

# SEALEY

# Professional TOOLS

# VS211

## FUEL INJECTOR & HARNESS TESTER

Thank you for purchasing a Sealey product. Manufactured to a high standard this product will, if used according to these instructions and properly maintained, give you years of trouble free performance.



### IMPORTANT

PLEASE READ THESE INSTRUCTIONS CAREFULLY. NOTE THE SAFE OPERATIONAL REQUIREMENTS, WARNINGS, AND CAUTIONS. USE THIS PRODUCT CORRECTLY AND WITH CARE, FOR THE PURPOSE FOR WHICH IT IS INTENDED. FAILURE TO DO SO MAY CAUSE DAMAGE, OR PERSONAL INJURY, AND WILL INVALIDATE THE WARRANTY.

The use of symbols in this document is to attract your attention to possible danger. The symbols and warnings themselves do not eliminate any danger, nor are they substitutes for proper accident prevention measures.

### 1. SAFETY INSTRUCTIONS

- ✓ Always wear approved eye protection.
  - ✓ Always operate the vehicle in a well-ventilated area. Do not inhale exhaust gases - they are very poisonous!
  - ✓ Always keep yourself, tools, and test equipment away from all moving or hot engine parts.
  - ✓ Always make sure the vehicle is in Neutral (manual transmission) or Park (automatic transmission) and that the parking brake is firmly applied. Block the drive wheels.
  - ✓ Always keep handy a fire extinguisher suitable for fuel/electrical/chemical fires.
  - ✓ Always turn ignition key 'OFF' when connecting or disconnecting electrical components, unless otherwise instructed.
  - ✓ Use shop rags to cover fuel line fittings when connecting or disconnecting fuel lines or gauges. Avoid contact with petrol.
  - ✓ Dispose of all rags properly.
  - ✓ Clean up all fuel spills immediately.
  - ✓ Keep away from engine cooling fan. On some vehicles, the fan may start up unexpectedly.
  - ✓ You must follow vehicle service manual cautions when working around the air bag system. If the cautions are not followed the air bag may deploy unexpectedly, resulting in personal injury. Note that the air bag can still deploy several minutes after the ignition key is turned 'OFF' (or even if the battery is disconnected) because of a special energy reserve module.
  - ✓ Always follow vehicle manufacturer's warnings, cautions and service procedures.
  - ✓ Always relieve fuel pressure before disconnecting fuel lines.
  - ✓ The Fuel Injector & Harness Tester requires an optional fuel pressure gauge VS210 to be used for fuel injector testing. Always follow all safety guidelines and testing procedures contained in the instruction manual provided with the fuel pressure gauge.
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- X Never lay tools on vehicle battery. You may short the terminals together, causing harm to yourself, the tools, or the battery.
  - X Never smoke or have open flames near vehicle. Vapours from petrol and charging batteries are highly flammable and explosive.
  - X Never leave vehicle unattended while running tests.
  - X Do not confuse Air Conditioning schrader valves with the fuel rail test port.

### 2. INTRODUCTION

In recent years, fuel injection has become standard equipment on most new vehicles. Although far more reliable and efficient than carburettors, fuel injection systems have their own unique problems. In many cases, fuel injection problems can be linked to blocked or sticky fuel injectors. Testing fuel injectors was once a complicated and inaccurate procedure, but, with the VS211 Fuel Injector & Harness Tester, you can now quickly and easily locate any malfunctioning fuel injector without removing it from the vehicle. The VS211 Fuel Injector & Harness Tester is a hand-held device used to check the function of fuel injectors and their associated wiring harnesses on most vehicles. The VS211 tests for clogged or leaking fuel injectors by using a single, half-second pulse. Multiple 5-millisecond pulses are used to test for sticky or sluggish fuel injectors. By using a fuel pressure gauge VS210 (optional) and comparing fuel pressure differences as each fuel injector is pulsed, faulty injectors can quickly be identified. In addition, the VS211 Fuel Injector & Harness Tester is able to test fuel injection wiring harnesses for faulty wiring and connectors.

**Power LED (1)** - As soon as the battery clips are attached to the vehicle battery the Power LED will light. This verifies a good power connection.

**Continuity LED (2)** - Indicates a good connection to the fuel injector or fuel injector wiring harness. This must be lit before proceeding with any testing.

