

TOYOTA SERVICE NEWS

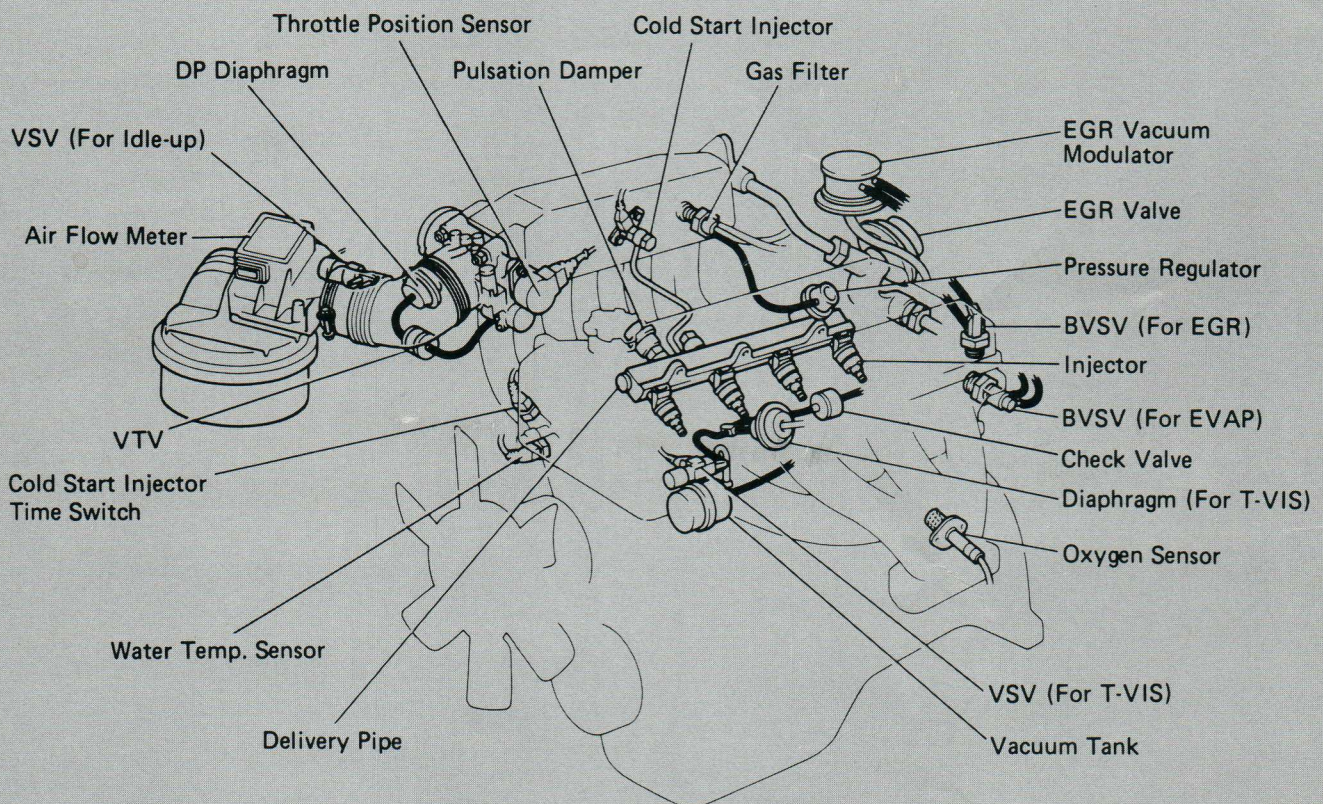
Fall 1987

The Independents' Guide to Professional Service and Repair

Bulletin 25

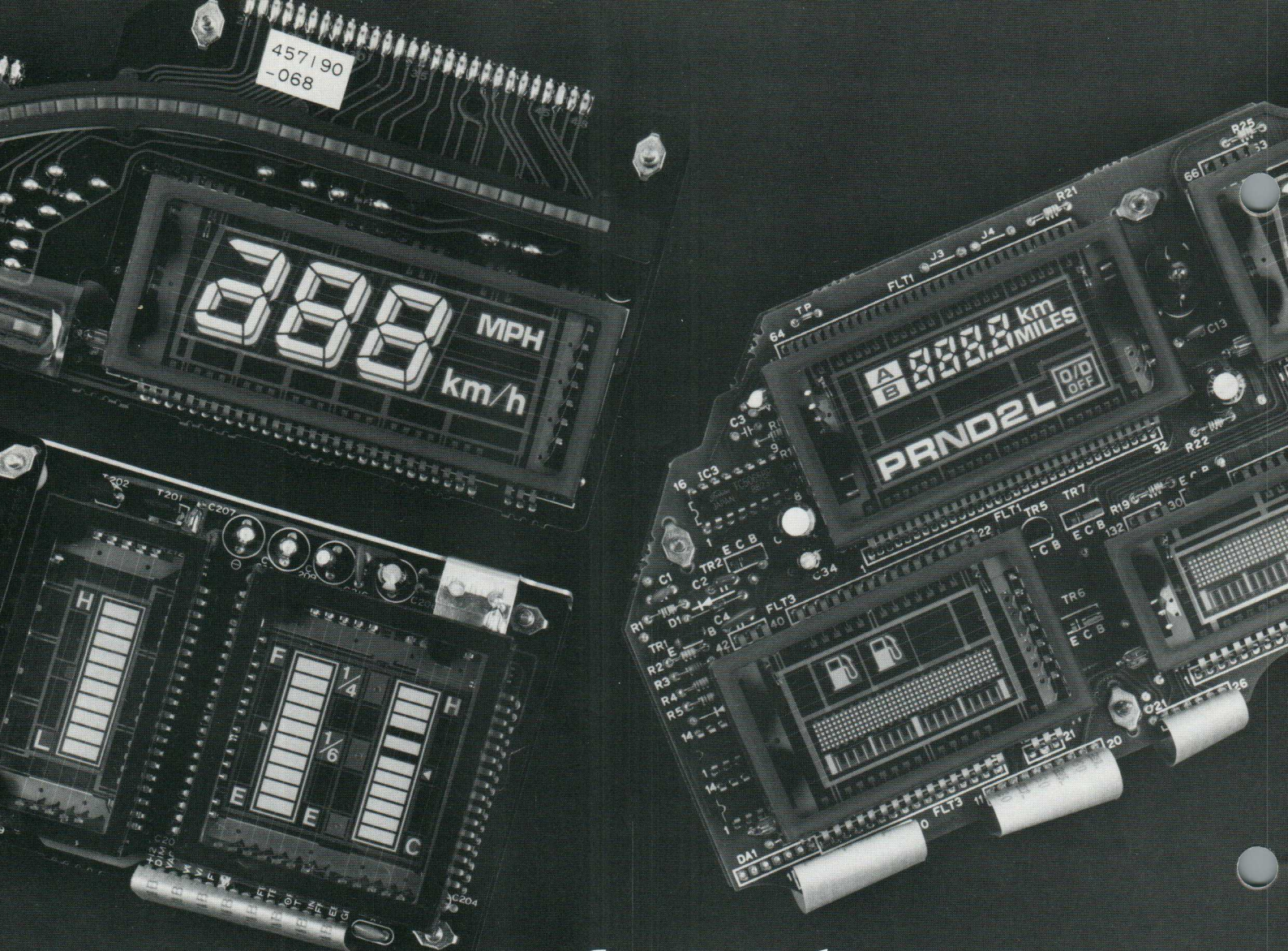
TCCS

TOYOTA COMPUTER CONTROLLED SYSTEM



IN THIS ISSUE

- Introduction to TCCS
- Troubleshooting TCCS
- High-Strength Steel (HSS)



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Bulletin 25

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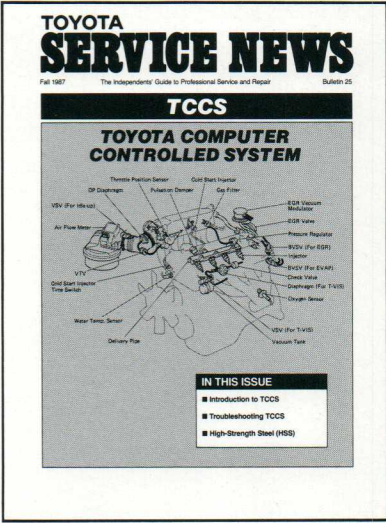
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On the Cover



The Toyota Computer Controlled System (TCCS), an electronic engine control system, was introduced on the 1983 six-cylinder 5M-GE engine used in the Supra and Cressida. This issue offers an introduction to TCCS, including helpful TCCS construction diagrams and troubleshooting charts for selected models.

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INTRODUCTION TO EFI AND TCCS

Toyota introduced its first Electronic Fuel Injection (EFI) system on the 1979½ Supra 4M-E six-cylinder engine. The EFI system precisely controlled fuel metering under varying operating conditions, providing improved fuel economy and performance in comparison to a similar carburetor-equipped engine.

The introduction of the Toyota Computer Controlled System (TCCS) on the 1983 5M-GE engine used in the Cressida and Supra added some obvious advantages to the previous EFI System. In place of the conventional EFI computer, the TCCS uses a more sophisticated Electronic Control Unit (ECU) with built-in microprocessor.

The TCCS ECU stores data to precisely control various engine functions and related systems, such as:

- Fuel injection duration.
- Injection timing.
- Ignition spark timing.
- Idle speed control.
- Exhaust Gas Recirculation (EGR).
- Electronically Controlled Transmission (ECT).
- Toyota Variable Induction System (T-VIS).
- Diagnosis.

Note: The functions will vary, depending on the application.

The TCCS controls the operation of the various systems according to present running conditions as informed by electronic signals sent to the ECU by various sensors. Figure 227-1 illustrates the operation of the basic system.

