Our innovation.
Your advantage

The worldwide first high-pressure diesel injection system with piezo injectors was the forerunner of the current Continental Common Rail Diesel System. Common Rail Diesel Injection Systems consist of the following main components: a high-pressure pump, piezo injectors, rail, lines and engine control unit. The high-pressure pump continually delivers diesel fuel into the rail under pressure; the rail supplies fuel to the piezo injectors through the lines. The engine unit controls the piezo injectors to ensure that the right amount of diesel fuel is injected into the cylinders at the right point in time.

The piezo actuator allows extremely short switching times for precise control and stability of smallest injection quantities possible. This means that the injector provides multiple injections with an outstanding repeatability.

The main components of the injector are:
- The nozzle
- The injector body with control module and throttles
- Servo valve with direct valve drive
- Piezo actuator

The brands of "VDO CR Injectors" mentioned in this manual could be Siemens, Siemens VDO or Continental. This due to historical reasons.
# Version History

<table>
<thead>
<tr>
<th>Document version</th>
<th>Previous version</th>
<th>Change description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.21</td>
<td>1.20</td>
<td>Injector packaging number has changed</td>
</tr>
</tbody>
</table>
| 1.20             | 1.11            | K9K EU4 repair information added:  
|                  |                 | - 3.1. Repair kit order number added  
|                  |                 | - 6.2. Pressure transfer adapter assigned  
|                  |                 | - 6.3. Tools spare parts for K9K EU4 added  
|                  |                 | - 6.4. Detailed data regarding the tightness of the high pressure connection added  
|                  |                 | - 6.5. Torque values for K9K EU4 added |
| 1.11             | 1.10            | Piezo stack capacitance check added |
| 1.10             | 1.09            | - 6.3. Tools – spare parts added  
|                  |                 | - 12. Height adjustment moved up to chapter 6 |
| 1.09             | 1.08            | 3.2.2. changed – detailed specified |
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1. Components

There are two different types of VDO CR Injectors covered in this manual. The first generation equipped with a long nozzle nut which covers the whole CR Injector body (Illustration 2.1) and the second generation (Illustration 2.2) which is equipped with a much shorter nozzle nut.

Illustration 2.1 First generation of VDO CR injector

Illustration 2.2 Second generation of VDO CR injector
CR Injector – main components

Illustration 2.3 The main components of a Common Rail Injector
2. Visual check – before start

The first step of the process is the visual check. This step makes sure that only CR injectors which are not physically damaged will remain in the process.

The injector is a very sensitive part and therefore must be handled with care! Inappropriate storage can lead to irreparable damages.

CR Injectors with broken connector housings cannot be repaired and must be thrown out.

Dirty injector bodies (rusty or carbonized) must be cleaned before testing.
CR Injectors which show signs of being overheated or burned on the surface cannot be tested as inner parts have been damaged.

If just the nozzle has been damaged the test & repair process should solve the problem.

Always check the angular between high pressure connection and piezo actuator. (example DV4 Euro 4)

The CR Injector which indicates any other damages of injector body, mustn't be reworked (for example deformed back leak connection).
3. Visual check

3.1. Identifying the injector

Before starting any operations the CR Injector type has to be identified. Please see table below for reference.

For further information please check the Diesel Handout which is available on the Extranet.

<table>
<thead>
<tr>
<th>Category</th>
<th>DV4 EU4</th>
<th>DV4 EU3</th>
<th>DW10TD</th>
<th>DW10BTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injector</td>
<td>5WS40149-Z replaced by A2C59511612</td>
<td>5WS40148-Z</td>
<td>5WS40000-Z not available anymore</td>
<td>5WS40156-4Z – Class 4 5WS40156-Z – Class 5 A2C59511601 – Class 6 A2C59513552 – Class 7 A2C59511603 – DW10B MFMA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category</th>
<th>DV6C TED4</th>
<th>K9K Euro 4</th>
<th>K9K Euro 5</th>
<th>Lynx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injector</td>
<td>A2C59513556</td>
<td>A2C59511606</td>
<td>A2C59513484</td>
<td>A2C59511610 A2C59511611 - V227</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category</th>
<th>VW Common Rail</th>
<th>Lion V6</th>
<th>Lion V6 Upgrade</th>
<th>Lion V8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injector</td>
<td>A2C59513554</td>
<td>A2C59511315 - JAGUAR EURO 3 A2C59511316 - DT17 EURO 4 A2C59511316 - LAND ROVER</td>
<td>A2C59513553</td>
<td>A2C59513597 - Red Clip A2C59513596 - White Clip</td>
</tr>
<tr>
<td>Rep. Kit</td>
<td>Not available</td>
<td>Not available</td>
<td>Not available</td>
<td>Not available</td>
</tr>
</tbody>
</table>
3.2. Initial electric test

