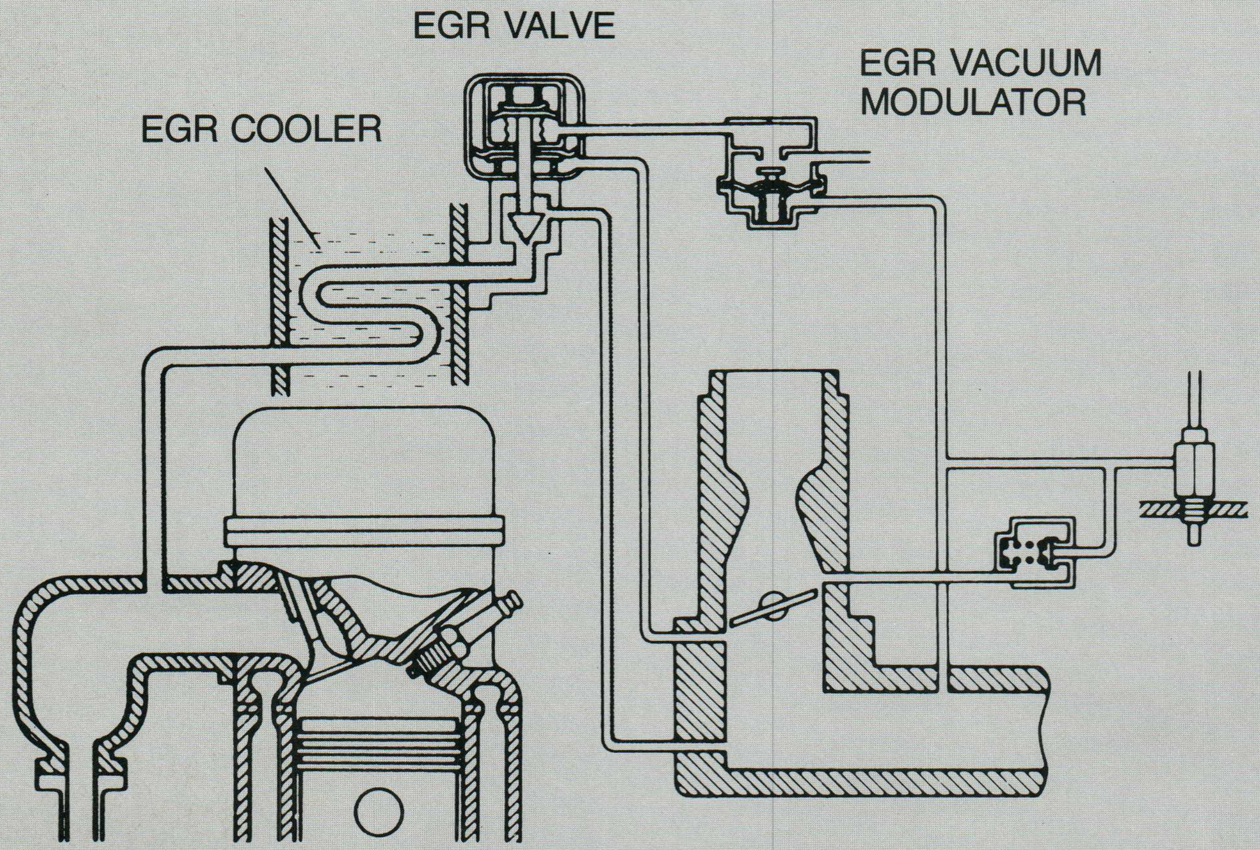
TOYOTA
SERVICE NEWS

Spring 1988 The Independents' Guide to Professional Toyota Service and Repair Bulletin 27

EMISSION CONTROL SYSTEMS



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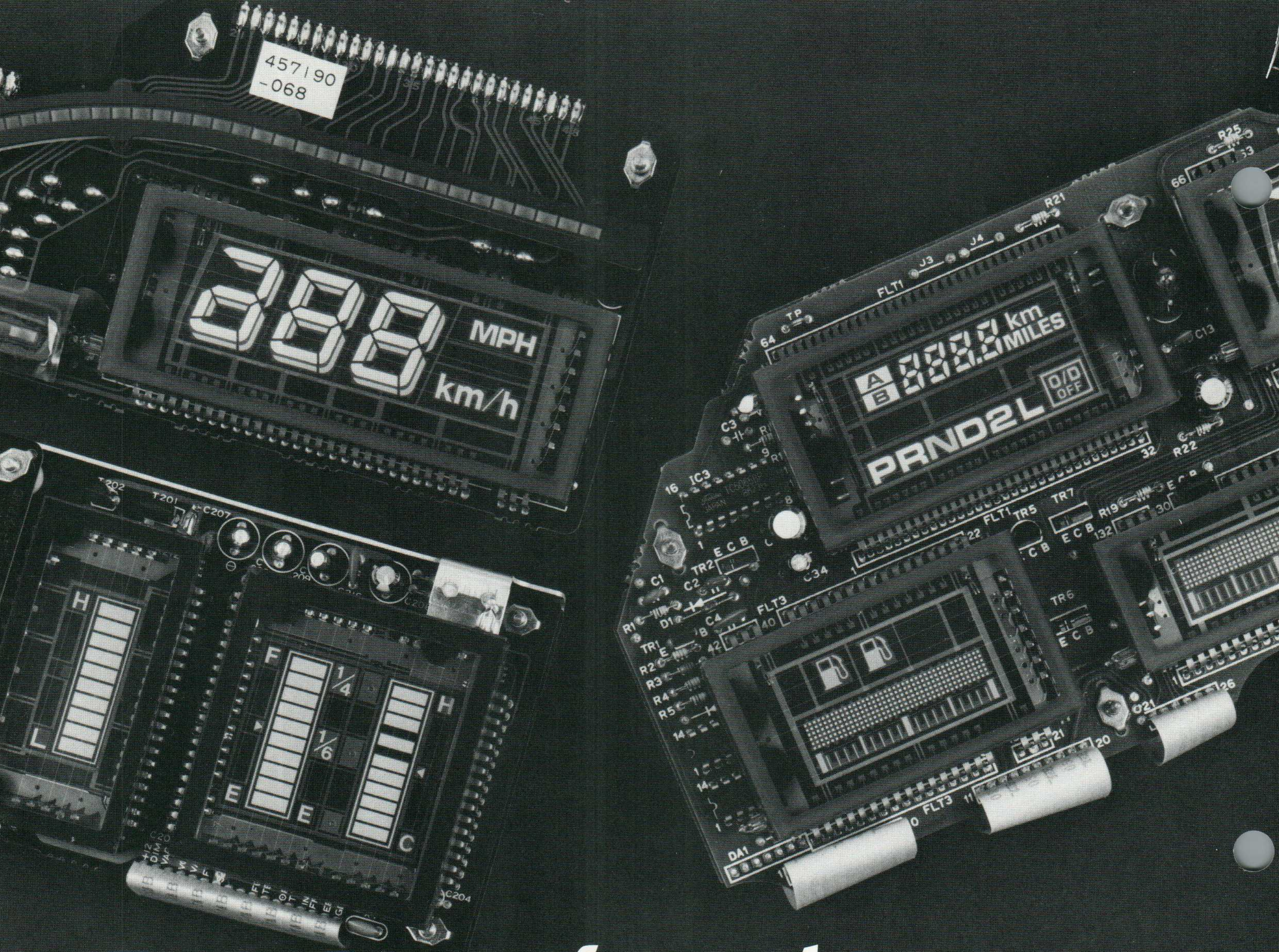
- Major Emission Control Devices
- Troubleshooting Tips
- Collision Repair Manuals



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Spring 1988 Bulletin 27

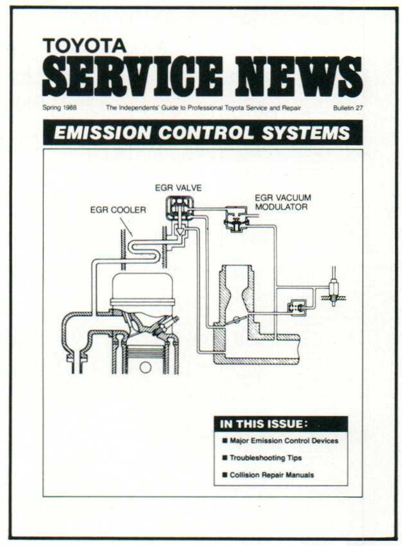
PAGE DESCRIPTION ARTICLE NO.

THIS ISSUE: EMISSION CONTROLS

SERVICE TIPS

BODY LANGUAGE

On The Cover



The EGR system reduces the amount of NOx in the exhaust. Most Toyota vehicles have a manifold-type EGR system like the one on the cover. It uses a vacuum modulator to control the amount of exhaust gas that is recirculated.

Next Issue: Air Conditioning, Troubleshooting Tips, Paint Refinishing

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Article No. 243

GENERAL DESCRIPTION

It is extremely difficult to find a means to reduce levels of HC, CO and NOx exhaust emissions to any great extent, because any attempt to do so usually results in lowered engine output and/or increased fuel consumption. This is because all of these conditions are interrelated, and changing one parameter usually changes several of the others, often for the worse.

We at Toyota have been refining exhaust emission control systems for several years to comply with government standards. We also have redesigned our engines to cut down on the amount of pollutants released into the atmosphere, while improving overall engine performance and fuel economy.

A list of commonly used emission control methods and devices is shown in Figure 243-2. By selecting various parts from this list, an appropriate emission control system can be custom tailored for each vehicle.

