GENERAL SERVICE AND DIAGNOSIS 1A

SECTION INDEX

GENERAL INFORMATION

GENERAL

This chapter contains **general** information that applies to all Jeep engines: 151 CID four-cylinder, 258 CID six-cylinder, and 360 CID eight-cylinder engines. Refer to Chapter 1B—Engines for **specific** procedures involving engine replacement, engine disassembly, internal component repair and replacement, and mechanical specifications.

The Engine Diagnosis section of this chapter presents information and procedures useful for locating problems not normally encountered during routine maintenance and tune-ups.

The Engine Tune-Up section of this chapter presents a systematic approach to the performance of a complete, precision tune-up required at the interval specified in the Engine Maintenance Schedule.

Emission Control Components – Canada Light Duty Vehicles

Engine and Carb.	Vehicle	Cooling System Type	Transmission	Air Injection	Air Control Valve	Diverter Valve	Catalytic Converter	Pre-Cat Converter	EGR	EGR TVS	EGR CTO Valve Temp.	TAC Type	TAC TVS	TAC Delay Valve (R) and Check Valve	Vacuum Advance CTO Valve Temp.	Non-Linear Valve	HD Vacuum Advance CTO Valve Temp.	Vacuum Advance Delay Valve	Carb. Vent to Canister	Electric Choke	Sole-Vac Idle Control	Sole-Vac TVS	Decel Valve	Microprocessor	Vacuum Switch Assembly	Trap Door (Air Cleaner)	PCV
258 CID 2V	CJ Scrambler	STD	M	•	—	•	•	—	•	•	115°F (46°C)	V	•	•	155°F (68°C)	—	—	R •	•	•	•	•	—	—	—	•	•
		HD	M	•	—	•	•	—	•	•	115°F (46°C)	V	•	•	155°F (68°C)	—	220°F (101°C)	R •	•	•	•	•	—	—	—	•	•
		STD	A	•	—	•	•	—	•	•	115°F (46°C)	V	•	•	155°F (68°C)	•	—	R •	•	•	•	•	—	—	—	•	•
		HD	A	•	—	•	•	—	•	•	115°F (46°C)	V	•	•	155°F (68°C)	•	220°F (101°C)	R •	•	•	•	•	—	—	—	•	•
	CKE WAG TRK	STD	M A	—	—	—	—	—	•	•	115°F (46°C)	V	•	•	155°F (68°C)	—	—	R •	•	•	•	—	—	•	•	•	•

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manufactured for sale in Canada. Vehicles designated California are the only vehicles certified for sale in the state of California.

EMISSION COMPONENTS

It is frequently helpful to know at a glance the emission control-related components that are installed on a particular vehicle. This information is contained in the emission control component charts. Vehicles designated 49-State are certified for sale in all states (and Canada) except California. Vehicles designated Canadian are

NOTE: *All reference to CJ vehicles also pertains to Scrambler vehicles.*

Emission Control Components – 49-State Light Duty Vehicles

Engine and Carb.	Vehicle	Cooling System Type	Transmission	Air Injection	Air Control Valve	Diverter Valve	Catalytic Converter	EGR	EGR TVS	EGR Forward Delay Valve	EGR CTO Valve Temp.	TAC Type	TAC TVS	TAC Delay Valve (R) and Check Valve	Vacuum Advance CTO Valve Temp.	Non-Linear Valve	HD Vacuum Advance CTO Valve Temp.	Vacuum Advance Delay Valve	Carb. Vent to Canister	Electric Choke	Sole-Vac Idle Control	Throttle Solenoid	Microprocessor	Vacuum Switch Assembly	Trap Door (Air Cleaner)	PCV
151 CID 2V	CJ Scrambler	STD	M	—	—	—	•	•	•	—	100°F (38°C)	V	•	•	120°F (49°C)	—	—	DR •	•	•	—	•	—	—	—	•
		HD	M	—	—	—	•	•	•	—	100°F (38°C)	V	•	•	120°F (49°C)	—	220°F (101°C)	DR •	•	•	—	•	—	—	—	•
258 CID 2V	CJ Scrambler	STD	M	•	•	•	•	•	•	•	115°F (46°C)	V	•	•	155°F (68°C)	—	—	R •	•	•	•	—	—	—	•	•
		HD	M	•	•	•	•	•	•	•	115°F (46°C)	V	•	•	155°F (68°C)	—	220°F (101°C)	R •	•	•	•	—	—	—	•	•
		STD	A	•	•	•	•	•	•	—	115°F (46°C)	V	•	•	155°F (68°C)	•	—	R •	•	•	•	—	—	—	•	•
		HD	A	•	•	•	•	•	•	—	115°F (46°C)	V	•	•	155°F (68°C)	•	220°F (101°C)	R •	•	•	•	—	—	—	•	•
	Cherokee Wagoneer J-10 Truck	STD	M	•	•	•	•	•	•	•	115°F (46°C)	V	•	•	155°F (68°C)	—	—	R •	•	•	•	—	•	•	•	•
		HD	M	•	•	•	•	•	•	•	115°F (46°C)	V	•	•	155°F (68°C)	—	220°F (101°C)	R •	•	•	•	—	•	•	•	•
		STD	A	•	•	•	•	•	•	—	115°F (46°C)	V	•	•	155°F (68°C)	—	—	R •	•	•	•	—	•	•	•	•
		HD	A	•	•	•	•	•	•	—	115°F (46°C)	V	•	•	155°F (68°C)	—	220°F (101°C)	R •	•	•	•	—	•	•	•	•
360 CID 2V	Cherokee Wagoneer Truck 25	STD	M4	•	•	•	•	•	•	—	115°F (46°C)	V	•	•	155°F (68°C)	•	—	R •	•	•	—	—①	—	—	•	•
		HD	M4	•	•	•	•	•	•	—	115°F (46°C)	V	•	•	155°F (68°C)	•	220°F (101°C)	R •	•	•	—	—①	—	—	•	•
		STD	A	•	•	•	•	•	•	—	115°F (46°C)	V	•	•	155°F (68°C)	•	—	R •	•	•	—	•	—	—	•	•
		HD	A	•	•	•	•	•	•	—	115°F (46°C)	V	•	•	155°F (68°C)	•	220°F (101°C)	R •	•	•	—	•	—	—	•	•

Trans. — Transmission Type: Manual (M) or Automatic (A)
Cat. Conv. — Catalytic Converter
CTO — Coolant Temperature Override
EGR — Exhaust Gas Recirculation
TVS — Thermal Vacuum Switch
Delay Valve — R = Reverse Delay
— F = Forward Delay
— DR = Dual Reverse Delay

PCV — Positive Crankcase Ventilation
TAC — Thermostatically Controlled Air Cleaner (vacuum)
• — On all models in vehicle specified
STD — Standard
HD — Heavy Duty
① — Dash Pot

NOTE: All vehicles have Fuel Tank Vapor Control, Vacuum Operated TAC Systems, and PCV Valves. All temperatures are nominal.

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Emission Control Components—California Light Duty Vehicles

Engine and Carb.	Vehicle	Cooling System Type	Transmission	Air Injection	Air Switch Valve	Diverter Valve	Catalytic Converter	EGR	EGR Forward Delay Valve	EGR TVS	EGR CTO Valve Temp.	TAC Type	TAC TVS	TAC Delay Valve (R) and Check Valve	Vacuum Advance CTO Valve Temp.	HD Spark CTO Valve Temp.	Spark Delay Valve	Carb. Vent to Canister	Electric Choke	Sole-Vac Idle Control	Throttle Solenoid	Decel Valve	Microprocessor	Vacuum Switch Assembly	Trap Door (Air Cleaner)	PCV	Ignition Advance Control Solinoid
151 CID 2V	CJ-Scrambler	STD	M	—	—	—	•	•	—	•	130°F (54°C)	V	•	•	120°F (49°C)	—	DR •	•	•	—	•	•	•	•	—	•	•①
		HD	M	—	—	—	•	•	—	•	130°F (54°C)	V	•	•	120°F (49°C)	—	DR •	•	•	—	•	•	•	•	—	•	•①
		STD	A	—	—	—	•	•	—	•	130°F (54°C)	V	•	•	120°F (49°C)	—	DR •	•	•	—	•	•	•	•	—	•	—
		HD	A	—	—	—	•	•	—	•	130°F (54°C)	V	•	•	120°F (49°C)	—	DR •	•	•	—	•	•	•	•	—	•	—
258 CID 2V	CJ-Scrambler	STD	M	•	•	•	•	•	•	•	115°F (46°C)	V	•	•	130°F (54°C)	—	R •	•	•	•	—	—	•	•	•	•	—
		HD	M	•	•	•	•	•	•	•	115°F (46°C)	V	•	•	130°F (54°C)	220°F (105°C)	R •	•	•	•	—	—	•	•	•	•	—
		STD	A	•	•	•	•	•	—	•	115°F (46°C)	V	•	•	130°F (54°C)	—	R •	•	•	•	—	—	•	•	•	•	—
		HD	A	•	•	•	•	•	—	•	115°F (46°C)	V	•	•	130°F (54°C)	220°F (105°C)	R •	•	•	•	—	—	•	•	•	•	—
	Cherokee Wagoneer Truck 25	STD	M4	•	•	•	•	•	•	•	115°F (46°C)	V	•	•	130°F (54°C)	—	R •	•	•	•	—	—	•	•	•	•	—
		HD	M4	•	•	•	•	•	•	•	115°F (46°C)	V	•	•	130°F (54°C)	220°F (105°C)	R •	•	•	•	—	—	•	•	•	•	—
		STD	A	•	•	•	•	•	—	•	115°F (46°C)	V	•	•	130°F (54°C)	—	R •	•	•	•	—	•	•	•	•	•	—
		HD	A	•	•	•	•	•	—	•	115°F (46°C)	V	•	•	130°F (54°C)	220°F (105°C)	R •	•	•	•	—	—	•	•	•	•	—

Trans. — Transmission Type: Manual (M) or Automatic (A)
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Delay Valve — R = Reverse Delay; F = Forward Delay; DR = Dual Reverse Delay
PCV — Positive Crankcase Ventilation
TAC — Thermostatically Controlled Air Cleaner (vacuum or mechanical)
• — On all models in vehicle specified
STD — Standard
HD — Heavy Duty
VSD — Vacuum Signal Dump
① — With A/C

NOTE: All vehicles have Fuel Tank Vapor Control, Vacuum Operated TAC Systems and PCV Valves. All temperatures are nominal.

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ENGINE DIAGNOSIS

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An engine diagnosis is helpful for identifying the causes of malfunctions not remedied by routine maintenance and tune-ups. These malfunctions are classified as either **mechanical** (e.g. a strange noise), or **performance** (e.g. engine idles rough and stalls). Refer to the Service Diagnosis—Mechanical chart and the Service Diagnosis—Performance chart.

Additional tests and diagnostic procedures may be necessary to pinpoint a particular problem. This information is provided within Diagnosis with Scope Analyzer, Cylinder Compression Pressure Test, Cylinder Combustion Pressure Leakage Test, Cylinder Head Gasket Failure Diagnosis and Intake Manifold Leakage Diagnosis.

Service Diagnosis—Mechanical

Condition	Possible Cause	Correction
EXTERNAL OIL LEAKS	(1) Fuel pump gasket broken or improperly seated.	(1) Replace gasket.
	(2) Cylinder head cover RTV Sealant broken or improperly seated.	(2) Replace sealant; check cylinder head cover gasket flange and cylinder head sealant surface for distortion.
	(3) Oil filter gasket broken or improperly seated.	(3) Replace oil filter.
	(4) Oil pan side gasket broken or improperly seated.	(4) Replace gasket; check oil pan gasket flange for distortion.
	(5) Oil pan front oil seal broken or improperly seated.	(5) Replace seal; check timing case cover and oil pan seal flange for distortion.
	(6) Oil pan rear oil seal broken or improperly seated.	(6) Replace seal; check oil pan rear oil seal flange; check rear main bearing cap for cracks, plugged oil return channels, or distortion in seal groove.
	(7) Excess crankcase pressure because of restricted PCV valve.	(7) Replace PCV valve.
	(8) Timing case cover oil seal broken or improperly seated.	(8) Replace seal.
	(9) Oil pan drain plug loose or has stripped threads.	(9) Repair as necessary and tighten.
	(10) Rear oil gallery plug loose.	(10) Use appropriate sealant on gallery plug and tighten.
	(11) Rear camshaft plug loose or improperly seated.	(11) Seat camshaft plug or replace and seal, as necessary.
	(12) Distributor base gasket damaged.	(12) Replace distributor base gasket.
EXCESSIVE OIL CONSUMPTION	(1) Oil level too high.	(1) Lower oil level to specifications.
	(2) Oil too thin.	(2) Replace with specified oil.
	(3) Valve stem oil deflectors are damaged, missing, or incorrect type.	(3) Replace valve stem oil deflectors.
	(4) Valve stems or valve guides worn.	(4) Check stem-to-guide clearance and repair as necessary.
	(5) Piston rings broken, missing.	(5) Replace missing or broken rings.
	(6) Incorrect piston ring gap.	(6) Check ring gap, repair as necessary.
	(7) Piston rings sticking or excessively loose in grooves.	(7) Check ring side clearance, repair as necessary.
	(8) Compression rings installed upside down.	(8) Repair as necessary.
	(9) Cylinder walls worn, scored, or glazed.	(9) Repair as necessary.

