

## MAZDA 1973 ROTARY ENGINE MODIFICATION

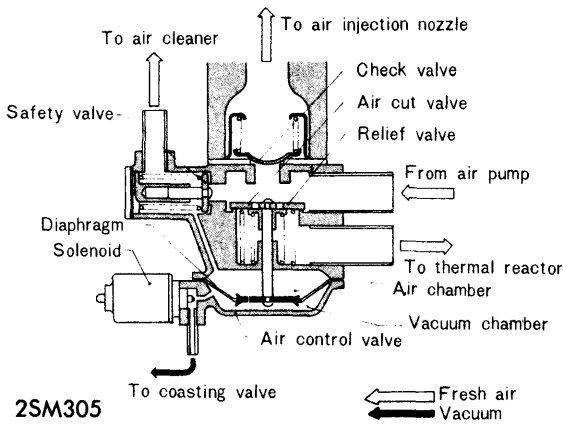
Mazda RX-2 (1973)  
Mazda RX-3 (1973)

**Deceleration Control System** — Consists of an anti-afterburn valve, a coasting valve, an idle switch, and a control box.

### DESCRIPTION

The exhaust emission control system consists of an air injection system, an ignition and air flow control system, and a deceleration control system.

**Air Injection System** — Consists of an air pump, a check valve, an air injection nozzle, an air control valve, and a thermal reactor.



**AIR CONTROL VALVE**

**Ignition and Air Flow Control System** — Consists of a thermosensor, a thermodetector, a vacuum switch, and a control box.

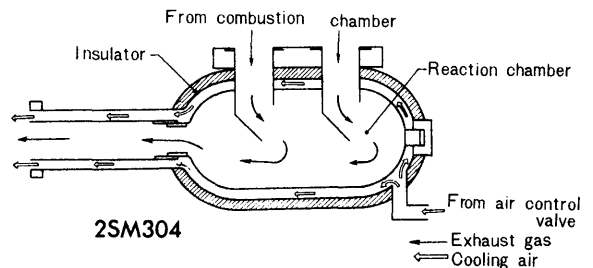
### OPERATION

#### AIR INJECTION SYSTEM

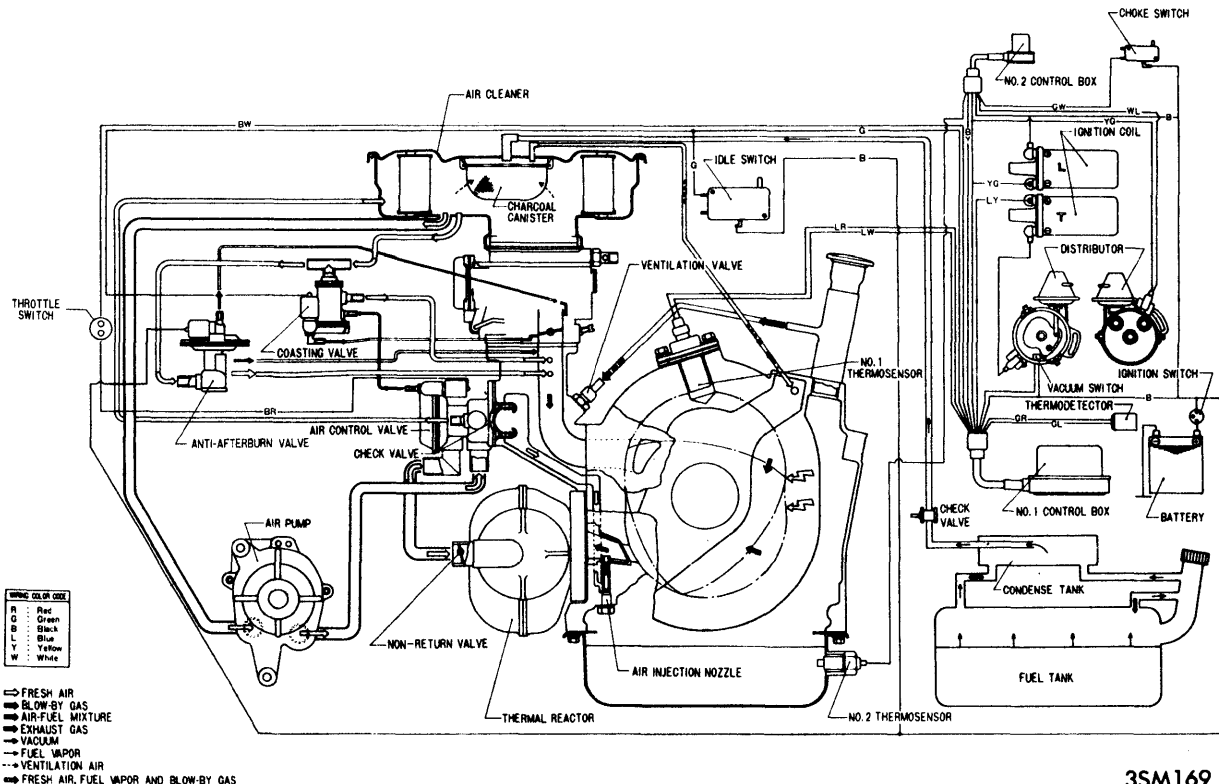
**Air Pump** — A two-vane type driven by a "V" belt mounted on the eccentric shaft pulley.

