

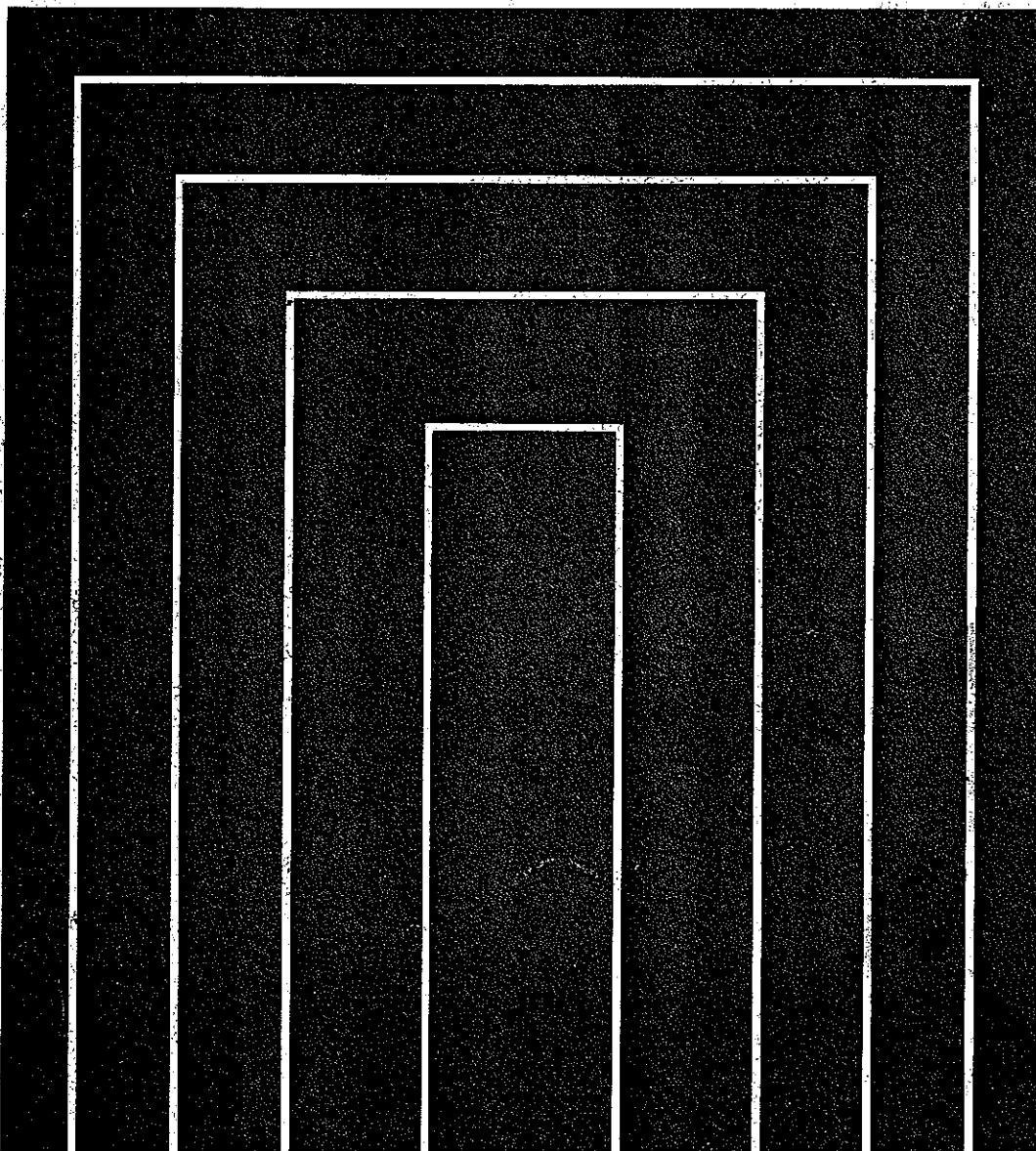
# TOYOTA

## 5M-GE

## ENGINE

**REPAIR MANUAL FOR 1982  
EMISSION CONTROL**

Aug., 1981



For USA  
& Canada  
Pub. No. 36143

# FOREWORD

This repair manual has been prepared to provide information covering general service repairs for the Emission Control System of the 5M-GE engine.

Applicable models:

1982	MA61L-BLMQFA
1982	MA61L-BLPQFA
1982	MA61L-BLMQFK
1982	MA61L-BLPQFK

For service of the 5M-GE engine, refer to the following repair manual.

5M-GE Engine Repair Manual (Pub. No. 36145)

All information contained in this manual is the most up-to-date at the time of publication. However, specifications and procedures are subject to change without notice.

TOYOTA MOTOR SALES CO., LTD.

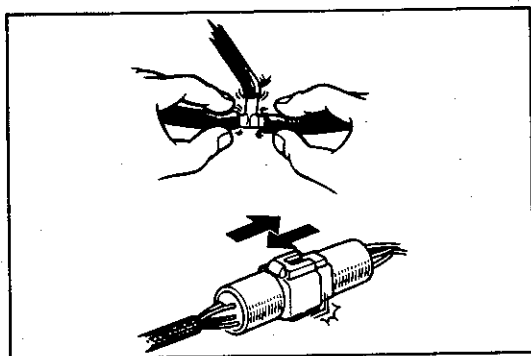
# INTRODUCTION

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## GENERAL PRECAUTIONS

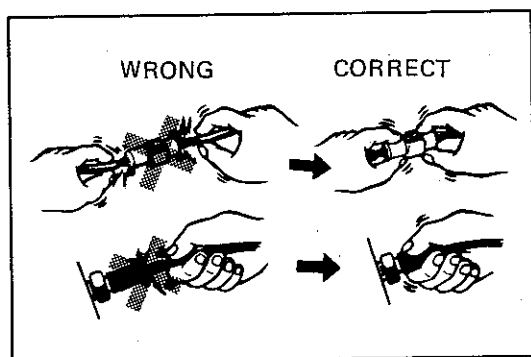
1. **Know the importance of periodic maintenance.**
  - (a) Every service item in the periodic maintenance list must be performed.
  - (b) Failing to do even one item can cause the engine to run poorly and increase exhaust emissions.
2. **Listen to the customers comments carefully.**

Always determine exactly what the customer complaint is, if any, and verify it before proceeding with repairs.
3. **Determine if you have an engine or emission system problem.**
  - (a) Engine problems are usually not caused by the emission control systems.
  - (b) When troubleshooting, always check the engine, EFI system and the ignition system first.



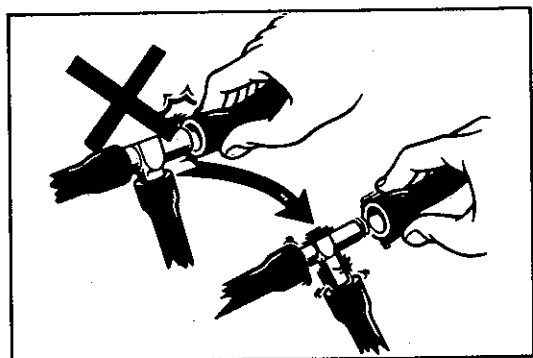
4. **Check hose and wiring connections first.**

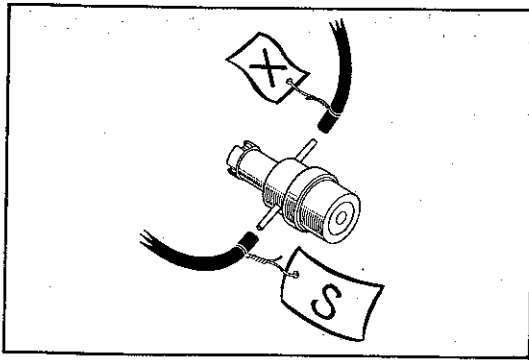
The most frequent cause of problems is simply a bad connection in wiring or vacuum hoses. Always make sure that connections are secure and correct.



5. **Observe the following precautions to avoid damage to the parts:**

- (a) To disconnect vacuum hoses, pull on the end, not the middle of the hose.
- (b) To pull apart electrical connectors, pull on the connector itself, not the wires.
- (c) Be careful not to drop electrical components, such as sensors or relays. If they are dropped on a hard floor, they should be replaced and not reused.
- (d) When steam cleaning an engine, protect the distributor, coil, air filter, and VCV from water.
- (e) Never use an impact wrench to remove or install thermo switches or thermo sensors.
- (f) When checking for continuity at a wire connector, insert the tester probe carefully to prevent terminals from bending.
- (g) When using a vacuum gauge, never force the hose onto a connector that is too large. Use a step-down adapter instead. Once the hose has been stretched, it may leak.





**6. Tag hoses before disconnecting them:**

- (a) When disconnecting vacuum hoses, use tags to identify how they should be reconnected.
- (b) After completing a job, double check that the vacuum hoses are properly connected. A label under the hood shows the proper layout.

## **PRECAUTIONS FOR VEHICLES EQUIPPED WITH A CATALYTIC CONVERTER**

**WARNING:** If large amounts of unburned gasoline flow into the catalytic converter, it may overheat and create a fire hazard. To prevent this, observe the following precautions and explain them to your customer.

- 1. Use only unleaded gasoline.**
- 2. Avoid prolonged idling.**  
Avoid running the engine at idle speed for more than 20 minutes.
- 3. Avoid spark jump test.**
  - (a) Spark jump only when absolutely necessary. Perform this test as rapidly as possible.
  - (b) While testing, never race the engine.
- 4. Avoid prolonged engine compression measurement.**  
Engine compression tests must be made as rapidly as possible.
- 5. Do not run engine when fuel tank is nearly empty.**  
This may cause the engine to misfire and create an extra load on the catalytic converter.
- 6. Avoid coasting with ignition turned off and prolonged braking.**
- 7. Do not dispose of a used catalytic converter along with parts contaminated with gasoline or oil.**

## ABBREVIATIONS USED IN THIS MANUAL

BTDC	Before Top Dead Center
BVSV	Bi-metal Vacuum Switching Valve
DOHC	Double Over Head Cam
DP	Dash Pot
EFI	Electronic Fuel Injection
EGR	Exhaust Gas Recirculation
EVAP	Evaporative (Emission Control)
EX.	Exhaust (manifold or valve) or Except
IN.	Intake (manifold or valve) or Inch
IG	Ignition
PCV	Positive Crankcase Ventilation
SC	Spark Control
S/W	Switch
T/M	Transmission
TWC	Three-Way Catalyst
VCV	Vacuum Control Valve
W/	With
W/O	Without

# TROUBLESHOOTING

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## ENGINE OVERHEATING

Problem	Possible cause	Remedy	Page
Engine overheats	Cooling system faulty Incorrect ignition timing	Troubleshoot cooling system Reset timing	

## HARD STARTING

Problem	Possible cause	Remedy	Page
Engine will not crank or cranks slowly	Starting system faulty	Troubleshoot starting system	
Engine will not start/ Hard to start (cranks OK)	No fuel supply to injector <ul style="list-style-type: none"> <li>• No fuel in tank</li> <li>• Fuel pump not working</li> <li>• Fuel filter clogged</li> <li>• Fuel line clogged or leaking</li> </ul> EFI system problems Ignition problems <ul style="list-style-type: none"> <li>• Ignition coil</li> <li>• Igniter</li> <li>• Distributor</li> </ul> Spark plugs faulty Ignition wiring disconnected or broken Vacuum leaks <ul style="list-style-type: none"> <li>• PCV hoses</li> <li>• EGR valve</li> <li>• Intake manifold</li> <li>• Air intake chamber</li> <li>• Throttle body</li> </ul> Pulling in air between air flow meter and throttle body ✓ Compression low	Troubleshoot EFI system  Repair as necessary Perform spark test  Inspect plugs Inspect wiring Repair as necessary  Repair as necessary  Check compression	3-4 3-16

## ROUGH IDLING

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses	Spark plugs faulty Ignition wiring faulty Ignition problems <ul style="list-style-type: none"> <li>• Ignition coil</li> <li>• Igniter</li> <li>• Distributor</li> </ul> Incorrect ignition timing	Inspect plugs Inspect wiring  Inspect coil Inspect igniter Inspect distributor Reset timing	4-2



**ROUGH IDLING (CONT'D)**

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses (cont'd)	Vacuum leaks <ul style="list-style-type: none"> <li>• PCV hoses</li> <li>• EGR valve</li> <li>• Intake manifold</li> <li>• Air intake chamber</li> <li>• Throttle body</li> </ul>	Repair as necessary	3-4 3-16
	Pulling in air between air flow meter and throttle body		
	Incorrect idle speed	Adjust idle speed	4-3
	EFI system problems	Repair as necessary	
	Engine overheats	Check cooling system	
	Compression low	Check compression	

**ENGINE HESITATES/POOR ACCELERATION**

Problem	Possible cause	Remedy	Page
Engine hesitates/ Poor acceleration	Spark plugs faulty	Inspect plugs	
	Ignition wiring faulty	Inspect wiring	
	Vacuum leaks <ul style="list-style-type: none"> <li>• PCV hoses</li> <li>• EGR valve</li> <li>• Intake manifold</li> <li>• Air intake chamber</li> <li>• Throttle body</li> </ul>	Repair as necessary	3-4 3-16
	Pulling in air between air flow meter and throttle body	Repair as necessary	
	Incorrect ignition timing	Reset timing	4-2
	Fuel system clogged	Check fuel system	
	Air cleaner clogged	Check air cleaner	
	EFI system problems	Repair as necessary	
	Emission control system problem (cold engine) <ul style="list-style-type: none"> <li>• EGR system always on</li> <li>• SC system faulty</li> </ul>	Check EGR system Check SC system	3-16 3-11
	Engine overheats	Check cooling system	
	Compression low	Check compression	

**ENGINE DIESELING**

Problem	Possible cause	Remedy	Page
Engine diesels (runs after ignition switch is turned off)	EFI system problems	Repair as necessary	

**AFTER FIRE, BACKFIRE**

Problem	Possible cause	Remedy	Page
Muffler explosion (after fire) on deceleration only	Deceleration fuel cut system always off	Check EFI (fuel cut) system	
Muffler explosion (after fire) all the time	Air cleaner clogged EFI system problem Incorrect ignition timing	Check air cleaner Repair as necessary Reset timing	4-2
Engine backfires	EFI system problem Vacuum leak <ul style="list-style-type: none"> <li>• PCV hoses</li> <li>• EGR valve</li> <li>• Intake manifold</li> <li>• Air intake chamber</li> <li>• Throttle body</li> </ul> Pulling in air between air flow meter and throttle body Insufficient fuel flow Incorrect ignition timing Carbon deposits in combustion chambers	Repair as necessary Check hoses and repair as necessary  Repair as necessary  Troubleshoot fuel system Reset timing Inspect cylinder head	3-4 3-16    4-2