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Service Diagnosis—Mechanical (Continued)

Condition	Possible Cause	Correction
EXCESSIVE OIL CONSUMPTION (Continued)	(10) Piston ring gaps not properly staggered.	(10) Repair as necessary.
	(11) Excessive main or connecting rod bearing clearance.	(11) Check bearing clearance, repair as necessary.
	(12) PCV valve stuck closed	(12) Replace PCV valve.
NO OIL PRESSURE	(1) Low oil level.	(1) Add oil to correct level.
	(2) Oil pressure gauge or sending unit inaccurate.	(2) Refer to Oil Pressure Gauge in Chapter 1L.
	(3) Oil pump malfunction.	(3) Refer to Oil Pump in Chapter 1B
	(4) Oil pressure relief valve sticking.	(4) Remove and inspect oil pressure relief valve assembly. Refer to Chapter 1B.
	(5) Oil passages on pressure side of pump obstructed.	(5) Inspect oil passages for obstructions.
	(6) Oil pickup screen or tube obstructed.	(6) Inspect oil pickup for obstructions.
	(7) Loose oil inlet tube.	(7) Replace inlet tube.
LOW OIL PRESSURE	(1) Low oil level.	(1) Add oil to correct level.
	(2) Oil excessively thin due to dilution, poor quality, or improper grade.	(2) Drain and refill crankcase with correct grade oil.
	(3) Oil pressure relief spring weak or sticking.	(3) Remove and inspect oil pressure relief valve assembly.
	(4) Oil pickup tube and screen assembly has restriction or air leak.	(4) Remove and inspect oil inlet tube and screen assembly. (Fill pickup with lacquer thinner to find leaks.) Replace if defective.
	(5) Excessive oil pump clearance.	(5) Check clearances; refer to Oil Pump in Chapter 1B.
	(6) Excessive main, rod, or camshaft bearing clearance.	(6) Measure bearing clearances, repair as necessary.
HIGH OIL PRESSURE	(1) Improper grade oil.	(1) Drain and refill crankcase with correct grade oil.
	(2) Oil pressure gauge or sending unit inacurrate.	(2) Refer to Oil Pressure Gauge in Chapter 1L.
	(3) Oil pressure relief valve sticking closed.	(3) Remove and inspect oil pressure relief valve assembly.
	(4) Oil pressure relief valve anti-lock port blocked (eight-cylinder only).	(4) Check for obstruction; repair as necessary.
MAIN BEARING NOISE	(1) Insufficient oil supply.	(1) Check for low oil level or low oil pressure.
	(2) Main bearing clearance excessive.	(2) Check main bearing clearance, repair as necessary.
	(3) Crankshaft end play excessive.	(3) Check end play, repair as necessary.

Service Diagnosis—Mechanical (Continued)

Condition	Possible Cause	Correction
MAIN BEARING NOISE	(4) Loose flywheel or drive plate.	(4) Tighten flywheel or drive plate bolts.
	(5) Loose or damaged vibration damper.	(5) Repair as necessary.
CONNECTING ROD BEARING NOISE	(1) Insufficient oil supply.	(1) Check for low oil level or low oil pressure.
	(2) Bearing clearance excessive or bearing missing.	(2) Check clearance, repair as necessary.
	(3) Crankshaft connecting rod journal out-of-round.	(3) Check journal measurements, repair or replace as necessary.
	(4) Misaligned connecting rod or cap.	(4) Repair as necessary.
	(5) Connecting rod bolts tightened improperly.	(5) Tighten bolts to specified torque.
PISTON NOISE	(1) Piston-to-cylinder wall clearance excessive (scuffed piston).	(1) Check clearance, repair as necessary.
	(2) Cylinder walls excessively tapered or out-of-round.	(2) Check cylinder wall measurements, rebore cylinder.
	(3) Piston ring broken.	(3) Replace all rings on that piston.
	(4) Loose or seized piston pin.	(4) Check piston-to-pin clearance, repair as necessary.
	(5) Connecting rods misaligned.	(5) Check rod alignment, straighten or replace.
	(6) Piston ring side clearance excessively loose or tight.	(6) Check ring side clearance, repair as necessary.
	(7) Carbon build-up on piston is excessive.	(7) Clean carbon from piston.
VALVE TRAIN NOISE	(1) Insufficient oil supply.	(1) Check for: (a) Low oil level. (b) Low oil pressure. (c) Plugged pushrods. (d) Wrong hydraulic tappets. (e) Plugged oil gallery in block. (f) Excessive tappet to bore clearance
	(2) Push rods worn or bent.	(2) Replace worn or bent push rods.
	(3) Rocker arms or pivots worn.	(3) Replace worn rocker arms or pivots.
	(4) Dirt or chips in hydraulic tappets.	(4) Clean tappets.
	(5) Excessive tappet leak-down.	(5) Replace valve tappet.
	(6) Tappet face worn.	(6) Replace tappet; check corresponding cam lobe for wear.
	(7) Broken or cocked valve springs.	(7) Properly seat cocked springs; replace broken springs.
	(8) Stem-to-guide clearance excessive.	(8) Check stem-to-guide clearance, ream guide, install oversize valve.
	(9) Valve bent.	(9) Replace valve.

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Service Diagnosis—Mechanical (Continued)

Condition	Possible Cause	Correction
VALVE TRAIN NOISE (Continued)	(10) Loose rocker arms.	(10) Tighten bolts to specified torque.
	(11) Valve seat runout excessive.	(11) Regrind valve seat/valves.
	(12) Missing valve lock.	(12) Install valve lock.
	(13) Push rod rubbing or contacting cylinder head.	(13) Remove cylinder head and remove obstruction in head.
	(14) Excessive oil level (4-cyl.).	(14) Correct oil level.

Service Diagnosis—Performance

Condition	Possible Cause	Correction
HARD STARTING (STARTER MOTOR OPERATES NORMALLY)	(1) Binding linkage, choke valve or choke piston.	(1) Repair as necessary.
	(2) Restricted choke vacuum and hot air passages.	(2) Clean passages.
	(3) Improper fuel level.	(3) Adjust float level.
	(4) Dirty, worn or faulty needle valve and seat.	(4) Repair as necessary.
	(5) Float sticking.	(5) Repair as necessary.
	(6) Exhaust manifold heat valve stuck (eight-cylinder engine only).	(6) Lubricate or replace.
	(7) Faulty fuel pump.	(7) Replace fuel pump.
	(8) Incorrect choke cover adjustment.	(8) Adjust choke cover.
	(9) Inadequate unloader adjustment.	(9) Adjust unloader.
	(10) Faulty ignition coil.	(10) Test and replace as necessary.
	(11) Improper spark plug gap.	(11) Adjust gap.
	(12) Incorrect initial timing.	(12) Adjust timing.
	(13) Incorrect valve timing.	(13) Check valve timing; repair as necessary.
ROUGH IDLE OR STALLING	(1) Incorrect curb or fast idle speed.	(1) Adjust curb or fast idle speed.
	(2) Incorrect initial timing.	(2) Adjust timing to specifications.
	(3) Improper idle mixture adjustment.	(3) Adjust idle mixture.
	(4) Damaged tip on idle mixture screw(s).	(4) Replace mixture screw(s).
	(5) Improper fast idle cam adjustment	(5) Adjust fast idle speed.
	(6) Faulty EGR valve operation.	(6) Test EGR system and replace as necessary.
	(7) Faulty PCV valve air flow.	(7) Test PCV valve and replace as necessary.

Service Diagnosis—Performance (Continued)

Condition	Possible Cause	Correction
ROUGH IDLE OR STALLING (Continued)	(8) Exhaust manifold heat valve inoperative (eight-cylinder engine only).	(8) Lubricate or replace heat valve as necessary.
	(9) Choke binding.	(9) Locate and eliminate binding condition.
	(10) Improper choke setting.	(10) Adjust choke.
	(11) Faulty TAC unit.	(11) Repair as necessary.
	(12) Air leak into manifold vacuum.	(12) Check manifold vacuum and repair as necessary.
	(13) Improper fuel level.	(13) Adjust fuel level.
	(14) Faulty distributor rotor or cap.	(14) Replace rotor or cap.
	(15) Leaking engine valves.	(15) Perform cylinder combustion or compression test, repair as necessary
	(16) Incorrect ignition wiring.	(16) Check wiring and correct as necessary.
	(17) Faulty ignition coil.	(17) Test coil and replace as necessary.
	(18) Clogged air bleed or idle passages.	(18) Clean passages.
	(19) Restricted air cleaner.	(19) Clean or replace air cleaner.
FAULTY LOW-SPEED OPERATION	(1) Clogged idle transfer slots.	(1) Clean transfer slots.
	(2) Restricted idle air bleeds and passages.	(2) Clean air bleeds and passages.
	(3) Restricted air cleaner.	(3) Clean or replace air cleaner.
	(4) Improper fuel level.	(4) Adjust fuel level.
	(5) Faulty spark plugs.	(5) Clean or replace spark plugs.
	(6) Dirty, corroded, or loose secondary circuit connections.	(6) Clean or tighten secondary circuit connections.
	(7) Faulty ignition coil wire.	(7) Replace coil wire.
	(8) Faulty distributor cap.	(8) Replace cap.
FAULTY ACCELERATION	(1) Improper pump stroke.	(1) Adjust pump stroke.
	(2) Incorrect ignition timing.	(2) Adjust timing.
	(3) Inoperative pump discharge check ball or needle.	(3) Clean or replace as necessary.
	(4) Faulty elastomer valve. (Eight-cylinder engine only.)	(4) Replace valve.

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Service Diagnosis—Performance (Continued)

Condition	Possible Cause	Correction
FAULTY ACCELERATION (Continued)	(5) Worn or damaged pump diaphragm or piston.	(5) Replace diaphragm or piston.
	(6) Leaking main body cover gasket.	(6) Replace gasket.
	(7) Engine cold and choke too lean.	(7) Adjust choke.
	(8) Improper metering rod adjustment (BBD Model carburetor)	(8) Adjust metering rod.
	(9) Faulty spark plug(s).	(9) Clean or replace spark plug(s).
	(10) Leaking engine valves.	(10) Check cylinder leakdown rate or compression, repair as necessary.
	(11) Faulty coil.	(11) Test coil and replace as necessary.
FAULTY HIGH SPEED OPERATION	(1) Incorrect ignition timing.	(1) Adjust timing.
	(2) Faulty distributor centrifugal advance.	(2) Check centrifugal advance and repair as necessary.
	(3) Faulty distributor vacuum advance.	(3) Check vacuum advance and repair as necessary.
	(4) Low fuel pump volume.	(4) Replace fuel pump.
	(5) Wrong spark plug gap; wrong plug.	(5) Adjust gap; install correct plug.
	(6) Faulty choke operation.	(6) Adjust choke.
	(7) Partially restricted exhaust manifold, exhaust pipe, muffler or tailpipe.	(7) Eliminate restriction.
	(8) Clogged vacuum passages.	(8) Clean passages.
	(9) Improper size or obstructed main jet.	(9) Clean or replace as necessary.
	(10) Restricted air cleaner.	(10) Clean or replace as necessary.
	(11) Faulty distributor rotor or cap.	(11) Replace rotor or cap.
	(12) Faulty coil.	(12) Test coil and replace as necessary.
	(13) Leaking engine valve(s).	(13) Perform cylinder combustion or compression test, repair as necessary.
	(14) Faulty valve spring(s).	(14) Inspect and test valve spring tension and replace as necessary.
	(15) Incorrect valve timing.	(15) Check valve timing and repair as necessary.

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Service Diagnosis—Performance (Continued)

Condition	Possible Cause	Correction
FAULTY HIGH SPEED OPERATION (Continued)	(16) Intake manifold restricted.	(16) Remove restriction or replace manifold.
	(17) Worn distributor shaft.	(17) Replace shaft.
MISFIRE AT ALL SPEEDS	(1) Faulty spark plug(s).	(1) Clean or replace spark plug(s).
	(2) Faulty spark plug wire(s).	(2) Replace as necessary.
	(3) Faulty distributor cap or rotor.	(3) Replace cap or rotor.
	(4) Faulty ignition coil.	(4) Test coil and replace as necessary.
	(5) Trigger wheel too high.	(5) Set to specifications.
	(6) Primary circuit shorted or open intermittently.	(6) Trace primary circuit and repair as necessary.
	(7) Leaking engine valve(s).	(7) Perform cylinder combustion or compression test, repair as necessary.
	(8) Faulty hydraulic tappet(s).	(8) Clean or replace tappet(s).
	(9) Faulty valve spring(s).	(9) Inspect and test valve spring tension, repair as necessary.
	(10) Worn lobes on camshaft.	(10) Replace camshaft.
	(11) Air leak into manifold vacuum.	(11) Check manifold vacuum and repair as necessary.
	(12) Improper carburetor adjustments.	(12) Adjust carburetor.
	(13) Fuel pump volume or pressure low.	(13) Replace fuel pump.
	(14) Cylinder head gasket failure.	(14) Replace gasket.
	(15) Intake or exhaust manifold passage(s) restricted.	(15) Pass chain through passages.
	(16) Wrong trigger wheel.	(16) Install correct wheel.
POWER NOT UP TO NORMAL	(1) Incorrect ignition timing.	(1) Adjust timing.
	(2) Faulty distributor rotor.	(2) Replace rotor.
	(3) Trigger wheel positioned too high or loose on shaft.	(3) Reposition or replace trigger wheel.
	(4) Incorrect spark plug gap.	(4) Adjust gap.
	(5) Faulty fuel pump.	(5) Replace fuel pump.
	(6) Incorrect valve timing.	(6) Check valve timing and repair as necessary.
	(7) Faulty ignition coil.	(7) Test coil and replace as necessary.
	(8) Faulty ignition wires.	(8) Test wires and replace as necessary.

