Maintenance on the Injector

MAN Diesel | PrimeServ Academy

Augsburg

1. Maintenance on the Injector
2. Checking injector on a modern four stroke diesel engine
3. Dismantling of the injection valve
4. Checking parts of the injector

Maintenance on the Injector

1. Maintenance on the Injector
    - Spirit and purpose of the job
    - Maintenance Schedule

Spirit and purpose of the job

Why ?

- For a safe and reliable operation of the engine / plant
- Permit / support economic operation
- Prevent operating problems / damage
- To operate the engine according to environmental requirements

Maintenance Schedule

According to the maintenance schedule (see Operating-Instructions, chapter 4) an overhaul is necessary:

- Every 3000 – 4000 running hours
- By deviation from the operational values

Wartungsplan (Motor)
Maintenance Schedule (Engine) **4.7.2**

1, 2, 3				x / y			per	24	250	500	1-2*	3-4*	5-6*
Kraftstoffeinspritzventil • Fuel injection valve													
322	Einspritzventile ausbauen, Düsenelemente prüfen und ggf. durch neue bzw. regenerierte Düsenelemente ersetzen	*Remove injection valves, check nozzle elements or replace them by new or reconditioned nozzle elements if necessary*	221.01 221.02 221.03 221.04		2	3.5	Ventil *Valve*					X	

Maintenance on the Injector

2. Checking injector on a modern four stroke diesel engine

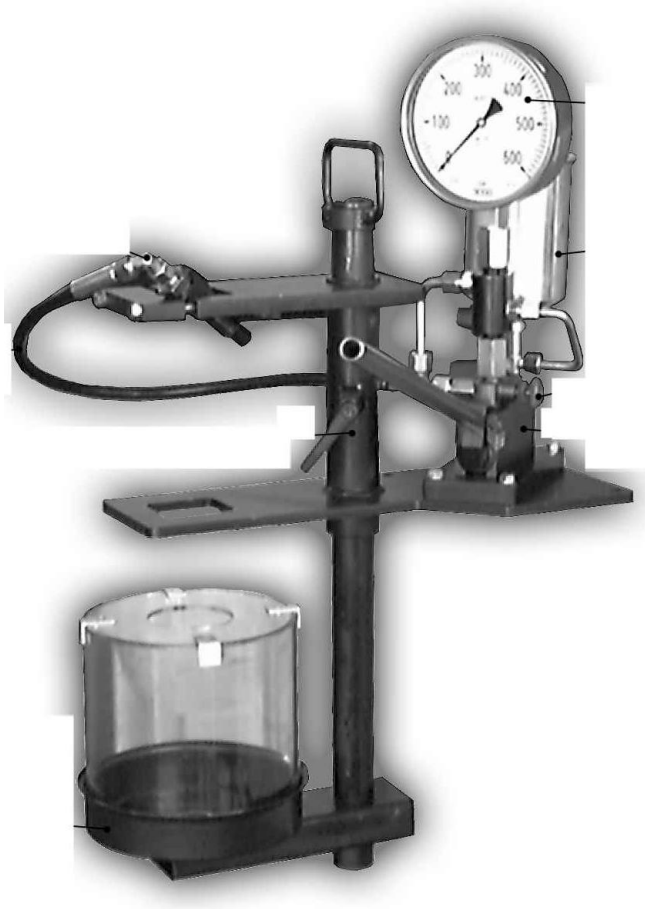
- Starting condition – Injector
- Nozzle test bed – general remarks
- Nozzle test bed General remarks
- Valve arrangement on the nozzle test bed
- Starting condition – Nozzle test bed
- Installing the injector to the nozzle test bed
- Operating sequence – checking injection valve
- Checking opening pressure
- Checking nozzle bores - Opening Sequence
- Judging the nozzle bores
- Adjust opening pressure
- Checking the tightness

Starting condition – Injector

Starting condition:

- Fuel injector removed from the engine
- Fuel injector cleaned:
  - To operate the engine at least one hour with diesel oil
  - By HFO operation you have to clean the internal parts of the injector prior to the testing
- Fuel injector fixed in the nozzle test bed

