TUNE-UP

ENGINE IDENTIFICATION

VEHICLE IDENTIFICATION NUMBER CODE

Eighth digit of Vehicle Identification Number is used to identify engine size. VIN is located on top left side of dashboard on all vehicles.

VIN Engine Code

Application	Code
1.6L (98") 2-Bbl.	C
1.8L (112") 2-Bbl.	G
1.8L (112") TBI OHC-Engine	O
2.0L (122") 2-Bbl.	B
2.5L (151") TBI	R, 2

ENGINE IDENTIFICATION NUMBER CODE

Engine code is stamped on the lower right side of block on 1.6L engines. 1.8L 2-Bbl. and 2.0L engines have a code stamped on the top of the water pump. 1.8L TBI OHC-engine has the code stamped on the transmission mounting flange on the left side of the engine. Code is stamped in the front of the block above the water pump on 2.5L engines.

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.*

NOTE – *The 1.6L engine is supplied with 2 different emission control systems. "System A" applies to all Federal models (except 5-speed). "System B" applies to all other models.*

CAUTION – *Before making compression test, or cranking engine with a remote starter switch, disconnect ignition switch connector (pink wire) from H.E.I. system.*

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 the H.E.I. electronic module and/or coil may result if "TACH" terminal is directly grounded.*

ENGINE COMPRESSION

Compression Ratio	
1.6L	9.2:1
1.8L	9.0:1
2.0L	9.0:1
2.5L	8.2:1
Compression Pressure	
1.6L	145 psi
1.8L & 2.0L	100 psi (Minimum)
2.5L	140 psi
Max. Variation Between Cylinders	
1.6L, 2.5L	20 psi
All Others	30%

Test compression pressure with engine at normal operating temperature, all spark plugs removed and throttle and choke valves wide open. Crank engine through 6 compression strokes to make compression reading.

VALVE CLEARANCE

Hydraulic Lifters	
1.6L & 2.5L	Zero Lash
1.8L & 2.0L	1½ Turns Past Zero Lash
1.8L OHC	Automatic Compensation

VALVE ARRANGEMENT

1.6L
I-E-I-E-I-E-I-E (Front-to-rear)
1.8L & 2.0L
E-I-I-E-E-I-I-E (Front-to-Rear)
1.8L OHC
E-I-E-I-E-I-E-I (Front-to-Rear)
2.5L
I-E-I-E-E-I-E-I (Front-to-rear)

SPARK PLUGS

Application	Gap (In.)	Torque Ft. Lbs. (N·m)
1.6L	.035	22 (30)
1.8L	.045	25 (34)
1.8L OHC	.060	20 (27)
2.0L	.045	25 (34)
2.5L	.060	15 (20)

Spark Plug Type

Application	AC No.
1.6L, 1.8L, 2.0L	R42TS
1.8L OHC	R42XLS6
2.5L	R44TSX

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)

Wire Length	Resistance
0-24"	30,000 Max.
Over 24"	50,000 Max.

DISTRIBUTOR

All engines except 1.6L System A use the Electronic Spark Timing (EST) High Energy Ignition (HEI) distributor. This distributor uses a 7-terminal HEI module and does not have vacuum or mechanical advance. The 1.6L System A engine uses a conventional HEI distributor with vacuum and mechanical advance.

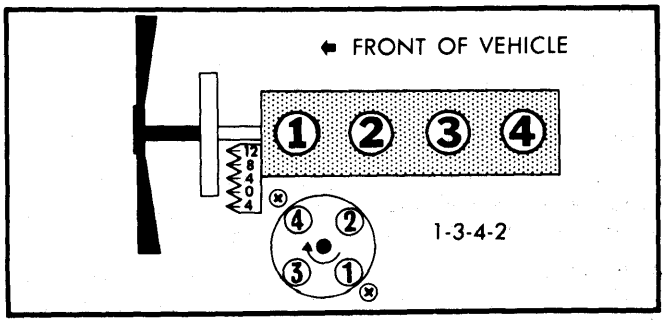

Fig. 1 1.6L Firing Order & Timing Marks

TUNE-UP (Cont.)

