

TUNE-UP

ENGINE IDENTIFICATION

VEHICLE IDENTIFICATION NUMBER CODE

Engines may be identified by the 8th letter of Vehicle Identification Number (VIN). The VIN is located at the left front corner of instrument panel and is visible through windshield.

VIN Engine Codes

Application	Code
2.8L (173") 2-Bbl.	X
2.8L (173") 2-Bbl. High Output	Z
3.8L (229") 2-Bbl.	K
3.8L (231") 2-Bbl.	A
3.8L (231") 4-Bbl. Turbo	3
4.1L (252") 4-Bbl.	4

ENGINE IDENTIFICATION NUMBER CODE

Engine code letters are provided on all engines. The 2.8L engine code is on labels attached to both ends of left valve cover. Engine codes on 3.8L (229") engine are stamped into block in front of right cylinder head. Engine codes on 3.8L (231") and 4.1L engines are stamped on rear flange of block on left side.

TUNE-UP NOTES

NOTE — In order to comply with emission standards, specifications shown on engine compartment emission control tune-up decal must be used in all instances.

CAUTION — Before making a compression test or cranking engine with a remote starting switch, disconnect ignition switch "BATT" terminal lead at distributor.

CAUTION — Do not remove spark plug wires with engine running. H.E.I. secondary voltage is higher than standard ignition systems and may inflict harmful electrical shock.

CAUTION — Damage to H.E.I. electronic module and/or ignition coil may result if "TACH" terminal, in distributor cap connector, is directly grounded.

ENGINE COMPRESSION

Compression Ratio	
2.8L & 3.8L (229") Engines	8.6:1
3.8L (231") & 4.1L Engines	8.0:1
Recommended Fuel	Unleaded (87 AKI Minimum)
Compression Pressure	100 psi minimum
Max. Variation Between Cylinders	30%

Test compression pressure with engine at normal operating temperature, all spark plugs removed and throttle and choke valves wide open.

VALVE CLEARANCE

Hydraulic Lifters	
2.8L	1.5 turns down from zero lash
3.8L (229")	1 turn down from zero lash
3.8L (231") & 4.1L	Zero lash

VALVE ARRANGEMENT

2.8L	E-I-I-E-I-E (Left Bank — Front to Rear)	E-I-E-I-I-E (Right Bank — Front to Rear)
3.8L & 4.1L	E-I-E-I-I-E (Left Bank — Front to Rear)	E-I-I-E-I-E (Right Bank — Front to Rear)

SPARK PLUGS

Application	Gap (In.)	Torque (Ft. Lbs.)
2.8L .....	.045	7-15
3.8L (229") .....	.045	22
3.8L (231")		
2-Bbl. ....	.080	15
Turbo .....	.040	15
4.1L .....	.080	15

Spark Plug Type

Application	AC No.
2.8L	R43TS
3.8L (229")	R45TS
3.8L (231")	
2-Bbl.	R45TS8
Turbo	R45TS
4.1L	
Eldorado & Seville	R47SX
DeVille & Fleetwood	R45NSX
All Other Models	R45TS8

HIGH TENSION WIRE RESISTANCE

Carefully remove ends of wire from spark plug and distributor. Using an ohmmeter, check resistance while gently twisting wire. If resistance is not to specification, or fluctuates from infinity to any value, replace wire.

Resistance (Ohms) Per Wire

Wire Length	Resistance
Under 24"	30,000 Max.
Over 24"	50,000 Max.

DISTRIBUTOR

All models are equipped with High Energy Ignition system and no adjustment is required.

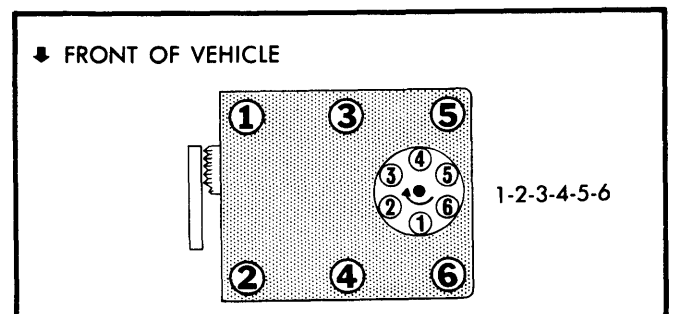


Fig. 1 2.8L Firing Order & Timing Marks

TUNE-UP (Cont.)

