Group Index, Alphabetical

Contents

Accelerator Pedal Assembly

The Williams electronic suspended accelerator pedal provides an electrical signal to the engine in response to the driver's demand for more engine power. The accelerator pedal converts downward pressure into an electrical signal via the pedal position sensor.

Pedal Position Sensor

Freightliner uses various pedal position sensors, depending on the engine. The pedal position sensor is mounted to the side of the pedal assembly. The sensor and the pedal assembly are both separately replaceable.

NOTE: Vehicles manufactured on or after April 2, 2007, do not have replaceable sensors. The new pedal assemblies use thread-forming screws to mount the sensor to the pedal housing. Sensor replacement will strip the threads, so the entire pedal assembly must be replaced when a new sensor is needed.

There are three basic technologies employed on pedal position sensors used with electronic engines:

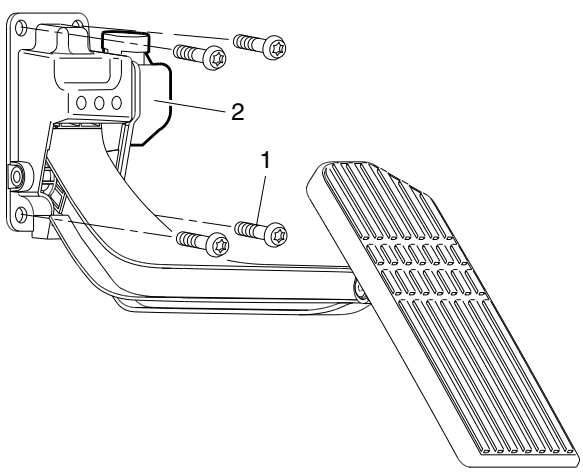
- A ratiometric sensor that generates a DC voltage output in proportion to the pedal position. The ratiometric sensor is used on Detroit Diesel, Mercedes-Benz, and pre-EPA07 Cummins engines.
- A pulse-width-modulating (PWM) sensor that generates a series of discrete voltage pulses. The width of the pulses is proportional to the pedal position. A narrower pulse width indicates a smaller accelerator pedal request and a wider pulse width indicates a larger pedal request. The PWM sensor is used on Caterpillar engines.
- A dual ratiometric sensor that uses Hall effect technology to generate two analog outputs that are proportional to the pedal position. The primary output is twice the voltage of the secondary output. The dual sensor is used on EPA07 Cummins engines.

An idle validation switch (IVS) is integrated into some ratiometric pedal position sensors. The IVS is a single-pole, double-throw switch. Some engine models monitor both switched poles, and some monitor only one pole. When the accelerator pedal returns to idle, the IVS moves to the "idle" position to signal the engine that the pedal has returned to idle. The IVS is not a serviceable part. If the IVS malfunctions, the sensor must be replaced.

Accelerator Pedal Removal and Installation

Removal

1. Apply the parking brakes and chock the tires.
2. Disconnect the batteries.
3. Remove the tie strap that attaches the pedal position sensor wiring harness to the air line. Disconnect the pedal position sensor wiring harness.
4. Remove the four fasteners that secure the accelerator pedal base cup to the inside of the bulkhead. See **Fig. 1**.
5. Remove the pedal assembly.



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NOTE: Washers not shown

1. Fastener (4 qty.)
2. Pedal Position Sensor

Fig. 1, Throttle Pedal

Installation

1. Align the accelerator pedal assembly with the mounting holes on the inside of the bulkhead.
2. Install the pedal assembly mounting fasteners and tighten them 7 to 10 lbf·ft (9 to 14 N·m).
3. Connect the pedal position sensor wiring harness. Using a tie strap, secure the wiring harness to the air line.
4. Depress the accelerator pedal several times and ensure that the pedal does not stick or bind.
5. Connect the batteries.
6. Test the pedal operation using the diagnostic software tool specified in **Table 1**.