Nozzle test bed – general remarks

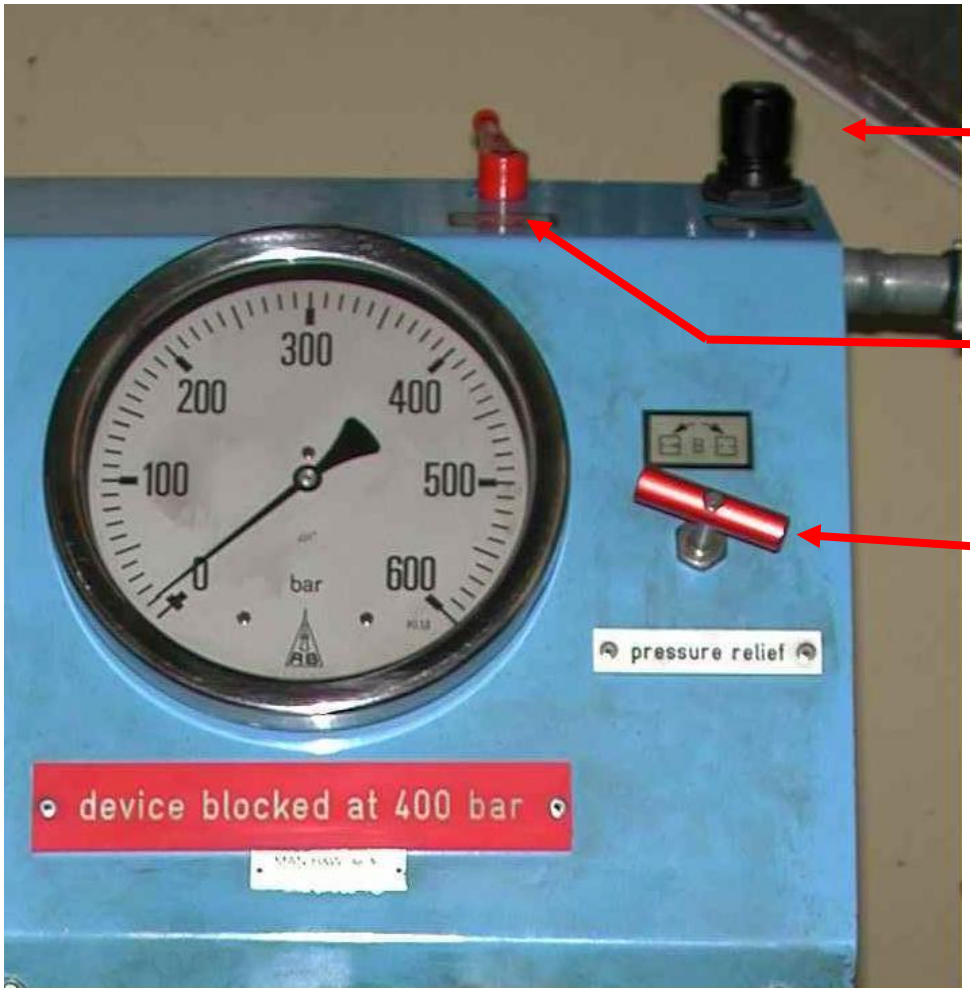


The nozzle test bed shown below is as standard tool delivered on the engine type 32/40. This nozzle test bed will be operated manually. In the following presentation we work with an pneumatic, hydraulic operated nozzle test bed. The performance test of the injector will be exactly the same, just the handling of the nozzle test bed is different. For further details, please refer to the working cards.

Nozzle test bed General remarks

The nozzle test bed shown below is delivered as standard tool from the engine type 40/54, 48/60 A / B and 58/64. The complete overhaul of the injector will be done with this nozzle test bed shown below.

Valve arrangement on the nozzle test bed



Pressure regulator

Air cock

Pressure relief valve

Starting condition – Nozzle test bed

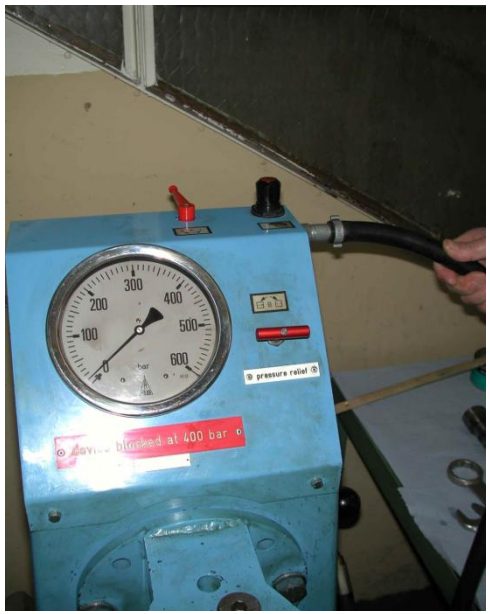
Before connecting the air supply make sure that the air cock is closed, the pressure relief valve is open and the pressure regulator at zero position (end position – counterclockwise)

Check oil level

Use only anti corrosion oil

Connect air supply

6 – 8 bar working air



Installing the injector to the nozzle test bed

Injector fixed in the clamping device:

- Screw in threaded piece and connect hose
- Bring the oil collector pan in position

Operating sequence – checking injection valve

Checking and adjusting the injection valves includes the following steps:

- Check the opening pressure
- Check the nozzle bores
- Adjust the specified pressure
- Check for tightness

Note:
When testing injection valves of modern four-stroke engines, atomization no longer is a test criterion, as the nozzle behavior during engine operation cannot be duplicated by means of the pressure tester.

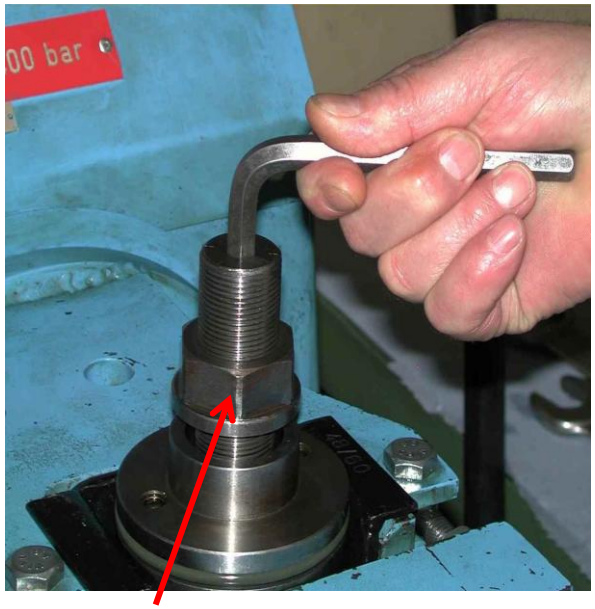
Checking opening pressure

Checking opening pressure

- Close pressure relief valve
- Open air cock
- Slowly increase the pressure on the pressure regulator
- Note down the opening pressure (Operating instructions sheet 2.5.2)
  - Decreases in opening pressure less than 90 bar continue with checking nozzle bores
  - Decreases in opening pressure more than 90 bar – dismantle the injection valve