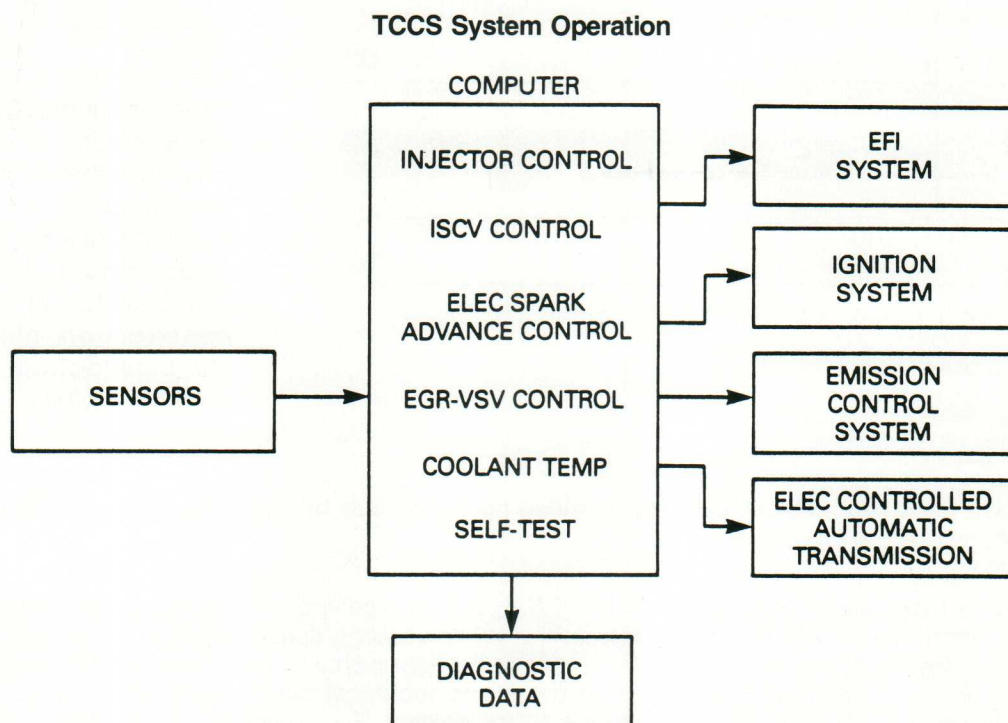


Figure 227-1



TCCS Model Application

MODEL	ENGINE	1983	1984	1985	1986	1987
Corolla GT-S (AE)	4A-GE			•	•	•
Corolla FX16	4A-GE					•
MR2 (AW)	4A-GE			•	•	•
Camry (SV)	2S-E				•	
Camry (SV)	3S-FE					•
Celica (RA)	22R-E			•		
Celica (ST)	2S-E				•	
Celica (ST)	3S-FE					•
Celica GT-S (ST)	3S-GE				•	•
Supra (MA)	5M-GE	•	•	•	•	
Supra (MA)	7M-GE				•	•
Supra (MA)	7M-GTE					•
Cressida (MX)	5M-GE	•	•	•	•	•
Van (YR)	3YE			•		
Van (YR)	4YE				•	•
Truck (RN)	22R-E			•	•	•
Truck (RN)	22R-TE			•	•	•

Note: Not all models listed are mentioned in this issue.

Abbreviations

The following abbreviations are used for identification of Toyota TCCS and EFI components and related systems.

BVSV	Bimetal vacuum switching valve
EFI	Electronic fuel injection
EGR	Exhaust gas recirculation
ESA	Electronic spark advance
ECU	Electronic control unit
ISCV	Idle speed control valve
TVSV	Thermostatic vacuum switching valve
TWC	Three-way catalyst
VCV	Vacuum control valve
VSV	Vacuum switching valve
VTV	Vacuum transmitting valve



Article No. 228

TCCS CONSTRUCTION AND COMPONENT LOCATION

The following general diagrams illustrate the relationships of components within the indicated system.

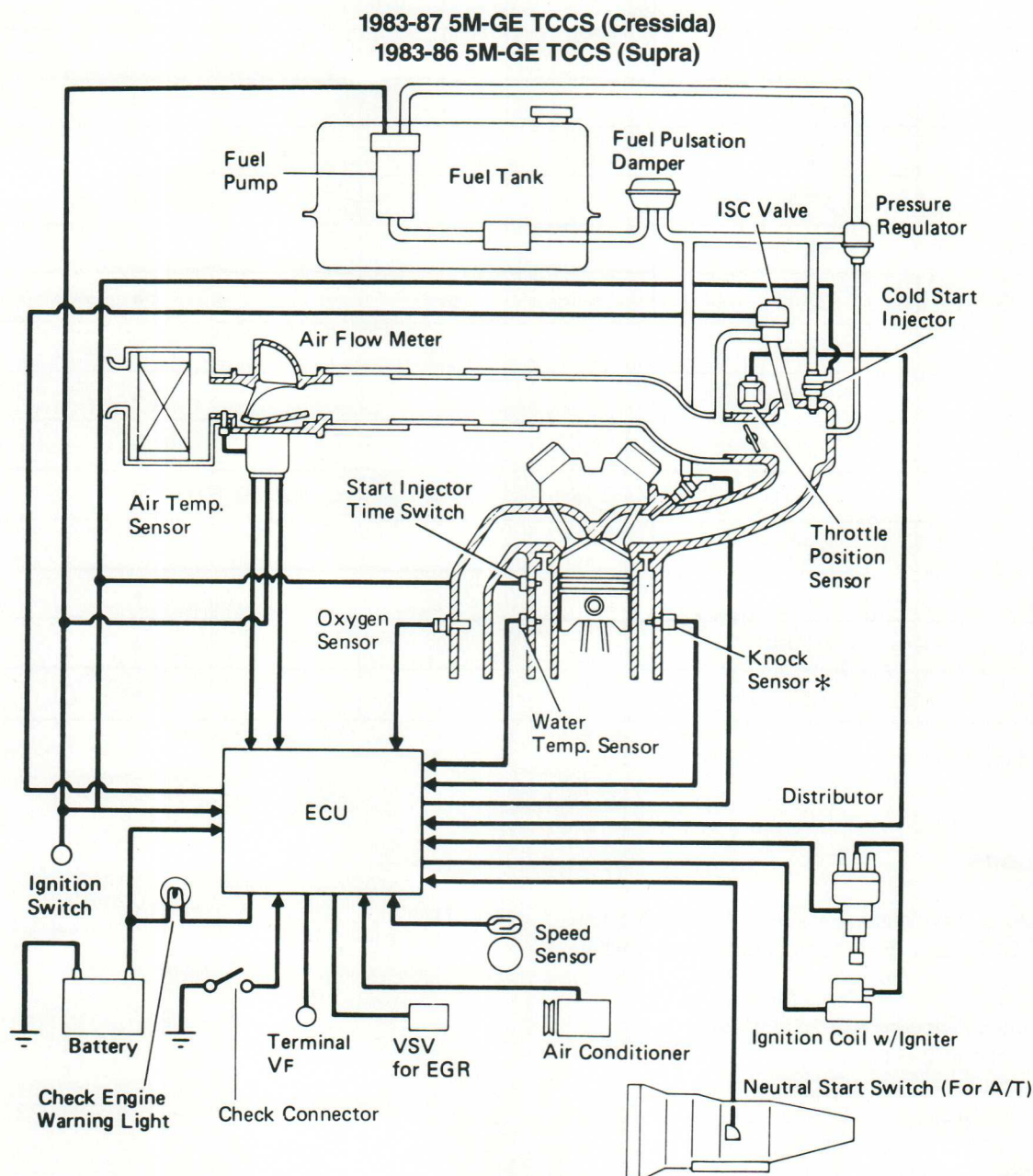
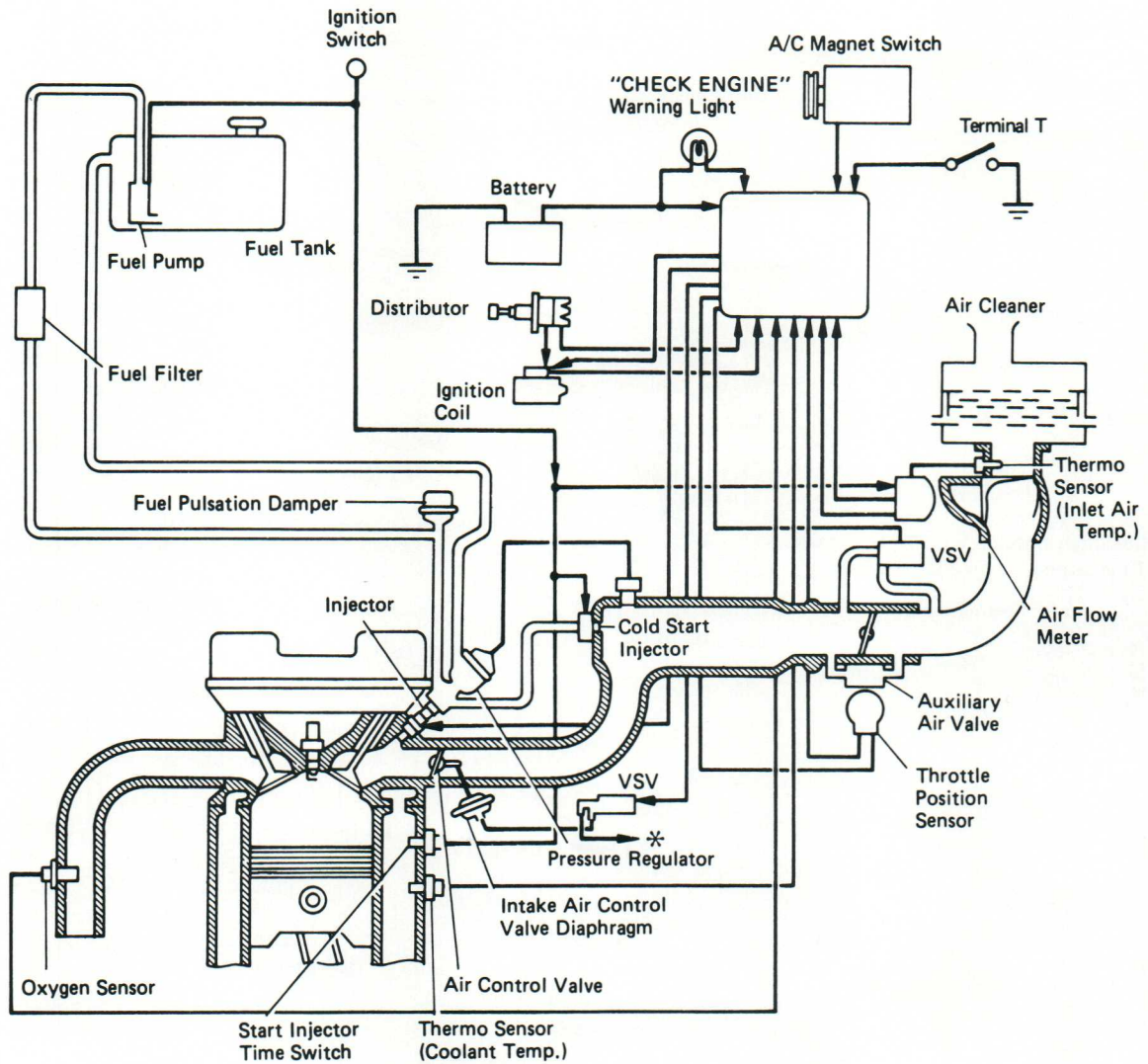


