ENGINE ADJUSTMENTS, TESTS AND DIAGNOSIS

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A1 — IGNITION TIMING ADJUSTMENT

STEP 1: Connect tachometer to engine. Start engine and allow to warm up to normal operating temperature.

STEP 2: Check engine curb idle speed to see that it is within specification (775 RPM ± 50, auto trans. in park). If idle speed is **not** within specification, perform "Idle Speed Control System Operation Test", item B2 in this section.

STEP 3: Disconnect vacuum hose at distributor advance and check to see there is **not** vacuum at the hose. Reconnect hose to advance unit.
If vacuum is present at hose during idle speed, diagnose malfunction in idle speed control system. (i.e., limit switch adjustment, distributor vacuum cut-off solenoid, TVS switch).

STEP 4: Connect timing light to #1 cylinder and check ignition timing. Set timing to 13° ± 2 BTDC at curb idle (775 RPM ± 50), adjust timing by loosening distributor hold-down nut and rotating distributor assembly.
Stop engine.

STEP 5: Tighten distributor hold-down nut and disconnect timing light.

A2 — IDLE SPEED ADJUSTMENT

The De Lorean is equipped with an electronic idle speed control system. This system continuously monitors engine idle RPM and electronically maintains a fixed curb idle speed. The curb idle speed is pre-determined within the factory installed ECU module and cannot be altered.

The engine should idle at 775 RPM ± 50 during normal engine operating temperature. This check is made with an external tachometer connected to the engine. If there is excessive deviation from specification, the "Idle Speed Control System Operation Test" (B2 in this section) should be performed.

A3 — CO EMISSION ADJUSTMENT

Since the De Lorean is equipped with an Idle Speed Control System, there is **no** provision to balance CO between left and right cylinder banks. This is due to the engine idle speed screw being completely closed and therefore non-functional. The **only** CO adjustment is total CO emission of left and right cylinder banks combined. This adjustment is performed with the air flow sensor adjusting screw.

ENGINE CO EMISSION CHECK:

STEP 1: Connect tachometer to engine.

STEP 2: Disconnect Lambda oxygen sensor wire from under vehicle at underbody connection located above left rear suspension. Do **not** attempt removing wire directly from oxygen sensor.

STEP 3: By-pass cooling fan temperature switch by disconnecting connectors from switch and installing a jumper wire between the terminals in the connectors. The temperature switch is located on the coolant pipe, left side of engine.

STEP 4: Remove both exhaust pipe plugs. Plugs are located in left and right exhaust pipes at exhaust manifolds.

STEP 5: Install exhaust gas probes and valve assembly, Tool No. J28886, in plug locations. Connect CO analyzer to probe and valve assembly.

STEP 6: Start engine and allow to warm up to normal operating temperature.

STEP 7: With both left and right gas probe assembly valves in the open position, read CO level. It should be 1.0% + .3% at an engine speed of 950 RPM. If not, perform "Air Flow Sensor Adjustment" (Page 120).
Note: To adjust idle speed to 950 RPM, open idle adjustment screw (slotted screw on inlet manifold).

STEP 8: Reconnect cooling fan temperature switch and Lambda oxygen sensor wire. Remove exhaust gas probe and valve assembly, and install exhaust pipe plugs. Disconnect tachometer.

STEP 9: Close idle adjustment screw.

AIR FLOW SENSOR ADJUSTMENT:

The air flow sensor is adjusted to the proper CO level at the factory. The adjustment screw access hole in the mixture control unit is sealed at the factory to prevent tampering with this setting.

If the proper CO reading could not be achieved in Step 7 of the "Engine CO Emission Check", it may be necessary to readjust the air flow sensor. Before performing this adjustment, it is important to check the following:

1) Proper procedures were followed when performing the "Engine CO Emission Check".
2) Possible intake manifold leaks causing a lean condition.
3) Possible vacuum hose or crankcase leaks causing a lean condition.
4) Refer to fuel injection "Troubleshooting Chart" (C4 in this section), and check for possible causes i.e., control pressure, cold start valve leaking, etc.

ADJUSTMENT PROCEDURE:

STEP 1: Perform Steps 1-6 of "Engine CO Emission Check".

STEP 2: Stop engine.

STEP 3: Remove air sensor adjustment access hole plug located between the fuel distributor and air flow sensor on the mixture control unit.

STEP 4: Start engine and insert 4mm allen wrench into air flow sensor adjusting access hole.

