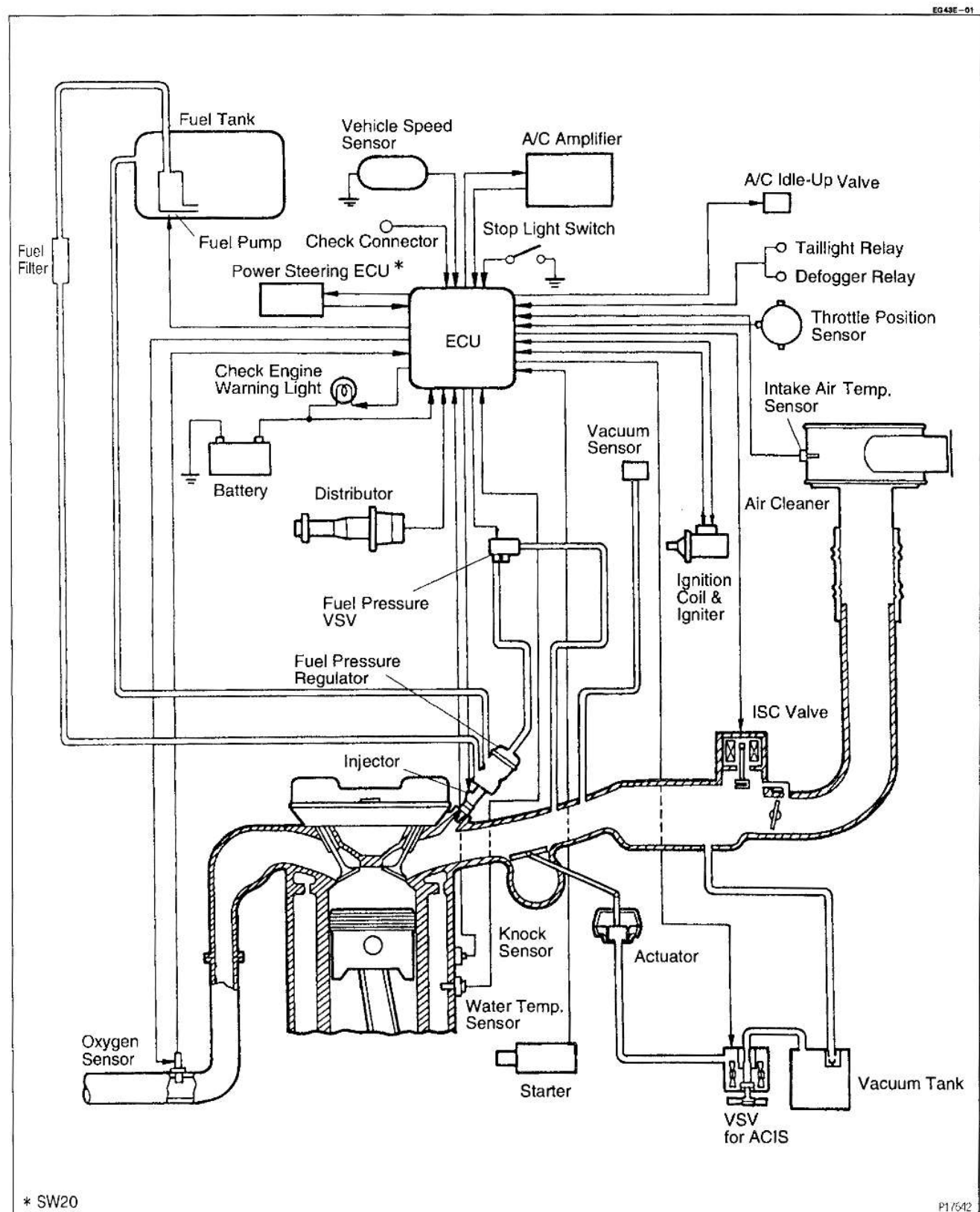


EFI SYSTEM

DESCRIPTION



EG-164**ENGINE — EFI SYSTEM**

The EFI system is composed of three basic sub—systems: Fuel, Air Induction and Electronic Control Systems.

FUEL SYSTEM

Fuel is supplied under constant pressure to the EFI injectors by an electric fuel pump. The injectors inject a metered quantity of fuel into the intake manifold in accordance with signals from the ECU (Engine Control Unit).

EG**AIR INDUCTION SYSTEM**

The air induction system provides sufficient air for engine operation.

ELECTRONIC CONTROL SYSTEM

The 3S—GE engine is equipped with a TOYOTA Computer Controlled System (TCCS) which centrally controls the EFI, ESA, ISC, Diagnosis systems etc. by means of an ECU—formerly EFI computer employing a microcomputer.

The ECU controls the following functions:

1. **Electronic Fuel Injection (EFI)**

The ECU receives signals from various sensors indicating changing engine operating conditions such as:

- Intake manifold pressure
- Intake air temperature
- Engine coolant temperature
- Engine speed
- Throttle valve opening angle
- Exhaust oxygen content etc.

