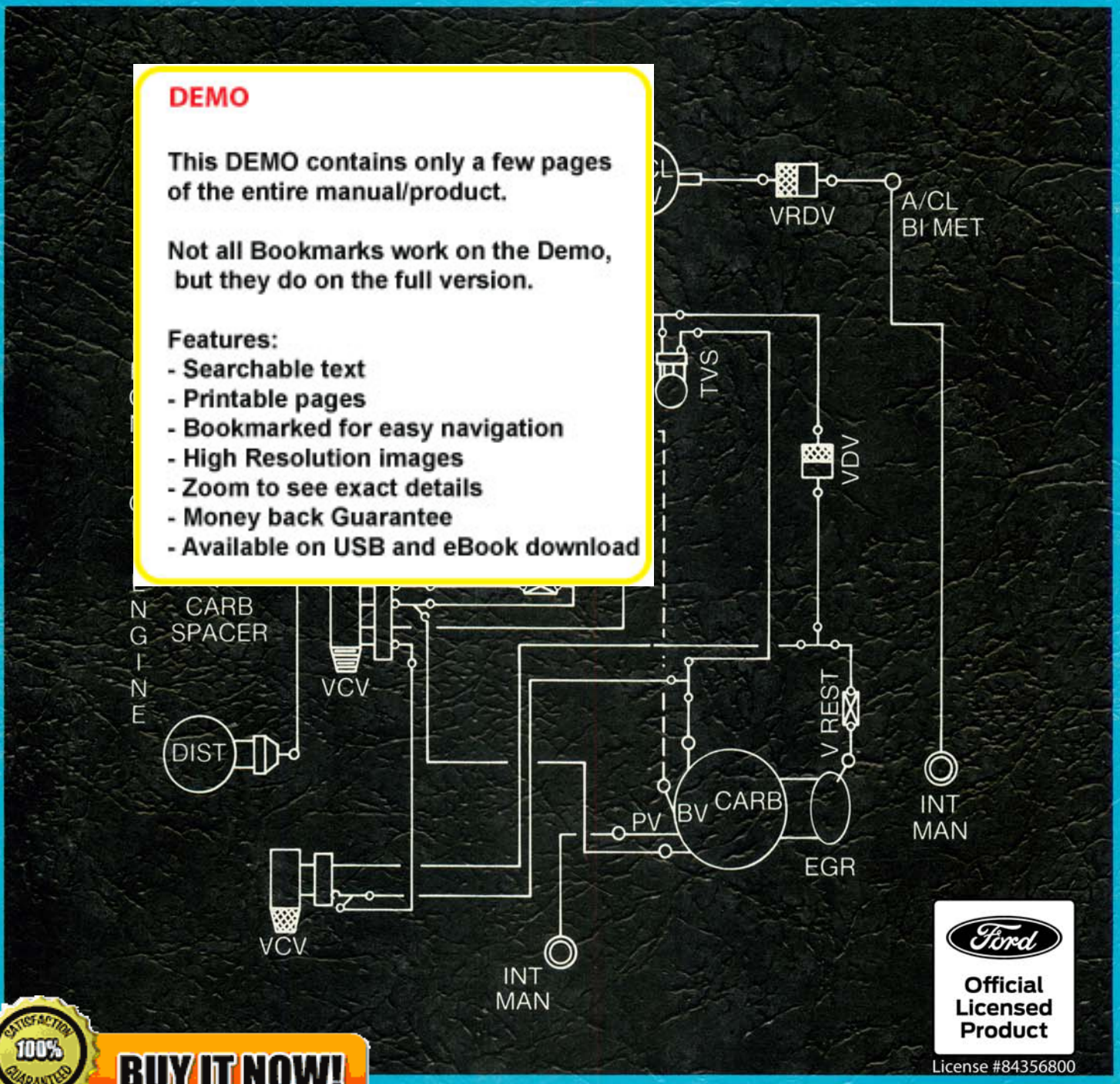
TECHNICIAN'S REFERENCE BOOK

HOW TO READ AND UNDERSTAND VACUUM DIAGRAMS



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Ford Parts and Service Division
Training and Publications Department

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IMPORTANT SAFETY NOTICE

Appropriate service methods and proper repair procedures are essential for the safe, reliable operation of all motor vehicles as well as the personal safety of the individual doing the work. This manual provides general directions for accomplishing service and repair work with tested, effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions to each. Accordingly, anyone who departs from the instructions provided in this manual must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools or parts.

As you read through the procedures, you will come across NOTES, CAUTIONS, and WARNINGS. Each one is there for a specific purpose. NOTES give you added information that will help you to complete a particular procedure. CAUTIONS are given to prevent you from making an error that could damage the vehicle. WARNINGS remind you to be especially careful in those areas where carelessness can cause personal injury. The following list contains some general WARNINGS that you should follow when you work on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires you to be under the vehicle.
- Be sure that the ignition is always in the OFF position, unless otherwise required by the procedure.
- Set the parking brake when working on the vehicle. If you have an automatic transmission, set it in PARK. If you have a manual transmission, it should be in REVERSE.
- Operate the engine only in a well-ventilated area to avoid the danger of carbon monoxide.
- Keep yourself and your clothing away from moving parts, when the engine is running, especially the fan and belts. Remove neckties and tie long hair securely behind the head.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on the vehicle.
- To avoid injury, always remove rings, watches, loose hanging jewelry, and loose clothing before beginning to work on a vehicle.

NOTE: The recommendations and suggestions contained in this manual are made to assist the dealer in improving his dealership parts and/or service department operations. These recommendations and suggestions do not supersede or override the provisions of the Warranty and Policy Manual and in any cases where there may be a conflict, the provisions of the Warranty and Policy Manual shall govern.

The descriptions, testing procedures, and specifications in this manual were in effect at the time the manual was approved for printing. Ford Motor Company reserves the right to discontinue models at any time, or change specifications, design or testing procedures without notice and without incurring obligation.

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NOTE

Most of the information in this manual is based on typical vacuum systems for 1981-83 1.6 liter engines. However, other vacuum system variations and their vacuum devices are included to provide a more complete reference source.

Also, certain values are stated for vacuum components and system operation during specific operating conditions. These are for illustrative and instructional purposes only and are not to be used for testing purposes.

This manual contains general test procedures and specifications. For those adjustment and test specifications not included, refer to the appropriate Shop Manual, TSB, Engine Control Systems Manuals, Engine/Emissions Facts Book or Emission Control (Vacuum System) Decal under the hood.

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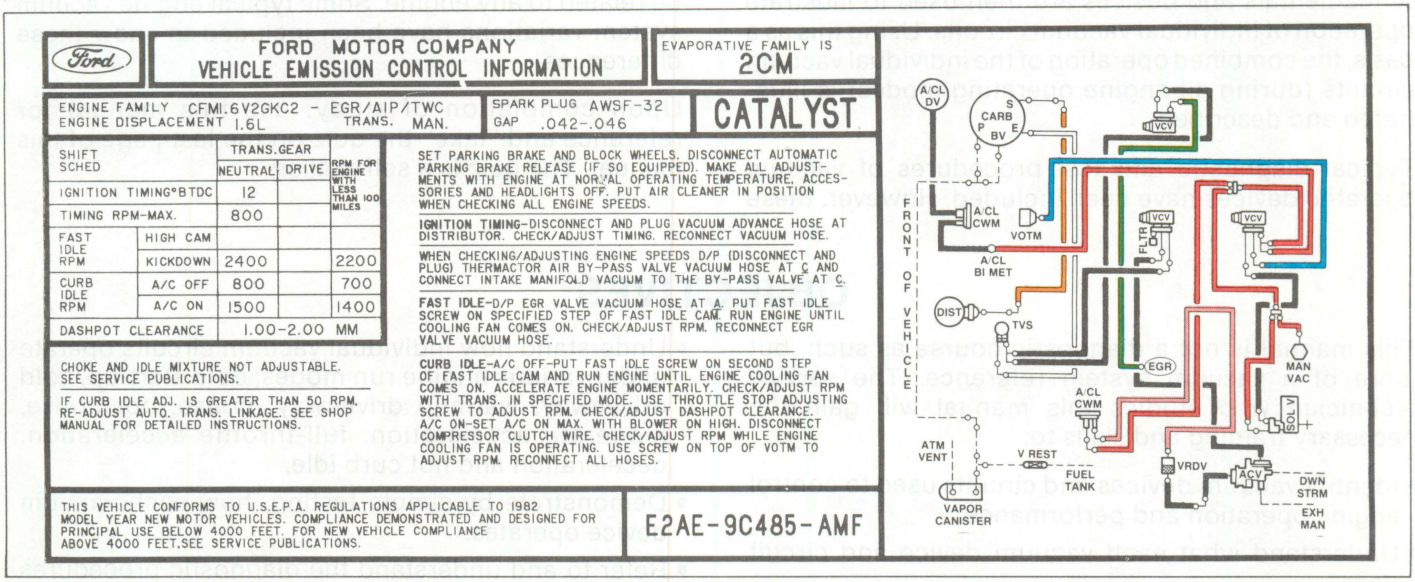
INTRODUCTION

This manual has been developed to help you read and understand vacuum diagrams similar to the diagrams shown in Figure 1 and Figure 1A. It describes the different vacuum-operated devices and circuits that are used to control engine operation and performance.



FORD MOTOR COMPANY
VEHICLE EMISSION CONTROL INFORMATION

EVAPORATIVE FAMILY IS 2CM

ENGINE FAMILY CFMI.6V2GKC2 - EGR/AIP/TWC
ENGINE DISPLACEMENT 1.6L TRANS. MAN.

SPARK PLUG AWSF-32
GAP .042-.046

CATALYST

SHIFT SCHED		TRANS.GEAR NEUTRAL	DRIVE	RPM FOR ENGINE WITH LESS THAN 100 MILES
IGNITION TIMING°BTDC		12		
TIMING RPM-MAX.		800		
FAST IDLE RPM	HIGH CAM			
	KICKDOWN	2400		2200
CURB IDLE RPM	A/C OFF	800		700
	A/C ON	1500		1400
DASHPOT CLEARANCE		1.00-2.00 MM		

CHOKE AND IDLE MIXTURE NOT ADJUSTABLE. SEE SERVICE PUBLICATIONS.

IF CURB IDLE ADJ. IS GREATER THAN 50 RPM, RE-ADJUST AUTO. TRANS. LINKAGE. SEE SHOP MANUAL FOR DETAILED INSTRUCTIONS.

