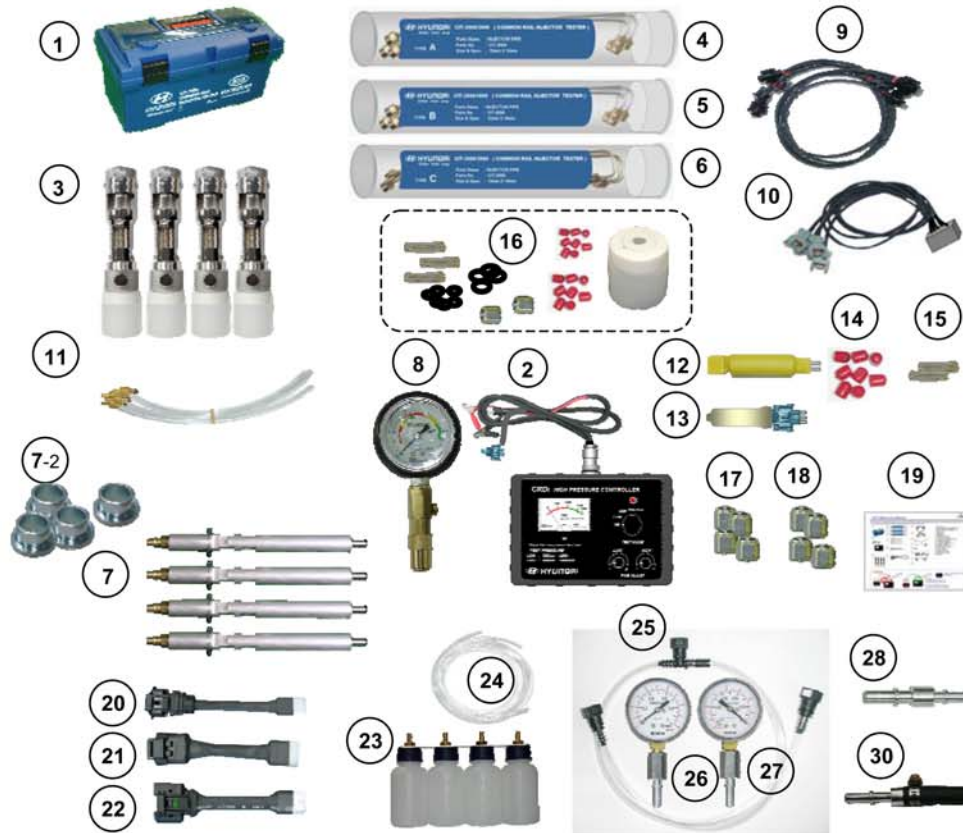


## NCT – 3000 KIT ( with NCT-1000 Kit )

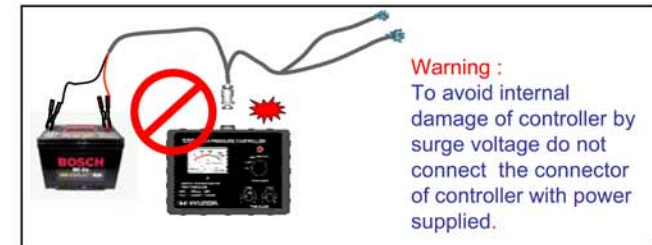


## NCT- 2000B KIT

1. CASE
2. HP CONTROLLER (Combination)
3. INJECTOR TEST TUBE ASSY
4. PIPE type A
5. PIPE type B
6. PIPE type C
7. DUMMY INJECTOR
- 7-2. ADAPTER (for DUMMY INJECTOR)
8. COMPRESSION GAUGE
9. I/CONTROL WIRE KIT (BOSCH)
10. I/CONTROL WIRE KIT (DELPHI)
11. B/ LEAK CONNECTOR SET
12. DUMMY RESISTER (PRV)
13. DUMMY RESISTER (HP Sensor)
14. DUST CAP (for Injector )
15. BLOCK HOSE (Injector return line)
16. SPARE PARTS KIT
17. RAIL PLUG (12mm)
18. RAIL PLUG (14mm)
19. USERS MANUAL

## NCT-1000 KIT ( Included )

20. RPS adapter Connector (for Bosch)
21. RPS Adapter Connector (for DELPHI OLD)
22. RPS Adapter Connector (for DELPHI NEW)
23. Back Leak Test bottle
24. Back Leak test hose
25. Low pressure gauge Connection tube
26. Low pressure gauge
27. Vacuum Gauge
28. Connection Adapter
29. Fuel Filter Plug (for DELPHI)
30. Connection Adapter with Hose



**Warning :**  
To avoid internal damage of controller by surge voltage do not connect the connector of controller with power supplied.

This new Injector Tester NCT- 2000 has developed in addition to NCT-1000, in order to improve diagnostic efficiency and accuracy for vehicles equipped with Common Rail System.

NCT-2000 enables Injection Quantity Comparison Test under Low and High fuel pressure conditions, which it was not possible with Hi-scan or NCT-1000.  
Also Cylinder compression and Rail pressure regulator test are additionally available.

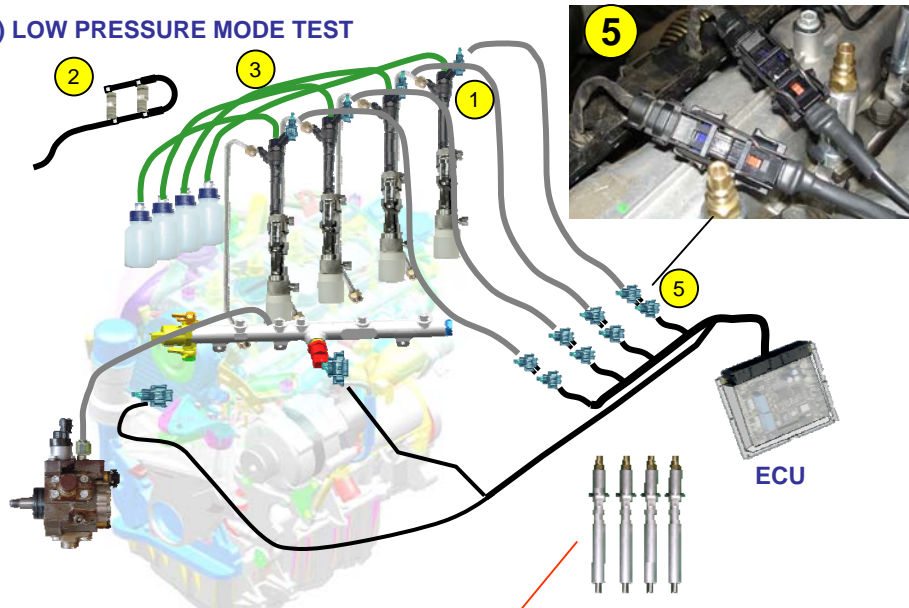


# STEP 1-1 INJECTION COMPARISON TEST ( LOW PRESSURE MODE )

Test Method : Automatic    Affected vehicle : All Model ( including EURO-IV)



