SIDI Diagnostics Reference Guide

About This Guide

The purpose of this guide is to aid you in diagnosing a vehicle's injectors based on the test results. On the following pages, locate the screen that best represents your results for interpretation and recommend action to take. If additional testing is recommended, the procedure for that particular test is also provided at the end of that section.

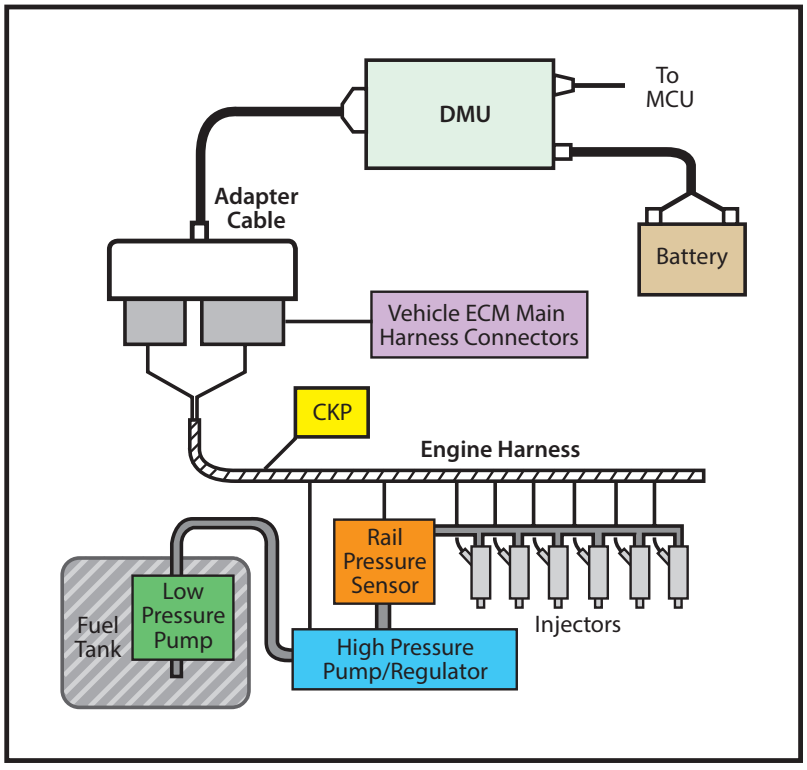
Acronyms Used

The following acronyms are used throughout this guide:

DMU—Drive & Measurement Unit
DTC—Diagnostic Trouble Code
ECM—Engine Control Module
FICM—Fuel Injector Control Module
ICP—Injector Characteristic Performance
MCU—Main Control Unit
SIDI—Spark Ignited Direct Injection

How the SIDI Fuel Injection System Works on Direct Injected Fuel Systems

The DMU connects to the vehicle harness and isolates the fuel injection system from all other engine components. **No fuel system disassembly or connection required.**



When first connected and a test is initiated the Injection System Tester does an electrical test on each injector. As the test routine unfolds the relative flow of each injector on the vehicle is measured using a compensated pressure decay method. The results are presented on the MCU screen as Balance. This balance is a comparison of the fuel delivered to the cylinder by each injector during engine operation.

During testing, the high-pressure fuel pump, starting system, and regulator are tested for proper operation. When the test is completed the results are displayed on the MCU. The results can also be downloaded to a PC running the companion PC program supplied with the Tester. On the Balance screen if some injectors are significantly out of balance it is an indication of a faulty injector. On the Pump Performance screen an assessment of the high-pressure pump's ability to deliver fuel is presented. If Pump Performance is below expectations the cause could be the low-pressure fuel delivery system so before replacing a pump always check the low-pressure fuel delivery. During the Pump Performance assessment battery voltage, engine temperature, and cranking RPM enter into the calculations. Those measures are also presented on the Pump Performance screen.

