# TUNE-UP

## ENGINE IDENTIFICATION

### VEHICLE IDENTIFICATION NUMBER CODE

Fifth digit of Vehicle Identification Number, located on plate attached to top left side of instrument panel, is the engine code letter.

**VIN Engine Code**

| Application | Code |
|---|---|
| 173" 2-Bbl. | 7 |
| 231" 2-Bbl. | A |
| 231" 4-Bbl. Turbo | 3 |
| 252" 4-Bbl. | 4 |

### ENGINE IDENTIFICATION NUMBER CODE

Engine codes are provided for identification of engine type, plant, and manufacture date. On 173" engines, code is on labels located on the front and rear of the left valve cover. On 231" and 252" engines, code is stamped into the left rear corner of the engine block.

### 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 connect (pink wire) from H.E.I. system.*

CAUTION — *Do not remove spark plug wires with engine running. High Energy Ignition 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 | |
| 173" 2-Bbl. | 8.6:1 |
| All Other 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 TAPPET CLEARANCE

| | |
|---|---|
| Hydraulic Lifters | |
| 173" 2-Bbl. | 1.5 turns down from zero lash |
| All Other Engines | Zero lash |

### VALVE ARRANGEMENT (EXC. 173" ENGINE)

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 | Torque Ft. Lbs. |
|---|---|---|
| 173" 2-Bbl. | .045" | 7-15 |
| 231" 2-Bbl. | .060" | 15 |
| 231" Turbo | .040" | 15 |
| 252" 4-Bbl. | .060" | 15 |

**Spark Plug Type**

| Application | AC No. |
|---|---|
| 173" 2-Bbl. | R44TS |
| 231" 2-Bbl. & 252" 4-Bbl. | R45TSX |
| 231" Turbo | R45TS |

## 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.

| Application | Resistance (Ohms) |
|---|---|
| All Models | |
| Up to 24" Long | 30,000 Max |
| Over 24" Long | 50,000 Max |

## DISTRIBUTOR

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

NOTE — *Turbocharged engines use a modified H.E.I. system which is called Electronic Spark Control (ESC). The ESC system is used to control engine detonation by automatically retarding ignition timing (up to 18° to 20°) during periods of engine operation when detonation occurs.*

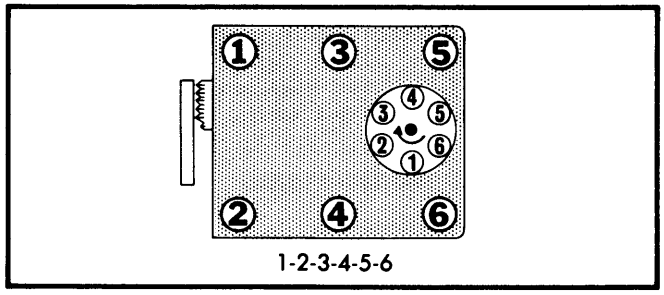


***Fig. 1 173" Firing Order and Timing Marks***

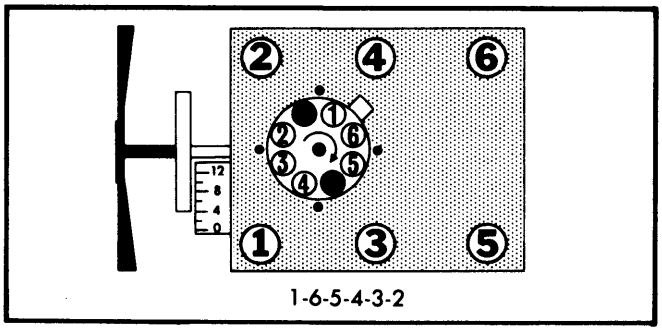


***Fig. 2 231" and 252" Firing Order and Timing Marks***

## TUNE-UP (Cont.)

### IGNITION TIMING

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

**173"** — Disconnect and plug EGR, canister purge, and distributor vacuum advance hoses. Set timing at specified idle RPM.

**All Other Engines** — Disconnect vacuum hose at distributor and plug; or remove electrical connector at base of distributor. Set timing at specified idle RPM.

**Ignition Timing Specifications (Degrees BTDC@RPM)**

| Application | Man. Trans. | Auto. Trans. |
|---|---|---|
| 173" 2-Bbl. | | |
| Federal | 2@750 | 6@700 |
| Calif. | 6@750 | 10@700 |
| 231" 2-Bbl. | 15@550 | 15@550 |
| 231" Turbo | ..... | ①15@650 |
| 252" | ..... | 15@550 |

① — Set Riviera to 15°@600 RPM

### HOT (SLOW) IDLE RPM

NOTE — *Idle speed adjustment procedures will vary with vehicle model and component application. Refer to Emission Control Tune-Up Decal in engine compartment for adjustment preparations, then proceed as follows:*

**Without A/C** — Adjust solenoid plunger to solenoid RPM. Disconnect solenoid lead and adjust curb idle with idle speed screw.

