

Clamp the two flats of nozzle holder (fuel inlet end) in a soft-jawed vise and remove the nozzle retaining nut (B), using 12-point, 3/4 in. (19 mm) wrench.

Remove the nozzle assembly (A).

Pull off intermediate plate (9, Fig. 61). Remove spring seat (8), spring (7), and shims (6).

Withdraw nozzle valve from nozzle. If valve is stuck, it may be necessary to soak the nozzle assembly in Bendix cleaner, acetone, or other commercial cleaners sold especially for freeing stuck valves.

⚠ CAUTION: Use these nozzle cleaning fluids in accordance with the manufacturer's instructions.

The valve and nozzle are individually fitted and hand lapped. Keep these mated parts together, and do not permit the lapped surfaces to come in contact with any hard substance. Do not touch the valve unless hands are wet with fuel.

Cleaning and Inspection

Nozzle Assembly

Remove anti-corrosive grease from new or reconditioned nozzles by washing them thoroughly in diesel fuel.

Remove carbon from used nozzles, and clean by washing in diesel fuel. If parts are coated with hardened carbon or lacquer, it may be necessary to use a brass wire brush.

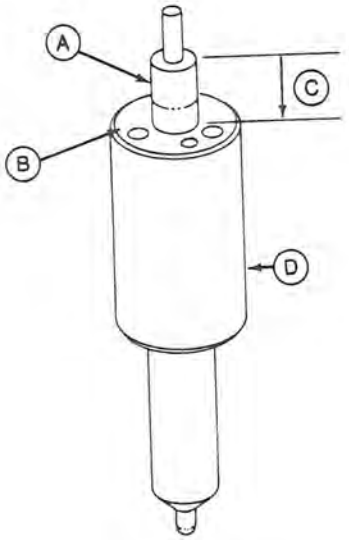
IMPORTANT: Never use a steel brush to clean nozzles as this will distort the spray orifices.

After removing carbon or lacquer from the exterior of nozzle, inspect the lapped machined surface (B, Fig. 63) for nicks or scratches.

Inspect the piston (large) part of nozzle valve to see that it is not scratched or scored. If any of these conditions are present, replace the nozzle assembly (see Figs. 63 and 64).

Inspect condition of seat for nozzle valve and nozzle. Contact area of seat (both parts) must not be scored or pitted. Use the inspection magnifier provided in the JDE-105 Nozzle Cleaning Kit to aid making the inspection.

NOTE: A bad nozzle valve seat will cause fuel to drip from the nozzle. This condition usually will be noted when making "Leakage Test" described on page 10-30.



R 26851N

A—Nozzle Valve
B—Lapped Surface
C—Free-Fall Distance
D—Nozzle

Fig. 63-Nozzle Assembly Slide Test

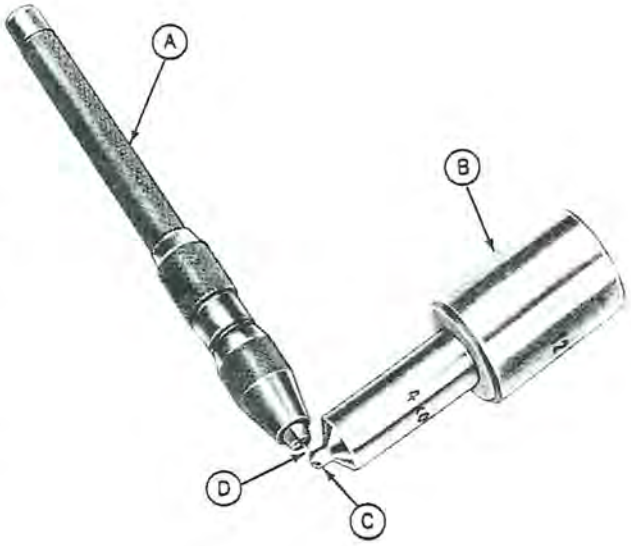
Further inspect the nozzle assembly by performing a slide test (Fig. 63). Use the following procedure:

1. Dip the nozzle valve (A) in clean diesel fuel. Insert valve in nozzle (D).

2. Hold nozzle vertical, and pull valve out about 1/3 of its engaged length (C).

3. Release valve. Valve should slide down to its seat by its own weight.

Always replace a nozzle assembly if the valve does not fall freely to its seat.



