

**IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF MICHIGAN
SOUTHERN DISTRICT**

MICHIGAN MOTOR TECHNOLOGIES LLC

Plaintiff,

v.

VOLKSWAGEN AKTIENGESELLSCHAFT
and VOLKSWAGEN GROUP OF AMERICA,
INC.,

Defendant.

C.A. No. 2:19-cv-10485-DML-SDD

JURY TRIAL DEMANDED

AMENDED COMPLAINT FOR PATENT INFRINGEMENT

Michigan Motor Technologies LLC (“MMT” or “Plaintiff”), for its Amended Complaint against Defendants Volkswagen Aktiengesellschaft (“VWAG” or “Defendant”) and Volkswagen Group of America, Inc. (“VWGOA” or “Defendant”) (collectively “Defendants”), alleges the following:

NATURE OF THE ACTION

1. This is an action for patent infringement arising under the Patent Laws of the United States, 35 U.S.C. § 1 et seq.

THE PARTIES

2. Plaintiff is a Limited Liability Company organized under the laws of the State of Michigan with a place of business at 2360 Orchard Lake Road, Suite 100, Sylvan Lake, Michigan 48320.

3. Upon information and belief, Volkswagen Aktiengesellschaft is a Corporation organized and existing under the laws of Germany, with its principal place of business at Berliner Ring 2, 38440 Wolfsburg, Germany.

4. Upon information and belief, Volkswagen Group of America, Inc. is a Corporation organized and existing under the laws of the State of New Jersey and a wholly
VW EX1029
U.S. Patent No. 6,763,804

owned subsidiary of Volkswagen Aktiengesellschaft. Volkswagen Group of America, Inc. has its principal place of business at 2200 Ferdinand Porsche Dr., Herndon, VA 20171.

JURISDICTION AND VENUE

5. This is an action for patent infringement arising under the Patent Laws of the United States, Title 35 of the United States Code.

6. This court has subject matter jurisdiction under 28 U.S.C. §§ 1331 and 1338(a).

7. Venue is proper in this judicial district under 28 U.S.C. § 1400(b). On information and belief, Defendants have committed acts of infringement in this District and have regular and established places of business within this District.

8. On information and belief, Defendant VWGOA has a place of business at 3800 Hamlin Road, Auburn Hills, MI 48326.

9. On information and belief, Defendants are subject to this Court's general and specific personal jurisdiction because Defendants have sufficient minimum contacts within the State of Michigan and this District, pursuant to due process and/or Michigan Long Arm Statute because Defendants purposefully availed themselves of the privileges of conducting business in the State of Michigan and in this District, because Defendants regularly conduct and solicit business within the State of Michigan and within this District, and because Plaintiff's causes of action arise directly from Defendants' business contacts and other activities in the State of Michigan and this District.

COUNT – I INFRINGEMENT OF U.S. PATENT NO. 6,588,260

10. The allegations set forth in the foregoing paragraphs 1-9 are incorporated into this First Claim for Relief.

11. On July 8, 2003, U.S. Patent No. 6,588,260 ("the '260 patent") entitled "Electronic Throttle Disable Control Test System," was duly and legally issued by the United

States Patent and Trademark Office. A true and correct copy of the '260 patent is attached as Exhibit 1.

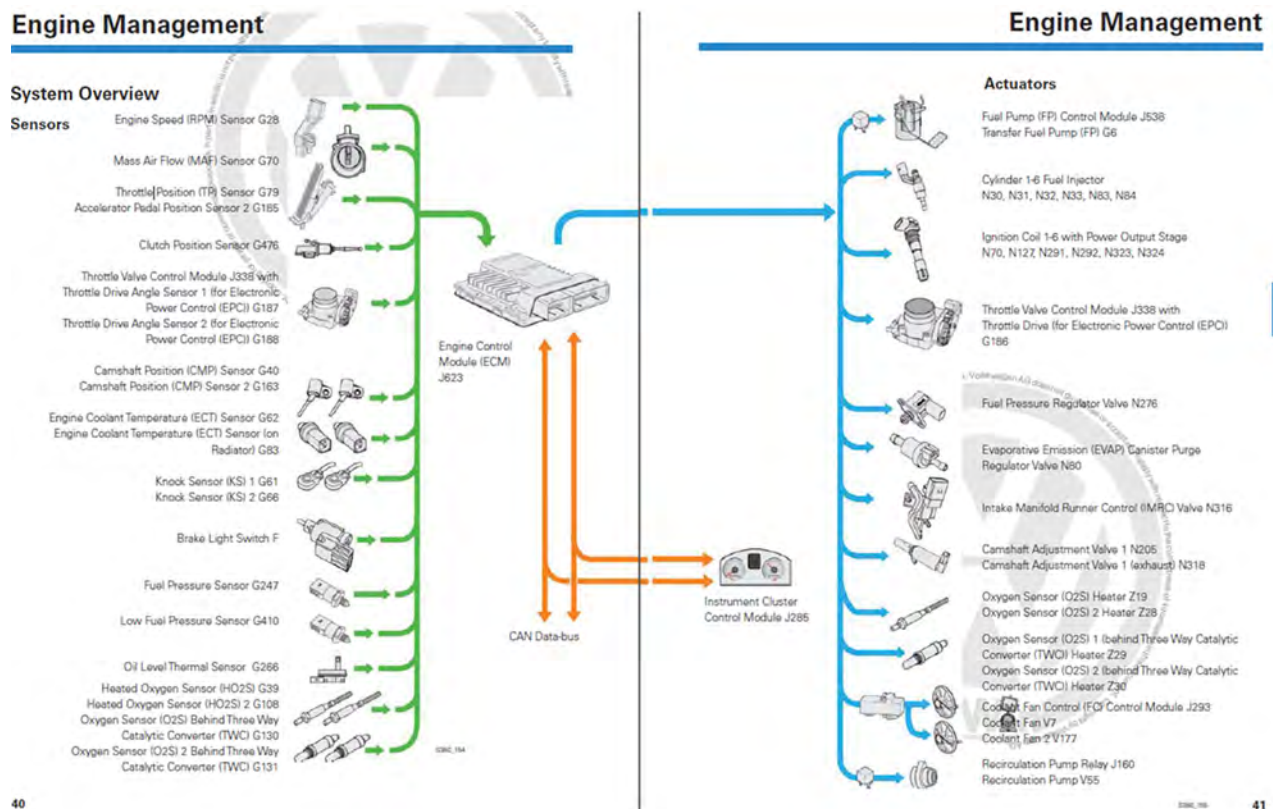
12. Plaintiff is the assignee and owner of the right, title and interest in and to the '260 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

13. Upon information and belief, Defendants have directly infringed at least claim 1 of the '260 patent by making, using, selling, importing and/or providing and causing to be used the at least the 2015-2018 3.6L Touareg (collectively the "'260 patent Accused Instrumentalities").

14. In particular, claim 1 of the '260 patent recites an electronic throttle control apparatus for testing integrity of a motor drive electronics disable feature comprising: a PCM having drive electronics for controlling a motor coupled to an electronic throttle plate, said PCM having control logic to disable said drive electronics and return said electronic throttle plate to a default position, determine a default throttle position sensor (TPS) output voltage corresponding to said default position, command a full closing motor voltage, compare a full closing TPS output voltage to said default TPS output voltage, and engage failure mode management when said full closing TPS output voltage and said default TPS output voltage are significantly different from each other.

15. Upon information and belief, the '260 patent Accused Instrumentalities infringe at least claim 1 of the '260 patent. The '260 patent Accused Instrumentalities comprise an electronic throttle control apparatus (*Figure 1*) for testing integrity of a motor drive electronics disable feature (*Figure 2*) comprising: a PCM having drive electronics for controlling a motor coupled to an electronic throttle plate (*Figure 3*), said PCM having control logic to disable said drive electronics and return said electronic throttle plate to a default position (*Figure 4*),

determine a default throttle position sensor (TPS) output voltage corresponding to said default position, command a full closing motor voltage, compare a full closing TPS output voltage to said default TPS output voltage (*Figure 5*), and engage failure mode management when said full closing TPS output voltage and said default TPS output voltage are significantly different from each other (*Figure 6*).



Volkswagen SSP 823603

As shown above, there is a Throttle Valve Control Module (J338), which in conjunction with the Throttle Drive Angle Sensor (G187) and Throttle Drive Angle Sensor 2 (G188), constitutes an electronic throttle control apparatus.

Figure 1

2015 Volkswagen Touareg (7P5) V6-3.6L (CGRA)

Vehicle » A L L Diagnostic Trouble Codes (DTC) » Testing and Inspection » P Code Charts » P0638 » Engine Control Module, 2016 MY

ENGINE CONTROL MODULE, 2016 MY**Engine Control Module, 2016 MY**

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0634 Control Module Internal Temperature "A" Too High	Engine Coolant Pump Over-Temperature Power Stage	Power stage temperature > 170° C	Ignition on	0.5 s Continuous	2 DCY	If a sensor/component DTC is also set, diagnose that code BEFORE replacing the ECM. Replace the Engine Control Module (J623). Refer to appropriate repair manual.
	Supplementary Coolant Pump Over-Temperature Power Stage	Power stage temperature > 150° C				
	Fuel Pump Control (FPC) Over-Temperature Power Stage		Engine speed > 80 RPM			
P0638 Throttle Actuator Control Range/Performance Bank 1	Throttle Actuator Rationality Check Close Movement	Time to close to reference point > 0.6 s And Deviation to reference point > 2.88%	Engine speed 0 RPM Vehicle speed 0 km/h ECT > -20° C IAT > -20° C Case 1: Ignition on Case 2: Engine shut-off-time > 5.0 s Number of checks 3.0 [-]	5.0 s Multiple	2 DCY	Check the Throttle Valve Control Module (GX3). Refer to » [Throttle Valve Control Module (GX3) Checking]
	Throttle Actuator Signal Range Check @ Mechanical Stop Low	TPS 1 signal voltage < 0.40; > 0.80 V Or TPS 2 signal voltage < 4.20; > 4.60 V	Engine speed 0 RPM Vehicle speed 0 km/h Case 1: Ignition on ECT -20 - 115° C IAT -20 - 143° C Case 2:	0.3 s Multiple		

testing
integrity of a
motor drive
electronics
disable feature

As shown above, there is an Electronic Throttle Control (ETC)[J388] system which tests integrity of a motor drive electronics disable feature.

The PCM/ECM uses the Throttle Drive Angle Sensor (G187) and Throttle Drive Angle Sensor 2 (G188) to monitor the actual throttle blade position and when the actual position is out of range with the target position, the ECM (J623) will set the DTC P0638. Bank 1 refers to the side of the engine with cylinder number one, however most vehicles use one throttle body for all cylinders. This code is similar to code P0639. Most throttle bodies of this type are not serviceable and need to be replaced. The throttle body is spring actuated to hold it at an open position in the event of a motor failure; in some cases, with a complete failure, the throttle will be unresponsive, and the vehicle will only be capable of driving at a slow speed.

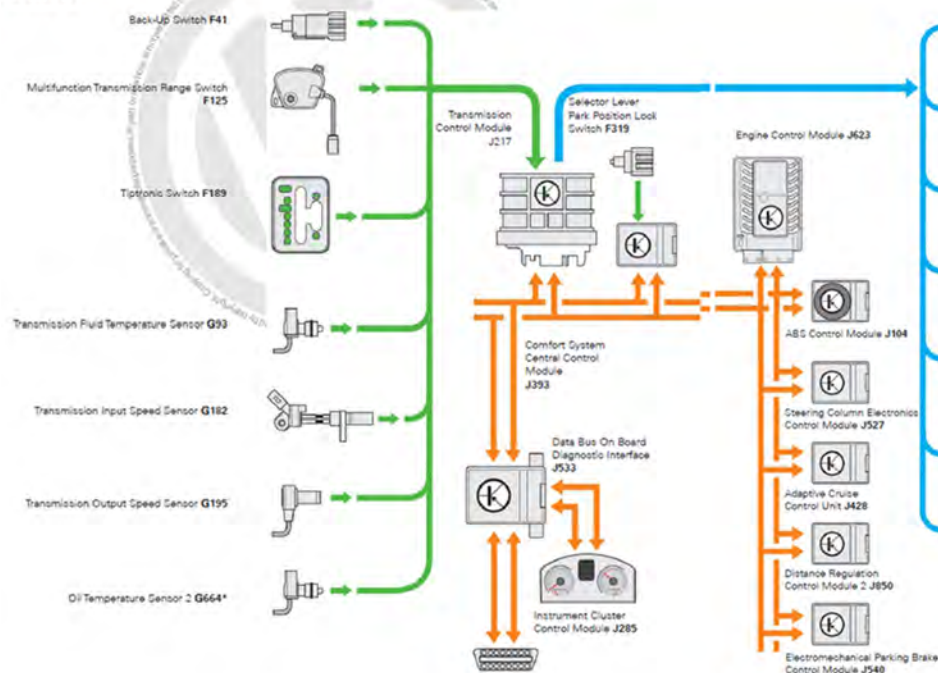
<https://www.obd-codes.com/p0638>

Figure 2

Transmission Management System

System Overview

Sensors



28

Volkswagen SSP 823603

The PCM (powertrain control module) comprises the ECM (J623) and the Transmission Control Module TCM (J217) (shown above).

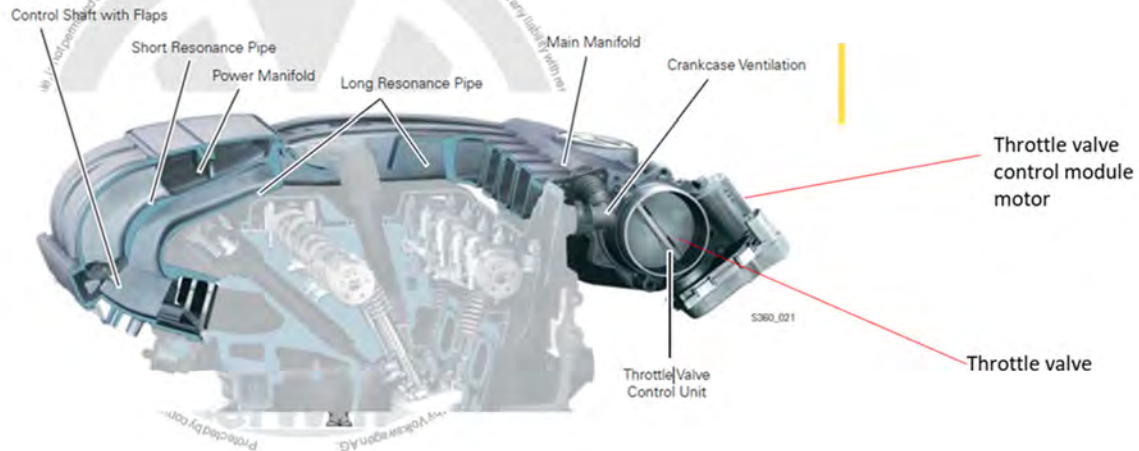
The PCM, shown above, has drive electronics for controlling a throttle valve control module motor coupled to an electronic throttle plate/throttle valve (shown below).

29

Engine Mechanics

The Intake Manifold

Both engines have a single piece overhead intake manifold made of plastic.



Volkswagen SSP 823603

Figure 3

2015 Volkswagen Touareg (7P5) V6-3.6L (CGRA)

Vehicle » A L L Diagnostic Trouble Codes (DTC) » Testing and Inspection » P Code Charts » P2106 » Engine Control Module, 2016 MY

ENGINE CONTROL MODULE, 2016 MY**Engine Control Module, 2016 MY**

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2106 Throttle Actuator Control System - Forced Limited Power	Throttle Actuator Short To Battery Plus / Short To Ground	Internal check failed	Duty cycle > 80.0% Or Deviation throttle value angles vs. throttle value set point > 4.0 - 50.0%	0.5 s Continuous	2 DCY	Check the Throttle Valve Control Module (GX3) . Refer to ⇒ [Throttle Valve Control Module (GX3) Checking]
	Throttle Actuator Open Circuit					
	Throttle Actuator Temperature / Current Monitoring					
	Throttle Actuator Functional Check					
P2122 Throttle/Pedal Position Sensor/Switch "D" Circuit Low	Accelerator Pedal Position (APP) Sensor 1 Out Of Range Low	Signal voltage < 0.65 V		0.5 s Continuous	2 DCY	Check the Accelerator Pedal Module (GX2) . Refer to ⇒ [Accelerator Pedal Module (GX2) Checking]
P2123 Throttle/Pedal Position Sensor/Switch "D" Circuit High	Accelerator Pedal Position (APP) Sensor 1 Out Of Range High	Signal voltage > 4.89 V		0.5 s Continuous	2 DCY	Check the Accelerator Pedal Module (GX2) . Refer to ⇒ [Accelerator Pedal Module (GX2) Checking]

DTC P2106 is exemplary of the DTCs that are more specific that will typically accompany DTC P0652.

<https://www.obd-codes.com>

For example, as shown above, control logic in the ECM issues a command which controls the throttle actuator control system - limiting power where there is a sensor or circuit error or failure of the throttle valve functionality check affecting the Throttle Valve Control Module (J388) (shown above) (disable drive electronics).

When there is an error detected during continuous monitoring (P2106, above), or when the ECM performs specific checks (P0638, below), a Throttle Actuator Rationality Check for Close

Movement (Default Position) or a Throttle Actuator Signal Range Check at the low mechanical stop, the ECM Turns on the Electronic Power Control (EPC) warning lamp and the ECM returns the electronic throttle plate to a default position.

Further, the ECM relinquishes control of the Throttle Valve Control Module (J388) which remains in a default position.

2.4 Electronic Power Control (EPC) Warning Lamp

When the ignition is switched on, the engine control module (ECM) checks the electronic throttle control system for static sys-

2. Description and Operation 7



Touareg 2013 ►
Generic Scan Tool - Edition 10.2017

tem integrity (e.g. circuit integrity, communications, etc); the electronic power control (EPC) warning light is turned on via the Instrument Cluster during this process. Shortly after engine start, the EPC warning light is turned off if no malfunction in the electronic throttle control system is detected. In the event of a malfunction while the engine is running, the ECM will activate the EPC warning light via the Instrument Cluster and at the same time, a Diagnostic Trouble Code (DTC) is stored in the ECM memory.

Touareg 2013, Generic Scan Tool, Edition 10.2017

Figure 4

For example, as demonstrated by DTC P0638 included below. The ECM makes a determination of the amount of time required to reach a reference point (default position of the electronic throttle plate) and the deviation from the reference point. On information and belief, the control logic in the ECM disables the drive electronics for controlling the throttle motor by not supplying power to the throttle motor, whereby the electronic throttle plate is returned to a default position. DTC P0638 also demonstrates that the ECM commands full motor closing voltage (signal range check at mechanical stop) and compares that to TPS 1 output voltage (< 0.40; > 0.80 V) or TPS 2 output voltage (< 4.20; > 4.60 V). Any significant difference from these voltage ranges are considered out of range, resulting in at least DTC P0638. The algorithms executed by the ECM for DTC P0638 and DTC P2106 differ, as such errors during a continuous monitor (see P2106 above); however, DTC P0638 algorithms are typically performed during initialization or shut down.

2015 Volkswagen Touareg (7P5) V6-3.6L (CGRA)

Vehicle » ALL Diagnostic Trouble Codes (DTC) » Testing and Inspection » P Code Charts » P0638 » Engine Control Module, 2016 MY

ENGINE CONTROL MODULE, 2016 MY**Engine Control Module, 2016 MY**

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0634 Control Module Internal Temperature "A" Too High	Engine Coolant Pump Over-Temperature Power Stage	Power stage temperature > 170° C	Ignition on	0.5 s Continuous	2 DCY	If a sensor/component DTC is also set, diagnose that code BEFORE replacing the ECM. Replace the Engine Control Module (J623) . Refer to appropriate repair manual.
	Supplementary Coolant Pump Over-Temperature Power Stage	Power stage temperature > 150° C				
	Fuel Pump Control (FPC) Over-Temperature Power Stage		Engine speed > 80 RPM			
P0638 Throttle Actuator Control Range/Performance Bank 1	Throttle Actuator Rationality Check Close Movement	Time to close to reference point > 0.6 s And Deviation to reference point > 2.88%	Engine speed 0 RPM Vehicle speed 0 km/h ECT > -20° C IAT > -20° C Case 1: Ignition on Case 2: Engine shut-off-time > 5.0 s Number of checks: 3.0 [-]	5.0 s Multiple	2 DCY	Check the Throttle Valve Control Module (GX3) . Refer to [9] . THROTTLE VALVE Control Module (GX3) Checking 1
	Throttle Actuator Signal Range Check @ Mechanical Stop Low	TPS 1 signal voltage < 0.40; > 0.80 V Or TPS 2 signal voltage < 4.20; > 4.60 V	Engine speed 0 RPM Vehicle speed 0 km/h Case 1: Ignition on ECT -20 - 115° C IAT -20 - 143° C Case 2:	0.3 s Multiple		

<https://www.obd-codes.com>

For example, as shown above, there are two checks for P0638; one is determined from the amount of time to reach a reference point (default position) and the deviation from the reference point. The second is a command for full motor closing voltage (signal range check at mechanical stop) is compared to TPS 1 output voltage (< 0.40; > 0.80 V) or TPS 2 output voltage (< 4.20; > 4.60 V) and any deviation from these voltage ranges are considered out of range and will set the DTC. These checks differ from errors detected during a continuous monitor (see above) and are typically performed during initialization or shut down.

Figure 5

Engine Management

The Throttle Drive Angle Sensor 1 G187 and Throttle Drive Angle Sensor 2 G188 in the Throttle Valve Control Unit

These sensors determine the current position of the throttle valve and send this information to the ECM.

Signal Utilization

The ECM recognizes the position of the throttle valve from the angle sensors signals. The signals from the two sensors are redundant, meaning that both sensors provide the same signal.

Effects of a Signal Failure

Example 1

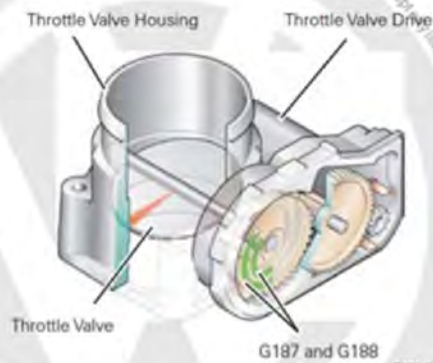
The ECM receives an implausible signal or no signal at all from an angle sensor:

- An entry is made in the DTC memory and the error light for electric throttle operation is switched on
- Systems which affect torque, (e.g. cruise control system or engine drag torque control), are switched off
- The load signal is used to monitor the remaining angle sensor
- The accelerator pedal responds normally

Example 2

The ECM receives an implausible signal or no signal from both angle sensors:

- An entry is made for both sensors in the DTC memory and the error light for electric throttle operation is switched on
- The throttle valve drive is switched off
- The engine runs only at an increased idle speed of 1,500 RPM and no longer reacts to the accelerator pedal



Volkswagen SSP 823603

2015 Volkswagen Touareg (7P5) V6-3.6L (CGRA)

Vehicle » A L L Diagnostic Trouble Codes (DTC) » Testing and Inspection » P Code Charts » P2106 » Engine Control Module, 2016 MY

ENGINE CONTROL MODULE, 2016 MY**Engine Control Module, 2016 MY**

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2106 Throttle Actuator Control System - Forced Limited Power	Throttle Actuator Short To Battery Plus / Short To Ground	Internal check failed	Duty cycle > 80.0% Or Deviation throttle value angles vs. throttle value set point > 4.0 - 50.0%	0.5 s Continuous	2 DCY	Check the Throttle Valve Control Module (GX3) . Refer to ⇒ [Throttle Valve Control Module (GX3) Checking]
	Throttle Actuator Open Circuit					
	Throttle Actuator Temperature / Current Monitoring					
	Throttle Actuator Functional Check					
P2122 Throttle/Pedal Position Sensor/Switch "D" Circuit Low	Accelerator Pedal Position (APP) Sensor 1 Out Of Range Low	Signal voltage < 0.65 V		0.5 s Continuous	2 DCY	Check the Accelerator Pedal Module (GX2) . Refer to ⇒ [Accelerator Pedal Module (GX2) Checking]
P2123 Throttle/Pedal Position Sensor/Switch "D" Circuit High	Accelerator Pedal Position (APP) Sensor 1 Out Of Range High	Signal voltage > 4.89 V		0.5 s Continuous	2 DCY	Check the Accelerator Pedal Module (GX2) . Refer to ⇒ [Accelerator Pedal Module (GX2) Checking]

For example, as shown above, engine failure mode management P2106 (throttle actuator control system-forced limited power) is engaged when a full closing TPS output voltage indicates a deviation of throttle angle values (as indicated by throttle output voltage [TPS1 output voltage signal) opposed to throttle value set point > 4% - 50%).

Figure 6

Based upon the totality of the foregoing evidence, and based further upon information and belief, the '260 patent Accused Instrumentalities include "an apparatus for testing integrity of a motor drive electronics disable feature comprising: a PCM having drive electronics for controlling a motor coupled to an electronic throttle plate, said PCM having control logic to disable said drive

electronics and return said electronic throttle plate to a default position, determine a default throttle position sensor (TPS) output voltage corresponding to said default position, command a full closing motor voltage, compare a full closing TPS output voltage to said default TPS output voltage, and engage failure mode management when said full closing TPS output voltage and said default TPS output voltage are significantly different from each other.”

COUNT II – INFRINGEMENT OF U.S. PATENT NO. 6,443,128

16. The allegations set forth in the foregoing paragraphs 1 through 15 are incorporated into this Second Claim for Relief.

17. On September 3, 2002, U.S. Patent No. 6,443,128 (“the ’128 patent”), entitled “Method of Controlling an Internal Combustion Engine,” was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the ’128 patent is attached as Exhibit 2.

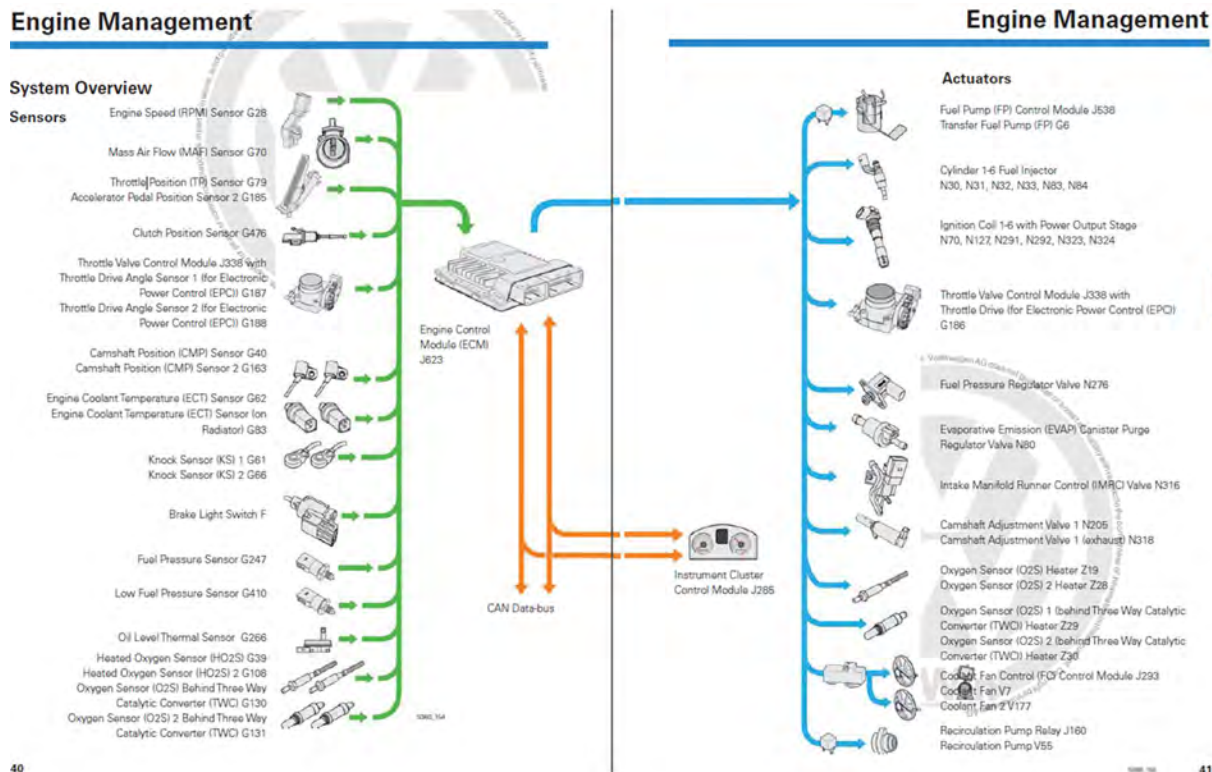
18. Plaintiff is the assignee and owner of the right, title and interest in and to the ’128 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

19. Upon information and belief, Defendants have directly infringed at least claim 1 of the ’128 patent by making, using, selling, importing and/or providing and causing to be used the 2015-2018 3.6L Touareg (the “’128 patent Accused Instrumentalities”).

20. In particular, claim 1 of the ’128 patent recites a method of controlling an internal combustion engine, the engine having an engine controller and an electronically controlled throttle including a throttle control motor driven by a throttle control circuit, the method comprising: determining a throttle position command for the throttle control motor; applying the throttle position command to the throttle control motor with the throttle control circuit; detecting an open circuit condition in the throttle control circuit; detecting a closed circuit condition in the throttle control circuit; after detection of the closed circuit condition, clipping the throttle

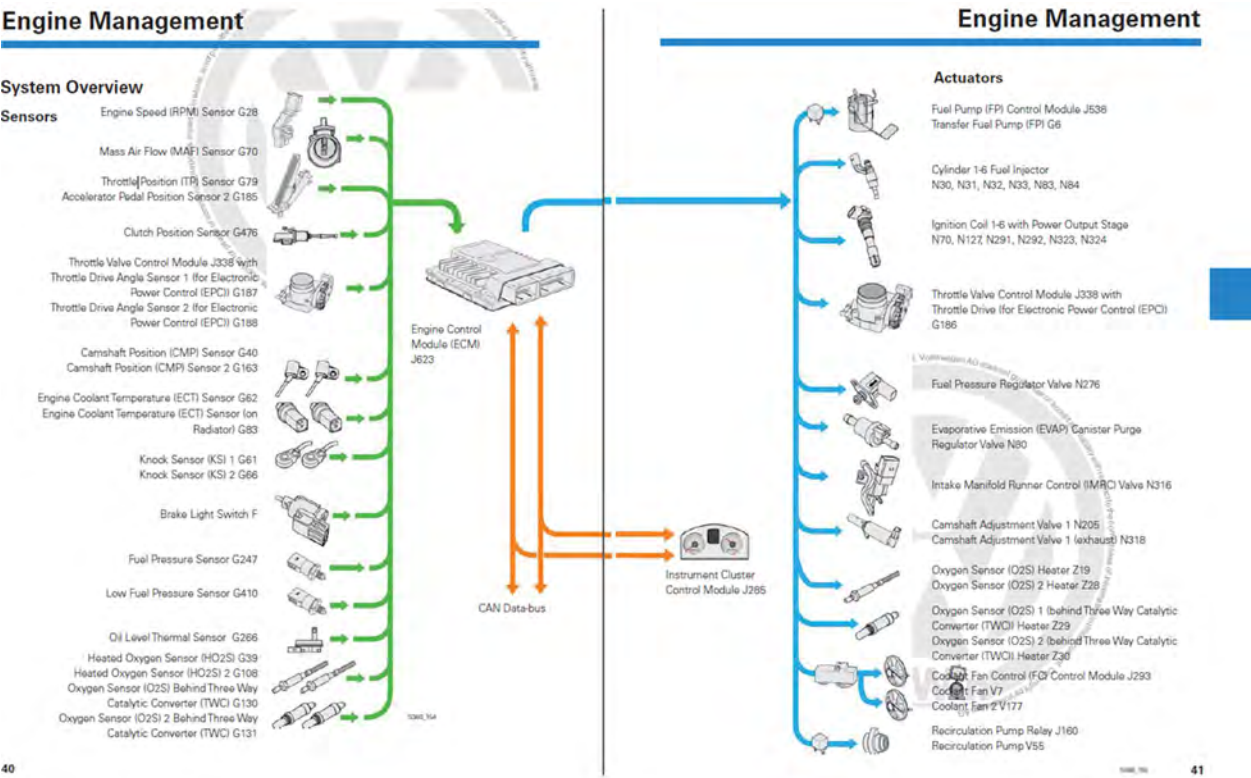
position command; and applying the clipped throttle position command to the throttle control motor with the throttle control circuit.

21. On information and belief, the '128 patent Accused Instrumentalities infringe at least claim 1 of the '128 patent. The '128 patent Accused Instrumentalities practice a method of controlling an internal combustion engine (*Figure 7*), the engine having an engine controller and an electronically controlled throttle including a throttle (*Figure 8*) control motor driven by a throttle control circuit (*Figure 8*), the method comprising: determining a throttle position command for the throttle control motor (*Figure 9*); applying the throttle position command to the throttle control motor with the throttle control circuit (*Figure 10*); detecting an open circuit condition in the throttle control circuit (*Figure 11*); detecting a closed circuit condition in the throttle control circuit (*Figure 11*); after detection of the closed circuit condition, clipping the throttle position command (*Figure 12*); and applying the clipped throttle position command to the throttle control motor with the throttle control circuit (*Figure 12*).

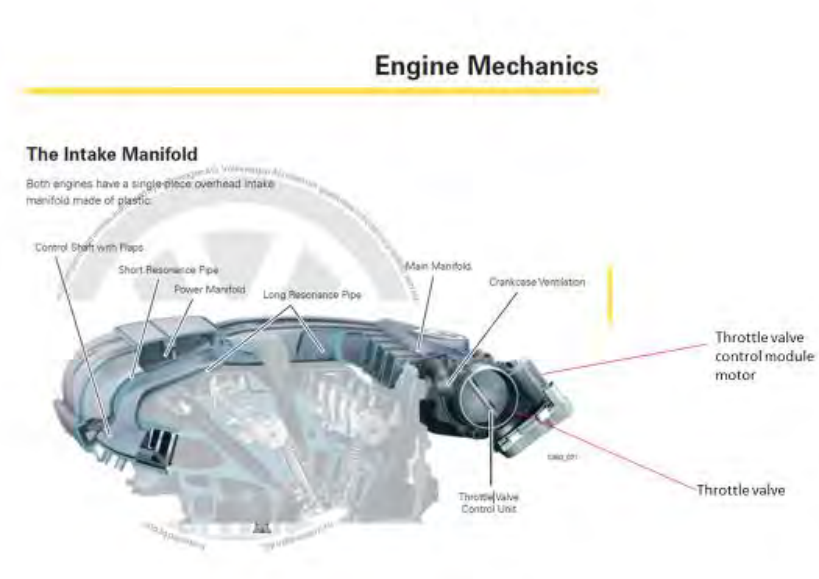


The Engine Control Module (J623) provides a method of controlling an internal combustion engine.

Figure 7

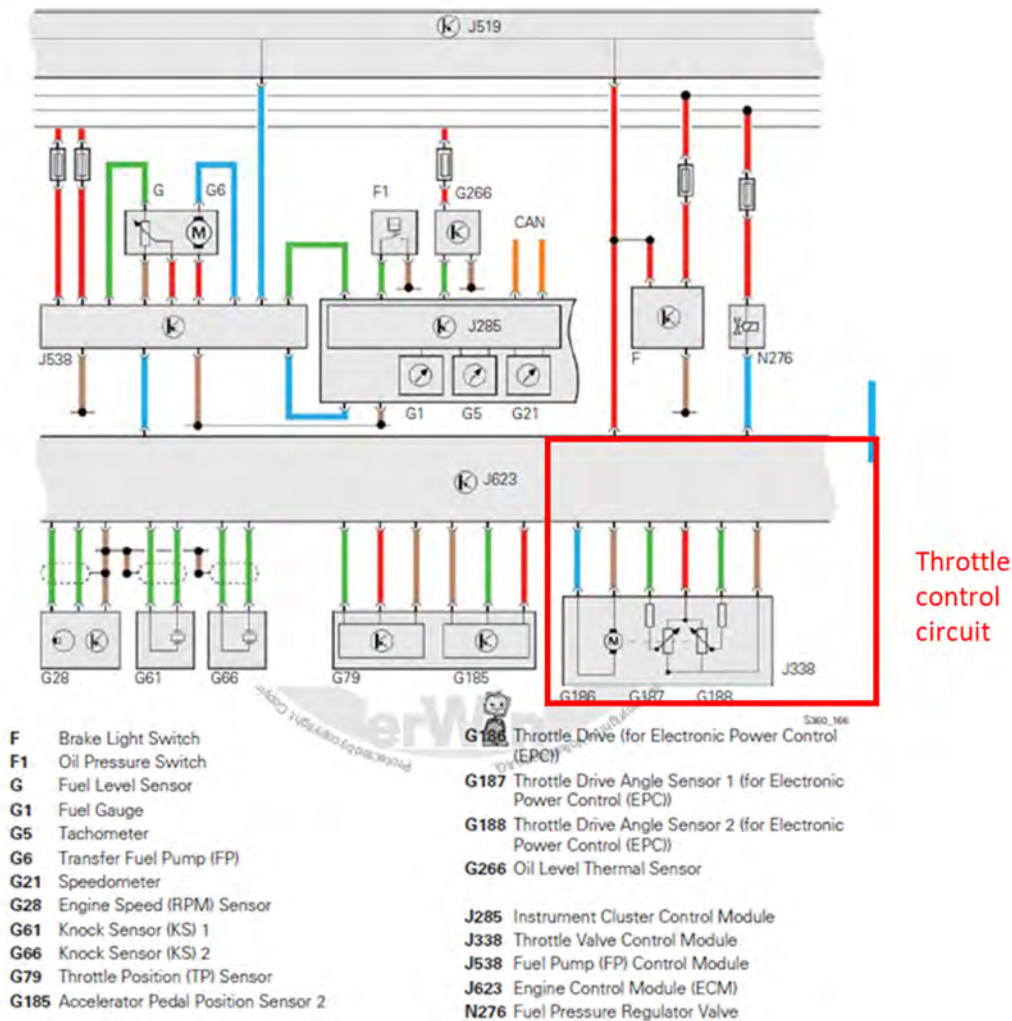


The '128 patent Infringing Instrumentalities comprise an Engine controller, the ECM (J623) and an electronically controlled throttle (J338).



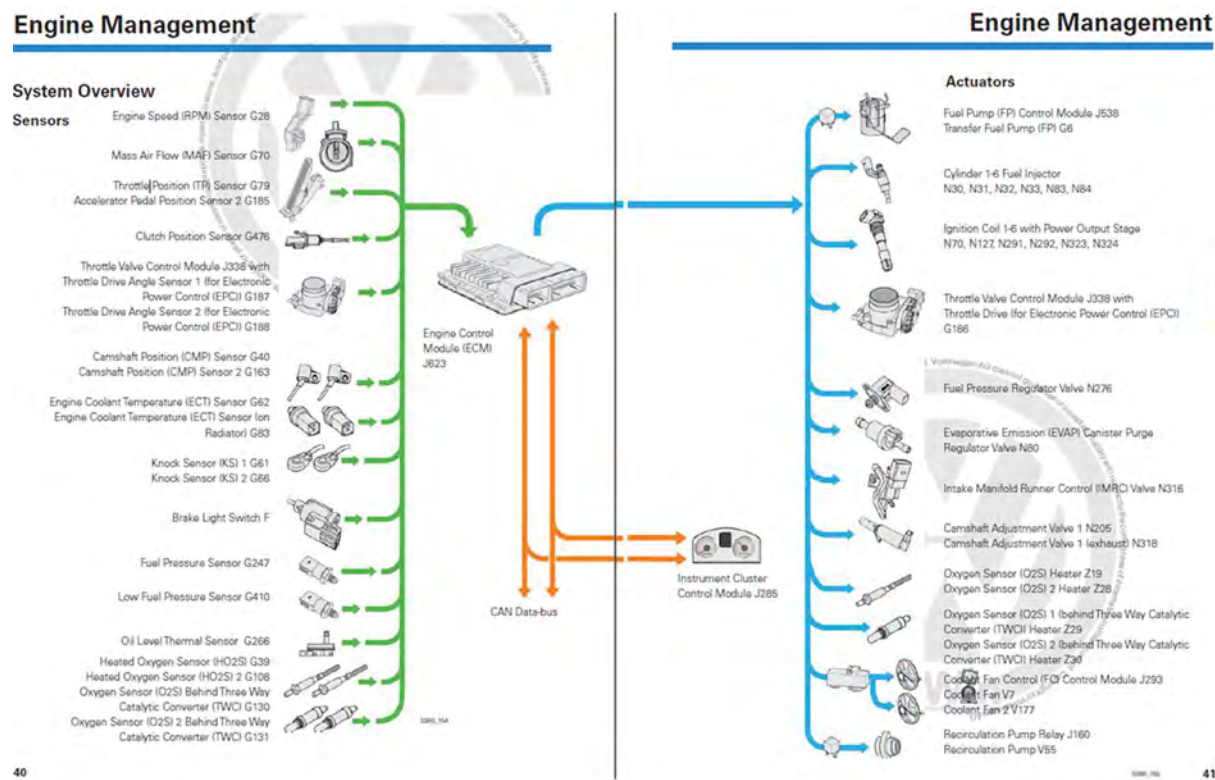
The method practiced by the '128 patent Infringing Instrumentalities comprises an electronically controlled throttle (J338) including a throttle control motor driven by a throttle control circuit.

Operating Diagrams



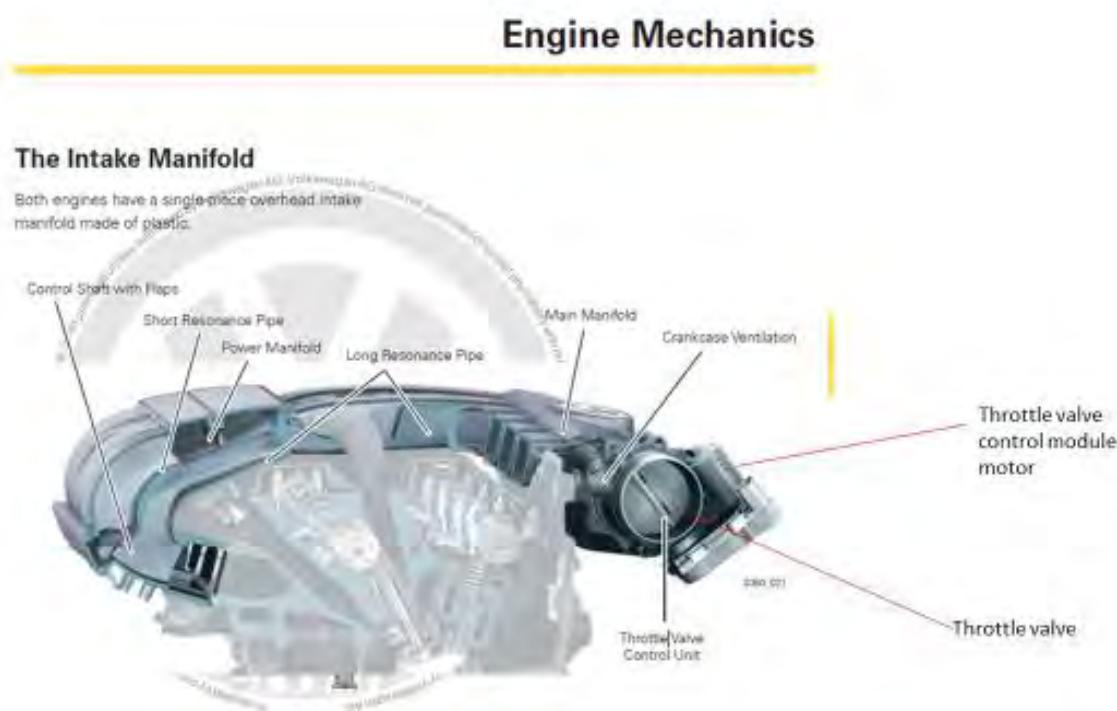
The electronically controlled throttle includes a throttle control motor (J338) driven by a throttle control circuit. *See above.*

Figure 8



The throttle position command is sent to the Electronic Throttle Control module from the ECM (J623) by way of a motor operation signal. The throttle position command is derived from the accelerator pedal position sensor 2 (G185).

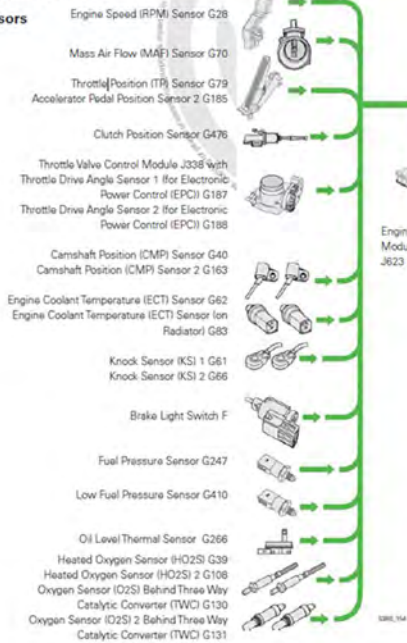
Figure 9



Engine Management

System Overview

Sensors



40

Engine Management

Actuators



41

The throttle position command (from the Accelerator Pedal Position Sensor 2 G185) is applied to the throttle valve control module (J388) motor (shown below) with the throttle control circuit (shown above).

