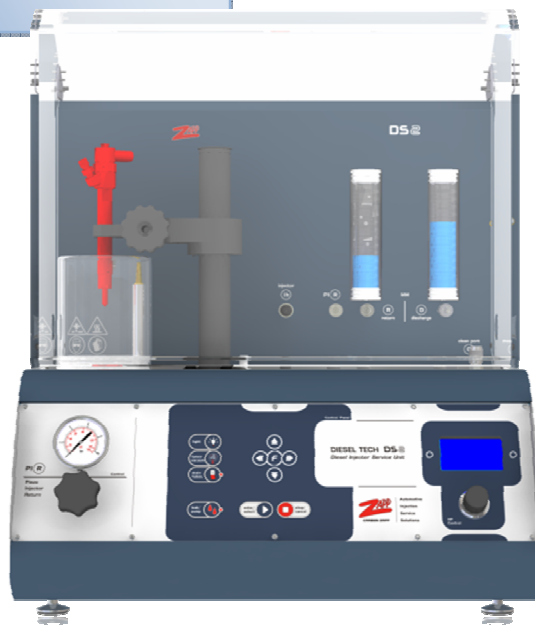


Operation Manual

Diesel Tech DS2

ver. 2010.2



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Warranty

2 –YEAR DS2 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 (Optional) before any test is performed on the DS2 test bench will void the warranty of the machine. *If the iVM hydraulic system operation and graduated tube indications are out of specification or accuracy due to dirt (verified), the machine’s warranty will not be liable*

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.

Machine serial number: _____

Signed by: Technical Department: _____

Date: ____/____/____

“Introduction”

Through the years, there has been an excess demand in Pollution Reduction, Fuel Economy and Enhanced Performance for Consumer Engines. Engine Manufacturers have gone a long way, since conventional Diesel systems, to reach today at the revolutionary approach of Electronically Controlled Injection systems, thereafter called Common-Rail (CRDI). With this approach they have successfully reduced emissions and gained fuel economy and performance through accurate injection of fuel.

The Electronically Controlled Diesel Fuel Injectors, although accurate, produce chronic defects. Through time numerous faults may occur, such as fuel residue built-up at nozzle and back-leak valve (pressure-relief valve), electrical coil or Piezo crystal failure and injector pathway blockage. These faults in turn, produce an undesired effect which causes increase in emissions and fuel consumption, unstable engine operation and loss of engine performance.

Carbon Zapp, a leading manufacturer in Automotive Injection Service Solutions, offers the DS2 Unit for the treatment of all Common-Rail Injectors presently used, and provides upgradeability of the machine for Future Injectors.

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 items:

- DS2 Series Common-Rail Testing and Servicing Unit
- Injector Ultrasonic Device [100/240 VAC] with: [DS2-X1]
 - o Operating Manual
 - o AC Power Cord[100/240 VAC]
 - o Injector Holder
- AC [100/240 VAC] Power Cord, for DS2 Series Unit
- Calibrating Oil (Shell V-OEL 1404 or equivalent), prefilled ½ tank start-up consumable for Testing injectors
- 4 liter Calibration Oil, start-up consumable for DS2 Testing injectors
- 4 liter Ultrasonic Cleaning Solvent, start-up consumable for Ultrasonic Cleaning injectors
- 2 liter Cleaning Detergent, start-up consumable for MACC Cleaning of injectors [DS2-X1 only]
- Calibration Oil/Fluid Funnel – Large
- Cleaning detergent Funnel (MACC) - Small with extension for quick coupler [C] [DS2-X1 only]
- Adapters and Accessories Kit for Testing Injectors [look at Appendix B]
- Adapters and Accessories Kit for Cleaning Injectors [look at Appendix B] [DS2-X1 only]
- Piezo Injector Back-Leak Regulator Kit "PIR" [Optional]
- Operating Manual and Quality Control Certificate

Options

There are a number of options to make the DS2 unit even more powerful and universal in diagnosing and servicing the Diesel Injectors. The following options are available:

Code	Description	Hardware Needed	Models
MACC	Upgrade Kit	YES	DS2-X0
CRIN ADAPTERS	Industrial Common-Rail Injector Adapters <i>(Request availability list from your local dealer)</i>	YES	DS2-XX
PS80	Portable stand DS2	YES	DS2-XX
PIR	Piezo Injector Back-Leak Regulator Kit "PIR"	YES	DS2-XX

“Product Tour”

This chapter provides an overview of the DS2 exterior views and connections. It covers the following topics:

- Front View
- Side View
- Rear View
- Rear View Symbols
- Serial Tag

A new user should be familiar with all the views and connections in this chapter.

Front View

- a. Injector Clamp
- b. Injector Spray Chamber fumes extractor
- c. Injector Spray Chamber
- d. Unit adjustable support pads
- e. PIR Pressure Regulator
- f. PIR Pressure Gauge
- g. Control Panel
- h. High Pressure Regulator
- i. LCD SCREEN
- j. Front Connections
 - a. [ih] Injector Harness connector
 - b. iVM
 - i. PI[R] Testing Return Connector (for PIR use)
 - ii. [R] Testing Return Connector
 - iii. [D] iVM Testing Discharge Connector
 - c. MACC
 - i. [C] Cleaning MACC Discharge and Return Port
- k. iVM lit Volumetric Tubes
- l. High Pressure clear protective cover opening switch
- m. Clear Protective cover

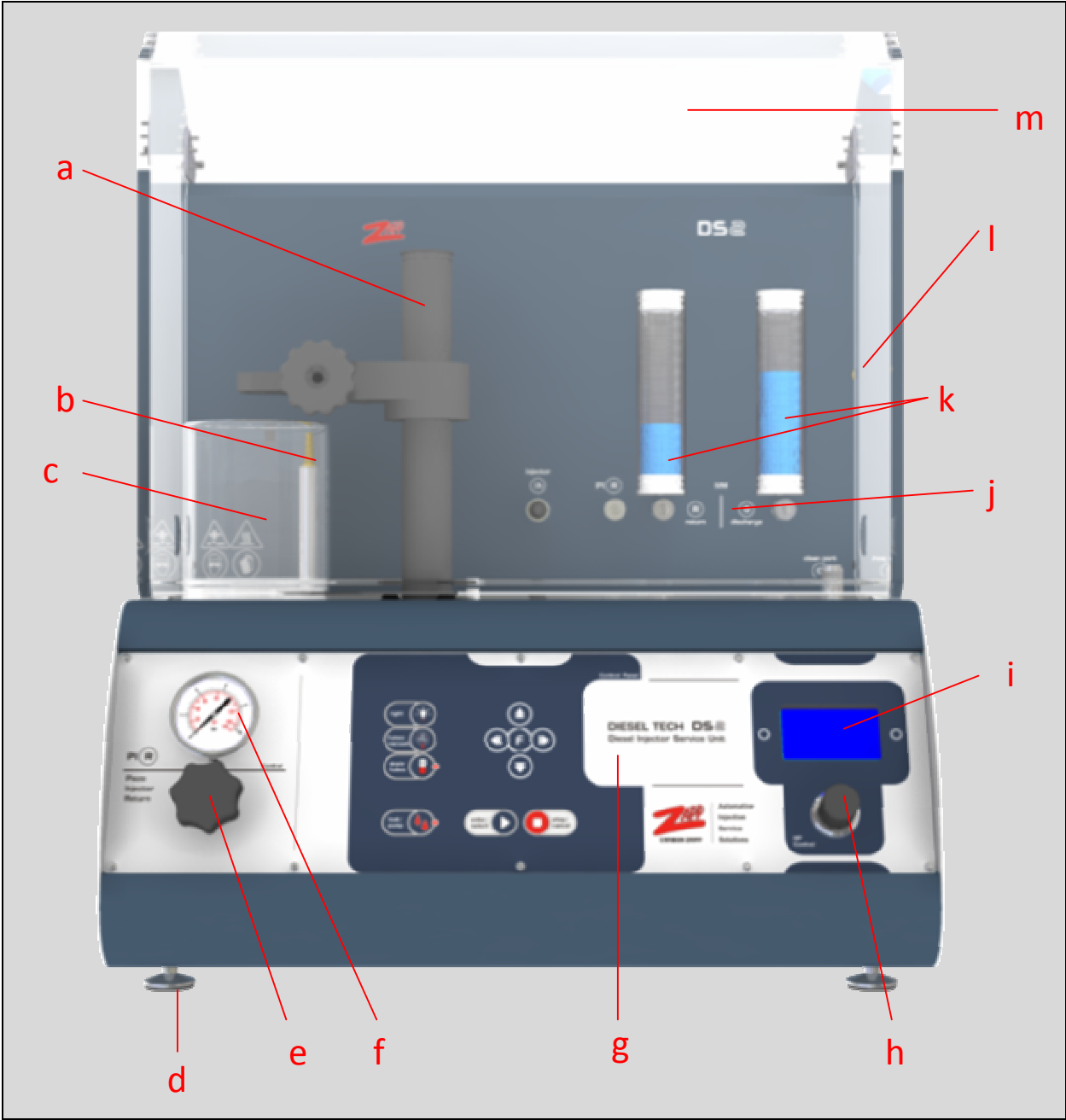


Figure 2-i

Side View

- a. Left, Side Panel
- b. Right, Side Panel
- c. Testing Calibration OIL level indicator
- d. Cleaning (MACC) detergent level indicators

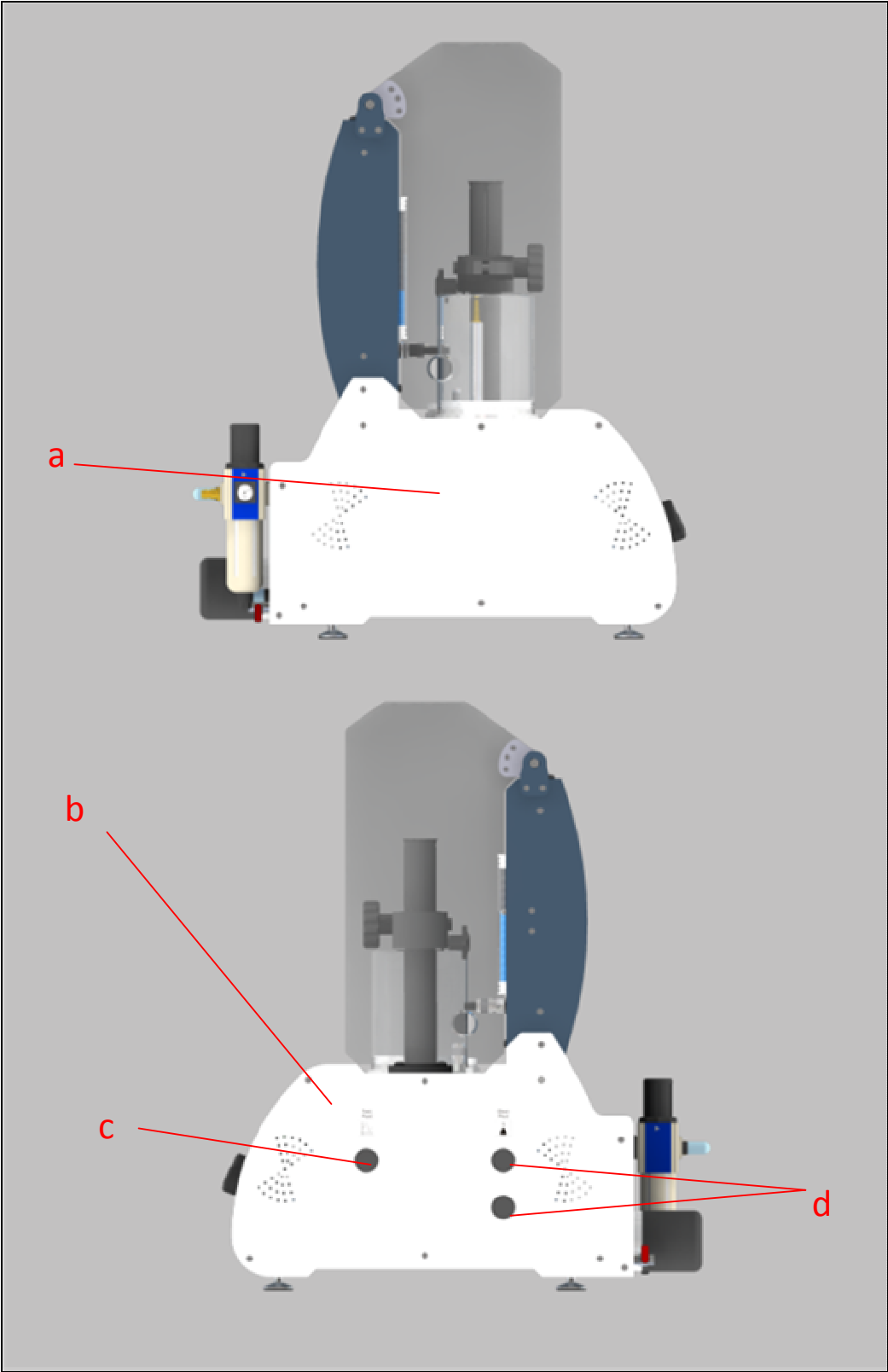


Figure 2-ii

Rear View

- a. Rear, Top Panel
- b. Serial Tag
- c. Spray Chamber fumes extractor output
- d. Regulated and filtered compressed air input
- e. HP Pump air exhaust port
- f. Testing Calibration OIL drain valve
- g. Testing Calibration OIL Filter
- h. Cleaning (MACC) Filter
- i. Cleaning (MACC) drain valve
- j. Rear, Bottom Panel
- k. Mains, Rear ON/OFF switch
- m. UIS Attachment unit connections (x.1 / x.2)