The signals are utilized by the ECU to determine the injection duration necessary for an optimum air—fuel ratio.

2. **Electronic Spark Advance (ESA)**

The ECU is programmed with data for optimum ignition timing under all operating conditions. Using data provided by sensors which monitor various engine functions (rpm, coolant temperature, etc.), the microcomputer (ECU) triggers the spark at precisely the right instant.

3. **Idle Speed Control (ISC)**

The ECU is programmed with target idling speed values to respond to different engine conditions (coolant temperature, air conditioning ON/OFF, etc.). Sensors transmit signals to the ECU which control the flow of air through the throttle valve bypass and adjust idle speed to the target value.

4. **Diagnosis**

The ECU detects any malfunctions and abnormalities in the sensor network and lights a check engine warning light in the combination meter. At the same time, trouble is identified and a diagnostic code is recorded by the ECU. The diagnostic code can be read by the number of blinks of the check engine warning light when terminals TE1 and E1 of the check connector are connected. The diagnostic code are referred to in a later page. (See page EG—182)

5. **Self—Correction Function**

If any sensor malfunctions, an average value recorded in the back—up circuit is substituted to make driving possible. If danger is predicted, the engine is stopped and the check engine warning light will light up.

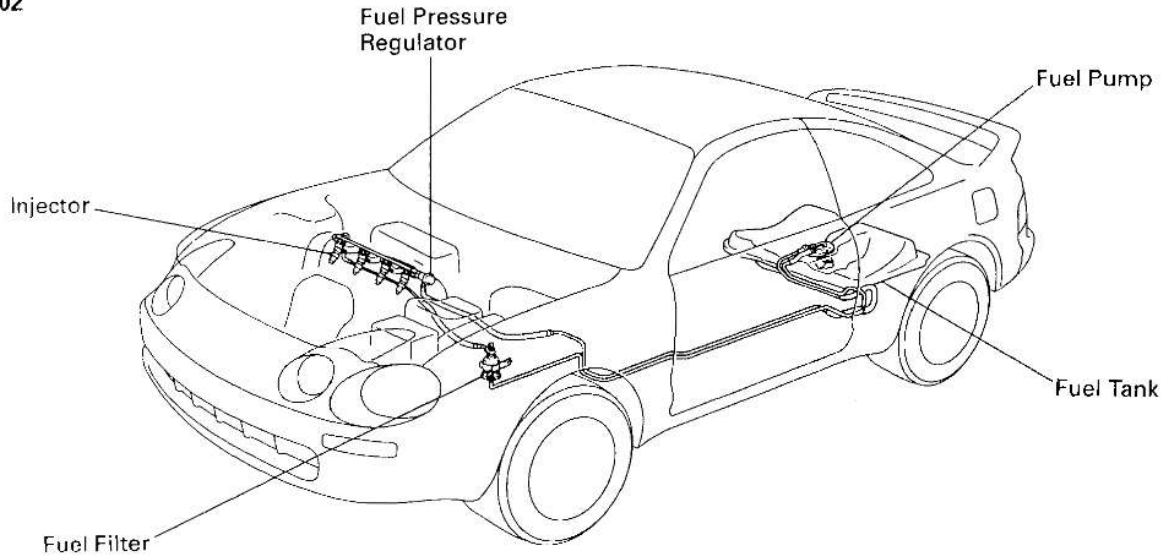
6. **Fail—Safe Function**

In the event of the sensor malfunctioning, a back—up circuit will take over to provide minimal driveability, and the check engine warning light will illuminate.

