

# I - SYSTEM/COMPONENT TESTS

## 1991 Mazda Miata

1990-91 ENGINE PERFORMANCE  
Mazda Systems & Component Testing - Fuel Injection  
Miata, Protege, 323

### INTRODUCTION

Before testing separate components or systems, perform procedures in F - BASIC TESTING article in this Section. Since many computer-controlled and monitored components set a trouble code if they malfunction, also perform procedures in G - TESTS W/CODES article in this Section.

NOTE: Testing individual components does not isolate shorts or opens. Perform all voltage tests with a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance, unless stated otherwise in test procedure. Use ohmmeter to isolate wiring harness shorts or opens.

### ENGINE SENSORS & SWITCHES

#### A/C SWITCH

See A/C CUT-OUT SYSTEM under FUEL CONTROL in this article.

#### AIRFLOW METER/SENSOR INSPECTION

Inspect airflow meter for damage and ensure measuring plate moves smoothly. See Fig. 1. Disconnect airflow meter connector. Move measuring plate and measure resistance between terminals. See appropriate AIRFLOW METER TERMINAL RESISTANCE table.

AIRFLOW METER TERMINAL RESISTANCE TABLE

Terminals	Fully Closed Ohms	Fully Open Ohms
E2-Vs .....	200-600 .....	(1) 20-1000
E2-Vc .....	200-400 .....	200-400
E2-THA .....	(2) 13,600-18,400 .....	(2) 13,600-18,400
	(3) 2200-2700 .....	(3) 2200-2700
	(4) 500-700 .....	(4) 500-700
E1-Fc .....	Infinite .....	0

- (1) - 20-1200 ohms on Protege and 323.  
(2) - Tested at -4°F (-20°C).  
(3) - Tested at 68°F (20°C).  
(4) - Tested at 140°F (60°C).

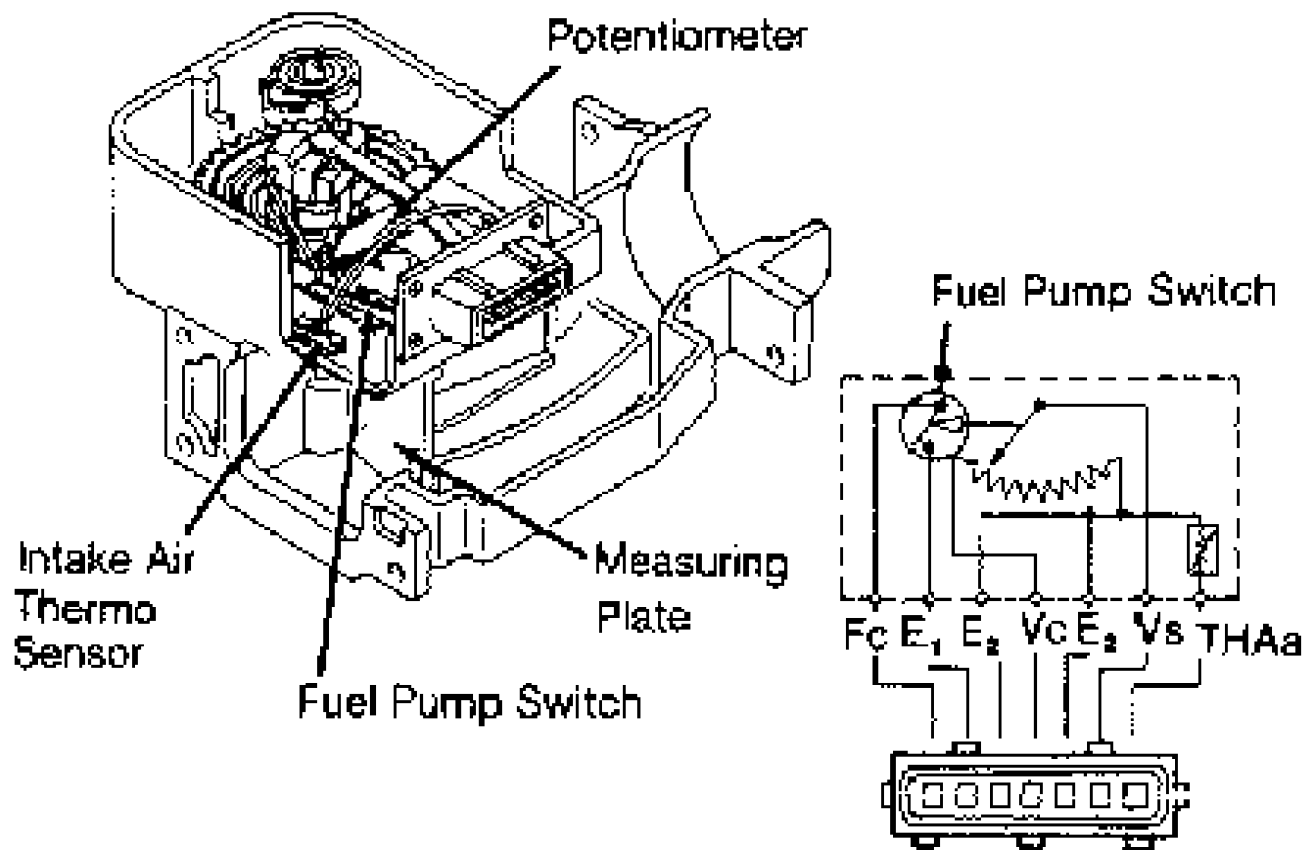


Fig. 1: Airflow Meter & Connector  
Courtesy of Mazda Motors Corp.

## BRAKE LIGHT SWITCH

Disconnect brake light switch connector. Measure resistance between terminals of brake light switch. With brake pedal released, resistance should be infinite. With brake pedal depressed, resistance should be zero ohms.

## CLUTCH SWITCH (M/T)

Remove connector from switch. Connect ohmmeter to switch terminals. Check continuity exists with clutch pedal depressed and no continuity exists with pedal released. Replace switch if continuity is not correct.