Figure 228-1

***Note:** The 1985-87 engines include a knock sensor not found on the 1983-84 engines.



1985-87 4A-GE TCCS (Corolla GTS, MR2)



* To Vacuum Reservoir Tank

Figure 228-2



1983-84 Cressida Six-cylinder 5M-GE Engine

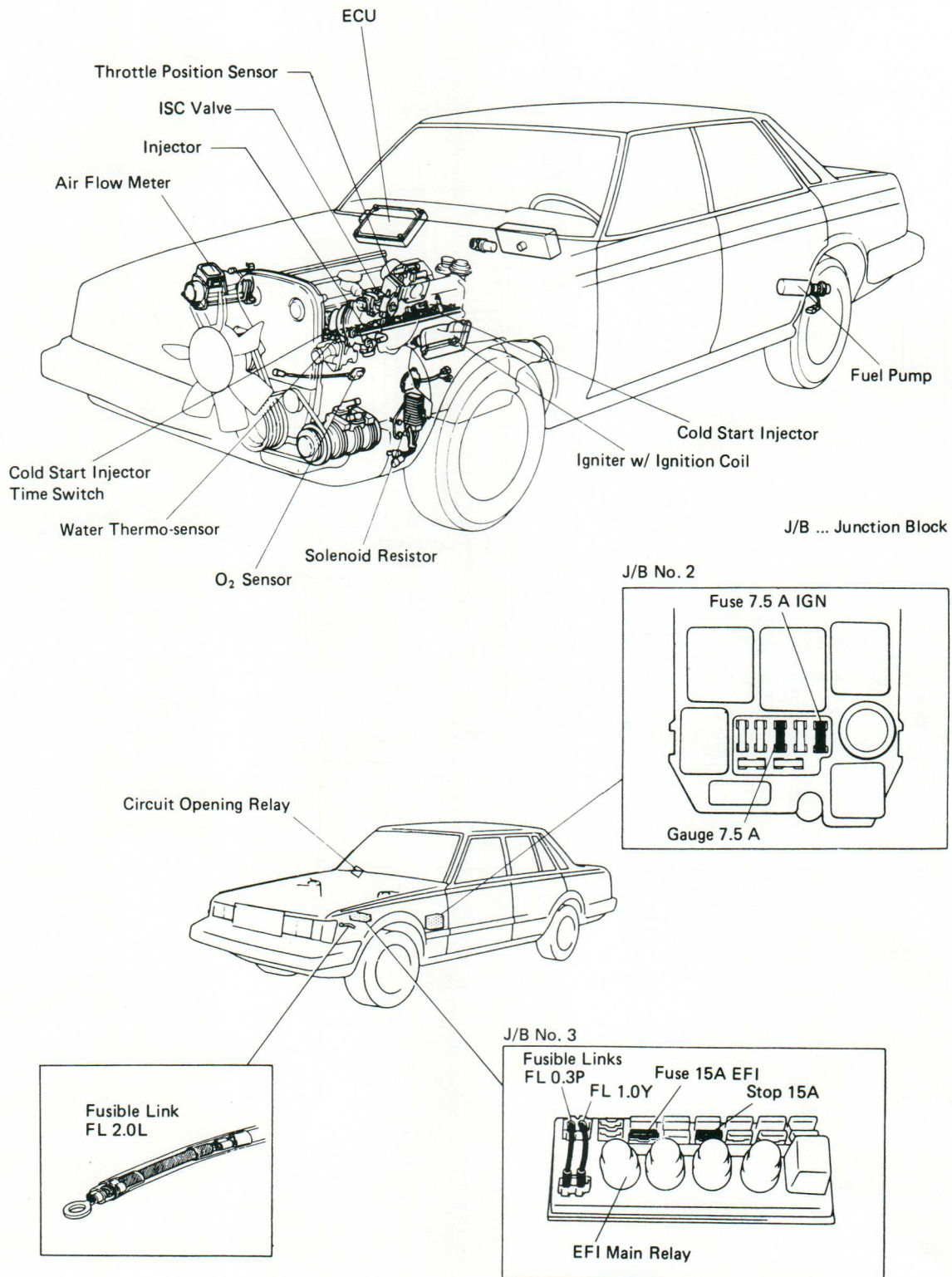
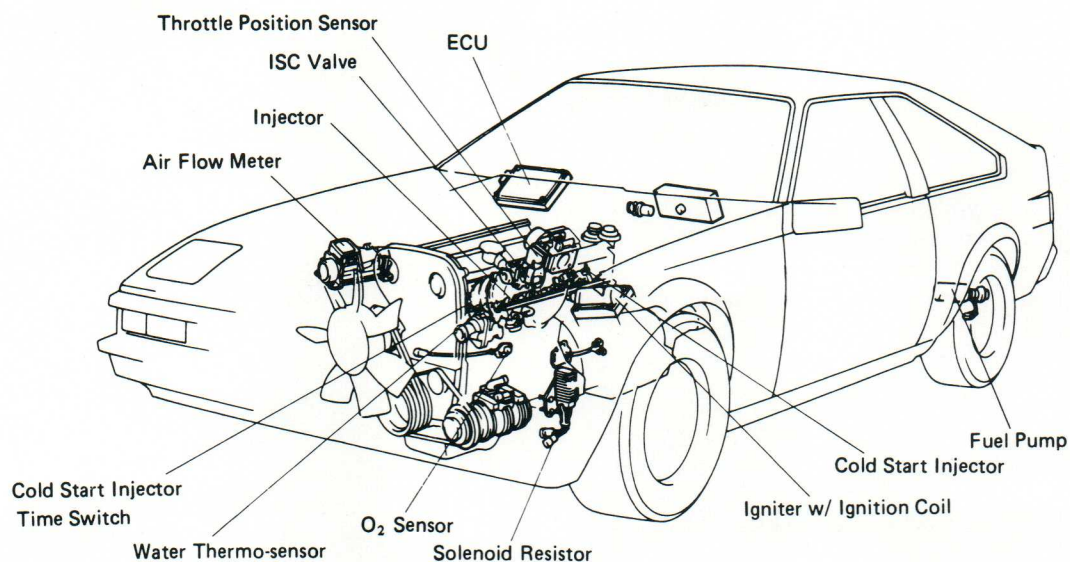


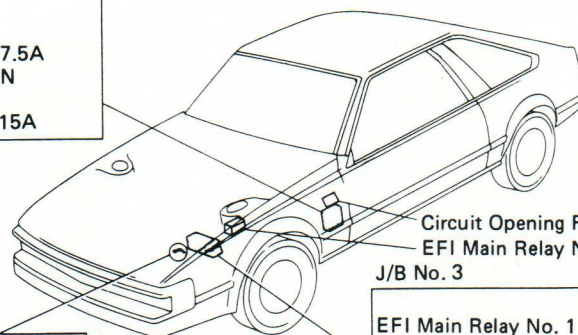
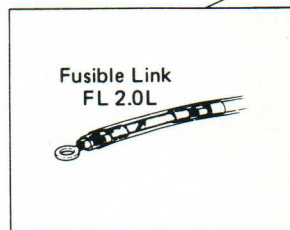
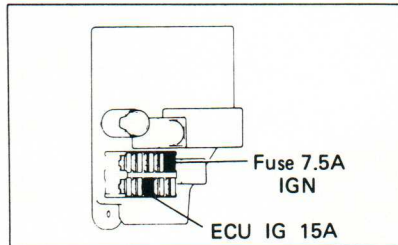
Figure 228-3