## 1) LOW PRESSURE MODE TEST

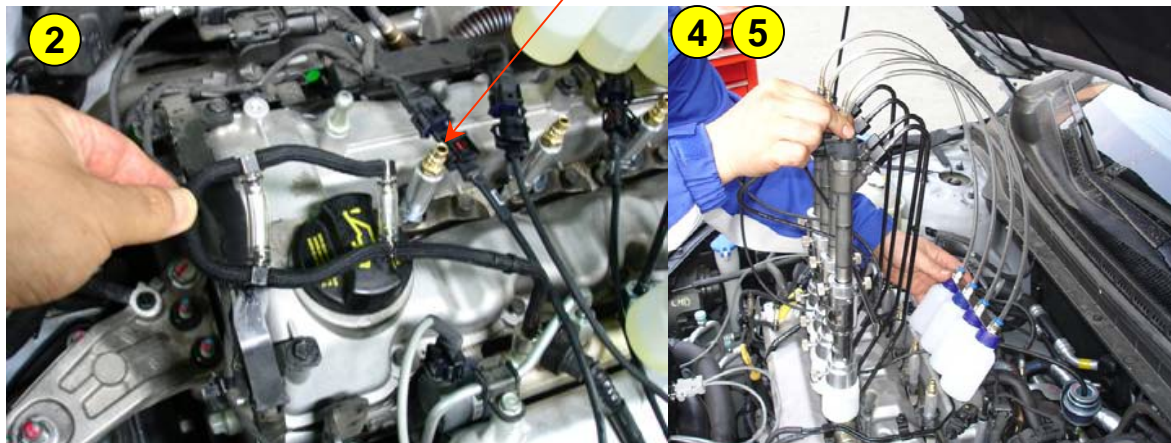


## LOW PRESSURE MODE TEST

1. Remove the injectors from engine
2. Block the return line of injectors
3. Install the test pipes in the rail (4ea) and Install Test Tubes in injectors.
4. Install the Back Leak bottle in the Injectors
5. Install the injector control wire.
6. Crank the engine until the injection amount level of 1 or 2 test tubes are close to 5.

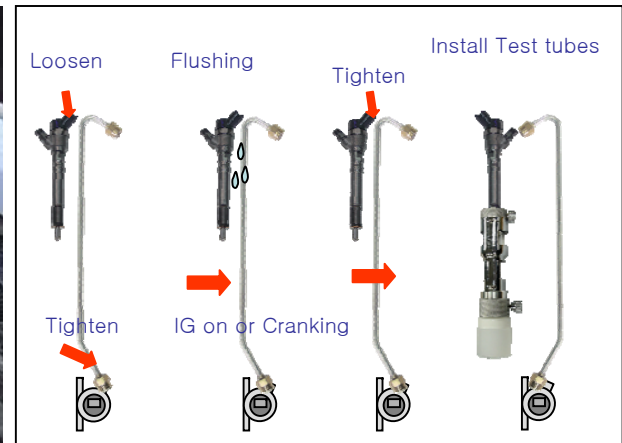
### NOTE :

Rail pressure will be maintained 250~300bar automatically by vehicle's ECU. Therefore you don't need to use HP controller during the test.



Remove injectors and install the dummy injectors instead.  
Block the fuel return line of injectors to prevent fuel leaking.

※ All the pipes must be cleaned before installed .  
( Clean it with an air gun )



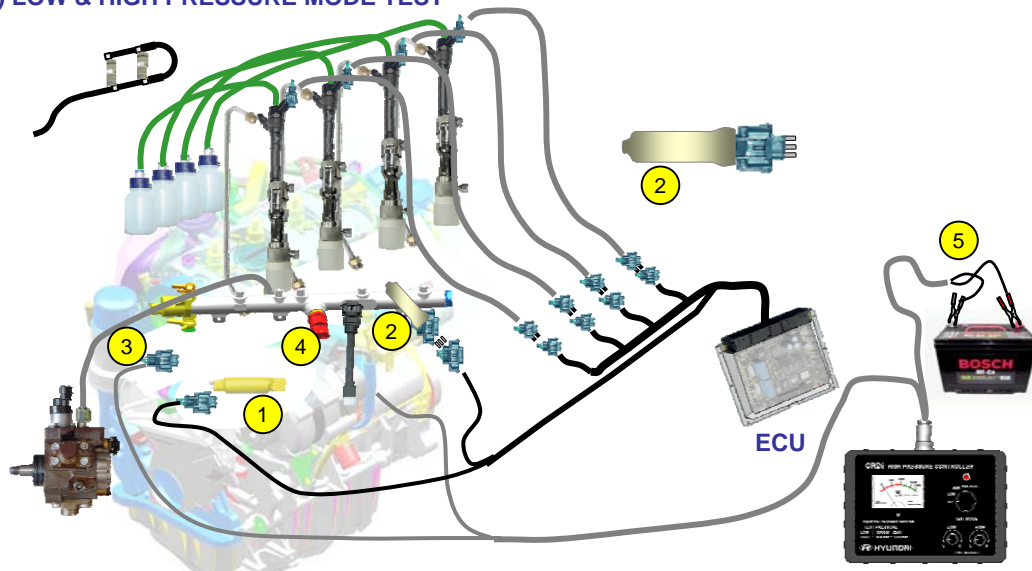
Flushing : Crank the engine and let the fuel leaks from the fitting area for flushing purpose.

# STEP 1-2 INJECTION COMPARISON TEST (LOW & HIGH PRESSURE MODE)

Test Method : Manual (with PRV Controller) Affected vehicle : All model Exempt EURO-IV/V model



## 1) LOW & HIGH PRESSURE MODE TEST



## LOW PRESSURE MODE TEST

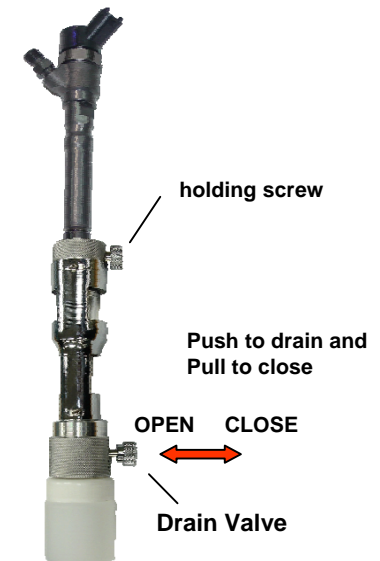
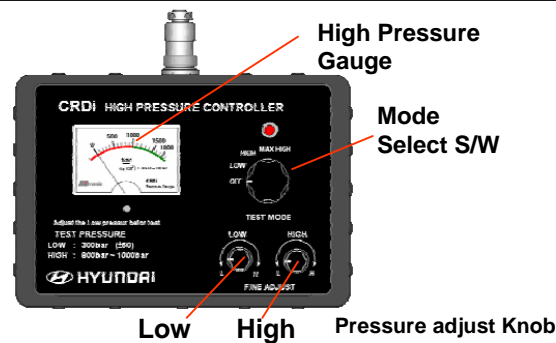
- 1) Disconnect the PRV's & rail pressure sensor's connector from the rail
- 2) Install ① Dummy Resistor and ② Rail Pressure Sensor Dummy in each wiring connectors.
- 3) Connect HP controller's leads to the ③PRV & ④ rail pressure sensor.
- 5) Connect HP controller's ⑤ power cable to battery.
- 4) Crank the engine until the injection amount level of 1 or 2 test tubes are close to target level. (5 scale in LOW, 8 scale in HIGH)

### NOTE :

- Rail pressure can be adjusted from 100 to 1000bar by pressure adjust knob.
- From Euro-4(09MY) model you must use rail pressure sensor dummy otherwise injector will not work while cranking.