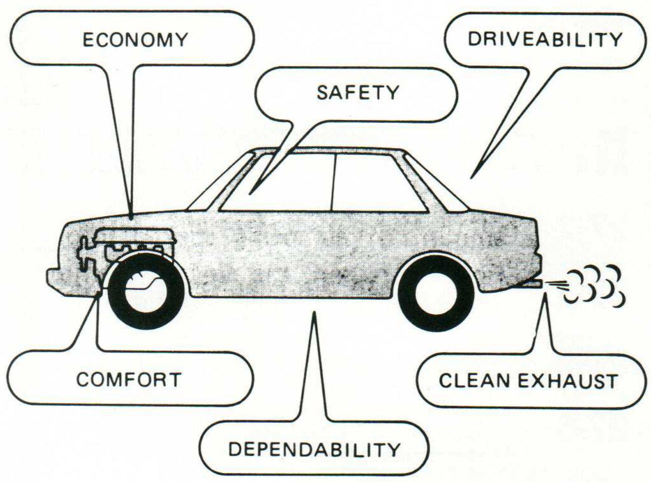


Figure 243-1

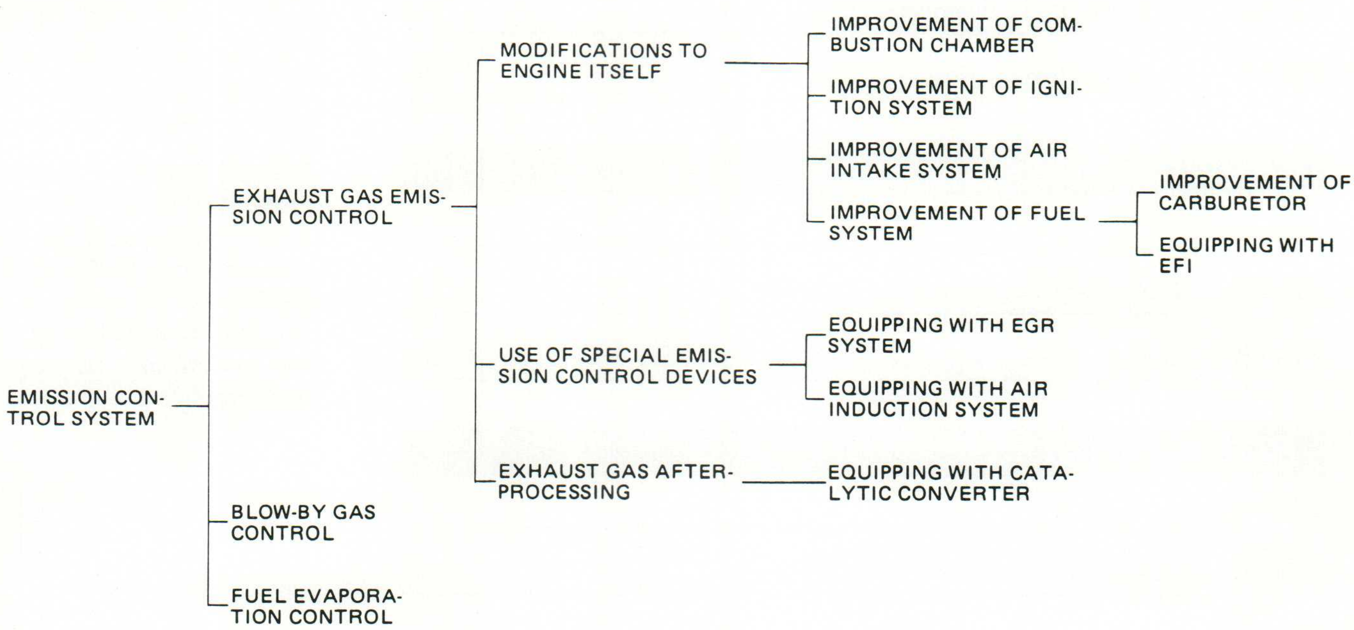


Figure 243-2

Note: This issue will focus on several of the most commonly used devices and systems found on Toyota vehicles today. The examples presented are applicable to the 3A engine used in the Tercel and the 4A engine used in the Corolla. For specific repair instructions and system applications, refer to the appropriate Toyota repair manual.

Article No. 244

MAJOR EMISSION CONTROL DEVICES

Positive Crankcase Ventilation (PVC) — redirects crankcase fumes through the engine to be reburned.

Fuel Evaporative Emission Control (EVAP) — prevents loss of fuel vapors to the atmosphere. A speed sensor, temperature sensor and simple computer are commonly used to control the operation.

Air Bleed with Feedback — adds air to the primary main and low-speed carburetor circuits to maintain the optimum air-fuel ratio. The operation is controlled by coolant temperature, engine speed and vacuum, the 0_2 sensor and computer circuit.

Air Injection with Feedback — similar to conventional air injection, with the addition of a feedback loop that switches air injection from the exhaust port to the air cleaner in response to the oxygen concentration of the exhaust gas. Additional components are the oxygen sensor and a computer circuit.

Air Suction (AS) — uses exhaust pulses rather than the air pump to open and close a valve, which adds air to the exhaust manifold. Vacuum and temperature controls are used on some models.

Catalytic Converters:

Oxidation Catalyst (OC) — assists in converting engine emissions to harmless byproducts. An oxidation catalyst is only effective in reduing HC and CO.

Three-Way Catalyst (TWC) — in addition to converting HC and CO, the three-way catalyst reduces NOx emissions. It is commonly used in conjunction with air injection or air suction.

Dashpot — slowly returns the primary throttle plate to the idle position during deceleration. It is controlled by the diaphragm and the VTV.

Exhaust Gas Recirculation (EGR) — recycles a small amount of the exhaust gases into the combustion chamber. Operation is commonly controlled by thermosensors and the vacuum controls.

High Altitude Compensation (HAC) — adds air to low- and/or high-speed carburetor circuits at high altitude. Some models also advance the ignition timing.

Mixture Control (MC) — adds air to the intake manifold during sudden deceleration. Operation is controlled by the pressure differential between the chambers of the control valve.

Spark Control (SC) — delays the vacuum advance for a specific amount of time. Temperature controls are commonly used. Operation varies with model.

Throttle Positioner (TP) — holds the throttle valve open slightly during deceleration. It is commonly controlled by the speed sensor and computer circuit.

MAJOR EMISSION CONTROL DEVICES (Continued)

Automatic Choke — enriches the mixture during cold engine operation by controlling the position of the choke plate.

Automatic Hot Air Intake (HAI) — preheats the cold intake air by routing it to the exhaust manifold area. It is controlled by the temperature sensor and air control valve.

Auxiliary Acceleration Pump (AAP) — supplies additional fuel to the acceleration nozzle during cold engine operation. It is controlled by the pump check valves and a temperature sensor.

Choke Breaker (CB) — opens the choke valve slightly when the engine starts to prevent flooding. It is controlled by a vacuum diaphragm.

Choke Opener — opens the choke above a predetermined engine temperature and speed; the opener also can override the automatic choke operation.

Cold Mixture Heater — preheats the air-fuel mixture to improve cold engine operation. It is controlled by the thermo switch and alternator ouput.

Deceleration Fuel Cut — reduces or shuts off fuel delivery to the slow circuit of the carburetor during continuous deceleration. It is commonly controlled by the speed and vacuum sensors and a computer circuit.

Double Diaphragm Distributor Idle Advance — pulls the distributor sub-diaphragm to provide vacuum advance at idle.

Heat Control Valve — preheats the intake manifold by redirecting exhaust gases during engine warm-up. The valve is opened by a bimetallic spring.

Hot Idle Compensator (HIC) — supplies additional air to the intake manifold when high engine temperatures exist. It is controlled by the HIC valve, and is combined with HAC on some models.

Idle Advance — provides vacuum advance at idle by actuating the distributor sub-diaphragm.

Electronic Fuel Injection — the EFI computer receives signals from various sensors indicating changing engine operating conditions. The signals are utilized by the EFI computer to determine the injection duration necessary for an optimum air-fuel ratio.

Electronic Bleed Control Valve (EBCV) — controls the air flow into the carburetor air bleeds according to the O_2 sensor information in order to maintain stoichometric air-fuel ratio. It was added in 1983.

Thermostatic Vacuum Switching Valve (TVSV) — a temperature-sensitive valve that regulates the flow of vacuum to a component.

Vacuum Transmitting Valve (VTV) — limits the rate of vacuum advance.

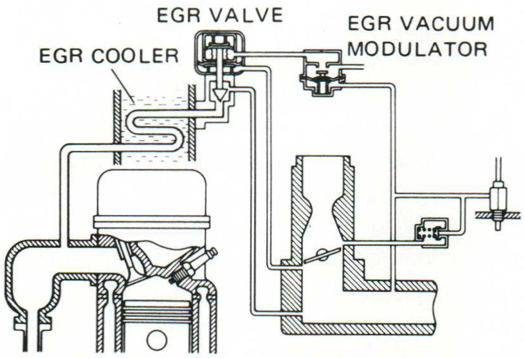
Article No. 245

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

Function

The Exhaust Gas Recirculation (EGR) system is used to reduce the amount of oxides of nitrogen (NOx) in the exhaust. This is done by recycling a small amount of exhaust gas into the combustion chamber. Operation is often controlled by vehicle speed, thermosensors, and computer circuits.

Toyota put the EGR system into use beginning in 1973 on the 3K, 2T, 18R, 4M and F engines.



Manifold Type EGR System

Figure 245-1

Manifold Type EGR

The EGR system most commonly used on Toyota vehicles is the manifold type (Figure 245-1). In this system, the amount of exhaust gas to be recirculated is controlled by the EGR vacuum modulator. The vacuum modulator is needed to reduce the amount of exhaust gas that is circulated when the load is small, thereby improving driveability. Figure 245-2 shows the relationship between the EGR and engine load.

