NISSAN

MODEL **LD20**

&

LD28

DIESEL ENGINE

SERVICE MANUAL

NISSAN

Model LD20 & LD28 Diesel Engine

FOREWORD

This service manual has been prepared primarily for the purpose of assisting service personnel in providing effective service and maintenance of the model LD20 & LD28 diesel engine for vehicles.

This manual includes procedures for maintenance, adjustments, removal and installation, disassembly and assembly of components, and trouble-shooting.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication. If your engine differs from the specifications contained in this manual, consult your NISSAN/ DATSUN dealer for information.

The right is reserved to make changes in specifications and methods at any time without notice.

NISSAN MOTOR CO., LTD.

QUICK REFERENCE INDEX

HOW TO USE THIS MANUAL

- This Service Manual is designed as a guide for servicing diesel engines for vehicles.
- A QUICK REFERENCE INDEX is provided on the first page. Refer to this index along with the index of the particular section you wish to consult.
- The first page of each section lists the contents and gives the page numbers for the respective topics.
- SERVICE DATA AND SPECIFICATIONS are contained in each section.
- TROUBLE DIAGNOSES AND CORRECTIONS are included in ET section. This feature of the manual lists the likely causes of trouble and recommends the appropriate corrective actions to be taken.
- A list of SPECIAL SERVICE TOOLS is included in each section. The special service tools are designed to assist you in performing repair safely, accurately and quickly.
- The measurements given in this manual are primarily expressed with the SI unit (International System of Unit), and alternately expressed in the metric system and in the yard/pound system.
- In the text, the following abbreviations are used:

S.D.S.:	Service Data and Specifications	L.H.:	Left Hand
Ⓣ:	Tightening Torque	R.H.:	Right Hand

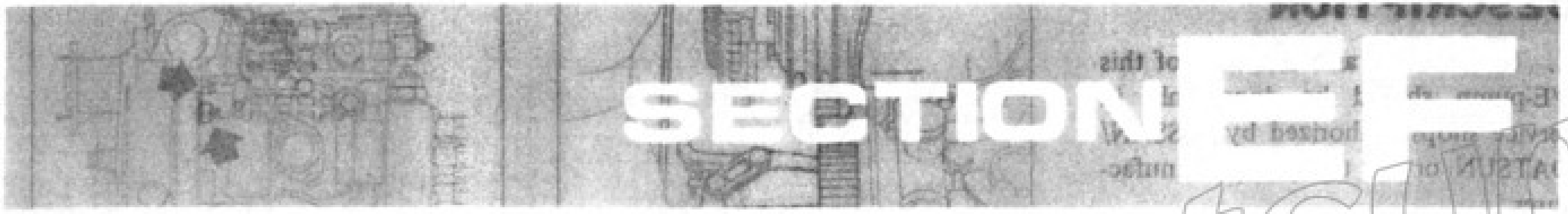
- The captions CAUTION and WARNING warn you of steps that must be followed to prevent personal injury and/or damage to some part of the engine.

IMPORTANT SAFETY NOTICE

The proper performance of service is essential for both the safety of the mechanic and the efficient functioning of the engine.
The service methods in this Service Manual are described in such a manner that the service may be performed safely and accurately.
Special service tools have been designed to permit safe and proper performance of service. Be sure to use them.

Service varies with the procedures used, the skills of the mechanic and the tools and parts available. Accordingly, anyone using service procedures, tools or parts which are not specifically recommended by NISSAN must first completely satisfy himself that neither his safety nor the engine's safety will be jeopardized by the service method selected.

ENGINE FUEL



CONTENTS

INJECTION PUMP ASSEMBLY (VE-type)

DESCRIPTION

1. Disassembly and assembly of this VE-pump should be done only in service shops authorized by NISSAN/ DATSUN or by the pump manufacturer.
2. Before removing fuel injection pump from vehicle, check closely to make sure that it is apparently malfunctioning.

Refer to Trouble Diagnoses and Corrections in ET section.

INJECTION PUMP

REMOVAL

1.
- Remove battery (LD28).
- Disconnect battery ground cable (LD20).

2. Remove undercover (LD20).
3. Drain coolant.
4.
- Remove air cleaner duct and resonator (LD28).
- Remove air cleaner duct (LD20).

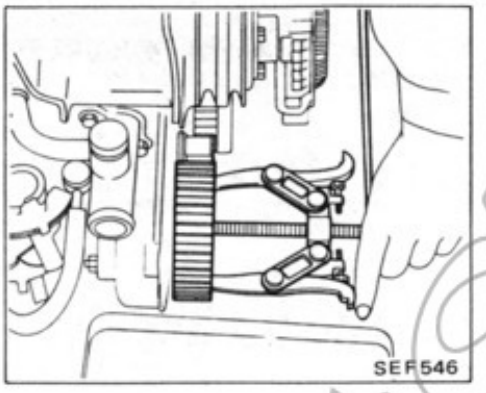
5. Remove radiator grille (LD20).
6. Remove radiator and shroud.
7. Remove cooling fan.
8. Loosen alternator bolts.
9. Remove drive belts.
- Alternator
- Power steering oil pump
- Compressor

10. Remove power steering oil pump (LD28).

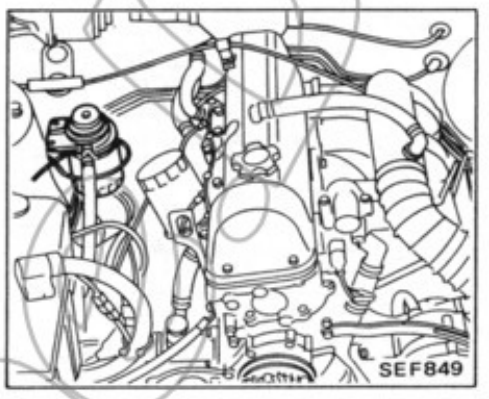
Never drain power steering oil while work is being performed.

11. Disconnect following wires and hoses.
- Accelerator wire
- Throttle control wire
- Fuel hose
- F.I.C.D. vacuum hose.
- Fuel cut solenoid wire.

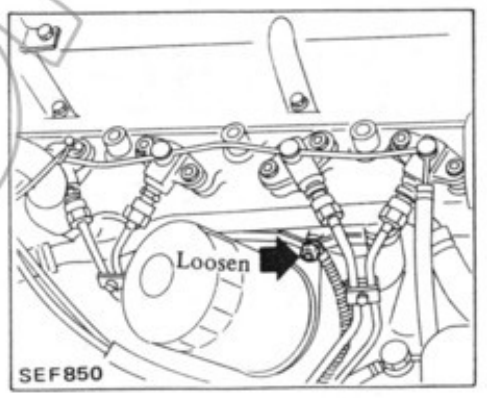
12. Remove crank damper pulley.
13. Remove dust cover.
14. Loosen spring set pin and set tensioner pulley to "free tension" position. Then tighten them.
15. Remove drive belt.



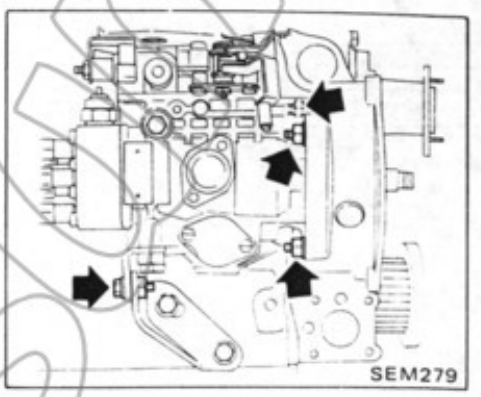
16. Remove injection pump drive pulley.
17. Disconnect wires and remove starter motor (LD20).
18. Remove water inlet (LD20).
19. Disconnect fuel filter sensor harness, then move fuel filter with bracket to work area for safety purposes (LD20).



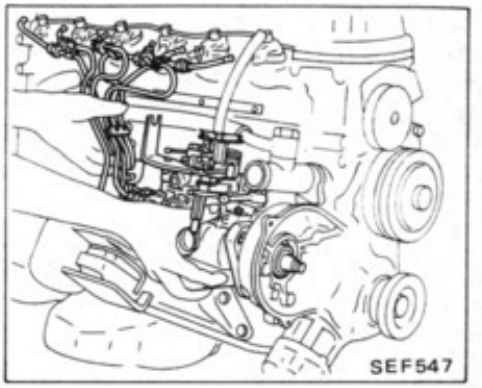
20. Remove glow plug harness (LD20).



21. Disconnect injection tube at injection nozzle side.
22. Remove injection pump fixing nuts and bracket bolt.



23. Take out injection pump assembly with injection tube.

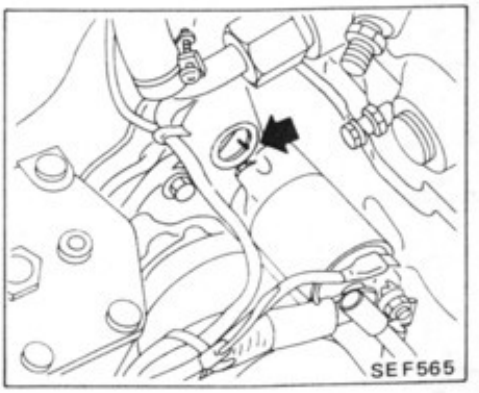


INSTALLATION

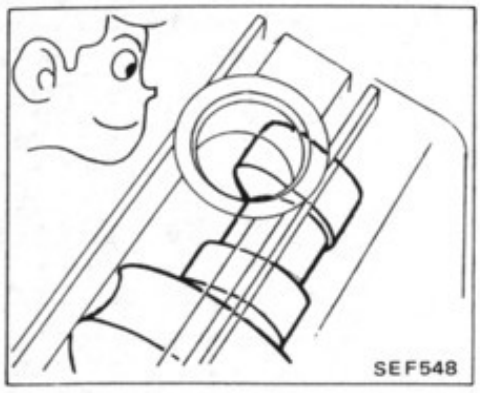
Install injection pump assembly in the reverse order of removal, observing the following.

1. Set No. 1 cylinder at top dead center on compression stroke.

Make sure that grooves in rear plate and drive plates are aligned with each other.

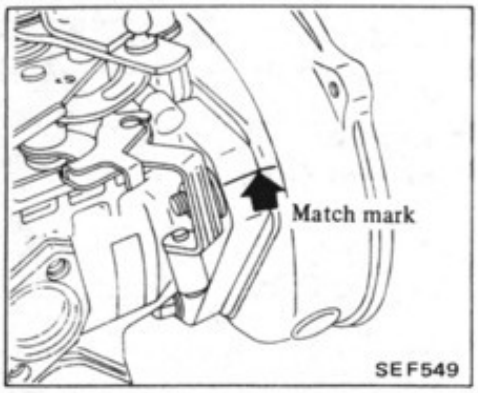


Make sure that No. 1 cam of camshaft is in a position as shown.



2. Install fuel injection pump.

Temporarily tighten fuel injection pump after side surface of this pump is aligned with aligning mark on side surface of front cover.

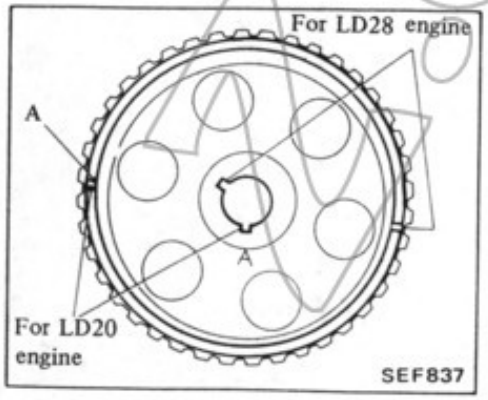


3. Attach fuel injection pump pulley.

There are two grooves and two drive belt align marks on the pulley. When installing injection pump, follow the instructions below.

a. When installing injection pump on LD28, use mark groove (without "A") and align mark.

b. When installing injection pump on LD20, use "A" mark groove and align mark.



c. Fuel injection pump drive shaft is tapered. Use a copper or plastic hammer to drive pulley into place.

Ⓣ: Pulley nut
59 - 69 N·m
(6.0 - 7.0 kg-m,
43 - 51 ft-lb)

d. In case of LD20, install starter motor after installing injection pump.

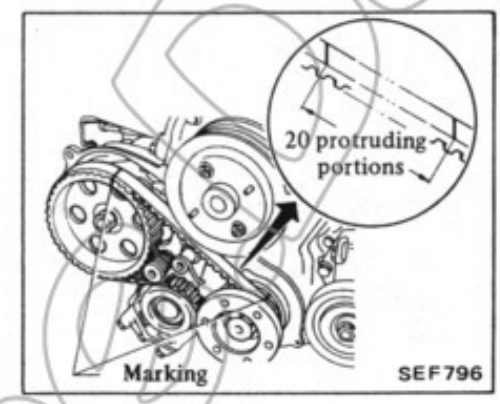
4. Make sure that tensioner is in "free" position.

5. Install injection drive belt.

(1) Align both timing marks of drive belt and crank pulley.

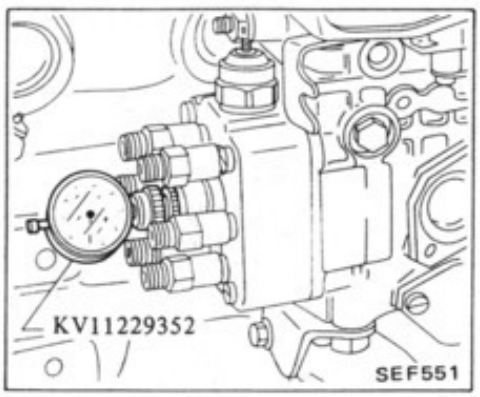
(2) Properly align timing mark of pump pulley with that of drive belt.

(3) If timing mark of drive belt is not clear enough to permit alignment, set marks of both crank pulley and injection pump pulley at positions so that there are 20 cogs of drive belt between these two marks.



6. Loosen spring set pin and tensioner so that belt is automatically set to "tension" position.

7. Remove air vent screw from rear end of fuel injection pump and, in its opening, attach KV11229352.



8. Plunger lift measurement and adjustment.

(1) Turn crankshaft counterclockwise from No. 1 cylinder at Top Dead Center.

LD28:
15 - 20 degrees
LD20:
20 - 25 degrees

(2) Find dial gauge needle rest point, then set the gauge to zero.

(3) Turn crankshaft clockwise two complete rotations in order to remove play in cam mechanism. Loosen tensioner and retighten.

Belt tension is automatically set by tension spring.

(4) Turn crankshaft clockwise until No. 1 cylinder is set at top dead center on compression stroke.

Make sure that No. 1 cam of camshaft is in same position as indicated in figure under step 1 above.

(5) Read dial gauge indication.

LD28:
Standard
0.75 ±0.04 mm
(0.0295 ±0.0016 in)
LD20:
Standard:
0.78 ±0.04 mm
(0.0307 ±0.0016 in)

(6) If dial gauge indication is not within above range, turn pump body until it falls within standard range.

a. If indication is smaller than 0.71 mm (0.0280 in) [LD28] or 0.74 mm (0.0291 in) [LD20], turn pump body counterclockwise.

b. If indication is larger than 0.79 mm (0.0311 in) [LD28] or 0.82 mm (0.0323 in) [LD20], turn pump body clockwise.

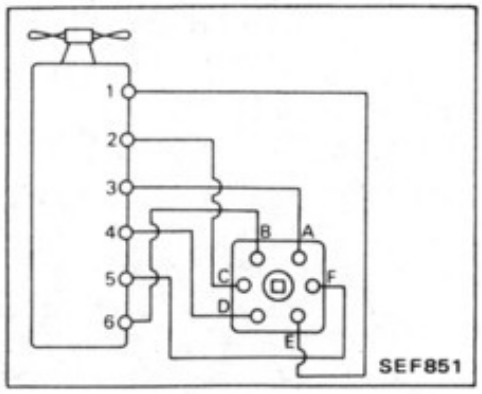
9. Tighten injection pump securely.

10. Disconnect dial gauge and reinstall plug bolt to new washer.

Ⓣ: Plug bolt
14 - 20 N·m
(1.4 - 2.0 kg-m,
10 - 14 ft-lb)

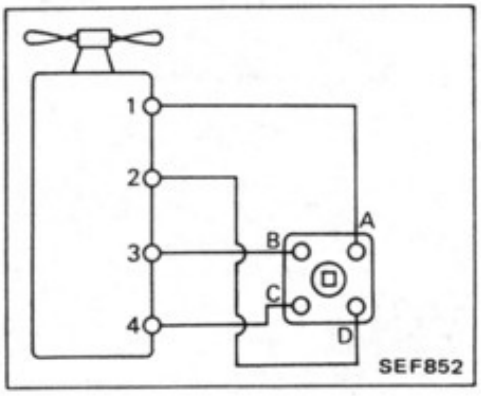
11. Connect fuel tubes.

LD28

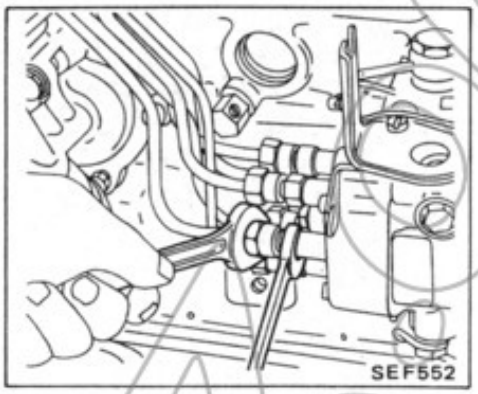


Connect cylinders in the order of 4, 2, 6, 1, 5 and 3.

LD20



Use two wrenches when installing tubes.

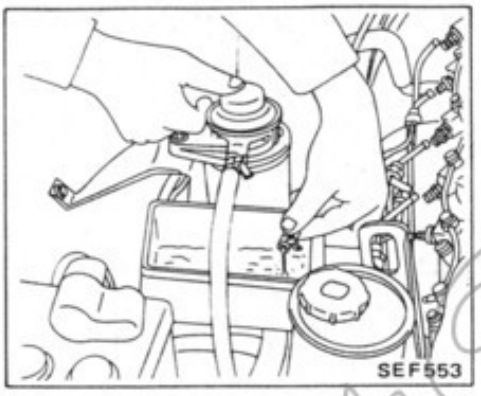


CHECKING PRIMING PUMP

1. Disconnect fuel return hose.

Place a container or jug beneath hose end.