**Output LED (3)** - Indicates the presence of a signal from the vehicle's on-board computer to the fuel injector OR a pulse from the tester to the fuel injector.

**Trigger Button (4)** - Activates fuel injector test pulses.

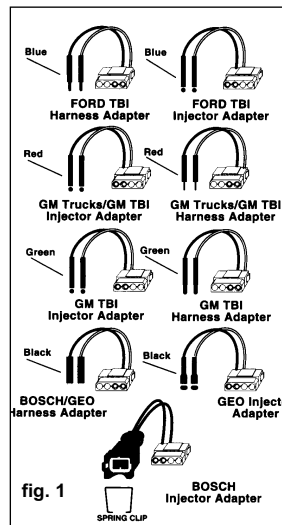
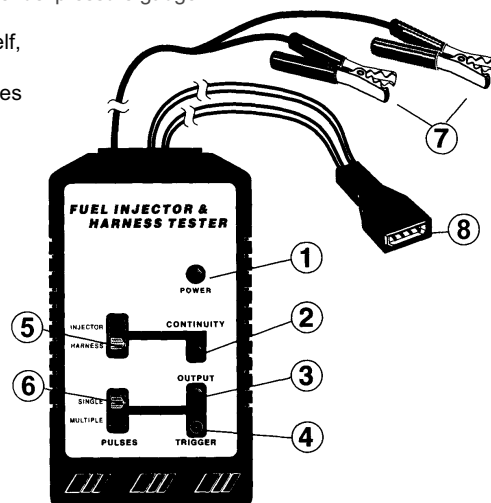
**Injector/Harness Switch (5)** - Selects 'fuel injector' or 'fuel injector wiring harness' testing.

**Single/Multiple Pulses Switch (6)** - Switches between one half-second and multiple 5-millisecond test pulses, produced when the Trigger Button is pressed.

**Battery Clips (7)** - Attach to vehicle battery to power the Fuel Injector & Harness Tester.

**Fuel Injector/Wiring Harness Interface Cable (8)** - Connects the Fuel Injector & Harness Tester to a fuel injector or fuel injector harness for testing via adaptors.

**Fuel Injector/ Wiring Harness Adaptors (fig.1)** - Used to connect interface cable to vehicle. Since all vehicles are different, several colour coded adaptors are included. Same colour adaptors are used for the same application - one adaptor is used to connect the interface cable to the fuel injector and the other connects the interface cable to the wiring harness.



### 3. TESTING PROCEDURE

❑ **WARNING! Before using equipment ensure you have read, understood and apply Section 1 safety instructions.**

#### 3.1. Pre-Test checks

1. Do a thorough visual and "hands-on" inspection of the engine and fuel system. Look for loose or cracked electrical wiring, battery cables, ignition wires, and fuel or vacuum lines.
2. Verify that the battery is fully charged and fuel tank has adequate fuel.
3. Verify that the inertia fuel cut-off switch (if fitted) has not been actuated - see vehicle manual.
4. Verify that all fuel system fuses are good.
5. Verify that the fuel vapour recovery system and filler cap are in good condition.
6. Verify that manifold vacuum is within manufacturer's specification (typically 18-20 in.Hg at idle).
7. Look for fuel leaks and wipe up any spilled fuel immediately.
8. Has the vehicle been serviced recently? Sometimes things get reconnected incorrectly, or not at all.
9. Do not take shortcuts. Inspect wiring which may be difficult to see because of location beneath air cleaner housings, alternators, etc.
10. Inspect wiring harnesses for:
  - Contact with sharp edges (this happens often). Pinched, burned or chafed insulation.
  - Contact with hot surfaces, such as exhaust manifolds. Proper routing and connections.
11. Check electrical connectors for:
  - Corrosion on pins. Bent or damaged pins.
  - Contacts not properly seated in housing.

**Note:** Problems with connectors are common in the engine control system - inspect carefully. Note that some connectors use a special grease on the contacts to prevent corrosion. **Do not wipe off!** Obtain extra grease, if needed, from your vehicle dealer. It is a special type for this purpose.