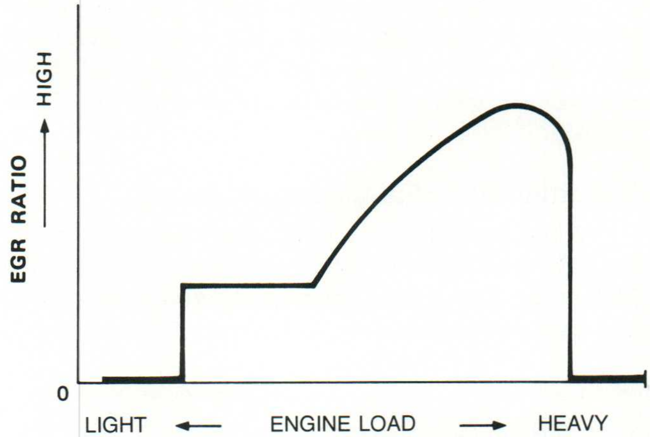


Figure 245-2

Also, when the temperature is low, NOx production is low, and it is not necessary to use the EGR system. The EGR therefore is automatically switched off under such conditions by the Thermostatic Vacuum Switching Valve (TVSV), shown in Figure 245-3. This also improves vehicle performance.

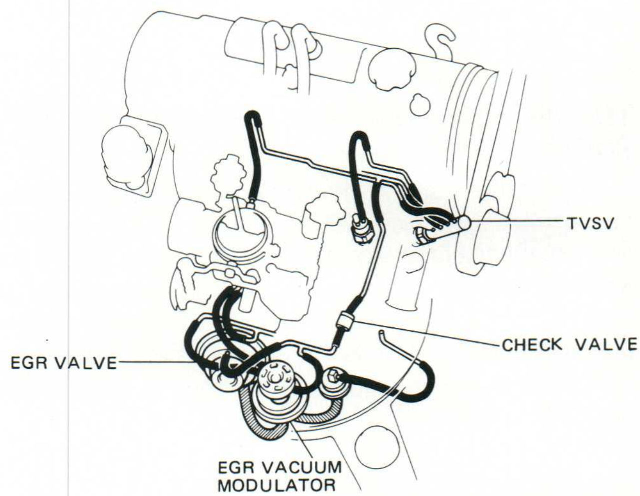


Figure 245-3

Article No. 246

OPERATION OF MANIFOLD-TYPE EGR SYSTEM

The operation of the EGR system after the engine warms up is explained and illustrated below. Note that although it is omitted in all of the illustrations, the TVSV is what actually shuts off the EGR system when the engine is cold.

Throttle Valve Fully Closed: Idling

At idle, the manifold vacuum does not pass through the EGR and EGR "R" ports, and does not act on the EGR valve. The throttle valve therefore remains closed and the exhaust gas is not recirculated (Figure 246-1).

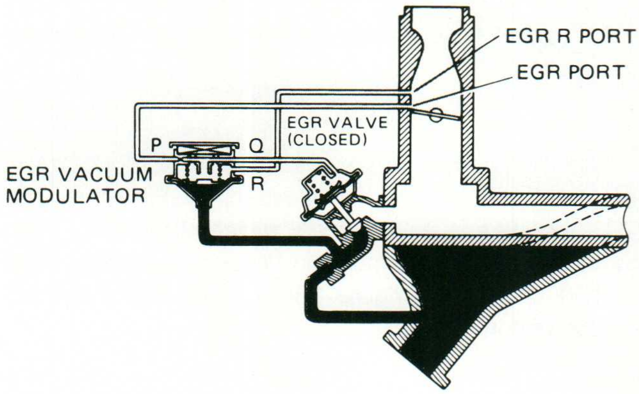


Figure 246-1

Throttle Valve Between EGR and EGR "R" Ports

During this part-throttle condition, the strength of the vacuum acting on the EGR valve is adjusted by the EGR vacuum modulator in accordance with engine load in the following manner. Vacuum from the EGR port acts on port "P" of the EGR vacuum modulator, while exhaust pressure acts on chamber "A" (Figure 246-2). When the load is small, the vacuum is strong and the exhaust gas pressure is weak.

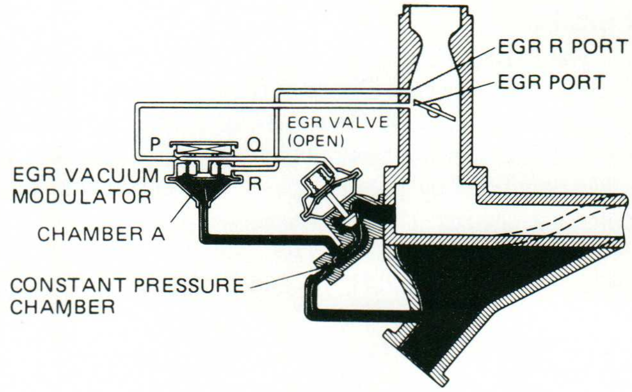


Figure 246-2

At this time, air, after passing through the filter, is introduced into the EGR vacuum modulator between "P" and "Q" (Figure 246-3), causing the strength of the vacuum acting on the EGR valve to fall. When the load is large, the opposite process takes place, air is no longer introduced into the modulator between "P" and "Q," and the strength of the vacuum acting on the EGR valve increases.

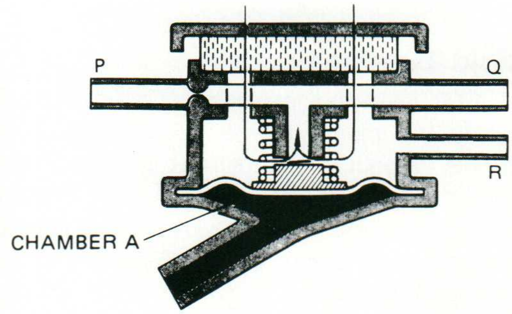


Figure 246-3

The vacuum acting on the EGR valve, and thus the opening of this valve, therefore remains almost constant regardless of the strength of the vacuum from the EGR port.

OPERATION OF MANIFOLD-TYPE EGR SYSTEM (Continued)

EGR Port Opened by the Throttle Valve

At this time, vacuum from the EGR port acts on port "R" of the modulator. The strength of the vacuum acting on the EGR valve increases, increasing the opening of this valve and thus the amount of exhaust gas that is recirculated (Figure 246-4).

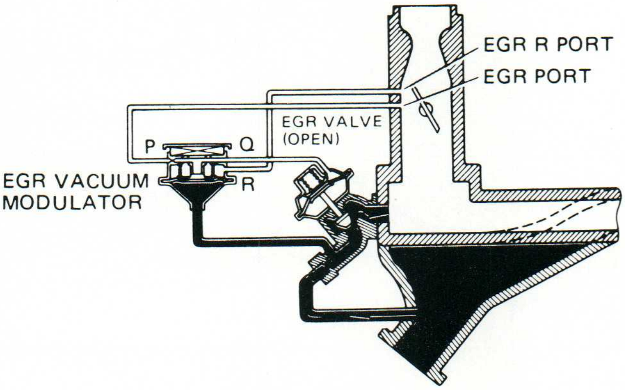


Figure 246-4

Throttle Valve Fully Opened

It takes 70 mmHg or more of vacuum to open the EGR valve. For this reason, when there is a heavy load (and the vacuum is therefore under 70 mmHg), no exhaust gas is recirculated (Figure 246-5).

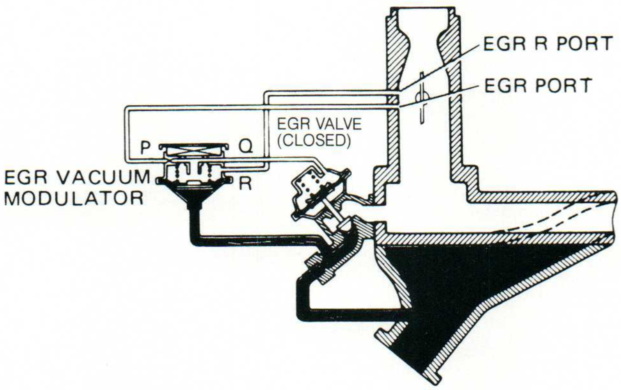


Figure 246-5

Troubleshooting Tips

1. **Preparation.** Using a 3-way connector, connect a vacuum gauge to the hose between the EGR valve and vacuum pipe (Figure 246-6).
2. **Check the seating of the EGR valve.** Make sure the engine starts and runs at idle.

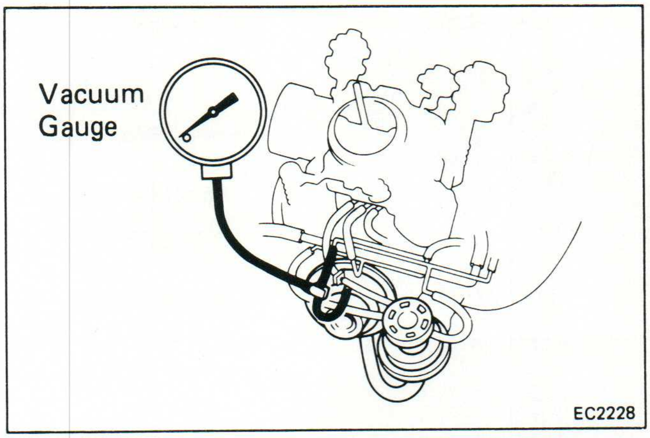


Figure 246-6

3. **Check the TVSV with a cold engine.** The coolant temperature should be below 50°C (122°F). Make sure the vacuum gauge indication is zero at approximately 2,000 rpm (Figure 246-7)

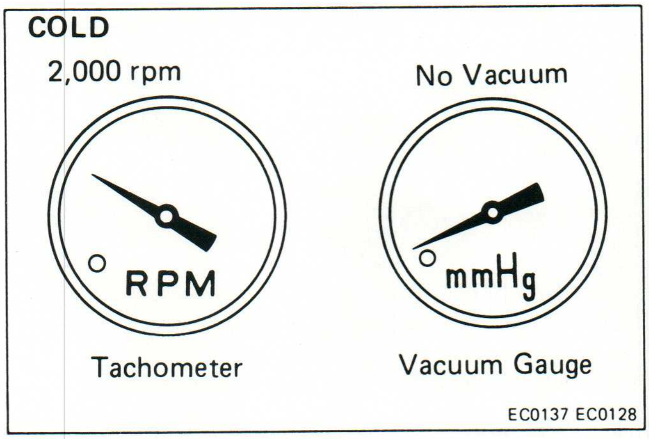


Figure 246-7

OPERATION OF MANIFOLD-TYPE EGR SYSTEM (Continued)

4. **Check the TVSV and EGR vacuum modulator with a hot engine.** Warm up the engine. Check that the vacuum gauge indicates low vacuum at 2,000 rpm (Figure 246-8).