2. Prime priming pump to make sure that fuel overflows at hose end. If not, replace priming pump.



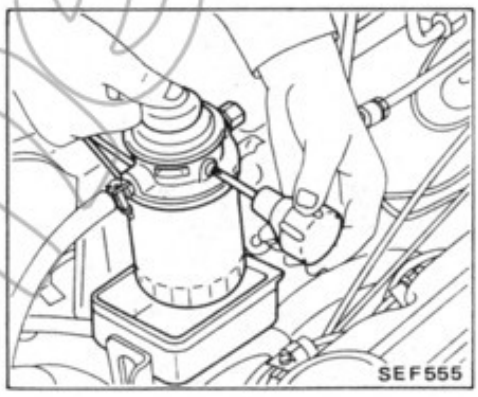
DRAIN WATER

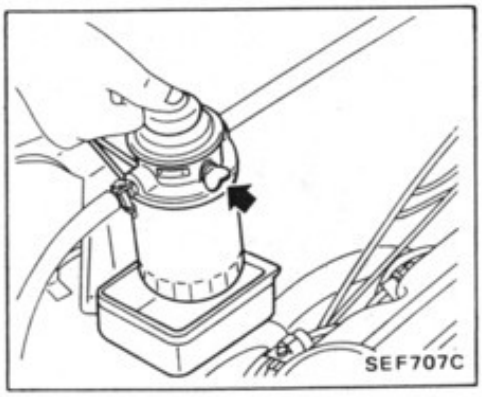
Drain water from fuel filter in accordance with maintenance schedule. Also do this when warning light comes on.

Refer to ET section for drain water of fuel filter.

BLEEDING FUEL SYSTEM

Air should be bled out of fuel system when injection pump is removed or fuel system is repaired.





1. Loosen bleeder screw or cock.
2. Loosen priming pump and priming.

Make sure that fuel overflows at bleeder screw or cock hole.

3. Tighten bleeder screw or cock.
4. Then, disconnect fuel return hose.

Refer to CHECKING PRIMING PUMP.

5. Prime priming pump to make sure that fuel overflows at hose end.
6. Install fuel return hose.
7. Tighten priming pump.

IDLE AND MAXIMUM SPEED ADJUSTMENT

Refer to section ET.

INJECTION NOZZLE ASSEMBLY

REMOVAL AND INSTALLATION

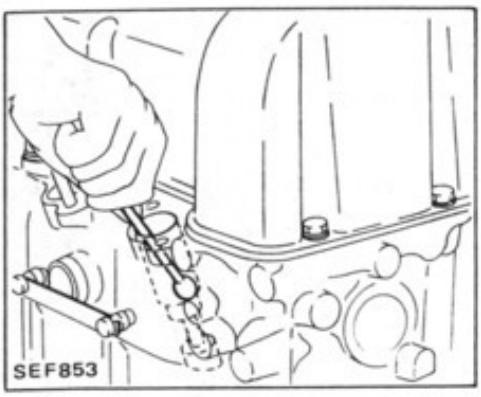
1. Remove fuel injection tube and spill tube assembly.
2. Remove injection nozzle assembly.

Also remove washers from nozzle end.

3. Install injection nozzle in the reverse order of removal.

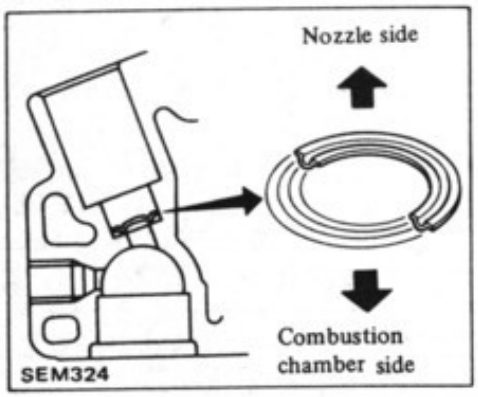
Ⓣ : Injection nozzle to engine
16 - 21 N·m
(1.6 - 2.1 kg-m,
12 - 15 ft-lb)
Injection nozzle to tube
22 - 25 N·m
(2.2 - 2.5 kg-m,
16 - 18 ft-lb)
Spill tube
15 - 18 N·m
(1.5 - 1.8 kg-m,
11 - 13 ft-lb)

a. Always clean nozzle holes.



b. Always use new injection nozzle gasket.

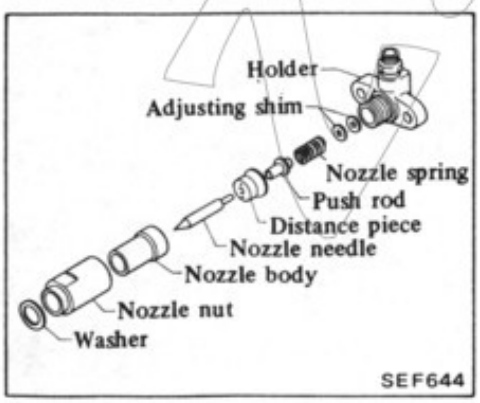
c. Note that small washer should be installed in specified direction.



d. Bleed air from fuel system.

DISASSEMBLY

1. Loosen nozzle nut while keeping nozzle top from turning.
2. Arrange all of disassembled parts in order shown below.



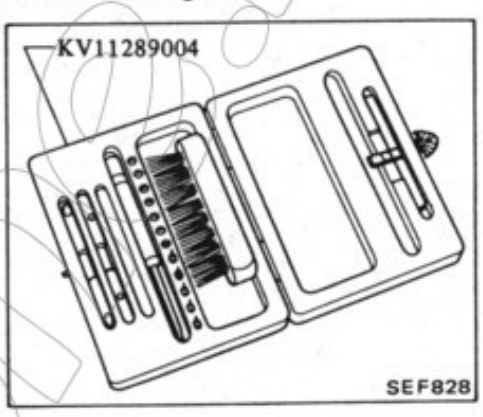
INSPECTION

Thoroughly clean all disassembled parts with fresh kerosene or solvent.

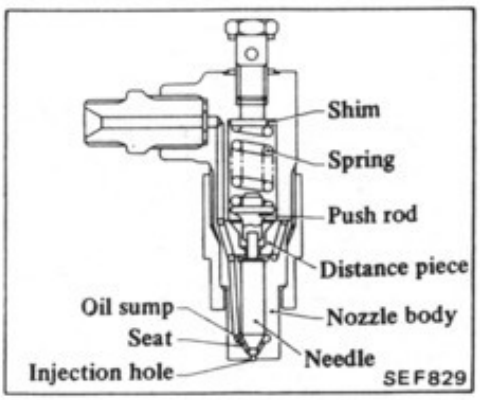
- If nozzle needle is damaged or fused, replace nozzle assembly with a new one.
- If end of nozzle needle is seized or excessively discolored, replace nozzle assembly.
- Check nozzle body and distance piece for proper contact. If excessively worn or damaged, replace nozzle assembly or distance pieces.
- Check distance piece and nozzle holder for proper contact. If excessively worn or damaged, replace distance piece or nozzle holder.
- Check nozzle spring for excessive wear or damage. If excessively worn or damaged, replace it with a new spring.

CLEANING

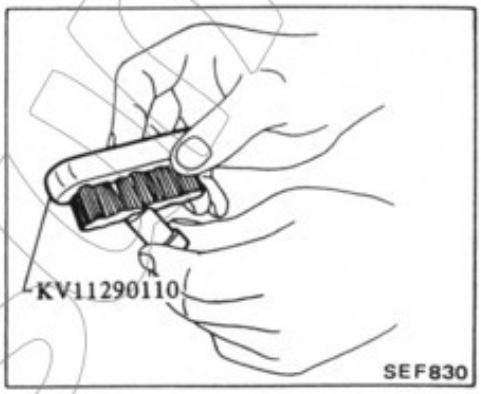
1. Clean nozzle assembly using the Nozzle Cleaning Kit.



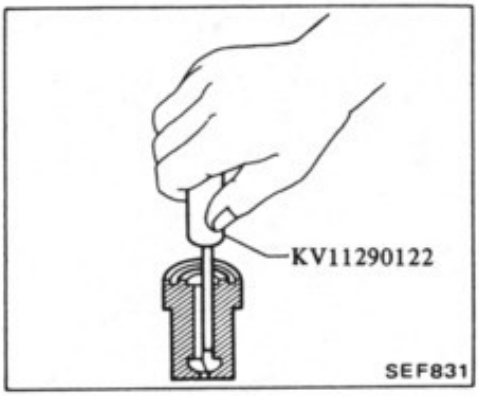
2. Portions which should be cleaned are indicated in figure below.



3. Remove any carbon from exterior of nozzle body (except wrapping angle portion) by using Tool.

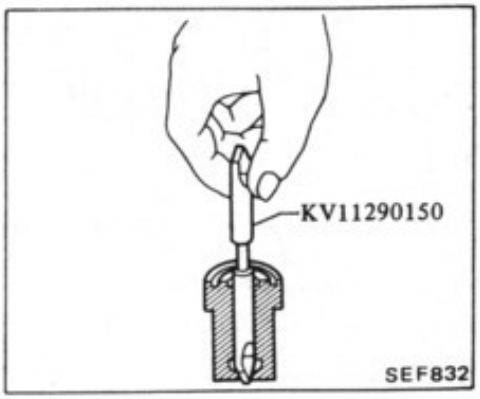


4. Remove oil sump of nozzle body using Tool.



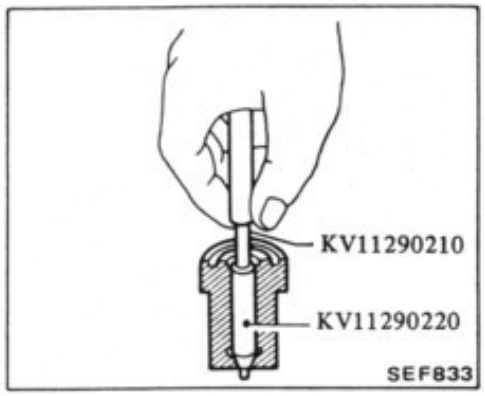
5. Clean nozzle seat by using Tool.

This job should be performed with extra precautions, since efficiency of nozzle depends greatly on a good nozzle seat.

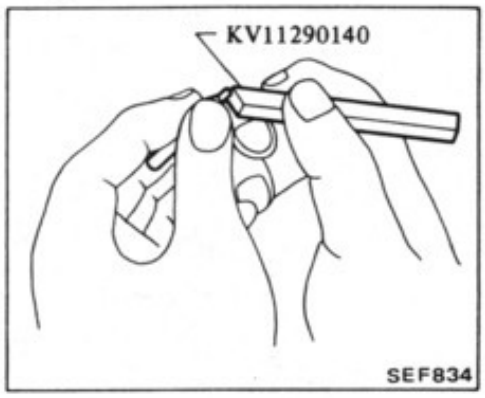


6. Clean spray hole of nozzle body by using Tool.

To prevent spray hole from canting, always clean it by starting with inner side and working towards outside.

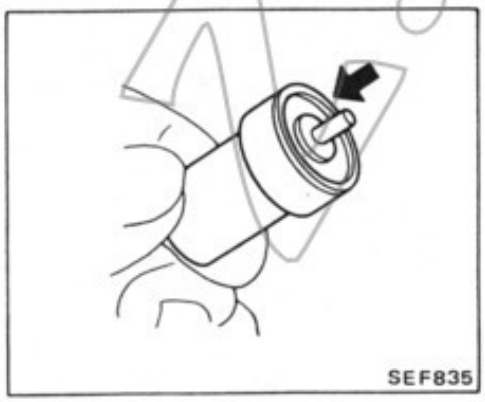


7. Decarbon nozzle needle tip by using Tool.



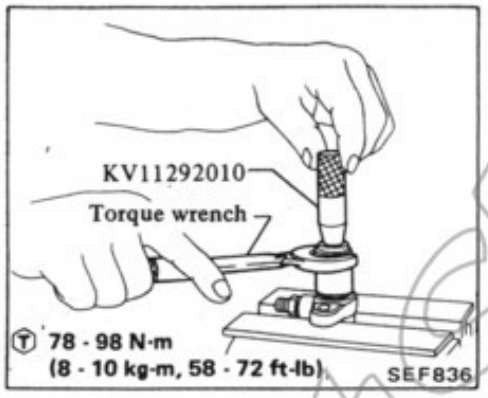
8. Check needle for proper position.
(1) Pull needle about halfway out from body and then release it.
(2) Needle should sink into body very smoothly from just its own weight.
(3) Repeat this test and rotate needle slightly each time.

If needle fails to sink smoothly from any position, replace both needle and body as a unit.



ASSEMBLY

1. Assemble in the reverse order of disassembly, observing the following.

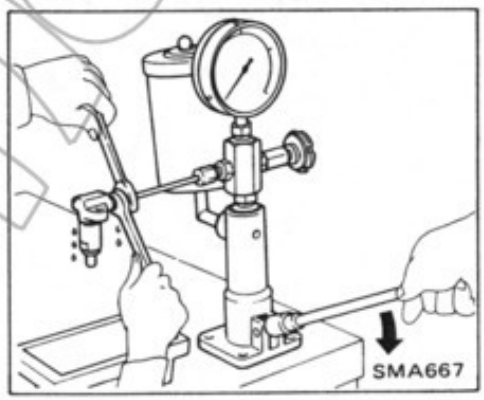


If nozzle body is not installed properly, tool may not come off and could be damaged.

TEST AND ADJUSTMENT

WARNING:
When using nozzle tester, be careful not to allow diesel fuel sprayed from nozzle to come into contact with your hand or body, and make sure that your eyes are properly protected with goggles.

1. Install nozzle to injection nozzle tester and **bleed air from flare nut.**

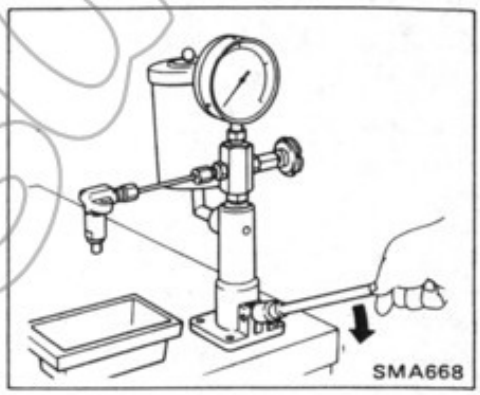


2. Check initial injection pressure by pumping tester handle one time per second.

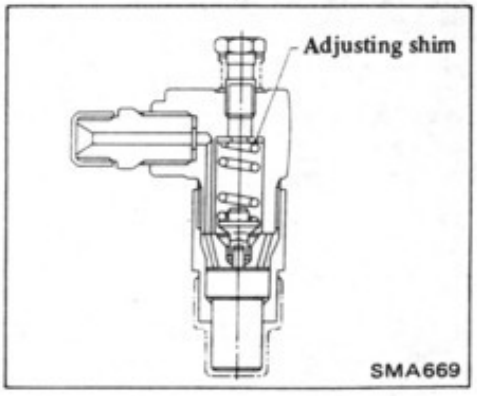
Initial injection pressure:
12,259 - 13,239 kPa
(122.6 - 132.4 bar,
125 - 135 kg/cm², 1,778 - 1,920 psi)

New nozzle initial injection pressure:
13,239 - 14,024 kPa
(132.4 - 140.2 bar,
135 - 143 kg/cm², 1,920 - 2,033 psi)

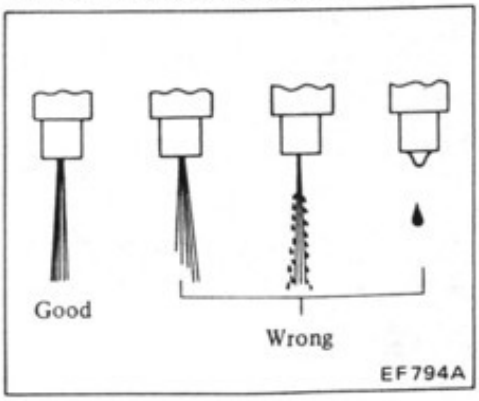
The new nozzle is not required to adjust initial injection pressure.



a. **Increasing the thickness of adjusting shims increases initial injection pressure. Decreasing shim thickness reduces initial injection pressure.**
b. **A shim thickness of 0.04 mm (0.0016 in) corresponds approximately to a difference of 471 kPa (4.71 bar, 4.8 kg/cm², 68 psi) in initial injection pressure.**