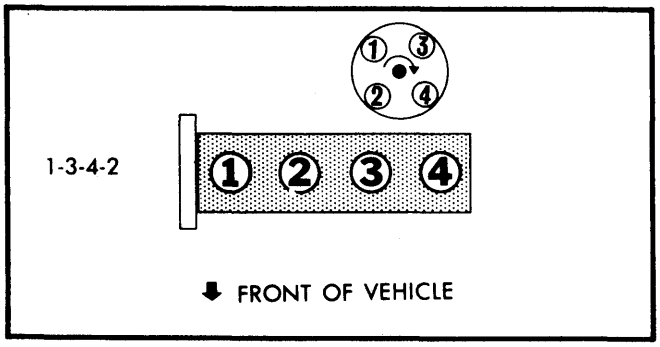

Fig. 2 1.8L, 1.8L OHC & 2.0L Engine Firing Order

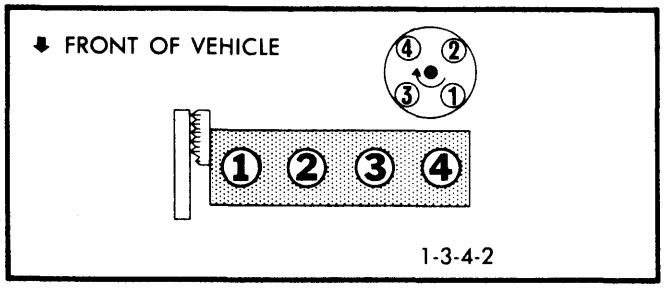

Fig. 3 2.5L Firing Order & Timing Marks

IGNITION TIMING

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

1.6L (SYSTEM "B" ONLY) & 2.5L – 1) Set parking brake and block drive wheels. Start and run engine until it reaches normal operating temperature. Ensure that A/C and electric cooling fan are off. Place manual transmission in Neutral and automatic transmission in "D".

2) Verify that "CHECK ENGINE" light is not on. Disconnect 4 wire connector at distributor or ground "A" to "B" at ALDL. "CHECK ENGINE" light should now be on. Set ignition timing with engine running at specified idle speed.

3) Reconnect 4 wire connector at distributor. If "CHECK ENGINE" light remains on, clear trouble codes from memory by removing ECM fuse from fuse block for 10 seconds.

NOTE – *Timing procedure and specifications for 1.6L System "A" are not available from the manufacturer. See Emission Control Decal for latest certified specifications and procedure.*

1.8L 2-Bbl. & 2.0L Only – 1) Ignition timing on these 2 engines is accomplished using an averaging method that checks timing on all 4 cylinders at once. The COIL wire, instead of the number 1 spark plug wire, is used to trigger the timing light.

2) With engine at normal operating temperature, connect an inductive timing light to the COIL wire (slide plastic cover back to gain access to coil wire). Disconnect 4-terminal connector from base of distributor.

3) Start engine and aim timing light at timing tab. Timing is correct when the total apparent notch width is centered about the specified degree mark on the timing tab.

4) If timing is to specifications, stop engine and remove timing light. If timing is not to specifications, loosen distributor hold down clamp and rotate distributor until total apparent notch width is centered about specified degree mark.

1.8L OHC ONLY – 1) Set parking brake and block drive wheels. Start and run engine until it reaches normal operating temperature. Ensure that A/C and electric cooling fan are off. Place manual transmission in Neutral and automatic transmission in "D" unless otherwise noted on vehicle tune-up and emission label.

2) Ensure that "CHECK ENGINE" light is not lit. Ground diagnostic connector. "CHECK ENGINE" light should now be flashing on and off in diagnostic mode. Using an inductive pick-up timing light, check timing and adjust as necessary.