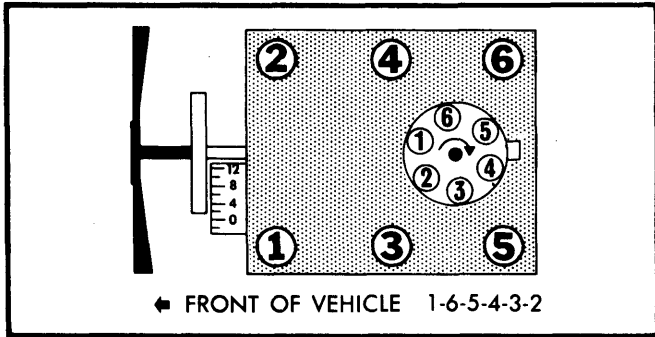


Fig. 2 3.8L (229") Firing Order & Timing Marks

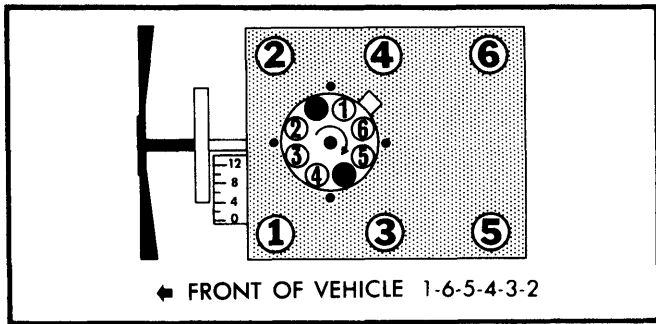


Fig. 3 3.8L (231") & 4.1L Firing Order & Timing Marks

IGNITION TIMING

NOTE — Engines are equipped with a receptacle for a magnetic probe timing light, located at 9.5° ATDC. Do not use this location for timing with a conventional light.

Check or adjust ignition timing with engine at normal operating temperature, choke off, air cleaner installed and A/C off. Disconnect and plug vacuum advance or disconnect 4-wire connector at base of distributor. On 2.8L engines, disconnect and plug EGR and canister purge hoses. After adjustment, reconnect hoses and connector at distributor.

Ignition Timing Specifications (Degrees BTDC@Idle)

Application	Man. Trans.	Auto Trans.
2.8L	6	10
3.8L (229")	6	6
3.8L (231")	15	15
4.1L	15	15

HOT (SLOW) IDLE RPM

NOTE — On most models, idle speed is controlled by the ECM and an Idle Speed Control (ISC) motor. Other models use standard solenoids to adjust idle RPM. Identify the idle speed system used on vehicle, then follow appropriate procedure for adjustment.

Idle Speed (With Solenoid) — 1) Warm engine to normal operating temperature and adjust timing. With A/C off, adjust idle speed screw to curb idle RPM.

2) Disconnect compressor clutch wire and turn A/C on. Open throttle slightly to allow plunger to extend. Turn solenoid plunger to obtain correct solenoid RPM. Reconnect compressor clutch wire.

Idle Speed (RPM)

Application	Curb Idle	Solenoid Energized
2.8L		
Man. Trans.	850	1100
Auto. Trans.		
With A/C	⓪650	850
Without A/C	⓪650 .....	.....
3.8L (231")	800 .....	.....
4.1L	550	690
⓪ — Set decals DBD and DBB to 600 RPM.		

Idle Speed (With Idle Speed Control) — 1) Idle speed is controlled by ISC and ECM. Adjustment is not normally needed.

NOTE — If idle problems are encountered, see General Motors Computer Command Control in COMPUTERIZED ENGINE CONTROLS Section.

2) If a new ISC motor has been installed, or if diagnosis indicates adjustment is needed, use the following steps to adjust high and low limits for ISC motor.

CAUTION — Do not disconnect or connect ISC connector with ignition on, or damage to ECM may result.

3) Connect tachometer to engine. Connect dwell meter to green mixture solenoid test lead near carburetor. Set dwell meter on 6-cylinder scale. With A/C off, run engine at fast idle until dwell meter begins to vary.