SET PARKING BRAKE AND BLOCK WHEELS. DISCONNECT AUTOMATIC PARKING BRAKE RELEASE (IF SO EQUIPPED). MAKE ALL ADJUSTMENTS WITH ENGINE AT NORMAL OPERATING TEMPERATURE. ACCESSORIES AND HEADLIGHTS OFF. PUT AIR CLEANER IN POSITION WHEN CHECKING ALL ENGINE SPEEDS.

IGNITION TIMING-DISCONNECT AND PLUG VACUUM ADVANCE HOSE AT DISTRIBUTOR. CHECK/ADJUST TIMING. RECONNECT VACUUM HOSE.

WHEN CHECKING/ADJUSTING ENGINE SPEEDS D/P (DISCONNECT AND PLUG) THERMACTOR AIR BY-PASS VALVE VACUUM HOSE AT C AND CONNECT INTAKE MANIFOLD VACUUM TO THE BY-PASS VALVE AT C.

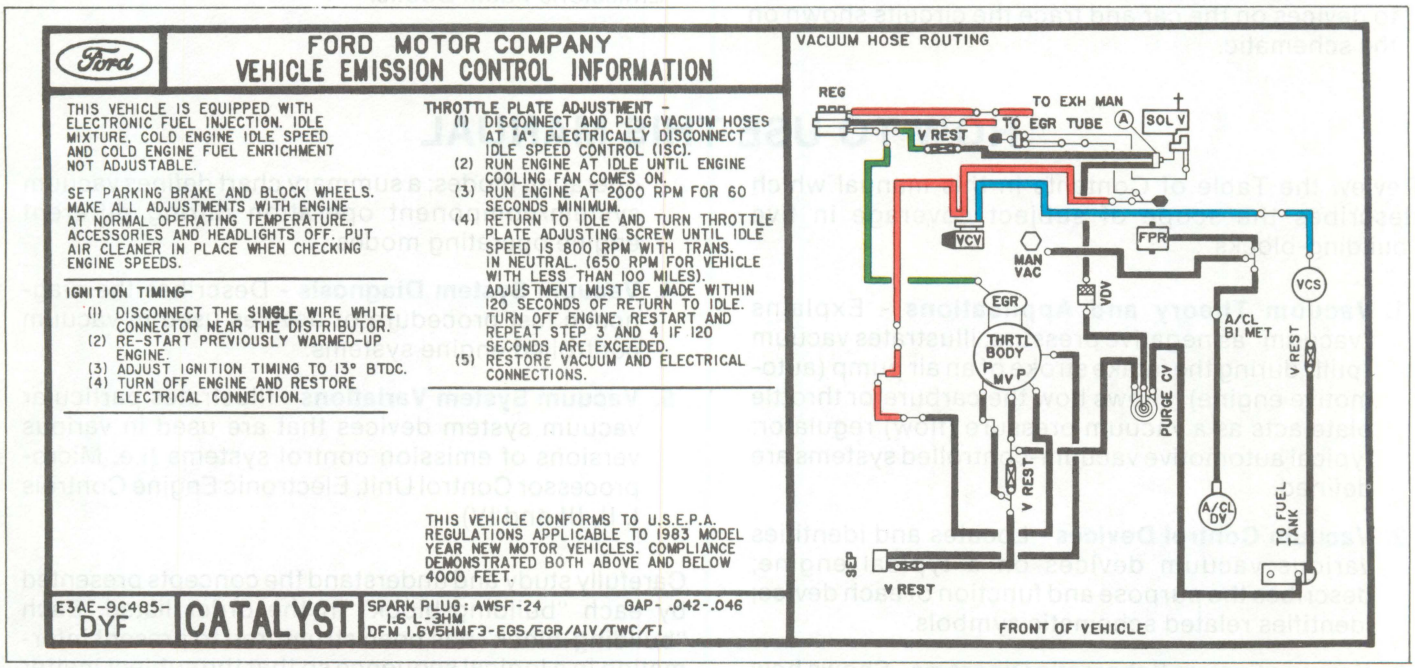
FAST IDLE-D/P EGR VALVE VACUUM HOSE AT A. PUT FAST IDLE SCREW ON SPECIFIED STEP OF FAST IDLE CAM. RUN ENGINE UNTIL COOLING FAN COMES ON. CHECK/ADJUST RPM. RECONNECT EGR VALVE VACUUM HOSE.

CURB IDLE-A/C OFF-PUT FAST IDLE SCREW ON SECOND STEP OF FAST IDLE CAM AND RUN ENGINE UNTIL ENGINE COOLING FAN COMES ON. ACCELERATE ENGINE MOMENTARILY. CHECK/ADJUST RPM WITH TRANS. IN SPECIFIED MODE. USE THROTTLE STOP ADJUSTING SCREW TO ADJUST RPM. CHECK/ADJUST DASHPOT CLEARANCE. A/C ON-SET A/C ON MAX. WITH BLOWER ON HIGH. DISCONNECT COMPRESSOR CLUTCH WIRE. CHECK/ADJUST RPM WHILE ENGINE COOLING FAN IS OPERATING. USE SCREW ON TOP OF VOTM TO ADJUST RPM. RECONNECT ALL HOSES.

THIS VEHICLE CONFORMS TO U.S.E.P.A. REGULATIONS APPLICABLE TO 1982 MODEL YEAR NEW MOTOR VEHICLES. COMPLIANCE DEMONSTRATED AND DESIGNED FOR PRINCIPAL USE BELOW 4000 FEET. FOR NEW VEHICLE COMPLIANCE ABOVE 4000 FEET,SEE SERVICE PUBLICATIONS.

E2AE-9C485-AMF

Figure 1 — Typical Vacuum System Schematic Underhood Decal, 1.6 Liter Engine (1982)



FORD MOTOR COMPANY
VEHICLE EMISSION CONTROL INFORMATION

THIS VEHICLE IS EQUIPPED WITH ELECTRONIC FUEL INJECTION. IDLE MIXTURE, COLD ENGINE IDLE SPEED AND COLD ENGINE FUEL ENRICHMENT NOT ADJUSTABLE.

SET PARKING BRAKE AND BLOCK WHEELS. MAKE ALL ADJUSTMENTS WITH ENGINE AT NORMAL OPERATING TEMPERATURE. ACCESSORIES AND HEADLIGHTS OFF. PUT AIR CLEANER IN PLACE WHEN CHECKING ENGINE SPEEDS.

IGNITION TIMING-

(1) DISCONNECT THE SINGLE WIRE WHITE CONNECTOR NEAR THE DISTRIBUTOR.
(2) RE-START PREVIOUSLY WARMED-UP ENGINE.
(3) ADJUST IGNITION TIMING TO 13° BTDC.
(4) TURN OFF ENGINE AND RESTORE ELECTRICAL CONNECTION.

THROTTLE PLATE ADJUSTMENT -

(1) DISCONNECT AND PLUG VACUUM HOSES AT "A". ELECTRICALLY DISCONNECT IDLE SPEED CONTROL (ISC).
(2) RUN ENGINE AT IDLE UNTIL ENGINE COOLING FAN COMES ON.
(3) RUN ENGINE AT 2000 RPM FOR 60 SECONDS MINIMUM.
(4) RETURN TO IDLE AND TURN THROTTLE PLATE ADJUSTING SCREW UNTIL IDLE SPEED IS 800 RPM WITH TRANS. IN NEUTRAL. (650 RPM FOR VEHICLE WITH LESS THAN 100 MILES). ADJUSTMENT MUST BE MADE WITHIN 120 SECONDS OF RETURN TO IDLE. TURN OFF ENGINE, RESTART AND REPEAT STEP 3 AND 4 IF 120 SECONDS ARE EXCEEDED.
(5) RESTORE VACUUM AND ELECTRICAL CONNECTIONS.

THIS VEHICLE CONFORMS TO U.S.E.P.A. REGULATIONS APPLICABLE TO 1983 MODEL YEAR NEW MOTOR VEHICLES. COMPLIANCE DEMONSTRATED BOTH ABOVE AND BELOW 4000 FEET.

E3AE-9C485-DYF

CATALYST

SPARK PLUG: AWSF-24 GAP- .042-.046
1.6 L-3HM
DFM 1.6V5HMF3-EGS/EGR/AIV/TWC/FI

VACUUM HOSE ROUTING

Figure 1A — Typical Vacuum System Schematic Underhood Decal, 1.6 Liter Engine (1983)

Note the differences in vacuum hose routing and the manner in which emission control information is presented for and 1983 1.6 liter engine (Figure 1 and 1A). The 1983 engine decal shown has electronic fuel injection to ured engine and a fuel injected engine with EEC-IV system.

APPROACH

A "building-block" approach has been used in this training manual, starting with vacuum fundamentals. Next, vacuum-controlled engine systems are identified. Each vacuum-operated device is shown with the schematic symbol used on vacuum diagrams. Vacuum fundamentals and devices are then used to illustrate operation of individual vacuum circuits. Using this as a basis, the combined operation of the individual vacuum circuits (during all engine operating modes) is illustrated and described.

Typical diagnostic and test procedures of vacuum operated devices have been included. However, these procedures relate to specific devices and not necessarily to the circuit in which they function. Therefore, this manual is not intended to replace Ford Shop Manuals or other technical publications. It is designed to provide you with an understanding of vacuum systems that can be related to any engine. Some typical engine vacuum system variations have been included to show these differences.

Upon completion of study, use this manual for reference and "take" the quiz on the last page of this manual. The quiz is a self-mailer.

OBJECTIVES

This manual is not a diagnostic course as such, but more of a vacuum system reference. The service technician who studies this manual will gain the necessary training and skills to:

- Identify vacuum devices and circuits used to control engine operation and performance.
- Understand what each vacuum device and circuit does.
- Relate the "underhood" vacuum schematic diagram to devices on the car and trace the circuits shown on the schematic.
- Understand how individual vacuum circuits operate under various engine run modes; cold start-up, cold driveaway, warmup driveaway, cruise, hot cruise, moderate acceleration, full-throttle acceleration, deceleration and hot curb idle.
- Demonstrate by simple testing, how each vacuum device operates.
- Refer to and understand the diagnostic procedures in appropriate Shop Manuals, TSBs and Engine/ Emissions Facts Books.

HOW TO USE THIS MANUAL

Review the Table of Contents in this manual which describes the scope of subject coverage in five "building-blocks":

1. **Vacuum Theory and Applications** - Explains "vacuum" as negative pressure; illustrates vacuum "pull" during the intake stroke of an air pump (automotive engine); shows how the carburetor throttle plate acts as a vacuum pressure (flow) regulator; typical automotive vacuum-controlled systems are defined.
2. **Vacuum Control Devices** - Locates and identifies various vacuum devices on a typical engine; describes the purpose and function of each device; identifies related schematic symbols.
3. **Vacuum System Schematic Diagrams** - Shows how to read the Engine Code Tag and engine decal color coding; defines six major vacuum circuits and traces vacuum flow on schematic diagrams. The vacuum system operating sequence shows how and during different engine operating modes; a summary chart defines vacuum system/component operation during different engine operating modes.
4. **Vacuum System Diagnosis** - Describes the diagnostic test procedure of devices used in vacuum controlled engine systems.
5. **Vacuum System Variations** - Illustrates particular vacuum system devices that are used in various versions of emission control systems (i.e. Microprocessor Control Unit, Electronic Engine Controls I, II, III and IV).

