

F - BASIC TESTING - 4-CYL

1993 Toyota Celica

1993 ENGINE PERFORMANCE
Basic Diagnostic Procedures

Celica

INTRODUCTION

The following diagnostic steps will help prevent overlooking a simple problem. This is also where to begin diagnosis for a no-start condition. The first step in diagnosing any driveability problem is verifying the customer's complaint with a test drive under the conditions problem reportedly occurred.

Before entering self-diagnostics, perform a careful and complete visual inspection. Most engine control problems result from mechanical breakdowns, poor electrical connections or damaged/ misrouted vacuum hoses. Before condemning the computerized system, perform each test listed in this article.

NOTE: Perform all voltage tests with a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance, unless stated otherwise in test procedure.

PRELIMINARY INSPECTION & ADJUSTMENTS

VISUAL INSPECTION

Visually inspect all electrical wiring, looking for chafed, stretched, cut or pinched wiring. Ensure electrical connectors fit tightly and are not corroded. Ensure vacuum hoses are properly routed and are not pinched or cut. See the M - VACUUM DIAGRAMS article to verify routing and connections (if necessary). Inspect air induction system for possible vacuum leaks.

MECHANICAL INSPECTION

Compression

Check engine mechanical condition with a compression gauge, vacuum gauge, or engine analyzer. See engine analyzer manual for specific instructions.

WARNING: DO NOT use ignition switch during compression tests. Use a remote starter to crank engine. Fuel injectors on many models are triggered by ignition switch during cranking mode, which can create a fire hazard or contaminate the engine's oiling system.

4-CYLINDER COMPRESSION SPECIFICATIONS

Application	psi (kg/cm ²)
Normal Compression Pressure	
1.6L (4A-FE)	191 (13.4)
2.0L Turbo (3S-GTE)	164 (11.5)
2.2L Non-Turbo (5S-FE)	178 (12.5)
Minimum Compression Pressure	142 (10.0)
Maximum Variation Between Cylinders	14 (1.0)

Exhaust System Backpressure

The exhaust system can be checked with a vacuum or pressure gauge. If using a pressure gauge, remove O2 sensor or air injection check valve (if equipped). Connect a 0-5 psi pressure gauge and run engine at 2500 RPM. If exhaust system backpressure is greater than 1 3/4 - 2 psi, exhaust system or catalytic converter is plugged.

If using a vacuum gauge, connect vacuum gauge hose to intake manifold vacuum port and start engine. Observe vacuum gauge. Open throttle part way and hold steady. If vacuum gauge reading slowly drops after stabilizing, check exhaust system for restriction.

FUEL SYSTEM

Basic diagnosis of fuel system should begin by checking fuel pump operation and fuel pressure.

WARNING: ALWAYS relieve fuel pressure before disconnecting any fuel injection-related component. DO NOT allow fuel to contact engine or electrical components.

FUEL PUMP OPERATION

1) Install Jumper Wire (SST-09843-18020) between +B and FP terminals of data link connector. See Fig. 1. The data link connector is located in engine compartment.

2) Turn ignition on. Listen for fuel pump operating sound and feel for pressure in fuel line near fuel filter. Turn ignition off. Remove jumper wire. If fuel pump operates, check fuel pressure. See FUEL PRESSURE.

3) If fuel pump does not operate, connect a jumper wire from battery source to FP terminal of data link connector. If fuel pump operates, EFI main relay, EFI No. 2 relay, circuit opening relay or fuel pump relay may be defective. For explanation of relay operation, see FUEL PUMP CONTROL CIRCUIT.

4) If relays are okay, check wiring circuit and fuses. If fuel pump does not operate, check for defective fuel pump, open circuit between data link connector and fuel pump, or defective fuel pump ground or fuses. See appropriate wiring diagram in the L - WIRING DIAGRAMS article.

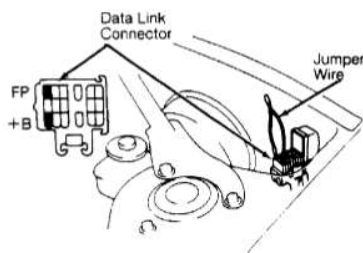


Fig. 1: Installing Jumper Wire In DLC (Celica)
Courtesy of Toyota Motor Sales, U.S.A., Inc

FUEL PRESSURE

NOTE: All models use in-tank fuel pump. Fuel pump contains internal relief valve and check valve.

1) Ensure battery is fully charged and ignition is off. Disconnect negative battery cable. Disconnect electrical connector from cold start injector (if equipped).