3) Remove ground from diagnostic connector. If "CHECK ENGINE" light remains on, clear trouble code from memory by removing ECM fuse from fuse block for 10 seconds.

Ignition Timing Specifications (Degrees BTDC@RPM)

Application	Man. Trans.	Auto. Trans.
1.6L	18@800	18@700
1.8L	12@①	12@①
1.8L OHC	8@800	8@800
2.0L	12@①	12@①
2.5L	8@1050	8@1050

① – Set timing at curb or base idle speed.

IDLE SPEED

SLOW & FAST IDLE ADJUSTMENT (1.6L ONLY)

1) Engine must be at operating temperature and in Closed Loop operation. Remove air cleaner. Disconnect and plug air cleaner vacuum line, vacuum line at EGR valve, canister purge hose and canister purge control valve hose.

2) Place throttle on high step of fast idle cam. Use fast idle speed screw to adjust for fast idle RPM. Open throttle slightly to allow engine to return to idle.

3) Adjust idle speed screw to specified idle RPM. On models with A/C, disconnect compressor clutch wire and turn A/C on. Open throttle slightly to allow solenoid plunger to extend fully. Adjust solenoid screw to obtain solenoid RPM.

4) Reconnect compressor clutch wire. Return all hoses to original locations, remove test equipment, and reinstall air cleaner.

THROTTLE POSITION SENSOR ADJUSTMENT (1.6L ONLY)

1) Disconnect electrical connector at TPS and attach a jumper wire to each of the 3 terminals of the connector. Attach opposite end of each wire to proper terminal on TPS2 Connect a digital voltmeter across Black and Dark Blue wires. Remove adjustment screw and coat threads with thread locking compound. See *Fig. 4*.

2) Turn ignition switch on, but do not start engine. Ensure A/C is off. Install adjustment screw and quickly adjust to obtain a reading of .92 volts with throttle screw on high step of fast idle cam on all Federal models (except 5-speed), or to obtain .40 volts at curb idle setting on all other models.

3) Seal adjustment screw and remove meter. Reconnect TPS connector.

TUNE-UP (Cont.)

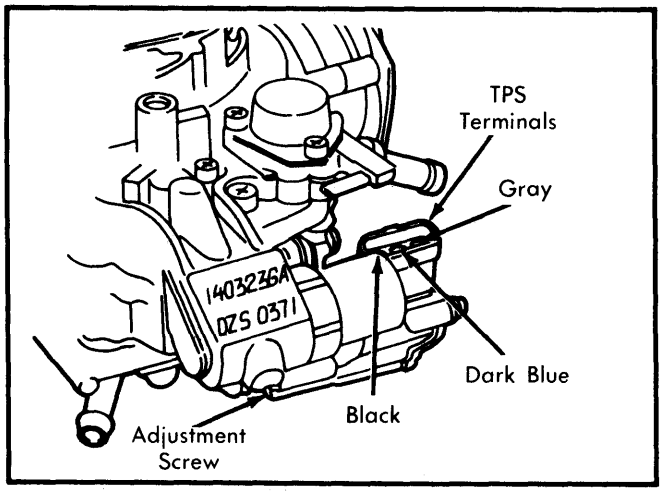

Fig. 4 TPS Adjustment Screw Location for 1.6L Engine

IDLE SPEED CONTROL (1.8L & 2.0L)

1) Engine idle speed is controlled by Idle Speed Control (ISC) motor and Electronic Control Module (ECM). Adjustment is not normally needed during routine tune-up procedures.

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, as ECM may be damaged.*

3) Connect tachometer to engine. Connect dwell meter to green mixture solenoid test lead (near carburetor). Set dwell meter to 6-cylinder scale. With A/C off, run engine until dwell meter begins to vary (closed loop operation).