## COOLANT TEMPERATURE SWITCH

1) Remove switch from radiator or engine block. Place switch in container of coolant with thermometer. Connect ohmmeter to switch terminals. Slowly heat coolant.

2) Note temperature at which continuity exists between switch terminals. Continuity should be present with coolant temperature greater than 207°F (97°C) and continuity should not be present with temperature less than 194°F (90°C). Replace switch if not operating as described.

## COOLANT THERMOSENSOR

1) Remove thermosensor. Place thermosensor in container of heated coolant with thermometer.

2) Connect ohmmeter to thermosensor terminals. Note resistance at specified temperatures. See appropriate COOLANT THERMOSENSOR RESISTANCE table. Replace if not within specification.

COOLANT THERMOSENSOR RESISTANCE TABLE

Coolant Temperature	Ohms
-4°F (-20°C) .....	14,600-17,800
68°F (20°C) .....	2200-2700
104°F (40°C) .....	1000-1300
140°F (60°C) .....	500-600
176°F (80°C) .....	290-350

## CRANK ANGLE SENSOR

See IGNITION TESTING in F - BASIC TESTING article in this Section.

## IDLE SWITCH

Idle switch is part of throttle position sensor. See D - ADJUSTMENTS article in this Section.

## INHIBITOR SWITCH (A/T)

Remove connector from switch. Connect ohmmeter to appropriate switch terminals. See Fig. 2 or 3. Continuity should exist with gearshift in Park and Neutral. No continuity should exist in any other ranges. If switch does not perform as indicated, replace switch.

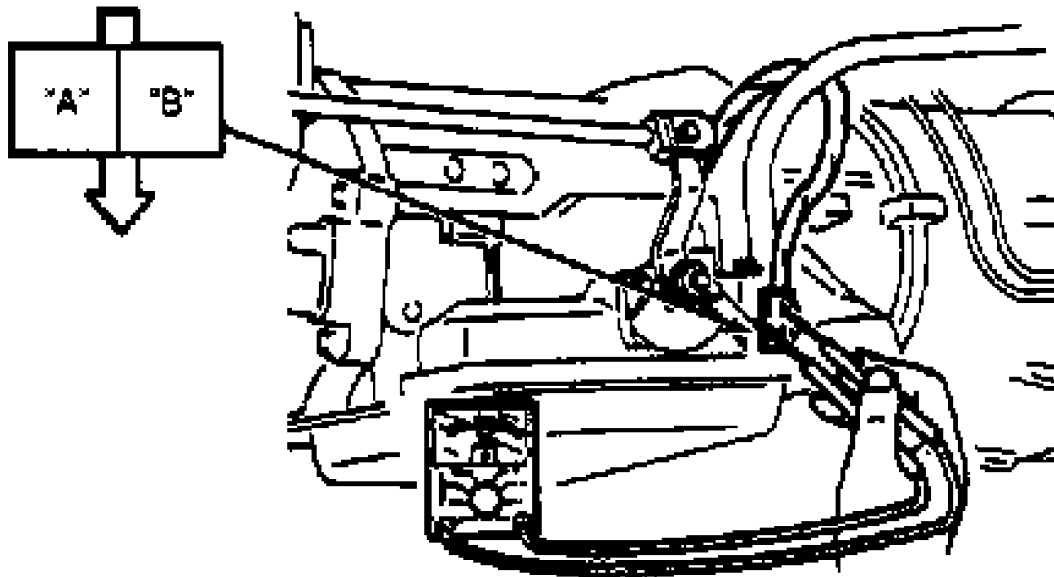


Fig. 2: Checking Inhibitor Switch Continuity (Miata)  
Courtesy of Mazda Motors Corp.

# Test Between Terminals 'A' and 'B'

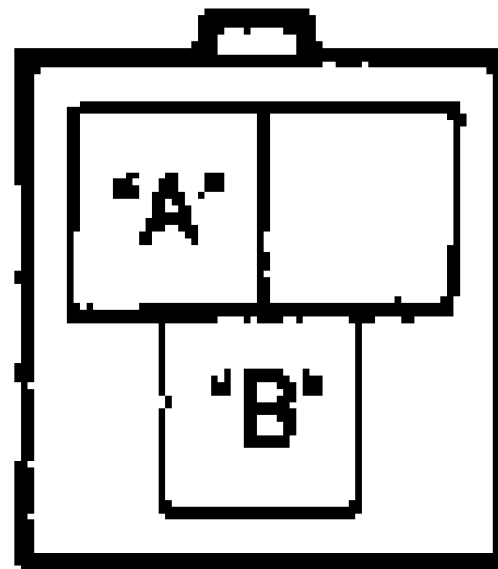


Fig. 3: Checking Inhibitor Switch Continuity (Protege & 323)  
Courtesy of Mazda Motors Corp.

## KNOCK SENSOR

See KNOCK CONTROL under IGNITION SYSTEM in this article.

## NEUTRAL SWITCH (M/T) TESTING

Remove connector from switch. Connect ohmmeter to switch terminals. Check continuity exists with transmission in Neutral and no continuity exists in other ranges. Replace switch if continuity is not correct.

## OXYGEN SENSOR (O2)

1) Warm engine to operating temperature. Run engine at fast idle. Disconnect O2 sensor. Connect a high impedance voltmeter between O2 sensor and ground.

2) Observe voltmeter while rapidly accelerating and decelerating engine speed. Voltage should be 0.5-1.0 volt while accelerating and 0-0.4 volt while decelerating. If sensor is not operating to specifications, replace O2 sensor. Ensure new oxygen sensor has anti-seize compound applied to threads. Tighten sensor to 21-36 ft. lbs. (29-49 N.m).

## POWER STEERING PRESSURE SWITCH TEST

1) Remove connector from switch. Connect ohmmeter to switch terminals. Start engine and allow to idle. Turn steering wheel from side to side and note continuity reading.