**EXCESSIVE OIL CONSUMPTION**

Problem	Possible cause	Remedy	Page
Excessive oil consumption	Oil leak PCV line clogged Piston ring worn or damaged Valve stem and guide worn Valve stem seal worn	Repair as necessary Check PCV system Check rings Check valves Check seals	3-4

## POOR GASOLINE MILEAGE

Problem	Possible cause	Remedy	Page
Poor gasoline mileage	Fuel leak	Repair as necessary	4-2
	Air cleaner clogged	Check air cleaner	
	Incorrect ignition timing	Reset timing	
	EFI system problems <ul style="list-style-type: none"> <li>• Injector faulty</li> <li>• Deceleration fuel cut system faulty</li> </ul>	Repair as necessary	
	Idle speed too high	Adjust idle speed	4-3
	Spark plugs faulty	Inspect plugs	3-16
	EGR system always on	Check EGR system	
	SC system faulty	Check SC system	3-11
	Compression low	Check compression	
	Tires improperly inflated	Inflate tires to proper pressure	
	Clutch slips	Troubleshoot clutch	
	Brakes drag	Troubleshoot brakes	

# EMISSION CONTROL SYSTEMS

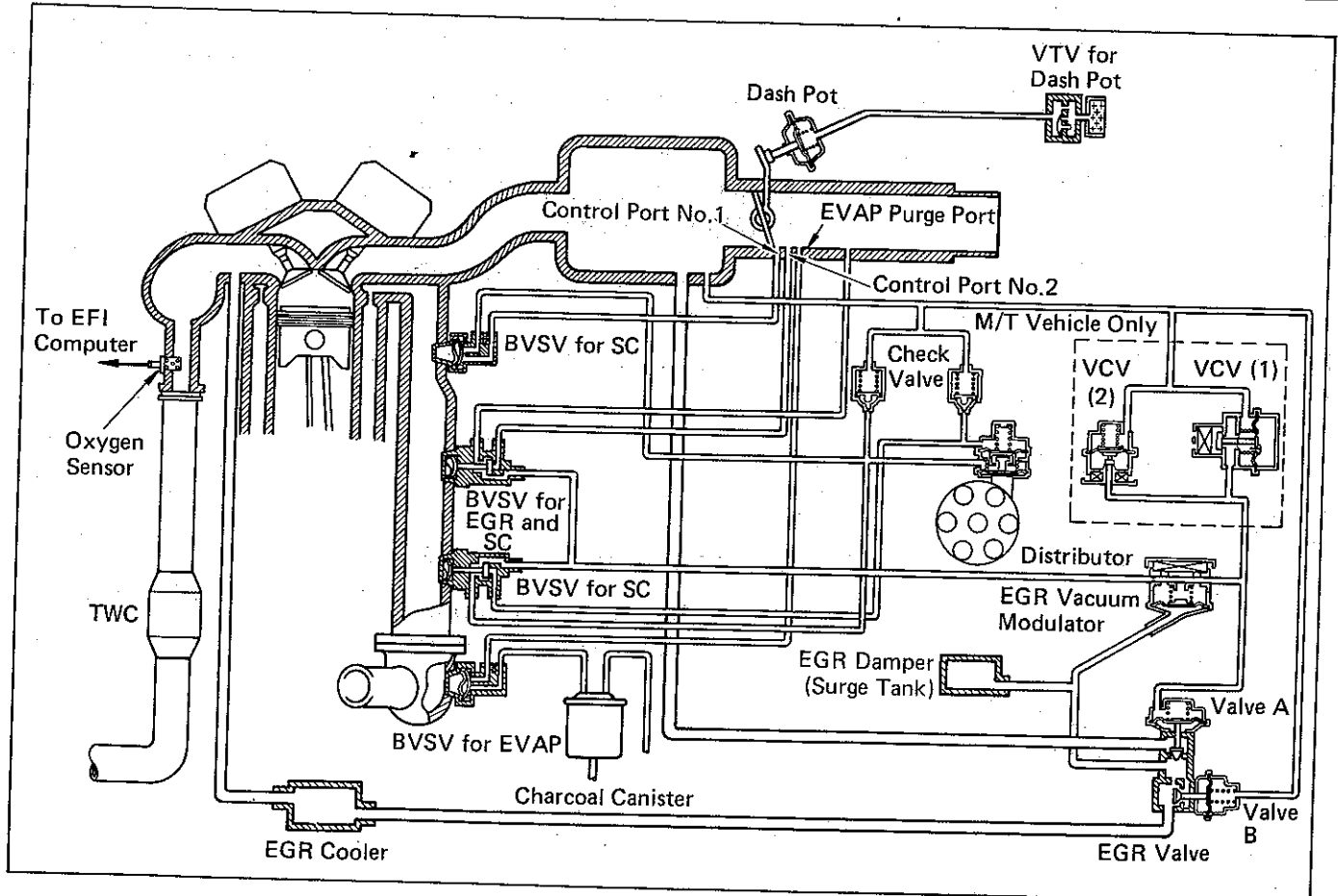
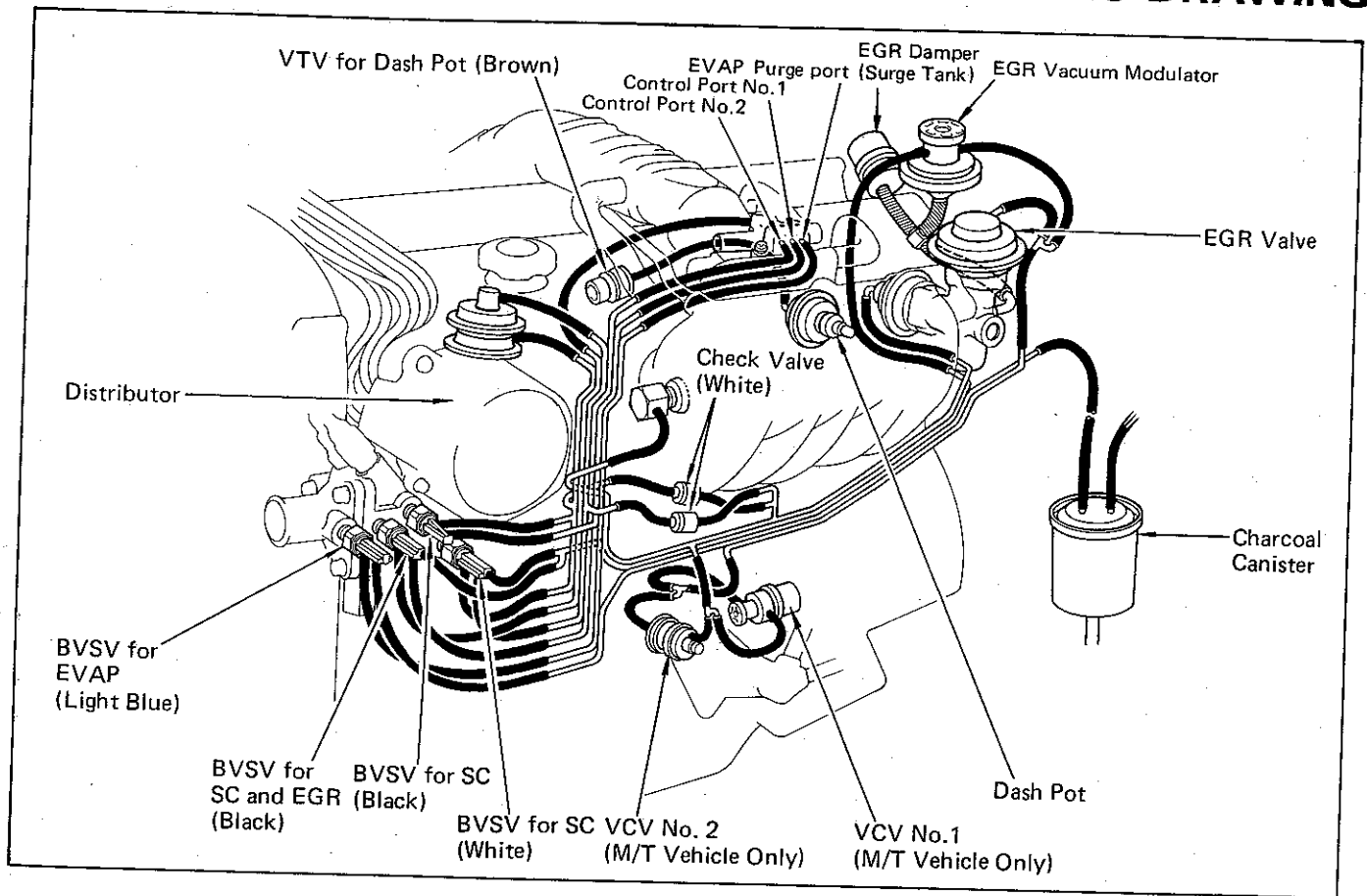
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## SYSTEM PURPOSE

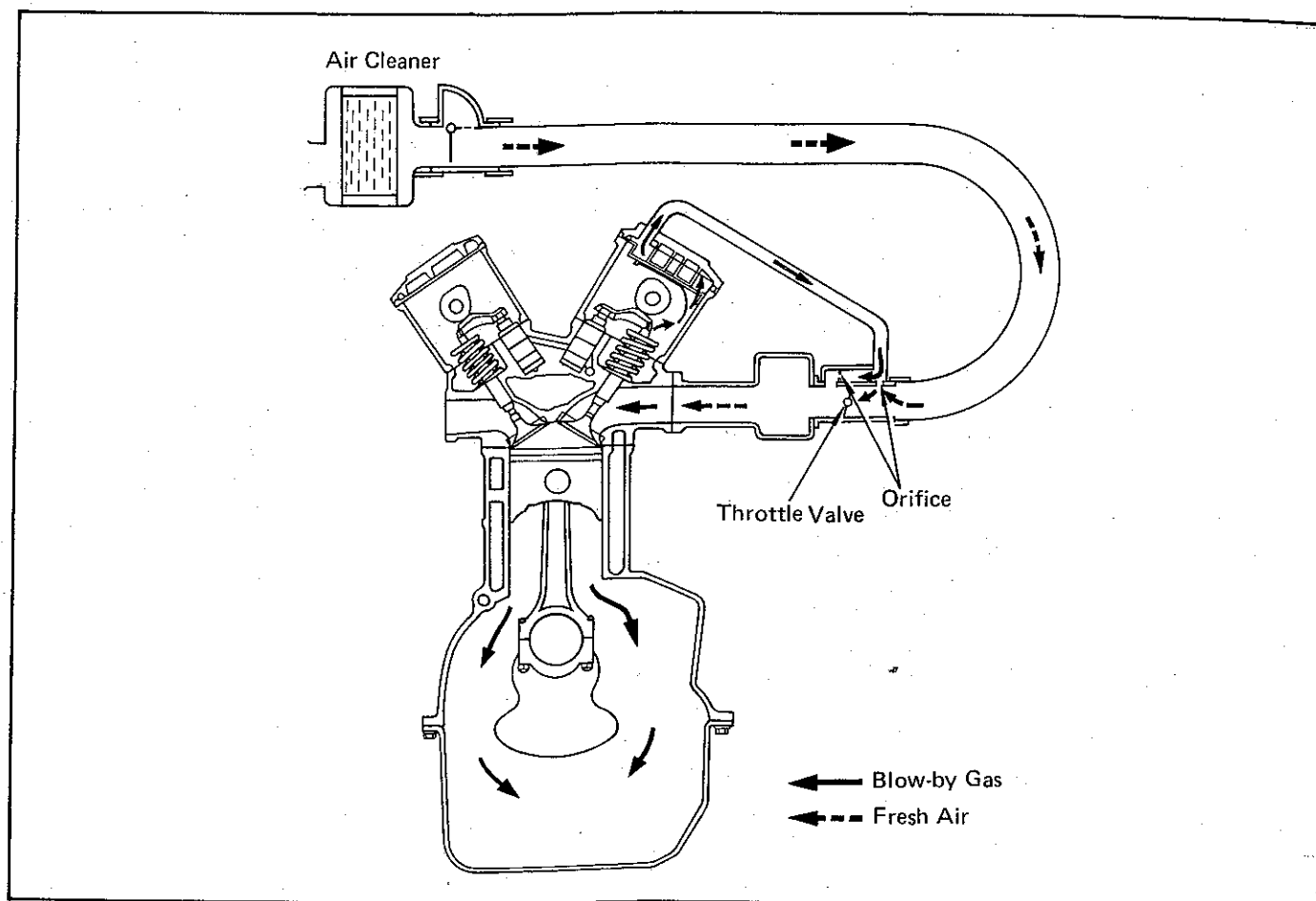
System	Abbreviation	Purpose
Positive crankcase ventilation	PCV	Reduces blow-by gas (HC)
Fuel evaporative emission control	EVAP	Reduces evaporative HC
Dash pot	DP	Reduces HC and CO
Spark control	SC	Improves driveability at cold and improves performance at idle
Exhaust gas recirculation	EGR	Reduces NOx
Three-way catalyst	TWC	Reduces HC, CO and NOx
Electronic fuel injection*	EFI	Regulates all engine conditions for reduction of exhaust emissions.

Remarks \* For inspection and repair of the EFI system, refer to the 5M-GE Engine Repair Manual (Pub. No. 36145).

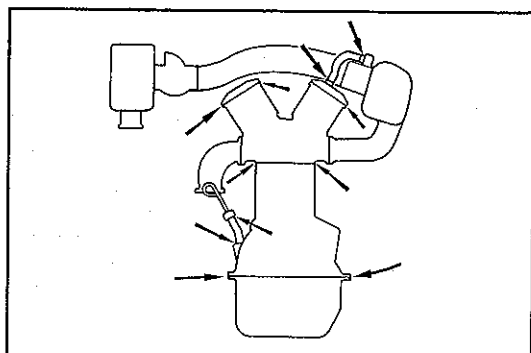
# COMPONENT LAYOUT AND SCHEMATIC DRAWING



## POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM



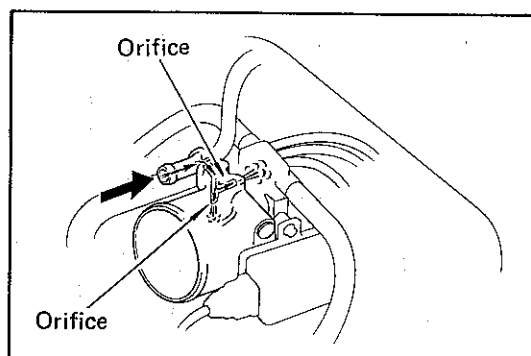
To reduce HC emission, crankcase blow-by gas (HC) is routed through two metering orifices to the intake manifold for combustion in the cylinders.