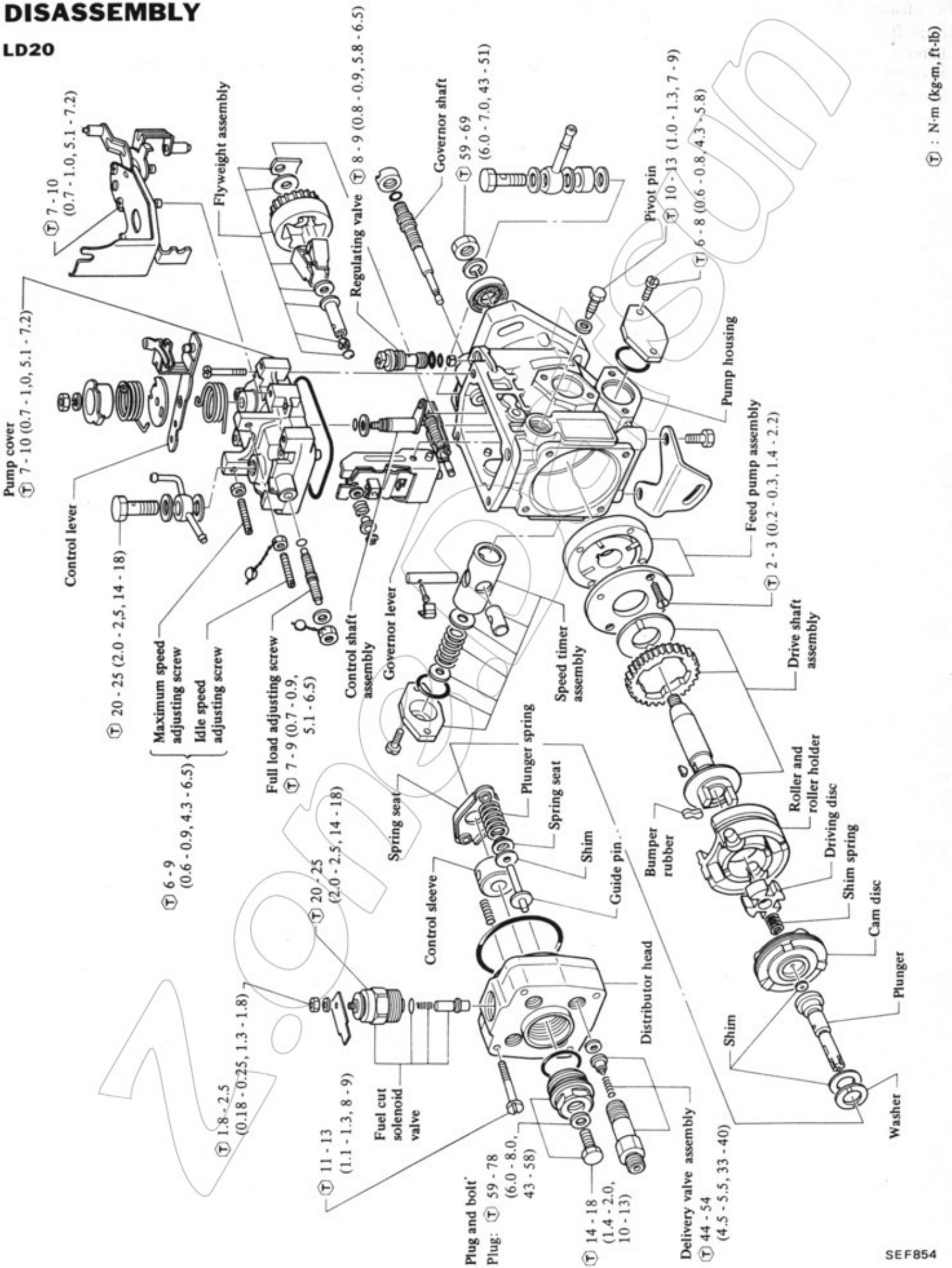


4. Check spray pattern by pumping tester handle one time per second.

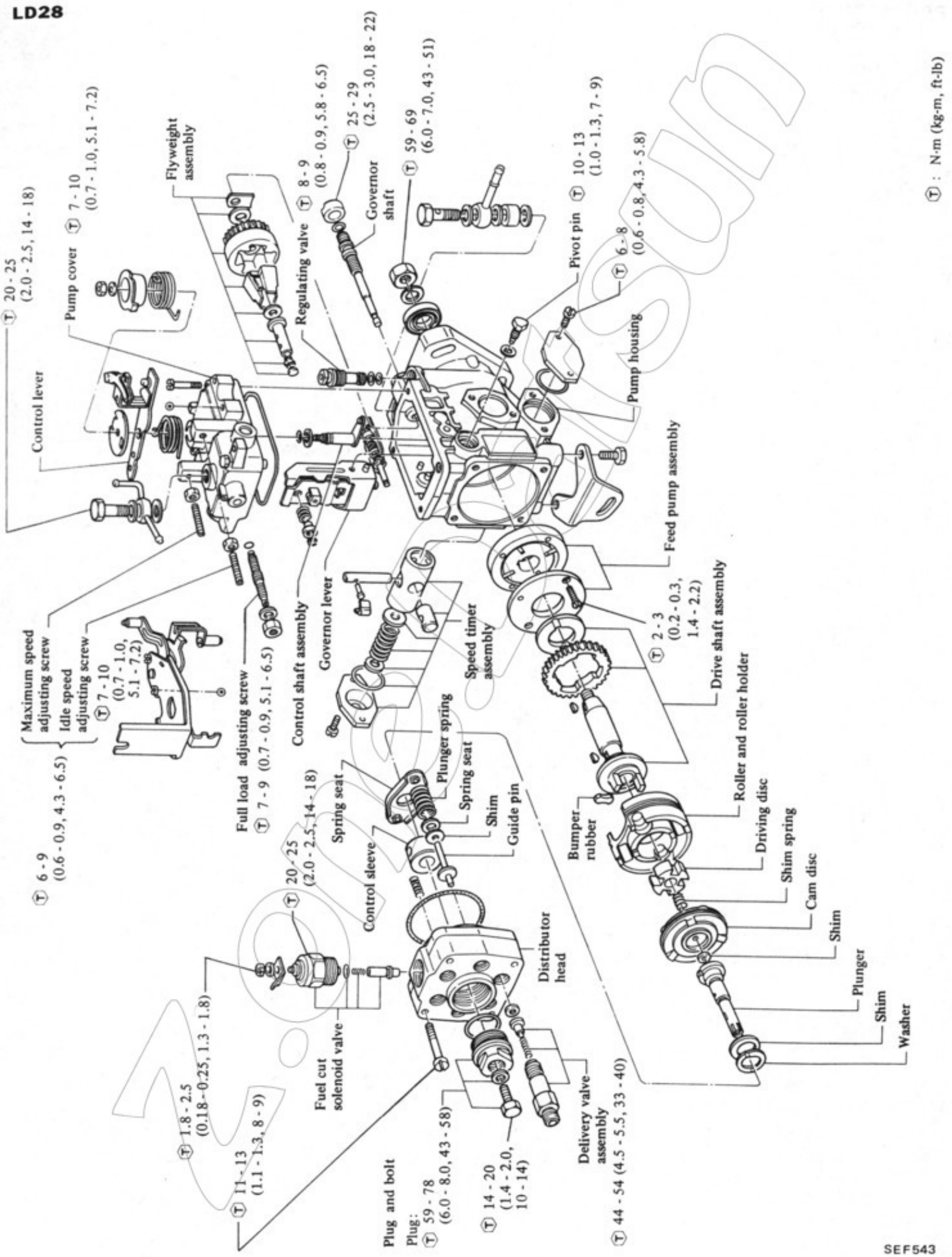


DISASSEMBLY

LD20



LD28

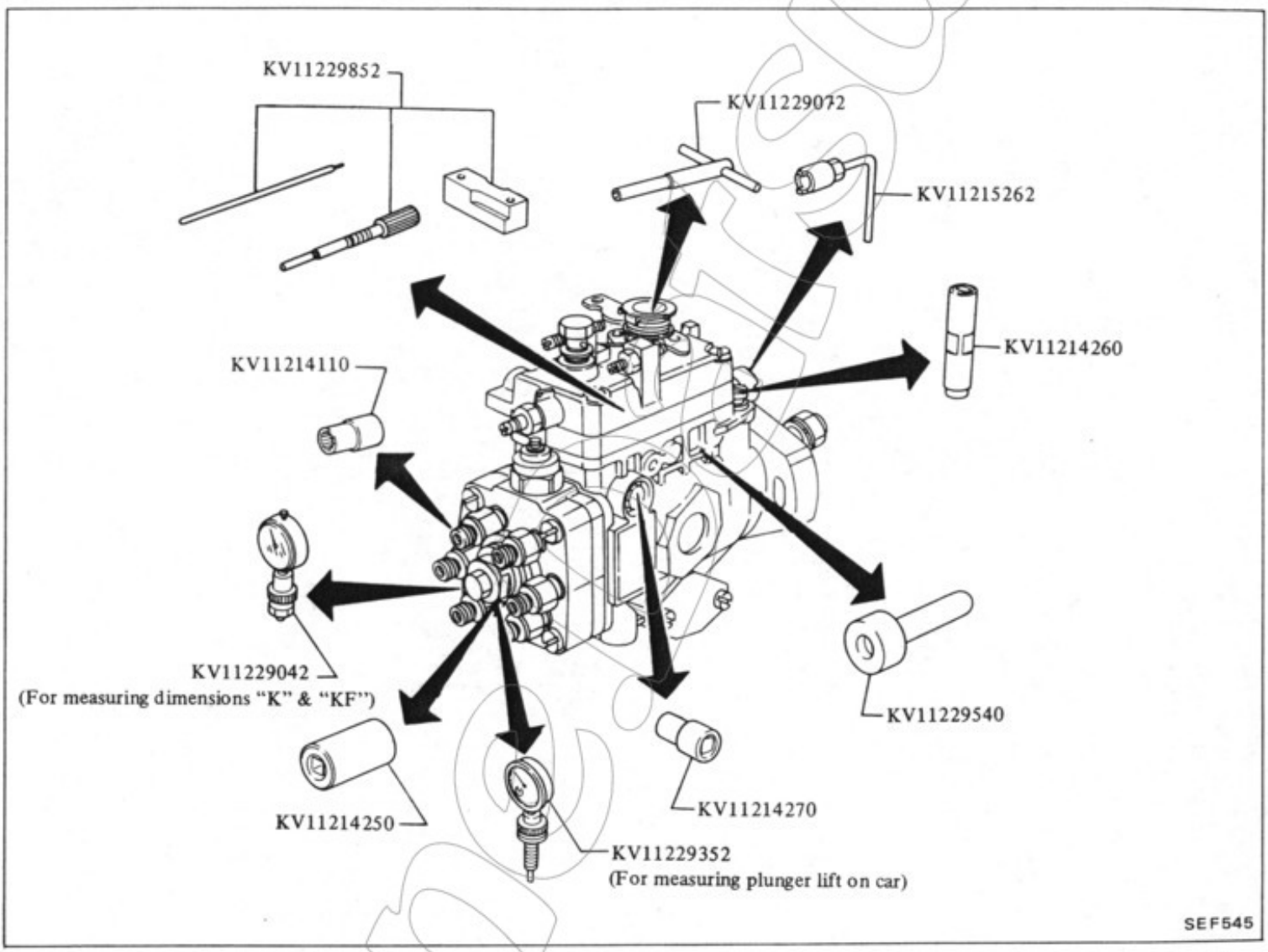

Ⓣ : N·m (kg-m, ft-lb)
Ⓣ 20 - 25 (2.0 - 2.5, 14 - 18)
Pump cover
Ⓣ 7 - 10 (0.7 - 1.0, 5.1 - 7.2)
Flyweight assembly
Regulating valve
Ⓣ 8 - 9 (0.8 - 0.9, 5.8 - 6.5)
Ⓣ 25 - 29 (2.5 - 3.0, 18 - 22)
Governor shaft
Ⓣ 59 - 69 (6.0 - 7.0, 43 - 51)
Pivot pin
Ⓣ 10 - 13 (1.0 - 1.3, 7 - 9)
Ⓣ 6 - 8 (0.6 - 0.8, 4.3 - 5.8)
Pump housing
Control lever
Maximum speed adjusting screw
Idle speed adjusting screw
Ⓣ 7 - 10 (0.7 - 1.0, 5.1 - 7.2)
Full load adjusting screw
Ⓣ 7 - 9 (0.7 - 0.9, 5.1 - 6.5)
Control shaft assembly
Governor lever
Feed pump assembly
Ⓣ 2 - 3 (0.2 - 0.3, 1.4 - 2.2)
Drive shaft assembly
Speed timer assembly
Roller and roller holder
Plunger spring
Spring seat
Shim
Guide pin
Bumper rubber
Driving disc
Shim spring
Cam disc
Shim
Plunger
Shim
Washer
Ⓣ 6 - 9 (0.6 - 0.9, 4.3 - 6.5)
Ⓣ 20 - 25 (2.0 - 2.5, 14 - 18)
Spring seat
Control sleeve
Distributor head
Ⓣ 1.8 - 2.5 (0.18 - 0.25, 1.3 - 1.8)
Ⓣ 11 - 13 (1.1 - 1.3, 8 - 9)
Fuel cut solenoid valve
Plug and bolt
Plug:
Ⓣ 59 - 78 (6.0 - 8.0, 43 - 58)
Ⓣ 14 - 20 (1.4 - 2.0, 10 - 14)
Delivery valve assembly
Ⓣ 44 - 54 (4.5 - 5.5, 33 - 40)

SEF543

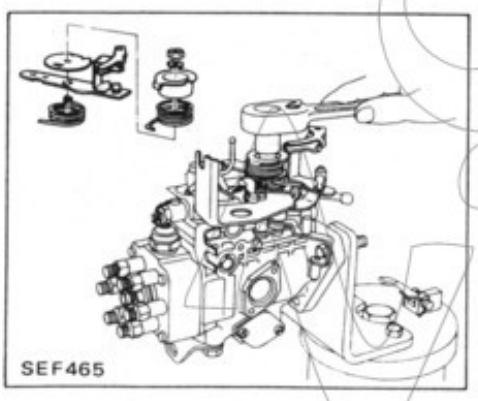
PREPARATION

- Before performing disassembly and adjustment, test fuel injection pump and note test results except when testing is impossible.
- Prior to beginning to disassemble fuel injection pump, clean all dust and dirt from its exterior.
- Disconnect overflow valve, and drain fuel.
- Clean work bench completely, removing all foreign mattter.
- Collect only those service tools necessary for disassembling and reassembling.
- Be careful not to bend or scratch any parts.

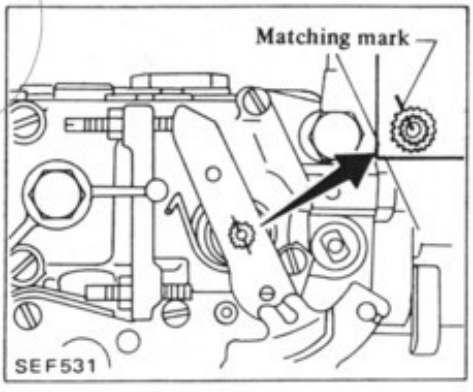
Special tools for disassembling and reassembling fuel injection pump



1. Remove nut, spring washer, spring seat and spring from control lever.

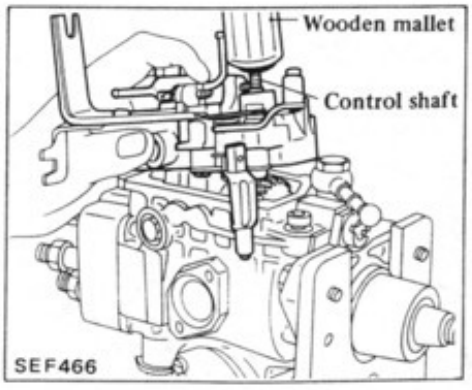


2. Draw aligning marks on control lever and control shaft.

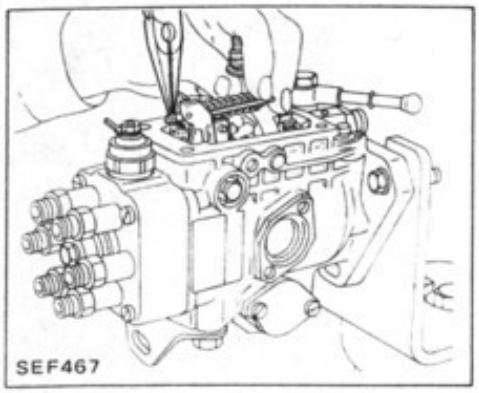


3. Remove governor cover.

Move control shaft down by lightly tapping on the end with a wooden mallet.

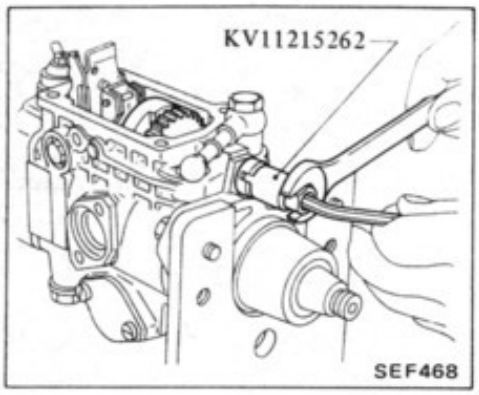


4. Remove control shaft from tension lever.

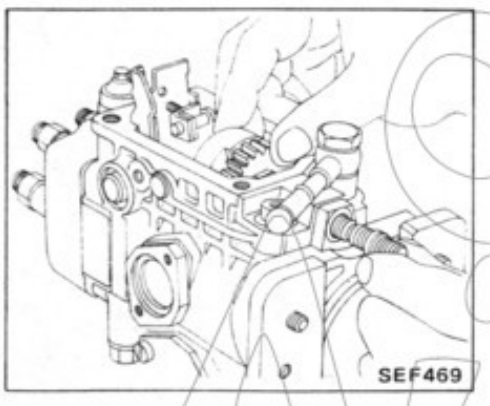


5. Remove governor shaft.

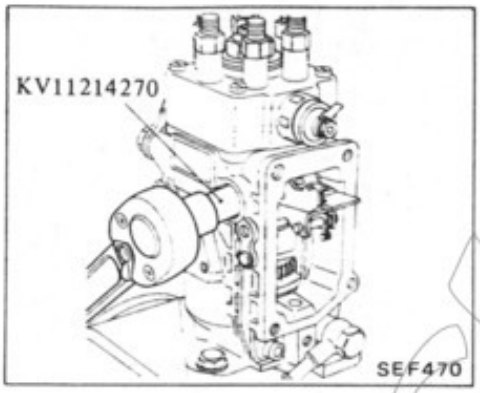
Loosen lock nut by turning it clockwise.



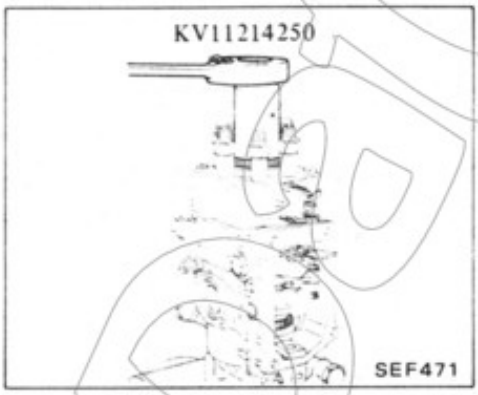
6. Remove governor sleeve, washer and flyweight, along with flyweight holder, then remove washer and shim(s).



7. Loosen left and right governor pivot bolts.

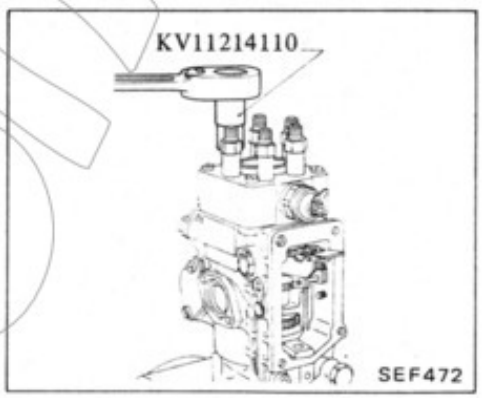


8. Remove plug.

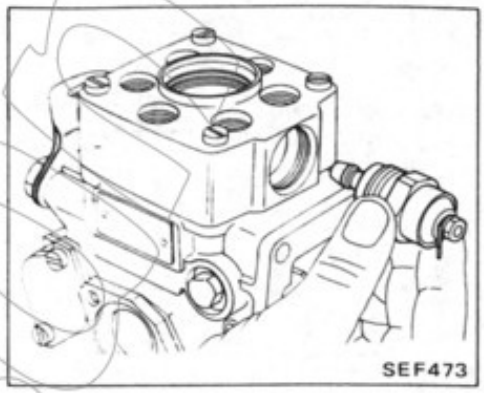


9. Remove delivery holder, spring, delivery valve and gasket.

Distributor head has letters (A, B, C, D, E, and F) stamped on it. Remove lettered parts in alphabetical order and arrange neatly.