Checking nozzle bores - Opening Sequence

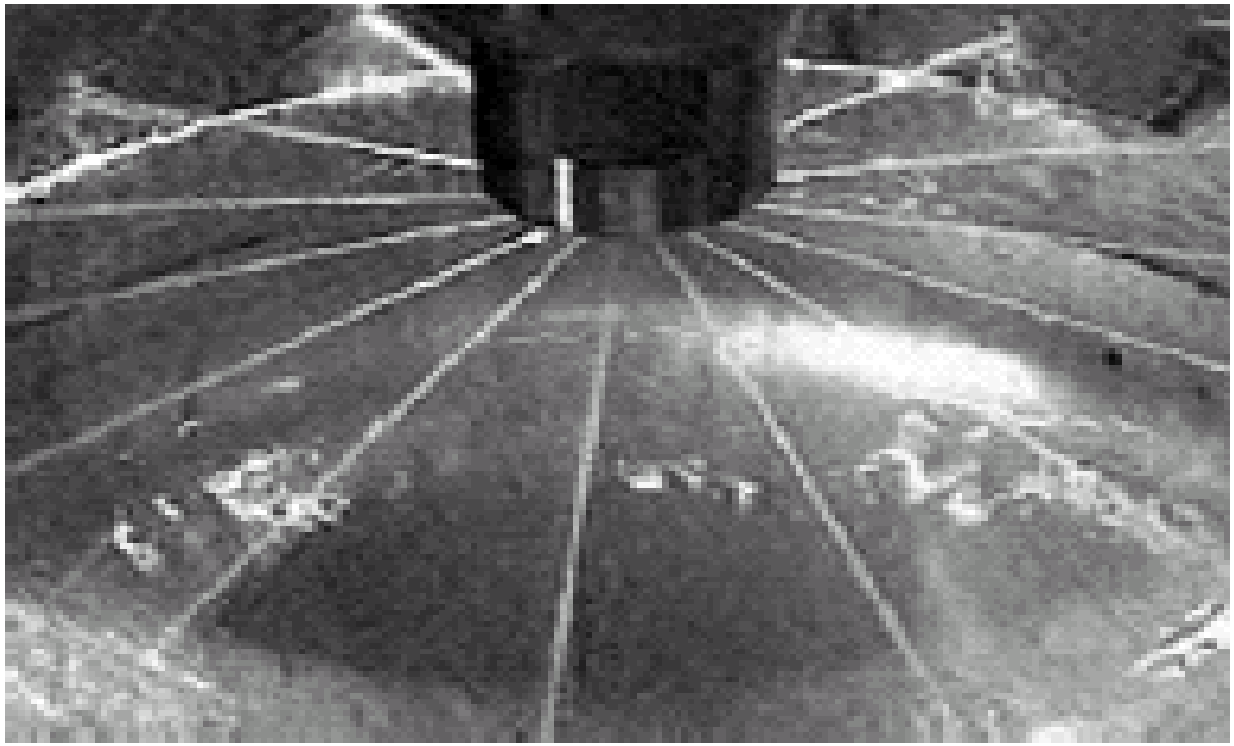
- Turn the pressure regulator all the way to the left (minus -)
- Loosen the hexagon nut and turn back the, setting screw until the tension of the setting has been released
- Close the pressure relief valve. Start the hydraulic pump and adjust the opening pressure by 30 bar.
- Are all nozzle bores open ?
  - Yes, continue with the next step.
  - No, disassemble the injection valve.