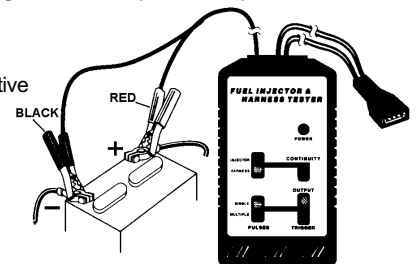
12. Check other vehicle systems:
  - Ignition - For safety reasons, many engine management systems will not deliver fuel without an ignition spark.
13. Electronic Control Unit (ECU) - The engine management system ECU has special drivers which energize the fuel injectors. These drivers are fragile and can easily fail. If you suspect an ECU driver problem, check by replacing the ECU with a known good one and retest.
14. Perform diagnostic procedures as described in vehicle service manual to eliminate other possible causes of driveability problems. Compression and ignition problems may imitate fuel injection system problems.

#### 3.2. Testing

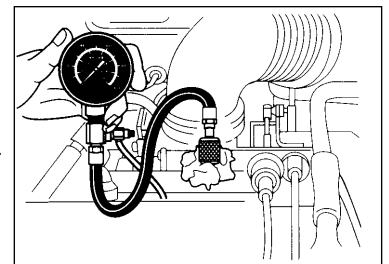
❑ **WARNING! Before proceeding with fuel injector and harness testing, read and understand all safety guidelines and perform all pre-test checks.**

##### 3.2.1. Fuel Injector test

1. Connect Tester to vehicle battery. RED clip to the positive (+) terminal and BLACK clip to the negative (-) terminal. Ensure that Power LED is lit before continuing.



2. Connect a Fuel Pressure Gauge (VS210, not included) to fuel line. Some vehicles have a schrader valve located on the fuel rail for this purpose. On vehicles without schrader valves, you must open the fuel line at the appropriate point to insert a fuel pressure gauge adaptor.



**IMPORTANT: Always follow fuel pressure gauge and vehicle service manual instructions and safety precautions when opening fuel lines.**

The information in this manual is not a substitute for the procedures outlined in the vehicle service manual.

**ALWAYS** follow manufacturer's instructions and safety precautions when working on fuel systems.

3. Depressurize fuel system by following procedure outlined in vehicle service manual. On most vehicles, this involves disconnecting or deactivating the electric fuel pump(s) and operating the engine until it stalls. **Note:** Some vehicles may have more than one fuel pump - deactivate **all** pumps!

Failure to do so can result in personal injury, vehicle damage, spilled fuel, fire or other hazardous conditions.

4. Using proper fuel pressure gauge adaptor, open fuel line at point specified in vehicle service manual and connect adaptor to fuel line.
5. Attach fuel pressure gauge to adaptor and tighten fitting until finger tight.

**IMPORTANT:** Read and follow all pre-test checks, safety instructions, and fuel pressure testing procedures contained in this document and in vehicle service manual.

❑ **WARNING! Always use caution when working around fuel systems. The fuel in the fuel rail may be pressurized even if the engine is not running. Use a rag to cover the schrader valve or fitting whenever opening the fuel system to attach gauge. Clean all fuel spills immediately.**

##### 3.2.2. Test for fuel system leaks

1. Pressurize fuel system by cycling ignition 'ON' and 'OFF' every ten seconds until fuel pressure is to manufacturer's specification (check vehicle service manual).

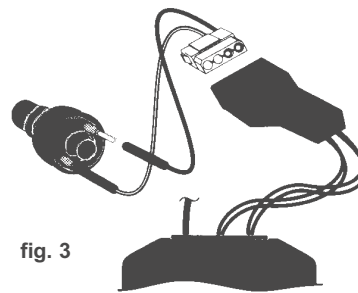
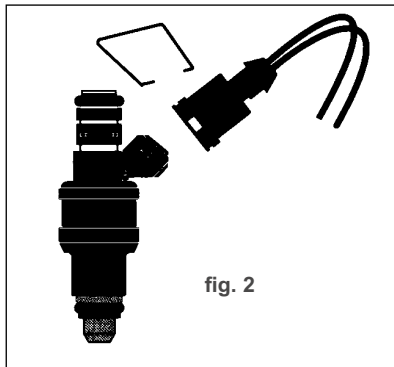
**Note:** Check fuel pressure gauge connection points for leaks. If leak occurs, clean all fuel spills immediately and check all fittings for tightness.