### INSPECTION OF PCV HOSES AND CONNECTIONS

#### 1. VISUALLY INSPECT HOSES, CONNECTIONS AND GASKETS

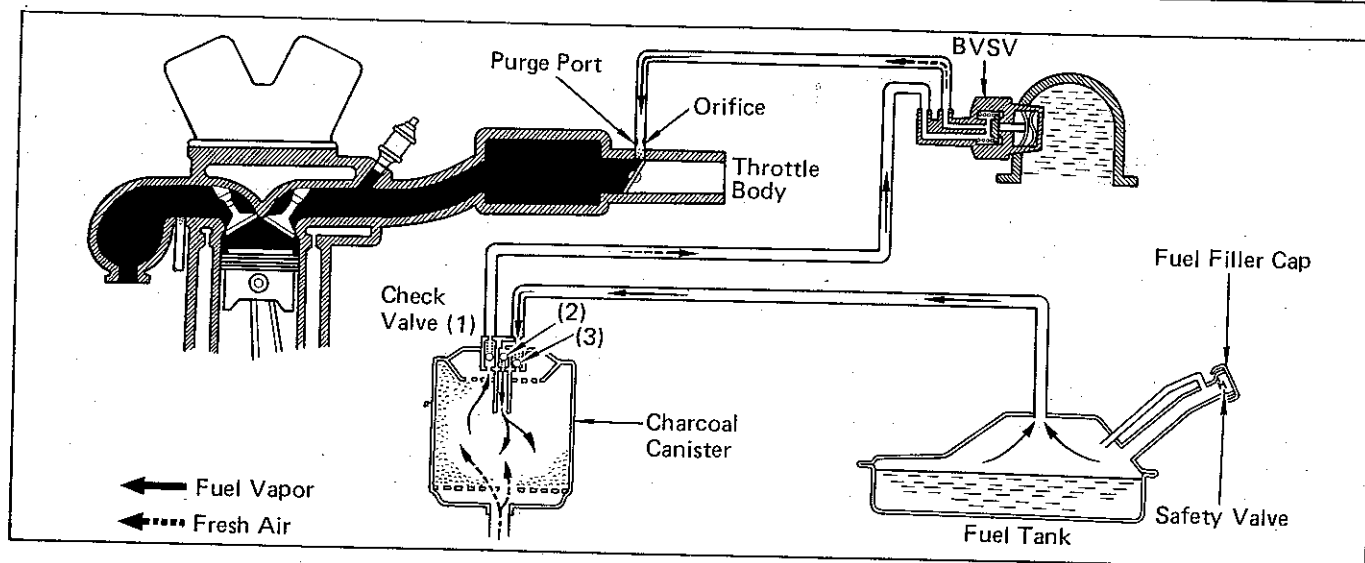
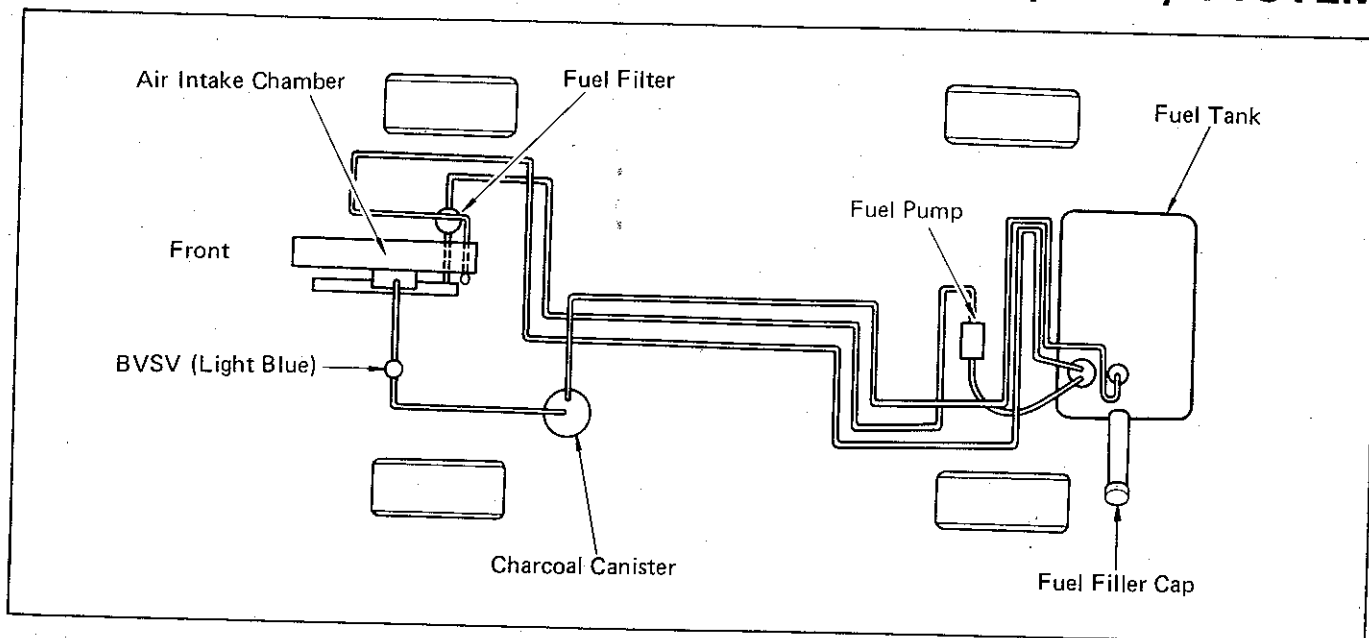
Check for cracks, leaks or damage.



#### 2. CLEAN TWO ORIFICES

Clean off any gum deposits in the orifices with solvent and blow out with compressed air.

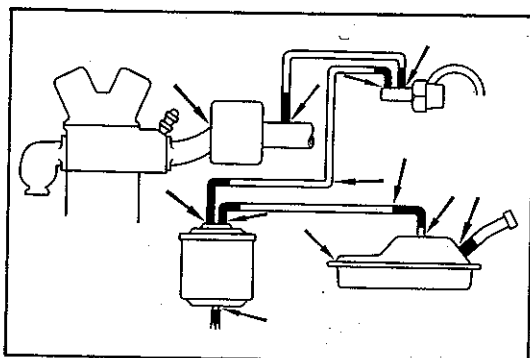
# FUEL EVAPORATIVE EMISSION CONTROL (EVAP) SYSTEM



To reduce HC emission, evaporated fuel from fuel tank is routed through the charcoal canister to the intake manifold for combustion in the cylinders.

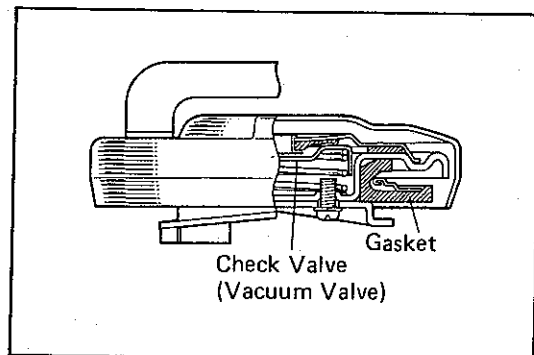
Coolant Temp.	BVS	Throttle Valve Opening	Check Valve			Safety Valve in Cap	Evaporated Fuel (HC)
			(1)	(2)	(3)		
Below 35°C (95°F)	CLOSED	—	—	—	—	—	HC from tank is absorbed in the canister
Above 54°C (129°F)	OPEN	Positioned below purge port	CLOSED	—	—	—	HC from canister is led into air intake chamber
		Positioned above purge port	OPEN	—	—	—	HC from canister is led into air intake chamber
High pressure in tank	—	—	—	OPEN	CLOSED	CLOSED	HC from tank is absorbed in the canister
High vacuum in tank	—	—	—	CLOSED	OPEN	OPEN	(Air is led into the fuel tank.)



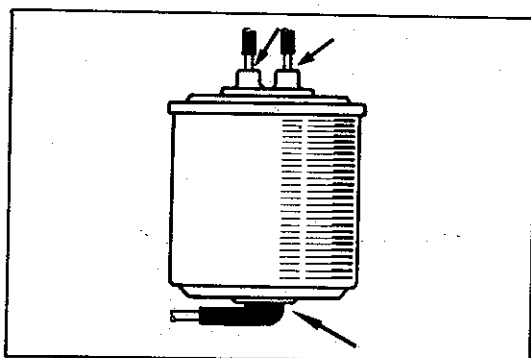


### INSPECTION OF FUEL VAPOR LINES, FUEL TANK AND FILLER CAP

1. **VISUALLY INSPECT LINES AND CONNECTIONS**  
Look for loose connections, sharp bends or damage.
2. **VISUALLY INSPECT FUEL TANK**  
Look for deformation, cracks or fuel leakage.

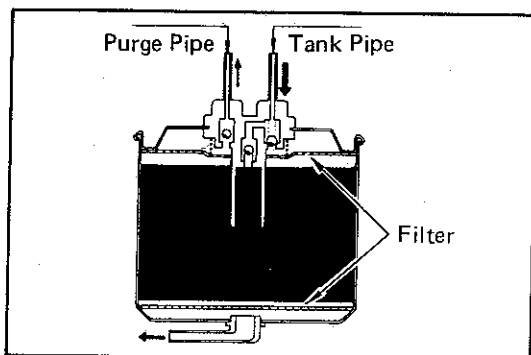


3. **VISUALLY INSPECT FUEL FILLER CAP**
    - (a) Remove four screws and retainer.
    - (b) Look for a damaged or deformed gasket.
    - (c) Reinstall the retainer.
- If a problem is found, repair or replace the cap.

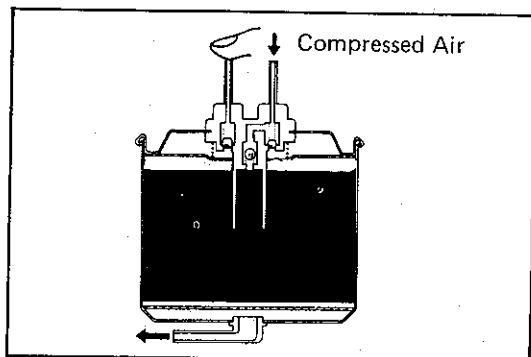


### INSPECTION OF CHARCOAL CANISTER

1. **REMOVE CHARCOAL CANISTER**
2. **VISUALLY INSPECT CHARCOAL CANISTER CASE**  
Look for cracks or damage.



3. **CHECK FOR CLOGGED FILTER AND STUCK CHECK VALVE**
    - (a) Using low pressure compressed air, blow into the tank pipe and check that the air flows without resistance from the other pipes.
    - (b) Blow into the purge pipe and check that the air does not flow from the other pipes.
- If a problem is found, replace the charcoal canister.



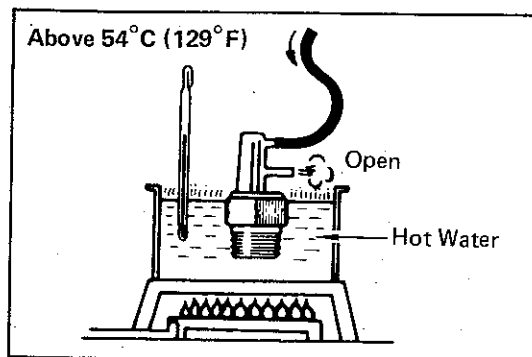
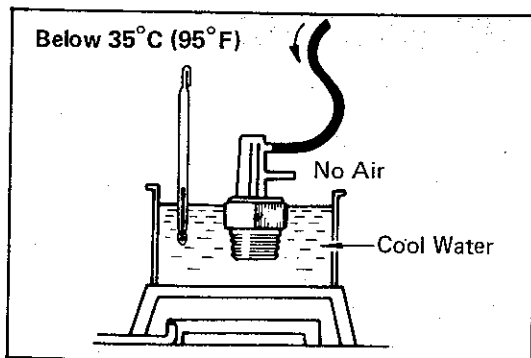
### 4. CLEAN FILTER IN CANISTER

Clean the filter by blowing 3 kg/cm<sup>2</sup> (43 psi) air into the tank pipe while holding the other upper canister pipes closed.

#### NOTE:

- Do not attempt to wash the canister.
- No activated carbon should come out.