1983-84 Supra Six-cylinder 5M-GE Engine



J/B No. 2



J/B No. 3

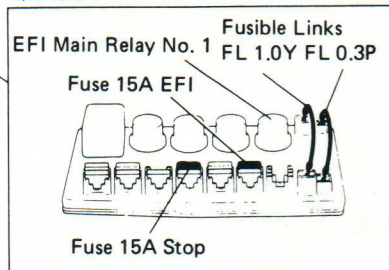


Figure 228-4



1985 Corolla 4A-GE Engine

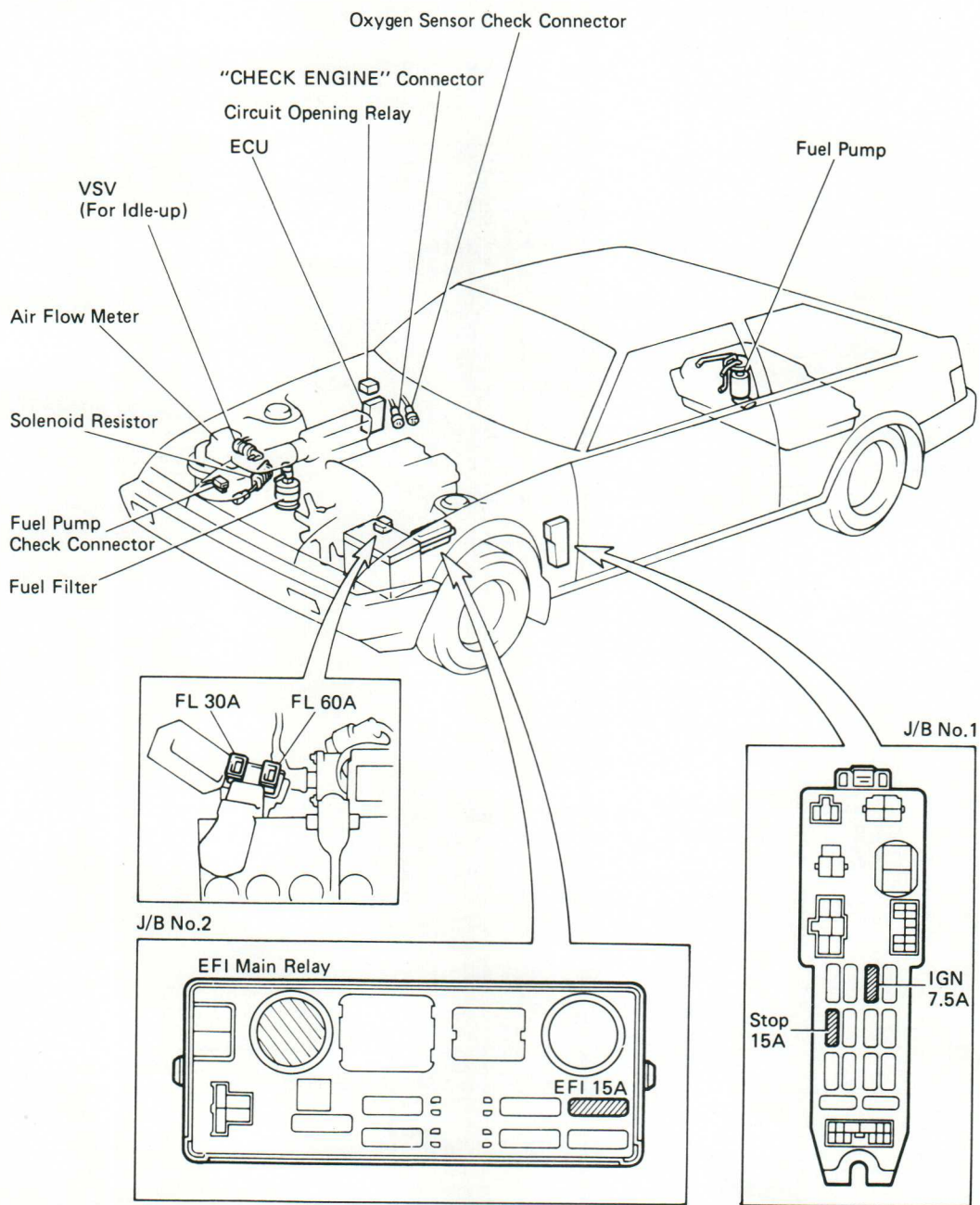


Figure 228-5



1985½-86 MR2 4A-GE Engine

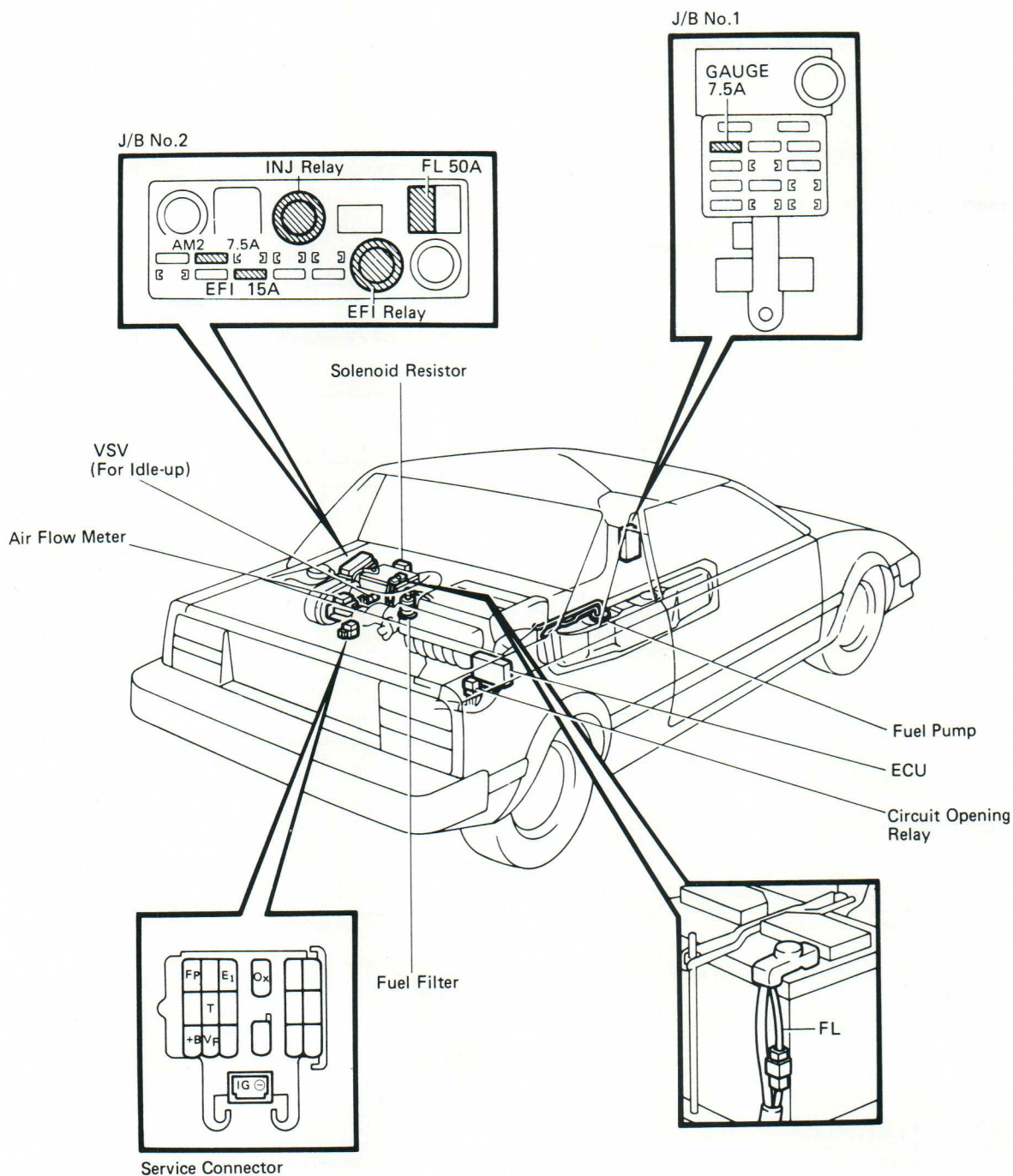


Figure 228-6



Article No. 229

DIAGNOSTIC CODE CHARTS

If a malfunction has been detected by the TCCS system, the Check Engine light is displayed. The technician may then obtain troubleshooting codes from the ECU memory. The meaning of these codes is illustrated by the following two charts for the models indicated.

A handy chart that shows how to obtain a diagnostic code appears on the inside back cover of this issue.

Note: While the TCCS system monitors various critical engine components, it is nonetheless limited in its diagnostic scope, and does not replace normal and systematic troubleshooting procedures.

For example, an oxygen sensor system code could well be caused by a too-lean or too-rich mixture, and not by a failure of the O2 sensor or its wiring. Always refer to the repair manual troubleshooting procedures when diagnosing an engine malfunction.

1983-87 Cressida, 1983-87 Supra, 1986-87 Celica GT-S, 1987 Camry and Celica 3S-FE

Code No.	Item	Check Engine Lamp On (O) Off (X)	Diagnosis	Trouble Area
—	Normal condition	X	—	—
11	ECU power supply	X	Power cut, however temporary, to ECU	○ Electrical system
12	RPM signal	○	No Ne or G signal to ECU while engine is cranked	○ Distributor circuit ○ Crank position, starter signal circuit ○ Distributor ○ ECU
13	RPM signal	○	No Ne signal to ECU within several seconds after engine reaches 1,000 rpm	○ Distributor circuit ○ Crank position, starter signal circuit ○ Distributor ○ ECU
14	Ignition signal	○	No signal from ignitor six times in succession	○ Igniter circuit ○ Igniter ○ Ignition coil ○ ECU
21	Oxygen sensor signal	○	Open or short in oxygen sensor signal	○ Oxygen sensor circuit ○ Oxygen sensor ○ ECU
22	Water thermo sensor signal	○	Open or short circuit in coolant temperature sensor signal	○ Water thermo sensor circuit ○ Water thermo sensor ○ ECU
23	Intake air thermo sensor signal	X	Intake air thermo signal is open or short-circuited	○ Intake air thermo sensor circuit ○ Intake air thermo sensor ○ ECU
31	Air flow meter signal	○	Open circuit in Vc when idle contacts are closed	○ Air flow meter circuit ○ Air flow meter ○ ECU
32	Air flow meter signal	○	Vc and Vs short-circuited	○ Air flow meter circuit ○ Air flow meter ○ ECU
41	Throttle position sensor signal	X	Simultaneous IDL and PSW (VTA)* signal to ECU	○ Throttle position sensor circuit ○ Throttle position sensor ○ ECU
42	Vehicle speed sensor signal	X	A/T: No signal over 5 seconds when vehicle is travelling under 1.7 km/h (1 mph), engine running and shift lever is in other than N or P range. M/T: No signal for over 5 seconds when vehicle is travelling under 1.7 km/h (1 mph), and engine running.	○ Speed sensor circuit ○ Speed sensor ○ Torque converter ○ ECU
43	Starter signal	X	STA signal was not received during cranking	○ Starter signal circuit ○ IG switch ○ ECU
51	Switch signal	X	Neutral start switch off or air conditioner switch on during diagnostic check	○ Air conditioning switch ○ Neutral start switch ○ ECU
*52	Knock sensor signal	○	Output signal is open or short-circuited	○ Knock sensor circuit ○ Knock sensor ○ ECU
*53	Knock control signal	○	Main CPU cannot react in 400 m.sec. or, main CPU is equal to KCS CPU output for 400 m.sec.	○ ECU

* New in 1985

Figure 229-1



**1985-86 Camry, 1985-86 Celica, 1985-87 Truck,
1985-87 Corolla GT-S, 1985-87 MR2, 1986-87 Van, 1987 FX16**

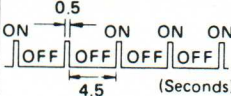
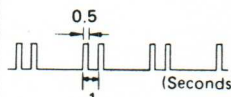