4) Turn ignition off and disconnect ISC connector. Connect jumper wires to pins "C" and "D" in motor side of connector. Connect pin "D" to ground and apply 12 volts to pin "C". Motor will retract. Disconnect wires as soon as motor reaches end of travel.

CAUTION — Always remove voltage when motor reaches end of travel. Do not apply voltage to pins "A" or "B" or internal switch will be damaged.

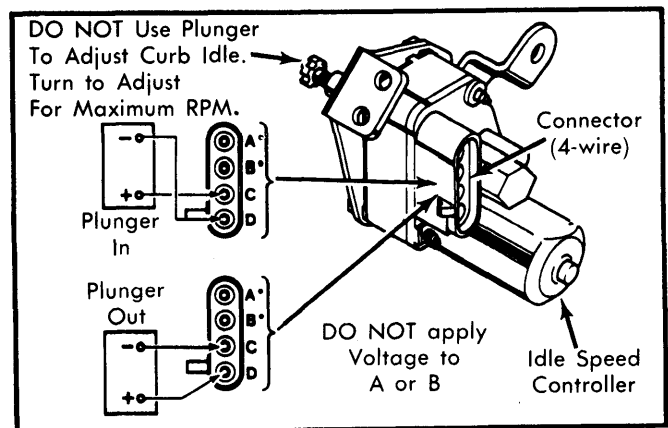


Fig. 4 Idle Speed Control Adjustment Connections

TUNE-UP (Cont.)

5) Start engine and run until dwell meter begins to vary (closed loop). Place transmission selector in "D" and adjust idle stop screw for minimum RPM.

6) Place transmission selector in "N". Apply 12 volts to pin "D" with pin "C" grounded. Plunger will extend, then remove wires. On manual transmission models, turn ISC plunger to obtain maximum RPM.

7) On automatic transmission models, adjust plunger to obtain 1500 RPM. Place transmission selector in "D", then turn plunger to set maximum RPM.

8) Apply voltage to pin "D" with pin "C" grounded. Motor should ratchet and speed should not change. Reverse connections and retract plunger. Turn off ignition, remove test equipment, and reconnect the 4-wire connector. Disconnect ECM fuse for at least 10 seconds to erase trouble codes and "Check Engine" light.

NOTE — Disconnecting battery will erase trouble codes, but will also erase memory in electronic radio, clock, trip computer, and other devices. To avoid having to reset these functions, use ECM fuse if possible.

Idle Speed Control Adjustment

Application	Minimum RPM	Maximum RPM
3.8L (229")		
Man. Trans.	600	①1500
Auto. Trans.	500	②750
3.8L (231")	450	900

① — With A/C, set to 1100 RPM.

② — With A/C, set to 800 RPM.

IDLE MIXTURE

NOTE — Idle mixture adjustment is not normally necessary. Mixture should be checked only if vehicle fails testing or carburetor has been disassembled.

MIXTURE SCREW PLUG REMOVAL

1) Remove carburetor from engine, invert carburetor and drain fuel into a container. Place carburetor on a suitable holding fixture with manifold side up.

2) Use hacksaw to make 2 small cuts below mixture plugs on bottom of throttle body. Use flat punch or chisel to break out throttle body to gain access to plugs.

3) Use a punch to drive out plug. If hardened steel plug shatters, remove loose pieces.

4) Repeat steps 2) and 3) to remove remaining plug (if equipped).

MIXTURE CONTROL ADJUSTMENT

2.8L Engine — 1) Remove carburetor and remove mixture screw plugs. Turn screws in until lightly seated, then back out 1½ turns. If plug in air horn has been removed, seat idle air bleed screw and back out 5 turns. If plug is in place, DO NOT remove.

2) Remove vent stack screen. Turn part throttle lean mixture screw in until lightly seated and back out 2½ turns. Reinstall carburetor without air cleaner.

3) Disconnect bowl vent line; disconnect and plug vacuum hose at "T" in vent line if used. Disconnect EGR valve and canister purge at carburetor and plug ports. Remove secondary vacuum break thermal vacuum switch from air cleaner, disconnect hot air valve hose from air cleaner, and plug switch. Leave all other hoses connected.

4) Connect tachometer to brown connector and dwell meter to green connector near carburetor. Set dwell meter on 6 cylinder setting. Run engine for at least 3 minutes or until dwell reading begins to vary.