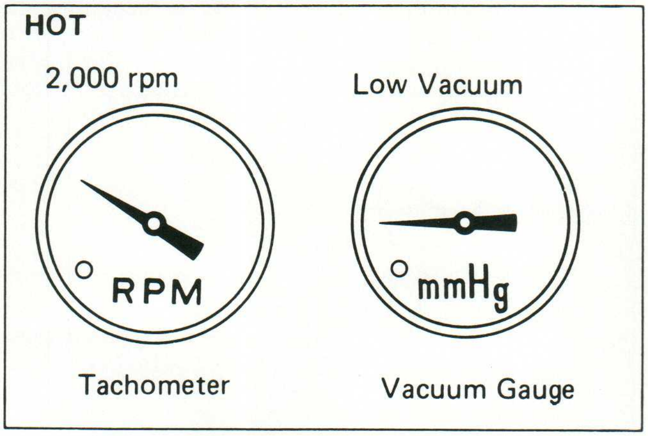


Figure 246-8

Disconnect the vacuum hose from the "R" port of the EGR vacuum modulator and connect the "R" port directly to the intake manifold with another hose. Make sure the vacuum gauge indicates high vacuum at 2,000 rpm (Figure 246-9). Note: As a large amount of EGR gas enters, the engine will misfire slightly.

Disconnect the vacuum gauge and reconnect the vacuum hoses to the proper locations.

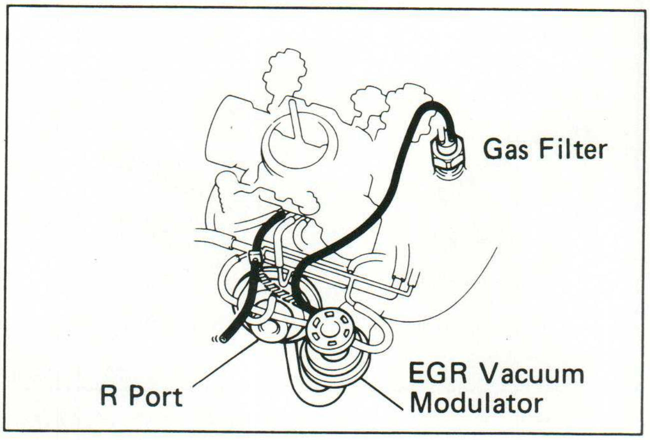


Figure 246-9

5. **Check the EGR valve.** Apply vacuum directly to the EGR valve with the engine idling. Make sure that the engine stalls. Reconnect the vacuum hoses to the proper location (Figure 246-10).

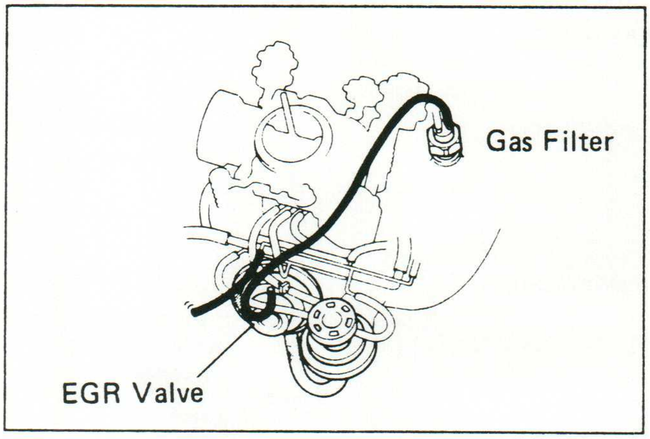


Figure 246-10

If no problem is found during these inspections, the system is OK. Otherwise, inspect each part.

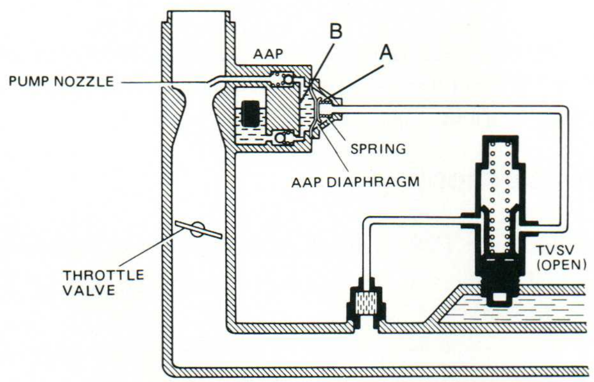
Note: For specific repair procedures, refer to the appropriate Toyota repair manual.

Article No. 247

AUXILIARY ACCELERATION PUMP

If the vehicle is suddenly accelerated when the engine is cold, the amount of gasoline delivered by the acceleration pump on carbureted vehicles may not be sufficient, and the vehicle may not accelerate smoothly.

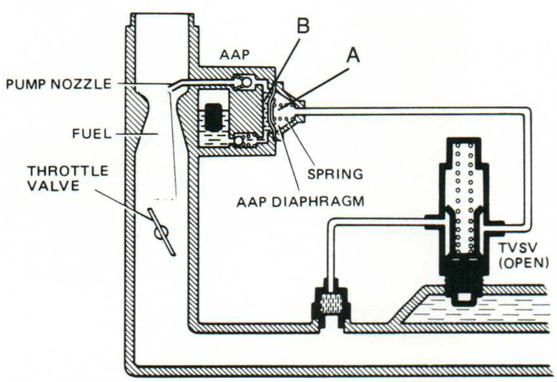
An auxiliary acceleration pump (AAP) eliminates this problem by supplementing the main acceleration pump when the engine is cold. When the coolant is cold, the Thermostatic Vacuum Switching Valve (TVSV) is open and the mainfold vacuum is applied to chamber "A" of the AAP. This pulls out the diaphragm, causing chamber "B" of the AAP to fill with gasoline. If the accelerator pedal is depressed at this time, the vacuum in the intake manifold weakens causing the spring to pull the diaphragm back to its original position, and push gasoline from the pump nozzle into the carburetor intake (Figure 247-1).



CRUISING

Figure 247-1

After the engine has warmed up, the TVSV closes, preventing vacuum from acting upon the AAP (Figure 247-2).



ACCELERATING

Figure 247-2

The AAP system has been used on all Toyota carbureted engines built since 1974.

Troubleshooting Tip

1. Check the system operation with a cold engine (Figure 247-3).
   a. Check that coolant temperature is below 50°C (122°F)
   b. Remove the air cleaner cover.
   c. Start the engine.
   d. Pinch the AAP hose, and stop the engine.
   e. Release the hose.
   f. Check that gasoline spurts out from the acceleration nozzle.

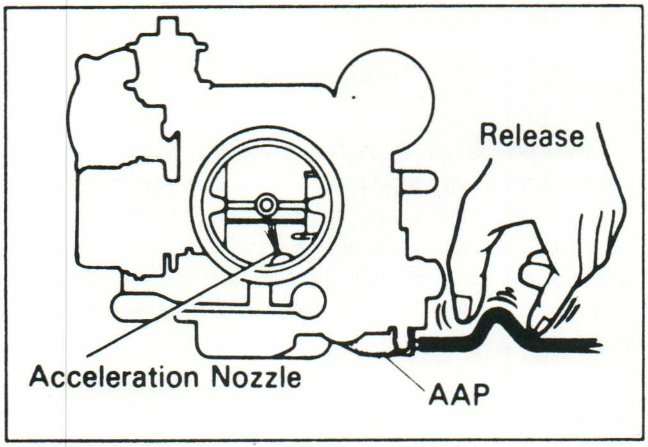


Figure 247-3

2. Repeat steps c, d and e above after warm-up.
   a. Check that gasoline does *not* spurt out from the acceleration nozzle.
   b. Reinstall the air cleaner cover.

3. If no problem is found with this inspection, the system is OK. Otherwise, inspect each part.

Note: Refer to the appropriate Toyota repair manual for specific repair procedures.

Article No. 248

AIR BLEED WITH FEEDBACK SYSTEM

The Air Bleed with Feedback System adds air to the primary main and low-speed carburetor circuits to maintain the optimum air fuel ratio. The operation is controlled by coolant temperature, engine speed and vacuum, the O_2 sensor and computer circuitry (Figure 248-1).

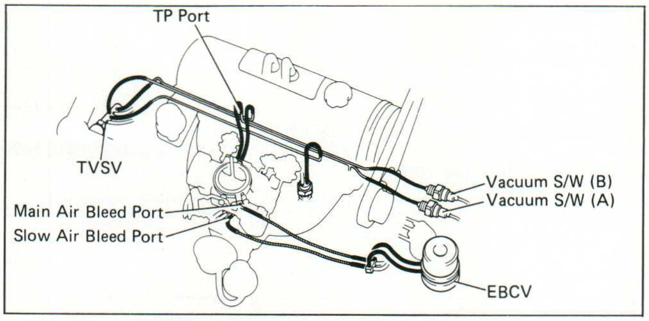


Figure 248-1

By means of a signal from the O_2 sensor, the carburetor primary side main air bleed and slow air bleed volume are controlled to maintain optimum air-fuel mixture in accordance with existing driving conditions, thereby reducing HC, CO and NOx (Figures 248-2 and 248-3). In addition, driveability and fuel economy are improved.