R33374N

A—Pin Vise
B—Nozzle
C—Orifice
D—Cleaning Wire

Fig. 64-Cleaning Nozzle Orifices

Remove any carbon that may be present in the spray orifices of the nozzle assembly before reassembling on nozzle holder.

To clean carbon from the spray orifices (Fig. 64):

1. Begin with cleaning wire 0.003-0.004 in. (0.07-0.10 mm) smaller than the nominal orifice size given on page 30-10-36.

NOTE: Stoning the wire to provide a flat surface on one side will help in reaming carbon from a clogged hole.

2. Clamp the cleaning wire in pin vise (A). Wire should not protrude from vise more than 1/32 in. (0.8 mm).

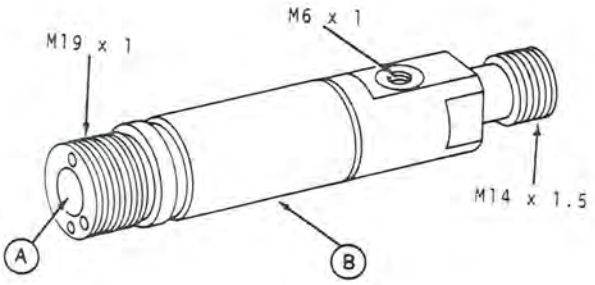
3. Insert wire into orifice (C), and rotate.

4. For final cleaning, use cleaning wire 0.001 in. (0.03 mm) smaller than orifice size. Follow steps given above.

KDEL FUEL INJECTION NOZZLES—Continued

Cleaning and Inspection—Continued

Nozzle Holder



R28375N

A—Lapped Surface **B—Nozzle Holder**

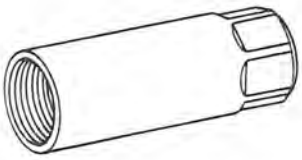
Fig. 65-KDEL Nozzle Holder

Inspect the lapped machined surface (A, Fig. 65) on bottom end of nozzle holder (B) for nicks or scratches. Replace holder if not in good condition.

Inspect threads (sizes are shown in Fig. 65) on nozzle holder for general condition. Threads that are nicked slightly may be "dressed-up". Replace holder if threads can not be restored to a serviceable condition.

Check fuel passages in nozzle holder to make sure that they are open. Clean with compressed air.

Nozzle Retaining Nut



R28376N

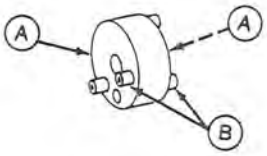
Fig. 66-Nozzle Retaining Nut

Remove carbon deposits on both inner and outer surfaces of the nozzle retaining nut (Fig. 66).

Inspect the retaining nut for cracks caused by over-tightening or a damaged lower seating surface. A seating surface may be restored by rubbing the surface on emory cloth.

Any nozzle retaining nut which cannot be reconditioned, must be replaced with a new one.

Intermediate Plate



R 26871N

A—Lapped Surfaces **B—Dowel Pins**

Fig. 67-Intermediate Plate

Examine the lapped surfaces (A, Fig. 67) for nicks, scratches, or worn areas which would permit the fuel to leak past. Replace the intermediate plate if the lapped surfaces are damaged or worn.

IMPORTANT: Do not lap the machined surfaces of the intermediate plate in an attempt to stop fuel leakage at these locations. The dowel pins (B) in plate have to be removed before the surfaces can be lapped. Removing these dowels is not recommended as removal is likely to damage them, and replacement dowels are not available as service parts.

Spring Seat

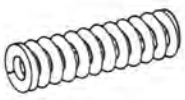
R28377N

Fig. 68-Spring Seat

Inspect the spring seat (Fig. 68) for splitting, cracking, or excessive wear. Replace seat if any of these conditions are evident.