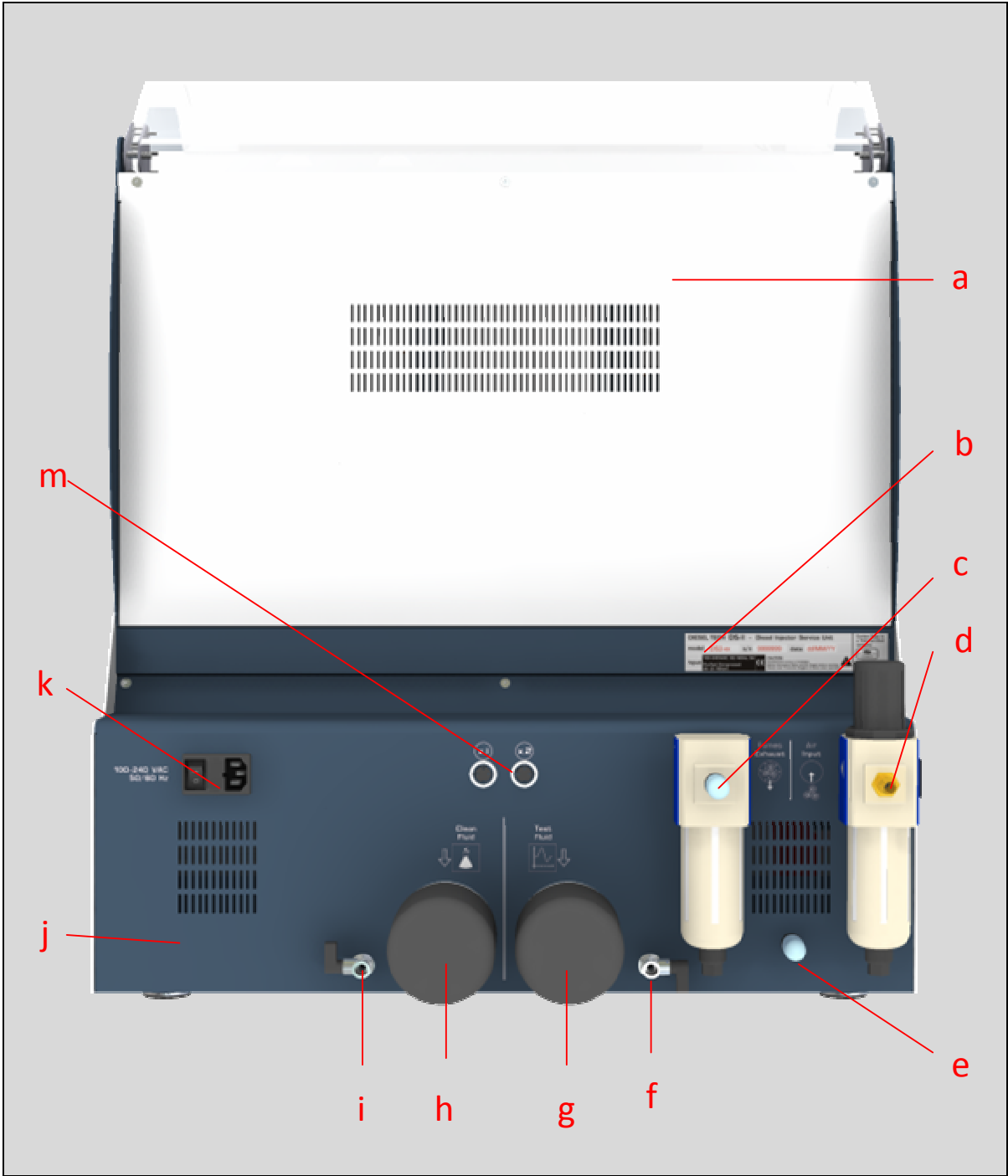
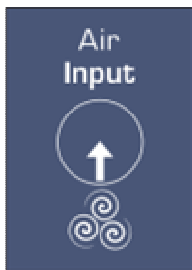


Figure 2-iii

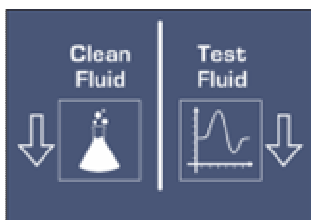
Rear Panel symbols



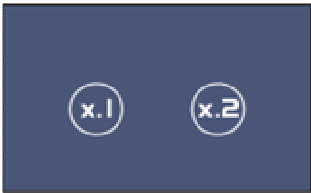
: This symbol is used to denote the Air Input connection. Please consult Appendix A for specifications. Beneath it is a Water Trap/Filter/Regulator (Figure 2-iii-[d]).



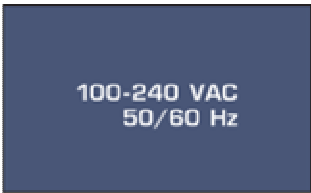
: This symbol is used to denote the Fumes Output (Spray Chamber Extractor) Connection. DO NOT connect the compressed air line here. Beneath it, is a Fumes - liquid Trap/collector / Separator (Figure 2-iii-[c]).



: 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.

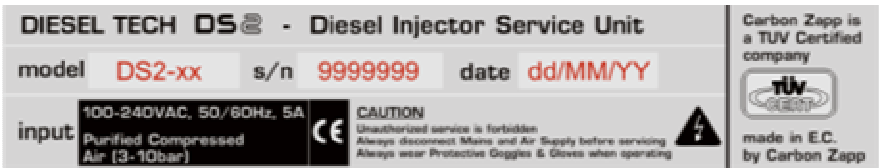


: These symbols, x.1 and x.2, provide relative positions for further connectors.



: This symbol denotes the Mains Power Supply of the unit. Beneath it are the: ON/OFF switch, Fuse Holder and Mains Power Connector (Figure 2-iii-[k]). For further specifications, please consult Appendix A.

Serial Tag



: The Serial Tag of the machine provides information on the Machine Model, Serial Number, Date of Manufacturing and also basic specifications.

“Getting Started”

This chapter provides basic information to start using the DS2 unit and covers the following topics:

[info]

All users should be familiar with diesel 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 DS2 Unit and Ultrasonic Device [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].

Connecting the AC power

DS2 Unit

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-i)
2. Connect the other end of the AC Power cord to any grounded 100/240 VAC, 50/60 Hz power source (live wall outlet)

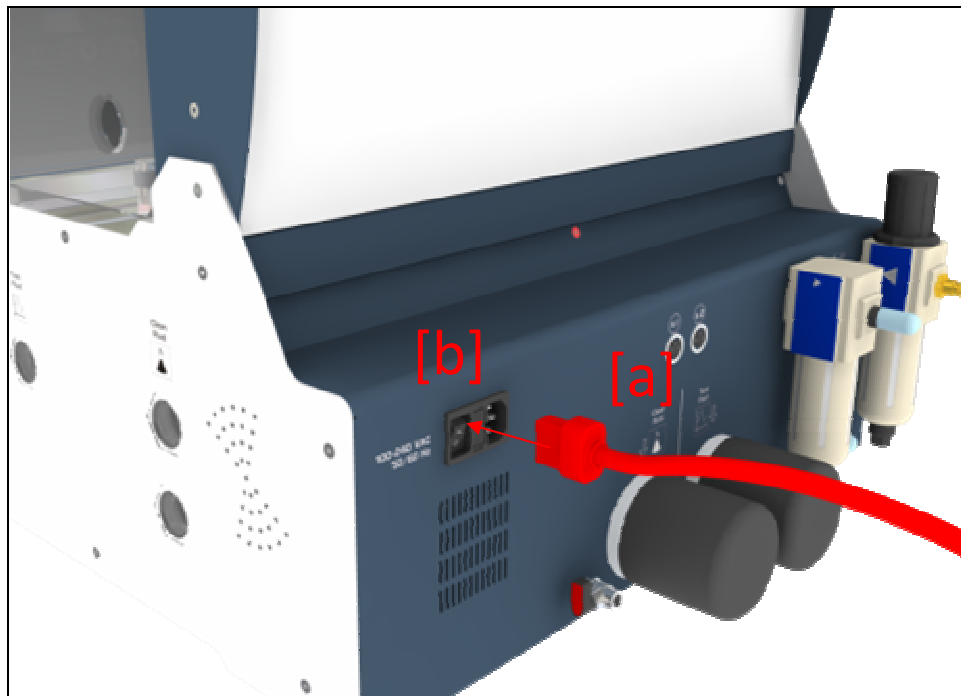


Figure 3-i

Injector Ultrasonic Device [optional / DS2-X1]

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 DS2 units 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-ii)

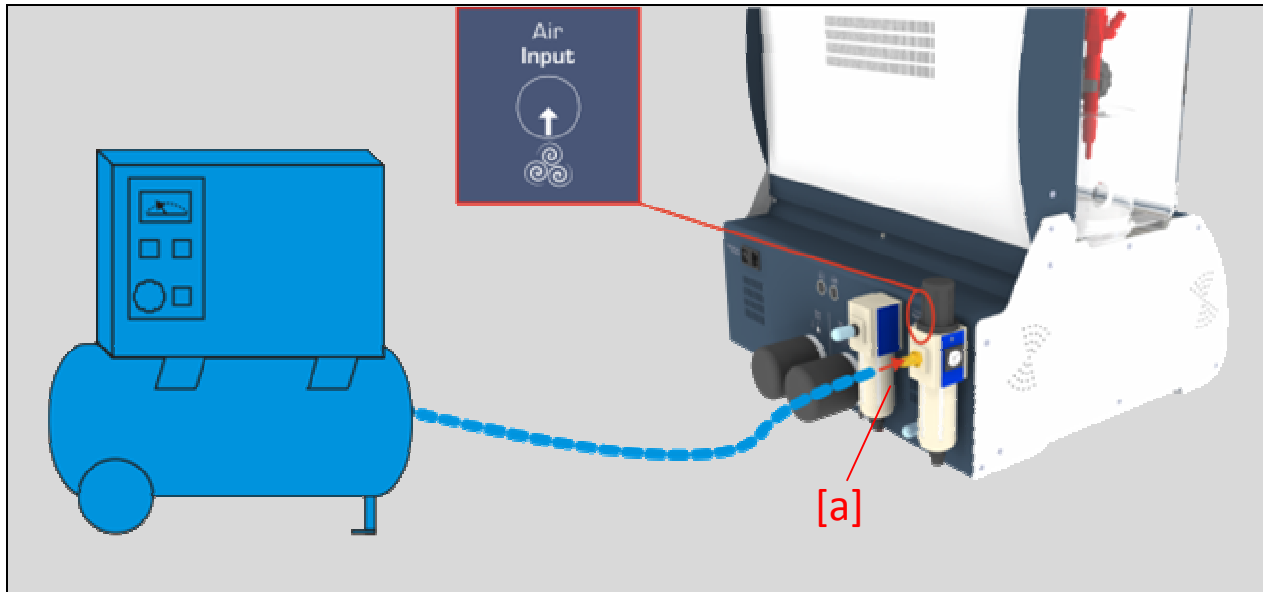


Figure 3-ii

2. [Optional] Disconnect the Fumes Extractor Exhaust Port muffler/filter [b] (Figure 3-iii) 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.

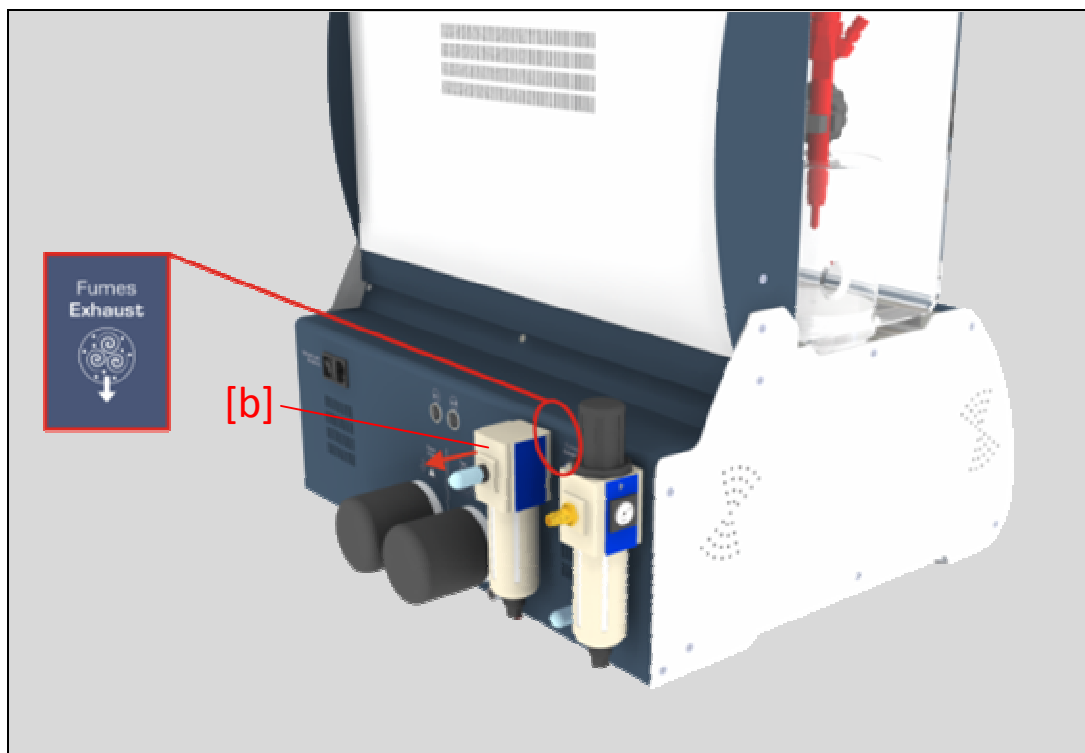


Figure 3-iii

[important]