Turn back the setting screw

Judging the nozzle bores

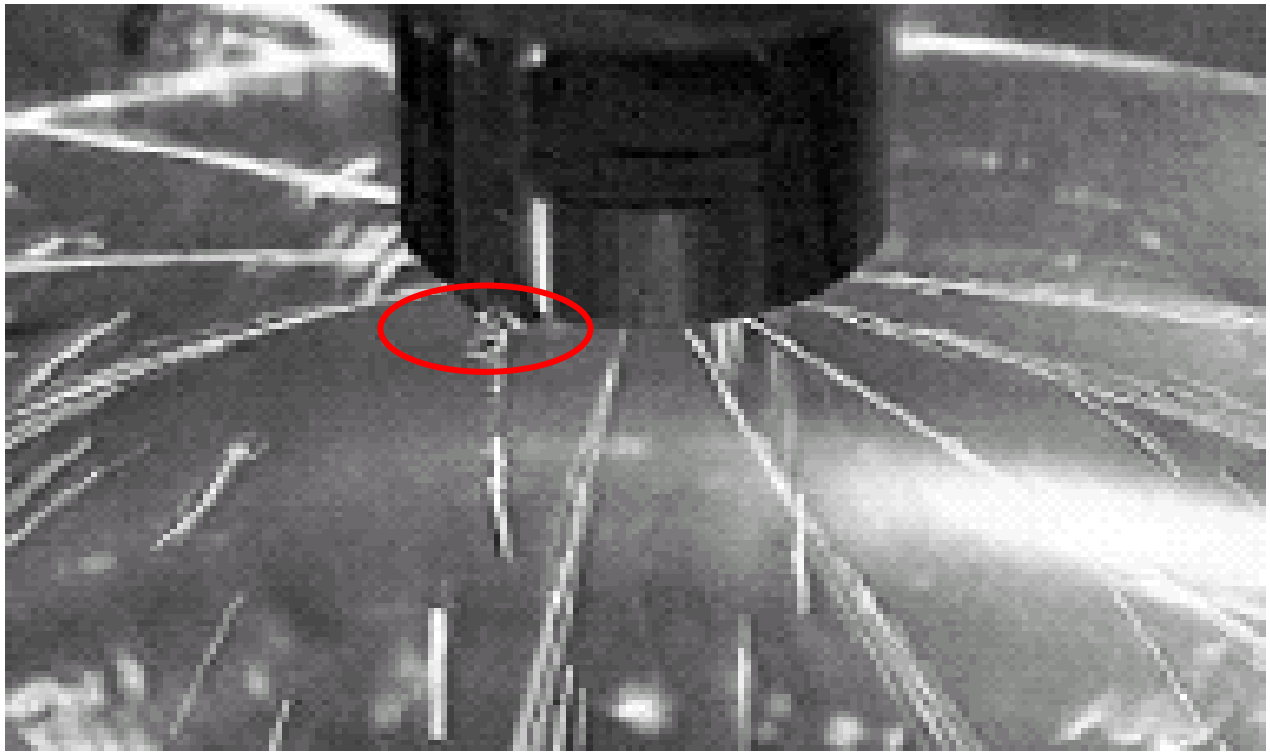
All bores open …
continue with next step



Judging the nozzle bores

Few bores clocked …

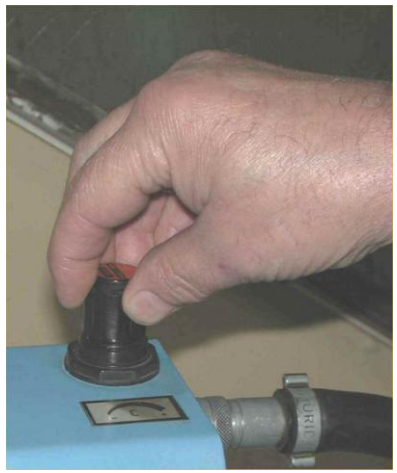
DISMANTLE



Adjust opening pressure

Pre-setting off the injector

- Slightly tension the compression spring (preliminary adjustment)
- Slightly increase the pressure regulator
- Note the opening pressure
- Close air cock
- Release the pressure on the pressure relief valve (so that the needle will be placed on to the seat again)



Adjust opening pressure

Pre-setting off the injector

- Increase the tension on the compression spring
- Slightly increase the pressure regulator
- Note the opening pressure
- Repeat this action until you have reached the specified opening pressure

Note:

Before increasing the compression spring, always depressurize the system!!

Adjust opening pressure

Correct opening pressure:

- The nominal value of the opening pressure is listed in the operating instructions data sheet 2.5.2, as also in Acceptance Test paper
- You have to adjust the nominal value due to the given tolerance

Adjusted opening pressure

Here: on a 48/60 engine

Checking the tightness

For checking the tightness:

Adjust the pressure to 250 bar by means of the knob on the pressure regulator and keep it at this value. The injection nozzle can be considered tight, if no drop falls within a period of 5 seconds.

- Yes – the injection valve can be used.
- No – the injection valve should be sent to MAN B&W Diesel for regeneration.

3. Dismantling of the injection valve

- Back of the setting screw
- Loosen nozzle tensioning nut
- Take the nozzle body off
- Remove the threaded piece
- Removing the inner parts

Back of the setting screw

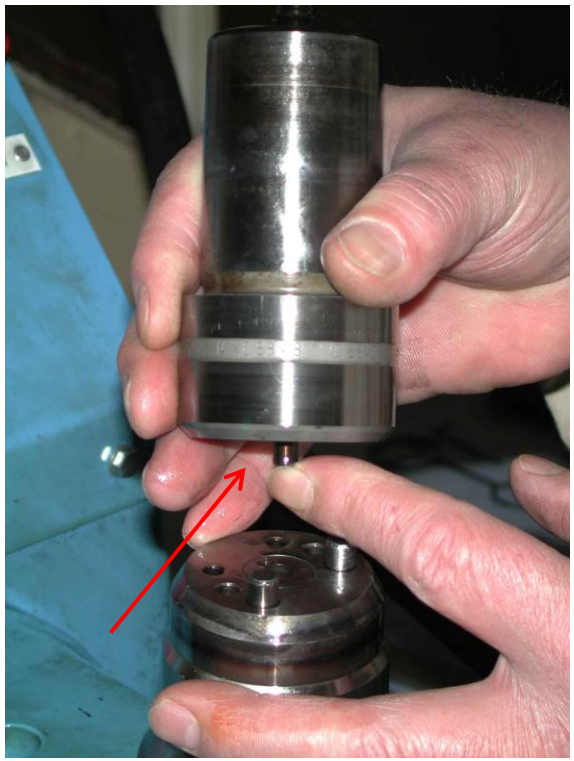
Loosen the hexagon nut and back off the setting screw until the tension on the compression spring has been released.

