

KIA CRT-3500

Common Rail Injector Tester







"PIEZO", "S" & "R" Engine



Delphi "A2" "U2" Engine



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1. CRT-3500 Composition





Enables Injection Quantity Comparison Test under Low and High fuel pressure conditions, which it was not possible with Hi-scan/GDS/G-Scan Also Cylinder compression and Rail pressure regulator test are additionally available.

2-1 INJECTION COMPARISON TEST (LOW PRESSURE MODE)

Test Method : Automatic

Affected vehicle : All Model (including EURO-IV)





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. 2-2 INJECTION COMPARISON TEST (LOW & HIGH PRESSURE MODE)

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



LOW PRESSURE MODE TEST

- 1) Disconnect the PRV's & rail pressure sensor's connector from the rail
- 2) Install ① Dummy Resister and ② Rail Pressure Sensor Dummy in each wiring connectors.
- 3) Connect HP controller's leads to the ③PRV & ④ rail pressure sensor.

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- 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



4) Perform test in each mode: LOW & HIGH.

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







High pressure test with Injectors (Step 2-1)



BOSCH EURO- 3 SYTEM (With PRV type)



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)

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.





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.

3-3 HIGH PRESSURE TEST for each system







Electric pump type (BOSCH Type ||)

EURO-III model

CASE	PRESSURE (bar)	JUDGMENT
1	1.5~3.5 kg/cm²	System normal
2	0 ~1.5 kg/cm²	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/cm²	System normal
2	0.5~2.0 kg/cm²	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		



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, Π,Π : D3EA(1.5D-ENG), D4EA(2.0D-ENG), D4FA(U-ENG), D4CB(2.5A-ENG)
- 3) Start engine \rightarrow 3 minutes at idle \rightarrow accelerate engine up to 2500 rpm and keep the 2500rpm for 2 minutes \rightarrow Stop Engine after 2 minutes
- 4) When the test is completed, measure the amount of fuel in each flask
- 5) Judgments

BOSCH Type I,Ⅲ,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 should be empty before the 2nd test started.
- 6) Judgments

DELPHI

Replace the injector which indicates exceeds 25cc.





stop

30sec / 3000rpm

4-1. Diagnostic & Repair procedure of CRDi system



* Injector repairs : Repair injector (replacing internal parts) if it is not recovered after cleaning.

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* Replace injector assembly when the internal parts are not available.

4-2. 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.





Diesel

More than 5min

Thinner

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









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 Incase 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.

- Cost saving

- Mechanical wearing and increasing tolerance (even rest of all injectors) There is no space for re-labeling on injector head
- 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).

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







- ※ Piezo Injector is not an previous Solenoid Type. Piezo injector making satisfy method of the high exhaust, power and precision.
- Previous Solenoid Valve needs an oil pressure coupler to help limited movement of Piezo injector and there is a system to maintain the oil pressure coupler for the safety maintain of it. Piezo injector is high reply and power, it is also less exhaust.

Set-up

- 1. Detached Injector Back Leak Line and attached as left picture by Tube.
- 2. Set-up the dummy resister
- % Why? : If control valve of Rail is detached, ECU order to stop the fuel pump by disconnect the line.
- 3. Set-up the back Leak test bottle.
- 4. Detached the injectors form engine and set up the dummy injectors.
- 5. Cleaning the nozzle at end of Injector by sinner
- 6. Attached the test pipe and injector on the rail.
- 7. Connecting the injector drive line and the back leak measurement kit as left picture.
- 8. Tighten pipe connection to stand up test tubes.
- 9. Check all connection are right to connect included injector pipes

Test

- 1. Keep ignition (engine) on until injected fuel.
- 2. If not to injected fuel, please check the leaking fuel in any parts.



- Detached injectors and set up the dummy injectors.
- Set up the tube and plastic holder on the injector return hole
- X After low pressure supply by Piezo injector, please check any fuel leaking





- Set up the pipe and tube and back leak test bottle.
- Before the set up those, please clean all connections between pipes and injectors

Dust cleaning method :

- Not to open nut between injector and connection, and littlebit injected some fuel , then dust will be leaked more.