Diagnostic Software Tools	
Engine Manufacturer	**Software Tool**
Caterpillar	Caterpillar Electronic Technician (CAT ET)
Cummins	INSITE
Mercedes-Benz	Detroit Diesel Diagnostic Link

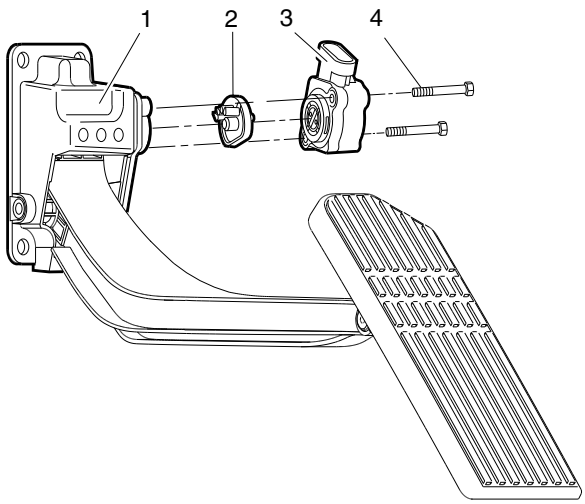
Table 1, Diagnostic Software Tools

Replacement

NOTE: Vehicles manufactured on or after April 2, 2007, do not have replaceable sensors. The new pedal assemblies use thread-forming screws to mount the sensor to the pedal housing. Sensor replacement will strip the threads, so the entire pedal assembly must be replaced when a new sensor is needed. See **Subject 100** for instructions.

Replace the pedal position sensor as follows:

1. Apply the parking brakes and chock the tires.
2. Remove the pedal assembly. See **Subject 100** for instructions.
3. Remove the two sensor mounting screws that connect the sensor to the pedal assembly. See **Fig. 1**. Remove the pedal position sensor from the pedal assembly.



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1. Accelerator Pedal Assembly
2. Pinion Gear
3. Pedal Position Sensor
4. Mounting Screws

Fig. 1, Pedal Position Sensor Installation

4. Align the new sensor with the spline on the pinion gear, then push it into the pedal assembly. Rotate the sensor slightly so the mounting holes line up with the pedal assembly. See **Fig. 1**.
5. Install the sensor mounting fasteners and tighten them 25 to 30 lbf·in (280 to 340 N·cm).
6. Install the pedal assembly and test its operation as instructed in **Subject 100**.

Complete the following procedures to diagnose accelerator pedal assembly and pedal position sensor problems.

Common Problems and Indications

The accelerator pedal assembly was designed so that the pedal position sensor will not reach the internal stop points when it is mounted to the pedal assembly. Attempting to modify the sensor or forcing the sensor shaft beyond the internal stop points will result in severe damage to the sensor.

A number of symptoms may be reported that can indicate a problem with the accelerator pedal, pedal position sensor, or wiring to the engine, including:

- low power or poor acceleration
- slow deceleration
- vehicle does not reach top speed
- engine is stuck at idle
- engine brake does not function
- check engine light comes on
- engine fault code indicates a pedal position sensor problem

A thorough diagnosis of the entire sensor system must be performed to ensure that a pedal position sensor is faulty. Symptoms may disappear when the pedal position sensor is replaced even if the sensor is not faulty.

Diagnostics

IMPORTANT: Vehicles manufactured on or after April 2, 2007, do not have replaceable sensors. The new pedal assemblies use thread-forming screws to mount the sensor to the pedal housing. Sensor replacement will strip the threads, so the entire pedal assembly must be replaced when a new sensor is needed. See **Subject 100** for instructions on replacing the entire pedal assembly.

1. Connect the vehicle to the appropriate diagnostic software tool. See **Table 1** for a list of diagnostic software tools for each engine.

Diagnostic Software Tools	
Engine Manufacturer	**Software Tool**
Caterpillar	Caterpillar Electronic Technician (CAT ET)
Cummins	INSITE
Mercedes-Benz	Detroit Diesel Diagnostic Link

Table 1, Diagnostic Software Tools

2. Make a note of the signal values at idle. See **Table 2** for the correct signal values.

NOTE: All desired signal values are approximate. Each individual vehicle and electrical system will exhibit some variation in signal values. The engine control system compensates for this variation. These diagnostic procedures are designed to identify malfunctioning components of the pedal assembly and electrical system.

3. Slowly depress the accelerator pedal and monitor the signals.

NOTE: There is a short time delay between pedal movement and display of the corresponding data.

4. Make a note of all signal values when the pedal has been pressed halfway.
5. Make a note of all signal values at full throttle.
6. Verify idle validation signal (IVS) inputs, if equipped.

