Diesel Injector Test Bench CRU2i-3210 (without rinsing function)

User's Manual

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Warranty

2 –YEAR LIMITED WARRANTY

"Carbon Zapp" company manufactures its equipment from new parts and components that are in accordance with industry-standard practices. Carbon Zapp warrants that the equipment it manufactures will be free of defects in materials and workmanship.
The warranty terms are 2 years, beginning on the date of the Carbon Zapp invoice in accordance with the following described:

This warranty does not cover damage due to external causes, including accident, abuse, misuse, scratches on external components or surfaces, problems with electrical power supply, servicing not authorized by Carbon Zapp, usage not in accordance with machine's operating manual, failure to perform required preventative maintenance, failure to change the testing calibration oil fluid (and cleaning detergent) when indicated by machine, failure to change the testing (and cleaning) fluid filter when indicated by machine, to permit machines fluid pump to sit or operate without fluid in it, usage of improper testing or cleaning fluid in the machine, usage of improper ultrasonic cleaning fluid in the ultrasonic bath, usage of ultrasonic fluid instead of testing fluid or the opposite, usage of cleaning solvents and chemicals not provided or indicated/approved by Carbon Zapp, use of parts and components not supplied or approved by Carbon Zapp.

Note: Failure to clean injectors with Carbon Zapp's ultrasonic device (provided) before any test is performed on the test bench will void the warranty of the machine. *If the iVM sensor reading is out of specification or accuracy due to dirt (verified), the machine's warranty will be voided*.

Carbon Zapp will repair or replace parts and components returned to manufacturer's facility. To request warranty service, contact Carbon Zapp within the warranty period. If warranty service is required, you must ship the defective part or component in their original or equivalent packaging, prepay shipping charges, and insure, or accept the risk of loss or damage during shipment. Carbon Zapp will return the repaired or replacement part or component freight prepaid. If Carbon Zapp repairs or replaces a part or component, its warranty term is Not Extended.

Carbon Zapp does not accept liability beyond the remedies set forth in this warranty statement or liability for incidental or consequential damages.

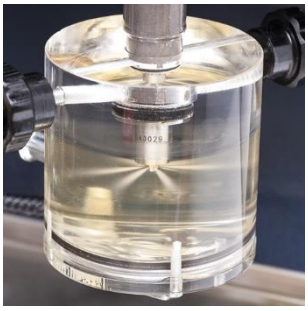
Chapter 1
“Introduction”

Equipment checklist

Carefully unpack the machine and its components. Save the box and packaging materials for future use.

Check if you have all the following accompanying items:

- AC [100/240 VAC] Power Cord, for machine
- Injector Ultrasonic Device [100/240 VAC] with (optional):
  - Operating Manual
  - AC Power Cord[100/240 VAC]
  - Injector Holder
  - 4 liter Ultrasonic Cleaning Solvent, start-up consumable for Ultrasonic Cleaning injectors
- TESTING
  - 4 liter Calibration Oil, start-up consumable for Testing injectors [GDU units]
  - Calibration Oil/Fluid Funnel
  - Adapters and Accessories Kit for Testing Injectors [look at Appendix B]
- MACC (Cleaning) [MACC enabled units only]
  - 2 liter Cleaning Detergent, start-up consumable for MACC Cleaning of injectors
  - Cleaning detergent Funnel (MACC)
  - Adapters and Accessories Kit for Cleaning Injectors [look at Appendix B]
- Optional
  - Piezo Injector Back-Leak Regulator Adapters "PIR"
  - RSP Sensor
  - SPR Adapter



- Operating Manual and Quality Control Certificate

Options

There are a number of options to make these units even more powerful and universal in diagnosing and servicing Injectors. The following options are available:

DIESEL SERIES ORDERING SPECIFICATIONS																			
●: standard ○: optional																			
CODE	**INJECTORS**	**TESTING**	**CLEANING**	**1200 BAR**	**1850 BAR**	**2400BAR**	**UB-15s**	**UB-15e**	**PRCO**	**PIR / PIRV**	**PS1 / PS2**	**DS/CRU UNIT**	**CRIN ADAPT**	**UA2i UNIT**	**EUI/P ADAPT**	**HUA UNIT**	**HEUI ADAPT**	**OILS**	**DETERGENT**	**U/S SOLVENT**
CRU.4i-3210	4	●	x	x	●	○	○	○	●	○	x	●	○	○	x	○	x	○	x	●
CRU.4i-4210	4	●	x	x	x	●	○	○	●	○	x	●	○	○	x	○	x	○	x	●
CRU.2i-3210	1	●	○	x	●	○	●	○	●	○	○	●	○	○	x	○	x	○	x	●
CRU.2i-3211	1	●	●	x	●	○	●	○	●	○	○	●	○	○	x	○	x	○	●	●
CRU.2i-4210	1	●	x	x	x	●	●	○	●	○	○	●	○	○	x	○	x	○	x	●

GASOLINE SERIES ORDERING SPECIFICATIONS																			
●: standard ○: optional																			
CODE	**INJECTORS**	**TESTING**	**CLEANING**	**300 BAR+**	**0-10 BAR**	**COIL**	**PIEZO**	**UB-15s**	**UB-15e**	**PRCO**	**ACCESSORIES**	**PS1 / PS2**	**STD-ADAPT**	**TBI-ADAPT**	**EXCL-ADAPT**	**ETEC-ADAPT**	**OILS**	**DETERGENT**	**U/S SOLVENT**
GDU.4i	4	●	x	●	x	●	●	○	○	●	○	○	x	x	x	x	●	○	○
GDU.2i	1	●	x	●	x	●	●	○	○	●	○	○	x	x	x	x	●	○	○

Chapter 2
“Product Tour”

This chapter provides an overview of the machine Parts and Symbols. A new user should be familiar with all the views and connections in this chapter.

Parts and Symbols

Front View:

a. Injector Clamp

b. Injector Spray Chamber [CRU.2i and GDU.2i]

c. Test-Fluid Filling Port [CRU.4i and GDU.4i]

d. HMI PC / Touch Panel

e. Front Connections

a. **[HP-T]:** High Pressure Testing Fluid Supply Hose
b. **[HP-C]:** High Pressure MACC Cleaning Fluid Supply Hose
c. **[ih]:** Injector Harness connector
d. **[sh]:** Extra harness for (RSP and SPR adapters)
e. iVM (CRU.4i and GDU.4i units have 4 ports each for up to 4 injectors)
    i. **[D]:** Discharge Port**,** connects injector nozzle to measuring device
    ii. **[R]:** Return Port**,** connects injector return valve to measuring device
f. MACC **[C]**: Cleaning Port, to connect C-Adapter from injector nozzle-(and return) to the Cleaning fluid tank.
g. Clear Protective cover & High Pressure clear protective cover opening switch

Side Views:

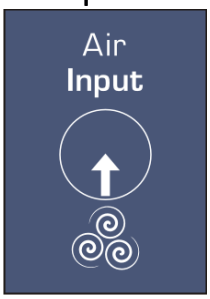
a. Left, Side Panel // Testing Calibration OIL level indicator
b. Right, Side Panel // Cleaning (MACC) detergent level indicators. Always Fill to the lowest indicator and discard when the level reaches the top indicator.

Rear Views:

a. Top Panel (Inside are the fuses (FFA) for injector protection
b. The Serial Tag of the machine provides information on the Machine Model, Serial Number, Date of Manufacturing and also basic specifications.

c. 

Spray Chamber fumes extractor output [CRU.2i and GDU.2i]. DO NOT connect the compressed air line here. Beneath it, is a Fumes - liquid Trap/collector / Separator

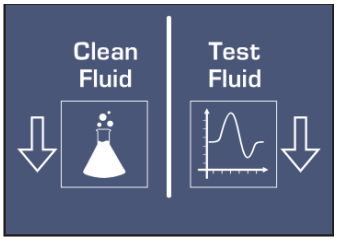
d. 

Regulated and filtered compressed air input. Please consult Appendix A for specifications. Beneath it is a Water Trap/Filter/Regulator.

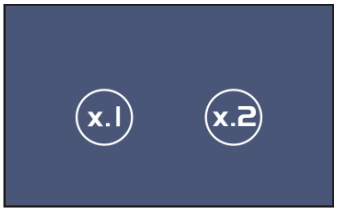
e. HP Pump air exhaust port [Optional]

f. 

Mains, Rear ON/OFF switch. Beneath it are the: ON/OFF switch, Fuse Holder and Mains Power Connector. For further specifications, please consult Appendix A.

g. 

These symbols denote that in the left part of the machine the hydraulics are used for the Cleaning (MACC) and in the right part of the machine the hydraulics are used for Testing (Calibration Oil). The **filters** and **drain valves** are considered hydraulics in this case.

m. 

: These connectors, **[x.1]** / [**x.2]**, or **[A]**, located on the rear of the machine, are used to connect Attachment units such as UA2i or HUA [CRU.2i only].

Chapter 3
"Getting Started"

This chapter provides basic information to start using the machine and covers the following topics:

[**info**]

All users should be familiar with diesel/gasoline systems and should always wear protective goggles and gloves.

- Unpacking and setting up
- Connecting the AC power
- Connecting the Pneumatics
- Starting up for the first time
- Powering down the system

A new user should follow the steps in each section of this chapter in order to operate the machine.

Unpacking and setting up

- Verify that all the items in the equipment check list in Chapter 1 are present
- Place the Machine, Ultrasonic Device and Printer [optional] in a clean and well ventilated space
- Use a leveled, steady bench that can support the weight and vibrations of the machine, or use the PS80 Portable Stand [optional]. When using the PS80, the adjustable support pads of the machine unit should be removed (Figure 3-i).

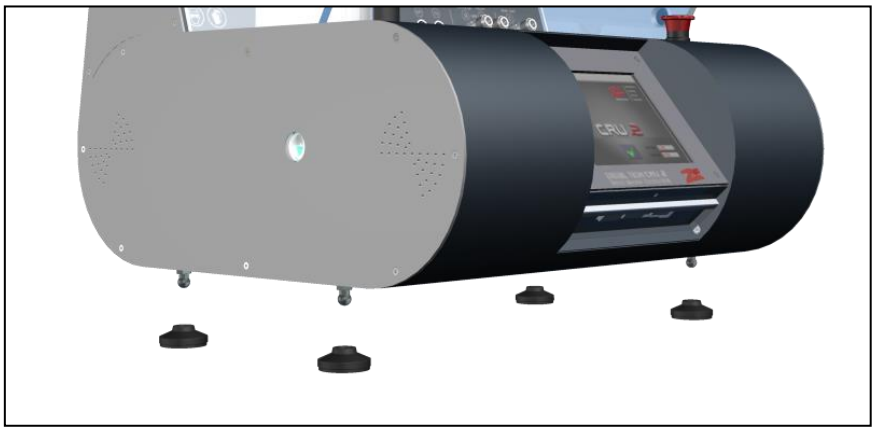


Figure 3-i

Connecting the AC power

CRU / GDU machines

Verify that the rear ON/OFF Power Switch is in the OFF position.

1. Connect one end of the AC power cord [a] to the rear power socket of the machine [b] (Figure 3-ii)
2. Connect the other end of the AC Power cord to any grounded 100/240 VAC, 50/60 Hz power source (live wall outlet)

Figure 3-ii

Injector Ultrasonic Device [optional / CRU / MACC]

1. Connect one end of the AC power cord to the rear power socket of the device
2. Connect the other end of the AC Power cord to any grounded 100/240 VAC, 50/60 Hz power source (live wall outlet), depending on the Ultrasonic device specifications.

[**info**]

Please consult the accompanying Ultrasonic device Operating Manual.