IMPORTANT: If spring seat is worn where spindle end of nozzle valve contacts seat, a noticeable drop in opening pressure will occur.

Nozzle Valve Spring

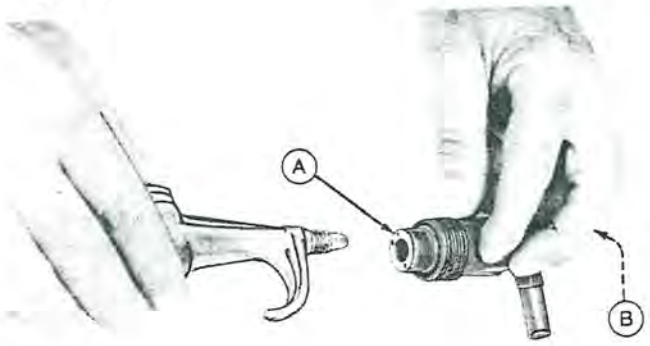


R28378N

Fig. 69-Nozzle Valve Spring

Examine spring (Fig. 69) and shims for pitting or excessive wear. Replace, if not in good condition.

Edge-Type Filter



R 26874N

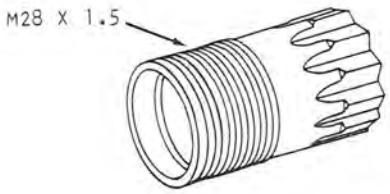
A—Fuel Passage **B—Edge-Type Filter Location**

Fig. 70-Cleaning Edge-Type Filter

The edge-type filter is pressed into the nozzle holder (B, Fig. 70), and is not removable for service.

Clean the filter by applying compressed air to the nozzle holder fuel passage (A) at nozzle end. Applying compressed air in a direction opposite to fuel flow will expell foreign particles from the nozzle holder.

Gland Nut



R28379N

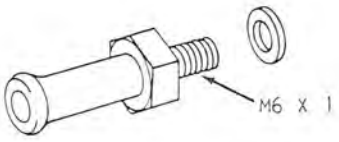
Fig. 71-Gland Nut

Inspect the nozzle holder gland nut (Fig. 71) for general condition, especially to be sure that it is not cracked or split.

Also check condition of threads (M28 x 1.5). Threads which are slightly nicked or damaged may be "dressed-up".

Replace gland nut if unable to restore to a serviceable condition.

Leak-Off Connector



R28380N

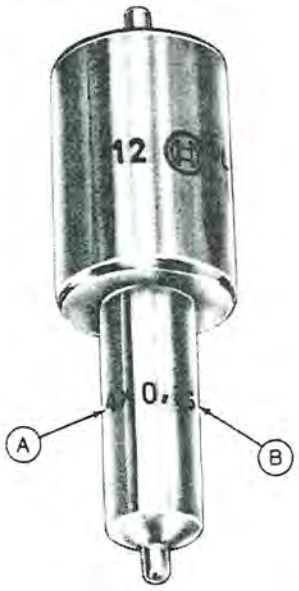
Fig. 72-Leak-Off Connector and Washer

Check passage in leak-off connector (Fig. 72) to see that it is open. Blow through connector passage with compressed air.

Check threads (M6 x 1) for general condition. Replace connector if threads are damaged and can not be restored to a serviceable condition.

Assembly

IMPORTANT: Be sure to install the correct nozzle assembly on nozzle holder. Do not intermix different size nozzle assemblies.



R28734N

A—Number of Orifices **B—Orifice Size**

Fig. 73-Nozzle Markings

FUEL INJECTION NOZZLES—Continued

Assembly—Continued

To help determine the right nozzle assembly for each application, note that markings (Fig. 73) appear on the lower part of nozzle.

For example, the illustration shows a nozzle marked 4 x 0.36. The number "4" indicates the number of orifices (A), and "0.36" indicates the orifice size (B) in millimeters.

The engine-nozzle size relationship for engines using the KDEL injection nozzle are listed below.