NOTE: The pedal position sensor used with Caterpillar engines is a pulse-width modulated (PWM) sensor. It cannot be diagnosed using a digital multimeter set to measure voltage or resistance. A multimeter capable of measuring "duty cycle" may be used to view the sensor output.

The pedal position sensor used with EPA07 Cummins engines uses Hall effect technology. Attempting to measure resistance across the sensor will not provide valid results and may damage the sensor.

7. If any signal does not change, measure the sensor voltage supply and ground circuits with a digital multimeter as follows.

Troubleshooting

7.1 Use EZWiring™ in ServicePro or PartsPro to identify the circuit(s) that supply voltage to the pedal position sensor.

IMPORTANT: The ignition key must be in the ON position.

7.2 Disconnect the connector nearest the pedal and measure the voltage supply.

8. If a 5-volt supply is not present, look for a fault in the circuit between the pedal and the common powertrain controller (Mercedes-Benz) or the motor control module (Caterpillar and Cummins engines).
9. Inspect and ensure that all connector pins at the pedal position sensor, frontwall, and the engine controller are free of corrosion and are not bent or damaged. Inspect and ensure that the connections between the pins and the wires are secure and also free of corrosion.
10. If the problem has not been resolved, the problem is not with the pedal position sensor. See the engine manufacturer's service literature for further guidance.

Diagnostic Software Values*			
Engine	**Signal**	**Pedal Position**	**Desired Value†**
Caterpillar, pre-EPA07	Throttle Position	Idle	0%
		Full throttle	100%
		Between idle/full throttle	Varies smoothly between 0% and 100%
	Duty Cycle	Idle	15%
		Full throttle	85%
		Between idle/full throttle	Varies smoothly between 15% and 85%
Caterpillar, EPA07	Accelerator Pedal Position	Idle	0%
		Full throttle	100%
		Between idle/full throttle	Varies smoothly between 0% and 100%
	Throttle Position	Idle	0%
		Full throttle	100%
		Between idle/full throttle	Varies smoothly between 0% and 100%
	Duty Cycle	Idle	15%
		Full throttle	85%
		Between idle/full throttle	Varies smoothly between 15% and 85%

Diagnostic Software Values*			
Engine	**Signal**	**Pedal Position**	**Desired Value†**
Cummins, pre-EPA07	Accelerator Pedal Position	Idle	0%
		Full throttle	100%
		Between idle/full throttle	Varies smoothly between 0% and 100%
	Accelerator Pedal Sensor	Idle	0.5 volts
		Full throttle	4.5 volts
		Between idle/full throttle	Varies smoothly between 0.5 and 4.5 volts
	IVS	Idle	ON
		Full throttle	OFF
	Sensor Supply	Idle	5.0 volts
		Full throttle	5.0 volts
		Between idle/full throttle	5.0 volts
Cummins, EPA07	Accelerator Pedal Position	Idle	0%
		Full throttle	100%
		Between idle/full throttle	Varies smoothly between 0% and 100%
	Accelerator Pedal Sensor	Idle	1.0 volts
		Full throttle	4.5 volts
		Between idle/full throttle	Varies smoothly between 1.0 and 4.5 volts
	Accelerator Pedal Sensor 2	Idle	0.5 volts
		Full throttle	2.25 volts
		Between idle/full throttle	Varies smoothly between 0.5 and 2.25 volts
	Sensor Supply (both)	Idle	5.0 volts
		Full throttle	5.0 volts
		Between idle/full throttle	5.0 volts
Mercedes-Benz, pre-EPA07	Accelerator Pedal Raw Sensor	Idle	15%
		Full throttle	75%
		Between idle/full throttle	Varies smoothly between 15% and 75%
	Accelerator Pedal Position	Idle	0%
		Full throttle	100%
		Between idle/full throttle	Varies smoothly between 0% and 100%
	IVS	Idle	ON (grounded)
		Full throttle	OFF (open)
	Supply Analog Accelerator Pedal	Idle	5.0 volts
		Full throttle	5.0 volts
		Between idle/full throttle	5.0 volts