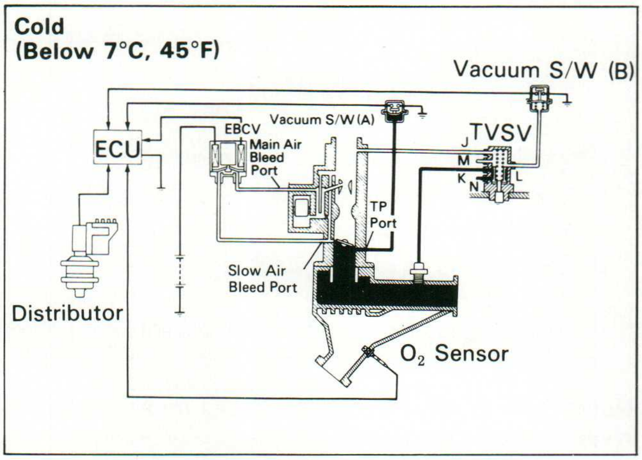


Figure 248-2

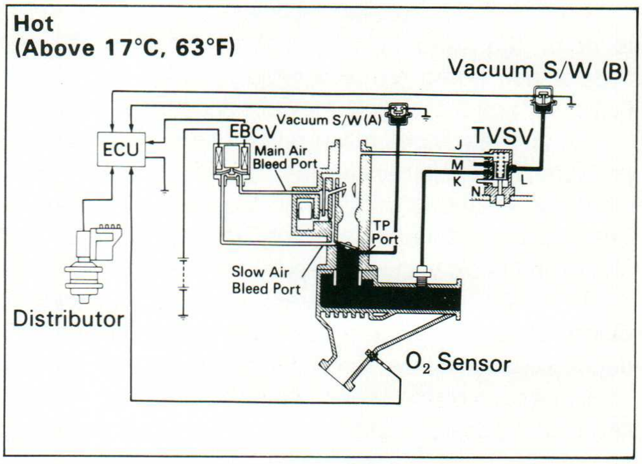


Figure 248-3

The Air Bleed with Feedback System has been used since 1983 on the 3A and 4A engines in the Tercel and Corolla models.

Troubleshooting Tips

1. **Check the TVSV with a cold engine** (Figure 248-4).
   a. The coolant temperature should be below 7°C (45°F).
   b. Disconnect the vacuum hose from vacuum switch B.
   c. Start the engine and check that no vacuum is felt in the disconnected vacuum hose.
   d. Reconnect the vacuum hose.

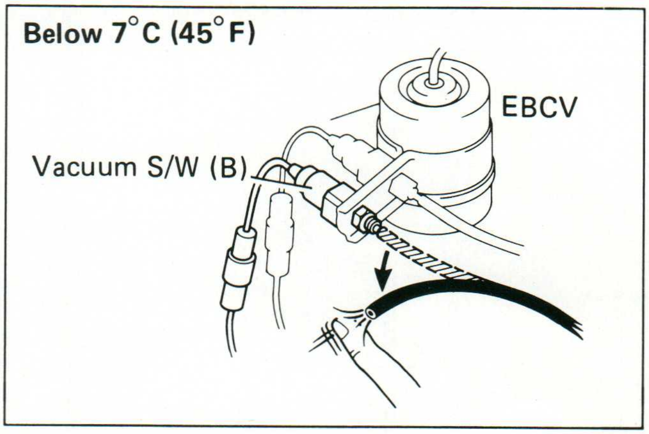


Figure 248-4

AIR BLEED WITH FEEDBACK SYSTEM (Continued)

2. **Check the EBCV with a hot engine** (Figure 248-5).
   a. Warm up the engine to normal operating temperature.
   b. Disconnect the EBCV electrical connector.
   c. Maintain engine speed at 2,500 rpm.

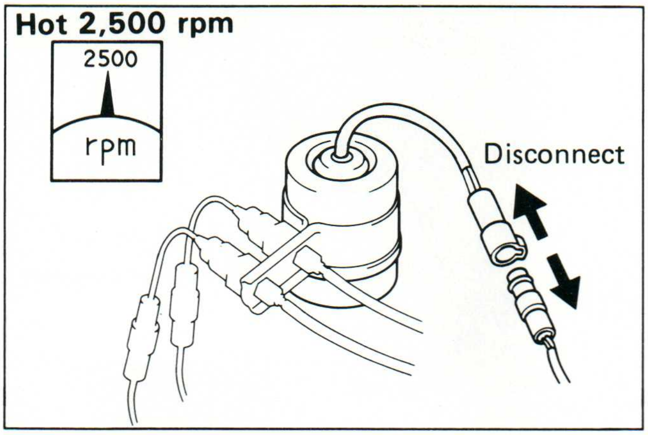


Figure 248-5

   d. Reconnect the connector and check that the engine speed momentarily drops about 300 rpm (Figure 248-6).

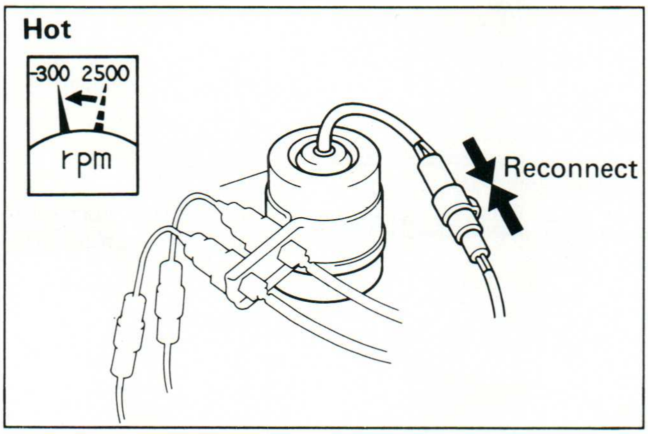


Figure 248-6

   e. With the engine idling, repeat steps b and d (Figure 248-7).
   f. Check that the engine revolution does *not* change.

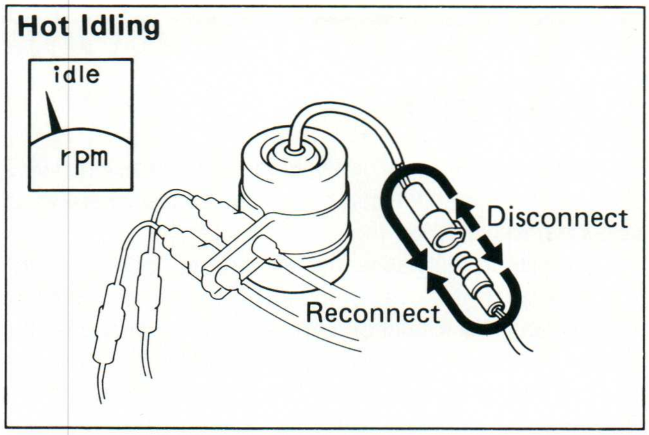


Figure 248-7

   g. Disconnect the vacuum hose from vacuum switch B.
   h. Repeat steps b, c and d. Check that the engine revolution does *not* change (Figure 248-8).

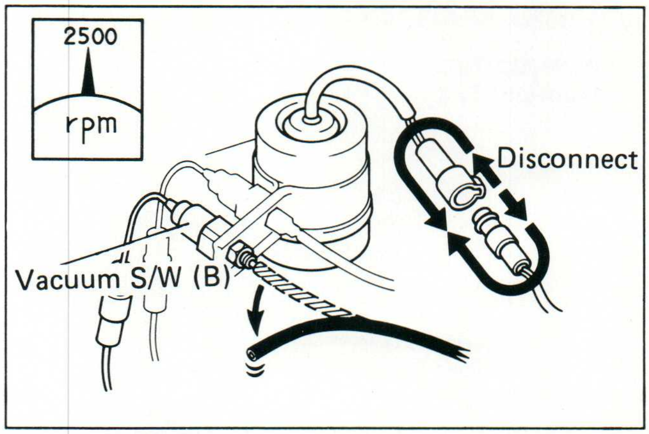


Figure 248-8

If no problem is found with this inspection, the system is OK. Otherwise, inspect each part.

Note: For detailed troubleshooting procedures, refer to the applicable Toyota repair manual.

Article No. 249

HIGH ALTITUDE COMPENSATION (HAC) SYSTEM

Toyota utilizes a High Altitude Compensation (HAC) System to improve fuel economy and driveability at altitudes above 3,930 feet (1,198 meters).

As altitude increases, the air density decreases and the air-fuel mixture becomes richer. The HAC system overcomes the enriched condition and provides the proper air-fuel mixture by supplying additional air to the primary low and high speed circuit of the carburetor. In addition, the ignition timing is advanced to improve driveability.

The "heart" of this system is the HAC valve (Figure 249-1), which uses a bellows to sense air pressure. The bellows expand and contract to regulate valve port openings and control air flow to the primary and slow air bleeds (Figure 249-2).

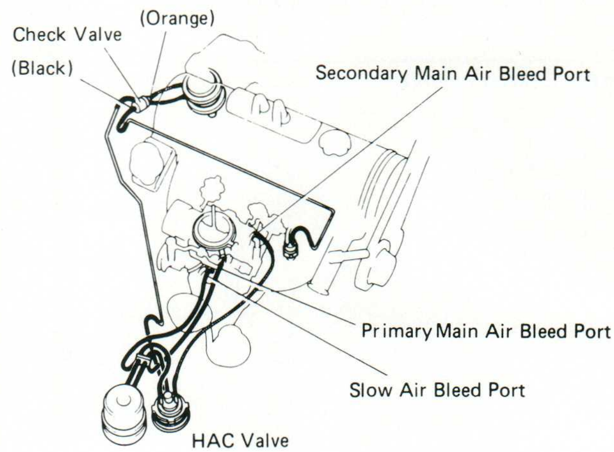


Figure 249-1

HIGH ALTITUDE (Above 3,930 ft.)