**Check Valve** — Check valve is incorporated in air control valve. Should exhaust gas pressure exceed air pump pressure, valve closes to prevent the backflow of exhaust gas which could damage air pump.

**Air Injection Nozzle** — Nozzles are attached to each of the front and rear rotor housings. Air from the air pump passes through the check valve and is injected through the nozzle into the exhaust port adjacent to the thermal reactor.



**THERMAL REACTOR COOLING AIR CIRCUIT**

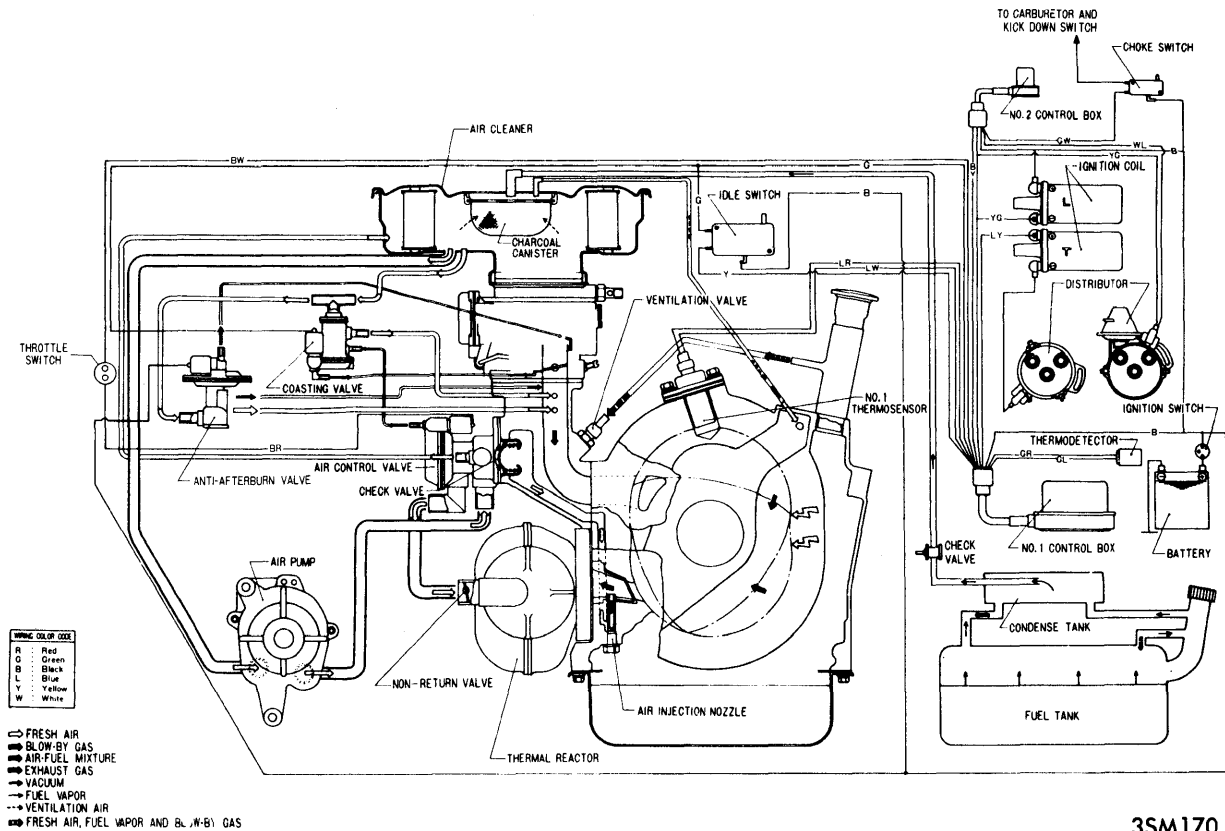


**3SM169**

### RX-2 & RX-3 EXHAUST EMISSION CONTROL (MAN. TRANS.)

# Exhaust Emission Systems

## MAZDA 1973 ROTARY ENGINE MODIFICATION (Cont.)



3SM170

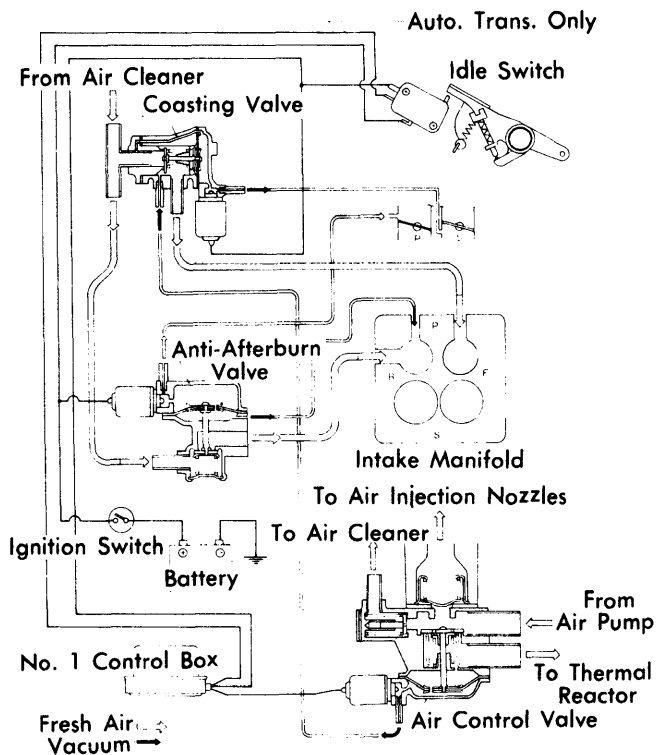
### RX-2 & RX-3 EXHAUST EMISSION CONTROL (AUTO. TRANS.)

**Air Control Valve** — Air control valve contains three valves which, depending upon engine operation, directs air from air pump to either air injection nozzles or thermal reactor. In addition, should air become trapped due to a malfunction, a safety valve opens and directs air pump air to the air cleaner to prevent damage to the system. Operational conditions of air control valve are as follows:

1) During normal engine operation, air from air pump flows into air control valve and passes through the check valve to air injection nozzles. When engine speed exceeds 4000 RPM (Man. Trans.), or 3400 RPM (Auto. Trans.), an electronic control box actuates a solenoid which shuts off vacuum to air control valve vacuum chamber. During operation with engine cold this will take place at 5200 RPM (Auto. Trans. only). Spring pressure opens air cut valve which shuts off air to air injection nozzles and allows air from air pump to pass to thermal reactor cooling circuit.

2) During periods of deceleration when running at engine speed above 1200 RPM (Man. Trans.) or 1400 RPM (Auto. Trans.), the coasting valve of the deceleration control system shuts off vacuum to the air control vacuum chamber. This causes spring pressure to open air cut valve and shuts off air to air injection nozzles and allows air from air pump to pass to the thermal reactor cooling circuit.

3) The relief valve is controlled by air pressure in the air injection system. When pressure exceeds 2.0-2.8 psi, (.14-.20 kg/sq. cm), relief valve is opened and air is led to thermal reactor cooling circuit. This system maintains a constant pressure of air flowing to the air injection nozzles.