OPERATION FUEL SYSTEM

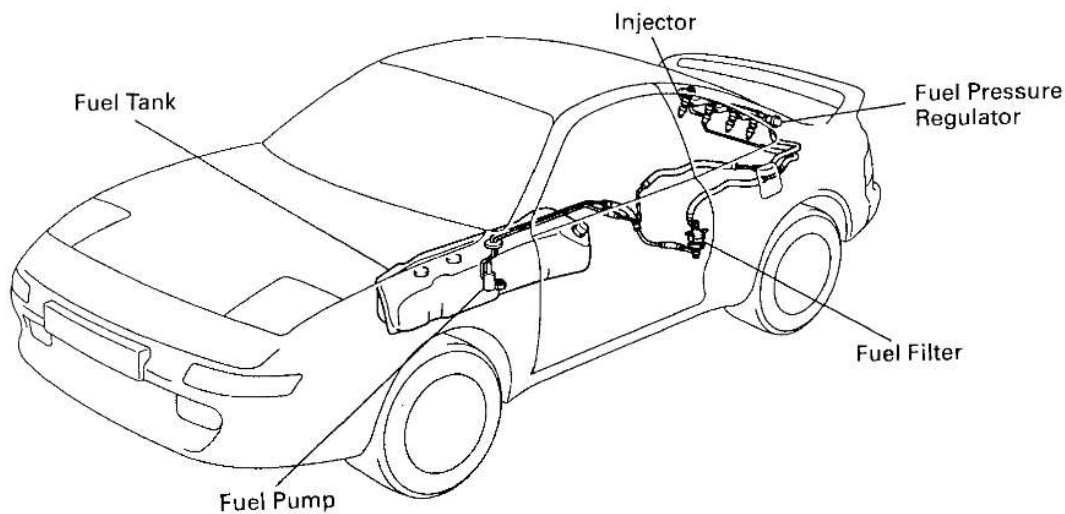
EG48F-01

ST202



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SW20

P17771
P17772

Z13025

Fuel pumped up by the fuel pump, flows through the fuel filter and is distributed to each injector at a set pressure maintained by the fuel pressure regulator.

The fuel pressure regulator adjusts the pressure of the fuel from the fuel line (high pressure side) to a pressure 284 kPa (2.9 kgf/cm², 41 psi) higher than the pressure inside the intake manifold, and excess fuel is returned to the fuel tank through the return pipe.

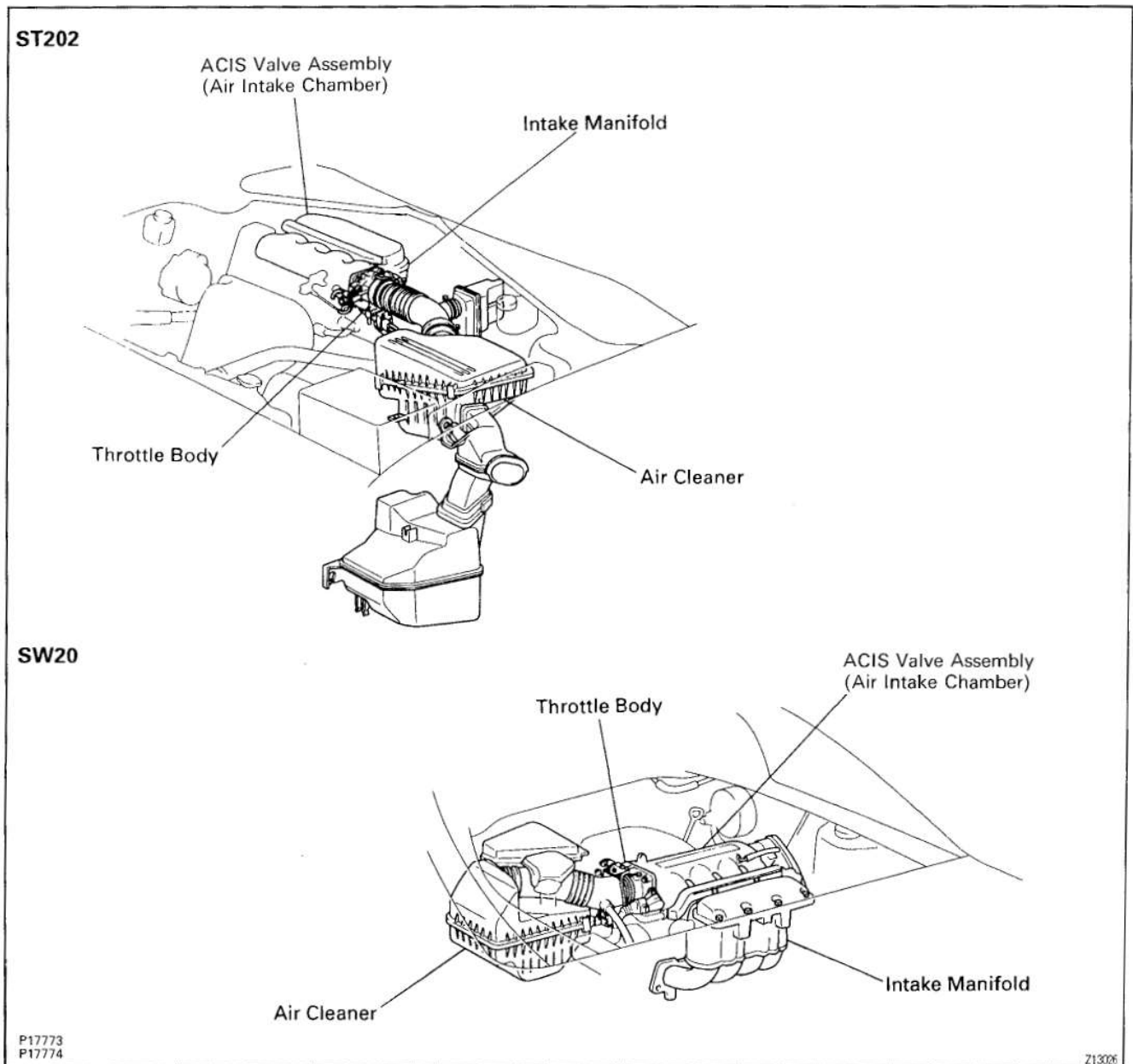
Fuel is injected into the intake manifold according to signals from the ECU.

