SECTION 1F3

DIESEL ENGINE CONTROLS

Caution: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

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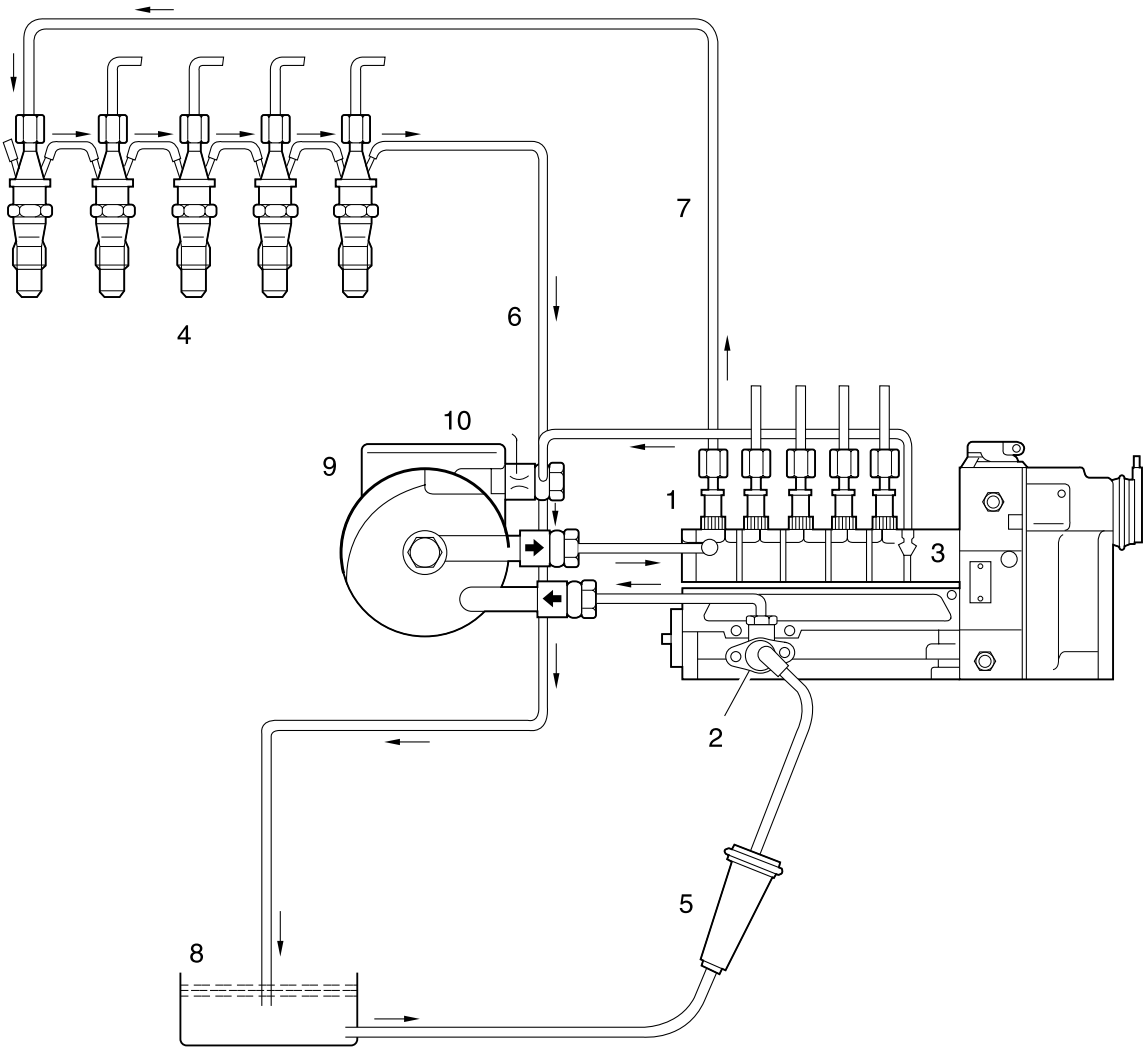
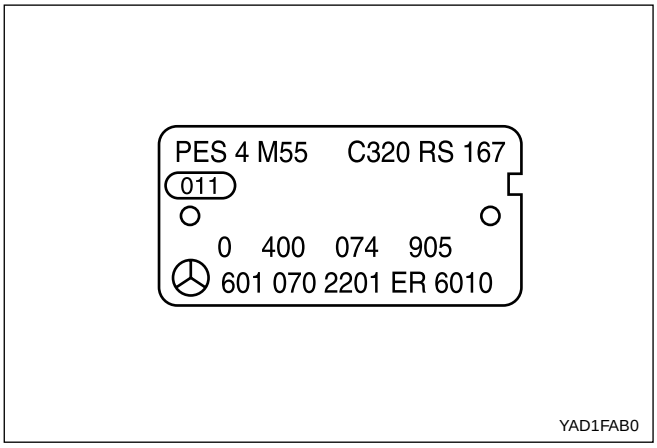
DESCRIPTION AND OPERATION

FUEL SYSTEM

Fuel Injection System



1 Fuel Injection Pump
2 Fuel Feed Pump
3 Overflow Valve
4 Injection Nozzle
5 Pre-filter
6 Fuel Return Hoses
7 Injection Line
8 Fuel Tank
9 Fuel Filter
10 Choke Orifice



Fuel Injection Pump Coding

PES 5M 55C 320 RS 167

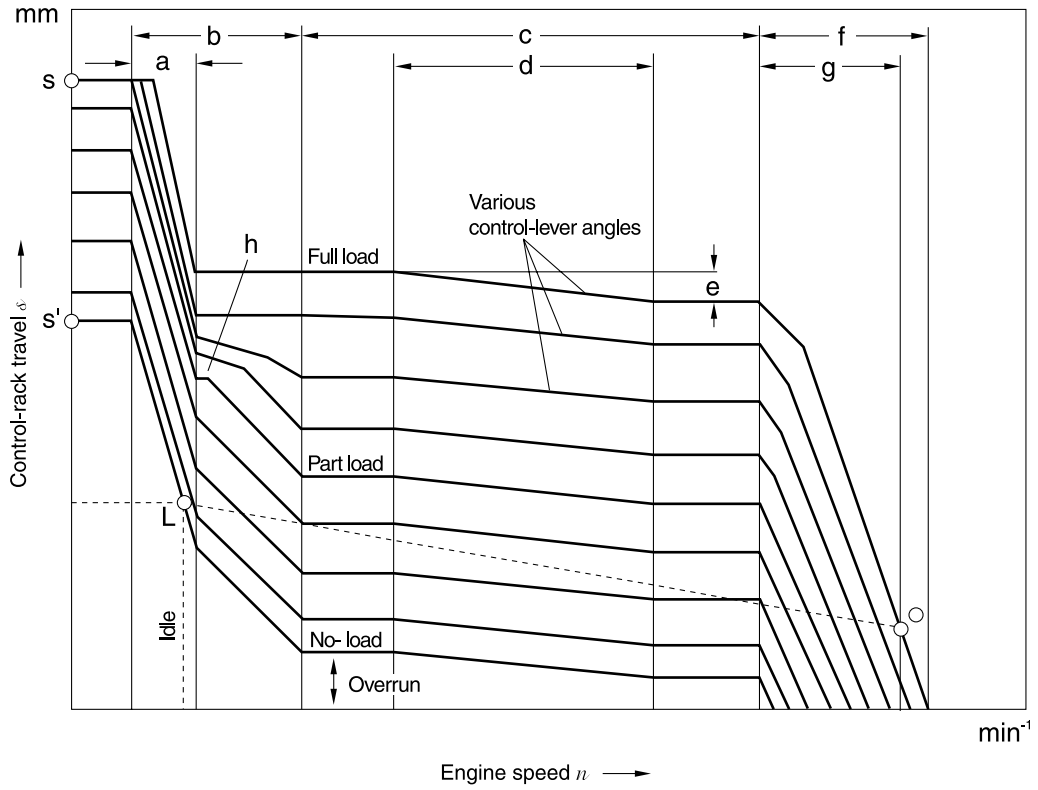
P Injection Pump
E Self - Driven
S End Flange Mounting
5 Number of Cylinders (5EA)
M Pump Size (Flange Stroke)
- M - 7 mm
- A - 8 mm
- M, W - 8 mm, 10 mm
- P - 10 mm, 11 mm, 12 mm
- Z - 12 mm
- O - 15 mm

55 Element Diameter
C Modification Letter
320 Assembly Number
R Direction of Rotation (clockwise)
S167 Special Version

GOVERNOR

RSF Minimum-maximum-speed governor

The RSF mechanical governor was developed specifically as a minimum-maximum-speed governor. It is suitable for use in those on-road vehicles (passenger cars and commercial vehicles) in which control requirements are restricted to low idle and high idle (maximum) speeds.control requirements are restricted to low idle and high idle (maximum) speeds. In the uncontrolled range between these two speed, the driver uses the accelerator pedal to directly adjust the setting of the injection-pump control rack so that the engine develops the right torque.



a Idle Range (Working Range of the Idle Spring)
b Extended Idle Range at No-Load and Minimum Part Load (Working Range of the Idle Spring and the Auxiliary Idle Spring)
c Uncontrolled Range
d Torque-Control Range (Working Range of the Torque-Control Spring)
e Torque-Control Travel
f Speed-Regulation Range (Working Range of the Governor Spring)
g Full-Load Speed Regulation to the High Idle Speed
h Start of the Auxiliary Idle-Spring Shutoff

S Start Setting With Accelerator Pedal fully Depressed (Cold-Start)
S ' Start Setting With Accelerator Pedal Released (Hot/ Warm Start)
L Low-Idle-Speed Setting
O High-Idle-Speed Setting

n_{1u} Low Idle Speed
n_{1o} High Idle Speed
n_{vo} Maximum Full-Load Speed
n_1 Speed at Start of Torque Control
n_2 Speed at End of Torque Control

Speed-sensing mechanism stage 1 (low idle)

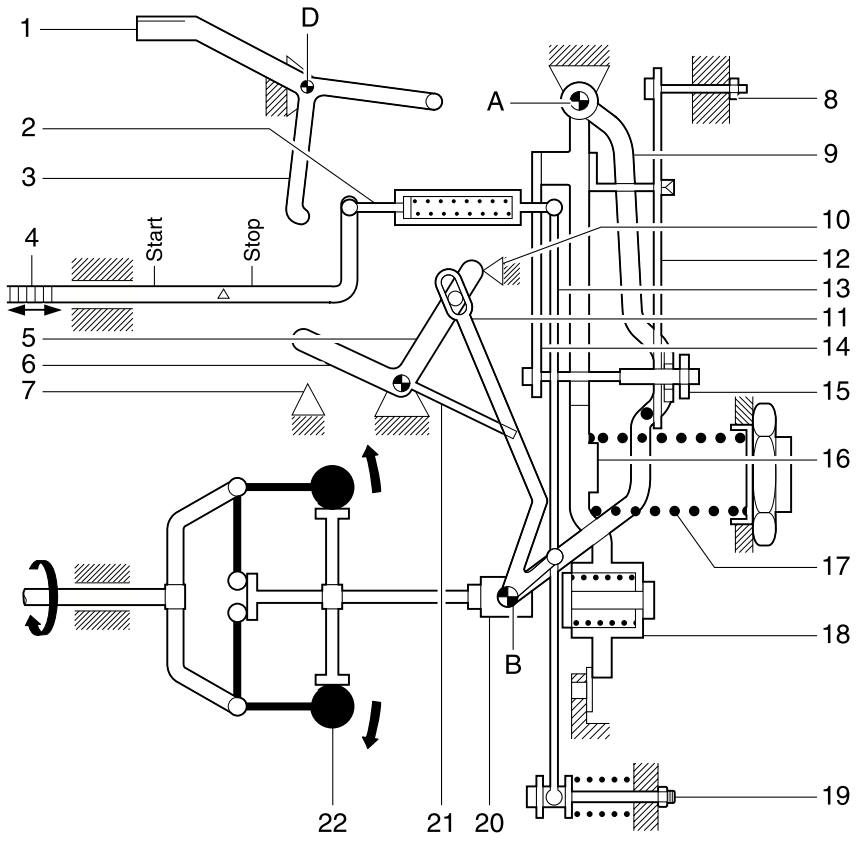
The force path starts at flyweights (22) and travels through sliding sleeve (20) and guide lever (9) to idle spring (12) and auxiliary idle spring (14). Both springs are leaf springs.

Speed-sensing machanism, stage 2 (until full-load speed regulation)

After completion of idle-speed sleeve travel, the force path is from governor sliding sleeve (20) through torque-control spring retainer (18) and tensioning lever (16) to governor spring (17).