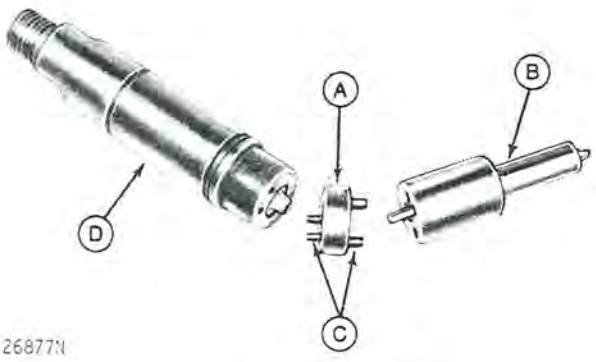
Engine	Nozzle Size
6404D (500000-)	5 x 0.25
6404T; 6466T	4 x 0.33
6404A	
(-357083)	4 x 0.33
(357084-445947)	3 x 0.40
(445948-)	4 x 0.345
6466D	4 x 0.275
6466A	4 x 0.36

IMPORTANT: Immerse parts in clean fuel before assembly. Do not dry parts with towels or compressed air, as dust particles might collect and stay on pressure faces of nozzle valve and nozzle holder.

To assemble the injection nozzle:

Place shims (6, Fig. 61), spring (7), and spring seat (8) in nozzle holder while still wet with diesel fuel.

Position the intermediate plate (A, Fig. 74) on nozzle holder (D). Note that the dowel pins (C) in plate will permit installation only one way.



A—Intermediate Plate
B—Nozzle and Valve
C—Dowel Pins
D—Nozzle Holder

Fig. 74-Assembling Intermediate Plate

Insert the nozzle valve into the nozzle (B) while holding parts below the fuel level in pan.

Install the nozzle assembly on holder and secure with the nozzle retaining nut (12, Fig. 61).

Clamp the nozzle holder in a soft-jawed vise, and tighten the nozzle retaining nut to 44-58 ft-lbs (60-79 Nm) (6.0-7.9 kgm) torque.

Install lower snap ring (4) on nozzle holder.

Coat bore of gland nut (3) liberally with an anti-seize compound (such as Never-Seez) to help prevent gland nut from seizing on holder body. Slide gland nut on nozzle holder.

Install upper snap ring (1) on nozzle holder, and position O-ring (2) against gland nut.

Install leak-off connector (E, Fig. 62) on nozzle holder, using a new washer.

NOTE: The leak-off connector and washer should be installed on the nozzle holder, even though they will have to be removed to install the injection nozzle in cylinder head. This will help prevent misplacement of connector and washer before installation on engine.

Installation

Before installing the KDEL injection nozzle, check engine cylinder head for:

a. Condition of threads for nozzle gland nut. Threads are metric (M28 x 1.5).

b. Condition of machined surface to seat nozzle.

Cylinder head threads and nozzle seating surface must be free of rust and carbon deposits.

IMPORTANT: If the injection nozzle gland nut threads are not clean, a false reading on the torque wrench may be obtained when the injection nozzle is installed. This may prevent the injection nozzle from seating properly in the cylinder head.

To clean threads which have light or moderate foreign deposits, connect the D-17029BR Thread Cleaning Brush to an electric drill. Work brush up and down several times to thoroughly clean threads.