EG-166

ENGINE — EFI SYSTEM

EG480-01

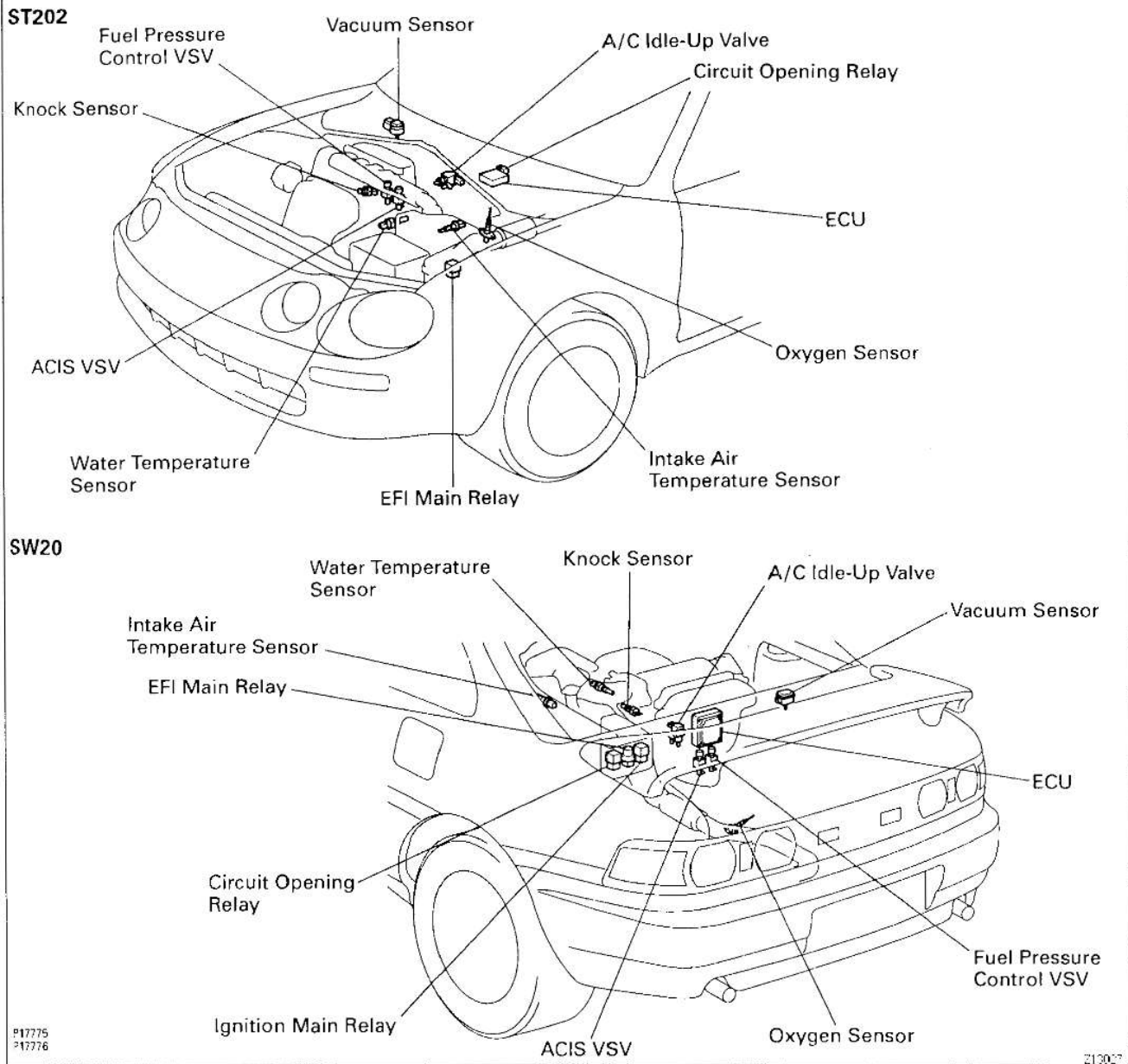
AIR INDUCTION SYSTEM



Air is filtered through the air cleaner and the amount flowing to the air intake chamber is determined according to the throttle valve opening in the throttle body and the engine speed. Intake air controlled by the throttle valve opening is distributed from the air intake chamber to the manifold of each cylinder and is drawn into the combination chamber.

At low temperatures the ISC valve opens and air flows through the ISC valve and the throttle body, into the air intake chamber. During engine warming up, even if the throttle valve is completely closed, air flows to the air intake chamber, thereby increasing the idle speed (first idle operation). The air intake chamber prevents pulsation of the intake air. It also prevents intake air interference in each cylinder.