The flyweights (22) are fastened directly to the injection-pump camshaft and when they move outward, governor sliding sleeve (20) is moved axially. The sliding sleeve does not move except in the idle, full-load torque-control, and speed-regulation breakaway ranges. The fuel delivery quantity needed for the required engine torque is selected by the actuator-mechanism control lever.

The guide lever (9) is movably connected at pivot point B with the governor sliding sleeve. In addition, guide lever and tensioning lever (16) also pivot at point A.



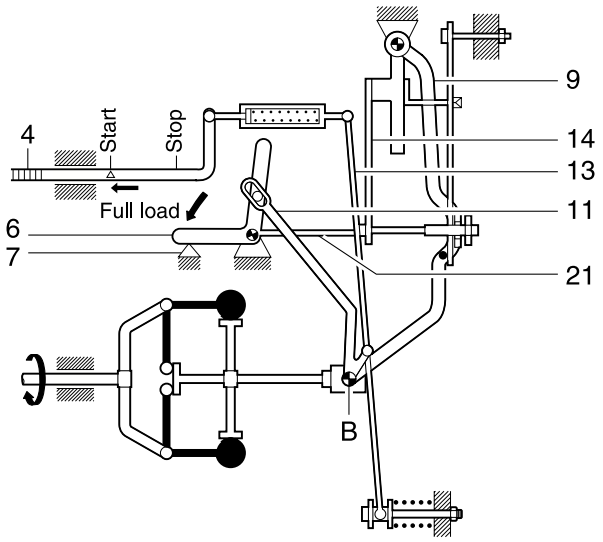
1 Stop(Shutoff) Lever
2 Strap
3 Stop Lever
4 Control Rack
5 Linkage Lever (Inner)
6 Control Lever (Outer)
7 Full-Load Stop
8 Adjusting Screw For Idle Speed
9 Guide Lever
10 Idle Stop
11 Reverse-Transfer Lever
12 Idle-Speed Spring
13 Variable-Fulcrum Lever
14 Auxiliary Idle Spring
15 Adjusting Screw for Auxiliary Idle Spring
16 Tensioning Lever
17 Governor Spring
18 Spring Retainer (Torque Control)
19 Full-Load Adjusting Screw
20 Governor Sliding Sleeve
21 Auxiliary-Idle-Spring Switch-Off Device
22 Flyweight

Actuator mechanism

Input of the desired valve is through control lever (6) linkage lever (5) and reverse-transfer lever (11) to variable fulcrum lever (13), and from there through strap (2) to injection-pump control rack (4). The strap is spring-loaded, and compensates for the extra movement of the fulcrum lever. Similar to the guide lever, the reverse-transfer lever is also flexibly mounted at pivot point B of the sliding sleeve, and is also attached to the fulcrum lever (13) via a shaft and bushing. Full-load delivery at the fulcrum lever's lower bearing point, which also acts as the spring-loaded yield point for the fulcrum lever for absorbing the sliding sleeve's additional travel in case of excessive speed. The bearing shaft of the stop lever (3) protrudes from the governor housing. Attached to its end is a stop (shutoff) lever (1) which switches off the engine, whereby the stop lever pulls the control rack in the stop (shoutoff) direction.

Starting the engine

The engine is to be started according to the vehicle manufacturer's operating instructions. Normally, it can be started without pressing the accelerator pedal. Only with a cold engine at low temperatures is the accelerator pedal to be pushed to the floor so that control lever (6) is shifted up against full-load stop(7) – a fixed stop on the governor housing. Reverse- transfer lever (11) swivels around pivot point B, and in doing so shifts fulcrum lever (13) in the "Start" direction. The result is that the control rack (4) is moved to the start setting and the engine receives the required start quantity. Rapid speed regulation from the governor start setting is made possible by lifting the auxiliary idle spring (14) away from fulcrum lever (9) by a switch-off device (21) when the control lever is in the full-load position.



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4 Control Rack
6 Control Lever (Outer)
7 Full-Load Stop
9 Guide Lever
11 Reverse-Transfer Lever
13 Variable-Fuicrum Lever
14 Auxiliary-Idle Spring
21 Auxiliary-Idle Spring Switch-Off

Cold-start setting (only the components concerned in the governing process shown.)

Operating Characteristics

Low idle speed

Once the engine starts and the accelerator pedal is released, a return spring pulls control lever (6) back to the low-idle position. Linkage lever (5) is now up against idle-speed stop screw(10).

During warm-up, low idle speed follows the idle-speed control curve and stabilizes at Point L.

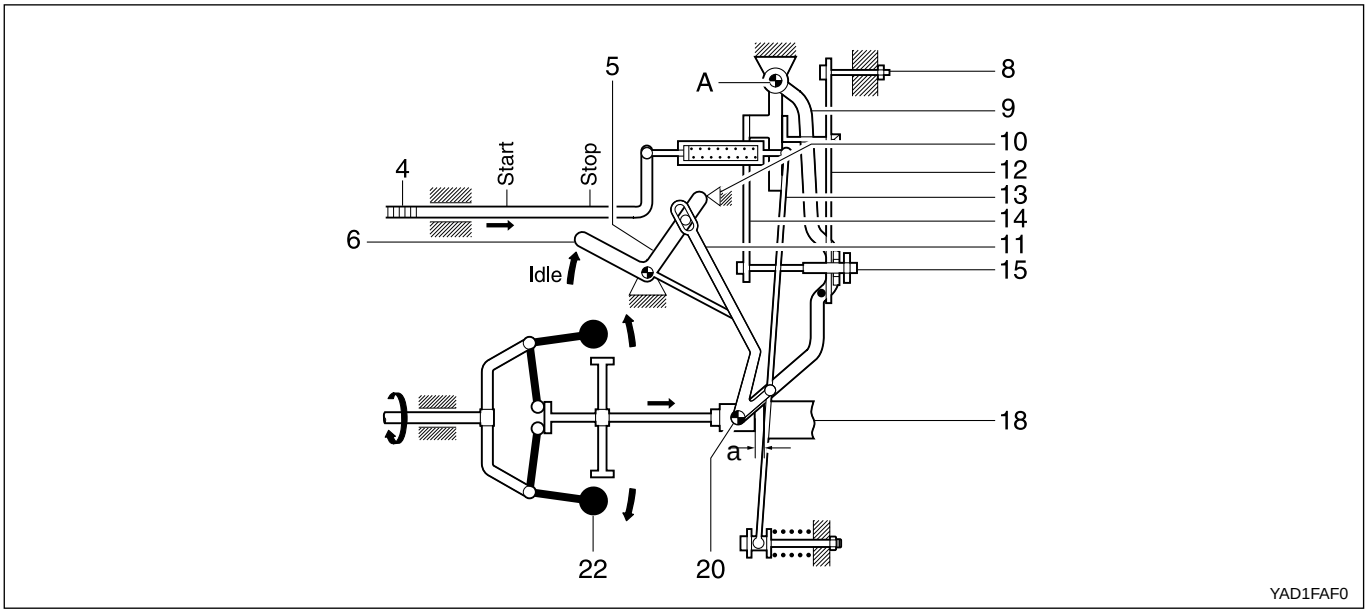
When speed increases, flyweights (22) move outward, and shift governor sliding sleeve (20) to the right. During operation within the idle range, sliding sleeve movement is transmitted through reverse-transfer lever (11) and fulcrum lever (13); moving the control rack (4) toward Stop (shutoff). At the same time, sliding-sleeve movement causes guide lever (9) to swivel about pivot point A, compressing the idle leaf spring (12). This spring's pretension (and thus the low idle speed) is set using adjusting screw(8). At a given speed, the fulcrum lever also comes up against the adjusting nut for auxiliary idle spring (14).

Intermediate speed

After passing through the idle stage (a), governor sliding sleeve (20) and spring retainer (18) for torque control come into contact with each other. In the uncontrolled range between idle and maximum speed, the position of the flyweights (22) remains constant up to high idle (maximum) speed, the only exception being for minor adjustments necessary for torque control. Control-rack setting and therefore delivery quantity are selected directly through control lever (6).

That is, the driver uses the accelerator pedal to select the delivery quantity necessary to increase speed or climb hills (control-lever position between idle stop and full-load stop).

If the driver depresses the accelerator pedal fully, the control rack shifts to the full-load delivery setting.



4 Control Rack
5 Linkage Lever (Inner)
6 Control Lever
8 Adjusting Screw For Idle Speed
9 Guide Lever
10 Idle Stop
11 Reverse-Transfer Lever
12 Idle-Speed Spring
13 Variable-Fulcrum Lever
14 Auxiliary Idle Spring
15 Adjusting Screw for Auxiliary Idle Spring
18 Spring Retainer (Torque Control)
20 Governor Sliding Sleeve
22 Flyweight

Idle-speed setting.

(only the components concerned in the governing process are shown)

Torque control

If torque control is fitted, full-load delivery quantity is reduced when a given speed n_1 is exceeded, because centrifugal force acting on sliding sleeve (20) exceeds the force of the torque-control spring fitted in spring retainer (18). The torque-control spring yields to this force. As a result, if speed increases further, control rack (4) shifts by the torque-control travel distance. Torque control ends at speed n_2.

Instead of positive torque control, the RDF governor can have negative torque control. Here the control-rack setting is controlled by a spring combination.

High idle (maximum) speed

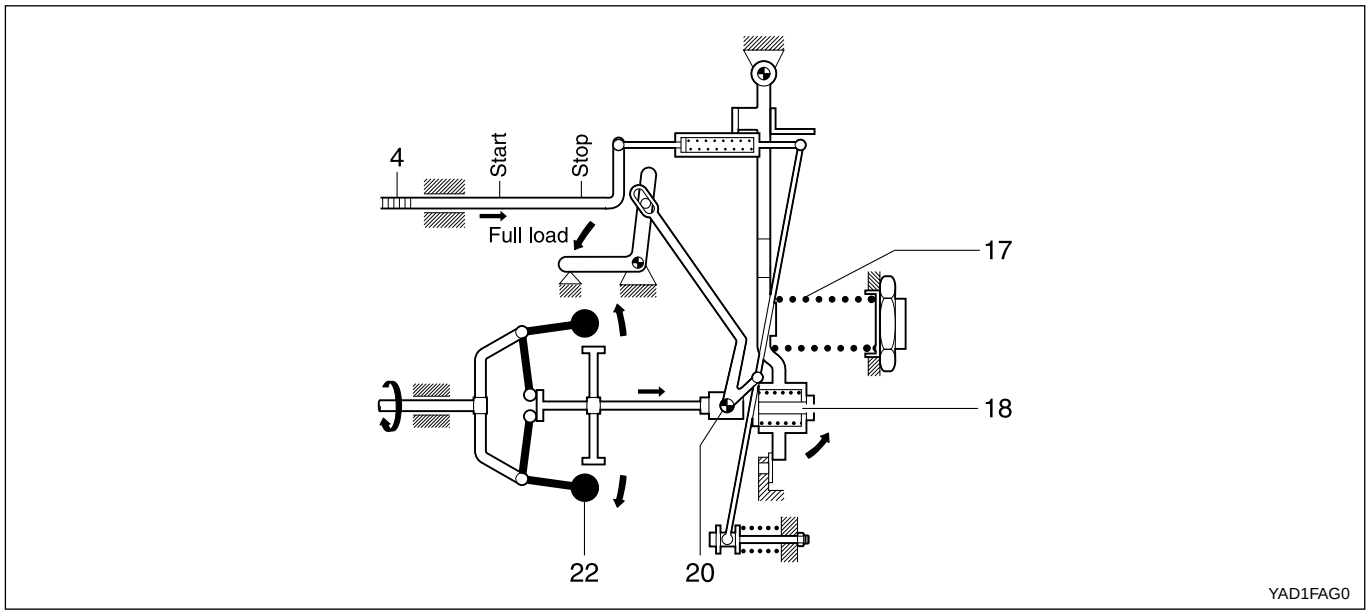
With the accelerator pedal pressed to the floor, the full-load quantity is injected until the maximum full-load speed n_{vo} is reached. If engine speed increases beyond full-load speed, the force exerted by the flyweights (22) suffices to overcome the force of governor spring (17) and full-load-speed regulation starts.

Engine speed increases slightly, and rack travel is reduced due to the rack being moved towards stop (shutoff) and the delivery quantity decreases.

Breakaway depends upon governor spring pretension. The engine adjusts to high idle (maximum) speed n_{10} when all load is removed.

When driving downhill with the accelerator released, the vehicle drives the engine (overrun) and accelerates it.