Carefully study and understand the concepts presented by each "building-block" in the order listed. Each "building-block" has been structured to present information in a logical sequence so that the subject matter can be easily understood by service technicians who have little or no technical knowledge about vacuum systems. Yet this manual is detailed enough to serve as a reference manual or refresher for those with a working knowledge of vacuum systems.

VACUUM THEORY AND APPLICATIONS

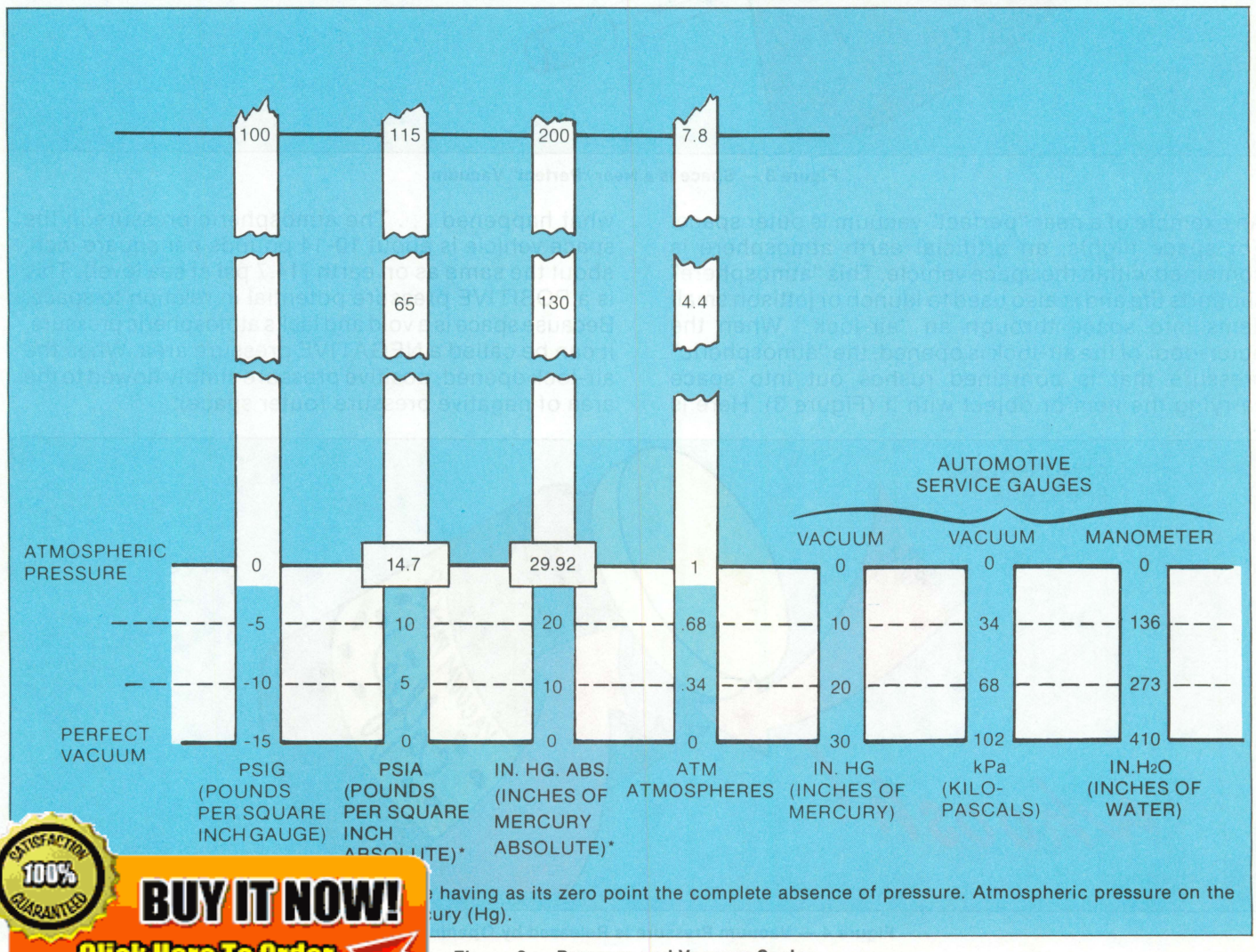
WHAT VACUUM IS

The term "vacuum" refers to a pressure level that is lower than the earth's atmospheric pressure at any given altitude. The higher the altitude, the lower the atmospheric pressure.

Vacuum pressure can be measured in relation to atmospheric pressure. Atmospheric pressure is the pressure exerted on every object on earth and is caused by the weight of the surrounding air. At sea level, the pressure exerted by the atmosphere is 14.7 psi (absolute). Most pressure gauges ignore atmospheric pressure and read **zero** under normal conditions. For service purposes, atmospheric pressure is **zero psi gauge**. But, we usually measure vacuum in inches of Mercury (**in. Hg**) instead of psi. Other units of vacuum measure seen on automotive service gauges are **kPa**, kilopascals and the manometer which measures pressure in "inches of water". The relationship of psi gauge (**psig**), pounds per square inch absolute (**psia**), inches of mercury absolute (**in. Hg abs**), atmospheres (**atm**), inches of mercury (**in. Hg**), kilopascals (**kPa**) and inches of water (in. H_2O) is shown in Figure 2.

A perfect vacuum, 29.92 in. Hg, is the complete absence of pressure (zero psi absolute). It is interesting to note that at 32° F (0° C), water will boil in a "perfect vacuum."

The pressure and vacuum scales (Figure 2) also identify vacuum as a **negative** pressure level that can be measured. However, the terms "absence of pressure" or "negative pressure" can be misleading. Under controlled conditions, such as an automotive vacuum system, vacuum is a form of energy that can be put to work.



having as its zero point the complete absence of pressure. Atmospheric pressure on the ury (Hg).

Figure 2 — Pressure and Vacuum Scales

VACUUM AT WORK

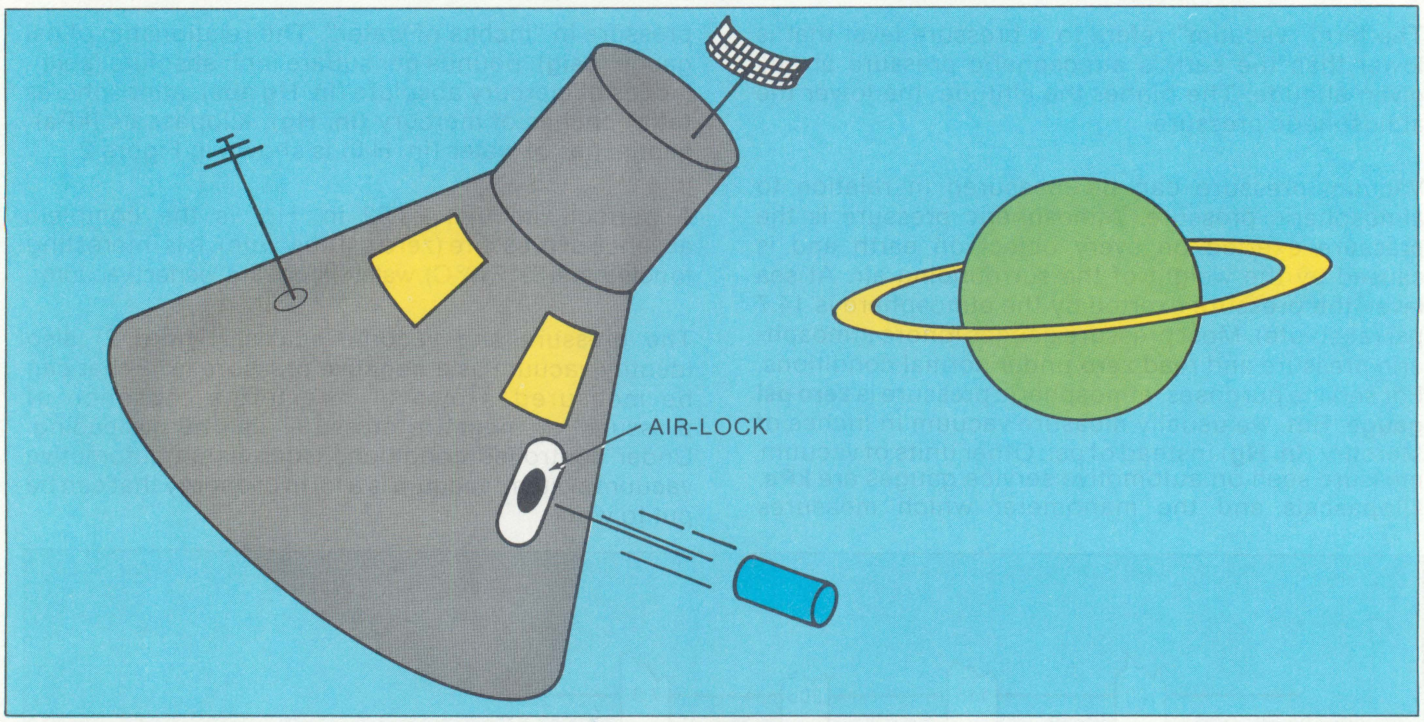
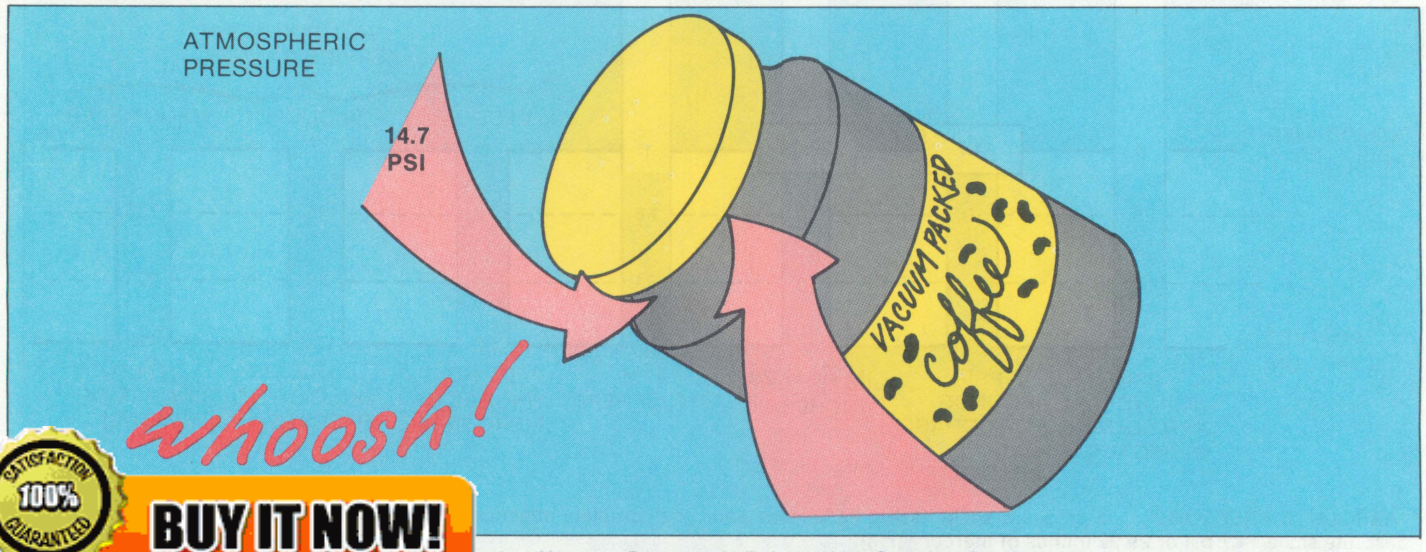