ELECTRONIC CONTROL SYSTEM



The control system consists of sensors which detect various engine conditions, and an ECU which determines the injection volume (timing) based on the signals from the sensors.

The various sensors detect the intake air pressure, engine speed, oxygen density in the exhaust gas, engine coolant temperature, intake air temperature and atmospheric pressure etc. and convert the information into an electrical signal which is sent to the ECU. Based on these signals, the ECU calculates the optimum ignition timing for the current conditions and operates the injectors. The ECU not only controls the fuel injection timing, but also the self-diagnostic function which records the occurrence of a malfunction, ignition timing control and idle speed control.

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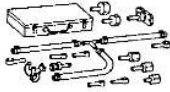
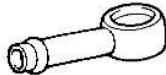
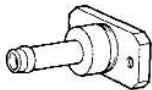
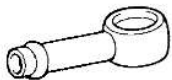
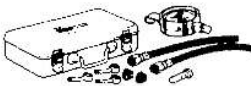
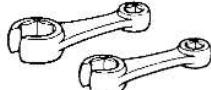
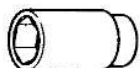
ENGINE — EFI SYSTEM

PREPARATION

SST (SPECIAL SERVICE TOOLS)

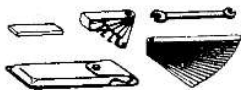
EG0CF-0L

EG

	09268-41045 Injection Measuring Tool Set	
	(09268-41080) No.6 Union	
	(09268-41090) No.7 Union	
	(90405-09015) No.1 Union	
	09268-45012 EFI Fuel Pressure Gauge	
	09631-22020 Power Steering Hose Nut 14 x 17 mm Wrench Set	Fuel line flare nut
	09816-30010 Oil Pressure Switch Socket	Knock sensor
	09842-30070 Wiring "F" EFI Inspection	Injector
	09843-18020 Diagnosis Check Wire	

RECOMMENDED TOOLS

EG0CG-01

	09082-00050 TOYOTA Electrical Tester Set	
	09200-00010 Engine Adjust Kit	
	09258-00030 Hose Plug Set	Plug for vacuum hose, fuel hose etc.

ENGINE — EFI SYSTEM

EG-169

EQUIPMENT

580CH-00

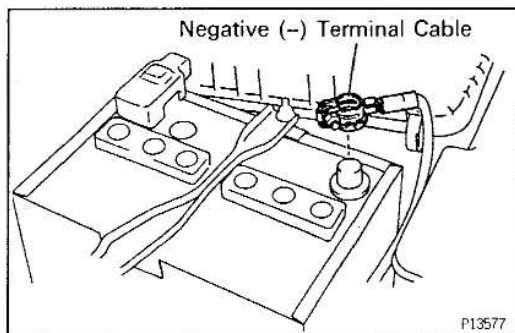
Carburetor cleaner	Throttle body
Graduated cylinder	Injector
Soft brush	Throttle body
Sound scope	Injector
Tachometer	
Torque wrench	
Vacuum gauge	
Thermometer	

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ENGINE — EFI SYSTEM

EG



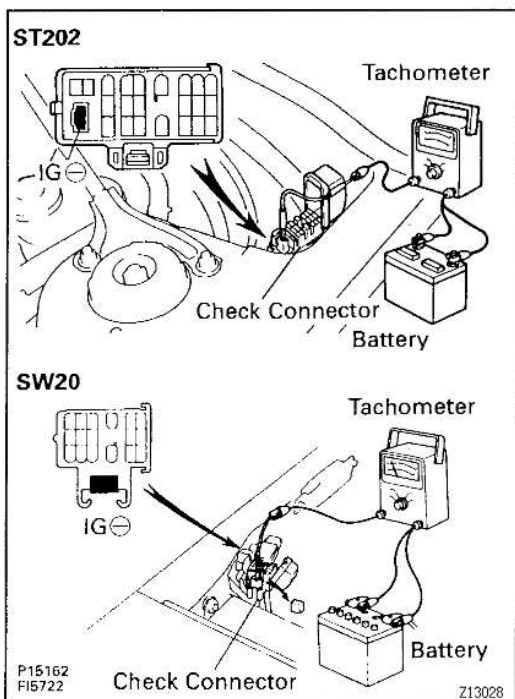
PRECAUTION

1. Before working on the fuel system, disconnect the negative (–) terminal cable from the battery.

HINT: Any diagnostic code retained by the computer will be erased when the negative (–) terminal cable is disconnected.

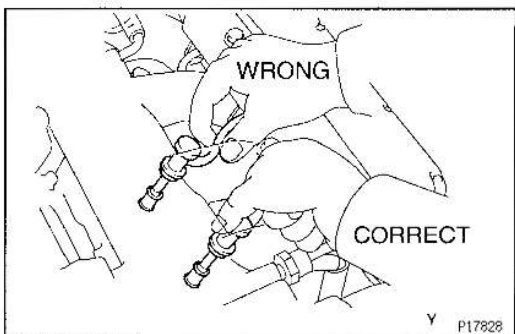
Therefore, if necessary, read the diagnosis before disconnecting the negative (–) terminal cable from the battery.