4) Turn ignition off and unplug 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 as soon as motor reaches end of travel. Do not apply voltage to pins "A" or "B", as damage to internal switch will result.*

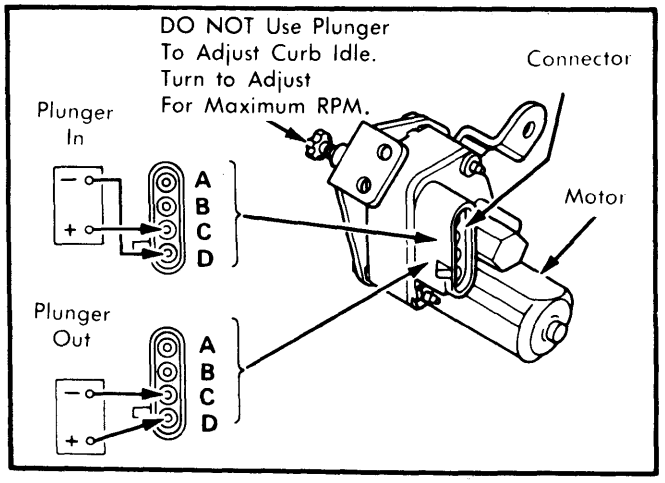

Fig. 5 Idle Speed Control Motor Connections

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

6) Place transmission in "N". Apply 12 volts to pin "D" and ground pin "C". Plunger wil extend. With plunger fully extended, turn plunger to obtain maximum RPM. Apply voltage to pin "D" and ground pin "C" to check plunger extension.

7) Turn ignition off. Disconnect jumper wires and reconnect ISC connector. Start engine and place fast idle screw on top step of fast idle cam. Adjust fast idle to specified RPM.

8) Remove test equipment. "Check Engine" light will come on to indicate adjustments have been made. Disconnect ECM fuse for at least 10 seconds to erase trouble code and light.

NOTE – *Battery cable can be disconnected to accomplish code memory erasing. However, if battery cable is disconnected, memory will be lost in electronic radio, trip computer, clock, and other devices. To avoid having to reset these items, use ECM fuse if possible.*

THROTTLE POSITION SENSOR ADJUSTMENT (1.8L & 2.0L)

1) Using a 5/64" drill bit, drill a hole in the steel plug covering TPS adjustment screw. Do not drill into adjusting screw head. Pull plug out of bore with a small slide hammer puller. *See Fig. 6.*

2) Disconnect TPS connector and attach a jumper wire to each of the 3 terminals of connector. Attach opposite end of each wire to proper terminal on TPS. Connect a digital voltmeter across center and bottom terminals of TPS.

3) Turn ignition on, but do not start engine. Adjust TPS screw to obtain .26 volts with throttle at curb idle position, A/C off and ISC retracted. Install new plug or fill hole with silicone sealer.

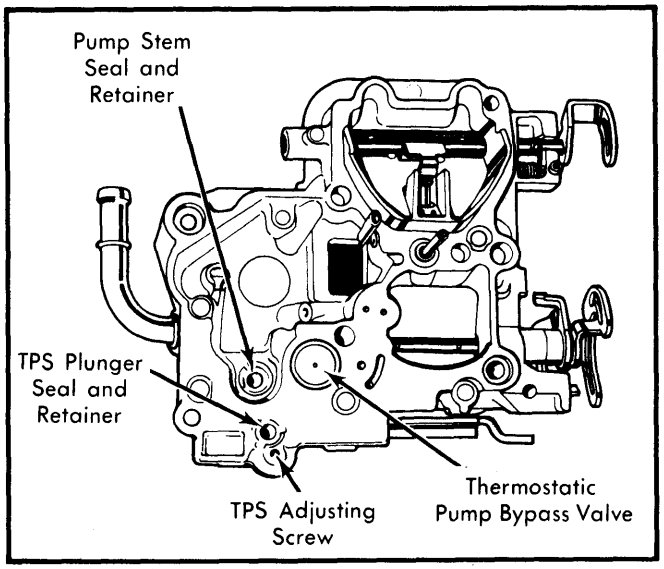

Fig. 6 TPS Adjustment Screw Location for 1.8L & 2.0L Engine

TUNE-UP (Cont.)