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

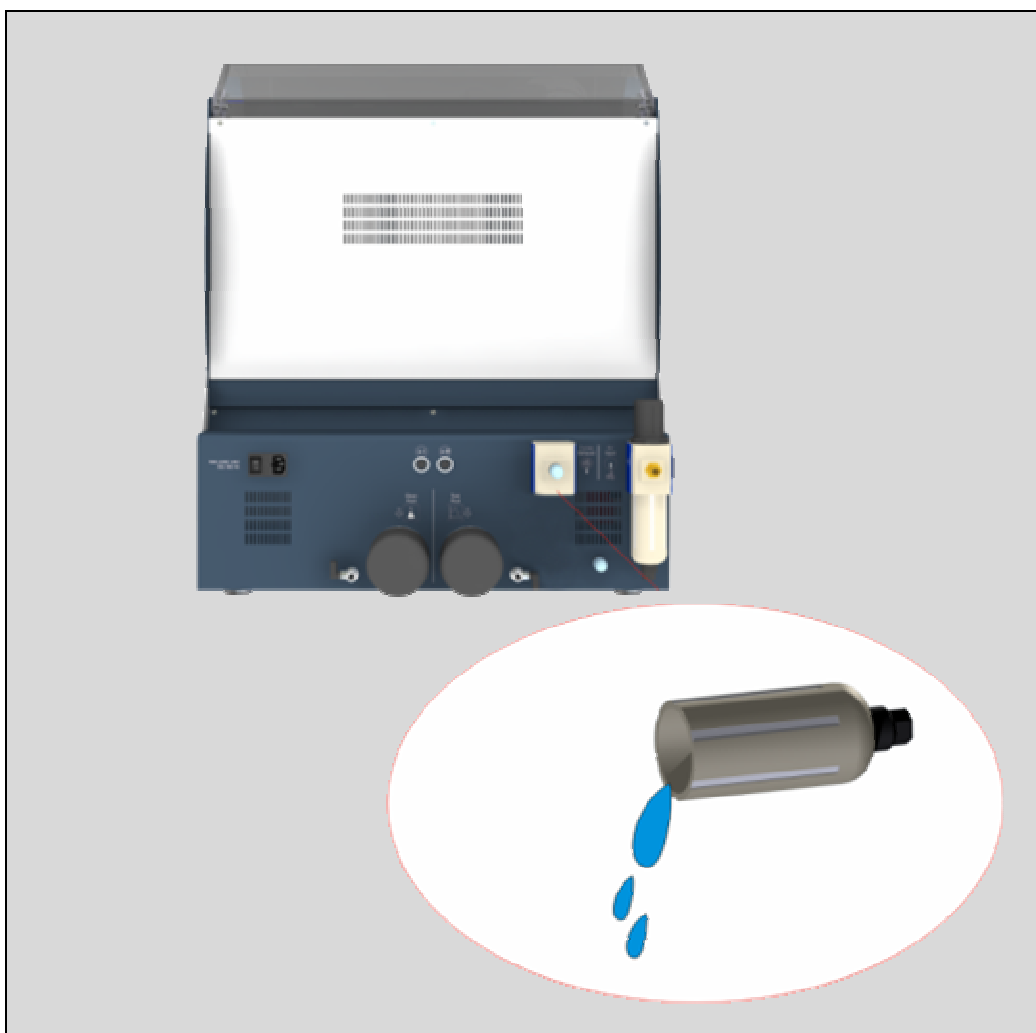


Figure 3-iv

Starting up for the first time

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

0: OFF / **I:** ON



Figure 3-v

2. Wait a few seconds until the DS2 Software Boots up. If more than 1 minute pass and the Software has not loaded (Blank screen), look at Chapter 7 “Troubleshooting”
3. Once the Software loads, the initial Screen will show the S/W and H/W version of the machine



Figure 3-vi

4. By Pressing the ENTER button once the unit is ready to operate
5. Look in Chapter 4 “Menu Tour” for further information on software navigation.

[important]

- Always wait at least 15 seconds when switching on the unit again (after a power down)

Powering down the system

1. Press the CANCEL button for more than 3 seconds until the Home screen is revealed
2. Once this operation is complete, you can switch off the machine using rear ON/OFF Power.

“Menu To ur”

This chapter provides useful information on the DS2 Menu. It covers the following topics:

- Control Panel
- Basic Screens
 - Start-up Screen
 - Settings Screen
 - Injector selection Screens
 - Test / MACC Screens

A new user should preview all the screens in this chapter prior to operating the DS2 unit.

Control Panel

In this section the Control Panel, buttons and features are previewed and explained. The Menu is designed for easy and simple operation.



Figure 4-i



: The ENTER button is used to Confirm and action, move forward in the menu, or select an option.



: The STOP button: This button is used to Stop / Cancel an action or move backward in the menu



: the Leak / PUMP button is used to toggle the High Pressure (HP) On and OFF. A red LED next to it denotes the state (lit when ON).



: the Drain Tubes button is used to toggle the Volumetric tube drain valves ON and OFF, draining the tubes from any remaining liquid. A red LED next to it denotes the state (lit when ON).



:the Fumes Vacuum button is used to toggle the Fumes extractor ON and OFF, clearing the Spray tube.



: the Light button is used to toggle the LEDs ON and OFF, Lighting the Spray and Volumetric tubes.



: the Arrow Keys are used to navigate through the menu, select another option, or change a value.



: the [F]unction button is used to edit or reset a value

Startup Screen

This screen is shown once the DS2 software loads. Information such as Software (S/W) and Hardware (H/W) versions are shown here. The DS2 is now ready for operation. Press the ACCEPT button to continue.

[info]

- If the Startup Screen loads and after pressing Accept Button there is no H/W or S/W version displayed, consult Chapter 7 “Troubleshooting”.

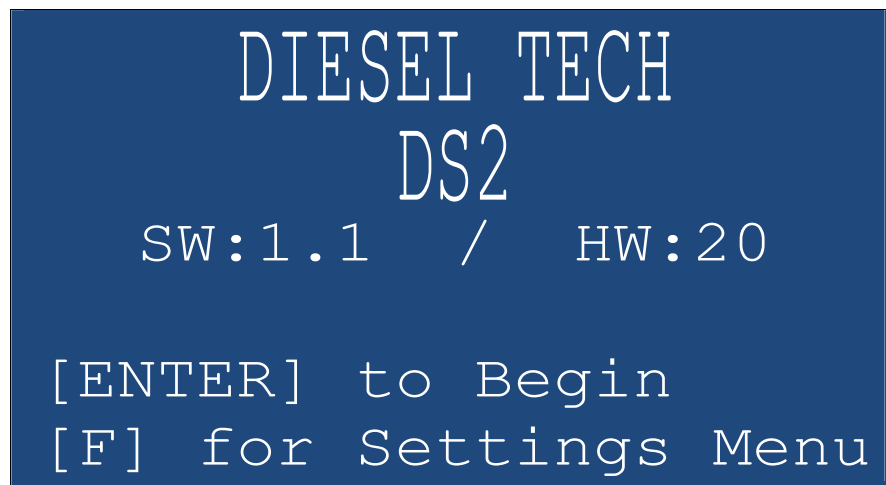


Figure 4-ii

Settings Screen

There are several options in the settings menu that can further customize the DS2 software. Scroll up/down using the Arrow keys to navigate in the setting menu, and press the Enter button to select an option:

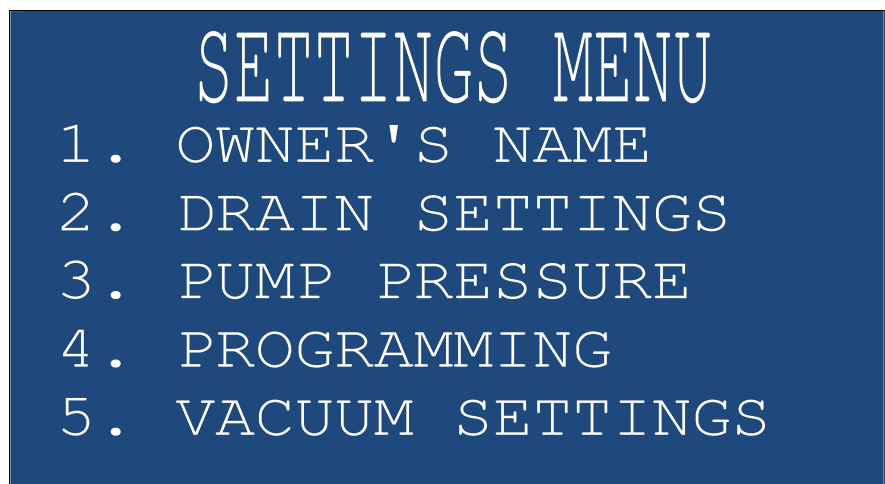


Figure 4-iii

- **OWNER'S NAME:** Change the company name on the screen saver.
- **DRAIN SETTINGS:** Change the drain time settings
- **PUMP PRESSURE:** Change the maximum time the pump will remain active
- **PROGRAMMING:** Edit the Default Test Plans for Spray, Volume metering and MACC, for the different types of injectors:
 1. Common Rail Diesel Injector (CRDI)
 2. UI/EUI Unit Injector
 3. Conventional Diesel Injector

For each injector type there is an option to change the test plans for:

1. Spray Testing
2. Volume Testing
3. MACC Cleaning

For each option, there are 4 different test plans, composed of STRK, milliseconds, time of test and Single or Multi injection operation. Each test plan can be edited by pressing the [F]unction key and using the arrow keys.

- **HEATING SETTINGS:** Not used on this version
- **VACUUM SETTINGS:** Change the vacuum time settings
- **LIGHT SETTINGS:** Change the LED time settings
- **FILTERS/FLUID Reset:** In these options the Filter and Fluid life span can be viewed (in hours) for the Cleaning (MACC) Filter and fluid. When the Life of the filter/fluid is over (equals to zero) a pop-up message will appear every time in the Home Screen informing that the filter/fluid needs to be changed. To RESET the TIME, press the [F]unction key for more than 3 seconds. More information regarding fluid and filter specification can be found Appendix A.
- **INJECTOR TYPE NAME:** Change the names of the customized Injector brands
- **LANGUAGE:** Select one of the available operation languages
- **LOAD DEFAULTS:** Reset the Test plans, Injectors and all other parameterized data on the board, to factory defaults
- **MULTI SHOT SETTINGS:** Edit the multi shot settings, Pilot and Post Pulse and Dwell time in milliseconds
- **INSTRUCTIONS:** Show or hide instructions before each test.

[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.

Injector Selection Screens

The DS2 unit can operate all types of diesel injectors (depending on the options installed). Before a test or a cleaning procedure is started, the injector selection process must be completed.

Below is the basic screen to define the injector selection process:

Choose between CRDI, UIS or Mechanical injectors:

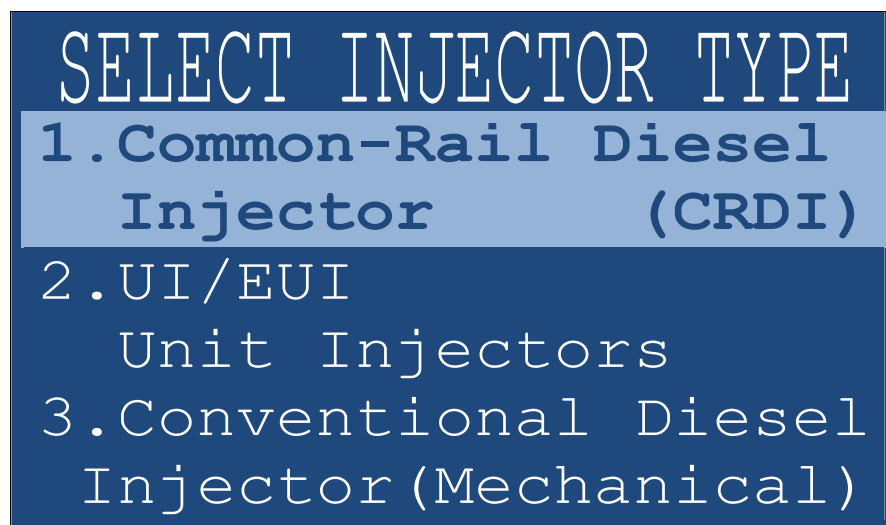


Figure 4-iv

Choose between COIL (Solenoid / older), PIEZO (Newer) actuation. An easy way to distinguish if an injector is coil or piezo, is to perform an OHM TEST, if the injector has OHM, most likely it is a coil injector:

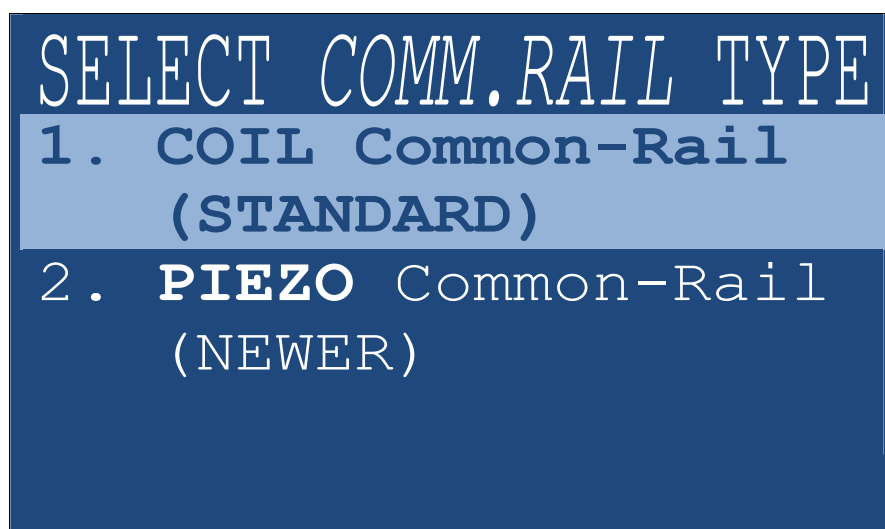


Figure 4-v

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-vi.