Connecting the Pneumatics

[**info**]

- Always use a Water Trap/Filter/Regulator to connect the Air Supply to the machine, even if the Shop Air Compressor has a dehumidifier installed.
- Always use the nearest route to the Shop Air Compressor and avoid Air Hose bottlenecks, in order to achieve maximum Air Pressure and Air Flow. Follow the specifications in Appendix A.
- The machines are equipped with a standard Water Trap. Always regulate the compressed air input according to the specifications in Appendix A, or on the Serial Tag of the machine.

1. Use a hose fitting [a] (not provided) to connect the Water Trap / Regulator to the hose that leads to the Shop Air Compressor (Figure 3-iii)

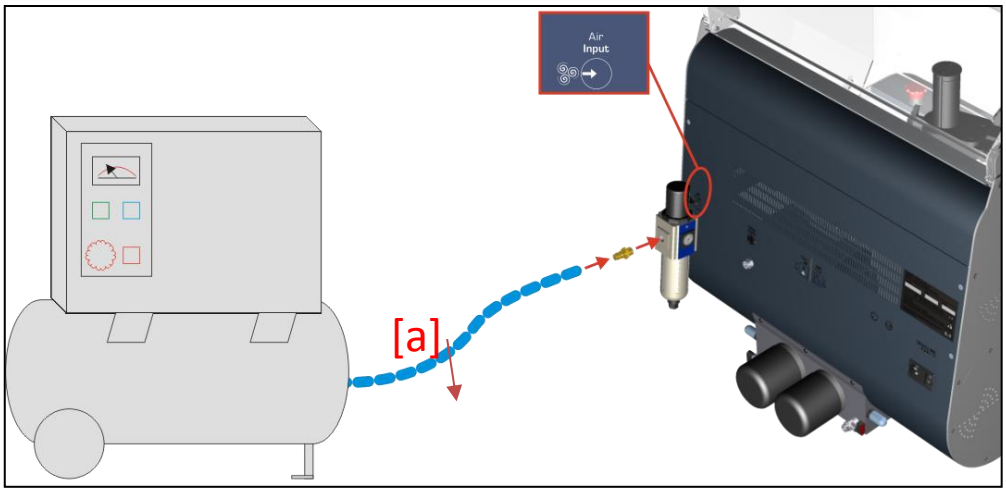


Figure 3-iii

2. [Optional] Disconnect the Fumes Extractor Exhaust Port muffler/filter [b] (Figure 3-iv) and connect a large diameter hose in order to reduce fumes and noise.

[**info**]

- Vacuum performance issues may occur by installing a hose instead of the muffler.

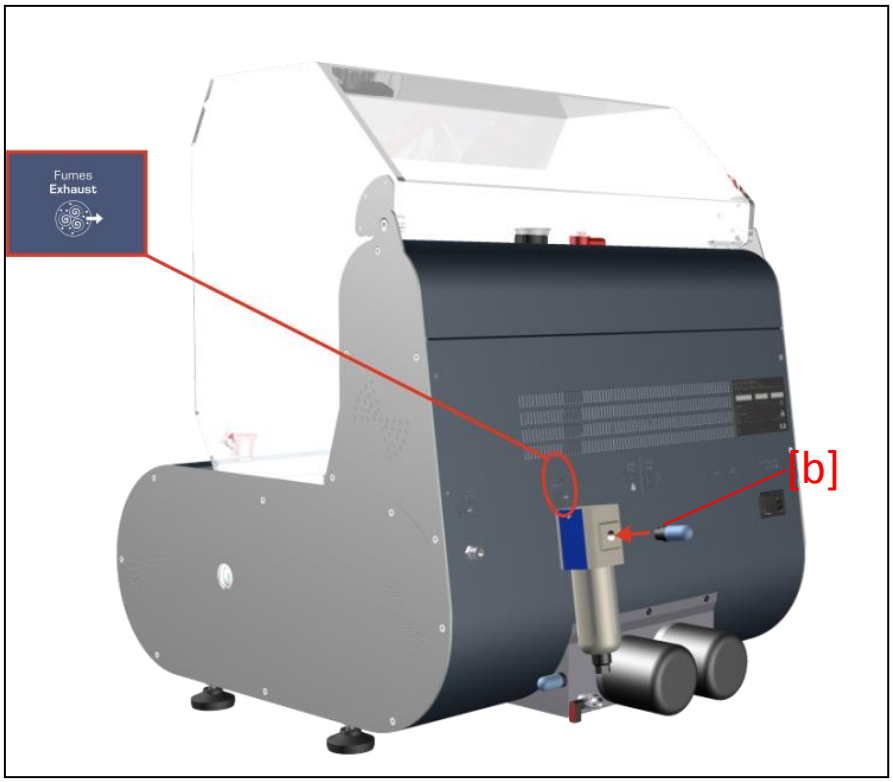


Figure 3-iv

[**important**]

- A periodic emptying of the vacuum collector is needed (Figure 3-v).

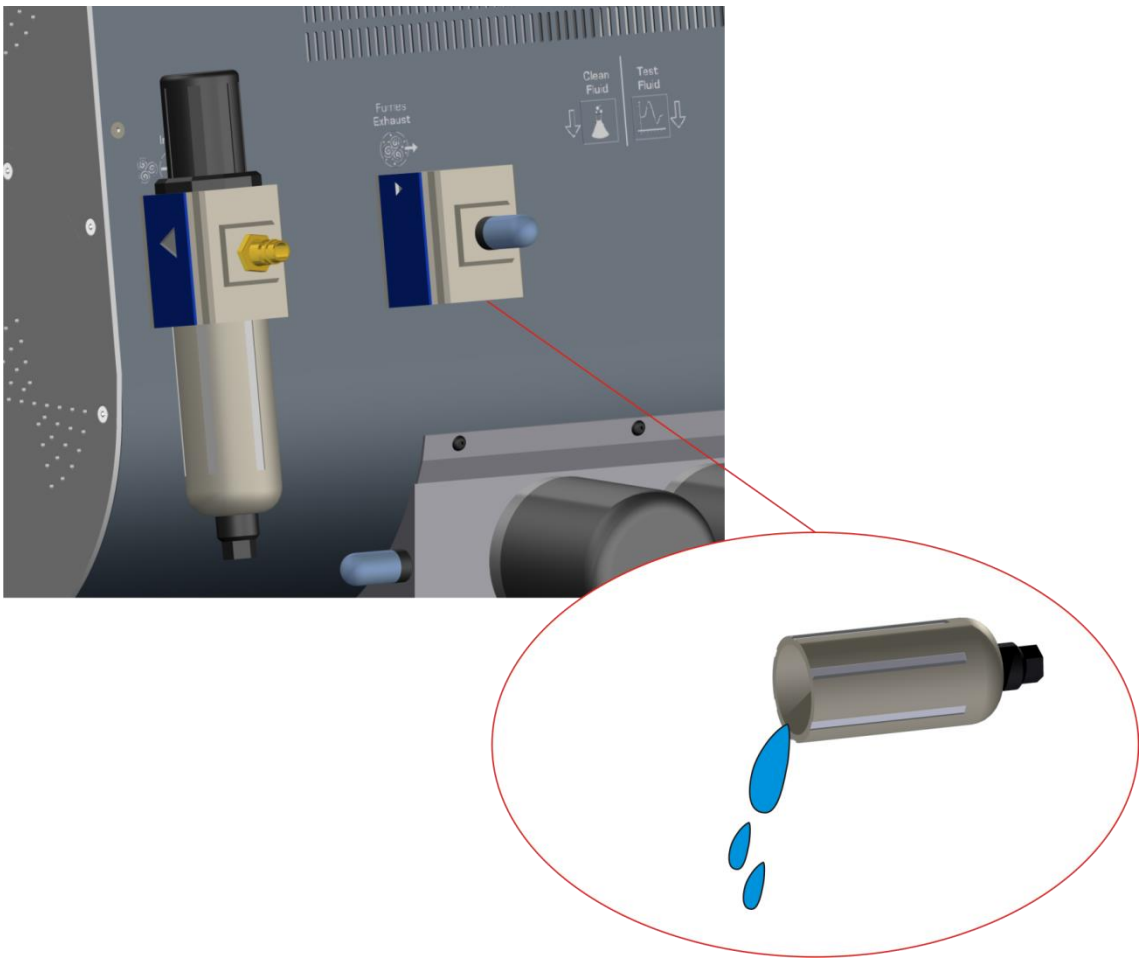


Figure 3-v

Starting up for the first time

1. Switch to the ON position the rear power Switch [a] (Figure 3-vi).

0: OFF / **I**: ON

Figure 3-vi

2. Switch to the ON position (Counter-Clockwise) the front Emergency Stop Switch (Figure 3-vii)

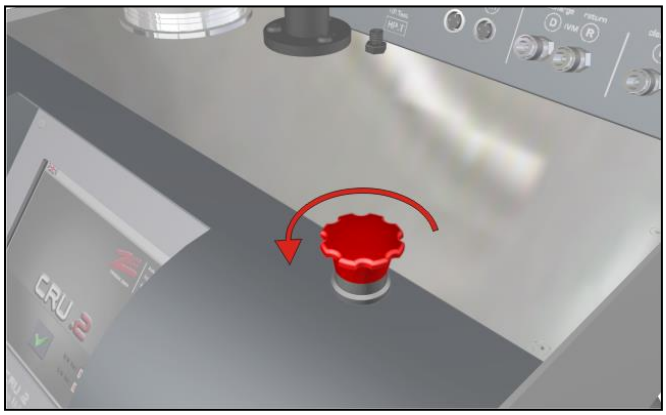


Figure 3-vii

3. Wait a few minutes until the Software Boots up. If more than 15 minutes pass and the Software has not loaded, look at Chapter 7 “Troubleshooting”

4. Once the Software loads, the initial Screen will show the S/W, H/W and Database versions of the machine
5. By Pressing the touching anywhere on the screen the user can continue to the main menu (HOME Screen)
6. Look in Chapter 4 “Menu Tour” for further information on software navigation.

[**important**]

- Always wait at least 45 seconds when switching on the unit again (after a power down)

[**info**]

- If the Touch Screen is not operable or if the software does not load, look at Chapter 7 “Troubleshooting”
- A keyboard and mouse are not needed. In case of Touch Screen failure or for ease of use, a USB Mouse is recommended

Powering down the system

1. Navigate to the HOME Screen:

Figure 3-viii

2. Press the POWER-OFF button (Figure 3-viii-[a]) and select the option to Power down the system
3. Wait at least 30 seconds until the Software Boots down
4. Once this operation is complete, you can switch off the machine using rear ON/OFF Power Switch and/or the EMERGENCY STOP switch (Figure 3-ix).

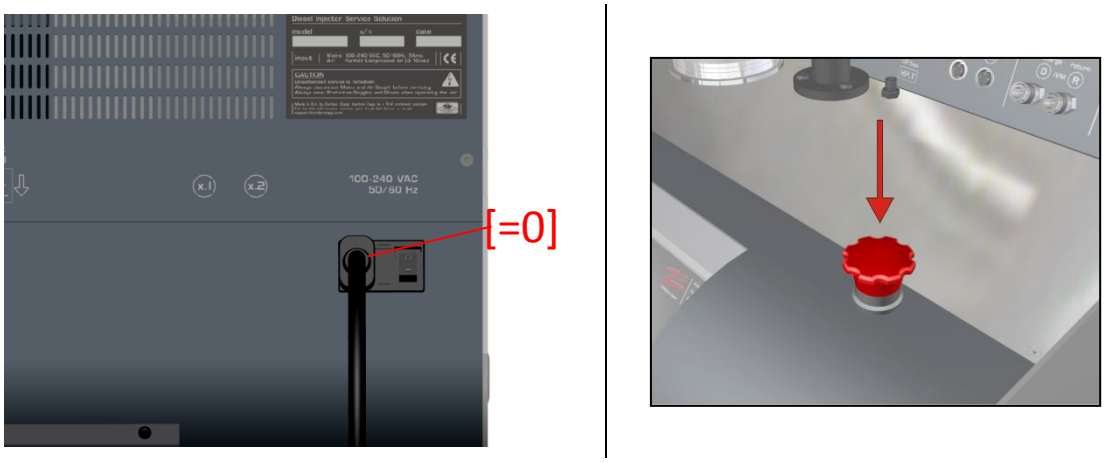


Figure 3-ix

[**info**]

- It is advised not to power down the system by use of the EMERGENCY STOP or ON/OFF Power Switch, before powering down the CRU.2 software. Doing so, it may result in file corruption and/or slow future boot up times

Chapter 4
“Menu Tour”

This chapter provides useful information on the Machine Interface Menu (HMI Software). It covers the following topics:

- General PC knowledge
- Common Buttons and Features
- Home Screen
- Settings
- Tests

A new user should preview all the screens in this chapter prior to operating the machine.