### 5. INSTALL CHARCOAL CANISTER



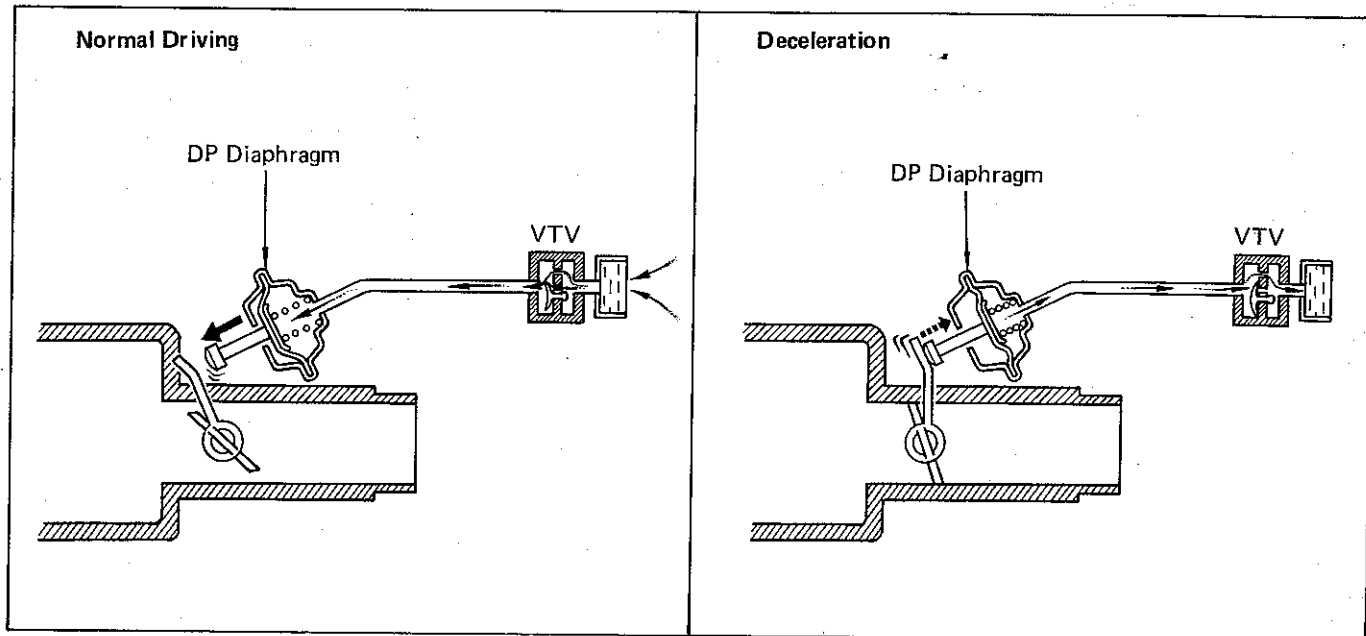
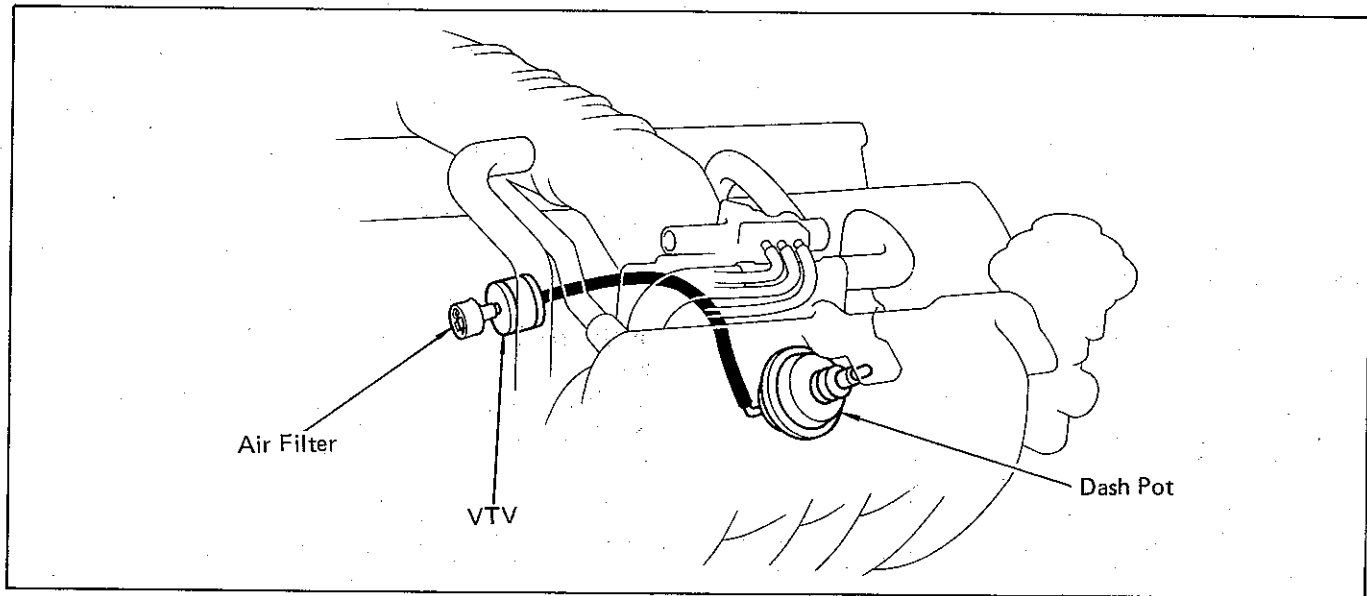
## INSPECTION OF BVSV

### CHECK BVSV BY BLOWING AIR INTO PIPE

- (a) Drain the coolant from the radiator into a suitable container.
- (b) Remove the BVSV from the water outlet.
- (c) Cool the BVSV to below 35°C (95°F) with cool water.
- (d) Blow air into pipe and check that the BVSV is closed.
- (e) Heat the BVSV to above 54°C (129°F) with hot water.
- (f) Blow air into pipe and check that the BVSV is open.
- (g) Apply liquid sealer to the threads of the BVSV and install.
- (h) Fill the radiator with coolant.

If a problem is found, replace the BVSV.

## DASH POT (DP) SYSTEM

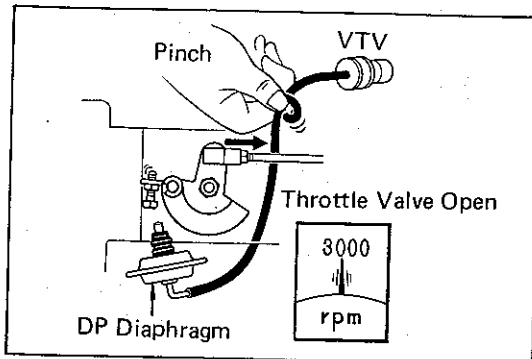


To reduce HC and Co emissions, when decelerating the dash pot opens the throttle valve slightly more than at idle. This causes the air-fuel mixture to burn completely.

Condition	Diaphragm A	VTV	Throttle Valve
Idling	Pushed in by return force of throttle valve	CLOSED	Idle speed position
Normal driving	Pushed out by diaphragm spring	OPEN	High speed position
Deceleration	Pushed in by return force of throttle valve	CLOSED	Slightly opens and then slowly closes to idle position

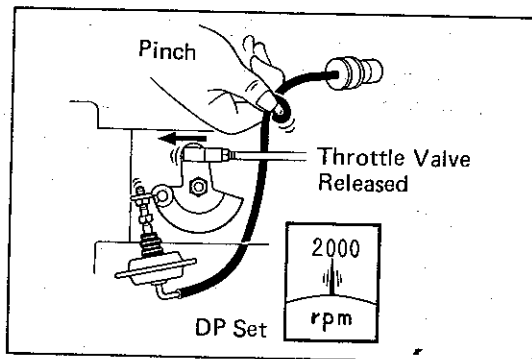
## INSPECTION OF DP SYSTEM

1. WARM UP ENGINE
2. CHECK IDLE SPEED AND ADJUST, IF NECESSARY



### 3. CHECK DP SETTING SPEED

- (a) Maintain the engine speed at 3,000 rpm.
- (b) Pinch the vacuum hose between DP and VTV.

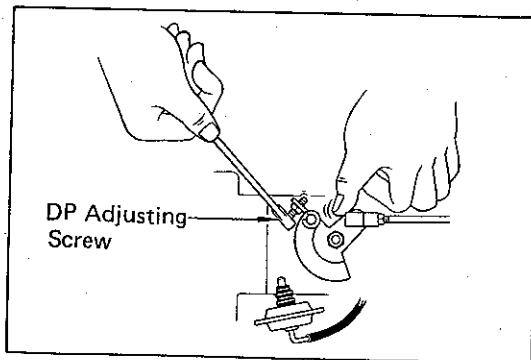


- (c) Release the throttle valve.

- (d) Check that the DP is set.

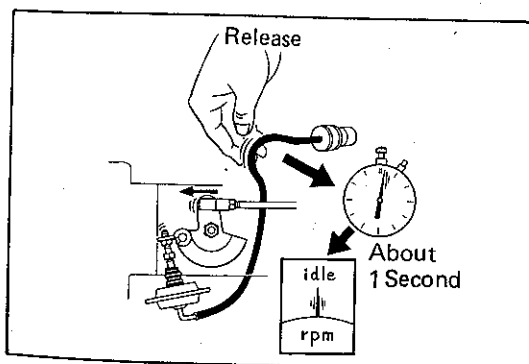
DP setting speed: 2,000 rpm

If not at specified speed, adjust with the DP adjusting bolt.

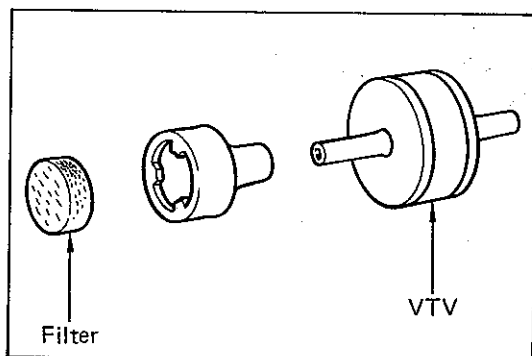


### 4. CHECK OPERATION OF VTV

- (a) Set the DP speed in the same procedure as above; (a) to (c).
- (b) Release the pinched hose and check that the engine returns to idle speed in about 1 second.



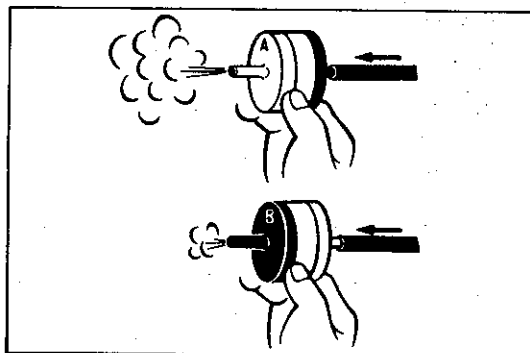
IF NO PROBLEM IS FOUND WITH THIS INSPECTION,  
THE SYSTEM IS OKAY; OTHERWISE INSPECT EACH  
PART



## INSPECTION OF VTV

### 1. CHECK AND CLEAN FILTER ON VTV

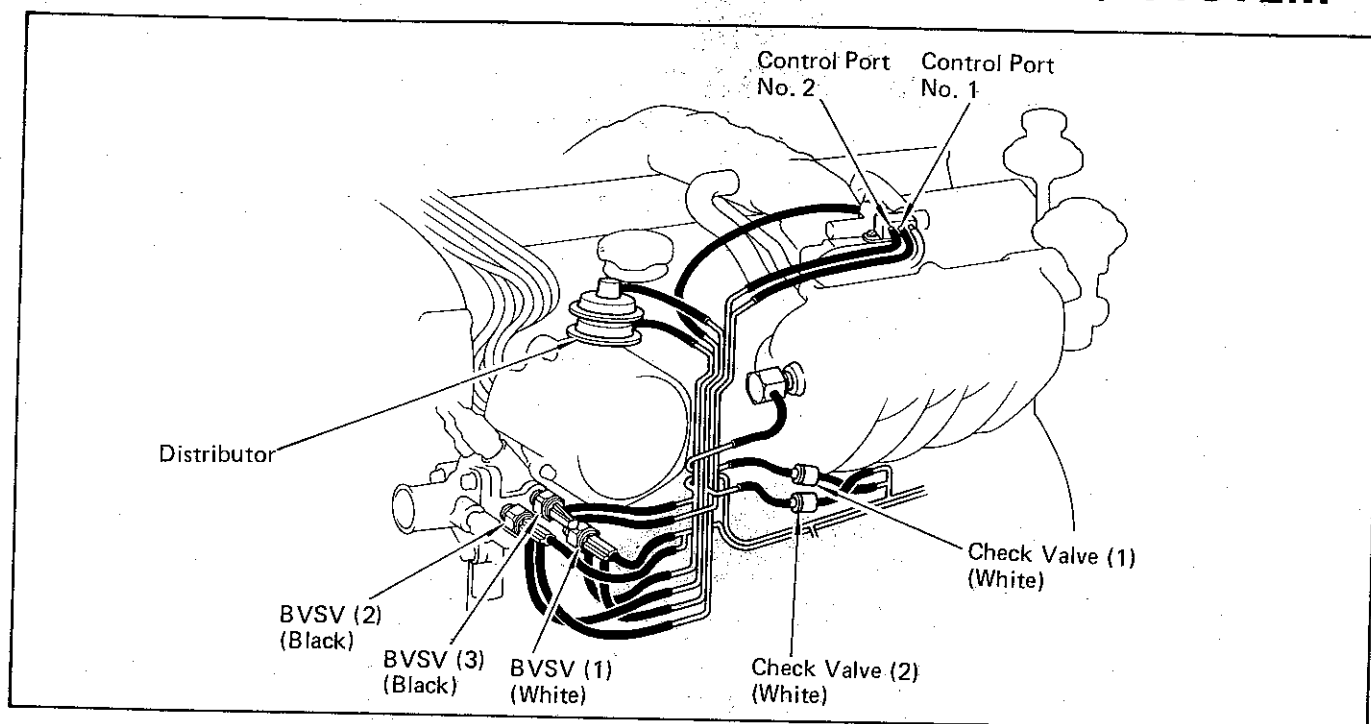
- (a) Check the filter for contamination or damage.
- (b) Using compressed air, clean the filter.



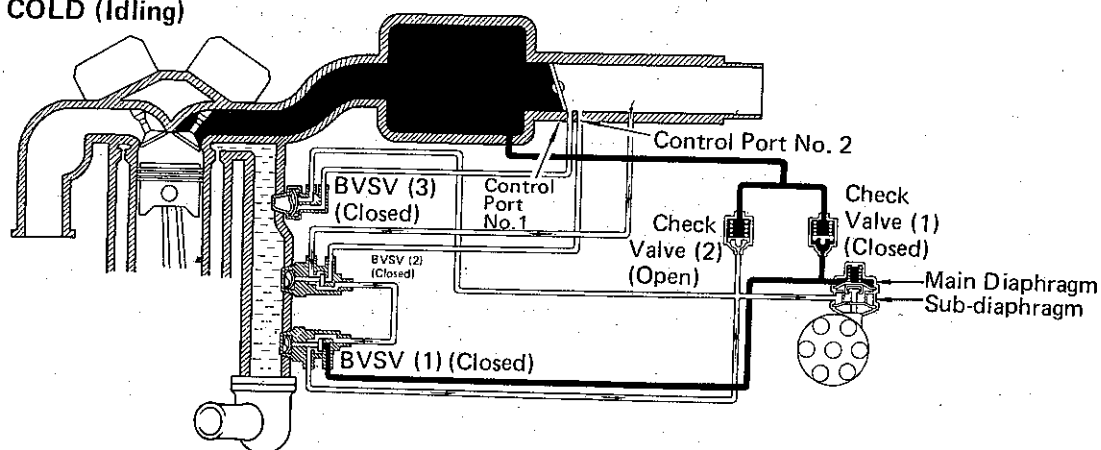
### 2. CHECK VTV BY BLOWING AIR INTO EACH SIDE

- (a) Check that air flows without resistance from B to A.
- (b) Check that air flows with difficulty from A to B.