Loosen nozzle tensioning nut

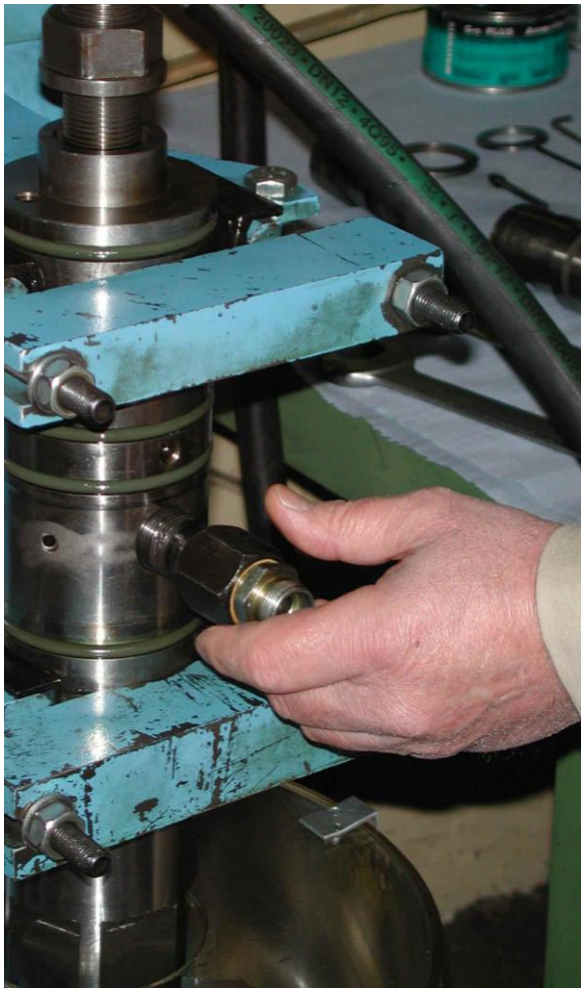
1. Turn the fixing head with the injection valve by 180°
2. Loosen carefully the nozzle tensioning nut

Take the nozzle body off

3. Unscrew the nozzle tensioning nut and take the nozzle body off.
4. Take care that the nozzle needle does not fall out.
5. Pull the nozzle needle out of the body, and immerse it in Diesel fuel for cleaning.



Remove the threaded piece



Before removing the inner parts, you have to remove the threaded piece.

Attention!!

On the engine type 32/40 you have also to remove the set screw before removing the inner parts.

Removing the inner parts

Normally the inner parts comes out by gravity. In case the inner parts are not loose, screw the eye bolt into the thrust pad and pull the thrust pad out.

Afterwards, remove the compression spring and spring plate

4. Checking parts of the injector

- Component check
- Cleaning the nozzle bores
- Checking nozzle body
- Checking nozzle specification

Component check

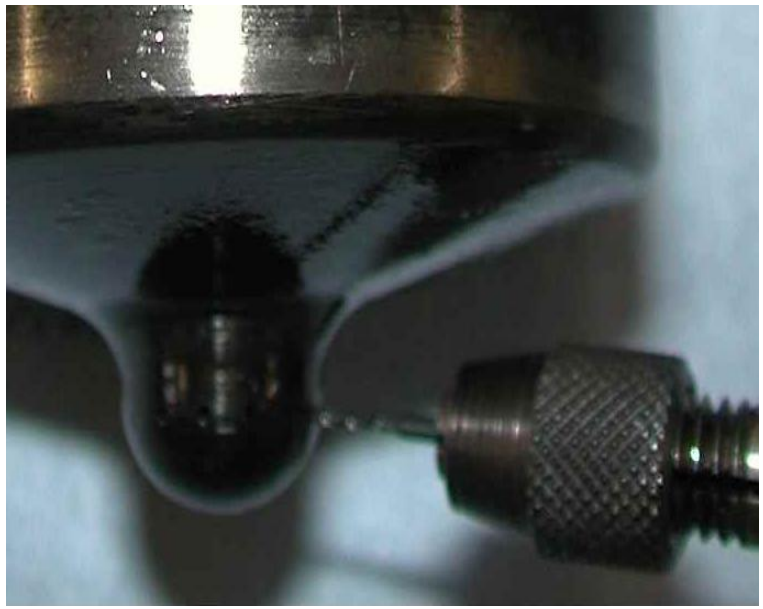
The component check includes the following:

- The nozzle bores
- The condition of the fitting area
- The movability of the needle
- Traces of corrosion on the nozzle tensioning nut and the nozzle body
- The nozzle specification

Tip!
Pay particular attention to such sources of error that caused unsatisfactory results when the injection valve was checked