5) Run engine at 3000 RPM and adjust lean mixture screw to achieve 35° dwell. Allow dwell to stabilize between adjustments. Return to idle and adjust idle speed to 700 RPM when cooling fan is off.

6) Adjust idle mixture screws to obtain dwell reading of 25°. Allow readings to stabilize between adjustments. Disconnect mixture control solenoid while cooling fan is off and check for drop of at least 50 RPM.

7) Repeat 3000 RPM check and adjustment procedure if necessary. When dwell readings are correct, reconnect system hoses, replace vent screen, and remove test equipment.

All Except 2.8L Engine — 1) Mixture control solenoid should be checked before adjustment. Stop engine and remove air cleaner. Insert thin metal scale in "D" shaped hole in air horn. Press down to determine travel of solenoid. Total movement should be between 1/16-1/8".

NOTE — If solenoid movement is not correct, see Rochester E2ME and E4ME Carburetor articles in FUEL SYSTEMS Section for adjustment procedures.

2) To adjust idle air bleed valve, set parking brake and block drive wheels. Disconnect and plug hoses as directed on Emission Control Tune-Up decal in engine compartment. Check ignition timing and adjust if necessary.

3) Connect a dwell meter to lead wire from mixture control solenoid in carburetor, then set dwell meter on 6 cylinder scale. Start engine and run at idle until normal operating temperature is reached and a varying dwell is noted on dwell meter.

NOTE — It is absolutely essential that engine is operated for a sufficient length of time to ensure the engine coolant sensor, and the oxygen sensor in the exhaust, are at full operational temperature.

4) Adjust curb idle speed (on models with ISC, do not adjust). Observe dwell reading. If dwell needle is moving, no adjustment is necessary. If needle is fixed at one point, proceed with adjustment.

5) With engine stopped, cover carburetor air intakes and vents with tape. Drill rivet heads on idle air bleed plug (above primary bores). Remove plug and blow out metal chips and rivet pieces. Start engine, run until warm, and adjust idle air bleed valve with screwdriver until dwell varies within 25-35° range.

TUNE-UP (Cont.)

CAUTION — Perform this step carefully. The idle air bleed valve is very sensitive in controlling air/fuel ratios and the valve should be turned only in 1/8 turn increments.

6) If after performing this adjustment, the dwell reading does not vary and is not within the 25-35° range, it will be necessary to remove carburetor to gain access to the plugs covering the idle mixture needles and adjust the idle mixture as follows:

7) Turn screws in until lightly seated. Back out 4 turns (E2ME) or 5 turns (E4ME). Reinstall carburetor and check dwell when engine is warm. Repeat idle air bleed adjustment if necessary.

8) If dwell is below limits, turn screws out 1/2 turn. If above limits, turn screws in. Reset idle air bleed valve to obtain correct dwell limit specifications. Reset idle speed if necessary, remove equipment, and connect hoses.

COLD (FAST) IDLE RPM

Disconnect and plug vacuum line to EGR valve. Place cam follower on high step of fast idle cam. With engine at normal operating temperature, set idle speed using fast idle screw. After adjustment, reconnect EGR valve.

IGNITION

DISTRIBUTOR

Delco-Remy — High Energy Ignition.

Application	System
2.8L	EST
3.8L (229")	EMR
3.8L (231")	
2-Bbl.	EST
Turbo	EST & ESC
4.1L	EST & ESC

IGNITION COIL

Coil Resistance (Ohms@75°F)

Application	Primary	Secondary
All Models	0.4-1.0	6000-30,000

Coil Output

At all engine speeds ①25-35 KV Minimum

① — Replace if below 25 KV.

CARBURETION

CARBURETORS

Application	Model
2.8L	Rochester E2SE
3.8L (229")	Rochester E2ME
3.8L (231") 2-Bbl.	Rochester E2ME
3.8L (231") Turbo	Rochester E4ME
4.1L	Rochester E4ME

Fast Idle (RPM)

Application	Man. Trans.	Auto. Trans.
2.8L		
With A/C	2600	①2400
Without A/C	2400	①2400
3.8L (229")	2200	2200
3.8L (231")	2200	②1800
4.1L		2200

① — Set decals DBD and DBB to 2600 RPM.

② — Set Turbo to 2200 RPM.