3SM171

### DECCELERATION CONTROL SYSTEM

## MAZDA 1973 ROTARY ENGINE MODIFICATION (Cont.)

**No. 1 Thermosensor (All Models)** — Located in engine cooling system. Thermosensor detects water temperature and sends signal to ignition system. On models with automatic transmission, it also sends signal to air control valve through No. 1 control box.

**No. 2 Thermosensor (Man. Trans. Only)** — Located in engine oil pan. Thermosensor detects oil temperature and sends signal to No. 2 control box. Ignition is retarded in leading ignition timing (by 10°) when engine is cold.

**Thermal Reactor** — Thermal reactor is mounted just outside the exhaust port. It oxidizes unburned exhaust gas expelled from the engine. When engine speed is approximately 4000 RPM, or during deceleration, the air control valve supplies fresh air from the air pump to the thermal reactor to maintain the necessary temperature for oxidation of exhaust gas.

### IGNITION & AIR FLOW CONTROL SYSTEM

**Thermodetector** — Thermodetector circuit is in No. 1 control box and prevents thermosensor from being influenced by ambient temperature.

**No. 1 Control Box** — Control box is common to ignition and air flow circuits as well as the deceleration control system. It receives signals from leading spark plug ignition coil (indicates engine RPM), a thermosensor (indicates engine temperature), and the vacuum switch (indicates engine load). The control box controls trailing ignition, either allowing ignition to fire or preventing it from firing. On automatic transmission models, the condition of the throttle valve also influences the control box.

**No. 2 Control Box** — Controls leading ignition timing. It receives signals and operates so as to open or close circuit between leading side ignition coil and retarded contact points.

**Leading Side Distributor** — Distributor has two contact points, one for normal advance, the other for retarded advance (phase angle is 10°). The retarded side contact point set is not provided with a vacuum advance system.

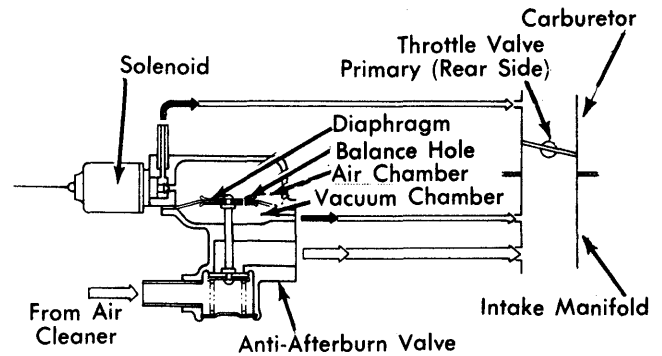
### DECELERATION CONTROL SYSTEM

**Anti-Afterburn Valve** — 1) Valve prevents afterburn by supplying air to intake manifold during deceleration, gear shifting, and immediately after engine is switched off. Valve operates by pressure difference between vacuum chamber and air chamber, and spring force. Operating time is .7 second when pressure difference is 15.75" (400 mm) of mercury.

2) Intake manifold vacuum rises during deceleration and gear shifting, and pressure difference between the two chambers opens valve connected to diaphragm so fresh air is led into intake manifold to correct over rich mixture, preventing afterburn.

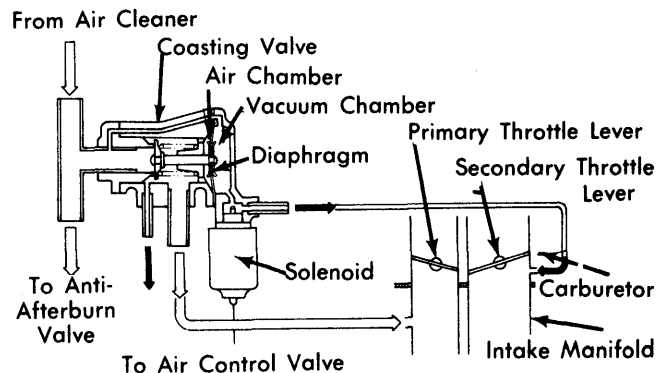
3) When engine is switched off, solenoid opens sensing line and due to pressure difference between vacuum chamber and air chamber, the valve connected to the diaphragm is opened, and fresh air is led from air cleaner to intake manifold.