**With A/C** — Set idle speed screw to curb idle RPM. Disconnect air conditioning compressor lead at compressor and turn air conditioning on. Open throttle slightly to allow solenoid plunger to extend fully. Adjust solenoid plunger to specified RPM. Reconnect compressor and remove test equipment.

**Idle Speed (RPM)**

| Application | Curb Idle | Solenoid Energized |
|---|---|---|
| 173" 2-Bbl. | | |
| Man. Trans. | | |
| Federal | 750 | 1200 |
| Calif. | 750 | ..... |
| Auto. Trans. | | |
| Federal | 700 | 850 |
| Calif. | 700 | 800 |
| 231" 2-Bbl. | | |
| Man. Trans. | 600 | 800 |
| Auto. Trans. | | |
| Federal | 550 | 670 |
| Calif. | 550 | 620 |
| 231" Turbo | | |
| Riviera | 600 | 650 |
| All Other Engines | 650 | ..... |
| 252" 4-Bbl. | 550 | 680 |

### IDLE MIXTURE

NOTE — *Idle mixture screws on all carburetors are covered by hardened steel plugs. Mixture adjustment is not part of a normal tune-up and should be performed only if carburetor has been disassembled or if vehicle fails emission testing.*

#### MIXTURE SCREW PLUG REMOVAL

If plugs must be removed, perform following procedure:

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

2) Place a punch between the two locator marks on throttle body beneath mixture screw plug (manifold side) and break out throttle body to gain access to plug.

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

4) Repeat steps **2)** and **3)** to remove remaining plug.

#### PROPANE ENRICHMENT PROCEDURE FEDERAL VEHICLES ONLY

1) With engine at normal operating temperature, choke fully open and air conditioning "OFF" (if equipped), set parking brake and block drive wheels. Disconnect and plug hoses as directed on Emission Control/Tune-Up Decal under the hood.

2) Connect tachometer to engine. Disconnect vacuum advance and set timing to specification on Emission Decal. Reconnect vacuum advance. Disconnect crankcase ventilation tube from air cleaner. Insert hose with rubber stopper tool J-26911 from propane valve into positive crankcase ventilation tube opening in air cleaner.

NOTE — *Too much propane will cause engine speed to drop.*

3) Propane cartridge must be in vertical position. Slowly open propane control valve until maximum engine speed is reached with automatic transmission in DRIVE and manual transmission in NEUTRAL.

4) Observe propane flow meter to ensure propane cartridge is full. With propane flowing, adjust idle speed screw to the "enriched RPM" (see specifications). Readjust propane flow to be certain of maximum engine speed and adjust idle speed if necessary.

5) Turn off propane. Place transmission in NEUTRAL and run at 2000 RPM for 30 seconds. Put transmission in DRIVE (manual transmission in NEUTRAL). Check idle speed. If idle speed agrees with idle speed shown on Emission Decal, idle mixture is correct. Proceed to step **8)**.

6) If idle speed is too low, use a 3/16" deep socket to back screws out 1/8 turn at a time until correct speed is reached. If

## TUNE-UP (Cont.)

speed is too high, turn mixture screws in 1/8 turn at a time until correct speed is obtained.

NOTE — *It may be necessary to remove air cleaner to reach idle mixture screws. Reinstall air cleaner to check idle speed.*

**7)** Turn propane on again to check maximum engine idle speed. If speed is different from specification, readjust idle speed screw to "enriched RPM" with propane flowing. Turn off propane, place transmission in NEUTRAL and accelerate engine to 2000 RPM for 30 seconds. Recheck idle speed. Idle speed should agree with specifications. If not, repeat procedure starting with step **6)**.

**8)** If idle is unusually rough, turn mixture screws in until lightly seated. Back screws out equally to previous position and rerun propane idle test starting with step **2)**. If idle is correct, turn engine off and remove propane tool. Connect PCV system and reconnect all other hoses.