70334D

Service Diagnosis—Performance (Continued)

Condition	Possible Cause	Correction
POWER NOT UP TO NORMAL (Continued)	(9) Leaking engine valves.	(9) Perform cylinder combustion or compression test, and repair as necessary.
	(10) Cylinder head gasket failure.	(10) Replace gasket.
	(11) Leaking piston rings.	(11) Check compression and repair as necessary.
	(12) Worn distributor shaft.	(12) Replace shaft.
INTAKE BACKFIRE	(1) Improper ignition timing.	(1) Adjust timing.
	(2) Faulty accelerator pump discharge.	(2) Repair as necessary.
	(3) Improper choke operation.	(3) Repair as necessary.
	(4) Defective EGR CTO valve.	(4) Replace EGR CTO valve.
	(5) Defective TAC unit.	(5) Repair as necessary.
	(6) Lean fuel mixture.	(6) Check float level or manifold vacuum for air leak. Remove sediment from bowl.
EXHAUST BACKFIRE	(1) Air leak into manifold vacuum.	(1) Check manifold vacuum and repair as necessary.
	(2) Faulty diverter valve.	(2) Test diverter valve and replace as necessary.
	(3) Faulty choke operation.	(3) Repair as necessary.
	(4) Exhaust leak.	(4) Locate and eliminate leak.
PING OR SPARK KNOCK	(1) Incorrect ignition timing.	(1) Adjust timing.
	(2) Distributor centrifugal or vacuum advance malfunction.	(2) Check advance and repair as necessary.
	(3) Excessive combustion chamber deposits.	(3) Use combustion chamber cleaner.
	(4) Carburetor set too lean.	(4) Adjust carburetor.
	(5) Air leak into manifold vacuum.	(5) Check manifold vacuum and repair as necessary.
	(6) Excessively high compression.	(6) Check compression and repair as necessary.
	(7) Fuel octane rating excessively low.	(7) Try alternate fuel source.
	(8) Heat riser stuck in heat ON position (eight-cylinder engine only).	(8) Free-up or replace heat riser.
	(9) Sharp edges in combustion chamber.	(9) Grind smooth.
SURGING (CRUISING SPEEDS TO TOP SPEEDS)	(1) Low fuel level.	(1) Adjust fuel level.
	(2) Low fuel pump pressure or volume.	(2) Replace fuel pump.

70334E

Service Diagnosis—Performance (Continued)

Condition	Possible Cause	Correction
SURGING (CRUISING SPEEDS TO TOP SPEEDS) (Continued)	(3) Metering rod(s) not adjusted properly (BBD Model Carburetor).	(3) Adjust metering rod.
	(4) Improper PCV valve air flow.	(4) Test PCV valve and replace as necessary.
	(5) Air leak into manifold vacuum.	(5) Check manifold vacuum and repair as necessary.
	(6) Clogged main jet(s).	(6) Clean main jet(s).
	(7) Undersize main jet(s).	(7) Replace main jet(s).
	(8) Blocked air bleeds.	(8) Clean air bleeds.
	(9) Clogged fuel filter screen.	(9) Replace fuel filter.
	(10) Restricted air cleaner.	(10) Clean or replace air cleaner.

70344F

DIAGNOSIS WITH SCOPE ANALYZER

The scope analyzer is an ignition system tester that provides a quick and accurate means for diagnosis of ignition system performance problems. All phases of the ignition cycle are displayed graphically on an oscilloscope (cathode ray tube) as they occur during engine operation.

The manufacturers of scope analyzer equipment provide descriptions of the test procedures possible with their equipment. This section is not intended to describe all uses of scope analyzer equipment, but to indicate differences in scope pattern between the HEI (High Energy Ignition) and SSI (Solid State Ignition) systems used on Jeep engines (fig. 1A-1).

The upper display illustrates a typical scope pattern for the HEI system from one ignition to the next ignition and areas of the pattern significant for diagnosis. The scope pattern displays the time duration horizontally and voltage amplitude vertically.

Compare the scope pattern of the HEI system with the typical pattern of the SSI system.

The SSI waveform pattern drops further below the zero voltage level (i.e., negative) during oscilation dampening but otherwise is similar to that of the HEI system in this area.

Other than the differences noted, scope analyzer ignition system diagnosis for HEI and SSI systems is essentially the same.

CYLINDER COMPRESSION PRESSURE TEST

The results of a cylinder compression pressure test can be utilized identifying the cylinder(s) with an abnormal compression pressure. With this information available, additional testing/inspection will provide the exact cause of the pressure loss.

(1) Clean spark plug recesses with compressed air.

(2) Remove spark plugs.

(3) Remove coil wire from distributor caps and connect to ground.

(4) Secure throttle in wide open position.

NOTE: *Ensure battery and starter motor are in good operating condition before starting test. Otherwise, indicated compression pressures may not be valid for diagnosis purposes.*

(5) Insert compression pressure gauge, engage starter motor and turn engine for three revolutions. Record compression pressure on third revolution.

(6) Test remaining cylinders and record compression pressures.

(7) Refer to Compression Pressure chart.

Compression Pressure

Engine	Pressure—PSI (kPa)	Max. Cyl. Deviation—PSI (kPa)
Four-Cylinder	140 (965)	30 (207)
Six-Cylinder	120-140 (827-965)	30 (207)
Eight-Cylinder	120-140 (827-965)	30 (207)

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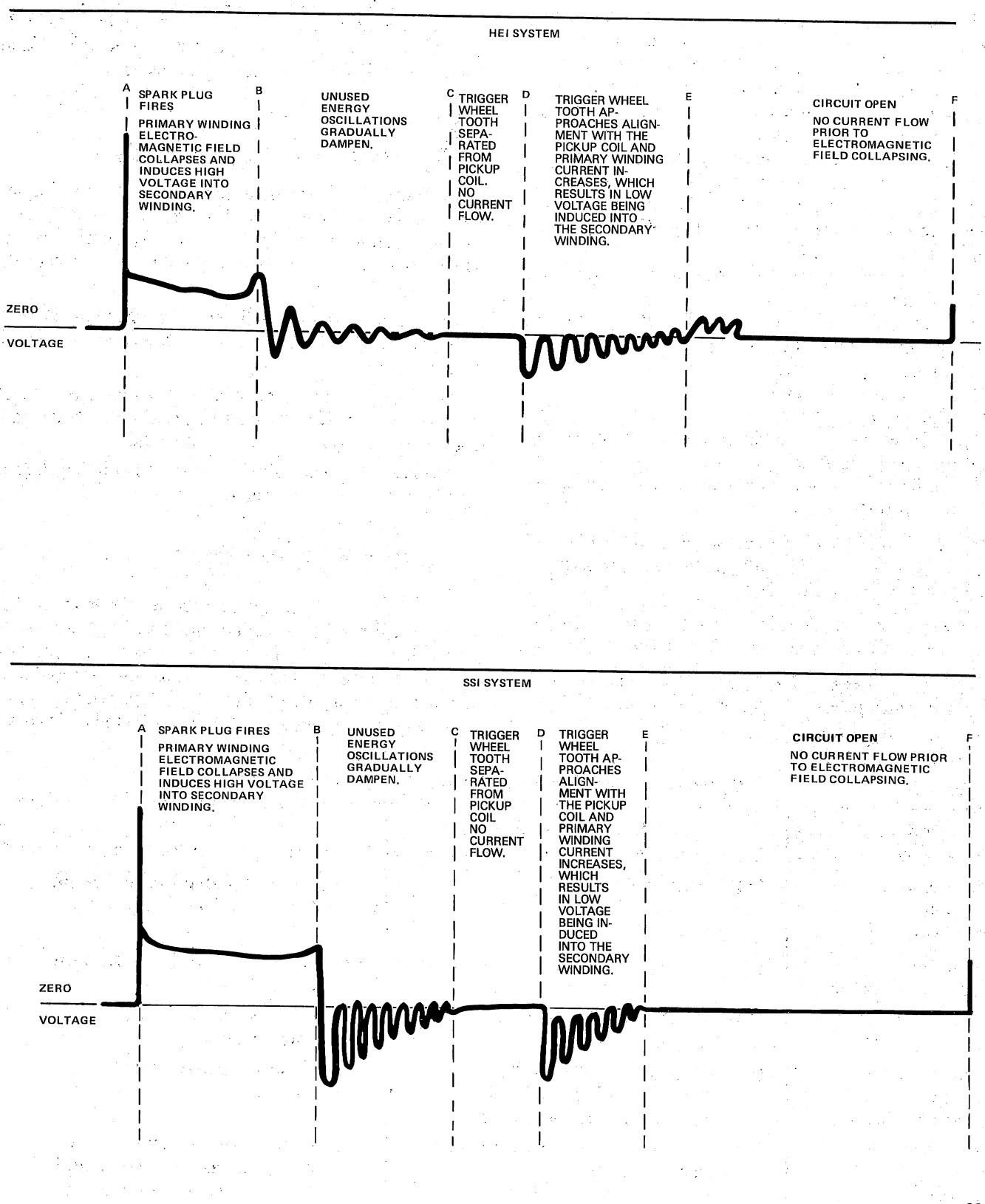

Fig. 1A-1 Scope Diagnosis Patterns

CYLINDER COMBUSTION PRESSURE LEAKAGE TEST

Satisfactory engine performance depends upon a mechanically sound engine. In many instances, unsatisfactory performance or rough idle is caused by combustion chamber leakage. A cylinder compression pressure test alone may not reveal this fault. The pressure leakage test outlined below provides an accurate means of evaluating engine condition. Pressure leakage testing will indicate if the exhaust or intake valves are improperly seated, if leaks exist between adjacent cylinders, if there are leaks into the water jacket and any other causes of compression pressure loss.

(1) Inspect coolant level and add as required. Do not install radiator cap.

(2) Start and operate engine until it attains normal operating temperature, then turn ignition Off.

(3) Remove spark plugs.

(4) Remove oil filler cap.

(5) Remove air cleaner.

(6) Position carburetor fast idle speed screw on top step of fast idle cam.

(7) Calibrate test equipment according to manufacturer's instructions.

NOTE: *Shop air source for testing should maintain 70 psi (483 kPa) minimum and 200 psi (1380 kPa) maximum (80 psi* [552 kPa] recommended).

(8) Perform test procedure on each cylinder according to equipment manufacturer's instructions.

NOTE: *While testing, listen for air escaping through carburetor, tailpipe and oil filler opening, and look for bubbles in radiator coolant.*

(9) All gauge indications should be equal, with no more than 25 percent leakage. For example, at 80 psi (552 kPa) input pressure, a minimum of 60 psi (414 kPa) should be maintained in cylinder. Refer to Cylinder Combustion Pressure Leakage Test Diagnosis.

CYLINDER HEAD GASKET FAILURE DIAGNOSIS

A "blown" cylinder head gasket usually results in a loss of power, loss of coolant and engine misfire. A "blown" cylinder head gasket may develop between adjacent cylinders or between a cylinder and adjacent water jacket.

A cylinder head gasket "blown" between two adjacent cylinders is usually indicated by a loss of power and engine misfire.

A cylinder head gasket "blown" between a cylinder and an adjacent water jacket is indicated by foaming of coolant or overheating and loss of coolant.

Replace a "blown" cylinder head gasket using the procedure outlined in Chapter 1B—Engines.

Cylinder-to-Cylinder Leakage Test

To determine if the cylinder head gasket is "blown" between cylinders, perform a compression pressure test as outlined under Cylinder Compression Pressure Test. A cylinder head gasket "blown" between two cylinders will result in approximately a 50 to 70 percent reduction in compression pressure in the two affected cylinders.

Cylinder Combustion Pressure Leakage Test Diagnosis

Condition	Possible Cause	Correction
(1) Air escapes through carburetor.	(1) Intake valve leaks.	(1) Refer to Valve Reconditioning (Chapter 1B).
(2) Air escapes through tailpipe.	(2) Exhaust valve leaks.	(2) Refer to Valve Reconditioning (Chapter 1B).
(3) Air escapes through radiator.	(3) Head gasket leaks or crack in cylinder block.	(3) Remove cylinder head and inspect.
(4) **More than 25% leakage into adjacent cylinder.**	(4) Head gasket leaks or crack in cylinder block or head between adjacent cylinders.	(4) Remove cylinder head and inspect.
(5) More than 25% leakage and air escapes through oil filler cap opening only.	(5) Stuck or broken piston ring(s); cracked piston; worn rings and/or cylinder wall.	(5) Inspect for broken ring(s) or piston. Measure ring gap and cylinder diameter, taper, and out-of-round.