4) A valance hole in the diaphragm connects vacuum chamber and air chamber to control duration of valve opening. When pressures between chambers are equal, valve is kept closed by spring force. When pressure difference exceeds 3.94" (100 mm) of mercury, valve is opened to lead fresh air from air cleaner into intake manifold. When valance hole equalizes pressure difference, valve is closed and shuts off air.



3SM172

### ANTI-AFTERBURN VALVE



3SM173

### COASTING VALVE

**Coasting Valve** — Connected to intake manifold, valve supplies fresh air from air cleaner to intake manifold to correct overrich mixture during deceleration. When coasting valve opens, intake manifold vacuum connected to vacuum chamber of air control valve is released to atmosphere. This shuts off air to air injection nozzles and directs it to the thermal reactor cooling circuit. The rise of intake manifold vacuum during deceleration and gear shifting causes valve to open, and air from air cleaner is directed to intake manifold to prevent afterburn. When engine speed exceeds 1200 RPM (Man. Trans.) or 1400 RPM (Auto. Trans.), No. 1 control box and idle switch energizes solenoid which opens vacuum line to vacuum chamber. Pressures in vacuum and air chamber are equalized and air from air cleaner overcomes spring force and flows into intake manifold. When coasting valve opens, vacuum chamber of air control valve is subjected to atmosphere and pressures in vacuum and air chambers are equalized, allowing spring force to operate air cut valve. Valve also prevents afterburn when engine is shut off.

**Idle Switch** — Switch is connected in series between ignition switch and coasting valve solenoid. Idle switch detects deceleration condition and current between ignition switch and coasting valve is cut off when throttle valve is in idle position. When engine is idling, circuit is completed between No. 1 control box (Auto. Trans.), and coasting valve operates during deceleration from speed of more than 1200 RPM (Man. Trans.) or 1400 RPM (Auto. Trans.). On automatic transmission models, the idle switch also sends idle position signal to No. 1 control box to control trailing ignition system.

# Exhaust Emission Systems

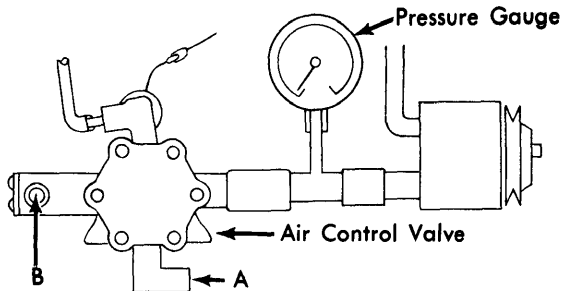
## MAZDA 1973 ROTARY ENGINE MODIFICATION (Cont.)

### TESTING

**Air Pump** — Make sure hoses are free of air leaks. Connect a pressure gauge between air pump and air control valve. With engine at idle speed, 900 RPM (Man. Trans.) or 750 RPM (Auto. Trans. in D), gauge pressure should be more than .63 psi (Man. Trans.) or .46 psi (Auto. Trans.).

**Check Valve** — Remove air control valve. Remove check valve seat, valve, and spring from air control valve. Check seating of valve and seat. Inspect spring. Free length of spring should be 1.06" (Man. Trans.) or .75" (Auto. Trans.).

**Thermal Reactor** — Check for damage or cracks. Remove air hose leading to air control valve, insert finger into valve and make sure non-return valve works smoothly. Start engine and make sure that there are no major exhaust gas leaks from the cooling air injection pipe of the thermal reactor.