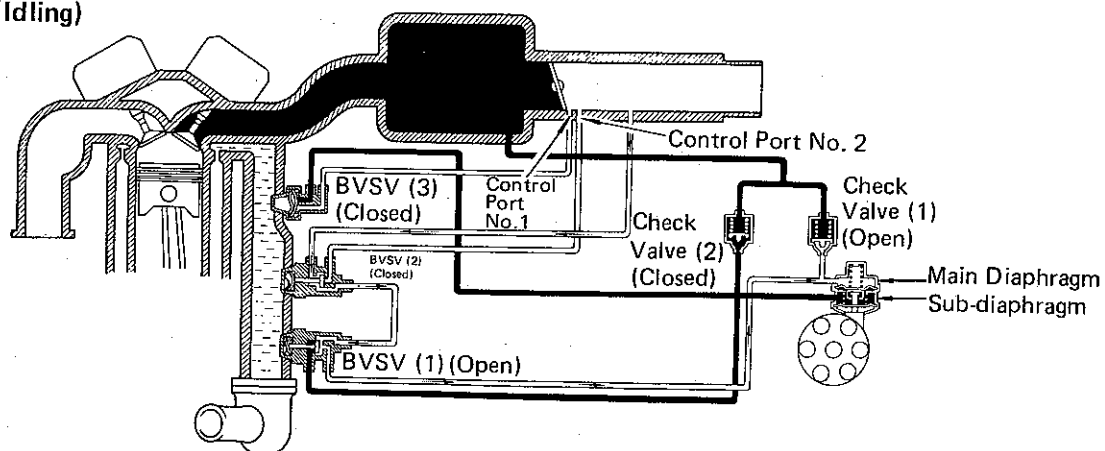
# SPARK CONTROL (SC) SYSTEM

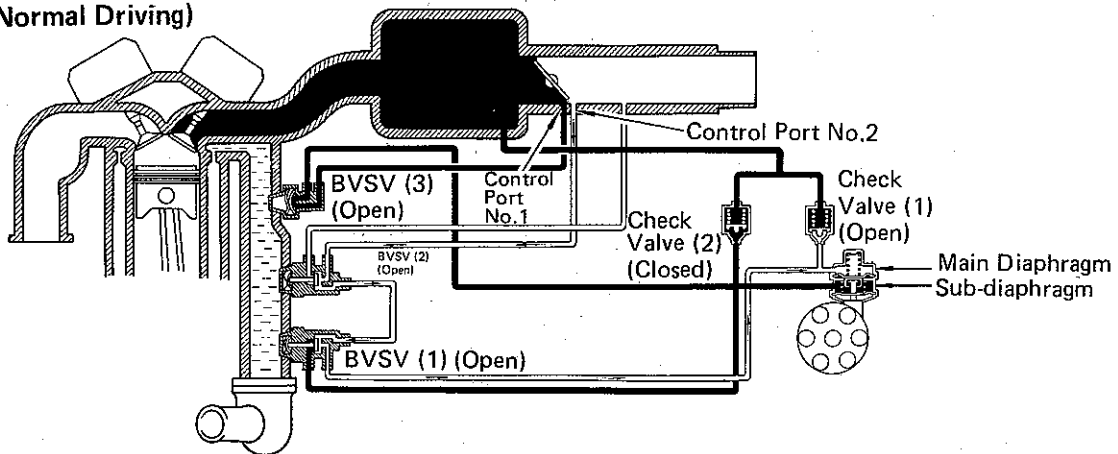
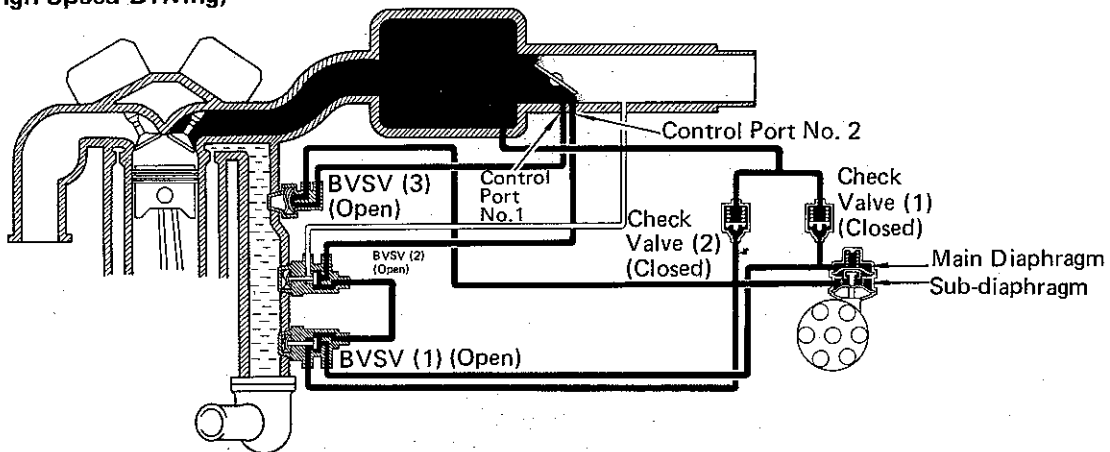


[1] VERY COLD (Idling)



[2] COLD (Idling)



**[3] HOT (Normal Driving)****[4] HOT (High Speed Driving)**

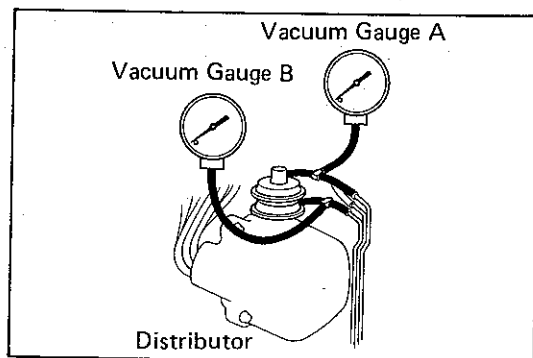
To improve cold engine performance, this ignition system advances the ignition timing when the engine is cold, and to improve idle performance, advances the ignition timing when there is a load on the engine. The distributor is equipped with two diaphragms that have different vacuum advance characteristics.

Coolant Temp.	BVSV (1)	BVSV (2)	BVSV (3)	Throttle Valve Opening	Condition	Vacuum at Control Port No. 1	Vacuum at Control Port No. 2	Distributor		Ignition Timing
								Main Diaphragm	Sub-diaphragm	
Below $-10^{\circ}\text{C}$ ( $14^{\circ}\text{F}$ ) [1]	CLOSED	CLOSED	CLOSED	—	—	—	—	* Fully pulled	Not pulled	$18^{\circ}$ (Main) + initial timing
Between $4^{\circ}\text{C}$ ( $39^{\circ}\text{F}$ ) and $45^{\circ}\text{C}$ ( $113^{\circ}\text{F}$ ) [2]	OPEN	CLOSED	CLOSED	—	—	—	—	Not pulled	* Fully pulled	$8^{\circ}$ (Sub) + initial timing
Above $64^{\circ}\text{C}$ ( $147^{\circ}\text{F}$ )	OPEN	OPEN	OPEN	Positioned below control port No. 1	Idling	No vacuum	No vacuum	Not pulled	Not pulled	Initial timing
				Positioned between control port No. 1 and No. 2 [3]	Normal driving	* Vacuum	No vacuum	Not pulled	** Pulled	Sub + initial timing
				Positioned above control port No. 2 [4]	High speed driving	Vacuum	Vacuum	** Pulled	** Pulled	Main + sub + initial timing
				Fully open	High load and low speed	Low vacuum	Low vacuum	*** Not pulled	*** Not pulled	Initial timing

Remarks: \* Always pulled during low vacuum, such as when accelerating, because vacuum is maintained by check valve (1) or (2).

\*\* Not pulled during low vacuum, such as when accelerating.

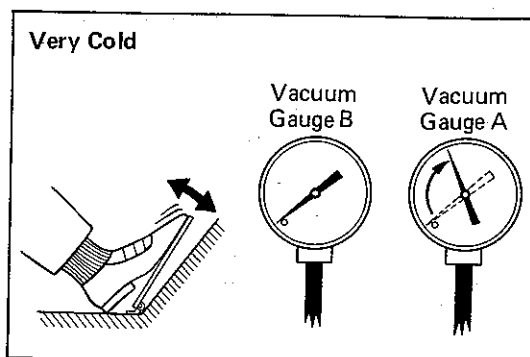
\*\*\* Not pulled during low vacuum, such as when intake manifold vacuum is below 60 mmHg (2.36 in.Hg).



## INSPECTION OF SC SYSTEM

### 1. CONNECT VACUUM GAUGES

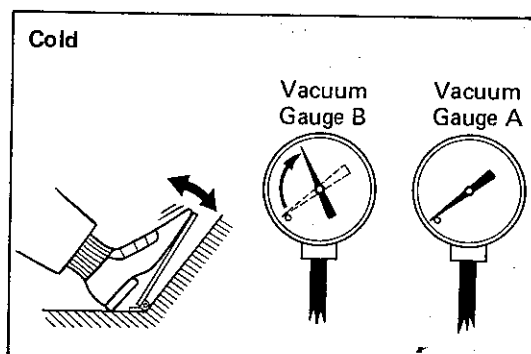
- Using a 3-way connector, connect a vacuum gauge (A) to the hose between the distributor main diaphragm and pipe.
- Using a 3-way connector, connect a vacuum gauge (B) to the hose between the distributor sub-diaphragm and pipe.



### 2. CHECK BVSV WITH VERY COLD ENGINE (Arctic Regions)

- The coolant temperature should be below  $-10^{\circ}\text{C}$  ( $14^{\circ}\text{F}$ ).
- Start the engine.
- Check that vacuum gauge A indicates high regardless of whether the throttle valve is open or closed.

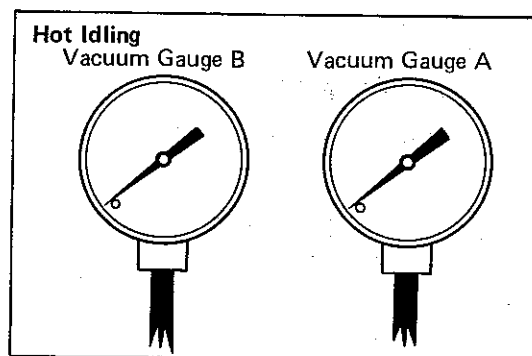
If not, check the BVSV (1) or check valves.



### 3. CHECK BVSV WITH COLD ENGINE

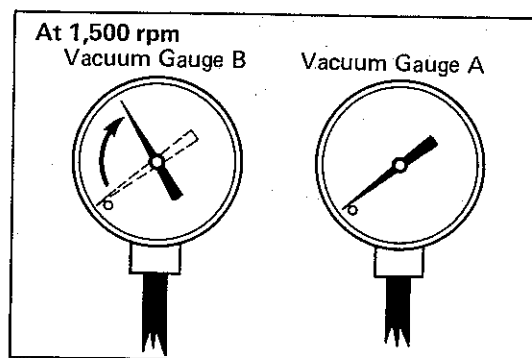
- The coolant temperature should be between  $4^{\circ}\text{C}$  ( $39^{\circ}\text{F}$ ) to  $45^{\circ}\text{C}$  ( $113^{\circ}\text{F}$ ).
- Start the engine.
- Check that vacuum gauge B indicates high regardless of whether the throttle valve is open or closed.

If not, check the BVSV (1) (3) or check valves.



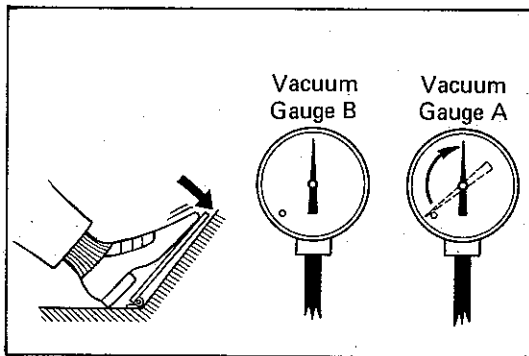
### 4. CHECK BVSV WITH HOT ENGINE

- With the engine warm and idling, check that vacuum gauges A and B indicate low vacuum.



- Check that vacuum gauge B indicates high vacuum at 1,500 rpm.
- If not, check the BVSV (3).



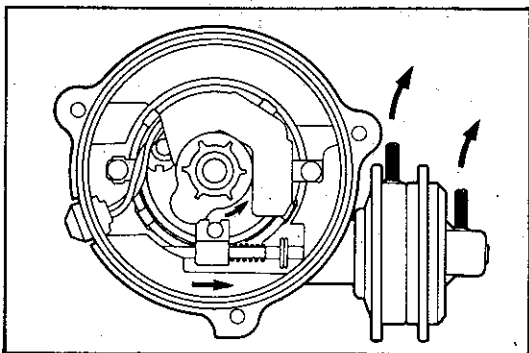


- (c) Check that vacuum gauges A and B indicate high vacuum when the throttle valve is open.

If not, check the BVS (2).

NOTE: Gauge A indication rises and gauge B remains steady.

**5. DISCONNECT VACUUM GAUGES AND RECONNECT HOSES TO PROPER LOCATIONS**

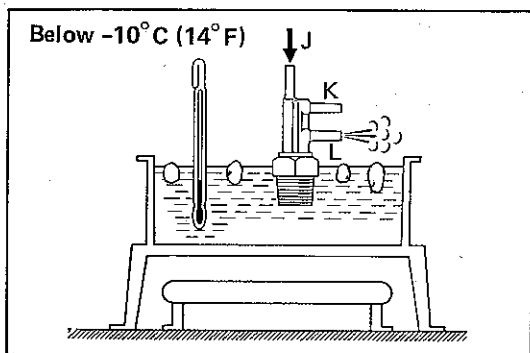


**6. CHECK OPERATION OF DISTRIBUTOR VACUUM ADVANCER**

- Remove the distributor cap and rotor.
- Apply vacuum to the diaphragms, and check that the vacuum advancer moves in accordance with the vacuum.
- Reinstall the rotor and distributor cap.

If a problem is found, repair or replace the distributor vacuum advancer.