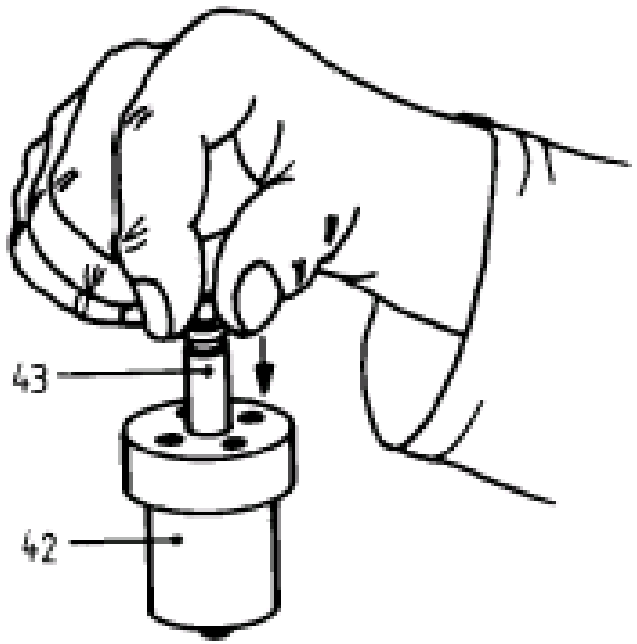
Cleaning the nozzle bores

For nozzle bore cleaning, clamp a suitable wire into the chuck and run it through the nozzle bores



Checking nozzle body

Check to see if the nozzle needle can be easily moved in the nozzle body, without noticeable resistance



42 *Nozzle body*
43 *Nozzle needle*

Checking nozzle specification

Read the nozzle specification off at the collar of the nozzle body, and compare it with the required specification. For the original specification, please refer to the engine's acceptance records

Seat surfaces

The seats and fitting areas must neither to be reworked by hand nor by machine, as the required accuracy cannot be achieved

5. Assembly of the injector

- Assembly injector – Proposals
- Parts of the injector
- Position of the groove
- Only by the 32/40 engine
- Screw in the setting screw
- Check movement of the needle
- Clean contact surface
- Tensioning nut
- Tightening of the tensioning nut

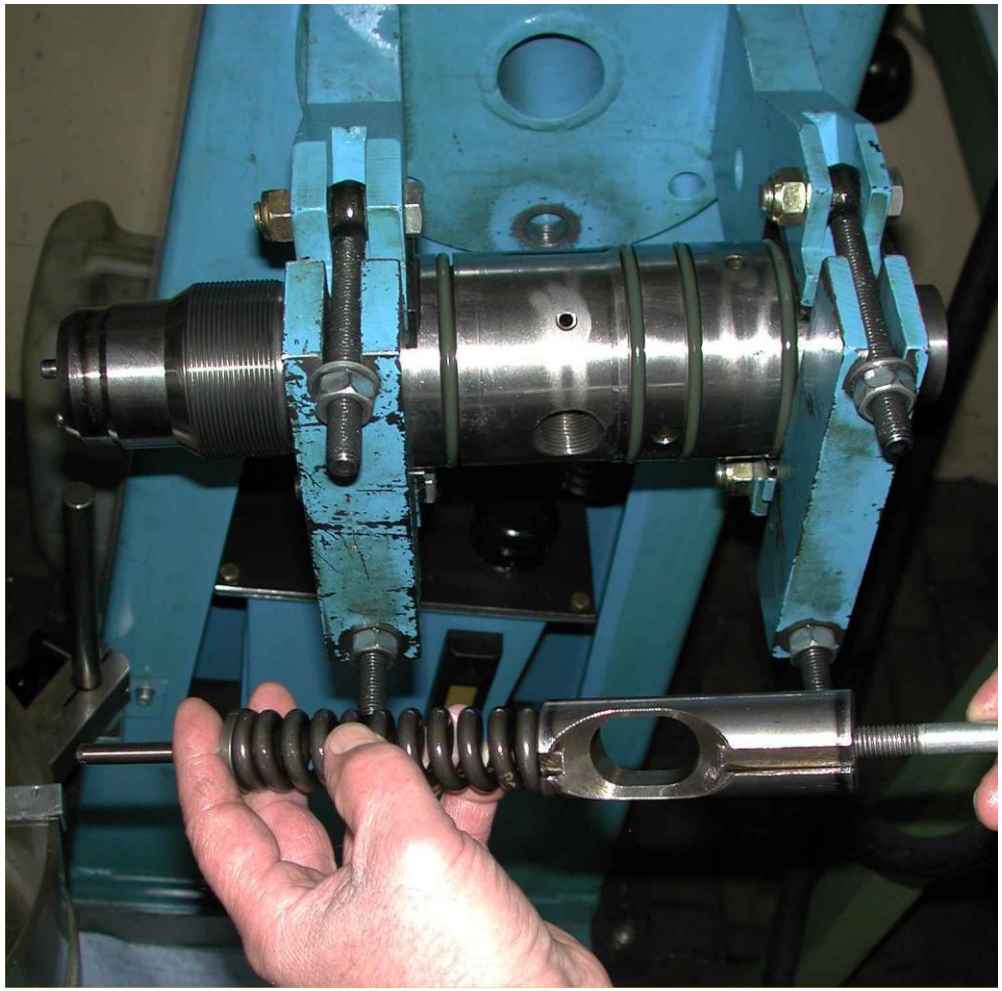
Assembly injector - Proposals

Important!

- Prior to assembly, check whether the specification of the injection nozzle coincides with the required specification. The original specification can be gathered from the acceptance record (number, number of nozzle bores, bore diameter, injection angle).
- The injection valve has been disassembled, all individual components carefully cleaned and defective parts replaced.