2SM308

### TESTING AIR CONTROL VALVE

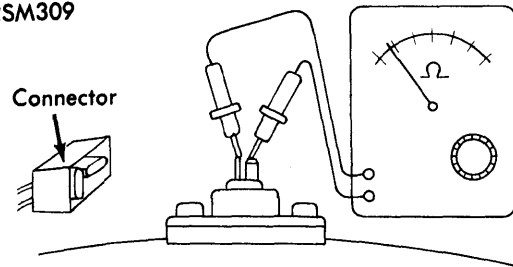
**Air Control Valve** — With ignition turned off, check solenoid by connecting it directly to battery. If clicking sound is heard, solenoid is normal. Attach pressure gauge as shown in illustration and proceed as follows:

- 1) Remove hoses from outlets "A" and "B" of air control valve and run engine at idle. Check to see that there are no air leaks from the outlets.
- 2) Increase engine speed to 3500 RPM (Man. Trans.) or 3000 RPM (Auto. Trans.). Pressure gauge should now read 2.0-2.8 psi (.14-.20 kg/sq. cm) (Man. Trans.) or 2.0-2.6 psi (.14-.18 kg/sq. cm) (Auto. Trans.). There should be air coming from both outlets.
- 3) Remove solenoid terminal. Pressure gauge should read .75 psi (.053 kg/sq. cm), and air should flow from outlet "A" but not from outlet "B" of air control valve. Remove pressure gauge and connect hoses.

**No. 1 Thermosensor** — Disconnect wire connector and attach an ohmmeter as shown in illustration. When ambient and water temperatures are under 86°F (before engine warm-up), reading should be over 7,000 ohms. When temperature is over 156°F (warmed engine), a reading of under 2300 ohms should be achieved.

**No. 2 Thermosensor** — Make sure that there is no terminal breakage and connect ohmmeter between terminal and ground. When ambient and water temperatures are under 86°F (before engine warm-up), reading should be over 5000 ohms. When temperature is over 156°F (warmed engine), a reading of under 2000 ohms should be achieved.

2SM309

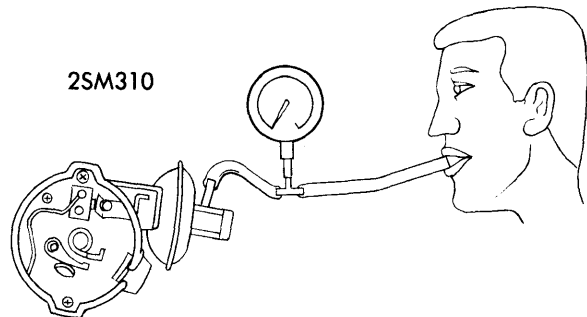


### TESTING THERMOSENSOR

**Vacuum Switch (Man. Trans. Only)** — With cap of trailing ignition distributor removed, remove vacuum sensing tube from vacuum advance of leading distributor, then attach vacuum gauge in its place. Proceed as follows:

- 1) Hold mouth to tube of vacuum gauge and suck in. Watch vacuum gauge and listen for the vacuum switch to change from ON to OFF at approximately 7.09 in. (180 mm) Hg. Vacuum switch should then change from OFF to ON when vacuum is reduced to approximately 4.72 in. (120 mm) Hg.
- 2) Replace distributor cap and replace vacuum sensing tube to the vacuum advance of the distributor. Remove thermosensor connector and connect timing light to the high tension lead of the trailing distributor.
- 3) Run engine at idle speed and then raise RPM. Timing light should not stop flashing until engine speed is raised to 1900 ± 300 RPM. This indicates that vacuum switch is off.

2SM310



### TESTING VACUUM SWITCH

**No. 1 Control Box** — Remove connectors from No. 1 thermosensor, idle switch, and vacuum switch (Man. Trans. only). Connect timing light to high tension cord of trailing distributor and proceed as follows:

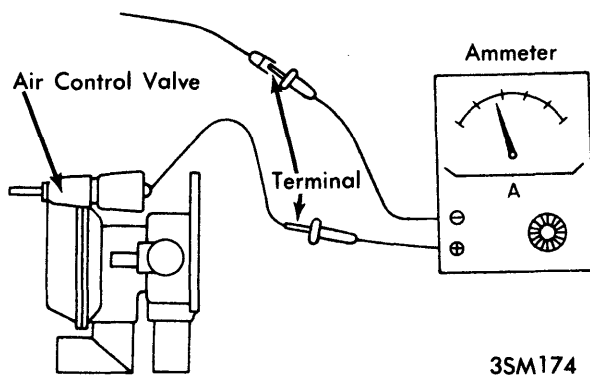
- 1) When engine speed is under 4000 ± 200 RPM (Man. Trans.), or 5200 +0 - 600 RPM (Auto. Trans.), timing light should not be on. When engine RPM is raised to more than 4200 RPM (Man. Trans.) or 5200 RPM (Auto. Trans.) timing light should go on.