Code No.	Number of blinks "CHECK ENGINE"	Item	Diagnosis	"CHECK ENGINE" Warning Light
1	 (Seconds)	Normal condition	—	—
2	 (Seconds)	Air flow meter signal	<ul style="list-style-type: none"> • Open circuit in Vc, Vs, VB or E₂. • Short circuit in Vc. 	ON
3		Ignition signal	No signal from igniter four times in succession.	ON
4		Water temp. sensor signal	Open or short circuit in coolant temperature sensor signal.	ON
5		Oxygen sensor signal	Sufficient feed back condition but not changed Oxygen sensor signal.	ON
6		RPM signal	No Ne signal to ECU within cranking, or Ne value being over 1,000rpm in spite of no Ne signal to ECU.	ON
7		Throttle position sensor signal	Open or short circuit in throttle position sensor signal.	OFF
8		Intake air temp. sensor signal	Open or short circuit in intake air temperature sensor.	OFF
10		Starter signal	No STA signal to ECU when vehicle speed 0km/h and engine is running over 800rpm.	OFF
11		Switch signal	Idle switch OFF or neutral start switch OFF (A/T) during diagnosis check.	—
12		Knock control sensor signal	Knock control sensor signal has not reached judgement level in succession.	ON
13		Knock control CPU (ECU)	Knock CPU faulty.	ON

Figure 229-2

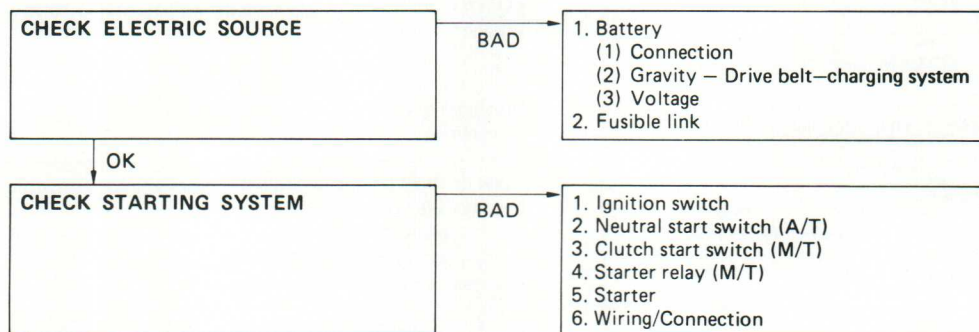


Article No. 230

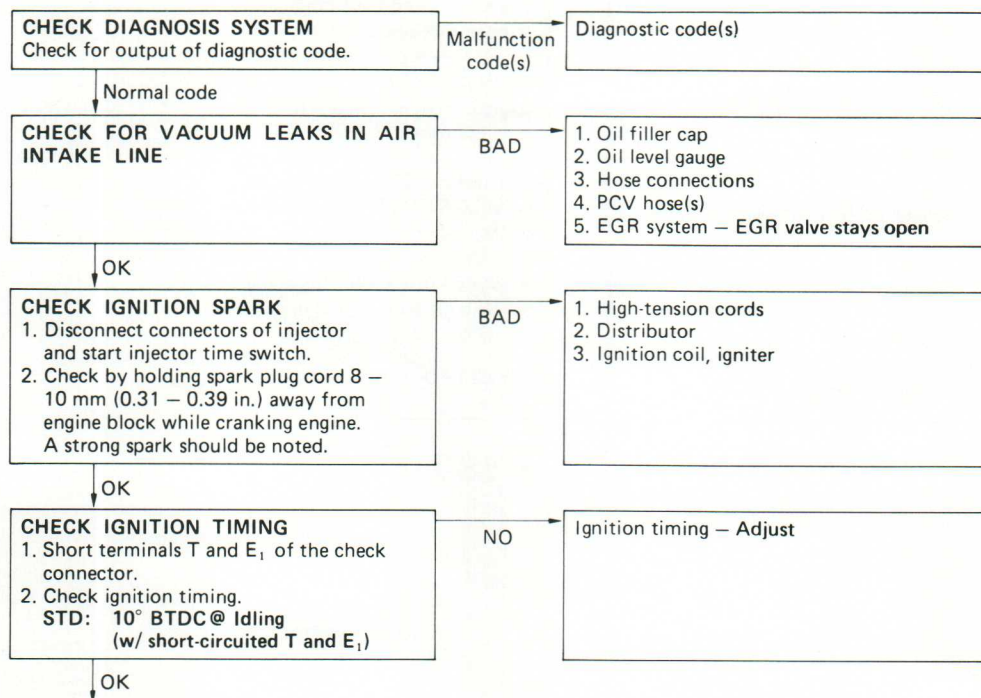
TROUBLESHOOTING TCCS

The following general troubleshooting procedures for the specified symptoms may not apply to all models. For specifics, consult the appropriate repair manual.

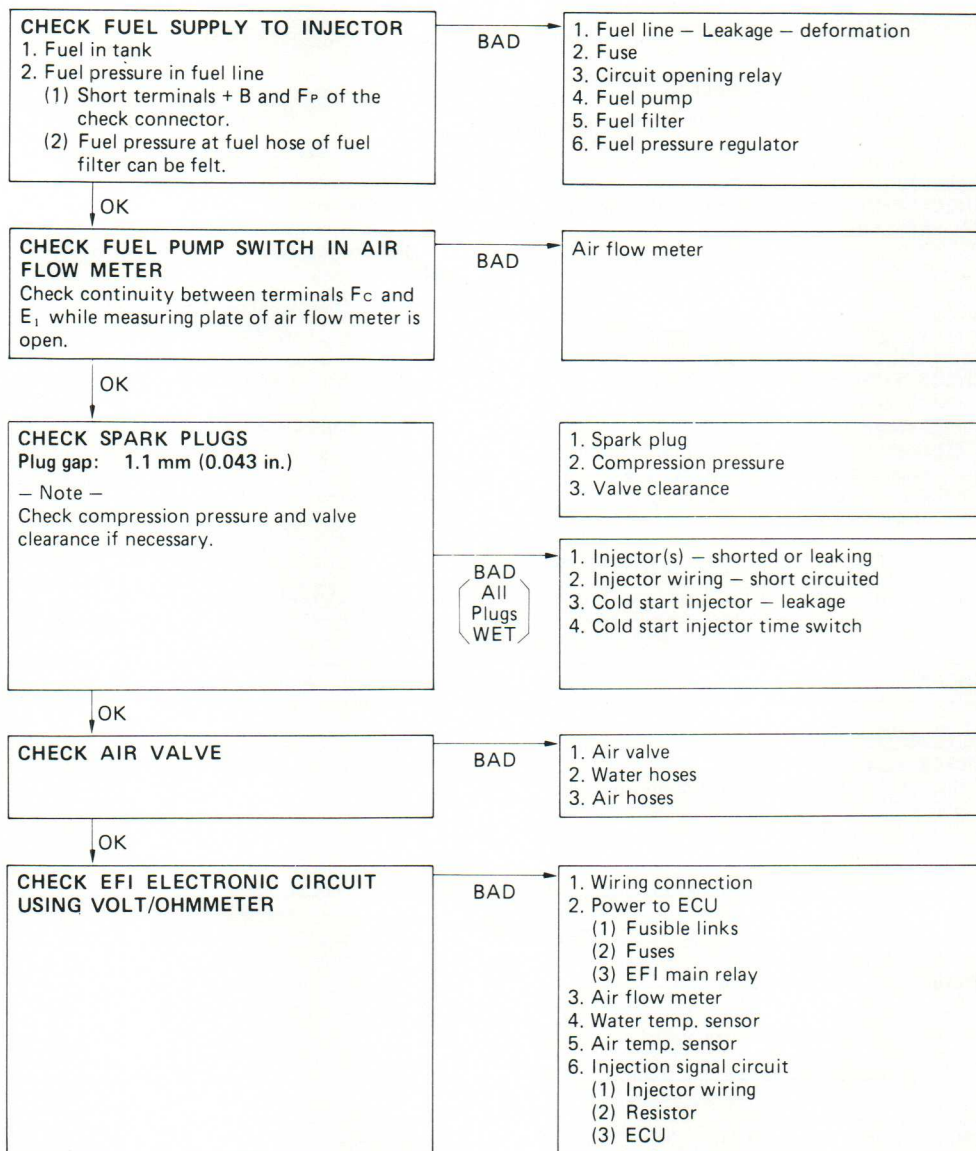
Symptom: Difficult to start or won't start (engine will not crank or cranks slowly).



Symptom: Difficult to start or will not start (engine cranks OK).