[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-vii.(a) to see the

most common PLUS (+) polarity for BOSCH 115, 116 and 117 and Figure 4-vii.(b) for SIEMENS Piezo 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-vi

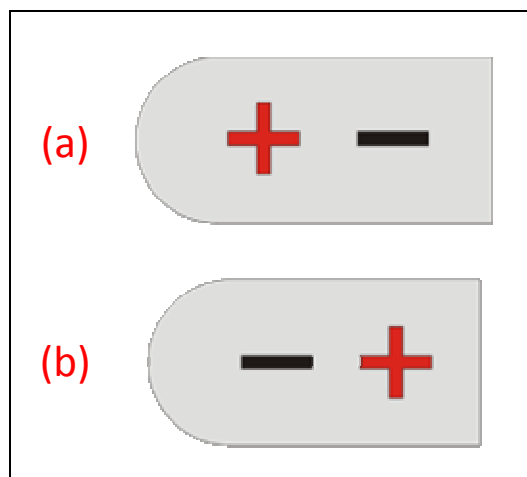


Figure 4-vii

Choose the brand of the injector:

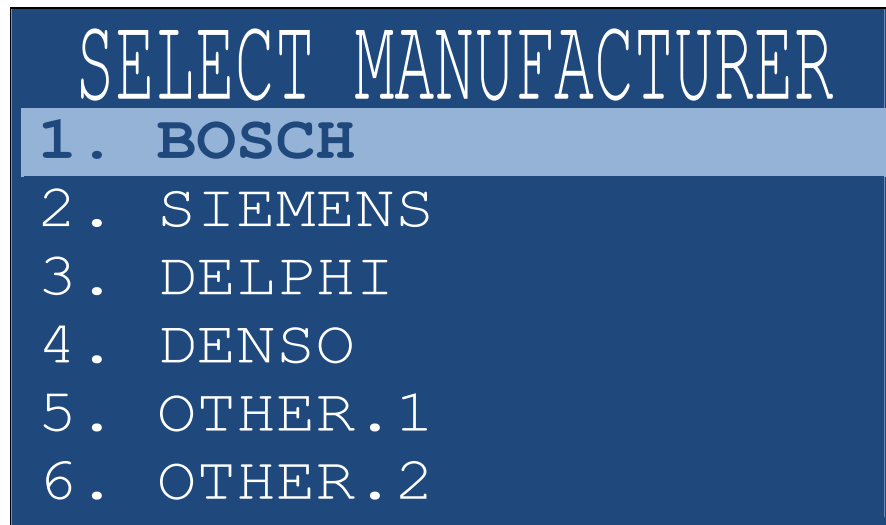


Figure 4-viii

Choose a profile of the injector. The GENERIC profile should be used for new users:

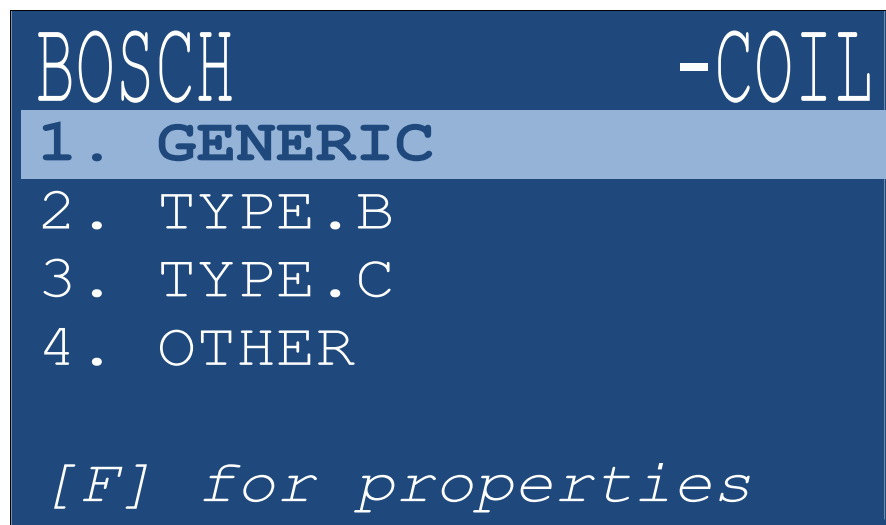


Figure 4-ix

Test / MACC Screens

Once the Injector has been selected, the TESTING CYCLE ACTIVE screen will appear, giving the option to the operator to select either Spray or Volume testing. In addition for units equipped with MACC, by pressing the [F]unction button, the unit will switch to Cleaning Cycle Active (MACC) providing the user with the option to MACC clean the injectors. Before a Spray or Volume test is performed, an OHM test is also performed for COIL INJECTORS:

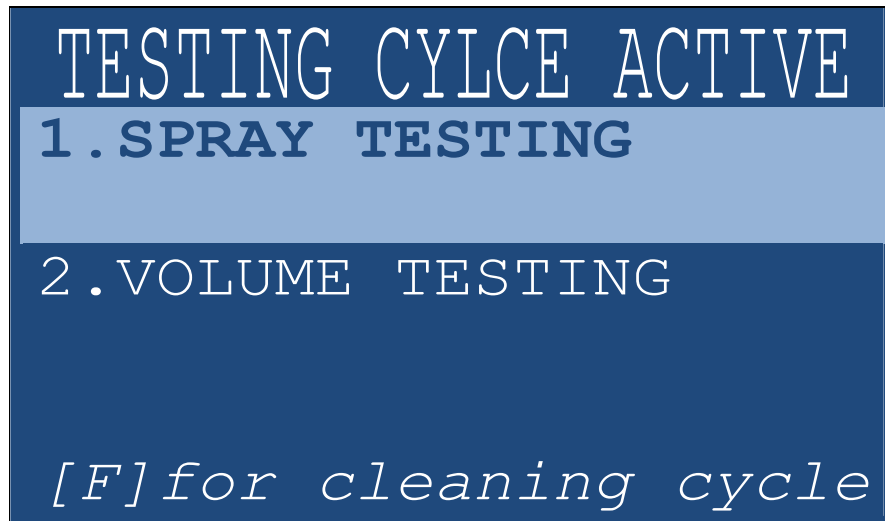


Figure 4-x

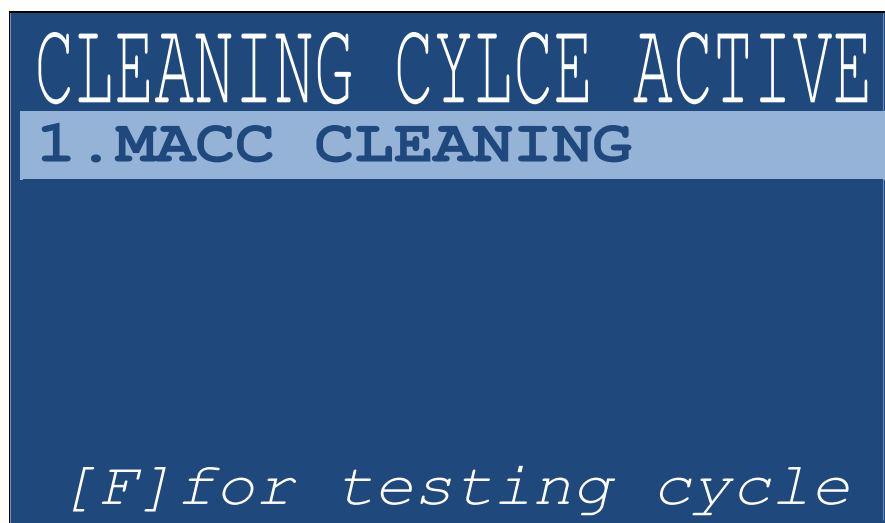


Figure 4-xi

“Prepare the DS2”

This chapter provides useful information on preparing the DS2 unit for the initial operation. It covers the following topics:

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

Fluids and Filters

The DS2 comes with half a tank of Testing fluid (Diesel Calibration oil) and an empty tank of Cleaning fluid. The machine filters and drain valves are divided into two parts, left/right and are shown on the rear panel of the machine (Figure 5-i).

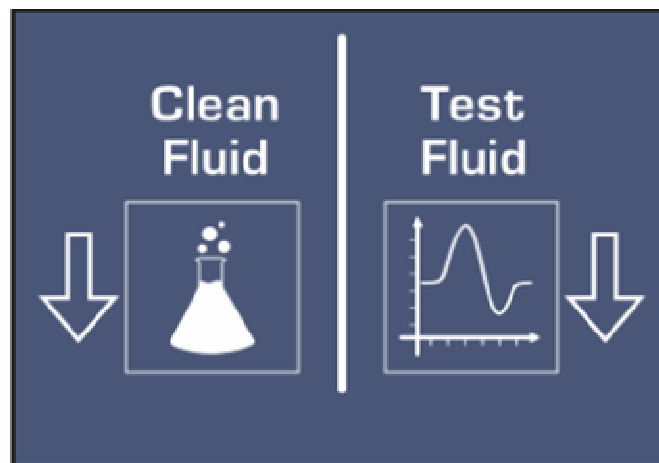


Figure 5-i

[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**) as shown in Appendix C.

Testing Fluid & Filter

- 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).
- 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).
- 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.
- In order to fill with Testing fluid, use the accompanied funnel through the large Spray Chamber (Figure 5-ii). The fluid will drain directly into the testing tank.

[important]

- When completely replacing the testing fluid/filter, air elimination process should be followed, after filling the tank:
 - o Connect the air input (if not yet done)
 - o Place the High Pressure hose directly into the large Spray Chamber, without connecting anything to the hose end
 - o Slowly increase the system pressure pressing the HP ON/OFF button, from the Control Panel, and turning pressure regulator clockwise
 - o Some fluid will run through the hose into the
 - o After a period of 20 seconds, press the HP ON/OFF button, and turn off the pressure
 - o Now the DS2 Testing Tank, Filter and Lines are free of air.

[info]

- After replacing the filter and filling the tank, drain some fluid in order to eliminate some air pockets in the lines
- Fluid level is acceptable when it is visible through the level indicator
- Always check fluid level when the DS2 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

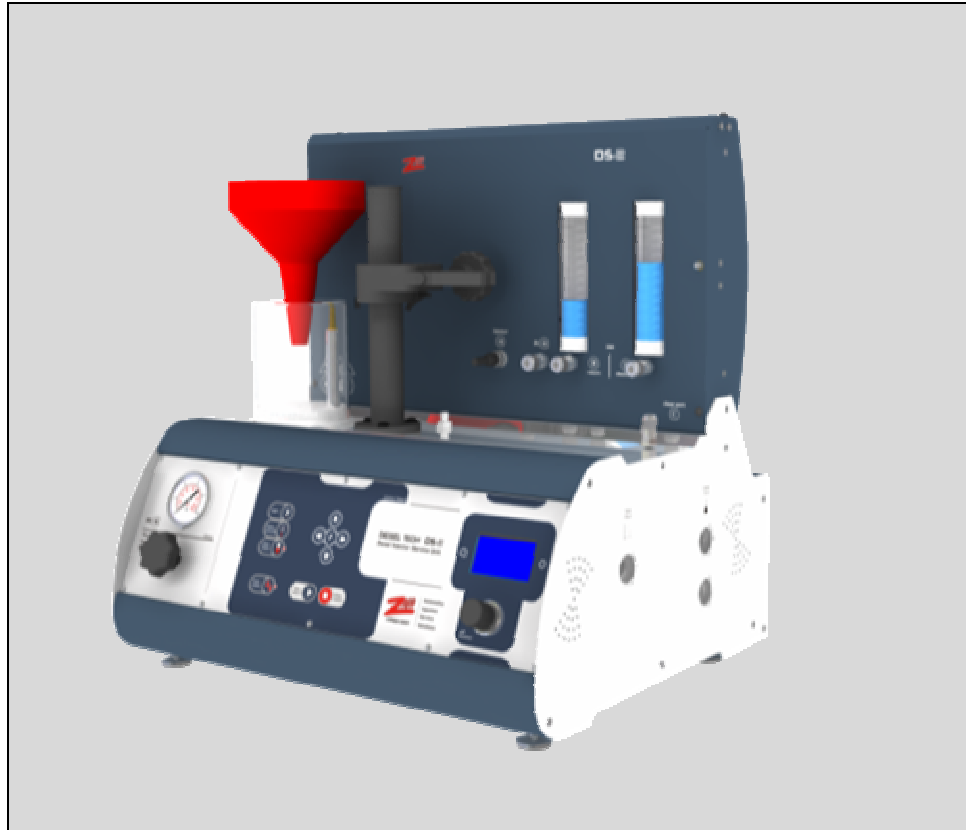


Figure 5-ii

Cleaning Fluid & Filter [DS2-X1 only]

- 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).
- 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).
- 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.

[info]

- After replacing the filter and filling the tank, drain some fluid in order to eliminate some air pockets in the lines
- Fluid level is acceptable when it is visible through the bottom level indicator
- Always check fluid level when the DS2 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 DS2 Software will provide a visual prompt on when to change the Filter.

