# 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 Code**

| Application | Code |
|---|---|
| 173" 2-Bbl. | 7 |
| 229" 2-Bbl. | K |
| 231" 2-Bbl. | A |
| 231" 4-Bbl. Turbo | 3 |

### ENGINE IDENTIFICATION NUMBER CODE

Engine code letters are provided on all engines. The 173" engine code is located on labels on both ends of the left valve cover. Engine codes on the 229" engine are stamped into the block above the water pump on the right side. Engine codes on the 231" engine are stamped into the block on the left rear corner near the bellhousing.

### 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 | |
| 173" 2-Bbl. | 8.6:1 |
| 229" 2-Bbl. | 8.6:1 |
| 231" 2-Bbl. | 8.0:1 |
| 231" 4-Bbl. | 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 |
| 229" 2-Bbl. | One turn down from zero lash |
| 231" 2-Bbl. and 4-Bbl. | Zero lash |

### VALVE ARRANGEMENT

173"
E-I-I-E-I-E (Left Bank — Front to Rear)
E-I-E-I-I-E (Right Bank — Front to Rear)
229" & 231"
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 |
|---|---|---|
| 173" 2-Bbl. | .045" | 7-15 ft. lbs. |
| 229" 2-Bbl. | .045" | 22 ft. lbs. |
| 231" 2-Bbl. and 4-Bbl. | .060" | 15 ft. lbs. |

**Spark Plug Type**

| Application | AC No. |
|---|---|
| 173" 2-Bbl. | R44TS |
| 229" 2-Bbl. | R45TS |
| 231" 2-Bbl. and 4-Bbl. | R45TSX |

## 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.

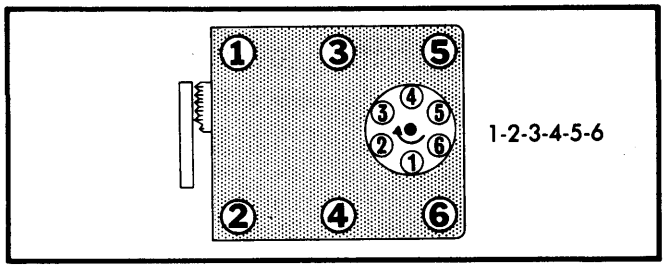


*Fig. 1 173" Firing Order and Timing Marks*

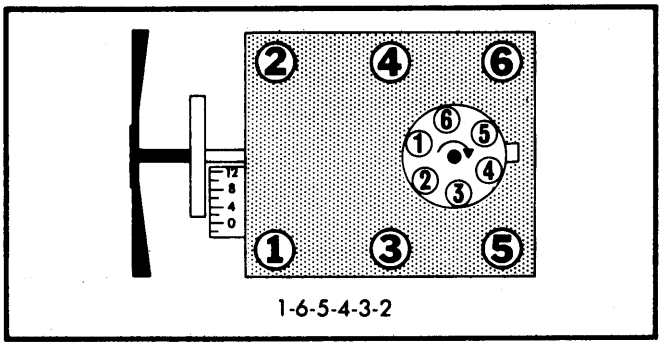


*Fig. 2 229" Firing Order and Timing Marks*

## TUNE-UP (Cont.)

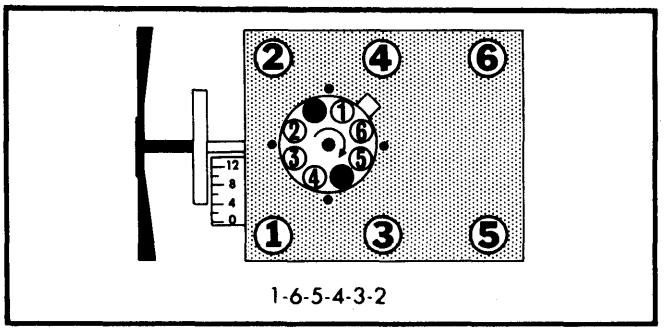


*Fig. 3 231" Firing Order and Timing Marks*

### 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 fully open, air cleaner installed and air conditioning "OFF". Disconnect and plug distributor vacuum advance or disconnect electrical connector at base of distributor housing. On 173" engines, also disconnect and plug EGR and canister purge hoses.