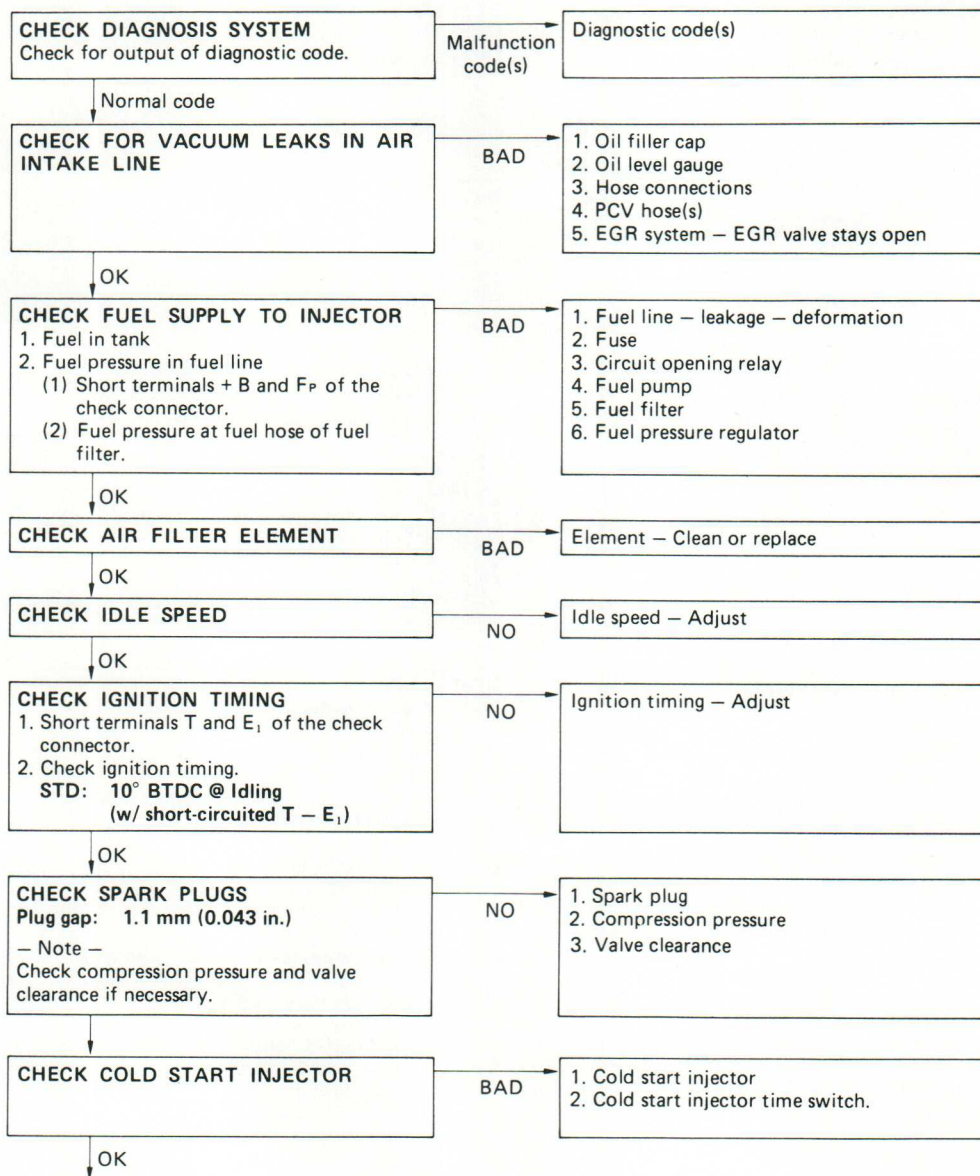


(Continued on page 25-13)

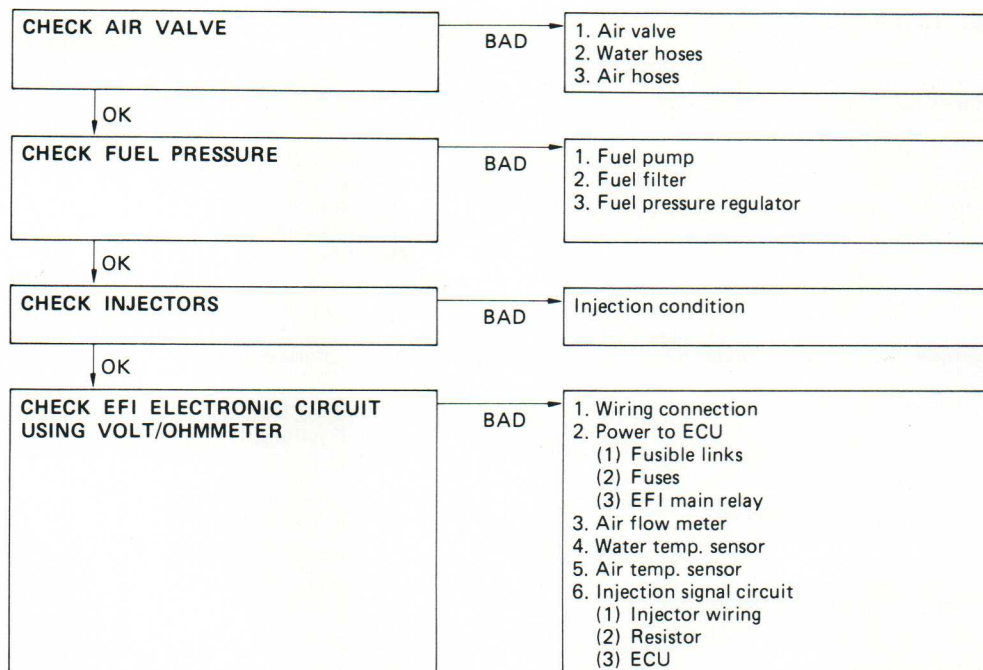




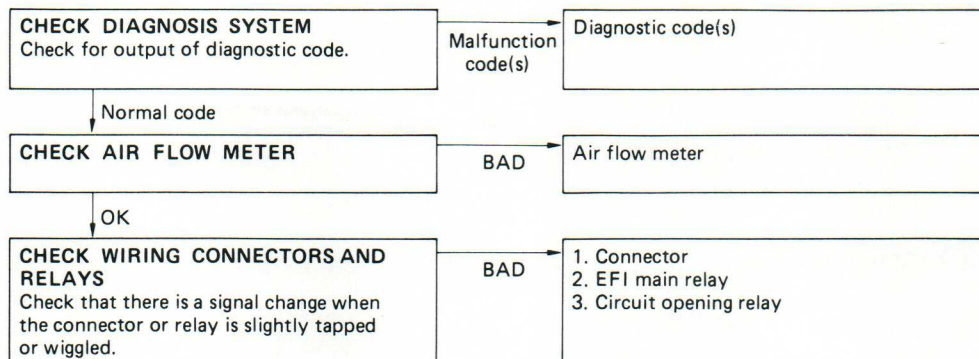
Symptom: Engine often stalls.



(Continued on page 25-15)

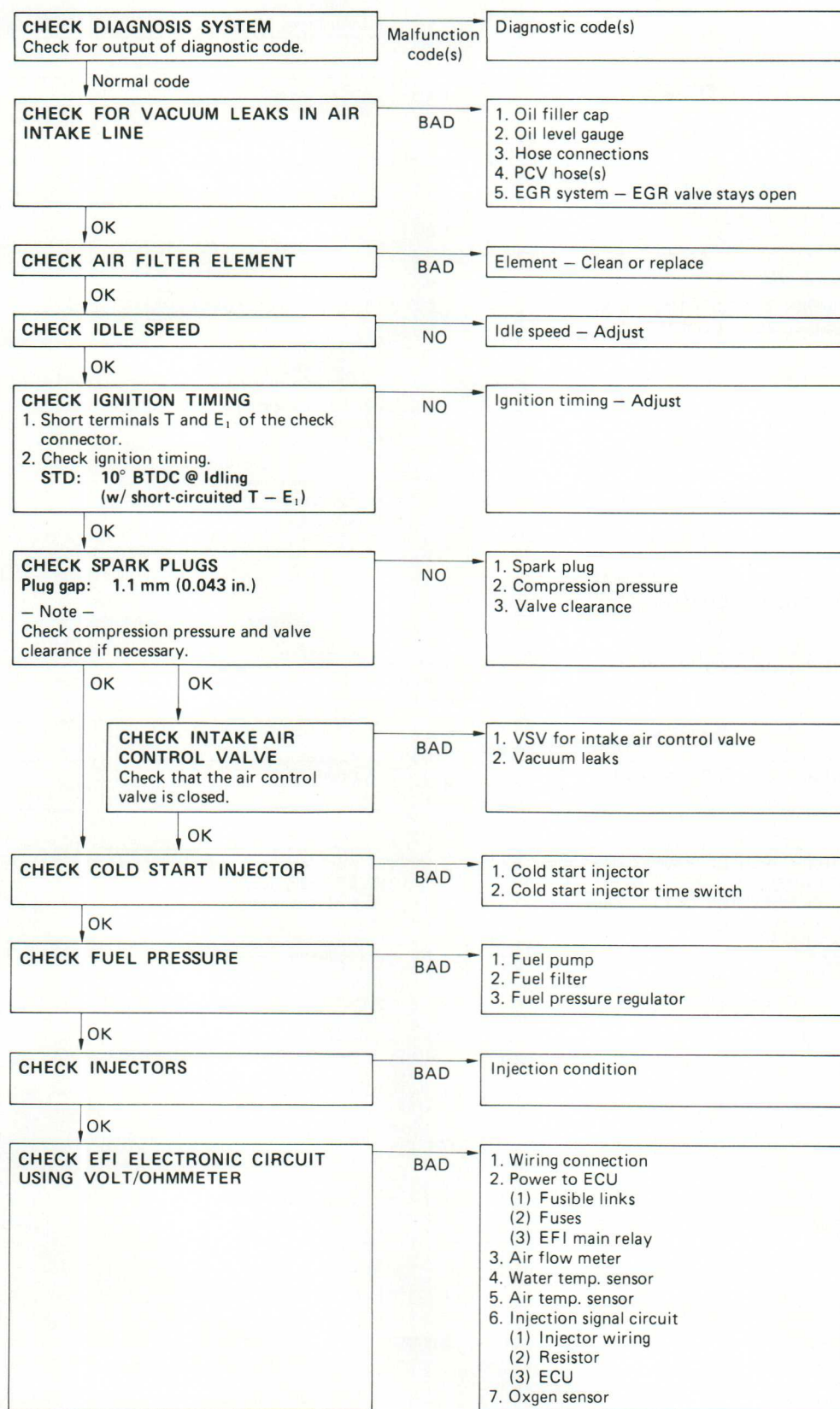


Symptom: Engine sometimes stalls.





Symptom: Rough idling and/or missing.





Article No. 231

4A-GE ENGINE TCCS

The TCCS on the 1985-87 Corolla GT-S and MR2 and 1987 FX-16 is a bit different from that used on the Cressida/Supra or the Celica/Truck, even though it controls many of the same systems.

The most unique feature of this system is the fuel injector firing order. It can get you into trouble if you forget that the injectors are energized in *pairs* in this engine, and that each pair is "fired" on every other crank revolution, as opposed to energizing all injectors simultaneously, as is the case with our other EFI systems.

The pairing of injector No. 1 with No. 2 and No. 3 with No. 4 allows more precise fuel metering at the high rpms this engine may be subjected to. (Redline is 7500 rpm.) If they all fired at once, you'd have to leave them on constantly to get that kind of rev limit.

Remember: With conventional EFI, if one injector shorted open, all the rest would go full open and the engine would flood and stall. Not on the 4A-GE, though. If one injector shorts, only two injectors will be full open and the engine can still run (although very badly).

Remember to consult or fully review the appropriate repair manual for specifics of this system.