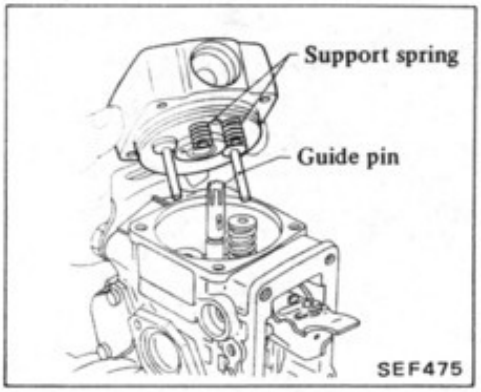


10. Remove fuel-cut solenoid valve.



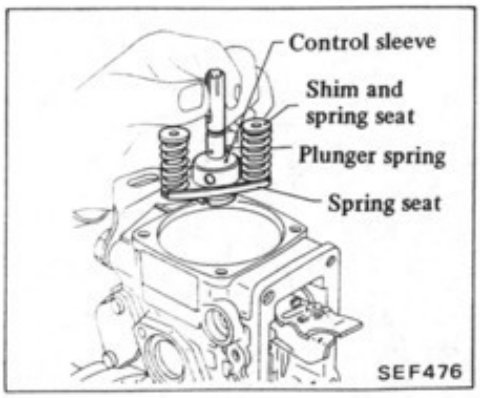
11. Remove distributor head.

Be careful not to drop the two support springs and guide pins.



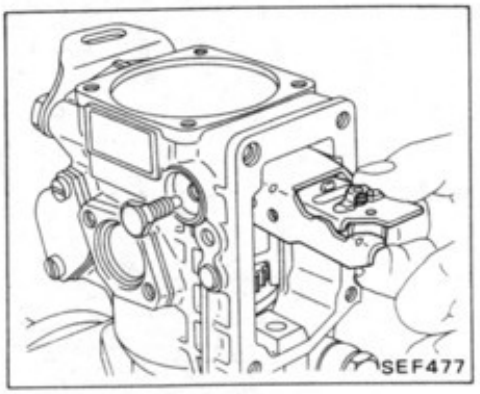
12. Remove plunger assembly.

Lift plunger, along with control sleeve, shim, spring seat and plunger spring.

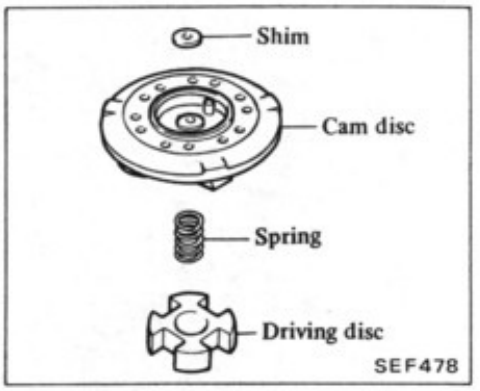


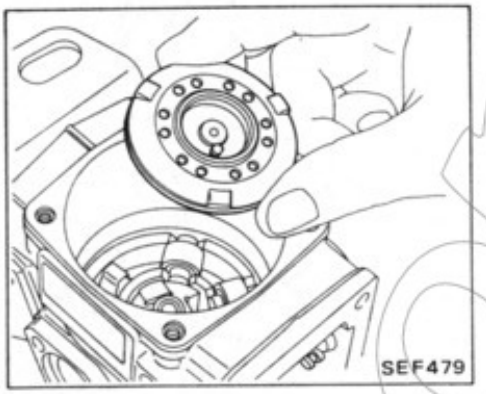
13. Remove governor lever assembly.

Avoid pulling on start spring and start idle spring.

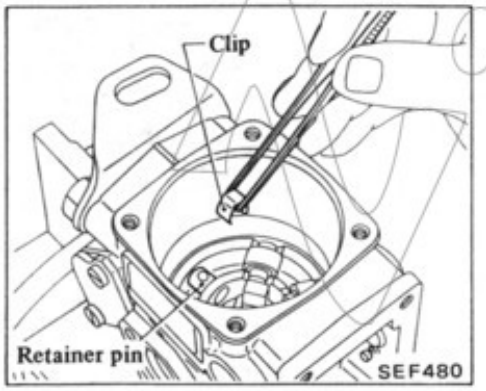


14. Remove shim, cam disc, spring and driving disc.

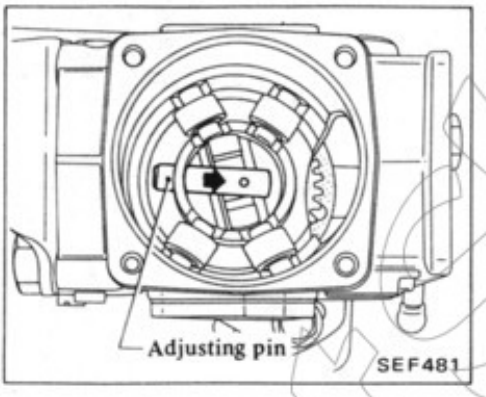




15. Remove clips and pins.

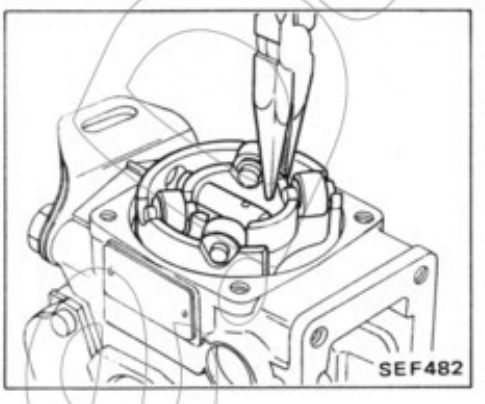


16. Move adjusting pin to center of roller holder, as shown.



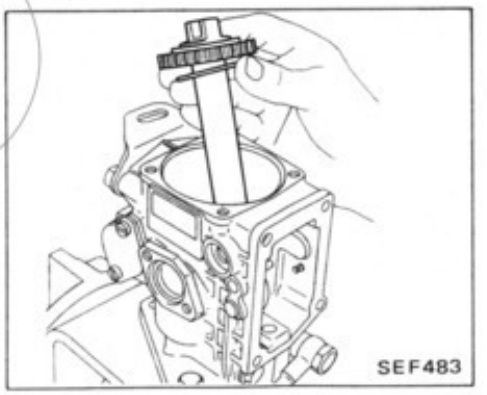
17. Lift out roller holder with rollers without tilting.

Be careful not to drop rollers.

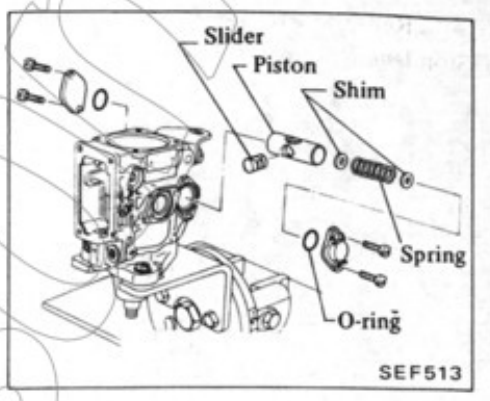


18. Remove drive shaft.

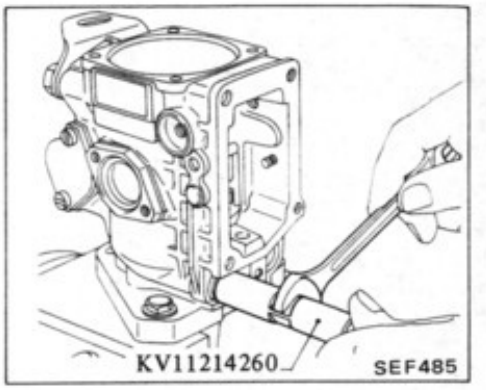
a. Be careful not to scratch inner surface of fuel injection pump body.
b. Use care to avoid dropping key.



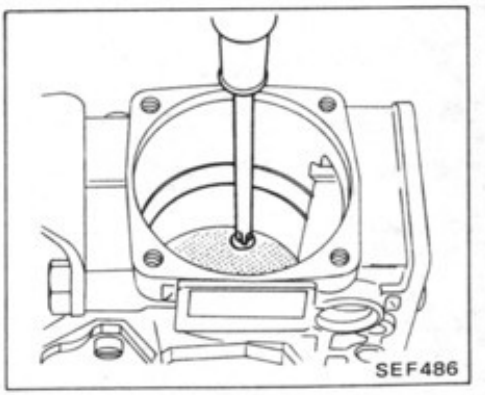
19. Remove speed timer cover, O-ring, shims, spring, piston and slider.



20. Remove regulating valve.

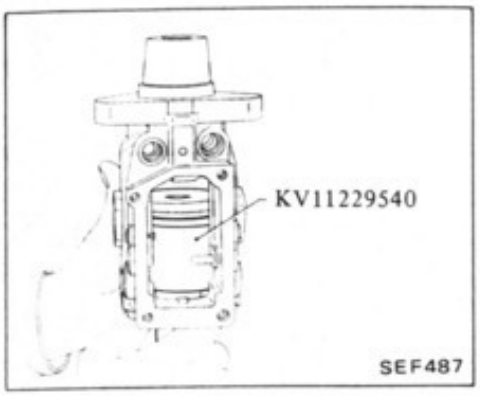


21. Loosen screw from feed pump cover.



22. Remove cover and feed pump assembly as a unit.
1) Insert service tool KV11229540 into fuel injection pump housing.
2) Turn injection pump's top side down, as shown.
3) Remove cover and feed pump assembly as a unit.

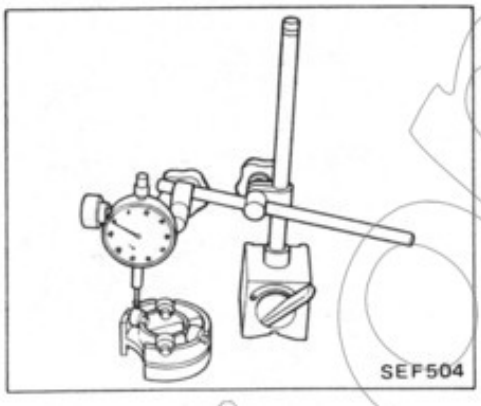
a. If cover and feed pump assembly are hard to remove or stuck midway, strike pump body lightly.
b. Do not move position of vanes.



INSPECTION

1. Wash all parts completely.
2. Replace worn or damaged parts.
3. Control edge of plunger must be sharp and contact surfaces must not exhibit any noticeable running tracks. If such is not the case, replace plunger.
4. Check for height of all rollers.

Difference in max. and min. roller height should be less than 0.02 mm (0.0008 in).



ASSEMBLY

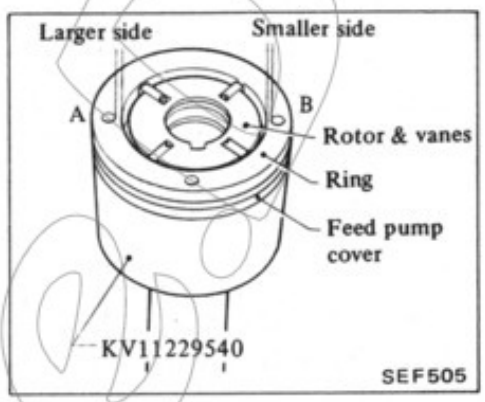
It should be noted that following service parts assemblies should always be replaced as a unit.

- Distributor head, control sleeve and plunger
- Feed pump assembly (pump impeller and vanes with eccentric ring)
- Plunger spring kit
- Roller assembly
- Flyweight kit
- Governor lever assembly

PREPARATION

Dip all movable parts and O-rings in test oil and clean.

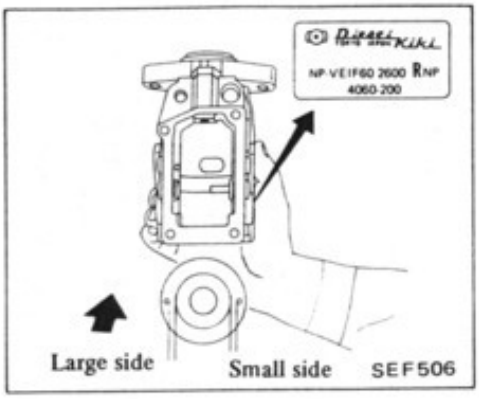
1. Set feed pump cover, rotor with vanes, and ring on service tool KV11229540.
   1) Align the three holes in feed pump cover and ring.
   2) Do not change positions of vanes.
   3) Holes A and B in ring are not equally spaced to inner wall of ring.



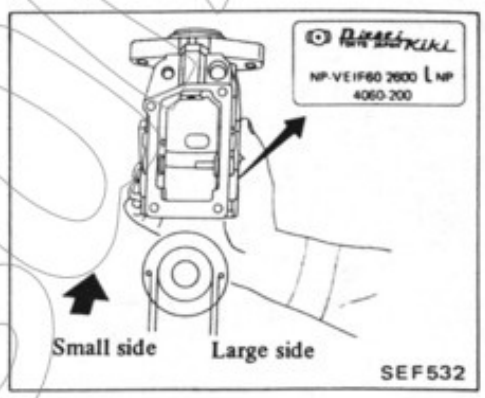
2. Install feed pump cover, rotor with vanes, and ring to pump housing.

Be careful to install liner correctly. If left and right are reversed, fuel will not be discharged from feed pump.

When fuel injection pump rotates in direction "R"



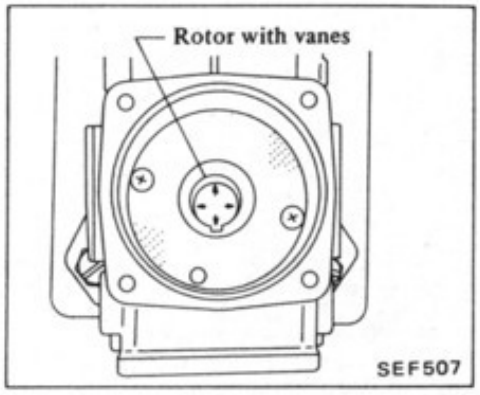
When fuel injection pump rotates in direction "L"



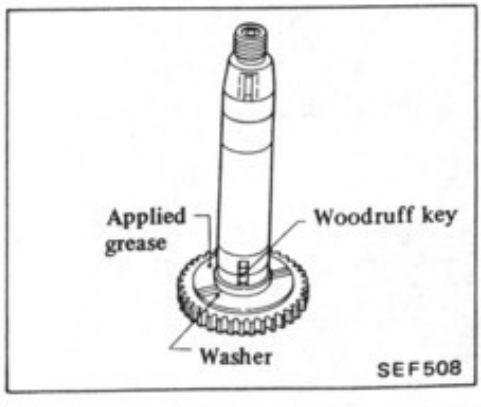
The following description applies to fuel injection pumps that rotate in direction "R".

3. Turn fuel injection pump 180°, and remove service tool KV11229540. Tighten screw to retain pump cover.

a. When tightening screws, be careful not to scratch inner wall of pump housing.
b. After tightening screws, make sure that rotor with vanes moves smoothly.

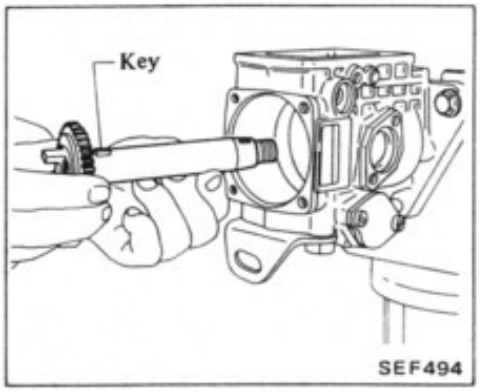


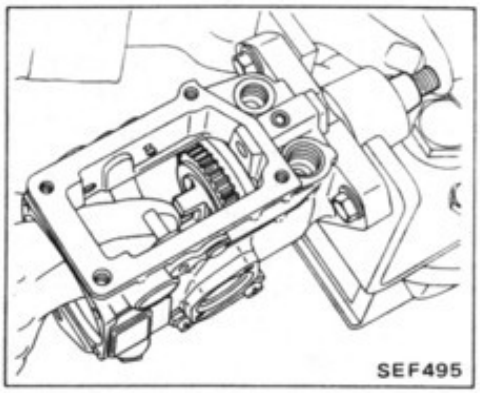
4. Make sure that drive shaft and gear are assembled properly, as shown.



5. Install drive shaft to housing while key in drive shaft engages with key groove in rotor.

Be careful not to scratch oil seals and inner wall of housing.



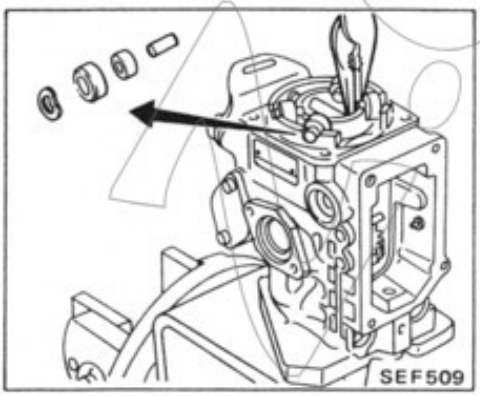


6. Set drive shaft's nail parallel to timer.

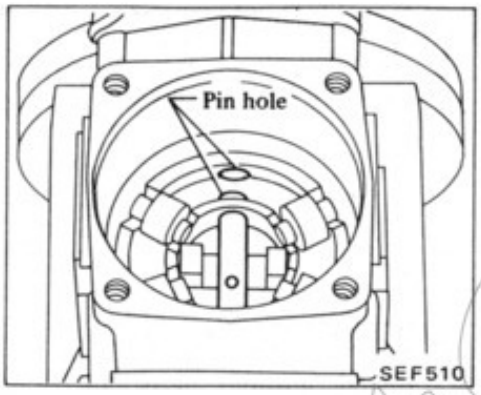
7. Install roller and holder.

a. Do not interchange roller positions. If they are interchanged, refer to Inspection for correction.

b. Make sure that washer is situated outward of rollers.



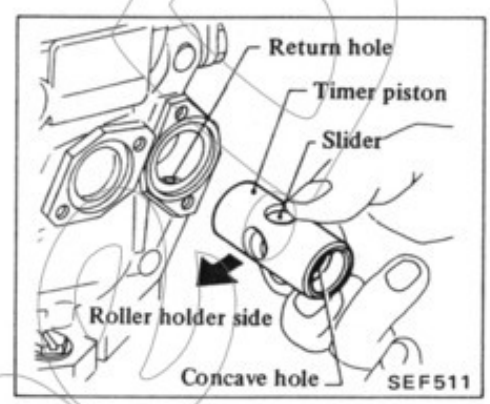
8. Align holder and timer adjusting pin holes.