STEP 5: Adjust CO level to 1.0% ± .3% at 775 RPM ± 50.

NOTE: After each CO level adjustment, wrench must be removed and access hole covered to prevent a lelan condition during CO reading. Counterclockwise reduces total CO level and clockwise *increases* total CO level.

STEP 6: Stop engine, install new access hole plug.

STEP 7: Perform Step 8 of "Engine CO Emission Check".

B1 - LAMBDA SYSTEM OPERATION TEST

The purpose of this test is to check if the Lambda Emission Control System is working properly. This test is not intended to determine what component of the system is malfunctioning. If the vehicle fails any procedure within this test it is necessary to refer to the "Lambda Systems Diagnostic Chart," Item C3 in this section.

STEP 1: Perform procedure for "Ignition Timing Adjustment" (A-1 in this section) to check timing and curb idle speed.

STEP 2: Remove both exhaust pipe plugs. Plugs are located in left and right exhaust pipes at exhaust manifold.

STEP 3: Install exhaust gas probes and valve assembly, Tool No. 105336. in plug locations. Connect CO analyzer to probe and valve assembly. With both left and right gas probe valves in the open position read combined total CO level of right and left cylinder banks.

STEP 4: Connect dwell meter leads to diagnostic plug. The positive dwell lead is connected to the lower right corner terminal of the plug as viewed with the plug cover hinge on the right side. The negative dwell lead is connected to the terminal directly above the positive as viewed with the plug cover hinge on the right. Set the dwell meter to four (4) cylinder scale.

STEP 5: Disconnect Lambda oxygen sensor wire from under vehicle at underbody connection located above left rear suspension. **Do not** attempt removing wire directly from oxygen sensor.

STEP 6: Check for dwell reading to confirm correct hook-up and meter operation. Start engine and check pulse ratio of Lambda frequency valve by reading on dwell meter. Dwell should be steady within 40° to 50°. Record reading.

STEP 7: Check total CO reading. CO should be 1.0% ± .3% at curb idle speed (750 RPM).

STEP 8: Connect jumper wire to disconnected oxygen sensor lead which goes to ECU module. Ground jumper wire.

STEP 9: Check CO and dwell readings. The CO percentage should increase and the dwell should be steady at a minimum of 87°.

STEP 10: Apply a 1.5 volt power source (flashlight battery) to jumper wire from ECU module.

STEP 11: Check CO and dwell readings. The CO percentage should decrease and the dwell should be steady at a maximum of 20°.

STEP 12: Reconnect the Lambda oxygen sensor wire.

STEP 13: Check total CO reading. CO should drop below 1.0% and dwell reading should fluctuate between 35° to 45°.

NOTE: If CO does not drop below 1.0% raise engine speed to 1500 RPM. If CO now drops check for leaks in exhaust manifold or mixture control unit to inlet manifold gasket.

STEP 14: Depress full-throttle microswitch with finger to simulate full-throttle condition. The microswitch is located at the rear of the engine adjacent to the thermostat housing cover.

STEP 15: Check CO and dwell readings. The CO percentage should increase and the dwell should be 50° to 60°. Release microswitch.

STEP 16: Remove exhaust gas probes and valve assembly, install exhaust pipe plugs, and disconnect dwell meter.

B2 - IDLE SPEED CONTROL OPERATION TEST

The curb idle speed on the De Lorean Sports Car is non-adjustable. The speed is electronically controlled by an ECU module which is preset internally and cannot be altered. The module is also designed with a variable range fast idle circuit which is activated by a thermistor when coolant temperature is below 15°C (59°F). As the coolant temperature decreases below 15°C the fast idle speed increased proportionally to compensate for the resistance within the engine due to cold temperature.

The purpose of this test procedure is to verify that idle speed control system operates with the engine at normal operating temperature. If the vehicle experiences a problem with the fast idle circuit it is necessary to perform a temperature-resistance test on the thermistor. These specifications follow the procedure below.

STEP 1: Connect tachometer to engine.

STEP 2: Start engine and allow to warm up to normal operating temperature. Read engine idle RPM. Idle speed should be 775 RPM ± 50.

STEP 3: Remove air cleaner and disconnect wire from idle speed microswitch.

STEP 4: Read engine idle RPM. The RPM should increase. Reconnect microswitch wire.

STEP 5: Stop engine. Install air cleaner and remove tachometer.