Figure 10

2015 Volkswagen Touareg (7P5) V6-3.6L (CGRA)

Vehicle » A L L Diagnostic Trouble Codes (DTC) » Testing and Inspection » P Code Charts » P2106 » Engine Control Module, 2016 MY

ENGINE CONTROL MODULE, 2016 MY**Engine Control Module, 2016 MY**

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2106 Throttle Actuator Control System - Forced Limited Power	Throttle Actuator Short To Battery Plus / Short To Ground	Internal check failed		0.5 s Continuous	2 DCY	Check the Throttle Valve Control Module (GX3) . Refer to ⇒ Throttle valve Control Module (GX3), Checking
	Throttle Actuator Open Circuit		Duty cycle > 80.0% Or Deviation throttle value angles vs. throttle value set point > 4.0 - 50.0%			
	Throttle Actuator Temperature / Current Monitoring					
	Throttle Actuator Functional Check					

DTC P2106 Throttle Actuator Control System - Forced Limited Power – The monitor strategy looks for an open circuit condition in the throttle actuator, therefore, detecting open circuitry in the throttle control circuit.

Figure 11

Engine Management

The Throttle Drive Angle Sensor 1 G187 and Throttle Drive Angle Sensor 2 G188 in the Throttle Valve Control Unit

These sensors determine the current position of the throttle valve and send this information to the ECM.

Signal Utilization

The ECM recognizes the position of the throttle valve from the angle sensors signals. The signals from the two sensors are redundant, meaning that both sensors provide the same signal.

Effects of a Signal Failure

Example 1

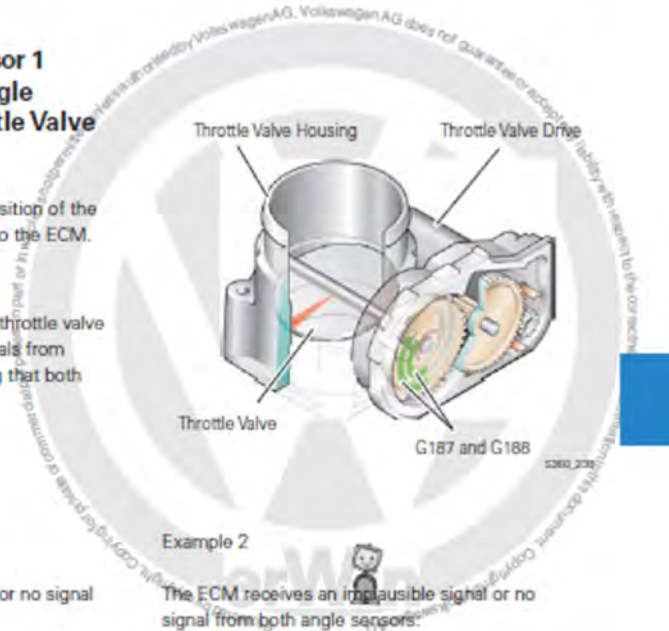
The ECM receives an implausible signal or no signal at all from an angle sensor:

- An entry is made in the DTC memory and the error light for electric throttle operation is switched on
- Systems which affect torque, (e.g. cruise control system or engine drag torque control), are switched off
- The load signal is used to monitor the remaining angle sensor
- The accelerator pedal responds normally

Example 2

The ECM receives an implausible signal or no signal from both angle sensors:

- An entry is made for both sensors in the DTC memory and the error light for electric throttle operation is switched on
- The throttle valve drive is switched off
- The engine runs only at an increased idle speed of 1,500 RPM and no longer reacts to the accelerator pedal



2015 Volkswagen Touareg (7P5) V6-3.6L (CGRA)

Vehicle » A L L Diagnostic Trouble Codes (DTC) » Testing and Inspection » P Code Charts » P0638 » Engine Control Module, 2016 MY

ENGINE CONTROL MODULE, 2016 MY**Engine Control Module, 2016 MY**

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0638: Control Module Internal Temperature "A" Too High	Engine Coolant Pump Oper Temperature > Power Mgmt	Power Mgmt temperature > 130°C	Ignition on	3.3 s - Continuous	1 DTC	If a sensor (associated) DTC is also set, diagnose that code BEFORE replacing the ICM. Replace the Engine Control Module (ECM). Refer to appropriate repair manual.
	Displacementary Coolant Pump Oper Temperature > Power Mgmt	Power Mgmt temperature > 130°C				
	Fuel Pump Control (FPC) Oper Temperature > Power Mgmt		Engine speed > 800 RPM			
P0638: Throttle Actuator Control Range/Position Bank 1	Throttle Actuator Positionality Check Close Movement	Time to close to reference point > 0.0 s And Deviation to reference point > 2.88%	Engine speed < 800 RPM Vehicle speed < 10 km/h ECT < 20°C AT < 30°C Case 1: Ignition on Case 2: Engine shut off-time > 5.0 s Number of checks > 10	3.3 s - Multiple	2 DTC	Check the Throttle Valve Control Module (ICM). Refer to [] 
	Throttle Actuator Signal Range Check @ Mechanical Stop Limit	TPS 1 signal voltage < 0.40 V < 0.80 V Or TPS 2 signal voltage < 4.20 V > 4.60 V	Engine speed < 800 RPM Vehicle speed < 10 km/h Case 1: Ignition on ECT < 20 - 115°C AT < 30 - 143°C Case 2:	3.3 s - Multiple		

Zoom**Sized for Print**

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			Engine shut off-time > 5.0 s ECT < 20 - 115°C AT < 30 - 143°C			

A circuit which removes the peak of a waveform is known as a clipper. A clipper is designed to prevent the output of a circuit from exceeding a predetermined voltage level.

<https://www.allaboutcircuits.com/textbook/semiconductors/chpt-3/clipper-circuits/>

Clipping prohibits a surge in engine power which results from an Accelerator Pedal Position Sensor 2 (G185) signaling to the Throttle Valve Control Module (J338) through the Electronic Control Module (ECM; J623)) that a sharp increase in power is needed. An open circuit condition in the throttle control circuit, may result in a driver applying more pressure to the accelerator pedal thereby causing the Accelerator Pedal Position Sensor 2 (G185) to send a

higher voltage signal to the ECM. On information in belief, the ECM creates a throttle position command based on the throttle position sensor. However, if there is a malfunction detected by the system, such as an open circuit condition in one drive cycle, which is later followed by a closed circuit condition, then the throttle position command will be clipped to a throttle position command. On information and belief, the clipped throttle position command is applied to the throttle control motor with the throttle control circuit.

The throttle position command is limited or clipped prior to application to the throttle control motor, resulting in smooth changing of the applied throttle position command.

2.3 Electronic Throttle Control (ETC) System

The electronic throttle control (ETC) system consists of the accelerator-pedal module, the engine control module (ECM), and the electronic throttle body. The electronic throttle body mainly consists of the throttle valve, the electric throttle-valve drive element, and the throttle-valve position sensor (TPS). The drive element is a DC servomotor, which acts on the throttle-valve shaft via a gear unit. The throttle-valve position sensor is a redundant sensor system that detects the position of the throttle valve. The sensors have opposite resistance curves so that the ECM can always cross check the signals to ensure the correct position of the throttle valve is always known.

The driver command is detected by a redundant sensor system in the accelerator-pedal module, and the signal is sent to the engine control module. The engine control module then determines the required throttle-valve position by performing calculations from data measured by sensors such as accelerator pedal position sensor, engine speed sensor and vehicle speed sensor. The actual throttle opening can be more or less in proportion to accelerator pedal position given different engine operating points.

The throttle position command is limited or clipped prior to application to the throttle control motor, resulting in smooth changing of the applied throttle position command. “The actual throttle opening can be more or less in proportion to accelerator pedal position given different engine operating points.”

P0121 Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance	Throttle Position Sensor 1 Rationality Check	<ul style="list-style-type: none"> • TPS 1 – TPS 2 > 5.10 – 6.30% • And • Actual TPS 1 calculated value > actual TPS 2 calculated value • Or • TPS 1 calculated value > 9.0% 	<ul style="list-style-type: none"> • Engine speed > 480 RPM 	<ul style="list-style-type: none"> • 0.3 s • Multiple 	<ul style="list-style-type: none"> • 2 DCY 	<ul style="list-style-type: none"> – Check the Throttle Valve Control Module - GX3- . Refer to <u>⇒ "3.6.32 Throttle Valve Control Module GX3, Checking", page 893 .</u>
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Figure 12

Based upon the totality of the foregoing evidence, and based further upon information and belief, the '128 patent Accused Instrumentalities practice a method for controlling an internal combustion engine, the engine having an engine controller and an electronically controlled throttle including a throttle control motor driven by a throttle control circuit, the method comprising: determining a throttle position command for the throttle control motor; applying the throttle position command to the throttle control motor with the throttle control circuit; detecting an open circuit condition in the throttle control circuit; detecting a closed circuit condition in the throttle control circuit; after detection of the closed circuit condition, clipping the throttle position command; and applying the clipped throttle position command to the throttle control motor with the throttle control circuit.

COUNT III – INFRINGEMENT OF U.S. PATENT NO. 6,581,565

22. The allegations set forth in the foregoing paragraphs 1 through 21 are incorporated into this Third Claim for Relief.

23. On June 24, 2003, U.S. Patent No. 6,581,565 ("the '565 patent"), entitled "Engine Torque Controller" was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the '565 patent is attached as Exhibit 3.

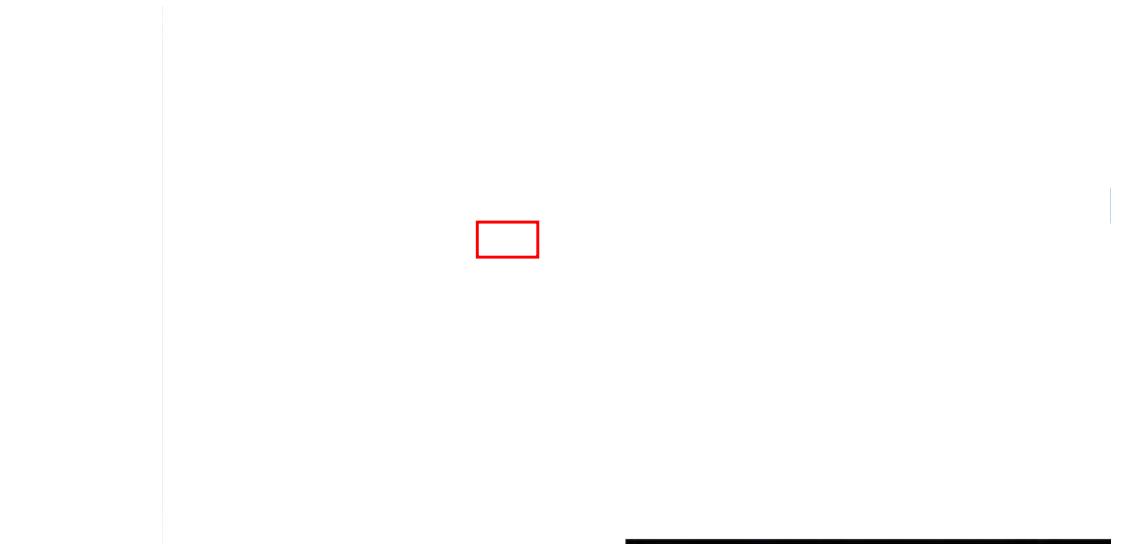
24. Plaintiff is the assignee and owner of the right, title and interest in and to the '565 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

25. Upon information and belief, Defendants have directly infringed at least claim 1 of the '565 patent by making, using, selling, importing and/or providing and causing to be used

the 2013-2018 Passat, 2012-2016 CC, 2012-2017 Touareg, 2018-2019 Atlas, and 2012-2016 Porsche Cayenne (the “’565 patent Accused Instrumentalities”).

26. In particular, claim 1 of the ’565 patent recites a device for controlling a torque output of an engine, the device comprising: a torque demand controller for generating a torque demand signal; and a torque producer which receives the torque demand signal, the torque producer includes: an estimator which receives as inputs a current spark angle signal, a current air/fuel ratio signal and an estimated air charge signal and outputs an estimated torque signal; a comparator which receives as inputs the estimated torque signal and a desired torque signal and outputs a difference signal; a high pass filter which receives as an input the difference signal and outputs a filtered difference signal in which low frequency components are absent; and a transient torque controller which receives as an input the filtered difference signal and outputs a fuel adjustment signal and a spark adjustment signal.

27. On information and belief, the ’565 patent Accused Instrumentalities infringe at least claim 1 of the ’565 patent. The ’565 patent Accused Instrumentalities comprise a device for controlling (*Figure 13*) a torque output of an engine, the device comprising: a torque demand controller for generating a torque demand signal (*Figure 14*); and a torque producer which receives the torque demand signal (*Figures 15*), the torque producer includes: an estimator which receives as inputs a current spark angle signal (*Figure 16*), a current air/fuel ratio signal and an estimated air charge signal and outputs an estimated torque signal (*Figure 16*); a comparator which receives as inputs the estimated torque signal and a desired torque signal and outputs a difference signal (*Figure 17*); a high pass filter which receives as an input the difference signal and outputs a filtered difference signal in which low frequency components are absent (*Figure 18*); and a transient torque controller which receives as an input the filtered difference signal and outputs a fuel adjustment signal and a spark adjustment signal (*Figure 19*).



For example, as shown above, the Engine Control Module (ECM) J623 is a device for controlling the torque output of the engine.

Figure 13

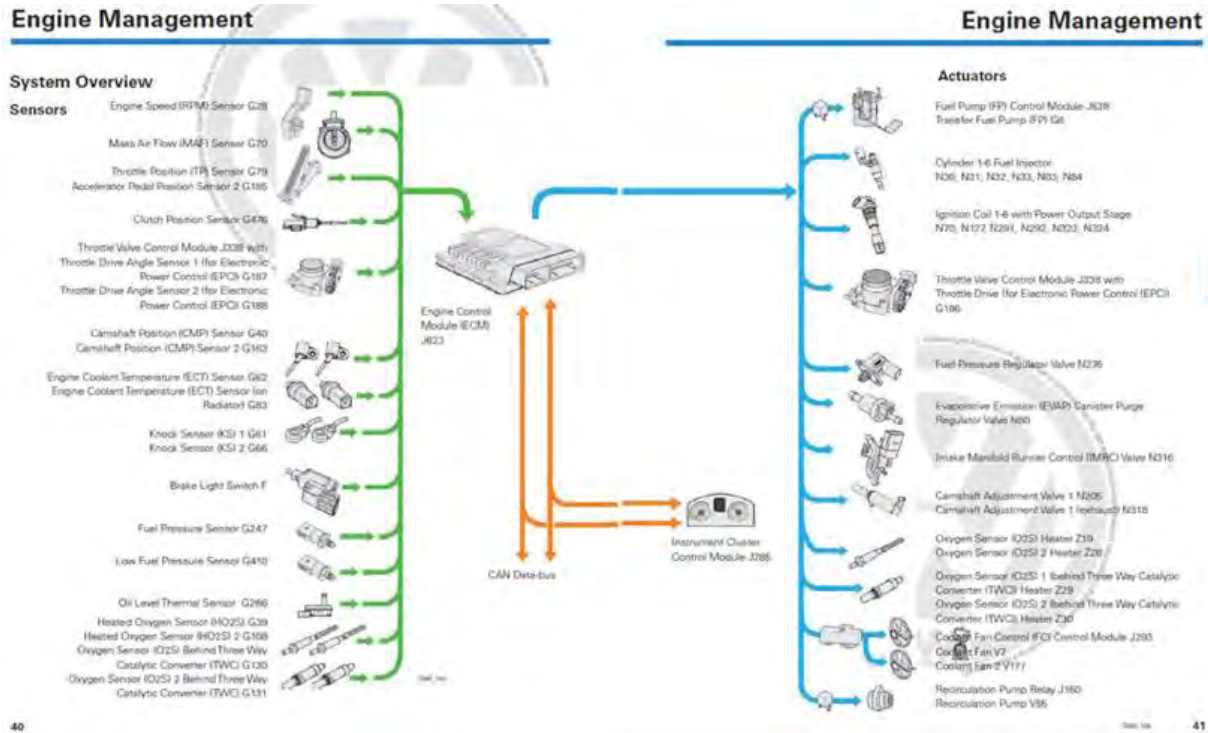


As shown above, the '565 patent Accused Instrumentalities comprise a torque demand controller (ECM) that generates a torque demand signal based on at least an accelerator pedal position signal (Accelerator Pedal Position Sensor G185), an engine speed signal (Engine Speed Sensor G28) and engine coolant temperature signal (Engine Coolant Temperature (ECT) Sensor G62).



The '565 patent Accused Instrumentalities comprise an engine coolant temperature signal (Engine Coolant Temperature (ECT) Sensor G62)).

Figure 14



The Engine Control Module ECM J623 is a torque producer device that controls the torque output of the engine and it receives the torque demand signal internally.

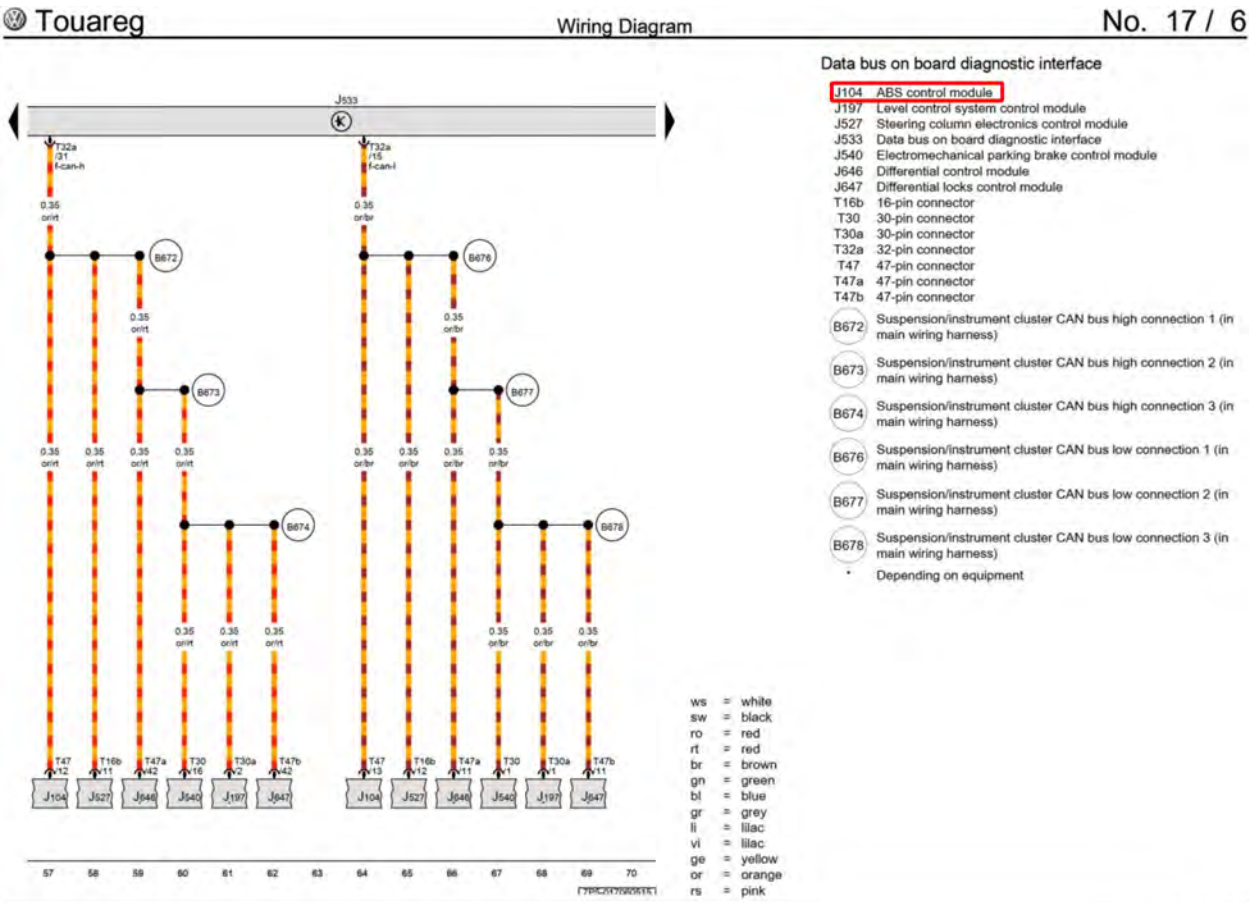
Figure 15



As shown above, the '565 patent Accused Instrumentalities comprise an estimator (Engine Control Module ECM J623) which receives as inputs a current spark angle signal (Ignition coils 1-6), a current air/fuel ratio signal (Heated Oxygen Sensor (HO2S), G39 and Heated Oxygen Sensor (HO2S) 2, G108) and an estimated air charge signal (Mass Air Flow (MAF) signal G70) and outputs an estimated torque signal.

Estimated torque signal ECM J623 (torque demand controller) sends torque demand (reduction) signal within the ECM, wherein, based upon information a belief, there is a software-implemented estimator which makes calculations based at least partially upon sensor feedback signals from engine sensors (i.e. crankshaft position sensor (CKPS), mass airflow sensor (MAF), fuel injector duty cycle command) and calculates (estimates) an estimated torque signal prior to execution by the ECM.

Figure 16



05.2015

Upon information and belief, the comparator in the ECM receives two inputs: (1) the estimated torque signal calculated internally and (2) a desired torque signal calculated internally and includes input from the ABS control module J104 and the Transmission Control Module (TCM) J217.

Figure 17

P0606 Control Module Processor	Baromet- ric Pres- sure Sen- sor Plausi- bility Check	<ul style="list-style-type: none">Signal gradi- ent > 14.0 kPa/sSignal gradi- ent < -14.0 kPa/s	<ul style="list-style-type: none">2.0 sMulti- ple	<ul style="list-style-type: none">2 DCY	<ul style="list-style-type: none">Replace the Engine Control Module - J623- . Re- fer to appro- priate repair manual.
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Touareg 2011 >

Generic Scan Tool - Edition 09.2016

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Barometric Pressure Sensor Short To Battery / Open Circuit	• Signal voltage > 4.88 V		• 1.0 s • Multiple		
	Barometric Pressure Sensor Short To Ground	• Signal voltage < 0.20 V				
	Barometric Pressure Sensor Out Of Range High	• Measured barometric pressure > 115.0 kPa		• 2.0 s • Continuous		
	Barometric Pressure Sensor Out Of Range Low	• Measured barometric pressure < 45.0 kPa				
	Mass Air Flow Sensor Functional Check	• MAF sensor signal > 0 μ s	• MAF commanded off • After engine stop	• 0.4 s • Multiple		
	Ignition Control Communication Check	• Internal check failure • SPI communications check Identifier failure	• Engine speed > 80 RPM	• 0.5 s • Continuous		
	ECM: 5V Supply Voltage Internal Hardware Check	• Under-/ over-voltage detection		• 2.0 s • Continuous		
	ECM: EEPROM Functional Check	• Internal checksum failed	• Ignition on	• 0.5 s • Continuous		
	ECM: Electronic Throttle Control Module Function Monitoring: A/D Converter	• Test voltage / test pulse check failed				

Touareg 2011 ►
Generic Scan Tool - Edition 09.2016



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	ECM: Electronic Throttle Control Module Function Monitoring: Torque	<ul style="list-style-type: none"> Comparison with allowed engine torque incorrect 	<ul style="list-style-type: none"> Internal engine speed > 1,240 RPM 			
	ECM: Electronic Throttle Control Module Function Monitoring: Start/Engine Running	<ul style="list-style-type: none"> Engine re-start/run not allowed 				
	ECM: Electronic Throttle Control Module Function Monitoring: Start Control/Start Automatic	<ul style="list-style-type: none"> Engine start not allowed 				
	ECM: Electronic Throttle Control Module Function Monitoring: Engine Speed Deviation	<ul style="list-style-type: none"> Difference between calculated and internal engine speed > 320 RPM 	<ul style="list-style-type: none"> Internal engine speed > 520 RPM 			
	ECM: Electronic Throttle Control Module Function Monitoring: Ignition Timing	<ul style="list-style-type: none"> Internal check failed 				
	ECM: Electronic Throttle Control Module Function Monitoring: Intern	<ul style="list-style-type: none"> System reaction incorrect 				



Touareg 2011 ►
Generic Scan Tool - Edition 09.2016

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	ECM: Electronic Throttle Control Module Function Monitoring: Injection Rate Limitation					
	ECM: Electronic Throttle Control Module Function Monitoring: Accelerator Position	<ul style="list-style-type: none"> Internal check failed 				
	ECM: Electronic Throttle Control Module Monitoring Module	<ul style="list-style-type: none"> Function controller check failed And Monitoring module check no failure 	<ul style="list-style-type: none"> SPI-interface no failure 			
	ECM: Reset Monitoring	<ul style="list-style-type: none"> Internal logic 				
	ECM: Self Check for Sensor Integrated Circuit Internal Hardware Check (Electrical Adjustment Communication, Voltage Supply)	<ul style="list-style-type: none"> Check failed 				
	ECM: WDA Function Monitoring: WDA	<ul style="list-style-type: none"> General cause failure Internal check failure Over voltage detection failure 				

330 Rep. Gr-ST - Generic Scan Tool

Touareg 2011 ►



Generic Scan Tool - Edition 09.2016

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	CAN: Internal Fault CAN Controller RAM Check	<ul style="list-style-type: none"> RAM error memory checksum error 	<ul style="list-style-type: none"> Initialization phase 	<ul style="list-style-type: none"> None [-] Once / DCY 		

Upon information and belief, DTC P0606 (pp. 327-331) above exemplifies the '565 patent Accused Instrumentalities comprise an ECM comprising a comparator, which compares the difference between the current torque and allowed engine torque (desired torque signal) to generate an error signal (DTC P0606). Upon information and belief, the error signal is filtered by a high pass filter that filters and the resulting filtered error signal is used by the transient torque controller to generate signals to temporarily adjust the torque produced by the engine.

Figure 18

P0506 Idle Air Control System RPM - Lower Than Expec- ted	Idle Air Control System RPM Lower Than Ex- pected	<ul style="list-style-type: none"> Engine speed Deviation > 100 RPM AND <ul style="list-style-type: none"> RPM control- ler torque val- ue >= calcula- ted max value 	<ul style="list-style-type: none"> Engine speed – idle Vehicle speed 0 MPH Altitude < 2,700 m ECT, > 20° C IAT, @ manifold > -48° C external torque request not demanded EVAP purge valve closed <p>FOR MANUAL TRANSMISSION:</p> <ul style="list-style-type: none"> engine load < 28.01 – 37.99% 	<ul style="list-style-type: none"> 5.0 s Multi- ple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to "3.6.32 Throttle Valve Control Module GX3, Checking" page 893 .
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Transient torque is known in the art as a temporary torque condition which exists only until the vehicle stabilizes and in cases where the torque is excessive enough for the vehicle to lose traction, it requires a torque reduction output signal from the ABS/ESC. Based upon information and belief, the transient torque controller (software within the ECM) receives as an input the filtered difference signal (described above) and outputs a fuel adjustment signal (to the ECM) and spark adjustment signal (used for engine control intervention).

Based upon information and belief, the ECM detects external torque demands as shown in the DTC P0506, which causes the throttle opening to be either increased or decreased, thereby further requiring the addition (adjustment) of fuel and an adjustment in spark timing.

Figure 19

Based upon the totality of the foregoing evidence, and based further upon information and belief, the '565 patent Accused Instrumentalities incorporate "a device for controlling a torque output of an engine, the device comprising: a torque demand controller for generating a torque demand signal; and a torque producer which receives the torque demand signal, the torque producer includes: an estimator which receives as inputs a current spark angle signal, a current air/fuel ratio signal and an estimated air charge signal and outputs an estimated torque signal; a comparator which receives as inputs the estimated torque signal and a desired torque signal and outputs a difference signal; a high pass filter which receives as an input the difference signal and outputs a filtered difference signal in which low frequency components are absent; and a transient torque controller which receives as an input the filtered difference signal and outputs a fuel adjustment signal and a spark adjustment signal."

COUNT IV – INFRINGEMENT OF U.S. PATENT NO. 6,379,281

28. The allegations set forth in the foregoing paragraphs 1 through 27 are incorporated into this Forth Claim for Relief.

29. On April 30, 2002, U.S. Patent No. 6,379,281 (“the ’281 patent”), entitled “Engine Output Controller” was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the ’281 patent is attached as Exhibit 4.

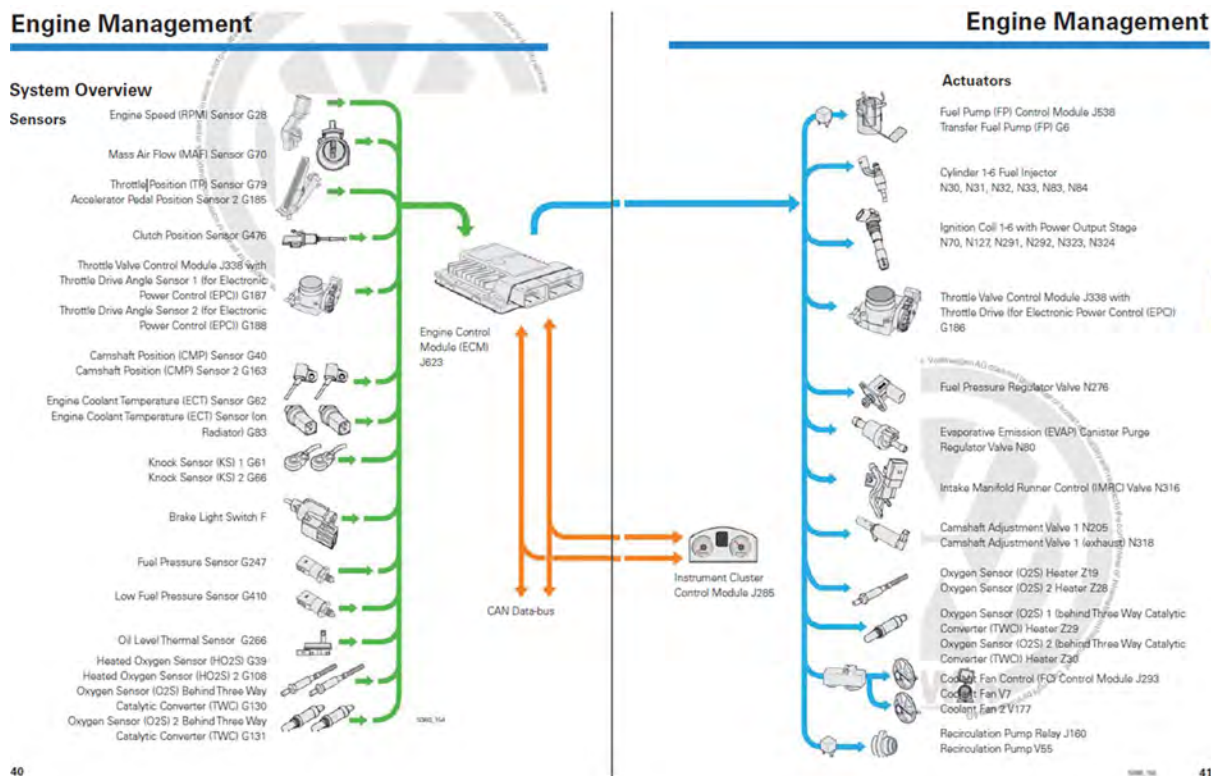
30. Plaintiff is the assignee and owner of the right, title and interest in and to the ’281 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

31. Upon information and belief, Defendants have directly infringed at least claims 1, 7 and 10 of the ’281 patent by making, using, selling, importing and/or providing and causing to be used the 2010-2015 Touareg 2011-2017 (the “’281 patent Accused Instrumentalities”).

32. In particular, claim 1 of the ’281 patent recites an engine output control method for a vehicle having a drive by wire engine system responsive to a desired engine torque signal, the method comprising the steps of: generating a driver demanded acceleration value corresponding to an operator input; generating a gear value as a function of a vehicle speed value and said driver demanded acceleration value; deriving a driveline torque demand comprising an inertial model torque value of said vehicle driveline corresponding to said driver demanded acceleration and said gear value, and a dynamic transmission model torque value for said gear value; deriving a demanded engine torque value from said driveline torque demand and a torque converter model; and controlling said engine output as a function of said demanded engine torque value.

33. On information and belief, the ’281 patent Accused Instrumentalities infringe at least claim 1 of the ’281 patent. The ’281 patent Accused Instrumentalities practice an engine

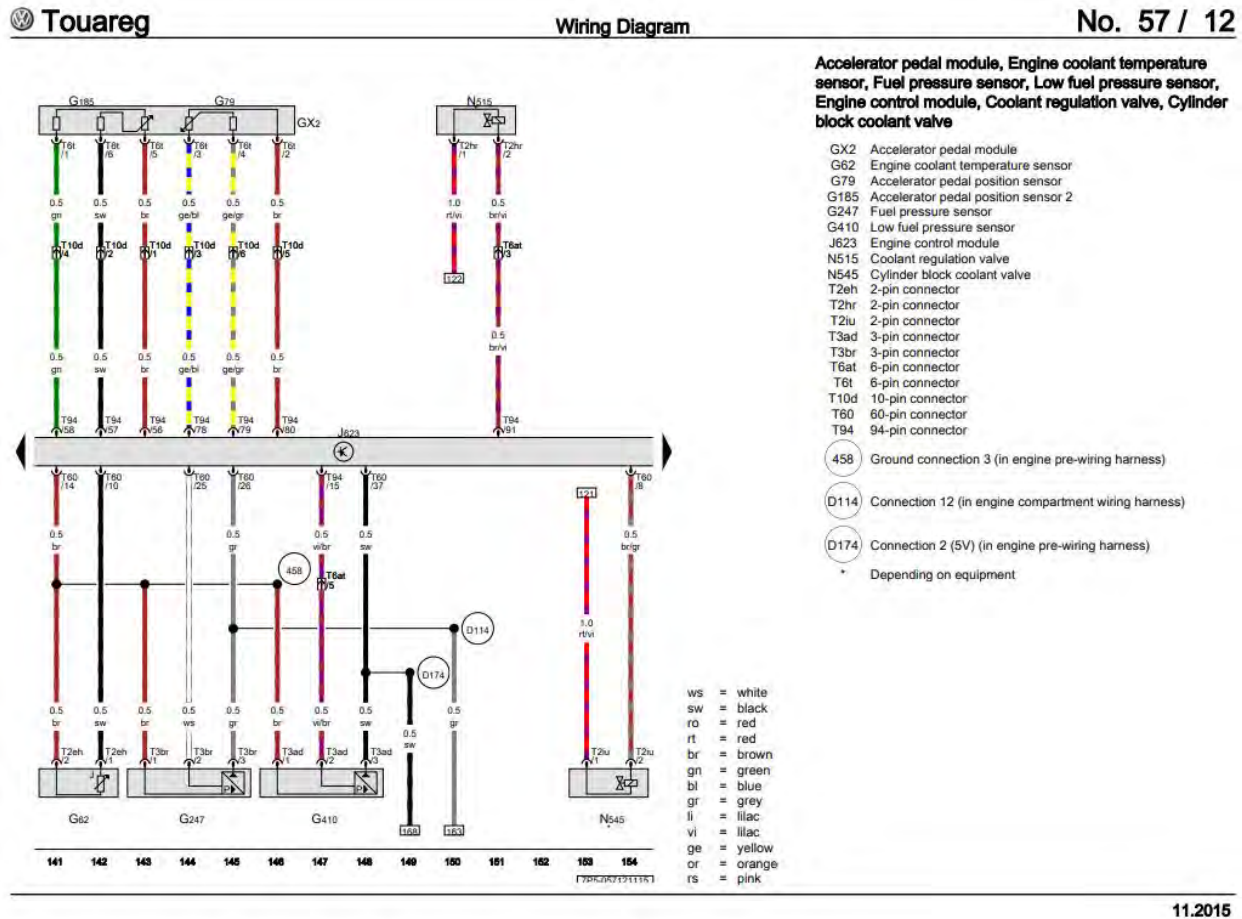
output control method for a vehicle having a drive by wire engine system (*Figure 20*) responsive to a desired engine torque signal (*Figure 20*), the method comprising the steps of: generating a driver demanded acceleration value corresponding to an operator input (*Figure 21*); generating a gear value as a function of a vehicle speed value and said driver demanded acceleration value (*Figure 22*); deriving a driveline torque demand comprising an inertial model torque value of said vehicle driveline corresponding to said driver demanded acceleration and said gear value, and a dynamic transmission model torque value for said gear value (*Figure 23*) deriving a demanded engine torque value from said driveline torque demand and a torque converter model (*Figure 24*); and controlling said engine output as a function of said demanded engine torque value (*Figure 25*).



The '281 patent Accused Instrumentalities comprise a CAN (Controller Area Network) which allows microcontrollers like the Engine Control Module (ECM), Transmission Control Module (TCM), and Antilock Brake System/Electronic Stability Control (ABS/ESC) to communicate with each other.

For example, as shown above, the drive by wire system comprises an Engine Control Module (J623), Accelerator pedal module (GX2), Throttle Position (TP) Sensor (G79), Accelerator pedal position sensor 2 (G185), throttle valve control module (J338) containing the throttle drive angle sensor 1 (for electronic power control (EPC) (G187, throttle drive angle sensor 2 (for EPC) (G188), and is controlled by the ECM (J623) via the CAN bus.

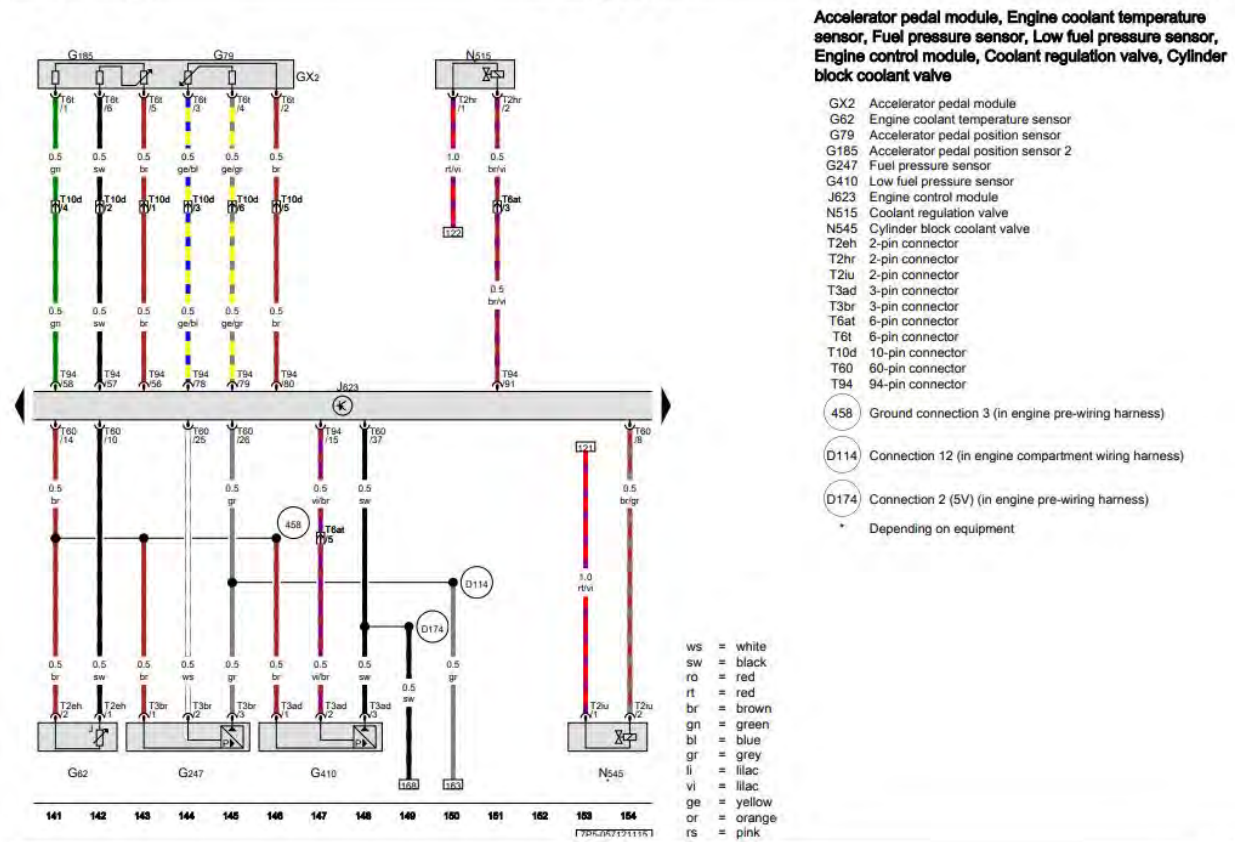
Figure 20



The '281 patent Accused Instrumentalities comprise an Accelerator pedal module (GX2), Accelerator pedal position sensor 2 (G79), Accelerator pedal position sensor 2 (G185), throttle valve control module (J338) containing the throttle drive angle sensor 1, electronic power control (EPC; G187), throttle drive angle sensor 2 (G188), which send a voltage signal to the ECM and generates a driver demanded acceleration value corresponding to operator input. *See above.*

For example, the Accelerator pedal module (GX2), Throttle Position (TP) Sensor (G79), and Accelerator pedal position sensor 2 (G185) each send a respective voltage signal to the ECM, which generates a driver demanded acceleration value corresponding to operator input (the operator pressing the accelerator pedal)

Figure 21



11.2015

Automatic transmissions have used mechanical (hydraulic) shift logic for years based on vehicle speed and driver demanded acceleration value to determine a gear value. Modern automatic transmission control logic (software) is modeled based on this mechanical shift logic. In short, this function is certainly present in the '281 patent Accused Instrumentalities.

As shown below, the gear values (transmission shift points) are determined by the Transmission Control Module (TCM; J217) based upon vehicle speed (vehicle speed value) provided by the ECM (J623) and the throttle percentage open value (derived from the APS and driver demanded acceleration value).

This is evidenced by DTC code P0730 – Incorrect Gear Ratio. For example, if the TCM detects that the transmission is trying to shift to a lower gear than intended DTC code P0730 is produced. The DTC code is based on monitoring actual gear position by checking the torque converter slip ratio calculated by the TCM as follows:

$$\text{Torque converter slip ratio} = A \times C/B$$

A: Output shaft revolution signal from speed sensor (revolution sensor)

B: Engine speed signal from Engine Control Module (ECM)

C: Gear ratio determined as gear position which TCM supposes

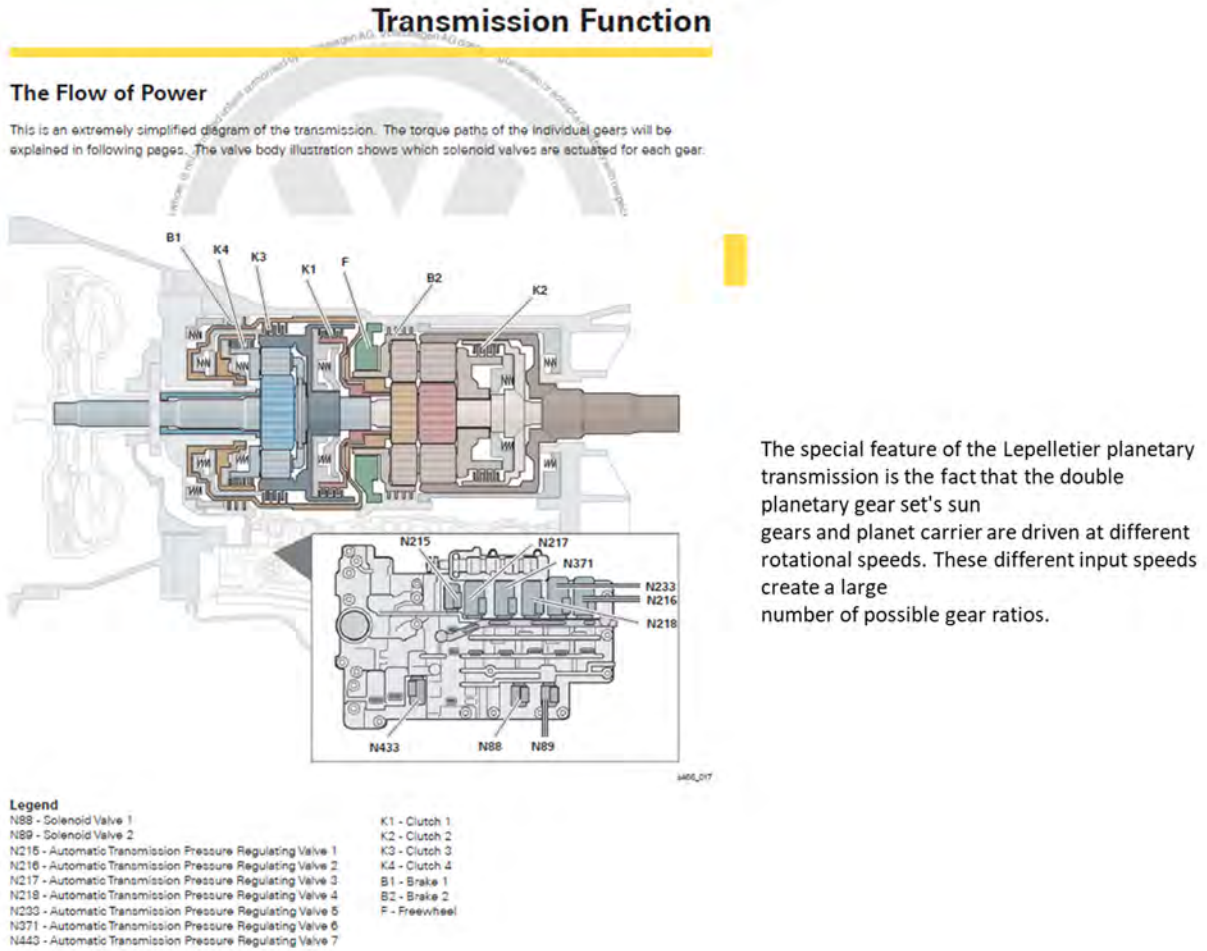
If the actual gear position is higher than the position supposed by the TCM, the slip ratio will be more than normal. In case the ratio exceeds the specified value, the TCM judges this diagnosis malfunction.