9. Install timer piston and slider as a unit.

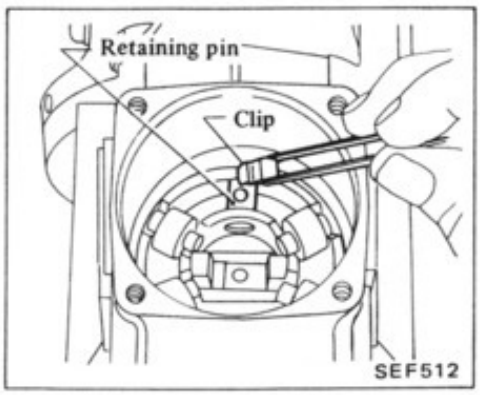
a. Make sure that hole in slider faces towards roller holder.

b. Make sure that concave hole in piston is on same side as return hole.



10. Insert timer adjusting pin into timer piston slider, and secure with retaining pin and clip.

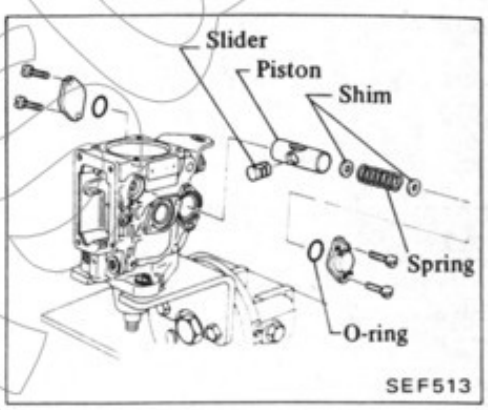
Make sure that timer piston moves smoothly.



11. Install timer, using a 0.6 mm (0.024 in) thick shim, then install timer spring, shim, O-ring, and cover, in that order.

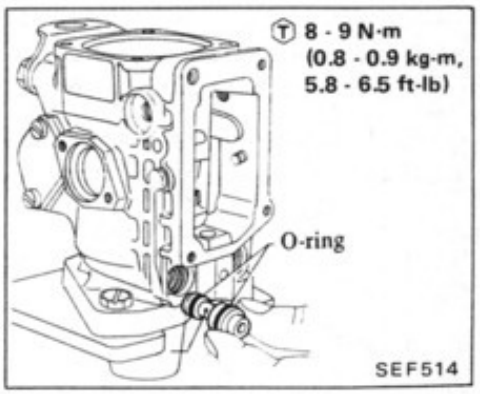
a. Use at least one shim on each side of timer spring.

b. Use shims that have been selected during bench test.

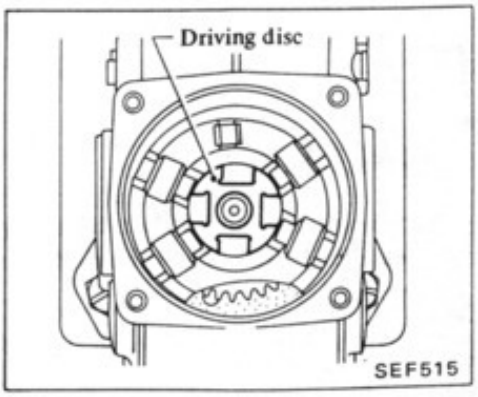


12. Install regulating valve.

Be careful not to scratch O-rings.



13. Install driving disc with its concave side facing up.

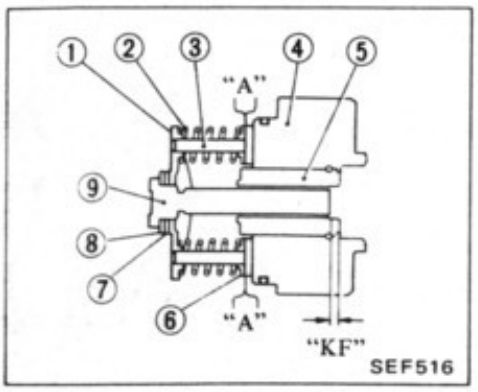


14. Measurement of plunger spring set length (dimension "KF")

Dimension "KF" is the distance between the end face of the distributor barrel and the end face of the plunger.

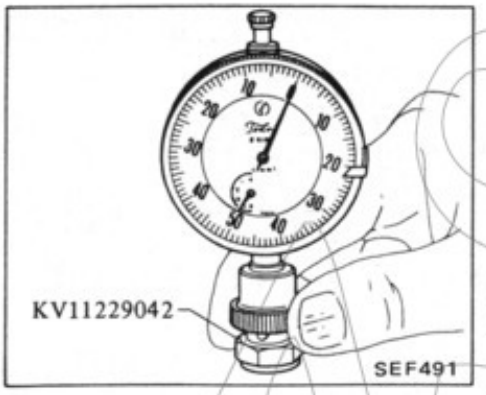
(1) Install distributor head, as shown.

- **Do not insert shim into "A" portion before measuring.**

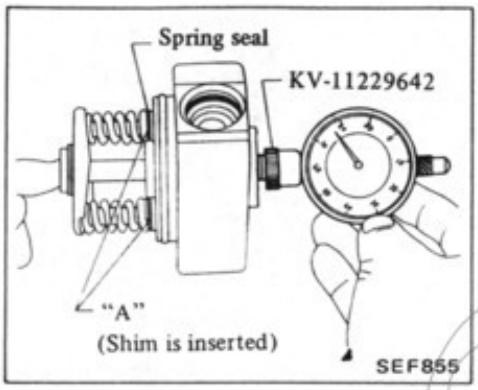


1 Spring seat
2 Plunger spring
3 Guide pin
4 Distributor head
5 Distributor barrel
6 Spring seat
7 Washer
8 Shim
9 Plunger

(2) Set dial gauge so that it can compress 25 mm (0.98 in), and reset to zero.



(3) Apply force (not enough to compress plunger spring) to plunger's bottom in axial direction, and measure dimension "KF" with dial gauge, as shown.



(4) Determine the shim to be used by calculating difference between standard and measured dimensions.

Standard dimension "KF":
LD20
5.8 mm (0.228 in)
LD28
6.6 mm (0.260 in)

[Example]
When measured (dial gauge reading) value is 5.4 mm,
6.6 mm - 5.4 mm = 1.2 mm (shim thickness to be used)

a. **When there are not shims available of a thickness which matches specified dimensions, use slightly thicker shim.**
b. **Use selected shim with distributor head in step 14-(3) above.**
c. **Use the same size shim on each side of distributor head.**
d. **Shims are available in seven different thicknesses.**

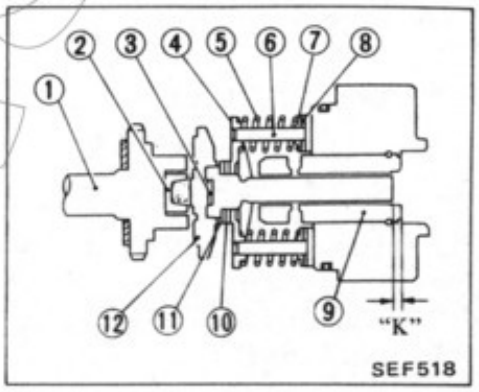
Part number	Thickness mm (in)
16882-V0700	0.5 (0.020)
16882-V0701	0.8 (0.031)
16882-V0702	1.0 (0.039)
16882-V0703	1.2 (0.047)
16882-V0704	1.5 (0.059)
16882-V0705	1.8 (0.071)
16882-V0706	2.0 (0.079)

15. Adjustment of plunger dimensions (Measurement of dimension "K")

Dimension "K" is the distance from the end face of the distributor barrel to the end face of the plunger top, when the plunger is at the bottom dead center position.

(1) Install parts as shown.

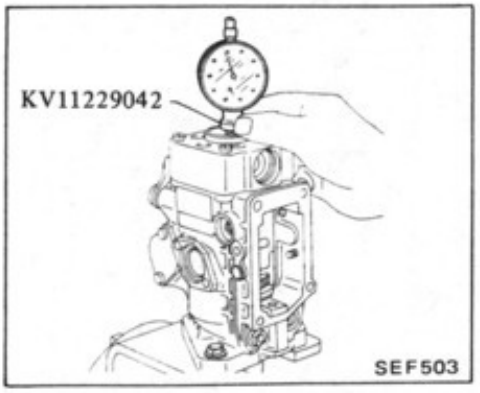
a. **Do not install "spring" on driving disc.**
b. **When inserting plunger and shim into cam disc, make sure that drive pin is situated in groove at bottom of plunger.**



1 Drive shaft
2 Driving disc
3 Shim
4 Spring seat
5 Plunger spring
6 Guide pin
7 Spring seat
8 Shim
9 Distributor barrel
10 Washer
11 Shim
12 Cam disc

(2) Using a dial gauge, measure dimension as shown.

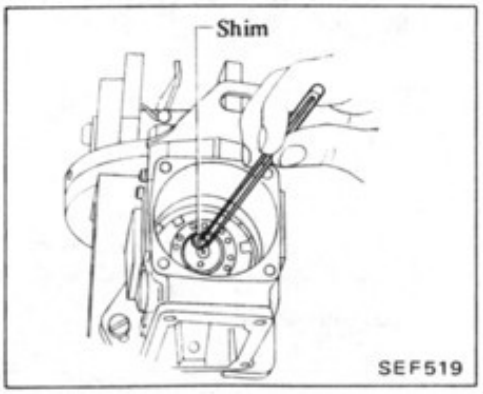
a. **Rotate drive shaft so that plunge is set at bottom dead center.**
b. **Securely mount distributor head with screws.**



(3) Determine shim to be used by calculating difference between measured (dial gauge reading) value and standard dimension "K", and position

that shim on plunger's bottom.

"K" = 3.3 mm (0.130 in)

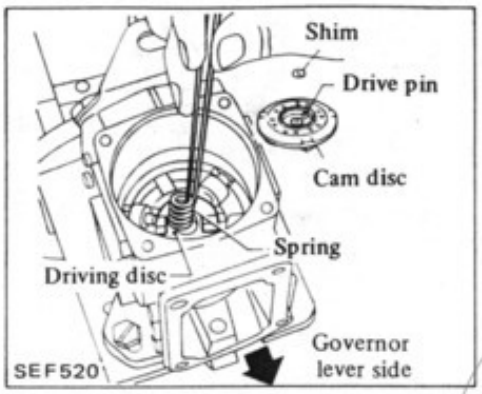


a. **When measured value is greater than standard dimension "K", use a thicker shim.**
b. **After shim has been positioned, measure dimension again to ensure that it is correct.**
c. **Shims are available in thirteen difference thickness.**

Part number	Thickness mm (in)
16884-V0700	1.92 (0.0756)
16884-V0701	2.00 (0.0787)
16884-V0702	2.08 (0.0819)
16884-V0703	2.16 (0.0850)
16884-V0704	2.24 (0.0882)
16884-V0705	2.32 (0.0913)
16884-V0706	2.40 (0.0945)
16884-V0707	2.48 (0.0976)
16884-V0708	2.56 (0.1008)
16884-V0709	2.64 (0.1039)
16884-V0710	2.72 (0.1071)
16884-V0711	2.80 (0.1102)
16884-V0712	2.88 (0.1134)

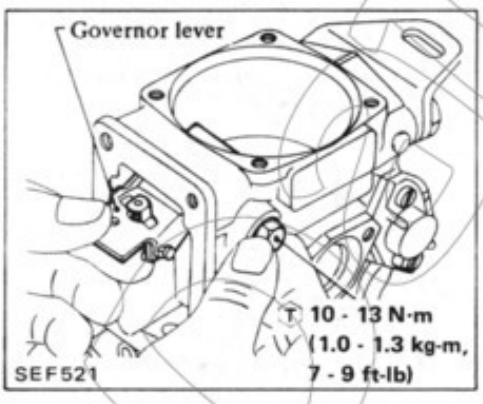
16. Install spring in top of driving disc, and install cam disc and shim in that order.

Make sure cam disc drive pin and drive shaft key way face governor lever side.



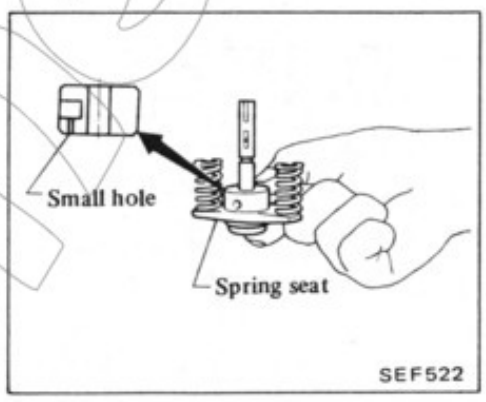
17. Install governor lever.

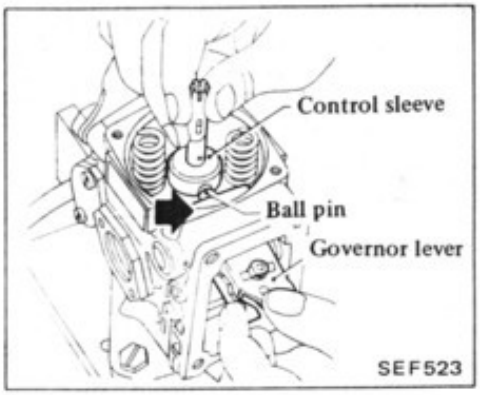
Avoid pulling on start spring and start idle spring.



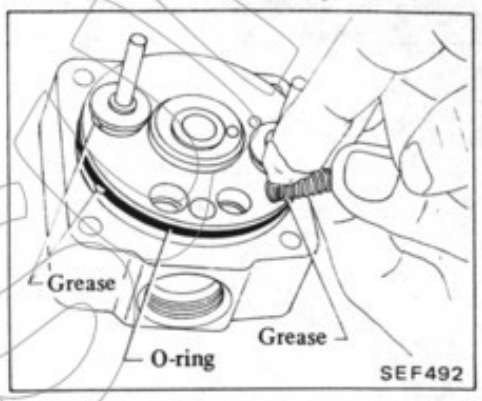
18. Install plunger assembly.

a. **Insert ball pin for governor lever into hole in control sleeve (shown by arrow).**
b. **Make sure control sleeve is installed with its small hole facing spring seat side.**



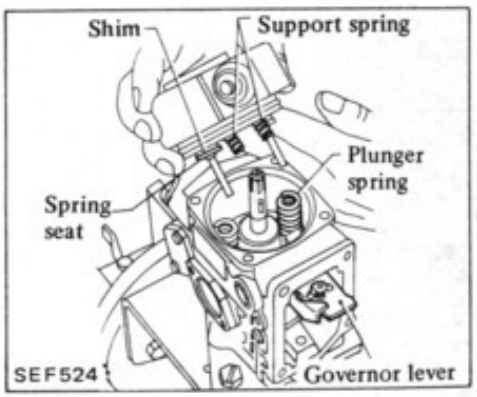


19. Apply a coat of grease to guide pin, shim and spring seat, and attach these parts to distributor head.

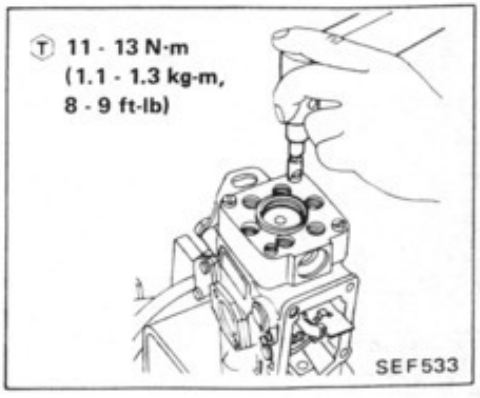


20. Install distributor head.

a. **Always face support spring toward governor lever.**
b. **Be careful not to drop spring.**
c. **Make sure that ball pin for governor lever is inserted properly into hole in control sleeve.**
d. **After installing distributor head, make sure that plunger spring is at guide hole in spring seat.**

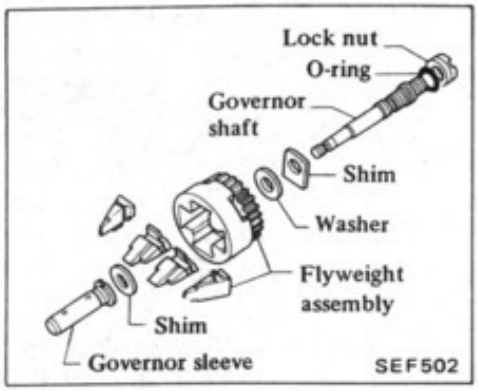


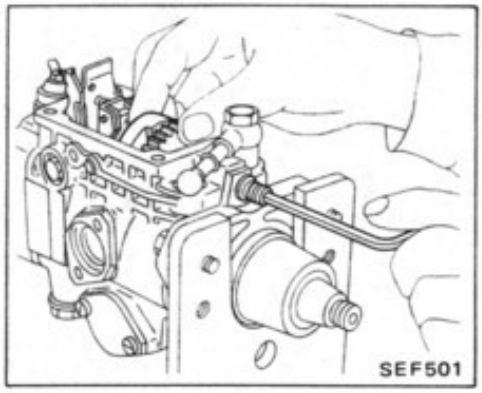
21. Tighten distributor head.



22. Attach governor weight assembly.

When installing governor shaft, be careful not to scratch O-rings.





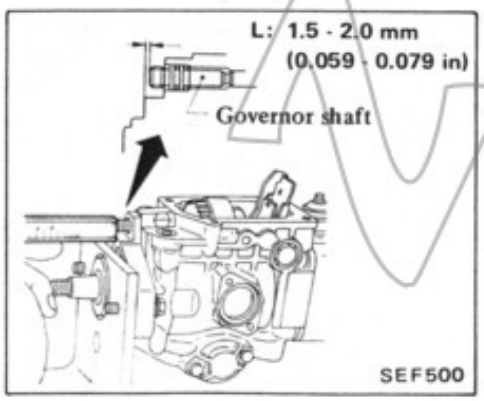
23. Adjust dimension "L", as shown.

"L":
1.5 - 2.0 mm (0.059 - 0.079 in)

a. Tighten lock nut to specified torque.

Ⓣ : 25 - 29 N·m (2.5 - 3.0 kg-m, 18 - 22 ft-lb)

b. Governor shaft has a left hand thread for injection pumps designed to rotate in "R" direction, and a right hand thread for those rotating in "L" direction.