Before the electrical test, make sure that the injector was stored at least for 3 hours at ambient temperature.
First inspection of the injector checks the circuit between the actuator and the body of the injector. For this test you can use both High voltage insulation tester or Digital multimeter/multitester.

3.2.1. High voltage insulation tester

This can be measured using insulation resistance tester. In order to check for an open or short circuit:
1) Connect plug supplying high voltage (approx. 300 V) to both actor pins.
2) Connect the ground pole to the injector body.
3) Measure the insulation resistance for at least 4 seconds. The measured value must be greater than 100 MΩ.

The insulation resistance should be tested under “Clean Room” conditions thus temperature and moisture have very strong influence on the measured value.

3.2.2. Piezo stack – resistance check

The piezo resistance can be measured using a multimeter / multitester. In order to check for open or short circuit:
1) Keep the temperature of the injector between 0 – 80°C
2) Set the multimeter to measure resistance (Ω Ohms).
3) Place the probes, one to the left pin and the other to the right pin of the connector in turn.
4) Wait for at least 5 seconds for the measurement to stabilize before reading. The resistance value must be between 160 kΩ – 220 kΩ

Please bear in mind that the used multimeter must fulfill following requirements:
1) Voltage 0 – 10V ± 0,1V
2) Current 0 – 400µA ± 0,4%

In case the injector fails one of the above mentioned tests, the injector’s actuator is faulty and the injector cannot be reworked.

3.2.3. Piezo stack – capacitance check

The piezo capacitance can be measured using a handheld LCR meter (e.g. Agilent U1730C Series). In order to perform the test, please keep following requirements:
1) Temperature of the injector 0 – 25°C
2) Voltage 1V and Frequency 1kHz
3) Stabilization time 15s

Below you will find a table within the capacitance values for different injector types. The capacitance value mustn’t be lower than specified.
<table>
<thead>
<tr>
<th>Injector type</th>
<th>The measured capacitance value mustn't be lower than</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV4 EU3</td>
<td>2,8µF</td>
</tr>
<tr>
<td>DV4 EU4</td>
<td>Still under development</td>
</tr>
<tr>
<td>DW10B</td>
<td>2,8µF</td>
</tr>
<tr>
<td>DW10U</td>
<td>2,8µF</td>
</tr>
<tr>
<td>Lynx</td>
<td>2,8µF</td>
</tr>
<tr>
<td>Lynx V227</td>
<td>2,8µF</td>
</tr>
<tr>
<td>K9K EU4</td>
<td>2,8µF</td>
</tr>
<tr>
<td>IESA NGD 3.0</td>
<td>2,8µF</td>
</tr>
<tr>
<td>Lion V6 Base</td>
<td>2,8µF</td>
</tr>
<tr>
<td>Lion V6 Upgrade</td>
<td>2,8µF</td>
</tr>
<tr>
<td>Lion V8</td>
<td>2,8µF</td>
</tr>
<tr>
<td>K9K EU5</td>
<td>Still under development</td>
</tr>
<tr>
<td>VW CR</td>
<td>Still under development</td>
</tr>
<tr>
<td>Puma</td>
<td>Still under development</td>
</tr>
<tr>
<td>DV6C</td>
<td>Still under development</td>
</tr>
</tbody>
</table>
4. Injector cleaning

After the visual check has been passed the Clean and Purge step can be started which is a part of the analysis preparing the CR Injectors for further tests. In order to clean the CR injector please use an ultrasonic cleaner (for example Hartridge HM1003).