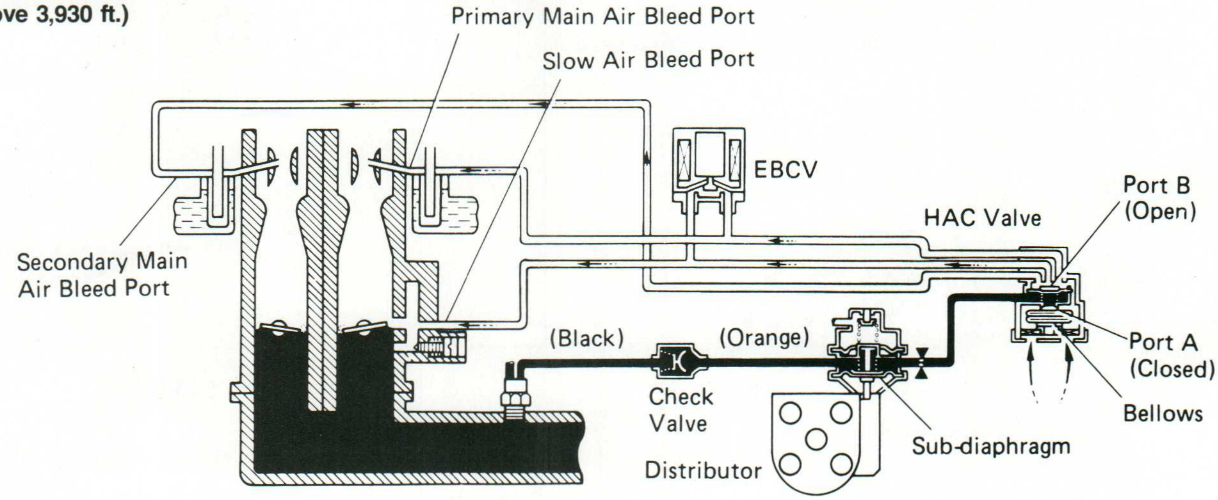


Figure 249-2

HIGH ALTITUDE COMPENSATION (HAC) SYSTEM (Continued)

Troubleshooting Tips

1. Visually check the air filter in the HAC valve (Figure 249-3), and clean if necessary.

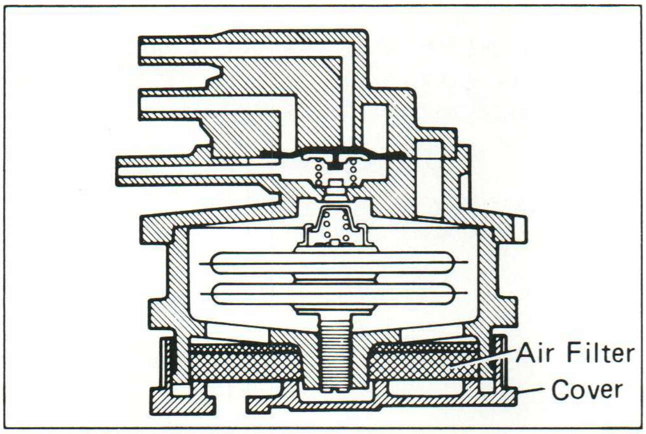


Figure 249-3

2. At high altitude — above 3,930 feet (1,198 meters) — blow air into any one of the three ports on top of the HAC valve with the engine idling. The HAC valve should be open (Figure 249-4).

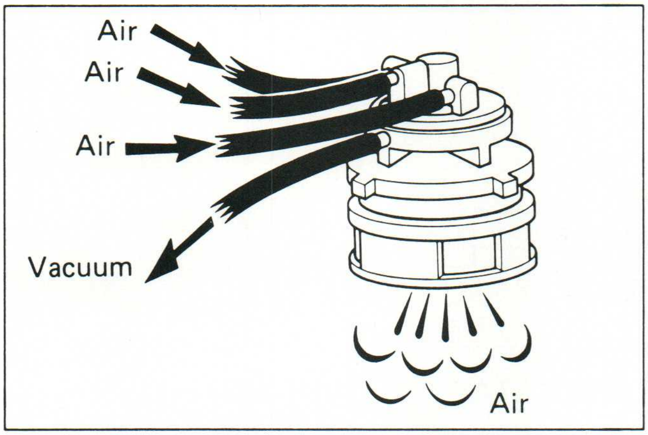


Figure 249-4

3. At low altitude — below 2,570 feet (783 meters) — blow air into any one of the three ports on top of the HAC valve with the engine idling. The HAC valve should be closed (Figure 249-5).

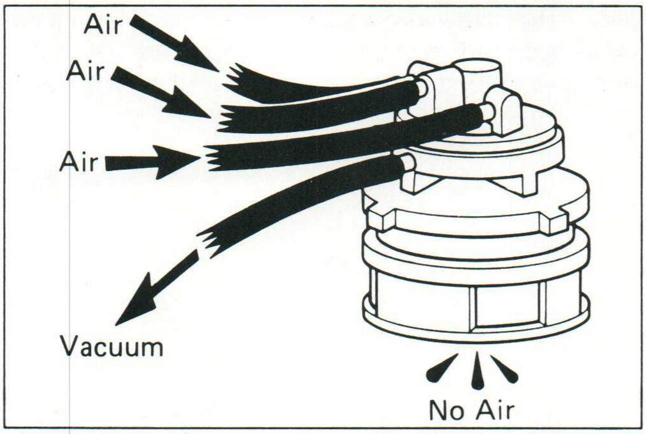


Figure 249-5

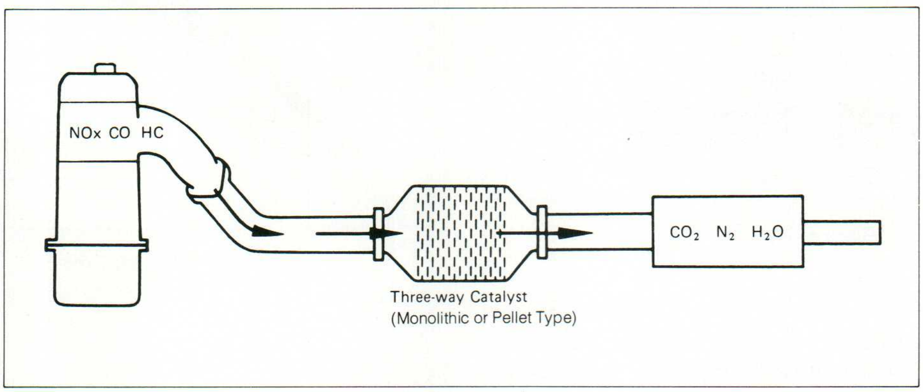
Article No. 250

CATALYTIC CONVERTERS

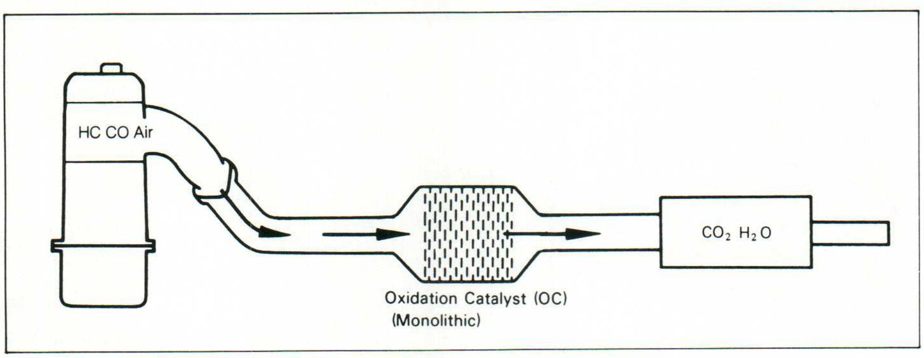
There are two major types of catalytic converters: the three-way catalyst (TWC) and the oxidation catalyst (OC). The three-way catalyst (TWC) reduces nitrous oxide, hydrocarbon and carbon monoxide emissions. The oxidation catalyst (OC) uses the oxidation process to reduce only hydrocarbon and carbon monoxide emissions.

Toyota uses both of these types, as well as a combined three-way oxidation catalyst (TWC-OC). The three systems are shown in figure 250-1.

THREE-WAY CATALYST (TWC) SYSTEM



OXIDATION CATALYST (OC) SYSTEM



THREE-WAY AND OXIDATION CATALYST (TWC-OC) SYSTEM

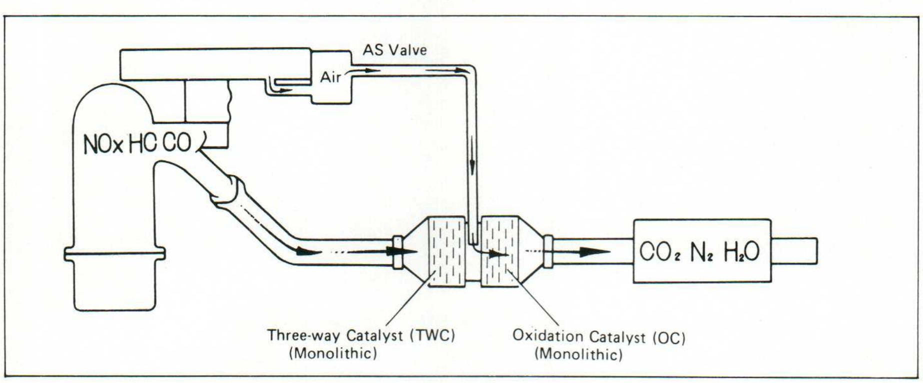


Figure 250-1

CATALYTIC CONVERTERS (Continued)

There are also two types of three way converters: the pellet type and the honeycomb type.