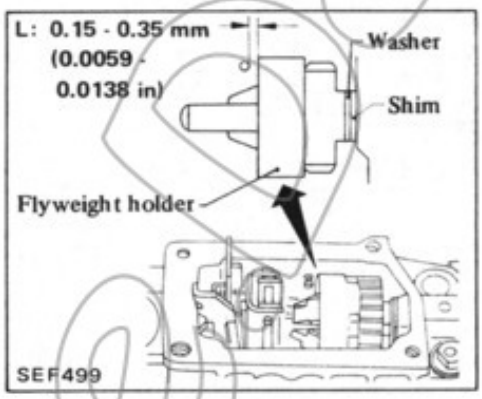


24. Measure axial play of flyweight holder. If it is not within specified range, adjust it by means of shim.

"L":
0.15 - 0.35 mm
(0.0059 - 0.0138 in)

Shims are available in five different thickness.

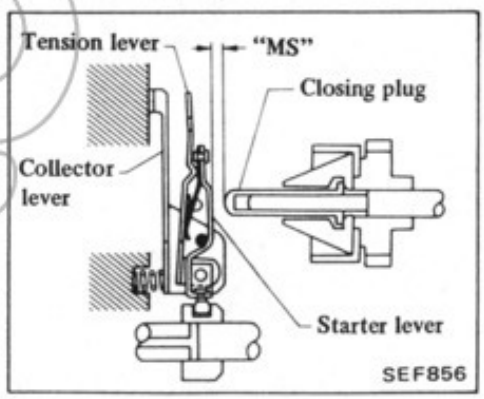
Part number	Thickness mm (in)
19208-V0700	1.05 (0.0413)
19208-V0701	1.25 (0.0492)
19208-V0702	1.45 (0.0571)
19208-V0703	1.65 (0.0650)
19208-V0704	1.85 (0.0728)



25. Measurement of dimension "MS" (for determining starting amount of fuel injection)

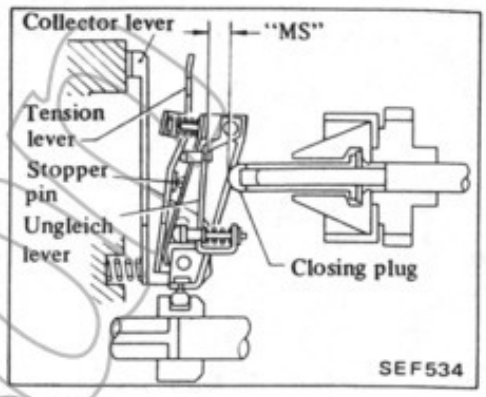
LD20 engine

Dimension "MS" is the distance from closing plug to start lever.

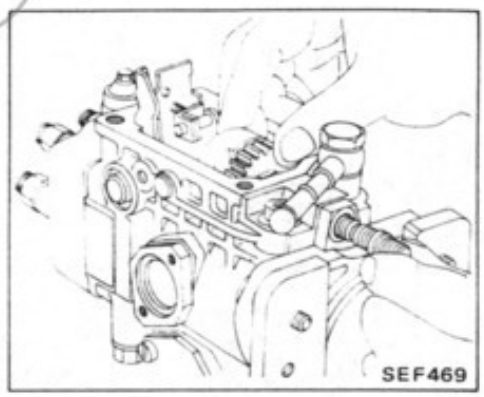


LD28 engine

Dimension "MS" is the distance from closing plug to Ungleich lever.

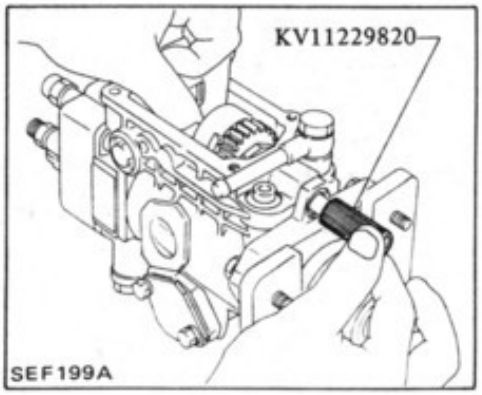


(1) Remove lock nut, governor shaft and flyweight assembly.

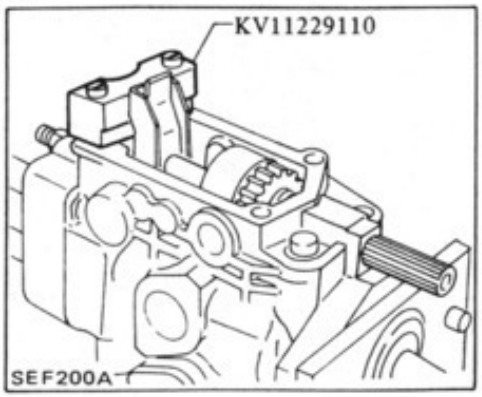


(2) Install Tool and flyweight assembly in place of governor shaft.

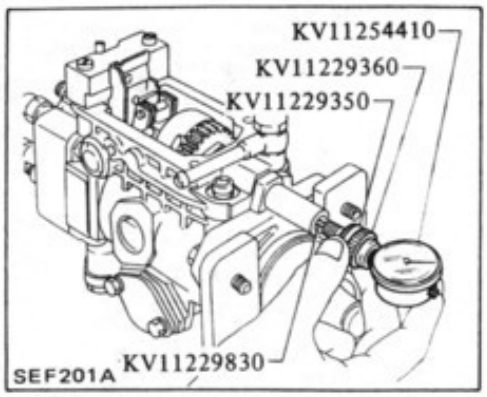
Be sure to install shim and washer when installing flyweight assembly.



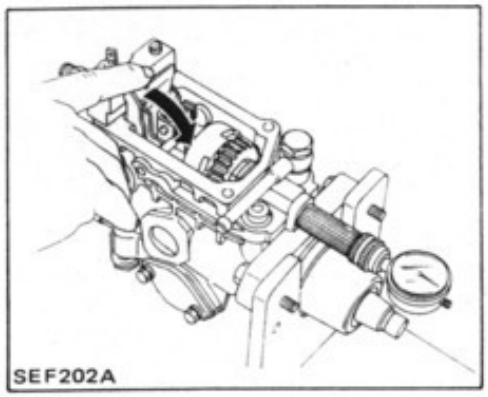
(3) Set Tool, as shown.



(4) Install dial gauge together with rod.

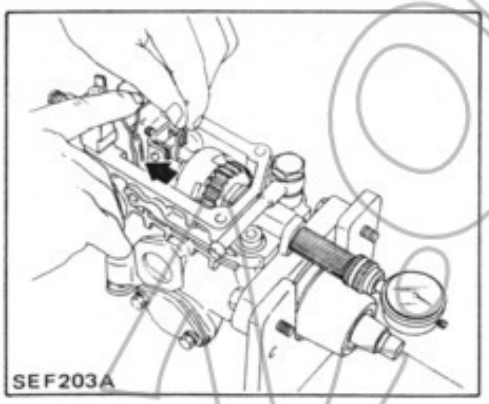


(5) Press governor sleeve to flyweight and set dial gauge to "0".



(6) Push tension lever until it comes into contact with stopper pin. Return governor sleeve until start lever (LD20) or Ungleich lever (LD28) comes into contact with tension lever and read dial gauge.

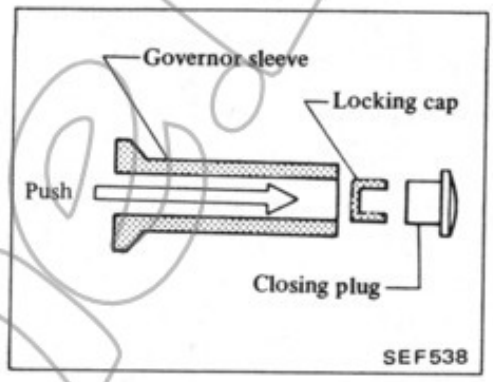
MS:
LD20
1.1 - 1.3 mm (0.043 - 0.051 in)
LD28
1.7 - 1.9 mm (0.067 - 0.075 in)



(7) If dial gauge indication is not within this range, replace closing plug and adjust dimension "MS" to that range.

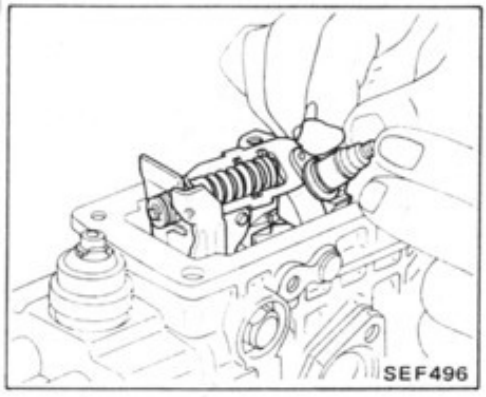
Closing plugs are available in eight different thickness.

Part number	Thickness mm (in)	Applied	
		LD20	LD28
19207-V0700	7.8 (0.307)	–	X
19207-V0701	8.0 (0.315)	–	X
19207-V0702	8.2 (0.323)	–	X
19207-V0703	8.4 (0.331)	–	X
19207-V0704	8.6 (0.339)	–	X
19207-V0705	8.8 (0.346)	X	X
19207-V0706	9.0 (0.354)	X	X
19207-V0707	9.2 (0.362)	X	X
19207-W1700	9.4 (0.370)	X	–
19207-W1701	9.6 (0.378)	X	–
19207-W1702	9.8 (0.386)	X	–
19207-W1703	10.0 (0.394)	X	–
19207-W1704	10.2 (0.402)	X	–

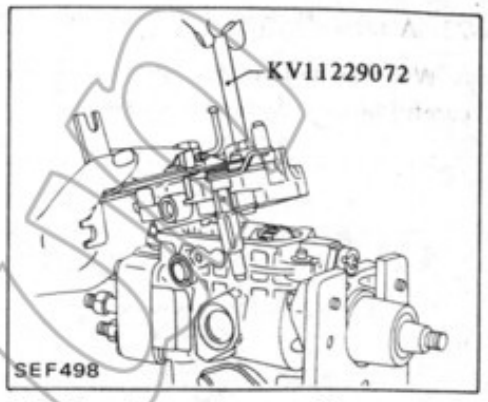


26. Install control lever shaft.

Apply a coat of grease to lever shaft end.

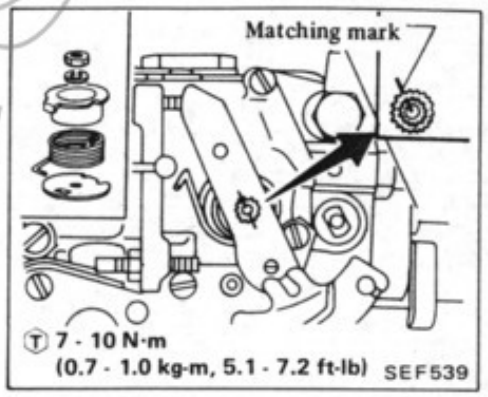


27. Install pump cover.



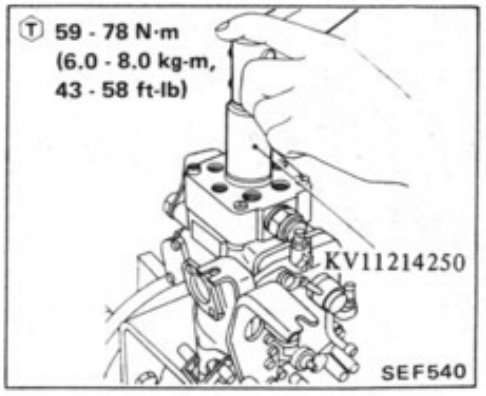
28. Install speed control lever assembly.

Align aligning marks of speed control lever and control lever shaft.

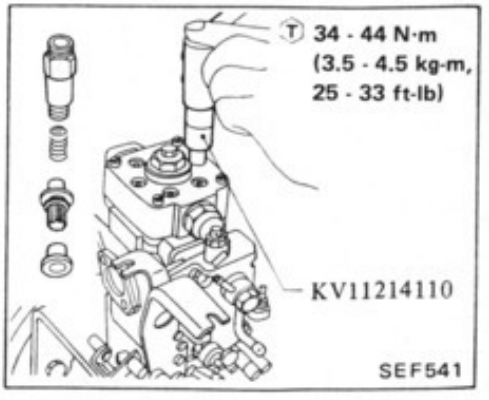


29. Install fuel cut solenoid valve and plug.

Always replace plugs with new ones.



30. Install delivery valve.
a. **Always use new washers.**
b. **Make sure that delivery valve is reinstalled in its original position.**



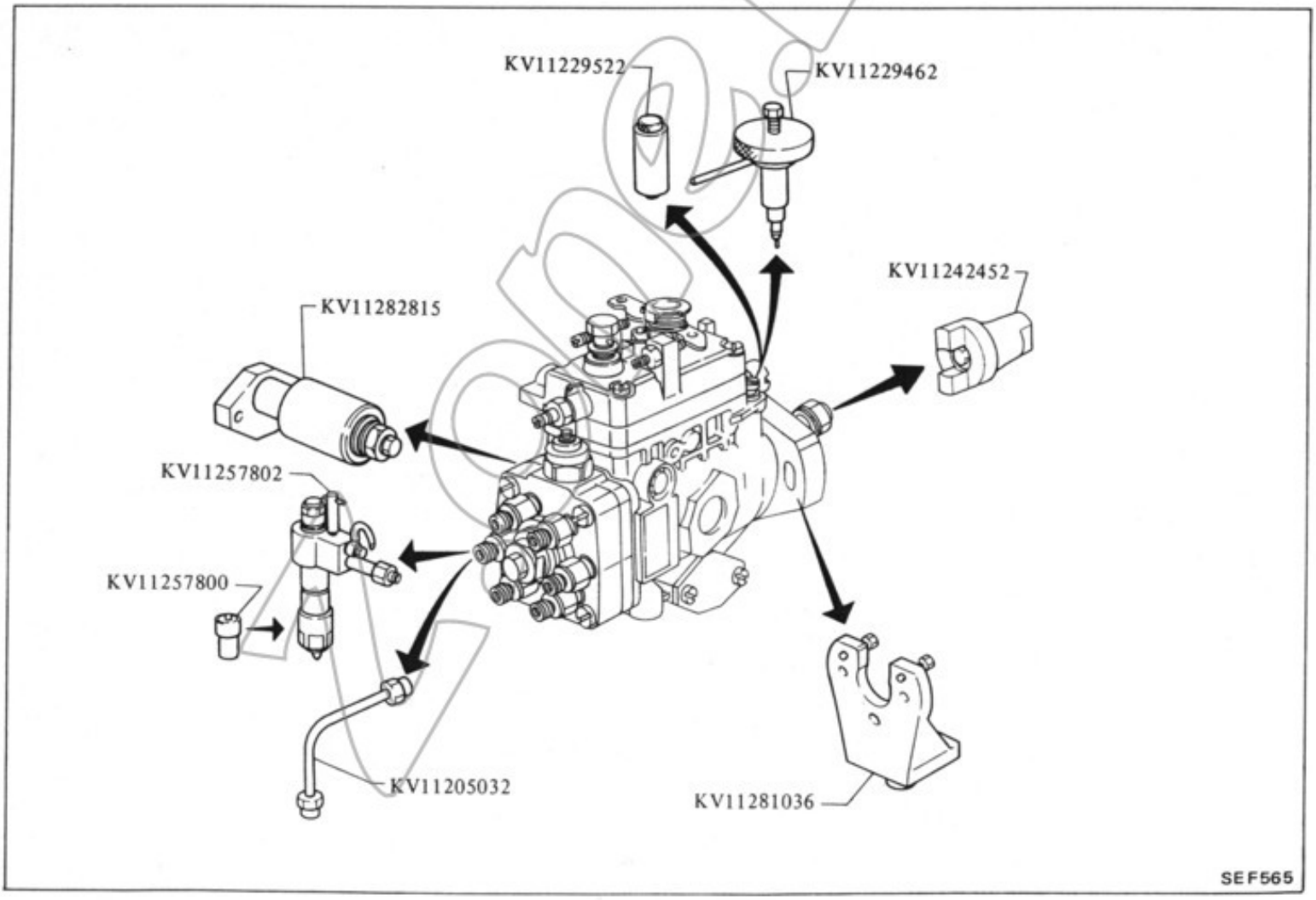
TESTING OF INJECTION PUMP

PREPARATION

INJECTION PUMP TEST CONDITIONS

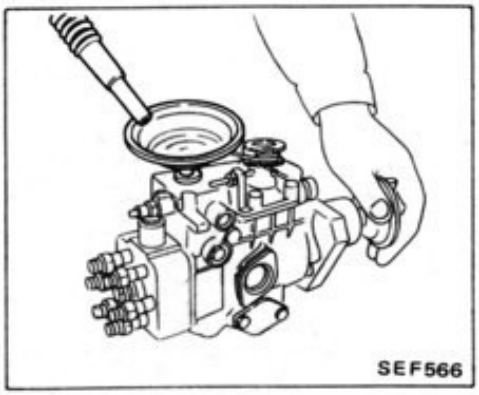
Nozzle	KV11257800
Nozzle holder	KV11257802
Nozzle starting pressure kPa (bar, kg/cm², psi)	14,711 - 15,201 (147.1 - 152.0, 150 - 155, 2,133 - 2,204)
Nozzle tube Inner dia. x outer dia. x length mm (in)	KV11205032 2.0 x 6.0 x 840 (0.079 x 0.236 x 33.07)
Fuel feed pressure kPa (bar, kg/cm², psi)	20 (0.20, 0.2, 2.8)
Fuel (test oil)	Shell calibration fluid B, Bosch oil OL61V11
Fuel temperature °C (°F)	45 - 50 (113 - 122)
Rotating direction	Right (observed from the drive shaft)
Injection sequence	LD20 1 - 3 - 4 - 2 LD28 1 - 5 - 3 - 6 - 2 - 4

1. Prepare necessary service tools.

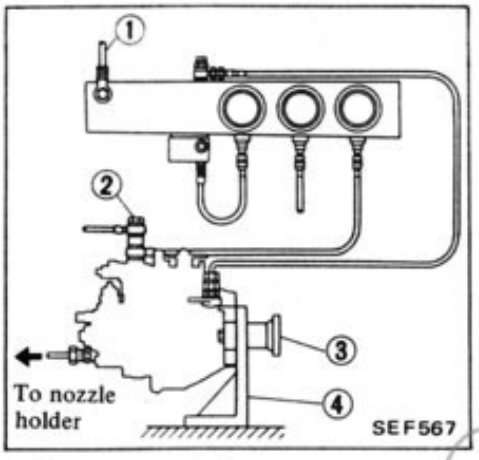


2. Pour test oil into fuel injection pump.

Test oil should be Shell calibration fluid B, Bosch test oil-OL61V11 or its equivalent.