No fuel is injected during this operating mode (overrun fuel shutoff).



4 Control Rack
17 Governor Spring
18 Spring Retainer (Torque Control)
20 Governor Sliding Sleeve
22 Flyweight

Full-load setting

(only the components concerned in the governing process are shown)

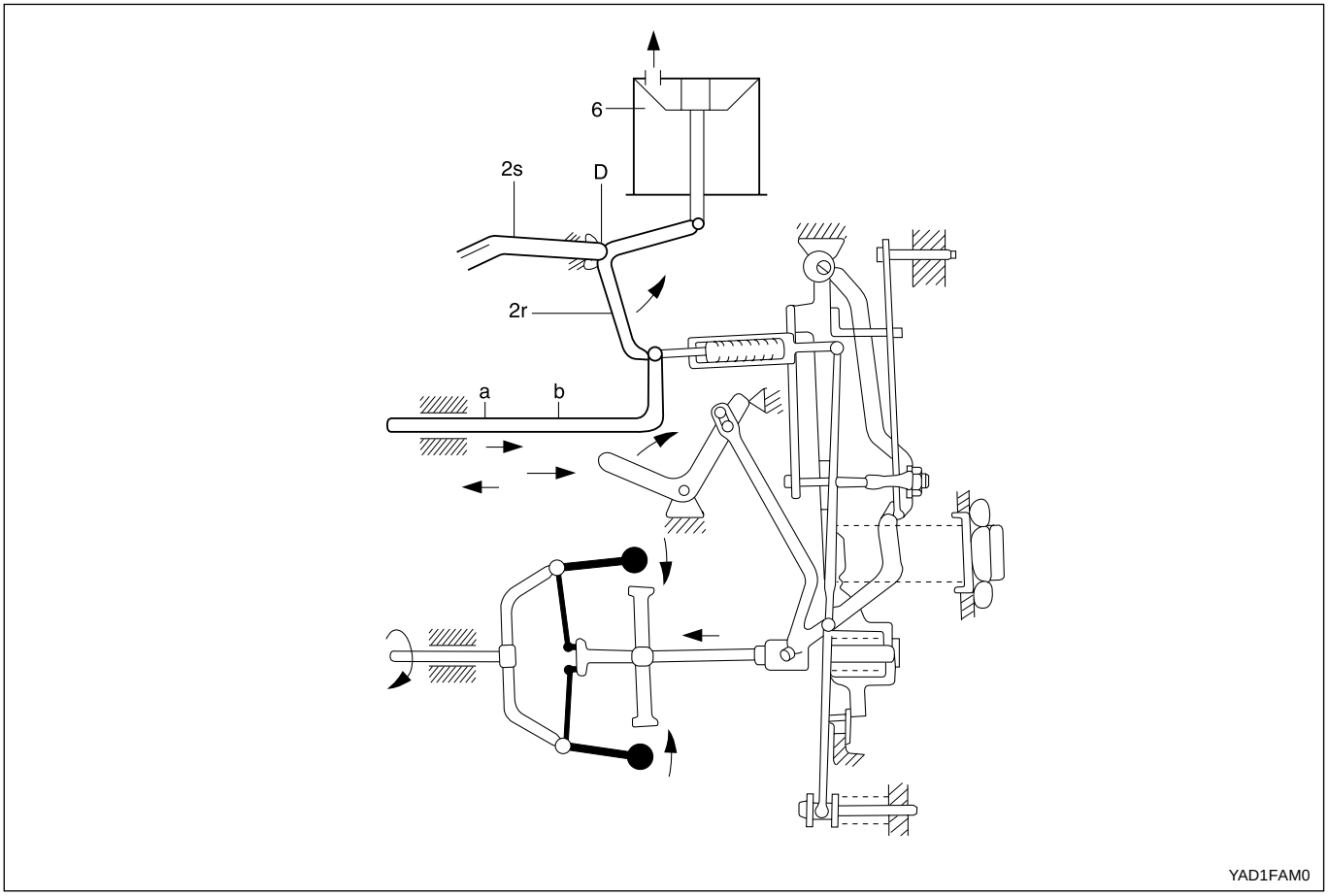
Stopping the engine

When Stop (shutoff) lever (1) is moved by hand, stop lever (3) shifts control rack (4) to the Stop (shutoff) position. The fuel supply is interrupted and the engine stops. A pneumatic shutoff device can also be used for engine switchoff.

Switching off

The vacuum unit (6) is connected to vacuum from the vacuum pump via the glow starter switch of the vehicle. As a result, the diaphragm of the vacuum unit is pulled against the compression spring.

The vacuum unit (6) is connected with a stop lever (2r). This lever pivots around the fulcrum “D” pulling the control rod of the injection pump into the “stop position”. The bypass spring of the fulcrum lever is overcome in this process. Via the emergency stop lever (2s) the control rod can likewise be pulled into “stop position” on the outside of the governor.

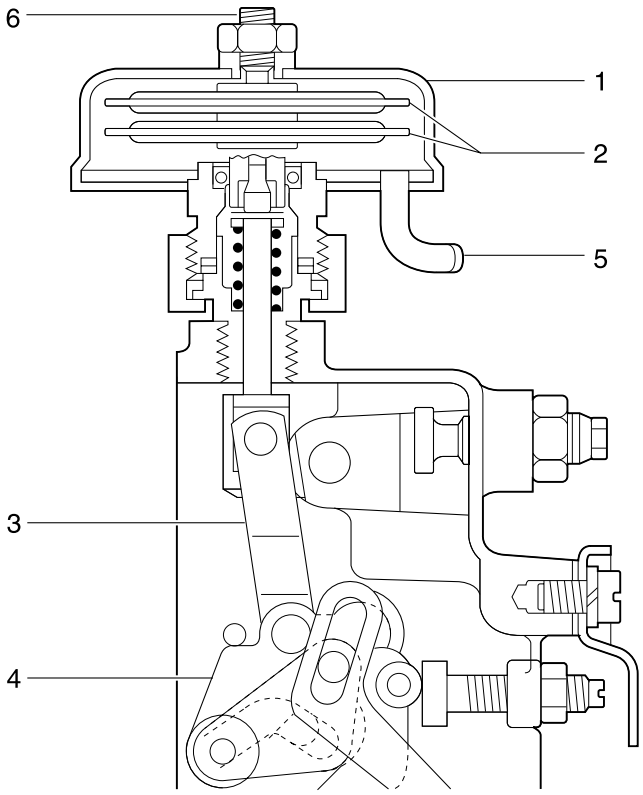


a Start
b Stop

ABSOLUTE METERING MANIFOLD PRESSURE COMPENSATOR (ALDA)

On a pressure-charged engine, the cylinder air charge depends upon the boost pressure, which in turn is influenced by the prevailing atmospheric pressure. The effects of variants in atmospheric pressure have an especially large influence when considerable differences in attitude are encountered in driving.

Because the engine's turbocharger further compresses the prevailing atmospheric pressure, the absolute pressure in the engine's intake manifold is a combination of the atmospheric pressure and the charge-air pressure. The absolute-metering manifold-pressure compensator registers this absolute pressure and adapts the fuel-delivery quantity accordingly.



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1 Adjusting Screw
2 Aneroid Box
3 Connection for the Line to the Engine Manifold
4 Aneroid Capsule
5 Adaptation
6 Guide Plate

PNEUMATIC IDLE SPEED INCREASE (PLA)

Application

The injected fuel quantity needed by a diesel engine at idle decreases along with increasing engine temperature.

When the engine is cold, the temperature-dependent idle-speed increase fitted to the RSF governor raises the idle speed accordingly, there by improving the engine's warm-up behaviour. It also prevents the cold engine stalling when additional loads are switched, such as power-assisted steering, air-conditioner, etc.

The PLA ceases to function above a certain temperature.

Design and Function

Depending upon temperature, pressure is applied to the aneroid capsule's diaphragm which in turn shifts a sliding bolt to change the pretension on the idle spring. The control rack now moves towards "increased fuel quantity" via the governor linkage and the control rack.

Operation

Coolant temparature <0°c

The thermovalve is open. The vacuum of approx. 700 mbar reaches the vacuum unit idle speed increase via the thermovalve. The idle speed is increased by approx 100/min. The choke in the ventilation filter causes a pressure loss of approx 100 mbar.

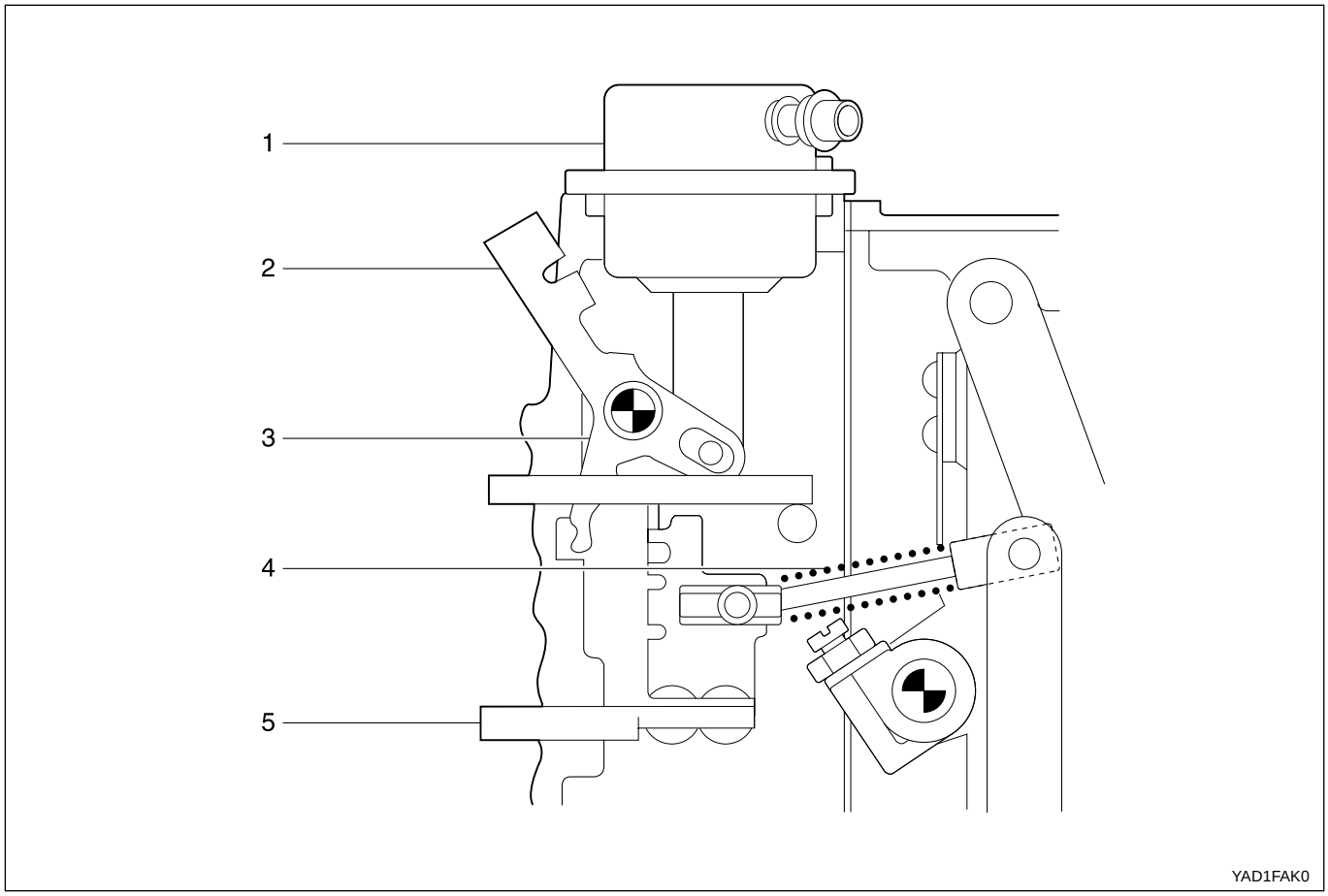
Coolant temperature >0°c

The thermovalve is closed. Atmospheric pressure reaches the vacuum unit through the choke in the ventilation filter. The speed increase is cancelled.

PNEUMATIC SHUT-OFF DEVICE (PNAB)

To shut off the engine, the key in the steering lock is turned to “stop”. This applies vacuum to the shut-off device diaphragm which pulls the control rack to the stop setting.

This device can only be installed on vehicle which are equipped with a vacuum pump.