General PC Knowledge

The HMI is based on a LINUX Operating System. Its sole purpose is to provide an easy way for the operator to control the machine with different commands, as well as view previously saved data, e.g. injector test reports.

Although the HMI is an advanced system on its own, patience may be required sometimes. Bear in mind that there are many calculations being made on every press of a button, such as searching through a large injector database or analyzing the injector condition and state, therefore slow reaction may be expected at normal operation.

The software is designed to provide visual feedback to the user on every step, such as the booting up screen or a press of a button. Only if the software is inoperable for a very long time (more than 15 minutes) should the operator terminate/restart the HMI by use of the ON/OFF switch or the EMERGENCY STOP switch.

[**important**]

- In the rare case that smoke comes out of the machine or the injector under test, or there is a high risk of personal injury, Only then should the operator use the EMERGENCY STOP switch. The HMI has a fail-safe mechanism (Back-Up/Restore) in order to restore the HMI to its original state, if something results in the system being inoperable.

Common Buttons and Features

In this section the most commonly used buttons and features are previewed and explained. The HMI is designed with simple images in order for the operator to be able to use the unit without reading each button or info.

ACCEPT Button:

With this button, the HMI operator confirms the changes made or accepts the message or procedure that will follow.

CANCEL Button:

With this button, the HMI operator cancels any changes made or declines the message or procedure that will follow.

RETURN Button:

With this button, the HMI operator can return to the previous screen, exit a current screen or just acknowledge the message provided.

 **HOME Button:**

With this button, the HMI operator can return to the Home Screen.

 **FUNCTIONS Button:**

This button is shown in the Manual Test and will open the Functions screen from which the operator can turn ON/OFF the LED, VACUUM and others.

 **Pass/Fail/Error Symbols:** These are the symbols for the Pass/Fail. They are shown every time a Test is completed, either in Auto or in Manual Mode. Pass denotes the current test is within specifications, whereas Fail denotes the opposite. Error symbol, denotes when there is a problem maintaining the pressure, either the air supply is low or the injector has a lot of return (Failing injector).

HP.T Module:

This is the High Pressure – Testing Module, and consists of 3 features, the Pressure Module Lock, the Pressure Indicator and the Pressure ON/OFF button.

HP-T ON/OFF button:

This button is both a button and an indicator, meaning that when the operator presses this button, it will toggle values (above images). Left image: the system HP-T pressure is OFF. When pressed, it will switch ON the pressure. Right image: the system HP-T pressure is ON. When pressed, it will switch OFF the pressure.

START button:

This button Starts the current test.

STOP button:

This button Stops / Terminates the current test or Auto sequence.

This module provides information such as which injector database is currently used: The Default DB  or User DB  . The Default DB is the database that comes with the machine, whereas the User DB is the database created by the user. Further, in the center of the module, the indicator/button shows the currently selected injector, Make, Type, Code and Actuation. When this indicator/button is pressed, the injector selection screen pops up, providing the operator the capability to select a different injector or database.

The Injector Harness is used to provide the injector with power while operating Electrical Diesel Injectors. Some Injectors have a PLUS (+) sign engraved on the connection fitting in order to denote how to correctly apply voltage. The machine harness connectors also denote the **PLUS (+)** sign with a RED Dot. The user should always connect the **Plus (+)** side of the connector to the **Plus (+)** side of the injector, see Figure 4-i.

[**info**]

The PIEZO Diesel Injectors must at all times use the correct polarity. Often the **PLUS (+)** is not denoted, therefore the user should always consult the manufacture's or the automobile's service manual. For example, look at Figure 4-ii.(a) to see the most common **PLUS (+)** polarity for **SIEMENS/VDO/Conti Piezo** and Figure 4-ii.(b) for **BOSCH 115, 116 and 117** Injectors.

If you accidentally connect the Polarity wrong, the injector will sound like it is operating, but it will not spray or discharge volume correctly.

Figure 4-i

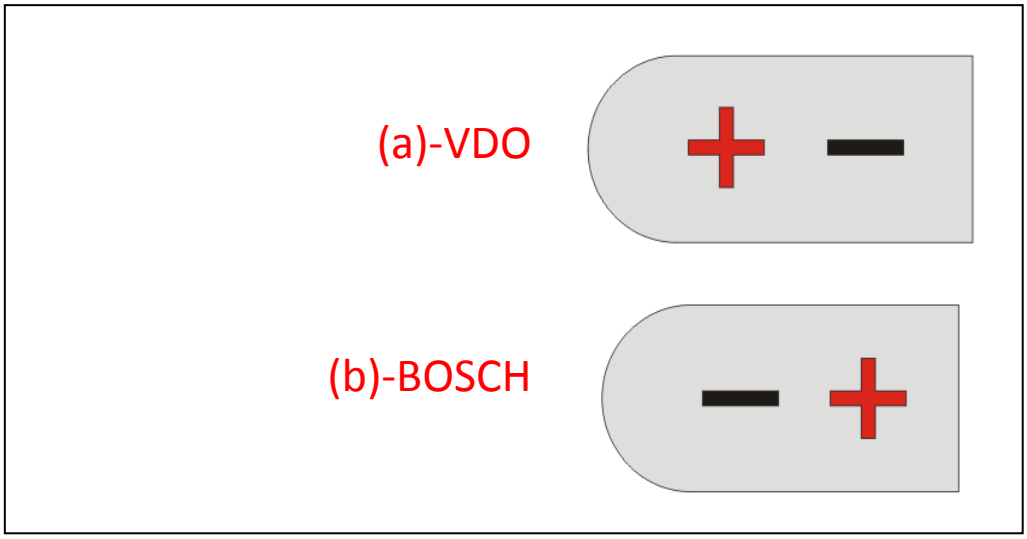


Figure 4-ii

Home Screen

From here the user can easily select one of the following options or change the system language:

1. Tests:
- Opens the Tests screen
2. MACC (Cleaning):
- Opens the MACC screen for cleaning the injector (not available on all machines)
3. Settings:
- Opens the Settings screen in order to customize the machine further.
4. Reports:
- Opens the saved Reports screen, from where the user can view, print/save to usb or delete a previously saved report.
5. Power Off :
- Provides an option to Reboot the Application, Reboot the System (PC) or just Power Off.

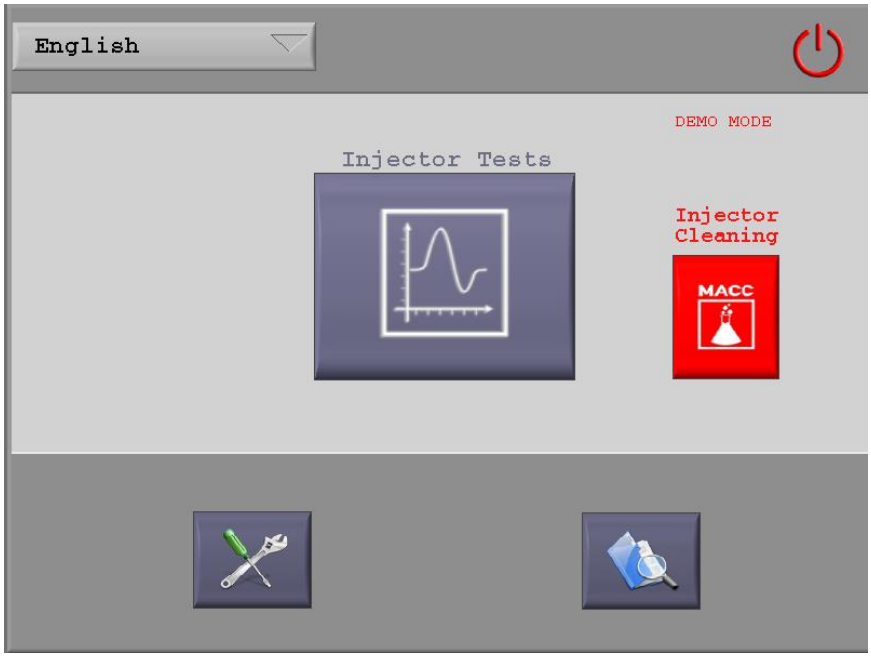
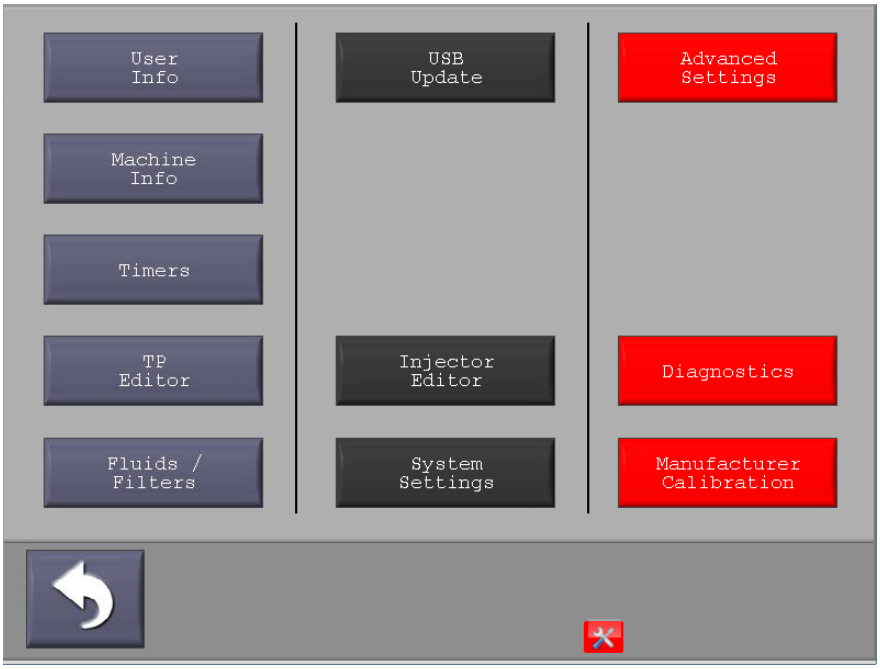


Figure 4-iii

Settings

There are several options in the settings menu that can further customize the software:



1. **User Info**: Change the Machine owner info (shows on report)
2. **Machine Info:** Shows H/W, S/W and MDB versions
3. **Fluids / Filters:** View and Reset the Fluid/Filter timers
4. **USB Update:** Update the HMI Software through a pre-downloaded file in a USB drive
5. **Injector Editor (Advance Users):** Create or Alter User Database.
6. **Advanced Settings (Advance Users):** Enable/Disable features like RSP, MACC tec.
7. Other options are used by the manufacturer to setup the machine for first time use.

[**important**] Every time the Testing filter is replaced, it is mandatory also to replace the screen filters (**30-88**) in the D and R adapters a shown in Appendix C.

Tests

There are several Tests to be performed for each injector and many have sub-categories (sub-tests). The operator should always run the tests in AUTO mode as show in the figure below, and in Manual mode only if an advanced user (For manual mode, the operator can toggle press the AUTO button).