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Cylinder-to-Water Jacket Leakage Test

WARNING: *Use extreme caution when engine is operating. Do not stand in direct line with fan. Do not put hands near pulleys, belts or fan. Do not wear loose clothing.*

(1) Remove radiator cap and start engine. Allow engine to warm up until thermostat opens.
(2) If large compression/combustion pressure leak exists, bubbles will be visible in coolant.
(3) If bubbles are not visible, install radiator pressure tester and pressurize system. If cylinder compression and combustion pressure is leaking into water jacket, pointer will pulsate with every combustion stroke of piston.

INTAKE MANIFOLD LEAKAGE DIAGNOSIS

An intake manifold air leak is characterized by lower than normal manifold vacuum. One or more cylinders may be "dead."

Exterior Leak

Two tests are possible, one with engine oil and one with acetylene.

WARNING: *Use extreme caution when engine is operating. Do not stand in direct line with fan. Do not put hands near pulleys, belts or fan. Do not wear loose clothing.*

(1) Start engine.
(2) Apply oil to gasket edge areas between intake manifold and cylinder head. If oil is forced into manifold, or if smoke is evident in exhaust, manifold has air leak.
(3) Open acetylene valve of oxyacetylene torch. **Do not ignite.** Pass torch tip over gasket edge areas. If engine speed increases, manifold has leak.

Interior Leak—Eight-Cylinder Engine Only

WARNING: *Use extreme caution when engine is operating. Do not stand in direct line with fan. Do not put hands near pulleys, belts or fan. Do not wear loose clothing.*

(1) Start engine. Remove PCV valve hose from intake manifold.
(2) Plug PCV valve hose fitting in manifold. Allow PCV valve to hang free.
(3) Remove oil filler cap. Cover filler tube with palm of hand. If vacuum is felt, crankcase is exposed to intake manifold or cylinder head vacuum.
(4) Remove intake manifold. Inspect for casting flaws.
(5) Inspect cylinder head for casting flaws. Thoroughly inspect area around intake valves and intake valve ports.
(6) With valve closed, fill port with gasoline and inspect for leaks. Alternate method: wrap shop cloth around air nozzle and apply air pressure to port. Listen for leaks.

ENGINE TUNE-UP

GENERAL

A complete, precision tune-up is required at the interval outlined in the Engine Maintenance Schedule—Chapter B. A tune-up will accomplish several things. First, it will assure that the engine is operating as efficiently and as economically as it was designed to operate. Second, it will assure that the undesirable exhaust and fuel vapor emissions are within the limits defined by Federal and state regulations.

A complete, precision tune-up includes all of the tasks listed in the Engine Maintenance Schedule. Some tasks involve highly-precision emission control devices. These devices are discussed within the applicable systems in their respective chapters of this manual. They are included in this chapter for reference only.

For convenience, when performing a precision tune-up, the necessary services are grouped together by either assembly or system.

ENGINE ASSEMBLY

Oil Filler Cap

On eight-cylinder engines, a polyurethane foam filter in the oil filler cap filters air coming into the PCV system. To clean the filter, apply light air pressure in the direction opposite normal airflow (through the filler

tube opening). If the filter is deteriorated, replace the filler cap.

Drive Belts

Inspect belts for defects such as fraying or cracking. Test belt tension. Belt tension testing, adjustment, arrangement and tension specifications are listed in Chapter 1C—Cooling Systems.

Vacuum Fittings and Hoses

Inspect vacuum hose fittings for looseness and corrosion. Inspect rubber hoses for brittleness and cracking. Thoroughly inspect the hose ends that are slipped onto nipples. Engine performance may be adversely affected by air leaks in such unlikely places as the heater and air conditioner control vacuum hoses, Cruise Command hoses or the power brake booster vacuum hose.

IGNITION SYSTEM

Spark Plugs

Remove and examine spark plugs for burned electrodes and fouled, cracked or broken porcelain insulators. Keep plugs arranged in the order removed from the engine. An isolated plug displaying an abnormal condition indicates that a problem exists in the cylinder from where it was removed. Replace plugs at the mileage interval recommended in the Engine Maintenance Schedule. Plugs that have less engine mileage may be cleaned and reused if not otherwise defective. Refer to Spark Plug Condition. After cleaning, file the center electrode flat with a point file. Adjust the gap (separation) between electrodes to 0.033-0.038 inch (0.84-0.97 mm) for six- and eight-cylinder engines, and 0.060 inch (1.52 mm) for four-cylinder engines (fig. 1A-2).

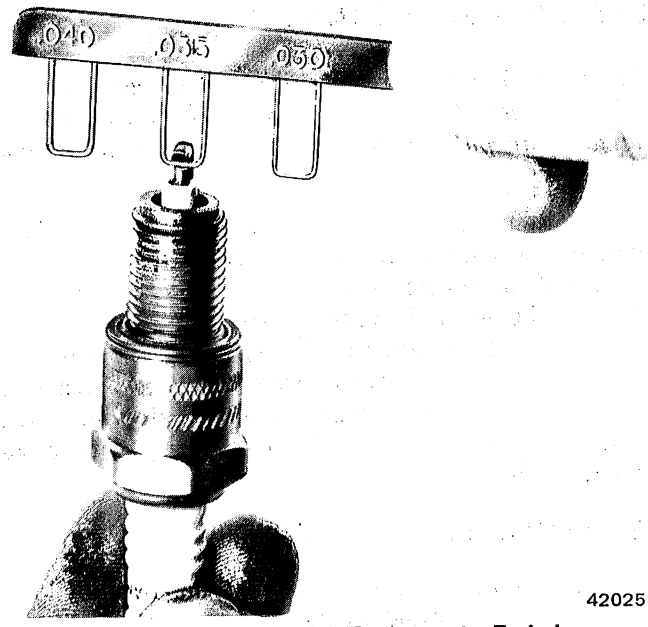

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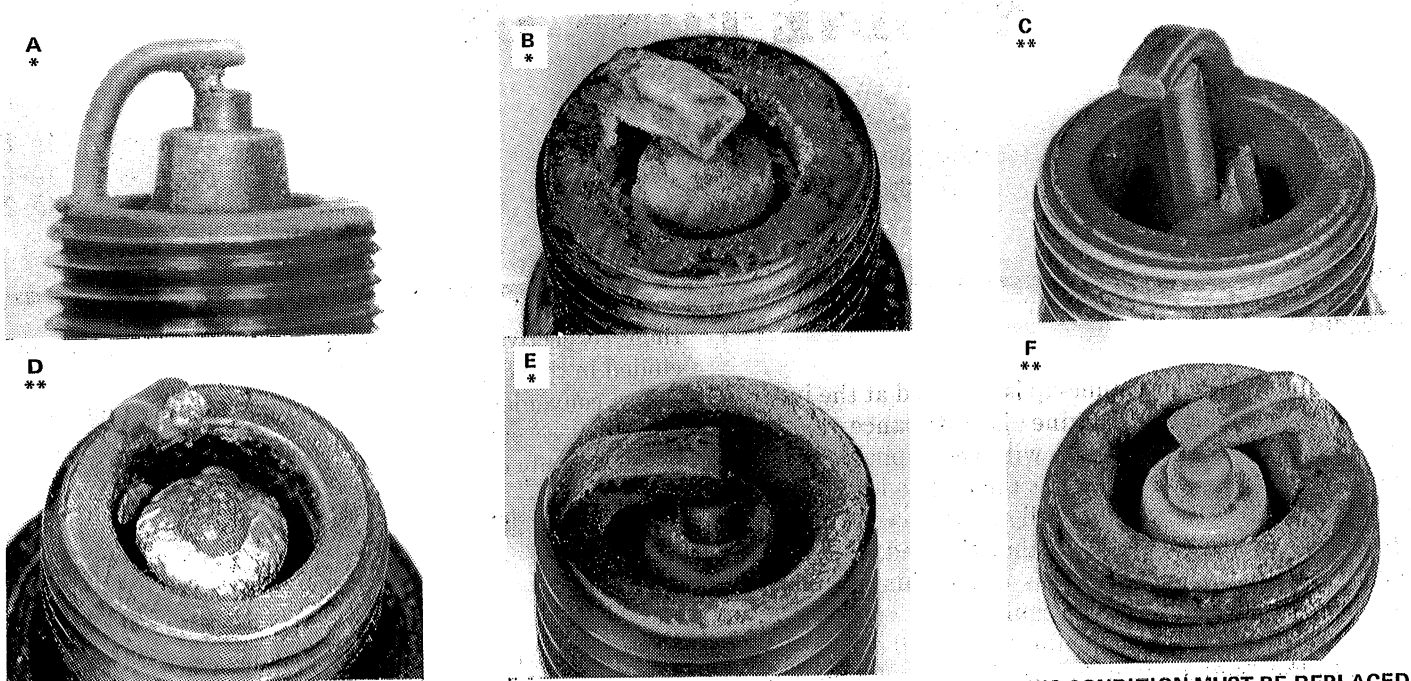
Fig. 1A-2 Spark Plug Gap Measurement—Typical

Always use a torque wrench when installing spark plugs. Distortion from overtightening will change the gap (separation) of the plug electrodes. For four- and six-cylinder engines, tighten plugs with 7 to 15 foot-pounds (9.5 to 23 N•m) torque. For eight-cylinder engines, tighten plugs with 25 to 30 foot-pounds (34 to 41 N•m) torque.

Spark Plug Condition

Refer to figure 1A-3. Compare the spark plugs with the illustrations and the following descriptions.



* LOW MILEAGE PLUGS WITH THIS CONDITION MAY BE CLEANED

** PLUGS WITH THIS CONDITION MUST BE REPLACED

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Fig. 1A-3 Typical Spark Plug Conditions

A—Electrode Gap Bridging

Electrode gap bridging may be traced to loose deposits in the combustion chamber. These deposits accumulate on the plugs during continuous stop-and-go driving. When the engine is suddenly subjected to a high torque load, the deposits partially liquefy and bridge the gap (i.e., short circuit the electrodes).

B—Scavenger Deposits

Fuel scavenger deposits may be either white or yellow. They may appear to be harmful but this is a normal condition caused by chemical additives in certain fuels. Such additives are designed to change the chemical nature of deposits and decrease spark plug misfire tendencies. Notice that accumulation on the ground (side) electrode and shell area may be heavy, but the deposits are easily removed. Plugs with scavenger deposits can be considered normal in condition and can be cleaned using standard procedures.

C—Chipped Electrode Insulator

A chipped electrode insulator usually results from bending the center electrode while adjusting the spark plug electrode gap (separation). Under certain conditions, severe detonation can also separate the insulator from the center electrode.

D—Preignition Damage

Preignition damage is caused by excessive combustion chamber temperature. First, the center electrode dissolves and, somewhat later, the ground (side) electrode. Insulators appear relatively deposit free. Determine if the spark plug has the correct heat range rating, if ignition timing is overadvanced or if other conditions are causing engine overheating.

NOTE: *The heat range rating refers to the operating temperature of a particular type spark plug. Spark plugs are designed to operate within specific temperature ranges depending upon the thickness and length of the center electrode porcelain insulator.*

E—Cold Fouling (or Carbon Fouling)

The deposits that cause cold fouling are basically carbon. A dry, black deposit on one or two plugs in a set may be caused by "sticking" valves or defective spark plug wires. Cold (carbon) fouling of the entire set may be caused by a clogged air cleaner, a sticking exhaust manifold heat valve (eight-cylinder engine only) or a faulty carburetor choke.

F—Spark Plug Overheating

Overheating is indicated by a white or gray electrode insulator that also appears blistered. The increase in electrode gap (separation) will be considerably in excess of 0.001 inch per 1000 miles (0.025 mm per 1 609 km) of engine operation. This suggests that a plug with a cooler heat range rating should be used. Overadvanced ignition timing, detonation and cooling system malfunctions can also cause spark plug overheating.

NOTE: *Some fuel refiners in several areas of the United States have introduced a manganese additive (MMT) for unleaded fuel. During combustion, fuel with MMT causes the entire tip of the spark plug to be coated with a rust-colored deposit. This rust color may be misdiagnosed as being caused by coolant in the combustion chamber. Spark plug performance is not affected by MMT deposits.*

Spark Plug and Ignition Coil Wires

To remove wires from spark plugs, twist the rubber protector boot approximately 1/2-turn to break the seal. Grasp the boot and pull it from the plug with constant force. Do not pull on the wire itself because this will damage the conductor and terminal connection.

To remove wires from the distributor cap or ignition coil tower, loosen the boot first, then grasp the upper part of the boot and the wire and gently pull straight up.

Wire Resistance Test

Do not puncture spark plug wires with a probe while performing any test. This may cause a separation in the conductor. The preferred method is to remove the suspected wire and use an ohmmeter to test for the correct resistance according to the length of the particular wire. Refer to Spark Plug and Coil Wire Resistance Wire Values chart.