**NOTE: Battery must be fully charged before test**



## TEST PROCEDURE

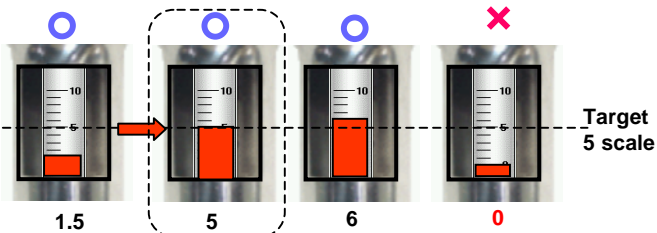
- 1) Select MAX HIGH mode and crank engine for 2-3seconds.
- 2) Crank engine and adjust the rail pressure in Low and High mode while engine cranking.
  - LOW = 300 ~ 350 bar
  - HIGH = 800 ~ 1000 bar
- 3) Drain the fuel from the test tube.
- 4) Perform test in each mode: LOW & HIGH.
 

NOTE : Perform the test more than 2 times to get accurate data.

# STEP- 1-3 Test & Diagnostic



## LOW PRESSURE MODE JUDGMENT

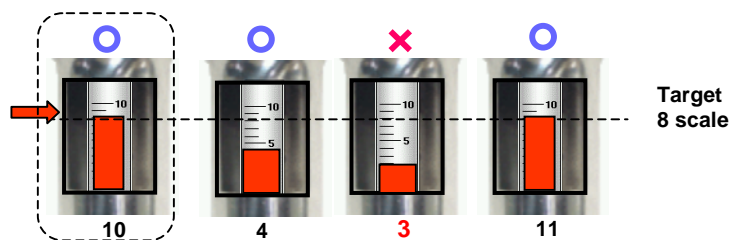


### Test & Judgment

Crank the engine until the highest level of one or more test tubes are close to targeted level . ( LOW : 5<sup>th</sup> / HIGH : 8<sup>th</sup> scale )

Judgment will automatically be made once you fill out measured values CRDi diagnosis check sheet in GDS (Global Diagnosis System)

## HIGH PRESSURE MODE JUDGEMENT



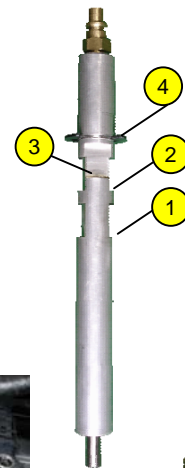
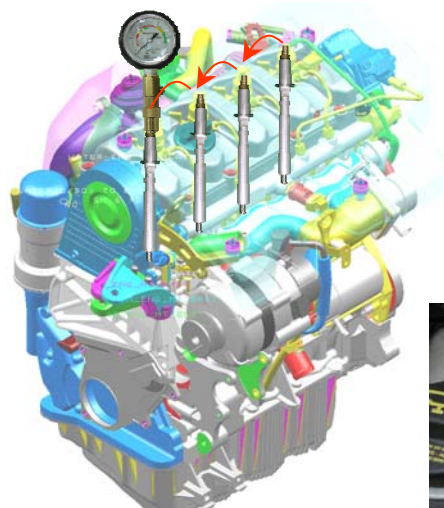
### For user who has no GDS

Crank the engine until the injection amount of 2<sup>nd</sup> largest fuel amount injector is close to target level. (5 scale when low pressure mode, 8 scale when high pressure mode)

Measure the other injector's injection amount and judge as below.  
 LOW PRESSURE MODE : 1.5 mm<sup>3</sup> ( 1.5 scale ) or higher is normal  
 HIGH PRESSURE MODE : 5 mm<sup>3</sup> ( 5 scale ) or higher is normal

NOTE : It is recommended to use CRDi diagnosis program in GDS for your convenient and accurate diagnosis.

## Compression Test



Select the correct groove according to engine type when you install dummy injector.

Quick coupling on dummy injector will help you to perform cylinder compression test easily and quickly.

### Judgments

Green : Normal condition (25~35)

Yellow : Gray zone ( insufficient pressure)

Red : Abnormal

Please refer shop manual for each vehicle

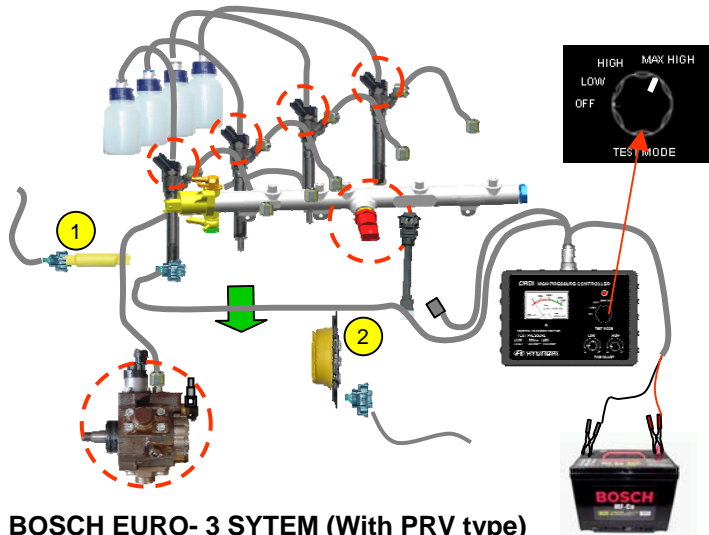


Adapter for new (A-ENG) Injectors



## STEP 2-1 HIGH PRESSURE TEST for each system

### High pressure test with Injectors ( Step 2-1)



BOSCH EURO- 3 SYTEM (With PRV type)

Purpose of this test is to check the High pressure pump's and the rail pressure sensor's performance.

### TEST PROCEDURE

- Install the back leak bottle and hose to injectors
- Remove the wiring connectors from all Injectors.
- Install the HP controller and set the mode switch to High position.
- Install ① PRV Dummy Resister and ② Rail Pressure Sensor Dummy in each wiring connectors.
- Crank the engine and measure the rail pressure and injector back leak amount.

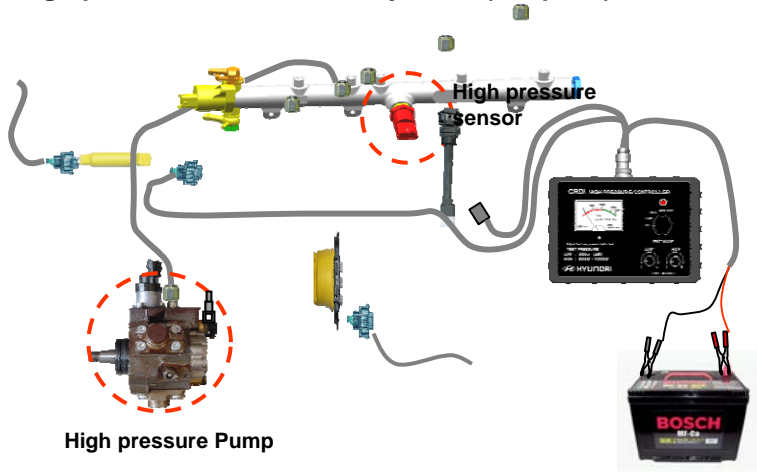
### SERVICE SPEC

High pressure : Above 700 bar ( with normal Back Leak )  
 Back Leak : Less than 3 times than minimum amount injector

### CHECK POINT ( if test is failed )

- Fuel Leak (rail plug or pipes connection)
- PRV (leakage or damaged)
- Fuel line
- HP pump (leakage or damaged)

### High pressure test without Injectors ( Step 2-2)



BOSCH EURO- 3 SYTEM (With PRV type)

Purpose of this test is to confirm the High pressure pump performance or to reconfirm high pressure pump performance when measured value of pressure was lower than 700bar during Step 2-1.