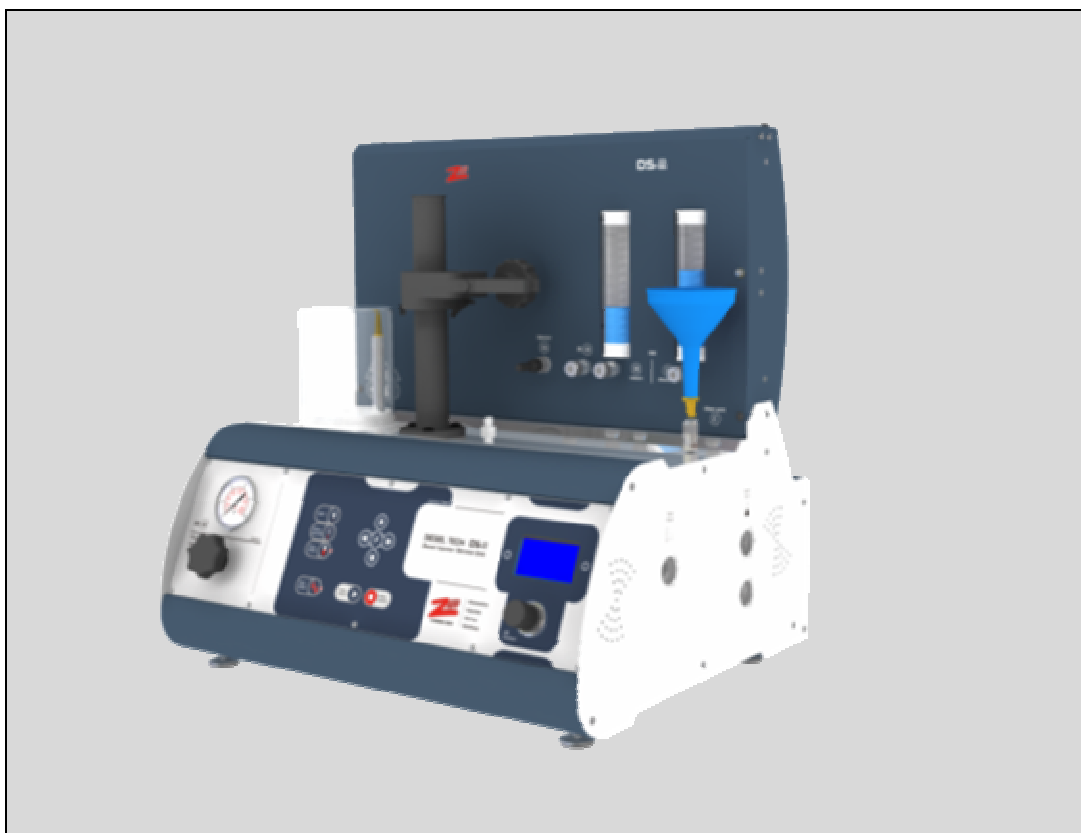


Figure 5-iii

“Operation Basics”

In this chapter instructions with figures will be shown on how to perform a basic operation with the DS2 unit. The following topics are covered:

- Cleaning Injectors with ultrasonic device
- Injector Mounting
- Injector Clamp
- Injector Spray Chamber Clamping Position and connections
- Injector iVM Clamping Position and connections
- Sample Procedure on testing injectors
 - Select the injector
 - OHM test
 - Spray test
 - Volume test
- Injector MACC Clamping Position and connections
- Sample Procedure on MACC cleaning injectors

A new user should fully understand this chapter prior to operating the DS2 unit.

Injector Ultrasonic Cleaner

Before mounting any injector on the DS2, it is obligatory to clean the Injectors (Nozzles) (Figure 6-i) in the ultrasonic device (Figure 6-ii).

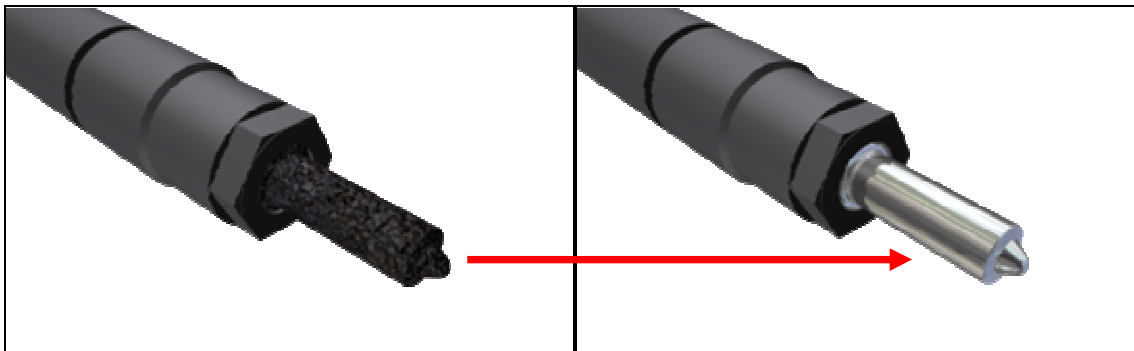


Figure 6-i

Injector Ultrasonic Cleaning is Mandatory

Failure to clean injectors with the use of Carbon Zapp's ultrasonic device (optional / DS2-X0) 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 drain 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 DS2 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**) as 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 Common-Rail injectors can be mounted on the DS2, using the Injector clamp (Figure 6-iii). Some injectors e.g. Side Feed Injectors (e.g.: BOSCH INDUSTRIAL CRIN) may need additional adapters. For further specifications on Clamping diameters, please consult the Appendix A. For further guidance in Side Feed Injector (CRIN) adapter mounting, please consult Appendix C.

Injector Clamp

The injector Clamp has two horizontal and many vertical positions.

- Using the (a) side handle you can securely clamp the injector, or loosen to free the injector (Figure 6-iii).
- Using the (b) rear handle you can adjust the height (vertical position) of the clamp (Figure 6-iv).
- Using just force Figure 6-iv-(c), the clamp rotates horizontally between two preset positions:
 - Left Position: Spray Chamber
 - Right Position: iVM (Volume metering) & MACC