<https://www.autocodes.com/p0730.html>

The engine speed signal is based on the Accelerator pedal module (GX2), Throttle Position (TP) Sensor (G79), and Accelerator pedal position sensor 2 (G185) which each send a respective voltage signal to the ECM, which generates a driver demanded acceleration value corresponding to operator input.

There are two transmission speed sensors, also commonly referred to as a vehicle speed sensors (VSS) which send data (respective inputs) to the powertrain control module (PCM), which compares these two inputs and calculates which gear the transmission should engage for efficient driving. The actual gear ratio is then compared to the desired gear ratio. If the desired gear and the actual gear do not match, then the PCM will set a diagnostic trouble code (DTC) and illuminate the Check Engine Light.

Figure 22



17

Additionally, adaptations are used to allow the system to learn during vehicle operation.

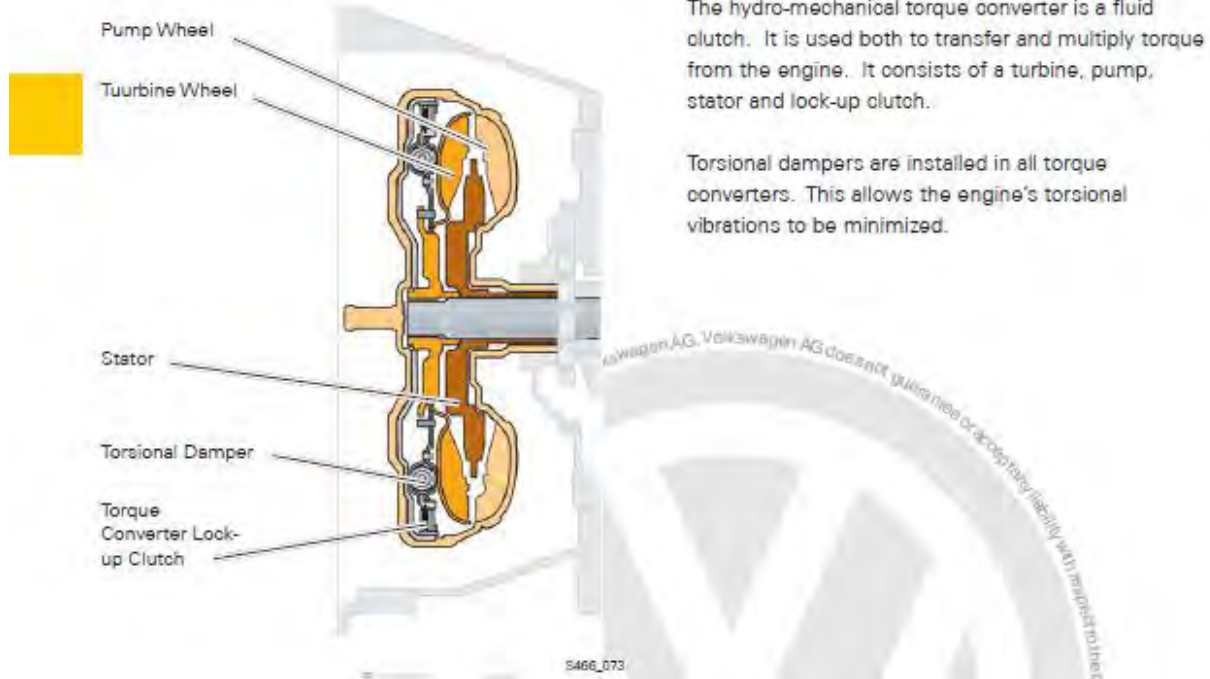
As shown by the exemplary images below, the Transmission Control Module (TCM; J217) (shown above) derives a driveline torque demand which, based upon information and belief for the reasons discussed below, is comprised of an inertial model torque value of the vehicle driveline corresponding with the driver demanded acceleration and gear values discussed above, and a dynamic transmission model torque value for the gear value..

Upon information and belief, the ECM/TCM calculates an inertial model torque value and a dynamic transmission model torque value.

Figure 23

Transmission Design

The Torque Converter



The torque converter can be expressed as functions of the engine speed (demanded engine torque value) and the turbine speed from driveline torque demand and a torque converter model.

The input-output characteristics of the torque converter can be expressed as functions of the engine speed and the turbine speed. In this example, the direction of power flow is always assumed to be from the impeller to the turbine (see Equation 2).

Equation 2

$$T_t = \frac{N_e^2}{K^2}$$

$$K = f_2 \frac{N_{in}}{N_e} = \text{K-factor (capacity)}$$

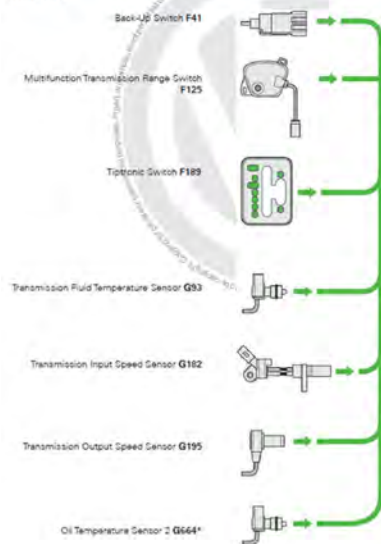
$$N_{in} = \text{speed of turbine (torque converter output) = transmission input speed (RPM)}$$

$$R_{TQ} = f_3 \frac{N_{in}}{N_e} = \text{torque ratio}$$

https://www.mathworks.com/help/simulink/examples/modeling-an-automatic-transmission-controller.html?s_tid=gn_loc_drop

Upon information and belief, the ECM/TCM calculates a demanded engine torque value and a driveline torque demand.

Figure 24

Transmission Management System**System Overview****Sensors****Transmission Management System****Actuators**

28

29

Service Training Self Study Program 850103 The 8-Speed Automatic Transmission 0C8 Design and Function

As demonstrated above, and further supported below, the ECM/TCM controls engine output as a function of demanded engine torque value.

Based upon the totality of the foregoing evidence, and based further upon information and belief, the '281 patent Accused Instrumentalities practice an engine output control method for a vehicle having a drive by wire engine system responsive to a desired engine torque signal, the method comprising the steps of: generating a driver demanded acceleration value corresponding to an operator input; generating a gear value as a function of a vehicle speed value and said driver demanded acceleration value; deriving a driveline torque demand comprising an inertial model torque value of said vehicle driveline corresponding to said driver demanded acceleration and said gear value, and a dynamic transmission model torque value for said gear value; deriving a demanded engine torque value from said driveline torque demand and a torque converter model; and controlling said engine output as a function of said demanded engine torque value.

Figure 25

COUNT V – INFRINGEMENT OF U.S. PATENT NO. 6,763,804

34. The allegations set forth in the foregoing paragraphs 1 through 33 are incorporated into this Fifth Claim for Relief.

35. On July 20, 2004, U.S. Patent No. 6,763,804 (“the ’804 patent”), entitled “Electronic Throttle Servo Overheat Protection System,” was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the ’804 patent is attached as Exhibit 5.

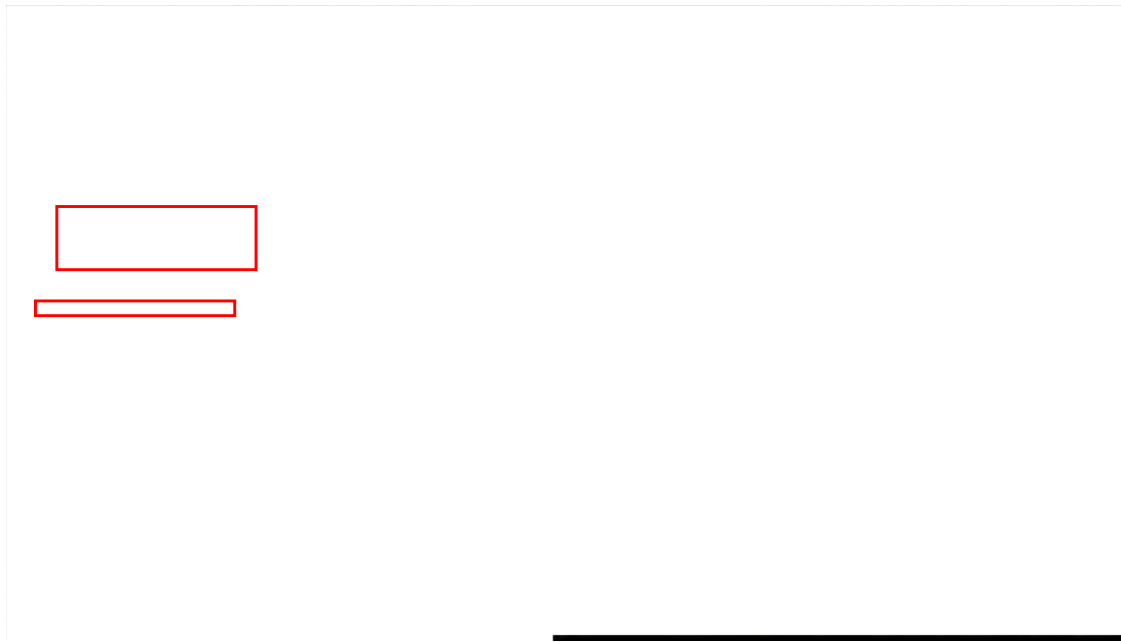
36. Plaintiff is the assignee and owner of the right, title and interest in and to the ’804 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

37. Upon information and belief, Defendants have directly infringed at least claims 1 and 11 of the ’804 patent by making, using, selling, importing and/or providing and causing to be used the 2013-2018 Passat, 2012-2016 CC, 2012-2017 Touareg, 2018-2019 Atlas, and 2012-2016 Porsche Cayenne (the “’804 patent Accused Instrumentalities”).

38. In particular, claim 1 of the ’804 patent recites a method for controlling a positioning device of an internal combustion engine, the method comprising the steps of: providing an electric motor for actuating the positioning device; commanding the positioning device to change to a commanded position; detecting a control effort required to change to said commanded position; determining whether said control effort exceeds a threshold for a predetermined time period; and reducing said control effort when said control effort exceeds said threshold for said predetermined time period; wherein commanding the positioning device to change to said commanded position comprises at least one of commanding the positioning device to open to a hold open mode and commanding the positioning device to close to a hold close mode.

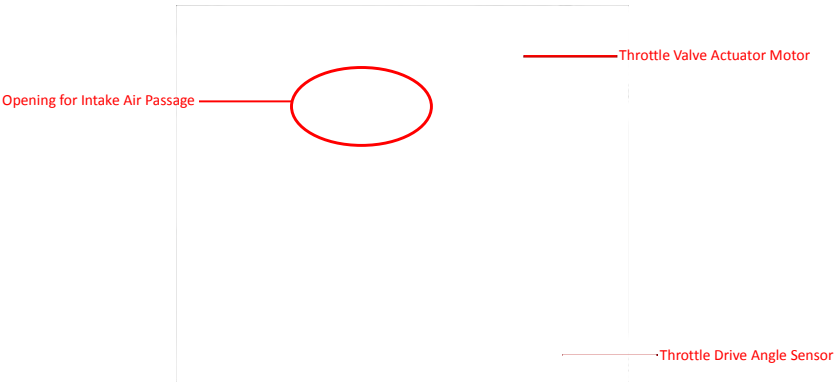
39. On information and belief, the ’804 patent Accused Instrumentalities infringe at least claim 1 of the ’804 patent. The ’804 patent Accused Instrumentalities practice a method for controlling a positioning device of an internal combustion engine (*Figure 26*), the method

comprising the steps of: providing an electric motor for actuating the positioning device (*Figure 27*); commanding the positioning device to change to a commanded position (*Figure 28*); detecting a control effort required to change to said commanded position (*Figure 29*); determining whether said control effort exceeds a threshold for a predetermined time period (*Figures 28-30*); and reducing said control effort when said control effort exceeds said threshold for said predetermined time period (*Figure 31*); wherein commanding the positioning device to change to said commanded position comprises at least one of commanding the positioning device to open to a hold open mode and commanding the positioning device to close to a hold close mode (*Figure 32*).



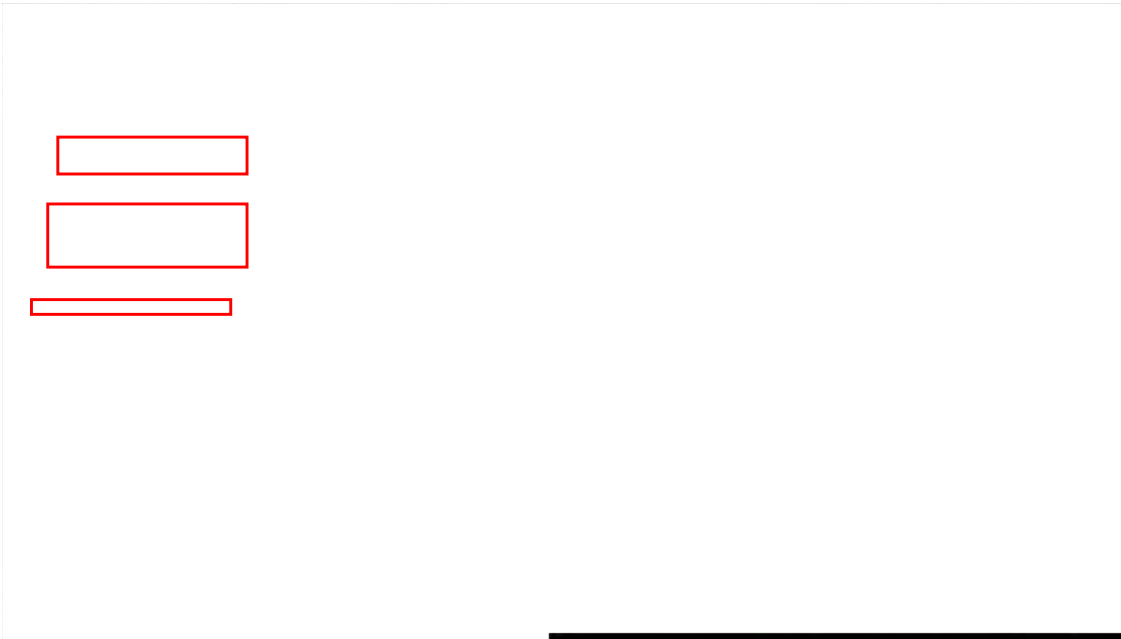
For example, as shown above the Engine Control Module (ECM) J623 controls a positioning device, the Throttle Valve Control Module J338 of an internal combustion engine (VW 3.2L & 3.6L).

Figure 26



For example, as shown above, a positioning device, the Throttle Valve Control Module J338 of an internal combustion engine (VW 3.2L & 3.6L), is actuated via a Throttle Valve Actuator Motor.


Figure 27



For example, as shown above, a positioning device, the Throttle Valve Control Module J338 of an internal combustion engine (VW 3.2L & 3.6L), is actuated via a Throttle Valve Actuator

Motor as commanded by the ECM, to change to a commanded position (based on the driver demand commanded from the Accelerator Position Sensor 2 G185).

Figure 28

 Touareg 2011 > Generic Scan Tool - Edition 09.2016						
DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Fuel Pump Control (FPC) Over-Temperature Power Stage		<ul style="list-style-type: none"> Engine speed > 80 RPM 			
P0638 Throttle Actuator Control Range/Performance Bank 1	Throttle Actuator Rationality Check Close Movement	<ul style="list-style-type: none"> Time to close to reference point > 0.6 s And Deviation to reference point > 2.88% 	<ul style="list-style-type: none"> Engine speed 0 RPM Vehicle speed 0 km/h ECT > -20° C IAT > -20° C Case 1: Ignition on Case 2: Engine shut-off-time > 5.0 s Number of checks 3.0 [-] 	<ul style="list-style-type: none"> 5.0 s Multiple 	2 DCY	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to 3.6.32 Throttle Valve Control Module GX3 Checking, page 893 .
	Throttle Actuator Signal Range Check @ Mechanical Stop Low	<ul style="list-style-type: none"> TPS 1 signal voltage < 0.40; > 0.80 V Or TPS 2 signal voltage < 4.20; > 4.60 V 	<ul style="list-style-type: none"> Engine speed 0 RPM Vehicle speed 0 km/h Case 1: Ignition on ECT -20 – 115° C IAT -20 – 143° C Case 2: Engine shut-off-time > 5.0 s ECT 5.0 – 115° C IAT 5.0 – 143° C 	<ul style="list-style-type: none"> 0.3 s Multiple 		
P0641 Sensor Reference Voltage "A" Circuit/Open	Engine Control Module (ECM): Sensor Reference Circuit A Short Circuit	<ul style="list-style-type: none"> Signal voltage < 4.8; > 5.2 V 		<ul style="list-style-type: none"> 0.5 s Continuous 	2 DCY	<ul style="list-style-type: none"> If a related sensor voltage code is also set, refer to that code for diagnosis. If no other related codes set, replace the Engine Control Module - J623- . Refer to appropriate repair manual.


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For example, control effort corresponds to the amount of motor torque that the Throttle Valve Control Module J338 requires to change the position of the throttle valve and this is related to the time it takes the Throttle Valve Control Module J338 to close to a reference point. The

commanded position is determined by the Engine Control Module (ECM) J623 based on information from the Accelerator Position Sensor 2 G185 derived from driver demand, to change to a commanded position (based on the driver demand commanded from the Accelerator Position Sensor 2 G185).

Figure 29

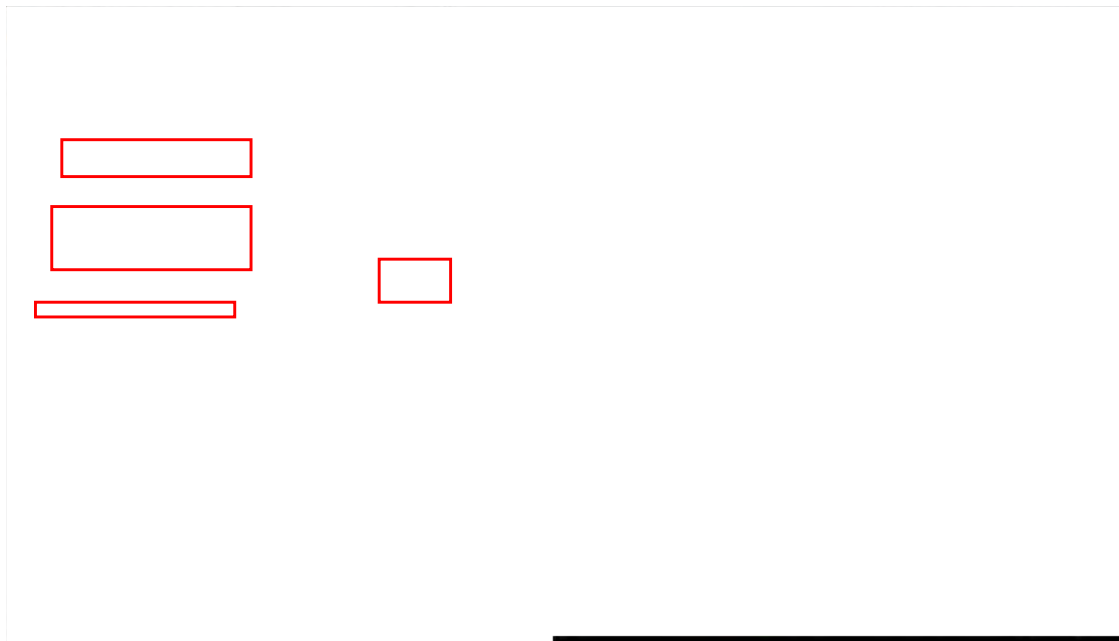
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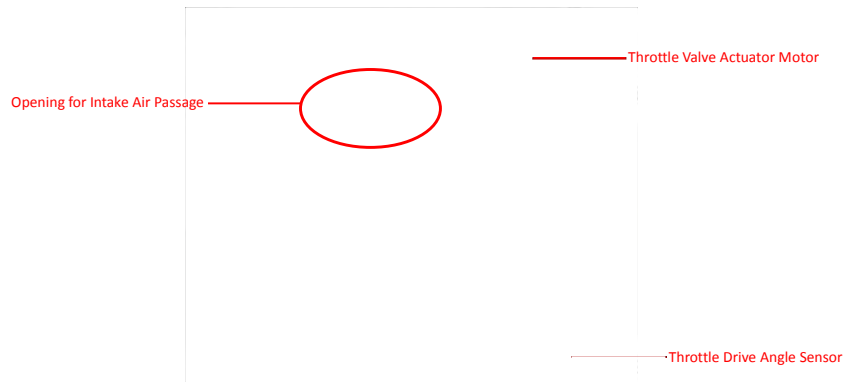
DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Fuel Pump Control (FPC) Over-Temperature Power Stage		<ul style="list-style-type: none"> Engine speed > 80 RPM 			
P0638 Throttle Actuator Control Range/Performance Bank 1	Throttle Actuator Rationality Check Close Movement	<ul style="list-style-type: none"> Time to close to reference point > 0.6 s And Deviation to reference point > 2.88% 	<ul style="list-style-type: none"> Engine speed 0 RPM Vehicle speed 0 km/h ECT > -20° C IAT > -20° C Case 1: Ignition on Case 2: Engine shut-off-time > 5.0 s Number of checks 3.0 [-] 	<ul style="list-style-type: none"> 5.0 s Multiple 	2 DCY	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to 3.6.32 Throttle Valve Control Module GX3 Checking, page 893.
	Throttle Actuator Signal Range Check @ Mechanical Stop Low	<ul style="list-style-type: none"> TPS 1 signal voltage < 0.40; > 0.80 V Or TPS 2 signal voltage < 4.20; > 4.60 V 	<ul style="list-style-type: none"> Engine speed 0 RPM Vehicle speed 0 km/h Case 1: Ignition on ECT -20 – 115° C IAT -20 – 143° C Case 2: Engine shut-off-time > 5.0 s ECT 5.0 – 115° C IAT 5.0 – 143° C 	<ul style="list-style-type: none"> 0.3 s Multiple 		
P0641 Sensor Reference Voltage "A" Circuit/ Open	Engine Control Module (ECM): Sensor Reference Circuit A Short Circuit	<ul style="list-style-type: none"> Signal voltage < 4.8; > 5.2 V 		<ul style="list-style-type: none"> 0.5 s Continuous 	2 DCY	<ul style="list-style-type: none"> If a related sensor voltage code is also set, refer to that code for diagnosis. If no other related codes set, replace the Engine Control Module - J623- . Refer to appropriate repair manual.

For example, as shown above, the threshold value demonstrates a determination being made by the Engine Control Module (ECM) J623 regarding whether a control effort exceeds a threshold for a predetermined time period.

Upon information and belief, the claim limitation “determining whether said control effort exceeds a threshold for said predetermined time period” is satisfied.

Figure 30





2.3 Electronic Throttle Control (ETC) System

The electronic throttle control (ETC) system consists of the accelerator-pedal module, the engine control module (ECM), and the electronic throttle body. The electronic throttle body mainly consists of the throttle valve, the electric throttle-valve drive element, and the throttle-valve position sensor (TPS). The drive element is a DC servomotor, which acts on the throttle-valve shaft via a gear unit. The throttle-valve position sensor is a redundant sensor system that detects the position of the throttle valve. The sensors have opposite resistance curves so that the ECM can always cross check the signals to ensure the correct position of the throttle valve is always known.

The driver command is detected by a redundant sensor system in the accelerator-pedal module, and the signal is sent to the engine control module. The engine control module then determines the required throttle-valve position by performing calculations from data measured by sensors such as accelerator pedal position sensor, engine speed sensor and vehicle speed sensor. The actual throttle opening can be more or less in proportion to accelerator pedal position given different engine operating points.



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DTC / Description	Monitor Strategy Description	Malfun-ction Crite-ria and Threshold Value	Secondary Param-e-ters with Enable Conditions	Monitor-ing Time Length	MIL Illumina-tion	Component Di-agnostic Proce-dure
	Fuel Pump Control (FPC) Over-Tempera-ture Power Stage		<ul style="list-style-type: none"> Engine speed > 80 RPM 			
P0638 Throttle Actuator Control Range/Performance Bank 1	Throttle Actuator Rationality Check Close Movement	<ul style="list-style-type: none"> Time to close to reference point > 0.6 s And Deviation to reference point > 2.88% 	<ul style="list-style-type: none"> Engine speed 0 RPM Vehicle speed 0 km/h ECT > -20° C IAT > -20° C Case 1: Ignition on Case 2: Engine shut-off-time > 5.0 s Number of checks 3.0 [-] 	<ul style="list-style-type: none"> 5.0 s Multi-ple 	2 DCY	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to 3.6.32 Throttle Valve Control Module GX3 Checking, page 893 .
	Throttle Actuator Signal Range Check @ Mechanical Stop Low	<ul style="list-style-type: none"> TPS 1 signal voltage < 0.40; > 0.80 V Or TPS 2 signal voltage < 4.20; > 4.60 V 	<ul style="list-style-type: none"> Engine speed 0 RPM Vehicle speed 0 km/h Case 1: Ignition on ECT -20 – 115° C IAT -20 – 143° C Case 2: Engine shut-off-time > 5.0 s ECT 5.0 – 115° C IAT 5.0 – 143° C 	<ul style="list-style-type: none"> 0.3 s Multi-ple 		
P0641 Sensor Reference Voltage "A" Circuit/ Open	Engine Control Module (ECM): Sensor Reference Circuit A Short Circuit	<ul style="list-style-type: none"> Signal voltage < 4.8; > 5.2 V 		<ul style="list-style-type: none"> 0.5 s Con-tinu-ous 	2 DCY	<ul style="list-style-type: none"> If a related sensor voltage code is also set, refer to that code for diagnosis. If no other related codes set, replace the Engine Control Module - J623- . Refer to appropriate repair manual.

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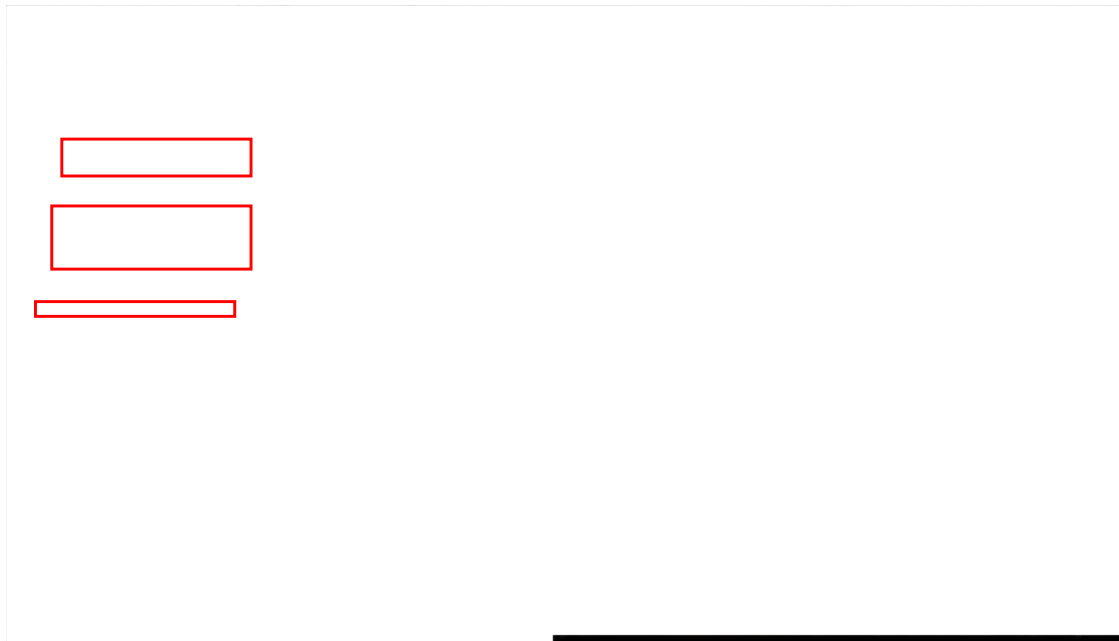
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Control effort is provided by the Throttle Valve Actuator Motor based on the signal sent by the Engine Control Module (ECM) J623. The ECM signal is derived from the Accelerator Position Sensor 2 G185 based on driver demanded acceleration input. The throttle valve is actuated by the Throttle Valve Actuator Motor, sending a Throttle Drive Angle Sensor signals (1 & 2) to the ECM. The Throttle Actuator Control Rationality check shows a threshold valve. The Throttle Valve Actuator Motor will attempt to close the throttle valve within a time limit with feedback

from the Throttle Drive Angle Sensor signals (1 & 2), if the Throttle Drive Angle Sensor signals (1 & 2) indicate a time greater than the time limit, then the DTC will set.

On information and belief, the ECM hardware and software perform the step of "reducing said control effort when said control effort exceeds a threshold for a period."

Figure 31






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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Fuel Pump Control (FPC) Over-Temperature Power Stage		<ul style="list-style-type: none"> Engine speed > 80 RPM 			
P0638 Throttle Actuator Control Range/Performance Bank 1	Throttle Actuator Rationality Check Close Movement	<ul style="list-style-type: none"> Time to close to reference point > 0.6 s And Deviation to reference point > 2.88% 	<ul style="list-style-type: none"> Engine speed 0 RPM Vehicle speed 0 km/h ECT > -20° C IAT > -20° C Case 1: Ignition on Case 2: Engine shut-off-time > 5.0 s Number of checks 3.0 [-] 	<ul style="list-style-type: none"> 5.0 s Multiple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to 3.6.32 Throttle Valve Control Module GX3 Checking, page 893 .
	Throttle Actuator Signal Range Check @ Mechanical Stop Low	<ul style="list-style-type: none"> TPS 1 signal voltage < 0.40; > 0.80 V Or TPS 2 signal voltage < 4.20; > 4.60 V 	<ul style="list-style-type: none"> Engine speed 0 RPM Vehicle speed 0 km/h Case 1: Ignition on ECT -20 – 115° C IAT -20 – 143° C Case 2: Engine shut-off-time > 5.0 s ECT 5.0 – 115° C IAT 5.0 – 143° C 	<ul style="list-style-type: none"> 0.3 s Multiple 		
P0641 Sensor Reference Voltage "A" Circuit/ Open	Engine Control Module (ECM): Sensor Reference Circuit A Short Circuit	<ul style="list-style-type: none"> Signal voltage < 4.8; > 5.2 V 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> If a related sensor voltage code is also set, refer to that code for diagnosis. If no other related codes set, replace the Engine Control Module - J623- . Refer to appropriate repair manual.

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17989/P1581/005505

Contents [hide]

- 1 17989/P1581/005505 - Throttle Actuator (J338): Basic Setting Not Performed
 - 1.1 Possible Symptoms
 - 1.2 Possible Causes
 - 1.3 Possible Solutions

17989/P1581/005505 - Throttle Actuator (J338): Basic Setting Not Performed

Possible Symptoms

- ✦ Malfunction Indicator Light (MIL) ON

Possible Causes

- ✦ Throttle Body Alignment (TBA) not performed
- ✦ Throttle Body Malfunction

Possible Solutions

- ✦ Perform Throttle Body Alignment (TBA)
- ✦ Check Wiring and/or Connector(s) Throttle Body ABC
- ✦ Check/Replace Throttle Body
 - ✦ Check Measuring Value Block (MVB) 060-064

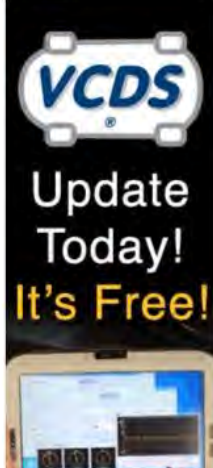
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For example, as shown above, the positioning device, Throttle Valve Control Module J338, is commanded by Engine Control Module (ECM) J623, to change to a commanded position (upper position or lower position) comprising at least one of the commands to the positioning device to open to a hold open mode (upper position) and one of the commands to the positioning device to close to a hold close mode (mechanical stop low).

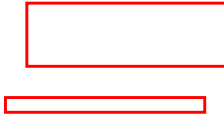
On information and belief, the ECM hardware and software perform the step of “commanding the positioning device to at least one of a hold open mode or a hold close mode.”

Figure 32

40. Claim 11 of the '804 patent recites a system for controlling a positioning device of an internal combustion engine to prevent overheat conditions, the system comprising: an electric motor for actuating the positioning device with a control effort; a control effort detector coupled to said electric motor and intended to detect said control effort; and a controller coupled to said electric motor and said control effort detector, said controller including control logic

operative to command the positioning device to change to a commanded position, detect a control effort required to change to said commanded position, determine whether said control effort exceeds a threshold for a predetermined time period, and reduce said control effort when said control effort exceeds said threshold for said predetermined time period; wherein said controller further includes control logic operative to command the positioning device to close to said commanded position in a hold close mode.

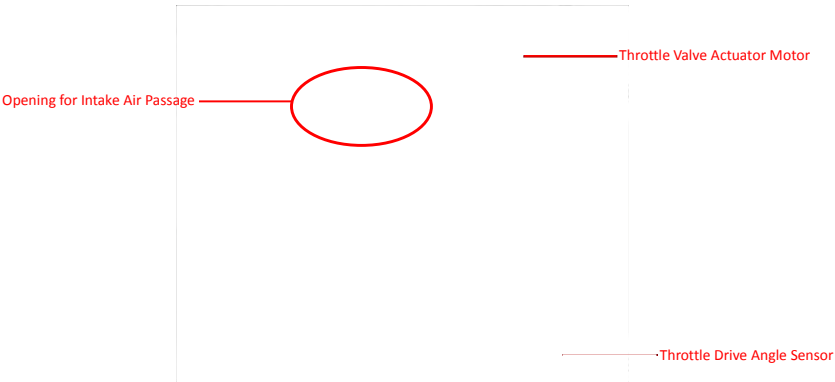
41. On information and belief, the '804 patent Accused Instrumentalities infringe claim 11 of the '804 patent. The '804 patent Accused Instrumentalities comprise a system for controlling a positioning device of an internal combustion engine to prevent overheat conditions (*Figure 33*), the system comprising: an electric motor for actuating the positioning device with a control effort (*Figure 34*); a control effort detector coupled to said electric motor and intended to detect said control effort (*Figure 35*); and a controller coupled to said electric motor and said control effort detector, said controller including control logic operative to command the positioning device to change to a commanded position, detect a control effort required to change to said commanded position, determine whether said control effort exceeds a threshold for a predetermined time period, and reduce said control effort when said control effort exceeds said threshold for said predetermined time period (*Figure 36*); wherein said controller further includes control logic operative to command the positioning device to close to said commanded position in a hold close mode (*Figures 36-37*).



2.3 Electronic Throttle Control (ETC) System

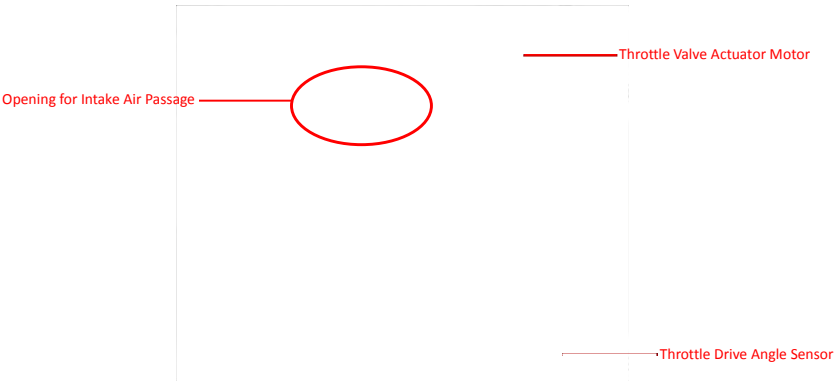
The electronic throttle control (ETC) system consists of the accelerator-pedal module, the engine control module (ECM), and the electronic throttle body. The electronic throttle body mainly consists of the throttle valve, the electric throttle-valve drive element, and the throttle-valve position sensor (TPS). The drive element is a DC servomotor, which acts on the throttle-valve shaft via a gear unit. The throttle-valve position sensor is a redundant sensor system that detects the position of the throttle valve. The sensors have opposite resistance curves so that the ECM can always cross check the signals to ensure the correct position of the throttle valve is always known.

The driver command is detected by a redundant sensor system in the accelerator-pedal module, and the signal is sent to the engine control module. The engine control module then determines the required throttle-valve position by performing calculations from data measured by sensors such as accelerator pedal position sensor, engine speed sensor and vehicle speed sensor. The actual throttle opening can be more or less in proportion to accelerator pedal position given different engine operating points.



For example, as shown above the Engine Control Module (ECM) J623 controls a positioning device, the Throttle Valve Control Module J338 of an internal combustion engine (VW 3.2L & 3.6L), which comprises a system for controlling a positioning device of an internal combustion engine to prevent overheating condition.

Figure 33



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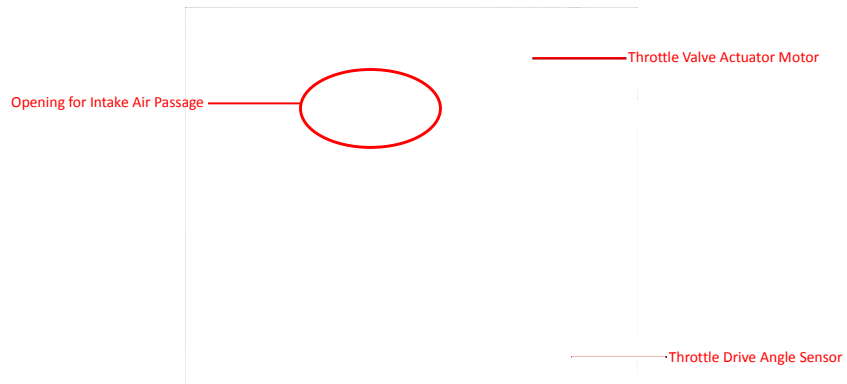
DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2106 Throttle Actuator Control System - Forced Limited Power	Throttle Actuator Short To Battery Plus / Short To Ground	<ul style="list-style-type: none"> Internal check failed 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to "3.6.32 Throttle Valve Control Module GX3 Checking" page 893 .
	Throttle Actuator Open Circuit		<ul style="list-style-type: none"> Duty cycle > 80.0% Or Deviation throttle value angles vs. throttle value set point > 4.0 – 50.0% 			
	Throttle Actuator Temperature / Current Monitoring					
	Throttle Actuator Functional Check					

For example, as shown above, a positioning device, the Throttle Valve Control Module J338 of an internal combustion engine (VW 3.2L & 3.6L), is actuated via a Throttle Valve Actuator Motor with control effort indicated by the amount of current required to actuate the motor.

Figure 34



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2106 Throttle Actuator Control System - Forced Limited Power	Throttle Actuator Short To Battery Plus / Short To Ground	• Internal check failed		• 0.5 s • Continuous	• 2 DCY	- Check the Throttle Valve Control Module - GX3- . Refer to "3.6.32 Throttle Valve Control Module GX3 Checking" page 893 .
	Throttle Actuator Open Circuit		• Duty cycle > 80.0% • Or • Deviation throttle value angles vs. throttle value set point > 4.0 – 50.0%			
	Throttle Actuator Temperature / Current Monitoring					
	Throttle Actuator Functional Check					



For example, as shown above, a control effort detector in the Engine Control Module (ECM) J623 is coupled to the Throttle Valve Actuator Motor and utilizes a diagnostic strategy (DTC P2106) to detect control effort indicated by the amount of current required to actuate the motor.

Figure 35

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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2106 Throttle Actuator Control System - Forced Limited Power	Throttle Actuator Short To Battery Plus / Short To Ground	<ul style="list-style-type: none"> Internal check failed 		<ul style="list-style-type: none"> 0.5 s Continuous 	2 DCY	- Check the Throttle Valve Control Module - GX3- . Refer to <u>⇒ "3.6.32 Throttle Valve Control Module GX3 Checking" page 893 .</u>
	Throttle Actuator Open Circuit		<ul style="list-style-type: none"> Duty cycle > 80.0% Or Deviation throttle value angles vs. throttle value set point > 4.0 – 50.0% 			
	Throttle Actuator Temperature / Current Monitoring					
	Throttle Actuator Functional Check					



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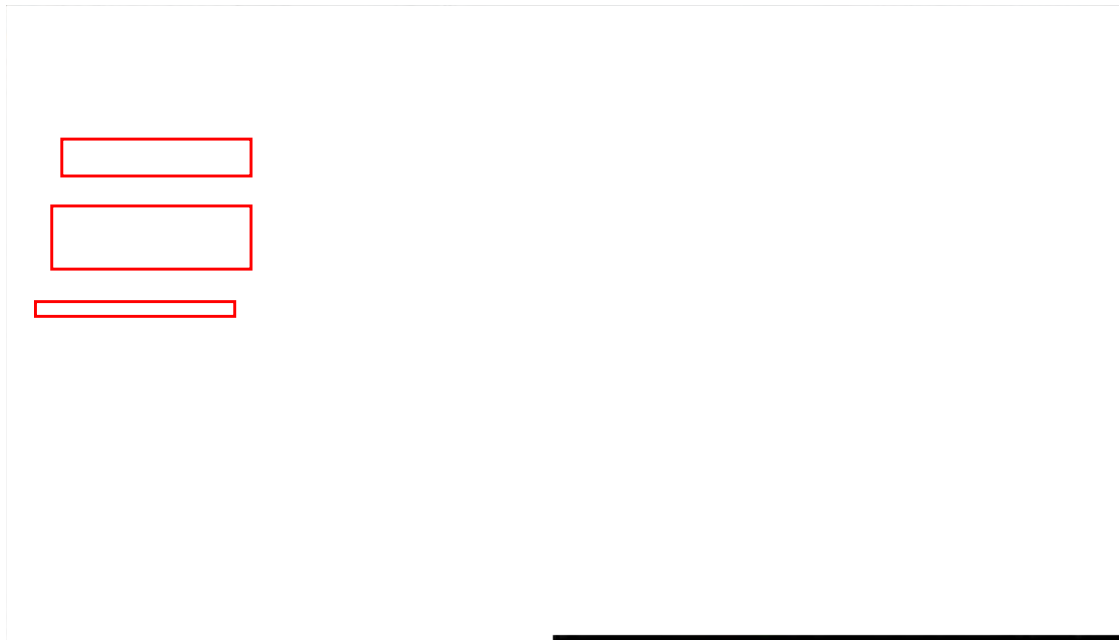
DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Fuel Pump Control (FPC) Over-Temperature Power Stage		<ul style="list-style-type: none"> Engine speed > 80 RPM 			
P0638 Throttle Actuator Control Range/Performance Bank 1	Throttle Actuator Rationality Check Close Movement	<ul style="list-style-type: none"> Time to close to reference point > 0.6 s And Deviation to reference point > 2.88% 	<ul style="list-style-type: none"> Engine speed 0 RPM Vehicle speed 0 km/h ECT > -20° C IAT > -20° C Case 1: Ignition on Case 2: Engine shut-off-time > 5.0 s Number of checks 3.0 [-] 	<ul style="list-style-type: none"> 5.0 s Multiple 	2 DCY	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to 3.6.32 Throttle Valve Control Module GX3- Checking, page 893 .
	Throttle Actuator Signal Range Check @ Mechanical Stop Low	<ul style="list-style-type: none"> TPS 1 signal voltage < 0.40; > 0.80 V Or TPS 2 signal voltage < 4.20; > 4.60 V 	<ul style="list-style-type: none"> Engine speed 0 RPM Vehicle speed 0 km/h Case 1: Ignition on ECT -20 – 115° C IAT -20 – 143° C Case 2: Engine shut-off-time > 5.0 s ECT 5.0 – 115° C IAT 5.0 – 143° C 	<ul style="list-style-type: none"> 0.3 s Multiple 		
P0641 Sensor Reference Voltage "A" Circuit/Open	Engine Control Module (ECM): Sensor Reference Circuit A Short Circuit	<ul style="list-style-type: none"> Signal voltage < 4.8; > 5.2 V 		<ul style="list-style-type: none"> 0.5 s Continuous 	2 DCY	<ul style="list-style-type: none"> If a related sensor voltage code is also set, refer to that code for diagnosis. If no other related codes set, replace the Engine Control Module - J623- . Refer to appropriate repair manual.