2. Do not smoke or work near an open flame when working on the fuel system.
3. Keep gasoline away from rubber or leather parts.



MAINTENANCE PRECAUTIONS

1. CHECK CORRECT ENGINE TUNE—UP
(See page EG—12)
2. PRECAUTION WHEN CONNECTING GAUGE
 - (a) Use battery as the power source for the timing light, tachometer, etc.
 - (b) Connect the tester probe of a tachometer to the terminal IG– of the check connector.



3. IN EVENT OF ENGINE MISFIRE, FOLLOWING PRECAUTIONS SHOULD BE TAKEN

- (a) Check proper connection of battery terminals, etc.
- (b) Handle high—tension cords carefully.
- (c) After repair work, check that the ignition coil terminals and all other ignition system lines are reconnected securely.
- (d) When cleaning the engine compartment, be especially careful to protect the electrical system from water.

4. PRECAUTIONS WHEN HANDLING OXYGEN SENSOR

- (a) Do not allow the oxygen sensor to drop or hit against an object.
- (b) Do not allow the sensor to come into contact with water.

EG

IF VEHICLE IS EQUIPPED WITH MOBILE RADIO SYSTEM (HAM, CB, ETC.)

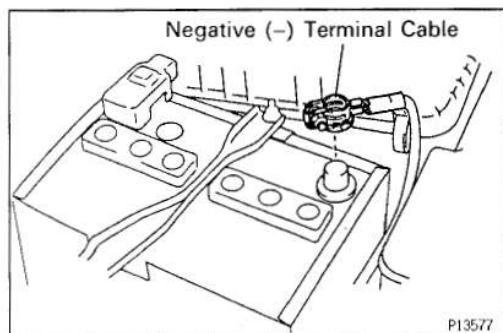
EG438-01

If the vehicle is equipped with a mobile communication system, refer to the precaution in the IN section.

EG438-01

AIR INDUCTION SYSTEM

1. Separation of the engine oil dipstick, oil filler cap, PCV hose, etc. may cause the engine to run out of tune.
2. Disconnection, looseness or cracks in the parts of the air induction system between the throttle body and cylinder head will cause air suction and cause the engine to run out of tune.



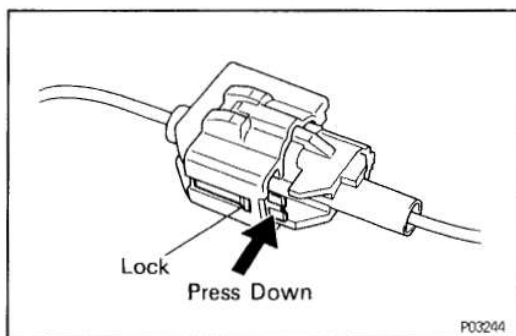
ELECTRONIC CONTROL SYSTEM

EG43J-01

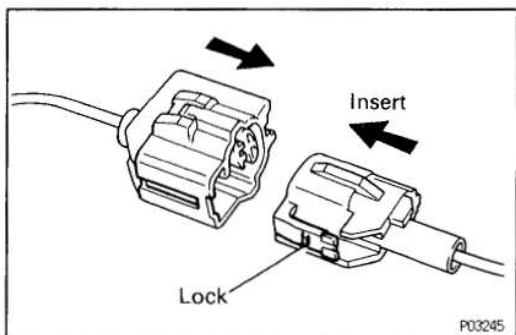
1. Before removing EFI wiring connectors, terminals, etc., first disconnect the power by either turning the ignition switch OFF or disconnecting the negative (–) terminal cable from the battery.
HINT: Always check the diagnostic code before disconnecting the negative (–) terminal cable from the battery.
2. When installing the battery, be especially careful not to incorrectly connect the positive (+) and negative (–) cables.
3. Do not permit parts to receive a severe impact during removal or installation. Handle all EFI parts carefully, especially the ECU.
4. Do not be careless during troubleshooting as there are numerous transistor circuits and even slight terminal contact can cause further troubles.
5. Do not open the ECU cover.

EG-172**ENGINE — EFI SYSTEM**

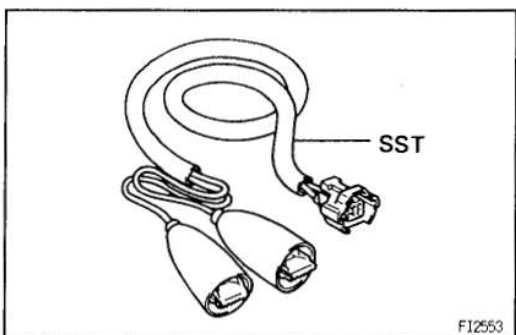
6. When inspecting during rainy weather, take care to prevent entry of water. Also, when washing the engine compartment, prevent water from getting on the EFI parts and wiring connectors.
7. Parts should be replaced as an assembly.