If the vehicle failed any step in the above procedure there is a possible malfunctioning component within the system. A list of items to check are as follows:

a) #1 fuse blown.
b) Restricted air filter element.
c) Improper or no RPM pulse signal from coil terminal #1.
d) Idle adjustment screw located on inlet manifold not completely closed.
e) Vacuum leak at idle circuit by-pass pipe or hoses.
f) Idle speed regulator shorted or open.
g) Open circuit in thermister or wiring giving a fast idle condition at all engine coolant temperatures.
h) Idle speed microswitch misadjusted or internally open.
i) Throttle plates not completely closed at idle.

j) Open idle speed diode causing no electronic idle speed control operation.
k) Shorted idle speed diode causing possible internal damage to idle speed ECU module by voltage feedback from distributor vacuum cut-off solenoid.
l) Idle speed ECU module malfunctioning.
m) Malfunction in Fuel Injection or Lambda system.

C1 - IGNITION SYSTEM DIAGNOSTIC CHART
CONDITION: "ENGINE WILL NOT START"

TEST	READING	PROBABLE FAULT	CHECK AND REMEDY AS NECESSARY
1). Turn engine over with starter and check the length of spark between the high tension lead from the coil to ground.	More than 12 mm	Starter circuit and solenoid probably working o.k., may be problem in areas indicated to check.	Check 0.5 compensating resistor (resistor with single wire attached) using ohmmeter. Check ignition timing. Check for flashover in coil insulator, distributor cap, rotor, ignition leads and plugs. Check fuel injection system.
	Less than 12 mm or no spark.	Starter circuit or starter solenoid resistance.	Check that current flows to the compensating resistor (blue/yellow lead) with starter cranking. With the starter cranking the voltage between this lead and the positive battery terminal should be approximately 0 V. If not, check for excessive resistance in starter solenoid or wiring to resistor. Proceed to Test 2
2). Battery voltage **must** be greater than 11 volts. Turn ignition switch to 'Run' and measure voltage between terminal #15 on coil and ground.	0 Volts	Break in compensating resistor or open from main relay to compensating resistor.	Check compensating resistor using ohmmeter. Check that voltage is present at the white wire connected to the resistor. If not, check main relay and ignition switch wiring.
	Less than 6 Volts.	Short-circuit in primary winding of coil.	Check resistance of primary coil winding (0.95 - 1.4 Ohms)
	6-8 Volts.	Primary Coil winding and compensator resistor o.k.	Proceed to Test 3.
	8-12 Volts	Bad ground connection.	Check using ohmmeter that contact pin #31 on ignition ECU module has good ground connection.
	12 Volts	Break in primary coil winding. ECU Module not conducting.	Check resistance of primary coil winding (0.95 - 1.4 Ohms) Check for battery voltage at contact pin #15 of ignition ECU module, using voltmeter with ignition in 'Run' position.
3). Measure the voltage between terminal #1 on coil and ground.	0 Volts	Short-circuit in ECU module.	Exchange ignition ECU Module.
	0.5-2 Volts	Power Transistor in module o.k.	Proceed to test 4.
	12 Volts	ECU Module not conducting	Change ECU module. Check for faulty insulation on wire from terminal #1 on coil to terminal #16 on ECU module.

C1 - IGNITION SYSTEM DIAGNOSTIC CHART (cont.)
CONDITION: "ENGINE WILL NOT START"

TEST	READING	PROBABLE FAULT	CHECK AND REMEDY AS NECESSARY
4). Measure the resistance in the secondary coil winding.	5.5 - 8 k Ohm	O.K.	
	Appreciable deviation.	Defective secondary winding in coil.	Change coil. Proceed to test 5.
5). Connect Dwell Meter and check dwell angle.	45°±5° depending on engine RPM.	ECU Module and distributor pulse generator probably working o.k.	
	Maximum reading on scale.	Dwell meter range insufficient.	Connect a voltmeter between pins 7 and 31d of ECU module. At cranking speed (100RPM), a minimum reading of 1.0 volt A.C. should be obtained. This indicates that impulses of sufficient strength are being generated by the distributor. If there is no or low voltage, check the screened impulse cable for damage. Thereafter, check the pulse generator in the distributor with an ohmmeter (895-1285 Ohm). Check the air gap between the rotor and stator and adjust to 0.25 mm if necessary using a nonmetalic feeler gauge. If the fault persists change the pulse generator.
		The ECU module does not react to impulse changes from the pulse generator with varying engine RPM.	Change ignition ECU module.