Troubleshooting

Diagnostic Software Values*			
Engine	**Signal**	**Pedal Position**	**Desired Value†**
Mercedes-Benz, EPA07	Accelerator Pedal Raw Sensor	Idle	15%
		Full throttle	75%
		Between idle/full throttle	Varies smoothly between 15% and 75%
	Accelerator Pedal Position	Idle	0%
		Full throttle	100%
		Between idle/full throttle	Varies smoothly between 0% and 100%
	IVS1	Idle	ON (grounded)
		Full throttle	OFF (open)
	IVS2	Idle	OFF (open)
		Full throttle	ON (grounded)
	Supply Analog Accelerator Pedal	Idle	5.0 volts
		Full throttle	5.0 volts
		Between idle/full throttle	5.0 volts

* All desired signal values are approximate. Each individual vehicle and electrical system will exhibit some variation in signal values.

† There is a short time delay between pedal movement and display of the corresponding data.

Table 2, Diagnostic Software Values

Specifications

See **Fig. 1**, **Fig. 2**, **Fig. 3**, **Fig. 4**, and **Fig. 5** for a schematic of the accelerator pedal position sensor.

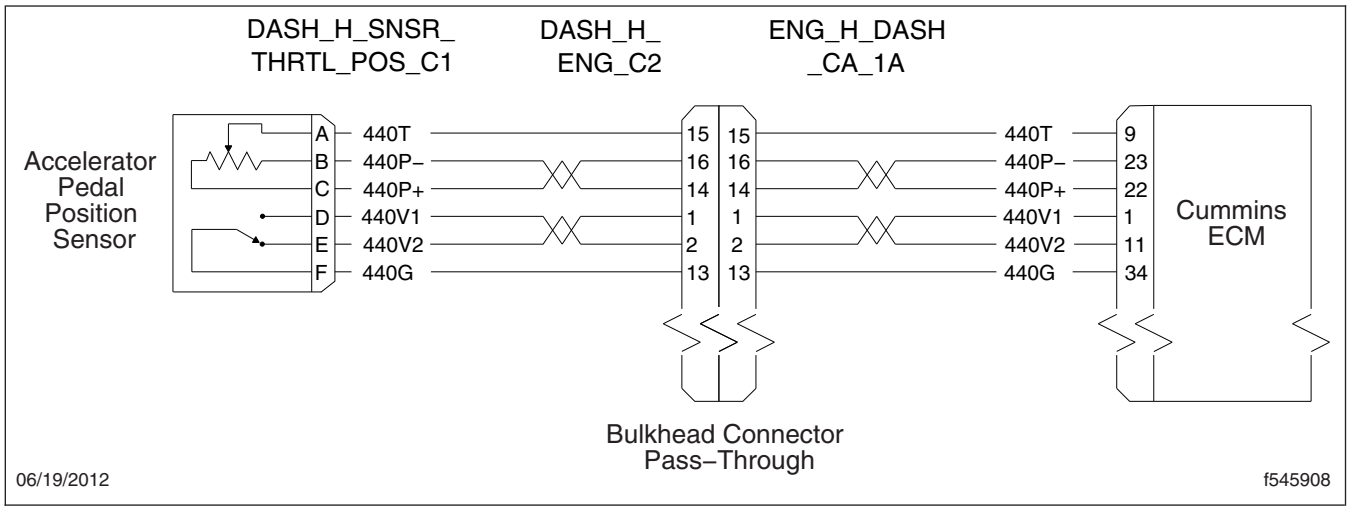

Fig. 1, Accelerator Pedal Position Sensor (Cummins engines, Pre-EPA07)