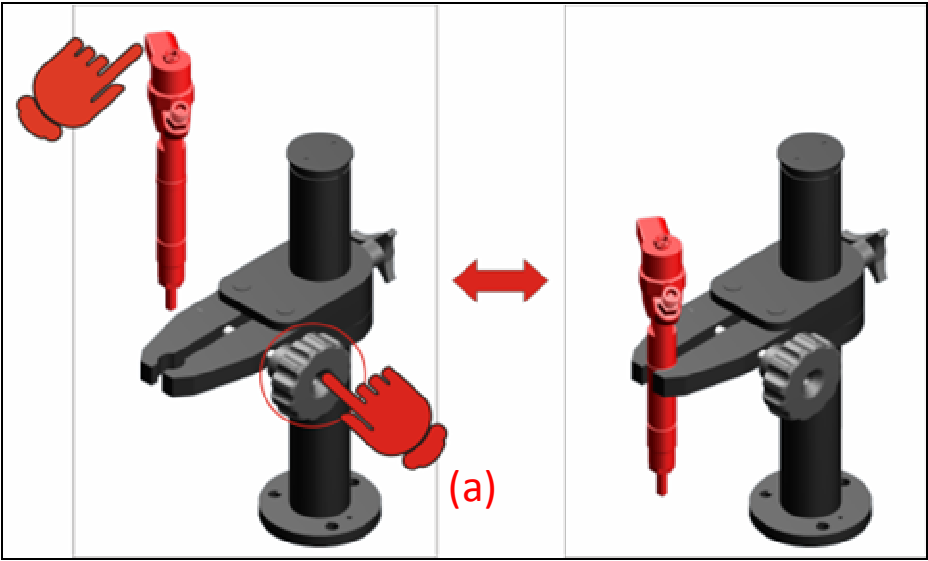


Figure 6-iii

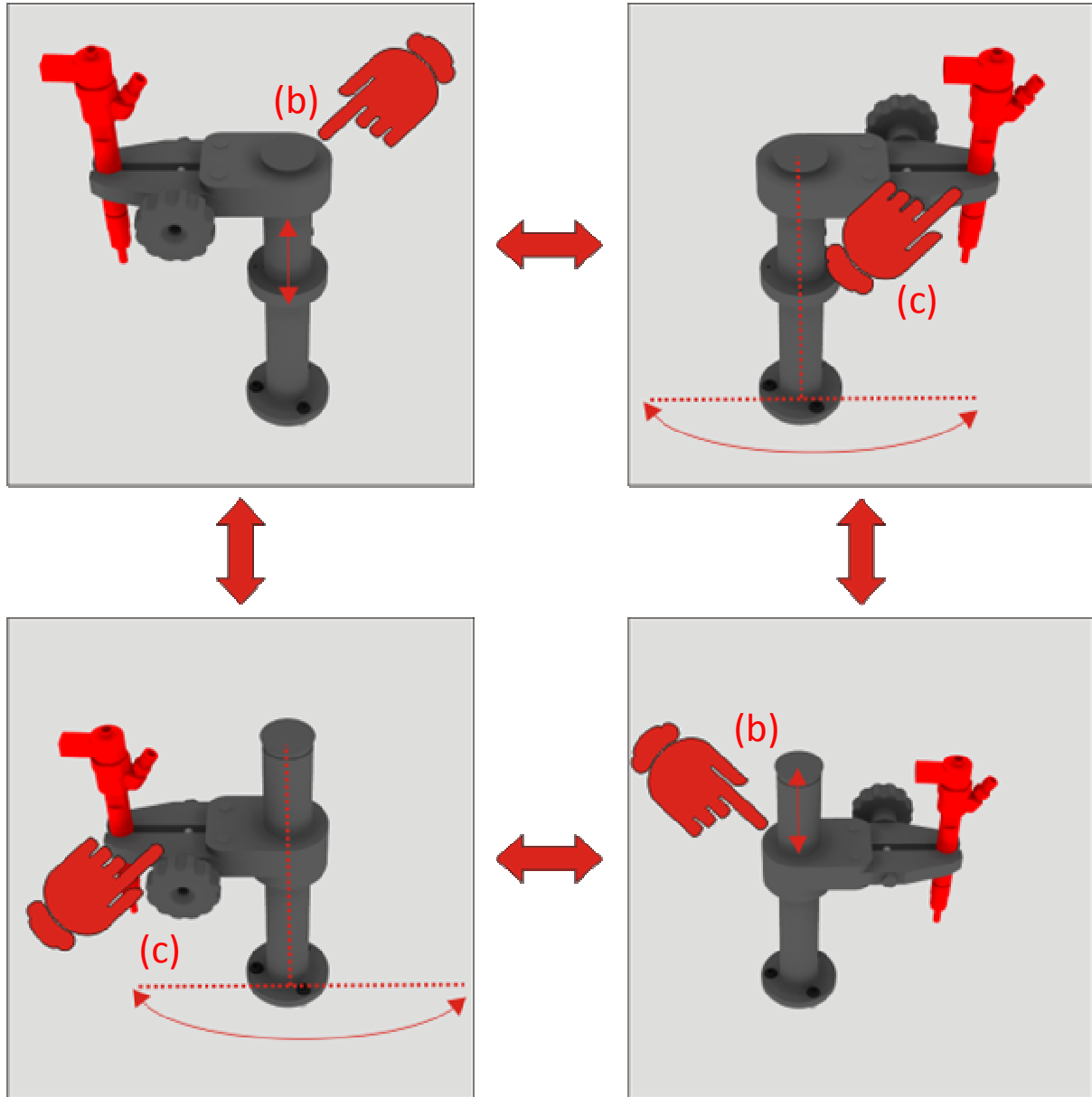


Figure 6-iv

Injector Spray Chamber Clamping Position and connections

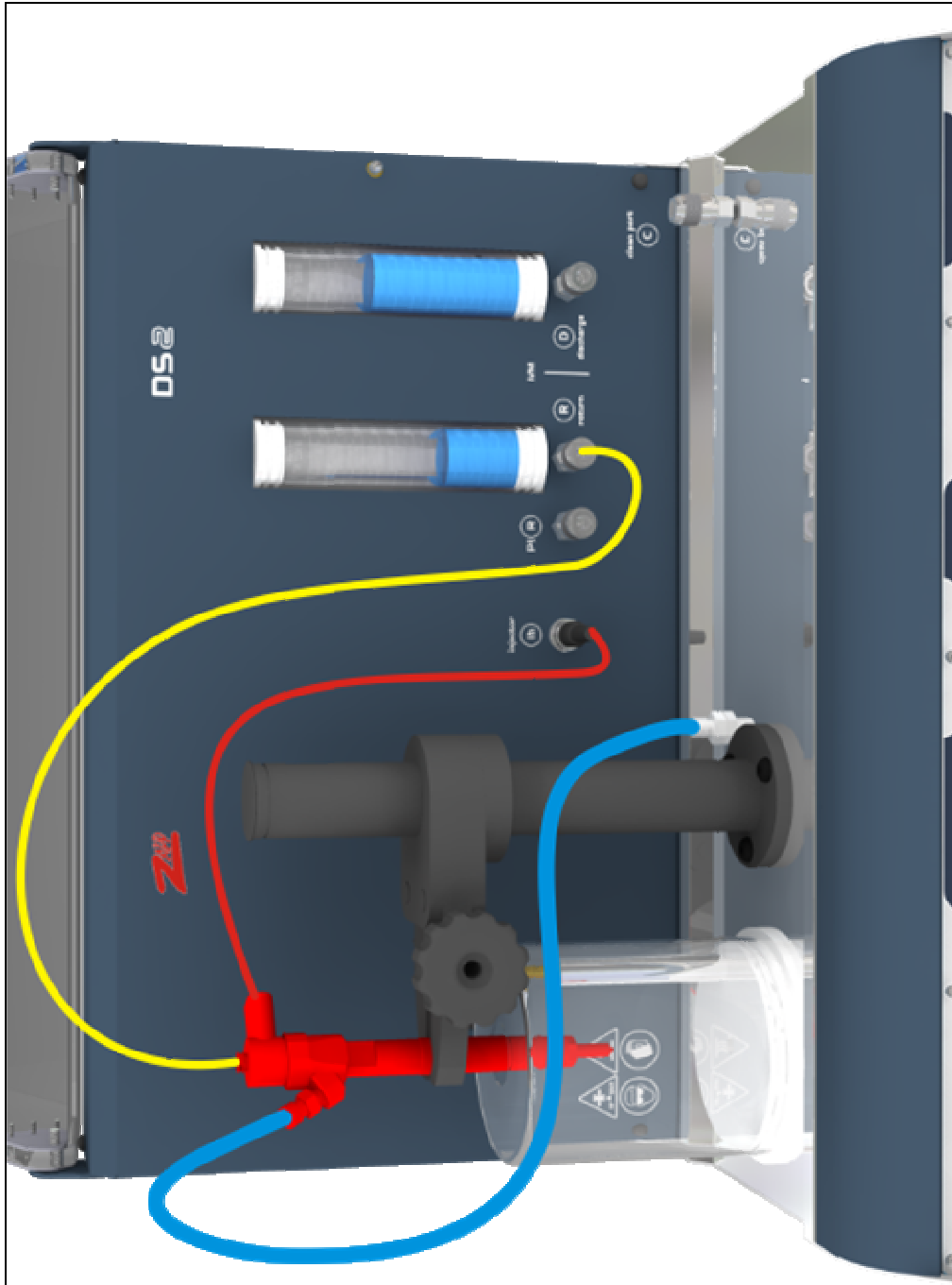


Figure 6-v

Injector iVM Clamping Position and connections

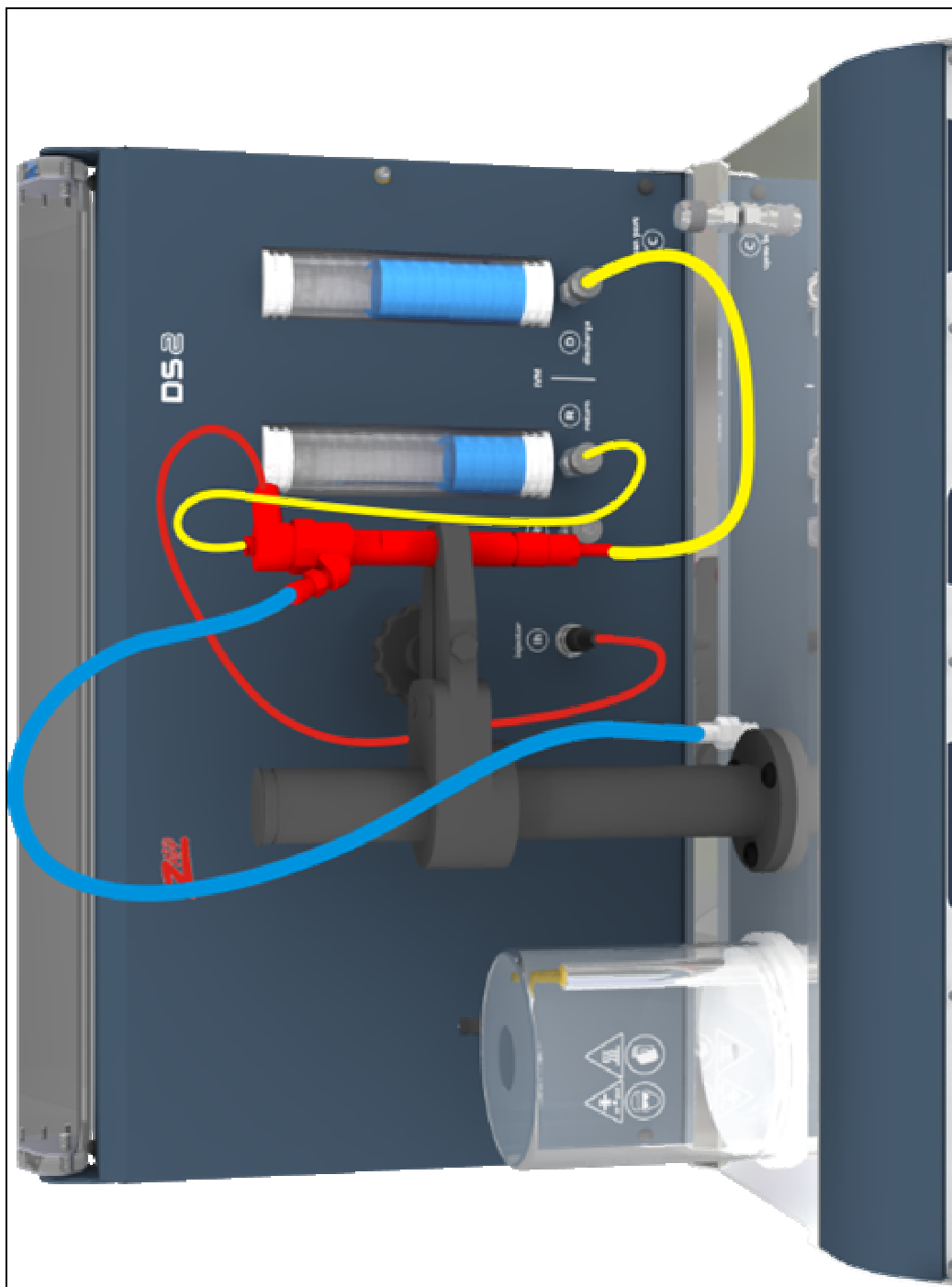


Figure 6-vi

Sample Procedure on Testing Injectors

[important]

- Always expect pressure in fluid lines, and wear protective goggles and gloves. For DS-1X models where the clear protective cover is not a standard option, extra care is advised when dealing with high pressures.
- 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**) as 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.

1: Select the injector

- a. Consult the screens in Chapter 4 on how to select the correct injector.

2: OHM Test

- a. This test is only performed for Coil Injectors, because Piezo Injectors do not have measurable resistance.
- b. When this test is performed, 1 of 3 values will be displayed:

- i. OHM value of the injector
- ii. OPEN (Open Coil Circuit)
- iii. SHORT (Short Coil Circuit)

3: Spray Test

- a. The Injector should be in the Spray Chamber clamping position.
- b. Use the R-Adapt and [ih] electrical harness.
- c. The will begin after the OHM test, and the vacuum and light will be automatically activated. The time and test plans can be altered from the SETTINGS menu.
- d. Use the HP Pressure Control Regulator to increase or decrease the system pressure.

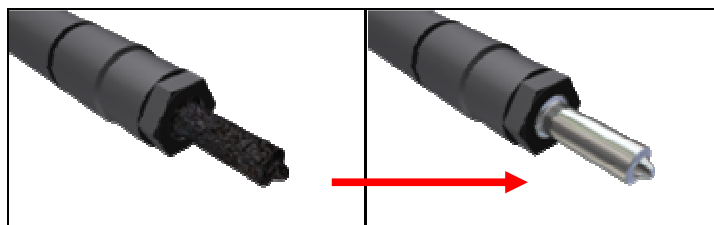
[info]

- If the [F]unction button is pressed while a single injection program is running, using the arrow keys the operator can dynamically change the Strokes and milliseconds of the test plan.

4: iVM (Injector Volume Metering)

- a. **Important: Please clean injectors in the ultrasonic device, for at least 15 minutes, prior to mounting on the DS2 unit. Injector Ultrasonic Cleaning is Mandatory** (Please review the Warranty).

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.



- b. The Injector should be in the iVM clamping position.
- c. Use the D-adapt, R-adapt and [ih] electrical harness, and connect the injector with the DS2.
- d. Each Test Plan will perform for a predefined time, measuring both [D]ischarge and [R]eturn volume per Test plan.
- e. Once each test plan is performed, the unit will provide some time for the operator to record the volume values from the [R] AND [D] tubes.
- f. The operator can either perform the next test plan by pressing ENTER/CANCEL button, or use the arrow keys to select a specific test plan.

[info]

- Before each test plan is performed, an automatic Draining of the tubes will also be performed. The operator can cancel the draining procedure at any time by pressing the CANCEL button.

5: CANCEL/STOP button in each test screen

- a. If the CANCEL/STOP button is pressed once, during a test, the current test will stop. By pressing the CANCEL button twice or for more than 3 seconds, the software will initialize to the home screen.

Injector MACC Clamping Position and connections

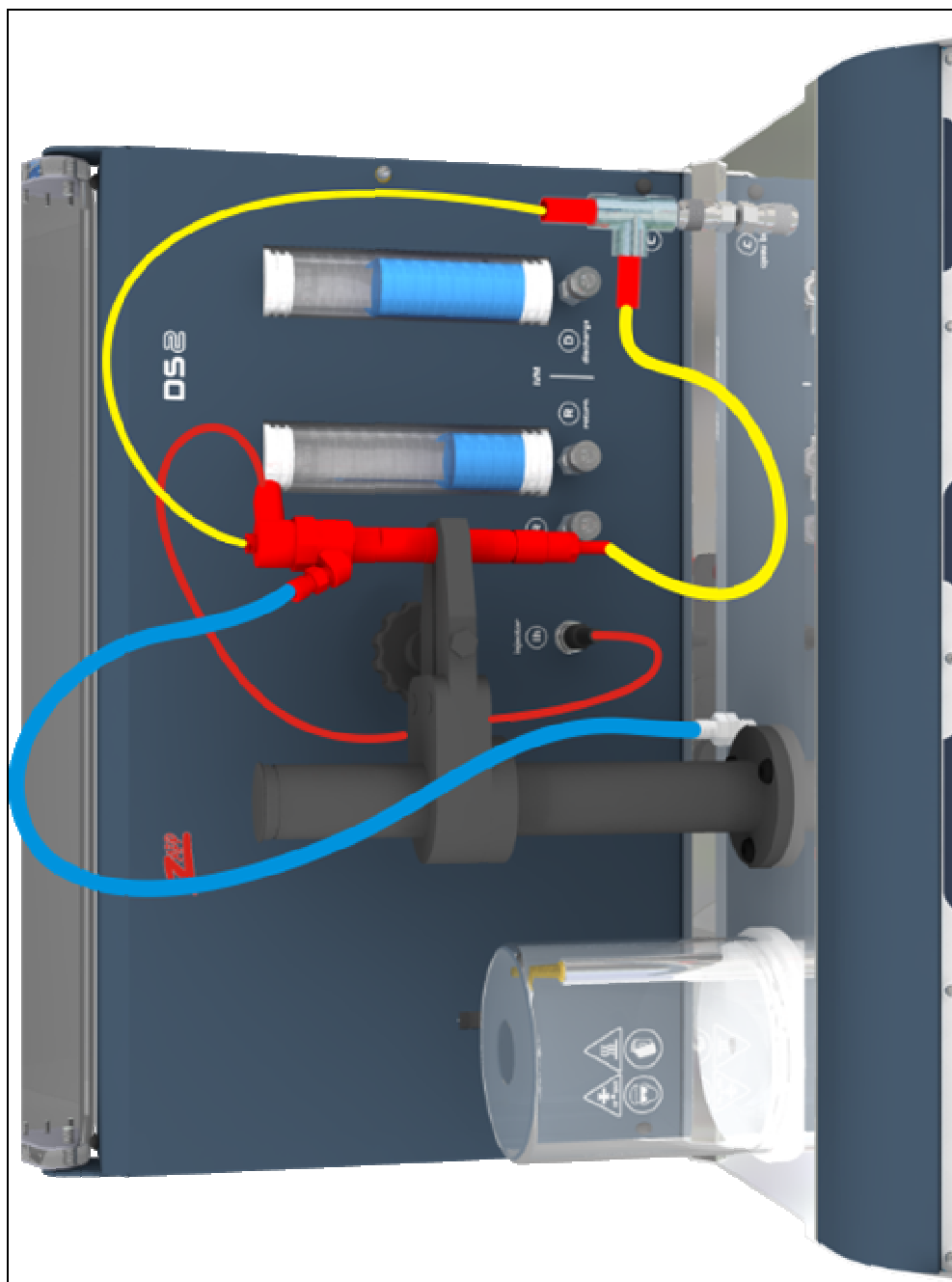


Figure 6-vii

MACC (Cleaning Injectors internally)

[DS2-X1 only]

The DS2 provides a separate function for cleaning injectors with the MACC (Molecule Activated Chemical Cleaning) method. Navigate to the Tests Screen and press the "F" button. The Cleaning Screen will appear. Follow the steps below to effectively service the injectors:

1. Mount the injector on the DS2 in the MACC clamping position.
2. Use the C-adapt and [ih] electrical harness, and connect the injector with the DS2 (Figure 6-iv).
3. Press the START button and the MACC process will begin.
4. Four predefined test plans will activate the injector in different frequencies for the full period of the time for more effective servicing.
5. As soon as this process has terminated, the program will remain in idle mode, and the operator can either repeat the process or Return to the Home Screen.
6. While exiting the MACC procedure, the DS2 will perform a Flush program, that will flush the injector and lines with Testing fluid, and it will drain the mixed fluid in the MACC / Cleaning tank.

[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, please redo the MACC procedure in order to perform the Flushing of the injector and lines.

“Troubles hooting”

Carbon Zapp designed the DS2 unit for durability. However, should problems occur, following the procedures in this chapter can help to determine the cause.

All DS2 operators should become familiar with this chapter. Knowing what might go wrong can help prevent problems from occurring.

Symptom / Problem	Detailed Description	Cause / Solution / Repair
CONTROL PANEL BASED PROBLEMS	No Boot / Start-up	• File System is corrupt • Perform a Full System Restore / reprogram PCB board via RS232 with latest version software. • or contact support@carbonzapp.com
	LCD screen	• LCD Screen was scratched / vandalized. Needs replacement. • or Contact: support@carbonzapp.com
	Software Update procedure	• Follow instructions shown in Appendix C.