Spark Plug and Coil Wire Resistance Values

Inches	Ohms
0 to 15	3,000 to 10,000
15 to 25	4,000 to 15,000
25 to 35	6,000 to 20,000
Over 35	8,000 to 25,000

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When installing spark plug wires and the ignition coil high voltage wire, ensure mechanically tight connections are made at the spark plugs, distributor cap tower and ignition coil tower. The wire protector boots on the spark plugs and distributor cap towers and coil tower must fit tightly. A partially seated wire terminal creates an air separation (resistance) in the high voltage circuit and the resulting arcing will cause terminal corrosion, wire conductor damage and decrease the voltage at the spark plugs.

When replacing spark plug wires, route the wires correctly and secure them within the proper retainers. Failure to route the wires properly can result in radio ignition noise and cross ignition of the plugs, or short circuit the wires to ground.

Ignition Coil

Always test a suspected defective ignition coil on the engine. Because a coil may "break down" after the engine has heated it to operating temperature, it is important that the coil be at normal operating temperature

when tested. If using an ignition coil tester (not an ohmmeter) perform the tests according to the instructions provided by the manufacturer of the equipment. Refer to Chapter 1G—Ignition Systems for additional information.

Distributor

The distributor used with all engines is a solid state, electronically controlled type (i.e., no contact points). Other than the cap and rotor inspection listed in the Engine Maintenance Schedule, there is no scheduled maintenance for distributors. Refer to Chapter 1G—Ignition Systems for distributor service procedures.

Distributor Rotor Inspection

Visually inspect the rotor for cracks, evidence of corrosion and the effects of arcing on the metal tip, and evidence of mechanical interference with the cap (fig. 1A-4). Some charring is normal on the end of the metal tip. The silicone dielectric compound applied to the rotor tip for radio interference noise suppression (six-and eight-cylinder engines) will appear charred. This is normal. Do not remove the charred compound. Test the spring for insufficient tension. Replace a rotor that displays any of the adverse conditions illustrated in figure 1A-4. Coat the tip of a replacement rotor (six- and eight-cylinder engines only) with Jeep Silicone Dielectric Compound, or equivalent.

Distributor Cap Inspection

Remove the distributor cap and wipe clean with a dry cloth. Perform a visual inspection for cracks, carbon paths, broken towers, charred or eroded terminals and damaged rotor button (fig. 1A-5). Replace any cap that displays any of the adverse conditions illustrated in figure 1A-5. When replacing a cap, transfer one spark plug wire at a time to the replacement cap. If necessary, refer to Distributor Wiring Sequence illustrated in Specifications. Ensure each wire is installed in the tower corresponding to its original tower position. Insert the wire terminals firmly into the towers.

Replace the cap if the terminal ends inside the cap are excessively eroded (fig. 1A-5). The vertical face of a terminal end will indicate some evidence of erosion from normal operation. Examine the terminal ends for evidence of mechanical interference with the rotor tip.

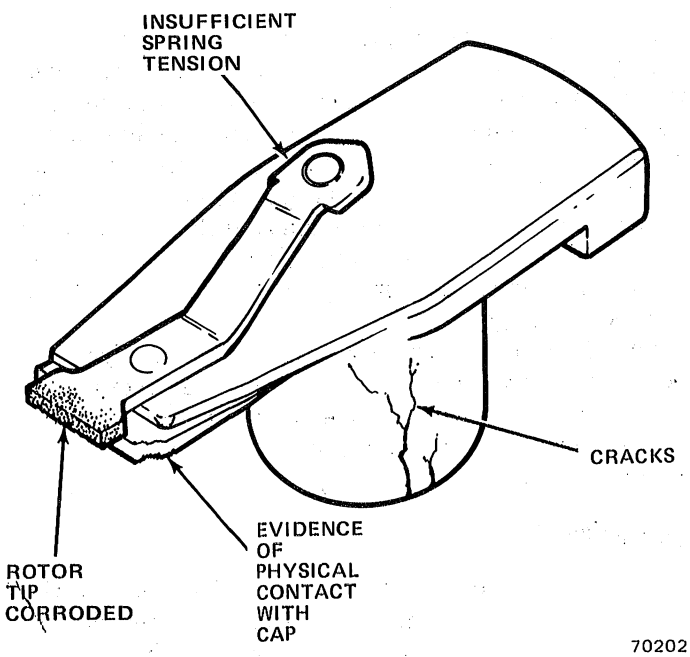

Fig. 1A-4 Rotor Inspection

Ignition System Timing

A graduated timing degree scale located on the timing case cover is used for timing each ignition system. An index notch milled into the vibration damper is used to reference the No. 1 cylinder ignition position of the crankshaft with the correct timing mark on the graduated scale (figs. 1A-6 and 1A-7).

Magnetic Timing Probe

A socket integral with the timing degree scale on the timing case cover is provided for use with a special magnetic timing probe that detects the milled notch in the vibration damper. The probe is inserted through the socket until it touches the vibration damper and is automatically spaced away from the damper by damper eccentricity. Ignition timing is indicated on a meter or computer printout, depending on the manufacturer's equipment.

The socket is located at 9.5° ATDC, and the equipment is calibrated to compensate for the degree difference. **Do not use the socket location when timing an ignition system with a conventional timing light.**

Ignition Timing Procedure

Refer to Tune-Up Specification charts and Emission Control Information label located in the engine compartment.

(1) Disconnect and plug distributor vacuum advance hose opening.

(2) With ignition switch off, connect ignition timing light and properly calibrated tachometer.

NOTE: *If the timing light has an adjustable advance control feature, turn the control to the OFF position.*

(3) For six-cylinder engines, disconnect two-wire connector (yellow and black wires) at electronic ignition module and short circuit ignition module connector terminals with jumper wire. This step does not apply to 49-state designated CJ vehicles.

NOTE: *When the ignition module connector terminals are short circuited with the jumper wire the electronic retard circuit is deactivated. This is necessary to accurately adjust the ignition timing.*

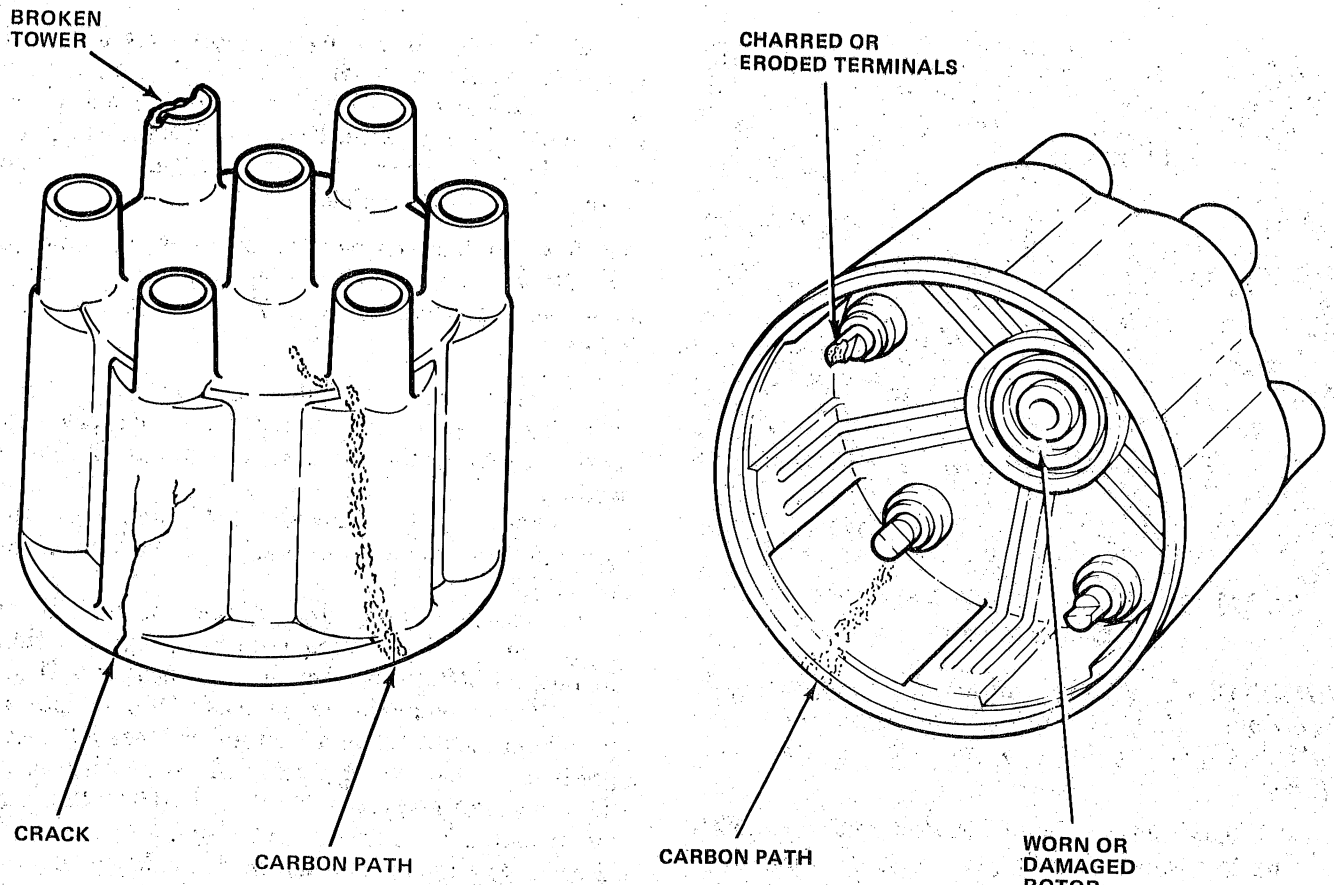

Fig. 1A-5 Distributor Cap Inspection—Typical

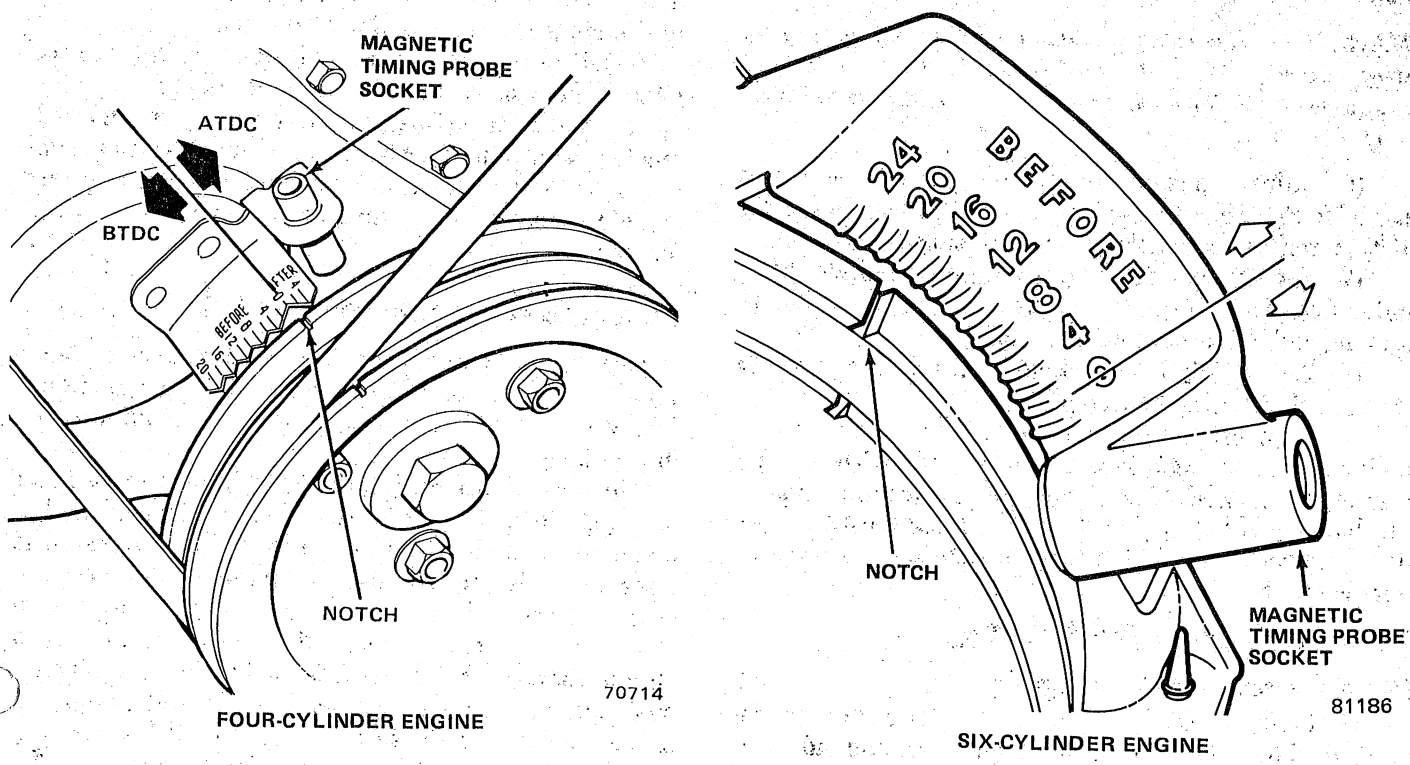

Fig. 1A-6 Timing Degree Scale and Notch Location—Four- and Six-Cylinder Engines

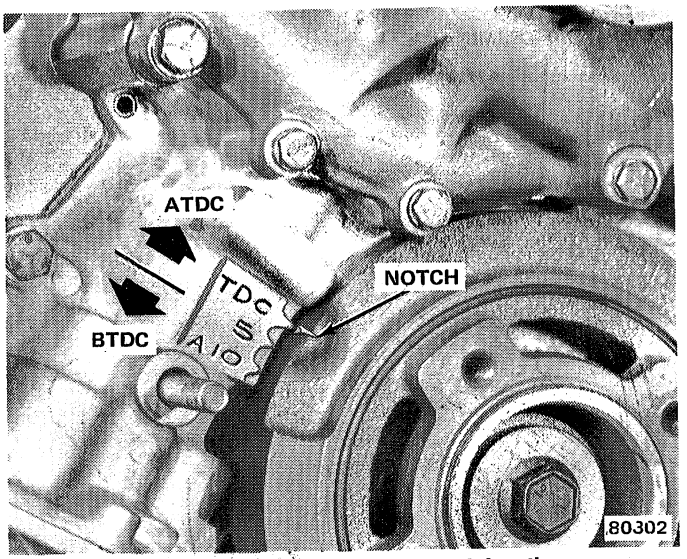

Fig. 1A-7 Timing Degree Scale and Notch Location—Eight-Cylinder Engine

WARNING: *Use extreme caution when engine is operating. Do not stand in direct line with fan. Do not put hands near pulleys, belts or fan. Do not wear loose clothing.*

(4) Engage parking brake, start engine and allow to warm up to normal operating temperature. Place automatic transmission in Drive, manual transmission in Neutral position.