1 Pneumatic Shut-Off Device
2 Shut-Off Lever for Manual Operation
3 Stop Lever
4 Spring-Loaded Strap
5 Control Rack

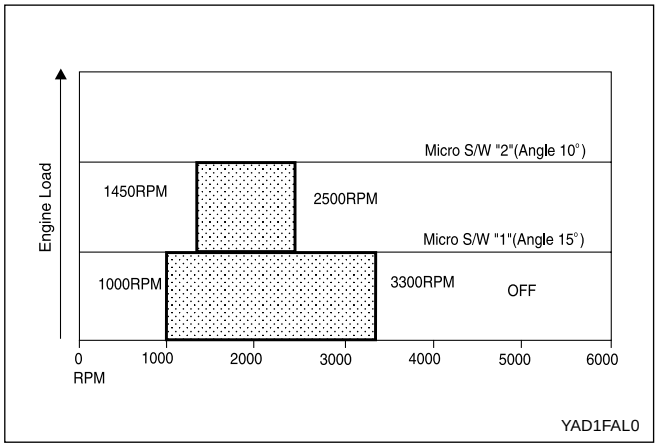
EXHAUST GAS RECIRCULATION (EGR) VALVE

The Exhaust Gas Recirculation (EGR) system is the device to lower the NOx (oxides of nitrogen) emission level caused by high combustion temperature.

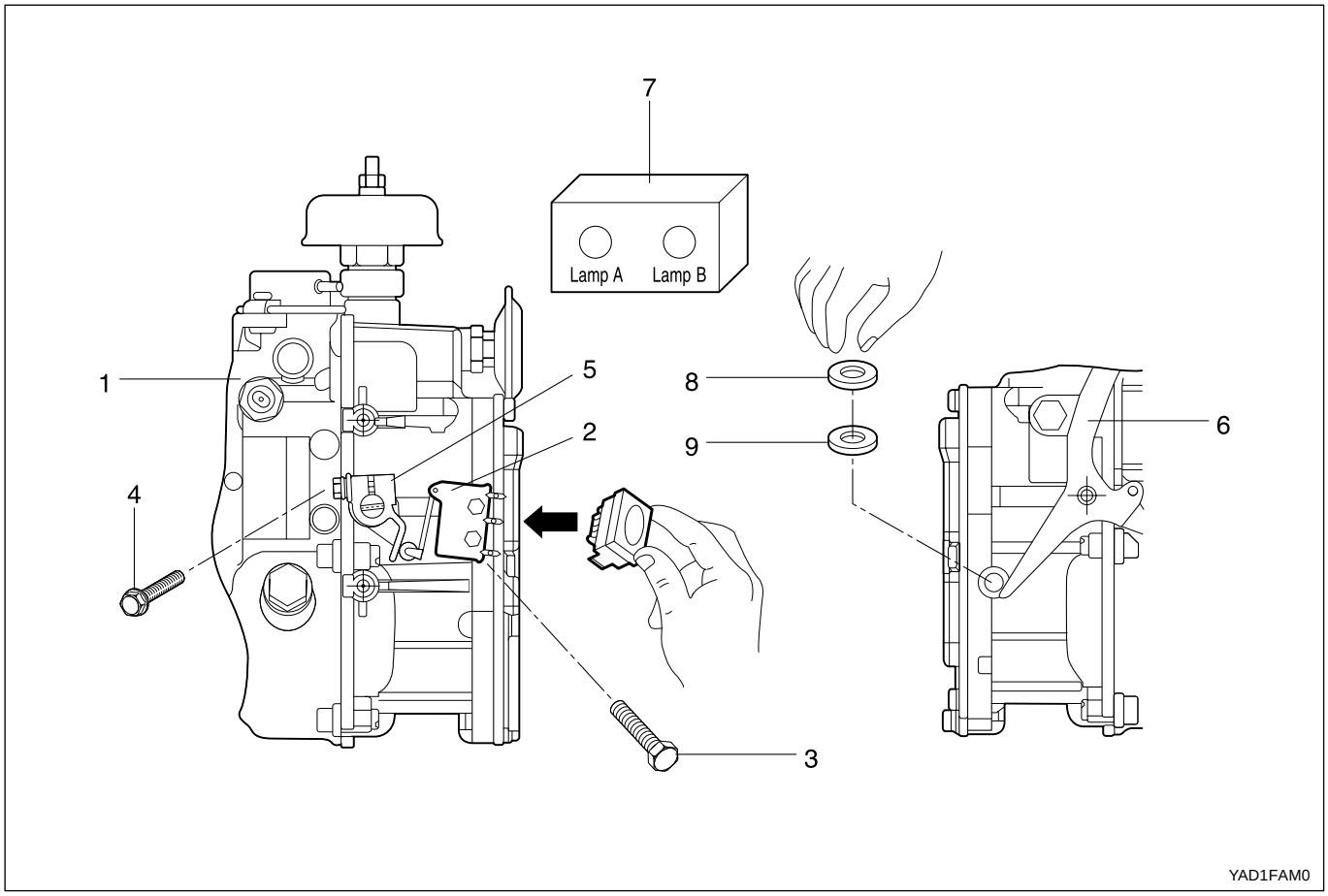
Because the combustion process of the diesel engine always needs excessive air, the exhaust gas contains large amount of NOx.

The EGR valve restricts NOx generation by recirculating some amount of the exhaust gas into the combustion chamber to reduce the combustion temperature.

But the recirculated gas results in reduced charging efficiency of mixture so that the engine performance drops down. Because of this fact, EGR valve is tuned to operate in the area where oxidized substances are generated much.



- Condition of working the EGR valve
  - 100 seconds after starting the engine
  - More than 200 RPM



1 Injection Pump
2 Micro Switch
3 Bolt
4 Screw ..... 5 N•m (44 lb-in)
5 Cam
6 Lever
7 Micro Switch
8 Adjusting Disc “A” Setting Indicator (10 inch)
9 Adjusting Disc “B” Setting Indicator (11 inch)

EGR Micro Switch Setting Procedure

Tools Required

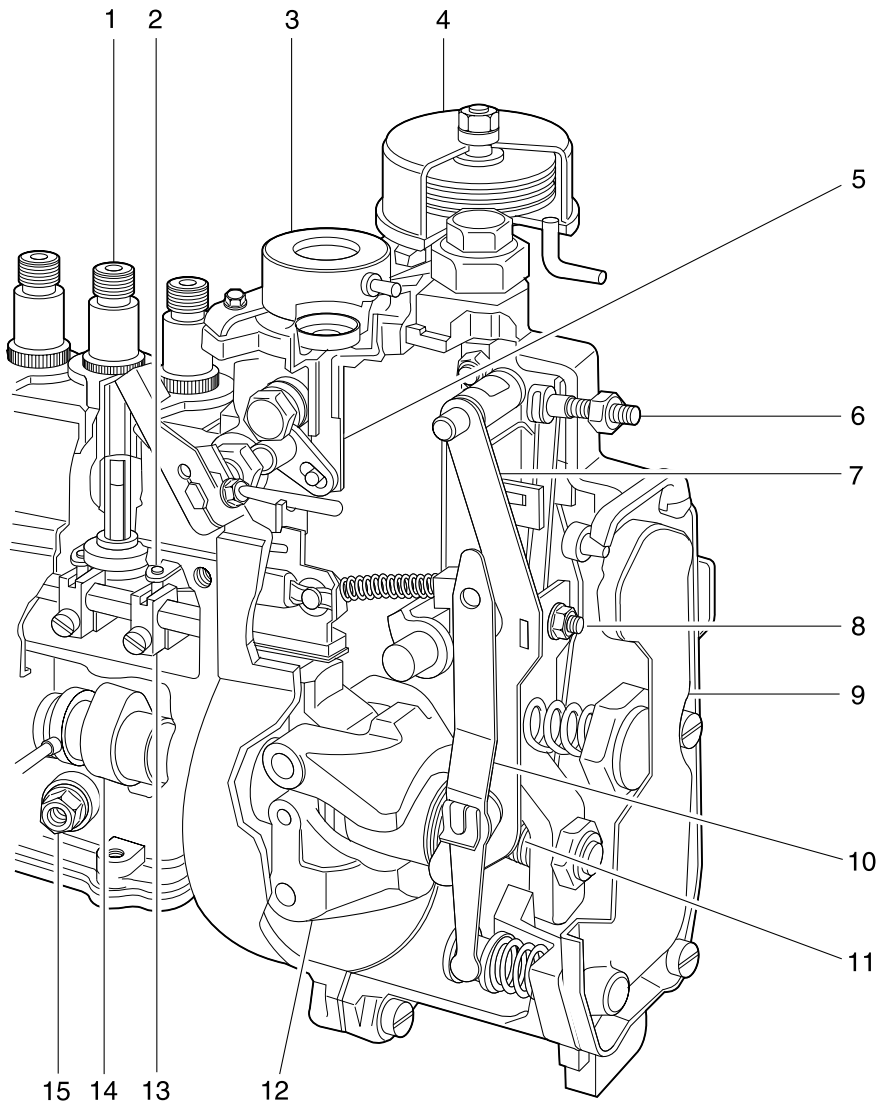
617 589 08 21 01 Micro switch Setting Device.

In turbo equipped vehicle, the timing of injection pump must be adjusted after repairing or replacement as follows:

1. Hold the injection with clamp (special) on the work bench.
2. Install the micro switch setting device 017 589 08 21 01 in the injection pump.
3. Adjust and fix the lever (6) at 10° ±1°
4. Insert the harness into the micro switch setting device 617 589 08 21 01.
5. Install the cam on the injection pump when the both lamps are “on”.
6. Install the screw.
7. At this moment, loosen the clamp and insert the adjusting disc “A” to the lever and check again.
8. If the lamp “A” is “on”, the setting is correct, thus, timing of injection pump is OK.
   If the both lamps are “on”, perform the setting as above procedure.

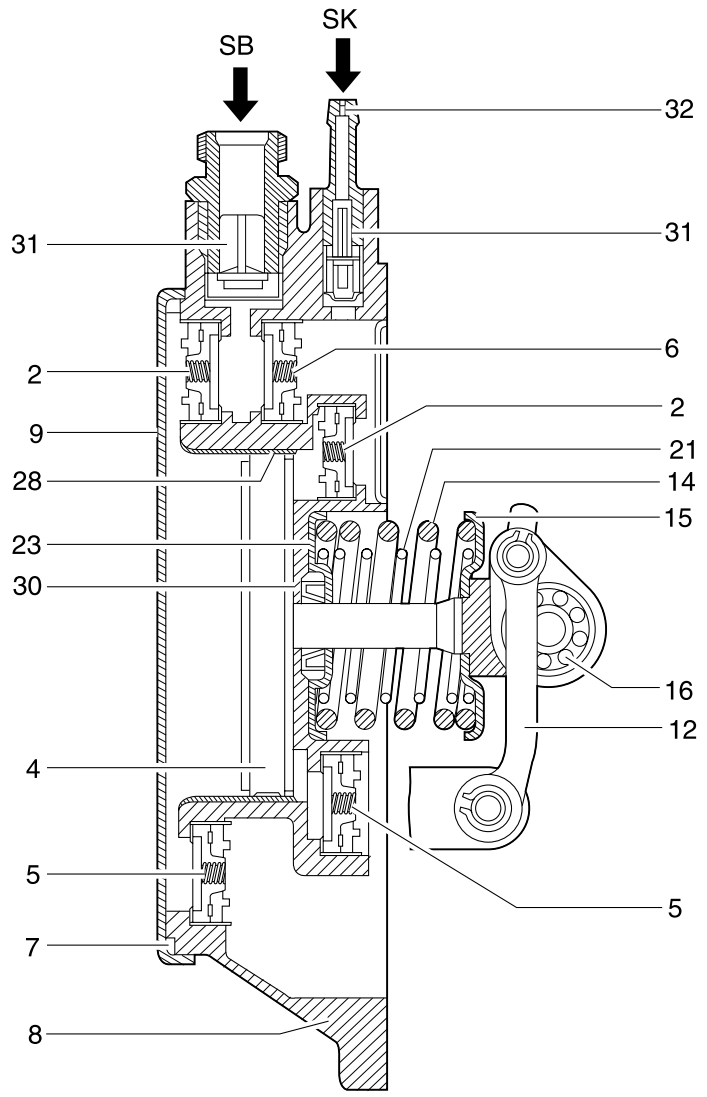
COMPONENT LOCATOR

FUEL INJECTION PUMP



1 Delivery Valve Holder
2 Control Lever
3 Engine Stop Unit
4 Idle Speed Adjustment (ALDA)
5 Stop Lever
6 Adjusting Screw for Idle Speed
7 Guide Lever
8 Adjusting Screw for Auxiliary Idle Speed
9 Governor Assembly
10 Hinge Lever
11 Spring Retainer (Torque Control)
12 Fly Weight
13 Clamping Piece
14 Plunger Driving Cam
15 Fuel Pump Driving Cam