**Propane Enrichment RPM**

| Application | Man. Trans. | Auto. Trans. |
|---|---|---|
| 173" 2-Bbl. | 825 | 725 |
| 231" 2-Bbl. | 830 | 600 |
| 231" Turbo | ..... | 715 |
| 252" 4-Bbl. | ..... | 600 |

### MIXTURE CONTROL ADJUSTMENT C-4 CALIFORNIA ONLY

**Skylark — 1)** Remove carburetor and remove idle mixture needle plugs. If plug in air horn has been removed, seat 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 seated and back out 2½ turns. Reinstall carburetor, but do not install air cleaner. Disconnect bowl vent hose and disconnect and plug vacuum line at "T" in vent line (if used).

**3)** Disconnect EGR valve and canister purge hoses and plug carburetor port. Remove secondary vacuum break TVS located in air cleaner. Disconnect hose from switch to air cleaner valve and cap open tube on switch. Leave other hoses on switch connected.

**4)** Connect dwell meter to green connector at carburetor and tachometer to brown connector. Set dwell meter at 6 cylinder position. Start engine and run on high step of fast idle cam for at least 3 minutes.

**5)** Run engine at 3000 RPM and adjust lean mixture screw carefully to obtain an average dwell reading of 35°. Back screw out to raise dwell; turn screw in to lower dwell.

**6)** Return engine to idle and adjust to 700 RPM with cooling fan off. Adjust idle mixture screw to obtain average dwell reading of 25°. Back screw out to raise dwell; turn screw in to lower dwell.

**7)** Disconnect mixture control solenoid while cooling fan is off and engine at idle. Check for drop of at least 50 RPM. Repeat 3000 RPM check and adjust if necessary. Remove test equipment, connect all hoses, and replace vent stack screen.

**All Other Models — 1)** Before adjusting mixture, mixture control solenoid must be checked and adjusted if necessary. See *Rochester E2ME and E4ME Carburetor articles in FUEL SYSTEMS Section.*

**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, if necessary. With engine idling, observe dwell reading. If within, or varying between 25-35° range, no further adjustment is necessary. If dwell does not vary and/or falls outside of the 10-50° range, perform the following:

**5)** With engine off, cover air intake and vents with tape. Drill rivet from air bleed cover and remove cover. Start engine and adjust valve with screwdriver. Dwell should be as close to 30° as possible. If dwell does not vary up and down slightly, or cannot be adjusted between 25-35°, remove carburetor and idle mixture screw plugs.

**6)** Turn screws in until lightly seated, then back out 4½ turns (2-Bbl.) or 3½ turns (4-Bbl.). Reinstall carburetor, run engine until warm, and repeat adjustment procedure.

**7)** If adjustment cannot be made to 25-35° dwell, turn mixture screw out ½ turn and repeat procedure. Reset curb and fast idle, remove equipment and install hoses.

### COLD (FAST) IDLE RPM

With engine at normal operating temperature, disconnect and plug hoses at EGR valve and distributor. Position cam follower on high step of fast idle cam and adjust idle with screw.

**Fast Idle RPM**

| Application | Man. Trans. | Auto. Trans. |
|---|---|---|
| 173" 2-Bbl. | | |
| Federal | 1900 | 2000 |
| Calif. | 2000 | 2000 |
| 231" 2-Bbl. | | |
| Federal | 2200 | 2000 |
| Calif. | ..... | 2200 |
| 231" Turbo | ..... | ①2200 |
| 252" 4-Bbl. | ..... | 2000 |

① — Set California models to 2500 RPM.

### AUTOMATIC CHOKE

The choke cover is riveted on and no adjustment is possible or necessary.

# TUNE-UP (Cont.)

## FUEL PUMP

**Skyhawk** – An electric fuel pump is located in fuel tank.

**All Other Models** – Make all tests at specified RPM with fuel vapor return hose pinched off (if equipped). Connect pressure gauge to fuel line at carburetor and hold gauge at level of carburetor inlet.

| | |
|---|---|
| Pressure | |
| Skyhawk (at 12.6 volts) | 3.0-4.5 psi |
| All Others | |
| 173" 2-Bbl. | 6.0-7.5 psi |
| 231" 2-Bbl. & 252" 4-Bbl. | 3.0 psi |
| 231" Turbo | 5.0 psi |
| Volume (At Idle) | 1 pint in 30 sec. |

## EXHAUST EMISSION SYSTEMS

See EXHAUST EMISSION SYSTEMS section.

# GENERAL SERVICING

## IGNITION

### DISTRIBUTOR

Delco-Remy – High Energy Ignition.