(5) Adjust idle speed to specified curb (slow) idle rpm. Refer to Tune-Up Specifications charts and Emission Control Information label.

WARNING: *Use extreme caution when engine is operating. Do not stand in direct line with fan. Do not put hands near pulleys, belts or fan. Do not wear loose clothing.*

(6) Adjust ignition timing to degrees specified in Tune-Up Specifications—On Vehicle chart by loosening distributor holddown clamp and rotating distributor.

(7) For six-cylinder engines (except 49-State 6-cylinder CJ) increase engine speed to 1600 rpm while observing and adjusting ignition timing.

(8) Tighten distributor holddown clamp and verify that ignition timing is correct.

(9) Turn off engine and remove timing light and tachometer. Connect No. 1 spark plug wire, if disconnected. Connect hose to distributor vacuum advance mechanism. If applicable, remove jumper wire and connect electronic ignition module connector to wire harness connector.

Testing Distributor Advance Mechanisms

Adjustable Advance Control Timing Light Procedure

(1) Connect timing light and tachometer as described above. Disconnect and plug vacuum advance hose. Connect vacuum pump (with gauge) to distributor vacuum advance mechanism.

(2) For six-cylinder engines, disconnect two-wire connector (yellow and black wires) at electronic ignition module and short circuit ignition module connector terminals with jumper wire. This will deactivate electronic retard circuit in module. This step does not apply to 49-state designated CJ vehicles.

WARNING: *Use extreme caution when engine is operting. Do not stand in direct line with fan. Do not put hands near pulleys, belts or fan. Do not wear loose clothing.*

(3) Start engine and allow to warm-up to normal operating temperature. Set parking brake, place automatic transmission in Drive, manual in Neutral position.

(4) Increase engine speed to 2000 rpm. Apply 18 in. Hg (60.8 kPa) vacuum to distributor vacuum advance mechanism.

(5) Observe timing degree scale and turn advance control on ignition timing light until ignition timing (degrees BTDC) has returned to idle speed specification (1600 rpm for six-cylinder engines). Degrees indicated on advance meter should be total degrees advance as specified in Distributor Curves in Specifications. Add vacuum advance degrees at 18 in. Hg (60.8 kPa) to mechanical advance degrees at 2000 rpm. For example, for six-cylinder engine, total advance should be 28.5 to 39 degrees BTDC.

(6) If total advance at 2000 rpm with 18 in. Hg (60.8 kPa) vacuum applied is less than specification, disconnect vacuum pump and, with engine at 2000 rpm, determine maximum centrifugal degrees advance. Refer to Distributor Curves in Specifications.

(7) If centrifugal advance degrees are within specification, replace vacuum advance mechanism.

(8) Turn off engine; remove timing light and tachometer; remove jumper wire and connect electronic ignition module connector to wire harness connector (six-cylinder engine only); and connect vacuum hose to distributor.

Testing Distributor Advance Mechanisms—Off Engine

Total distributor advance degrees also may be determined with the distributor removed from the engine. Follow the distributor test equipment manufacturer's instructions.

Information provided in the Distributor Curves is for on-engine testing. If the distributor advance mechanisms are tested with a distributor tester, convert the information in the Distributor Curves from engine rpm to distributor rpm and from engine degrees advance to distributor degrees advance. Divide engine rpm by 2 to obtain distributor rpm. Divide engine degrees advance by 2 to obtain distributor degrees advance. For instance, if the Distributor Curve indicates 8 to 12 degrees advance at 2000 rpm, the corresponding on-tester specifications would be 4 to 6 degrees advance at 1000 rpm.

NOTE: *The specified vacuum inches of mercury (or kPa) is the same, regardless if test is on-engine or off-engine.*

FUEL SYSTEM

General Inspection

Fuel systems depend on hoses and rigid tubing to route liquid fuel, fuel vapors and vacuum. Fuel vapor and air leaks upset the operation of the engine and may reduce the effectiveness of the emission control devices. Liquid fuel leaks not only waste fuel but also create a fire hazard. Carefully inspect hoses and tubing for cracks, dents, corrosion and abnormal bends. Inspect fittings for corrosion or looseness. Inspect the fuel tank for leaks caused by loose mounting straps, broken seams, dents or corrosion. Inspect filler neck grommets and hoses for proper installation.

Air Cleaner

Replace the dry-type air cleaner filter element during each precision tune-up. Under extreme conditions (e.g., dusty environment), more frequent replacement is recommended.

Fuel Filter

All Jeep vehicles have two fuel filters. The in-tank filter is designed to be maintenance-free. The in-line filter between the fuel pump and carburetor and in-carburetor filter (four-cylinder engine) require periodic replacement. When installing the replacement filter (six- and eight-cylinder engines), ensure the fuel return nipple is positioned at the top of the filter.

Carburetor Idle Speed Adjustment

General

The engine and related systems must be operating properly before performing idle speed adjustments.

The idle mixture should not require adjustment as part of a precision tune-up. The idle mixture adjustment screws are sealed on all carburetors (figs. 1J-8, 1J-9 and 1J-10). The plugs or dowel pins must be removed before the idle mixture can be adjusted. This effectively prevents indiscriminate adjustments. Do not remove the plug(s) or dowel pins and readjust the mixture screw(s) unless involved in a major carburetor overhaul, throttle body replacement or the emission of excessive CO at idle speed has been determined by a competent authority. Refer to Chapter 1J—Fuel Systems.

Idle Speed Control (Six-Cylinder Engines)

The Sole-Vac throttle positioner is part of the model BBD carburetor assembly. It is activated in two ways: by an electric holding solenoid and by a pneumatic vacuum actuator. The holding solenoid will maintain throttle position, but it does not have the ability to move the throttle to a new position. The vacuum actuator portion of the Sole-Vac, however, is capable of moving the throttle to a new position when manifold vacuum is applied to it.

The Sole-Vac throttle positioner has three positions. One is the off, or deactivated, position (curb idle); the second is the holding solenoid position; and the third is the vacuum actuator position. An electric vacuum switching solenoid allows manifold vacuum stored in a reservoir to reach the vacuum actuator and engage it. The electric vacuum switching solenoid is energized by

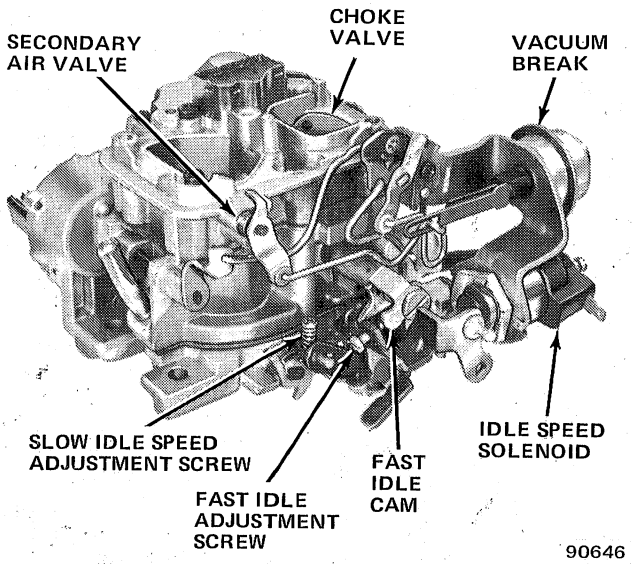

Fig. 1A-8 Rochester Model 2SE and E2SE Carburetors

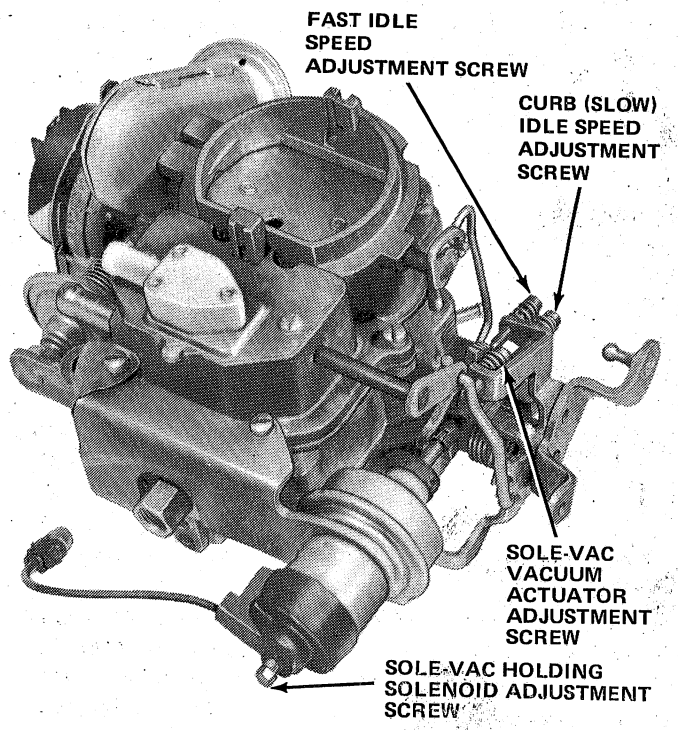

Fig. 1A-9 Carter Model BBD Carburetor

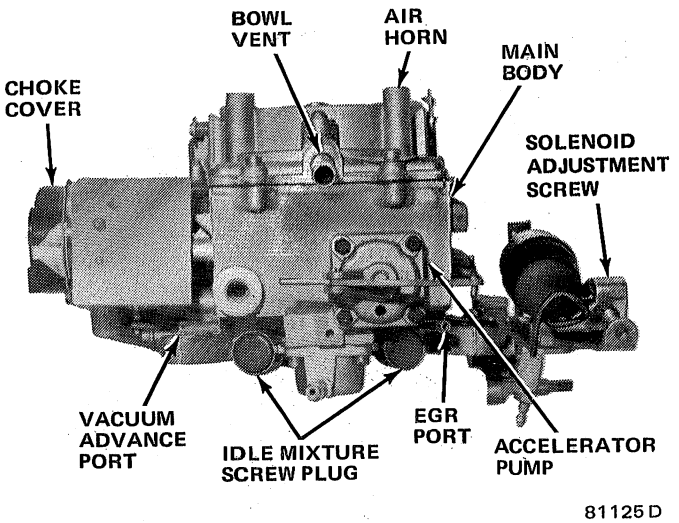

Fig. 1A-10 Motorcraft Model 2150 Carburetor

the idle speed controller (49-state designated CJ vehicles) or the feedback system microprocessor (California designated CJ and 50-state designated Cherokee, Wagoneer and Truck vehicles). For diagnosis procedure, refer to Chapter 1J.

The holding solenoid is energized if either the intake manifold heater, air conditioner or rear window defroster are in use. The vacuum actuator is engaged via the thermal electric switch (TES) if the air cleaner air temperature is below 55°F or 13°C (approximately). When the air cleaner air temperature is above the switching temperature, the idle speed controller or microprocessor energizes the vacuum switching solenoid to engage the vacuum actuator every time the idle speed decreases to the calibrated minimum rpm. When engine rpm increases to the calibrated maximum, the vacuum actuator is disengaged by the idle speed controller or microprocessor and the throttle returns to either the holding solenoid position (if energized) or to the curb idle speed position.