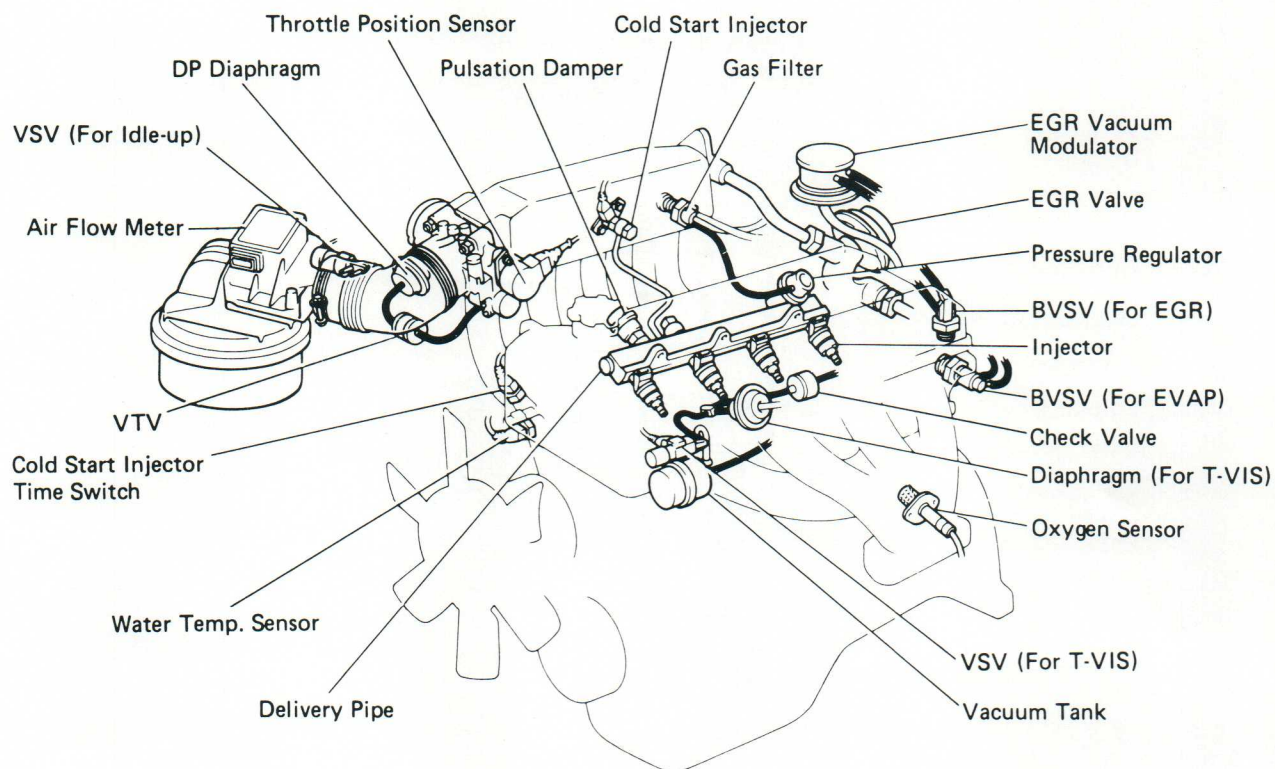


Figure 231-1



Article No. 232

CORRECTION TO LAST ISSUE (BULLETIN 24): A/C VAPOR CHARGE PROCEDURES

Figure 224-2 in the Summer 1987 issue of Toyota Service News (Bulletin 24, page 24-17) included an incorrect illustration of air conditioner **vapor charging** procedures. This incorrect information has the potential to cause serious personal injury by overpressurizing the refrigerant container, causing it to explode.

The correct **vapor charge** procedure is illustrated below (Figure 224-2).

A label with this correct illustration, which should be placed on the right side of page 24-17 over the incorrect one, is available from the dealer who supplied you the copy of Toyota Service News Bulletin 24, or from Toyota Motor Sales. All inquiries to Toyota Motor Sales should be sent to:

Toyota Motor Sales, U.S.A., Inc.
Attn: A107 Technical Research Dept.
P.O. Box 2991
Torrance, CA 90509

Please include the mailing address and the number of copies required.

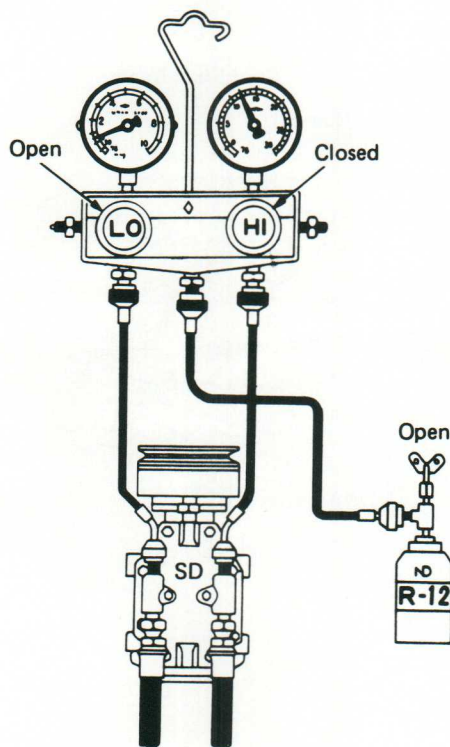


Figure 224-2



Article No. 233

HIGH-STRENGTH STEEL (HSS)

High-Strength Steel (HSS) is handled the same way as mild steel, but the following precautions should be observed:

- **Panel Hammering.** Because HSS is thinner than mild steel, care should be taken to avoid stretching during hammering operations.
- **Removing Spot Welds.** Because HSS is tougher than mild steel, a regular drill can be damaged more easily. An HSS Spot Cutter is recommended. Also, use a high-torque drill at low speed, and supply grinding oil to the drill during use.
- **Panel Welding.** Panel welding procedures for HSS are exactly the same as for mild steel. Plug welding should be done with a MIG (metal inert gas) welder. Do not gas weld or braze panels at areas other than specified in the collision repair manual.
- **Panel Repair.** Use of an oxy-acetylene torch is **not** recommended during the repair of some types of HSS.

High-strength sheet metal (high-tension steel) has a higher tensile strength than the mild steel ordinarily used in auto bodies (Figure 233-1). It has high tensile strength, high yield point and high yield ratio (Yield point/tensile strength).

If high-strength steel is used, the panel can be thinner, the same degree of strength can be obtained and body weight can be reduced.

High-strength sheet metal is divided into four types, according to the strengthening process used:

- **Rephosphorized steel** is produced by adding phosphorus to mild steel to upgrade its strength level. Rephosphorized steel, which has working characteristics similar to those of mild steel, was developed in recent years to provide better tensile strength to the exterior panels of auto bodies.
- **Si-Mn solid solution hardened steel** contains increased amounts of silicon, manganese and carbon to give it a higher tensile strength. It has been used for suspension-related components, frames, etc.
- **Precipitation-hardened steel** is strengthened by the formation of columbium (niobium) carbonitride precipitation. It was developed in the early 1970s as a high tensile strength steel with excellent welding and stamping characteristics. It is used mainly for door side guards, bumper reinforcements, etc.
- **Dual-phase steel** is made by quenching the steel on a continuous annealing line or in a hot strip mill. This steel has a two-phase microstructure (quenched martensitic structure and ferritic structure). Dual-phase steel has good formability for HSS with more than 55 kgf/mm² (78,000 psi) of tensile strength and is often used for door side guards and bumper reinforcements.

High-Strength Sheet Metal Characteristics.

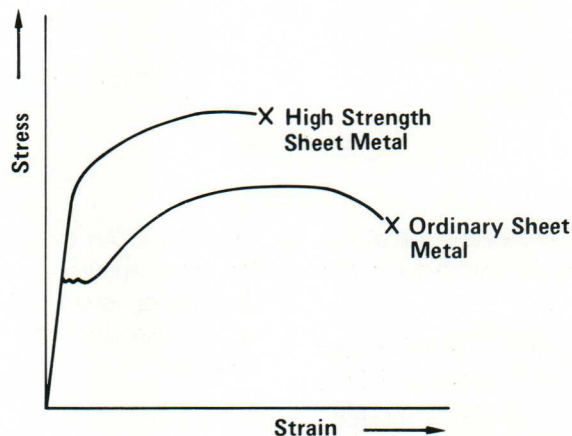


Figure 233-1



Figure 233-2 shows some of the areas that use high-strength steel.