2) Continuity should exist when front wheels are turned. Continuity should not exist when wheels are not turned. Replace switch if continuity is not as indicated.

## THROTTLE POSITION SENSOR

See D - ADJUSTMENTS article in this Section for checking and adjustment procedures.

## VEHICLE SPEED SENSOR

See J - PIN VOLTAGE CHARTS and K - SENSOR RANGE CHARTS articles in this Section.

## RELAYS, SOLENOIDS, MOTORS & MODULES

### CIRCUIT OPENING RELAY

See FUEL CONTROL CIRCUIT in F - BASIC TESTING article in this Section for test procedures.

### MAIN RELAY

- 1) Ensure main relay clicks when ignition is turned on and off.
- 2) If no sound is heard, unplug relay. Apply 12 volts to terminal "A" and ground terminal "B". See Fig. 4.
- 3) Use ohmmeter to check terminal continuity. Terminals "C" and "D" should have continuity with 12 volts applied. There should be no continuity with no voltage applied. If relay does not respond as described, replace main relay.

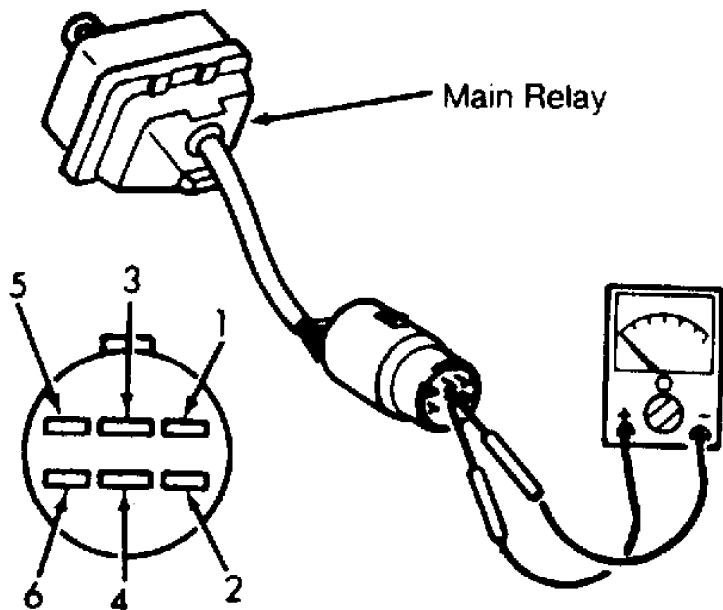


Fig. 4: Testing Main Relay  
Courtesy of Mazda Motors Corp.

### AIR INJECTION SOLENOIDS

For all related control solenoids, see AIR INJECTION under EMISSION SYSTEMS & SUB-SYSTEMS in this article.

## FUEL INJECTORS

Using stethoscope, listen for normal clicking sound at each injector during idle and acceleration. If clicking sound is not heard, check injector wiring circuit or main relay and circuit.

## FUEL INJECTOR RESISTANCE

Remove electrical connector from injector. Using ohmmeter, measure resistance between injector terminals. Replace injector if resistance is not within specifications.

FUEL INJECTOR RESISTANCE TABLE

Application	Ohms
Main Fuel Injectors .....	12-16

## PRESSURE REGULATOR CONTROL SOLENOID

1) Unplug vacuum hose from pressure regulator control solenoid. Blow through solenoid from port "A". Ensure air flows through port "B". See Fig. 5.

2) Unplug solenoid valve connector. Connect 12 volts and ground to solenoid terminals. Blow through solenoid from port "A". Air should exhaust through valve air filter. Replace solenoid valve if it does not pass test.

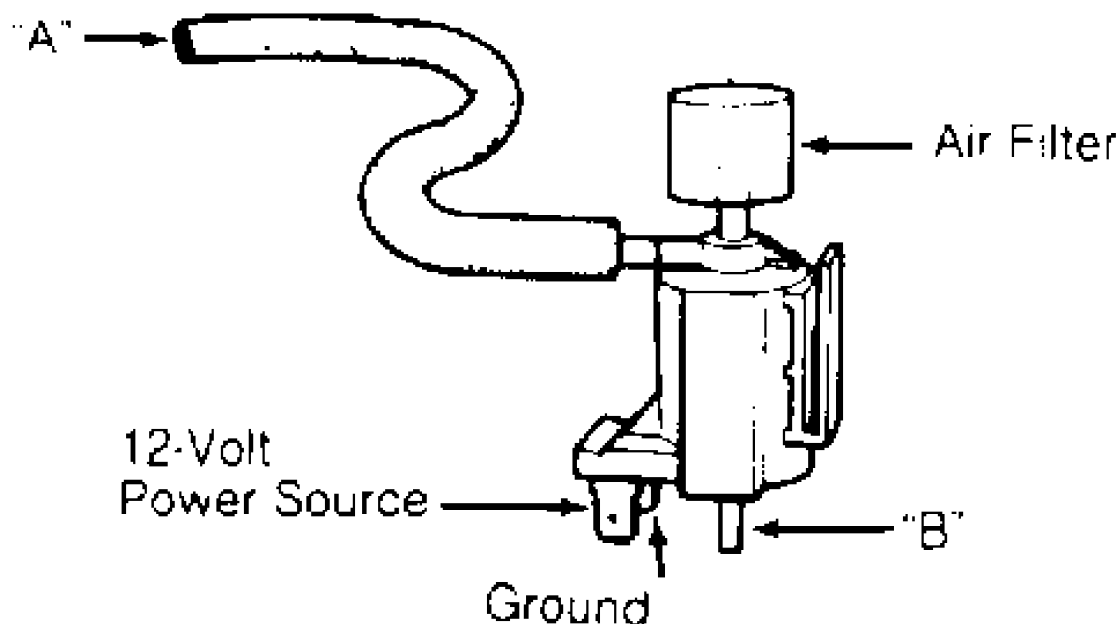


Fig. 5: Testing Pressure Regulator Control Solenoid  
Courtesy of Mazda Motors Corp.