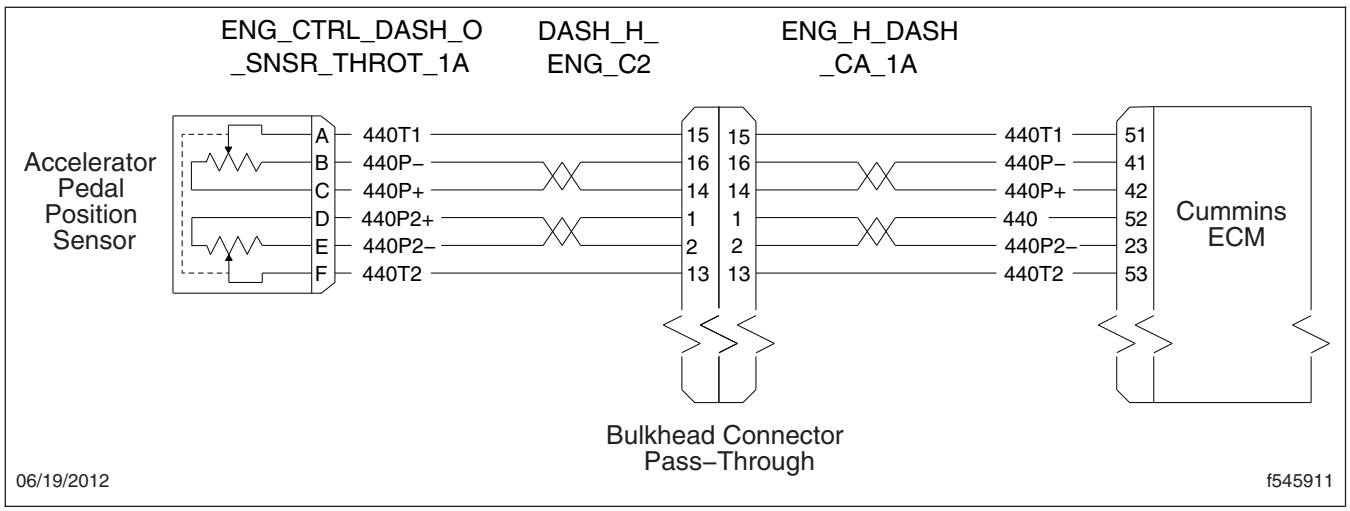

Fig. 2, Accelerator Pedal Position Sensor (Cummins engines, EPA07, EPA10)

Specifications

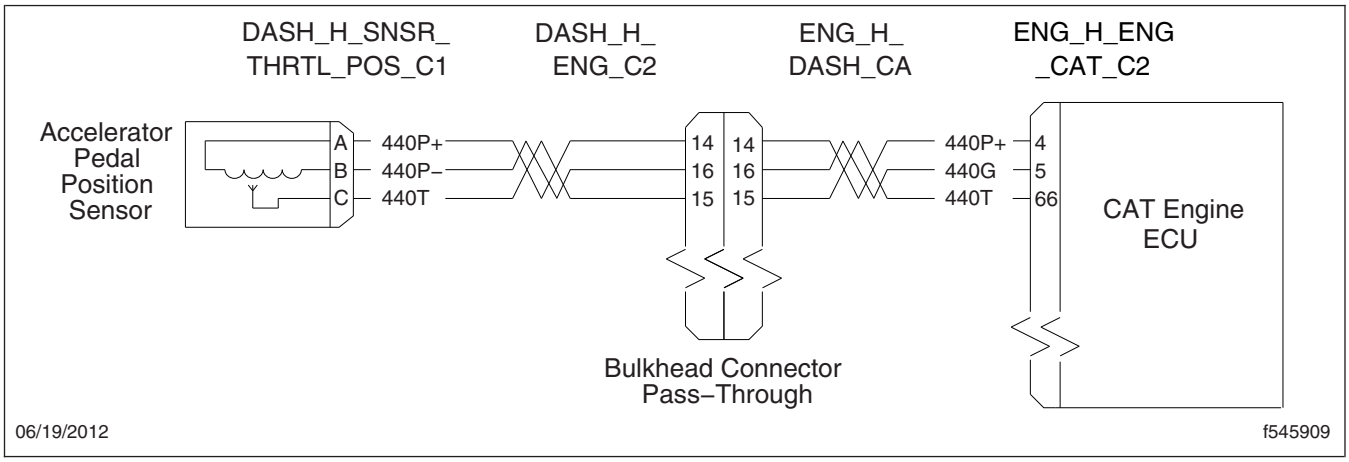

Fig. 3, Accelerator Pedal Position Sensor (CAT engines)