Pellet Type

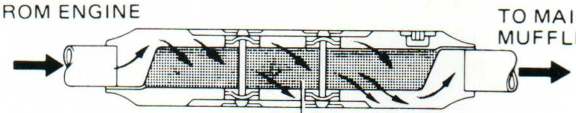


Figure 250-2

In the pellet type (Figure 250-2), a thin coating of a catalyst is applied to the surface of pellet-shaped aluminum carriers, which are several millimeters in diameter. The pellets are packed into the converter case. Pellet-type converters can generally be identified by their long, flat appearance.

This type of converter has the advantage of being easy to mass-produce, but the exhaust resistance created at heavy loads or high rpm is usually higher than the honeycomb type.

Catalytic converter damage can result in the dislodging of the pellets from the converter assembly, causing them to plug the muffler assembly. Severe plugging can cause a loss of power, engine overheating and possible engine damage.

Severe plugging can be detected in one of the following ways:

- Using an exhaust gas analyzer to detect high HC, CO, and NOx emissions.
- Tapping the converter with a wood block. If the muffler assembly is severely plugged, you'll hear a hollow, empty sound.
- Checking the exhaust back pressure through the use of a vacuum gauge.

If there is severe plugging, replacement of the converter *and* muffler is required. Toyota pellet-type converters *cannot* be refilled.

In the honeycomb (monolithic) type (Figure 250-3), the catalyst substance is applied to a one-piece honeycomb-shaped ceramic carrier.

Honeycomb Type

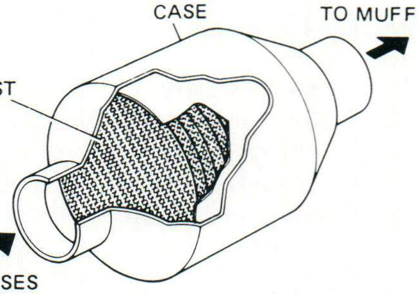


Figure 250-3

This type of converter has several advantages over the pellet type: It warms up more quickly to the temperature required for the catalytic reactions to take place, and it creates less exhaust resistance. For these reasons, this type is used more often.

Note: Catalytic converter damage can result in the converter's loss of efficiency in reducing emissions. Damage can be detected using an exhaust gas analyzer.

Catalytic converter failures are generally caused by an engine-related problem. Make sure the cause of the problem is found before replacing the converter.

Note: If leaded gasoline is used, the surface of the catalyst will become coated with lead and lose its effectiveness. For this reason, vehicles equipped with a catalytic converter **must always** use unleaded gasoline.

Article No. 251

PRELIMINARY TROUBLESHOOTING CHECKLIST

Listed below are *some* possible performance problems and *some* of their possible causes. Due to the very small percentage of emission system problems, it is essential that all tune-up related items be verified first. Refer to the appropriate Toyota service manual for more detailed information.

1. Verify the customer complaint.
   - Road test
   - Accuracy of complaint
   - Nature of complaint (determine if any abnormal condition exists)
2. Check maintenance and tune-up records. Adjust timing and idle using the appropriate repair manual.
3. Identify emission controls used (refer to the appropriate repair manual).
4. Visual inspection.
   - Vacuum hoses disconnected, misrouted or kinked
   - Emission components disconnected
   - Engine modifications
   - Evidence of recent engine repair
   - Position of moveable components (linkages, HAI valve, automatic choke, etc.)
5. Evaluate engine and exhaust system sounds and operation.
   - Air injection/suction
   - Mixture control
   - Throttle positioner
   - Exhaust gas recirculation
   - Muffler plugging (converter overheating)
6. Diagnose problem using test equipment.
   - Ignition scope
   - Exhaust gas analyzer
   - Volt-ohmmeter
   - Vacuum-pressure tester
   - Vacuum gauge
7. Analyze complaint versus emission system operating conditions.

Symptom Diagnosis

SYMPTOM	POSSIBLE CAUSES
Afterrun/dieseling/run-on	Incorrect idle speed (above specification) Retarded timing Lean air-fuel mixture Poor-quality fuel (low octane rating) Deceleration fuel cut solenoid (O-ring missing/broken) EGR system inoperative (raising combustion temperature) EGR-VSV malfunction (22R engine) Mechanical problems — carbon or oil buildup in combustion chamber
Rough idling	Tune-up related items • Spark plugs • Plug wires • Ignition timing • Carburetor adjustment • Valve clearances • Poor compression Vacuum leaks • PCV • EGR • MC • HAC • Intake manifold

PRELIMINARY TROUBLESHOOTING CHECKLIST (Continued)

SYMPTOM	POSSIBLE CAUSES
Rough idling (Continued)	Spark control malfunction
	Choke air system malfunction
	Hot air intake stuck
	EGR system (sticking modulator or valve)
	PCV valve stuck open
	Air leaks on EFI-equipped cars
	• Oil dipstick
	• Filler cap
Poor driveability	Tune-up related items
	• Spark plugs
	• Ignition timing
	• Carburetor adjustment
	• Valve clearances
	• Poor compression
	Auxiliary system malfunctions
	• Hot air intake
	• Automatic choke including choke opener and breaker
	• Idle advance (spark control)
	EFI system malfunction
	• Cold start injector
	• Air valve
	Ignition advance mechanisms sticking or inoperative
	Plugged muffler (loss of power)
	Vacuum or air leaks
	PCV valve stuck open or disconnected
Engine surge (lean air-fuel ratio)	Tune-up related items
	EGR modulator or valve malfunction (incorrect exhaust recirculation)
	Exhaust manifold leaks
	Incorrect air injection (poor vacuum or temperature signals)
	Vacuum leaks
	Sticking power valve (if used)
	Spark control malfunction
	Plugged muffler (catalyst-equipped vehicles)
	EFI vehicles — erratic air flow meter operation or air leak
Afterfire/backfire during deceleration (excessive richness or air injected at wrong time)	Air injection/air suction or delayed vacuum signal
	Deceleration fuel cut inoperative
	Mixture control inoperative
	Throttle positioner malfunction
Afterfire/backfire cold operation (excessive richness or air injected at wrong time)	Failure of thermo-sensitive component (TVSV, BVSV, etc.)
	Air injection/suction malfunction
	Choke system malfunction (stuck in open position)
Afterfire/backfire through intake (excessive richness of oxygen at wrong time)	Vacuum leaks
	Incorrect valve timing/clearance
	Incorrect ignition timing
Engine ping/detonation	Lack of EGR (higher combustion temp./leaner air-fuel mixture)
	Poor fuel quality
	Engine modifications (increased compression)
	Incorrect ignition timing
	Engine overheating
	Mechanical problems (carbon buildup)
	Knock sensor system

Article No. 252

CAUSES OF EXCESSIVE HC, CO, NOx

An exhaust gas analyzer is used to measure HC, CO and NOx. Before conducting the test, make sure the analyzer is at operating temperature and has been calibrated according to manufacturer recommendations, or more frequently if conditions warrant.

Causes of excessive HC

Misfiring or any engine problem that reduces combustion efficiency will increase HC emission levels. This can include:

Ignition misfire

- Battery is in low state of charge or has poor connections
- Fouled, improperly gapped or worn spark plugs
- Faulty coil, condenser, plug cap or wiring
- Dirty, pitted, burned, floating, sticking or misaligned points
- Faulty ignitor pickup coil

Spark timing retarded (late) or advanced (early)

- Worn contact point rubbing block due to lack of lubrication
- Incorrect point gap
- Malfunctioning spark advance mechanisms (centrifugal or vacuum)
- Electronic spark advance control problem

Excessively rich or lean mixtures

- Incorrect jetting
- Incorrect fuel (float) level
- Misadjusted choke
- Clogged or restricted internal passages
- Air cleaner restricted or dirty
- Idle mixture set incorrectly
- Exhaust system modification
- Air leaks
- Plugged fuel injectors
- Faulty pressure regulator
- Faulty air flow meter
- Fuel pump
- Faulty coolant sensor

Fuel injection problems

- Leaking main injector
- Leaking cold start injector
- Faulty pressure regulator

Engine mechanical problems

- Low compression
  - rings not sealing
  - valves not sealing
  - leaking head gasket
  - improperly torqued spark plug
- Excessive oil consumption
  - worn piston rings or cylinder walls
  - worn valve guides or valve guide seals
  - incorrectly installed rings
  - blocked crankcase breather
  - incorrect type of engine oil
- Incorrect valve clearance (too tight)
- Oil diluted by gasoline

CAUSES OF EXCESSIVE HC, CO, NOX (Continued)

Causes of Excessive CO

Rich fuel mixtures

- Idle mixture set incorrectly
- Incorrect jetting
- High fuel level (float level)
- Sticking float
- Misadjusted choke
- Worn internal parts
- Oil diluted by gasoline
- Plugged injectors
- Faulty pressure regulator
- Fuel pump
- Faulty air flow meter
- Faulty coolant sensor

Dirty or obstructed air cleaner

Oil entering the combustion chamber

Fuel injection problems

- Leaking main injector
- Leaking cold start injector
- Faulty pressure regulator

Causes of Excessive NOx

Incorrect spark timing

- Worn contact points
- Incorrect point gap
- Malfunctioning spark advance mechanisms (centrifugal or vacuum)
- Incorrect condenser value or faulty condenser
- Faulty knock control system

Excessively lean mixtures

- Incorrect jetting
- Incorrect fuel (float) level
- Misadjusted choke
- Clogging or restricted internal passages
- Idle mixture set incorrectly
- Exhaust system modifications
- Air leaks
- Plugged fuel injectors
- Faulty pressure regulator
- Faulty air flow meter
- Faulty coolant sensor

Inefficient cooling system

Article No. 253

AVAILABILITY OF COLLISION REPAIR MANUALS

Today's modern unibody vehicles have complex designs, and body repairs can be made easier if factory repair methods are utilized by the body repair technician.