Figure 3 — Space Is a Near "Perfect" Vacuum

An example of a near "perfect" vacuum is outer space. For space flights, an artificial earth atmosphere is contained within the space vehicle. This "atmosphere" supports life and is also used to launch or jettison small items into space through an "air-lock." When the outer-door of the air-lock is opened, the "atmospheric" pressure that is contained rushes out into space carrying the item or object with it (Figure 3). Here is what happened . . . The atmospheric pressure in the space vehicle is about 10-14 pounds per square inch, about the same as on earth (14.7 psi at sea level). This is a POSITIVE pressure potential in relation to space. Because space is a void and lacks atmospheric pressure, it can be called a NEGATIVE pressure area. When the air-lock opened, positive pressure simply flowed to the area of negative pressure (outer space).



e 4 — Vacuum Pressure Is Released by Opening Seal

VACUUM AT WORK (Cont'd)

The basic laws of physics state that positive pressure always flows to an area that has a greater value of negative pressure (increased vacuum level).

Examples of vacuum energy at work are found in everyday experiences. When a "vacuum-packed" coffee jar is opened, the "WHOOSH" sound you hear is atmospheric pressure, a positive force outside the jar rushing into an area of negative pressure inside the jar (Figure 4). The negative pressure was created during the packing process which literally "pulled" the air out of the jar and then sealed it to keep the air out.

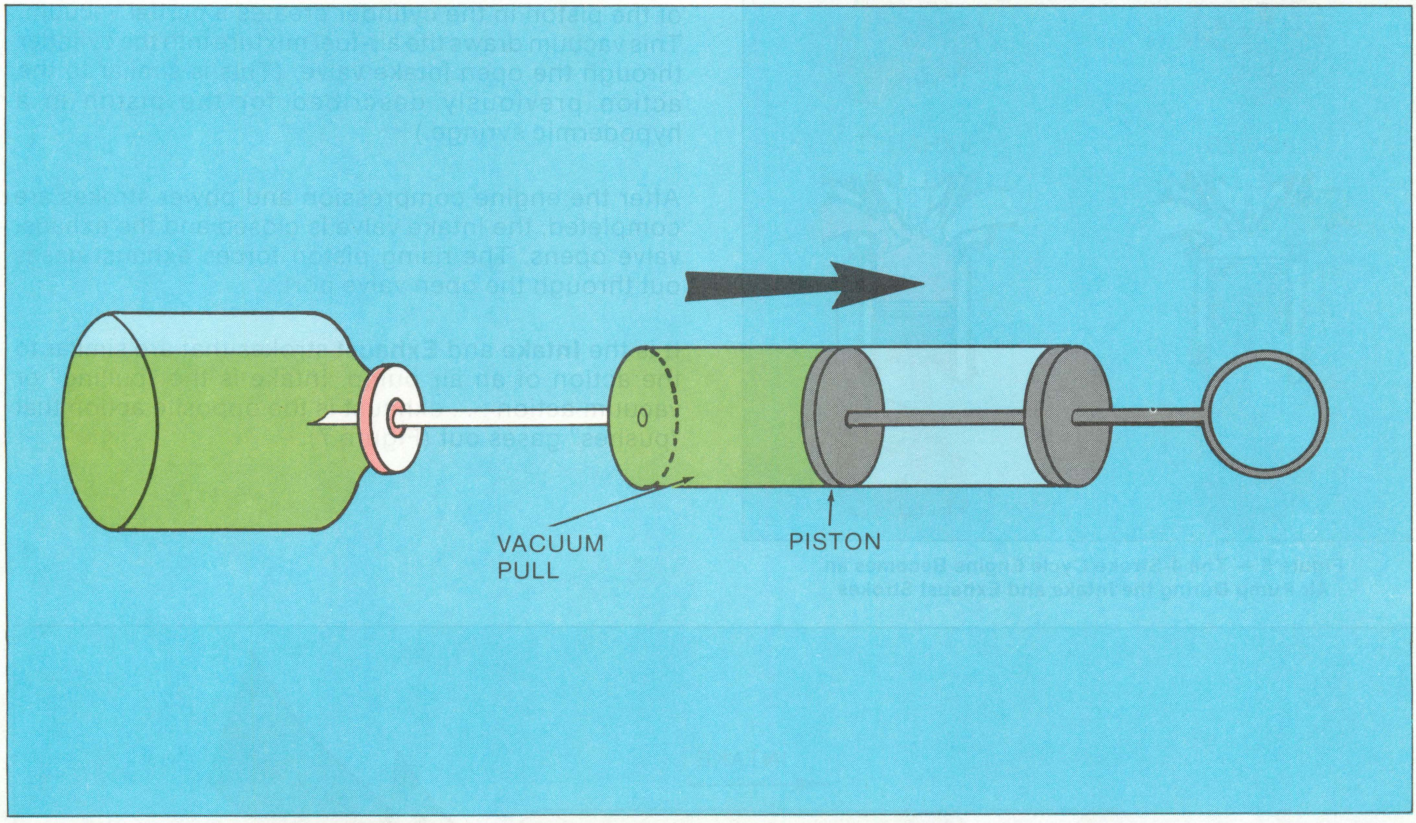


Figure 5 — The Action of a Piston in an Air-Tight Cylinder Creates a Negative Pressure . . . A Vacuum

An all too familiar example of vacuum action is a medical hypodermic syringe . . . we all remember shots! When the hypodermic needle is inserted into a vial of serum, the seal around the needle is virtually leak-proof. Pulling the hypodermic plunger outward pulls a piston inside the syringe which creates a vacuum. The serum is "pulled" out of the vial by the negative pressure (vacuum) created by the outward motion of the piston in a sealed chamber (Figure 5).

VACUUM SYSTEM SCHEMATIC DIAGRAMS

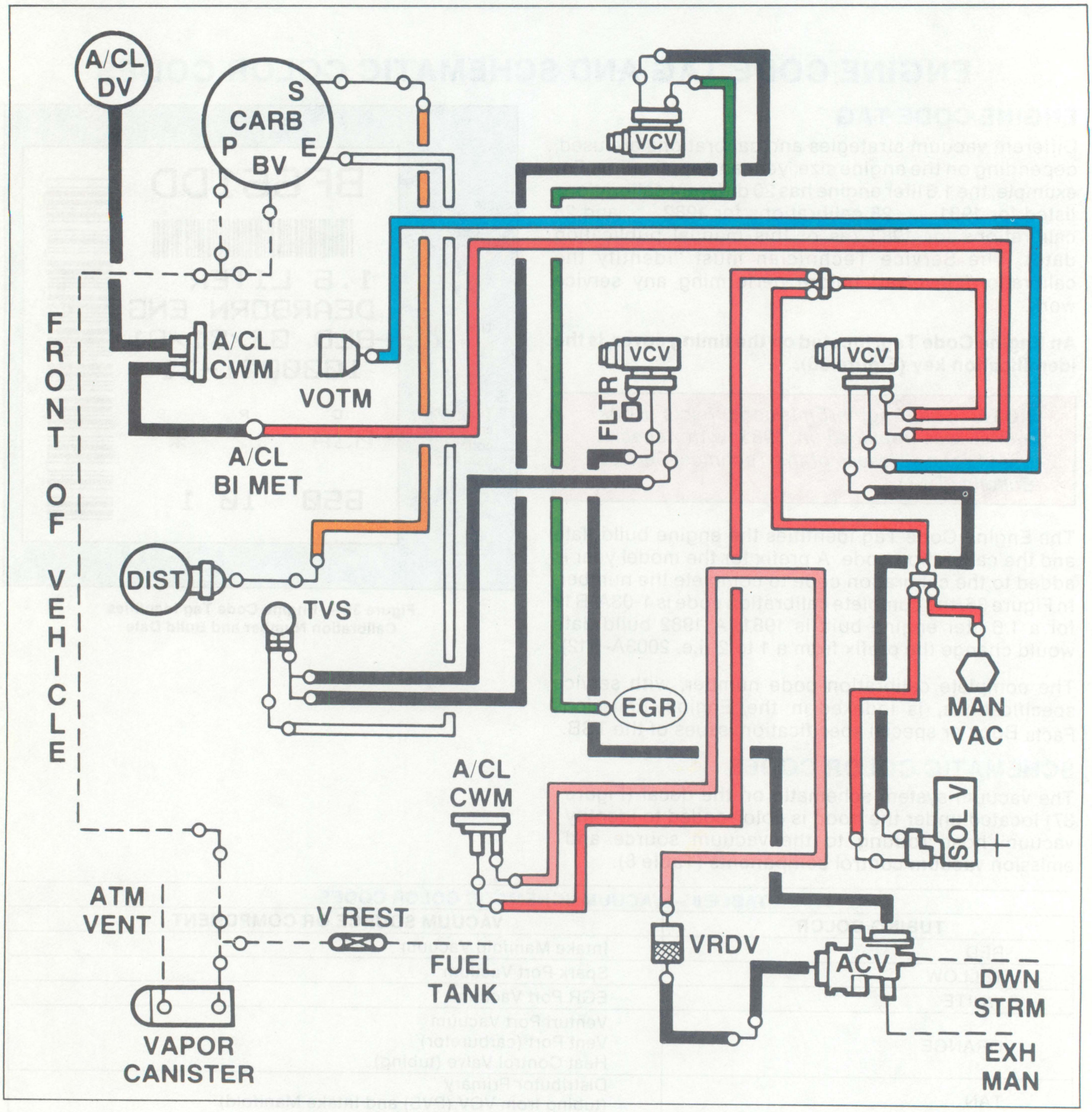


Figure 37 — Emission Control Decal (2-03E-R00 Calibration)

INDIVIDUAL VACUUM CIRCUIT OPERATION

Individual vacuum-operated circuits affect the air intake system, fuel intake system, ignition and emission controls. These circuits are inter-related during various engine operating modes. That is, no one circuit operates to the total exclusion of the others. Table 9 lists the vacuum circuits that "operate" in response to different engine loads and temperatures. However, for purposes of circuit tracing clarity, the vacuum circuits listed in Table 9 are described as individual, separate circuits on schematic drawings (Figures 38 through 54).