NOTE: *The calibrated minimum and maximum rpm's for vehicles equipped with automatic transmissions are 435 ± 10 rpm and 1050 ± 100 rpm. For vehicles equipped with manual transmissions, the calibrated minimum and maximum rpm's are 463 ± 10 rpm and 1175 ± 150 rpm.*

Adjustment Precautions and General Information

- Because vehicles with automatic transmissions are adjusted in Drive, set the parking brake firmly and do not accelerate the engine.
- Allow the engine to heat to normal operating temperature before adjusting the idle speed.
- Perform the adjustment with the air cleaner installed or with the air cleaner removed and associated vacuum hoses plugged and carburetor choke valve open. The A/C compressor clutch wire connector must be disconnected and the deceleration valve vacuum hose removed and plugged for four-cylinder engines.
- Do not operate the engine at idle speed more than three minutes at a time.
- Ensure the ignition timing is correct before adjusting the idle speed.
- Use extreme caution when engine is operating. Do not stand in direct line with fan. Do not put hands near pulleys, belts or fan. Do not wear loose clothing.

Idle Speed Adjustment Procedure—Four-Cylinder Engine with Model E2SE Carburetor

NOTE: *When adjusting idle speed, put manual transmission in Neutral.*

WARNING: *Set parking brake firmly. Do not accelerate engine.*

(1) Connect tachometer to ignition coil or pigtail wire connector.

(2) Disconnect hose from distributor vacuum advance mechanism and plug hose. Connect timing light.

(3) Adjust (if necessary) ignition timing with engine at or below specified idle speed.

(4) Connect vacuum hose to distributor vacuum advance mechanism. Disconnect timing light.

(5) Disconnect deceleration valve and purge hose from vapor cannister and plug hoses. Remove air cleaner.

NOTE: *The electronic fuel control system must be operating in the closed-loop mode during the idle speed adjustment. The system should be operating in the closed-loop mode when the engine heats to normal operating temperature. However, to ensure closed-loop mode of operation, the use of a dwell meter is recommended.*

(6) Insert dwell meter probes into terminal 6 (+) and terminal 13 (-) of diagnostic connector (fig. 1A-11). Turn meter selector switch to "six-cylinder" scale position.

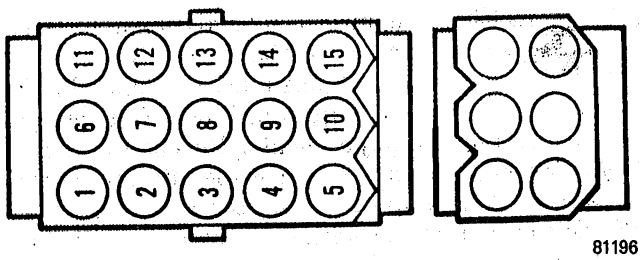

Fig. 1A-11 Diagnostic Connector

(7) Dwell meter pointer should be oscillating (15-degree sweep maximum) and pointer should be located within 10 to 50 degree range.

NOTE: *If dwell meter indicates system is in closed-loop mode of operation, continue with adjustment procedure. If not, the engine may not be sufficiently heated and the*

system is in the open-loop mode of operation. If this condition continues after several minutes with the engine at normal operating temperature, refer to Chapter 1J—Fuel Systems for diagnostic procedure.

(8) If equipped with air conditioning, adjust idle speed screw (fig. 1A-8) to obtain specified engine rpm. Turn A/C control switch On. Open throttle momentarily to ensure solenoid armature is fully extended. Adjust solenoid idle speed screw (fig. 1A-8) to obtain specified engine rpm. Turn A/C control switch off.

(9) If not equipped with air conditioning, adjust solenoid idle speed screw (fig. 1A-8) with solenoid energized to obtain specified engine rpm. Disconnect solenoid wire connector and adjust idle speed screw to obtain specified curb idle speed. Connect solenoid wire connector.

(10) Disconnect hose from EGR (exhaust gas recirculating) valve and plug hose.

(11) With fast idle speed screw on top step of fast idle speed cam, adjust fast idle speed to obtain specified engine rpm.

(12) Stop engine. Install air cleaner. Connect all vacuum hoses and A/C compressor wire connector. Disconnect tachometer.

Idle Speed Adjustment Procedure—Four-Cylinder Engine with Model 2SE Carburetor

(1) Connect tachometer to ignition coil or pigtail wire connector.

(2) Disconnect hose from distributor vacuum advance mechanism and plug hose. Connect timing light.

(3) Adjust (if necessary) ignition timing with engine at or below specified idle speed.

(4) Connect vacuum hose to distributor vacuum advance mechanism. Disconnect timing light.

(5) Disconnect deceleration valve hose and canister purge hose. Plug hoses. Remove air cleaner.

(6) If equipped with air conditioning, adjust idle speed screw (fig. 1A-8) to obtain specified engine rpm. Turn A/C control switch On. Open throttle momentarily to ensure solenoid armature is fully extended. Adjust solenoid idle speed screw (fig. 1A-8) to obtain specified engine rpm. Turn A/C control switch Off.

(7) If not equipped with air conditioning, adjust solenoid idle speed screw (fig. 1A-8) with solenoid energized to obtain specified engine rpm. Disconnect solenoid wire connector and adjust idle speed to obtain specified engine curb idle speed rpm.

(8) Disconnect hose from exhaust gas recirculating (EGR) valve and plug.

(9) With fast idle speed screw (fig. 1A-8) on top step of fast idle speed cam, adjust fast idle speed screw to obtain specified engine rpm.

(10) Stop engine. Install air cleaner and connect all vacuum hoses. Disconnect tachometer.

Idle Speed Adjustment Procedure—Six-Cylinder Engine

(1) Connect tachometer to ignition coil negative terminal or pigtail wire connector. Start and allow engine to attain normal operating temperature. Carburetor choke and intake manifold heater must be off. This occurs when engine coolant heats to approximately 160°F (71°C).

NOTE: *When adjusting the idle speed, place manual transmission in Neutral or automatic transmission in Drive. Turn all accessories Off.*

WARNING: *Set parking brake firmly. Do not accelerate engine.*

(2) Disconnect vacuum hose from Sole-Vac vacuum actuator and plug. Disconnect holding solenoid wire connector. Adjust carburetor curb (slow) idle speed adjustment screw (fig. 1A-9) to obtain specified curb (slow) idle engine rpm if not within specification. Refer to Emission Control Information label and Tune-Up Specifications chart.

(3) Apply direct source of vacuum to vacuum actuator. Use Vacuum Pump Tool J-23738, or equivalent.

(4) When throttle positioner is fully extended, turn vacuum actuator adjustment screw on throttle lever until specified engine rpm is obtained.

(5) Disconnect vacuum source from vacuum actuator.

(6) If equipped, turn air conditioner On.

(7) With jumper wire, apply battery voltage (12V) to energize holding solenoid (fig. 1A-9). Hold throttle open manually to allow throttle positioner to fully extend.

NOTE: *Without the vacuum actuator, throttle must be opened manually to allow Sole-Vac throttle positioner to be fully extended.*

(8) If holding solenoid idle speed is not within tolerance, adjust Sole-Vac (hex-head adjustment screw) to obtain specified engine rpm.

(9) Remove jumper wire from Sole-Vac holding solenoid wire connector.

(10) Connect Sole-Vac holding solenoid wire connector.

(11) Connect original hose to vacuum actuator.

(12) Disconnect tachometer.

Idle Speed Adjustment Procedure—Eight-Cylinder Engine

NOTE: *When adjusting the idle speed, put manual transmission in Neutral. Put automatic transmission in Drive.*

WARNING: *Set parking brake firmly. Do not accelerate engine.*

(1) Connect tachometer, start engine and warm to normal operating temperature. Choke must be off.

(2) If not within OK range, turn curb idle adjustment screw to obtain specified curb idle rpm.

(3) Turn hex screw on solenoid carriage to obtain specified idle rpm.

(a) Tighten locknut, if equipped.

(b) Disconnect solenoid wire connector and adjust curb idle screw to obtain 500 rpm idle speed.

(c) Connect solenoid wire connector.

(d) If model 2150 carburetor is equipped with dashpot: with throttle at curb idle position, fully depress dashpot stem and measure clearance between stem and throttle lever. Clearance should be 0.093 inch (2.36 mm). Adjust by loosening locknut and turning dashpot.

Choke Linkage

Inspect all choke linkages, including the fast idle cam, for free movement at the engine mileage interval specified in the Engine Maintenance Schedule.

Clean choke linkage by applying Jeep Carburetor and Combustion Area Cleaner, or equivalent. Never use oil to lubricate choke linkage.

For choke circuit adjustment procedures, refer to Chapter 1J—Fuel Systems.

PCV Air Inlet Filter

Four- and Six-Cylinder Engines

A polyester non-woven felt PCV air inlet filter is located in a retainer inside the air cleaner. Rotate the retainer to remove it from the air cleaner (fig. 1A-12). Replace or clean the filter at the engine mileage interval specified in the Engine Maintenance Schedule. Clean with kerosene or detergent and water. Squeeze excess liquid from filter. Do not wring or twist. After cleaning, lightly oil the filter with clean engine lube oil.

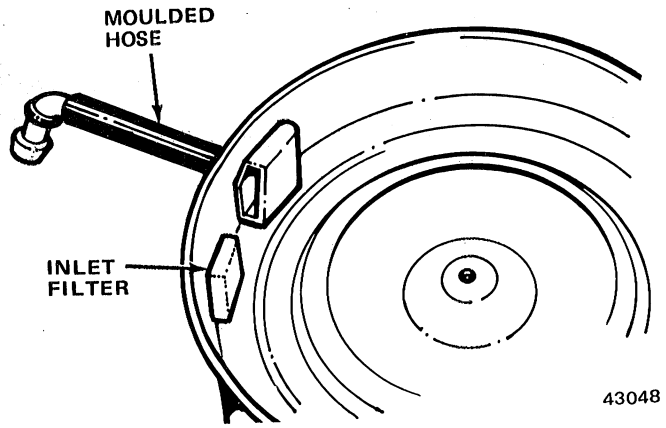

Fig. 1A-12 PCV Air Inlet Filter—Four- and Six-Cylinder Engines

Eight-Cylinder Engine

A PCV air inlet filter is located in the sealed oil filler cap. To clean the filter, apply light air pressure in the direction opposite normal air flow (through the filler tube opening in the cap). Do not apply oil to the filter. If the filter is deteriorated, replace the filler cap.

Fuel Tank Vapor Emission Control System

The fuel tank, filler cap, fuel hoses and vent hoses must be maintained in good condition to prevent raw fuel vapor (hydrocarbons) from entering the atmosphere.

Inspect the filler cap for evidence of fuel leakage stains at the filler neck opening. Remove the cap and examine the condition of the sealing gasket. Replace the filler cap if the gasket is damaged or deteriorated.

Inspect the fuel tank for evidence of fuel leakage stains. Trace stain to its origin and repair or replace the tank as required.

Inspect the fuel and vent hoses for leakage or damage. Repair or replace as required. Ensure all connections are tight.

If liquid fuel is present in the fuel vapor storage canister, inspect the liquid check valve and replace if necessary.

Fuel Vapor Storage Canister Filter

The filter pad located at the bottom of the canister is the only serviceable part of the canister assembly. Replace at the interval specified in the Engine Maintenance Schedule.

Thermostatically Controlled Air Cleaner (TAC) System

Inspect the air valve in the air cleaner snorkel for proper operation. If necessary, refer to Chapter 1J—Fuel Systems for functional test procedure.

Inspect hoses for cracks and brittleness. Replace as necessary.

EXHAUST SYSTEMS

Air Injection Systems

Inspect hoses and hose connections for defects. Replace as necessary. Refer to Chapter 1K—Exhaust Systems for system functional test procedures.

Exhaust Manifold Heat Valve—Eight-Cylinder Engine

The exhaust manifold heat valve is an often overlooked, but highly important, emission control related device. This valve can affect the fuel economy, engine performance and driveability, and cause excessive emission of undesirable exhaust gases.

Inspect the valve (located in front exhaust pipe) for correct operation and lubricate with Jeep Heat Valve Lubricant, or equivalent. Refer to Chapter 1K—Exhaust Systems for additional service procedures.