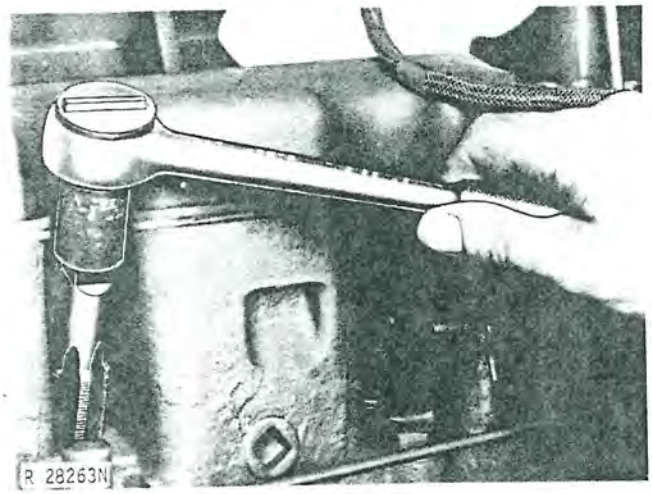


Fig. 75-Using JDF-5 Tap To Clean Threads In Cylinder Head

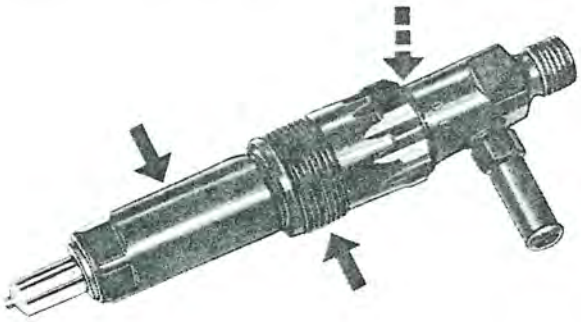
To clean threads with heavy foreign deposits, or to reclaim damaged threads, use the JDF-5 Tap (Fig. 75). Be sure to start tap straight to avoid possible crossthreading. A light coating of grease on tap will help to collect foreign deposits on tap and prevent them from falling into nozzle bore.

After cleaning threads, insert a 1/2-inch (13 mm) tapered hardwood dowel into nozzle bore. Blow out debris from nozzle cavity. Remove wood dowel.

Fig. 76-JDE-99 Nozzle Seat Reamer

Inspect the nozzle seating surface in cylinder head for carbon deposits. If seat is not clean, use the JDE-99 Nozzle Seat Reamer (Fig. 76) to remove carbon. Stop using tool when seat comes clean.

Insert wood dowel in nozzle bore and blow out debris with compressed air. Remove wood dowel.



R 26878N

Fig. 77-Locations To Apply Anti-Seize Compound

Apply anti-seize compound (such as Never-Seez) to the gland nut threads and nozzle barrel (Fig. 77). Be sure that anti-seize compound was also applied on inside (bore) of gland nut during assembly. See Paragraph 5 in right-hand column on previous page.

NOTE: Applying an anti-seize compound at these locations will help prevent possible seizure of the gland nut to the holder body. Future removal of the injection nozzle will be much easier when an anti-seize compound is used.

Install a new R64840 steel washer (G, Fig. 62) on tip end of injection nozzle. If the aluminum washer (R59104) has been used on the nozzle, discard it and use a steel one. The steel washer provides superior nozzle torque retension.

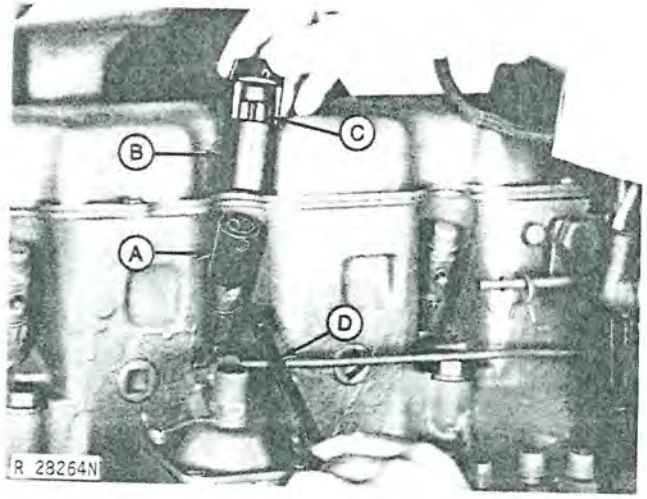
Insert the injection nozzle into cylinder head. Turn gland nut by hand to make sure that it is threaded straight in cylinder head.

Remove the leak-off connector and washer. Use outer part of the JDE-92 Nozzle Socket and turn gland nut down to remove most of the looseness.

Rotate nozzle holder so that the hole for the leak-off connector is facing straight out from the cylinder head (see Fig. 79).