TABLE 9 — ENGINE LOAD AND VACUUM CIRCUIT

SYSTEM OPERATING MODE	VACUUM	AIR INLET	THROTTLE KICKER	EXHAUST GAS RECIRC.	CANISTER PURGE	IGNITION ADVANCE	ANTI-BACKFIRE VALVE (1981 MTX ONLY)	THERMACTOR AIR CONTROL
COLD START-UP FAST IDLE RPM (COLD AMBIENT AIR)	STRONG	MANIFOLD HEATED AIR	MOST CALIBRATIONS ON	OFF	1982-83 TO PURGE PORT 1981 OFF	CENTRIFUGAL AND VACUUM	OPEN TO AIR CONTROL VALVE	DUMPED
COLD DRIVEAWAY PART THROTTLE (COLD AMBIENT AIR)	STRONG TO MODERATE							
WARMUP DRIVEAWAY OR CRUISE PART THROTTLE AIR CLEANER WARM	STRONG TO MODERATE	SWITCH FROM HEATED TO FRESH AIR						UPSTREAM
HOT CRUISE PART THROTTLE	STRONG TO MODERATE	FRESH AIR	ON WITH A/C ON OTHER-WISE OFF	ON	1982-83 TO PURGE PORT 1981 TO MANIFOLD			DOWNSTREAM
HOT ENGINE ACCELERATION AT 60% THROTTLE	WEAK			OFF	1982-83 TO PURGE PORT 1981 OFF	CENTRIFUGAL ONLY		DOWNSTREAM MAY DUMP AT PROLONGED ACCELERATION
HOT ENGINE ACCELERATION AT WIDE-OPEN THROTTLE	WEAK TO ZERO				OFF			
HOT ENGINE DECELERATION AT CLOSED THROTTLE	M-STRONG S-ZERO E-ZERO P-ZERO						DIVERTS TO MANIFOLD MOMENTARILY	DOWNSTREAM 1981 DUMPED AT PROLONGED IDLE
HOT CURB IDLE	M-STRONG S-ZERO E-ZERO P-ZERO							
HOT ENGINE SHUTDOWN	OFF	OFF			ALL VAPORS TO CANISTER	OFF	OFF	OFF

VACUUM SYSTEM SCHEMATIC DIAGRAMS

PRIMARY AIR INLET

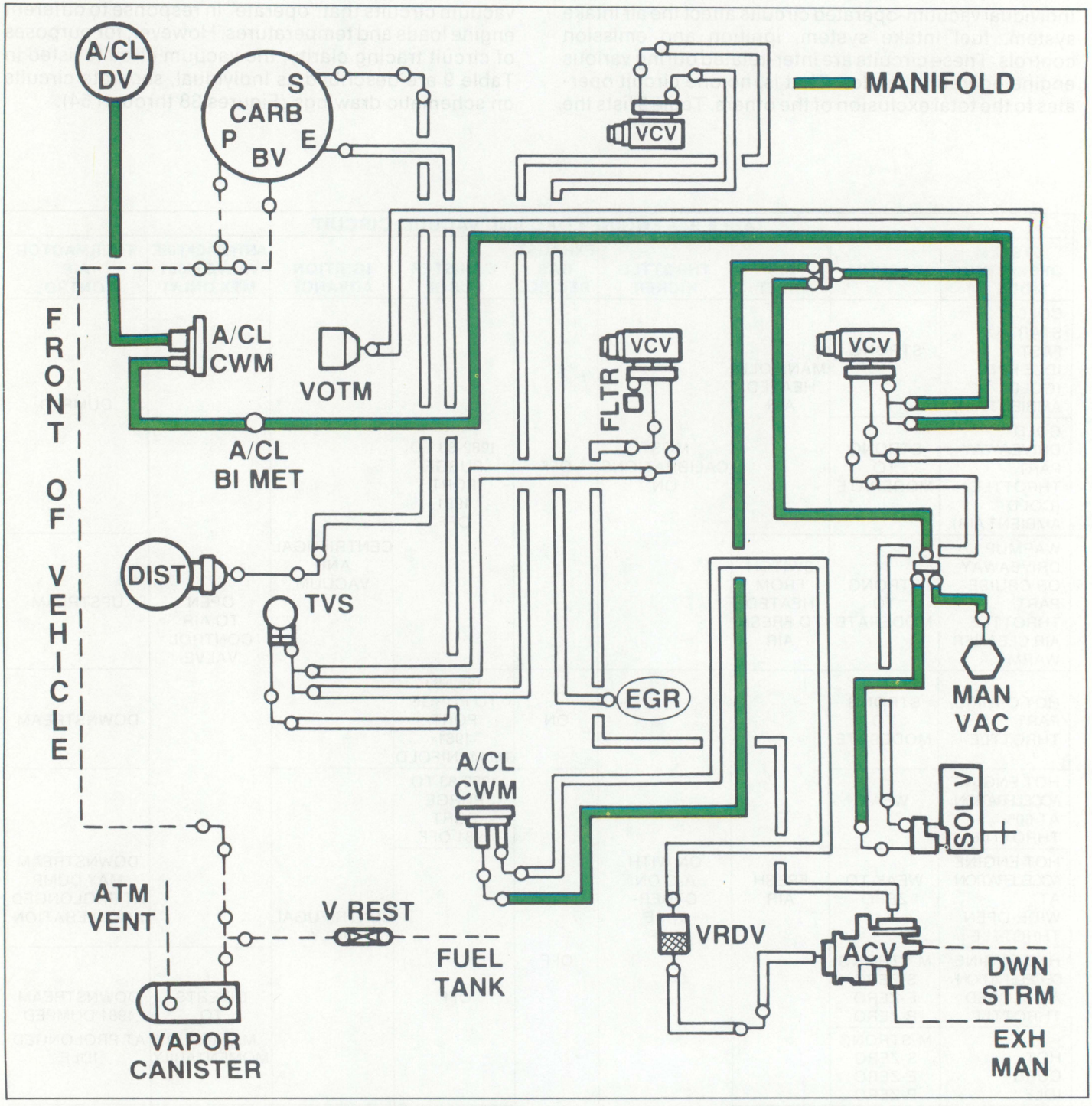


Figure 38 — Primary Air Inlet During Cold Startup, Cold Driveaway and Warmup Driveaway

Figures 38, 39 and 40 describe primary air inlet ...ion.

...y under light throt- ...in the air cleaner is ...N VAC) is applied to ...which closes. This opens the air cleaner to air heated by the exhaust manifold.

During wide-open throttle on a cold engine, the A/CL CWM traps vacuum at the A/CL DV to keep the door closed to cold, outside air.

VACUUM SYSTEM DIAGNOSIS

SAFETY PRECAUTIONS to observe when working on a vehicle:

- Do not operate engine with hood open until fan has first been examined for possible cracks or separation.
- Inspect each individual blade on the fan for tightness before starting engine.
- Whenever running the engine apply the parking brake and block the wheels.
- Never operate engine in a closed area.
- Make sure that no articles of clothing, such as ties or handkerchiefs, can become entangled with the moving parts of the engine. Watches, bracelets, and rings should also be removed. Tie long hair securely behind the head.
- Do not operate the engine at idle speeds for extended periods of time! This can cause high exhaust temperatures and excessive underbody temperatures.

VACUUM SYSTEM PRE-CHECKS

Vacuum system problems can produce or contribute to driveability symptoms, such as:

- Stalls
- No Start (cold)
- Hard Start (floods hot)
- Backfire (deceleration)
- Rough Idle
- Poor Acceleration
- Rich or Lean "Stumble"
- Overheating
- "Knock" or Pinging
- Detonation
- "Rotten Eggs" Odor
- Poor Fuel Economy

As a **routine** part of problem diagnosis, the service technician suspecting a "vacuum" condition should **first**:

- Inspect vacuum hoses for improper routing or disconnects (engine decal identifies hose routing).
- Look for kinks, tears or cuts in vacuum lines.
- Check vacuum hose routing and wear near "hot" spots, such as the exhaust manifold or the EGR tubes.
- Make sure there is no evidence of oil or transmission fluid on vacuum hose connections (valves can become contaminated by oil getting inside).
- Inspect vacuum system devices for damage (i.e. dents in cans; by-pass valves; broken nipples on VCV or PVS valves; broken "Tees" in vacuum lines, etc.).