INJECTOR DRIVER PCB board issues	• Good Injector not working correctly (Spray, Ohm): - Check the FFA (fast fuse adapter) connected on the PCB board and the injector wiring, for continuity while the unit is switched off. If there is no continuity on either pins, replace the FFA with one provided • Injector Driver is defective, contact: support@carbonzapp.com
MACHINE LEAKS FLUIDS INTERNALLY WHILE OPERATING <u>Possible LOW PRESSURE Leaks from:</u> 1. Low Pressure Supply Hoses filter assembly and HP pump 2. [D] and [R] hoses internally connecting to iVM system 3. iVM system	• 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 • 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

	hose connecting to machine Cleaning tank [DS2-X1 only] 6. Spray Chamber drain Hose 7. Fumes Extractor fluid hose from Spray Chamber to rear side of machine 8. Testing tank gaskets or level indicator Cleaning tank gaskets or level indicator [DS2- X1 only]	
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 •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 connected)	• Replace Quick connect coupler with New one supplied from your closest Carbon Zapp dealer
	EXHAUST in back-side of machine is spraying water mist along with air instead of dry air (Soaking wet behind the	• 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

		of water, you need to contact your hydraulic/air network provider to check your system for humidity and dehumidifier for possible problem
EXHAUST in back-side of machine after long operation and humid environment is 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 does not present a problem.
EXHAUST in back-side of machine is spraying calibration oil mist along with air instead of dry air		• Pump 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	<u>Possible Leaks from:</u> 1. Testing tank	• Open both side panels of machine • Visually inspect for leaks around

	gaskets or level indicator 2. Cleaning tank gaskets or level indicator [DS2-X1 only] 3. Low Pressure Supply Hoses to low pressure pump, filtering system and HP pump	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 VOLUMETRIC TUBES NOT DRAINING	1. Specific Draining valve not Draining. 2. Both Draining valves not Draining. 3. Volumetric tube draining slowly.	•Open rear side panel of machine •Visually inspect for wiring of the valves (disconnected wire) •Manually activate the drain valves and hear or feel that both valves are activating (listen for a strong clicking noise) •If neither valve is working, check for wiring circuit from PCB to the valves. Check for 12Volts between red and blue wire of the valves while activated. Assure there is no correlation to another part failing on the machine •If the valve clicks and operates but still does not drain, that means there is dirt that has clogged the valve and needs to be opened and cleaned. Disassemble the valve by first removing the solenoid holding

		nut, than unscrewing the valve assembly screws and pulling outwards all together. Wash off all parts and reassemble • If there is a damaged drain electro-valve 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	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”. • Injector to be tested has a very high back-leak value and injector cannot built the required pressure

	driver circuit on the pcb board has failed • Contact you closest Carbon Zapp dealer for spare part and instructions
Piezo injector ONLY <u>Not</u> operating	• Verify that injector is good and operating • Check and replace if needed (with spare provided) the injector wire protection circuit located at the beginning of the injector driving wire connecting to the pcb board • 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 • Check and replace if needed (with spare provided) the injector wire protection circuit located at the beginning of the injector driving wire connecting to the pcb board • Test with a good known injector • Check if OHM test gives valid

		• If the OHM test passes than the driver circuit on the pcb board has failed • Contact you closest Carbon Zapp dealer for spare part and instructions
	OHM test results are inaccurate	• Verify that injector is good and operating • Test with a good known injector • Check if OHM test gives valid numbers and not values out of specification (verify with a calibrated multimeter) • If the OHM 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/ SEPARATOR ISSUES	NOT WORKING	• Verify that there is air input at the machine of at least 4 Bars • Manually activate the vacuum button at the Control panel 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 MACHINE	• Remove the glass bottom of 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/filter (Figure 2-iii-[c]) from the exhaust of extractor/collector 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

Appendix A

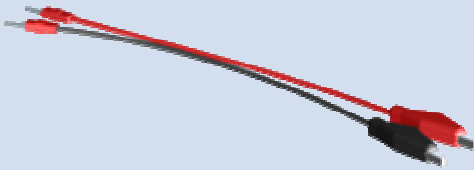
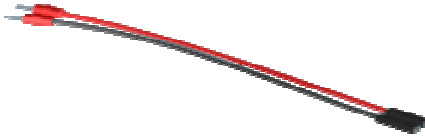
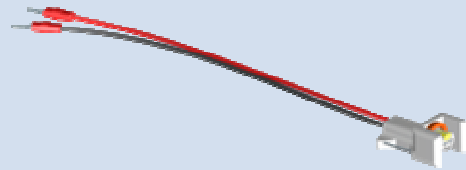
“Specifications”

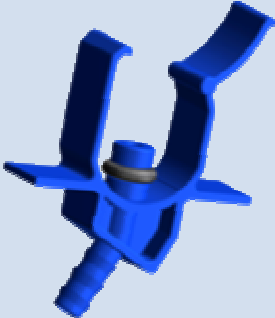
Mains Voltage	VAc	100-250 V
Mains Frequency	Hz	50 / 60
Mains Fuse	Ampere	5.0 A
Mains Power Cord (CE Approved) Voltage/Amperage/Length	V / A / mm	250 / 10 / 200
Power Consumption at Idle Operation	Watt	15.0
Power Consumption at Average Operation	Watt	100.0
Power Consumption at Max	Watt	250.0
Outer dimensions W / D / H	mm	605 / 702 / 730
Outer Max dimensions W / D / H (Clear Protection Cover Open)	mm	605 / 702 / 1015
Weight of DS2-X0 (Testing Unit only)	Kg / Lbs	41.0 / 90
Weight of DS2-X1 (Testing & Cleaning Unit)	Kg / Lbs	44.0 / 97
Weight of DS2-X0 [Complete in Box]	Kg / Lbs	56.0 / 123
Weight of DS2-X1 [Complete in Box]	Kg / Lbs	67.0 / 148
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	8.0

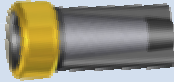
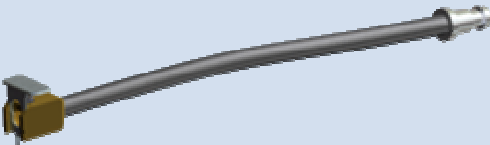
Cleaning Filter Life	Hours	30
Cleaning Fluid Life	Hours	10
Input System Pressure	Bar / Psi	03-10 / 45-145
Recommended Min. Operating Pressure (for iVM)	Bar / Psi	08 / 115
Min. Inner Diameter of Input Supply Hose	mm	10
Min. inner Diameter Exhaust Hose if used to replace the Exhaust muffler as shown in (Figure 3-iii)	mm	14
Max. System Build-Up Pressure	Bar / Psi	1850 / 26,830
Injector Clamping diameters	mm	9-45

Appendix B

“Adapters and Conne ctors”

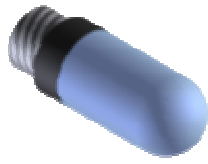
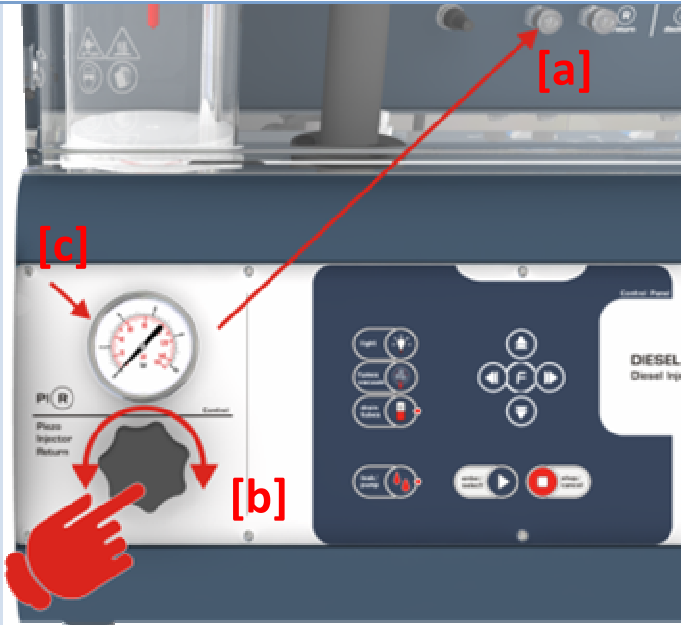
CODE	DESCRIPTION	Qty	IMAGE
IH.1	Generic_1 Electrical connector for connector [ih]	1	
IH.2	Generic_2 Electrical connector for connector [ih]	1	
IH.3	Delphi Electrical connector for connector [ih]	1	
HPT.14	High Pressure Hose Extension converter from M12 to M14 HP-T Connection	1	

RA.1	Bosch, Siemens etc. R-Adapt for Returned Testing Calibration Oil	1	
RA.2	Denso, CRIN etc. R-adapt for Returned Testing Calibration Oil	1	
RA.3	Delphi R-Adapt for Returned Testing Calibration Oil	1	
OR1	Spare o-ring for RA.1 Adapter	2	
OR2	Spare o-ring for D-ADAPT.7 (DA.7) Adapter	2	

OR3	Spare o-rings for D-ADAPT.7 (DA.7) Adapter	2	
30-88	Spare Screen Filter for [D] & [R] Adapters	6	
R- ADAPT .H	R-Adapt Hose for Returned Testing Calibration Oil for quick coupler [R]	1	
R- ADAPT .BP	Bosch Piezo R-Adapt for Returned Testing Calibration Oil for quick coupler [R]	1	
D- ADAPT .7	7mm D-Adapt for Discharged Testing Calibration Oil for quick coupler [D]	1	
D- ADAPT .9	9mm D-Adapt for Discharged Testing Calibration Oil for quick coupler [D]	1	

T-FUN	Calibration Oil/Fluid Funnel – Large	1	
DA.7	7mm Discharge Adapter for Cleaning MACC for quick coupler [C] [DS2-X1 only]	1	
DA.9	9mm Discharge Adapter for Cleaning MACC (C-Adapt) [DS2-X1 only]	1	
RA.BP	Bosch Piezo Return Adapter for Returned Cleaning MACC C-Adapt [DS2-X1 only]	1	

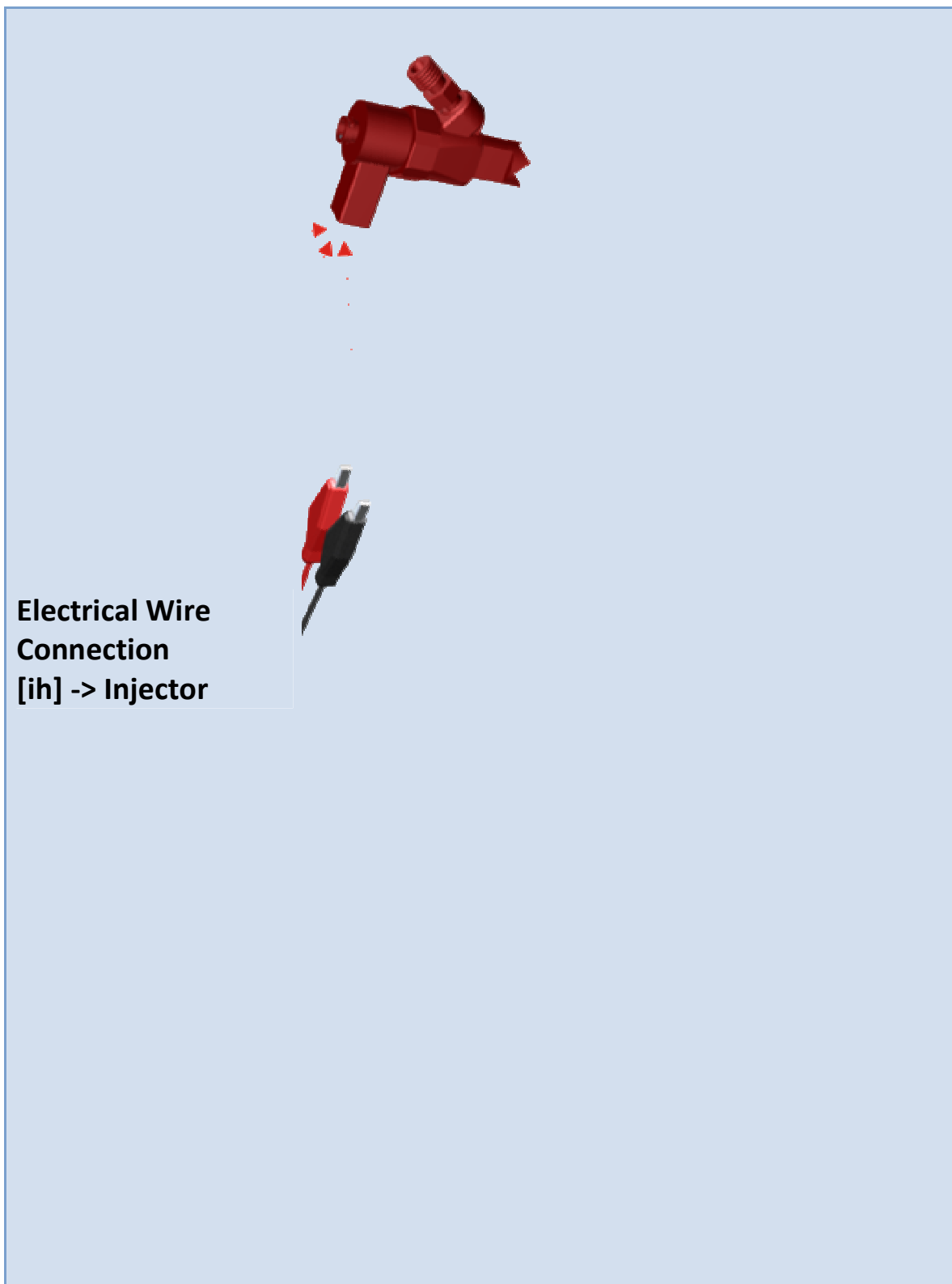
C-ADAPT	T-Piece C-Adapt Hose for quick coupler [C] [DS2-X1 only]	1	
C-FUN	Cleaning detergent Funnel (MACC) - Small with extension for quick coupler [C] [DS2-X1 only]	1	
PWC	100/240 VAC Mains Power Cable	1	
HC	Hose Clamp [DS2-X1] (+1 QTY)	1	