**Recommend:**
1) Cleaning fluid TICKOPUR TR 13
2) Temperature of 80°C
3) Duration of 30 minutes

Please note that the CR injector must not be placed under water or any other fluid. Only clean the injector’s body and nozzle (shown on the Illustration below).
The Actor connector needs to be sealed with "Sealing clip X39-800-100-040" (see below) to avoid any fluid getting into the contact housing. For high pressure connection and back leakage connection, use usual commercial caps.
5. Spray pattern test and injector purge

The spray pattern test gives initial information about the injector itself. This simple test determines if the nozzle is still delivering fuel through all holes or if the spray pattern is OK and purges the injector. To perform this test a CR Injector nozzle test bench is required (e.g. IFR-50 or IFT-70 from Hartridge).

<table>
<thead>
<tr>
<th>Injector type</th>
<th>Number of spray holes</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV4 EU3</td>
<td>6</td>
</tr>
<tr>
<td>DV4 EU4</td>
<td>6</td>
</tr>
<tr>
<td>DW10B</td>
<td>6</td>
</tr>
<tr>
<td>DW10U</td>
<td>6</td>
</tr>
<tr>
<td>Lynx</td>
<td>7</td>
</tr>
<tr>
<td>Lynx V227</td>
<td>7</td>
</tr>
<tr>
<td>K9K EU4</td>
<td>6</td>
</tr>
<tr>
<td>K9K EU5</td>
<td>7</td>
</tr>
<tr>
<td>DV6C</td>
<td>7</td>
</tr>
<tr>
<td>DW10TD</td>
<td>5</td>
</tr>
<tr>
<td>VW CR</td>
<td>7</td>
</tr>
<tr>
<td>Lion V6 Base</td>
<td>6</td>
</tr>
<tr>
<td>Lion V6 Upgrade</td>
<td>7</td>
</tr>
<tr>
<td>Lion V8</td>
<td>7</td>
</tr>
</tbody>
</table>
6. Nozzle change – CR injector repair

6.1. Tools – installation and adjustment

Please check whether all components have been delivered and then put the toggle press tool in a dry and secure place to avoid damage.

Please bear in mind that the toggle press has been covered with anti-corrosive coating to avoid any transportation damage.

The toggle press tool must not be cleaned with any aggressive cleaning agents.

Every quarter year, all unprotected parts of the toggle press tool need to be lubricated in order to maintain optimal functionality and longevity. In case any small rust stains appear on any of the parts, please use fine sandpaper (grit: 100-120 according to CAMI or P100, P120 according to ISO/FEPA) to remove them and afterwards please lubricate the parts accordingly.

6.1.1. Height adjustment

Due to a number of different injector variants, the height of the toggle press needs to be adjusted. Please see the instruction below.
6.2. Tools – overview

To change the CR Injector’s nozzle specific tools are required to perform repairs:

<table>
<thead>
<tr>
<th>Tools</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Toggle Press</strong></td>
<td>Order number: A2C59514000</td>
</tr>
<tr>
<td><strong>CR Injector Repair Tool Kit “version A”</strong></td>
<td>Order number: A2C59514886</td>
</tr>
<tr>
<td>Package contents:</td>
<td></td>
</tr>
<tr>
<td>1) Injector holder</td>
<td></td>
</tr>
<tr>
<td>2) Pre-load device</td>
<td></td>
</tr>
<tr>
<td>3) Pressure transfer adapter DV4 EU3, marked with the letter “E”</td>
<td></td>
</tr>
<tr>
<td>4) Pressure transfer adapter DV4 EU4, marked with the letter “D”</td>
<td></td>
</tr>
</tbody>
</table>
CR Injector Repair Tool Kit “version B”

Order number:

**A2C59514001**

Scope of delivery:
1) Injector holder
2) Injector holder pad

<table>
<thead>
<tr>
<th>System</th>
<th>Injector holder</th>
<th>Pressure transfer adapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV4 EU3</td>
<td>A2C59514886</td>
<td>Letter E</td>
</tr>
<tr>
<td>DV4 EU4</td>
<td>A2C59514886</td>
<td>Letter D</td>
</tr>
<tr>
<td>DW10B all classes</td>
<td>A2C59514001</td>
<td>Letter E</td>
</tr>
<tr>
<td>DW10U</td>
<td>A2C59514001</td>
<td>Letter E</td>
</tr>
<tr>
<td>Lynx</td>
<td>A2C59514886</td>
<td>Letter D</td>
</tr>
<tr>
<td>Lynx V227</td>
<td>A2C59514886</td>
<td>Letter D</td>
</tr>
<tr>
<td>K9K EU4</td>
<td>A2C59514886</td>
<td>Letter F</td>
</tr>
</tbody>
</table>
6.3. Tools – spare parts

The pressure transfer adapter is available as spare part (always a kit of 2 pieces) and must be replaced once a quarter.

<table>
<thead>
<tr>
<th>Pressure transfer adapter</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter D</td>
<td>A2C59513999</td>
</tr>
<tr>
<td>Letter E</td>
<td>A2C59514913</td>
</tr>
<tr>
<td>Letter F</td>
<td>A2C59506472</td>
</tr>
</tbody>
</table>

6.4. High pressure connection – tightness check

Under no circumstances loose the high pressure connection during the disassembling of the injector from the car!

If the high pressure connection, during the disassembly of the injector (high pressure pipe from the injector) loosens, please tighten it back with appropriate torque.
Under no circumstances exchange the high pressure connection.
Below, values for assembly of the **non-lubricated** high pressure connection.

<table>
<thead>
<tr>
<th>System</th>
<th>Initial torque (Nm)</th>
<th>Rotation angle Starting at initial torque (deg)</th>
<th>Final torque value (Nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV4 (EU3 and EU4)</td>
<td>-</td>
<td>-</td>
<td>35±5</td>
</tr>
<tr>
<td>DW10BTED (DW10U)</td>
<td>10</td>
<td>70±20</td>
<td>55±15</td>
</tr>
<tr>
<td>Lynx</td>
<td>10</td>
<td>104±5</td>
<td>60±20</td>
</tr>
<tr>
<td>Lynx V227</td>
<td>10</td>
<td>104±5</td>
<td>60±20</td>
</tr>
<tr>
<td>K9K Euro 4</td>
<td>10</td>
<td>70 -35/+20</td>
<td>55±15</td>
</tr>
</tbody>
</table>

6.5. Repair process

See below detailed instructions how to dismantle and re-assemble the injector with the tools mentioned in previous section.

**Please note:** always use the appropriate Personnel Protection Equipment (PPE)!

**Step 1**

Check the CR Injector condition according to section 3, Page 9.

If the CR Injector passed all tests and was cleaned accordingly so that there are no particles or dirt on the surface, identify the correct "Repair Kit" (see page 9).
**Step 2**

Mount the appropriate CR Injector holder, the Preload Device and select the suitable Pressure Transfer Adapter.
Put the CR Injector into the holder and secure it with the clamp.
Put the torque wrench on the nozzle retaining nut (Ø15) and close the toggle press clamp.

**Attention!**

Please note: the spring length in a closed position, should measure 29,70 mm.

Once closed, the nozzle retaining nut, can be released.

**Attention!**

Please use appropriate Pressure Transfer Adapter for each injector type!

---

**Step 3**

After the nozzle retaining nut has been released the CR Injector can be taken out of the holder and opened carefully.
**Step 4**

Carefully dismantle the nozzle from the injector. The injector’s stop disk must not be disassembled, therefore, please hold it firmly with your thumb to prevent it from falling apart.

**Attention!**

Do NOT touch the nozzle’s head!

**Step 5**

Clean the repair parts (nozzle and nozzle retaining nut) in the brake-cleaning fluid. Use compressed air or a suction system to remove excess brake-cleaning fluid.

Should parts like the spacer bolt (3), spiral spring (2), spacer washer (1) or stop disk with parallel pins (4), fallen out of the injector, please proceed with the brake-cleaning fluid and compressed air or suction.