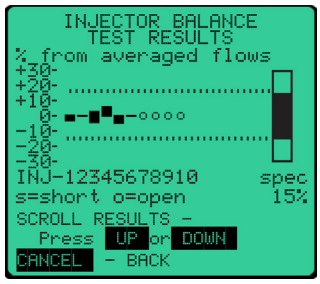
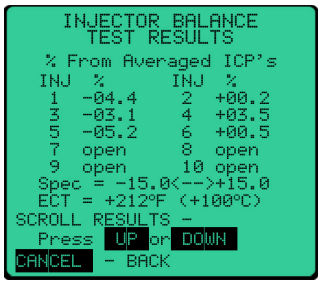
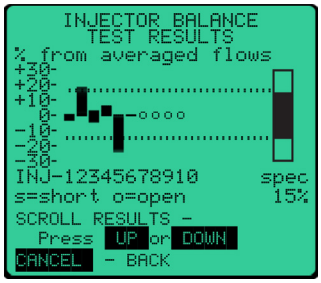
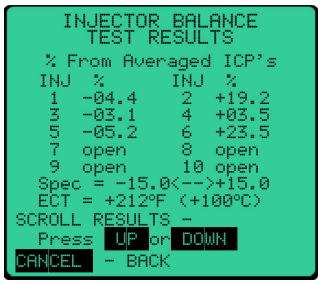
The tool determines high-pressure pump characteristics by measuring the fuel pressure developed at various engine speeds during each crank and compares the results to the expected Pressure vs. RPM profile built into the tool's database. It also measures battery voltage and cranking RPM and compares those results to specifications for the vehicle.

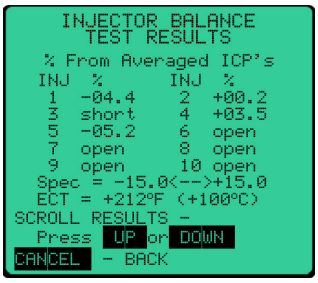
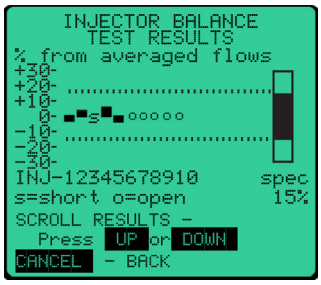
Balance Test Results

These screens represent the results of tests that are performed to determine if there is a proper balance between the fuel used to move the internal parts of the injector and the amount of fuel injected into the cylinder for combustion.

The tester measures the fuel consumption of all the injectors on the engine and presents the results to the technician in two forms. One screen is a balance graph pictorially showing all the injector balance values along with dotted tolerance lines. The second screen gives the same information numerically along with the engine temperature if the tester was connected to the DLC at the start of the test.

If one or more injectors are not injecting approximately the same amount of fuel as the other injectors it is an indication that the injector is not functioning properly.

Example Screen	Result	Interpreting Results	Action To Take
 	All injectors are between the tolerance lines	• All injectors are within tolerance.	• If the results for all injectors are *within the tolerance range*, and no problem is indicated by the Pump Performance Test, it is likely that the fuel injection system is not causing the DTC or symptom. • If the results for one or more injector(s) is *considerably* different (but still within the tolerance range) and the symptom is rough idle with no DTCs, the injectors with different balance values may be the cause.
 	One or more injectors is above (overfueling/ rich) or below (underfueling/ lean) tolerance line	• Any Injector above the tolerance line is using considerably ***more*** fuel that the other injectors. • Any Injector below the tolerance line is considerably less fuel than the other injectors.	• Clean the injectors and retest. After cleaning, replace out of tolerance injectors and retest.

Example Screen	Result	Interpreting Results	Action To Take
 	Open (o) and/or short (s) is displayed for one or more injectors	An open or short may be present in the wiring harness or the injector itself. *Note: An open is displayed (or **o** depending on the screen) for any cylinder not present on the vehicle. In this example, injectors 9 and 10 are open because is it an eight cylinder vehicle.*	If an open is indicated: • Verify the open injector ECM DTCs match the tester's results. If yes, see ***Pinpointing an Open***. If no, replace the ECM. If a short is indicated: • See ***Pinpointing a Short***.

Pinpointing an Open:

1. Disconnect the injector connector at the injector and short the two pins together.
2. Re-run the injection system test.
3. Does the injector show as Shorted?

   If yes – replace the injector

   If no – repair the harness

Pinpointing a Short

1. Disconnect the injector connector at the injector.
2. Re-run the injection system test.
3. Does the injector show as Open?