Once the injector is selected from the database, the user should press the Start/Play button in order for the Auto Tests to begin. An initial screen of injector setup, connections leak test is performed in order to assure correct operation. The user should activate the Pump and Injector manual, and then continue with the tests. The HP-T Leak button here, simply activates the injector without pressure in order to release any left-over pressure from the rail.

Figure 4-iv

Chapter 5
“Prepare the Machine”

This chapter provides useful information on preparing the machine for the initial operation. It covers the following topics:

- Fluids and Filters
  - Testing Fluid & Filter
  - Cleaning Fluid & Filter

Fluids and Filters

The machine comes with an empty tank of Testing fluid (Calibration oil) and an empty tank of Cleaning fluid. The machine tank indicators, filters and drain valves are divided into two parts, left/right and are shown on the rear panel of the machine (Figure 5-i).

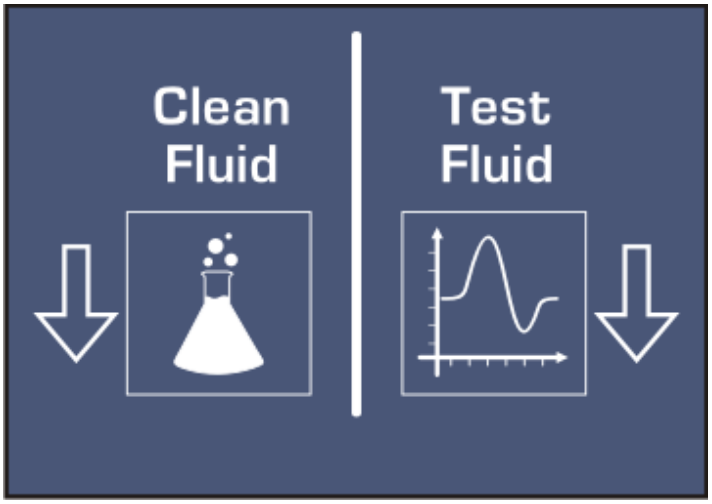


Figure 5-i

[**info**]

Always check if you have acceptable levels of fluids.

[**important**]

Every time the Testing filter is replaced, it is mandatory also to replace the screen filters (**30-88**) a shown in Appendix C.

Testing Fluid & Filter

a. In order to fill the Testing tank up to acceptable level, you must use the accompanied funnel and pour liquid through the Large Spray

Chamber (Figure 5-ii) [CRU.2i / GDU.2i only] or alternatively use the Funnel with Coupler to pour into the “TEST FLUID” port located on the Top-Left part of the machine (Figure 5-ii).

b. In order to change the filter, you must first empty the tank completely, using the drain valve next to the filter and then use a Filter tool to unscrew it (Counterclockwise).

c. In order to install a new filter, after taking out the old one, close the drain valve and screw the new one in (Clockwise) using the Filter tool. After that you can fill again the tank.

[**important**]

When completely replacing the testing fluid/filter, air elimination process should be followed, after filling the tank..

[**info**]

After replacing the filter and filling the tank, drain some fluid in order to eliminate some are pockets in the lines

- Fluid level is acceptable when it is visible through the level indicator
- Always check fluid level when the Machine is idle
- Never let the fluid level fall below the lowest visible point in the tank level indicator
- Always consult Appendix A for Tank and Filter capacity and specifications
- Excess Fluid can always be drained using the specified drain valve

Figure 5-ii

Cleaning Fluid & Filter [CRU.2i / GDU.2i only]

a. In order to fill the Cleaning tank up to acceptable level, you must use the accompanied funnel and pour liquid through the [C] Cleaning port (Figure 5-iii).

b. In order to change the filter, you must first empty the tank completely, using the drain valve next to the filter and then use a Filter tool to unscrew it (Counterclockwise).

[**info**]

- After replacing the filter and filling the tank, drain some fluid in order to eliminate some are pockets in the lines
- Fluid level is acceptable when it is visible through the BOTTOM level indicator
- Always Changes/Drain the fluid when it reaches the TOP level indicator.
- Always check fluid level when the Machine is idle
- Never let the fluid level fall below the lowest visible point in the tank level indicator
- Always consult Appendix A for Tank and Filter capacity and specifications
- Excess Fluid can always be drained using the specified drain valve
- The Software will provide a visual prompt on when to change the Filter.

Figure 5-iii

Chapter 6
“Operation Basics”

In this chapter instructions with figures will be shown on how to perform a basic operation with the machine. The following topics are covered:

- Injector Ultrasonic Cleaning
- Injector Mounting
- Sample Test Procedure
  - MDB (Injector Database)
  - SPR Test
  - eRLC Test
  - LKT Test
  - iVM test
  - NOP Test
  - RSP Test
- Injector MACC
  - Connections
  - Operation
  - Flushing

A new user should fully understand this chapter prior to operating the machine.

Injector Ultrasonic Cleaning

Before mounting any injector on the machine, it is obligatory to clean the Injectors (Nozzles) (Figure 6-i) in the ultrasonic device (Figure 6-ii).

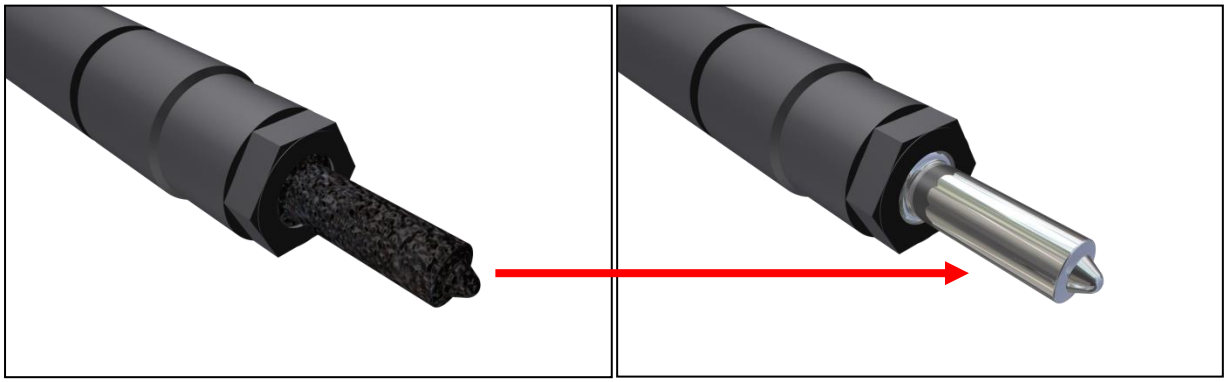


Figure 6-i

Injector Ultrasonic Cleaning is Mandatory

Failure to clean injectors with the use of Carbon Zapp's ultrasonic device (optional) before any test is completed on the test bench will void the warranty of the machine, if dirt particles enter the system lines. If the iVM valves are inoperable due to dirt (verified), the machine's warranty will be voided.

This step is needed, first to clean the (micro meter) nozzle openings as part of servicing the injector, and second to avoid any dirt particles to enter the hydraulics of the system.

The Ultrasonic Cleaning operation should be performed for at least 15 minutes, although 30 minutes is recommended.

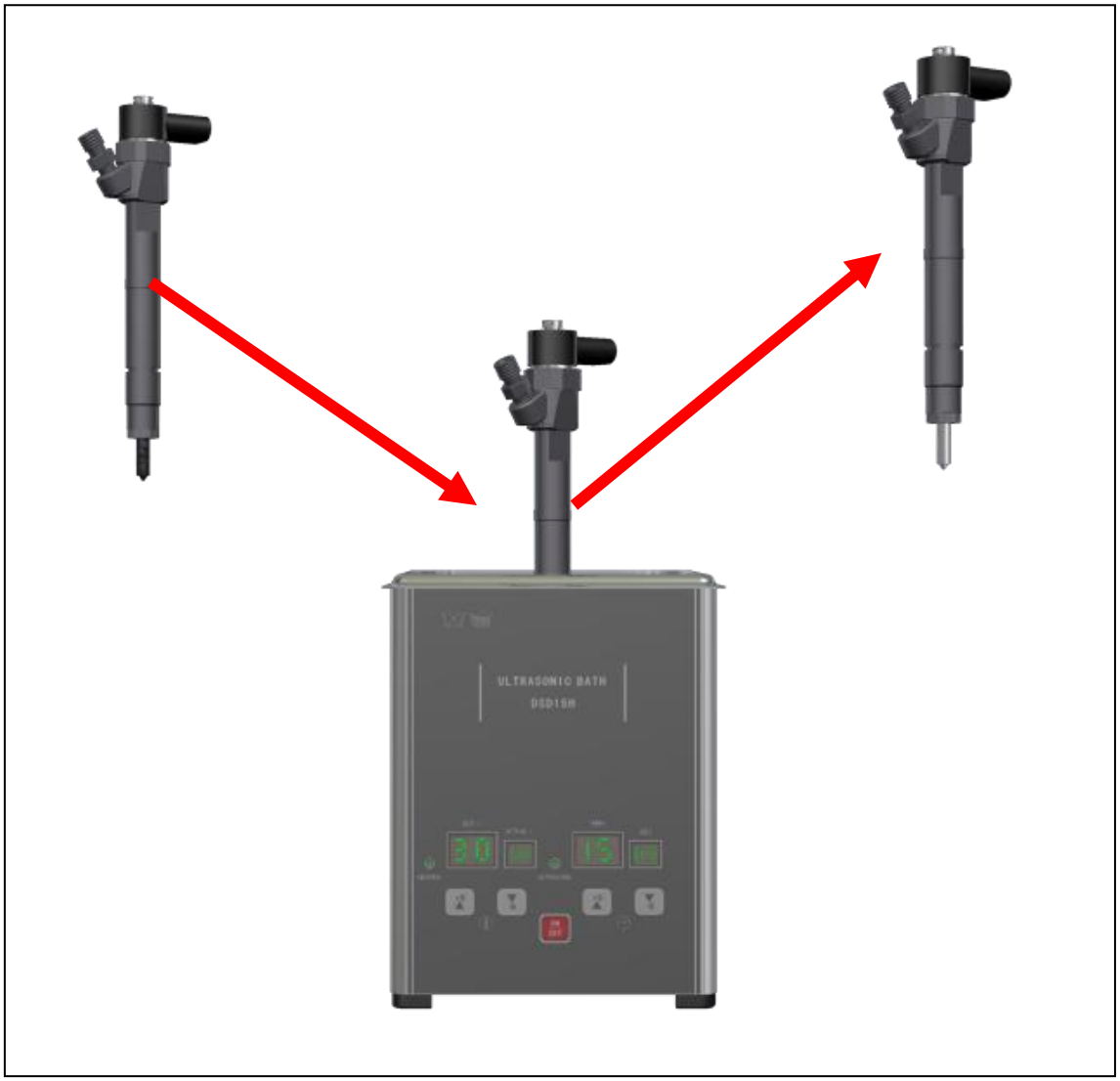


Figure 6-ii

[**important**]

Every time the Testing filter is replaced, it is mandatory also to replace the screen filters (**30-88**) a shown in Appendix C. Any dirt left after cleaning with the ultrasonic device, will be screened by these filters. Please note that this filter does not replace the ultrasonic cleaning operation.

Injector Mounting

All the injectors can be mounted on the machine, using the Injector clamp. Some injectors e.g. Side Feed Injectors (e.g.: BOSCH INDUSTRIAL CRIN) or Gasoline GDI may need additional adapters. For further specifications on Clamping diameters, please consult the Appendix A. For further guidance in adapters and mounting, please consult Appendix C.