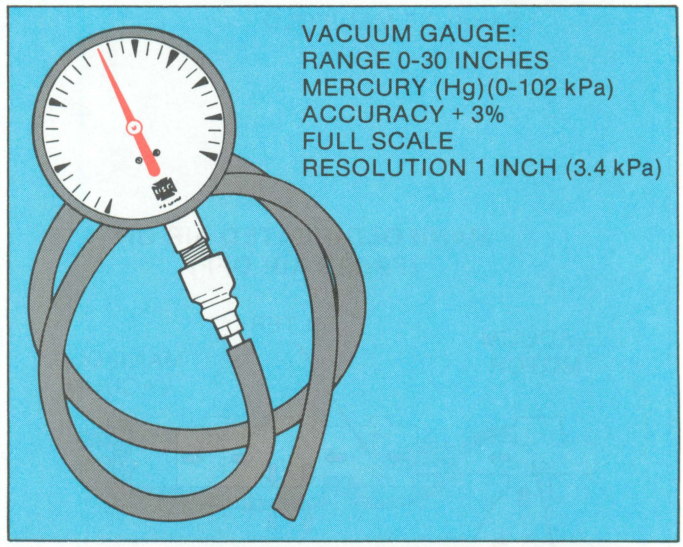


Figure 61 — Vacuum Gauge

VACUUM TEST EQUIPMENT

Special test equipment has been developed to check EEC (Electronic Engine Controls) and MCU (Microprocessor Control Unit) emission controls. **The test equipment described in this manual is limited to testing vacuum control devices only** ystem diagnostic procedures and in the applicable

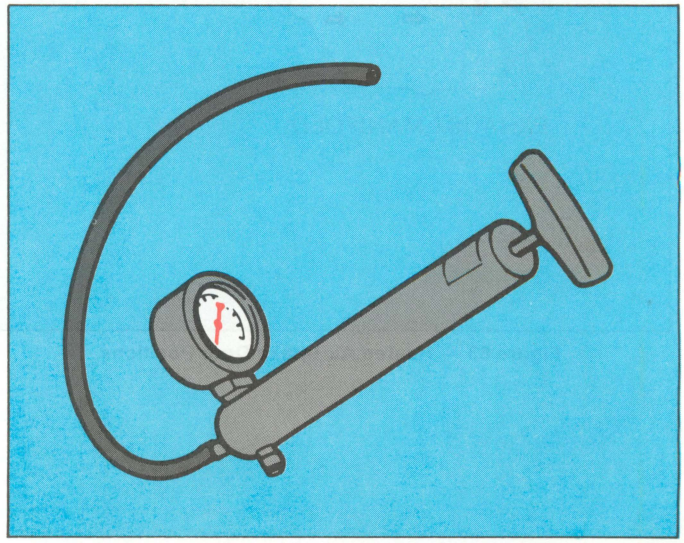


Figure 62 — Rotunda (Vacuum) Pump 21-0014 or Equivalent

VACUUM-CONTROLLED CIRCUITS AND DEVICES

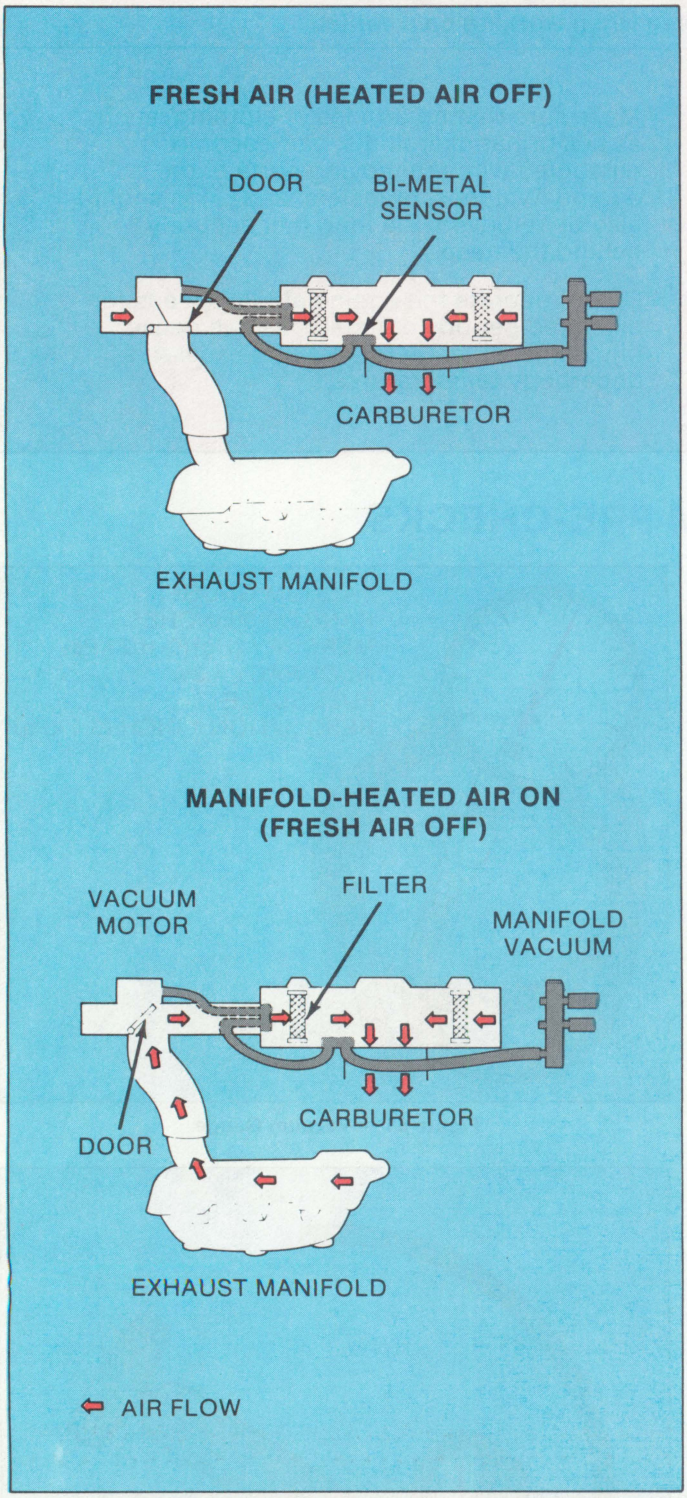


Figure 63 — Heated Air Intake Door Positions

HEATED AIR INTAKE

The heated air intake system aids vaporization of the fuel on cold start-up by warming the intake air at the exhaust manifold. The air valve in the snorkel (cold air intake) should close off outside (ambient) air when a cold engine starts. At 75-105 degrees F in the air cleaner (depending on temperature setting of bi-metal sensor), the bi-metal sensor causes the air valve to open to outside air and shut off heated air.

If this system doesn't work properly, the following poor performance symptoms may occur:

- Poor cold engine performance
- Rough cold idle
- Stall on cold driveaway
- Stall at high humidity
- Rough idle
- Poor acceleration
- Poor fuel economy
- Detonation

Visual Inspection

1. **Engine Cold and Not Running** — The air inlet door should be in the "Fresh Air, Heat-Off" position (Figure 63, top). If it is not, check for:

- Binding air inlet door.
- Plugged bi-metal sensor (Figure 63, top).
- Damaged, pinched or plugged vacuum lines.

2. **Engine Cold Running at Idle** — The air door should be in the "Heat-On" position (Figure 63, bottom). If not, check for:

- Disconnected vacuum lines.
- Pinched, plugged, cracked lines.
- If lines are okay, test the bi-metal switch and vacuum motor.

3. **Engine Warm and Running at Idle** — After the air cleaner temperature reaches 75 to 105 degrees F, as specified, the air door should move to the "Heat-Off" position. If it does not:

- Test the bi-metal sensor.
- Test the vacuum motor.

Bi-metal Sensor Test

To test the bi-metal sensor (Figure 64):

1. Apply heat to the sensor until it is warm to the touch (105° F).
2. Check the air door position. It should be in "Heat-Off" position (Figure 63, top).

- If the door is not in "Heat-Off" position, check for vacuum to and from the sensor. If vacuum is okay, replace the sensor.
- If the sensor and vacuum are okay, test the motor.

Vacuum Motor Test

To test the vacuum motor (Figure 65):

1. Remove the vacuum hose at the motor.
2. Apply approximately 10-15 inches vacuum to the motor with a vacuum pump.

- The motor should hold vacuum.
- Motor stem should pull the air door to the "Heat-On" position (Figure 63, bottom).

Replace the vacuum motor if it does not operate properly. (It it does work okay, check and repair the vacuum source.)