## PURGE CONTROL SOLENOID

For testing procedures, see FUEL EVAPORATION under EMISSION SYSTEMS & SUB-SYSTEMS in this article.

## **FUEL SYSTEM**

NOTE: For fuel system pressure testing, see F - BASIC TESTING article in this Section.

### **FUEL PUMP RELAY CONTROL**

See FUEL SYSTEM in F - BASIC TESTING article in this Section.

### **INJECTOR FUEL LEAKAGE**

1) Relieve fuel system pressure. See F - BASIC TESTING article in this Section. Remove air valve or dynamic chamber, if necessary. Remove delivery pipe with hoses still connected. Remove fuel injectors. Using wire, secure injectors tightly onto delivery pipe.

CAUTION: Ensure injectors are securely tied to delivery pipe. If not properly secured, fuel may spray from loose connections.

2) On Protege and 323, connect a jumper wire between terminals F/P and GND in diagnostic connector, located next to battery. See F - BASIC TESTING article in this Section for test connector location. On Miata, install a jumper wire between terminals of Yellow fuel pump check connector. Fuel pump check connector is located on firewall, under windshield wiper motor on Miata.

3) Turn ignition on for 10 seconds. Turn ignition off and clean injector nozzles. On 4-cylinder models, tilt injectors approximately 60 degrees. On all models, turn ignition on. Check that no fuel leakage exists at injectors. After one minute, a drop of fuel leakage is acceptable. If fuel leakage is excessive, replace faulty injector.

NOTE: Injector delivery volume information is not available for Miata, Protege and 323.

### **PULSATION DAMPER**

Start engine and run at idle. Pulsation damper is located at end of fuel rail. Place finger over pulsation damper and ensure damper pulsates. Replace pulsation damper if pulsations are not felt.

## **IDLE SPEED CONTROL (ISC) SYSTEM**

### **AIR VALVE**

Remove air valve. Cool air valve to less than 32°F (0°C). Using a drier, heat air valve and verify plunger moves in direction of arrow. See Fig. 6.

### **ISC VALVE**

Measure resistance of ISC valve at 2-wire connector. Resistance should be 11-13 ohms, at 68°F (20°C). If resistance is not within specification, replace ISC valve.

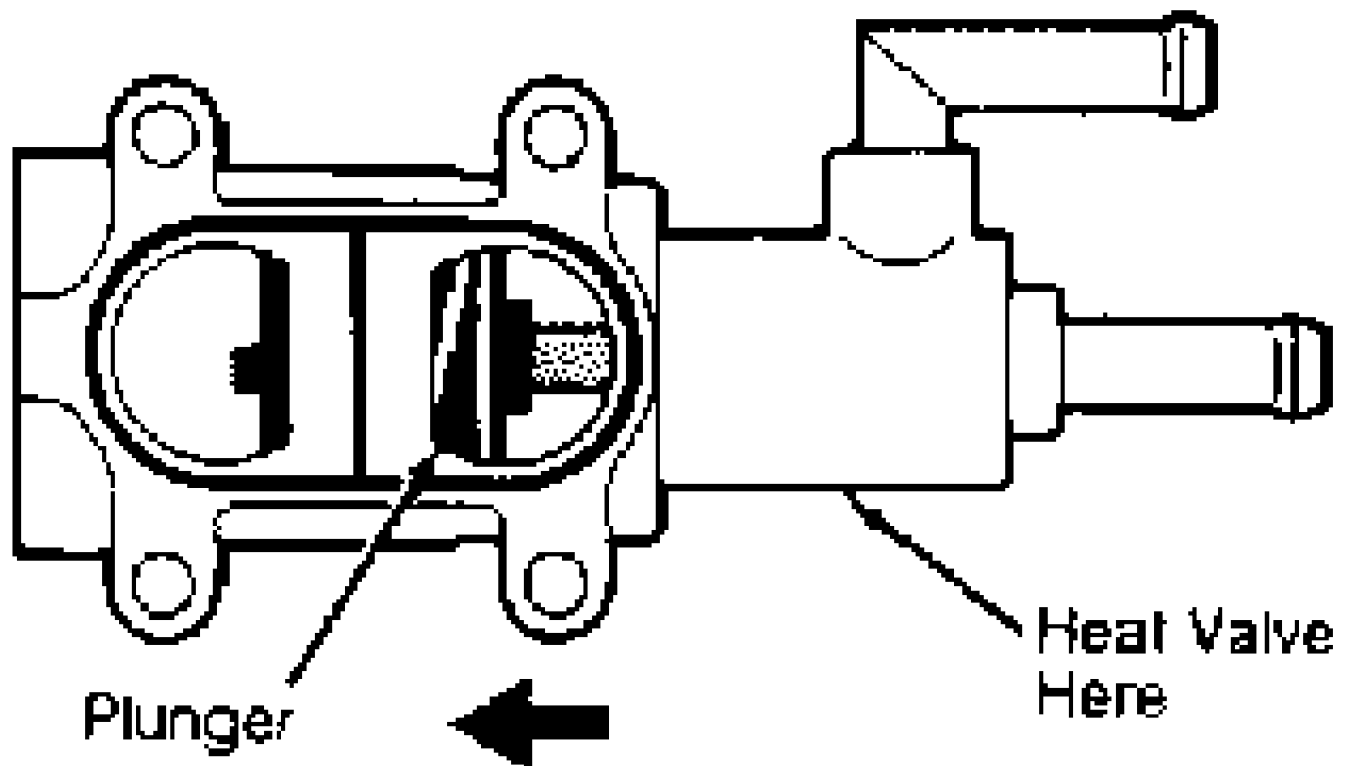


Fig. 6: Cross-Sectional View of Air Valve (Miata, Protege & 323)  
Courtesy of Mazda Motors Corp.