Sample Test Procedure

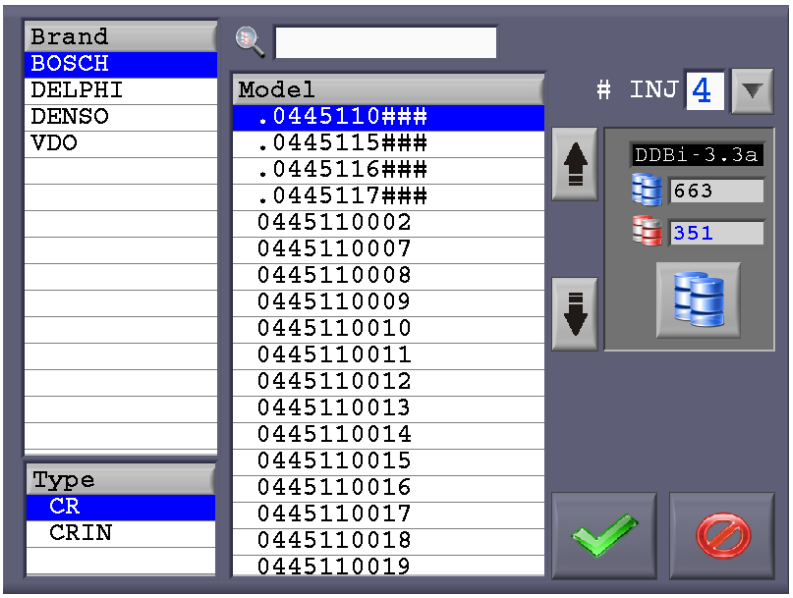
[**important**]

- Always expect pressure in fluid lines, and wear protective goggles and gloves
- It is recommended to observe the condition of the screen filters (**30-88**) before each operation as shown in Appendix C.
- Every time the Testing filter is replaced, it is mandatory also to replace the screen filters (**30-88**) a shown in Appendix C.

[**info**]

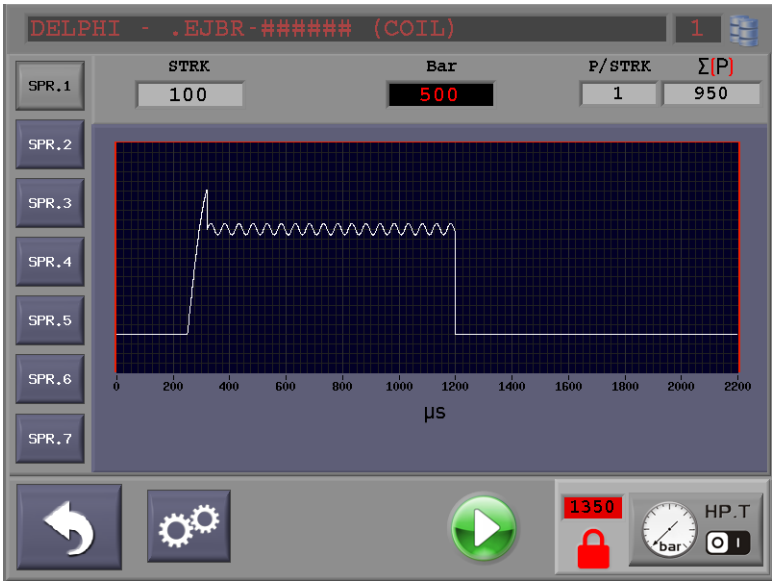
- If the Test is performed for a Piezo injector, please consult the Appendix C for PIR (Piezo Injector Return) connectivity instructions and procedure.
- When switching injectors, it may be needed to perform a de-aeration in the high pressure lines, as shown in Appendix C.

- **MDB (Injector Database Selection)**



If the code is not listed, select the closest generic code, e.g. Bosch/CR/0445110###

- **SPR:**

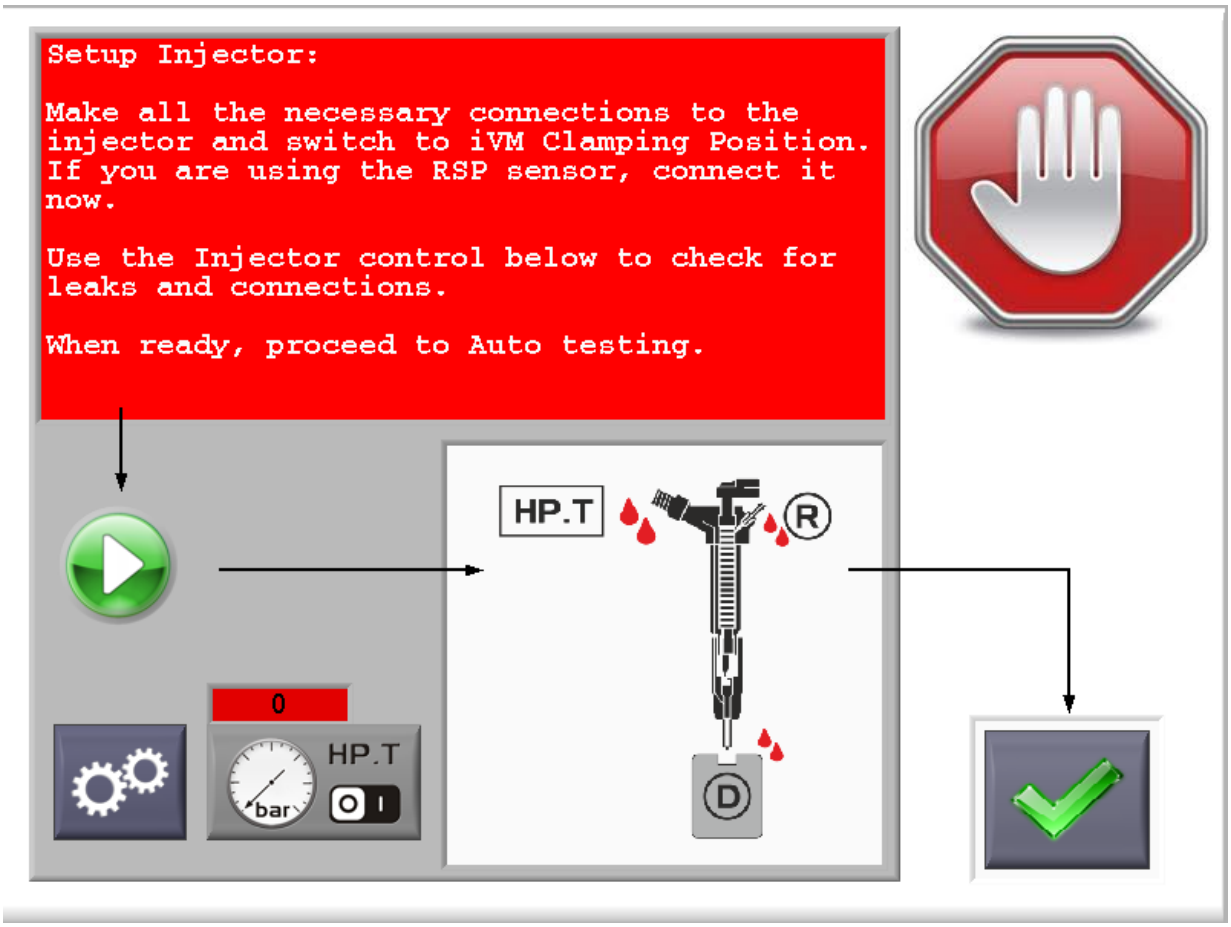


○ Spray test, check the injector spray pattern using different parameters of Frequency (STRK), Duration (µs) and BAR.

○ This test can be performed in the Large Light Spray (if the machine is equipped with one) or in the SPR-Adapter.

AUTO Sequence (pop-up):

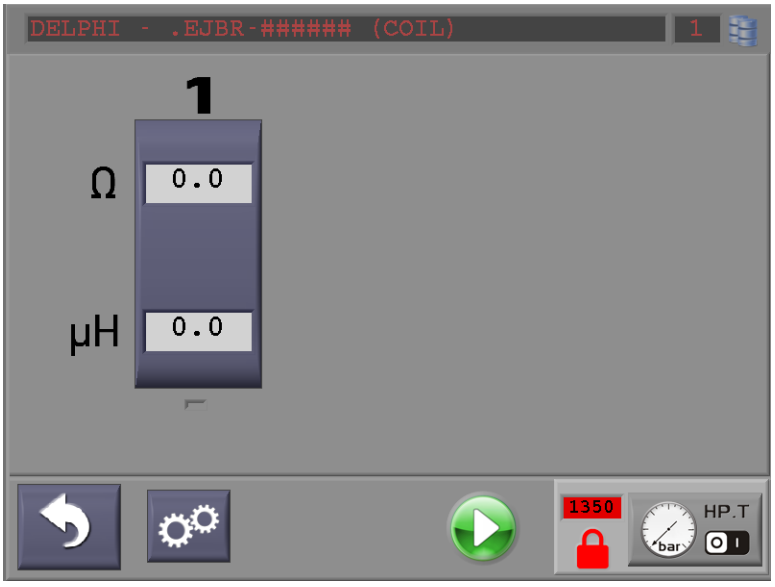
Once the operator starts the AUTO sequence, the following screen will appear, consulting the user to check for leaks and connections, before beginning:



- **LKT:**

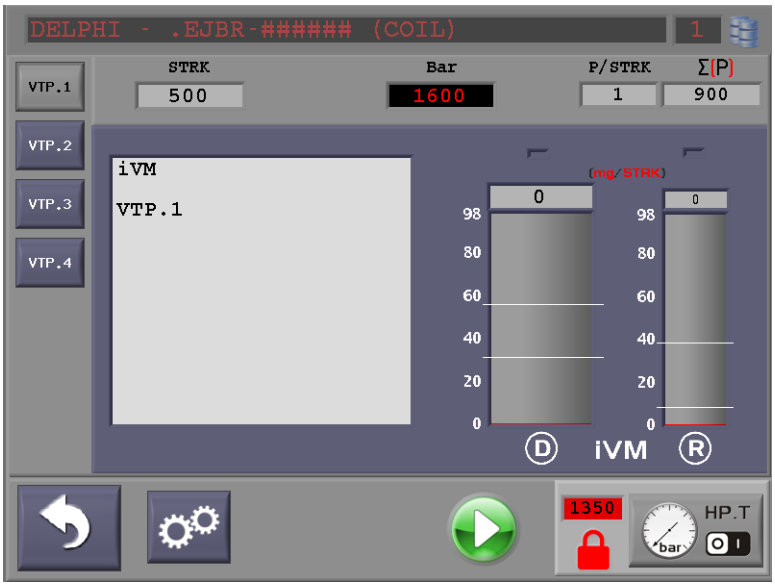
○ Leak Test, check the injector Return Valve for excessive leak [Diesel CR/CRIN Injectors only]

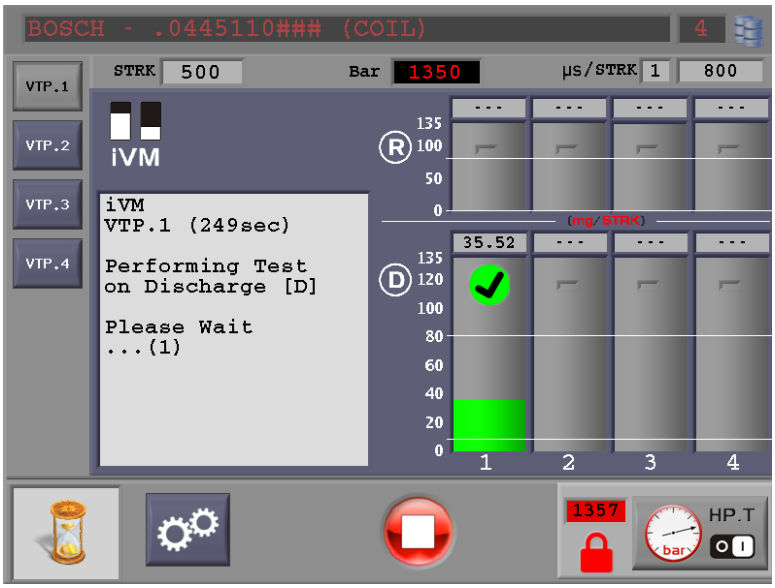
- **eRLC:**



○ Electrical Test, check the condition of coil/coils or piezo crystal through this automatic test.