KDEL FUEL INJECTION NOZZLES—Continued

Installation—Continued



A—Inner Socket
B—Outer Socket
C—Window
D—Handle

Fig. 78-Installing JDE-92 Nozzle Socket Wrench

Position the inner socket (A, Fig. 78) over the nozzle holder and engage with the two flats at top of nozzle holder.

Place outer socket (B) portion of JDE-92 Nozzle Socket on gland nut, with socket "window" (C) facing outward.

Insert handle (D) through window into the inner socket. The ball detent in handle will keep it secured to the inner socket.

NOTE: The handle simulates the position of the leak-off connector, which must be "square" with the engine to permit proper installation of leak-off lines.

Tighten the injection nozzle gland nut to 65 ft-lbs (88 Nm) (8.8 kgm) torque, keeping the handle pointing straight out while tightening (Fig. 79). Socket window is cut deep enough to obtain a new "bite" without also removing the inner socket.

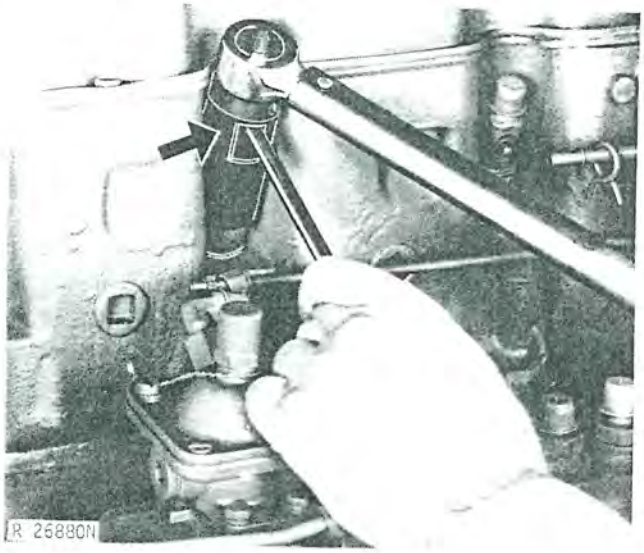


Fig. 79-Tightening KDEL Injection Nozzle Using JDE-92 Nozzle Socket Wrench

Be sure that rubber O-ring (2, Fig. 61) is positioned against the injection nozzle gland nut.

Install the leak-off connectors and washers on injection nozzles (7, Fig. 59).

Install leak-off line assembly (5, Fig. 58).

Install the fuel delivery pipes (4, Fig. 57). Tighten connectors to 20 ft-lbs (27 Nm) (2.7 kgm) torque.

Install fuel return pipe (2) and connect manifold pressure pipe to aneroid (3).

Bleed the fuel system (see page 10-4).

Start the engine and check for leaks.

OVERFLOW VALVE (6466A Engine)

General Information

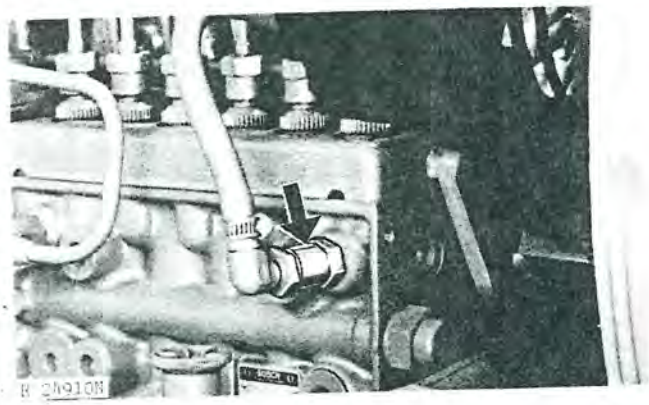


Fig. 80-Overflow Valve

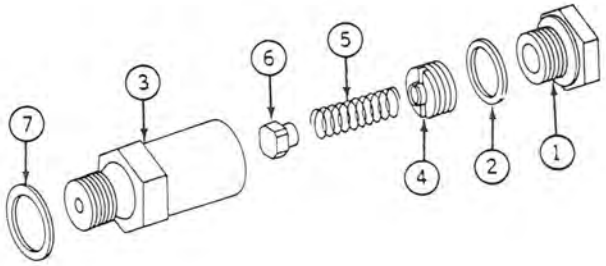
An overflow valve (Fig. 80) is used at the fuel return outlet on the injection pump to maintain a housing pressure of approximately 15 psi (1 bar) (1 kg/cm²). Valve malfunctioning can cause a loss of power.