Idle Speed (RPM)

Application	Base Idle①	Solenoid or ISC Max. Idle②
1.6L		
Auto. Trans.	800③	1150
Man. Trans.	700	1400
1.8L & 2.0L		
Auto. Trans.		
Carb. No.④		
1600, 2300 & 2630	700	2300
1606 & 2304	830	2300
Man. Trans.		
Carb. No.④		
1601, 2301 & 2631	750	1700
1607 & 2303	700	1200
1609 & 2305	800	1700

① – Measured in "DRIVE" on auto. trans. and "NEUTRAL" on man. trans.
② – Measured in "PARK" or "NEUTRAL".
③ – Set to 700 RPM on decal code AUN.
④ – Basic part number prefix for all carburetors is 1708.

Fast Idle (RPM)

Application	①Speed
1.6L	2500
1.8L & 2.0L	
Auto. Trans.	2300
Man. Trans.	2400

① – Measured in "PARK" or "NEUTRAL".

MINIMUM AIR RATE (1.8L OHC & 2.5L ONLY)

1) This adjustment controls idle speed and is preset at the factory. Air rate should only be adjusted when throttle body parts have been replaced or when required by TPS adjustment.

2) Remove air cleaner and gasket. Plug any vacuum connections for air cleaner. Remove T.V. cable from throttle control bracket. Remove throttle stop screw plug by drilling a hole behind plug from top of stop screw bore. Insert a drift punch through hole and drive out plug.

3) Connect a tachometer to engine. Start engine and place transmission in "P" (auto.) or Neutral (man.). Allow engine RPM to stabilize. Install idle air passage plug tool (J-33047) into air passage on throttle body. Ensure that tool seats fully in passage and no air leaks out.

4) Using a number 20 Torx bit screwdriver, turn stop screw until engine RPM seats minimum air rate adjustment speed. Stop engine and remove idle air passage plug tool from throttle body. Reinstall T.V. cable. Plug stop screw bore with silicone sealer. Reinstall air cleaner and gasket.

Minimum Air Rate Adjustment Speed (RPM)

Application	Speed
1.8L OHC	
Auto. Trans.	700 ±25
Man. Trans.	800 ±25
2.5L	
Auto. Trans.	500 ±25
Auto. Trans.	775 ±25

Curb Idle (RPM)

Application	With A/C	Without A/C
1.8L OHC	800	800
2.5L		
Auto. Trans. ("D")	750	680
Man. Trans. (Neutral)	900	850

THROTTLE POSITION SENSOR ADJUSTMENT (1.8L OHC & 2.5L)

1) Disconnect electrical connector at TPS and attach a jumper wire to each of the 3 terminals of connector. Attach opposite end of jumper wire to proper terminal on TPS. Connect a digital voltmeter across terminals B and C of TPS.

2) With ignition on and engine stopped, voltage should be .795-.845 volts on 1.8L OHC and .450-.600 volts on 2.5L. Adjust TPS if necessary. Turn off ignition and remove test equipment. Reconnect TPS connector.

IDLE AIR CONTROL VALVE RESET (1.8L OHC & 2.5L)

If the idle speed remains abnormally high and will not regulate down, the idle air control valve must be reset. To reset valve, run engine until it reaches normal operating temperature and then drive vehicle at a road speed of 40 MPH for a few moments to re-establish ECM-to-IACV reference point.

IDLE MIXTURE

NOTE – *Idle mixture screws on all carburetors are covered by plugs. Mixture adjustment is not part of a normal tune-up and should not be necessary unless carburetor has been dismantled or vehicle fails emissions testing.*

IDLE MIXTURE ADJUSTMENT (1.6L ONLY)

1) Engine must be idling at operating temperature. Set parking brake, block wheels, and disconnect canister purge hose. Connect tachometer, then connect dwell meter to green test connector. Adjust idle speed and timing.