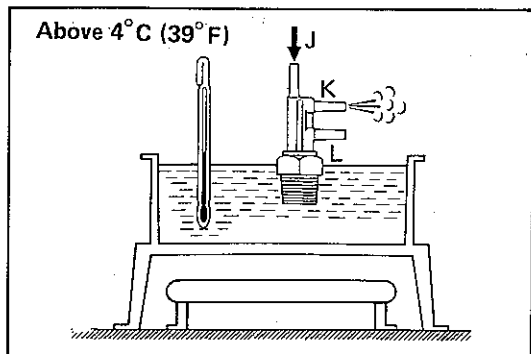
**IF NO PROBLEM IS FOUND WITH THIS INSPECTION, THE SYSTEM IS OKAY; OTHERWISE INSPECT EACH PART**



**INSPECTION OF BVS (1)**

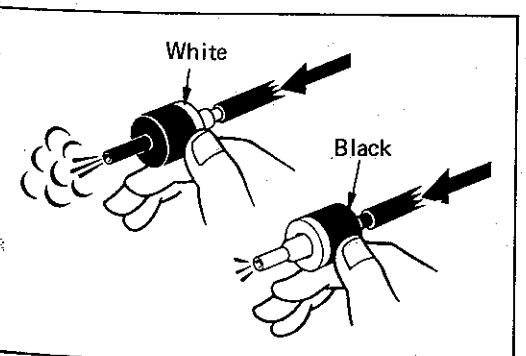
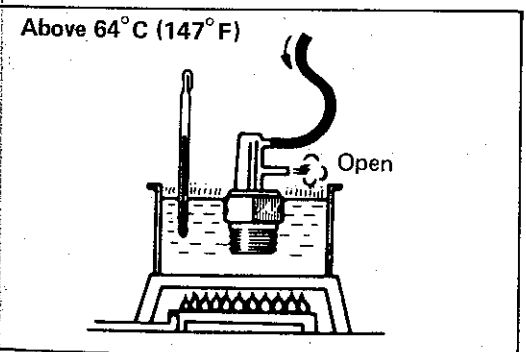
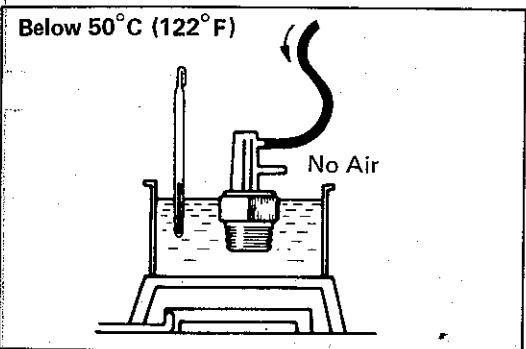
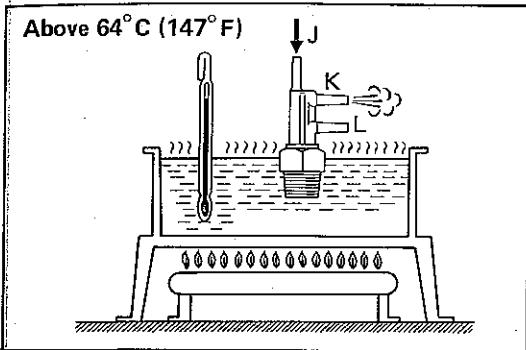
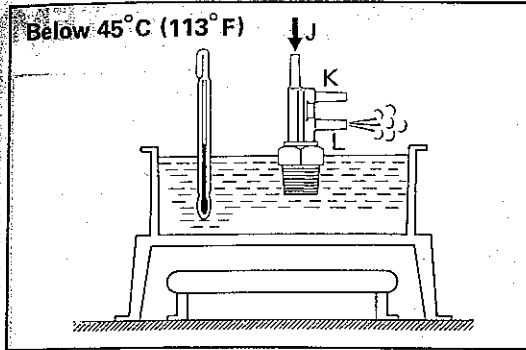
**CHECK BVS BY BLOWING AIR INTO PIPE**

- Drain the coolant from the radiator into a suitable container.
- Remove the BVS.
- Cool the BVS to below  $-10^{\circ}\text{C}$  ( $14^{\circ}\text{F}$ ).
- Check that air flows from pipe J to pipe L.



- Heat the BVS to above  $4^{\circ}\text{C}$  ( $39^{\circ}\text{F}$ ).
- Check that air flows from pipe J to pipe K.
- Apply liquid sealer to the threads of the BVS and reinstall.
- Fill the radiator with coolant.

If a problem is found, replace the BVS.



## INSPECTION OF BVSV (2)

### CHECK BVSV BY BLOWING AIR INTO PIPE

- Drain the coolant from the radiator into a suitable container.
- Remove the BVSV.
- Cool the BVSV to below 45°C (113°F).
- Check that air flows from pipe J to pipe L.

- Heat the BVSV to above 64°C (147°F).
- Check that air flows from pipe J to pipe K.
- Apply liquid sealer to the threads of the BVSV and reinstall.
- Fill the radiator with coolant.

If a problem is found, replace the BVSV.

## INSPECTION OF BVSV (3)

### CHECK BVSV BY BLOWING AIR INTO PIPE

- Drain the coolant from the radiator into a suitable container.
- Remove the BVSV.
- Cool the BVSV to below 50°C (122°F) with cool water.
- Blow air into the pipe and check that the BVSV is closed.

- Heat the BVSV to above 64°C (147°F) with hot water.
- Blow air into the pipe and check that the BVSV is open.
- Apply liquid sealer to the threads of the BVSV and reinstall.
- Fill the radiator with coolant.

If a problem is found, replace the BVSV.

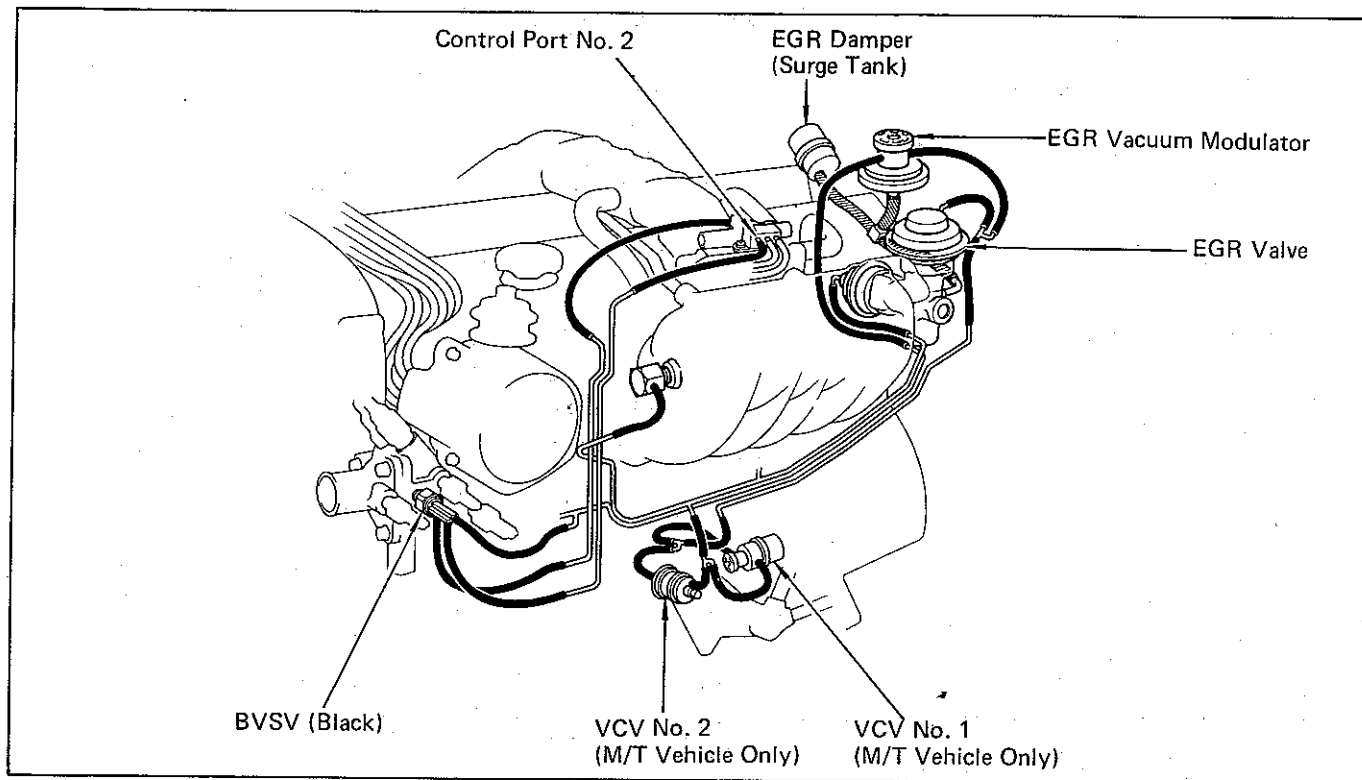
## INSPECTION OF CHECK VALVES

### CHECK VALVES BY BLOWING AIR FROM EACH SIDE

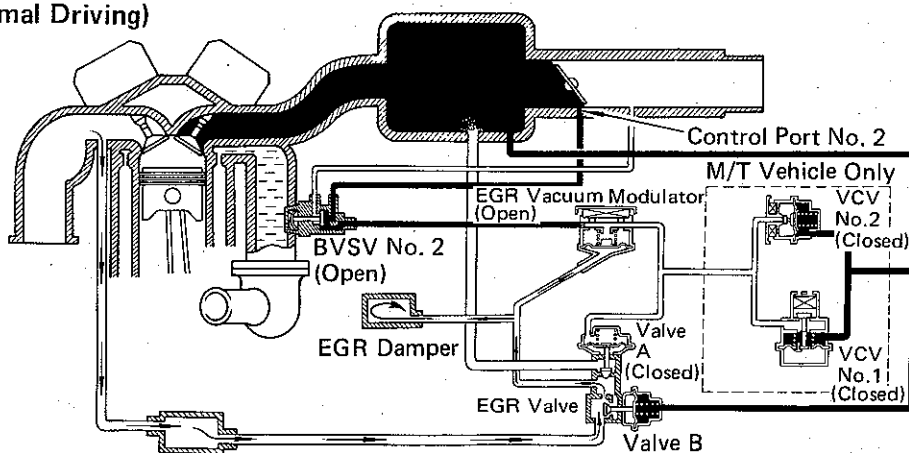
- Check that air flows from the white pipe to the black pipe.
- Check that air does not flow from the black pipe to the white pipe.

If a problem is found, replace the check valve.

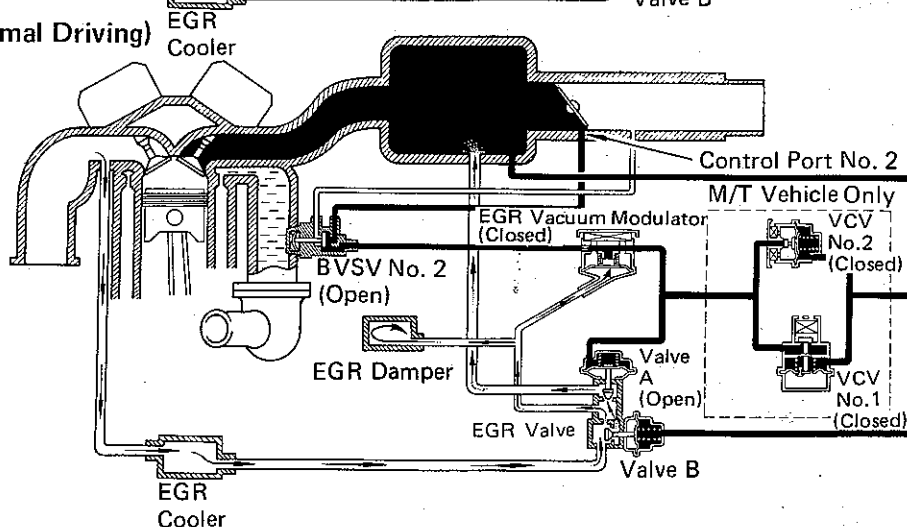
# EXHAUST GAS RECIRCULATION (EGR) SYSTEM

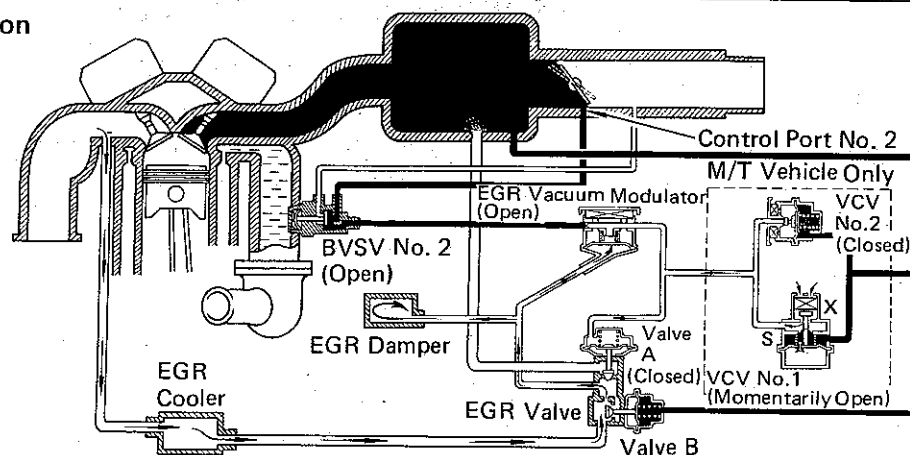
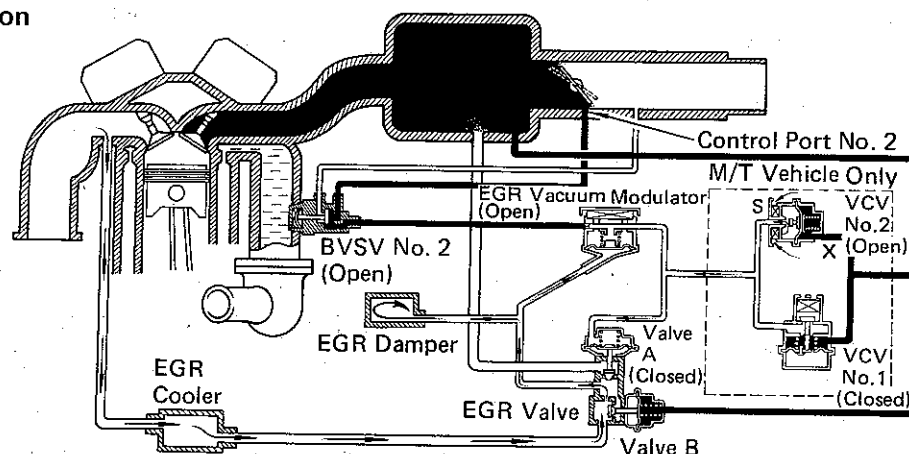


## HOT [1] (Normal Driving)



## HOT [2] (Normal Driving)



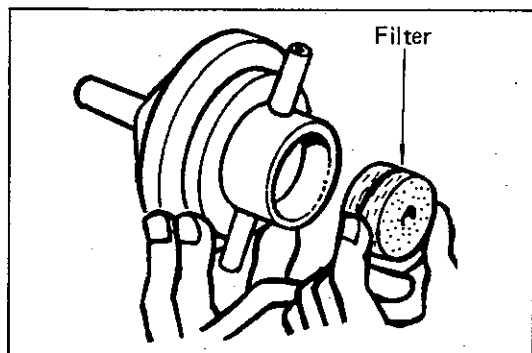
**[3] Deceleration****[4] Deceleration**

To reduce NO<sub>x</sub> emission, part of the exhaust gas is recirculated through the EGR valve to the intake manifold in order to lower the maximum combustion temperature.