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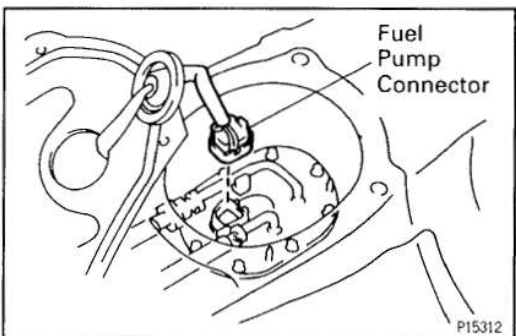
8. Care is required when pulling out and inserting wiring connectors.
- (a) Release the lock and pull out the connector, pulling on the connectors.



- (b) Fully insert the connector and check that it is locked.



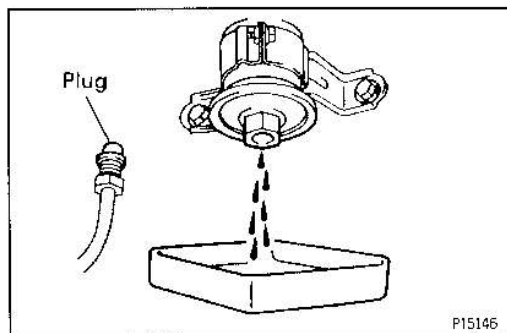
9. Use SST for inspection or test of the injector or its wiring connector.
SST 09842-30070

**FUEL SYSTEM**

EG43K-01

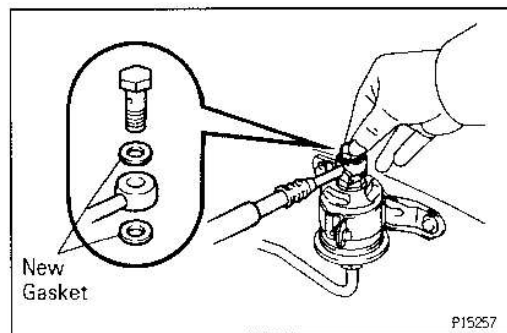
1. When disconnecting the high pressure fuel line, a large amount of gasoline will spill out, so observe the following procedures:
 - (a) Disconnect the fuel pump connector.
 - (b) Start the engine. After the engine has stopped on its own, turn the ignition switch OFF.

ENGINE — EFI SYSTEM



- (c) Put a container under the connection.
- (d) Slowly loosen the connection.
- (e) Disconnect the connection.
- (f) Plug the connection with a rubber plug.
- (g) Reconnect the fuel pump connector.

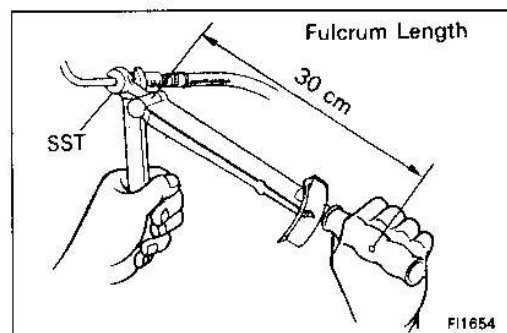
EG



2. When connecting the flare nut or union bolt on the high pressure pipe union, observe the following procedures:

Union Bolt Type:

- (a) Always use a new gasket.
 - (b) Tighten the union bolt by hand.
 - (c) Tighten the union bolt to the specified torque.
- Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)**



Flare Nut Type:

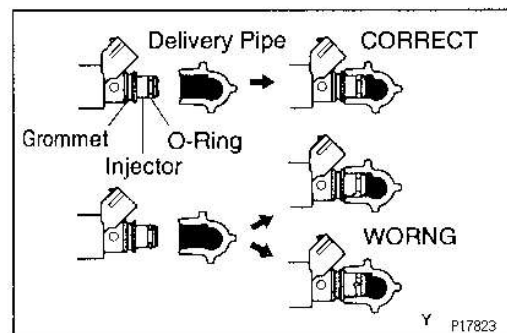
- (a) Apply a light coat of engine oil to the flare nut, and tighten the flare nut by hand.
 - (b) Using SST, tighten the flare nut to specified torque.
- SST 09631 – 22020**

Torque:

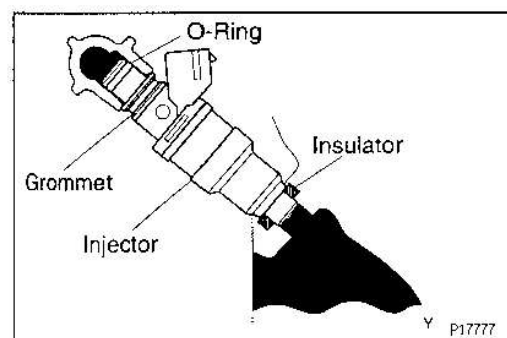
Fuel pump side: 24 N·m (240 kgf·cm, 18 ft·lbf)

Others: 30 N·m (310 kgf·cm, 22 ft·lbf)

HINT: Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).