2) With transmission selector in "D", observe dwell reading (on 6-Cyl. scale). If dwell varies between 10-50°, mixture is correct. If dwell reading is not correct, proceed with adjustment procedure.

3) Remove carburetor and place upside down in a holding fixture. Break out a small piece of throttle body with a punch at locator point (under idle mixture screw). Drive out idle mixture screw plug with a punch. Remove and check idle mixture needle. Replace if necessary. If needle is in good condition, turn in until lightly seated and back out 4½ turns.

4) Reinstall carburetor without air cleaner. Start engine and idle until completely warm (dwell will begin to vary). With transmission selector in "D", slowly turn needle in or out until dwell varies within 25-35° range.

5) If dwell cannot be adjusted, carburetor must be repaired. If dwell is set correctly, check idle speed, then remove test equipment and connect hoses. Seal mixture needle with silicone sealant, then reinstall air cleaner.

IDLE MIXTURE ADJUSTMENT (1.8L & 2.0L)

NOTE – *Dwell will normally vary 5-10°. If dwell does vary, mixture adjustment is not required. If adjustment is necessary, center the dwell variation at the specified reading on dwell meter.*

TUNE-UP (Cont.)

1) Idle mixture is controlled by the ECM and is not a normal tune-up item. However, if carburetor throttle body has been replaced or diagnosis indicates mixture must be adjusted, remove carburetor.

2) Invert carburetor and make 2 small cuts with hacksaw beneath mixture plug. Break away casting with flat punch, then draw out plug with center punch. Remove needle and check for damage. If needle is in good condition, turn it in until lightly seated, then back out 4 turns.

3) If plug in air horn which covers idle air bleed has been removed, check restrictor orifice for contamination and replace plug. If plug is in place, DO NOT remove.

4) Remove vent stack screen to gain access to lean mixture screw. Turn len mixture screw in until lightly seated, then back out 2 1/2 turns.

5) Reinstall carburetor but don't install air cleaner. Disconnect bowl vent line at carburetor and disconnect and plug vacuum line to "T" in bowl vent line (if used). Disconnect EGR valve and disconnect canister purge at carburetor. Cap carburetor port. Connect tachometer to engine and dwell meter to Green connector near carburetor. Set dwell meter on 6-cylinder scale.

6) Run engine at fast idle until cooling fan begins to cycle and dwell reading varies. Run engine at 3000 RPM and adjust lean mixture screw carefully until dwell reading is 35 degrees. Return engine to idle.

7) Adjust idle mixture screw with engine idling and cooling fan off. Dwell should read 25 degrees. Turn screw in to lower dwell; out to raise dwell. Allow time for reading to stabilize after each adjustment.

8) Disconnect mixture control solenoid while cooling fan is off. Engine speed should change at least 50 RPM. If not, check for air leaks or restrictions in carburetor.

9) Run engine at 300 RPM and check for 35 degree average dwell. If dwell reading is correct, remove test equipment. Reinstall vent stack screen and reconnect all hoses. Seal mixture screw with silicone sealant.

AUTOMATIC CHOKE

The choke cover on all models is riveted on and no adjustments are necessary.

FUEL PUMP

Application①	Specification
Pressure (At Idle)	
1.6L	5.0-6.5 psi
1.8L & 2.0L	4.5 psi Minimum
2.5L	6.5-8.0 psi
Volume	
All Models	1 pint in 30 sec.

EXHAUST EMISSION SYSTEMS

See EXHAUST EMISSION SYSTEMS section.

GENERAL SERVICING

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. DO NOT apply grease to terminals of module.*

DISTRIBUTOR

1.6L System A – Delco-Remy High Energy Ignition with vacuum and mechanical advance.

All Others – Delco-Remy High Energy Ignition with Electronic Spark Timing.

IGNITION COIL

Coil Resistance (Ohms@68°F)

Application	Primary	Secondary
All Models	0.4-1.0	6000-30,000
Coil Output		
At all engine speeds	25-35 KV Minimum①	

① – Replace if below 25 KV.