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

| Application | Man. Trans. | Auto. Trans. |
|---|---|---|
| 173" 2-Bbl. | | |
| Federal | 2@750 | 6@700 |
| Calif. | 6@750 | 10@700 |
| 229" 2-Bbl. | 8@700 | 12@600 |
| 231" 2-Bbl. | 15@550 | 15@550 |
| 231" 4-Bbl. | ..... | 15@650 |

### 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. | | |
| Fed. | 750 | 1200 |
| Cal. | 750 | ..... |
| Auto. Trans. | | |
| Fed. | 700 | 850 |
| Cal. | 700 | 800 |
| 229" 2-Bbl. | | |
| Man. Trans. | 700 | 800 |
| Auto. Trans. | 600 | 675 |
| 231" 2-Bbl. | | |
| Fed. | 560 | 670 |
| Calif. | 600 | ..... |
| 231" 4-Bbl. | | |
| Fed. | 550 | ..... |
| Calif. | 600 | ..... |

### IDLE MIXTURE

NOTE – *Idle mixture screws on all carburetors are covered with hardened steel plugs. Mixture adjustment is not part of a tune-up and is necessary only when carburetor has been disassembled or vehicle failed emission testing.*

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

**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).

#### 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.

**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.

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

## TUNE-UP (Cont.)

4) Check propane bottle and flow meter to be sure bottle is full. Continue with adjustment procedures for vehicle as specified below:

**Citation Only** – 1) Adjust idle speed screw to enriched RPM. Check propane flow and adjust enriched RPM again if necessary. Turn off propane, place in Neutral, and run engine at 2000 RPM for 30 seconds.

2) Return engine to idle. If idle speed is correct, procedure is complete. If not, remove mixture screw plugs. Turn screws out 1/8 turn at a time to raise RPM, or in 1/8 turn at a time to lower RPM to idle speed.

3) Turn on propane again to check enriched RPM. If necessary, use idle speed screw to adjust. Turn off propane, run engine at 2000 RPM for 30 seconds, and recheck idle speed.

4) If idle is correct, remove propane and test equipment. If not correct, turn mixture screws in until seated. Back screws out to previous position and repeat adjustment procedure.

**All Except Citation** – 1) If enriched RPM is at specification, mixture is correct. If not, remove mixture screw plugs. Turn screws in until seated, then back out equally so engine will just run.

2) Place in Drive or Neutral and turn screws out 1/8 turn at a time until maximum RPM is attained. Turn idle speed screw to set enriched idle RPM to specification.

3) Turn mixture screws in 1/8 turn at a time until engine is at curb idle speed. Recheck enriched RPM again with propane. If enriched RPM is correct, remove equipment and set fast idle. If not, repeat propane enrichment procedure.

**Propane Enrichment RPM**

| Application | Man. Trans. | Auto. Trans. |
|---|---|---|
| 173" 2-Bbl. | 825 | 725 |
| 229" 2-Bbl. | 850-900 | 630-650 |
| 231" 2-Bbl. | 830 | 600 |
| 231" 4-Bbl. | ..... | 600 |

### MIXTURE CONTROL ADJUSTMENT – C-4 SYSTEM

NOTE – *The following procedures should be followed carefully. The C-4 system is sensitive to adjustment and must be properly set to maintain precise control of carburetor air/fuel mixture.*

**Citation Only** – 1) Remove carburetor and remove mixture needle plugs. Turn screws in until lightly seated and back out 1 1/2 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 2 1/2 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 Citation** – 1) Mixture control solenoid must be checked before proceeding with adjustment. 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 the 10-50° range, perform the following:

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

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 nesessary 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 2 turns (E4ME) or 4 1/2 turns (E2ME). Reinstall carburetor and check dwell when engine is warm. Repeat idle air bleed adjustment if necessary.

## TUNE-UP (Cont.)

8) If dwell is below limits, turn screws out ½ 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

With engine at normal operating temperature, disconnect and plug vacuum lines at distributor and EGR valve. Position cam follower on high step of fast idle cam and adjust screw to obtain specified RPM.

**Fast Idle (RPM)**

| Application | Man. Trans. | Auto. Trans. |
|---|---|---|
| 173" 2-Bbl. | | |
| Federal | 1900 | 2250 |
| Calif. | 2000 | 2000 |
| 229" 2-Bbl. | 1300 | 1750 |
| 231" 2-Bbl. & 4-Bbl. | 2200 | 2200 |

### AUTOMATIC CHOKE

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

### FUEL PUMP

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

**All Others** – Make all tests at idle speed. For pressure test, pinch off fuel return line (if equipped).

| | |
|---|---|
| Pressure | |
| 173" 2-Bbl. | 6.0-7.5 psi |
| All Other Engines | 4.5-6.0 psi |
| Volume | |
| All Engines | 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) | 6000-30,000 ohms |

**Coil Output**

| | |
|---|---|
| At all engine speeds | ①25-35 KV Minimum |

① – Replace if below 25 KV.