2) Note location of fuel pressure gauge installation. See

Figs. 2, 3, or 4. Place container under cold start injector pipe, deliver pipe or fuel filter. Cover union bolt with shop towel, and slowly loosen union bolt to relieve fuel pressure.

3) Remove union bolt and gaskets. Install Fuel Pressure Gauge (SST 09268-45012) using NEW gaskets. See Fig. 2, 3 or 4. Tighten union bolt. Reconnect negative battery cable.

4) Install jumper wire between +B and FP terminals of data link connector. See Fig. 1. The data link connector is located in engine compartment.

5) Turn ignition on and note fuel pressure. Fuel pressure should be within specification. See FUEL PUMP PERFORMANCE table.

6) If fuel pressure exceeds specification, replace fuel pressure regulator. If fuel pressure is less than specified, check for defective fuel lines, connections, fuel pump, fuel filter or fuel pressure regulator.

7) Remove jumper wire from data link connector. Start engine and allow to idle. Disconnect and plug vacuum line at fuel pressure regulator. Note fuel pressure.

8) Reconnect vacuum hose on fuel pressure regulator, and note fuel pressure. Fuel pressure should be within specification. See FUEL PRESSURE SPECIFICATIONS table.

9) If fuel pressure is not within specification, check for defective vacuum hose or fuel pressure regulator. Shut engine off and note fuel pressure.

10) Fuel pressure should hold at least 21 psi (1.5 kg/cm²) for a minimum of 5 minutes. If fuel pressure does not hold as specified, check for defective fuel pump, fuel injector or fuel pressure regulator.

11) Disconnect negative battery cable. Remove fuel pressure gauge. Reinstall union bolt using NEW gaskets. Tighten union bolt. Install cold start injector electrical connector (if equipped). Install negative battery cable.

NOTE: For more information on checking fuel injectors and other fuel sub-systems, see the I - SYSTEM/COMPONENT TESTS article.

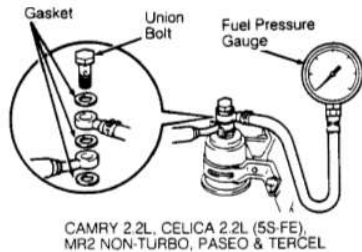
FUEL PUMP PERFORMANCE

Application	(1) psi (kg/cm ²)
1.6L (4A-FE)	38-44 (2.7-3.1)
2.0L Turbo	33-38 (2.3-2.7)
2.2L (5S-FE)	38-44 (2.7-3.1)

(1) - Check fuel pressure with jumper wire installed between data link connector +B and FP terminals, ignition on and engine off.

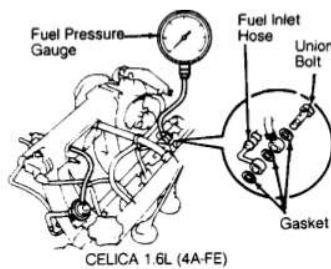
FUEL PRESSURE SPECIFICATIONS

Application	At Idle W/ Vacuum psi (kg/cm ²)	At Idle W/O Vacuum psi (kg/cm ²)
1.6L (4A-FE)	31-37 (2.2-2.6)	38-44 (2.7-3.1)
2.0L Turbo	27-31 (1.9-2.2)	33-38 (2.3-2.7)
2.2L (5S-FE)	31-37 (2.2-2.6)	38-44 (2.7-3.1)



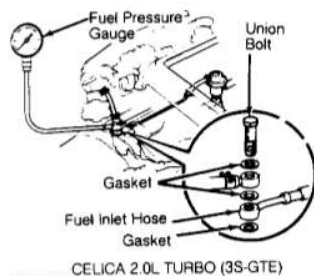
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Fig. 2: Installing Fuel Pressure Gauge (2.2L)
Courtesy of Toyota Motor Sales, U.S.A., Inc



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Fig. 3: Installing Fuel Pressure Gauge (1.6L)
Courtesy of Toyota Motor Sales, U.S.A., Inc



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Fig. 4: Installing Fuel Pressure Gauge (2.0L Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc

FUEL PUMP CONTROL CIRCUIT

NOTE: For information on testing relays and fuel system components, see the I - SYSTEM/COMPONENT TESTS article. Relays may be identified by appropriate illustration in the E - THEORY/OPERATION article.

EFI Main Relay

The EFI fuse supplies constant battery voltage to EFI main relay. The EFI main relay provides battery voltage to +B terminal of circuit opening relay (some models) and data link connector. Depending on model, EFI main relay may either be turned on directly by ignition switch or by M-REL terminal of Engine Control Module (ECM). The EFI main relay may also provide battery voltage to +B and +B1 terminals of ECM when ignition is turned on. The EFI main relay is located in engine compartment relay box.