Tune-Up Specifications—On-Vehicle

CID and Venturi	Vehicle	Trans.	Curb Idle Speed - RPM①	Sole-Vac Speed RPM		Initial Timing BTDC at Curb 1600 RPM② With Vacuum Advance Hose Disconnected	Distributor Model Number	Vacuum Advance Mechanism	Centrifugal Degrees Advance At 2000 RPM	Vacuum Degrees Advance	Spark Plug Type And Gap
			Set To	Holding Solenoid Energized	Vacuum Actuator Energized	Set To					
258 2V	CJ	Manual (49-S)	650±70	750±50	900±50	8°±1° ③	3241334	8122802	8°-13°	Refer To Distributor Curves	Champion RFN14LY (Alternate FN14LY) 0.035 inch (0.033 to 0.038) inch (0.84) to 0.97 mm) Gap
		Manual (Calif.)	650±70	750±50	900±50	15°±1° ③	3231333	8122802	9.5°-13°		
		Automatic (49-S)	550±70	650±50	800±50	8°±1°	3241334	8122802	8°-13°		
		Automatic (Calif.)	550±70	650±50	800±50	15°±1°	3241333	8122802	9.5°-13°		
	Cherokee Wagoneer Truck	Manual (50-S)	600±70	750±50	900±50	15°±1°	3241333	8122802	9.5°-13°		
		Automatic (50-S)	500±70	650±50	800±50	15°±1°					
		Manual (Hi-ALT)	600±70	750±50	900±50	19°±1°	3241333	8122802	9.5°-13°		
		Automatic (Hi-ALT)	500±70	650±50	800±50	21°±1°	3241333	8122802	9.5°-13°		

NOTE: Automatic Adjusted in Drive; Manual in Neutral

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①Sole-Vac de-energized. ② Electronic retard deactivated

③ Timing set at curb idle (49S CJ)

CID and Venturi	Vehicle	Transmission	Slow Idle RPM		Initial Timing at Curb Idle With Vacuum Advance Hose Disconnected	Distributor Model Number	Vacuum Mechanism Number	Centrifugal Degrees Advance at 2000 RPM	Vacuum Degrees Advance	Spark Plug
			Set To	OK Range						
151 2V	CJ Scrambler	Manual (49-S)	900	800-1000	12°±1°	1110598	8134116	5°-7°	Refer To Distributor Curves	Type AC R44TSX 0.060 Inch (1.52 mm) Gap
		Manual (Calif.)	900	800-1000	8°±1000	1110598	8134116	5°-7°		
		Manual (HI—ALT)	900	800-1000	17°±1°	1110598	8134116	5°-7°		
360 2V	Cherokee Wagoneer Truck	Manaul (49-S)	600	550-650	10°±1°	3233174	8129470	6°-10.5°		RN12Y (Alt. N12Y) Gap 0.033 (0.84 mm) to 0.038 (0.97 mm)
		Automatic (49-S)	600	550-650	10°±1°	3233174	8129470	6°-10.5°		
		Manual/Automatic (HI—ALT)	600	550-650	16°±1°	3233174	8129470	6°-10.5°		

NOTE: Automatic Adjusted in Drive; Manual in Neutral. Idle Speed is 500 rpm with solenoid de-energized.

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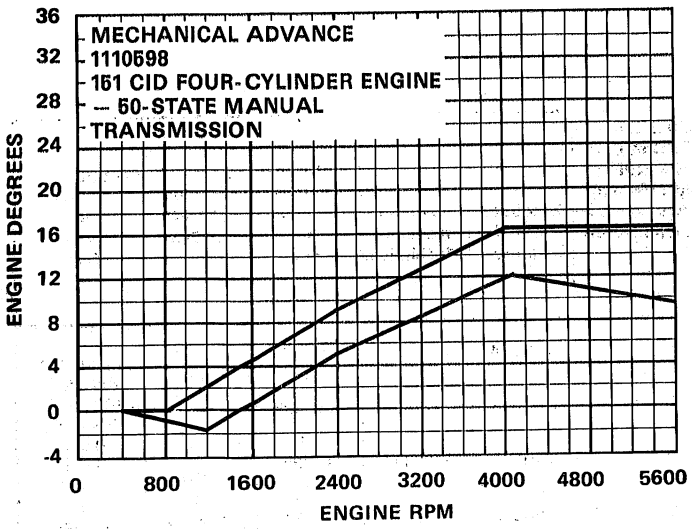
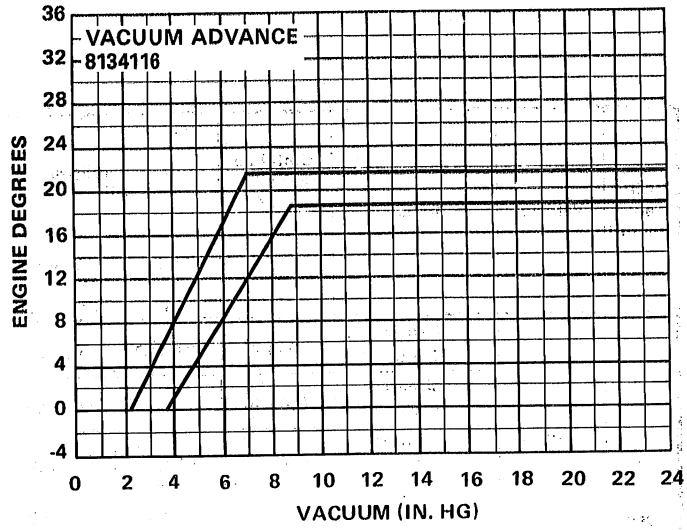
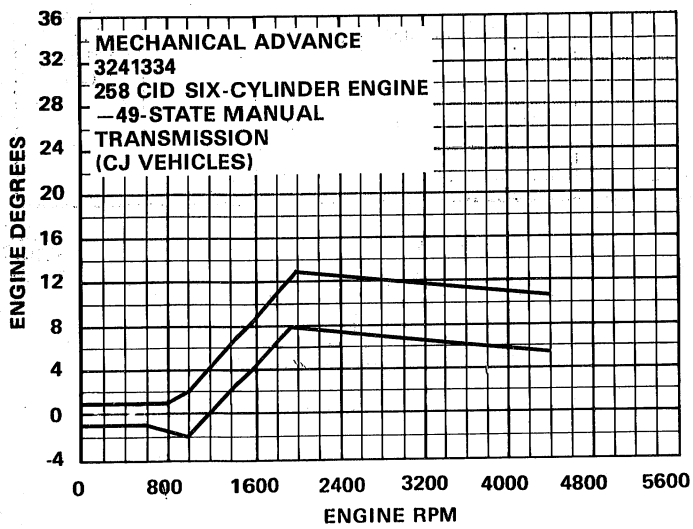
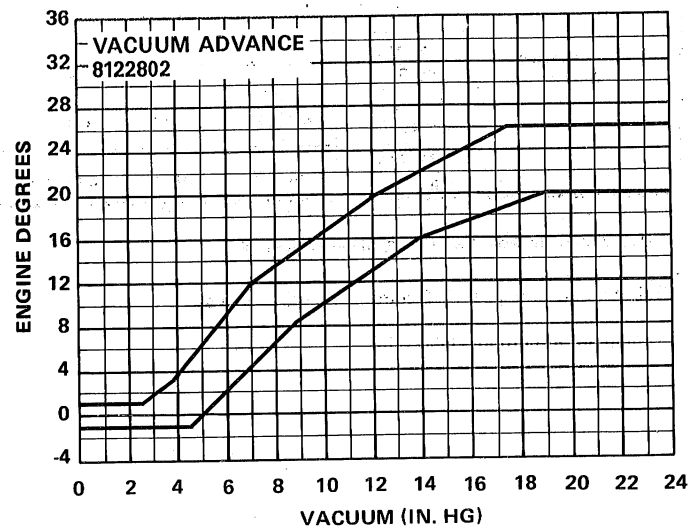
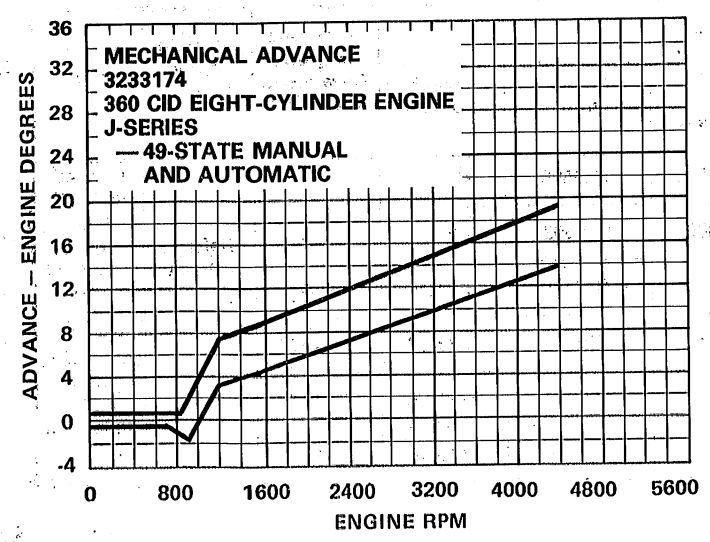
Distributor Curves—On-Vehicle

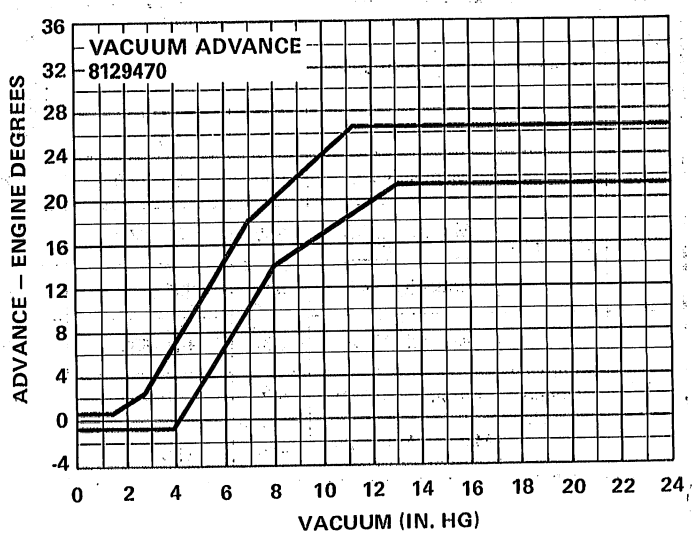












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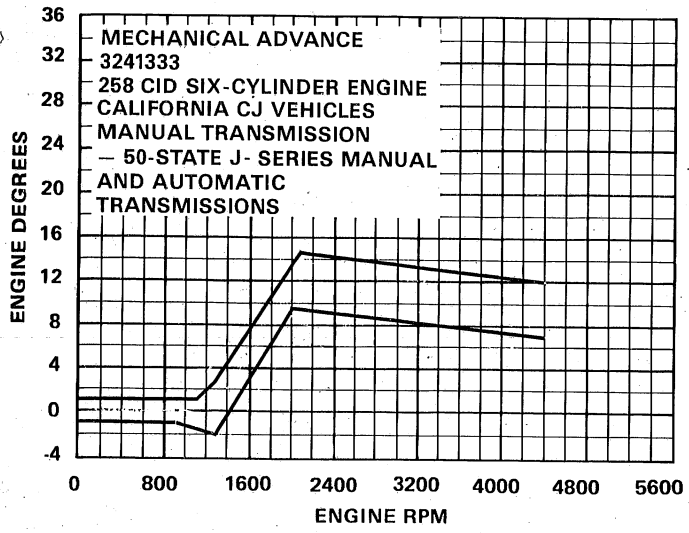
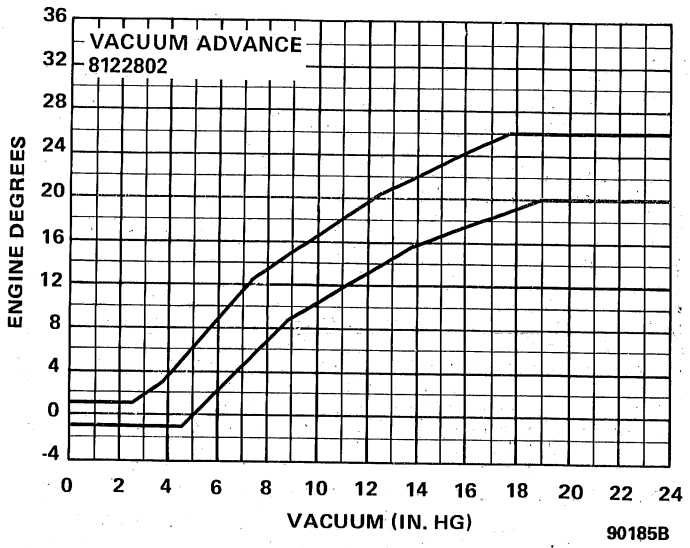
Distributor Curves—On-Vehicle





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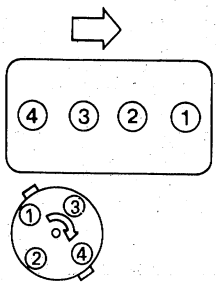
Distributor Wiring Sequence and Engine Firing Order

Four-Cylinder Engine



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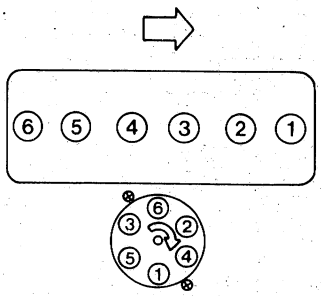
Six-Cylinder Engine



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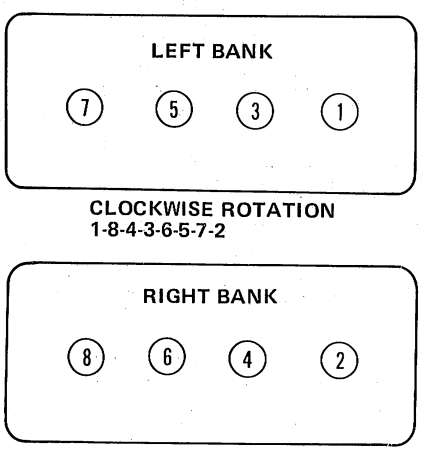
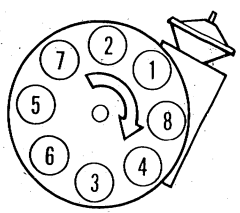
Eight-Cylinder Engine





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NOTES