The numbers shown on the Illustration show you the proper sequence for assembly.
**Step 6**

Carefully put the nozzle on the stop disk.

**Step 7**

Clean the injector’s thread with brake-cleaning fluid.
**Step 8**

Use compressed air to remove residual dust and brake-cleaning fluid.

**Step 9**

Slightly lubricate both the nozzle nut thread and the contact surface between the nozzle and the nozzle nut before re-fitting and tightening of the nozzle nut.

**Attention!**

Do NOT use LUBRICATING GREASE instead of OIL!

**TIP!**

You can use oil with parameters like Molykote L-1346FG
**Step 10**

Carefully put the nozzle nut on the nozzle.

Put the CR injector into the holder and secure it with the clamp. Slowly tighten the nozzle’s nut by hand.

*Attention!*

**Do not rotate the injector’s nozzle!**

**Never touch the nozzle’s head while assembling the injector!**

**Step 11**

Place the torque wrench on the nozzle retaining nut and close the toggle press clamp.

Tighten the nut according to the specification shown below (see page 24).

*Attention!*

Start measuring the rotation angle at 10Nm of initial torque.
6.5.1. Repair process – CR Injector Repair Tool Kit “version B”

See below detailed instructions how to dismantle and re-assemble the injector with the CR Injector Repair Tool Kit “version B”.

Please note: always use appropriate Personnel Protection Equipment (PPE)!

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Step 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>See previous section (page 17)</td>
<td>Mount the appropriate CR Injector holder, the Preload Device and select the suitable Pressure Transfer Adapter. Put the CR Injector into the holder using the injector holder pad. Put the torque wrench on the nozzle retaining nut (Ø15) and close the toggle press clamp.</td>
</tr>
</tbody>
</table>

**Attention!**

Please note: the spring length in a closed position, should measure 29,70 mm.

Once closed the nozzle retaining nut can be released.

**Attention!**

Please use appropriate Pressure Transfer Adapter for each injector type!
Steps 3 - 11

<table>
<thead>
<tr>
<th>System</th>
<th>Initial torque (Nm)</th>
<th>Rotation angle (deg)</th>
<th>Max torque value (Nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV4 (EU3 and EU4)</td>
<td>10</td>
<td>104±5</td>
<td>60±20</td>
</tr>
<tr>
<td>DW10BTED (DW10U)</td>
<td>10</td>
<td>104±5</td>
<td>60±20</td>
</tr>
<tr>
<td>DV6C TED4</td>
<td>10</td>
<td>104±5</td>
<td>60±20</td>
</tr>
<tr>
<td>K9K Euro 4</td>
<td>10</td>
<td>104±5</td>
<td>65±20</td>
</tr>
<tr>
<td>K9K Euro 5</td>
<td>10</td>
<td>104±5</td>
<td>60±20</td>
</tr>
<tr>
<td>Lynx</td>
<td>10</td>
<td>104±5</td>
<td>60±20</td>
</tr>
<tr>
<td>Lynx V227</td>
<td>10</td>
<td>104±5</td>
<td>60±20</td>
</tr>
<tr>
<td>VW Common Rail</td>
<td>10</td>
<td>104±5</td>
<td>60±20</td>
</tr>
</tbody>
</table>
7. Test on bench – Continental specific software for CRi-PC

To test VDO CR Injectors on the Hartridge CRi-PC test bench, customized software is required. Once the injectors have been tested and passed every single step of the test plan, then the injector is ready to use.

Please note: the software has been exclusively developed to run on the Hartridge CRi-PC. It requires the generic Hartridge "All Makes Application" to run.

Below, please find details regarding software version 1.00b12 and the test procedure.

7.1. Important notices

Before testing on the test bench, make sure that the injector has been stored at least for 3 hours at room temperature.

Due to some technical issues it may happen that the injector won't pass the CP2 test step. In this case we advise you to repeat the test procedure. If the injectors fail twice at the same test step, they are no longer repairable.