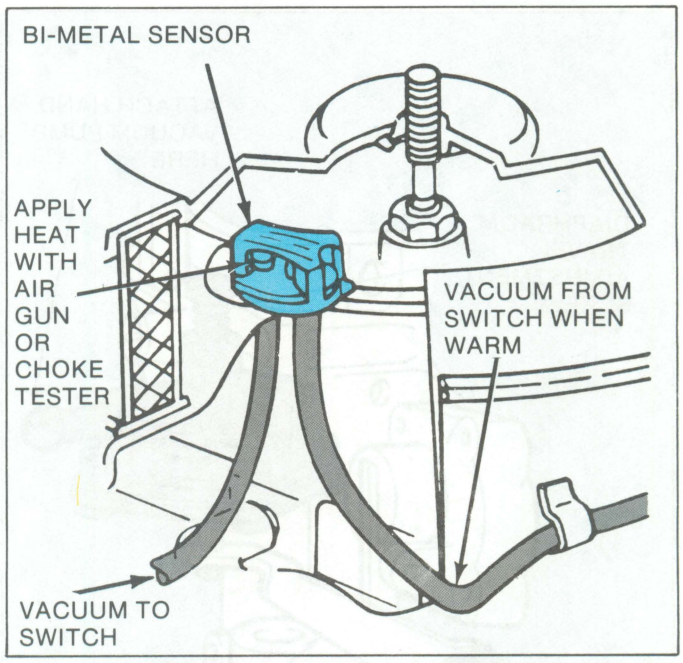


Figure 64 — Bi-metal Sensor Test

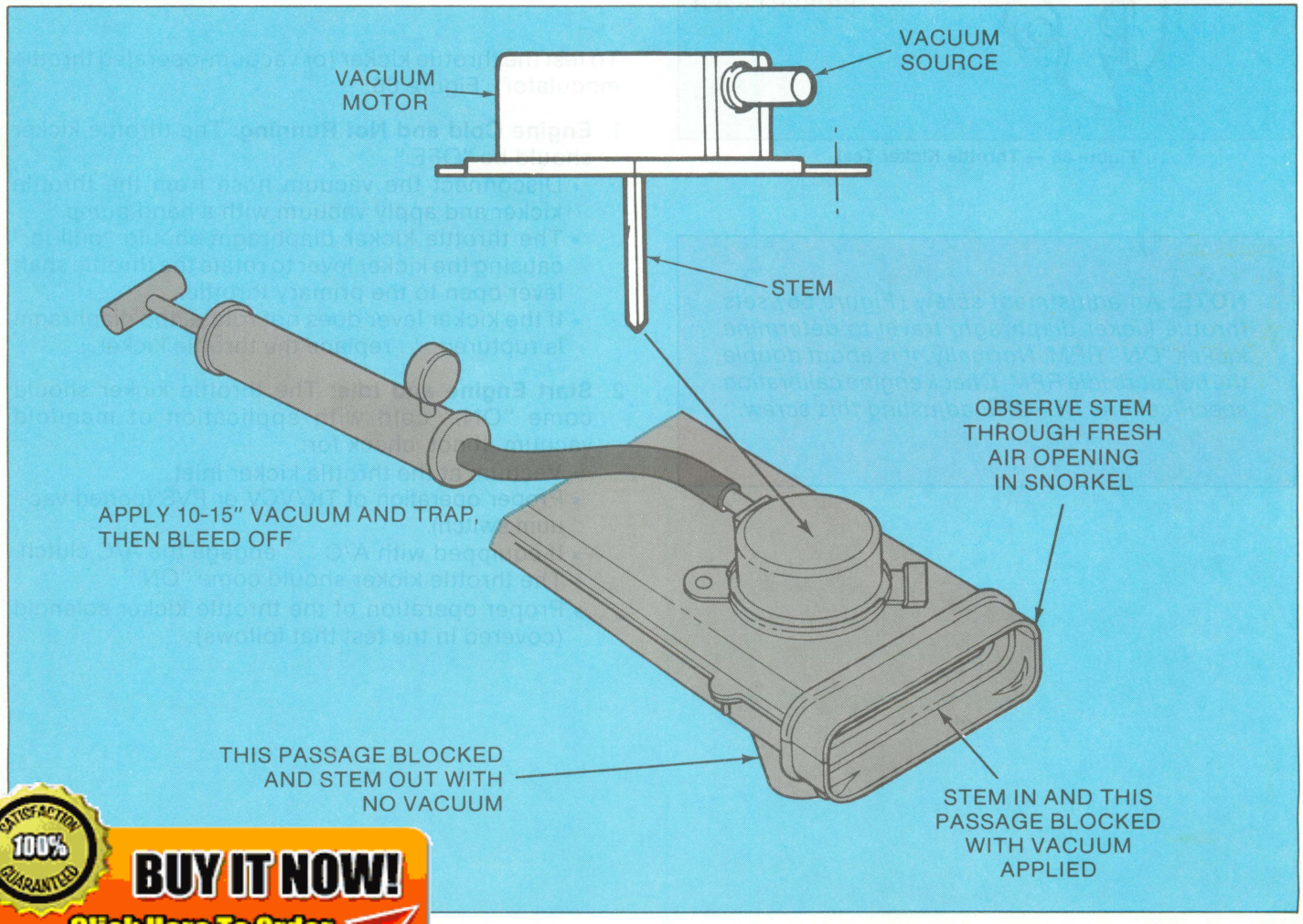


Figure 65 — Vacuum Motor Test

3. If only part of a nylon connector is damaged or broken . . . cut the connector apart (as illustrated in Figure 109) and discard the damaged half of the harness. Replace it with rubber vacuum hoses and a tee from service stock.

Circled numbers identify same connection points on both original and repaired harness to ensure proper routing.

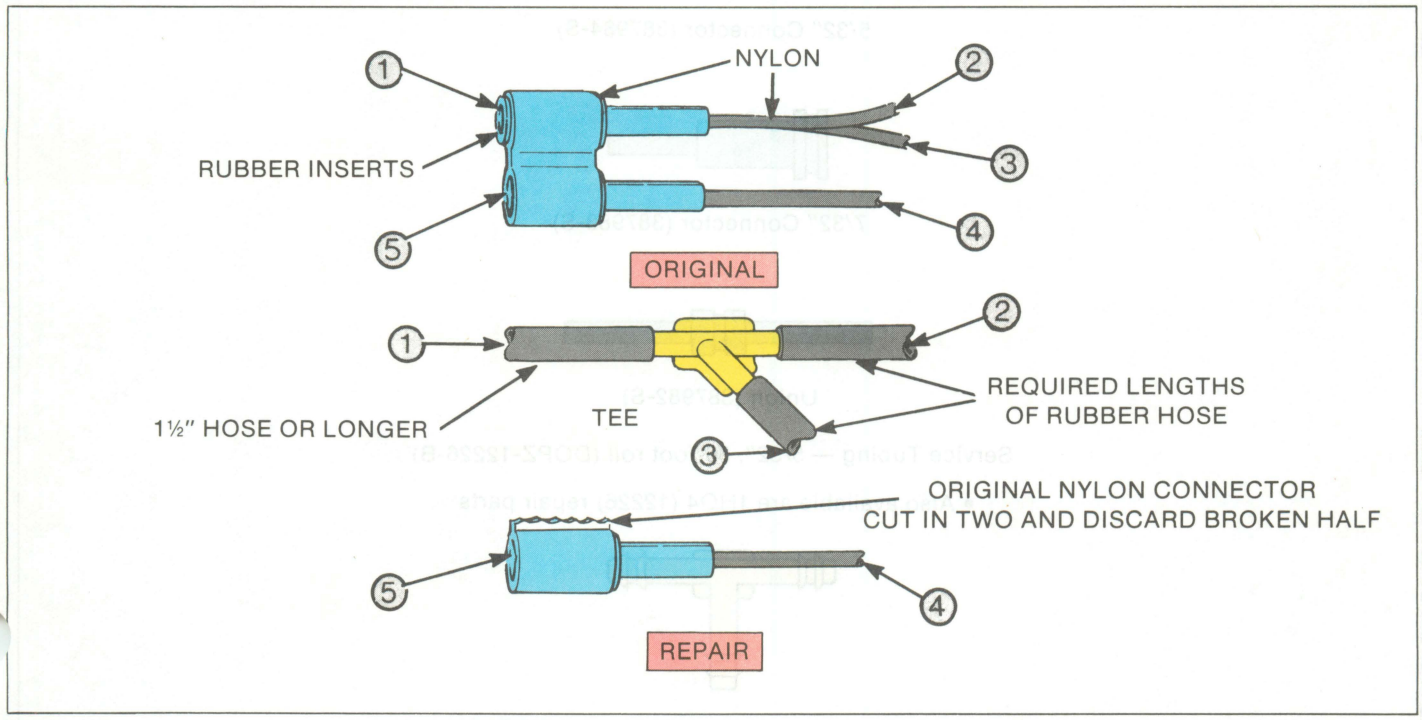
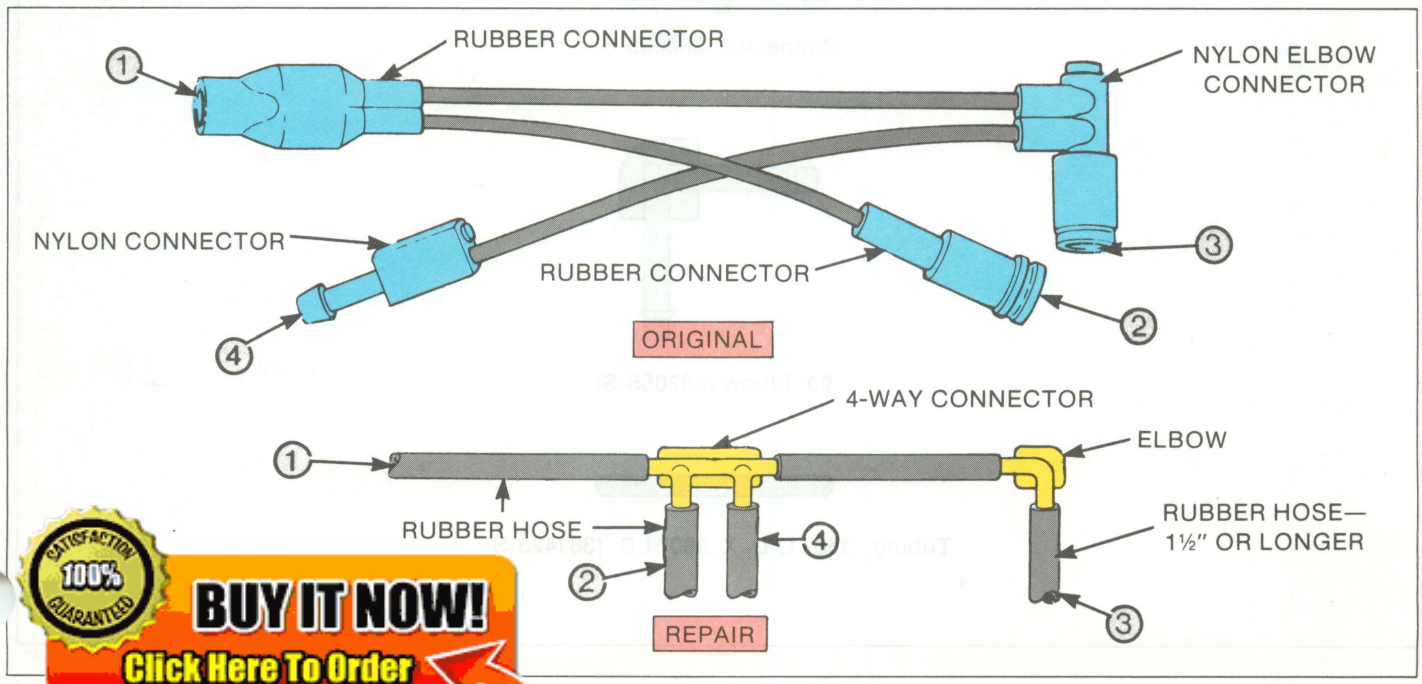


Figure 109 — Damaged Nylon Connector Repair

4. Figure 110 . . . shows how to replace a damaged harness with available service stock . . . rubber hoses (5/32-inch and 7/32-inch), tees and elbows. Cut the hoses to the required lengths but never less than 1½ inches. Be sure to properly route the hoses, using the identification numbers provided for this purpose.

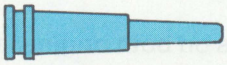


...10 — Replacement of Damaged Harness

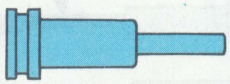
NYLON VACUUM HOSE

Nylon Repair Parts

- The following nylon repair parts are available:



5/32" Connector (387984-S)

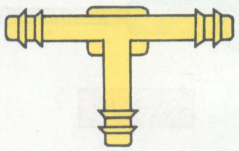


7/32" Connector (387983-S)

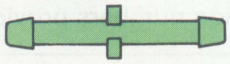
Union (387982-S)

Service Tubing — 5/32", 50-foot roll (DOPZ-12226-B)

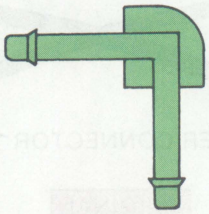
- Also available are 1HO4 (12226) repair parts:



3-way Tee (373846-S)



Connector (383003-S)



90° Elbow (387065-S)

Tubing, .150" O.D. X .090" I.D. (381423-S)

QUIZ

Upon completion of study, use this manual for reference and "take" the quiz (self-mailer, last page of manual).

Figures 111 and 112 must be used to answer quiz questions.