AUTOMATIC CHOKE

The choke cover is riveted on in a fixed position on all carburetors and no adjustment is necessary or possible.

FUEL PUMP

Make all tests at slow idle speed. For models with fuel return line, pinch off return line. For vacuum test, connect vacuum gauge to inlet side of pump.

Pressure	
2.8L	6.0-7.5 psi
All Other Engines	4.5-6.5 psi
Vacuum	Minimum 15 in. Hg
Volume	1 pint in 30 sec.

EXHAUST EMISSION SYSTEMS

See EXHAUST EMISSION SYSTEMS section.

GENERAL SERVICING

Other Data & Specifications — See *Tune-Up and Rochester Carburetors* in FUEL SYSTEMS Section.

ELECTRICAL

BATTERY

Application	Cold Crank Amps @ 0°F	Reserve Capacity Minutes
Standard		
Citation, Omega, Phoenix, Skylark, Firebird,		
Grand Prix, Lemans	315	75
Bonneville, Catalina	370	80
All Other Models	350	90
Optional		
Firebird, Grand Prix		
LeMans	370	80
Toronado	550	135
All Other Models	465	115

STARTER

Delco-Remy solenoid actuated with overrunning clutch.

Starter Specifications

Application	Volts	Amps	Test RPM
4.1L	9	65-95	7500-10,500
All Other Models.....	9	60-85	6800-10,300

GENERAL SERVICING (Cont.)

ALTERNATOR

Application	Standard Amps.	Optional Amps.
2.8L	42	63, 70
3.8L (229")	37	55, 63, 70
3.8L (231")	42, 55	55, 63, 70, 85
4.1L		
Cadillac	80	100
All Other Models	70	85

ALTERNATOR REGULATOR

Delco-Remy nonadjustable, integral with alternator.
 Operating Voltage (At 85°F) 13.8-14.8

OIL & FUEL CAPACITIES

Application	Quantity
Crankcase (Including filter)	
2.8L	4.0 qts.
3.8L (229")	4.0 qts.
3.8L (231")	4.5 qts.
4.1L	5.0 qts.
Fuel Tank	
Citation, Omega, Phoenix, Skylark	14.0 gals.
Camaro, Firebird	20.8 gals.
Eldorado, Riviera, Seville, Toronado	21.1 gals.
Century, Cutlass, Grand Prix, LeMans, Malibu, Monte Carlo, Regal	18.1 gals.
El Camino	
Standard	17.5 gals.
Optional	22.5 gals.
All Other Models	
Station Wagon	22.0 gals.
Exc. Station Wagon	25.0 gals.

BELT ADJUSTMENT

Tension (Lbs.) Using Strand Tension Gauge

Application	New	Used
2.8L		
Air Pump	100	45
All Other Belts	135	65-80
All Other Engines		
Air Pump	80	45
Alternator	145	70
A/C & Pwr. Str.	170	90

TRANSMISSION & DIFFERENTIAL CAPACITIES

Application	Quantity
Man. Trans. (SAE 80W-90)	3.5 pts.
Man. Transaxle (Dexron II)	3.0 qts.
Auto. Trans. (Dexron II)	
200C	7.0 pts.
200-4R	7.0 pts.
250C	8.0 pts.
350C	6.3 pts.
Auto. Transaxle (Dexron II)	
125	5.0 pts.
325	10.0 pts.
Rear Axles (SAE 80W-90)	
7.5"	3.5 pts.
8.5" & 8.75"	4.3 pts.
Final Drive (SAE 80W-90)	3.3 pts.

COOLING CAPACITIES

Application	Quantity
2.8L	11.5 qts.
3.8L (229")	
Malibu, Monte Carlo, El Camino	18.5 qts.
Camaro, Caprice, Impala	14.5 qts.
3.8L (231")	
Camaro, Caprice, Firebird, Impala	12.0 qts.
Malibu, Monte Carlo, El Camino	15.5 qts.
All Other Models	13.0 qts.
4.1L	
Cadillac, Oldsmobile	13.0 qts.
All Other Models	18.2 qts.

REPLACEMENT INTERVALS

Component	Interval (Miles)
Oil Filter	
Turbo (Every oil change)	3000
All Other Engines (Every 2nd oil change)	15,000
Air Filter	30,000
PCV Filter & Valve	30,000
Spark Plugs	30,000