Before testing on the bench, make sure that all copper rings are in good condition; exchange if necessary.

Please test always pairs of injectors placed on the lines 1 and 2 or 3 and 4 to avoid any cross talk between the test lines. If you should test only one injector please use a dummy injector placed next to the one tested.

7.2. Software purchase

The VDO specific Hartridge CRi-PC software will be provided, authorized and handled between you and Hartridge directly.
The order form will also be provided by Hartridge.
7.3. Software updates
Software updates as well as new test plans will be provided exclusively by Hartridge.

7.4. Overall information about the software

The CRi-PC will always start with the „Allmakes“ software. In order to open up the VDO application, please close the „Allmakes“ solution and double click on the CRi-PC VDO icon that is to find on the desktop.

If one of the applications is already running („All Makes“ or VDO), an error message will appear.
The main screen of the VDO Software contains the information about:

- Software version (on the top of the screen)

- Test plan

```
Illustration 6 Main screen

<table>
<thead>
<tr>
<th>Testplan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixture Clamped</td>
</tr>
<tr>
<td>Teststep</td>
</tr>
<tr>
<td>Test Comments / Instructions</td>
</tr>
</tbody>
</table>
```

```
Supply Temp: 38.7 °C
Rail Pressure: 1 bar

Supply Temp: 40.0 °C
Pressure Demand: 0 bar
Injection Speed: 0 IPM
Pulse Width: 0 μS
```

```
<table>
<thead>
<tr>
<th>Inj. 1</th>
<th>Inj. 2</th>
<th>Inj. 3</th>
<th>Inj. 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piezo Charge Voltage</td>
<td>-1.0</td>
<td>-1.0</td>
<td>-1.0</td>
</tr>
<tr>
<td>Supply Temp</td>
<td>0.0</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Rail Pressure</td>
<td>0</td>
<td>bar</td>
<td></td>
</tr>
<tr>
<td>Response Time</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Response Variation</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Back Leak Flow</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Back Leak Temp</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Delivery</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Delivery Variation</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Overall Test Pass/Fail</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

---

33
• Overall parameters defined in the test plan

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Supply Temp</td>
<td>38.7°C</td>
<td></td>
</tr>
<tr>
<td>Rail Pressure</td>
<td>1 bar</td>
<td></td>
</tr>
</tbody>
</table>

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Temp</td>
<td>40.0°C</td>
<td></td>
</tr>
<tr>
<td>Pressure Demand</td>
<td>0 bar</td>
<td></td>
</tr>
<tr>
<td>Injection Speed</td>
<td>0 IPM</td>
<td></td>
</tr>
<tr>
<td>Pulse Width</td>
<td>0 μS</td>
<td></td>
</tr>
</tbody>
</table>

• Test data of the injectors

<table>
<thead>
<tr>
<th></th>
<th>Inj. 1</th>
<th>Inj. 2</th>
<th>Inj. 3</th>
<th>Inj. 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piezo</td>
<td>-1.0</td>
<td>-1.0</td>
<td>-1.0</td>
<td>-1.0</td>
</tr>
<tr>
<td>Charge Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply Temp</td>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rail Pressure</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response Time</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Response Variation</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Back Leak Flow</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Back Leak Temp</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Delivery</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Delivery Variation</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Overall Test Pass/Fail</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

• Additional buttons

<table>
<thead>
<tr>
<th>Start Test</th>
<th>Print</th>
<th>Features Enabled</th>
<th>Owner Details</th>
<th>Status</th>
<th>Diagnostic</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>F2</td>
<td>F3</td>
<td>F4</td>
<td>F5</td>
<td>F6</td>
</tr>
</tbody>
</table>

The buttons allows you to control the machine:

✓ F1 – starts the test procedure (it opens the mask, where the general information can be defined incl. choice which line should be activated) – see Illustration 13
✓ F5 – allows you to open and print out the reports from particular tests – see Illustrations 11 and 12
✓ F6 – allows you to check the detailed information about the license – see Illustration 10
✓ F8 – allows you to enter and save the owner’s data – see Illustration 7
✓ F12 - allows you to switch to diagnostic menu – see Illustration 8
- F1 – allows you to check whether there are any problems with Back Leak – see Illustration 9