**NOTE** — Do not touch cord of timing light to high tension cord of leading side ignition.

- 2) Connect an ammeter to air control valve solenoid and check to see that current flows to solenoid when engine speed is under 4000 ± 200 RPM (Man. Trans.), or 5200 + 0 - 600 RPM (Auto. Trans.). When engine speed is raised beyond 4200 RPM (Man. Trans.) or 5200 RPM (Auto. Trans.), there should be no flow of current to the solenoid.

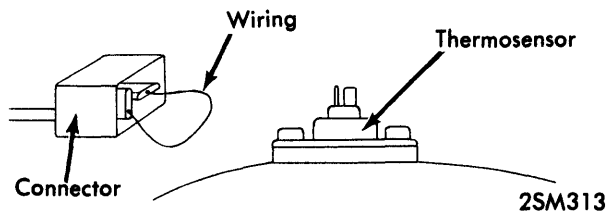
## MAZDA 1973 ROTARY ENGINE MODIFICATION (Cont.)

From Control Box



**CHECKING NO. 1 CONTROL BOX  
(AIR CONTROL VALVE)**

3) Using a short piece of wire, connect both terminals of the No. 1 thermosensor connector terminal to each other in order to short circuit the connector. The timing light should go on at all speeds below  $4000 \pm 200$  RPM (Man. Trans.), or  $5000 - 0 + 600$  RPM (Auto. Trans.).



**CONNECTOR SHORT-CIRCUIT**

4) On automatic transmission models only, connect ammeter to air control valve solenoid. Current should flow to solenoid when engine speed is under  $3400 \pm 200$  RPM. There should be no current flow to solenoid when engine speed exceeds 3600 RPM.

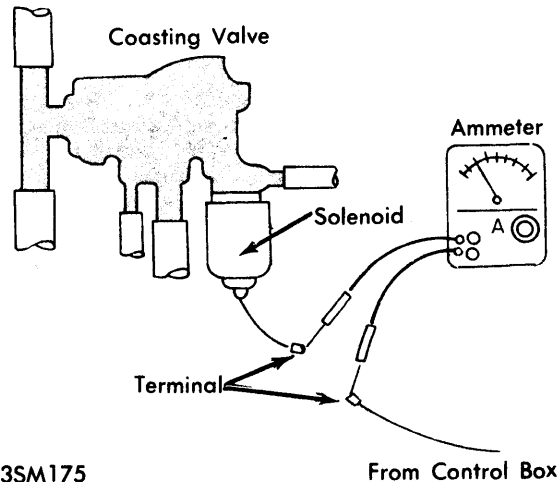
5) Connect No. 1 thermosensor connector and vacuum switch. With idle switch coupler removed, connect an ammeter to coasting valve solenoid. At idle speed there should be current flow. When engine speed is brought to 2000-3000 RPM and lowered from that point, current should begin to flow at about 1200 RPM (Man. Trans.) or 1400 RPM (Auto. Trans.). Reconnect idle switch coupler as before.

**No. 2 Control Box** – On manual transmission models only, remove connectors from both thermosensors and vacuum switch. On automatic transmission models only, disconnect idle switch connector. Start engine and run to 2000-2500 RPM at no load. Pull choke switch about .2-.4" (Man. Trans.) or .8-1.0" (Auto. Trans.) to actuate choke switch. Engine speed should drop 200-300 RPM.