Avoid injector back leak completely by blocking rail outlet.

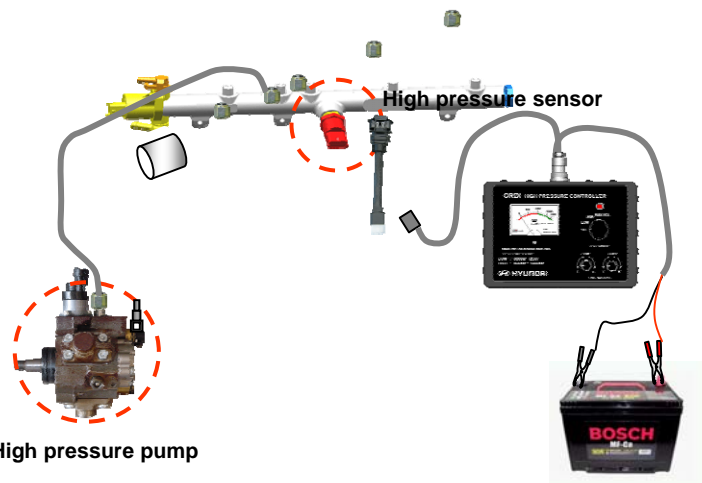
### Test Procedure

- Remove the Injector pipes from the rail.
- Block the rail outlet using rail plug.
- Install the HP controller and set the mode switch to High position
- Crank the engine and measure the rail pressure.

SERVICE SPEC : Above 900 bar  
 If measured pressure from Step2-1was below 700bar and measured pressure from Step2-2 was over 1000bar, the high pressure pump is in good condition. The low pressure (below 700bar) might be read due to too much injector back leak.

## STEP 2-2 HIGH PRESSURE TEST for each system

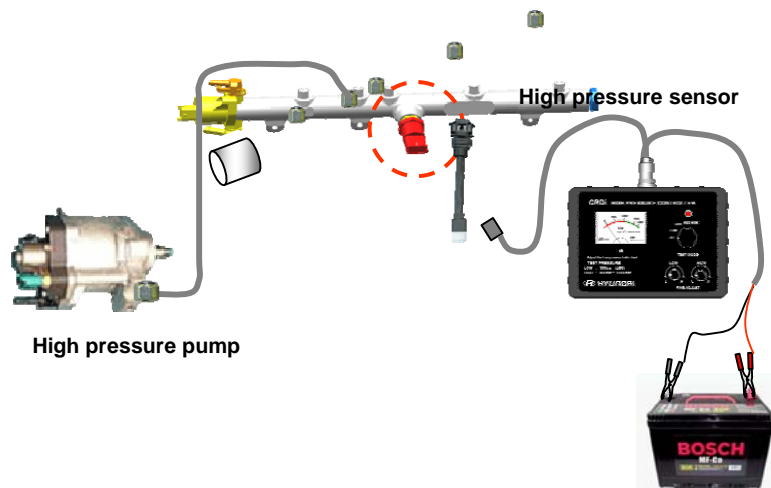
### High pressure test without Injectors ( Step 2-3)



High pressure pump

**BOSCH EURO- 2 SYTEM (Without PRV type)**

### High pressure test without Injectors ( Step 2-4)



High pressure pump

**DELPHI SYSTEM (Without PRV type)**

### Test Procedure

- Remove the injector pipes from the rail
- Block the rail outlet using rail plug.
- Install the HP controller and set mode switch to High position.
- Crank the engine and measure rail pressure.

#### SERVICE SPEC

BOSCH : Above 900 bar

DELPHI SYSTEM : 1000 bar

#### NOTE :

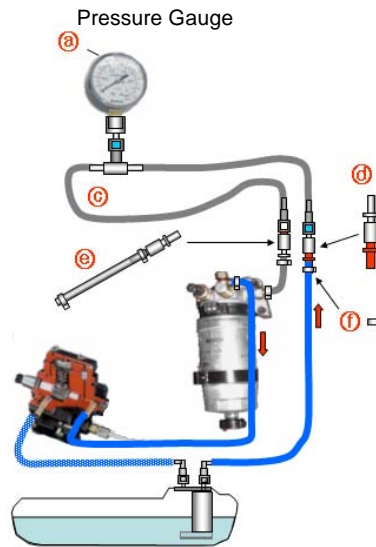
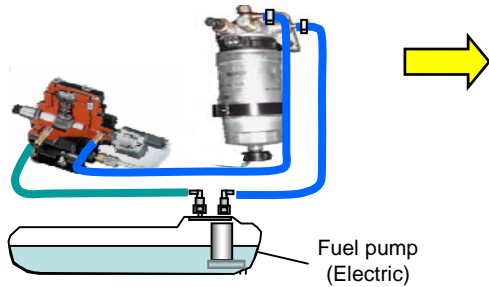
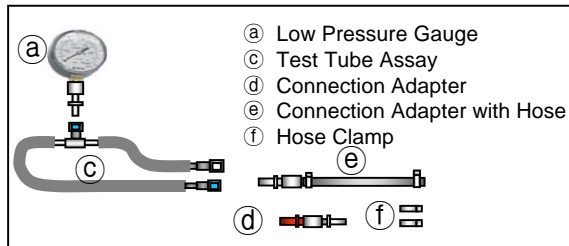
If measured rail pressure value was out of specification check following items.

- Low pressure pump (or suction pump) and its strainer (Including fuel tank)
- High pressure pump and IMV (Inlet Metering Valve)

If the vehicle problem is still persisted while rail pressure value is in specification check whether the fuel pump was contaminated or damaged.

# STEP 2-3 HIGH PRESSURE TEST for each system

## Electric pump type (Bosch Type II)



## Electric pump type (BOSCH Type II)

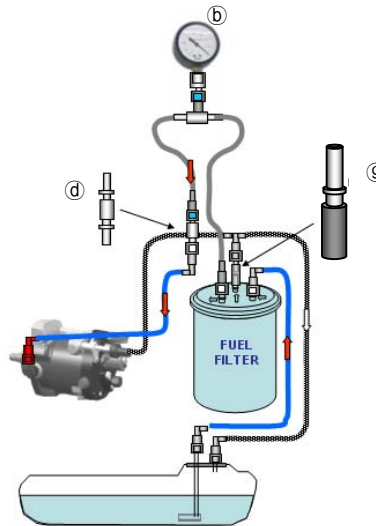
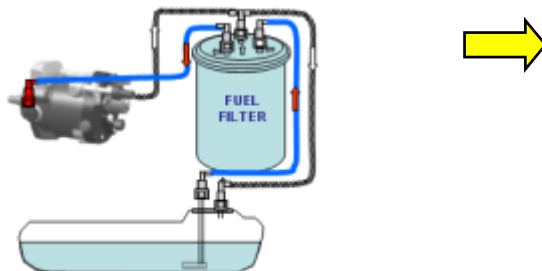
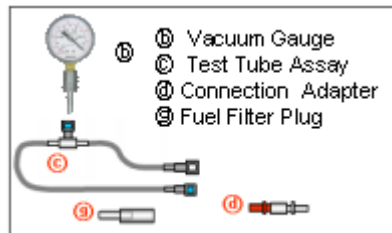
### EURO-III model