VACUUM PUMP (SECTIONAL VIEW)



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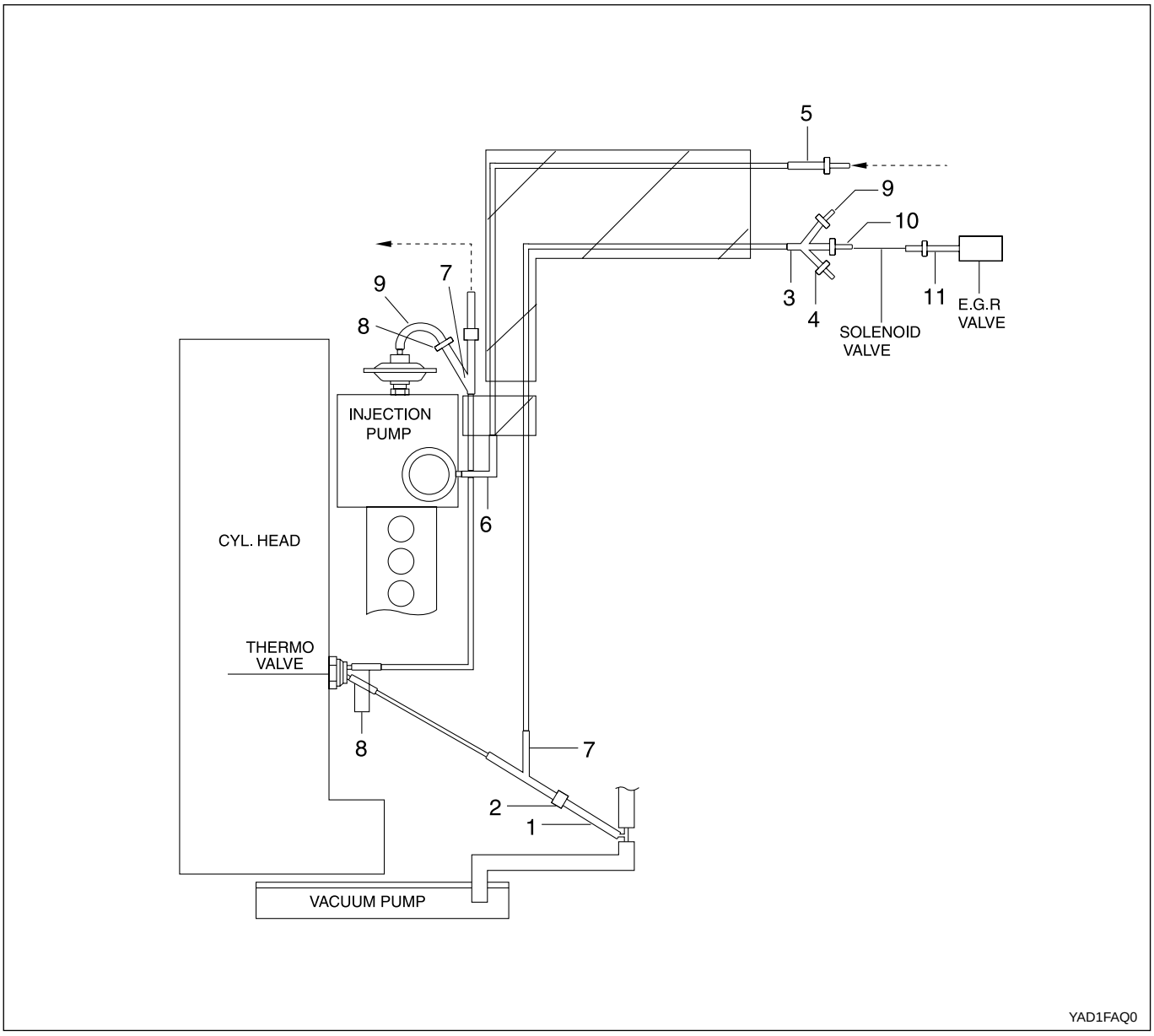
2 Suction Valve
4 Piston
5 Pressure Valve
6 Safety Valve
7 O-Ring
8 Pump Housing
9 Pump Cover
12 Lever
14 Outer Return Spring
15 Inner Spring Retainer
16 Roller Cam
17 Piston Rod
21 Inner Return Spring
23 Upper Spring Retainer
28 Piston Ring
30 Seal Ring
31 Oil Return Valve
32 Restrictor
SB To Brake Booster
SK To Vacuum Lines

DIAGNOSTIC INFORMATION AND PROCEDURE

VACUUM CONTROL SYSTEM TEST



1 Rubber Hose
2 Air Filter
3 Distributor
4 Chock
5 Rubber Hose
6 Molding Hose
7 Distributor
8 Molding Hose
9 Connector
10 Chock Filter
11 Molding Hose

Service Data

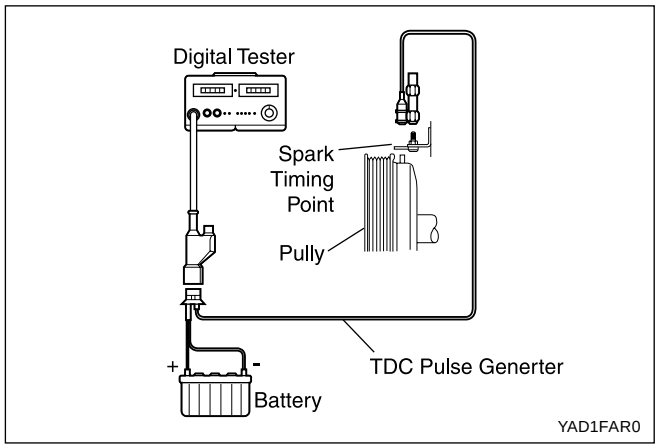
Idle Speed Increase	At least 100 rpm at approx. 500 mbr
Permissible Pressure Drop of System	400 - 500 mbar approx. 1 min

Tools Required

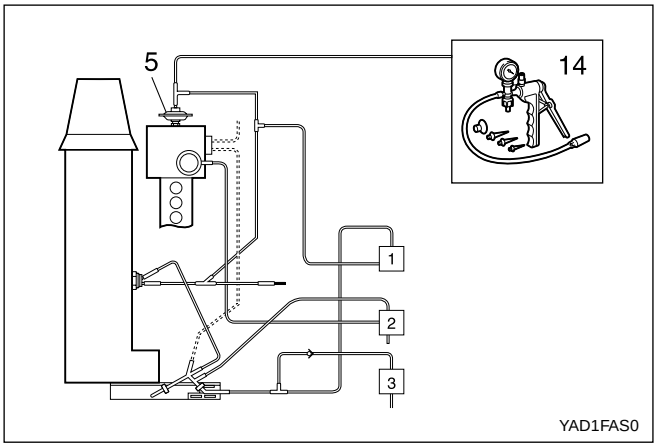
001 589 73 21 00 Vacuum Pump
201 589 13 21 00 Vacuum Tester
667 589 00 21 00 TDC pulse generator

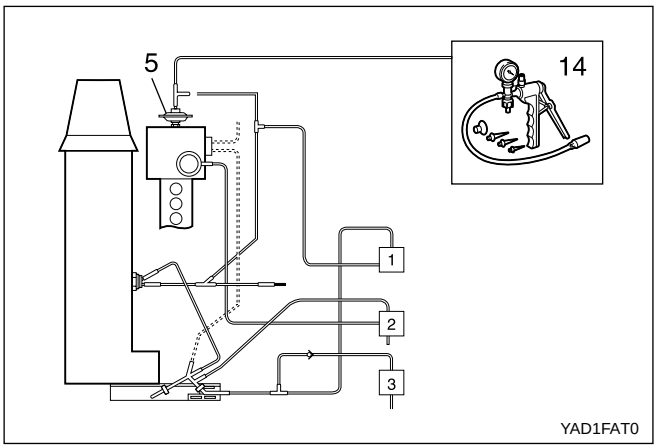
Commercial Tools

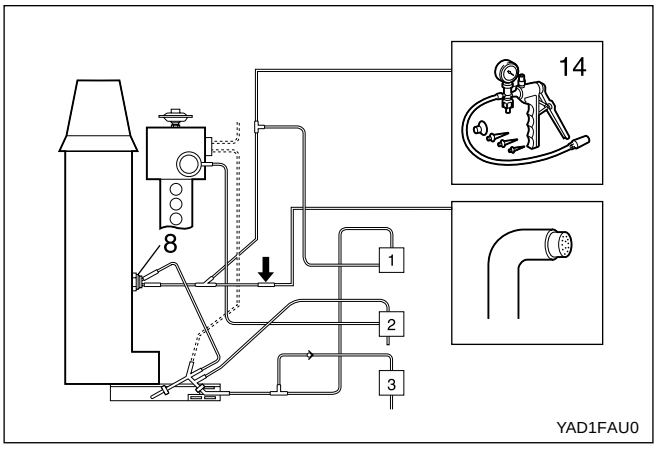
Digital tester	e.g Bosch MOT 001.03 Sun DIT 9000
Temperature measuring instrument with test probe WB24	e.g Ahlborm, Therm 2263 - 2 Eichenfeldstrabe 1 - 3 D - 8150 Holzkirichen

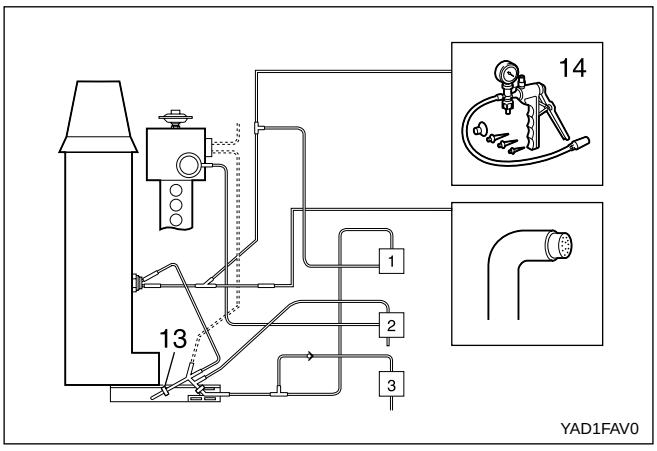


Tester Connection









Test step 1 (Coolant Temp. ≤ 0°C)

Connect vacuum pump (14) with Y adapter to PLA vacuum unit (5). Run engine at idle speed.

Vacuum ≧ 500 mbar?

YES

NO

Lines and connections leaking.
Faulty PLA vacuum unit.

(Remove the connection hose from vacuum pump)

Connect vacuum pump (14) direct to PLA vacuum unit (5) and pressurize with vacuum.

Vacuum is built up and idle speed increases approx. 150-200 rpm ?

YES

NO

Faulty PLA vacuum unit

(Coolant Temperature 0 ± 3°C)

Stop the engine and seal the air admission line with plug (arrow). Connect the vacuum pump to line to thermovalve and pressurize the line with vacuum.

Vacuum is built up?

YES

NO

Lines and connections leaking.
Faulty thermovalve.

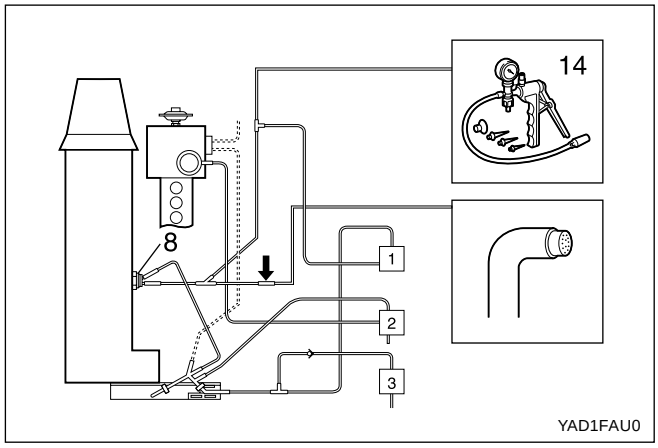
Detach line downstream of air admission filter (13).

Vacuum drops off?

YES

NO

Faulty thermovalve



Fit the line onto air admission filter. Built up vacuum with vacuum pump. Detach the plug from air admission line.