Parts of the injector

Assembly of the inner parts

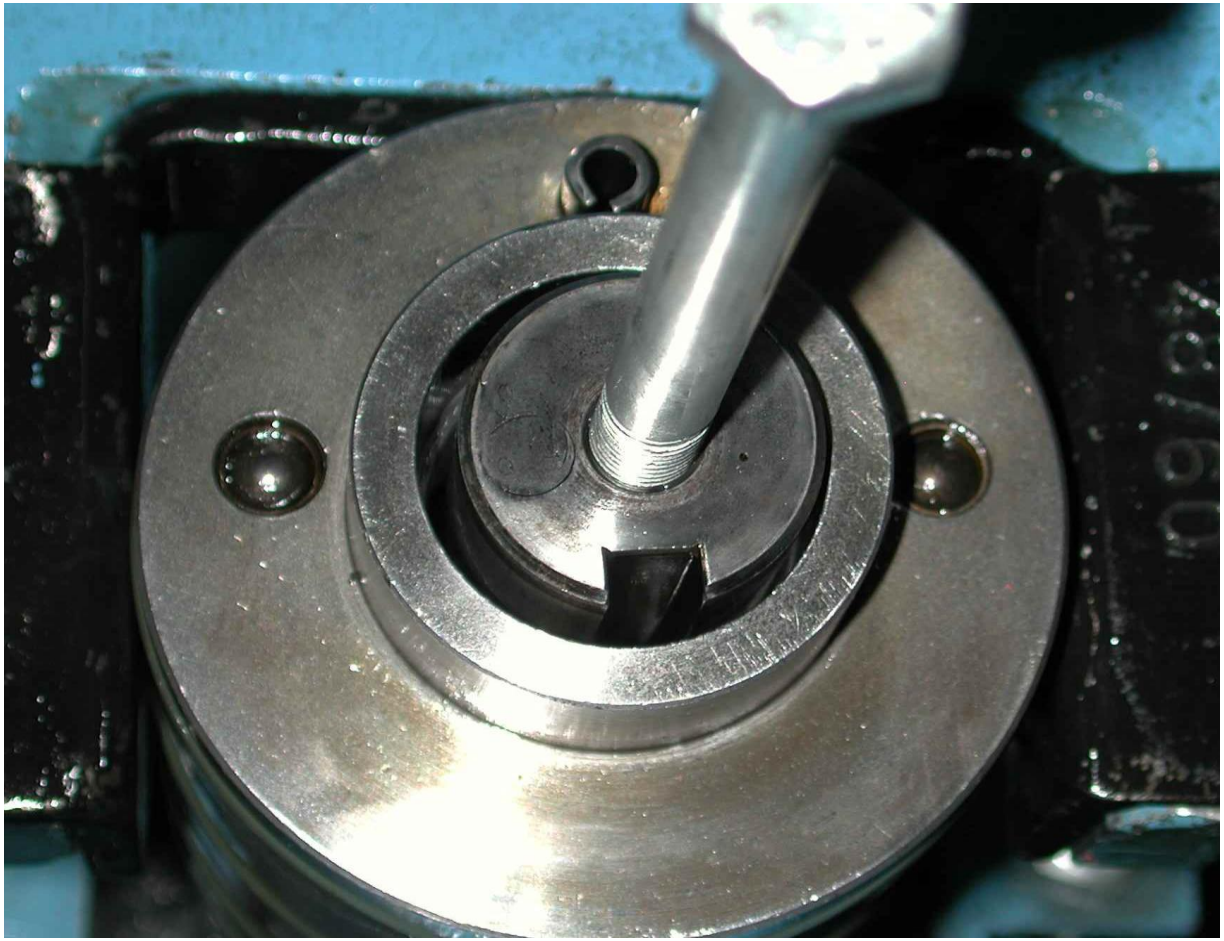


Insert the inner part from the right hand side to the left in the following sequence:

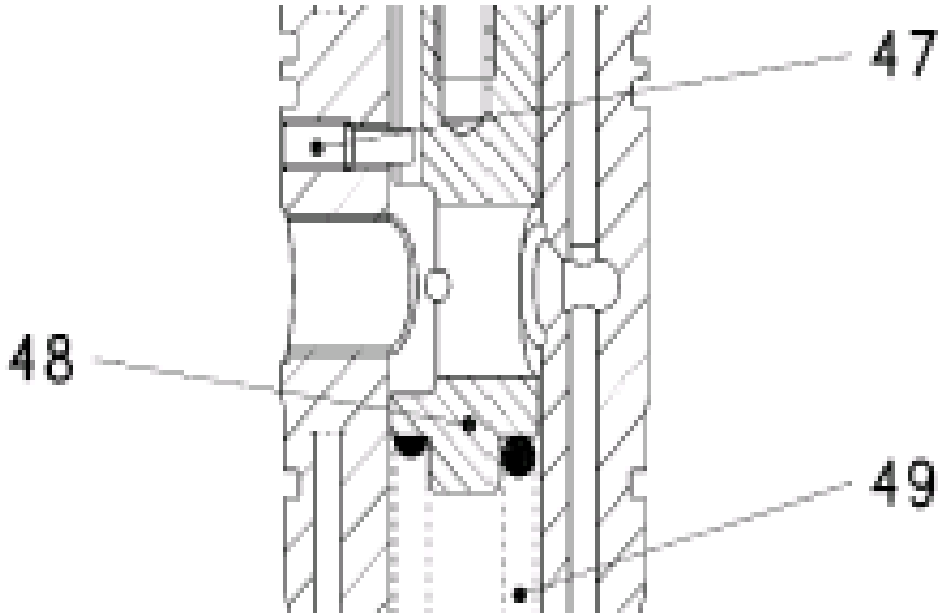
1. Spring plate
2. Compression spring and
3. Thrust pad