Common Locations of HSS

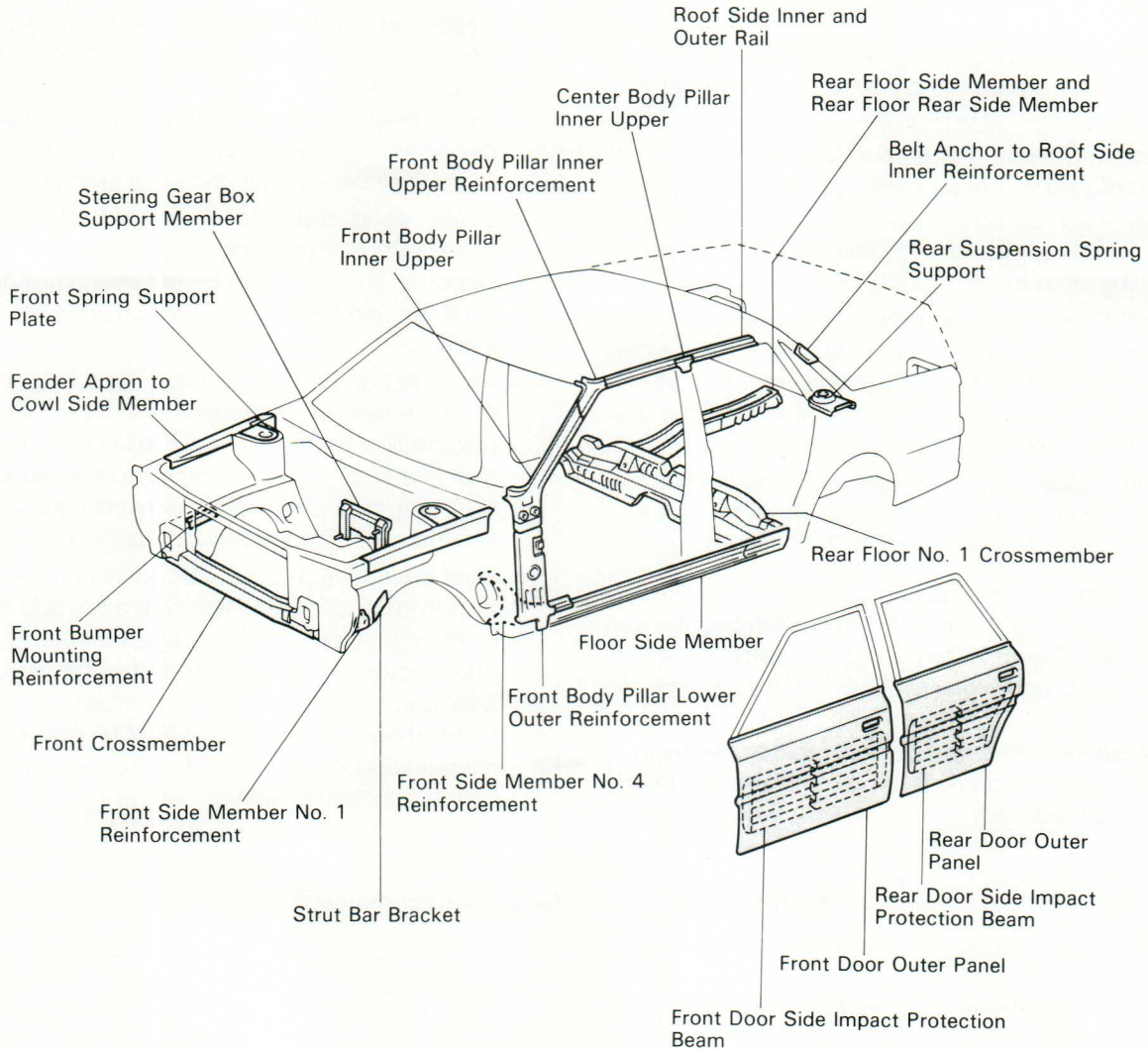


Figure 233-2

Note: Use of HSS varies by model and year applications. Refer to the appropriate collision repair manual for correct locations.

Generally, solid solution hardened steel is used for door and hood outer panels, rocker inner panels and front apron upper members. Bumper reinforcements and door impact beams are made of precipitation-hardened steel or dual-phase steel. It is not necessary to distinguish solid solution hardened steel from ordinary steels for repair purposes.

Important: An oxy-acetylene torch should not be used for repair purposes to heat precipitation-hardened or dual-phase steel, since the quality and strength will deteriorate and the brittleness of the material will increase.

OBTAINING A TCCS DIAGNOSTIC CODE

The Electronic Control Unit (ECU) of the TCCS has a built in self diagnosis system which constantly monitors the various TCCS sensors, and judges whether there is a problem with the sensor, or its circuit.

When a malfunction is detected, the ECU stores a failure code in memory, and lights a "Check Engine" light on the instrument panel.

instrument panel.

The "Check Engine" light will stay on as long as the malfunction exists. If the condition is intermittent, the light will go out once the problem has been corrected, however, the failure code will be retained in the ECU memory until the correct fuse is pulled to clear memory.

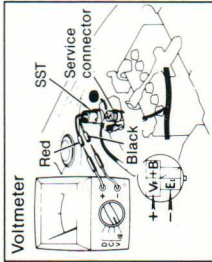
Initial Check Conditions:

- Battery voltage 11 volts or more.
- Throttle valve fully closed.
- Transmission in P or N.
- Air conditioner off.
- Engine at normal operating temperature.
- Ignition switch to "ON".

1983-84 Cressida and Supra (Voltmeter)

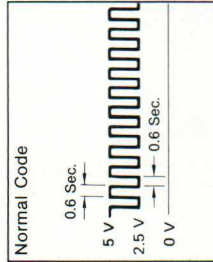


Short terminals T and E1 of the round Check Engine Connector.



Using SST Harness (09842-14010), install an analog voltmeter to the service connector.

Read the diagnostic code as indicated by the needle fluctuating between 0V-2.5V-5.0V.

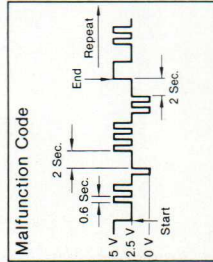


Normal Code:

- Voltmeter will fluctuate between 5-2.5V every 0.6 sec.

Malfunction Code:

- 5V indication for 2 sec., followed by a 2.5V indication for another 2 sec.
- First group of fluctuations, between 2.5-5.0V, equals the first digit of two digit number.
- Second group of fluctuations, between 2.5-0V, equals the second digit of the code.

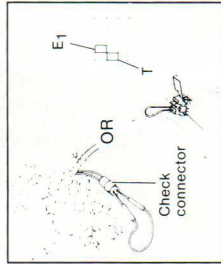


Malfunction Code

- If more than one malfunction code is present in memory, the one with the lower number will be displayed first.

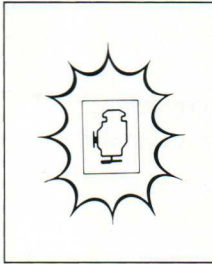
Clearing Code:

- Remove "STOP" fuse for 30 sec. Ignition switch must be off, or battery disconnected.

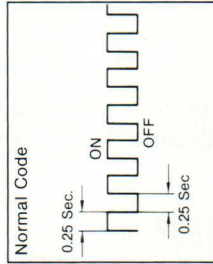


1985-87 Cressida, Supra, Camry, Celica, MR2, Corolla, 4-Runner, Truck and Van models equipped with TCCS. (Flashing Engine Light)

Short terminals T and E1 of the round/square Check Engine Connector, depending on model.



Read the diagnostic code by interpreting the flashes of the "Check Engine" light on the instrument panel.

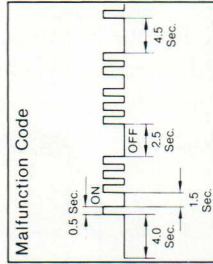


Normal Code:

- Light blinks every 0.25 sec.

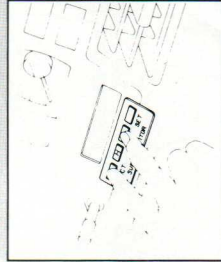
Malfunction Code:

- Light will blink every 0.5 sec.
- First group of flashes equals the first digit of two digit code.
- After a 1.5 sec. pause, the second number of blinks will equal the second number of two digit code.



Malfunction Code

- Remove applicable fuse for 30 sec. Ignition switch must be off, or battery disconnected.
- AE, RA, MA — Remove "STOP" fuse.
- RN, YR, ST, SV, MX — "EFI" fuse.
- MR2 — "AM2" fuse.



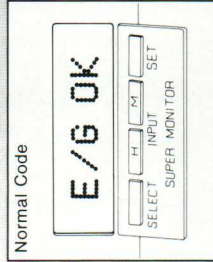
1985-87 Cressida, Supra, Camry, Celica, MR2, Corolla, 4-Runner, Truck and Van models equipped with TCCS. (Super Monitor Display)

Some Cressidas and Supras are equipped with a Super Monitor Display on the instrument panel, which will project a number code on its screen when the diagnostic system is accessed.

Simultaneously push and hold in the "SELECT" and "INPUT M" keys for at least 3 sec.

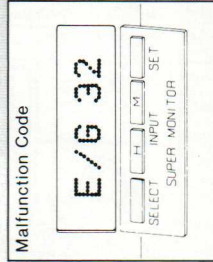


After a short pause, hold in "SET" key for at least 3 sec.



Normal Code

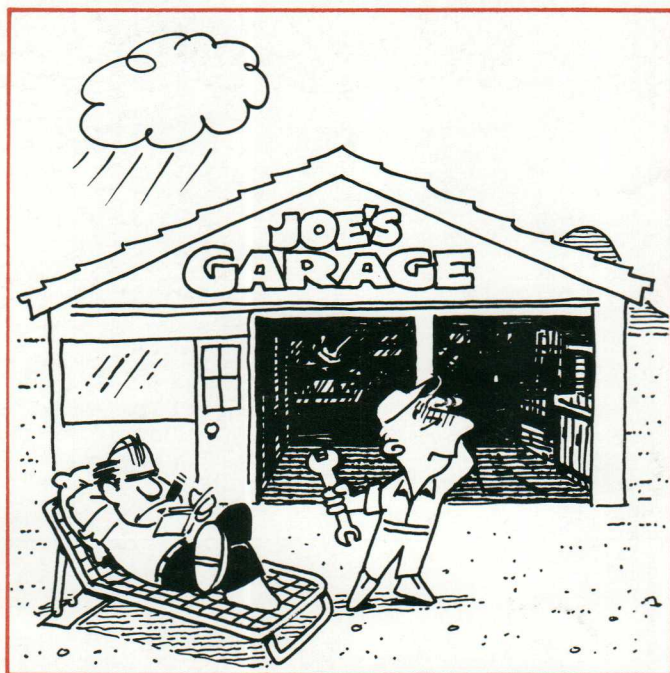
- E/G (engine) OK will be displayed.



Malfunction Code

- If a malfunction exists, the code number for it will be displayed.
- If more than one malfunction code exists, the lower number will be displayed first.

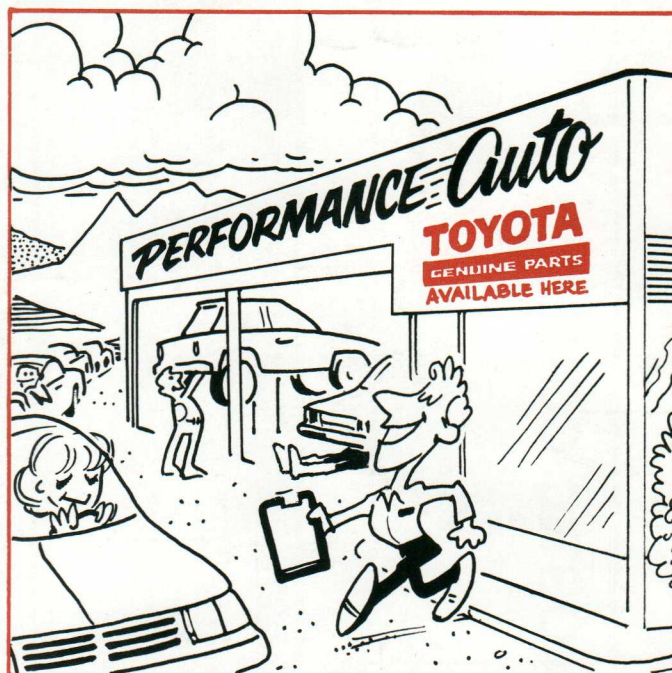
Traffic Sign.



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.