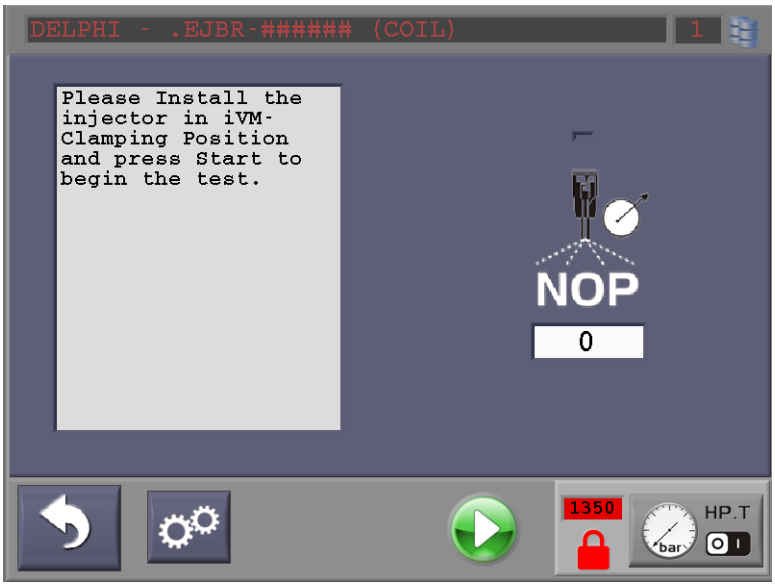
- **iVM:**





○ Injector Discharge (and Return) Mass Metering, check the precise fluid the injector Discharges and Returns on different parameters.

- **NOP:**



○ Nozzle Opening Pressure, check what the minimum required pressure is for this specific injector to operate [Diesel CR/CRIN Injectors only]

- **RSP:**

Injector Mechanical Response Test, check if the injector is responsive enough and measure the time in microseconds need for this. An optional RSP sensor is needed for this test. Additionally, Coding cannot be generated without this sensor.

Injector MACC [CRU.2i and GDU.2i only]

Connection:

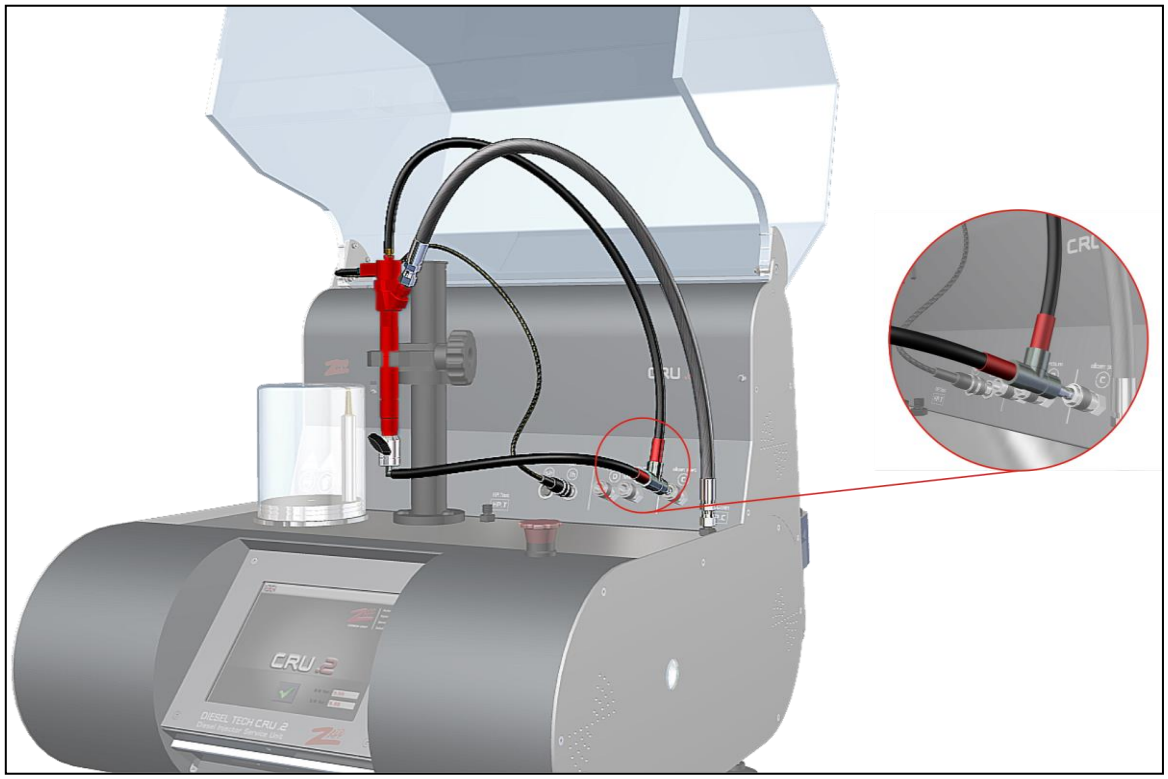


Figure 6-iii

Operation:

This operation will perform MACC Cleaning for a pre-defined time on 4 different Test Plans.

Once the MACC has finished, the user must perform an Injector Flushing (flushes the injector with Testing fluid), in order for the MACC fluid to clear out of the current injector and hydraulic system.

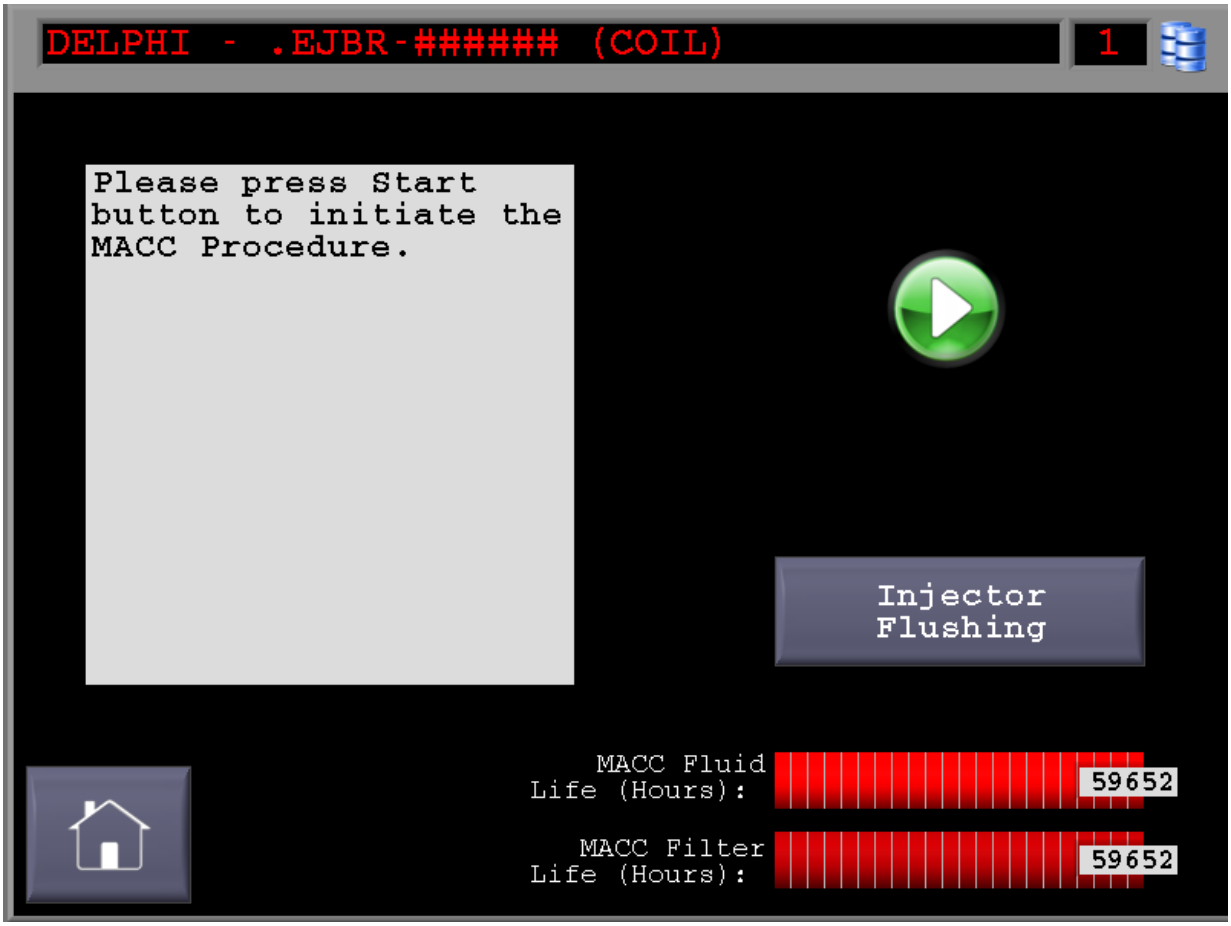
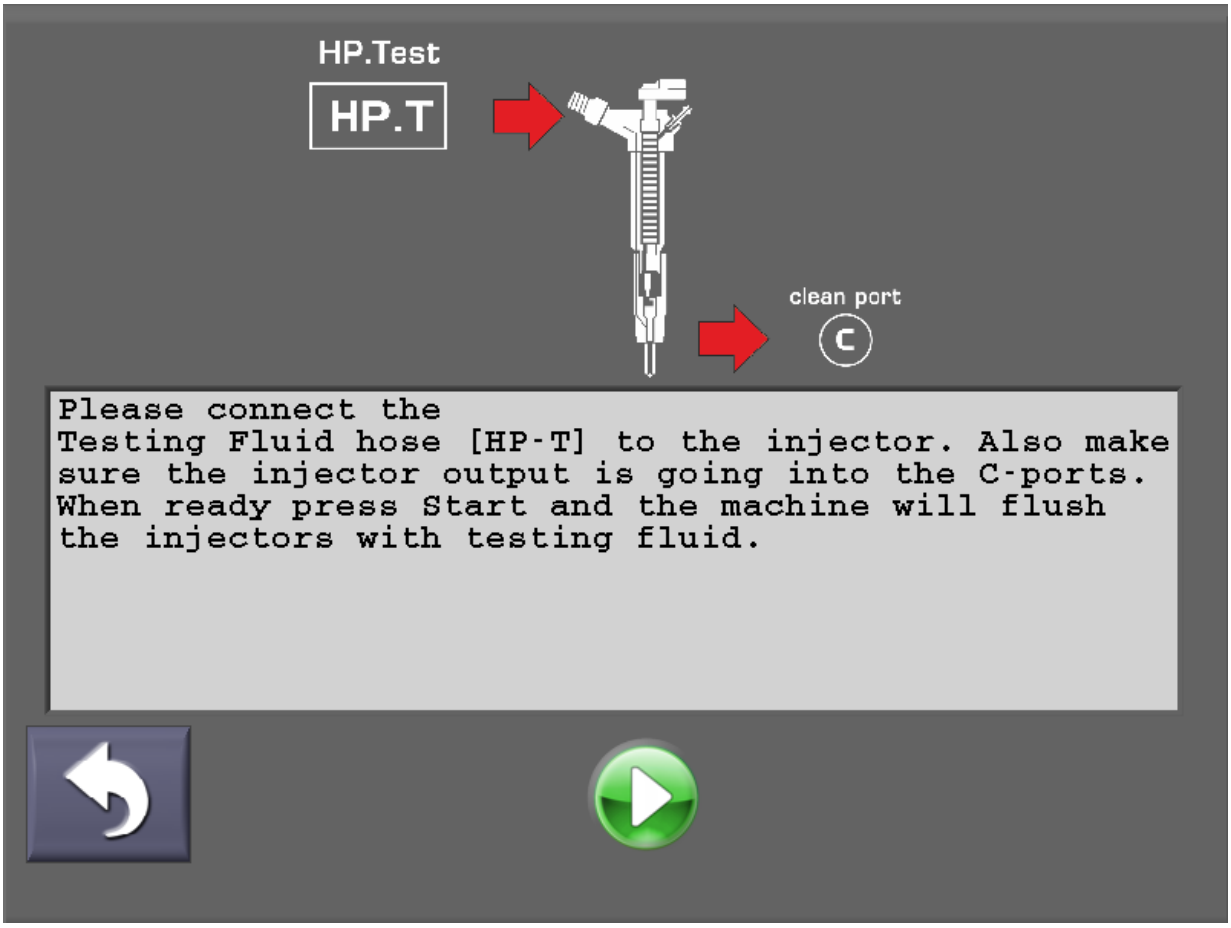


Figure 6-iv

[**IMPORTANT**]

- The MACC hydraulic system is considered separate from the Testing system, please use all adapters, hoses and connectors marked with a [C].
- It is important to follow the Flushing procedure after the MACC cleaning. If the Flushing procedure is not performed for any reason, there is a risk of fluid lines/tank contamination and injector problems if left for long time outside the car.