- F11 – reboots the software without rebooting of the machine
- F12 – switch to the main view

The personal information of the company can be defined here
Under Status and Diagnostics all the information about the present status of the machine can be found. From this mask it is possible to reset the counter of the fuel filter hours, in case it should have been changed due to the regular maintenance (please see the CRI-PC Manual delivered from Hartridge).
Illustration 9 Status and Diagnostics – Back Leak Errors mask
License details for the VDO software can be found in window shown on Illustration 10.
Illustration 11 Open Dialog Box for printing of the reports
# Injector Test Results

**Date:** 01/11/2011  
**Time:** 11:20:01  
**Ref:** VDO 4Line 2nd run  
**Part No:** DV4 EU4

<table>
<thead>
<tr>
<th>Serial Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>17-24</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>19-24</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>18-24</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>20-24</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

**Overall Status**

- CP5  
- CP4  
- CP3  
- CP2  
- CP1  
- CP1_2

**Service Dealer**

- **Name:** VDO 4Line
- **Address:** Frankfurt
- **DRS No:**
- **Telephones No.x:**
- **Fax No.x:**
- **E-Mail:** replacementparts@vdo.com

**Operator:** MP  
**Signature:**

**Date:**

*Illustration 12 Printout of the report opened in Internet Explorer*
7.5. Injector testing

To start testing procedure, Push F1 button, Input the operator’s name and Customers Reference (for example the number of the Invoice) choose which line is to be operated (only for 4 line machine) type the serial numbers of the injectors. Choose the test plan for the identified injectors and push the “OK” button. The test will start automatically.
If the injectors are not correctly installed or the motor is not running, a message in the centre of the screen will appear. Please check and correct and push the “OK” button.
Once the injectors are installed in clamping fixture and the motor is running, two green ticks/check marks (see Illustration 15) will be visible and test procedure will start (see Illustration 16 and 17).

During the first two test steps (“Low Pressure Leakage Test” and “High Pressure Leakage Test”) please check whether there are any leakages.
The software shows details of each test step (incl. the number of the test step, short description, "wait to start" time before measurement, average readings and the requirements of the system).
Illustration 17 Testing - Learning of the firing sequence
Illustration 19 The completion of the second test step
After the final test step is finished the software will open a dialogue window for saving the report file, which can be later opened and printed out. It is possible to add some comments to the report file or re-enter the values from the fields coloured white.

If all the data is correct, don’t forget to save or the data will be lost!
Once the report is saved or cancelled, software will show a summary window.
Illustration 22 Opening of the result report
## Injector Test Results

### Report of the measured results

<table>
<thead>
<tr>
<th>Serial Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>17-24</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>18-24</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>19-24</td>
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<tr>
<td>20-24</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

### Overall Status

- CP5
- CP4
- CP3
- CP2
- CP1
- CP1_2

### Service Dealer

- Name: VDO 4Line
- Address: 
- DRS No.
- Teleph. No.: 
- Fax No.: 
- E-Mail: replacementparts@vdo.com

### Operator: MP

- Signature:
- Date:

[Illustration 23 Report of the measured results]
7.6. Language support

Illustration 24 Changing the language

In order to change the language please click on “Change Language” under menu entry “Help”. After that the language will be switched automatically to the language of your choice (Illustrations 24 and 25).

Important notice: the software supports only 2 languages installed on the machine at the same time. Report will be also saved in the desired language. Please note that once you have saved a report file in one language, for example English, it will always be opened in that language!
Illustration 25 Language changed
7.7. Tips

7.7.1. Cable check

The VDO software checks automatically that the correct cable is connected, otherwise an error message will appear.
7.7.2. **Injector not connected or broken actuator**

Illustration 27 Broken piezo actuator or no plug connected

If the connection to the injector cannot be established the software will still keep showing the dialogue box “Learning Firing Sequence”. The Response Time will be at the level of 999µs and the injector will fail every step of the test.