NOTE – *Module must be replaced as a unit. A liberal coat of silicone grease MUST be applied to surface on which module will be mounted.*

### IGNITION COIL

**Resistance**

| | |
|---|---|
| Primary (At 75°F) | .4-1.0 ohms |
| Secondary (At 75°F) | 6,000-30,000 ohms |

**Coil Output**

| | |
|---|---|
| At all engine speeds | 25-35 KV Minimum① |

① – Replace if below 25 KV.

## CARBURETION

### CARBURETORS

| Application | Model |
|---|---|
| 173" 2-Bbl. | |
| Federal | Rochester 2SE |
| Calif. | Rochester E2SE |
| 231" 2-Bbl. | |
| Federal | Rochester M2ME |
| Calif. | Rochester E2ME |
| 231" 4-Bbl. Turbo | |
| Federal | Rochester M4ME |
| Calif. | Rochester E4ME |
| 252" 4-Bbl. | Rochester M4ME |

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

## ELECTRICAL

### BATTERY

12 Volt – Negative Ground.

| Application | Cold Crank (Amps @0°F) | Reserve Capacity (Minutes) |
|---|---|---|
| 173" & 252" | | |
| Standard | 350 | 80 |
| Optional | 465 | 125 |
| 231" | | |
| Standard | 275 | 60 |
| Optional | 465 | 125 |

### STARTER

Delco-Remy solenoid actuated with overrunning clutch.

| Application | Volts | Amps | Test RPM |
|---|---|---|---|
| 173" | 9 | 45-70 | 7000-11,900 |
| 231" & 252" | 9 | 60-85 | 6800-10,300 |

### ALTERNATOR

| Application | Standard (Amps.) | Optional (Amps.) |
|---|---|---|
| Skyhawk | 37 | 55,63 |
| All Others | 42 | 63, 70 |

### ALTERNATOR REGULATOR

Delco-Remy nonadjustable, integral with alternator.

## ENGINE

### INTAKE MANIFOLD TIGHTENING

Check intake manifold bolts using a criss-cross pattern and beginning with bolts nearest center. Torque all intake manifold bolts to 20-25 ft. lbs. on 173" engine, and to 45 ft. lbs. on all other engines.

## GENERAL SERVICING (Cont.)

### FILTERS & CLEANERS

| Filter or Cleaner | Service Interval (Miles) |
|---|---|
| Oil Filter | ①Replace every 2nd oil change |
| Fuel Filter | Replace every 15,000 |
| PCV Valve | Replace every 30,000 |
| PCV Filter | Replace every 30,000 |
| Air Filter | Replace every 30,000 |
| Canister Filter | Replace every 30,000 |

① — Replace every 3000 miles on Turbocharged engines.

### CAPACITIES (COOLING)

| Application | Standard (Qts.) | A/C or Opt. (Qts.) |
|---|---|---|
| Skylark | 11.5 | 11.75 |
| Skyhawk | 12.3 | 12.7 |
| Riviera | 13.7 | 14.1 |
| Century & Regal | | |
| Turbo | 13.7 | 14.0 |
| All Others | 13.3 | 13.3 |
| LeSabre | | |
| 231" | 13.4 | 13.8 |
| 252" | 13.0 | 13.0 |

### BELT ADJUSTMENT

**Tension (Lbs.) Using Strand Tension Gauge**

| Application | New | Used |
|---|---|---|
| Power Steering & A/C | 165 | 90 |
| Skyhawk AIR Pump | 80 | 50 |
| All Others | 145 | 70 |

### CAPACITIES (EXCEPT COOLING)

| Application | Quantity |
|---|---|
| Crankcase (Including filter) | |
| 173" | 4.0 qts. |
| All Others | 5.0 qts. |
| Auto. Trans. (Dexron II) | |
| THM 200 | 7.0 qts. |
| THM 250C | 8.0 qts. |
| THM 350 | 6.0 qts. |
| Auto. Transaxle (Dexron II) | |
| Skylark | 8.0 qts. |
| Riviera | 10.0 qts. |
| Final Drive (SAE 80W-90) | 3.2 pts. |
| Man. Trans. (SAE 80W-90) | 3.5 pts. |
| Man. Transaxle (Dexron II) | 3.0 qts. |
| Rear Axle (SAE 80W-90) | |
| 7½" Ring Gear | 3.5 pts. |
| 8½" Ring Gear | 4.25 pts. |
| 8¾" Ring Gear | 5.4 pts. |
| Fuel Tank | |
| Skylark | 14.0 gals. |
| Skyhawk | 18.5 gals. |
| Riviera | 20.0 gals. |
| Regal & Century | 18.1 gals. |
| LeSabre | |
| Wagon | 22.0 gals. |
| All Other | 25.0 gals. |