MACC Flushing:



Chapter 7 “Troubleshooting”

Carbon Zapp designed the machine for durability. However, should problems occur, following the procedures in this chapter can help to determine the cause.

All operators should become familiar with this chapter. Knowing what might go wrong can help prevent problems from occurring.

Symptom / Problem	Detailed Description	Solution / Repair
PC BASED PROBLEMS	Long Delay in Boot or No Boot	• Machine was not shutdown properly • File System is corrupt • Perform a Full System Restore: • or contact support@carbonzapp.com
	LCD /Touch screen	• Touch Screen was scratched / vandalized • Contact: support@carbonzapp.com
	HMI: HW and/or SW not showing on boot up, injector properties/data not showing, Pop-up messages not showing	• No Hardware Connection • Machine was not shutdown properly • File System is corrupt • Open Left Side Panel and check wiring. • Perform a Full System Restore • or contact: support@carbonzapp.com
	System Restore Procedure	1. Plug a USB Printer on the Machine 2. Reboot / Power ON and press ESC key on keyboard when you see the 5 second count down on the top left position on the screen (before the HMI begins to load. 3. There you will press Down arrow and Enter (Advanced settings) 4. Then you will need to perform an OEM Restore, option “r” 5. Then “y” yes and wait for the

		system to restore. 6. Once the system restores and boots up, then you will need to update the Software again to the latest version with a USB drive like before.
	Software Update Failure	• Update file missing from USB Drive or USB drive did not have time to be read by the system • Updating version is earlier than current version.
	PC locks-up, while in HMI	• Wait, up to 5 minutes, if no hazardous condition exist • If problem does not repair automatically, switch OFF the Machine using the ON/OFF switch on the Rear of the machine, wait at least 1 minute and then switch ON the machine again.
	INJECTOR DRIVER PCB board issues	• Good Injector not working correctly (Spray, Ohm, Inductance, Capacitance): Injector Driver PCB is defective, contact: support@carbonzapp.com
MACHINE LEAKS FLUIDS INTERNALLY WHILE OPERATING	<u>Possible LOW PRESSURE Leaks from:</u> 1. Low Pressure Pump 2. Low Pressure Supply Hoses to low pressure pump,	• Open both side panels of machine • Operate unit in Manual mode at both spray test and iVM test • Visually inspect for leaks while operating unit • When leak is located, focus on the origin of the problem. • If a hose clamp is loose, tighten it to solve the problem

	filtering systems and HP pumps 3. [D] and [R] hoses internally connecting to iVM sensor 4. iVM sensor hoses connecting to machine tank 5. iVM electro hydraulic control valves 6. Cleaning [C] hose connecting to machine Cleaning tank 7. Spray Chamber drain Hose 8. Fumes Extractor fluid hose from Spray Chamber to rear side of machine 9. Testing tank gaskets or level indicator Cleaning tank gaskets or level indicator	• If there is a damaged or worn hose or part, replace with equivalent from the local market or contact your closest Carbon Zapp dealer for spare part • Re-test unit after repairing to verify the problem is solved
	Possible HIGH PRESSURE Leaks Inside the machine:	• Open both side panels of machine • Operate unit in Manual mode at spray test and adjust pressure at 200Bar

		• Visually inspect for leaks while operating unit. If there is no visual leak, then increase gradually the operating pressure in increments of 50Bar until leak is visible (diesel system only) • When leak is located, focus on the origin of the problem. • If there is a damaged, loose or worn HP hose or connector/part, ONLY replace with new from your closest Carbon Zapp dealer • Re-test unit after repairing to verify the problem is solved
MACHINE LEAKS FLUIDS EXTERNALLY WHILE OPERATING	HP hose [D] squirting fluid from the connectors or the hose itself	• Replace complete HP hose with new one supplied from your closest Carbon Zapp dealer
	BACK-LEAK [R] hose leaking fluid from the connectors or the hose itself	• Replace complete Back-Leak hose with new one supplied from your closest Carbon Zapp dealer
	[D] or [R] QUICK CONNECT COUPLER AT FRONT PANEL OF MACHINE Is leaking while operating ([D]or[R] hose	• Replace Quick connect coupler with New one supplied from your closest Carbon Zapp dealer

connected	
EXHAUST(S) in back-side of machine are spraying water mist along with air instead of dry air (Soaking wet behind the machine)	• Check Air supply circuit and water trap (dehumidifier) of the shop for water and dirt. • Empty the water trap which is located at the rear side of the machine • After this has been done, operate again the machine for at least 5 minutes for the system to free the water from within • If the system is still releasing a lot of water, you need to contact your hydraulic/air network provider to check your system for humidity and dehumidifier for possible problem
EXHAUST(S) in back-side of machine after long operation and humid environment are spraying a <u>small</u> amount of water mist along with air instead of dry air (<u>NOT</u> soaking wet behind the machine)	• This is Normal operation of the machine and pump(s) and does not present a problem.

	EXHAUST(S) in back-side of machine are spraying calibration oil mist along with air instead of dry air	• One or both pumps will need to be replaced or serviced from authorized personnel only. Please contact you nearest Carbon Zapp dealer to report the problem or email to support@carbonzapp.com to be send the service guide for replacing or repairing the pump(s)
MACHINE LEAKS FLUIDS AT STAND-BY	Possible Leaks from: 1. Testing tank gaskets or level indicator 2. Cleaning tank gaskets or level indicator 3. Low Pressure Supply Hoses to low pressure pump, filtering system and HP pump	• Open both side panels of machine • Visually inspect for leaks around the body of the unit • When leak is located, focus on the origin of the problem. • If a hose clamp is loose, tighten it to solve the problem • If there is a damaged or worn hose or part, replace with equivalent from the local market or contact your closest Carbon Zapp dealer for spare part
GLASS SPRAY CHAMBER	Cracked or broken Glass tube	• Replace with new one. Contact your closest Carbon Zapp dealer for spare part
	Leaky Glass tube	• Remove Glass Tube by turning counterclockwise and applying an upward force • Replace both Viton o-rings at

		the base with equivalent from the local market or contact your closest Carbon Zapp dealer for spare part • Replace the Glass tube in its position and test
FLUID PRESSURE ISSUES	ERROR (Screen message)	• Run test once more to verify that the message shows again and eliminate the possibility to be an intermediate problem • Injector to be tested has a very high back-leak value and injector cannot built the required pressure to operate • Check Air Supply and verify that the input specifications are according to the ones listed in Appendix A “Specifications”. • If message shows only at tests performed at high pressures (more than 1250 Bars), then the Air Supply is not according to specifications (diesel systems only)
	NO or LOW Pressure built-up	• Check Air Supply and verify that the input specifications are according to the ones listed at Appendix A “Specifications”.
	Pump is continuously pumping but NO Pressure is built	• **Clear Protection cover Switch has failed.** Use contact spray at the switch to solve the problem. If

	in the system	problem is not solved this way, replace switch with new one. Contact your closest Carbon Zapp dealer for spare part and instructions • **Pressure Regulator** located inside the machine at the center bottom compartment has been disconnected from the control wire. Re-connect wire to pressure regulator to solve the problem. If this does not solve the problem, then replace the regulator with a new one. Contact you closest Carbon Zapp dealer for spare part and instructions
	Inaccurate pressure Indication	• Use an analog gauge to verify the Pressure
INJECTOR DRIVING PROBLEMS	Coil Injector ONLY <u>Not</u> operating	• Verify that injector is good and operating • Test with a good known injector • Check if eRLC test gives valid numbers and not values out of specification • If the ERLC test passes than the driver circuit on the pcb board has failed • Contact you closest Carbon Zapp dealer for spare part and instructions

Piezo injector ONLY Not operating	• Verify that injector is good and operating • Test with a good known injector • If Piezo does not work, test the machine with a coil injector and verify normal operation • If test fails, then the high voltage circuit on the PCB board has failed • Contact you closest Carbon Zapp dealer for spare part and instructions
No injector operation	• Verify that injector is good and operating • Test with a good known injector • Check if ERLC test gives valid numbers and not values out of specification • If the ERLC test passes than the driver circuit on the pcb board has failed • Contact you closest Carbon Zapp dealer for spare part and instructions
ERLC test results are inaccurate	• Verify that injector is good and operating • Test with a good known

		injector • Check if ERLC test gives valid numbers and not values out of specification (verify with a calibrated multimeter) • If the ERLC test passes than the low power resistance metering circuit on the pcb board has failed • Contact you closest Carbon Zapp dealer for spare part and instructions
CLEAR PROTECTION COVER CRACKED OR BROKEN		• Replace the clear protection cover with a new one • Contact you closest carbon Zapp dealer for spare part and instructions
EXHAUST VACUUM AND FUMES EXTRACTOR/ SEPERATOR ISSUES	NOT WORKING	• Verify that there is air input at the machine of at least 4 Bars • Inside the menu manually activate the vacuum (refer to Common Buttons and Features, page 4-3) and check if vacuum is operating • If not, replacement of the vacuum electrical valve controller is needed to be replaced. Contact you closest Carbon Zapp dealer for spare part and instructions
	LEAKING AT BACK-SIDE OF	• Remove the glass bottom of

	MACHINE	the device and empty the fluid • Visually check o-ring seal at upper position of glass bottle and replace if needed • Replace into original position
	POOR SPRAY CHAMBER CLEARING EFFICIENCY	• Remove the silencer from the exhaust of extractorcollector at rear-side of machine and verify the problem still exists or not • If it still exists, then remove the glass bottom of the device and empty the fluid • Replace into original position
IVM OPERATION	INACCURATE OR INCONSISTENT iVM Sensor indication light blinks or constantly lights Red *(remove Rear panel to observe)*	<u>NOTE:</u> Failure to clean injectors with the use of Carbon Zapp's ultrasonic device (provided) before any test is completed on the test bench will void the warranty of the machine. If the sensor reading is out of specification or accuracy due to dirt (verified), the machine's warranty will be voided. • The iVM sensor will need to be serviced, calibrated or replaced from authorized personnel only. Please contact you nearest Carbon Zapp dealer to report the problem or email to support@carbonzapp.com to be send the service guide for

	diagnosing, repairing or replacing the iVM sensor

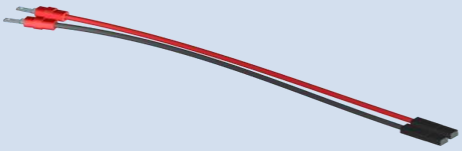
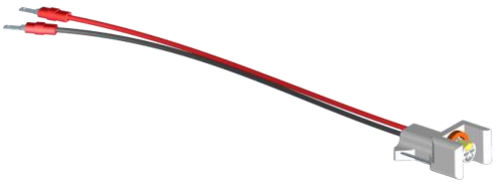
Appendix A “Specifications”