CASE	PRESSURE (bar)	JUDGMENT
1	1.5~3.5 kg/cm <sup>2</sup>	System normal
2	0 ~1.5 kg/cm <sup>2</sup>	Fuel Filter (or fuel line / strainer or etc ) clogging
3	no pressure	Abnormal function of fuel pump

### EURO-IV model

CASE	PRESSURE (bar)	JUDGMENT
1	2.5 ~ 5 kg/cm <sup>2</sup>	System normal
2	0.5~2.0 kg/cm <sup>2</sup>	Filter or fuel line clogging (pump in good condition)
3	no pressure	Abnormal function of fuel pump

## Internal suction pump type (Delphi)



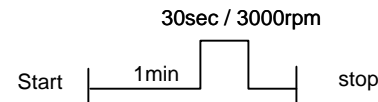
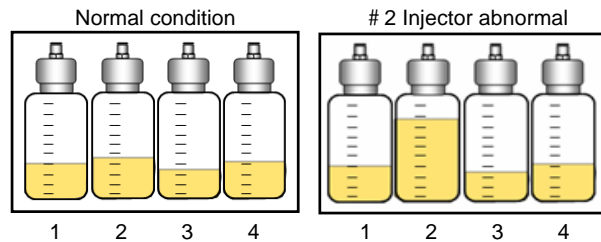
## Internal suction pump type ( Delphi)

CASE	VACUUM	JUDGMENT
1	10~20 cmHg	System normal (good condition)
2	20~60 cmHg	Filter or fuel line clogging (pump in good condition)
3	0~10 cmHg	Air leak in to the system or Suction pump damage

# STEP 2-4 INJECTOR BACK LEAK TEST( DYNAMIC)

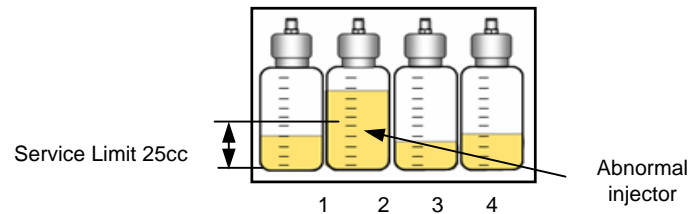
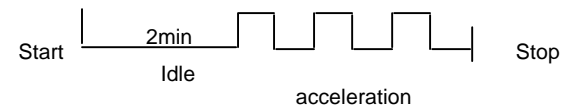
## INJECTOR BACK LEAK TEST (DYNAMIC)

- 1) Remove the return hose from each injector and Install injector return hose adapter visible tubes flasks and injector return hose plug referring to Injector back leak test (STATIC) in previous page.
- 2) Conduct the high pressure leak test referring to following explanation.  
**BOSCH Type I , II , III : D3EA(1.5D-ENG), D4EA(2.0D-ENG), D4FA(U-ENG), D4CB(2.5A-ENG)**
- 3) Start engine → 3 minutes at idle → accelerate engine up to 2500 rpm and keep the 2500rpm for 2 minutes → Stop Engine after 2 minutes
- 4) When the test is completed, measure the amount of fuel in each flask
- 5) Judgments  
**BOSCH Type I , II , III**  
 Replace the injector which is shown more 3 times than the minimum value.



## DELPHI : J3 (2.9L)

- 3) Connect the Hi-Scan and select the 'High Pressure Leak Test' mode.
- 4) Conduct the 'High Pressure Leak Test' until the Hi-Scan finish the test automatically.  
 or manually : Start engine → 2minutes at idle → 3 times acceleration → Stop Engine
- 5) For the accuracy of the test, perform the test more than twice and select the largest amount as a measured value.  
 ※ The flasks (NCT-1030) should be empty before the 2nd test started.
- 6) Judgments  
**DELPHI**  
 Replace the injector which indicates exceeds 25cc.