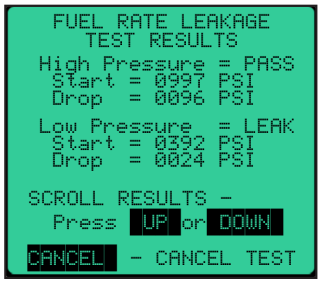
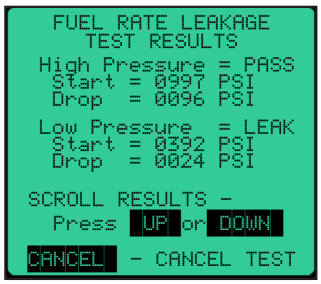
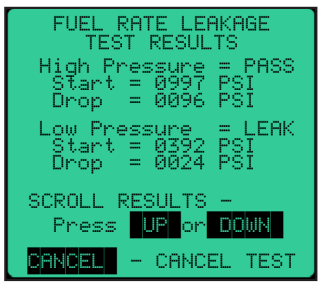
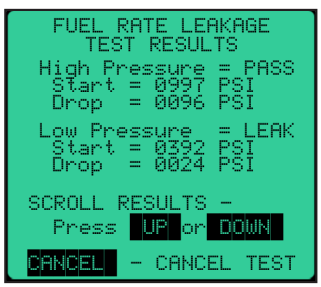
   If yes – replace the injector

   If no – repair the harness

Fuel rate Leakage Test Results

These screens represent the results of tests that are performed to determine the return flow of the fuel injection system.

The High/Low Leak Test checks for leakage in the fuel rail system by cranking the engine to pressurize the system and then measuring pressure while the engine is stopped. The unit performs the pressure leakage test at high and low pressures because certain issues are pressure dependent.

Example Screen	Result	Interpreting Results	Action To Take
	Drop in high pressure is <20%	• PASS—High Pressure is normal.	• None.
	Drop in high pressure is >20%	• Results indicate a high pressure leak is present	• Check for a faulty high-pressure pump check valve. • Check for a fuel rail leak or an injector leaking into a cylinder
	Drop in low pressure is <10%	• PASS—Low Pressure is normal.	• None.
	Drop in low pressure is >10%	• Results indicate a low pressure leak is present	• Check for a faulty high-pressure pump check valve. • Check for a fuel rail leak or an injector leaking into a cylinder

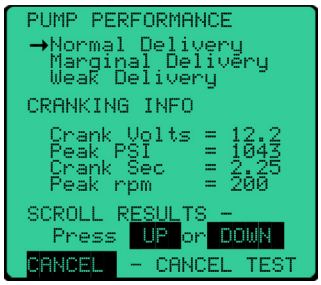
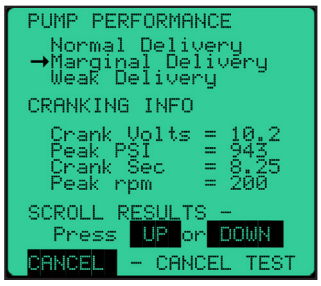
Pump Performance

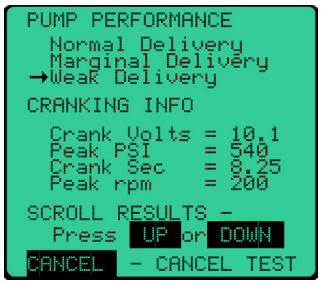
These screens present an evaluation of the ability of the fuel delivery system to provide sufficient fuel to the injectors.

The tester compensates for crank engine speed, system return flow, and other variables to determine if the High-Pressure Pump can supply sufficient fuel under all engine operating conditions. The low –pressure fuel delivery system can effect the Pump Performance measurements if it is restricted or sucking air.

It is important to evaluate the low-pressure system if the Pump Performance result is Marginal or Weak before replacing the High-Pressure Pump.