Removal and Repair

Disconnect the leak-off hose at elbow fitting. Unscrew valve from pump.

Remove reducer (1, Fig. 81) with copper washer (2) from valve body (3). Unscrew spring seat (4) out of body, and remove spring (5) and valve (6).

Look for foreign material that may be in body or imbedded in seat of nylon valve. Check spring to see that it is not weak or broken.



R 24911N

1—Reducer
2—Washer
3—Valve Body
4—Spring Seat
5—Spring
6—Valve
7—Washer

Fig. 81-Exploded View of Overflow Valve

Wash parts in solvent and air dry using compressed air. Make certain that no restrictions are present in valve body.

NOTE: There is no adjustment on valve to regulate housing pressure. If suspected that the valve is malfunctioning, replace valve to restore proper operation.

Installation

Reassemble valve. Tighten spring seat securely. Install valve on pump using a new copper washer (7). Connect leak-off hose and tighten hose clamp securely.

Bleed the fuel system. (See page 10-4).

Group 15
CONTROL LINKAGE

THROTTLE CABLE

General Information

On stationary engines, the hand throttle is mounted on the instrument panel and is connected to the governor control lever on the injection pump.

Removal

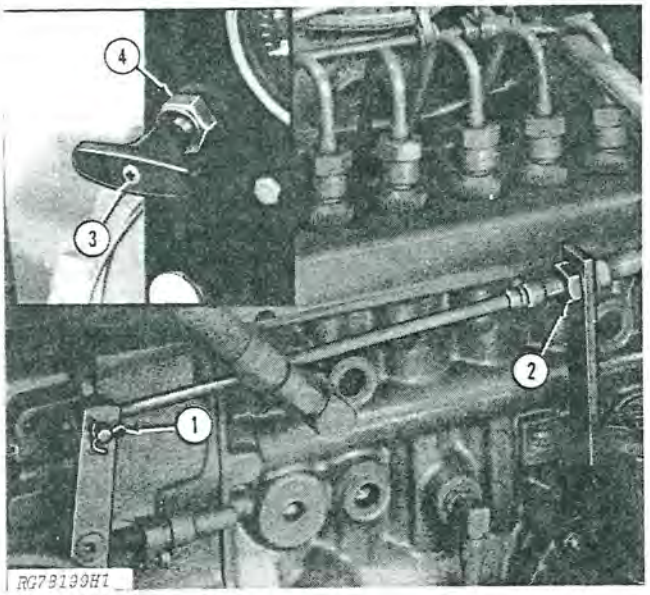


Fig. 1-Throttle Cable Removal Steps (6466A Shown)

1. Disconnect throttle cable at governor control lever.

2. Remove nut and separate cable from bracket.

3. Remove screw and remove throttle handle.

4. Remove trim nut from cable assembly.

5. Remove cable assembly from panel (not shown).

Repair

The cable is not repairable and must be replaced if defective.

Installation

1. Reverse removal steps 2 through 5, tightening nuts securely.

2. Adjust throttle cable as directed in Section 230, Group 15.

STARTING FUEL CONTROL LINKAGE - 6404T AND A (INJECTION PUMPS EQUIPPED WITH ANEROID)

General Information

The starting fuel control linkage automatically engages the aneroid on engines not equipped with a hydraulic aneroid activator.