Coolant Temp.	BVS (2)	Throttle Valve Opening Angle	Condition	VCV (M/T Vehicle)		Pressure in the EGR Valve Pressure Chamber	EGR Vacuum Modulator	EGR Valve		Exhaust Gas
				(1)	(2)			Valve (A)	** Valve (B)	
Below 45°C (113°F)	CLOSED	—	—	—	—	—	—	CLOSED	—	Not recirculated
Above 64°C (147°F)	OPEN	Positioned below control port No. 2	Idling	—	—	—	—	CLOSED	OPEN	Not recirculated
			Normal driving	—	—	LOW (1)	OPENS Passage to atmosphere CLOSES Passage to atmosphere	CLOSED	OPEN	Not recirculated
		Positioned above control port No. 2	*** [3] Momentarily OPEN	—	—	—		Momentarily CLOSED	OPEN	Momentarily not recirculated
			Deceleration Intake vacuum above 495 mmHg (18.49 in. Hg) (4)	—	OPEN	—	—	CLOSED	OPEN	Not recirculated
			Intake vacuum above 600 mmHg (23.62 in. Hg)	—	—	—	—	CLOSED	CLOSED	Not recirculated

Remarks \* Pressure increase → Modulator closes → EGR valve opens → Pressure drops —  
 \*\* EGR valve B controls EGR gas volume; if intake manifold vacuum is high, it decreases the gas volume, if intake manifold vacuum is low, it increases volume.

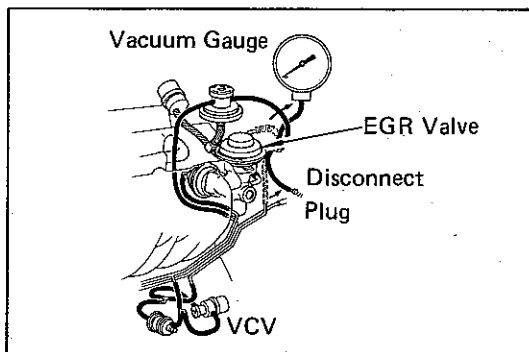
\*\*\* During deceleration, if the vacuum difference between ports X and S of the VCV exceeds 50 mmHg (1.97 in. Hg), air is bled to the EGR valve and exhaust gas is not recirculated.



## INSPECTION OF EGR VALVE

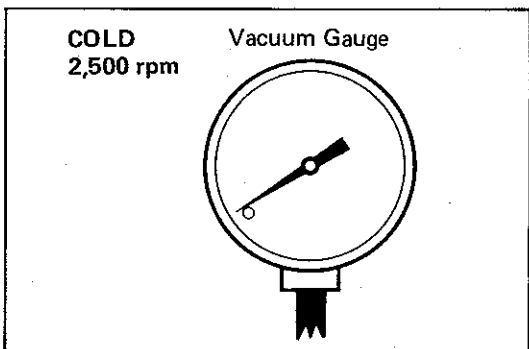
### 1. CHECK AND CLEAN FILTER IN EGR VACUUM MODULATOR

- (a) Check the filter for contamination or damage.
- (b) Using compressed air, clean the filter.



### 2. PREPARATION

- (a) Disconnect the vacuum hose from the EGR valve (valve A) and connect a vacuum gauge to it.
- (b) [For M/T vehicle]  
Disconnect the vacuum hose from the VCV pipe and plug the hose end.

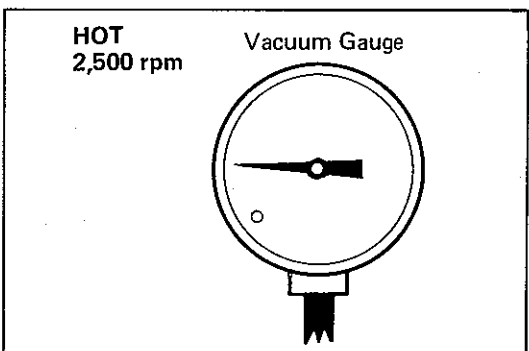


### 3. CHECK SEATING OF EGR VALVE

Start the engine and check that the engine starts and runs at idle.

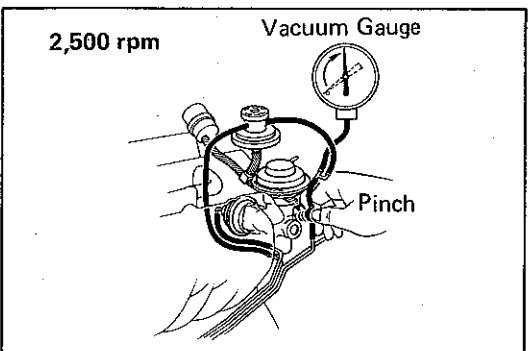
### 4. CHECK BVSV WITH COLD ENGINE

- (a) The coolant temperature should be below 45°C (113°F).
- (b) Check that the vacuum gauge indicates zero at 2,500 rpm.



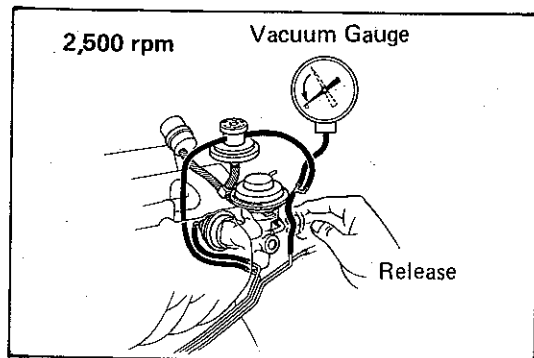
### 5. CHECK BVSV AND EGR VACUUM MODULATOR WITH WARM ENGINE

- (a) Warm up the engine.
- (b) Check that the vacuum gauge indicates high vacuum at 2,500 rpm.
- (c) [For M/T vehicle]  
Reconnect the vacuum hose to VCV pipe.

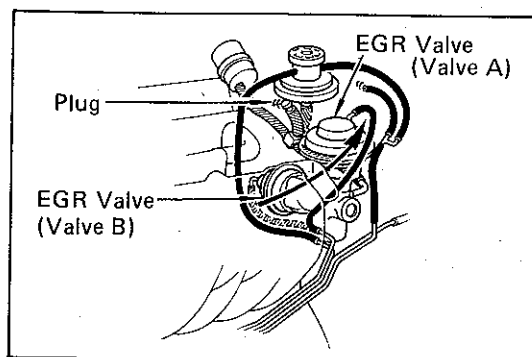


### 6. CHECK OPERATION OF VCVs [For M/T Vehicle]

- (a) Pinch the vacuum hose to the VCV at idle.
- (b) Maintain the engine speed at 2,500 rpm.
- (c) Make sure that the vacuum gauge indicates high vacuum at 2,500 rpm.



- (d) Release the pinched hose.
- (e) Check that the vacuum gauge indicates zero.
- (f) Disconnect the vacuum gauge.



## 7. CHECK EGR VALVE

- (a) Stop the engine.
- (b) Remove the EGR vacuum modulator exhaust gas hose and plug the exhaust gas hose.
- (c) Start the engine and race it once.
- (d) Apply vacuum directly to the EGR valve with the engine idling.
- (e) Check that the engine runs rough or dies.
- (f) Reinstall the EGR vacuum modulator.
- (g) Reconnect the vacuum hoses to the proper location.

IF NO PROBLEM IS FOUND WITH THIS INSPECTION, THE SYSTEM IS OKAY; OTHERWISE INSPECT EACH PART

## INSPECTION OF BVSV (2)

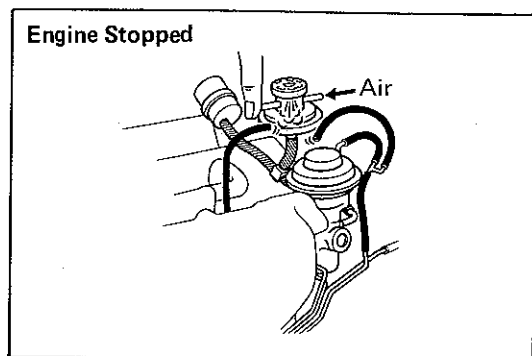
See page 3-15.

## INSPECTION OF EGR VALVE

### 1. REMOVE EGR VALVE

Check the valve for sticking and heavy carbon deposits. If a problem is found, replace it.

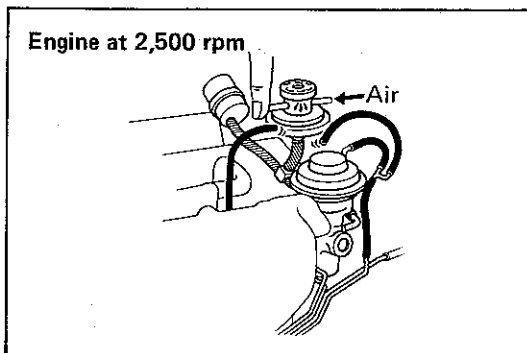
### 2. INSTALL EGR VALVE WITH A NEW GASKET



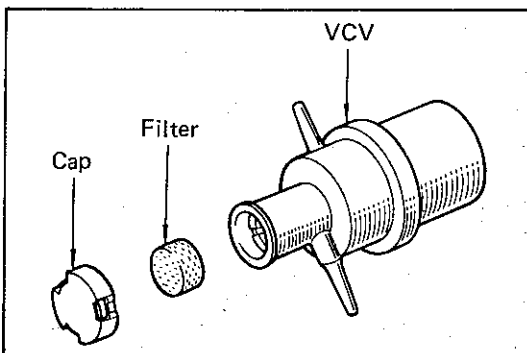
## INSPECTION OF EGR VACUUM MODULATOR

### CHECK EGR VACUUM MODULATOR OPERATION

- (a) Disconnect two vacuum hoses from the EGR vacuum modulator.
- (b) Plug the pipe with your finger.
- (c) Blow air into another pipe and check that the air passes through to the air filter side freely.



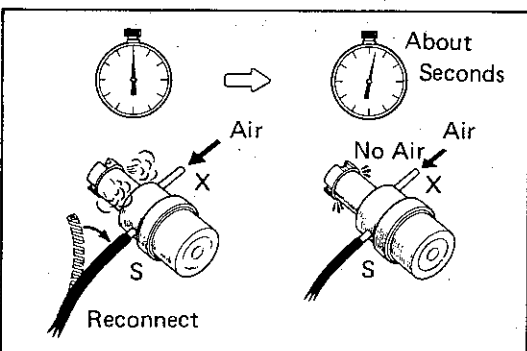
- (d) Start the engine and maintain engine speed at 2,500 rpm.
  - (e) Repeat the above test and check that there is a strong resistance to air flow.
  - (f) Reconnect the vacuum hoses to the proper locations.
- If a problem is found, replace the EGR vacuum modulator.



## INSPECTION OF VCV (1)

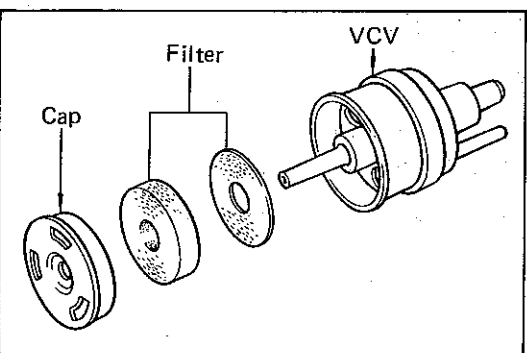
### 1. CHECK AND CLEAN FILTER IN VCV

- (a) Check the filter for contamination or damage.
- (b) Using compressed air, clean the filter.



### 2. CHECK VCV OPERATION

- (a) While blowing air into pipe X apply 50 mmHg (1.97 in.Hg) vacuum to pipes.
- (b) Check that the VCV opens for about 1 second.



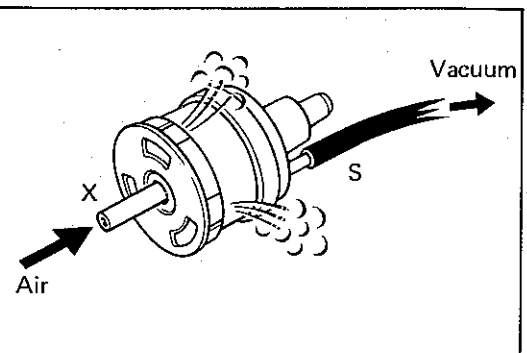
## INSPECTION OF VCV (2)

### 1. CHECK AND CLEAN FILTER IN VCV

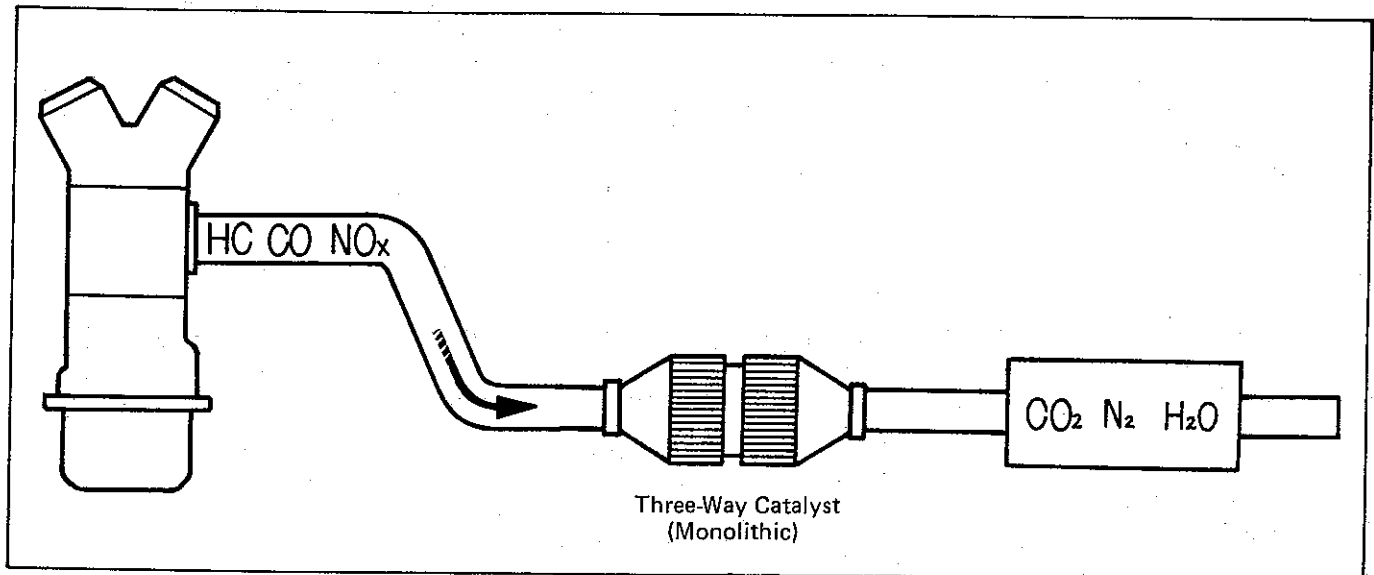
- (a) Check the filter for contamination or damage.
- (b) Using compressed air, clean the filter.

### 2. CHECK VCV OPERATION

- (a) Apply above 495 mmHg (19.49 in.Hg) vacuum to pipe S.
- (b) Blow air into pipe X and check that the VCV is open.