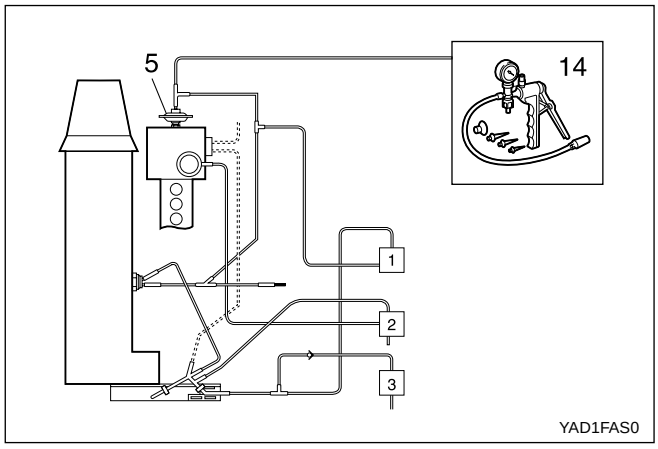
Vacuum drops off?

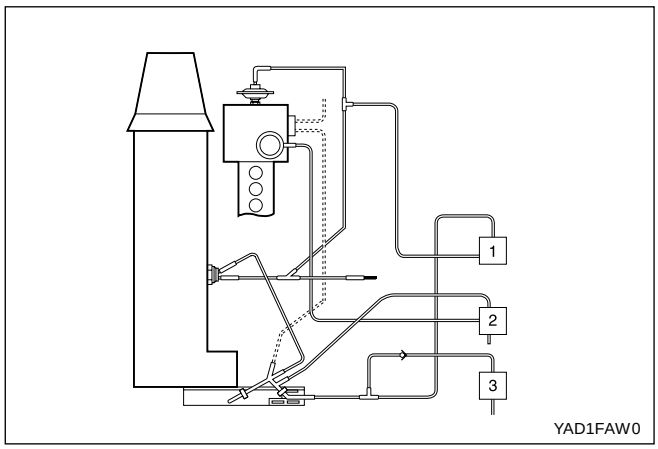
YES

NO

Faulty filter with restriction.

Go to test step 2.





Test step 2

Connect vacuum pump (14) with Y adapter to PLA vacuum unit (5). Run the engine at idle speed.

Vacuum drops to '0' at approx. ± 3°C of the thermovalve.

YES

NO

Faulty thermovalve. Defective filter with restriction.

Stop the engine. Detach the filter with restriction.

Filter with restriction is clear.

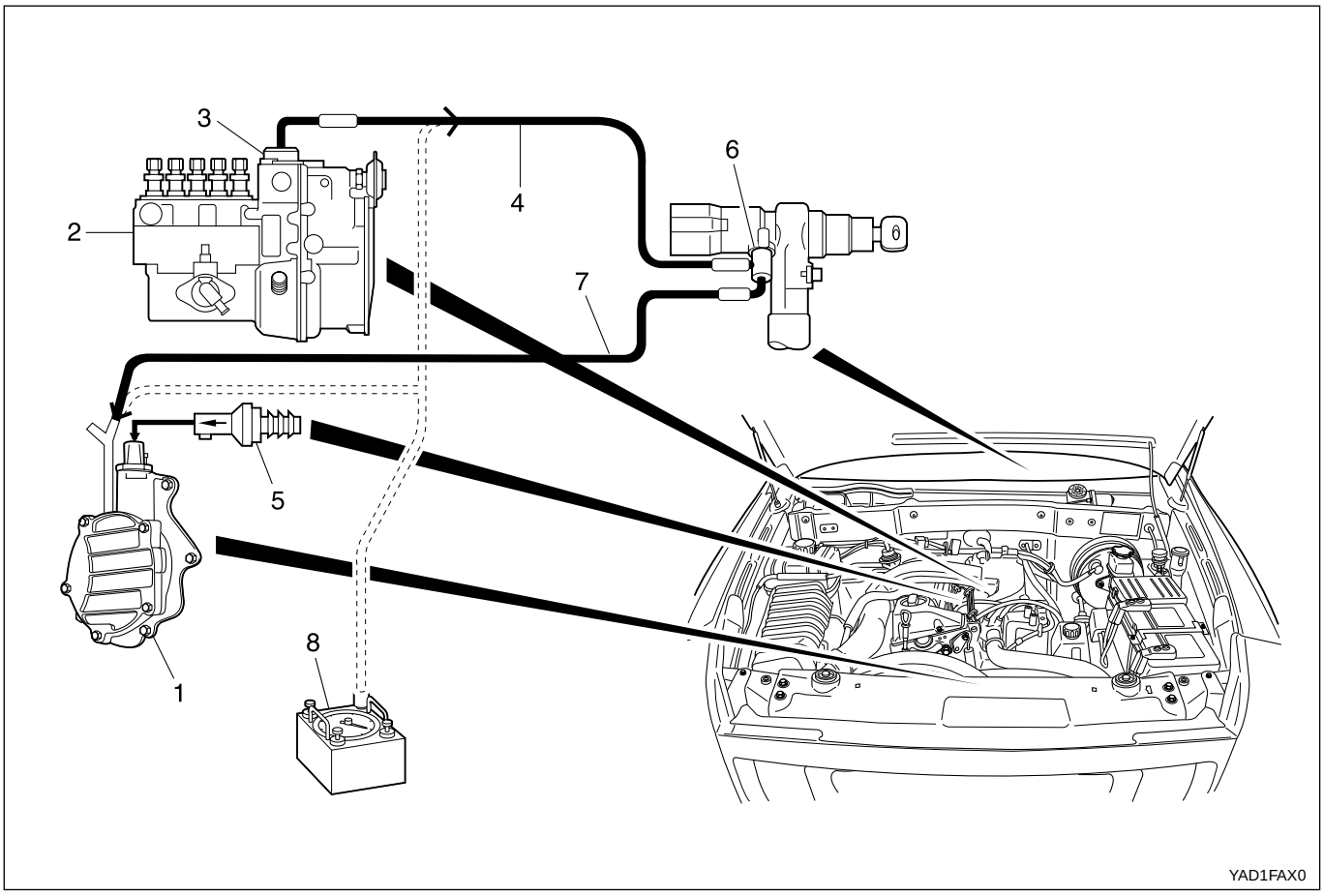
YES

NO

Defective filter with restriction.

OK

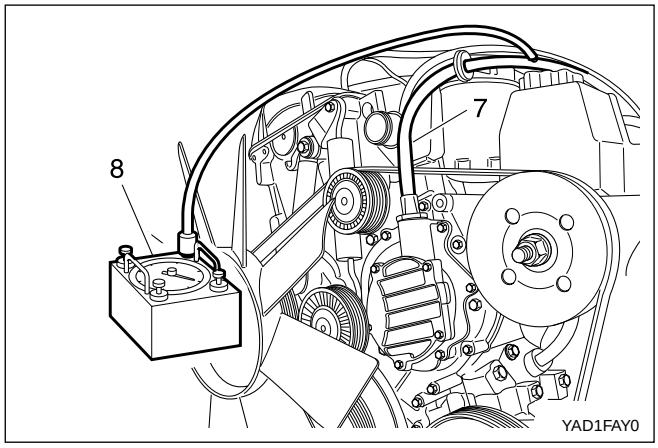
VACUUM SHUT-OFF LEAK TEST

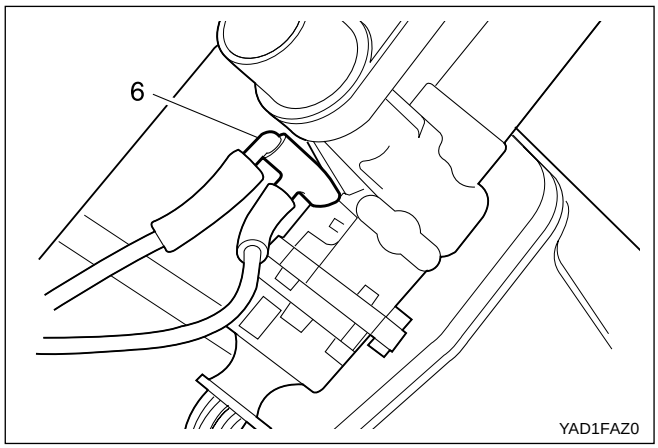


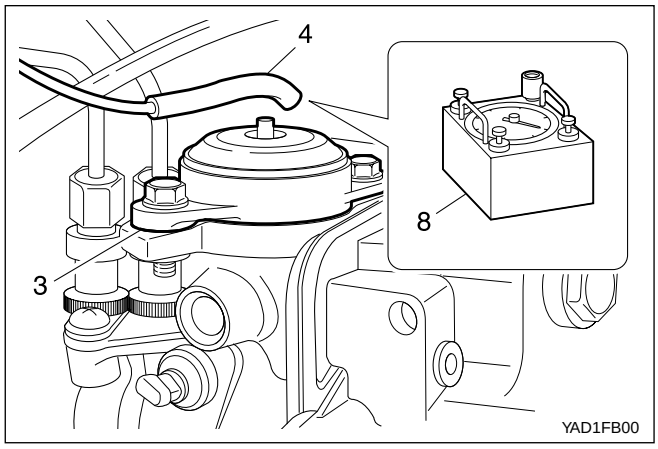
1 Vacuum Pump
2 Fuel Injection Pump
3 Engine Stop Unit
4 Control Line
5 Check Valve (to Brake Booster)
6 Engine Shut-Off Valve
7 Suction Line
8 Vacuum Tester

Service Data

Model	Permissible loss of vacuum
Entire System at 400 + 50 mbar Vacuum	6 mbar / min.
Individual Part at 300 + 50 mbar Vacuum	5 mbar / min.







Tools Required

201 589 13 21 00 Vacuum Tester

1. After fully warming up the engine, turn the ignition switch to 'LOCK' position.
2. Disconnect the suction (7) line from vacuum pump.
3. Connect the vacuum teater 201 589 13 21 00 (8) to suction line (7) and apply vacuum of 400 + 50 mbar.

Permissible loss of vacuum	6 mbar / min

If a vacuum drop is more than sperified value, check the engine shut-off valve or vacuum unit.

4. Engine Shut-off valve test
   - Turn the ignition switch to 'ON' position.
   - Connect the vacuum tester 201 589 13 21 00 to engine shut-off valve (6) and apply vacuum of 300 + 50 mbar.

Permissible loss of vacuum	5 mbar / min

If a vacuum drop is more than specified value, replace the engine shut-off valve (6)

Notice: Before replacing the valve for the glow starter system and the vacuum unit of the injection pump, check the hose lines and connections.

5. Vacuum Stop Unit Test.
   - Disconnect the control line (4) from the vacuum stop unit (3).
   - Connect the vacuum tester 201 589 13 21 00 to vacuum stop unit (3) and apply vacuum of 300 + 50 mbar.

Permissible loss of vacuum	5 mbar / min

   - If a vacuum drop is more than specified valve, replace the vacuum stop unit.

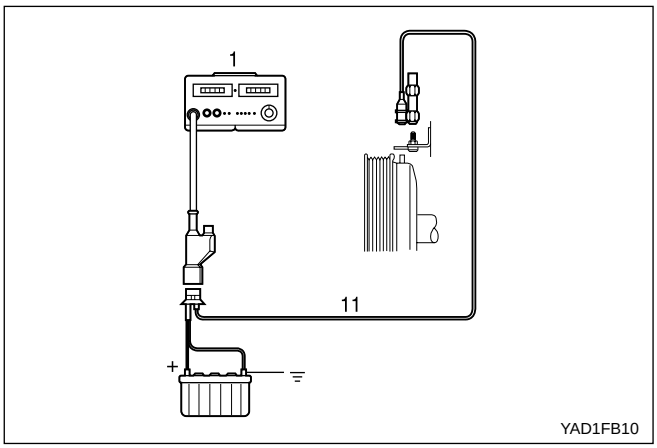
IDLE SPEED ADJUSTMENT

Service Data

Engine	Idle Speed
OM662LA Engine	720 - 820 rpm

Commercial Tool

Digital tester	e.g. Bosch, MOT 001.03
	Sun, DIT 9000



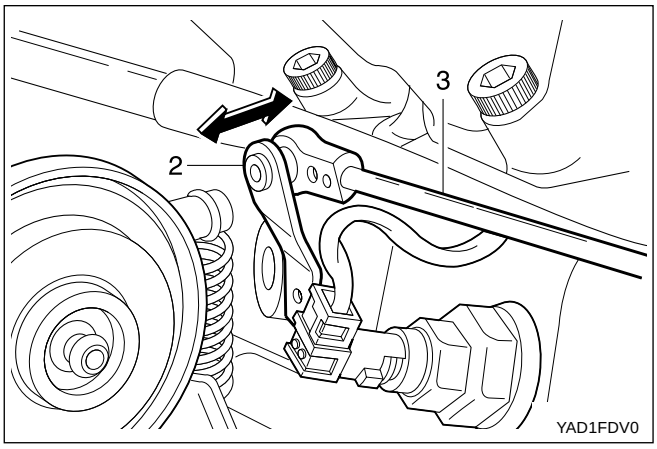
Tools Required

001 589 73 21 00 Vacuum Pump

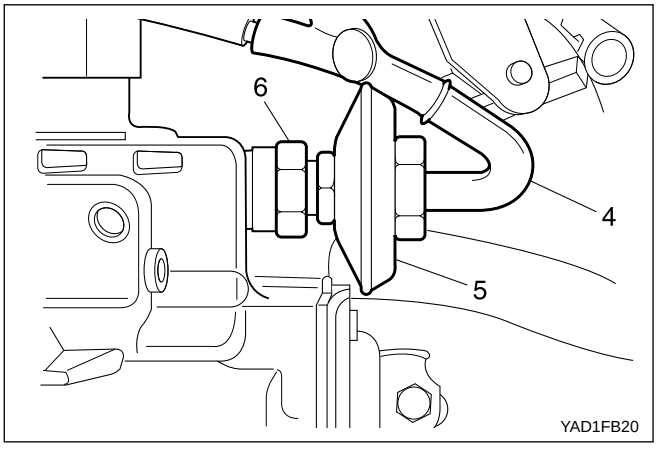
667 589 00 73 21 TDC Pulse Generator

Adjustment Procedure

1. Connect the digital tester (1) and TDC pulse generator 667 589 02 21 00 (11).
2. Run the engine and warm up the coolant to 60~80°C.