2. Observe pressure gauge for 10 -15 seconds, looking for pressure drop.
3. If the pressure does not drop, continue with fuel injector testing. If fuel pressure does drop, continue looking for leaks by blocking off the return line between the fuel pressure regulator and the fuel tank. Re-test as described above.
4. If the pressure drops again, there may be one or more leaky injectors. Later tests will identify malfunctioning injectors.

### 3.3. Fuel Injector tests

**IMPORTANT:** Do not pulse fuel more than once per cylinder. Start and run the engine briefly after pulsing fuel once into all cylinders. This clears excess fuel from the intake ports. Failure to do so could cause difficult starting, severe engine flooding, catalytic converter damage, or fire.

1. Carefully disconnect wiring harness from fuel injector to be tested. **Note:** Do not jerk or pull on wires - some harnesses are attached with clips (fig.2). It is a good ideal to test injectors in sequence, beginning with cylinder No.1.
2. Set Injector/Harness switch to 'Injector'.
3. Attach appropriate injector adaptor to Fuel Injector/Wiring Harness interface cable.
4. Connect tester to fuel injector (fig.3). For most injectors (except Bosch type) it does not matter which wire is connected to which terminal on the injector. Make sure the injector adaptor wires are securely fastened to the fuel injector terminals and that there is no exposed metal between them. For Bosch type injectors, the injector adaptor is keyed and can be attached one way only.



5. Verify that the continuity LED is lit. If continuity LED does not light, check all electrical connections. If all electrical connections are secure, injector is faulty and should be replaced.
6. Set Pulse switch -  
'Single' will test for clogged injectors.  
'Multiple' will test for sticky or sluggish injectors.
7. Re-pressurize fuel system as described in para. 3.2.2.1. Be sure that fuel pressure is stable before continuing. Record this initial fuel pressure for reference. **Note:** Fuel system must be re-pressurized to manufacturer's specifications before testing **each** fuel injector.
8. Press Trigger button to energize fuel injector. Output LED will flash briefly as injector is energized by the tester.
9. Record fuel pressure drop 2-3 seconds after pulse. **Note:** Make sure that each injector's pressure drop is recorded at the same length of time after the pulse. If this time interval varies, the test results will be inaccurate due to normal fuel system leakdown.
10. Repeat steps 1, 4, 5, 7, 8, 9 with the next injector until all injectors have been tested.
11. After testing all injectors with pulse switch in one position ('Single' or 'Multiple'), repeat test procedure with the pulse switch in the other position.

### 3.4. Fuel Injector test results

1. Compare the pressure drop values for each injector (recorded in para. 3.3.9.). Any injector showing a result significantly different (more than  $\pm 2.0$  psi) from the others should be retested to be certain that there were no variations in the test procedure.  
Single Pulse test: Clogged injectors will show **less** pressure drop than healthy injectors. Leaking injectors will show **more** pressure drop than healthy injectors.  
Multiple Pulse test: Sticky or sluggish injectors will show **less** pressure drop than healthy injectors.
2. Flush or clean any injector which continues to show a variation of more than 2.0 psi when compared to the other injectors. **Note:** Be sure to compare readings taken during Single and Multiple pulse testing separately. Pressure drop values for single pulse tests can be very different from values for multiple pulse tests.
3. Retest and then replace any injector which has not improved after being flushed or cleaned.

### 3.5. After testing

1. Disconnect all tester leads from fuel injectors and harnesses. **Note:** Always grasp adaptor ends near terminals, when removing from injectors or harnesses, to prevent damage. Do not tug or jerk adaptor wires from terminals.
2. Remove tester clips from vehicle battery.
3. Fully depressurize fuel pressure gauge and fuel system.
  - a) Schrader valve - when removing gauge from schrader valve use a shop rag to cover the valve in case fuel sprays out. Replace schrader valve cap. **Note:** Fuel system may still be under pressure, even if the engine is not running. Clean all fuel spills immediately.
  - b) Fuel line adaptors - remove adaptors using tools and procedure as outlined in vehicle service manual. Reconnect all fuel lines. Test for leaks. Clean up all fuel spills immediately.