### CARBURETION

#### CARBURETORS

| Application | Model |
|---|---|
| 173" 2-Bbl. | |
| Federal | Rochester 2SE |
| Calif. | Rochester E2SE |
| 229" 2-Bbl. & 231" 2-Bbl. | |
| Federal | Rochester M2ME |
| Calif. | Rochester E2ME |
| 231" 4-Bbl. | |
| Federal | Rochester M4ME |
| Calif. | Rochester E4ME |

**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 |
|---|---|---|
| Standard | 350 | 80 |
| With A/C or Defogger | 430 | 100 |
| Optional | 465 | 125 |

#### STARTER

Delco-Remy solenoid actuated with overrunning clutch.

| Application | Volts | Amps | Test RPM |
|---|---|---|---|
| 173" | 9 | 45-70 | 7000-11,900 |
| 229" | 10.6 | 50-80 | 7500-11,400 |
| 231" | 9 | 60-85 | 6800-10,300 |

#### ALTERNATOR

| Application | Standard Amps. | Optional Amps. |
|---|---|---|
| 173" | 42 | 63, 70 |
| 229" | 37 | 55, 63, 70 |
| 231" 2-Bbl. | 42 | 55, 63, 70 |
| 231" 4-Bbl. | 55 | 63, 70 |

## GENERAL SERVICING (Cont.)

### ALTERNATOR REGULATOR

Delco-Remy nonadjustable, integral with alternator.

Operating Voltage (At 85°F) ..... 13.8-14.8

## ENGINE

### INTAKE MANIFOLD TIGHTENING

Tighten intake manifold bolts alternately, starting in center of manifold and working toward ends. On 173" engines, tighten bolts to 20-25 ft. lbs. On 229" engines, tighten bolts to 30 ft. lbs. On 231" engines, tighten bolts to 45 ft. lbs.

### BELT ADJUSTMENT

Tension (Lbs.) Using Strand Tension Gauge

| Application | New | Used |
|---|---|---|
| 173" | | |
| Air Conditioning | 145-155 | 75-85 |
| All Other Belts | 130-140 | 50-60 |
| 229" | | |
| Air Conditioning | 135-145 | 85-95 |
| All Other Belts | 120-130 | 70-80 |
| 231" | | |
| Alternator | 145 | 80 |
| Monza A.I.R. Pump | 80 | 55 |
| All Other Belts | 165 | 100 |

### FILTERS & CLEANERS

| Filter or Cleaner | Service Interval (In Miles) |
|---|---|
| Oil Filter | |
| 231" Turbo | Replace every 3000 |
| All Other Engines | Replace every 2nd oil change |
| Air Cleaner | Replace every 30,000 |
| Fuel Filter | Replace every 15,000 |
| PCV Valve & Filter | Replace every 30,000 |
| Vapor Canister Filter | Replace every 30,000 |

### CAPACITIES

| Application | Quantity |
|---|---|
| Crankcase | ①4.0 qts. |
| Cooling System | |
| 173" | |
| Standard | 11.5 qts. |
| With A/C | 11.75 qts. |
| 229" | |
| Chevrolet | 14.25 qts. |
| Camaro | 14.5 qts. |
| All Other Models | 18.5 qts. |
| 231" | |
| Chevrolet | 11.75 qts. |
| Monza | 12.0 qts. |
| All Other Models | 15.5 qts. |
| Auto. Trans. (Dexron II) | ②7.0 pts. |
| Auto. Transaxle (Dexron II) | ②8.0 pts. |
| Man. Trans. (SAE 80W-90) | 3.5 pts. |
| Man. Transaxle (Dexron II) | 6.0 pts. |
| Rear Axle (SAE 80W-90) | |
| 7.5" Ring Gear | 3.5 pts. |
| 8.5" Ring Gear | 4.25 pts. |
| 8.75" Ring Gear | 4.25 pts. |
| Fuel Tank | |
| Monza | 18.5 gals. |
| Chevrolet | |
| Sedan and Hardtop | 25.0 gals. |
| Station Wagon | 22.0 gals. |
| Camaro | 20.8 gals. |
| Malibu & Monte Carlo | 18.1 gals. |
| El Camino | |
| Standard | 17.7 gals. |
| Optional | 22.0 gals. |
| Citation | 14.0 gals. |

① — With or without oil filter change.
② — Drain and refill capacity.