VACUUM HOSE ROUTING

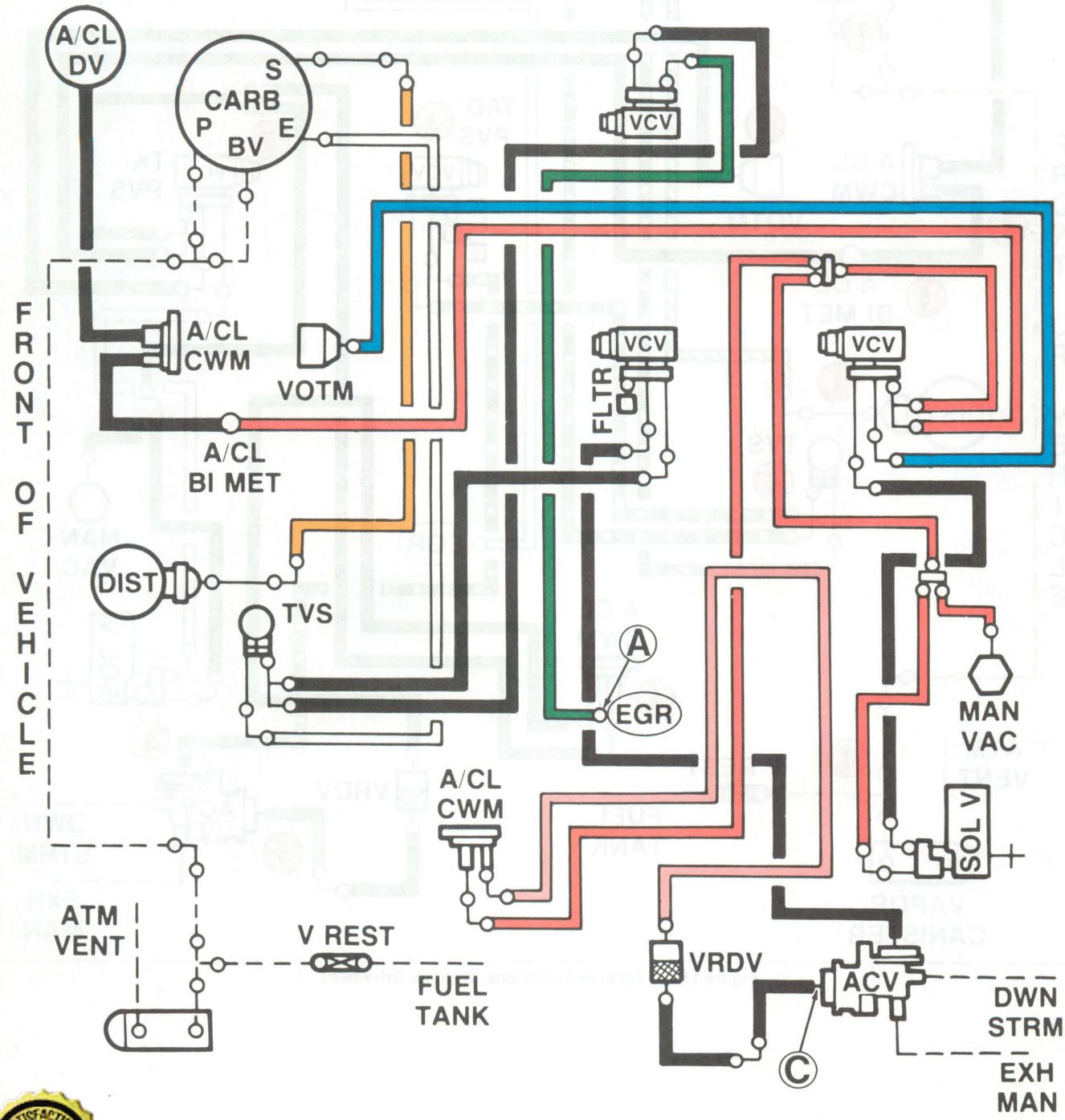


Figure 111 — Vacuum Hose Routing

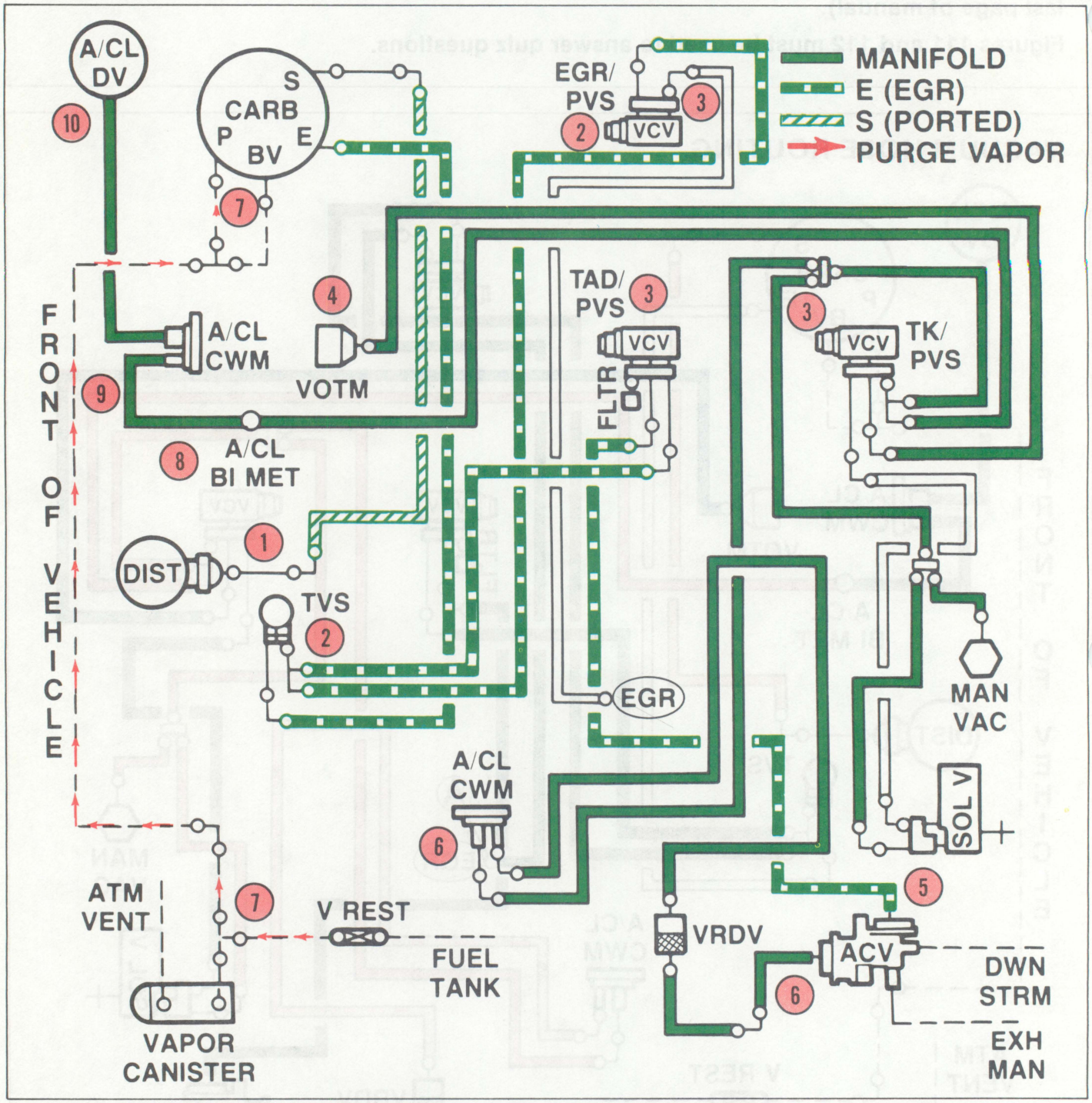


Figure 112 — Vacuum Conditions, Warmup Driveaway

QUIZ
CTP-1983

CERTIFIED TRAINING PROGRAM
FORD PARTS AND SERVICE DIVISION

HOW TO READ AND UNDERSTAND VACUUM DIAGRAMS

QUIZ
CTP-1983

INSTRUCTIONS: Place a circle around the letter preceding the correct answer as shown below:

QUESTION: A four-door sedan has how many doors?

A. Two
Ⓑ Four
C. One

1. **Refer to Figure 111.** The red circuit is:
   A. EGR vacuum source
   B. Throttle Kicker Control
   C. Manifold Vacuum
   D. Controlled by the solenoid vacuum valve (SOL V)

2. **Refer to Figure 111.** The distributor vacuum advance diaphragm (DIST) is controlled by the:
   A. Carburetor, "S" port vacuum
   B. Centrifugal advance at idle
   C. Ignition timing
   D. Intake manifold vacuum (MAN VAC)

3. **Refer to Figure 112.** The EGR valve is:
   A. Not operating. Vacuum is "blocked" by the TVS.
   B. Not operating. Vacuum is "blocked" at carburetor "E" port.
   C. Not operating. Vaccum is "blocked" at EGR/VCV or PVS.
   D. Operating.

4. **Refer to Figure 112.** The EGR/VCV or PVS will:
   A. Open cold, close hot
   B. Close cold, open hot
   C. Not be affected by temperature
   D. Open or close, depending on throttle opening

5. **Refer to Figure 112.** Which of the following is a vacuum trap in the heated air intake circuit?
   A. ACV
   B. A/CL BI MET
   C. A/CL CWM
   D. TK/VCV or PVS

6. Which device is used to "dump" vacuum at wide-open throttle?
   A. Dump valve (ACV)
   B. EGR valve (EGR)
   C. Vacuum Vent Control Valve (VVAC)
   D. Vacuum Retard Delay Valve (VRDV)

7. **Refer to Figure 112.** If the air cleaner is cold (30°F), Thermactor air should go:
   A. to the atmosphere because the A/CL CWM is closed
   B. "Downstream"
   [illegible]eam"
   [illegible]M is open

8. When manifold vacuum is at maximum, carburetor "E" and "P" port vacuum is:
   A. strongest
   B. never equal
   C. weak, but equal to manifold vacuum
   D. zero

9. **Refer to Figure 112.** Note that the TAD/VCV or PVS has a filter (FLTR). At "hot" cruise, this device should:
   A. dump moisture accumulated in the ACV
   B. "bleed" off the TAD signal from the ACV . . . TAD "OFF"
   C. use filtered atmospheric air to initiate the TAB signal
   D. use filtered atmospheric air to turn "OFF" the TAB signal

10. On 1982-83 1.6 liter engines, the carburetor "P" port is connected to:
    A. the carburetor bowl vent (BV)
    B. the canister atmospheric vent (ATM VENT)
    C. EGR valve (EGR/VCV or PVS)
    D. vapor canister and bowl vent (BV) tube

11. **Refer to Figure 112.** The throttle kicker solenoid is:
    A. "ON" because the TK/VCV or PVS applies manifold vacuum
    B. "OFF" because the SOL V is not energized
    C. "ON" because the air conditioning clutch has engaged
    D. not shown

12. One of the purposes of the vacuum retard delay valve (VRDV) is:
    A. to prevent "backfire" during acceleration
    B. to "retard" distributor vacuum advance
    C. to provide temperature control in the delay valve circuit
    D. to delay release of vacuum from the Thermactor by-pass (dump) valve at engine idle

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