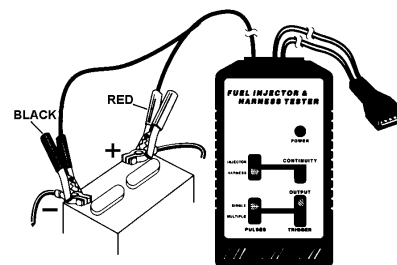
**IMPORTANT:** Follow all procedures outlined in the fuel pressure gauge instruction manual for the safe way to remove the gauge from the schrader valve or fuel line adaptor.

4. If the excess fuel in the intake ports has been purged, by starting the vehicle after each injector test, reconnect all injector wiring harnesses to injectors.

**IMPORTANT SAFETY NOTE:** If excess fuel has NOT been purged following each injector test, vehicle damage may result when engine is started. To clear excess fuel, disconnect ALL fuel injector harnesses and then crank engine. Engine may start and run roughly, then die. This is normal. Reconnect all injectors.

### 3.6. Injector Harness tests

1. Connect Tester to vehicle battery. RED clip to the positive (+) terminal and BLACK clip to the negative (-) terminal. Ensure that Power LED is lit before continuing.
2. Carefully disconnect wiring harness to be tested from fuel injector. Do not jerk or pull on wires - some harnesses are attached with clips (fig. 2). It is a good idea to test injector wiring harnesses in sequence, beginning with cylinder No.1.



3. Set Injector/Harness switch to 'Harness'.
4. Connect appropriate harness adaptor to the interface cable.
5. Connect Fuel Injector/Wiring Harness Interface Cable to injector harness being tested using the adaptor (fig.4). For all harness adaptors, either wire may be connected to either terminal of the harness. The tester is designed in such a way that hook-up orientation does not matter.

**Note:** The continuity LED may be bright, dim or off. The status of the continuity LED becomes important in later testing.

6. Turn vehicle ignition key 'ON', but do not start vehicle. On most vehicles, the continuity LED will now be on. If the continuity LED remains off, further testing will determine if a problem exists.

7. Start the engine - if engine will not start, then have an assistant crank the engine. Observe the LEDs. **Note:** vehicle may start and run even with one or more injectors disconnected. This does not affect the harness test. **Observe all safety precautions.**

Verify that the continuity LED is lit, and the output LED is flashing.

**Note:** Output LED may flash so quickly that it appears to be continuously on. This is normal.

If the continuity LED does not light, and the output LED is not flashing, then check all electrical connections. If all electrical connections are good, then proceed to para 3.7.

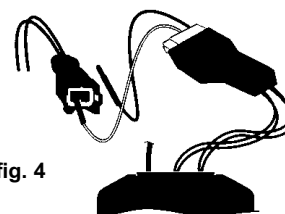


fig. 4

### 3.7. Wiring Harness Test Results

1. If the continuity LED lights and the output LED flashes, the wiring harness for that fuel injector is good.
2. If the continuity LED fails to light, then there is a problem with the fixed voltage wire in the injector wiring harness. Use a digital multimeter to check for an open or short circuit.
3. If the output LED does not flash then...
  - a) Check fuel injector wiring harness for an open or short circuit in the wire that turns the fuel injector 'ON' and 'OFF'.
  - b) The driver in the engine management ECU may be faulty. Substitute known good unit and retest.
  - c) Check ignition system. For safety reasons, most fuel injection systems will not deliver fuel without the presence of ignition reference pulses from the ignition module. **Note:** This only applies to a "No Start" condition.
4. Disconnect Tester from wiring harness and from vehicle battery. Reconnect all injector harnesses. Start and run engine to be sure that all injectors are firing normally.

## 4. CARE & MAINTENANCE

1. Keep all Fuel Injector & Harness Tester electrical connections clean and free of corrosion.
2. If tester face becomes dirty, wipe clean with a damp rag. **DO NOT** use alcohol or other strong solvents as they may remove face printing.
3. Use care to prevent tester wiring insulation from becoming chafed or broken. Do not use tester if insulation or wiring is damaged.
4. When not in use, store instrument in a safe, dry childproof location.

**NOTE:** It is our policy to continually improve products and as such we reserve the right to alter data, specifications and component parts without prior notice.

**IMPORTANT:** No liability is accepted for incorrect use of product.

**WARRANTY:** Guarantee is 12 months from purchase date, proof of which will be required for any claim.

**INFORMATION:** For a copy of our latest catalogue, call us on 01284 757525 and leave your full name and address including postcode.