7.7.3. False test plan selected

If the wrong test plan was selected at beginning of the test procedure, the injector will fail the test.
7.7.4. Connection of the plugs to different measuring units

7.7.4.1. Two plugs wrongly connected

If the plugs are connected to the wrong injectors, this will result in slow response time. If the value reaches the level of 999µs check that the cables are connected to the correct injector position—see Illustration 29 and 30.
7.7.4.2. Four plugs wrongly connected

Illustration 30 The plugs are switched (1st with 4th and 2nd with 3rd)
7.7.4.3. Two plugs wrongly connected and line deactivated

Illustration 31 The plugs for line 2 and 3 are switched and the line 3 is deactivated

In this scenario the plugs from line 2 and 3 were switched and the line 3 was deactivated. It means that injector 2 is operated by line 3 cable and this particular line is inactive. The software tries to measure the delivery from the 2nd injector and once again the response time stays constantly at the level of 999µs.
8. Workflow

CR Injector

Visual check

Injectors cleaning

Spray pattern and inj. purge

Change nozzle

Test on bench

Documentation packaging

Good parts

Sorted out parts

Correct injector?
Defect connector?
Corrosion?
9. Injector storage

If the repaired injectors are to be stored for a long period of time, it is recommended that they are stored in special VCI bags with water vapour permeability ≤ 0,01 g/m²•d (measured at 23°C / 85% ambient air humidity according to DIN 53122).

Injectors stored in vacuum-sealed bags have a maximum storage period of one year. After this time, we recommend retest and repackaging as necessary.

Order number X11-800-100-101

9.1. Injector packaging

As and when required, VDO original packaging can be used. In this case, the repaired injector must be sealed in an appropriate coated bag (for details see section 9 on this page), then packed in VDO Original Box (Order Number A2C59507770) and marked with a VDO Label, designed especially for the repaired injectors. Illustration below reflects the VDO label design:

The QR-Code includes the following data:
- [Part Number]
- Refurbished [Date of Repair]
- UseBefore [Use Before Date]
- [DRS Number]

For example:

A2C59511601
Refurbished 28.07.2012
UseBefore 27.07.2013
DRS 001/08
10. Test on bench – monthly feedback

In order to meet the quality level and to continuously improve the service we need your feedback. We kindly ask you to provide a monthly feedback by sending the data files created by your Hartridge CRi-PC which includes data about the tests which have been run on the bench. The result files can be found on your CRi-PC under C:\VDO\Cri\Results\.

Please forward us the data to the following email address:

07DEFMDiesellAM@continental-corporation.com
11. Engine test – test drive

In order to finish the repair procedure the repaired injector/injectors need to be tested in a car. If possible mount the CR Injectors exactly in the same position (cylinder) as before, and start the engine. If the engine jerks in idle or during the test drive isn’t functioning smoothly the CR Injector have to be replaced.

11.1. Injector copper ring

The injector Copper Ring must always be replaced.

Order numbers for the different systems, can be found in the latest Diesel Handout catalogue on the VDO Extranet site.
12. FAQs listed by problems

Where do I get software to test VDO CR Injectors on a Hartridge test bench?

The VDO CR Injector test software for the Hartridge CRi-PC can only be sourced by authorised DRS partners.

Software installation problems. What I am doing wrong?

If there are any further questions/problems, please contact your local Hartridge distributor/Hartridge support.

Software license, where do I get it from and how long is it valid?

The software license is valid for 1 year from the day of the activation on CRi-PC. After the expiration date, the software will no longer function. To extend it, please contact your local Hartridge dealer.

Problems with the CRi-PC

In case of any problems with CRi-PC, please contact your local Hartridge representative, who provide appropriate support.

What if a CR Injector fails the tests after being repaired?

In case a repaired CR Injector does not work properly, please replace the nozzle and nozzle retaining nut again and run the test on the bench. If this does not help, this particular CR Injector cannot be repaired and needs to be replaced.
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Sodener Strasse 9
65824 Schwalbach
Deutschland
Tel: +49 6196 87-0
Fax: +49 6196 86571
www.vdo.de
E-Mail: replacementparts@vdo.com
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