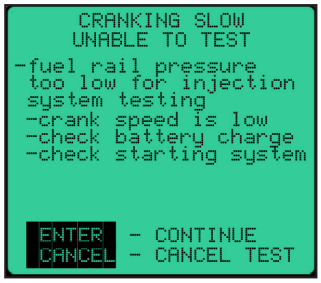
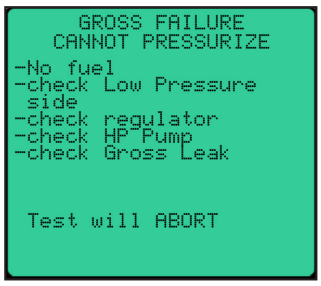
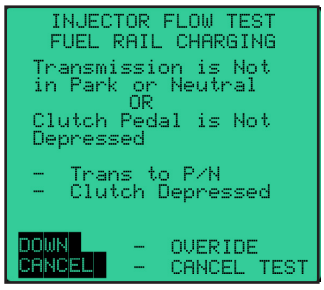
Crank Volts, Peak PSI and Peak RPM values are presented on this screen as additional information for the technician. The Pump Performance evaluation takes these values, along with the system leakage, into account when determining the Pump Performance result.

Example Screen	Result	Interpreting Results	Action To Take
	Normal Delivery Reading	If the symptom occurs *only* under heavy-load conditions (maximum fuel is demanded) and the tester does not indicate a fuel injection issue in the results screens • Restriction such as a clogged fuel filter or a small air leak into the low-pressure system may be the cause. If symptom *does not* occur under heavy-load conditions • Indicates the high Pressure Pump is delivering the pressures needed for proper fuel injection system operation and is not the cause of the problem. *Note: If there is an indication of a Significant or Gross Leakage on the Fuel Rate Leakage screen, pump performance is set to Normal.*	If symptom occurs only under heavy fuel demand conditions: • Follow the vehicle's shop manual to be certain there is not an issue in the low-pressure fuel delivery system. If symptom does not occur under heavy fuel demand conditions: • No action related to the high-pressure pump is required
	Marginal Delivery Reading	• Indicates the High Pressure Pump's ability to provide sufficient pressure is marginal and may cause a symptom or code caused by insufficient high-pressure fuel. • Severely restricted low-pressure system or an severe air leak may cause the high-pressure pump to appear Marginal. If it is the high-pressure pump most likely harsh driving conditions such as towing heavy loads or driving up steep grades are where the symptom occurs or the code(s) is set. If the vehicle is sluggish under most driving conditions a low-pressure fuel delivery issue is the likely cause.	• Before replacing the Pump follow Shop Manual procedures to be certain there is not an issue with fuel contamination or the low-pressure fuel delivery. • If none found, replace high-pressure pump and re-test.

Example Screen	Result	Interpreting Results	Action To Take
	Weak Delivery Reading	• Indicates the High Pressure Pump is not delivering sufficient pressure for most engine operating conditions. • Severely restricted low-pressure system or severe air leak may cause the high-pressure pump to appear Weak.	• Before replacing the Pump follow Shop Manual procedures to be certain there is not an issue with fuel contamination or the low-pressure fuel delivery. • If none found, replace high-pressure pump and re-test.

Unable to Perform Test Screens

These screens represent those that may displayed if AFIT is unable to complete a test because of severe conditions, such as the inability of the vehicle to build sufficient pressure.

Example Screen	Interpreting Results	Action To Take
	• The cranking speed of the engine is too slow to build sufficient pressure to allow testing of the fuel system	• The vehicle starting/charging system must be diagnosed and repaired to enable fuel injection system testing.
	• Fuel rail pressure is too low. The system is unable to develop sufficient pressure for any testing.	Following the vehicle's shop manual: • Test the fuel low side supply and the fuel filter restriction/contamination. • Test the pressure regulator If both of these items are not the cause of the low pressure, either there is extreme return flow, or the high-pressure pump is not working.
	• Vehicle transmission is not in Park or Neutral, or Clutch Pedal is not depressed. The vehicle engine may not be safely cranked.	• Verify transmission lever position or manual transmission, depress clutch. *Note: Vehicles equipped with ETRS (Electronic Transmission Range Select) uses BUS (GMLAN) data communications to determine lever position. AFIT is unable to retrieve this data to determine cranking safely.* • Verify that the transmission or clutch pedal is in the proper position to safely crank the engine, select the **DOWN-OVERRIDE** to continue testing.

Error Screens

There are several error screens that are displayed if the unit determines there is an issue with some of the internal functions of the tester. These are not pertinent to diagnosing the vehicle under test. Most often these errors are caused by a poor connection to the vehicle battery on the DMU battery clips. A weak vehicle battery can also cause them. If they are displayed double check the connections and the battery before returning the unit for service.

For technical assistance or to order service parts, contact:

www.gmglobaltools.com

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