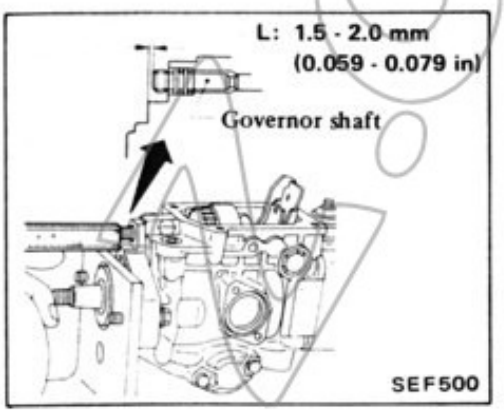


3. Install fuel injection pump to pump tester.
4. Connect necessary piping.



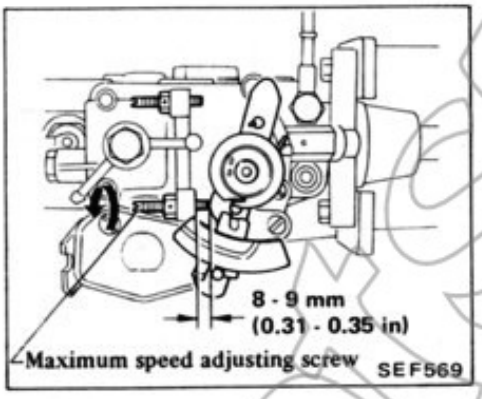
1 Fuel supply inlet from pump tester
2 Overflow valve
3 Coupling
4 Fixing stand

5. Make sure that governor shaft is properly installed.



6. Run in fuel injection pump as follows:
(1) Maintain test oil in tank to 45 to 50°C (113 to 122°F).
(2) Set control lever at "full load" using a spring.

Set maximum speed adjusting screw in position shown, by turning counterclockwise.



(3) Furnish specified voltage of 12 volts to fuel-cut solenoid valve to activate it.
(4) Rotate fuel injection pump by hand to see if it moves smoothly.
(5) Rotate fuel injection pump at 300 rpm to make sure that all air inside pump chamber is discharged through overflow valve.
(6) Set feed oil pressure at 20 kPa (0.20 bar, 0.2 kg/cm², 2.8 psi).
(7) Run in fuel injection pump by rotating it at 1,000 rpm for ten minutes.

If fuel leakage, fuel injection failure or unusual noise is noticed, immediately halt pump tester operation and check fuel injection pump for abnormalities.

ADJUSTMENT

PREADJUST FULL-LOAD DELIVERY

1. Set control lever at "full load" using a spring.

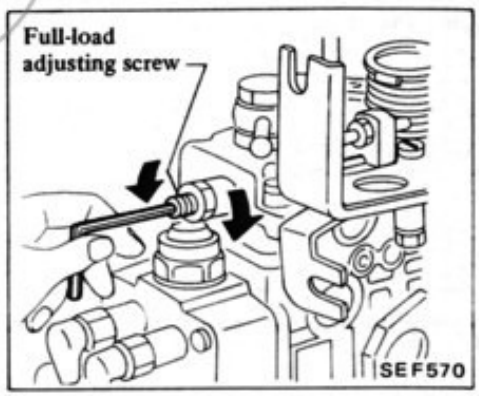
Set maximum speed adjusting screw in position shown, by turning counterclockwise. Refer to step 6–(2) in Preparation.

2. Furnish specified voltage of 12 volts to activate fuel-cut solenoid valve.
3. Rotate fuel injection pump at specified rpm, and measure amount of fuel injection.

Standard fuel injection:
LD20
33.3 - 34.3 mℓ
(1.17 - 1.21 Imp fl oz)/1,000 stroke at 900 rpm
LD28
34.6 - 35.6 mℓ
(1.22 - 1.25 Imp. fl oz)/1,000 stroke at 1,200 rpm

4. If fuel injection is less than standard, adjust it with full-load adjusting screw.

Turn adjusting screw clockwise to increase fuel injection.



ADJUSTMENT OF FEED PUMP PRESSURE

1. Repeat steps 1 and 2 outlined under heading "Preadjust Full Load Delivery".
2. Measure feed pump pressure at specified fuel injection pump rpms'.

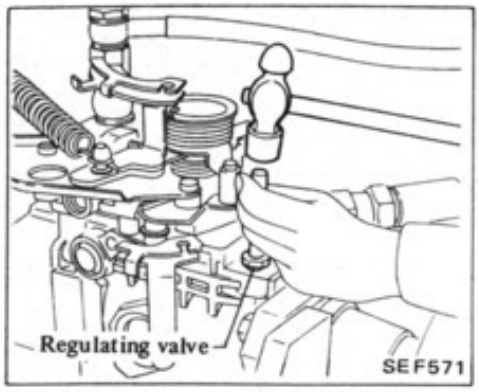
LD20

Fuel injection pump rpm	Specified pressure kPa (bar, kg/cm², psi)
900	294 - 353 (2.94 - 3.53, 3.0 - 3.6, 43 - 51)
1,800	500 - 559 (5.00 - 5.59, 5.1 - 5.7, 73 - 81)
2,300	628 - 686 (6.28 - 6.86, 6.4 - 7.0, 91 - 100)

LD28

Fuel injection pump rpm	Specified pressure kPa (bar, kg/cm², psi)
800	353 - 412 (3.53 - 4.12, 3.6 - 4.2, 51 - 60)
1,800	579 - 637 (5.79 - 6.37, 5.9 - 6.5, 84 - 92)
2,500	726 - 785 (7.26 - 7.85, 7.4 - 8.0, 105 - 114)

a. When measured pressure is lower than specifications.

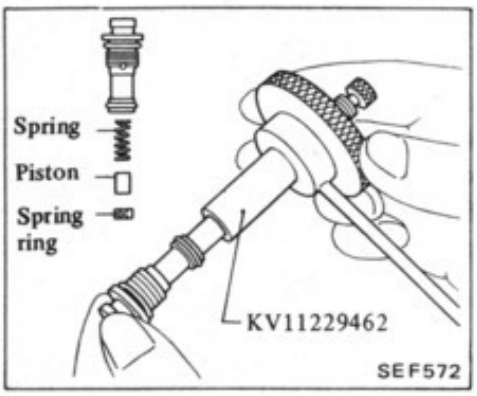


Push in plug that is driven into regulating valve body.

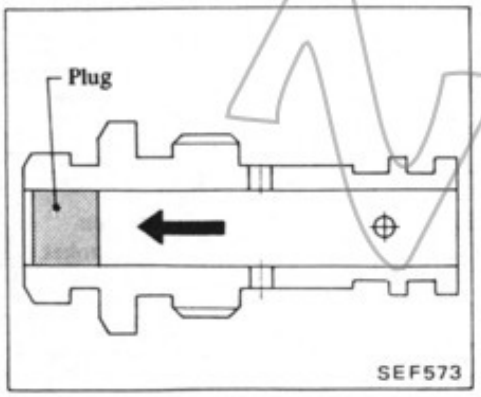
Be careful not to push plug in too far.

b. When measured pressure is higher than specifications.

Remove regulating valve from fuel injection pump, and disassemble regulating valve using KV11229462.

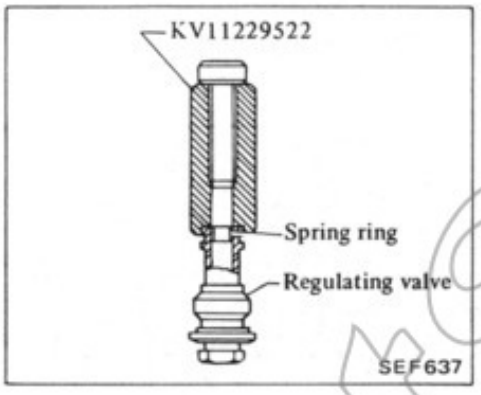


Drive plug out until it is flush with end face of regulating valve.



Install spring, piston and spring ring, in that order, to regulating valve.

Make sure that spring ring is flush with end face or regulating valve body when it is pushed in.



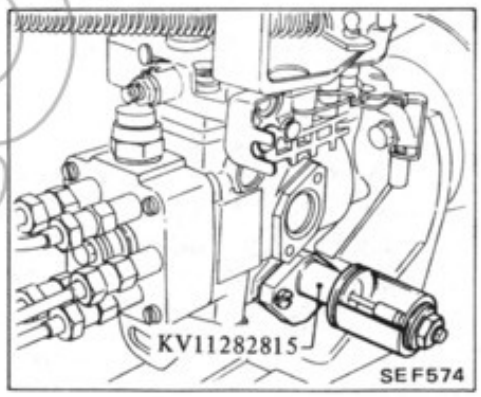
Attach regulating valve to fuel injection pump.

Ⓣ : **Regulating valve**
8 - 9 N·m
(0.8 - 0.9 kg-m,
5.8 - 6.5 ft-lb)

Adjust supply pump pressure to specifications. Refer to step 2-a.

ADJUST SPEED TIMER

1. Repeat steps 1 and 2 outlined under heading "Preadjust Full-Load Delivery".
2. Remove cover from high pressure side (side without spring) of timer, **and attach service tool KV11282815 to that side.**



3. Measure timer piston strokes at specified fuel injection pump rpm indicated below.

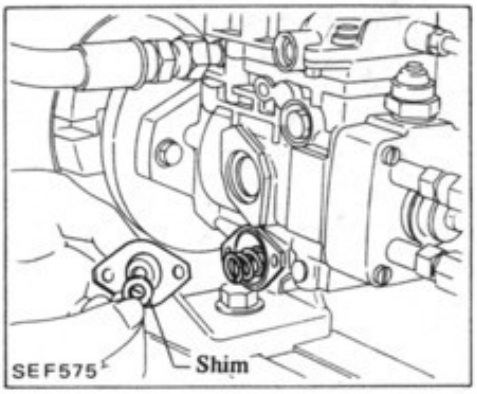
LD20

Fuel injection pump rpm	Timer piston stroke mm (in)
900	1.1 - 1.7 (0.043 - 0.067)
1,800	4.6 - 5.8 (0.181 - 0.228)
2,300	6.9 - 7.8 (0.272 - 0.307)

LD28

Fuel injection pump rpm	Timer piston stroke mm (in)
1,200	2.5 - 3.1 (0.098 - 0.122)
1,800	4.9 - 6.1 (0.193 - 0.240)
2,300	7.7 - 8.6 (0.303 - 0.339)

4. If timer piston stroke is not within specified range, remove cover from low pressure side of timer and adjust piston stroke by adding shim(s).



a. Shims (service parts)

Parts number	Thickness mm (in)
16880-V0700	0.6 (0.024)
16880-V0701	0.7 (0.028)
16880-V0702	0.9 (0.035)
16880-V0703	1.0 (0.039)
16880-V0704	1.2 (0.047)

b. Make sure that at least one shim is used on each side of timer spring.

ADJUST FUEL INJECTION UNDER FULL-LOAD

1. Set control lever at "full load" using a spring.
2. Furnish specified voltage of 12 volts to activate fuel cut solenoid valve.
3. Measure fuel injection at each specified fuel injection pump rpm.

Standard fuel injection:

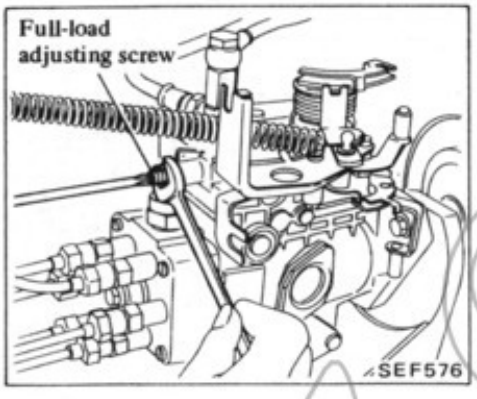
LD20

Fuel injection pump rpm	Standard fuel injection mℓ (Imp fl oz)/1,000 stroke
600	32 - 36 (1.13 - 1.27)
900	33.3 - 34.3 (1.17 - 1.21)
2,300	31.4 - 35.4 (1.11 - 1.25)

LD28

Fuel injection pump rpm	Standard fuel injection mℓ (Imp fl oz)/1,000 stroke
600	28.5 - 32.5 (1.00 - 1.14)
1,200	34.6 - 35.6 (1.22 - 1.25)
2,300	28.8 - 32.8 (1.01 - 1.15)

4. If fuel injection is not within standard range, adjust it using full-load adjusting screw.



ADJUST FUEL INJECTION DURING IDLE

1. Pull spring until control lever comes into contact with idle speed adjusting screw.
2. Furnish specified voltage of 12 volts to activate fuel cut solenoid valve.
3. Measure fuel injection at specified fuel injection pump rpm.

Standard fuel injection:

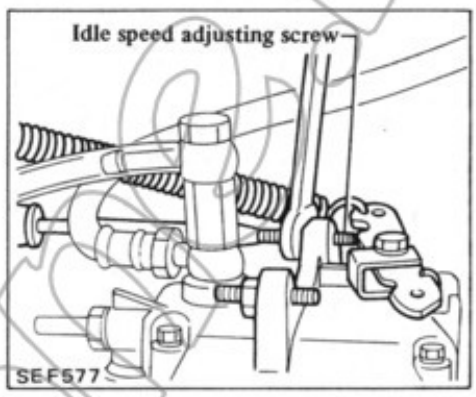
LD20

Fuel injection pump rpm	Standard fuel injection mℓ (Imp fl oz)/1,000 stroke
325	8.9 - 11.9 (0.31 - 0.42)
500	Less than 4 (0.14)

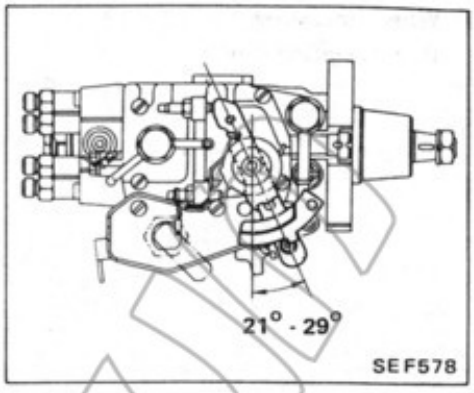
LD28

Fuel injection pump rpm	Standard fuel injection mℓ (Imp fl oz)/1,000 stroke
350	7.1 - 10.1 (0.25 - 0.36)
500	Less than 4 (0.14)

4. If fuel injection is not within specified range, adjust using idle speed adjusting screw.



a. **Tightening this screw will increase fuel injection amount.**
b. **Make sure that control lever angle is set at 21 to 29° range.**
If control lever angle is not within specified range, adjust it by re-positioning control lever on control shaft. (One serration pitch: 15°)
After control lever has been re-positioned, be sure to measure amount of fuel injection at idle speed again.



ADJUST FUEL INJECTION DURING START

1. Set control lever at "full load" by pulling spring.
2. Furnish specified voltage of 12 volts to activate fuel-cut solenoid valve.
3. Measure fuel injection at specified fuel injection pump rpm.

Standard fuel injection:

LD20

More than 53 mℓ (1.87 Imp fl oz)/1,000 stroke at 100 rpm

LD28

More than 50 mℓ (1.76 Imp fl oz)/1,000 stroke at 100 rpm

4. If fuel injection is lower than standard, check "MS" dimension. Refer to step 25 for Injection Pump Assembly.

ADJUST FUEL INJECTION AT MAX. PUMP RPM

1. Set control lever at "full load" by pulling spring.
2. Furnish specified voltage of 12 volts to activate fuel-cut solenoid valve.
3. Measure fuel injection at specified fuel injection rpm.

Standard fuel injection:

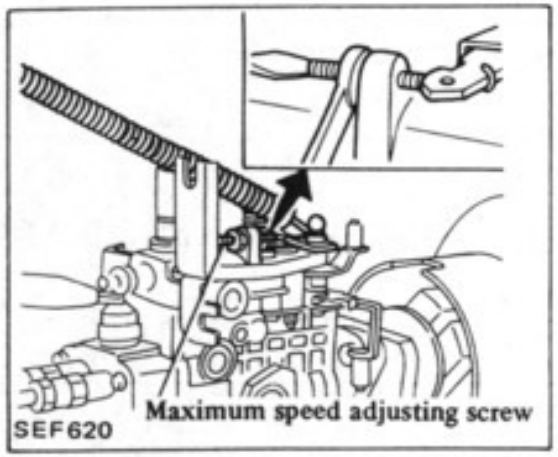
LD20

Fuel injection pump rpm	Standard fuel injection mℓ (Imp fl oz)/1,000 strokes
2,700	7.5 - 13.5 (0.26 - 0.48)
2,800	Less than 6 (0.21)

LD28

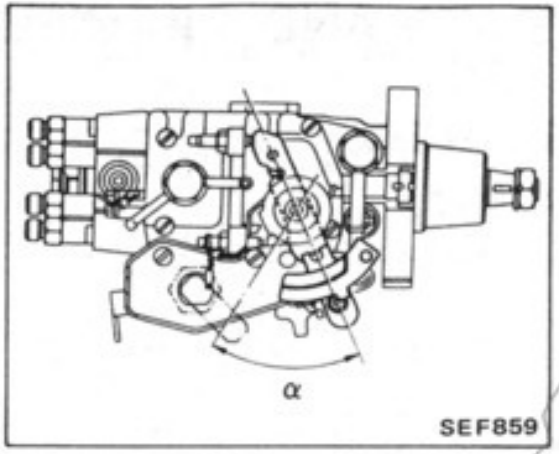
Fuel injection pump rpm	Standard fuel injection mℓ (Imp fl oz)/1,000 stroke
2,700	8.7 - 14.7 (0.31 - 0.52)
2,800	Less than 5 (0.18)

4. If fuel injection is not within standard range, adjust using max. speed adjusting screw.



a. Tightening screw will increase fuel injection.

b. Make sure that control lever angle is within 36° to 46° range (LD20), or within 39° to 49° range.



α: **LD20 36° - 46°**
LD28 39° - 49°

MEASURE OVERFLOW AMOUNT

1. Set control lever at "full load" by pulling spring.
2. Furnish specified voltage of 12 volts to activate fuel-cut solenoid valve.
3. Measure fuel overflow at specified fuel injection rpm.