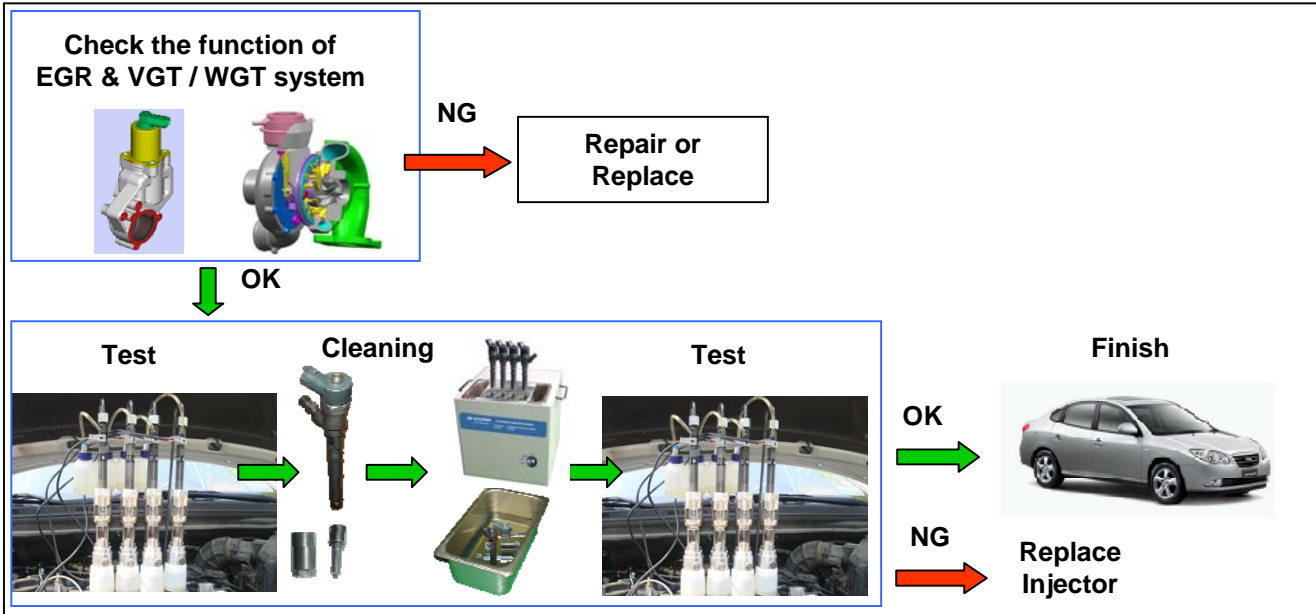


### 3-1. Diagnostic & Repair procedure of CRDi system

#### Classify the symptoms

##### Injector / EGR / TC problem

- Engine Vibration
- Hesitation / jerking
- Smoke emitting

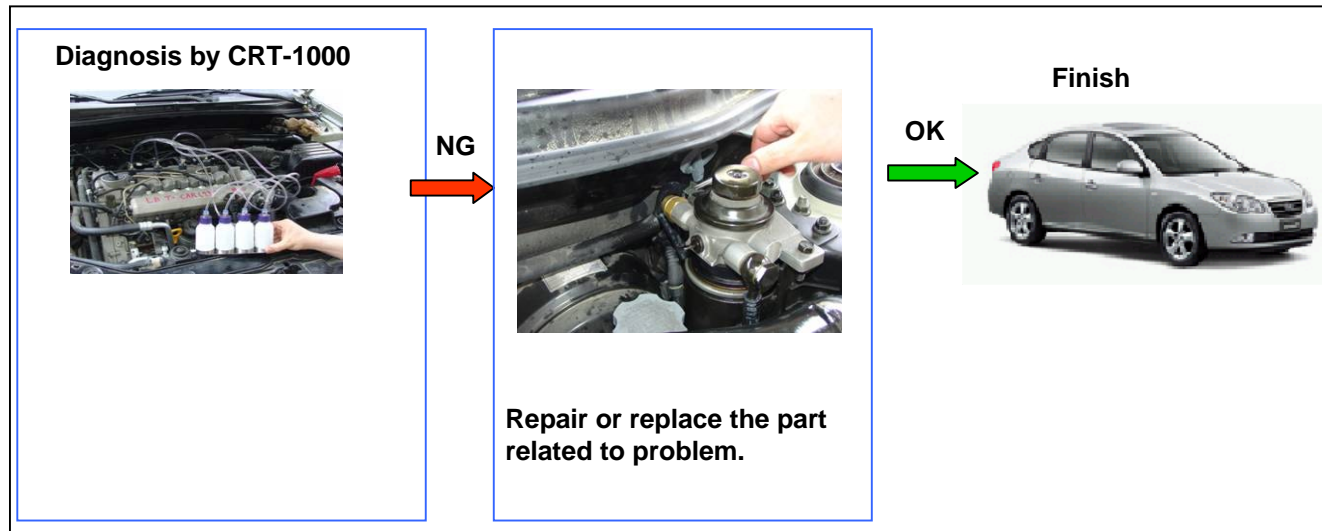


##### Fuel line or pump problem

- Engine stall
- Hard start or impossible to start
- Fuel pump noise
- DTC set ( related with pressure line )



Enter

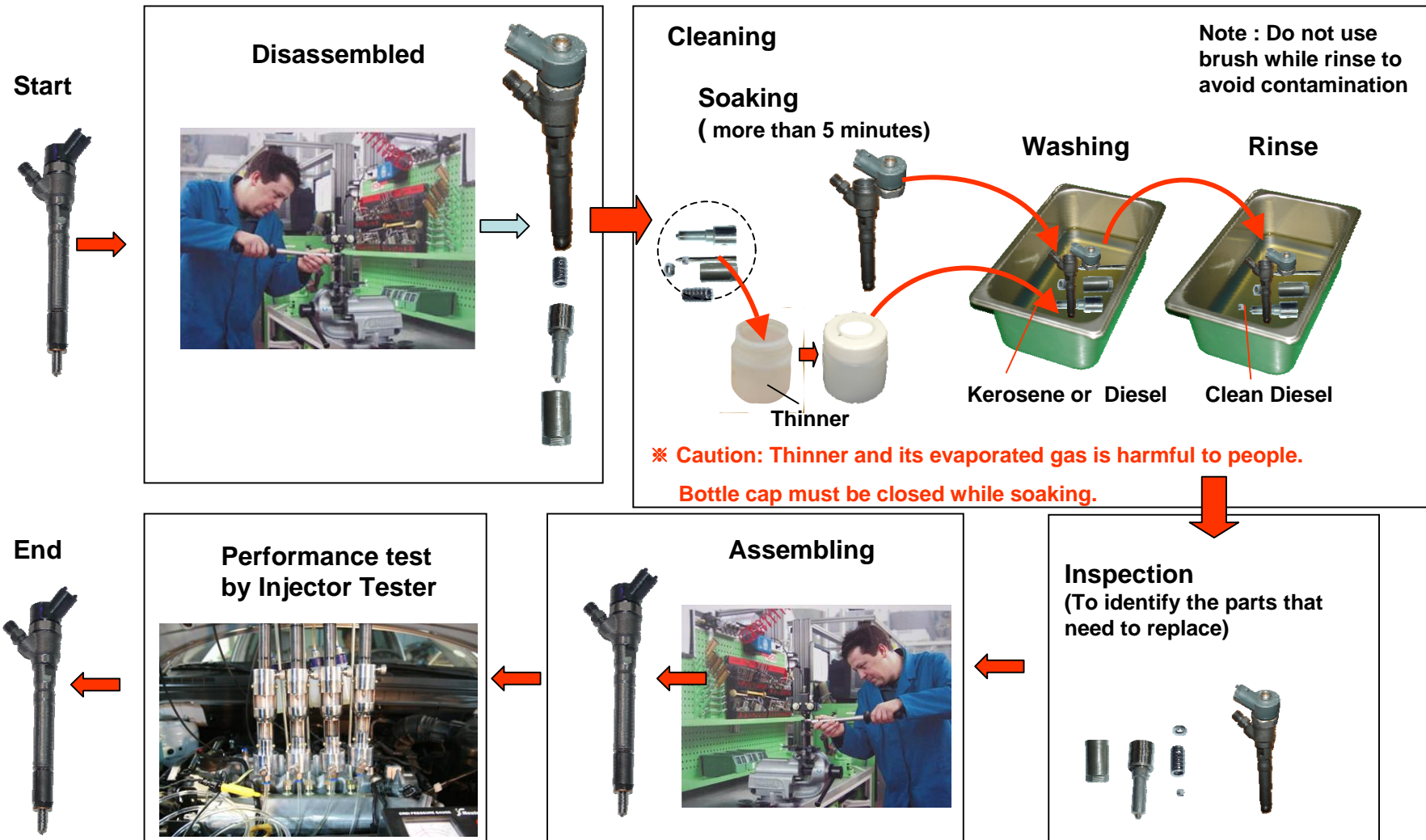


\* Injector repairs : Repair injector (replacing internal parts) if it is not recovered after cleaning.  
 \* Replace injector assembly when the internal parts are not available.

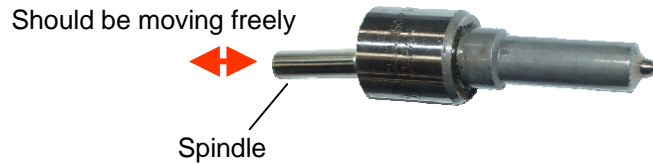
### 3-2. Cleaning procedure of injector

Repairing injector must be done in a clean and dust free environment to prevent injector contamination.

Do not interchange internal parts of injectors as it will influence on its calibration. Use only original parts to maintain the proper performance.

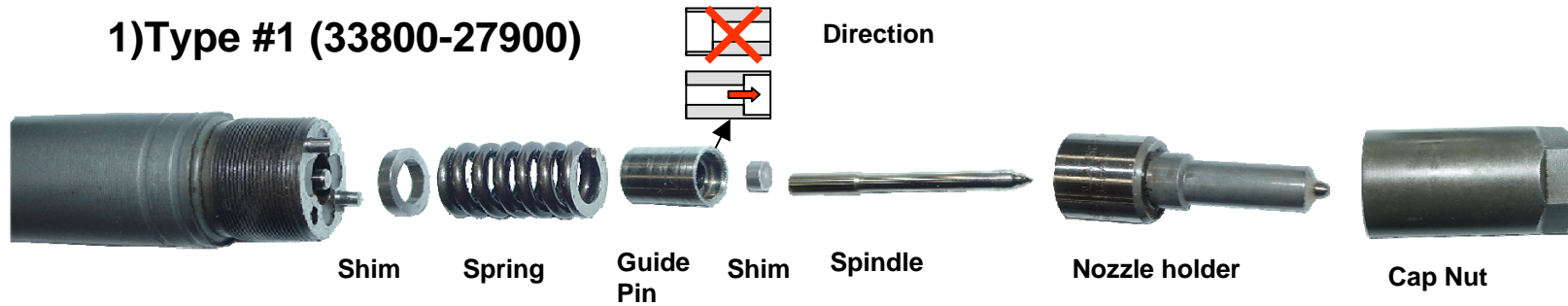


### 3-3. Injector assembly (Nozzle area)



Spindle should be inserted into nozzle holder freely (without any resistance).