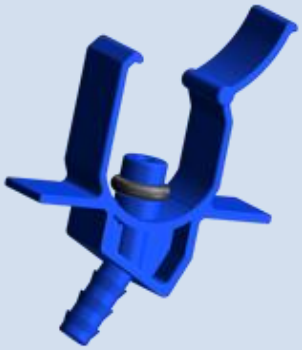
Mains Voltage	Vac	100-250 V
Mains Frequency	Hz	50 / 60
Mains Fuse	Ampere	5.0 A
Mains Power Cord (CE Approved) Voltage/Amperage/Length	V / A / mm	250 / 10 / 200
Power Consumption at Idle Operation	Watt	35.0
Power Consumption at Average Operation	Watt	160.0
Power Consumption at Max	Watt	370.0
Outer dimensions W / D / H	mm	605 / 702 / 730
Outer Max dimensions W / D / H (Clear Protection Cover Open)	mm	605 / 702 / 925
Max. Filling Volume for Testing/Calibration Oil Tank	lt. / gal.	2.92 / 0.771
Filtering for Testing/Calibration Oil (MANN 5-WK712/2 or Equivalent)	µm	2.0
Testing Filter Life	Hours	60
Testing Fluid Life	Hours	20
Max. Filling Volume for Cleaning Detergent Tank	lt. / gal.	2.30 / 0.607
Filtering for Cleaning Detergent (FLEETGUARD 7-FF-5074 or Equivalent)	µm	10.0
Cleaning Filter Life	Hours	30
Cleaning Fluid Life	Hours	10
Input System Pressure	Bar / Psi	03-10 / 45-145
Recommended Min. Operating Pressure (for iVM)	Bar / Psi	

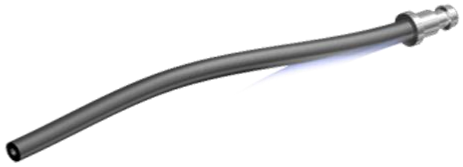
Diesel **Gasoline**		08 / 115 05 / 72
Min. Inner Diameter of Input Supply Hose	mm	10
Min. Exhaust Hose if used to replace the Exhaust muffler as shown in (Figure 3-iv)	mm	14
Max. System Build-Up Pressure **CRU – 4xxx** **CRU – 3xxx** **GDU**	Bar / Psi	2450 / 35500 1850 / 27000 1000 / 14500
Injector Clamping diameters	mm	9-35

Appendix B
“Adapters and Connectors”

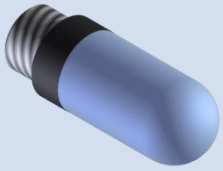
Quantity below (Qty) is shown for:
CRU.2i / CRU.4i
GDU.2i / GDU.4i

CODE	DESCRIPTION	Qty	IMAGE
IH.ab	Generic_a / b Electrical connector for connector [ih]	**2/8** **2/8**	
IH.3	Delphi Electrical connector for connector [ih]	**1/4** **-/-**	
HPT.14	High Pressure Hose Extension converter from M12 to M14 HP-T Connection	**1/4** **-/-**	

RA.1	Bosch, Siemens, Denso etc. R-Adapt for Returned Testing Calibration Oil	**4/16** **-/-**	
RA.3	Delphi R-Adapt for Returned Testing Calibration Oil	**1/4** **-/-**	
OR1	Spare o-ring for RA.1 Adapter	**2/8** **-/-**	
OR2	Spare o-ring for D-ADAPT.7 (DA.7) Adapter	**2/8** **2/4**	
OR3	Spare o-rings for D-ADAPT.9 (DA.9) Adapter	**2/8** **-/-**	

30-88	Spare Screen Filter for [D] & [R] Adapters	**3/12** **4/4**	
R-ADAPT.H	R-Adapt Hose for Returned Testing Calibration Oil for quick coupler [R]	**1/4** **-/-**	
R-ADAPT.BP	Bosch Piezo R-Adapt Connector for Returned Testing Calibration Oil (for quick coupler [R])	**1/4** **-/-**	
D-ADAPT.7	7mm D-Adapt for Discharged Testing Calibration Oil for quick coupler [D]	**1/4** **1/4**	
D-ADAPT.9	9mm D-Adapt for Discharged Testing Calibration Oil for quick coupler [D]	**1/4** **-/-**	

T-FUN	Calibration Oil/Fluid Funnel – Large	**1**	
C-ADAPT	T-Piece C-Adapt connector for connecting hoses to quick coupler [C]	**1/-** **1/-**	
C-FUN	Cleaning detergent Funnel (MACC) - Small with extension for quick coupler [C]	**1/-** **1/-**	
PWC	100/240 VAC Mains Power Cable	**1**	

HC	Hose Clamp	**1**	
VMF	Vacuum Muffler for connecting to the rear Spray Chamber fumes extractor (**Błąd! Nie można odnaleźć źródła odwołania.**-[c])	**1**	
FFA.v3	Spare Fast Acting Fuse (located on rear of machine)	**1/4** **1/4**	No Photo Available

1 long black

1 short black

4 threads

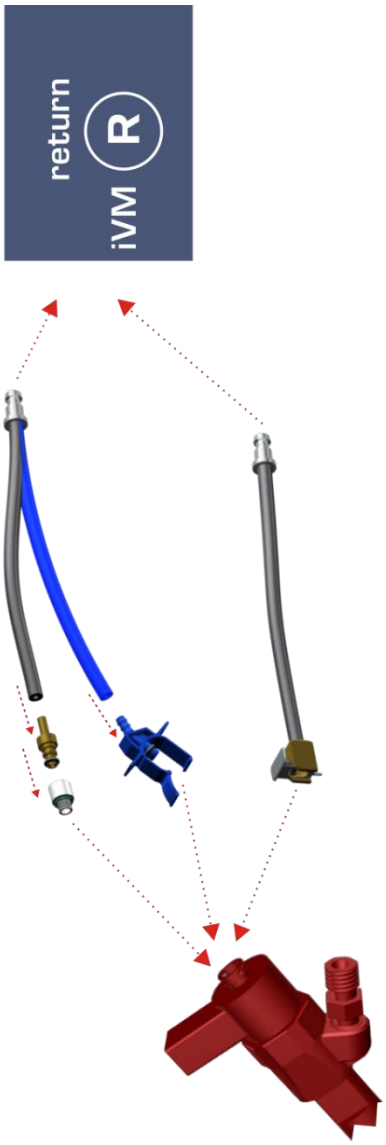
1 pomolo

+ 4/8

Appendix C
“Connectivity/Illustrations”

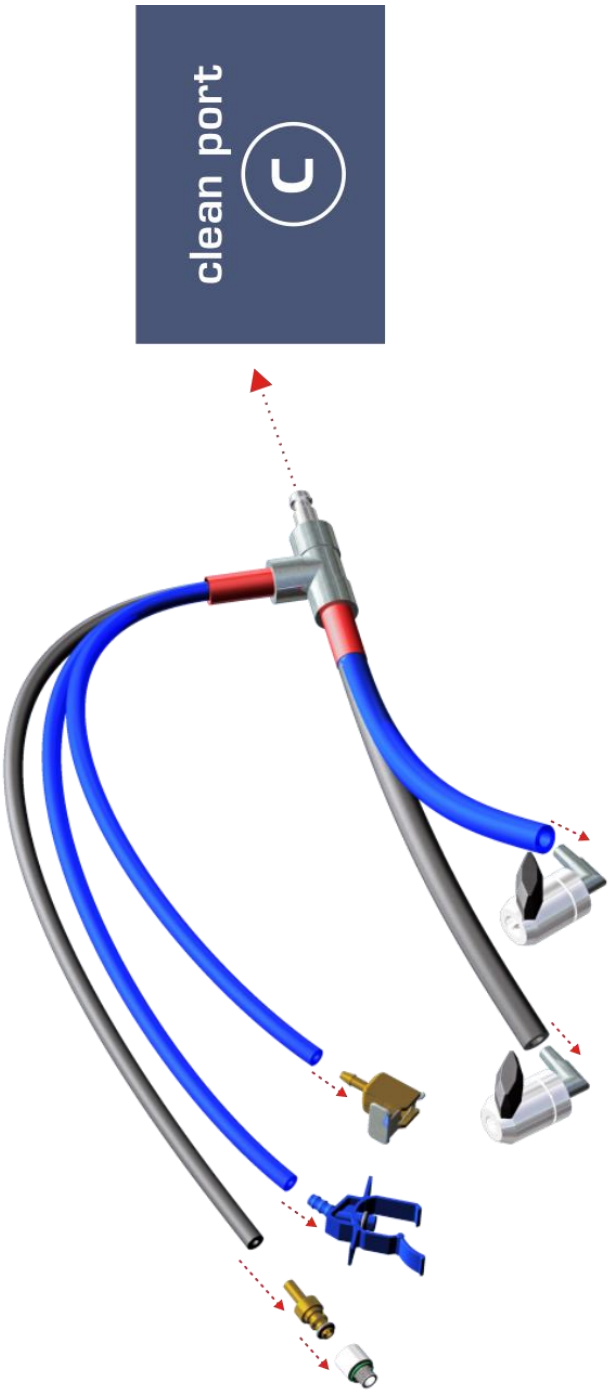
Description	Illustration
Electrical Wire Connection **[ih] -> Injector**	

Return Adapter (R-Adapt) Connection for Testing Calibration Oil [R] iVM



Discharge Adapter (D-Adapt) Connection for Testing Calibration Oil [D] iVM

Discharge and Return T-Piece Adapter (C-Adapt) Connections for Cleaning MACC [C]



PIR - Piezo Injector Back-Leak Adapters

For correct operation of the Piezo injectors, use the optional Carbon Zapp Piezo Back-leak adapters (PIR). Connect using the proper back-leak adapter from the injector to the [R] Hose.

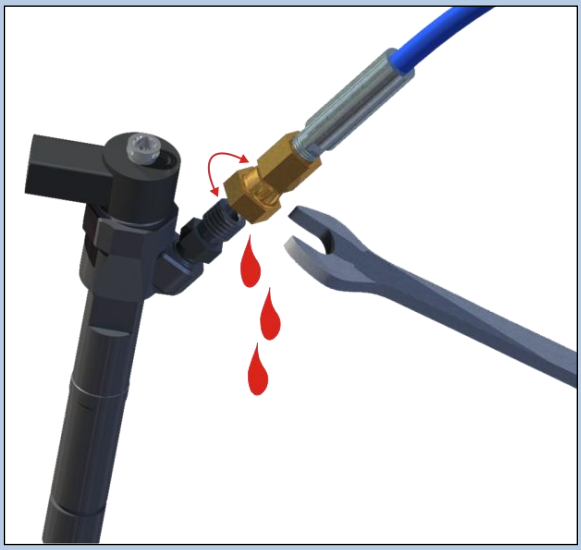
a. PRV.10 / Bosch Piezo: **10 bars**
b. PRV.2 / Siemens Piezo: **2.5 bars**

[D] & [R] Adapter Screen Filter (30-88) Replacement

CRIN / Side Feed Injector Adapter connection

GDI Injector
Adapters

High Pressure lines
De-aeration



Air pockets in the High Pressure lines restrict pressure build up, and therefore the HP pumps will pulsate in a high frequency with almost very low or no pressure build-up.

Magneti Marelli Aftermarket Spółka z.o.o.

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