6-2 PIEZO Injector Low Fuel Test





Low Pressure (bar)	Measurement	Judgment
3.5 ~4.5 bar	Bar	Normal Condition
Above 4.5 bar	bar	Fuel Filter / Low Pressure Line Choked (Blocked)
Less 2.0 bar	bar	Low Pressure Line Leaking / Electronic Pump damaged





Low Pressure (bar)	Measurement	Judgment
3.5 ~4.5 bar	bar	Normal Condition
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4) PIEZO Injector Back Leak Test (Dynamic)





Normal Condition

3

4



■ Outline (Dynamic Test)

If injector back leak too much, it will be caused engine start fault, delay and etc. This test is very popular test nowadays. The test is very important test to check abrasion pressure control valve and leaking from return line of injector.

Set up

- 1. Assemble the Tube and Plastic Holder on the return hole of iniector
- 2. The low pressure supplied by the Piezo injector. So, block up a hole of hose by the low pressure gauge.
- 3. After engine start, please check the leaking fuel in any parts.
- 4. After 1 mints idling and than to keep the 1000rpm in 30 sec, than off the engine.
- 5. For the accuracy test, please test at least 3 times again and again.

Judgment

As show picture, if injected-fuel-quantity much more than 3 times to compare with base injected-fuel-quantity, the injector should be consider to replace.



Outline (Static Test)

2

This test is one of best efficiency test for the injector test. If this test testing together with fuel testing, it will be is very good test to find out faulty of injector. If we check the actual pressure test of high fuel pressure pump by the Static test, it could be check the high pressure line and measuring the injected-fuel-quantity simultaneously

- Set up
- 1. After detached injector, please attached dummy injector
- 2. The low pressure supplied by the Piezo injector, So, block up a hole of hose by the low pressure gauge.
- 3. After back leak kit set up, please detached a connector of oil control valve of the rail pressure sensor and high pressure pump and to connect the high pressure gauge with the rail pressure sensor and battery each by each.
- 4. Disconnecting the connector of rail pressure valve on CRDI side.
- * To supply power less than 5 mints to protect an electronic damage of rail pressure control valve.
- 5. Connecting the test tube with rail pressure control valve line.
- 6. Switch on the high pressure gauge
- \triangleright Engine cracking 5 sec.
- ▷ Measuring highest measurement of high pressure gauge (above 1,000bar)
- ▷Measuring back leak injected-fuel-quantity of tube connected with injector return hole. (less than 5mm)
- * Piezo return quantity is almost noting compare with previous solenoid type. The solenoid type should be less than 200mm





The previous CRDI Fuel Test is only test injector pressure and back leak test. The important part of diagnosis is an injection test of the injector, it is real combustion. As shown picture, this test is a measuring injected-fuelquantity and compare each measurement of injectors. Than it should have result of differences. Also, it can be compare injected-fuel-quantity by real pressure controller, which controlling low and high pressure.

Set up

- 1. Disconnect the pressure control valve (PRV) and rail pressure sensor
- 2. Block up low pressure line 1 to connect dummy of rail pressure sensor 23
- 3. Connect the connector of pressure control line (4)(5).
- 4. After set up the tube, leaking the air.
- * For the accuracy measurement, using the actuation cracking

Test

1. Possible to control rail pressure from 100 to 1000 bar by the control part.

Warning : At the first engine cracking , there is possible to have a declination of injected-fuel-quantity, because of the air.





- Low pressure = 5 scale, - High pressure = 10scale





Cylinder Pressure Test Method

- 1) Need to use dummy injector to prevent oil leaking at the compression and pressure test.
- 2) Before attach the dummy, need to check injector combined space.
- 3) Standard pressure is 30 kg/m² (Possible to have a difference, according to the performance of Diesel Vehicle or old vehicle)