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For example, as shown above, a control effort detector in the Engine Control Module (ECM) J623 is coupled to the Throttle Valve Actuator Motor and includes software-implemented control logic operative to command the positioning device to change to a commanded position (P0638), detect a control effort required to change to said commanded position (P2106), determine whether said control effort exceeds a threshold (Throttle Actuator Temperature/Current Monitoring), continuously monitor which continuously monitors the Throttle Actuator Control System, for a predetermined time period (Time to close to reference point > 0.6 s), and reduce said control effort when said control effort exceeds said threshold for said predetermined time period.

On information and belief, the ECM hardware and software “reduce[s] said control effort when said control effort exceeds said threshold for said predetermined time period.”

Figure 36



For example, as shown above (and in Figure 36), the Engine Control Module (ECM) J623 is a controller with control logic to command the positioning device, the Throttle Valve Control Module J338, to close to said commanded position in a hold close mode (P0638).

Figure 37

Based upon the totality of the foregoing evidence, and based further upon information and belief, the '804 patent Accused Instrumentalities practice a method for controlling a positioning device of an internal combustion engine, the method comprising the steps of: providing an electric motor for actuating the positioning device; commanding the positioning device to change to a commanded position; detecting a control effort required to change to said commanded position; determining whether said control effort exceeds a threshold for a predetermined time period; and reducing said control effort when said control effort exceeds said threshold for said predetermined time period; wherein commanding the positioning device to change to said commanded position comprises at least one of commanding the positioning device to open to a hold open mode and commanding the positioning device to close to a hold close mode.

COUNT VI – INFRINGEMENT OF U.S. PATENT NO. 6,347,680

42. The allegations set forth in the foregoing paragraphs 1 through 41 are incorporated into this Sixth Claim for Relief.

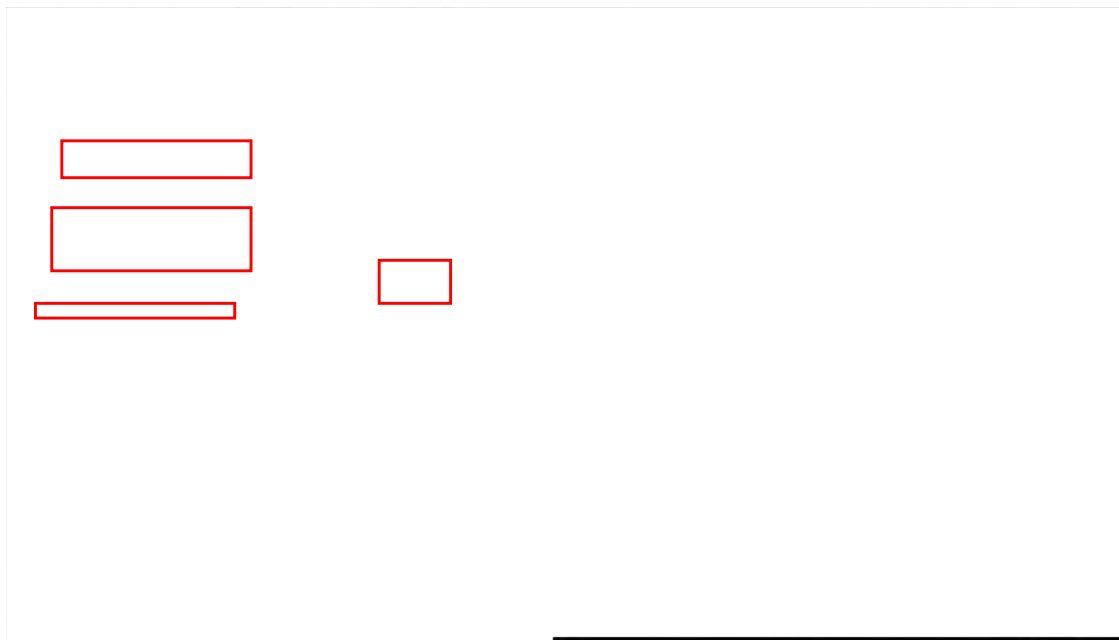
43. On February 19, 2001, U.S. Patent No. 6,347,680 (“the ’680 patent”), entitled “Engine Output Controller,” was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the ’680 patent is attached as Exhibit 6.

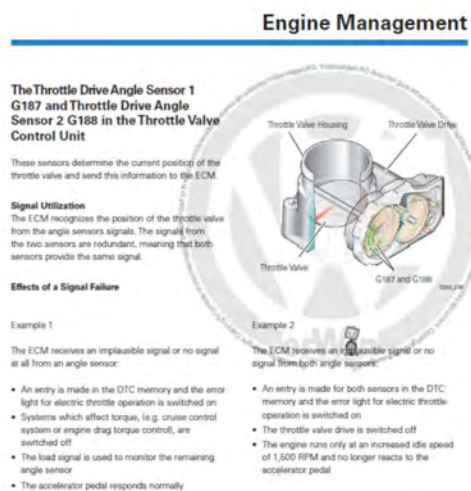
44. Plaintiff is the assignee and owner of the right, title and interest in and to the ’680 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

45. Upon information and belief, Defendants have directly infringed at least claim of the ’680 patent by making, using, selling, importing and/or providing and causing to be used the 2013-2018 Passat, 2012-2016 CC, 2012-2017 Touareg, 2018-2019 Atlas, and 2012-2016 Porsche Cayenne (the “’680 patent Accused Instrumentalities”).

46. In particular, claim 1 of the ’680 patent recites an engine output control method for a vehicle having a drive by wire engine system responsive to a desired engine speed signal, the method comprising the steps of: generating a driver demanded engine speed value corresponding to an operator input; generating a speed control system engine speed value corresponding to a predetermined speed value to permit vehicle operation at a constant speed by a speed control system; arbitrating between said driver demanded engine speed value and said speed control system engine speed value to derive a first desired engine speed value; limiting said first desired engine speed value by a vehicle speed limit value, engine speed limit value, and transmission speed limit value to generate a second desired engine speed value; and controlling said engine output as a function of said second desired engine speed value and an actual engine speed value.

47. On information and belief, the '680 patent Accused Instrumentalities infringe at least claim 1 of the '680 patent. The '680 patent Accused Instrumentalities practice an engine output control method for a vehicle having a drive by wire engine system responsive to a desired engine speed signal (*Figure 38*), the method comprising the steps of: generating a driver demanded engine speed value corresponding to an operator input (*Figure 39*); generating a speed control system engine speed value corresponding to a predetermined speed value to permit vehicle operation at a constant speed by a speed control system (*Figure 40*); arbitrating between said driver demanded engine speed value and said speed control system engine speed value to derive a first desired engine speed value (*Figure 41*); limiting said first desired engine speed value by a vehicle speed limit value, engine speed limit value, and transmission speed limit value to generate a second desired engine speed value (*Figure 42*); and controlling said engine output as a function of said second desired engine speed value and an actual engine speed value (*Figures 38-42*).



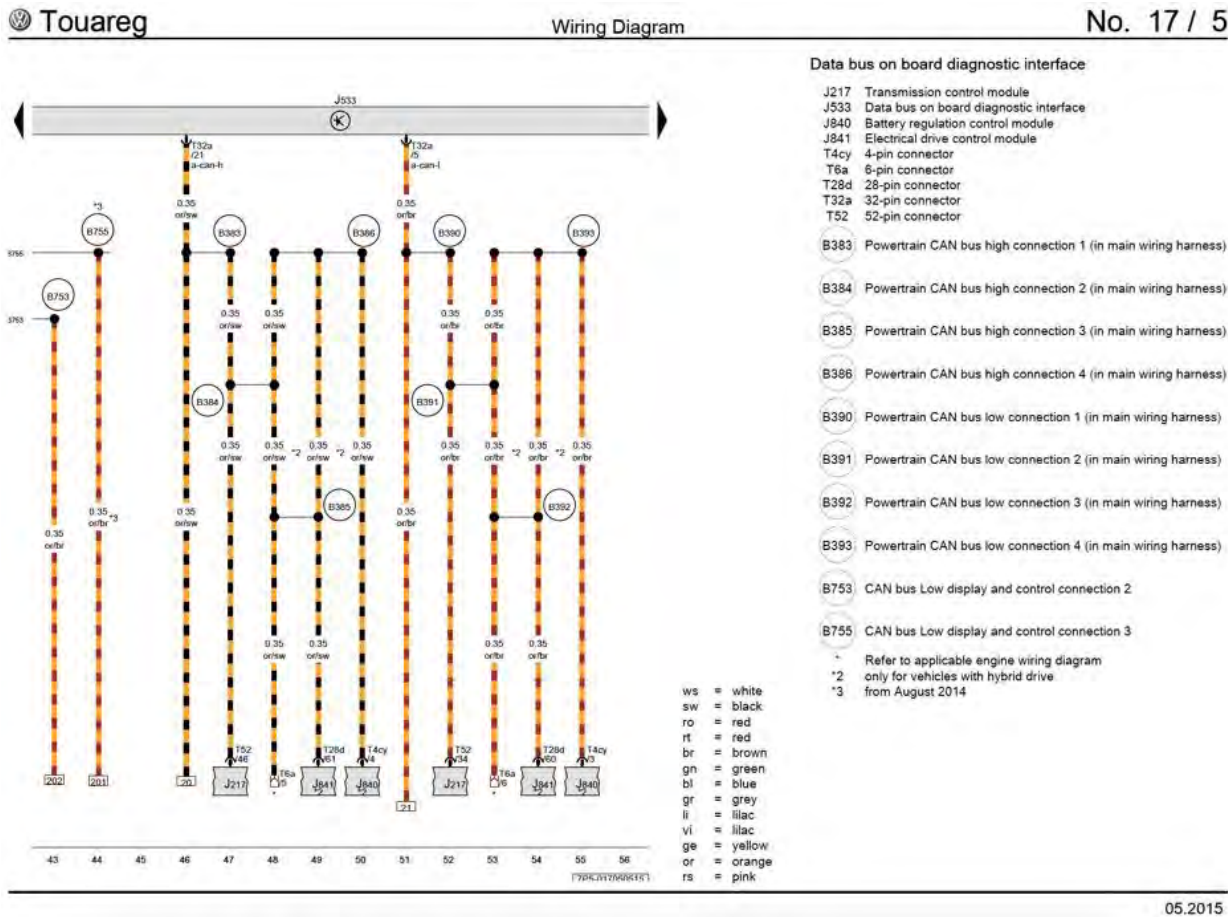


The CAN data bus and the ECM (J623), TCM (J217), ABS System (J104) (controllers) practice an engine output control method.

3.6.32 Vehicle Speed Signal, Checking

General Description

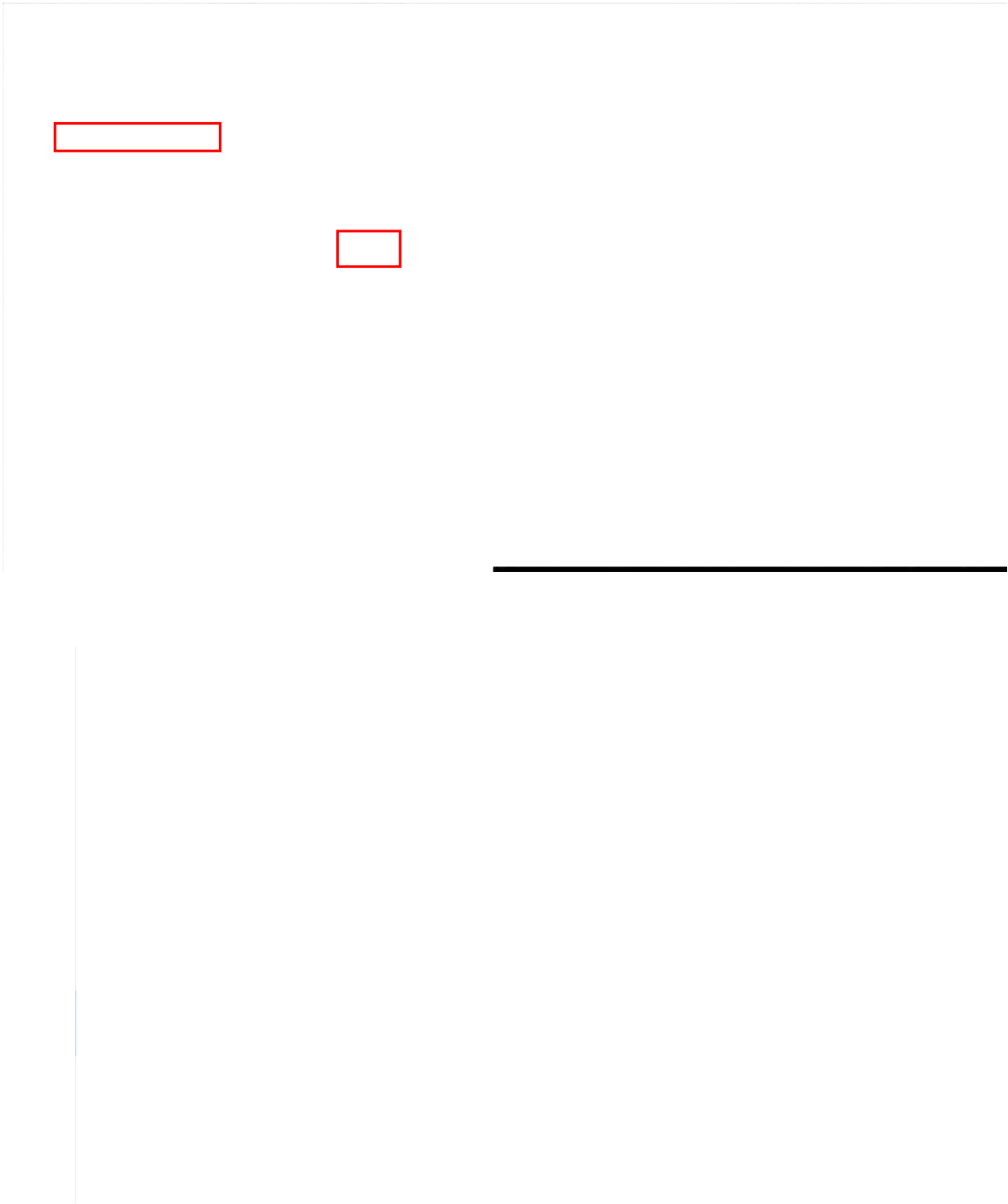
The Vehicle Speed Signal or VSS measures Transmission / Transaxle output or Wheel Speed from the ABS System. The signal is broadcasted over the CAN Bus. The Engine Control Module - J623- uses this information to modify engine functions such as ignition timing, A/F ratio, transmission shift points, and to initiate diagnostic routines.



The '680 patent Accused Instrumentalities comprise a CAN (Controller Area Network) which allows microcontrollers like the Engine Control Module (ECM) J623, Transmission Control Module (TCM), and Antilock Brake System/Electronic Stability Control (ABS/ESC) to communicate with each other.

For example, as shown above, the drive by wire system comprises the Accelerator Pedal Position Sensor 2 G185, Throttle Valve Control Module J338, and other components, and is controlled by the ECM J623.

Figure 38



2.3 Electronic Throttle Control (ETC) System

The electronic throttle control (ETC) system consists of the accelerator-pedal module, the engine control module (ECM), and the electronic throttle body. The electronic throttle body mainly consists of the throttle valve, the electric throttle-valve drive element, and the throttle-valve position sensor (TPS). The drive element is a DC servomotor, which acts on the throttle-valve shaft via a gear unit. The throttle-valve position sensor is a redundant sensor system that detects the position of the throttle valve. The sensors have opposite resistance curves so that the ECM can always cross check the signals to ensure the correct position of the throttle valve is always known.

The driver command is detected by a redundant sensor system in the accelerator-pedal module, and the signal is sent to the engine control module. The engine control module then determines the required throttle-valve position by performing calculations from data measured by sensors such as accelerator pedal position sensor, engine speed sensor and vehicle speed sensor. The actual throttle opening can be more or less in proportion to accelerator pedal position given different engine operating points.

2.4 Electronic Power Control (EPC) Warning Lamp

When the ignition is switched on, the engine control module (ECM) checks the electronic throttle control system for static sys-

12 Rep. Gr.ST - Generic Scan Tool

The '680 patent Accused Instrumentalities comprise an ECM (J623), which generates a driver demanded engine speed value corresponding to operator input from the Accelerator Pedal Position Sensor 2 (G185).

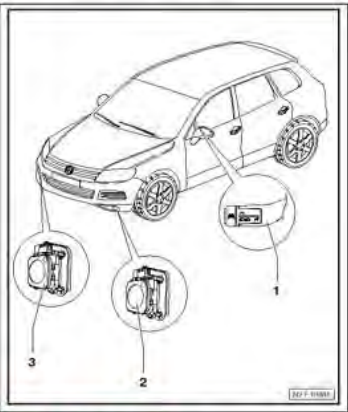
Figure 39



2015 Volkswagen Touareg (7P5) V6-3.6L (CGRA)
Vehicle » Cruise Control » Service and Repair

SERVICE AND REPAIR

Overview - Adaptive Cruise Control (ACC)



Zoom Sized for Print

1 - Adaptive Cruise Control Button (E357)

The Adaptive Cruise Control Button (E357) is a component in the turn signal switch on the steering column.

Turn signal switch on steering column, removing and installing. Refer to [Steering Column Switch Module] See: [Accessories and Optional Equipment/Steering Mounted Controls Communication Module/Description and Operation](#)

2 - Distance Regulation Control Module 2 (J850)

- Contains Adaptive Cruise Control Sensor 2
- Removing and installing. Refer to [Distance Regulation Control Module (J428), Removing and Installing] See: [Cruise Control Module/Description and Operation/Distance Regulation Control Module \(J428\), Removing and Installing](#)

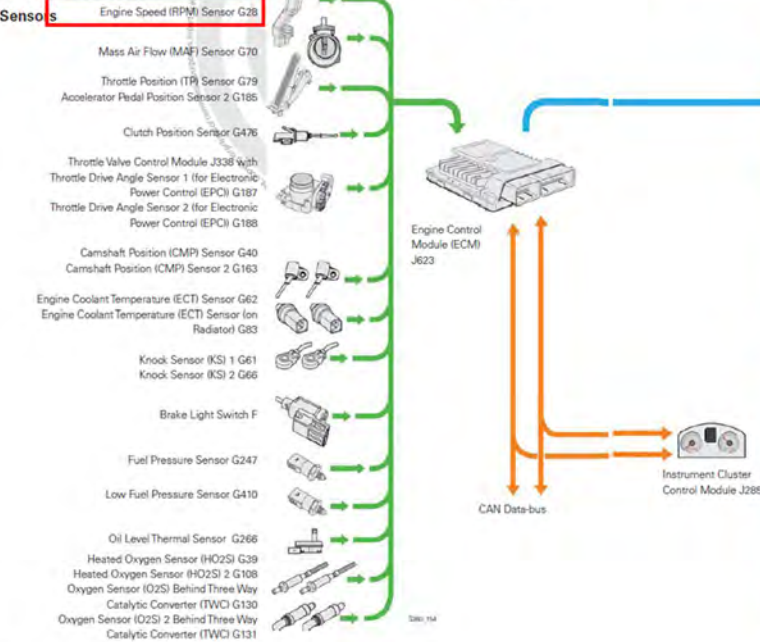
3 - Distance Regulation Control Module (J428)

- Contains Adaptive Cruise Control Sensor (G550)
- Removing and installing. Refer to [Distance Regulation Control Module (J428)] See: [Cruise Control Module/Description and Operation](#)

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Engine Management

System Overview



Engine Management

Actuators

- Fuel Pump (FP) Control Module J538
- Transfer Fuel Pump (FP) G6
- Cylinder 1-6 Fuel Injector N30, N31, N32, N33, N83, N84
- Ignition Coil 1-6 with Power Output Stage N70, N127, N291, N292, N323, N324
- Throttle Valve Control Module J338 with Throttle Drive (for Electronic Power Control (EPC)) G186
- Fuel Pressure Regulator Valve N276
- Evaporative Emission (EVAP) Canister Purge Regulator Valve N80
- Intake Manifold Runner Control (IMRC) Valve N316
- Camshaft Adjustment Valve 1 N205
- Camshaft Adjustment Valve 1 (exhaust) N318
- Oxygen Sensor (O2S) Heater Z19
- Oxygen Sensor (O2S) 2 Heater Z28
- Oxygen Sensor (O2S) 1 (behind Three Way Catalytic Converter (TWC)) Heater Z29
- Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater Z30
- Coolant Fan Control (FC) Control Module J293
- Coolant Fan V7
- Coolant Fan 2 V177
- Recirculation Pump Relay J160
- Recirculation Pump V55

3.6.32 Vehicle Speed Signal, Checking

General Description

The Vehicle Speed Signal or VSS measures Transmission / Transaxle output or Wheel Speed from the ABS System. The signal is broadcasted over the CAN Bus. The Engine Control Module - J623- uses this information to modify engine functions such as ignition timing, A/F ratio, transmission shift points, and to initiate diagnostic routines.

2015 Volkswagen Touareg (7P5) V6-3.6L (CGRA)

Vehicle » Cruise Control » Description and Operation » General Information

GENERAL INFORMATION

General Information

Cruise control system functions are controlled by the Engine Control Module (ECM).

Cruise control is operated with 2 button blocks in the multifunction steering wheel or, on vehicles without a multifunction steering wheel, with front rocker switch in windshield washer lever.

- Perform assembly work at multifunction steering wheel.
- Perform assembly work on windshield wiper lever. Refer to [Steering Column Switch Module] See: [Accessories and Optional Equipment/Steering Mounted Controls Communication Module/Description and Operation](#)
- Cruise control system can be activated/deactivated. Refer to [Cruise Control System, Activating and Deactivating] See: [Testing and Inspection/Cruise Control System, Activating and Deactivating](#).

Malfunction Recognition and Malfunction Indicator:

Diagnostic Trouble Code (DTCs) in conjunction with Cruise control system are transmitted via ECM and via Steering Column Electronic Systems Control Module (J527).

The "Guided Fault Finding" function is to be used for troubleshooting of one of the systems described as in chapter "Vehicle Diagnosis, Testing and Information System".

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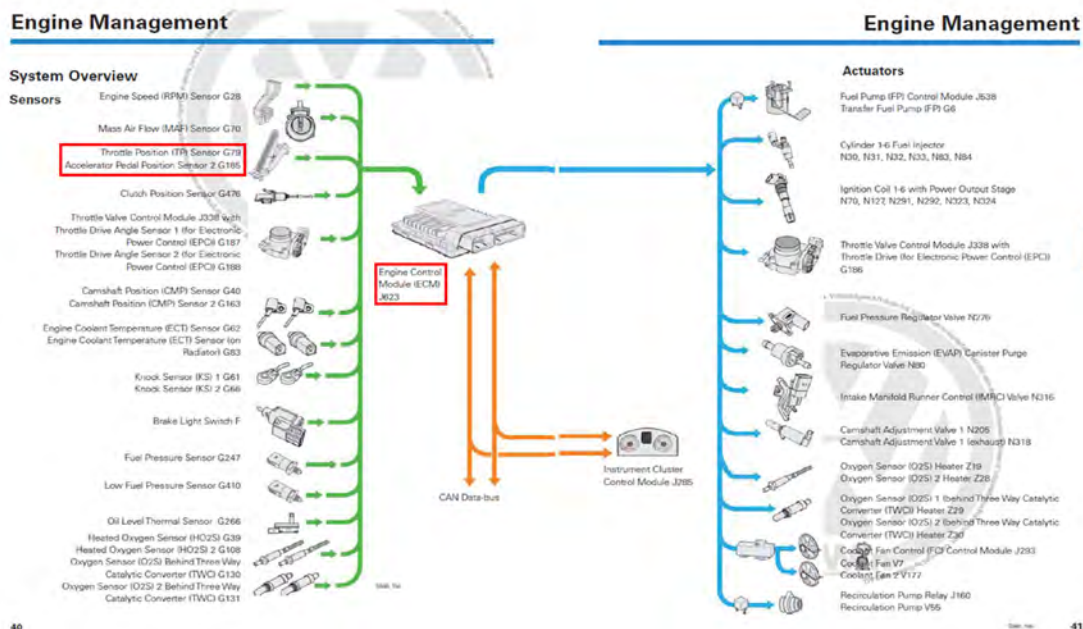
For example, as shown above, the adaptive cruise control (ACC) is a cruise control system with speed regulation that influences driving behavior with both active acceleration and deceleration. Upon information and belief, using ACC, any desired speed between 0 km/hr and 210 km/hr can be maintained. System-specified thresholds are set during operation of the ACC; the ECM (J623) generates an engine speed value to maintain vehicle operation at a constant speed based on the predetermined speed value from the set/coast switch of the cruise control system.

Figure 40

2.5 Engine Control Module (ECM)

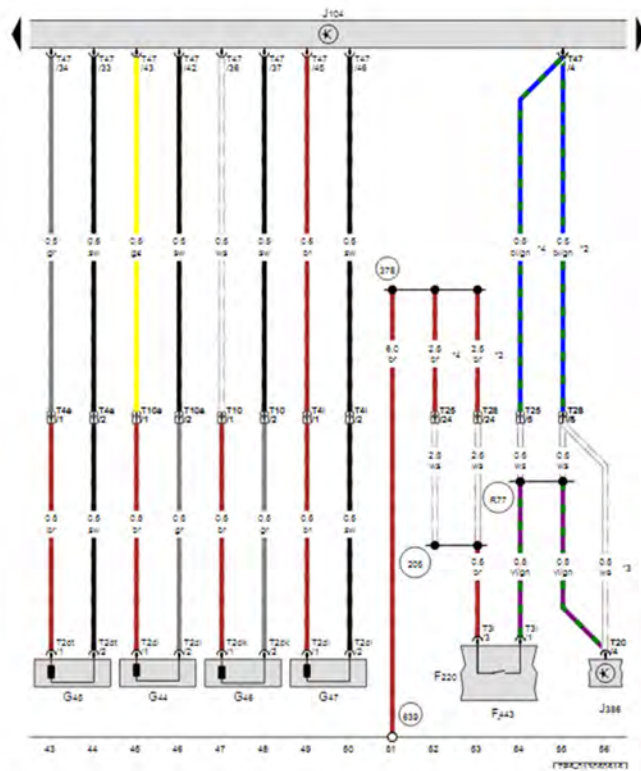
The Engine Control Module (ECM) is a generic term for any embedded system that controls one or more of the electrical systems or subsystems in a vehicle. It controls a series of actuators on an internal combustion engine to ensure that driver commands (e.g. to accelerate) are translated into appropriate engine performance. It reads values from a multitude of sensors, interprets the data, and adjusts the engine actuators accordingly. The ECM also interacts with the transmission control module (TCM), ABS/traction/stability control module and other vehicle function related control systems.

ECM controlled systems and functions (performance and emission related) will be introduced in the following chapters. These include the OBD system, controller area network (CAN), throttle control module, fuel supply, ignition, variable valve timing, exhaust-gas recirculation, secondary air injection, exhaust system, and EVAP system.



Upon information and belief, the ECM (J623) receives signals from sensors. Accelerator Pedal Position Sensor 2 (G185), which determine the driver demanded engine speed value. The speed control system engine speed value is determined by the ECM based upon the set speed of the cruise control. The engine management system (a drive by wire system) arbitrates between the driver demanded engine speed value and said speed control system engine speed value to derive a first desired engine speed value.

Figure 41



05.2015

Upon information and belief, the first desired engine speed value limited by an engine speed limit value determined by the ECM based on various monitored conditions (e.g. road conditions; driving conditions).

2015 Volkswagen Touareg (7P) V6-5.0L (G0RA)

Vehicle > Cruise Control > Description and Operation > Adaptive Cruise Control

ADAPTIVE CRUISE CONTROL

General Information

General Description

Adaptive Cruise Control (ACC) is a cruise control system with distance regulation that influences driving behavior with both active acceleration and deceleration.

The 2015 Touareg has an improved ACC system. The ACC with Front Assist is also known as "Stop and Go". In addition to the current ACC features, the vehicle will resume driving 2 seconds after it has stopped. Using ACC, any desired speed between 0 km/h and 210 km/h (130.48 mph) can be maintained. In addition, ACC maintains a pre-set time distance to the vehicle ahead.

With active brake intervention, the vehicle can brake to a stop. System-specified thresholds are set and driver intervention is prompted with optical and acoustic warnings when necessary.

The driver assistance system is activated using the front button in the turn signal lever and a selection display in the instrument cluster display. ACC is operated using the multifunction steering wheel buttons or, on vehicles without multifunction steering wheel, using the front rocker switch in the windshield wiper lever. While driving, important information is shown in the instrument cluster display.

Malfunction Recognition And Malfunction Indicator

Distance Regulation Control Module (J428) is equipped with On Board Diagnostics (OBD) which assists troubleshooting.

The "Guided Fault Finding" function is to be used for troubleshooting of one of the systems described as in chapter "Vehicle Diagnosis, Testing and Information System".

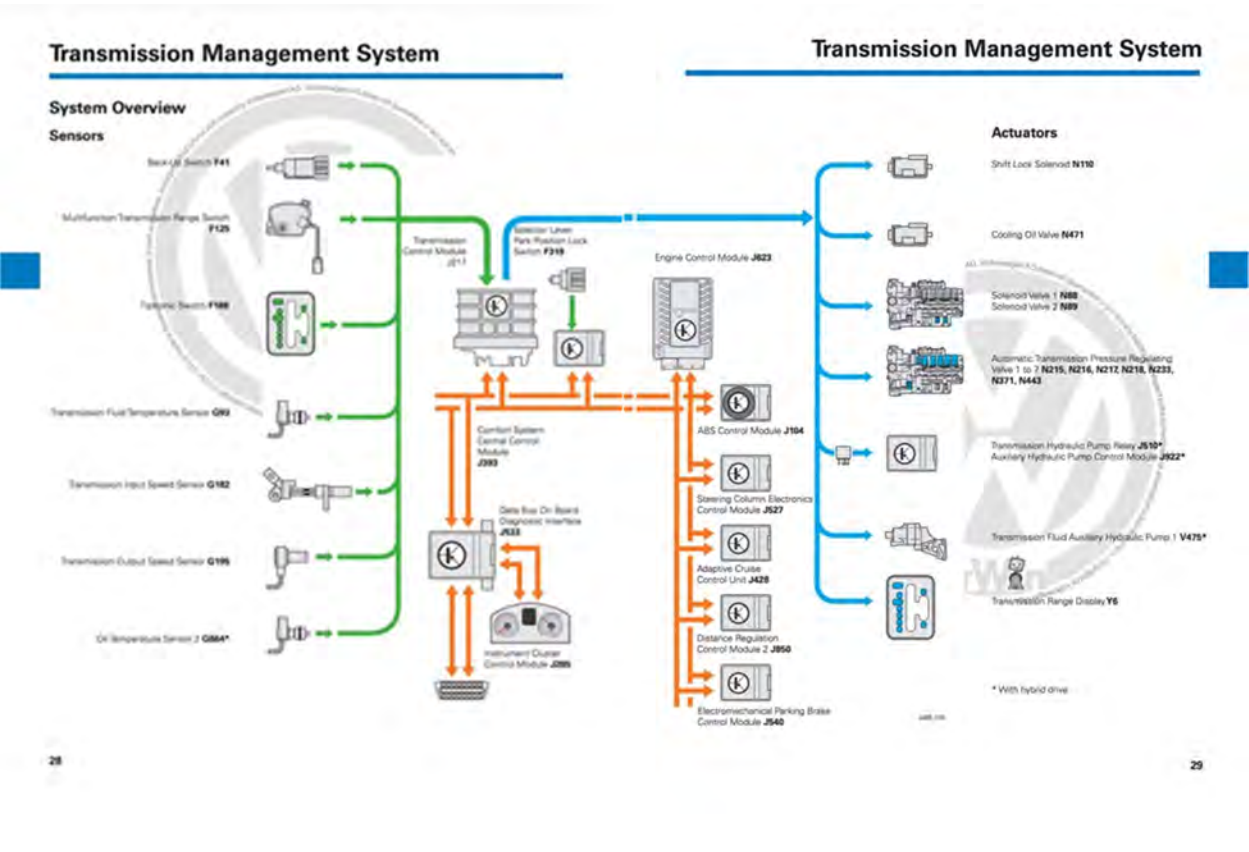
Start the ACC when first using the or replacing the Distance Regulation Control Module (J428). Refer to (Automatic) Distance Regulation, Initializing (See Testing and Inspection/Automatic Distance Regulation, Initializing).

Automatic Distance Regulation, Adapting

- Distance Regulation Control Module (J428)
- Distance Regulation Control Module 2 (J428)
- Adaptive Cruise Control Button (E337) inside the turn signal switch
- Image Processing Control Module (J428) (See Accessories and Optional Equipment/Collision Avoidance, Module Description and Operation/Image Processing Control Module J428)
- Depending on equipment, for adjusting ACC, the multifunction steering wheel buttons or
- The front rocker switch on the windshield wiper lever

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Upon information and belief, the first desired engine speed value is further limited by a transmission speed limit value based on transmission torque capacity limits which is monitored by the Transmission Control Module (J217).



Transmission Management System

The Transmission Control Module J217

The Transmission Control Module J217 is located under the right front seat. It is connected to the gateway via the powertrain CAN - bus.

J217 receives information from the sensors inside of the transmission and actuates the solenoid valves in the valve body.

If equipped with the Transmission Fluid Auxiliary Hydraulic Pump 1 V475, the Oil Temperature Sensor 2 G664 transmits the operating temperature of the pump.

The dynamic shift program is also integrated into J217. It selects gear changes based on the operating status (aerodynamic drag and rolling resistance and driving style).



J217 under the right front seat

W406_061

Upon information and belief, the first desired engine speed value is limited by a vehicle speed limit value, engine speed limit value, and transmission speed limit value to generate a second

desired engine speed value which is generated when a lower engine speed value is desired due to various system capacities or limits as shown above (e.g. transmission torque capacity below).

Introduction

Technical Data

Developer/Manufacturer	AISIN AW CO. LTD Japan
Designation	• Automatic transmission 0C8
Transmission Features	<ul style="list-style-type: none"> • Electrohydraulically controlled 8-speed planetary transmission with a simple primary planetary gear set and a Ravigneaux planetary gear set • Torque converter with slip-controlled torque converter lock-up clutch • Designed for longitudinal installation in combination with a transfer case
Control System	<ul style="list-style-type: none"> • Hydraulic control unit (valve body) in the oil sump with external electronic control module • Dynamic Shift Program DSP with separate sports program in "position S" and "Tiptronic" mode for manual gear changes • Special feature: Starting off in 2nd gear is possible in Tiptronic mode
Torque	Depending on version, up to 737 lb/ft (1000 Nm)
Service	For fluid maintenance and intervals, see ElsaWeb
Weight	Depending on adaptation of the transmission to the engine, between 200 and 240 lb (91 and 108 kg)
Speed	Depending on engine, the top speed can be achieved in 6th, 7th or 8th gear

As stated above, the first desired engine speed value is determined via the ECM (J623).

Upon information and belief, the first desired engine speed value is limited by a vehicle speed limit value which is generated from the ABS control module (J104) based on conditions such as wheel slippage from the wheel speed sensors (J44-47) communicated via the CAN data-bus (shown above).

For example, as shown above the CAN Data bus and ECM (J623) control the drive by wire system by calculating engine output as a function of said second desired engine speed value and an actual speed value. Necessarily, the second desired speed value must be reconciled with the actual engine speed value, thereby controlling the commanded throttle position and resultant engine output.

Figure 42

Based upon the totality of the foregoing evidence, and based further upon information and belief, the '680 patent Accused Instrumentalities practice "an engine output control method for a vehicle having a drive by wire engine system responsive to a desired engine speed signal, the method comprising the steps of: generating a driver demanded engine speed value corresponding to an operator input; generating a speed control system engine speed value corresponding to a

predetermined speed value to permit vehicle operation at a constant speed by a speed control system; arbitrating between said driver demanded engine speed value and said speed control system engine speed value to derive a first desired engine speed value; limiting said first desired engine speed value by a vehicle speed limit value, engine speed limit value, and transmission speed limit value to generate a second desired engine speed value; and controlling said engine output as a function of said second desired engine speed value and an actual engine speed value.”

COUNT VII – INFRINGEMENT OF U.S. PATENT NO. 6,561,166

48. The allegations set forth in the foregoing paragraphs 1 through 47 are incorporated into this Seventh Claim for Relief.

49. On May 13, 2003, U.S. Patent No. 6,561,166 (“the ’166 patent”), entitled “Purge Fuel Canister Measurement Method and System,” was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the ’166 patent is attached as Exhibit 7.

50. Plaintiff is the assignee and owner of the right, title and interest in and to the ’166 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

51. Upon information and belief, Defendants have directly infringed at least claim 1 of the ’166 patent by making, using, selling, importing and/or providing and causing to be used the 2012-2018 Tiguan, 2012-2018 Audi A3, 2012-2018 Audi A4, 2012-2018 Audi A5, 2012-2018 Audi A6, 2016-2018 Audi TT, 2015-2018 Audi S3, 2015-2018 VW Golf, 2012-2018 VW Golf GTI, 2015-2018 VW Golf R, 2015-2018 Golf Sportwagon, 2013-2018 Jetta GLI, 2014-2018 VW Jetta Sedan, 2014-2018 VW Passat, 2012-2017 WV CC, 2012-2018 VW Beetle, 2018 VW Atlas, 2015- 2018 Audi Q3, 2012-2018 Audi Q5, and 2017-2018 Porsche Macan with the EA888 engines (the “’166 patent Accused Instrumentalities”).

52. In particular, claim 1 of the ’166 patent recites a method of controlling a direct injection spark ignited internal combustion engine that is capable of operating in a stratified mode where fuel is injected during a compression stroke of the engine and a homogeneous mode

where fuels is injected during an intake stroke of the engine, the internal combustion engine having a catalytic converter and an NOx trap, comprising: measuring a first temperature of an NOx trap that is in contact with an exhaust gas exhausted from a combustion chamber while the engine is operating in the stratified mode; enabling evaporated fuel vapors to enter the combustion chamber at a flow rate while the engine is operating in the stratified mode; measuring a second temperature of the NOx trap while the engine is operating in the stratified mode; and adjusting the flow rate of the evaporated fuel vapors as a function of the second temperature when the second temperature is within a lower temperature threshold and an upper temperature threshold.

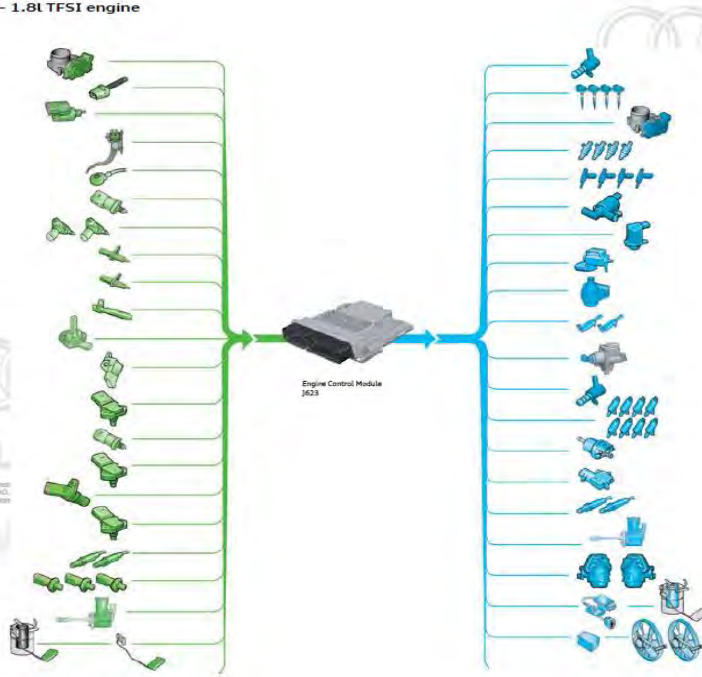
53. On information and belief, the '166 patent Accused Instrumentalities infringe at least claim 1 of the '166 patent. The '166 patent Accused Instrumentalities practice a method of controlling a direct injection spark ignited internal combustion engine (*Figure 43*) that is capable of operating in a stratified mode (*Figure 44*) where fuel is injected during a compression stroke of the engine (*Figure 45*) and a homogeneous mode where fuels is injected during an intake stroke of the engine, the internal combustion engine having a catalytic converter (*Figure 46*) and an NOx trap (*Figure 47*), comprising: measuring a first temperature of an NOx trap that is in contact with an exhaust gas exhausted from a combustion chamber while the engine is operating in the stratified mode (*Figures 48*); enabling evaporated fuel vapors to enter the combustion chamber at a flow rate while the engine is operating in the stratified mode (*Figure 49*); measuring a second temperature of the NOx trap while the engine is operating in the stratified mode (*Figure 50*); and adjusting the flow rate of the evaporated fuel vapors as a function of the second temperature when the second temperature is within a lower temperature threshold and an upper temperature threshold (*Figure 51*).

Engine management system

System overview example – 1.8L TFSI engine

Sensors

Throttle Valve Control Module J338
 EPC Throttle Drive Angle Sensors 1 & 2 C187, C188
 Brake Light Switch F
 Clutch Position Sensor G476
 Clutch Pedal Switch F36
 Clutch Pedal Starter Interlock Switch F194
 Accelerator Pedal Position Sensor C79
 Accelerator Pedal Position Sensor 2 C185
 Knock Sensor 1 C61
 Low Fuel Pressure Sensor G410
 Hall Sensor G40
 Hall Sensor 3 C300
 Engine Coolant Temperature Sensor G62
 Engine Coolant Temperature Sensor on Radiator Outlet G83
 Engine Speed Sensor C28
 Oil Level Thermal Sensor C266
 Intake Manifold Runner Position Switch C836
 Intake Air Temperature Sensor C42
 Manifold Absolute Pressure Sensor C71
 Fuel Pressure Sensor C247
 Charge Air Pressure Sensor C31
 Gear Recognition Sensor G604
 Brake Booster Pressure Sensor C294
 Heated Oxygen Sensor C39
 Oxygen Sensor after Three Way Catalytic Converter C130
 Oil Pressure Switch F72
 Reduced Oil Pressure Switch F378
 Oil Pressure Switch, Level 3 F447
 Charge Pressure Actuator Position Sensor C581
 Fuel Level Sensor C
 Fuel Level Sensor 2, C169
 Auxiliary signals:
 - Cruise control system
 - Speed signal
 - Start required for engine control module (keyless start 1 + 2)
 - Terminal 50
 - Crash signal from airbag control Module

**Actuators**

Piston Cooling Nozzle Control Valve N522
 Ignition Coils 1 - 4 with Output Stage
 N70, N127, N281, N292
 EPC Throttle Drive C186
 Injectors 2, cylinders 3 - 4 N532 - N535
 (ECU does not generate or receive any feedback
 on this command. Copyright by AUDI AG)
 Injector, cylinder 1 - 4 N30 - N33
 Transmission Coolant Valve N488
 Turbocharger Recirculation Valve N249
 Intake Manifold Runner Control Valve N316
 Coolant Recirculation Pump V50
 Camshaft Adjustment Valve 1 N205
 Exhaust Camshaft Adjustment Valve 1 N338
 (N338 only on 2.0L engines)
 Fuel Metering Valve N290
 Oil Pressure Regulation Valve N428
 Cam Adjustment Actuators 1 - 8, F366, F373
 (only on 2.0L engines)
 Carbon Canister Purge Regulator Valve N80
 Engine Temperature Control Actuator N493
 Oxygen Sensor Heater 219
 Heater for Oxygen Sensor 1 after Catalytic Converter 229
 Charge Pressure Actuator V465
 Left Electro-hydraulic Engine Mount Solenoid Valve N144
 Right Electro-hydraulic Engine Mount Solenoid Valve N145
 Fuel Pump Control Module J538
 Transfer Fuel Pump G6
 Coolant Fan Control Module J293
 Coolant Fan V7
 Coolant Fan 2 V127
 Auxiliary signals:
 - Dual Clutch Mechatronic Module / engine speed
 - ABS/ESP Control Module
 - A/C compressor
 - Starter control Module

As shown above, the Engine Management System including the Engine Control Module (ECM; J623) controls the Audi 1.8L and 2.0L Third Generation EA888 Engines (direct injection spark ignited internal combustion engine). The '166 patent Accused Instrumentalities comprise the Audi 1.8L and 2.0L Third Generation EA888 Engines.

Figure 43



S3, TT 2015 >

Audi Generic Scan Tool - Edition 12.2017

Direct Injection

Injectors in directly injected (DI) engines are mounted on the cylinder head and fuel is injected directly into the engine's combustion chamber. In order to overcome the pressure in the combustion chamber during compression and power stroke, injectors often operate at a primary pressure as high as 3000 psi. At such extreme pressure level, no single fuel pump can supply the required pressure directly from the fuel tank to the injectors. Instead, a low-pressure and a high-pressure system are employed. The low-pressure system principally utilizes the same fuel systems and components for multiport injected engines. The high-pressure system consists of a high-pressure fuel pump driven directly by the camshaft, a fuel rail (high-pressure accumulator), a high-pressure sensor and, depending on the system, a pressure-control valve or a pressure limiter. The injectors are operated by the ECM to send a precise amount of fuel from the high-pressure rail directly into the combustion chamber.