C2 - FUEL SYSTEM DIAGNOSTIC CHART
CONDITION: "ENGINE WILL NOT START"

TEST	READING	PROBABLE FAULT	CHECK AND REMEDY AS NECESSARY
1). Turn engine over with starter and check the length of spark between the high tension lead from the coil to ground.	12 mm. More/less 12mm or no spark.	Normal Malfunction in ignition system.	Proceed to Test 2. Refer to C1 chart in this section ("Ignition System Diagnostic Chart")
2). Connect Fuel pressure gauges for primary line pressure check. Crank engine.	Pressure exists No pressure reading.	Fuel pump o.k. No voltage to fuel pump. Open fuel pump ground-inertia switch.	Proceed to test 3. Check condition and voltage at Fuse #1. Voltage should be present in 'Run' and 'Start' positions. If not, check main relay circuits. Check condition and voltage at fuse #7. Voltage should be present at all times. If not, check wiring. Check RPM relay. By-pass relay with jumper wire between terminal 87 and 30 in relay socket. If fuel pump runs, either RPM relay is defective or there is an open circuit between coil and terminal 31b on relay. With RPM relay by-passed check for voltage at black/purple wire attached to inertia switch. If none, there is an open between RPM relay and pump or pump and inertia switch. If there is voltage, by-pass inertia switch by connecting a jumper wire between the black/purple and black wires at the switch. If the pump runs, the inertia switch is open or improperly grounded.
3). Check for air flow sensor deflection during engine cranking.	Normal deflection Minimal or no deflection.	Air intake system and sensor o.k. Air intake leak. Air flow sensor binding or seized.	Proceed to test 4. Check for intake manifold leaks. Check for air leaks at vacuum hose connections, hoses between by-pass pipe and idle speed regulator, and by-pass pipe connection to take manifold. By-pass RPM relay (see test 2 above) and depress sensor plate releasing it quickly. The plate should return at once. NOTE: Injectors spray when plate is depressed, so use caution not to flood engine. The control pressure will offer some resistance when plate is depressed. Do not confuse this resistance with siezure.

C2 - FUEL SYSTEM DIAGNOSTIC CHART (cont.)
CONDITION: "ENGINE WILL NOT START"

TEST	READING	PROBABLE FAULT	CHECK AND REMEDY AS NECESSARY
4). With coolant temp. below 35°C (95°F) place cold start valve in vessel and check operation with starter motor cranking. NOTE: If engine was previously cranked, let set for 10 minutes to allow thermo-time switch heating element to cool before proceeding with test.	Valve operates for 0-7.5 seconds depending on coolant temp.	7.5 sec. at -20°C (-5°F) decreasing to 0 sec. at 35°C (95°F) - valve o.k.	Proceed to test 5.
	Valve does not operate.	Thermo-time switch to warm.	Allow thermo-time switch to cool. Coolant temp. too high.
		Electrical Malfunction.	Check for voltage at cold start valve during cranking. Check for open between cold start valve and thermo-time switch.
		Defective thermo-time switch.	Replace Switch.
		Defective cold start valve.	Replace Valve.
5). Check additional items for possible no start condition.		Spark plugs and engine fuel flooded.	Clean or replace plugs. If engine starts, check fuel injection system to eliminate reoccurance. -Cold start valve leaking. -Control plunger in fuel distributor binding. -Other mixture control unit malfunctions.
		Low engine compression.	Perform engine compression test.
		Low secondary voltage.	Perform "Ignition System Diagnosis" (C1 in this section.)
		Incorrect ignition timing.	Perform "Ignition Timing Adjustment" (A1 in this section.)
		Low primary fuel pressure.	Plugged fuel filter, ruptured accumulator, primary pressure regulator stuck open, etc.
		Control pressure out of specification.	Check and diagnose control pressure regulator

C3-LAMBDA SYSTEM TROUBLESHOOTING CHART

Allow engine to reach operating temperature, stop engine and install dwell meter to diagnostic connector.