## THREE-WAY CATALYST (TWC) SYSTEM

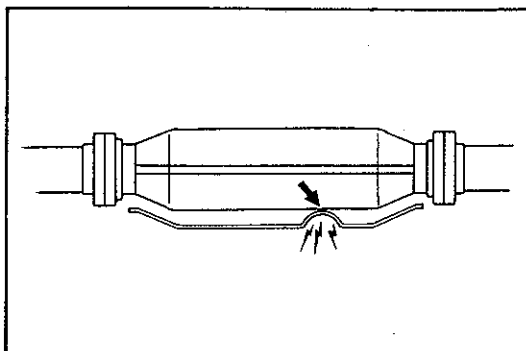


To reduce HC, CO and  $\text{NO}_x$  emissions, they are oxidized, reduced and converted to dinitrogen ( $\text{N}_2$ ), carbon dioxide ( $\text{CO}_2$ ) and water ( $\text{H}_2\text{O}$ ) by the catalyst.

Exhaust Port		TWC		Exhaust Gas
HC, CO, AND $\text{NO}_x$ (Proper Temperature)	→	OXIDATION AND REDUCTION (Temperature is increased.)	→	$\text{CO}_2$ $\text{H}_2\text{O}$ $\text{N}_2$

### INSPECTION OF EXHAUST PIPE ASSEMBLY

1. CHECK CONNECTIONS FOR LOOSENESS OR DAMAGE
2. CHECK CLAMPS FOR WEAKNESS, CRACKS OR DAMAGE

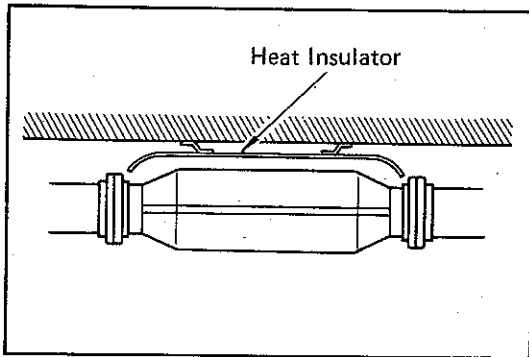


### INSPECTION OF OXIDATION CATALYST

#### CHECK FOR DENTS OR DAMAGE

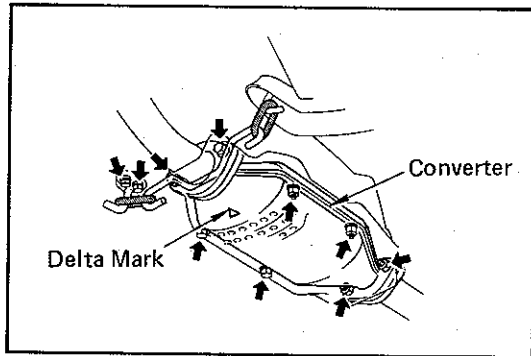
If any part of protector is damaged or dented to the extent that it contacts the catalyst, repair or replace.





## INSPECTION OF HEAT INSULATOR

1. CHECK HEAT INSULATOR FOR DAMAGE
2. CHECK FOR ADEQUATE CLEARANCE BETWEEN CATALYTIC CONVERTER AND HEAT INSULATOR



## REPLACEMENT OF CATALYTIC CONVERTER

### 1. REMOVE CONVERTER

- (a) Jack up the vehicle.
- (b) Check that the converter is cool.
- (c) Remove the protector.
- (d) Remove the bracket bolts and the bolts at the front and rear of the converter.
- (e) Remove the converter and gaskets.

### 2. INSTALL CAONVERTER

- (a) Place new gaskets on the converter front and rear pipes, and connect the converter to the exhaust pipes.
- (b) Tighten the bolts.

**Torque: Catalyst — Exhaust pipe**  
3.5 — 4.5 kg-m (26 — 32 ft-lb)

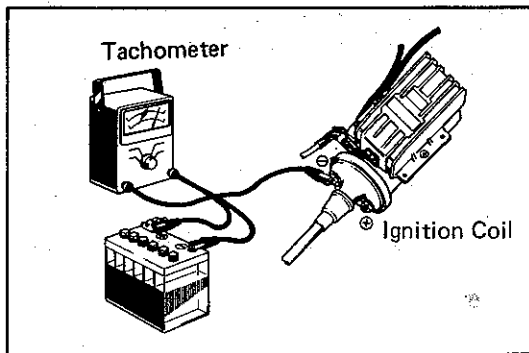
- (c) Reinstall the bracket bolts and tighten the bolts.
- (d) Reinstall the protector and tighten the bolts.

**Torque: Protector — Catalyst**  
1.5 — 2.2 kg-m (11 — 16 ft-lb)

**NOTE:** Be sure to install with the delta mark toward the engine.

# ENGINE ADJUSTMENT

	Page
IGNITION TIMING .....	4-2
IDLE SPEED .....	4-3
IDLE HC/CO CONCENTRATION CHECK METHOD .	4-4



## IGNITION TIMING

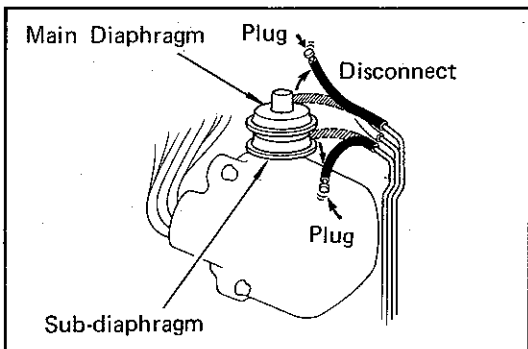
### INSPECTION AND ADJUSTMENT OF IGNITION TIMING

#### 1. CONNECT A TACHOMETER AND TIMING LIGHT TO ENGINE

Connect the tachometer  $\oplus$  terminal to the ignition coil  $\ominus$  terminal.

#### CAUTION:

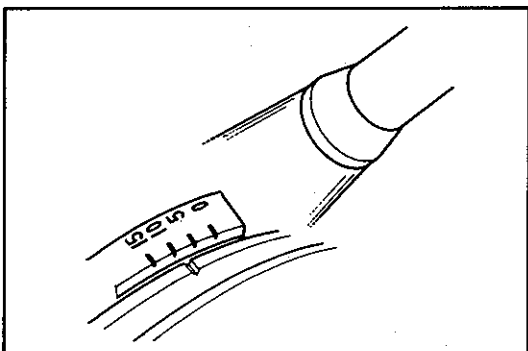
1. NEVER allow the tachometer terminal to touch ground as it could result in damage to the igniter and/or ignition coil.
2. As some tachometers are not compatible with this ignition system, it is recommended that you consult with the manufacturer.



#### 2. WARM UP ENGINE

Allow the engine to reach full operating temperature.

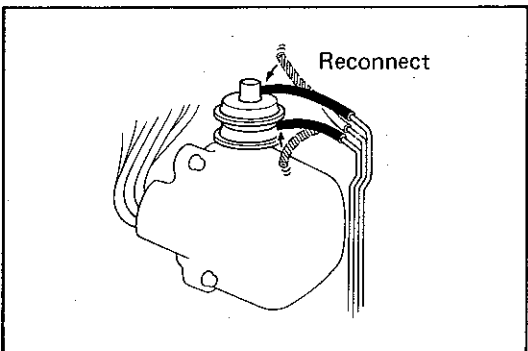
#### 3. DISCONNECT VACUUM HOSES FROM DISTRIBUTOR SUB-DIAPHRAGM AND MAIN DIAPHRAGM, AND PLUG HOSE ENDS



#### 4. CHECK IGNITION TIMING

Ignition timing:  $8^{\circ}$  BTDC @Max. 950 rpm

- (a) With the engine idling as specified, use a timing light to check the timing.
- (b) If necessary, loosen the distributor bolt and turn the distributor to align the marks. Recheck the timing after tightening the distributor.



#### 5. RECONNECT VACUUM HOSES TO DISTRIBUTOR

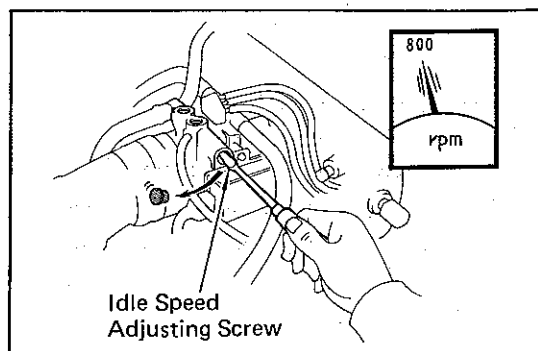
NOTE: Leave the tachometer connected until engine adjustments are completed.

## IDLE SPEED

### ADJUSTMENT OF IDLE SPEED

#### 1. INITIAL CONDITIONS

- (a) Air cleaner installed
- (b) Normal engine operating temperature
- (c) All pipes and hoses of air intake system connected
- (d) All accessories switched off
- (e) All vacuum lines properly connected (i.e., SC, EGR systems, etc.)
- (f) EFI system wiring connectors fully plugged
- (g) Ignition timing set correctly
- (h) Transmission in N range



#### 2. RACE ENGINE AT 2,500 RPM FOR ABOUT 2 MINUTES

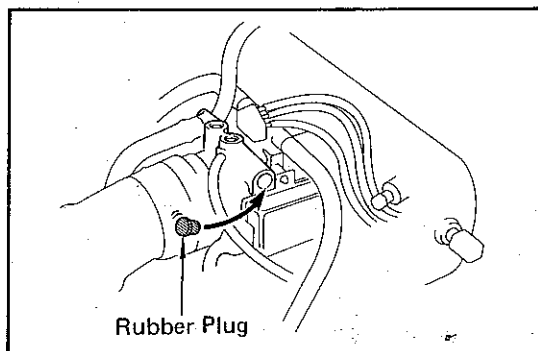
#### 3. REMOVE RUBBER PLUG FROM THROTTLE BODY

#### 4. ADJUST IDLE SPEED

Adjust the idle speed by turning the idle speed adjusting screw.

Idle speed: 800 rpm

#### 5. REINSTALL RUBBER PLUG



## IDLE HC/CO CONCENTRATION CHECK METHOD

**NOTE:** This check method is used only to determine whether or not the idle HC/CO complies with the state or city regulations.

### PRECHECK

#### INITIAL CONDITIONS

- (a) Air cleaner installed
- (b) Normal engine operating temperature
- (c) All pipes and hoses of air intake system connected
- (d) All accessories switched off
- (e) All vacuum lines properly connected

**NOTE:** All vacuum hoses for spark control, EGR systems, etc. should be properly connected.

- (f) EFI system wiring connectors fully plugged.
- (g) Ignition timing set correctly
- (h) Transmission in N range
- (i) Tachometer and HC/CO meter at hand and calibrated

### MEASUREMENT

1. **RACE ENGINE AT 2,500 RPM FOR ABOUT 2 MINUTES**
2. **INSERT TESTING PROBE OF HC/CO METER INTO TAILPIPE AT LEAST 60 cm (2 ft)**
3. **MEASURE HC/CO CONCENTRATION AT IDLE**

Wait at least one minute before measuring to allow the concentration to stabilize.

Complete the measuring within three minutes.

If the HC/CO concentration does not conform to regulations, see table below for possible causes.

### TROUBLESHOOTING

HC	CO	Symptoms	Causes
High	Normal	Rough idle	<ol style="list-style-type: none"> <li>1. Faulty ignition: <ul style="list-style-type: none"> <li>• Incorrect timing</li> <li>• Fouled, shorted or improperly gapped plugs</li> <li>• Open or crossed ignition wires</li> <li>• Cracked distributor cap</li> </ul> </li> <li>2. Leaky exhaust valves</li> <li>3. Leaky cylinder</li> </ol>
High	Low	Rough idle Fluctuating HC reading	<ol style="list-style-type: none"> <li>1. Vacuum leak: <ul style="list-style-type: none"> <li>• Vacuum hose</li> <li>• Intake manifold</li> </ul> </li> <li>2. Lean mixture causing misfire</li> </ol>
High	High	Rough idle Black smoke from exhaust	<ol style="list-style-type: none"> <li>1. Restricted air filter</li> <li>2. Faulty EFI system: <ul style="list-style-type: none"> <li>• Faulty pressure regulator</li> <li>• Clogged fuel return line</li> <li>• Faulty air flow meter</li> <li>• Defective water thermo sensor</li> <li>• Defective air thermo sensor</li> <li>• Faulty EFI computer</li> <li>• Faulty injector</li> <li>• Faulty cold start injector</li> </ul> </li> </ol>

# SPECIFICATIONS

	Page
ENGINE .....	A-2
MAINTENANCE AND TUNE-UP .....	A-3

**ENGINE**

Engine model	5M-GE	
Displacement	2,759 cc	168.4 cu in.
Bore x Stroke	83 x 85 mm	3.27 x 3.35 in.
Number of cylinders	6	
Type of cylinder head	DOHC (Twin-Cam)	
Nominal compression ratio	8.8 : 1	
Maximum horse power (SAE-NET)	145 HP/5,200 rpm	
Maximum torque (SAE-NET)	21.4 kg-m/4,400 rpm	155 ft-lb/4,400 rpm
Recommended fuel	Regular (Unleaded only)	
Research octane number (Anti-knock index)	91 (87)	

# MAINTENANCE AND TUNE-UP

Drive belt tension (w/Borroughs drive belt tension gauge No. BT-33-73F)				
New belt (All)		125 ± 25 lb		
Used belt (All)		80 ± 20 lb		
Battery specific gravity		1.25 — 1.27		
When fully charged at 20°C (68°F)				
Coolant capacity w/heater or air conditioner		8.0 liters	8.5 US qts	7.0 Imp. qts
Engine oil capacity	Dry fill	5.7 liters	6.0 US qts	5.0 Imp. qts
	Drain and refill			
	w/ oil filter change	5.1 liters	5.4 US qts	4.5 Imp. qts
	w/o oil filter change	4.6 liters	4.9 US qts	4.0 Imp. qts
Spark plug	Type	ND	W16EXR-U	
		NGK	BPR5EY	
Distributor air gap	Gap		0.8 mm	0.031 in.
			0.2 — 0.4 mm	0.008 — 0.016 in.
Ignition timing			8° BTDC @ Max. 950 rpm (w/vacuum advance cut)	
Firing order			1 — 5 — 3 — 6 — 2 — 4	
Idle speed	at T/M in N range		800 rpm	
Intake manifold vacuum	at Idle speed		More than 430 mmHg (16.93 in.Hg)	
Compression pressure	at 250 rpm	STD	More than 11.5 kg/cm <sup>2</sup> (164 psi)	
		Limit	9.0 kg/cm <sup>2</sup>	128 psi
Difference of pressure between each cylinder			Less than 1.0 kg/cm <sup>2</sup> (14 psi)	



Prepared by  
**TOYOTA MOTOR SALES CO., LTD.**

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First Issue: August 20, 1981

Publication No. 36143

Printed in Japan