Two different starting fuel control linkage assemblies were used on early 6404T and A engines:

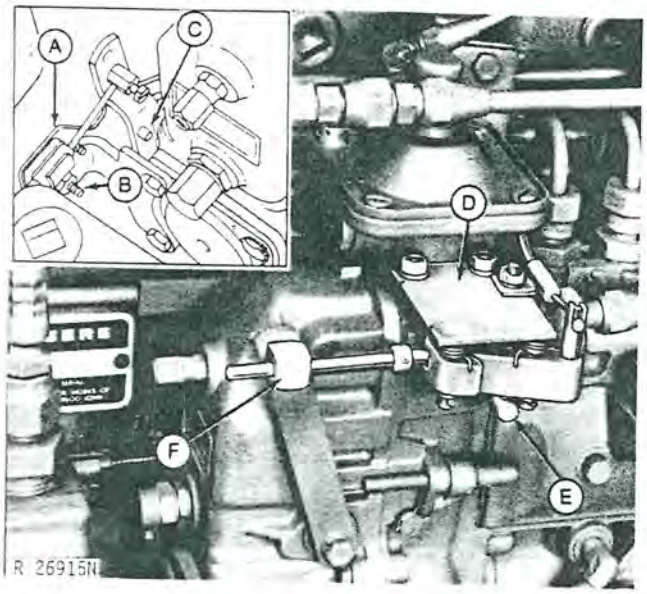
Early Linkage		
	6404T	(-390173)
	6404A	(-393346)
Late Linkage		
	6404T	(390174-445569)
	6404A	(393346-445947)

Engines after the above serial numbers are fitted with a hydraulic aneroid activator instead of the starting fuel control linkage.

STARTING FUEL CONTROL LINKAGE - 6404T and A—Continued

Early Linkage

Removal



A—Cable Guide Bracket
B—Screw
C—Cable
D—Mounting Bracket
E—Control Shaft
F—Swivel

Fig. 2-Early Linkage Removal

1. To remove guide bracket and control cable from injection pump:

a. Remove screw (B, Fig. 2) which fastens guide bracket (A) and cable clamp to support bracket.

b. Disengage "L"-shaped end of control cable (C) from pump fuel shut-off lever.

2. Remove stud nuts from mounting bracket (D).

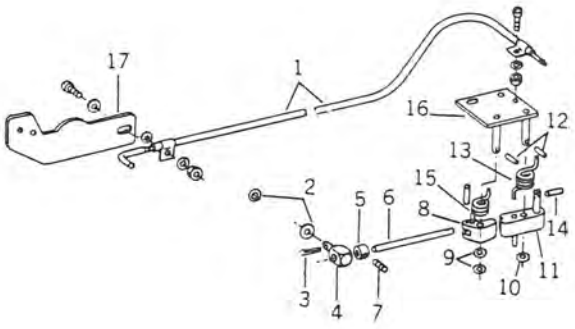
3. Remove cotter pin and washers from swivel (F) connection on governor control lever.

4. Remove linkage assembly from injection pump.

Disassembly and Repair

Disassemble linkage assembly using Fig. 3 as a guide.

Repair or replace any part that is excessively worn. Worn parts may prevent the linkage from engaging and disengaging the aneroid.



1—Cable
2—Washers
3—Cotter Pin
4—Swivel
5—Collar
6—Control Rod
7—Set Screw
8—Latch
9—Washers
10—Special Washer
11—Bell Crank
12—Spring Pins
13—Spring (7 coils)
14—Spring Pin
15—Spring (9 coils)
16—Mounting Bracket
17—Guide Bracket

Fig. 3-Exploded View of Early Linkage

Assembly and Installation

Referring to Fig. 3:

1. Apply a light film of grease to pivot pins on bracket (16).

2. Assemble bell crank (11) to bell crank bracket front pin, with 7-coil spring (13) positioned between the two. Retain with washer (10) and spring pin (12).

3. Secure ball end of control cable (1) in bell crank pin slot and retain with spring pin (14).

4. Attach cable clamp to mounting bracket (16). Attach rear cable clamp to guide bracket (17), placing star washer between bracket and cable clamp.

5. Assemble control rod (6) to latch (8), using spring pin (12).

6. Install 9-coil spring (15) and latch to the bell crank bracket pin. Retain with washers (9) and (12).

7. Install the bell crank bracket over aneroid studs, and at the same time, engage bell crank pin in the starting fuel control shaft hole. Secure bracket to aneroid housing with nuts and washers.