TEST	READING	PROBABLE FAULT	CHECK AND REMEDY AS NECESSARY
1). By-pass RPM relay terminals 30 and 87b. Read dwell. Should be steady between 40°-50°.	Frequency valve audibly works and dwell within spec.	Frequency valve o.k.	Proceed to test 2.
	Frequency valve audibly works, dwell deviates from 40°-50° spec.	Dwell meter incorrectly connected.	Check meter hook-up, if o.k. proceed to test 2.
	Frequency valve audibly works, no dwell readout.	Open or short in wire from ECU terminal 17 to diagnostic connector.	Check for continuity of wire from ECU terminal 17 to diagnostic connector.
	Frequency valve does not work and dwell deviates from 40°-50° spec. or is 0°.	Defective frequency valve winding.	Check frequency valve winding resistance (2-3 Ohms).
		Open or short in Lambda system wiring harness.	Test continuity of Lambda wiring harness. If wiring is o.k. ECU module is defective.
2). Disconnect oxygen sensor wire at underbody connector. **Do Not** ground.	Dwell remains stable at 40°-50°.	None	Proceed to test 3.
	Dwell slowly moves to within 40°-50°.	Oxygen sensor defective.	Replace oxygen sensor.
	Dwell still deviates from 40°-50° spec.	Lambda thermal switch defective.	Disconnect wire at thermal switch. If dwell moves within 40°-50° switch is defective.
		Full throttle microswitch misadjusted or defective.	Move throttle to 'Full' position. If dwell does not move to 50°-60° check switch for ground **only** in 'Full' throttle position.
		Lambda ECU module defective.	Proceed to test 3.

C3 - LAMBDA SYSTEM TROUBLESHOOTING CHART (cont.)

TEST	READING	PROBABLE FAULT	CHECK AND REMEDY AS NECESSARY
3) Disconnect oxygen sensor wire at connector and ground connector lead from ECU module.	Dwell does not increase.	Open or short in wire from ECU terminal 2 to oxygen sensor connector.	Check for continuity of wire from ECU terminal 2 to oxygen sensor connector. If o.k., exchange Lambda ECU module.
	Dwell increases to a minimum of 87°.	None.	Reconnect oxygen sensor connector, dwell should return to 40°-50° steady.

C4 — TROUBLESHOOTING DIAGNOSTIC CHART

- FUEL INJECTION SYSTEM -
- LAMBDA CONTROL SYSTEM -
- IDLE SPEED CONTROL SYSTEM -

CONDITION / FAULT	ENGINE WILL NOT START WHEN COLD	ENGINE WILL NOT START WHEN HOT	POOR COLD STARTING	POOR WARM STARTING	POOR IDLING - IN WARM-UP PHASE	POOR IDLING - WHEN ENGINE IS WARM	ENGINE BACKFIRES IN INTAKE MANIFOLD	ENGINE BACKFIRES IN EXHAUST	ENGINE MISFIRES WHILE DRIVING CAR	ENGINE POWER OUTPUT INSUFFICIENT	ENGINE RUNS ON	FUEL CONSUMPTION TOO HIGH	CO% BY VOLUME AT IDLE TOO HIGH	CO% BY VOLUME AT IDLE TOO LOW
Electric fuel pump does not run	X	X												
Cold control pressure out of tolerance	X		X		X									
Warm control pressure too high		X		X		X	X		X	X				X
Warm control pressure too low		X		X		X		X		X		X	X	
Hot start relay inoperative (if equipped)			X											
Cold start valve does not open	X		X											
Cold start valve leaks			X	X	X	X		X		X	X	X	X	
Primary pressure out of tolerance									X					
Sensor plate rest position set incorrectly	X	X	X	X										
Sensor plate or control piston binding	X	X	X	X	X	X			X	X	X		X	
Leaks in air intake system	X	X	X	X	X	X	X			X				X
General fuel system leaks	X	X	X	X	X	X		X	X			X	X	
Injection valves leak				X	X	X					X			
Idle CO adjustment too rich				X		X		X		X		X	X	
Idle CO adjustment too lean				X	X	X	X			X				X
Injection valves not spraying properly					X	X			X	X				
Fuel accumulator leaks				X										
Seals in primary pressure valve or fuel pump leak				X										
Lambda E.C.U. malfunction						X						X	X	X
Lambda sensor malfunction						X						X	X	X
Lambda full-throttle micro-switch malfunction										X		X	X	
Lambda thermal switch malfunction												X	X	
Lambda frequency valve malfunction						X						X	X	X
Idle speed E.C.U. malfunction					X	X								
Idle speed regulator inoperative or sticking					X	X					X			
Idle speed throttle micro-switch malfunction					X	X								
Idle speed thermistor malfunction					X	X								