#### 1) Type #1 (33800-27900)



#### 2) Type #2 (33800-27000)

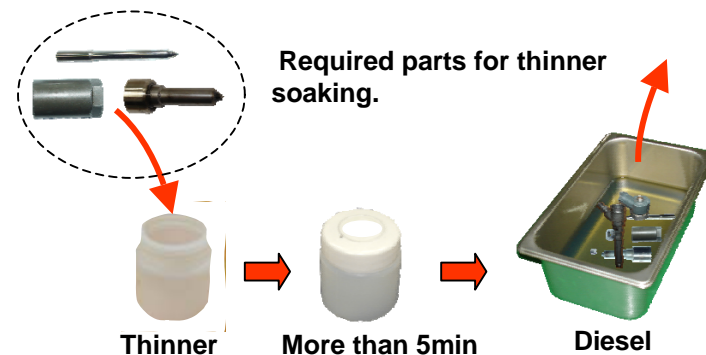


**NOTE :**

Cap nut must be tightened by Torque wrench.  
 Over torque will cause to have lack of injection amount while insufficient torque will cause to have fuel leaking or abnormal function.

**Tightening Torque : 45N-m**

Repairing injector must be done in a clean and dust free environment to prevent injector contamination.



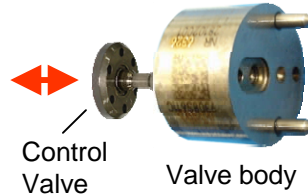
### 3-4. Injector assembly (Nozzle area)

#### 3) Type #3 (DELPHI)

Repairing injector must be done in a clean and dust free environment to prevent injector contamination.

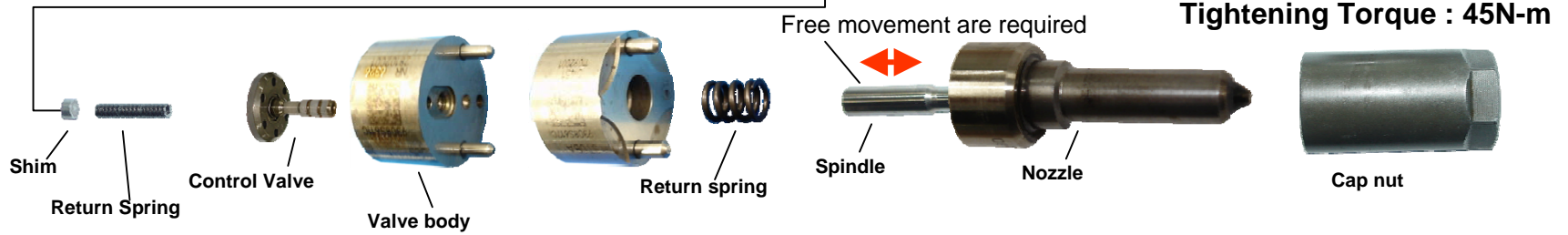


Should be moving freely



Control valve should be inserted into valve body freely ( without any resistance).

The purpose of the control valve on the Delphi injector is to control injection amount. It might cause incorrect injection amount and excessive back leak if the valve has stuck.



Required parts for thinner soaking



**NOTE**  
When you test injector after cleaning operate injector more than 3~4 times in high pressure mode of HP controller for bed-in and flushing.

### 3-5. Tips for Injector assembly (Nozzle area)

#### Cleaning procedure of nozzle

1. Remove the spindle from the nozzle holder



2. Change the direction of spindle

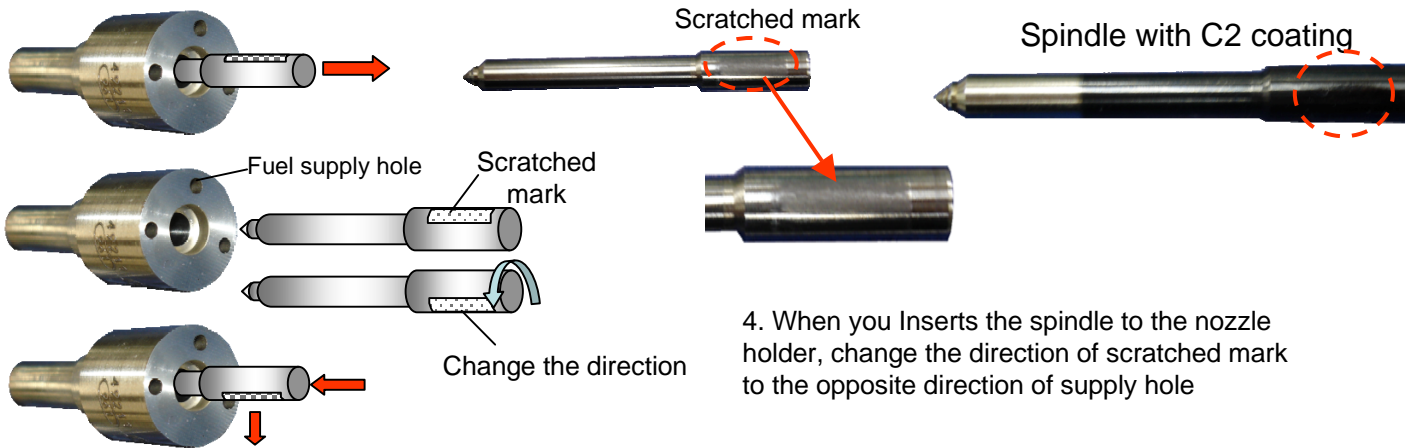


Free movements are required

3. While cleaning the injector in cleaning fluid it must be checked for free movement of the spindle in nozzle holder. It must be gently moved until there is no resistance to movement.



Try to in and out the spindle for the cleaning



4. When you Insert the spindle to the nozzle holder, change the direction of scratched mark to the opposite direction of supply hole

**Most scratched marks on spindle of nozzle are due to wearing.**

**The damaged spindle causes friction increase and produce low or over injection  
Normally , you must replace the damaged nozzle assembly or change to new injector.**

**But it is possible to fix the injector without replacing the parts by using the above method.  
Usually(100%) scratch marks match with the fuel supply hole, therefore if you change the direction of scratched area, you may save the parts without technical problem.  
By using the CIT- 2000 or 3000, you can get the right results.**

