

# Throttle Actuator Control (TAC) System Description

## Purpose

The throttle actuator control (TAC) system delivers improved throttle response and greater reliability and eliminates the need for mechanical cable. The TAC system performs the following functions:

- Accelerator pedal position sensing
- Throttle positioning to meet driver and engine demands
- Throttle position sensing
- Internal diagnostics
- Cruise control functions
- Manage TAC electrical power consumption

The TAC system includes the following components:

- The accelerator pedal position (APP) sensors
- The throttle body assembly
- The engine control module (ECM)

## Accelerator Pedal Position (APP) Sensor

The accelerator pedal contains 2 individual accelerator pedal position (APP) sensors within the assembly. The APP sensors 1 and 2 are potentiometer type sensors each with 3 circuits:

- A 5-volt reference circuit
- A low reference circuit
- A signal circuit

The APP sensors are used to determine the pedal angle. The engine control module (ECM) provides each APP sensor a 5-volt reference circuit and a low reference circuit. The APP sensors provide the ECM with signal voltage proportional to the pedal movement. The APP sensor 1 signal voltage at rest position is less than 1 volt and increases as the pedal is actuated. The APP sensor 2 signal voltage at rest position above 4 volts and decreases as the pedal is actuated.

## Throttle Body Assembly

The throttle assembly contains the following components:

- The throttle blade
- The throttle actuator motor
- The throttle position (TP) sensor 1 and 2

The throttle body functions similar to a conventional throttle body with the following exceptions:

- An electric motor opens and closes the throttle valve.
- The throttle blade is spring loaded in both directions and the default position is slightly open.
- There are 2 individual TP sensors within the throttle body assembly.

The TP sensors are used to determine the throttle plate angle. The TP sensors provide the engine control module (ECM) with a signal voltage proportional to throttle plate movement. The TP sensor 1 signal voltage at closed throttle is above 4 volts and decreases as the throttle plate is opened. The TP sensor 2 signal voltage at closed throttle is below 1 volt and increases as the throttle plate is opened.

## **Engine Control Module**

The engine control module (ECM) is the control center for the throttle actuator control (TAC) system. The ECM determines the drivers intent and then calculates the appropriate throttle response. The ECM achieves throttle positioning by providing a pulse width modulated voltage to the TAC motor.

## **Modes of Operation**

### **Normal Mode**

During the operation of the throttle actuator control (TAC) system, several modes or functions are considered normal. The following modes may be entered during normal operation:

- Minimum pedal value--At key-up, the engine control module (ECM) updates the learned minimum pedal value.
- Minimum throttle position (TP) values--At key-up, the ECM updates the learned minimum TP value. In order to learn the minimum TP value, the throttle blade is moved to the closed position.
- Ice break mode--If the throttle is not able to reach a predetermined minimum throttle position, the ice break mode is entered. During the ice break mode, the ECM commands the maximum pulse width several times to the throttle actuator motor in the closing direction.
- Battery saver mode--After a predetermined time without engine RPM, the ECM commands the battery saver mode. During the battery saver mode, the TAC module removes the voltage from the motor control circuits, which removes the current draw used to maintain the idle position and allows the throttle to return to the spring loaded default position.

### **Reduced Engine Power Mode**

When the ECM detects a condition with the TAC system, the ECM may enter a reduced engine power mode. Reduced engine power may cause one or more of the following conditions:

- Acceleration limiting--The ECM will continue to use the accelerator pedal for throttle control, however, the vehicle acceleration is limited.
- Limited throttle mode--The ECM will continue to use the accelerator pedal for throttle control, however, the maximum throttle opening is limited.
- Throttle default mode--The ECM will turn OFF the throttle actuator motor and the throttle will

return to the spring loaded default position.

- Forced idle mode--The ECM will perform the following actions:
  - Limit engine speed to idle by positioning the throttle position, or by controlling the fuel and spark if the throttle is turned OFF.
  - Ignore the accelerator pedal input.
- Engine shutdown mode--The ECM will disable fuel and de-energize the throttle actuator.