NOTE: Circuit opening relay is used on all models.

Circuit Opening Relay

Circuit opening relay controls fuel pump circuit. The Engine Control Module (ECM) receives an input signal at STA terminal when engine is cranking. Starter signal is also applied to STA terminal of

circuit opening relay.
Starter signal energizes circuit opening relay during cranking. Circuit opening relay then provides voltage to fuel pump or fuel pump relay. Fuel pump relay is used on Celica Turbo only.
On Celica, the circuit opening relay is grounded by ECM through FC terminal.

Fuel Pump Relay & Fuel Pump Resistor (Celica Turbo)
Fuel pump relay receives voltage from circuit opening relay and operates fuel pump. Fuel pump operating speed may be varied by Engine Control Module (ECM). When ECM grounds fuel pump relay, relay contacts close, and voltage is supplied through fuel pump resistor, to fuel pump. This changes fuel pump operating speed.

IGNITION CHECKS

SPARK TEST

NOTE: Before performing spark test, ensure ignitor is properly grounded.

1) On Celica 1.6L (4A-FE), disconnect spark plug wires. Remove spark plugs. Install spark plug on each spark plug wire. Ground spark plug against cylinder block.
2) On all other models, disconnect high tension coil wire from distributor. Hold coil wire approximately 1/2" away from cylinder block.

CAUTION: To prevent gasoline from being injected, DO NOT crank engine for longer than 2 seconds.

3) On all models, crank engine and check for spark. If spark does not occur, check ignition coil, ignitor and distributor electrical connections.
4) If electrical connections are okay, using ohmmeter, check resistance of high tension wires. Replace high tension wires if resistance is not within specification. See HIGH TENSION WIRE RESISTANCE table. If resistance is within specification, proceed to step 5).

HIGH TENSION WIRE RESISTANCE

Application	Maximum Ohms
All Models	25,000 Per Wire

5) Check voltage at ignition coil and ignitor. Turn ignition on. Ensure voltage exists at ignition coil positive terminal. If voltage exists, proceed to step 6). If voltage does not exist, check wiring between ignition switch, ignition coil and ignitor. Refer to the L - WIRING DIAGRAMS article for wiring circuit.
6) Check ignition coil resistance. See IGNITION COIL RESISTANCE under IGNITION CHECKS. Replace ignition coil if resistance is not within specification. If ignition coil resistance is within specification, proceed to step 7).
7) Check pick-up coil resistance. See PICK-UP COIL RESISTANCE under IGNITION CHECKS. Replace pick-up coil or distributor assembly if pick-up coil resistance is not within specification. If pick-up coil resistance is within specification, proceed to step 8).
8) Check pick-up coil air gap. See PICK-UP COIL AIR GAP under IGNITION CHECKS. If pick-up coil air gap is incorrect, replace

distributor assembly. If air gap is correct, proceed to step 9).

9) Check ignition IGT signal from ECU. See appropriate DIAGNOSTIC TROUBLE CODE 14 chart in the G - TESTS W/CODES article. If IGT signal is okay, replace ignitor.

IGNITION COIL RESISTANCE

- 1) Disconnect wiring from ignition coil so ignition coil is isolated from system. Using ohmmeter, check primary resistance between ignition coil positive (+) and negative (-) terminals. See Figs. 5, 6 or 7.
- 2) Check secondary resistance between ignition coil positive (+) terminal and high tension wire terminal (coil wire tower). See Figs. 8, 9 or 10. Replace ignition coil if resistance is not within specification. See appropriate IGNITION COIL RESISTANCE table.

IGNITION COIL RESISTANCE (4-CYLINDER) - Ohms @ 68°F (20°C)

Application	Primary	Secondary
1.6L (4A-FE)	1.1-1.7	9000-15,000
2.0L Turbo (3S-GTE)	.30-.60	9000-15,000
2.2L (5S-FE)	.30-.60	9000-15,000

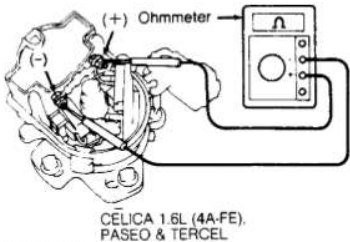


Fig. 5: Checking Ignition Coil Primary Resistance (1.6L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