## IGNITION SYSTEM

NOTE: For basic ignition checks, see F - BASIC TESTING article in this Section.

## EMISSION SYSTEMS & SUB-SYSTEMS

NOTE: For complete vacuum schematics, see M - VACUUM DIAGRAMS article in this Section.

## DECELERATION CONTROL SYSTEM

NOTE: On all models, the deceleration control system is a function of dashpot and ECU. Dashpot prevents sudden closure of throttle valve. ECU controls fuel cut-off during deceleration. For adjustment and testing, see D - ADJUSTMENTS article in this Section.

## EGR POSITION SENSOR

- 1) Backprobe EGR position sensor connector with voltmeter. See Fig. 7.
- 2) With EGR vacuum hose disconnected, connect vacuum pump to the EGR valve. Turn ignition on and check voltages at connector. Use EGR POSITION SENSOR VOLTAGE table to compare results.
- 3) If voltage is not correct at terminals A and B, check wiring harness and connection at ECU connector terminals 2A and 2C. If



voltage is not correct at terminal C, check sensor resistance, harness and ECU connector terminal 2F.

4) Check sensor resistance according to EGR POSITION SENSOR RESISTANCE table. If resistance is not within specifications, replace sensor.

EGR POSITION SENSOR VOLTAGE TABLE

Terminal	Volts
"A" .....	4.5-5.5
"B" .....	Less Than 1.5
"C"	
Without Vacuum .....	.25-.95
With Vacuum .....	Approx. 4

EGR POSITION SENSOR RESISTANCE TABLE

Terminals	Ohms
"A"- "B" .....	5000
"A"- "C" .....	700-5000
"B"- "C" .....	700-5000

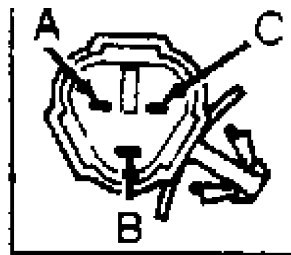
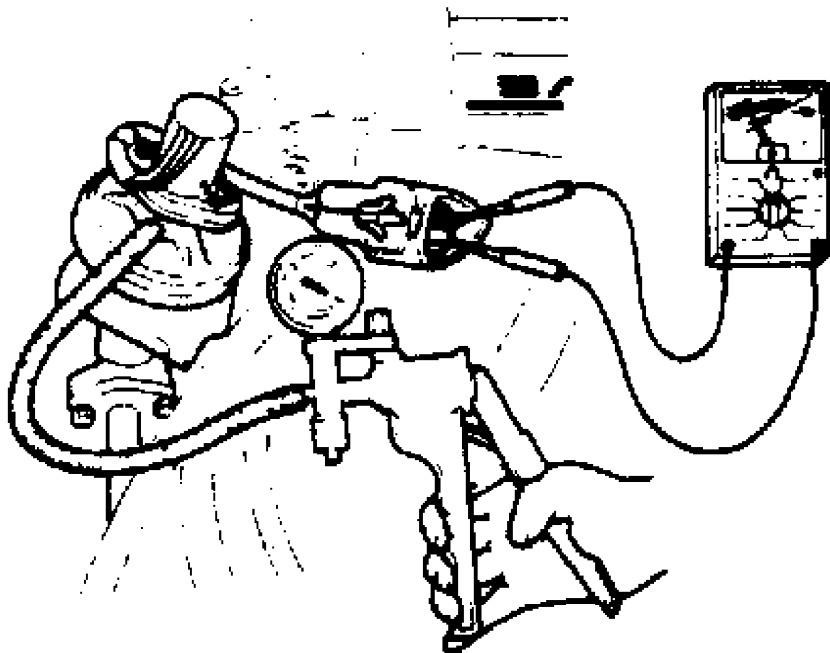


Fig. 7: EGR Position Sensor  
 Courtesy of Mazda Motors Corp.

### EGR SOLENOID

- 1) Disconnect vacuum hoses and blow through vent hose. See Fig. 8. Ensure air flows. Disconnect solenoid connector.
- 2) Apply 12 volts to White/Blue wire ("B" terminal) of

solenoid and ground both Red/Black wires ("A" and "C" terminals) of solenoid. Blow through vent hose and ensure air does not flow. Replace solenoid if not okay.

3) Blow through vacuum hose and ensure air does not flow. Apply 12 volts to Blue/White wire connector of solenoid and ground both Red/Black wire connectors of solenoid. Blow through vacuum hose and ensure air does flow. Replace solenoid if not okay.