### Compensation of injected-fuel-quantity

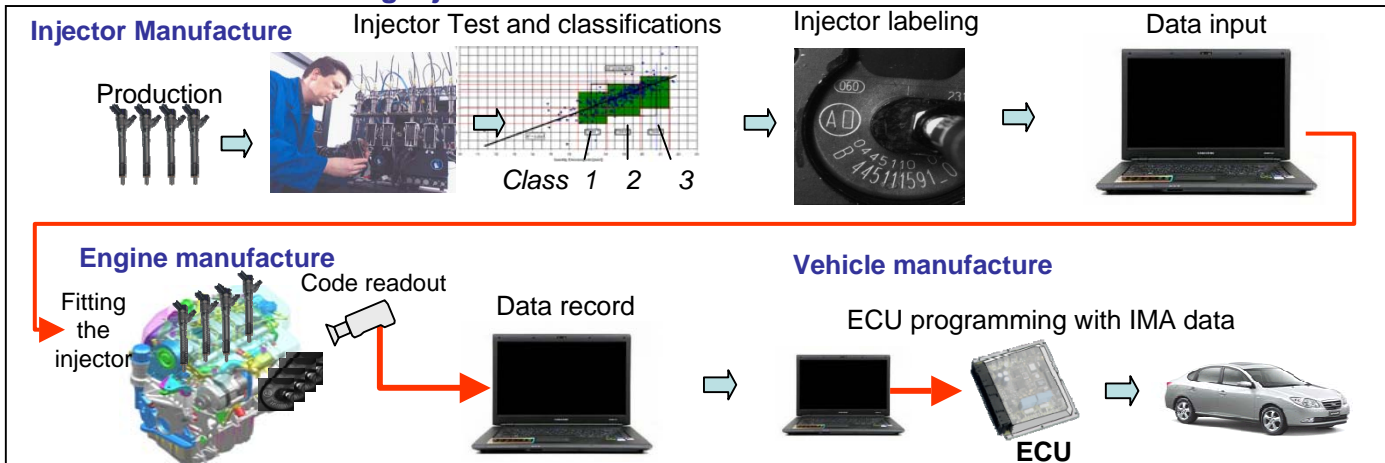
New functions are added to common-rail systems to enhance the high precision of the fuel-injection system further, and ensure them for the service life of the vehicle. With injector delivery compensation (IMA), a mass of measuring data is detected for each injector during the injector manufacturing process. The data is then affixed to the injector in the form of a data-matrix code. This data is transferred to the ECU during vehicle production. While the engine is running, these values are used to compensate for deviation in metering and switching response.

But in case of re-manufactured injectors (for in-use car service), it is almost impossible to classify control and label due to technical limitation as remarked as below.

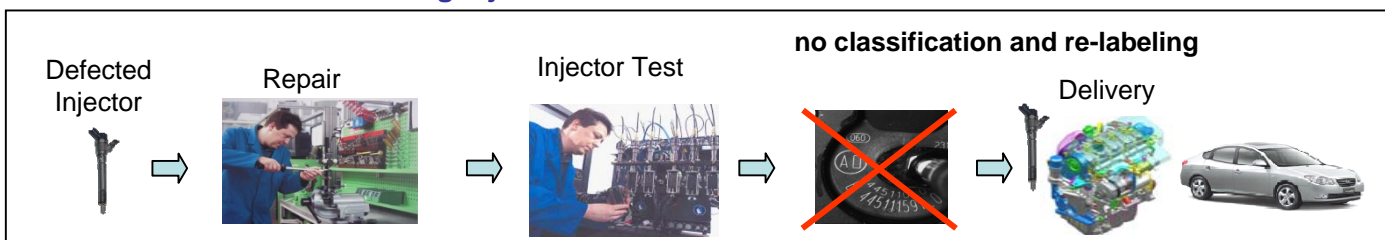
- Mechanical wearing and increasing tolerance (even rest of all injectors)
- Different regulation between new car and in-use car (no required)
- According to mileage of vehicle tolerance of all injectors are increased simultaneously (most of them out of control range).
- There is no space for re-labeling on injector head
- Cost saving

The Injector Delivery Compensation system offers solutions to above situation. Thus using an unclassified repaired injector will not influence engine performance or emission level in significant ways.

#### Process for Manufacturing Injectors

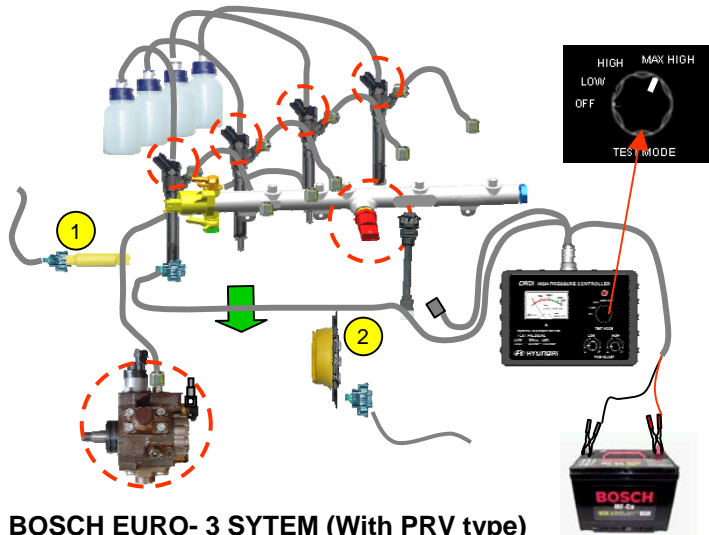


#### Process for Re-manufacturing Injectors



## STEP 2-1 HIGH PRESSURE TEST for each system

### High pressure test with Injectors ( Step 2-1)



BOSCH EURO- 3 SYTEM (With PRV type)

Purpose of this test is to check the High pressure pump's and the rail pressure sensor's performance.

### TEST PROCEDURE

- Install the back leak bottle and hose to injectors
- Remove the wiring connectors from all Injectors.
- Install the HP controller and set the mode switch to High position.
- Install ① PRV Dummy Resister and ② Rail Pressure Sensor Dummy in each wiring connectors.
- Crank the engine and measure the rail pressure and injector back leak amount.

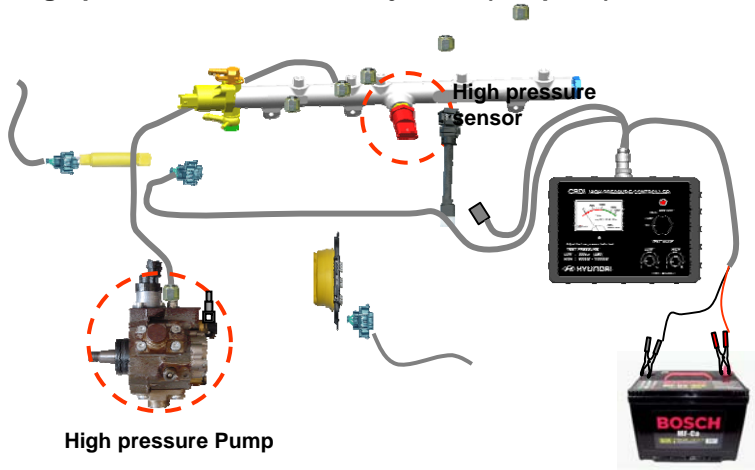
### SERVICE SPEC

High pressure : Above 700 bar ( with normal Back Leak )  
 Back Leak : Less than 3 times than minimum amount injector

### CHECK POINT ( if test is failed )

- Fuel Leak (rail plug or pipes connection)
- PRV (leakage or damaged)
- Fuel line
- HP pump (leakage or damaged)

### High pressure test without Injectors ( Step 2-2)



BOSCH EURO- 3 SYTEM (With PRV type)

Purpose of this test is to confirm the High pressure pump performance or to reconfirm high pressure pump performance when measured value of pressure was lower than 700bar during Step 2-1.

Avoid injector back leak completely by blocking rail outlet.

### Test Procedure

- Remove the Injector pipes from the rail.
- Block the rail outlet using rail plug.
- Install the HP controller and set the mode switch to High position
- Crank the engine and measure the rail pressure.

SERVICE SPEC : Above 900 bar  
 If measured pressure from Step2-1was below 700bar and measured pressure from Step2-2 was over 1000bar, the high pressure pump is in good condition. The low pressure (below 700bar) might be read due to too much injector back leak.