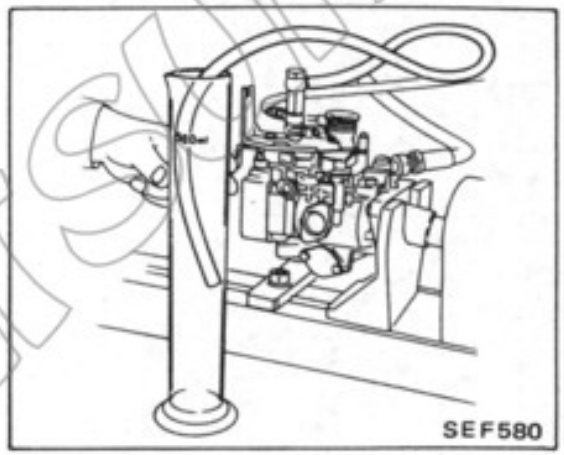
Fuel overflow:

LD20

31 - 75 mℓ
(1.09 - 2.64 Imp fl oz)/10 sec.
at 1,000 rpm

LD28

48 - 92 mℓ
(1.69 - 3.24 Imp fl oz)/10 sec.
at 1,000 rpm



OPERATION CHECK OF FUEL CUT SOLENOID VALVE

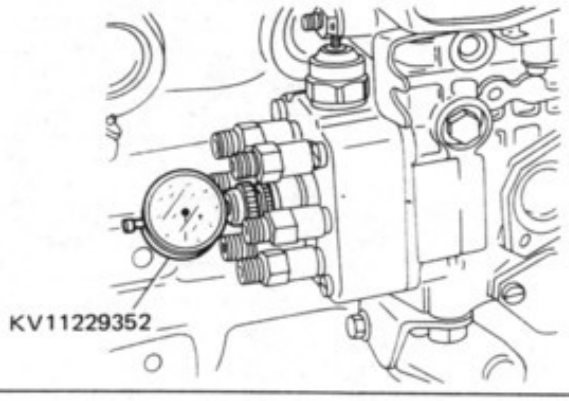
When engine is idling and fuel-cut solenoid valve current is OFF, be sure there is no injection. This check has to be done for approx. 5 seconds.

SERVICE DATA AND SPECIFICATIONS

INSPECTION AND ADJUSTMENT

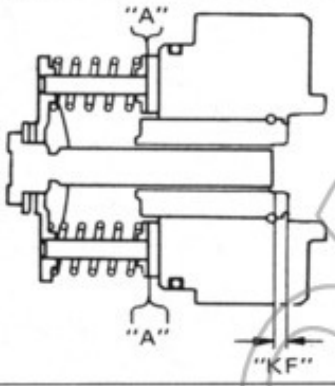
INSTALLATION OF INJECTION PUMP

Item \ Applied engine	LD20	LD28
Plunger lift mm (in)	0.78 ±0.04 (0.0307 ±0.0016)	0.75 ±0.04 (0.0295 ±0.0016)



USE OF ADJUSTMENT VALUE AND ADJUSTING SHIM WHEN INSTALLING INJECTION PUMP

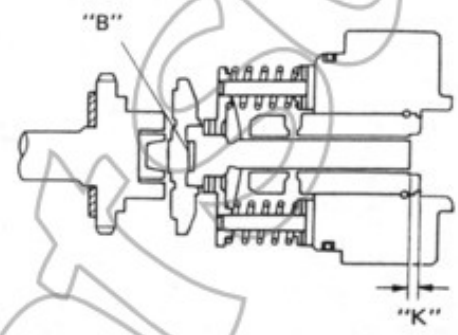
Item \ Applied engine	LD20	LD28
Dimension "KF" mm (in)	5.8 (0.228)	6.6 (0.260)



Adjusting shim ("A" position)

Part number	Thickness mm (in)
16882-V0700	0.5 (0.020)
16882-V0701	0.8 (0.031)
16882-V0702	1.0 (0.039)
16882-V0703	1.2 (0.047)
16882-V0704	1.5 (0.059)
16882-V0705	1.8 (0.071)
16882-V0706	2.0 (0.079)

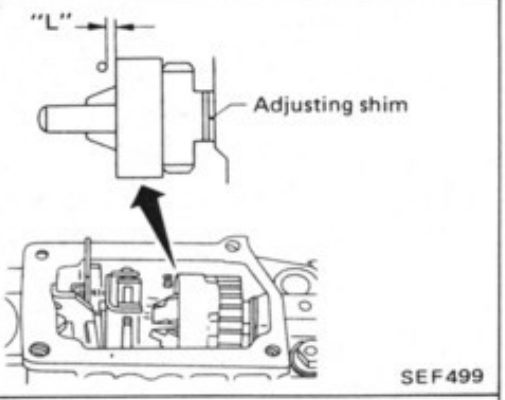
Item \ Engine	LD20 & LD28
Dimension "K" mm (in)	3.3 (0.130)



Adjusting shim ("B" position)

Part number	Thickness mm (in)
16884-V0700	1.92 (0.0756)
16884-V0701	2.00 (0.0787)
16884-V0702	2.08 (0.0819)
16884-V0703	2.16 (0.0850)
16884-V0704	2.24 (0.0882)
16884-V0705	2.32 (0.0913)
16884-V0706	2.40 (0.0945)
16884-V0707	2.48 (0.0976)
16884-V0708	2.56 (0.1008)
16884-V0709	2.64 (0.1039)
16884-V0710	2.72 (0.1071)
16884-V0711	2.80 (0.1102)
16884-V0712	2.88 (0.1134)

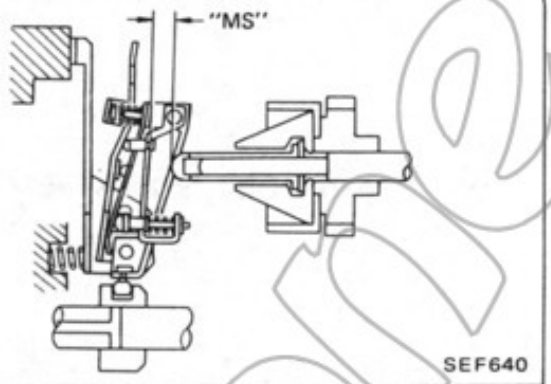
Axial play of flyweight holder "L" mm (in)	0.15 - 0.35 (0.0059 - 0.0138)



Adjusting shim

Part number	Thickness mm (in)
19208-V0700	1.05 (0.0413)
19208-V0701	1.25 (0.0492)
19208-V0702	1.45 (0.0571)
19208-V0703	1.65 (0.0650)
19208-V0704	1.85 (0.0728)

Item \ Applied engine	LD20	LD28
Dimension "MS" mm (in)	1.1 - 1.3 (0.043 - 0.051)	1.7 - 1.9 (0.067 - 0.075)

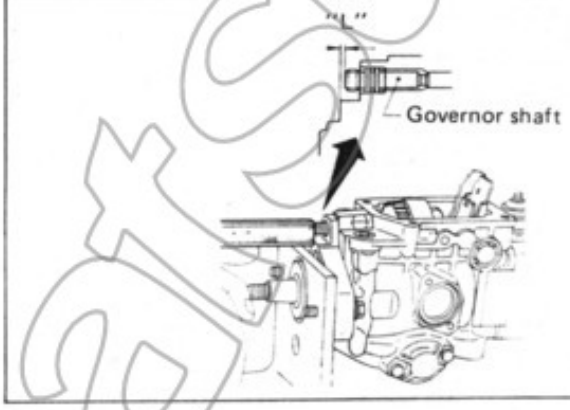


Adjusting closing plug Thickness mm (in)

Part number	LD20	LD28
19207-V0700	–	7.8 (0.307)
19207-V0701	–	8.0 (0.315)
19207-V0702	–	8.2 (0.323)
19207-V0703	–	8.4 (0.331)
19207-V0704	–	8.6 (0.339)
19207-V0705	8.8 (0.346)	
19207-V0706	9.0 (0.354)	
19207-V0707	9.2 (0.362)	

Part number	LD20	LD28
19207-W1700	9.4 (0.370)	–
19207-W1701	9.6 (0.378)	–
19207-W1702	9.8 (0.386)	–
19207-W1703	10.0 (0.394)	–
19207-W1704	10.2 (0.402)	–

Dimension "L" mm (in)	1.5 - 2.0 (0.059 - 0.079)



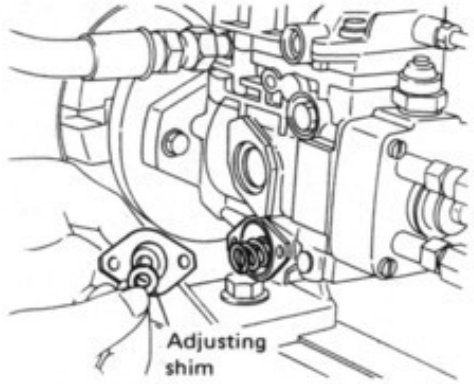
ADJUSTMENT VALUE ON INJECTION PUMP TESTER

Feed pump pressure

Fuel injection pump rpm	Specified pressure kPa (bar, kg/cm^2, psi)	
	LD20	LD28
800	–	353 - 412 (3.53 - 4.12, 3.6 - 4.2, 51 - 60)
900	294 - 353 (2.94 - 3.53, 3.0 - 3.6, 43 - 51)	–
1,800	500 - 559 (5.00 - 5.59, 5.1 - 5.7, 73 - 81)	579 - 637 (5.79 - 6.37, 5.9 - 6.5, 84 - 92)
2,300	628 - 686 (6.28 - 6.86, 6.4 - 7.0, 91 - 100)	–
2,500	–	726 - 785 (7.26 - 7.85, 7.4 - 8.0, 105 - 114)

Speed timer (Timer piston stroke)

Fuel injection pump rpm	Timer piston stroke mm (in)	
	LD20	LD28
900	1.1 - 1.7 (0.043 - 0.067)	–
1,200	–	2.5 - 3.1 (0.098 - 0.122)
1,800	4.6 - 5.8 (0.181 - 0.228)	4.9 - 6.1 (0.193 - 0.240)
2,300	6.9 - 7.8 (0.272 - 0.307)	7.7 - 8.6 (0.303 - 0.339)



Adjusting shim

Part number	Thickness mm (in)
16880-V0700	0.6 (0.024)
16880-V0701	0.7 (0.028)
16880-V0702	0.9 (0.035)
16880-V0703	1.0 (0.039)
16880-V0704	1.2 (0.047)

Fuel injection quantity

Setting condition of fuel injection pump	Fuel injection pump rpm	Standard fuel injection mℓ (Imp fl oz)/1,000 stroke	
		LD20	LD28
Start	100	More than 53 (1.87)	More than 50 (1.76)
Idle	325	8.9 - 11.9 (0.31 - 0.42)	–
	350	–	7.1 - 10.1 (0.25 - 0.36)
	500	Less than 4 (0.14)	Less than 4 (0.14)
Full-load	600	32 - 36 (1.13 - 1.27)	28.5 - 32.5 (1.00 - 1.14)
	900	33.3 - 34.3 (1.17 - 1.21)	–
	1,200	–	34.6 - 35.6 (1.22 - 1.25)
	2,300	31.4 - 35.4 (1.11 - 1.25)	28.8 - 32.8 (1.01 - 1.15)
Max. pump speed	2,700	7.5 - 13.5 (0.26 - 0.48)	8.7 - 14.7 (0.31 - 0.52)
	2,800	Less than 6 (0.21)	Less than 5 (0.18)
Fuel overflow (10 sec at 1,000 rpm)		31 - 75 mℓ (1.09 - 2.64 Imp fl oz)	48 - 92 mℓ (1.69 - 3.24 Imp fl oz)

INJECTION NOZZLE ASSEMBLY

Type	Closed, throttle type
Injection angle	0°
Initial injection pressure kPa (bar, kg/cm², psi)	
New	13,239 - 14,024 (132.4 - 140.2, 135 - 143, 1,920 - 2,033)
Used	12,259 - 13,239 (122.6 - 132.4, 125 - 135, 1,778 - 1,920)

Adjusting shim

Part number	Thickness mm (in)
16613-V0700	0.50 (0.0197)
16613-V0702	0.54 (0.0213)
16613-V0704	0.58 (0.0228)
16613-V0706	0.62 (0.0244)
16613-V0708	0.66 (0.0260)
16613-V0710	0.70 (0.0276)
16613-V0712	0.74 (0.0291)
16613-V0714	0.78 (0.0307)
16613-V0716	0.82 (0.0323)
16613-V0718	0.86 (0.0339)
16613-V0720	0.90 (0.0354)
16613-V0722	0.94 (0.0370)
16613-V0724	0.98 (0.0386)
16613-V0760	1.00 (0.0394)

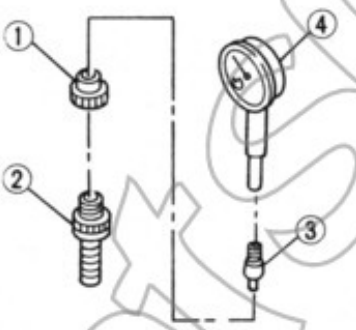
TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Distributor head to pump housing	11 - 13	1.1 - 1.3	8 - 9
Plug to distributor head	59 - 78	6.0 - 8.0	43 - 58
Delivery valve to distributor head	44 - 54	4.5 - 5.5	33 - 40
Pivot pin to pump housing	10 - 13	1.0 - 1.3	7 - 9
Regulating valve to pump housing	8 - 9	0.8 - 0.9	5.8 - 6.5
Control shaft to control lever	7 - 10	0.7 - 1.0	5.1 - 7.2
Injection pump pulley nut	59 - 69	6.0 - 7.0	43 - 51
Injection nozzle to engine	16 - 21	1.6 - 2.1	12 - 15
Injection nozzle to tube	22 - 25	2.2 - 2.5	16 - 18
Spill tube	15 - 18	1.5 - 1.8	11 - 13
Feed pump cover to pump housing	2 - 3	0.2 - 0.3	1.4 - 2.2
Speed timer cover to pump housing	6 - 8	0.6 - 0.8	4.3 - 5.8
Governer shaft lock nut	25 - 29	2.5 - 3.0	18 - 22
Overflow valve	20 - 25	2.0 - 2.5	14 - 18
Maximum and idle speed adjusting screw lock nut	6 - 9	0.6 - 0.9	4.3 - 6.5
Full load adjusting screw lock nut	6 - 9	0.6 - 0.9	4.3 - 6.5
Fuel cut solenoid valve	20 - 25	2.0 - 2.5	14 - 18
Plug bolt	14 - 20	1.4 - 2.0	10 - 14

SPECIAL SERVICE TOOLS

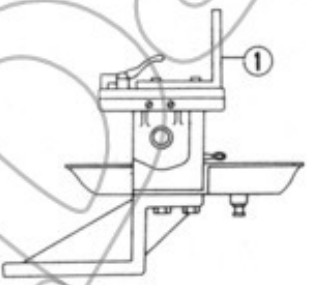
Adjusting device on car

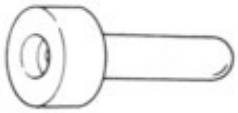
Tool number	Tool name
KV11229352 ① KV11229350 ② KV11229360 ③ KV11229370 ④ KV11254410	Measuring device (Set length of plunger spring) Holder Nut Pin Dial gauge



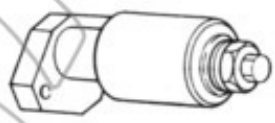
Disassembling and assembling tools

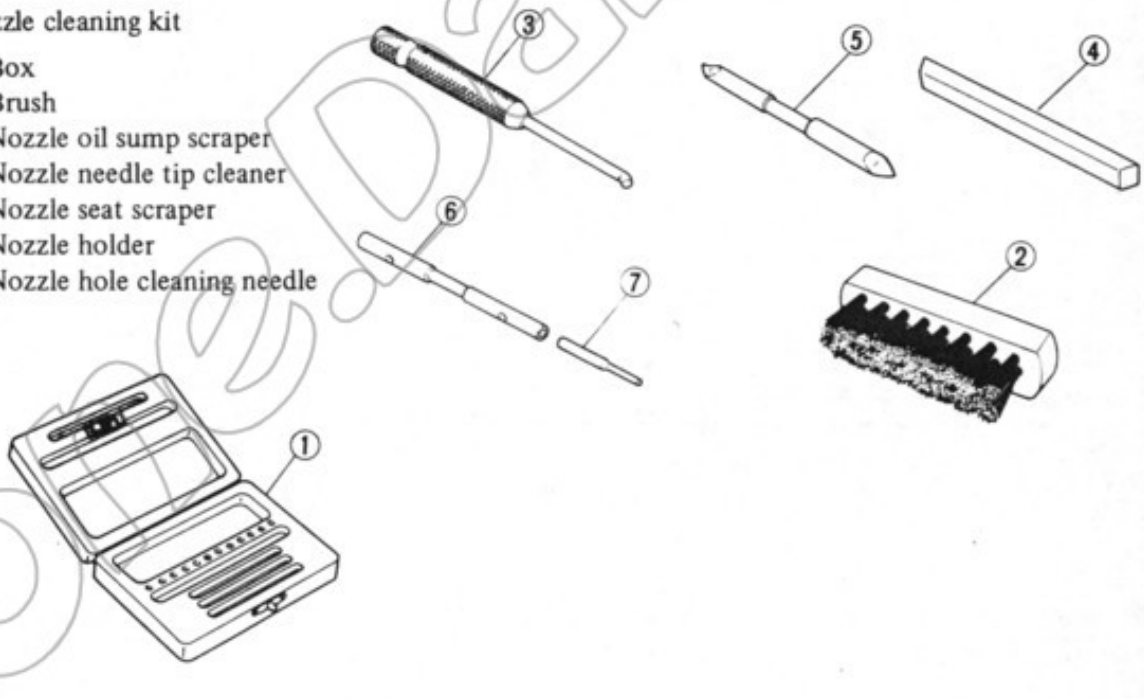
KV11294005 ① KV11244260	Universal vice assembly Injection pump attaching plate
KV11229072	Insert device
KV11214110	Socket wrench for delivery valve
KV11214270	Socket wrench for governor pivot bolt
KV11214260	Socket wrench for regulating valve
KV11214250	Socket wrench for distributor head plug



Tool number	Tool name
KV11215262	Governor shaft adjusting device 
KV11229540	Feed pump holder 
KV11229852 ① KV11229110 ② KV11229820 ③ KV11229830	"MS" measuring device set Block gauge Dummy shaft Rod 
KV11229042	"K" & "KF" measuring device 

Adjusting device on pump tester

KV11281036	Fixing stand 
KV11242452	Coupling 
KV11282815	Measuring device (Timer advance angle) 
KV11205032	Injection pipe [840 mm (33.07 in)] 
KV11229462	Extractor (Disassembling of regulating valve) 
KV11229522	Insert device (Assembling of regulating valve) 

Tool number	Tool name
KV11257802	Nozzle holder (Bosch type EF8511-9A) 
KV11257800	Nozzle (Bosch type DN 12SD12T) 
KV11289004 ① KV11290012 ② KV11290110 ③ KV11290122 ④ KV11290140 ⑤ KV11290150 ⑥ KV11290210 ⑦ KV11290220	Nozzle cleaning kit Box Brush Nozzle oil sump scraper Nozzle needle tip cleaner Nozzle seat scraper Nozzle holder Nozzle hole cleaning needle 
KV11292010	Nozzle centering device