Factory-approved cutting and sectioning procedures save time and money by providing an alternative to the task of removing numerous spot welds, rewelding and trying to effectively reapply a rustproofing material to the various seams and weld joints.

Toyota's individual collision repair manuals contain instructions for cutting and replacing many body and support member components, identification and location of plastic parts and high-strength steel components, as well as body seam sealing locations and handy factory body dimension drawings with easy-to-locate reference points and reference lengths.

The collision repair manuals supplied by Toyota are available at a reasonable cost. For more information on how to obtain these manuals, contact your nearest Toyota dealer.

Specialty Manuals

In addition to the collision repair manuals, the following specialty manuals are available and can be ordered through your local Toyota dealer:

Toyota Fundamental Painting Procedures (00400-36438E)
Covers fundamentals, facilities, tools and equipment, repainting processes, problem areas, safety and cleanliness, and an explanation of refinishing terminology.

Toyota Fundamental Collision Repair Manual (00400-BRM002E)
Covers body structure, body materials, body repairs, welding techniques and tools and equipment.

Truck Corrosion Repair Instructions (00401-42806)
Aids in repairing rust conditions on Toyota vehicles.

Toyota Body Dimension Guide (00104-87861)
Covers body dimensions for most Toyota models through the 1987 model year.

Collision Repair Manuals (1980-88)

Model	Model Year	Part Number
Starlet	81-84	00400-36158
Tercel	80-82	00400-98367
Tercel 2WD	83-86	00400-36431E
Tercel 4WD	83-88	00400-36432E
Tercel 2WD	87-88	00400-BRM007U
Corolla	80-83	00400-36001
Corolla FF/FR	84-87	00400-36434E
Corolla	88	00400-BR012
Camry	83-86	00400-36433E
Camry	87-88	00400-BRM010E
Celica/Supra	82-85	00400-36182
Celica	86-88	00400-BRM001E
Supra	86½-88	00400-BRM005E
Supra W/Sport Roof	87-88	00400-BRM009E
Cressida	81-84	00400-36118
Cressida	85-88	00400-36441E
Cressida Wagon	85-87	00400-36442E
MR2	85-88	00400-36440A
MR2 W/T-Bar Roof	87-88	00400-BRM008E
Van	84-88	00400-BRM003E

"The Toyota STAR Cabinet helped me solve my wait problem."

"Wait loss. That's what happens when your customer goes somewhere else because *you* don't have the part you need to fix his car. It happened to me, and believe me, it's painful.

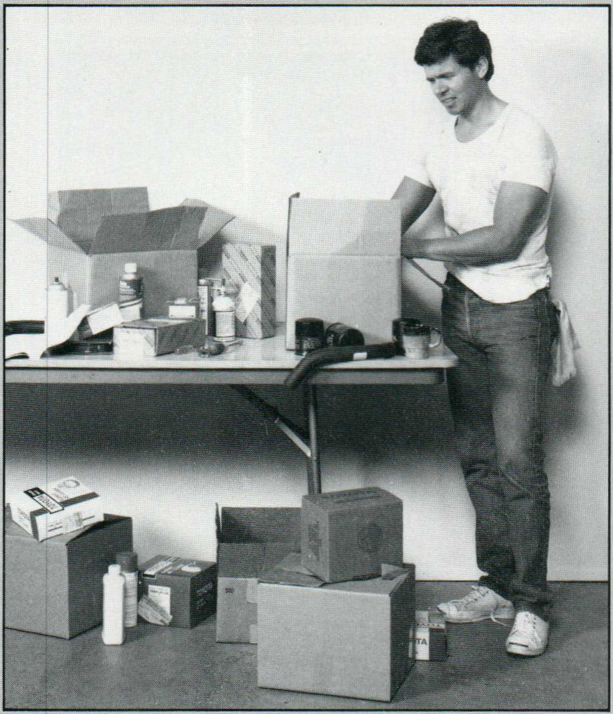
"Then my Toyota STAR Dealer showed me what the STAR Cabinet could do for my business. Now I can stock the fast-moving Toyota Genuine Parts my shop needs.

"The inventory is tailored to *my* business, and it's restocked regularly – with no delivery charge. That means parts are within reach, or a phone call away.

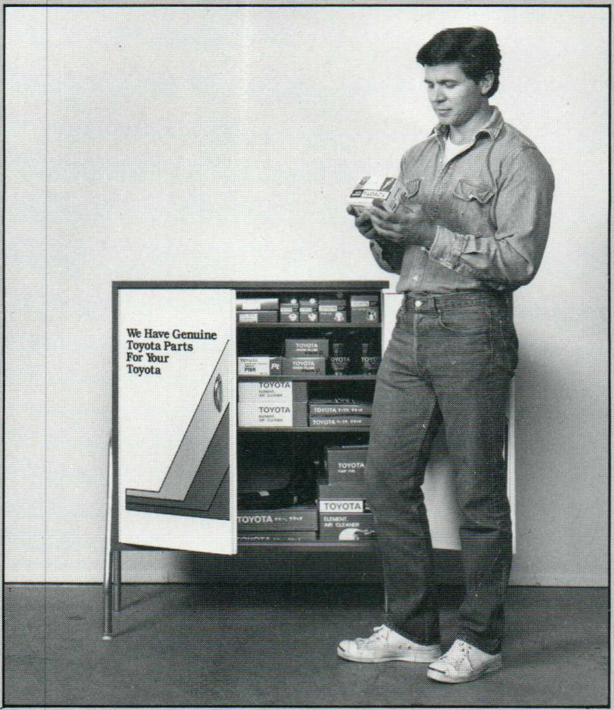
"The STAR Cabinet is attractive, too. It can hang on the wall or sit on the floor, and the shelves are adjustable. It even comes with a security lock.

"It's just one of many services my Toyota STAR dealer offers.

"Now my customers are satisfied. And so am I."



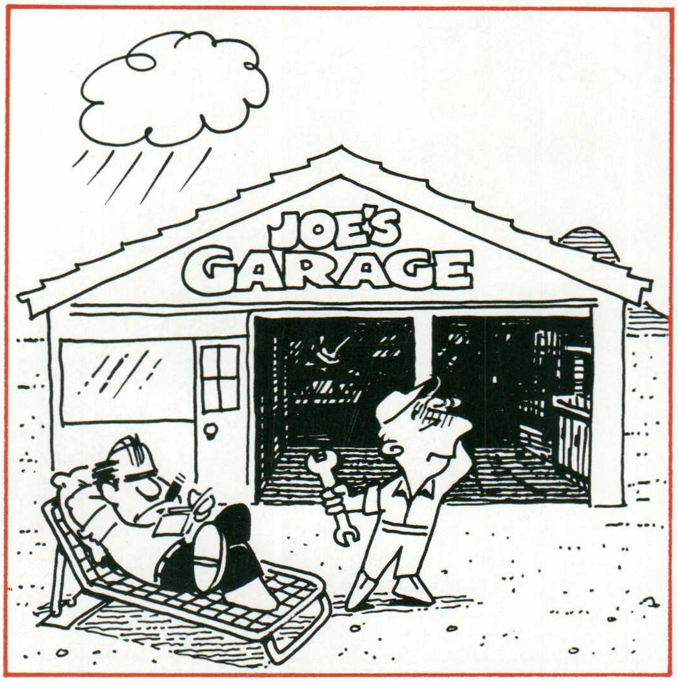
Before

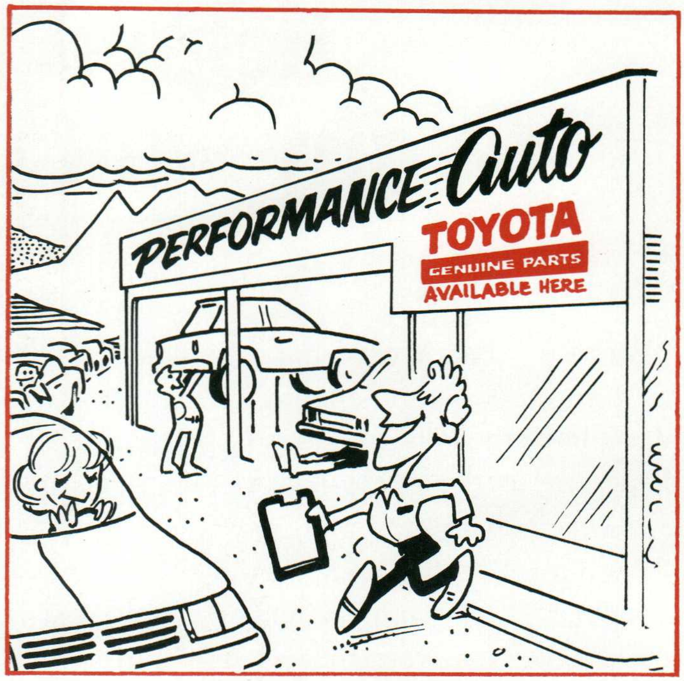


After

TOYOTA
GENUINE PARTS

Traffic Sign.





When the flow of traffic into your shop is stop-and-go, it definitely can slow down your profitability.

But there's one sure way to attract more customers: Display Toyota Genuine Parts signage.

A Toyota Genuine Parts sign in your window or outside your shop says a lot of good things about you: That you're a professional. That you're concerned with providing excellent work. That you offer the quality and value of Toyota Genuine Parts.

Toyota Genuine Parts signage sets your shop apart from the rest. It's a sign Toyota owners trust. And it's a sign that you care about a job well done.

Ask your Toyota dealer how you can get Toyota Genuine Parts signage for your shop.

Once Toyota owners know you're part of the team, there'll be no stopping them.