The distinctive difference between direct injection and other injection methods is that direct injection offers the flexibility regarding when in the combustion cycle the fuel is added and how. MPI systems can only add fuel during induction; A DI system can add fuel whenever it needs to. For example, fuel can be added during induction to create a homogeneous charge then added again after ignition to enhance power delivery under full load conditions.

VW/Audi Fuel Stratified Injection (FSI)

The goal of a stratified-charge operation is to form an ignitable mixture near the spark plug at the instant of ignition. This means that, instead of supplying the corresponding stoichiometric fuel quantity to the amount of air in the combustion chamber, the fuel interacts only with a portion of the air before it is conveyed to the spark plug. The rest of the fresh air surrounds the stratified charge allowing an ultra-lean condition with air-fuel ratio exceeding 50:1 in some instances. As less fuel is used to "burn" more air, stratified injection helps to further reduce fuel consumption when the engine is operating in low-load conditions (e.g. highway cruising). This is created by designing the combustion chamber so that a "swirling" effect of the air-fuel charge is caused.

2.9 Ignition and Timing

Ignition

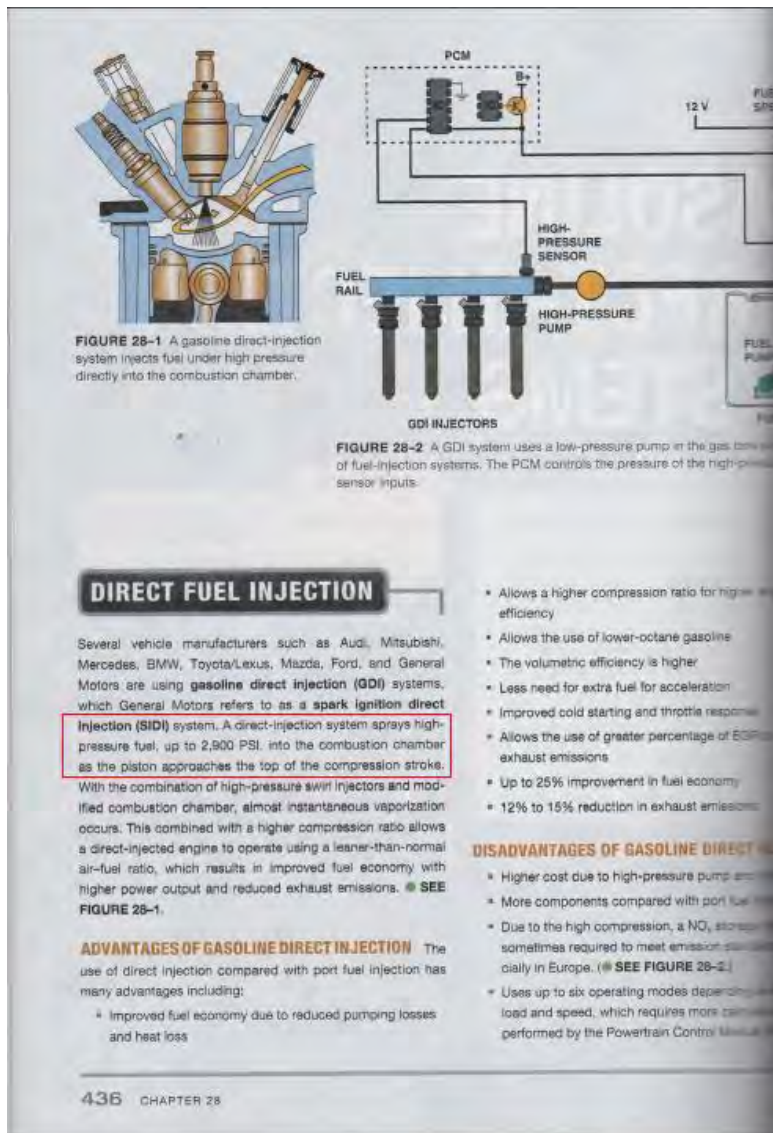
A spark ignition (SI) engine requires a spark to initiate combustion in the combustion chamber. Voltage is supplied to the spark plug where the electricity will arc across a gap at a voltage as high as 100 kilovolts. The ECM determines the precise moment to fire each spark plug using ignition logic which is pre-programmed into the ECM as a function of engine speed and load. An optimally calibrated ignition system ensures consistent and reliable ignition under all conditions. Knock or misfire as a result of incorrect ignition can lead to destruction of engine components or damage of the catalytic converter.

Timing

Shifts in the moment of ignition (ignition timing) can result in increased emissions, decreased performance and fuel economy. Whereas more spark advance improves power and fuel economy, it also raises HC and NOx emissions. Excessive spark advance can cause engine knock which is potentially destructive to engines. If the ECM detects knock from a signal sent by a knock sensor, it will delay (retard) the timing of the spark. Excessive spark retard lowers power output and produces high exhaust temperatures, which can also harm the engine. Carefully designed ignition logic provides optimum timing that best balances performance, fuel economy and emissions.

As shown above, the 1.8L and 2.0L TFSI engines are capable of operating in the stratified mode.

Figure 44



James D Halderman, *Automotive Engine Performance* 436 (5 ed. 2017)

For example, as suggested by the image above, the '166 patent Accused Instrumentalities inject fuel during the compression stroke as is common in a Gasoline Direct Injection (GDI) systems. The Audi 1.8L & 2.0L engines are a GDI engine.

Figure 45

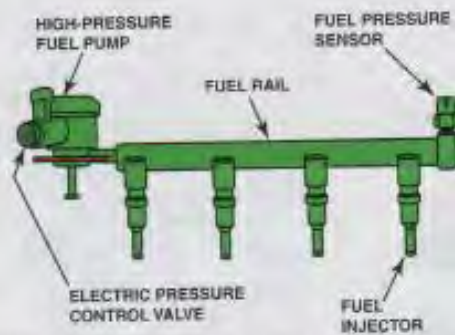


FIGURE 28-5 A gasoline direct-injection (GDI) fuel rail and pump assembly with the electric pressure control valve.

The PCM uses internal drivers to control the power feed and ground for the pressure control valve. When both PCM drivers are deactivated, the inlet valve is held open by spring pressure. This causes the high pressure fuel pump to default to low-pressure mode. The fuel from the high-pressure fuel pump flows through a line to the fuel rail and injectors. The actual operating pressure can vary from as low as 500 PSI (3,440 kPa) at idle to over 2,000 PSI (13,800 kPa) during high speed or heavy load conditions. • **SEE FIGURE 28-5.**

NOTE: Unlike a port fuel-injection system, a gasoline direct injection system varies the fuel pressure to achieve greater fuel delivery using a very short pulse time, which is usually less than one millisecond. To summarize:

- **Port Fuel Injection** = constant fuel pressure but variable injector pulse-width.
- **GDI** = almost constant injector pulse-width with varying fuel pressure.

GASOLINE DIRECT-INJECTION FUEL INJECTORS

Each high-pressure fuel injector assembly is an electrically magnetic injector mounted in the cylinder head. In the GDI system, the PCM controls each fuel injector with 50 to 80 volts (usually 60 to 70 volts), depending on the system, which is created by a boost capacitor in the PCM. During the high-voltage boost phase, the capacitor is discharged through an injector, allowing for initial injector opening. The injector is then held open with 12 volts. The high-pressure fuel injector has a small slit or six precision-machined holes that generate the desired spray pattern. The injector also has an extended tip to allow for cooling from a water jacket in the cylinder head.

• **SEE CHART 28-1** for an overview of the differences between a port fuel-injection system and a gasoline direct-injection system.

PORT FUEL-INJECTION SYSTEM COMPARED WITH GDI SYSTEM

	PORT FUEL INJECTION	GASOLINE DIRECT INJECTION
Fuel pressure	35–60 PSI	Lift pump—50 to 60 PSI High-pressure pump—500 to 2,900 PSI
Injection pulse width at idle	1.5–3.5 ms	About 0.4 ms (400 µs)
Injector resistance	12–16 ohms	1–3 ohms
Injector voltage	6 V for low-resistance injectors, 12 V for most injectors	50–90 V
Number of injections per event	One	1–3
Engine compression ratio	8:1–11:1	11:1–13:1

CHART 28-1

A comparison chart showing the major differences between a port fuel-injection system and a gasoline direct-injection system.

MODES OF OPERATION

The two basic modes of operation include:

1. **Stratified mode.** In this mode of operation, the air-fuel mixture is richer around the spark plug than it is in the rest of the cylinder.
2. **Homogeneous mode.** In this mode of operation, the air-fuel mixture is the same throughout the cylinder.

There are variations of these modes that can be used to fine-tune the air-fuel mixture inside the cylinder. For example, Bosch, a supplier to many vehicle manufacturers, uses the following six modes of operation:

- **Homogeneous mode.** In this mode, the injector's pulse width is varied one time to create an even air-fuel mixture in the cylinder. The injection occurs during the intake stroke. This mode is used during high-speed and/or high-torque conditions.
- **Homogeneous lean mode.** Similar to the homogeneous mode except that the overall air-fuel mixture is slightly lean for better fuel economy. The injection occurs during the intake stroke. This mode is used under steady, light load conditions.
- **Stratified mode.** In this mode of operation, the injection occurs just before the spark occurs resulting in lean combustion, reducing fuel consumption.
- **Homogeneous stratified mode.** In this mode, there are two injections of fuel:

Direct Injection

Injectors in directly injected (DI) engines are mounted on the cylinder head and fuel is injected directly into the engine's combustion chamber. In order to overcome the pressure in the combustion chamber during compression and power stroke, injectors often operate at a primary pressure as high as 3000 psi. At such extreme pressure level, no single fuel pump can supply the required pressure directly from the fuel tank to the injectors. Instead, a low-pressure and a high-pressure system are employed. The low-pressure system principally utilizes the same fuel systems and components for multiport injected engines. The high-pressure system consists of a high-pressure fuel pump driven directly by the camshaft, a fuel rail (high-pressure accumulator), a high-pressure sensor and, depending on the system, a pressure-control valve or a pressure limiter. The injectors are operated by the ECM to send a precise amount of fuel from the high-pressure rail directly into the combustion chamber.

The distinctive difference between direct injection and other injection methods is that direct injection offers the flexibility regarding when in the combustion cycle the fuel is added and how. MPI systems can only add fuel during induction; A DI system can add fuel whenever it needs to. For example, fuel can be added during induction to create a homogeneous charge then added again after ignition to enhance power delivery under full load conditions.

VW/Audi Fuel Stratified Injection (FSI)

The goal of a stratified-charge operation is to form an ignitable mixture near the spark plug at the instant of ignition. This means that, instead of supplying the corresponding stoichiometric fuel quantity to the amount of air in the combustion chamber, the fuel interacts only with a portion of the air before it is conveyed to the spark plug. The rest of the fresh air surrounds the stratified charge allowing an ultra-lean condition with air-fuel ratio exceeding 50:1 in some instances. As less fuel is used to "burn" more air, stratified injection helps to further reduce fuel consumption when the engine is operating in low-load conditions (e.g. highway cruising). This is created by designing the combustion chamber so that a "swirling" effect of the air-fuel charge is caused.

2.9 Ignition and Timing

Ignition

A spark ignition (SI) engine requires a spark to initiate combustion in the combustion chamber. Voltage is supplied to the spark plug where the electricity will arc across a gap at a voltage as high as 100 kilovolts. The ECM determines the precise moment to fire each spark plug using ignition logic which is pre-programmed into the ECM as a function of engine speed and load. An optimally calibrated ignition system ensures consistent and reliable ignition under all conditions. Knock or misfire as a result of incorrect ignition can lead to destruction of engine components or damage of the catalytic converter.

Timing

Shifts in the moment of ignition (ignition timing) can result in increased emissions, decreased performance and fuel economy. Whereas more spark advance improves power and fuel economy, it also raises HC and NOx emissions. Excessive spark advance can cause engine knock which is potentially destructive to engines. If the ECM detects knock from a signal sent by a knock sensor, it will delay (retard) the timing of the spark. Excessive spark retard lowers power output and produces high exhaust temperatures, which can also harm the engine. Carefully designed ignition logic provides optimum timing that best balances performance, fuel economy and emissions.

For example, a homogeneous mode may be used during high load operation. As shown above, fuel is injected during an intake stroke of the GDI engine.

Figure 46



the vehicle (often underneath the rear bumper). A passenger-car exhaust system consists of the following; exhaust manifold, exhaust treatment components, sound absorption components and the system of pipes connecting these components.

Exhaust Manifold

The manifold is an important component in the exhaust system. It routes the exhaust gas out of the cylinder outlet ports into the subsequent exhaust system. The geometry of the manifold (i.e. length and cross-section of the individual pipes) has an impact on the performance characteristics, the acoustic behavior of the exhaust system, and the exhaust temperature. In some cases, the manifold is insulated with an air gap to quickly reach high exhaust temperature and to shorten the time taken by the catalytic converter to reach its operating temperature.

Emission Control

The primary emission control component is the catalytic converter, which breaks down the gaseous pollutants in the exhaust gas (CO, HC and NOx). Catalytic converters are installed as close as possible to the engine so that they can quickly reach their operating temperature and therefore be effective in urban driving. It also bears a sound-absorbing function, especially to the higher frequency portion of the engine combustion noise.

Sound Absorption

Mufflers dampen or absorb the noise produced by engine combustion. In principle, they can be installed at any position in the exhaust system. However, they are mostly located in the middle and rear sections of the exhaust system. Depending on the number of cylinders and engine output, generally 1 to 3 mufflers are used in an exhaust system. In V-engines, the left and right cylinder banks are often run separately, each being fitted with its own catalytic converters and mufflers. Although the aim of mufflers is to reduce noise in compliance with legislations, they can also help to create the sound specific to the type of vehicle.

2015 Audi A4 Quattro Sedan (8K2) L4-2.0L Turbo (CAED)

Vehicle » Engine, Cooling and Exhaust » Exhaust System » Description and Operation

DESCRIPTION AND OPERATION**Exhaust Systems****Overview**

There are three important functions of the exhaust system: to reduce the pollutants in exhaust gas, muffle engine combustion noise and to discharge exhaust gas at a convenient location on the vehicle (often underneath the rear bumper). A passenger-car exhaust system consists of the following: [exhaust manifold](#), exhaust treatment components, sound absorption components and the system of pipes connecting these components.

Exhaust Manifold

The manifold is an important component in the exhaust system. It routes the exhaust gas out of the cylinder outlet ports into the subsequent exhaust system. The geometry of the manifold (i.e. length and cross-section of the individual pipes) has an impact on the performance characteristics, the acoustic behavior of the exhaust system, and the exhaust temperature. In some cases, the manifold is insulated with an air gap to quickly reach high exhaust temperature and to shorten the time taken by the [catalytic converter](#) to reach its operating temperature.

Emission Control

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Sound Absorption

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The '166 patent Accused Instrumentalities comprise a NO_x trap.

As shown above, there is a catalytic converter in the engine exhaust after treatment system.

Figure 47

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0136 O2 Sensor Circuit	Oxygen Sensors rear response check	<ul style="list-style-type: none"> gradient sensor voltage < 600.00 [mV/s] 	general conditions: <ul style="list-style-type: none"> forced close the gap stimulation not active internal resistance O2S rear < 700.00 [Ohm] close the gap stimulation request active vehicle speed ≥ 6 [mph] catalyst overheating protection not active turbine overheating protection not active O2S rear ready O2S front ready ECT @ cylinder head > 60 [°C] modeled catalyst temperature 470...780 [°C] difference between dynamic and stationary catalyst temperature -306...304 [°C] modeled catalyst temperature once after engine start > 550 [°C] integrated MAF, catalyst temp. conditions fulfilled ≥ 0.0 [g] modeled EGT @ O2S rear ≤ 900 [°C] MAF per cylinder 30.00...200.00 [kg/h] MAF per cylinder per stroke, lower range ≥ 89.99 [mg/stk] 	<ul style="list-style-type: none"> 60-70 [s] once / DCY 	<ul style="list-style-type: none"> 1 DCY 	- Check the Oxygen Sensor After Three Way Catalytic Converter - G130-. Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 1004

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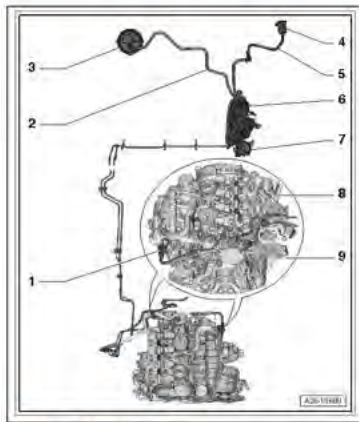
Figure 48

2015 Audi A4 Quattro Sedan (8K2) L4-2.0L Turbo (CAED)

Vehicle » Powertrain Management » Emission Control Systems » Evaporative Emissions System » Diagrams » Connection Diagram - EVAP System, with Tank Leak Diagnosis System, Vehicles with 4-Cylinder Engine

CONNECTION DIAGRAM - EVAP SYSTEM, WITH TANK LEAK DIAGNOSIS SYSTEM, VEHICLES WITH 4-CYLINDER ENGINE

Connection Diagram - EVAP System, with Tank Leak Diagnosis System, Vehicles with 4-Cylinder Engine



1 EVAP Canister Purge Regulator Valve 1 (N80)

2 Breather Line

- From the Fuel Tank locking flange to the EVAP canister
- Clipped into brackets under the vehicle underbody

3 Fuel Tank Locking Flange

4 Air Filter

- For the Leak Detection Pump (V144)

5 Connecting Line

- From the Leak Detection Pump (V144) to the air filter
- Clipped into brackets under the vehicle underbody

6 Evaporative Emission (EVAP) Canister

- Installed location: under the luggage compartment floor
- Removing and installing. Refer to => [EVAP Canister, Removing and Installing] See: Evaporative Emission Control Canister/Service and Repair [EVAP Canister, Removing and Installing]

7 Leak Detection Pump (V144)

- From MY 2013 replaced with Fuel Tank Leak Detection Control Module (J909) with integrated Fuel Tank Pressure Sensor (G400)
- Installed location: on the EVAP canister under the bottom of the luggage compartment
- Check in Guided Fault Finding mode using the Vehicle Diagnostic Tester.
- Removing and installing. Refer to => [Leak Detection Pump, Removing and Installing] See: Leak Detection Pump/Service and Repair

8 Breather Line

- From EVAP canister to EVAP Canister Purge Regulator Valve 1 (N80)
- Clipped into brackets under the vehicle underbody

9 Vacuum Line

- From the engine to the Leak Detection Pump (V144).
- Clipped into brackets under the vehicle underbody

As shown above, the NOx trap (catalyst) is in contact with an exhaust gas exhausted from a combustion chamber. The '166 patent Accused Instrumentalities both measured and model catalyst temperature.

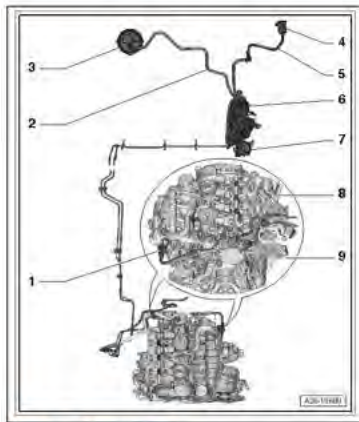
The '166 patent Accused Instrumentalities comprise a method of controlling a direct injection spark ignited internal combustion engine enabling evaporated fuel vapors to enter the combustion chamber at a flow rate while the engine is operating in the stratified mode.

2015 Audi A4 Quattro Sedan (8K2) L4-2.0L Turbo (CAED)

Vehicle » Powertrain Management » Emission Control Systems » Evaporative Emissions System » Diagrams » Connection Diagram - EVAP System, with Tank Leak Diagnosis System, Vehicles with 4-Cylinder Engine

CONNECTION DIAGRAM - EVAP SYSTEM, WITH TANK LEAK DIAGNOSIS SYSTEM, VEHICLES WITH 4-CYLINDER ENGINE

Connection Diagram - EVAP System, with Tank Leak Diagnosis System, Vehicles with 4-Cylinder Engine



Zoom

Sized for Print

1 EVAP Canister Purge Regulator Valve 1 (N80)

2 Breather Line

- From the [fuel tank](#) locking flange to the EVAP canister
- Clipped into brackets under the vehicle underbody

3 Fuel Tank Locking Flange

4 Air Filter

- For the [Leak Detection Pump](#) (V144)

5 Connecting Line

- From the [Leak Detection Pump](#) (V144) to the air filter
- Clipped into brackets under the vehicle underbody

6 Evaporative Emission (EVAP) Canister

- Installed location: under the luggage compartment floor
- Removing and installing. Refer to »> [[EVAP Canister, Removing and Installing](#)] See: [Evaporative Emission Control Canister/Service and Repair](#) [[EVAP Canister, Removing and Installing](#)]

7 Leak Detection Pump (V144)

- From MY 2013 replaced with [Fuel Tank Leak Detection Control Module](#) (J909) with integrated Fuel Tank Pressure Sensor (G400)
- Installed location: on the EVAP canister under the bottom of the luggage compartment
- Check in Guided Fault Finding mode using the Vehicle Diagnostic Tester.
- Removing and installing. Refer to »> [[Leak Detection Pump, Removing and Installing](#)] See: [Leak Detection Pump/Service and Repair](#)

8 Breather Line

- From EVAP canister to EVAP Canister Purge Regulator Valve 1 (N80)
- Clipped into brackets under the vehicle underbody

9 Vacuum Line

- From the engine to the [Leak Detection Pump](#) (V144).
- Clipped into brackets under the vehicle underbody

The '166 patent Accused Instrumentalities comprise a charcoal canister (Evaporative Emissions EVAP Canister) which contains evaporative fuel content.

Figure 49

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0136 O2 Sensor Circuit	Oxygen Sensors rear response check	<ul style="list-style-type: none"> gradient sensor voltage < 600.00 [mV/s] 	general conditions: <ul style="list-style-type: none"> forced close the gap stimulation not active internal resistance O2S rear < 700.00 [Ohm] close the gap stimulation request active vehicle speed ≥ 6 [mph] catalyst over-heating protection not active turbine over-heating protection not active O2S rear ready O2S front ready ECT @ cylinder head > 60 [°C] modeled catalyst temperature 470...780 [°C] difference between dynamic and stationary catalyst temperature -306...304 [°C] modeled catalyst temperature once after engine start > 550 [°C] integrated MAF, catalyst temp. conditions fulfilled ≥ 0.0 [g] modeled EGT @ O2S rear ≤ 900 [°C] MAF per cylinder 30.00...200.00 [kg/h] MAF per cylinder per stroke, lower range ≥ 89.99 [mg/stk] 	<ul style="list-style-type: none"> 60-70 [s] once / DCY 	<ul style="list-style-type: none"> 1 DCY 	~ Check the Oxygen Sensor After Three Way Catalytic Converter - G130- . Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter G130- Checking" page 1604

As shown above, the '166 patent Accused Instrumentalities comprise a method of modeling catalyst temperature.

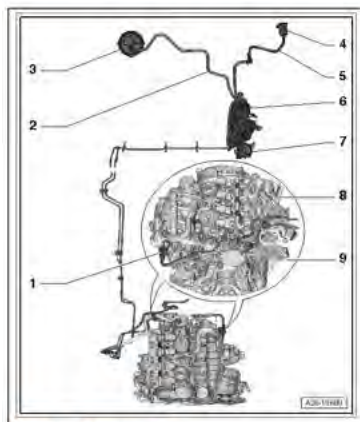
Figure 50

2015 Audi A4 Quattro Sedan (8K2) L4-2.0L Turbo (CAED)

Vehicle » Powertrain Management » Emission Control Systems » Evaporative Emissions System » Diagrams » Connection Diagram - EVAP System, with Tank Leak Diagnosis System, Vehicles with 4-Cylinder Engine

CONNECTION DIAGRAM - EVAP SYSTEM, WITH TANK LEAK DIAGNOSIS SYSTEM, VEHICLES WITH 4-CYLINDER ENGINE

Connection Diagram - EVAP System, with Tank Leak Diagnosis System, Vehicles with 4-Cylinder Engine



Zoom

Sized for Print

1 EVAP Canister Purge Regulator Valve 1 (N80)**2 Breather Line**

- From the fuel tank locking flange to the EVAP canister
- Clipped into brackets under the vehicle underbody

3 Fuel Tank Locking Flange**4 Air Filter**

- For the Leak Detection Pump (V144)

5 Connecting Line

- From the Leak Detection Pump (V144) to the air filter
- Clipped into brackets under the vehicle underbody

6 Evaporative Emission (EVAP) Canister

- Installed location: under the luggage compartment floor
- Removing and installing. Refer to »> [EVAP Canister, Removing and Installing] See: Evaporative Emission Control Canister/Service and Repair [EVAP Canister, Removing and Installing]

7 Leak Detection Pump (V144)

- From MY 2013 replaced with Fuel Tank Leak Detection Control Module (J909) with integrated Fuel Tank Pressure Sensor (G400)
- Installed location: on the EVAP canister under the bottom of the luggage compartment
- Check in Guided Fault Finding mode using the Vehicle Diagnostic Tester.
- Removing and installing. Refer to »> [Leak Detection Pump, Removing and Installing] See: Leak Detection Pump/Service and Repair

8 Breather Line

- From EVAP canister to EVAP Canister Purge Regulator Valve 1 (N80)
- Clipped into brackets under the vehicle underbody

9 Vacuum Line

- From the engine to the Leak Detection Pump (V144).
- Clipped into brackets under the vehicle underbody

Upon information and belief, the ECM is capable of “adjusting the flow rate of the evaporated fuel vapors as a function of the second temperature when the second temperature is within a lower temperature threshold and an upper temperature threshold.”

Figure 51

Based upon the totality of the foregoing evidence, and based further upon information and belief, the '166 patent Accused Instrumentalities practice a “method of controlling a direct injection spark ignited internal combustion engine that is capable of operating in a stratified mode where fuel is injected during a compression stroke of the engine and a homogeneous mode where fuels is injected during an intake stroke of the engine, the internal combustion engine having a catalytic converter and an NOx trap, comprising: measuring a first temperature of an NOx trap that is in contact with an exhaust gas exhausted from a combustion chamber while the engine is operating in the stratified mode; enabling evaporated fuel vapors to enter the combustion

chamber at a flow rate while the engine is operating in the stratified mode; measuring a second temperature of the NOx trap while the engine is operating in the stratified mode; and adjusting the flow rate of the evaporated fuel vapors as a function of the second temperature when the second temperature is within a lower temperature threshold and an upper temperature threshold.”

COUNT VIII – INFRINGEMENT OF U.S. PATENT NO. 6,988,031

54. The allegations set forth in the foregoing paragraphs 1 through 53 are incorporated into this Eighth Claim for Relief.

55. On January 17, 2006 U.S. Patent No. 6,988,031 (“the ’031 patent”), entitled “System and Method for Determining Engine Stop Position,” was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the ’031 patent is attached as Exhibit 8.

56. Plaintiff is the assignee and owner of the right, title and interest in and to the ’031 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

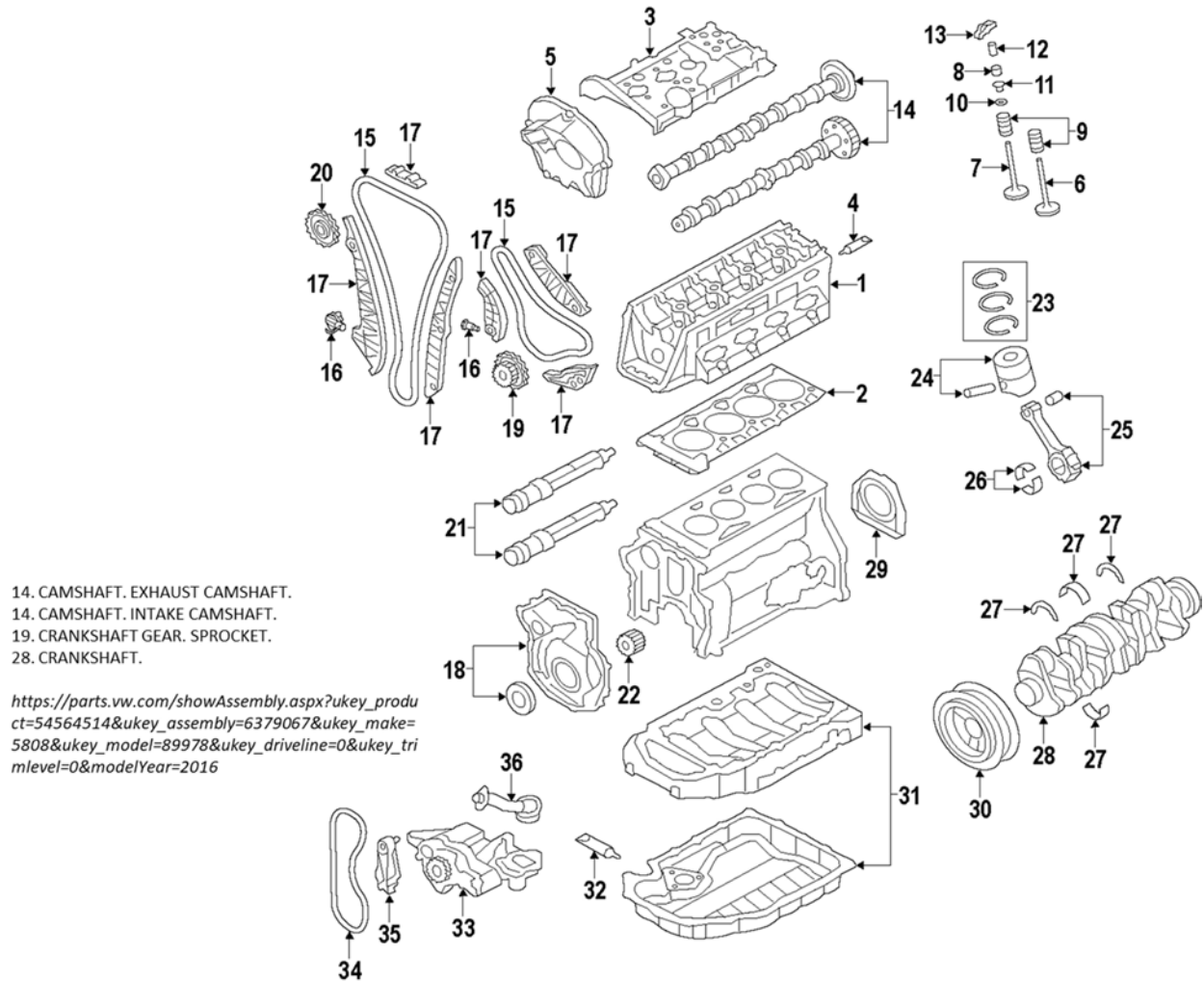
57. Upon information and belief, Defendants have directly infringed at least claim 1 of the ’031 patent by making, using, selling, importing and/or providing and causing to be used the 2015-2018 Jetta (1.4L) or other vehicles having incorporated the DTI engine (the “’031 patent Accused Instrumentalities”).

58. Upon information and belief, the ’031 patent Accused Instrumentalities incorporate the Theta II Engine which comprises a system for determining a stop position of an engine.

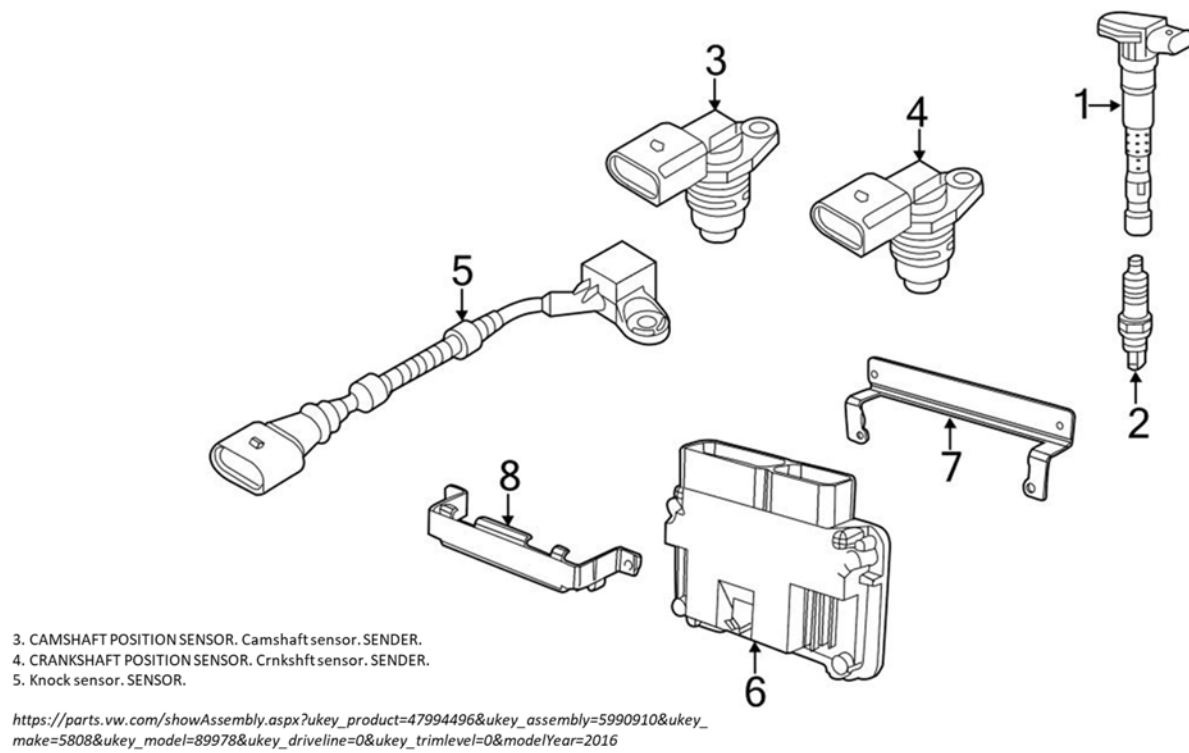
59. In particular, claim 1 of the ’031 patent recites a system for determining a stop position of an engine, the system comprising: a sensor configured to generate a signal corresponding to the angle of the engine; a controller coupled to the sensor and configured to receive the signal; and an air flow control device coupled to the engine to control air intake, the

controller being configured to control the air flow control device to lower air pressure in the engine based on an engine shutdown signal.

60. On information and belief, the '031 patent Accused Instrumentalities infringe claim 1 of the '031 patent. The '031 patent Accused Instrumentalities comprise a system for determining a stop position of an engine (*Figure 52*), the system comprising: a sensor configured to generate a signal corresponding to the angle of the engine (*Figure 53*); a controller coupled to the sensor and configured to receive the signal (*Figure 54*); and an air flow control device coupled to the engine to control air intake (*Figure 55*), and upon information and belief the controller being configured to control the air flow control device to lower air pressure in the engine based on an engine shutdown signal (*Figures 52-53*).

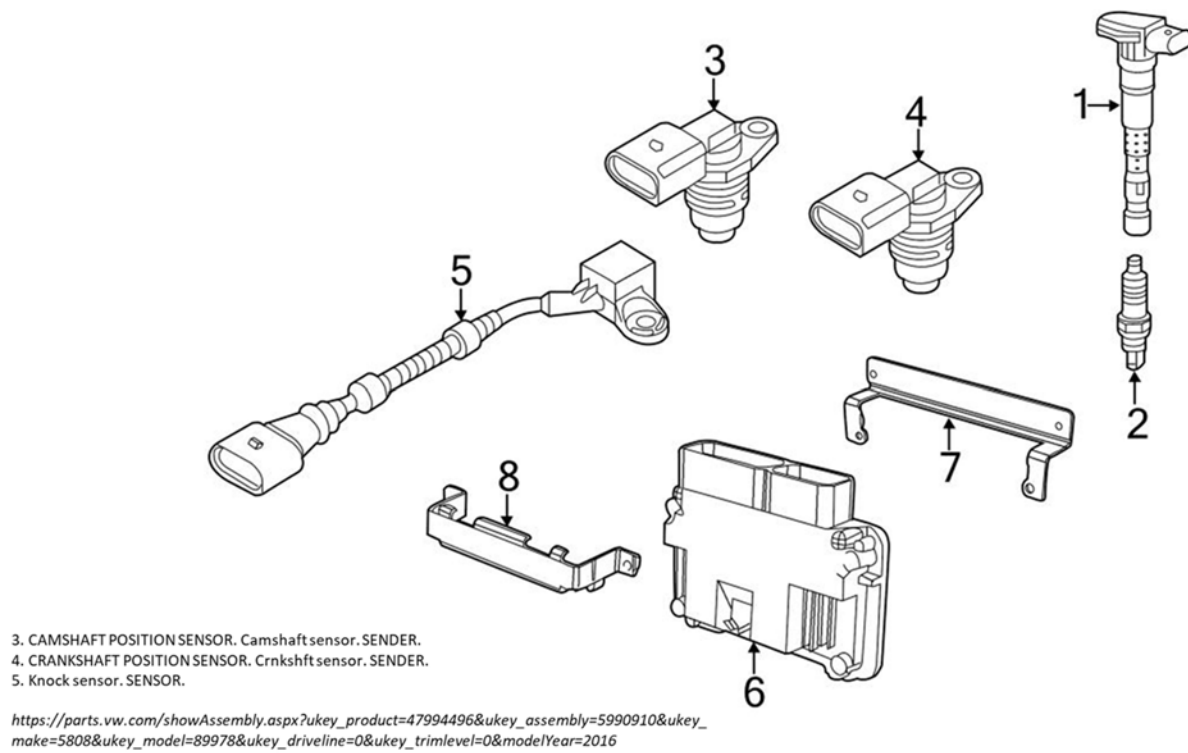


The camshaft (14 above) and crankshaft (28 above) control the piston position in an internal combustion engine.



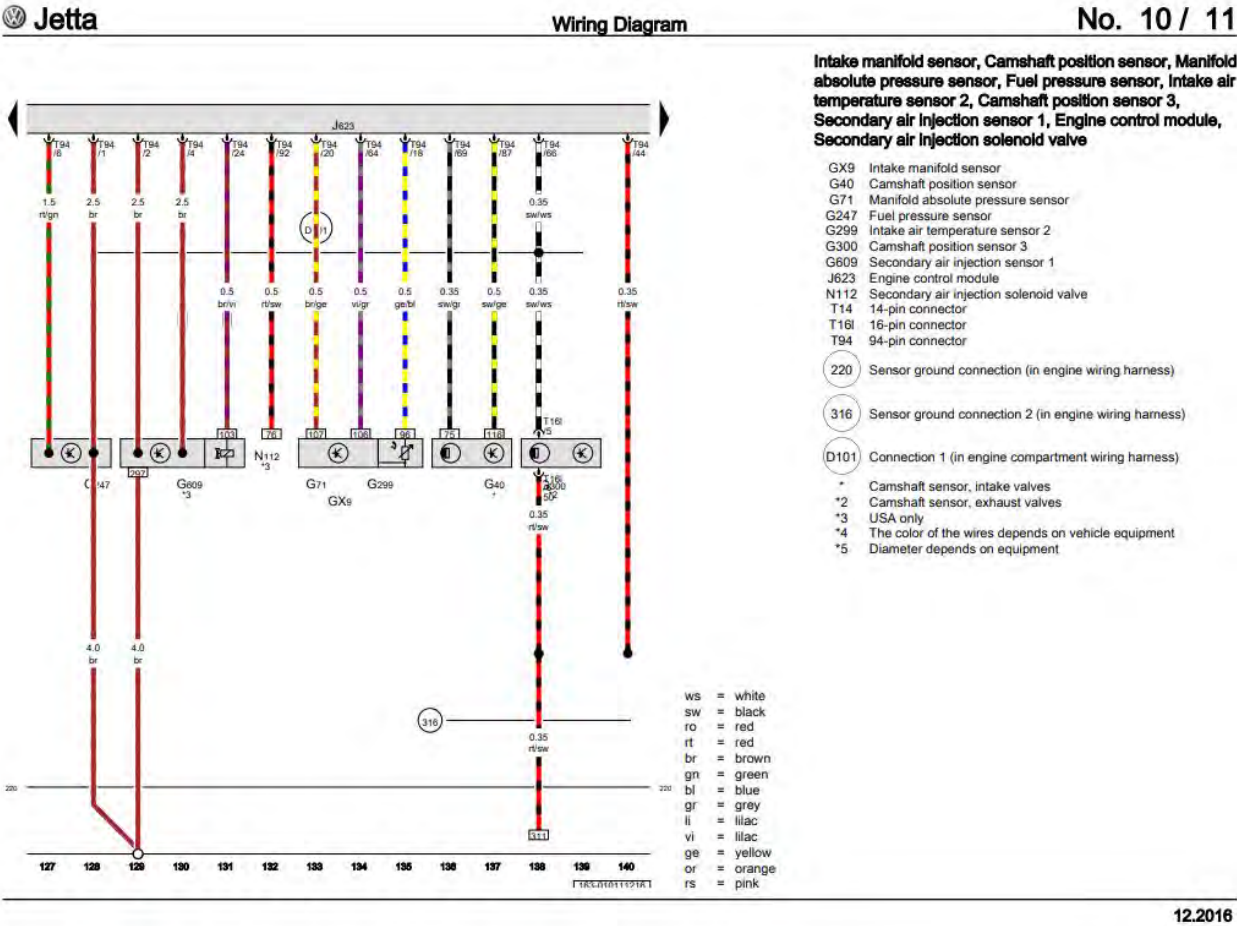
The camshaft position sensor (3 above) sends a signal to the ECM corresponding with the stop position of an engine.

Figure 52



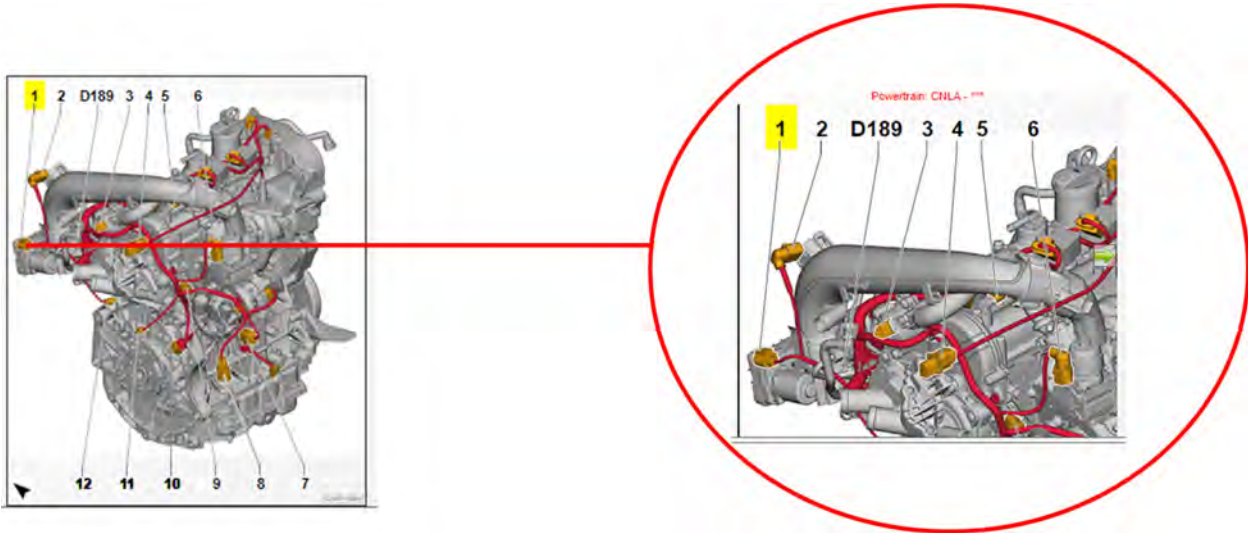
The '031 patent Accused Instrumentalities comprise a Camshaft Position Sensor (3 above) which generates a signal corresponding to the angle of the engine.