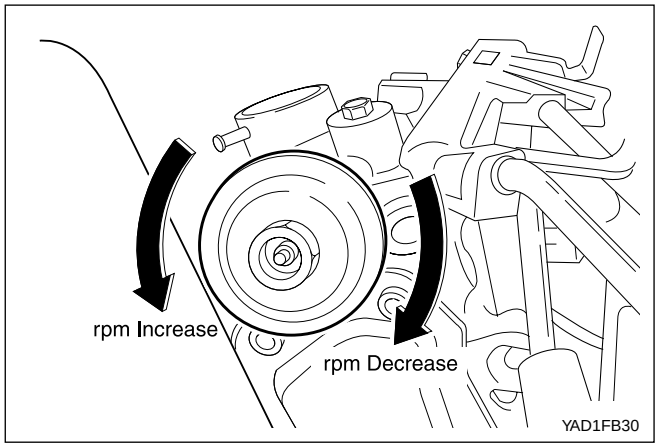
3. Disconnect the connecting rod (3) from control lever (2).



4. Disconnect the vacuum hose (4) from the PLA unit to check idle speed with tester.
5. Check idle speed with tester.

Idle Speed	720 - 820 rpm

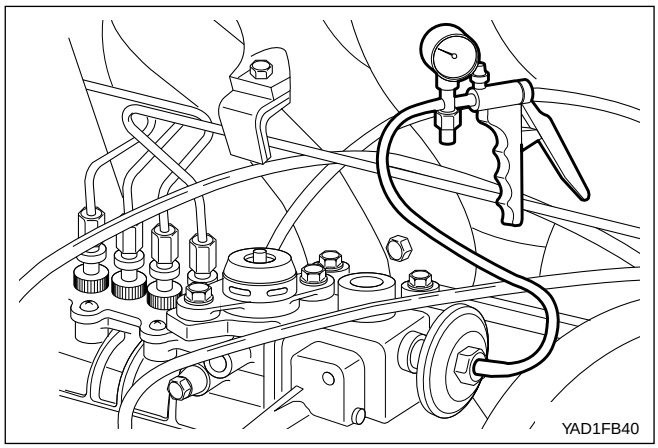
Notice: To adjust idle speed, loosen the locking nut (6) of PLA unit.



6. Ensure not to damage the idle spring in the governor and adjust idle speed by turning the PLA unit (5) slowly.

Clockwise	RPM Decrease
Counterclockwise	RPM Increase

Notice: Do not rotate the PLA unit over ½ turn from the position marking. If do, idle spring in the governor will be severely damaged.

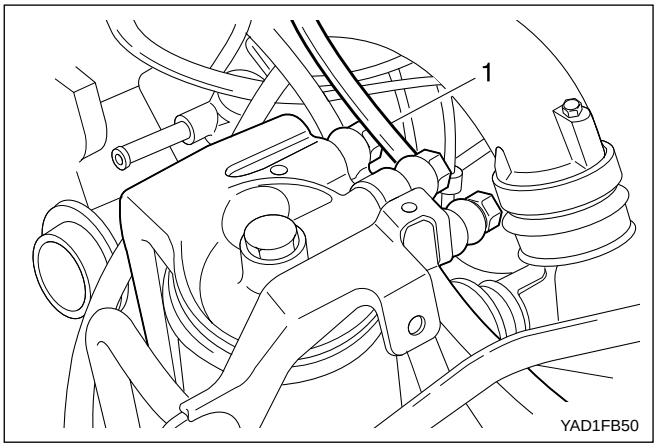


7. After adjustment, tighten the locking nut and place the position marking with different color of paint.

   Notice: If there are no changes in idle speed with PLA unit adjustment, perform the service at a BOSCH Service Center.

8. Connect the vacuum pump 001 589 73 21 00 to the PLA vacuum unit and build up vacuum approx. 500 mbar. If engine rpm increases by approx. 150 rpm. It is normal.

9. Connect the vacuum line (4).
10. Install the connecting rod.
11. Switch on all ancillaries and check the idle speed.



FUEL PUMP TEST

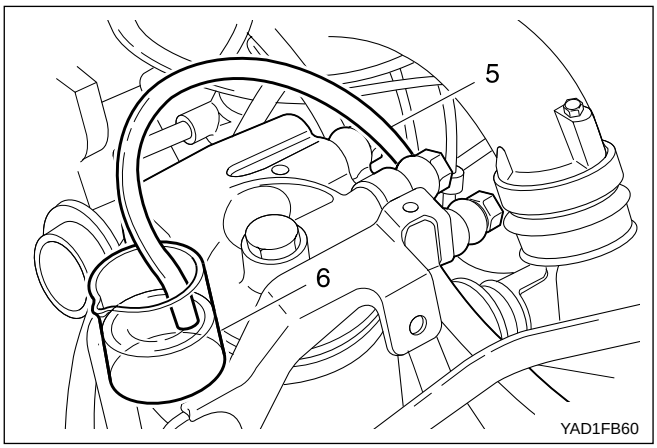
Notice: Before test, replace the fuel filter cartridge and fuel prefilter.

Fuel Feed Test

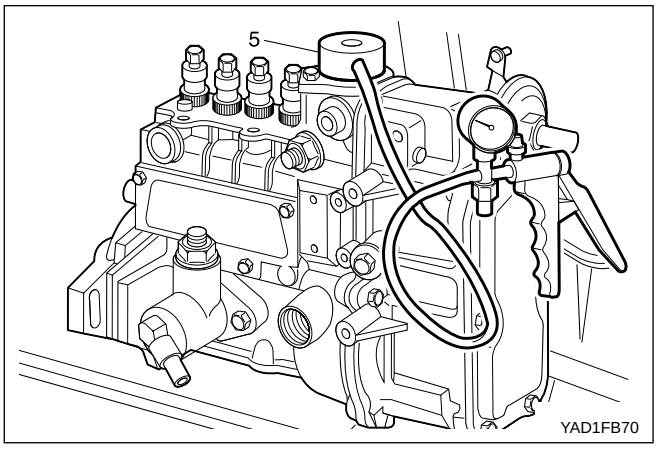
Tools Required

001 589 73 21 00 Vacuum Pump

1. Disconnect the fuel return line (1) and seal up it with plug.



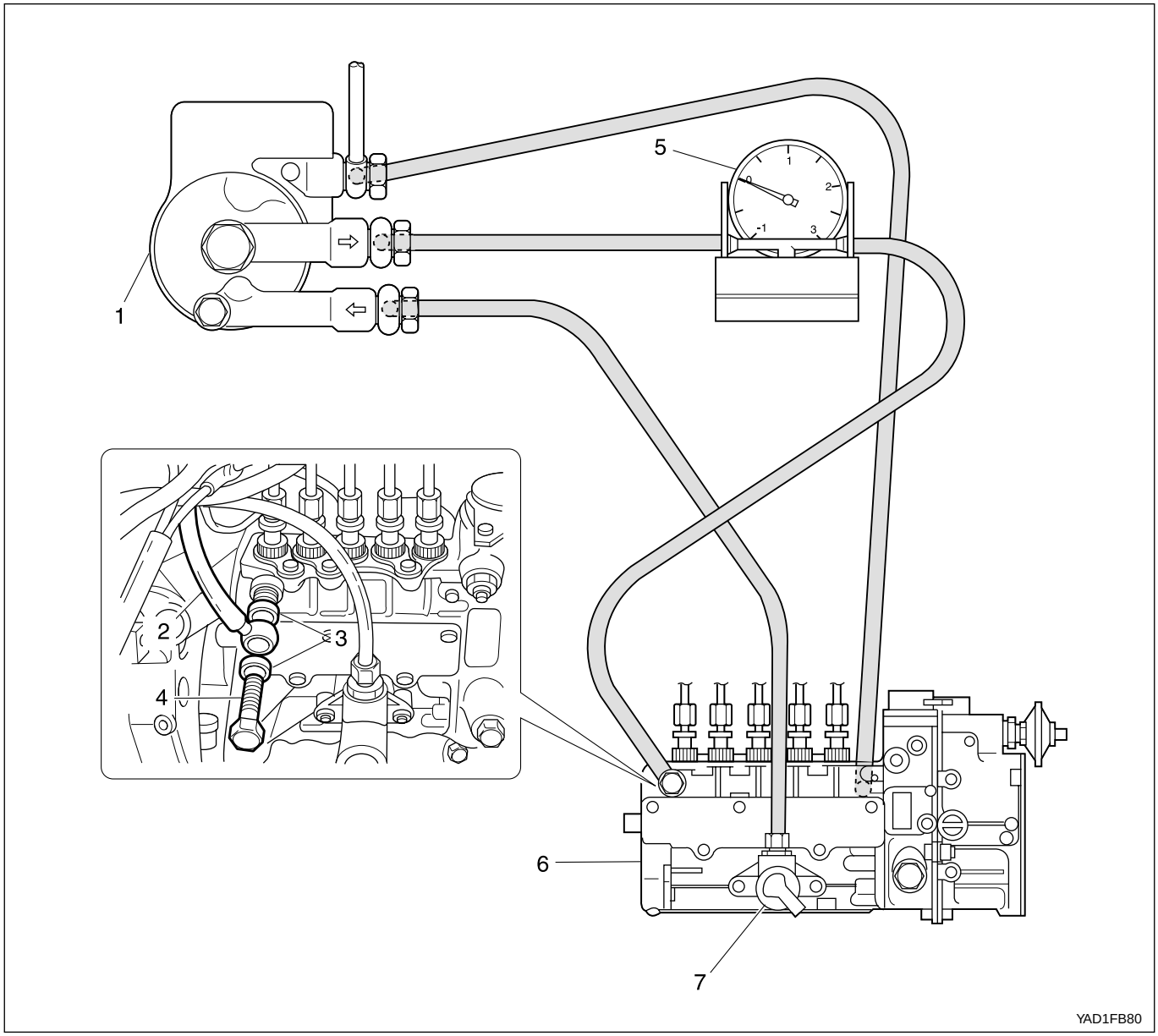
2. Insert the plastic hose (5) and put the end into the measuring beaker (6).



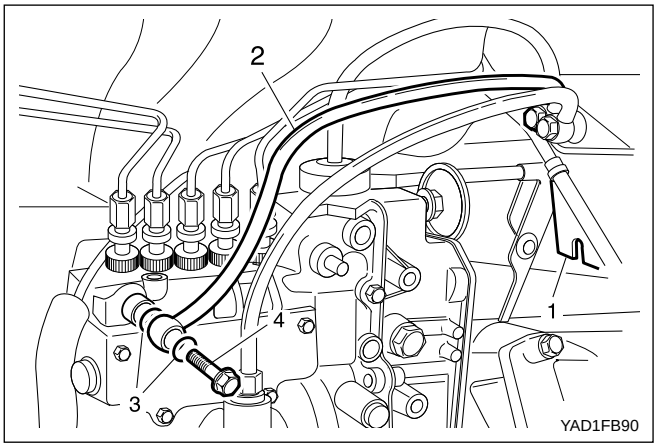
3. Disconnect the vacuum line from vacuum unit (engine stop) (5) and connect the vacuum pump 001 589 73 21 00 to the vacuum unit.
4. To avoid the engine starting, build up vacuum (approx. 500 mbar).
5. Operate the starter motor for exactly 30 seconds and measure fuel volume in the beaker.