CARBURETION/FUEL INJECTION

CARBURETORS

Application	Model
1.6L	Holley 6510-C
1.8L	Rochester E2SE
2.0L	Rochester E2SE

GASOLINE FUEL INJECTION

Application	Model
1.8L OHC	General Motors EFI

ELECTRICAL

BATTERY

Application	Cold Crank Amps@0°F	Reserve Capacitity Minutes
1.6L		
Man. Trans.	260	58
Auto. Trans.	315	75
1.8L & 2.0L		
Standard	315	75
Heavy Duty	440	90
1.8L OHC		
Standard	440	90
Heavy Duty	465	115
2.5L		
Standard	315	75
Heavy Duty	465	115

STARTER

Delco-Remy solenoid actuated with overrunning clutch.

GENERAL SERVICING (Cont.)

Starter Specifications

Application	Volts	Amps	Test RPM
1.6L	9	45-70	7,000-11,900
1.8L	9	45-75	6,500-9,700
1.8L OHC	9	55-85	6,000-12,000
2.0L	9	45-70	7,000-11,900
2.5L	9	85	6,800-10,300

ALTERNATOR

Amp Output	42, 63, 70, 85
Field Current Draw	4-5 Amps
Model	Delco-Remy 10 SI

ALTERNATOR REGULATOR

Delco-Remy non-adjustable, integral with alternator.

Operating Voltage (At 85°F)	13.8-14.8

BELT ADJUSTMENT

Tension (Lbs.) Using Strand Tension Gauge

Application	New	Used
1.6L		
With A/C	135-145	90-100
All Others	120-130	70-80
All Other Models		
With A/C	135-165	80
All Others	120-150	50

COOLING CAPACITIES

Application	Quantity
1.6L	
With A/C	9.3 qts.
Without A/C	9.0 qts.
1.8L, 1.8L OHC & 2.0L	
Buick, Oldsmobile & Pontiac	8.0 qts.
Cadillac	
Man. Trans.	8.7 qts.
Auto. Trans.	9.3 qts.
Chevrolet	
With A/C	9.8 qts.
Without A/C	9.3 qts.
2.5L	
Camaro & Firebird	
With A/C	9.1 qts.
Without A/C	8.8 qts.
Buick	
Auto. Trans. With A/C	9.7 qts.
Auto. Trans. Without A/C	9.4 qts.
Century With Heavy Duty Cooling	12.1 qts.
All Others	
With A/C	9.8 qts.
Without A/C	9.5 qts.

REPLACEMENT INTERVALS

Component	Interval (Miles)
Oil Filter	15,000
Air Filter & PCV Filter	
Chevette & T1000	50,000
All Other Models	30,000
PCV Valve	30,000
Spark Plugs	30,000
Oxygen Sensor	30,000

OIL & FUEL CAPACITIES

Application	Quantity
Crankcase (Includes Filter)	
1.6L	4.0 qts.
1.8L & 2.0L	4.5 qts.
1.8L OHC	3.0 qts.
2.5L	3.0 qts.
Fuel Tank	
Camaro & Firebird	16.0 gals.
Chevette & T1000	12.5 gals.
Celebrity, Century, Cutlass Ciera & 6000	15.7 gals.
All Others	14.0 gals.

TRANSMISSION & DIFFERENTIAL CAPACITIES

Application	Quantity
Man. Trans. (SAE 80W-90)	
70 MM	3.4 pts.
76 MM	3.5 pts.
83 MM	3.5 pts.
Man. Transaxle (Dexron II)	①
Auto. Trans. (Dexron II)	
THM-180C	6.0 pts.
THM-200C	7.0 pts.
Auto. Transaxle (Dexron II)	8.0 pts.
Rear Axle (SAE 80W-90)	
6½" Ring Gear	1.75 pts.
7½" Ring Gear	3.5 pts.
8½" & 8¾" Ring Gear	4.25 pts.

① — Fill to bottom of fill plug hole.