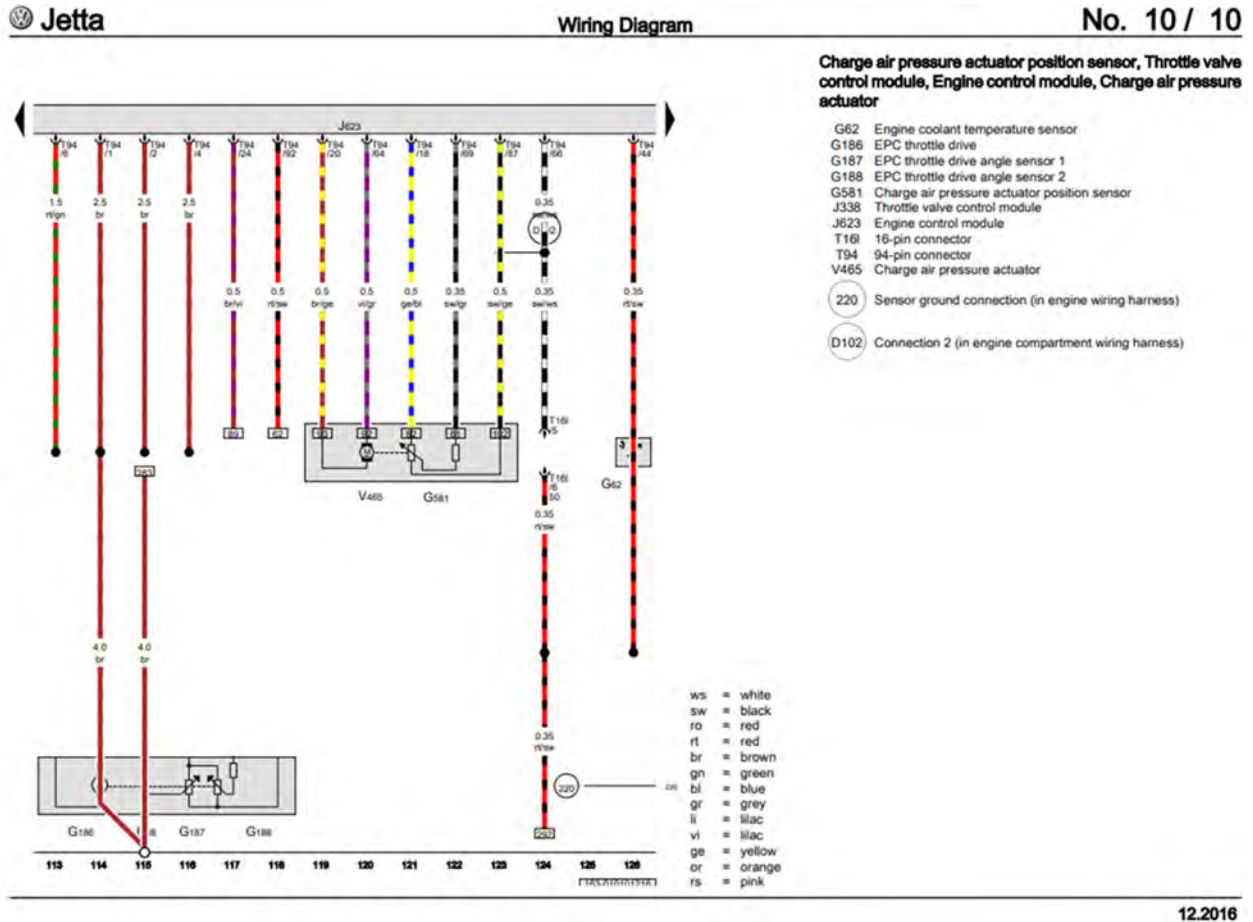
Figure 53



For example, the Engine Control Module (ECM; J623), a controller, is coupled to the Camshaft Position Sensors (G40; G300) and to receive the signals generated by these sensors.

Figure 54





For example, the ECM (J623) is configured to control the air flow control device (throttle valve not shown here) to lower air pressure in the engine based on an engine shutdown signal.

The engine shutdown signal is communicated at the end of a drive cycle. When the engine is shut down, the throttle angle is at 0 degrees, thereby decreasing the air pressure in the engine.

Figure 56

Based upon the totality of the foregoing evidence, and based further upon information and belief, the '031 patent Accused Instrumentalities include "a system for determining a stop position of an engine, the system comprising: a sensor configured to generate a signal corresponding to the angle of the engine; a controller coupled to the sensor and configured to receive the signal; and an air flow control device coupled to the engine to control air intake, the controller being configured to control the air flow control device to lower air pressure in the engine based on an engine shutdown signal."

COUNT IX – INFRINGEMENT OF U.S. PATENT NO. 6,612,287

61. The allegations set forth in the foregoing paragraphs 1 through 60 are incorporated into this Ninth Claim for Relief.

62. On September 2, 2003 U.S. Patent No. 6,612,287 (“the ’287 patent”), entitled “Electronic Throttle Position Feedforward System,” was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the ’287 patent is attached as Exhibit 9.

63. Plaintiff is the assignee and owner of the right, title and interest in and to the ’287 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

64. Upon information and belief, Defendants have directly infringed at least claim 1 of the ’287 patent by making, using, selling, importing and/or providing and causing to be used the 2012-2018 Tiguan, 2012-2018 Audi A3, 2012-2018 Audi A4, 2012-2018 Audi A5, 2012-2018 Audi A6, 2016-2018 Audi TT, 2015-2018 Audi S3, 2015-2018 VW Golf, 2012-2018 VW Golf GTI, 2015-2018 VW Golf R, 2015-2018 Golf Sportwagon, 2013-2018 Jetta GLI, 2014-2018 VW Jetta Sedan, 2014-2018 VW Passat, 2012-2017 VW CC, 2012-2018 VW Beetle, 2018 VW Atlas, 2015-2018 Audi Q3, 2012-2018 Audi Q5, and 2017-2018 Porsche Macan with the EA888 engines (the “’281 patent Accused Instrumentalities”).

65. In particular, claim 1 of the ’287 patent recites a method for controlling a positioning device of an internal combustion engine, the method comprising the steps of: providing an electronic motor for actuating said positioning device with a torque being applied to said motor over the positioning range and said torque changing sign thereby defining a torque reversal point; detecting a commanded position of said positioning device; determining whether said positioning device's command is in the region of said torque reversal point; forming a drive signal for the motor on the basis of said commanded position for said positioning device; and changing said drive signal to abruptly change the motor voltage when said commanded position is in said region of said torque reversal point.

66. On information and belief, the '281 patent Accused Instrumentalities infringe claim 1 of the '287 patent. The '281 patent Accused Instrumentalities practice a method controlling a positioning (*Figure 57*) device of an internal combustion engine (*Figure 57*), the method comprising the steps of: providing an electronic motor (*Figure 57*) for actuating said positioning device with a torque being applied to said motor over the positioning range and said torque changing sign thereby defining a torque reversal point (*Figure 57*); detecting a commanded position of said positioning device (*Figure 57*); determining whether said positioning device's command is in the region of said torque reversal point (*Figure 57*); forming a drive signal for the motor on the basis of said commanded position for said positioning device (*Figure 57*); and changing said drive signal to abruptly change the motor voltage when said commanded position is in said region of said torque reversal point (*Figure 57*).

2.3 Electronic Throttle Control (ETC) System

The electronic throttle control (ETC) system consists of the accelerator-pedal module, the engine control module (ECM), and the electronic throttle body. The electronic throttle body mainly consists of the throttle valve, the electric throttle-valve drive element, and the throttle-valve position sensor (TPS). The drive element is a DC servomotor, which acts on the throttle-valve shaft via a gear unit. The throttle-valve position sensor is a redundant sensor system that detects the position of the throttle valve. The sensors have opposite resistance curves so that the ECM can always cross check the signals to ensure the correct position of the throttle valve is always known.

The driver command is detected by a redundant sensor system in the accelerator-pedal module, and the signal is sent to the engine control module. The engine control module then determines the required throttle-valve position by performing calculations from data measured by sensors such as accelerator pedal position sensor, engine speed sensor and vehicle speed sensor. The actual throttle opening can be more or less in proportion to accelerator pedal position given different engine operating points.

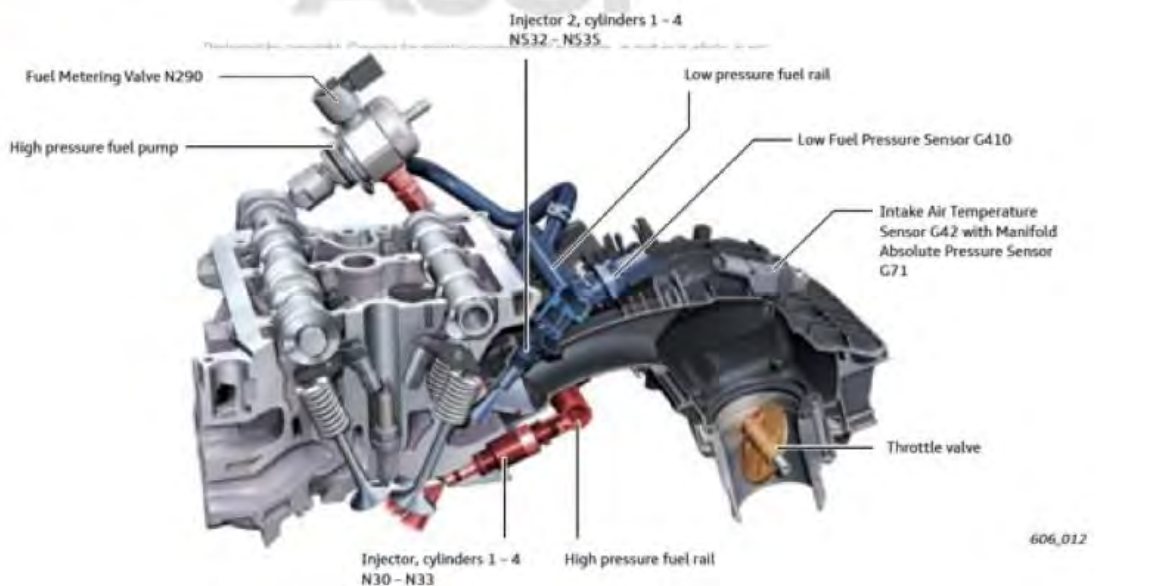
Engine management system**System overview example – 1.8L TFSI engine****Sensors**

Throttle Valve Control Module J338
 RPM Throttle Drive-Angle Sensors 1 & 2 G187, G188
 Brake Light Switch F
 Clutch Position Sensor G476
 Clutch Pedal Switch F130
 Clutch Pedal Starter (Interlock) Switch F134
 Accelerator Pedal Position Sensor G79
 Accelerator Pedal Position Sensor 2 G185
 Knock Sensor 1 G82
 Low Fuel Pressure Sensor G410
 Hall Sensor (G40)
 Hall Sensor 2 G300
 Engine Coolant Temperature Sensor G62
 Engine Coolant Temperature Sensor in Radiator (Start) G81
 Engine Speed Sensor G26
 Oil Level Thermal Switch G268
 Intake Manifold Runner Position Switch G138
 Intake Air Temperature Sensor G42
 Manifold Absolute Pressure Sensor G71
 Fuel Pressure Sensor G247
 Charge Air Pressure Sensor G51
 Crankshaft Position Sensor G204
 Brake Boost Pressure Sensor G294
 Inertial Steerer Sensor G78
 Oxygen Sensor after Three-Way Catalysts Converter G170
 Oil Pressure Switch G22
 Back and Oil Pressure Switch F1378
 Oil Pressure Switch, Level 3 F447
 Charge Pressure Actuator Pressure Sensor G481
 Fuel Level Sensor G
 Fuel Level Sensor 2 G180
 Auxiliary signals:
 - Cruise control system
 - Ignition signal
 - Start request to engine control module (starts 1 x 2)
 - Terminal 30
 - Load signal from driving control Module

Actuators

Throttle Valve Control Module J338
 Ignition Coils 1 - 4 with Oxygen-Sensor
 N16, N17, N19, N20
 EPC Throttle Drive G186
 Injectors 2-cylinders 1 & 4 N532 - N535
 Oil pressure (in gas engine) sensor
 Ignition cylinders 1 - 4 N30 - N33
 Transmission Control Valve N888
 Turbocharger Bypass Valve N140
 Intake Manifold Runner Control Valve N110
 Control Bypass Valve V50
 Camshaft Adjustment Valve 1 N205
 Exhaust Camshaft Adjustment Valve 1 N318
 N318 only on 2.0L engine
 Fuel Metering Valve N290
 Oil Pressure Regulation Valve N428
 Gas Adjustment Actuators 1 - 8, G166, F171
 Intake air 2.0L engine
 Exhaust Exhaust Valve Regulator Valve N80
 Engine Temperature Control Actuator N481
 Oxygen Sensor Heater 218
 Heater for Oxygen Sensor 1 after Catalysts Converter 270
 Charge Pressure Actuator N485
 Left Electro-Hydraulic Engine Mount Solenoid Valve N144
 Right Electro-Hydraulic Engine Mount Solenoid Valve N145
 Fuel Pump Control Module J538
 Transfer Fuel Pump G6
 Oilpan Fan Control Module J712
 Control Fan V7
 Control Fan 2 V177
 Auxiliary signals:
 - Dual Air Intake Manifold Module 7 engine speed
 - ABS/ESP Control Module
 - A/C compressor
 - Master control Module

High pressure system
 Low pressure system



The positioning device (throttle valve) is within the Throttle Valve Control Module J338 shown above.

The Engine Control Module (ECM) controls the positioning device (throttle valve) of an internal combustion position. The positioning device (throttle valve) is within the Throttle Valve Control Module J338 shown above.

Figure 57

COUNT X – INFRINGEMENT OF U.S. PATENT NO. 7,487,761

67. The allegations set forth in the foregoing paragraphs 1 through 66 are incorporated into this Tenth Claim for Relief.

68. On February 10, 2009 U.S. Patent No. 7,487,761 (“the ’761 patent”), entitled “Detection of Fuel System Problems,” was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the ’761 patent is attached as Exhibit 10.


69. Plaintiff is the assignee and owner of the right, title and interest in and to the ’761 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

70. Upon information and belief, Defendants have directly infringed at least claims 1 and 17 of the ’761 patent by making, using, selling, importing and/or providing and causing to be used the 2012-2018 Tiguan, 2012-2018 Audi A3, 2012-2018 Audi A4, 2012-2018 Audi A5, 2012-2018 Audi A6, 2016-2018 Audi TT, 2015-2018 Audi S3, 2015-2018 VW Golf, 2012-2018 VW Golf GTI, 2015-2018 VW Golf R, 2015-2018 Golf Sportwagon, 2013-2018 Jetta GLI, 2014-2018 VW Jetta Sedan, 2014-2018 VW Passat, 2012-2017 WV CC, 2012-2018 VW Beetle, 2018 VW Atlas, 2015- 2018 Audi Q3, 2012-2018 Audi Q5, and 2017-2018 Porsche Macan with the EA888 engines (the “’761 patent Accused Instrumentalities”).

71. In particular, claim 1 of the ’761 patent recites a method for detecting failures in a fuel system for a motor vehicle, the fuel system includes a fuel pump providing fuel from a fuel tank to a fuel injector rail of an engine, a fuel pump controller is electrically connected to the fuel pump and a rail pressure sensor, the rail pressure sensor is attached to the fuel injector rail in fluid communication with fuel being provided from the fuel tank, the method comprises: monitoring an actual fuel pump parameter of the fuel pump and a fuel injector rail pressure; comparing the actual fuel pump parameter required to achieve a desired fuel injector rail pressure

to an initial fuel pump parameter to achieve the desired fuel injector rail pressure; and signaling a fuel system problem if a difference between the actual fuel pump parameter and the initial fuel pump parameter exceeds a predetermined threshold.

72. On information and belief, the '761 patent Accused Instrumentalities infringe claim 1 of the '761 patent. The '761 patent Accused Instrumentalities practice a method for detecting failures in a fuel system for a motor vehicle (*Figure 58*), the fuel system includes a fuel pump providing fuel from a fuel tank to a fuel injector rail of an engine (*Figure 59*), a fuel pump controller is electrically connected to the fuel pump and a rail pressure sensor (*Figure 60*), the rail pressure sensor is attached to the fuel injector rail in fluid communication with fuel being provided from the fuel tank (*Figure 61*), the method comprises: monitoring an actual fuel pump parameter of the fuel pump and a fuel injector rail pressure (*Figure 62*); comparing the actual fuel pump parameter required to achieve a desired fuel injector rail pressure to an initial fuel pump parameter to achieve the desired fuel injector rail pressure (*Figure 63*); and signaling a fuel system problem if a difference between the actual fuel pump parameter and the initial fuel pump parameter exceeds a predetermined threshold (*Figure 64*).

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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0087 Fuel Rail/ System Pressure - Too Low Bank 1	Fuel System Pressure Sensor, High Pressure Side Out Of Range Low	<ul style="list-style-type: none"> Deviation between reference fuel pressure setpoint and current fuel pressure > 2,999.80 kPa Case 1: Deviation lambda of controller included adaption -50.00 - 50.00 % High pressure controller output > 45 mg Fuel pressure < 3,500.31 kPa Case 2: Fuel pump at max limit Mass fuel flow setpoint < 1,389.00 mg/rev Fuel pressure < 34,777.60 kPa 	General: <ul style="list-style-type: none"> Engine speed 608 - 6,816 rpm Fuel mass setpoint 5.00 - 1,389.00 mg/rev Time after engine start > 10.0 s Engine warm-up not calibrated Catalyst heating not calibrated Full load not calibrated Catalyst purge not calibrated Lambda control not calibrated Evap purge functionality diagnosis not calibrated Fuel pressure setpoint <= 34,777.60 kPa And Depending on low dynamic conditions: Fuel mass setpoint lower range > 5.00 mg/rev For time >= 10.0 s Fuel mass setpoint upper range < 187.17 - 229.23 mg/rev Fuel mass setpoint gradient -1389.00...1389.00 mg/rev For time >= 5.0 s And Depending on canister purge: Canister load not calibrated [-] Or Evap purge valve not calibrated 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in "3.1 Preliminary Check, page 13 and/or to appropriate repair manual. Check the Fuel Pressure Sensor - G247-. Refer to "3.6.17 Fuel Pressure Sensor G247-, Checking, page 983. Check the Fuel Pressure Regulator Valve - N276-. Refer to "3.6.16 Fuel Metering Valve N290, Checking, page 981. Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module - J538-. Refer to "3.6.16 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1, Checking, page 985.

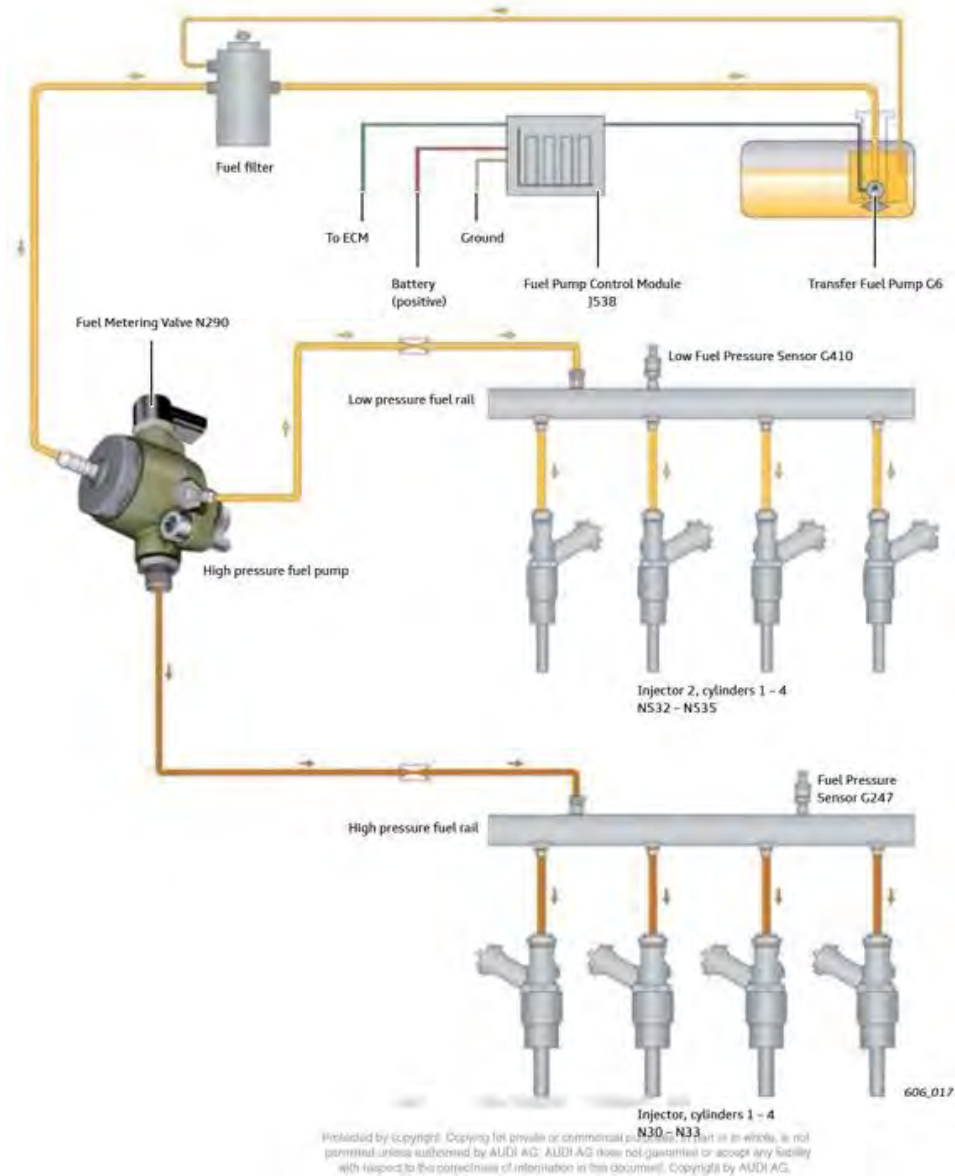
3. Diagnosis and Testing 621

For example, as shown in the DTC chart above, the fuel system is monitored using a self-test diagnostic strategy within the ECM and when low fuel pressure is detected in two sequential driving cycles, the ECM illuminates the Malfunction Indicator Lamp (MIL).

Figure 58

Fuel system

System overview



Note

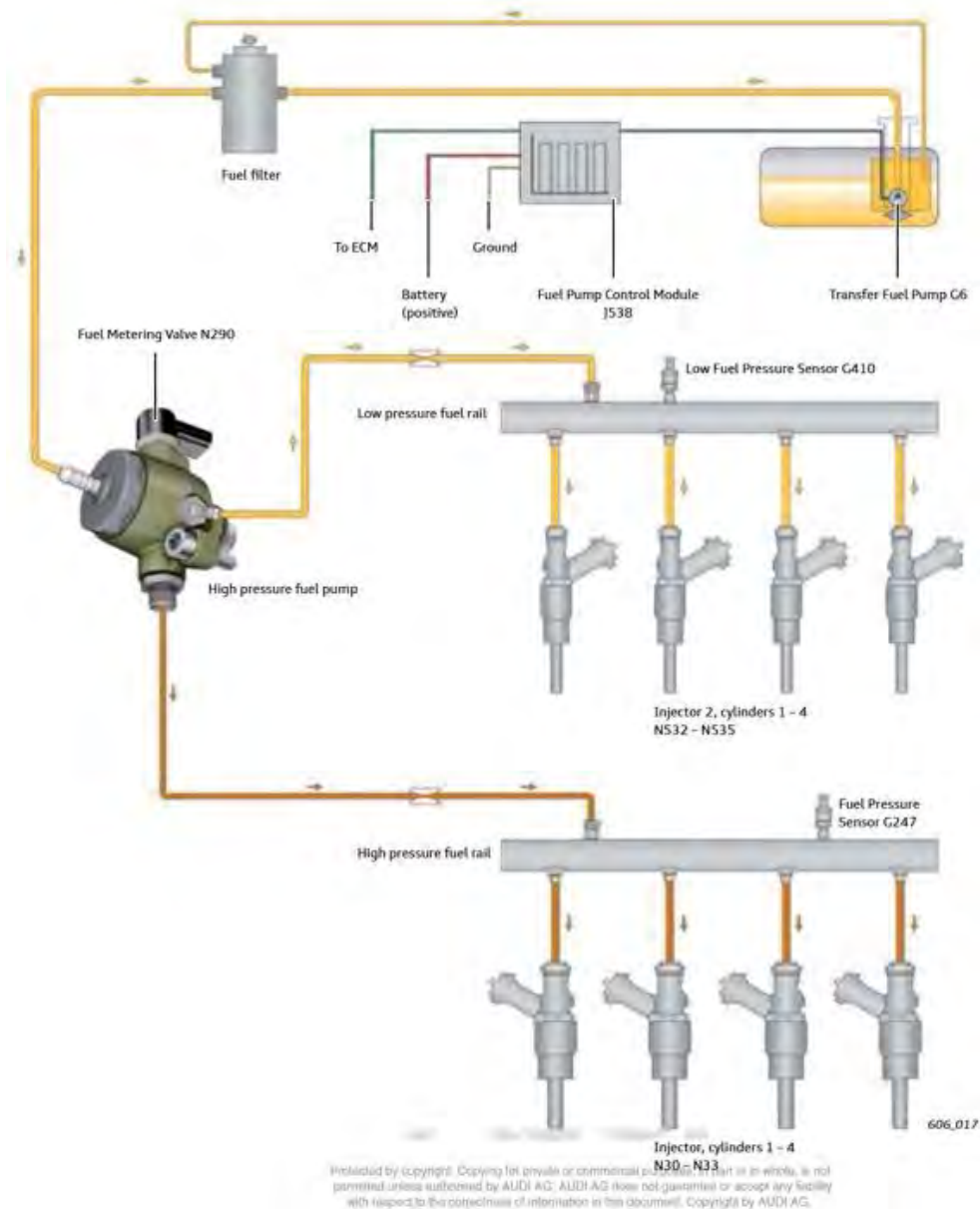
Only the FSI (high pressure) system will be used on the 2015 A3 engines. The use of MPI and FSI may introduced on later Audi models.

For example, as shown in the figures above, the fuel system includes a Fuel Pump, providing fuel from a fuel tank to the fuel injector rail of an engine.

Figure 59

Fuel system

System overview



Note

Only the FSI (high pressure) system will be used on the 2015 A3 engines. The use of MPI and FSI may introduced on later Audi models.

For example, as depicted above the fuel pump controller (Powertrain Control Module (PCM)) is electrically connected to the fuel pump.

2015 Audi TT Quattro Coupe (8J3) L4-2.0L Turbo (CETA)

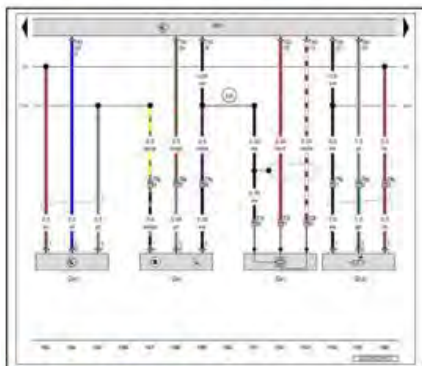
Vehicle » Powertrain Management » Diagrams » Electrical Diagrams » Diagram 61/15 (Tracks 183-196)

DIAGRAM 61/15 (TRACKS 183-196)**IMPORTANT NOTE:**

This manufacturer uses "Track" style wiring diagrams.

For information on how to use these diagrams effectively, please refer to Diagram Information and Instructions. See: [Diagrams\Diagram Information and Instructions](#)

Camshaft position sensor, Knock sensor 1, Fuel pressure sensor, Intake manifold runner position sensor, Engine control module

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ws = white
 sw = black
 ro = red
 br = brown
 gn = green
 bl = blue
 gr = grey
 li = lilac
 ge = yellow
 or = orange
 rs = pink

- G40** - Camshaft position sensor See: [Computers and Control Systems\Locations\Engine Management System](#)
- G61** - Knock sensor 1 See: [Computers and Control Systems\Locations\Engine Management System](#)
- G247** - Fuel pressure sensor See: [Computers and Control Systems\Locations\Engine Management System](#)
- G336** - Intake manifold runner position sensor See: [Computers and Control Systems\Locations\Engine Management System](#)
- J623** - Engine control module See: [Locations\Components](#)
- T3f** - 3-pin connector, green
- T6p** - 6-pin connector, on the engine, front
- T60** - 60-pin connector See: [Computers and Control Systems\Engine Control Module\Locations](#)
- (220)** - Sensor ground connection (in engine wiring harness)
- (316)** - Sensor ground connection 2 (in engine wiring harness)
- (D141)** - Connection 5V (in engine pre-wiring harness)
- (D174)** - Connection 5V (in engine pre-wiring harness) 2

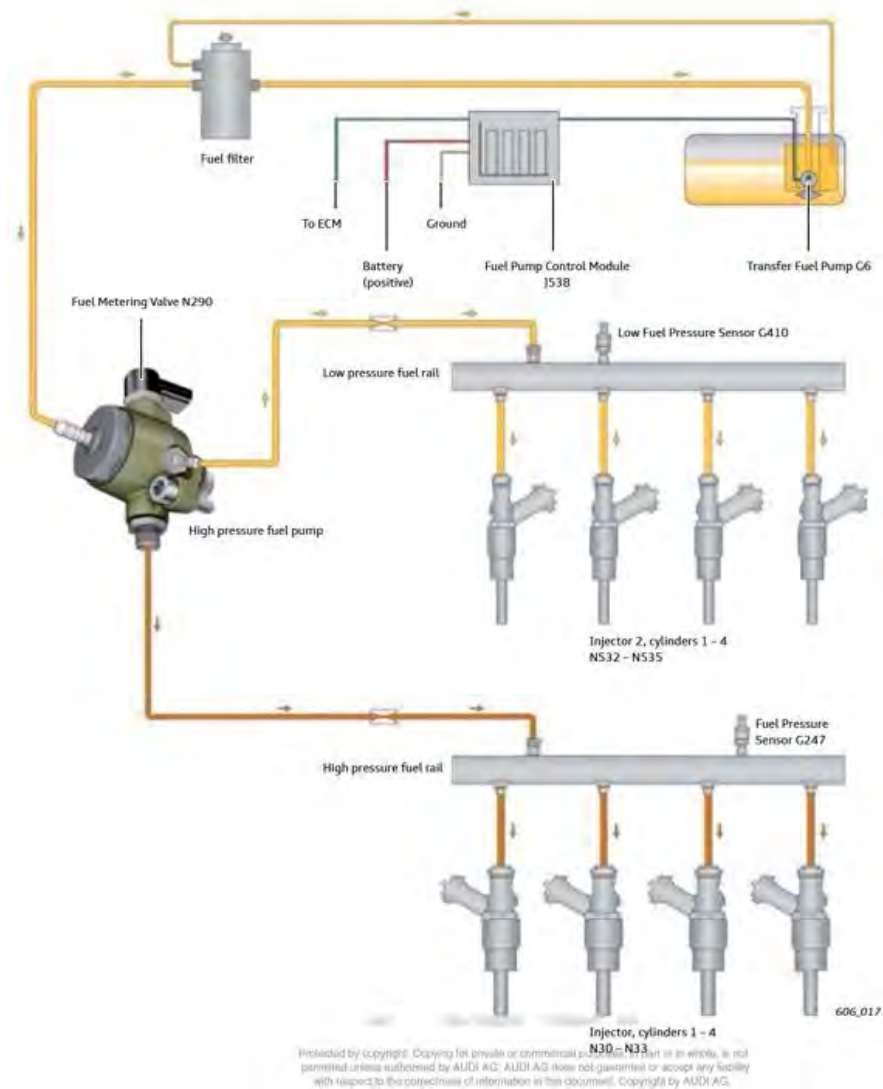
Previous See: [Diagram 61/14 \(Tracks 169-182\)](#)Next See: [Diagram 61/16 \(Tracks 197-210\)](#)© 2018 ALLDATA LLC. All rights reserved. [Terms and Conditions](#)

For example, as depicted above, the PCM is electrically connected to the fuel (rail) pressure sensor.

Figure 60

Fuel system

System overview



Note

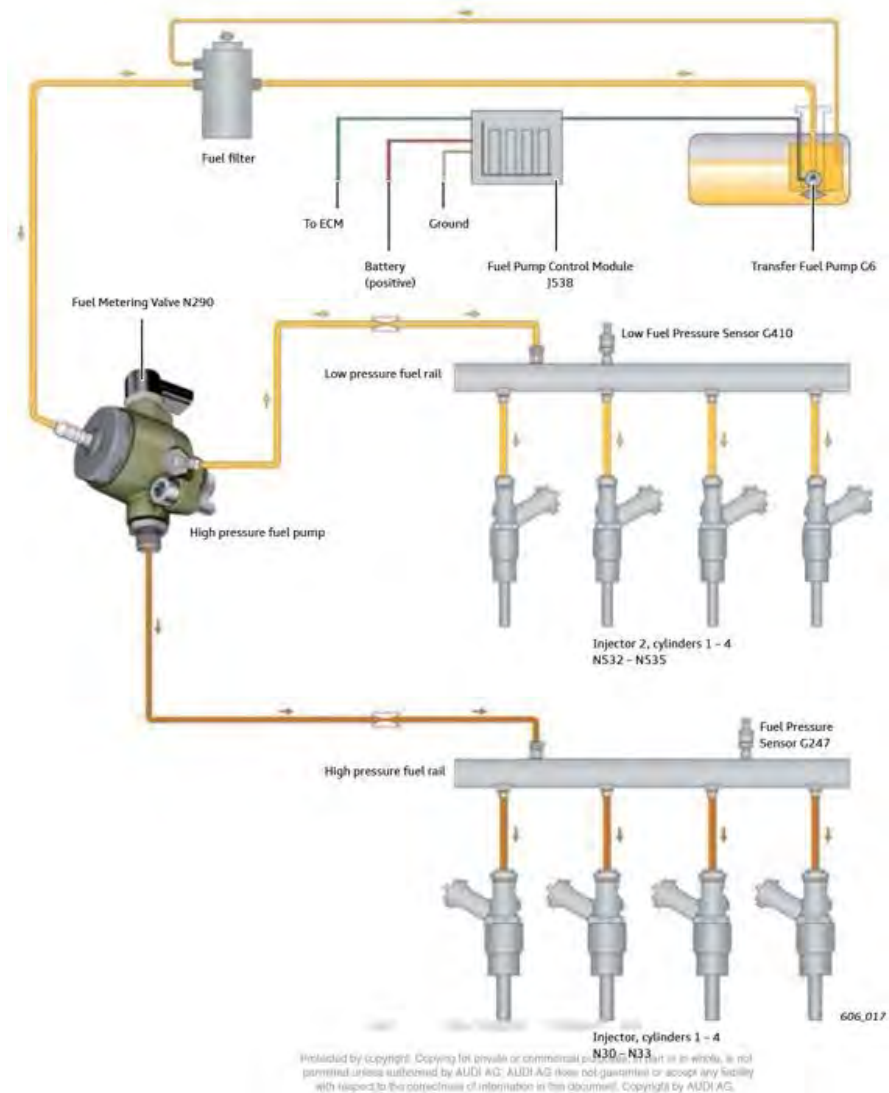
Only the FSI (high pressure) system will be used on the 2015 A3 engines. The use of MPI and FSI may introduced on later Audi models.

For example, as depicted in the images above, the fuel (rail) pressure sensor is attached to the fuel (injector) rail in fluid communication with fuel being provided from the fuel tank.

Figure 61

Fuel system

System overview



Note

Only the FSI (high pressure) system will be used on the 2015 A3 engines. The use of MPI and FSI may introduced on later Audi models.

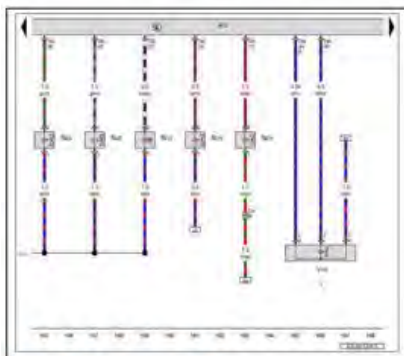
2015 Audi TT Quattro Coupe (8J3) L4-2.0L Turbo (CETA)

Vehicle » Powertrain Management » Diagrams » Electrical Diagrams » Diagram 61/13 (Tracks 155-168)

DIAGRAM 61/13 (TRACKS 155-168)

IMPORTANT NOTE:

This manufacturer uses "Track" style wiring diagrams.

For information on how to use these diagrams effectively, please refer to Diagram Information and Instructions. [See: Diagrams/Diagram Information and Instructions](#)[Engine control module](#), [Fuel pressure regulator valve](#), [Leak detection pump](#)


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ws = white
 sw = black
 ro = red
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 gn = green
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 gr = grey
 li = lilac
 ge = yellow
 or = orange
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- J623** - [Engine control module](#) See: [Locations/Components](#)
- N112** - [Secondary air injection solenoid valve](#) See: [Computers and Control Systems/Locations/3.2L Gasoline BUB, CBRA Overviews](#)
- N249** - [Turbocharger recirculation valve](#) See: [Computers and Control Systems/Locations/Engine Management System](#)
- N276** - [Fuel pressure regulator valve](#) See: [Computers and Control Systems/Locations/Engine Management System](#)
- N316** - [Intake manifold runner control valve](#) See: [Computers and Control Systems/Locations/Engine Management System](#)
- N428** - [Oil pressure regulation valve](#) See: [Computers and Control Systems/Locations/Engine Management System](#)
- T14** - 14-pin connector, in the engine compartment, left front
- T60** - 60-pin connector See: [Computers and Control Systems/Engine Control Module/Locations](#)
- T94** - 94-pin connector See: [Computers and Control Systems/Engine Control Module/Locations](#)
- V144** - [Leak detection pump](#) See: [Emission Control Systems/Evaporative Emissions System/Locations](#)
- (D102)** - Connection 2 (in engine compartment wiring harness)
- *** - Omitted as a running change
- *2** - Only for vehicles with a fuel system diagnostic pump

Previous See: [Diagram 61/12 \(Tracks 141-154\)](#)Next See: [Diagram 61/14 \(Tracks 169-182\)](#)© 2018 ALLDATA LLC. All rights reserved. [Terms and Conditions](#)

S3, TT 2015 > 
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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0087 Fuel Rail/ System Pressure - Too Low Bank 1	Fuel System Pressure Sensor, High Pressure Side Out Of Range Low	<ul style="list-style-type: none"> Deviation between reference fuel pressure setpoint and current fuel pressure > 2.999.80 kPa Case 1: Deviation lambda of controller included adaption -50.00 – 50.00 % High pressure controller output > 45 mg Fuel pressure < 3,500.31 kPa Case 2: Fuel pump at max limit Mass fuel flow setpoint < 1,389.00 mg/rev Fuel pressure < 34,777.60 kPa 	<ul style="list-style-type: none"> General: Engine speed 608 – 6,816 rpm Fuel mass setpoint 5.00 – 1,389.00 mg/rev Time after engine start > 10.0 s Engine warm-up not calibrated Catalyst heating not calibrated Full load not calibrated Catalyst purge not calibrated Lambda control not calibrated Evap purge functionality diagnosis not calibrated Fuel pressure setpoint <= 34,777.60 kPa And Depending on low dynamic conditions: Fuel mass setpoint lower range > 5.00 mg/rev For time >= 10.0 s Fuel mass setpoint upper range < 187.17 – 229.23 mg/rev Fuel mass setpoint gradient -1389.00...1389.00 mg/rev For time >= 5.0 s And Depending on canister purge: Canister load not calibrated [-] Or Evap purge valve not calibrated 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in 3.1 Preliminary Check, page 13 and/or to appropriate repair manual. Check the Fuel Pressure Sensor - G247-. Refer to 3.6.17 Fuel Pressure Sensor G247, Checking, page 983. Check the Fuel Pressure Regulator Valve - N276-. Refer to 3.6.16 Fuel Metering Valve N290, Checking, page 981. Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module - J538-. Refer to 3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1, Checking, page 985.


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Audi Generic Scan Tool - Edition 12.2017

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Fuel Rail Pressure (FRP) rationality check low	<ul style="list-style-type: none"> • Deviation lambda of controller included adaption -50.00 – 50.00% • And • High pressure controller output > 45 mg • And • Deviation between fuel pressure setpoint and current fuel pressure > 2999.80 kPa • And • Fuel pressure >= 3500.31 kPa 	<ul style="list-style-type: none"> • General: • Engine speed 608 – 6816 rpm • Fuel mass setpoint 5.00 – 1389.00 g/rev • Time after engine start > 10.0 s • Engine warm-up not calibrated • Catalyst heating not calibrated • Full load not calibrated • Catalyst purge not calibrated • Lambda control not calibrated • Evap purge functionality diagnosis not calibrated • Fuel pressure setpoint gradient <= 34777.60 kPa • And • Depending on low dynamic conditions: • Fuel mass setpoint lower range > 5.00 mg/rev • For time >= 10.0 s • Fuel mass setpoint upper range < 187.17 – 229.23 mg/rev • Fuel mass setpoint gradient -1389.00 – 1389.00 mg/rev • For time >= 5.0 s • And • Depending on canister purge: • Canister load not calibrated [-] • Or • Evap purge valve not calibrated 			

622 Rep. Gr. ST – Generic Scan Tool

For example, as depicted below the fuel pump with the fuel pressure regulator valve control the fuel flow flowing into the injectors in accordance with the ECM signal. The ECM calculates the fuel amount to be injected based on actual fuel pump parameter (Deviation between reference fuel pressure setpoint and current fuel pressure > 2,999.80 kPa, which is calculated based on various engine conditions) and monitors the rail pressure sensor (fuel injector rail pressure: Fuel pressure < 3,500.31 kPa).

Figure 62

S3, TT 2015 > 
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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0087 Fuel Rail/ System Pressure - Too Low Bank 1	Fuel System Pressure Sensor, High Pressure Side Out Of Range Low	<ul style="list-style-type: none"> Deviation between reference fuel pressure setpoint and current fuel pressure > 2.999.80 kPa Case 1: Deviation lambda of controller included adaption -50.00 – 50.00 % High pressure controller output > 45 mg Fuel pressure < 3,500.31 kPa Case 2: Fuel pump at max limit Mass fuel flow setpoint < 1,389.00 mg/rev Fuel pressure < 34,777.60 kPa 	<ul style="list-style-type: none"> General: Engine speed 608 – 6,816 rpm Fuel mass setpoint 5.00 – 1,389.00 mg/rev Time after engine start > 10.0 s Engine warm-up not calibrated Catalyst heating not calibrated Full load not calibrated Catalyst purge not calibrated Lambda control not calibrated Evap purge functionality diagnosis not calibrated Fuel pressure setpoint <= 34,777.60 kPa And Depending on low dynamic conditions: Fuel mass setpoint lower range > 5.00 mg/rev For time >= 10.0 s Fuel mass setpoint upper range < 187.17 – 229.23 mg/rev Fuel mass setpoint gradient -1389.00...1389.00 mg/rev For time >= 5.0 s And Depending on canister purge: Canister load not calibrated [-] Or Evap purge valve not calibrated 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in "3.1 Preliminary Check", page 13 and/or to appropriate repair manual. Check the Fuel Pressure Sensor - G247-. Refer to "3.6.17 Fuel Pressure Sensor G247-, Checking", page 983. Check the Fuel Pressure Regulator Valve - N276-. Refer to "3.6.16 Fuel Metering Valve N290-, Checking", page 981. Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module - J538-. Refer to "3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1-, Checking", page 985.



S3, TT 2015 >

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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Fuel Rail Pressure (FRP) rationality check low	<ul style="list-style-type: none"> • Deviation lambda of controller included adaption -50.00 – 50.00% • And • High pressure controller output > 45 mg • And • Deviation between fuel pressure setpoint and current fuel pressure > 2999.80 kPa • And • Fuel pressure >= 3500.31 kPa 	<ul style="list-style-type: none"> • General: • Engine speed 608 – 6816 rpm • Fuel mass setpoint 5.00 – 1389.00 g/rev • Time after engine start > 10.0 s • Engine warm-up not calibrated • Catalyst heating not calibrated • Full load not calibrated • Catalyst purge not calibrated • Lambda control not calibrated • Evap purge functionality diagnosis not calibrated • Fuel pressure setpoint gradient <= 34777.60 kPa • And • Depending on low dynamic conditions: • Fuel mass setpoint lower range > 5.00 mg/rev • For time >= 10.0 s • Fuel mass setpoint upper range < 187.17 – 229.23 mg/rev • Fuel mass setpoint gradient -1389.00 – 1389.00 mg/rev • For time >= 5.0 s • And • Depending on canister purge: • Canister load not calibrated [-] • Or • Evap purge valve not calibrated 			



622

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For example, as shown above, the actual fuel pump parameter required to achieve a desired fuel injector rail pressure (Fuel pump at max limit) is the ECM signal shown below (Deviation between reference fuel pressure setpoint and current fuel pressure > 2,999.80 kPa).

Figure 63

As depicted below a fuel system problem is signaled (DTC P0087) if there is a difference between the ECM signal (actual fuel pump parameter of: current fuel pressure) and the initial fuel pump parameter (fuel pressure setpoint) when it exceeds a predetermined threshold (> 2,999.80 kPa).

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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0087 Fuel Rail/ System Pressure - Too Low Bank 1	Fuel System Pressure Sensor, High Pressure Side Out Of Range Low	<ul style="list-style-type: none"> Deviation between reference fuel pressure setpoint and current fuel pressure > 2,999.80 kPa Case 1: <ul style="list-style-type: none"> Deviation lambda of controller included adaption -50.00 – 50.00 % High pressure controller output > 45 mg Fuel pressure < 3,500.31 kPa Case 2: <ul style="list-style-type: none"> Fuel pump at max limit Mass fuel flow setpoint < 1,389.00 mg/rev Fuel pressure < 34,777.60 kPa 	General: <ul style="list-style-type: none"> Engine speed 608 – 6,816 rpm Fuel mass setpoint 5.00 – 1,389.00 mg/rev Time after engine start > 10.0 s Engine warm-up not calibrated Catalyst heating not calibrated Full load not calibrated Catalyst purge not calibrated Lambda control not calibrated Evap purge functionality diagnosis not calibrated Fuel pressure setpoint <= 34,777.60 kPa And Depending on low dynamic conditions: <ul style="list-style-type: none"> Fuel mass setpoint lower range > 5.00 mg/rev For time >= 10.0 s Fuel mass setpoint upper range < 187.17 – 229.23 mg/rev Fuel mass setpoint gradient -1389.00...1389.00 mg/rev For time >= 5.0 s And Depending on canister purge: <ul style="list-style-type: none"> Canister load not calibrated [-] Or Evap purge valve not calibrated 	<ul style="list-style-type: none"> 5.0 s Continuous 	2 DCY	<ul style="list-style-type: none"> Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in "3.1 Preliminary Check, page 13" and/or to appropriate repair manual. Check the Fuel Pressure Sensor - G247-. Refer to "3.6.17 Fuel Pressure Sensor G247, Checking, page 983". Check the Fuel Pressure Regulator Valve - N276-. Refer to "3.6.18 Fuel Metering Valve N290, Checking, page 981". Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module - J538-. Refer to "3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1, Checking, page 985".