Min. volume	150 cm^3 for 30 seconds

Fuel Pressure Test



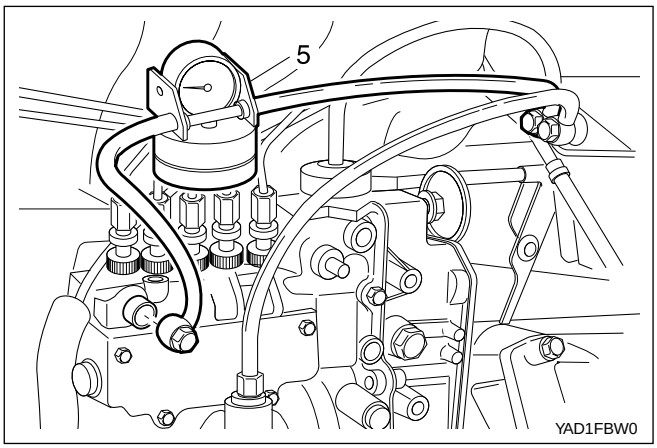
1 Fuel Filter Housing
2 Fuel Line
3 Seal ..... Replace
4 Bolt ..... 13 N•m (10 lb-ft)
5 Tester ..... At Idle Speed > 0.3 bar
..... At Full Load > 0.5 bar
6 Fuel Injection Pump
7 Fuel Pump



Tools Required

617 589 04 21 00 Tester

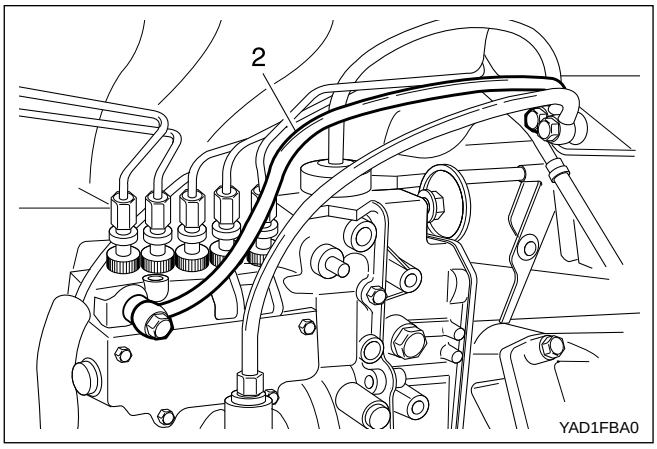
1. Disconnect the fuel line (2) from the fuel filter.
2. Remove the banjo bolt (4) from the fuel injection pump and remove the seals (3) and fuel line (2).



3. Connect the tester 617 589 04 21 00 (5).
4. Start the engine and read off the fuel pressure on tester 617 589 04 21 00 (5).

At Idle Speed	> 0.3 bar
At Full Load	> 0.5 bar

Notice: If out of standard, replace the fuel feed pump.



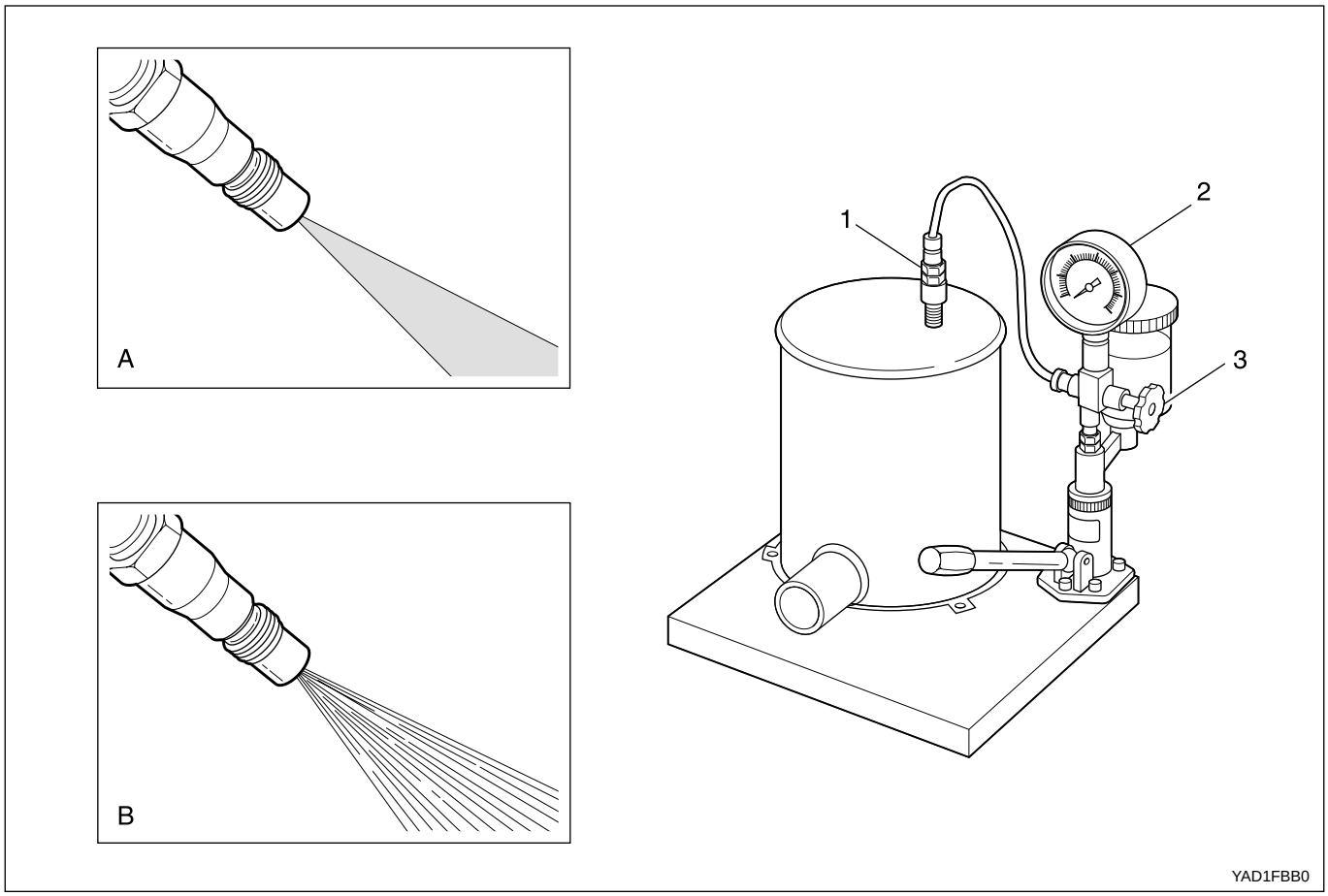
5. Stop the engine.
6. Remove the tester 617 589 04 21 00.
7. Replace the seal and connect the fuel line (2).

Inatallation Notice

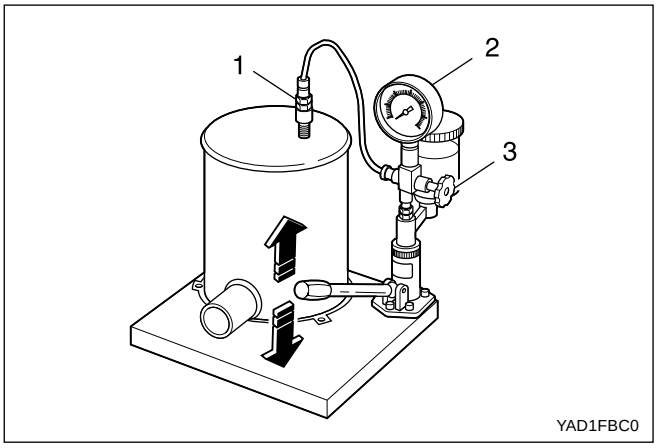
Tightening Torque	13 N•m (10 lb-ft)

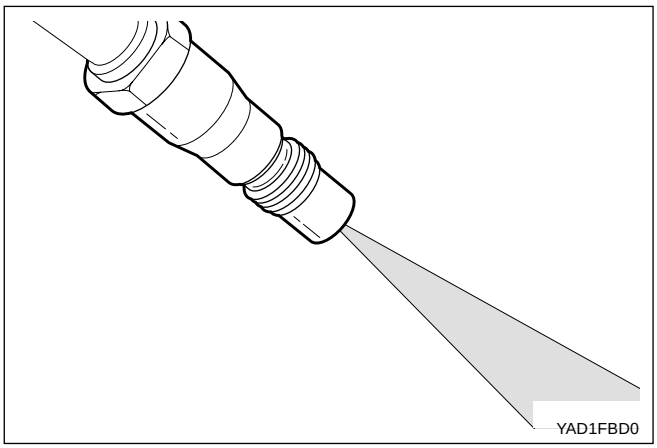
INJECTION NOZZLE TEST

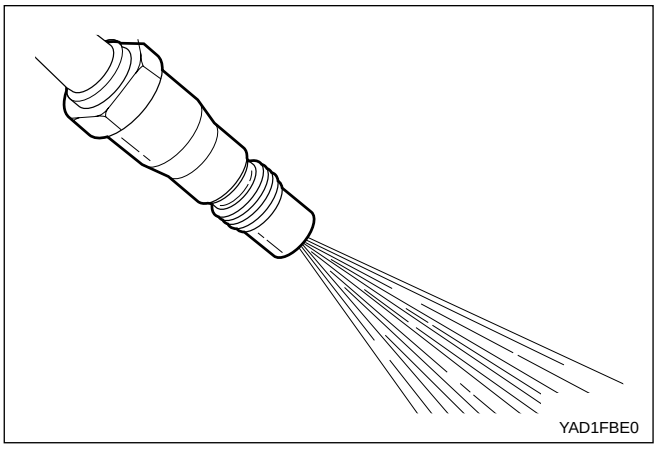
Preceding Work: Removal of fuel injection nozzle



1 Fuel Injection Nozzle .....New : 135 - 143 bar
..... Used : min. 120 bar
2 Tester
3 Valve
A Closed Spray = good
B Stringy Spray = poor







Tools Required

000 589 14 27 00 Fuel Injection Nozzle Tester

Notice: When testing the injection nozzle, do not place your hand into the spray of a nozzle. The spray will penetrate deep into the skin and destroy the tissue.

1. Connect the fuel injection nozzle to the fuel injection nozzle tester 000 589 14 27 00.
2. Close the valve (3) and pump 5 times strongly.
3. Chatter test :

   Slowly operate the hand lever at tester (approx. 1 stroke per second). The nozzle must spray with a gentle chattering.

4. Spray pattern test :

   Operate the hand lever at tester rapidly (approx. 2~3 strokes per second).

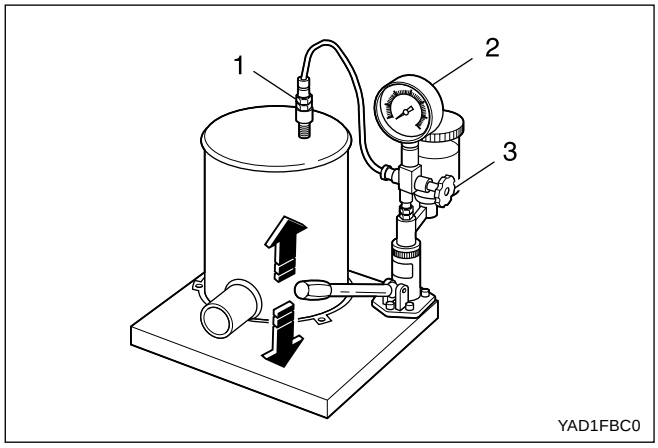
   - Good

     The spray pattern shows closed and well atomized.

   - Poor

     The spray pattern shows split, too wide and stringy.

     (Repair the fuel injection nozzle)



5. Opening pressure test :

   Open the valve (3) and slowly operate the hand lever at tester (approx. 1 stroke / second) and measure opening pressure.

New Nozzle	135 - 143 bar
Used Nozzle	Min. 120 bar
Difference Between Nozzles	Max. 5 bar

   Notice: If out of standard, repair the injection nozzle.

6. Leak test

   Slowly operate the hand lever at the tester until get a pressure of approx. 90 bar. Maintain this pressure for more than 20 seconds and within this period no drop of fuel should build up at the nozzle tip.