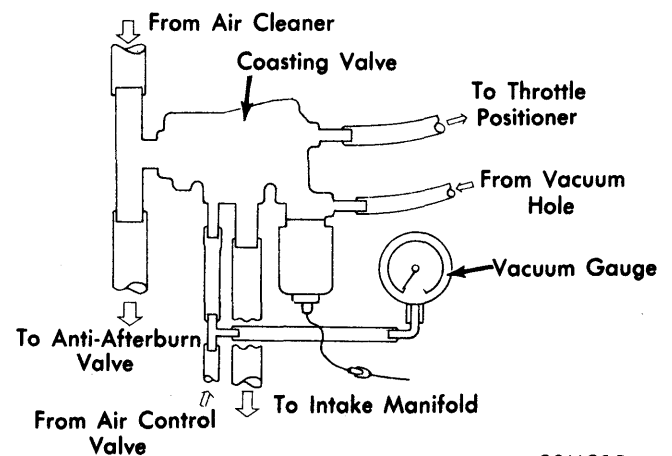
**Anti-Afterburn Valve** – With suction hose removed from valve and engine at idle speed, hold hand over opening of suction hose. If strong vacuum is felt, valve should be replaced. Run engine at 3500-3800 RPM. When throttle valve is closed suddenly, air should be sucked in for .4-1.0 seconds through air suction hose. Run engine at idle speed and remove anti-afterburn valve solenoid wire. Air should continue to be sucked in through hose while wire is disconnected.

**Coasting Valve** – 1) With vacuum gauge installed in line from air control valve to coasting valve, start and warm up engine. At idle speed (transmissions in neutral), the vacuum reading should be more than 15.7" of mercury.

2) Raise engine speed to about 2500 RPM. When throttle valve is now closed suddenly, gauge reading should be 0-1.18" of mercury. When engine speed is lowered from 2500 RPM to 1150-1250 RPM (Man. Trans.) or 1350-1450 RPM (Auto. Trans.), vacuum reading should be more than 15.7" of mercury.



**CHECKING NO. 1 CONTROL BOX (COASTING VALVE)**



**TESTING COASTING VALVE**

3) If vacuum gauge readings are excessive, check that solenoid operates properly and that there is no clogging in the vacuum relief passage connecting vacuum chamber and air inlet pipe in coasting valve. Check for correct current flow to coasting valve solenoid. See No. 1 Control Box.

**Idle Switch** – Remove idle switch connector and check for conduction between ignition switch terminal (terminal "A"), and No. 1 control box terminal (terminal "C"). There should be no conduction between ignition switch terminal (terminal "A") and coasting valve terminal (terminal "C") when external force is not applied to switch knob (primary throttle valve in idle position). If there is no conduction between ignition switch ter-

# Exhaust Emission Systems

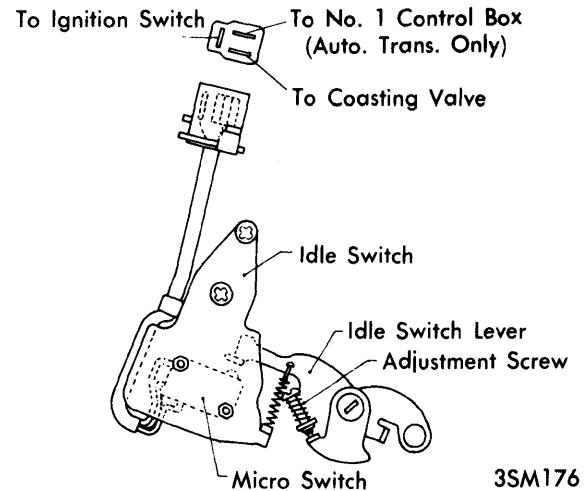
## MAZDA 1973 ROTARY ENGINE MODIFICATION (Cont.)

terminal and No. 1 control box terminal, and there is conduction between ignition switch terminal and coasting valve terminal when external force applied (throttle valve open), idle switch is normal.

### ADJUSTMENT

**Idle Switch Adjustment - 1)** With engine warm, set engine to idle speed by turning air by-pass adjusting screw. Using accelerator pedal, increase and decrease engine speed making sure that switch changes from OFF to ON, or from ON to OFF at engine speed of 1000-1100 RPM (Man. Trans.) or 1200-1300 RPM (Auto. Trans.).

**2)** If switch does not change within range of specified RPM, adjust by turning adjusting screw of idle switch lever. Turn screw counterclockwise if setting revolution is higher than specified RPM. Turn clockwise if lower. Repeat procedure until engine speed is within range of specified RPM and recheck idle RPM.



**CHECKING IDLE SWITCH**