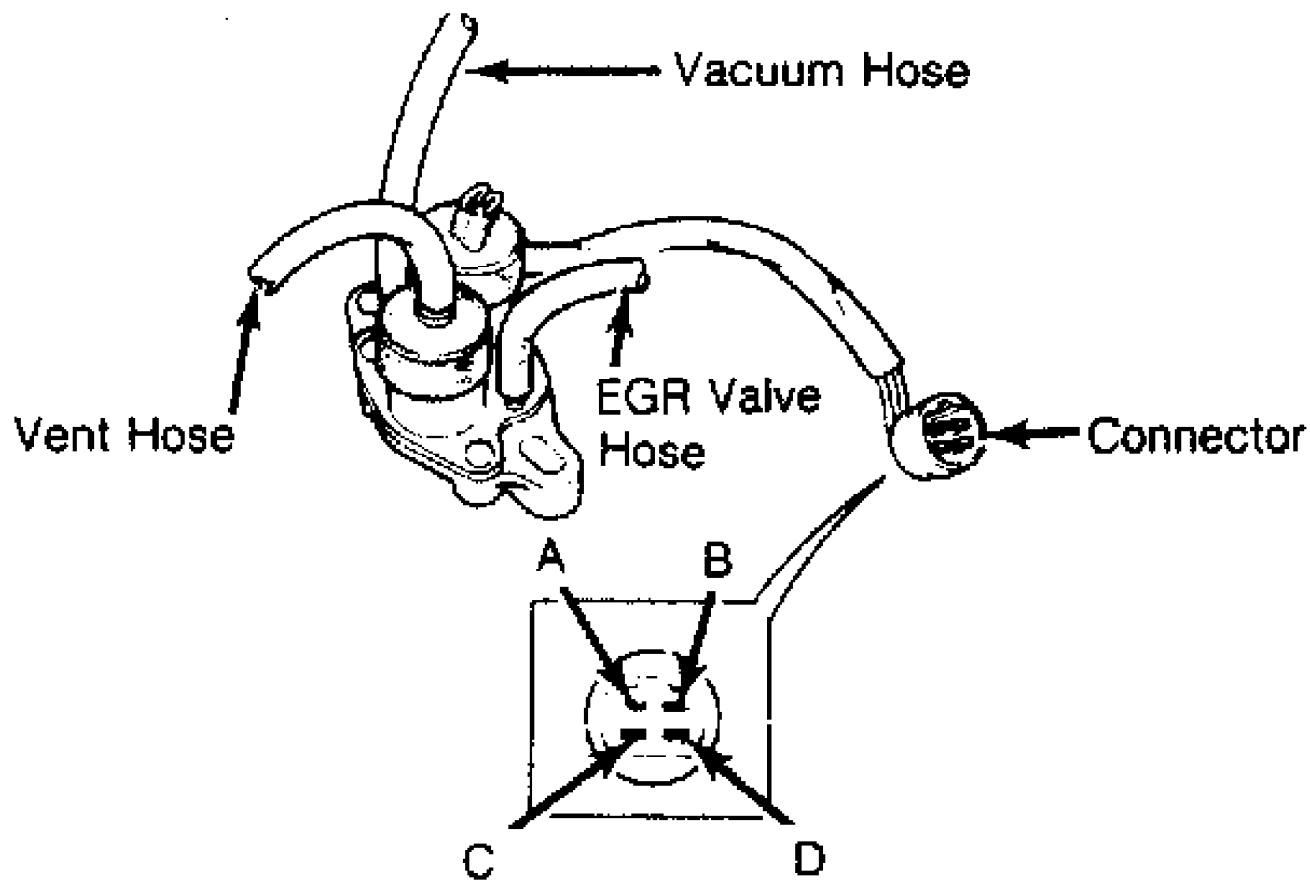
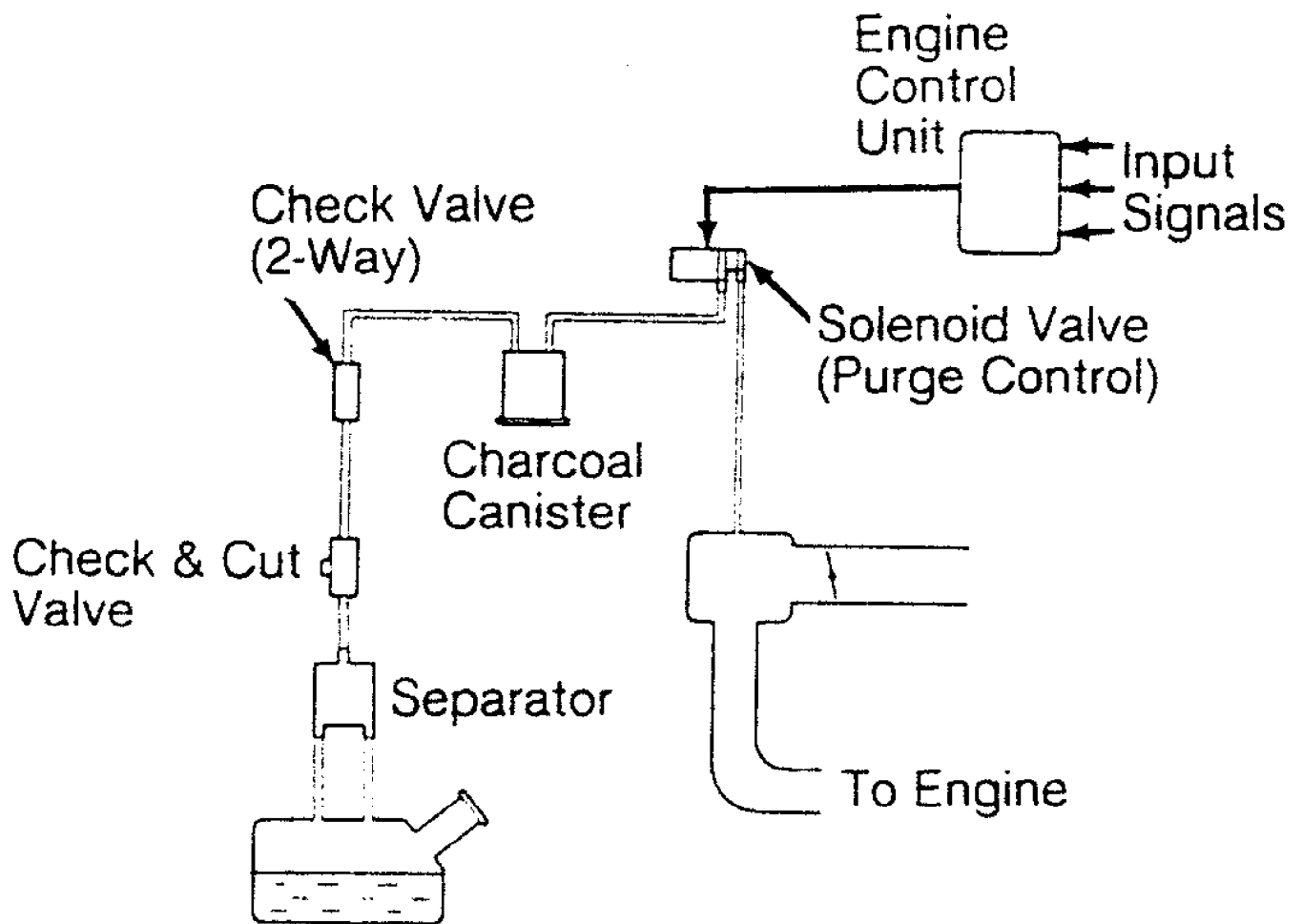


Fig. 8: EGR Vent & Vacuum Solenoids  
Courtesy of Mazda Motors Corp.