Position of the groove

Observe the position of the thrust pad to nozzle body



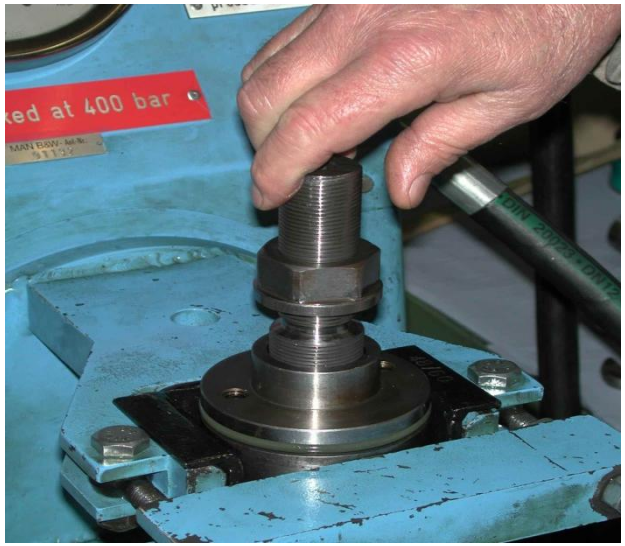
Only by the 32/40 engine



This applies only to the 32/40 engine: Carefully clean the set screw (47) and the bore hole according to Loctite specification

Coat the thread of the set screw with Loctite 234 securing compound over a length of 5mm, and screw the set screw into the holder until it does no longer protrude. Verify that the thrust pad is still movable is still movable in axial direction

Screw in the setting screw

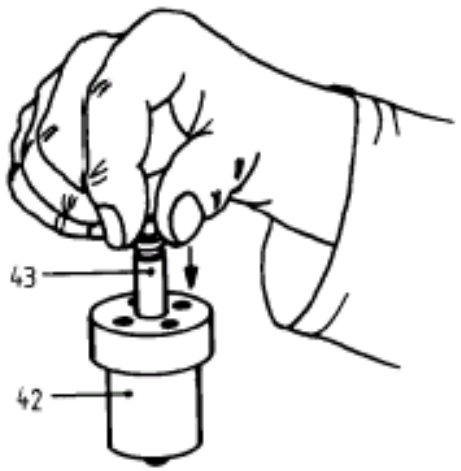


- Screw the setting screw in, do not yet tension the compression spring (see the left figure).

- Verify that the spring plate has been positioned correctly (see the right figure)

Check movement of the needle

- Dip the nozzle needle into clean Diesel fuel oil, and insert it into the nozzle body.
- Verify it moves easily.



42 *Nozzle body*
43 *Nozzle needle*

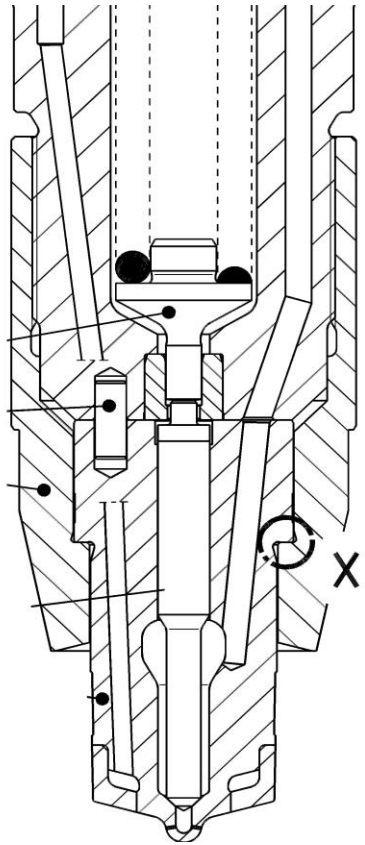
Clean contact surface

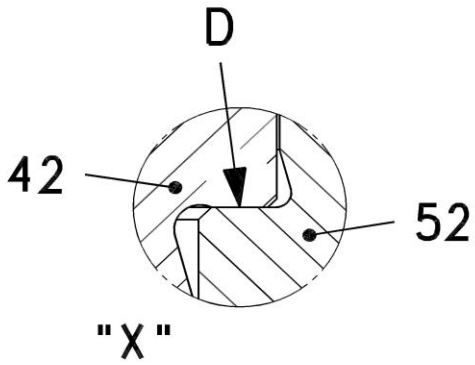
- Wipe the sealing face dry using a paper towel.
- Slip the nozzle body and nozzle needle onto the holder, paying attention to the position of the two parallel pins.

Tensioning nut

- Coat the pressure shoulder with “Optimol paste white T”

  (see the figure below for details)





Tensioning nut

- Coat the thread of the holder and nozzle tensioning nut with “Optimol paste white T” lubricant.
- Screw the nozzle tensioning nut onto the holder, hand-tight, and tighten it to the specified torque

Tightening of the tensioning nut

- Tighten the nut to the specified torque (see work card 000.30)

Tightening of the tensioning nut

Turn the fixing head by 180°
and
Fix it in place

Screw the hexagon nut loosely onto the setting screw, and tighten it only after adjusting the injection pressure.

The adjustment of the injector is described in slide 4 till slide 18.

We hope this presentation is of assistance to you for carrying out your maintenance work

We wish you an successful overhaul

Thank you very much for your attention!!