VMF Vacuum Muffler for connecting to the rear Spray Chamber fumes extractor (Figure 2-iii-[c])	1 
PIR Piezo Injector Back-Leak Regulator Kit [a]: (Input) Piezo Injector Return (from injector) [b]: (Regulator) Increase Pressure Clockwise [c]: (Gauge) Piezo Return Indicator	[Optional]  Important: To be used ONLY in Testing Mode

Appendix C

“Connectivity/Illustrations”

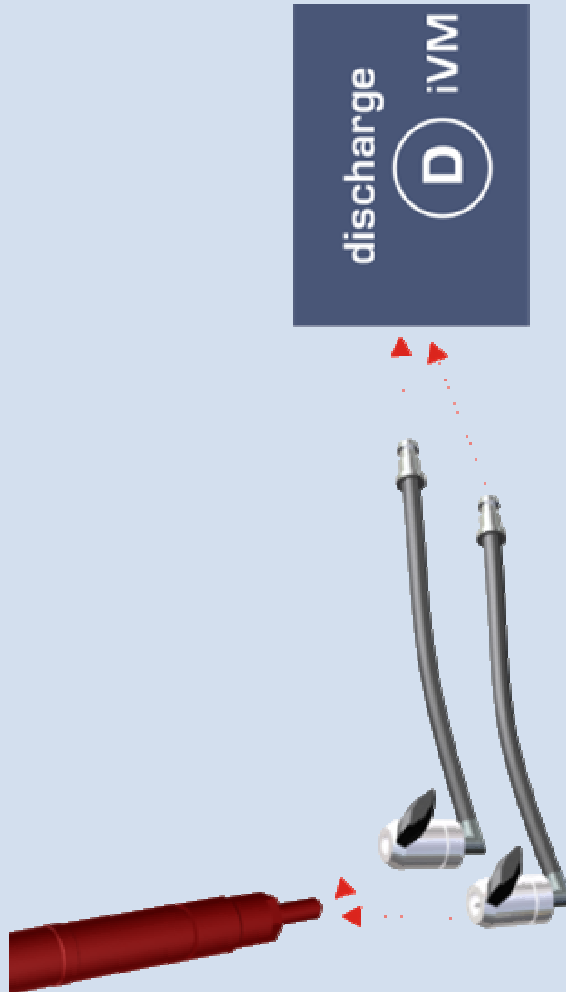
Description	Illustration
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**Return Adapter
(R-Adapt)
Connection for
Testing Calibration
Oil [R] iVM**

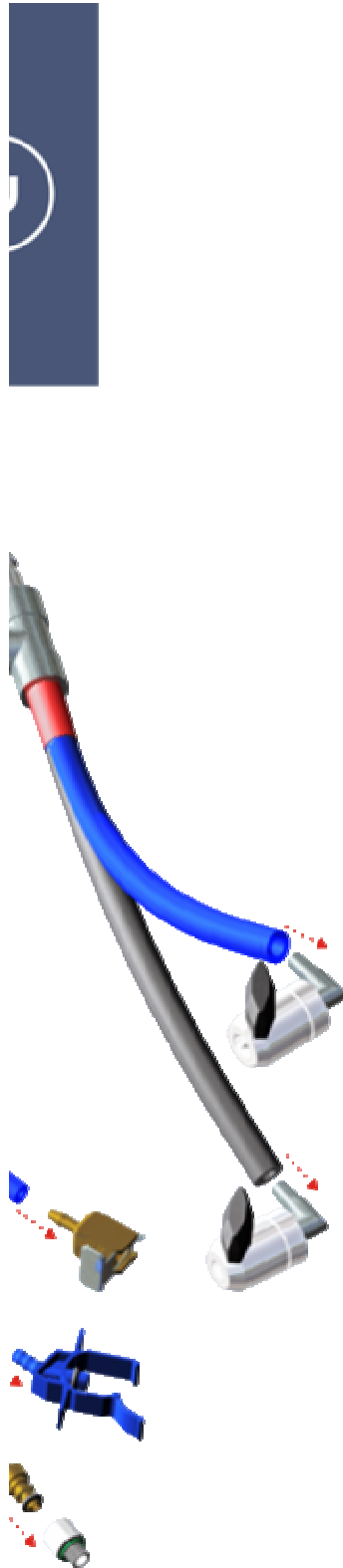


**Discharge Adapter
(D-Adapt)
Connection for
Testing Calibration
Oil [D] iVM**



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

[DS2-X1 only]



**“PIR”
Piezo Injector
Back-Leak Pressure
Regulator**



Piezo Injector Back-Leak**Pressure Regulation/Operation Instructions:**

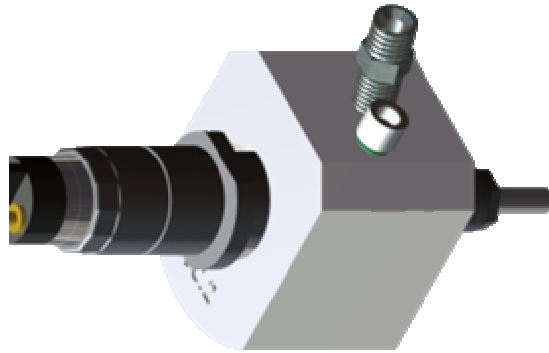
For correct operation of the Piezo injectors (Testing Mode ONLY), use the optional Carbon Zapp Piezo Back-leak Pressure Controller (PIR). Connect using the proper back-leak adapter from the injector to the PIR and then connect the PIR to the DS2 unit at the front side at connector [R] as shown in above figure. Unwind completely the pressure regulator to drop pressure. Close clear protection cover, Choose Piezo injector type and select [Spray Test] from Manual Tests at the menu to start. Let injector operate for at least 30sec at 1000STRK, 700us and at least 750bar HP-T pressure, and read the pressure indicated on the PIR gauge. Adjust pressure according to the following values:

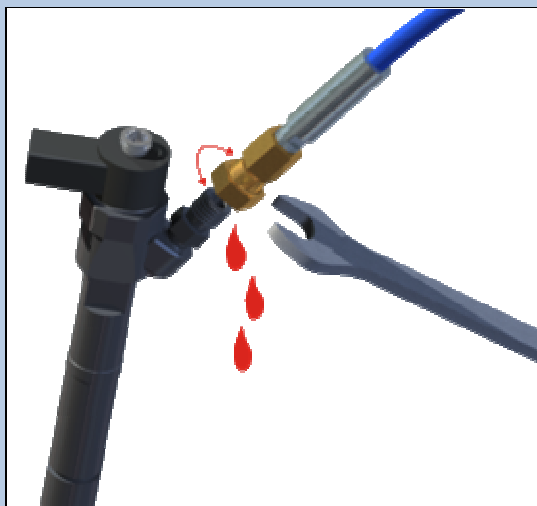
- Bosch Piezo: **8 bars**
- Siemens Piezo: **1.5 bars**

Note: All injectors to be tested should be tested at the exact same Back-Leak pressure.

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

**CRIN / Side Feed
Injector Adapter
connection**





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.

High Pressure lines De-aeration

To bleed the system from air:

1. Connect the HP hose to the injector, and tighten by hand
2. Release the HP pressure by unwinding the HP regulator
3. Press the leak/PUMP button, to activate the HP Pump
4. Slowly increase the HP Pressure by winding the HP regulator (Clockwise). Remember the High Pressure Safety Switch, it must be pressed for the HP pressure to build up.
5. While the HP pump is pulsating in low frequency and some liquid is flowing of the HP hose, tighten the HP hose to the injector with an appropriate wrench.
6. Close the Clear Protective Cover and increase more pressure. Confirm that there is no leak in the lines.

***IMPORTANT: Disconnect any injectors from the machine
(high risk of destroying the injector)!!!!***

NOTE: Read all the instruction once and then proceed step by step.

Please visit the www.atmel.com web site, search and download the latest FLIP utility in order to update the software (*search in AVR Solutions / Tools & Software*).

Direct Link:

http://www.atmel.com/dyn/products/tools_card.asp?tool_id=3886

Upon contact, you will be sent a .HEX file which is the software file for the PCB boards.

Software Update Procedure

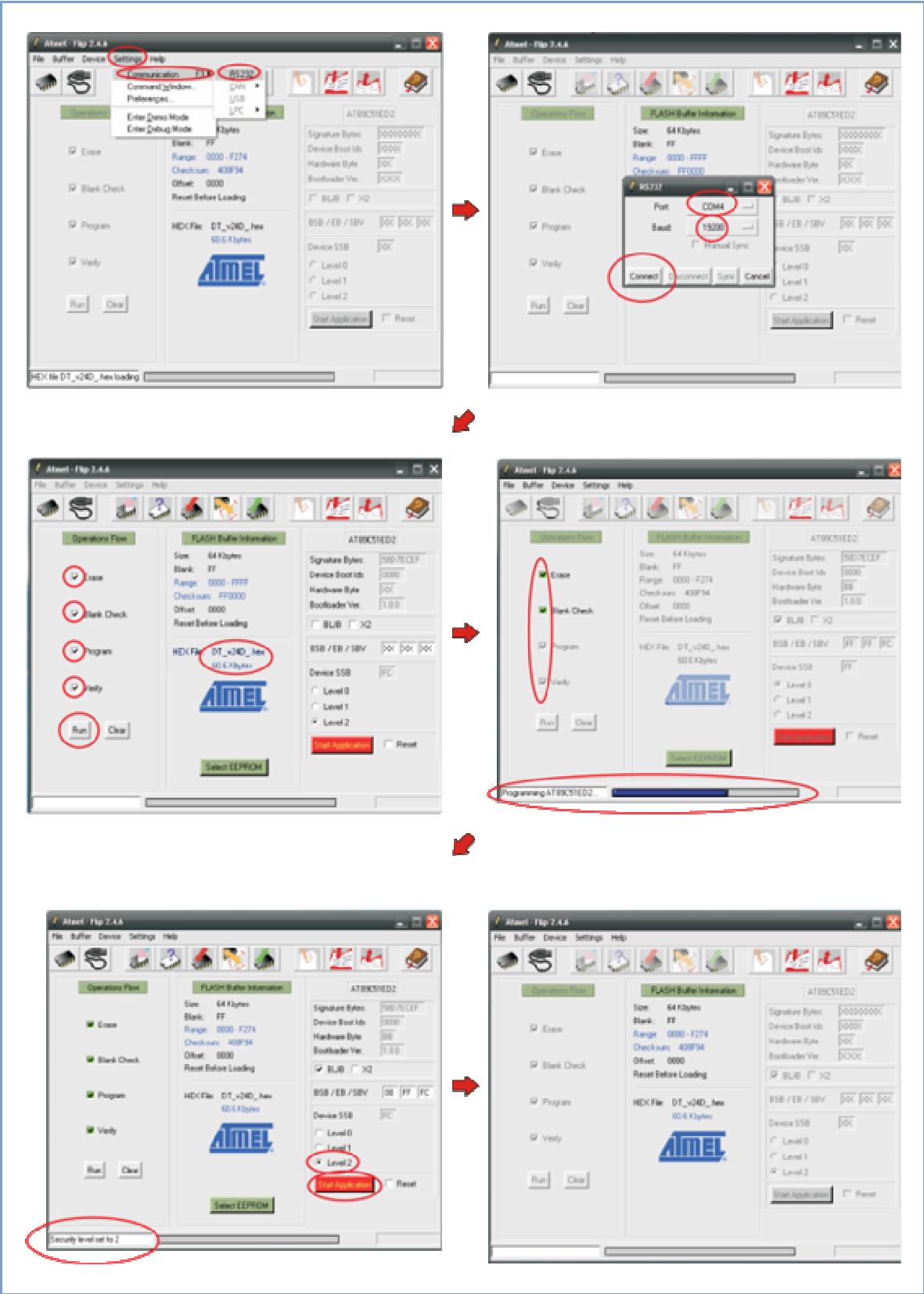
Please follow the instructions below in order to program the boards:

1. Acquire a PC or laptop that has a 9 pin Serial COM port (or buy a USB-TO-SERIAL(DB9) adapter from the local computer market and install the required software on that computer).
2. Save the FLIP program and the .HEX file on that PC.
3. Unzip and Install the FLIP program on the PC to be used.
4. (FLIP) Device->Select->AT89C51ED2
5. (FLIP) File -> Load HEX file
6. (FLIP) Settings -> Preferences -> ISP Conditions controlled by Flip (this option should always be checked)

7. Reveal the DS2 PCB board 9PIN SERIAL connector by removing the side panel.
8. Connect the PC to the Boards COM port using the 9 pin COM/SERIAL cable.
- 9. IMPORTANT: Disconnect any injectors from the machine!!!!**
10. Power-up the machine.
11. (FLIP) Settings->Communication->RS232->Port (COM1 or COMxx) -> Baud <=19200->Connect
12. *If the PC already has a 9 pin Serial Port, the COM number is usually COM1, otherwise, open the Device Manager from Windows System Properties, and look for the USB-TO-SERIAL Device.*
13. (FLIP) Make sure ERASE/BLACK CHECK/PROGRAM/VERIFY are checked and click on "Run"
14. (FLIP) When step 12 is done, check the option "Level 2", and then click on "START APPLICATION"
15. Power Off the machine.
16. Disconnect the COM cable and power ON the machine.
17. From the machines settings MENU, scroll down to Option "**LOAD DEFAULTS**" and press ENTER.

Below are some sample picture of the FLIP utility.





This image shows a full page of blank, lined paper. It features approximately 28 horizontal blue lines spaced evenly across the page, typical of standard notebook paper. The lines are thin and light blue, set against a plain white background. There are no margins, text, or other markings on the page.