3. Observe the following precautions when removing and installing the injectors.
- (a) Never reuse the O-ring.
- (b) When placing a new O-ring on the injector, take care not to damage it in any way.
- (c) Coat a new O-ring with spindle oil or gasoline before installing—never use engine, gear or brake oils.

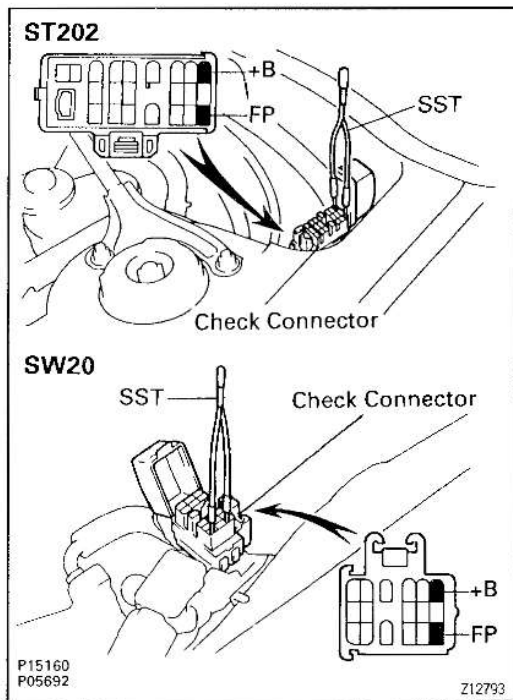


4. Install the injector to the delivery pipe and intake manifold as shown in the illustration.

EG-174

ENGINE — EFI SYSTEM

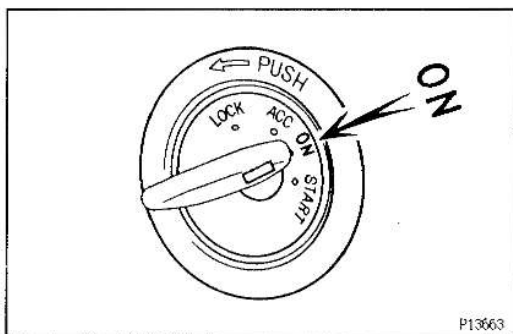
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5. Check that there are no fuel leaks after performing maintenance anywhere on the fuel system.

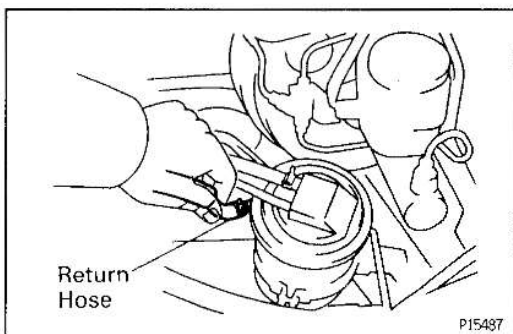
- (a) Using SST, connect terminals +B and FP of the check connector.

SST 09843-18020



- (b) Turn the ignition switch ON.

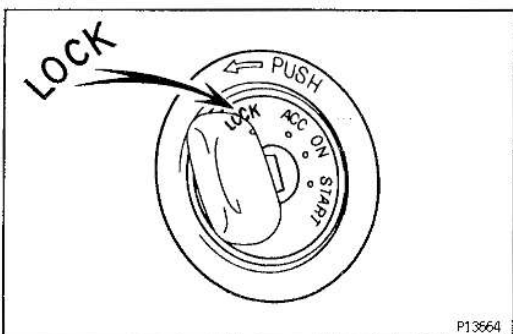
NOTICE: Do not start the engine.



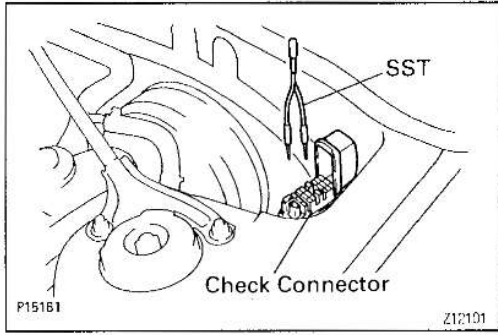
- (c) Pinch the fuel return hose.

The pressure in the high pressure line will rise to approx. 392 kPa (4 kgf/cm², 57 psi). In this state, check to see that there are no leaks from any part of the fuel system.

NOTICE: Always pinch the hose. Avoid bending as it may cause the hose to crack.



- (d) Turn the ignition switch to LOCK.

ENGINE — EFI SYSTEM**EG-175**

- (e) Remove the SST from the check connector.
SST 09843–18020

EG