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Fuel Rail Pressure (FRP) rationality check low	<ul style="list-style-type: none"> • Deviation lambda of controller included adaption -50.00 – 50.00% • And • High pressure controller output > 45 mg • And • Deviation between fuel pressure setpoint and current fuel pressure > 2999.80 kPa • And • Fuel pressure >= 3500.31 kPa 	<ul style="list-style-type: none"> • General: • Engine speed 608 – 6816 rpm • Fuel mass setpoint 5.00 – 1389.00 g/rev • Time after engine start > 10.0 s • Engine warm-up not calibrated • Catalyst heating not calibrated • Full load not calibrated • Catalyst purge not calibrated • Lambda control not calibrated • Evap purge functionality diagnosis not calibrated • Fuel pressure setpoint gradient <= 34777.60 kPa • And • Depending on low dynamic conditions: • Fuel mass setpoint lower range > 5.00 mg/rev • For time >= 10.0 s • Fuel mass setpoint upper range < 187.17 – 229.23 mg/rev • Fuel mass setpoint gradient -1389.00 – 1389.00 mg/rev • For time >= 5.0 s • And • Depending on canister purge: • Canister load not calibrated [-] • Or • Evap purge valve not calibrated 			

622 Rep. Gr. ST – Generic Scan Tool

As depicted below a fuel system problem is signaled (DTC P0087) if there is a difference between the ECM signal (actual fuel pump parameter of: current fuel pressure) and the initial fuel pump parameter (fuel pressure setpoint) when it exceeds a predetermined threshold (> 2,999.80 kPa).

“Deviation between reference fuel pressure setpoint and current fuel pressure > 2,999.80 kPa”
 Based upon the totality of the foregoing evidence, and based further upon information and belief, the '761 patent Accused Instrumentalities include “a method for detecting failures in a fuel system for a motor vehicle, the fuel system includes a fuel pump providing fuel from a fuel tank to a fuel injector rail of an engine, a fuel pump controller is electrically connected to the fuel

pump and a rail pressure sensor, the rail pressure sensor is attached to the fuel injector rail in fluid communication with fuel being provided from the fuel tank, the method comprises: monitoring an actual fuel pump parameter of the fuel pump and a fuel injector rail pressure; comparing the actual fuel pump parameter required to achieve a desired fuel injector rail pressure to an initial fuel pump parameter to achieve the desired fuel injector rail pressure; and signaling a fuel system problem if a difference between the actual fuel pump parameter and the initial fuel pump parameter exceeds a predetermined threshold.”

Figure 64

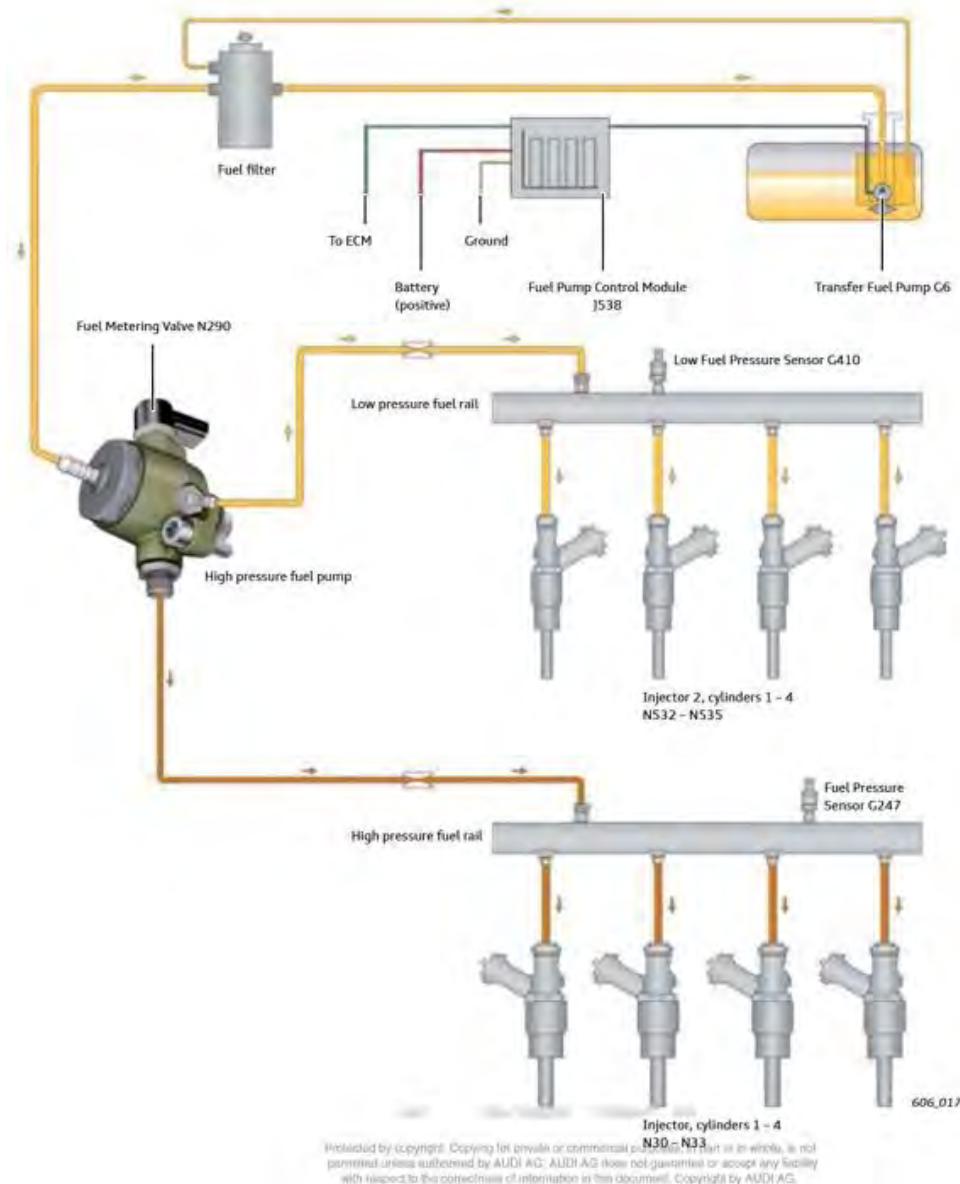
73. Claim 17 of the '761 patent recites a device for detecting failures in a fuel system of a motor vehicle, the fuel system includes a fuel pump providing fuel from a fuel tank to a fuel injector rail of an engine, a rail pressure sensor is attached to the fuel injector rail in fluid communication with the fuel being provided from the fuel tank, the device comprises: a fuel pump controller being electrically connected to the fuel pump and the rail pressure sensor, the fuel pump controller being configured to monitor an actual fuel pump parameter of the fuel pump and an actual fuel injector rail pressure measured by the rail pressure sensor and to compare the actual fuel pump parameter required to achieve a desired fuel injector rail pressure to an initial fuel pump parameter and to signal a fuel system problem if a difference between the actual fuel pump parameter and the initial fuel pump parameter exceeds a predetermined threshold.

74. On information and belief, the '761 patent Accused Instrumentalities infringe claim 17 of the '761 patent. The '761 patent Accused Instrumentalities comprise a device for detecting failures in a fuel system of a motor vehicle (*Figure 65*), the fuel system includes a fuel pump providing fuel from a fuel tank to a fuel injector rail of an engine (*Figure 65*), a rail pressure sensor is attached to the fuel injector rail in fluid communication with the fuel being provided from the fuel tank (*Figure 66*), the device comprises: a fuel pump controller being electrically connected to the fuel pump and the rail pressure sensor (*Figure 66*), the fuel pump controller being configured to monitor an actual fuel pump parameter of the fuel pump and an

actual fuel injector rail pressure measured by the rail pressure sensor and to compare the actual fuel pump parameter required to achieve a desired fuel injector rail pressure to an initial fuel pump parameter and to signal a fuel system problem if a difference between the actual fuel pump parameter and the initial fuel pump parameter exceeds a predetermined threshold (*Figure 66*).

Fuel system

System overview



Note

Only the FSI (high pressure) system will be used on the 2015 A3 engines. The use of MPI and FSI may be introduced on later Audi models.

As shown above, the fuel system includes a fuel pump providing fuel from a fuel tank to a fuel injector rail of an engine, a rail pressure sensor is attached to the fuel injector rail in fluid communication with the fuel being provided from the fuel tank.

Figure 65

As depicted below the fuel pump controller (Powertrain Control Module (PCM)) is electrically connected to the fuel pump and the PCM is electrically connected to the fuel (rail) pressure sensor.

As shown below in DTC P0087, the fuel pump controller, (PCM) is configured to monitor an actual fuel pump parameter (Fuel pump at max limit) and an actual fuel injector rail pressure (current fuel pressure) by the rail pressure sensor (G247) and compares the actual fuel pump parameter required to achieve a desired fuel injector rail pressure to an initial fuel pump parameter (fuel mass setpoint) and to signal a fuel system problem (DTC P0087) if a difference between the actual fuel pump parameter and the initial fuel pump parameter exceeds a predetermined threshold (deviation between fuel pressure setpoint and actual fuel pressure or mass fuel flow setpoint and actual mass fuel flow).

Based upon the totality of the foregoing evidence, and based further upon information and belief, the '761 patent Accused Instrumentalities include "a device for detecting failures in a fuel system of a motor vehicle, the fuel system includes a fuel pump providing fuel from a fuel tank to a fuel injector rail of an engine, a rail pressure sensor is attached to the fuel injector rail in fluid communication with the fuel being provided from the fuel tank, the device comprises: a fuel pump controller being electrically connected to the fuel pump and the rail pressure sensor, the fuel pump controller being configured to monitor an actual fuel pump parameter of the fuel pump and an actual fuel injector rail pressure measured by the rail pressure sensor and to compare the actual fuel pump parameter required to achieve a desired fuel injector rail pressure to an initial fuel pump parameter and to signal a fuel system problem if a difference between the actual fuel pump parameter and the initial fuel pump parameter exceeds a predetermined threshold."

2015 Audi TT Quattro Coupe (8J3) L4-2.0L Turbo (CETA)

Vehicle » Powertrain Management » Diagrams » Electrical Diagrams » Diagram 61/15 (Tracks 183-196)

DIAGRAM 61/15 (TRACKS 183-196)**IMPORTANT NOTE:**

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For information on how to use these diagrams effectively, please refer to Diagram Information and Instructions. See: [Diagrams\Diagram Information and Instructions](#)

Camshaft position sensor, Knock sensor 1, Fuel pressure sensor, Intake manifold runner position sensor, Engine control module

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ws = white
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- G40** - Camshaft position sensor See: [Computers and Control Systems\Locations\Engine Management System](#)
- G61** - Knock sensor 1 See: [Computers and Control Systems\Locations\Engine Management System](#)
- G247** - Fuel pressure sensor See: [Computers and Control Systems\Locations\Engine Management System](#)
- G336** - Intake manifold runner position sensor See: [Computers and Control Systems\Locations\Engine Management System](#)
- J623** - Engine control module See: [Locations\Components](#)
- T3f** - 3-pin connector, green
- T6p** - 6-pin connector, on the engine, front
- T60** - 60-pin connector See: [Computers and Control Systems\Engine Control Module\Locations](#)
- (220)** - Sensor ground connection (in engine wiring harness)
- (316)** - Sensor ground connection 2 (in engine wiring harness)
- (D141)** - Connection 5V (in engine pre-wiring harness)
- (D174)** - Connection 5V (in engine pre-wiring harness) 2

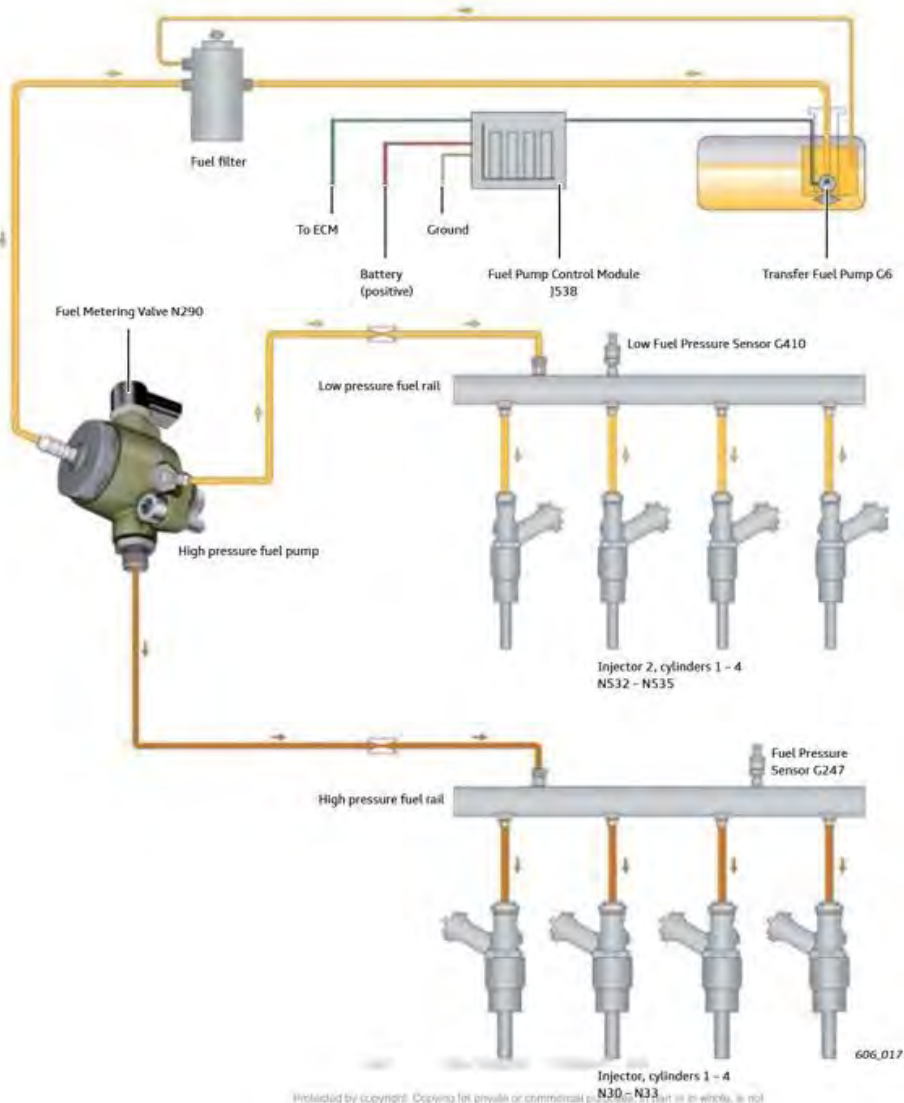
Previous See: [Diagram 61/14 \(Tracks 169-182\)](#)Next See: [Diagram 61/16 \(Tracks 197-210\)](#)© 2018 ALLDATA LLC. All rights reserved. [Terms and Conditions](#)**2015 Audi TT Quattro Coupe (8J3) L4-2.0L Turbo (CETA)**

Vehicle » Powertrain Management » Fuel Delivery and Air Induction » Fuel Pressure Regulator » Testing and Inspection » Fuel Pressure Regulator Valve (N276), Checking

FUEL PRESSURE REGULATOR VALVE (N276), CHECKING**Fuel Pressure Regulator Valve (N276), Checking****Function**The [Engine Control Module \(J623\)](#) regulates Fuel Pressure Regulator Valve (N276) directly at the High Pressure [Fuel Pump](#) to control the low pressure valve inside the High Pressure Fuel Pump.

Fuel system

System overview




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Note

Only the FSI (high pressure) system will be used on the 2015 A3 engines. The use of MPI and FSI may introduced on later Audi models.

S3, TT 2015 > 
Generic Scan Tool - Edition 12.2017

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0087 Fuel Rail/ System Pressure - Too Low Bank 1	Fuel System Pressure Sensor, High Pressure Side Out Of Range Low	<ul style="list-style-type: none"> Deviation between reference fuel pressure setpoint and current fuel pressure > 2.999.80 kPa Case 1: <ul style="list-style-type: none"> Deviation lambda of controller included adaption -50.00 - 50.00 % High pressure controller output > 45 mg Fuel pressure < 3,500.31 kPa Case 2: <ul style="list-style-type: none"> Fuel pump at max limit Mass fuel flow setpoint < 1,389.00 mg/rev Fuel pressure < 34,777.60 kPa 	General: <ul style="list-style-type: none"> Engine speed 608 - 6,816 rpm Fuel mass setpoint 5.00 - 1,389.00 mg/rev Time after engine start > 10.0 s Engine warm-up not calibrated Catalyst heating not calibrated Full load not calibrated Catalyst purge not calibrated Lambda control not calibrated Evap purge functionality diagnosis not calibrated Fuel pressure setpoint <= 34,777.60 kPa And <ul style="list-style-type: none"> Depending on low dynamic conditions: <ul style="list-style-type: none"> Fuel mass setpoint lower range > 5.00 mg/rev For time >= 10.0 s Fuel mass setpoint upper range < 187.17 - 229.23 mg/rev Fuel mass setpoint gradient -1389.00...1389.00 mg/rev For time >= 5.0 s And <ul style="list-style-type: none"> Depending on canister purge: <ul style="list-style-type: none"> Canister load not calibrated [-] Or <ul style="list-style-type: none"> Evap purge valve not calibrated 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in "3.1 Preliminary Check, page 13" and/or to appropriate repair manual. Check the Fuel Pressure Sensor - G247-. Refer to "3.6.17 Fuel Pressure Sensor G247- Checking, page 983". Check the Fuel Pressure Regulator Valve - N276-. Refer to "3.6.16 Fuel Metering Valve N290- Checking, page 981". Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module - J538-. Refer to "3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1- Checking, page 985".

3. Diagnosis and Testing 621

Figure 66

COUNT XI – INFRINGEMENT OF U.S. PATENT NO. 6,644,115

75. The allegations set forth in the foregoing paragraphs 1 through 74 are incorporated into this Eleventh Claim for Relief.

76. On November 11, 2003 U.S. Patent No. 6,644,115 (“the ’115 patent”), entitled “Method and Device for Indicating Liquid Volume in a Tank,” was duly and legally issued by

the United States Patent and Trademark Office. A true and correct copy of the '115 patent is attached as Exhibit 11.

77. Plaintiff is the assignee and owner of the right, title and interest in and to the '115 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

78. Upon information and belief, Defendants have directly infringed at least claims 1, 2, 3, and 7 of the '115 patent by making, using, selling, importing and/or providing and causing to be used the 2012-2018 Tiguan, 2012-2018 Audi A3, 2012-2018 Audi A4, 2012-2018 Audi A5, 2012-2018 Audi A6, 2016-2018 Audi TT, 2015-2018 Audi S3, 2015-2018 VW Golf, 2012-2018 VW Golf GTI, 2015-2018 VW Golf R, 2015-2018 Golf Sportwagon, 2013-2018 Jetta GLI, 2014-2018 VW Jetta Sedan, 2014-2018 VW Passat, 2012-2017 WV CC, 2012-2018 VW Beetle, 2018 VW Atlas, 2015- 2018 Audi Q3, 2012-2018 Audi Q5, and 2017-2018 Porsche Macan with the EA888 engines (the "'115 patent Accused Instrumentalities").

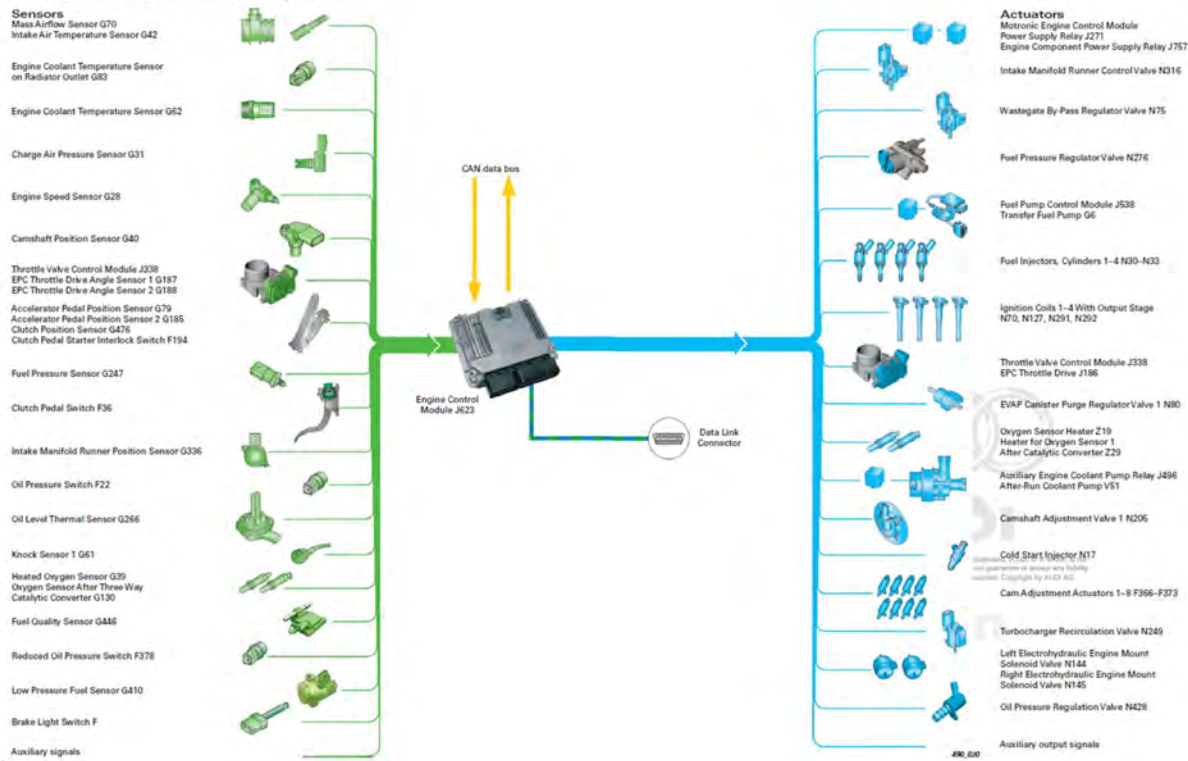
79. In particular, claim 1 of the '115 patent recites a system for determining a level of a liquid present in a storage container in an automobile, the system comprising: a liquid level sensor for determining a preliminary liquid level of the liquid stored in the storage container; a vehicle speed sensor for determining the automobile's speed; a transmission gear selection sensor for determining a transmission gear position of a transmission of the automobile; and a processor for receiving input signals from the liquid level sensor, the vehicle speed sensor and the transmission gear selection sensor for modifying the preliminary liquid level to arrive at a final liquid level indication of the liquid present in the storage container when the automobile's speed is equal to zero, the automobile transmission gear is in park position, and the preliminary liquid level exceeds a predetermined threshold.

80. On information and belief, the '115 patent Accused Instrumentalities infringe claim 1 of the '115 patent. The '115 patent Accused Instrumentalities comprise a system for determining a level of a liquid present in a storage container in an automobile (*Figure 67*), the system comprising: a liquid level sensor for determining a preliminary liquid level of the liquid stored in the storage container (*Figure 68*); a vehicle speed sensor for determining the automobile's speed (*Figure 69*); a transmission gear selection sensor for determining a transmission gear position of a transmission of the automobile (*Figure 70*); and a processor for receiving input signals from the liquid level sensor (*Figure 71*), the vehicle speed sensor and the transmission gear selection sensor (*Figure 71*) for modifying the preliminary liquid level to arrive at a final liquid level indication of the liquid present in the storage container when the automobile's speed is equal to zero (*Figure 71*), the automobile transmission gear is in park position, and the preliminary liquid level exceeds a predetermined threshold (*Figure 71*).

The '115 patent Accused Instrumentalities comprise a Controller Area Network (CAN) system which sends and receives data to and from various microcontrollers in the system. For example, the Fuel Level Sensor (FLS) measures the fuel level in the fuel tank and provides information to the Powertrain Control Module (PCM) and the brake fluid level warning switch measures the brake fluid level and provides information to the anti-lock braking system (ABS) and the Electronic Stability Control System (ESC).

Engine Management

Overview of the Bosch MED 17.1 System

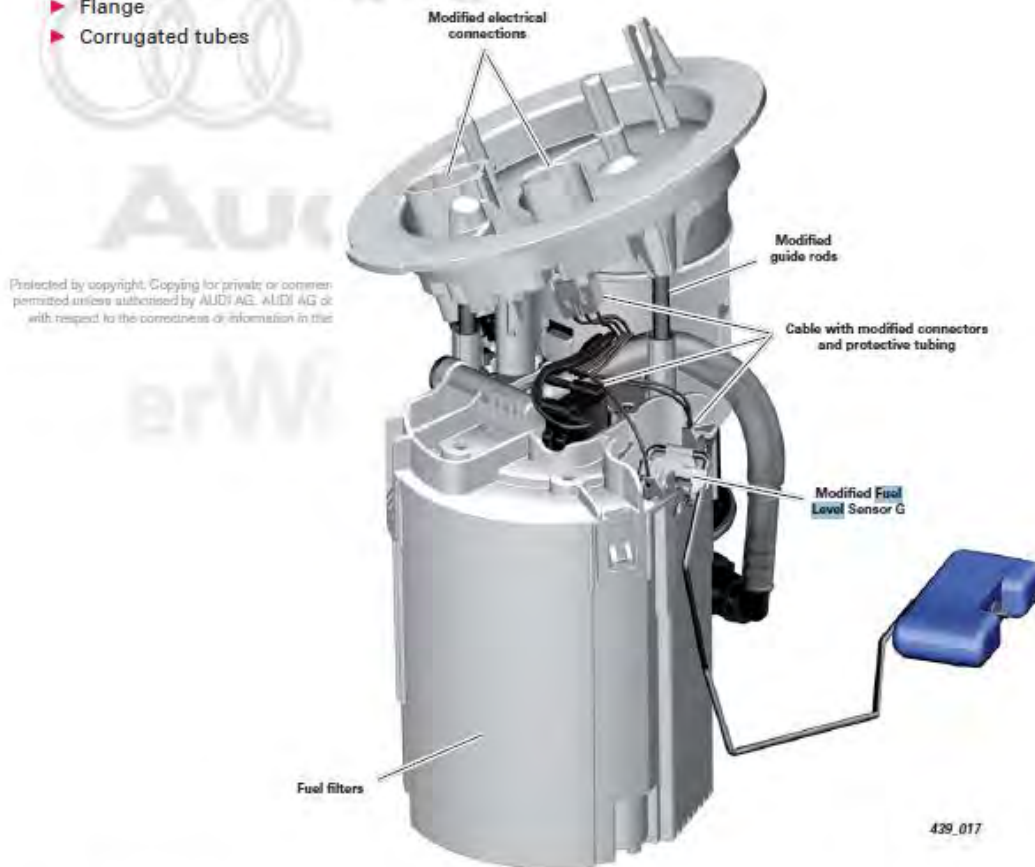


For example, the '115 patent Accused Instrumentalities comprise a fuel system which includes a fuel level sensor for determining a level of fuel present in the fuel tank.

Fuel Delivery Module

The following components of the fuel delivery module have been modified for bioethanol fuel:

- ▶ Guide rods
- ▶ Insulation for the electrical wiring
- ▶ Fuel Level Sensor G
- ▶ Flange
- ▶ Corrugated tubes



The following components of Transfer Fuel Pump G6 have also been modified for bioethanol fuel:

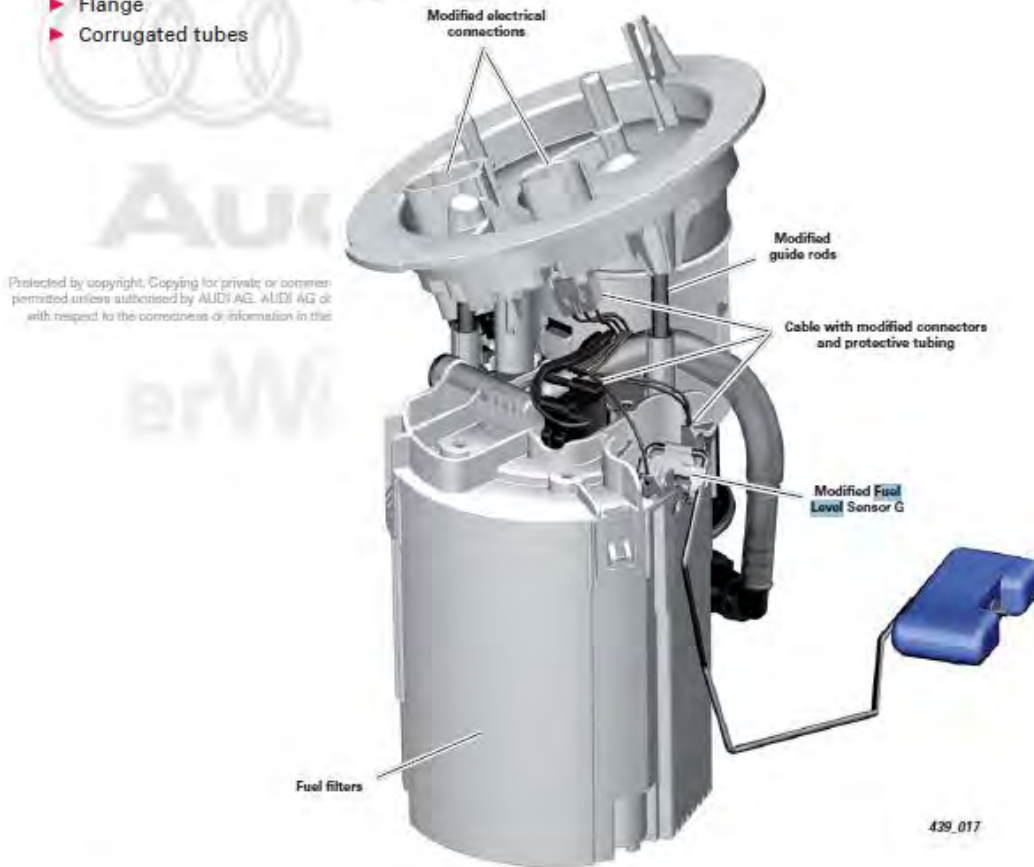
- ▶ Pump housing
- ▶ Pump stage
- ▶ Connector cover

Figure 67

Fuel Delivery Module

The following components of the fuel delivery module have been modified for bioethanol fuel:

- ▶ Guide rods
- ▶ Insulation for the electrical wiring
- ▶ Fuel Level Sensor G
- ▶ Flange
- ▶ Corrugated tubes



The following components of Transfer Fuel Pump G6 have also been modified for bioethanol fuel:

- ▶ Pump housing
- ▶ Pump stage
- ▶ Connector cover

12

As demonstrated in the exemplary images above, the '115 patent Accused Instrumentalities include a Fuel Level Sensor (FLS), which is a liquid level sensor. The FLS determines the preliminary liquid level of the fuel (liquid) stored in the storage container (fuel tank).

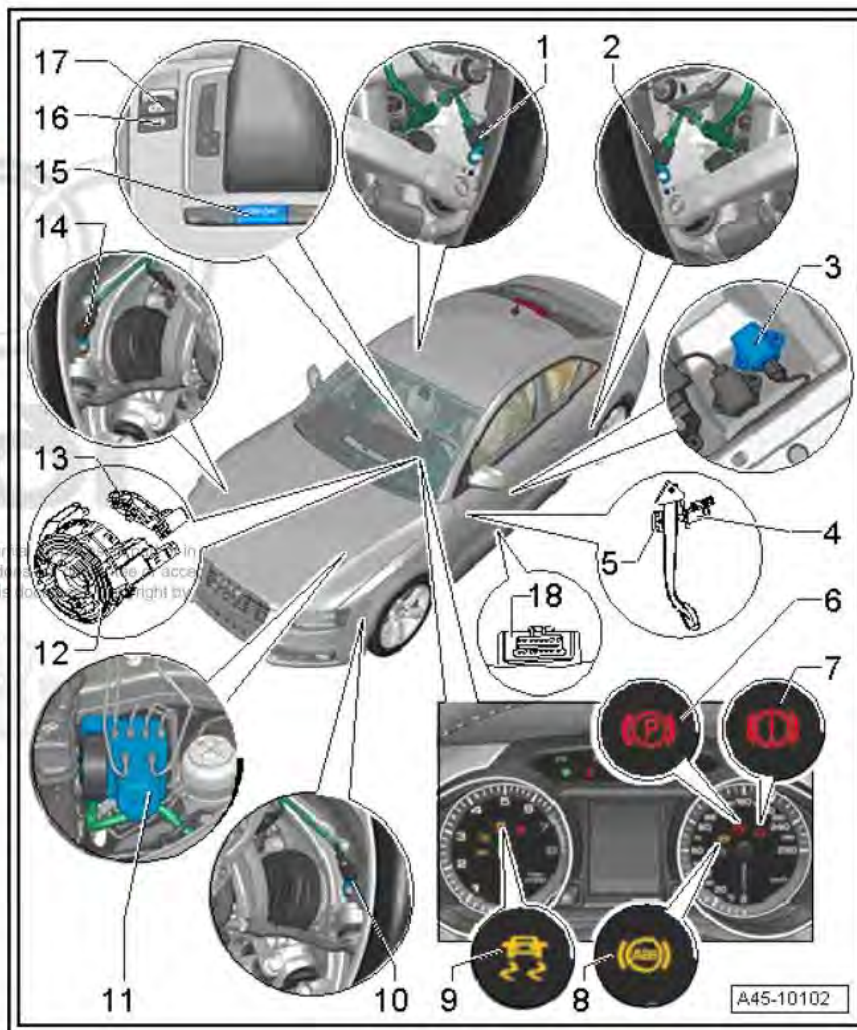
Figure 68

1 - Right Rear ABS Wheel Speed Sensor - G44-

- ❑ Removing and installing. Refer to ["4.2 Overview - Rear Axle Speed Sensor", page 37](#).
- ❑ Can be tested in "Guided Fault Finding" with the Vehicle Diagnostic Tester

2 - Left Rear ABS Wheel Speed Sensor - G46-**3 - ESP Sensor Unit - G419-**

- ❑ 9 Nm
- ❑ Component location: under the left seat
- ❑ Removing and installing. Refer to ["4.5 ESP Sensor Unit G419, Removing and Installing", page 42](#).
- ❑ Combined transverse acceleration sensor G200, rotation rate sensor G202 and longitudinal acceleration sensor G251.
- ❑ Can be tested in "Guided Fault Finding" with the Vehicle Diagnostic Tester
- ❑ Observe installation instructions
- ❑ Check the arrow in the



The ESC Module shares the vehicle speed information with the PCM.



3 Control Module and Hydraulic Unit

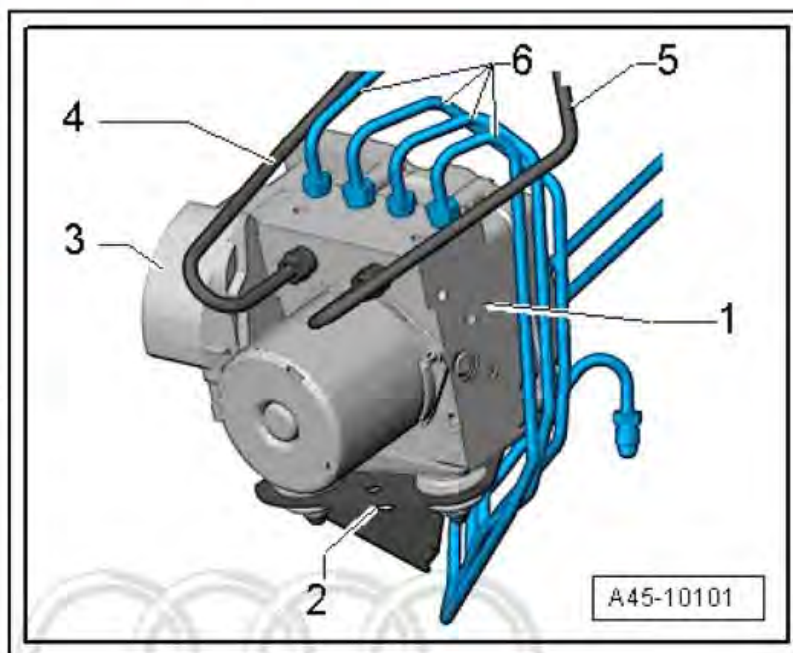
⇒ "3.1 Overview - Control Module and Hydraulic Unit",
page 30

⇒ "3.2 ABS Control Module J104 / ABS Hydraulic Unit N55, Re-
moving and Installing", page 31

3.1 Overview - Control Module and Hydraulic Unit

1 - ABS Hydraulic Unit - N55-
with ABS Control Module -
J104-

- ☐ Installed location: in the front left engine compartment.
- ☐ Removing and Installing. Refer to
⇒ "3.2 ABS Control
Module J104 / ABS Hy-
draulic Unit N55, Re-
moving and Installing",
page 31 .
- ☐ The hydraulic control unit is comprised of the ABS hydraulic unit N55 with integrated brake pressure sensor G201 and the ABS control module J104.
- ☐ The components must not be separated from each other.
- ☐ Do not disconnect the connector before successfully completing OBD.
- ☐ Switch the ignition off before disconnecting the connector.
- ☐ The brake pressure sensor G201 is integrated into the ABS hydraulic unit N55 and cannot be replaced.



Caution

The ABS hydraulic unit N55 and ABS control module J104 must not be separated from each other.

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The Wheel Speed Sensor (WSS) generates a signal having a waveform with a frequency proportional to the speed of the vehicle. The signal generated by the WSS informs the ABS Control Module if the vehicle is moving or not and indicates the velocity of the vehicle. Then, the ABS Control Module informs ECM of this information. The ECM uses this information to control fuel injection, ignition timing, transmission shift points and torque converter clutch scheduling. The WSS signal is also used to detect rough road conditions.

As demonstrated in the exemplary images above, the '115 patent Accused Instrumentalities include an ABS Wheel Speed Sensor (WSS) for determining the automobile's speed. The ABS

Wheel Speed Sensor (WSS) generates a signal having a waveform with a frequency proportional to the speed of the vehicle. The signal generated by the ABS WSS informs the ESC Module not only if the vehicle speed is low or high but also if the vehicle is or is not moving. Then, ESC Module informs the PCM of this information. The PCM uses this information to control fuel injection, ignition timing, transmission shift points and torque converter clutch scheduling. The WSS signal is also used to detect rough road conditions.

Figure 69

As demonstrated in the exemplary images below, the inhibitor switch (transmission gear selection sensor) determines the transmission gear position of the transmission of the '115 patent Accused Instrumentalities.

Audi A4

Component Locations

No. 861 / 5

1.4.1 Transmission Control Module

◆ Location: Transmission Control Module (TCM) -J217- is on the back end of transmission, secured directly to hydraulic control module.

The following components are integrated in Transmission Control Module (TCM) -J217- :

- 1 - Solenoid Valve 1 -N88-
- 2 - Automatic Transmission Pressure Regulating Valve 2 -N216-
- 3 - Automatic Transmission Pressure Regulating Valve 1 -N215-
- 4 - Transmission Input Speed (RPM) Sensor -G182- and Transmission Input Speed (RPM) Sensor 2 -G612-
- 5 - Automatic Transmission Hydraulic Pressure Sensor 1 -G193-
- 6 - Multi-Function Transmission Range (TR) Switch -F125-
- 7 - Automatic Transmission Hydraulic Pressure Sensor 2 -G194-
- 8 - Transmission Output Speed (RPM) Sensor -G195-

P070500	Transm.Range Sensor "A" Circ.(PRNDL Inp.) Malfunction
P070600	Transm.Range Sensor "A" Circ. Range/Performance
P070700	Transm.Range Sensor "A" Circ. Low Input
P070800	Transm.Range Sensor "A" Circ. High Input
P071000	Transm.Fluid Temp.Sensor Circ. Malfunction
P071100	Transm.Fluid Temp.Sensor Circ. Range/Performance
P071200	Transm.Fluid Temp.Sensor Circ. Low Input
P071300	Transm.Fluid Temp.Sensor Circ. High Input
P071400	Transm.Fluid Temp.Sensor Circ. Intermittent
P071500	Input Turbine/Speed Sensor "A" Circ.
P071600	Input Turbine/Speed Sensor "A" Circ. Range/Performance
P071700	Input Turbine/Speed Sensor "A" Circ. No Signal
P072000	Output Speed Sensor Circ. Malfunction
P072100	Output Speed Sensor Circ. Range/Performance
P072200	Output Speed Sensor Circ. No Signal
P072500	Engine Speed Input Circuit
P072600	Engine Speed Inp.Circ. Range/Performance
P072700	Engine Speed Inp.Circ. No Signal
P072900	Gear 6 Incorrect Ratio
P072B00	Stuck in Reverse
P072C00	Stuck in Gear 1

Figure 70

The ECM receives input signals from the Fuel Level Sensor (liquid level sensor) and Fuel Level Sensor 2 via the Instrument Cluster Control Module through the CAN bus.

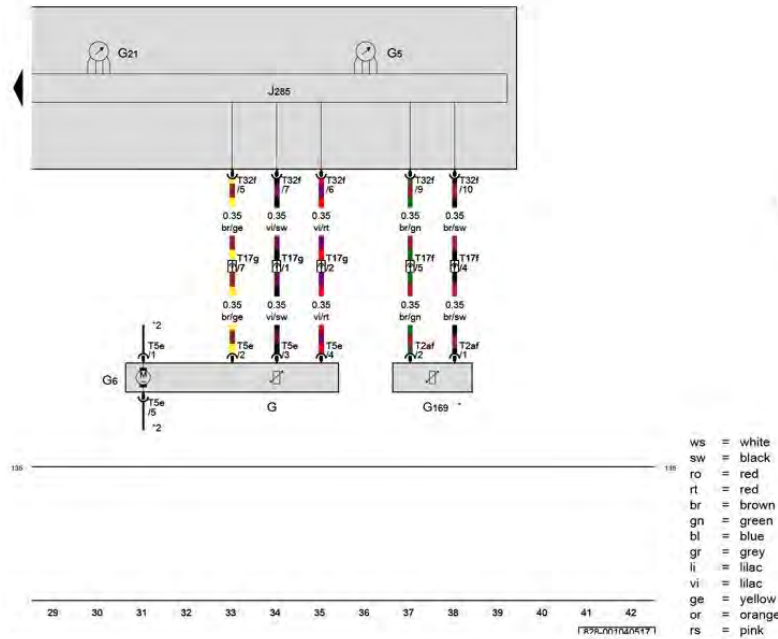
Fuel level sensor, Transfer fuel pump, Instrument cluster control module

- G Fuel level sensor
- G5 Tachometer
- G6 Transfer fuel pump
- G21 Speedometer
- G169 Fuel level sensor 2
- J285 Instrument cluster control module
- T2af 2-pin connector
- T5e 5-pin connector
- T17f 17-pin connector, in the connector station, right A-pillar
- T17g 17-pin connector, in the connector station, right A-pillar
- T32f 32-pin connector

- 135 Ground connection 2 (in instrument panel wiring harness)

* Depending on equipment

*2 Refer to applicable engine wiring diagram



05.2017

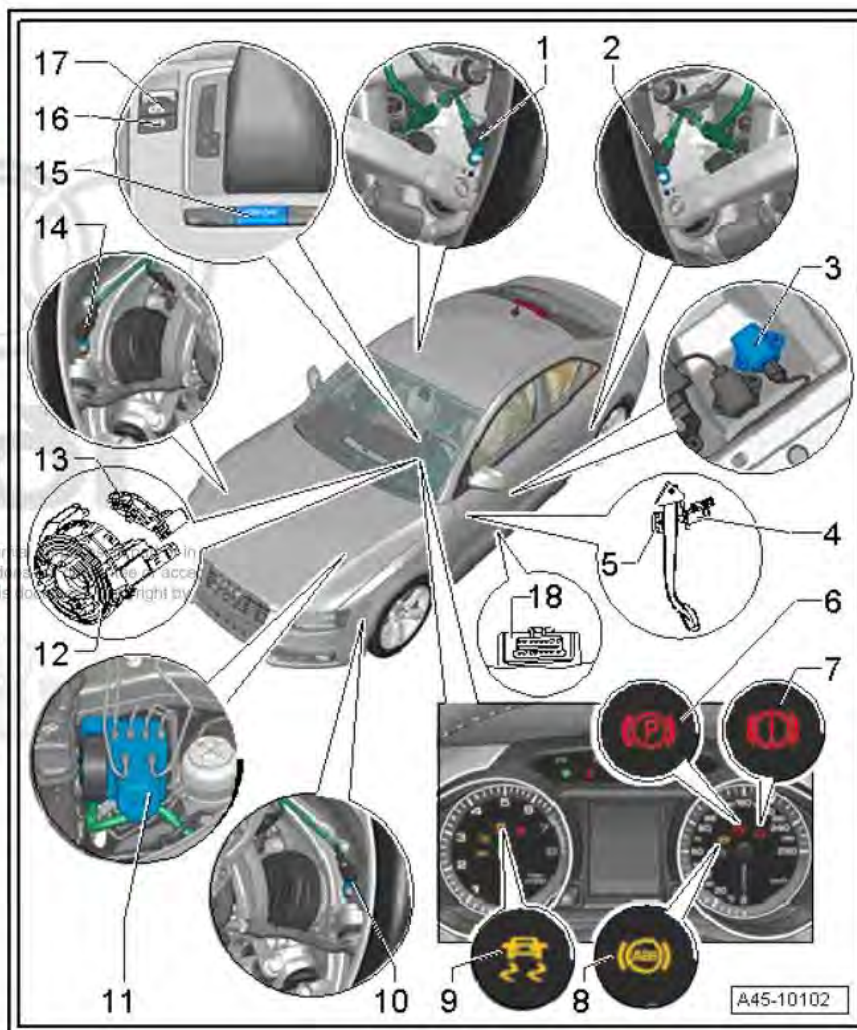
The '115 patent Accused Instrumentalities comprise a processor for receiving input signals from the vehicle speed sensor, as exemplified by the CAN in the circuit diagram below.