## FUEL EVAPORATION

### System Inspection

Purge system operation takes place when the following conditions are met. Vehicle is accelerating in gear (off idle), engine is at operating temperature and oxygen sensor is functioning normally. See Fig. 9.



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Fig. 9: Fuel Evaporation Control System  
Courtesy of Mazda Motors Corp.

#### Evaporation Line

Disconnect hose leading from charcoal canister to fuel tank and connect a vacuum pump to the hose. Apply vacuum and note if vacuum is held. No vacuum should be held. If vacuum is held, test check valve, cut-valve and evaporation hose for blockage.

#### Check Valve

Note direction of valve installation. Remove check valve. Blow air into both ends of valve. Air should flow through valve from charcoal canister side, but should not flow from airflow meter side (beveled end). Replace valve if defective.

#### Check & Cut Valve

1) Remove check and cut valve. Connect a pressure gauge with "T" fitting to check and cut valve nipple leading to fuel tank. Cap the opposite nipple. See Fig. 10.

2) Blow through passage "A". When pressure gauge reads .14-.71 psi (.01-.05 kg/cm<sup>2</sup>), valve should open. Remove "T" fitting and pressure gauge. Connect "T" fitting to bottom of valve. Blow through passage "B". When pressure gauge reads .78-1.0 psi (.06-.07 kg/cm<sup>2</sup>), valve should open. Replace assembly if valve did not open at specified pressure.

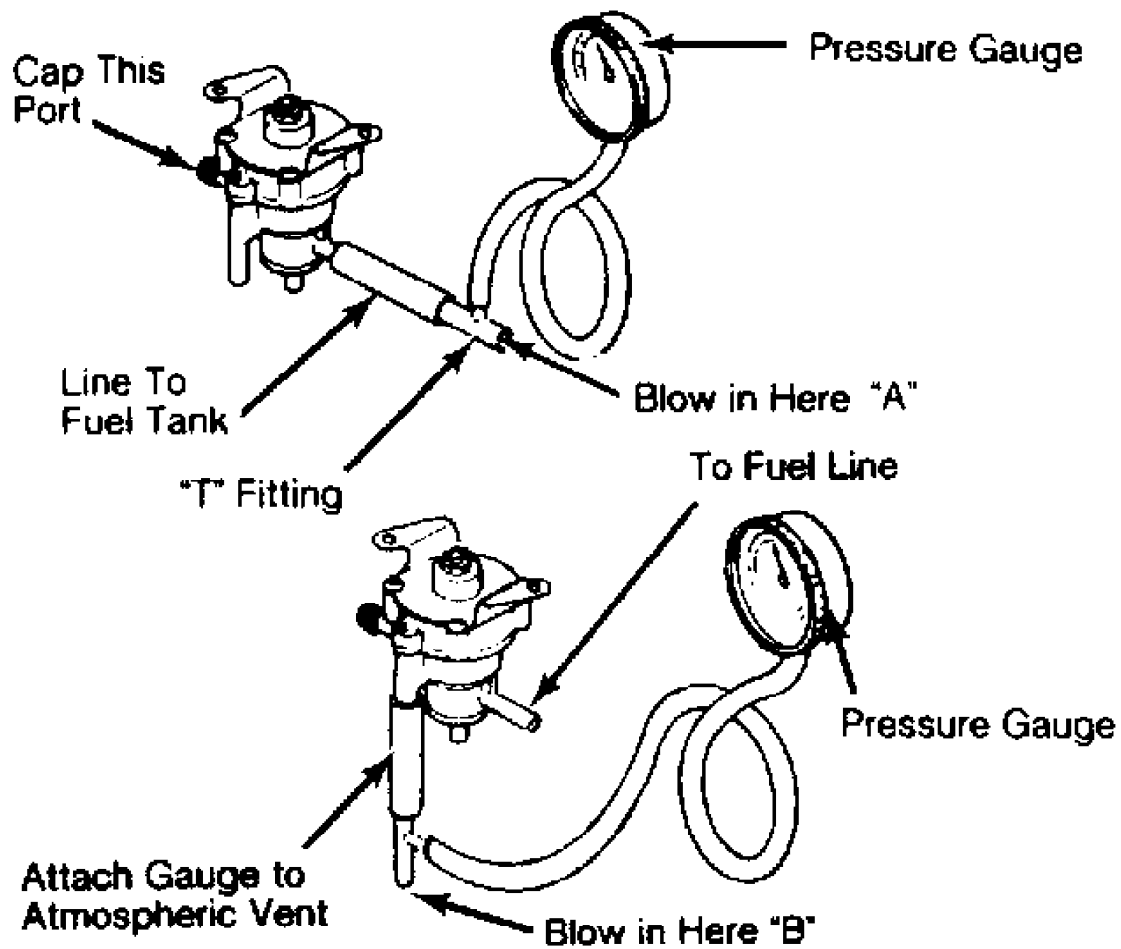
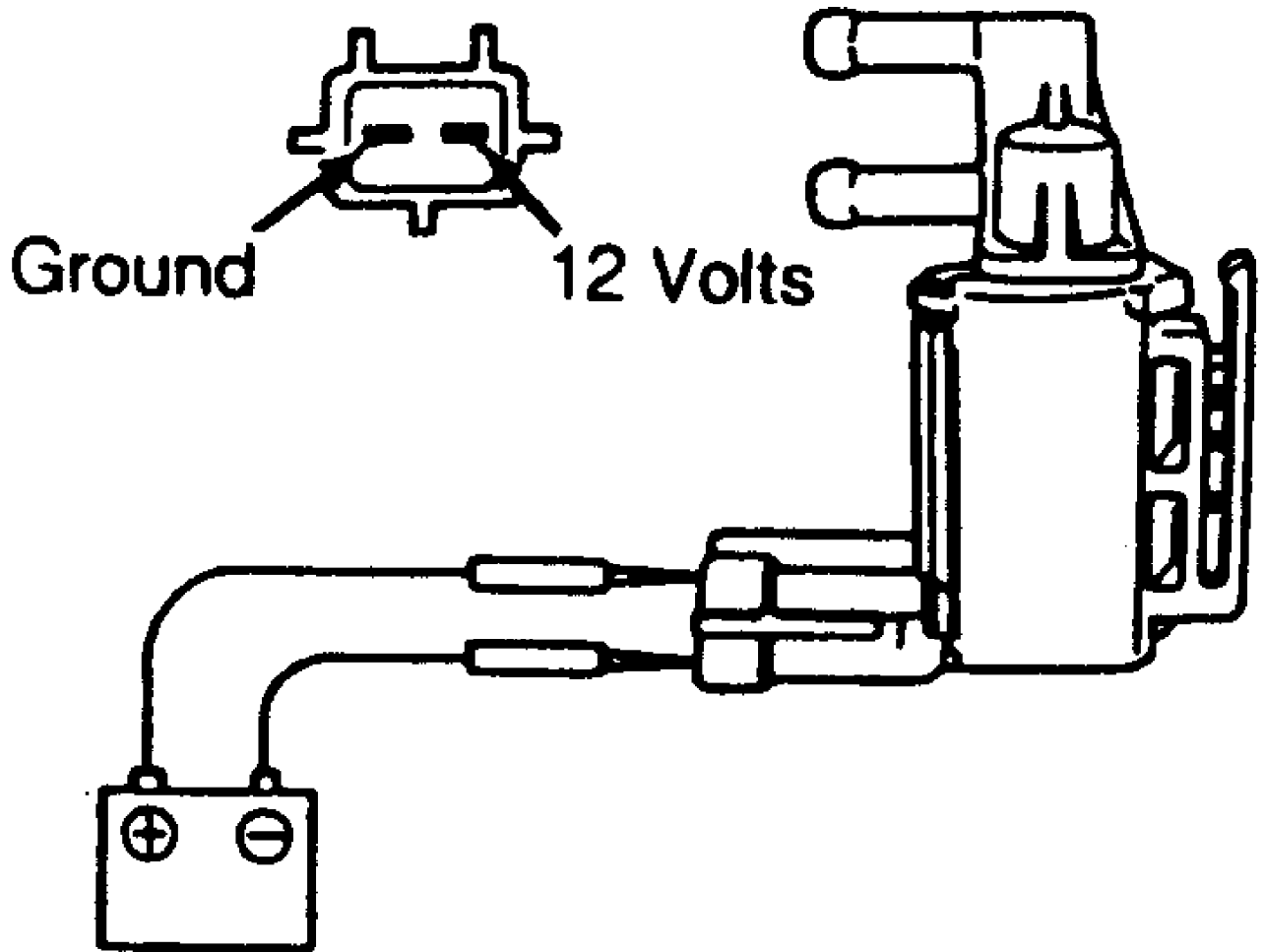