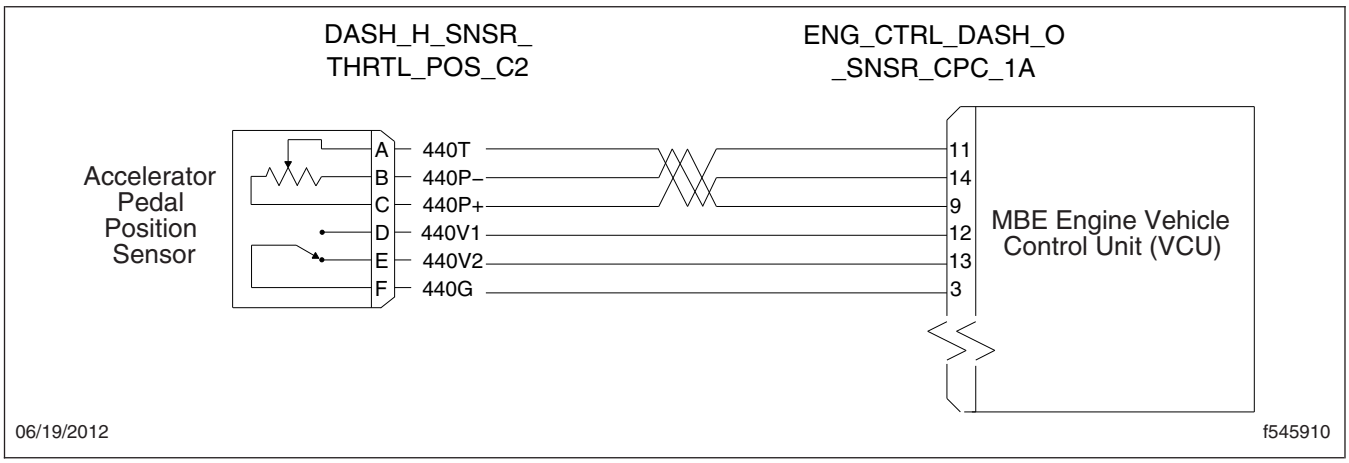

Fig. 4, Accelerator Pedal Position Sensor (MBE engines, Pre-EPA07)

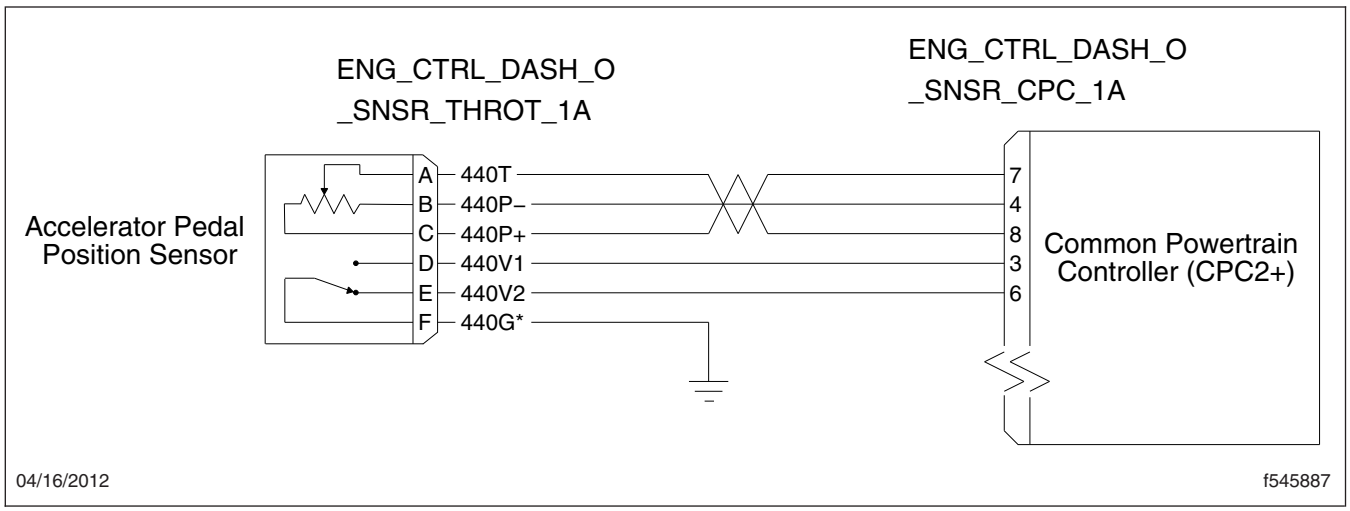

Fig. 5, Accelerator Pedal Position Sensor (Detroit and MBE engines, EPA07, and EPA10 engines)