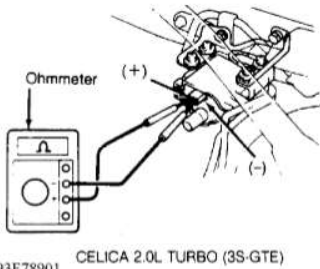
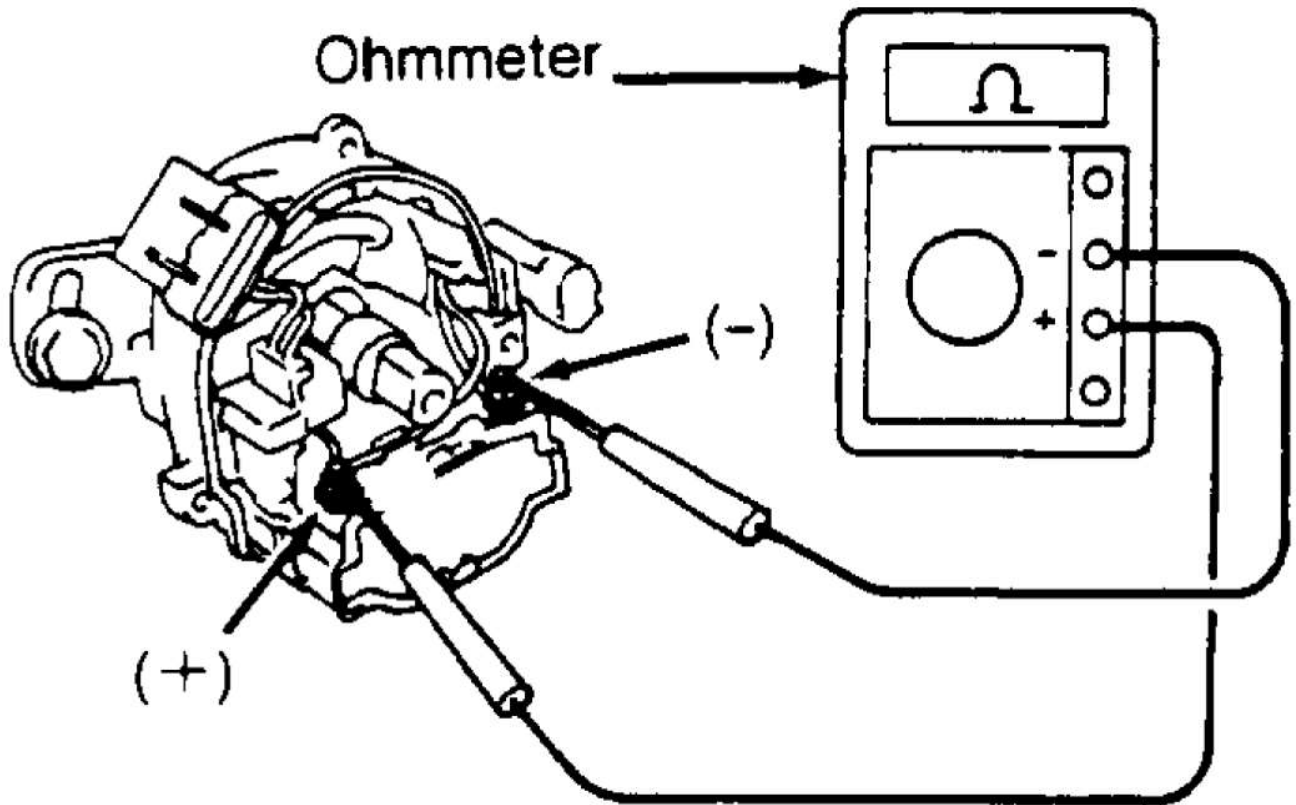


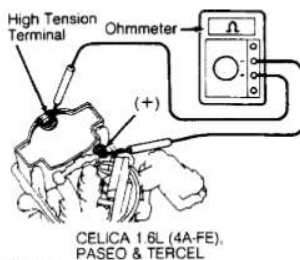
Fig. 6: Checking Ignition Coil Primary Resistance (2.0L Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



CAMRY 2.2L, CELICA 2.2L (5S-FE) & MR2 NON-TURBO

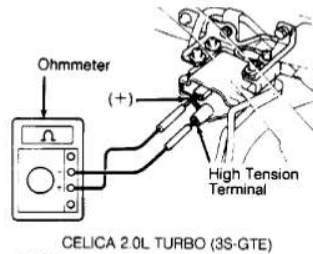
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Fig. 7: Checking Ignition Coil Primary Resistance (2.2L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