Fig. 10: Testing Check & Cut Valve  
 Courtesy of Mazda Motors Corp.

Purge Control Solenoid Valve  
 To check purge control solenoid valve, remove hoses from

charcoal canister. Attempt to blow through intake manifold port. Air should not pass. If air can be blown through solenoid valve, disconnect the solenoid valve connector and connect 12 volts and a ground to solenoid valve terminals. Blow through check valve, air should flow through valve. If not, replace valve. See Fig. 11.



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Fig. 11: Testing Purge Valve (Typical)  
Courtesy of Mazda Motors Corp.

## POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

### SYSTEM INSPECTION

Warm engine to normal operating temperature and run at idle. Disconnect PCV valve together with vent hose from valve cover. Block PCV valve opening and check for vacuum. If no vacuum is felt, check for collapsed line or blockage. See FUEL EVAPORATION vacuum diagrams for hose routing.

## 1991 THERMOSTATIC AIR CLEANER (TAC)

## AIR CLEANER TEMPERATURE SENSOR

With temperature sensor less than 75°F (24°C), apply 8 in. Hg vacuum to source port. Duct door should close. If door does not close, replace sensor. Sensor will bleed off vacuum to allow duct door to open and let in fresh air at specific temperatures. See AIR TEMPERATURE SENSOR OPENING IDENTIFICATION table.

AIR TEMPERATURE SENSOR OPENING IDENTIFICATION TABLE

Sensor Color	Temperature
Brown .....	70 °F (21°C)
Pink, Black or Red .....	90 °F (32°C)
Blue, Yellow, or Green .....	105 °F (41°C)

## AIR CONTROL DOOR

When a vacuum of 8 in. Hg or more is applied to vacuum motor, door should stay in appropriate position for as long as vacuum is applied. If vacuum bleeds off and door returns to rest position, replace vacuum motor.

## MISCELLANEOUS CONTROLS

### A/C CUT-OUT CONTROL SYSTEM

1) Turn A/C, blower and ignition switches on. DO NOT start engine. Shift transmission into a drive gear. Open throttle fully. Listen for A/C clutch disengaging and re-engaging after a few seconds. See A/C CUTOFF TIME SPECIFICATIONS.

2) If system does not perform as specified, check operations of related switches and relays. See J – PIN VOLTAGE CHARTS and K – SENSOR RANGE CHARTS articles in this Section.

A/C CUT-OUT TIME SPECIFICATIONS TABLE

Application	Time Before Re-engagement
Miata .....	16 Seconds
Protege	
DOHC .....	5 Seconds
SOHC .....	10 Seconds
323 .....	10 Seconds