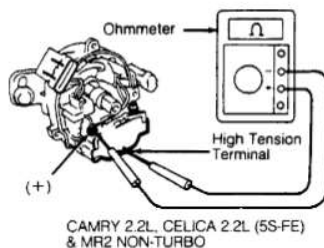
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Fig. 8: Checking Ignition Coil Secondary Resistance (1.6L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



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Fig. 9: Checking Ignition Coil Secondary Resistance (2.0L Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



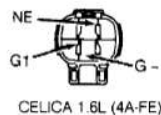
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Fig. 10: Checking Ignition Coil Secondary Resistance (2.2L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

PICK-UP COIL RESISTANCE

1) Note pick-up coil terminal identification on the distributor. See Fig. 11, 12, or 13. Using ohmmeter, measure resistance between specified terminals. See PICK-UP COIL RESISTANCE SPECIFICATIONS table.

2) Replace distributor assembly if pick-up coil resistance is not within specification.



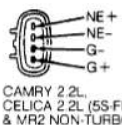
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Fig. 11: Pick-Up Coil Terminal I.D. (1.6L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



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Fig. 12: Pick-Up Coil Terminal I.D. (2.0L Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



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Fig. 13: Pick-Up Coil Terminal I.D. (2.2L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

PICK-UP COIL RESISTANCE SPECIFICATIONS

Application	Pick-Up Coil Terminals	(1) Ohms
1.6L (4A-FE)	G1 & G-	185-265
1.6L (4A-FE)	NE+ & G-	185-265
2.0L Turbo (3S-GTE)	G1 & G-	125-190
2.0L Turbo (3S-GTE)	G2 & G-	125-190
2.0L Turbo (3S-GTE)	NE & G-	155-240
2.2L (5S-FE)	G+ & G-	185-265
2.2L (5S-FE)	NE+ & NE-	370-530

(1) - With pick-up coil temperature at 14-104 °F (-10-40 °C) .

- PICK-UP COIL AIR GAP
- 1) Using a flat, non-magnetic feeler gauge, check air gap between signal rotor and pick-up coil projection. See Figs. 14, 15, or 16 for air gap measuring procedures.

2) Replace distributor assembly if pick-up coil air gap is not within specification. See PICK-UP COIL AIR GAP SPECIFICATIONS table.

PICK-UP COIL AIR GAP SPECIFICATIONS

Application	In. (mm)
All Engines	.008-.016 (.20-.40)

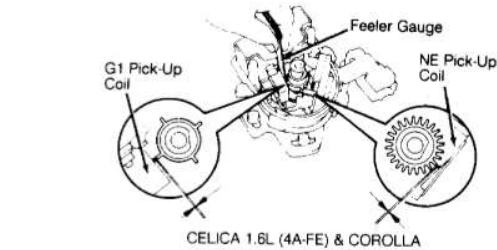


Fig. 14: Checking Pick-Up Coil Air Gap (1.6L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

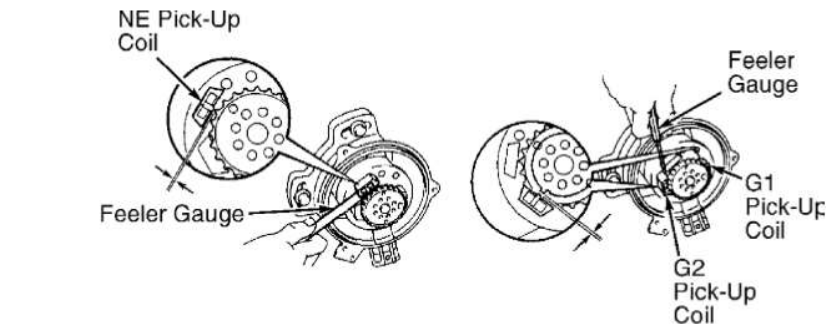


Fig. 15: Checking Pick-Up Coil Air Gap (2.0L Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

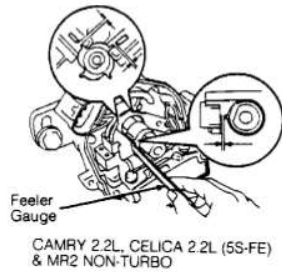


Fig. 16: Checking Pick-Up Coil Air Gap (2.2L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

IDLE SPEED & IGNITION TIMING

Ensure idle speed and ignition timing are set to specification. For adjustment procedures, refer to the appropriate D - ADJUSTMENTS - 4-CYL article in this section.

SUMMARY

If no faults were found while performing the test procedures in this article, proceed to G - TESTS W/CODES article. If no hard diagnostic trouble codes are found while performing self-diagnostics, go to the H - TESTS W/O CODES article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.) or intermittent diagnostic procedures.