1 - Right Rear ABS Wheel Speed Sensor - G44-

- ☐ Removing and installing. Refer to ["4.2 Overview - Rear Axle Speed Sensor", page 37](#).
- ☐ Can be tested in "Guided Fault Finding" with the Vehicle Diagnostic Tester

2 - Left Rear ABS Wheel Speed Sensor - G46-**3 - ESP Sensor Unit - G419-**

- ☐ 9 Nm
- ☐ Component location: under the left seat
- ☐ Removing and installing. Refer to ["4.5 ESP Sensor Unit G419, Removing and Installing", page 42](#).
- ☐ Combined transverse acceleration sensor G200, rotation rate sensor G202 and longitudinal acceleration sensor G251.
- ☐ Can be tested in "Guided Fault Finding" with the Vehicle Diagnostic Tester
- ☐ Observe installation instructions
- ☐ Check the arrow in the



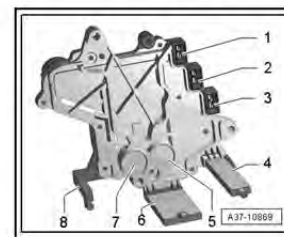
The '115 patent Accused Instrumentalities comprise a processor receiving input signals from the transmission gear selection sensor as exemplified by the figure below which demonstrates the data received from the transmission gear selection sensor.

1.4.1 Transmission Control Module

- ◆ Location: Transmission Control Module (TCM) -J217- is on the back end of transmission, secured directly to hydraulic control module.

The following components are integrated in Transmission Control Module (TCM) -J217- :

- 1 - Solenoid Valve 1 -N88-
- 2 - Automatic Transmission Pressure Regulating Valve 2 -N216-
- 3 - Automatic Transmission Pressure Regulating Valve 1 -N215-
- 4 - Transmission Input Speed (RPM) Sensor -G182- and Transmission Input Speed (RPM) Sensor 2 -G612-
- 5 - Automatic Transmission Hydraulic Pressure Sensor 1 -G193-
- 6 - Multi-Function Transmission Range (TR) Switch -F125-
- 7 - Automatic Transmission Hydraulic Pressure Sensor 2 -G194-
- 8 - Transmission Output Speed (RPM) Sensor -G195-



For example, as illustrated above (first picture), the Controller Area Network (CAN) systems include an ECM and other elements that collectively function as a processor for processing the data associated with the preliminary and final liquid levels communicated by the fuel level sensor, and for modifying the preliminary fuel level when the automobile's speed is zero, the automobile transmission gear is in the park position, and when the preliminary liquid level exceeds a predetermined threshold.. The fuel level sensor is in the fuel storage tank, which is the storage container.

Based upon the totality of the foregoing evidence, and based further upon information and belief, the '115 patent Accused Instrumentalities include "a system for determining a level of a liquid present in a storage container in an automobile, the system comprising: a liquid level sensor for determining a preliminary liquid level of the liquid stored in the storage container; a vehicle speed sensor for determining the automobile's speed; a transmission gear selection sensor for determining a transmission gear position of a transmission of the automobile; and a processor for receiving input signals from the liquid level sensor, the vehicle speed sensor and the transmission gear selection sensor for modifying the preliminary liquid level to arrive at a final liquid level indication of the liquid present in the storage container when the automobile's speed is equal to zero, the automobile transmission gear is in park position, and the preliminary liquid level exceeds a predetermined threshold."

Figure 71

81. Claim 2 of the '115 patent recites the system of claim 1, wherein the processor takes a plurality of liquid level readings using the liquid level sensor and then calculates an average to arrive at a preliminary liquid level.

82. On information and belief, the '115 patent Accused Instrumentalities infringe claim 2 of the '115 patent. The '115 patent Accused Instrumentalities comprise, the system of

claim 1, wherein the processor takes a plurality of liquid level readings using the liquid level sensor and then calculates an average to arrive at a preliminary liquid level (*Figure 72*).

As shown below, the PCM continuously monitors the fuel level and generates a filtered fuel level (average) fuel level.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0452 EVAP System Pressure Sensor/Switch Circuit Low	NVLD Switch Short To Ground	• Signal voltage < 0.24 V	• Case 1: • Engine running • Case 2: • Ignition off • NVLD (EVAP-System) diagnostic mode active	• 0.5 s • Continuous	• 2 DCY	- Check the Fuel Tank Leak Detection Control Module - J909- / Fuel Tank Pressure Sensor - G400-. Refer to "3.6.19 Fuel Tank Leak Detection Control Module J909 / Fuel Tank Pressure Sensor G400, Checking", page 987 .
P0453 EVAP System Pressure Sensor/Switch Circuit High	NVLD Switch Short To Battery Plus	• Signal voltage > 3.0 V	• Case 1: • Engine running • Case 2: • Ignition off • NVLD (EVAP-System) diagnostic mode active	• 0.5 s • Continuous	• 2 DCY	- Check the Fuel Tank Leak Detection Control Module - J909- / Fuel Tank Pressure Sensor - G400-. Refer to "3.6.19 Fuel Tank Leak Detection Control Module J909 / Fuel Tank Pressure Sensor G400, Checking", page 987 .
P0456 EVAP System Leak Detected (Very Small Leak)	EVAP System Small Leak Functional Check	• Natural vacuum leak detection (NVLD) switch position = open	• Ignition off • Fuel level < 85.10 % • Fuel temperature drop ≥ 6 K • For time > 1 h • AAT $\geq 4^{\circ}\text{C}$ • Barometric pressure > 73.00 kPa • Diff. barometric pressure @ stop and barometric pressure @ start < 0.65 kPa • Time since ignition off > 90 [min] ; < 600 min	• 0.1 s • Once / DCY	• 2 DCY	- Check the EVAP System visually for any leaking hoses or damage to components. - Check the EVAP Canister Purge Regulator Valve 1 - N80-. Refer to "3.6.13 EVAP Canister Purge Regulator Valve 1 N80, Checking", page 975 . - Check the Fuel Tank Leak Detection Control Module - J909- / Fuel Tank Pressure Sensor - G400-. Refer to "3.6.19 Fuel Tank Leak Detection Control Module J909 / Fuel Tank Pressure Sensor G400, Checking", page 987 .



On information and belief, information proving that this claim element is present is not publicly available, and only in the possession of Audi. However, in my opinion this element is highly likely present in the '115 patent Accused Instrumentalities. The source code for the ECM is necessary to further support that which has been inferred.

Figure 72

83. Claim 3 of the '115 patent recites the system of claim 1, wherein the processor monitors an ignition key position to determine when to initialize the system.

84. On information and belief, the '115 patent Accused Instrumentalities infringe claim 3 of the '115 patent. The '115 patent Accused Instrumentalities comprise, the system of claim 1, wherein the processor monitors an ignition key position to determine when to initialize the system (*Figure 73*).

Driving

Starting and stopping the engine

Starting the engine

The **START ENGINE STOP** button switches the ignition on and starts the engine.



Fig. 97 Cockpit: START ENGINE STOP button

Starting the engine

Applies to: vehicles with manual transmission

- Press the clutch pedal all the way down and move the shift lever to the neutral position.

Applies to: vehicles with automatic transmissions

- Press the brake pedal.
- Press the **START ENGINE STOP** button ⇒ *fig. 97*. The engine will start.
- There may be a slight delay when starting the engine in diesel vehicles in colder temperatures. Therefore, you must continue pressing the clutch pedal (manual transmission) or the brake pedal (automatic transmission) until the engine starts. The **READY** indicator light turns on while the engine is preheating.

Switching the ignition on/off

If you would like to switch the ignition on without starting the engine, follow these steps:

- Press the **START ENGINE STOP** button without pressing the clutch pedal (for manual transmissions) or the brake pedal (for automatic transmissions). Vehicles without the Start/Stop system*: the needle in the tachometer moves into the **READY** position.
- To switch the ignition off, press the button again. The needle in the tachometer moves into the **OFF** position.

The prewarming runs automatically in diesel vehicles when the ignition is switched on.

Equipment that uses a lot of electricity is switched off temporarily when you start the engine.

If the engine does not start immediately, the starting procedure stops automatically after a short time. Repeat the starting procedure.

Start/Stop system*

See the information in ⇒ *page 91, Start/Stop system*.

WARNING

To reduce the risk of poisoning, never allow the engine to run in confined spaces.

Note

Avoid high engine speed, full throttle, and heavy engine load if the engine has not reached operating temperature yet. You could damage the engine.

For the sake of the environment

Do not let the engine run while parked to warm up. Begin driving immediately. This reduces unnecessary emissions.

Tips

- Some noise after starting the engine is normal and is no cause for concern.
- If you leave the vehicle with the ignition switched on, the ignition will switch off after a certain amount of time. Make sure that electrical equipment such as the exterior lights are switched off.

Starting the engine

- Bring the vehicle to a full stop.
- Press the **START ENGINE STOP** button ⇒ *page 89, fig. 97*.


89

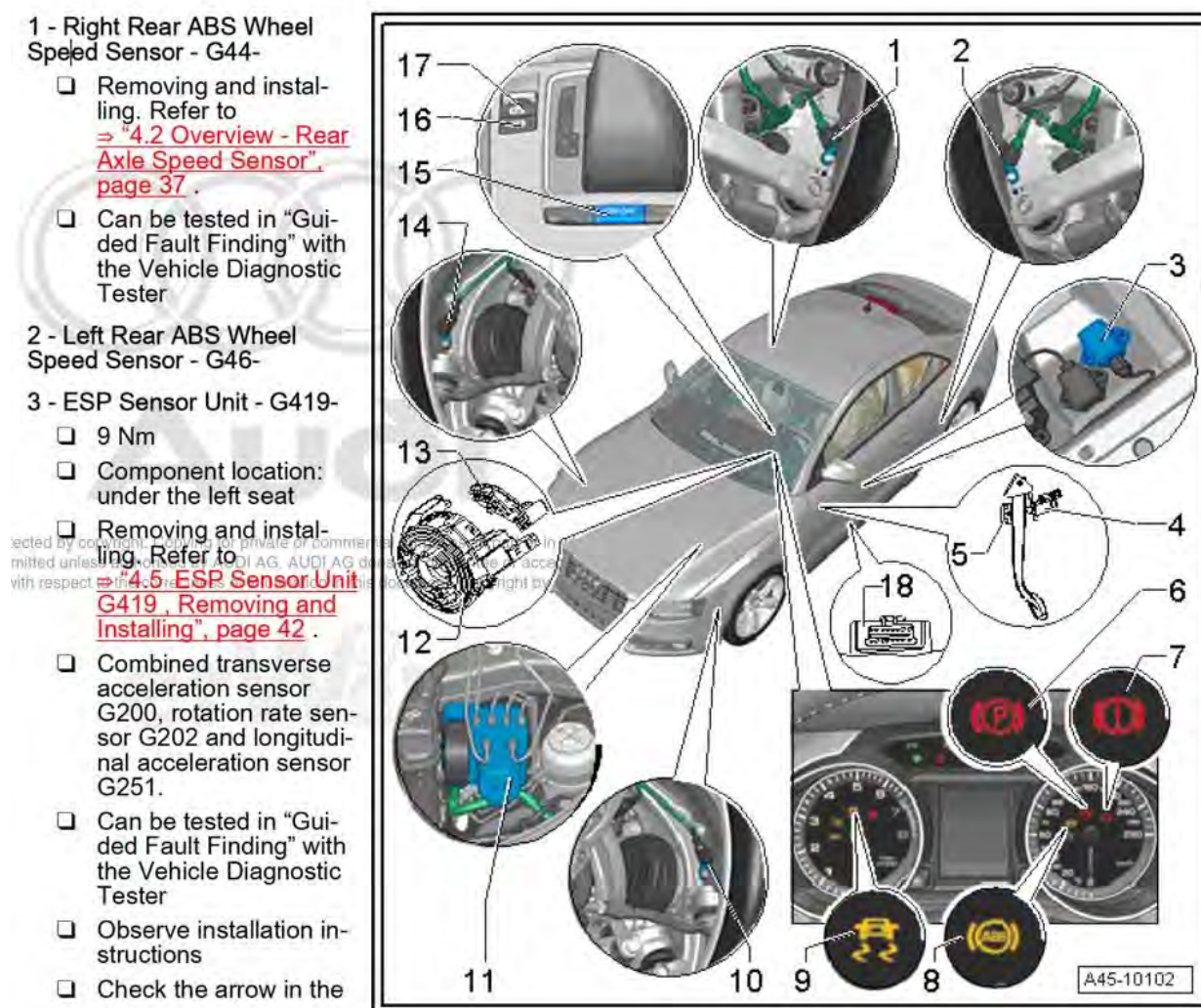
As shown above, the PCM initializes when the ignition is turned on.

Figure 73

85. Claim 7 of the '115 patent recites the system of claim 1, wherein the processor monitors the vehicle's speed.

86. On information and belief, the '115 patent Accused Instrumentalities infringe claim 3 of the '115 patent. The '115 patent Accused Instrumentalities comprise, the system of claim 1, wherein the processor monitors the vehicle's speed (*Figure 74*).

Audi A4 2008 ➤ , Audi A5 Cabriolet 2009 ➤ , Audi A5 Coupé 2008 ➤ 
Brake System - Edition 03.2017



As shown above, the '115 patent Accused Instrumentalities include an ABS Wheel Speed Sensor (WSS) for determining the automobile's speed. The ABS Wheel Speed Sensor (WSS) generates a signal having a waveform with a frequency proportional to the speed of the vehicle. The signal generated by the ABS WSS informs the ESC Module not only if the vehicle speed is low or high but also if the vehicle is or is not moving. Then, ESC Module informs the PCM of this

information. The PCM uses this information to control fuel injection, ignition timing, transmission shift points and torque converter clutch scheduling. The WSS signal is also used to detect rough road conditions.

Figure 74

COUNT XII – INFRINGEMENT OF U.S. PATENT NO. 6,581,574

87. The allegations set forth in the foregoing paragraphs 1 through 86 are incorporated into this Twelfth Claim for Relief.

88. On June 24, 2014 U.S. Patent No. 6,581,574 (“the ’574 patent”), entitled “Method for Controlling Fuel Rail Pressure,” was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the ’574 patent is attached as Exhibit 12.

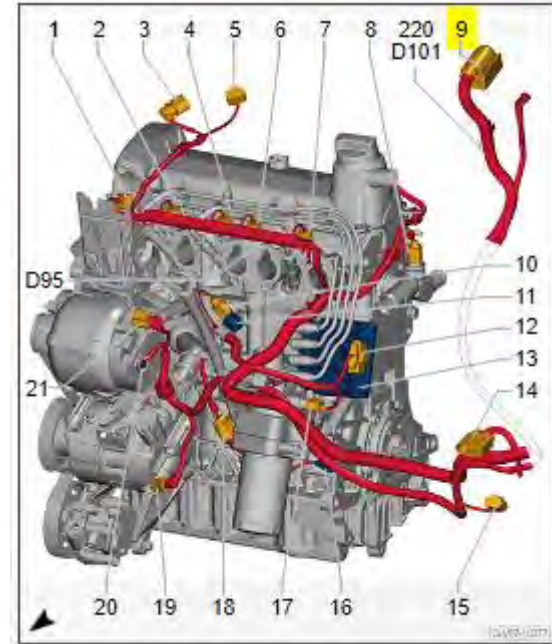
89. Plaintiff is the assignee and owner of the right, title and interest in and to the ’574 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

90. Upon information and belief, Defendants have directly infringed at least claims 1 and 7 of the ’574 patent by making, using, selling, importing and/or providing and causing to be used the 2015-2018 Jetta (1.4L) or other vehicles having incorporated the DTI engine (the “’574 patent Accused Instrumentalities”).

91. In particular, claim 1 of the ’574 patent recites a method of controlling the fuel pressure within a fuel delivery system having a fuel pump which delivers fuel to a fuel rail of an internal combustion engine comprising: providing a set-point fuel pressure; providing the estimated average fuel flow through the system; generating a feed forward control signal based upon the set-point fuel pressure and the average fuel flow; measuring the fuel rail pressure with a fuel pressure sensor; filtering the output of the fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors; comparing the fuel rail pressure to the set-point fuel pressure and generating an error signal based upon the difference between the fuel rail pressure

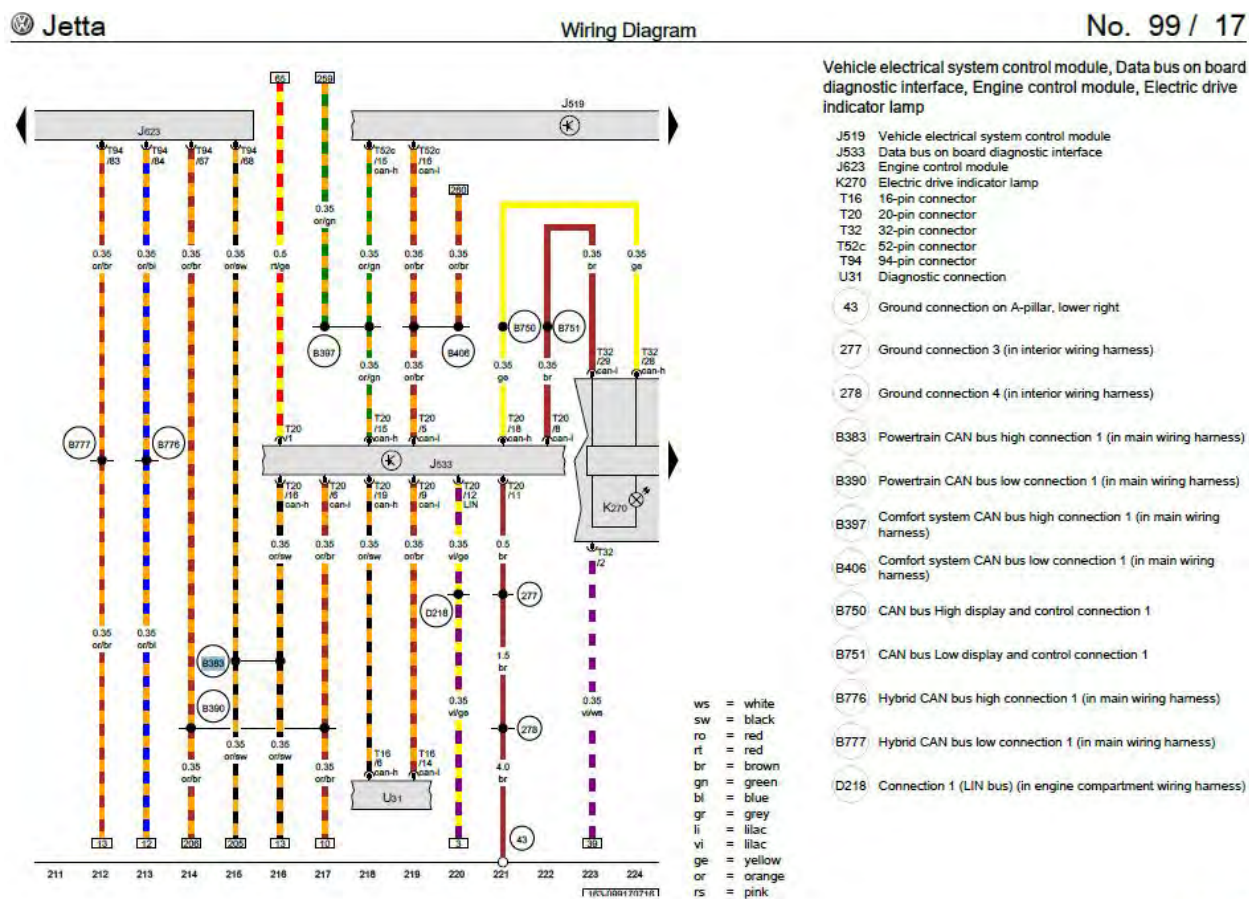
and the set-point fuel pressure; and modifying the feed forward control signal based upon the error signal thereby generating a motor controller signal and sending the motor control signal to the fuel pump motor.

92. On information and belief, the '574 patent Accused Instrumentalities infringe claim 1 of the '574 patent. The '574 patent Accused Instrumentalities practice a method of controlling (*Figure 75*) the fuel pressure within a fuel delivery system having a fuel pump which delivers fuel to a fuel rail of an internal combustion engine (*Figure 75*) comprising: providing a set-point fuel pressure (*Figure 75*); providing the estimated average fuel flow through the system (*Figure 76*); generating a feed forward control signal based upon the set-point fuel pressure and the average fuel flow (*Figure 77*); measuring the fuel rail pressure with a fuel pressure sensor (*Figure 78*); filtering the output of the fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors (*Figure 79*); comparing the fuel rail pressure to the set-point fuel pressure and generating an error signal based upon the difference between the fuel rail pressure and the set-point fuel pressure (*Figure 80*); and modifying the feed forward control signal based upon the error signal thereby generating a motor controller signal and sending the motor control signal to the fuel pump motor (*Figure 81*).



For example, the 1.4LTSI engine is an internal combustion engine.

As demonstrated in the exemplary images above (9) and below, the '574 patent Accused Instrumentalities comprise an Engine Control Module (ECM; 9; J623) and Powertrain CAN bus (B383, B390) which practice a method of controlling the fuel delivery system in conjunction with a fuel rail pressure sensor (1).



07.2016

The Fuel Pressure regulator valve (8; N276) controls the pressure of the fuel flow directly into the fuel rail and therefore, to the fuel injectors in accordance with the ECM signal based on engine conditions.

2016 Volkswagen Jetta Sedan (163) L4-1.4L Turbo (CZTA)

Vehicle » Powertrain Management » Fuel Delivery and Air Induction » Fuel Pressure Regulator » Testing and Inspection

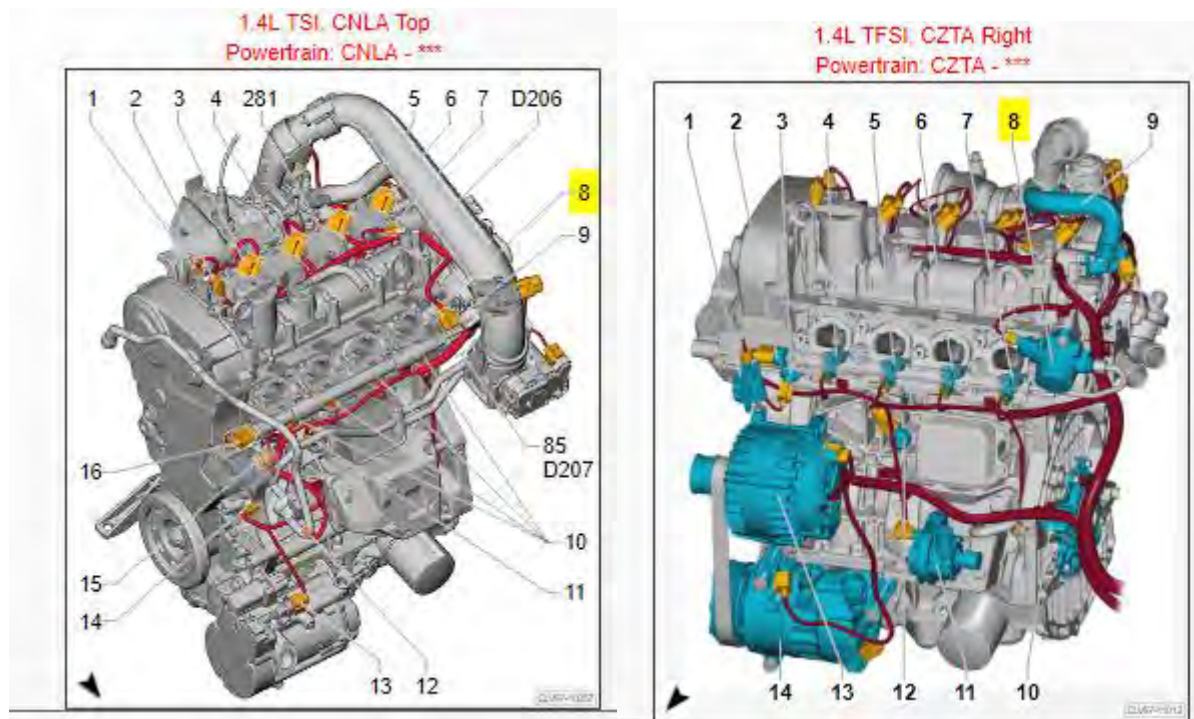
TESTING AND INSPECTION

Fuel Pressure Regulator Valve (N276), Checking

General Description

The [Engine Control Module](#) (J623) regulates the Fuel Pressure Regulator Valve (N276) directly at the High Pressure [Fuel Pump](#) to control the low pressure valve inside the High Pressure Fuel Pump.

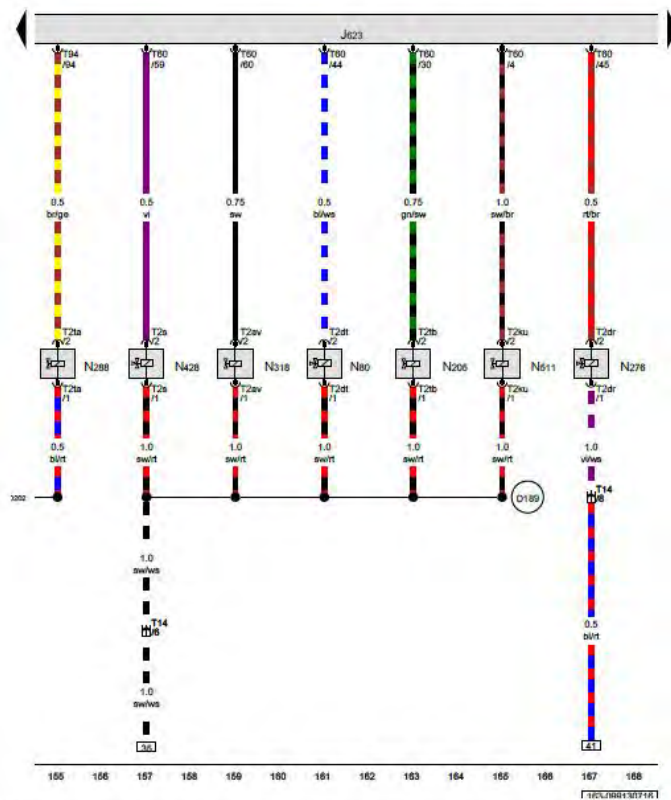
Source: ALLDATA Pro



Jetta

Wiring Diagram

No. 99 / 13



Engine control module, EVAP canister purge regulator valve 1, Camshaft adjustment valve 1, Fuel pressure regulator valve, Exhaust camshaft adjustment valve 1, Oil pressure regulation valve, Decoupler pressure actuator

J623 Engine control module
 N80 EVAP canister purge regulator valve 1
 N205 Camshaft adjustment valve 1
 N276 Fuel pressure regulator valve
 N288 Tank switch-off valve
 N318 Exhaust camshaft adjustment valve 1
 N428 Oil pressure regulation valve
 N511 Decoupler pressure actuator
 T2av 2-pin connector
 T2dr 2-pin connector
 T2dt 2-pin connector
 T2ku 2-pin connector
 T2s 2-pin connector
 T2ta 2-pin connector
 T2tb 2-pin connector
 T14 14-pin connector
 T60 60-pin connector
 T94 94-pin connector

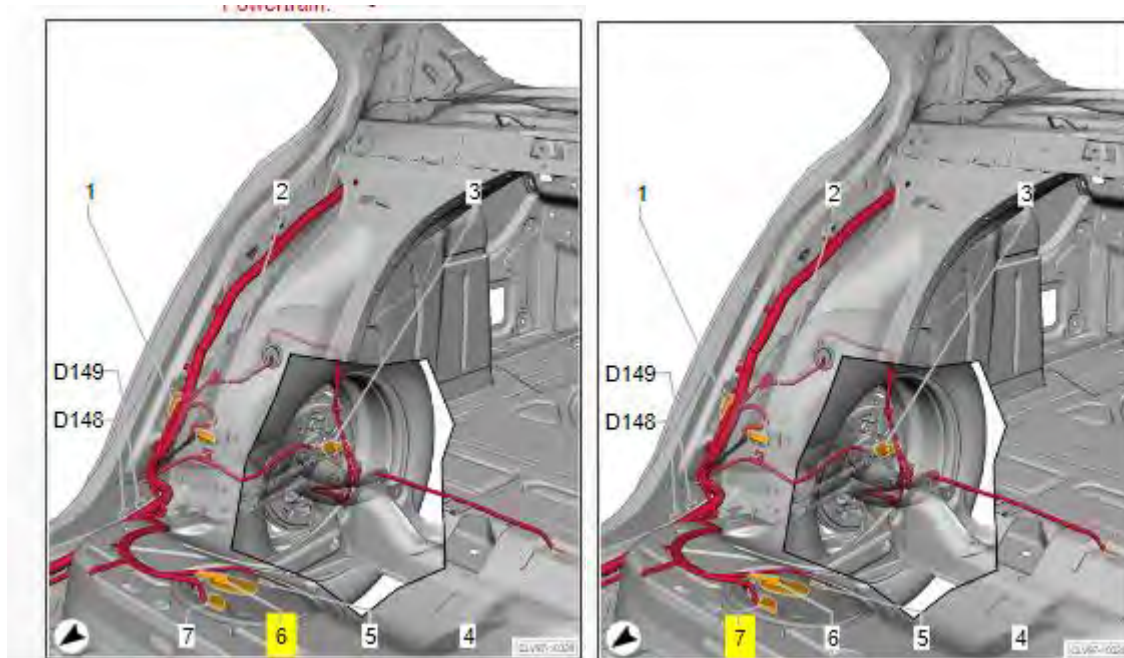
D189 Connection 87a (in engine pre-wiring harness)

D202 Connection 6 (87a) (in engine compartment wiring harness)

ws = white
 sw = black
 ro = red
 rt = red
 br = brown
 gn = green
 bl = blue
 gr = grey
 li = lilac
 vi = lilac
 ge = yellow
 or = orange
 rs = pink

07.2016

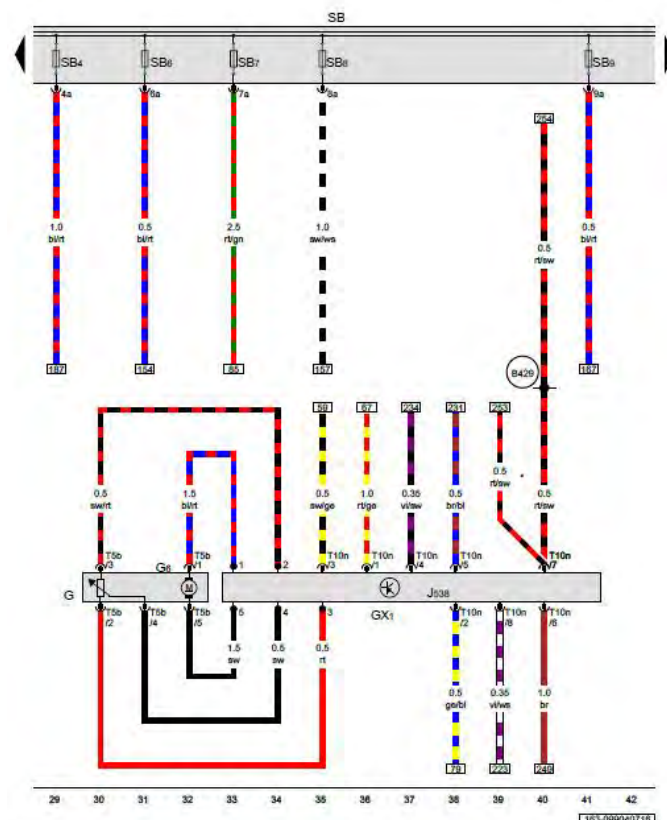
The '574 patent Accused Instrumentalities comprise a Fuel delivery unit (6; GX1) and Fuel Pump Control Module (7; J538), which controls a fuel pump delivering fuel to a High-Pressure Fuel Pump, connected to a fuel rail of an internal combustion engine.



® Jetta

Wiring Diagram

No. 99 / 4



Fuel level sensor, Fuel delivery unit, Transfer fuel pump, Fuel pump control module, Fuse panel B

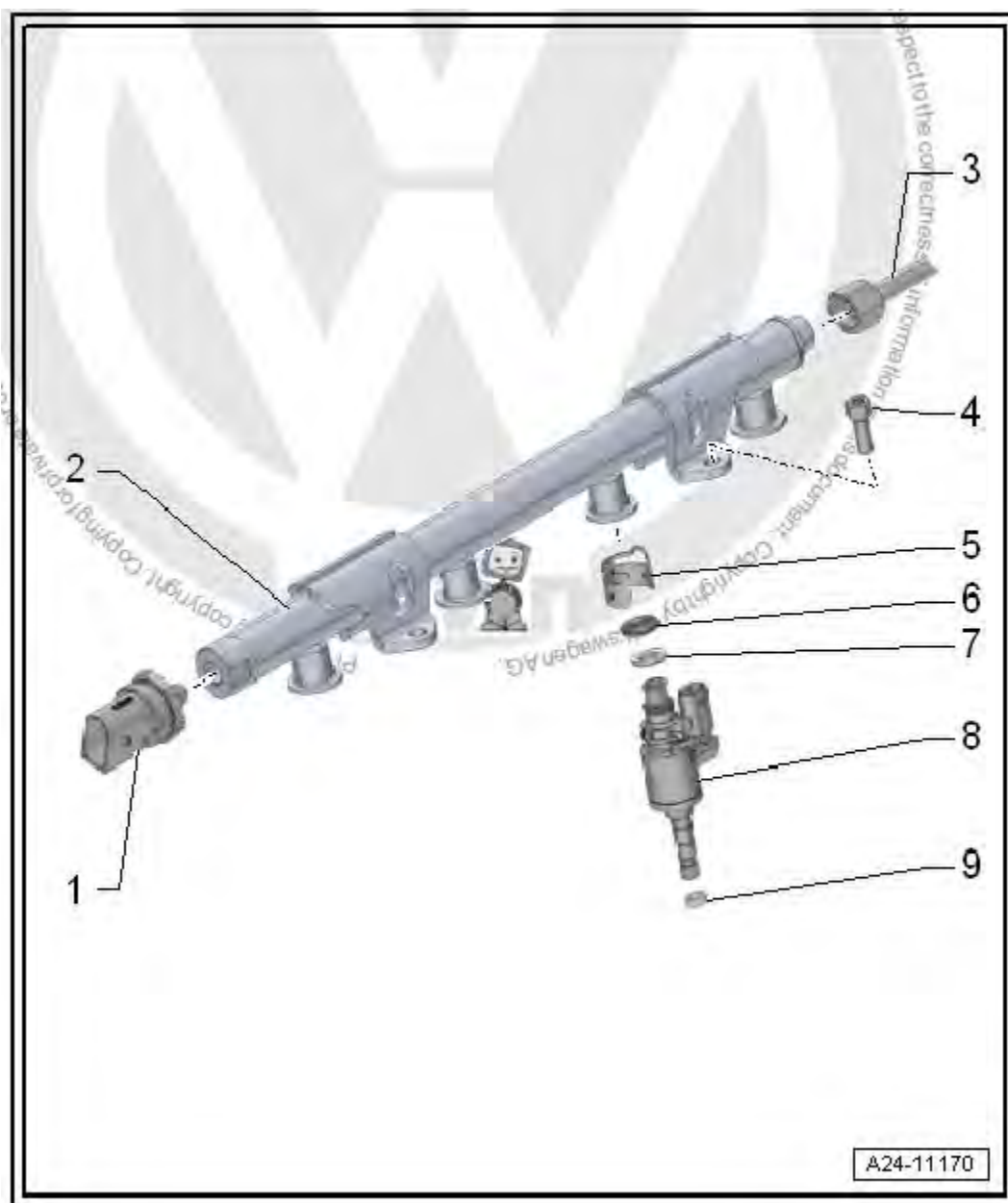
G Fuel level sensor
GX1 Fuel delivery unit
G6 Transfer fuel pump
J538 Fuel pump control module
SB Fuse panel B
SB4 Fuse 4 (on fuse panel B)
SB6 Fuse 6 (on fuse panel B)
SB7 Fuse 7 (on fuse panel B)
SB8 Fuse 8 (on fuse panel B)
SB9 Fuse 9 (on fuse panel B)
T5b 5-pin connector
T10n 10-pin connector

B429 Fuel pump relay connection (in main wiring harness)

* from July 2016

ws = white
sw = black
ro = red
rt = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
vi = lilac
ge = yellow
or = orange
rs = pink

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Jetta 2011 ►, Jetta 2015 ► 4-Cylinder Direct Injection (1.4L Engine, 4V, EA 211, Turbocharger, Hybrid) - Edition 12.2017

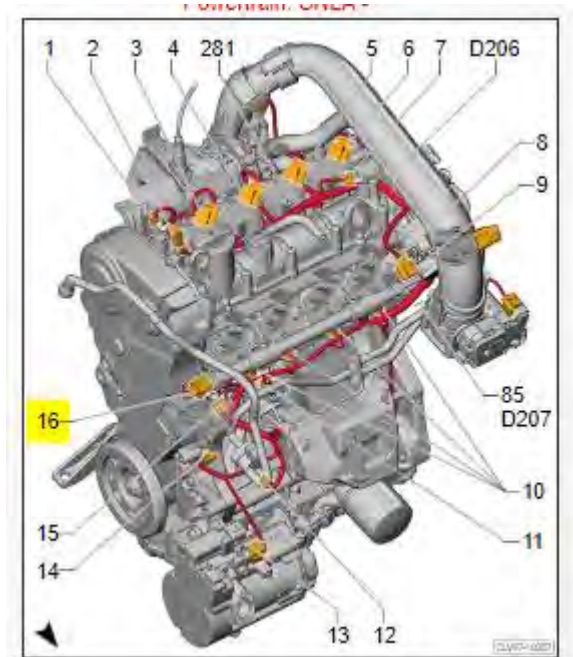
Upon information and belief, the fuel (rail) pressure sensor (1), shown immediately above, measures the fuel pressure in the delivery pipe. The fuel (rail) pressure sensor converts the pressure to a voltage signal. The ECM (J623 shown above) uses this signal to control the correct fuel rail pressure and adjusts the fuel pressure regulator valve (8; N276), shown above, if the target or set-point fuel pressure calculated by the ECM and the actual pressure measured by the rail pressure sensor are different (the difference being used to derive an error signal which is used for controlling the fuel pump motor).

Figure 75

The average fuel flow is calculated by the ECM and based upon injector pulse width and fuel pressure of the fuel rail (2) shown above.



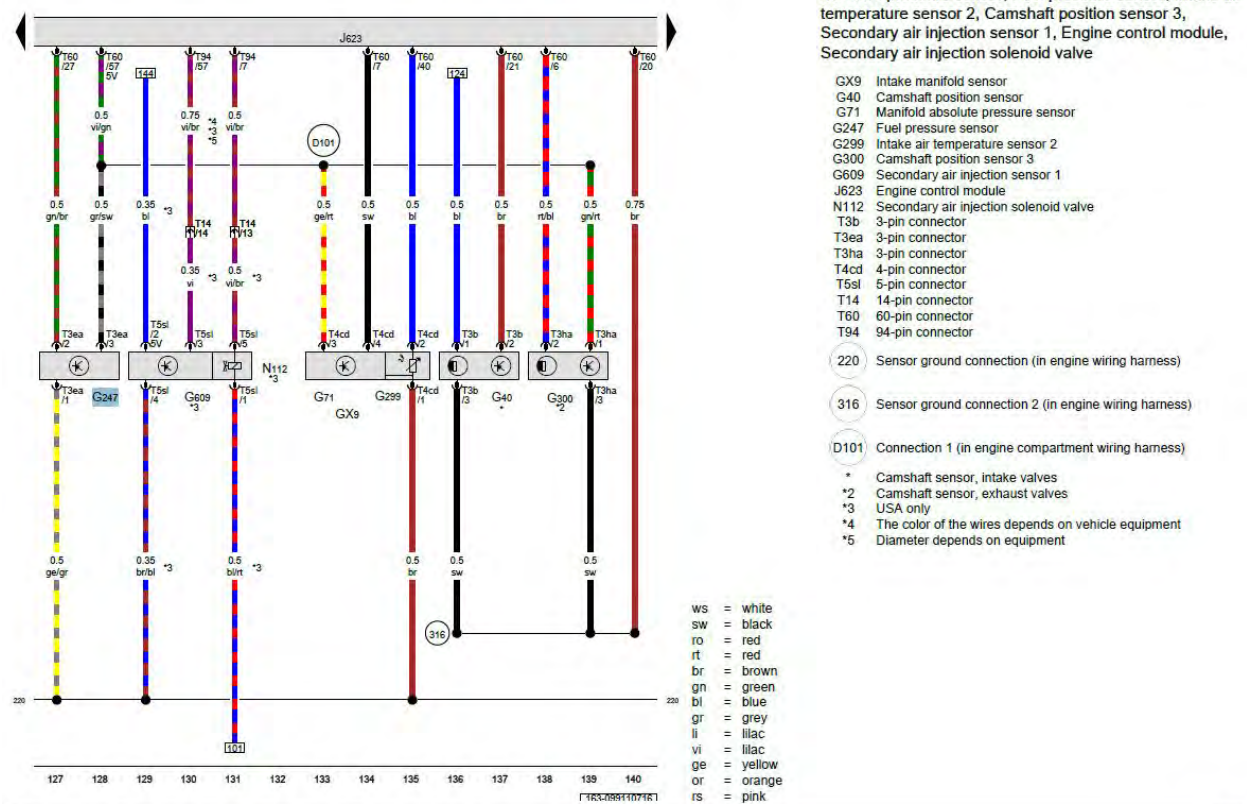
Figure 76





Wiring Diagram

No. 99 / 11



07.2016

Upon information and belief, the '574 patent Accused Instrumentalities generate a feed forward control signal via the ECM (J623) based upon the set-point fuel pressure (target pressure) and the average fuel flow (embodied in the average efficiency curve of fuel consumption). The feed forward signal is generated by the ECM/PCM software.

Figure 77

The '574 patent Accused Instrumentalities practice a method of measuring the fuel rail pressure with a fuel rail pressure sensor pictured below (1).

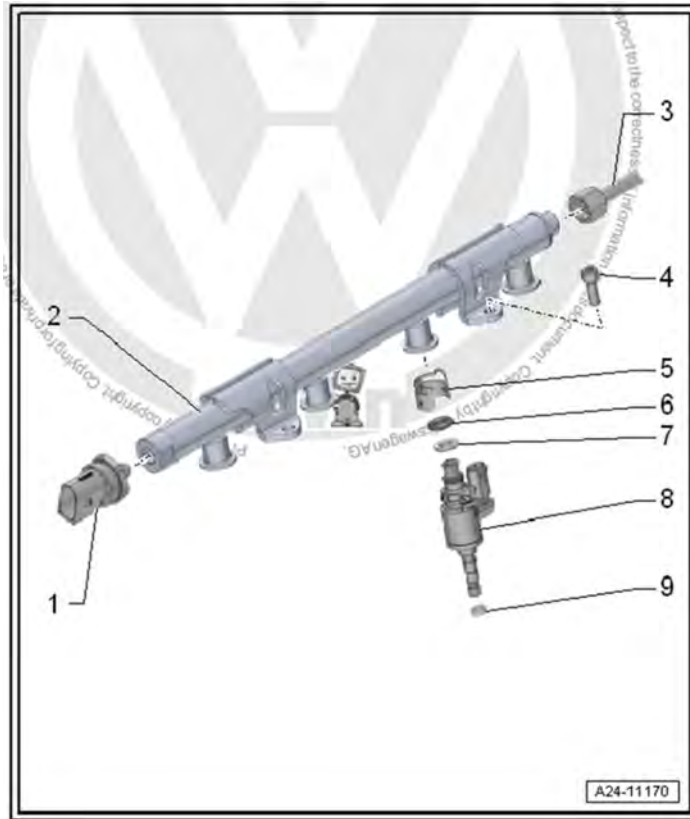


Figure 78

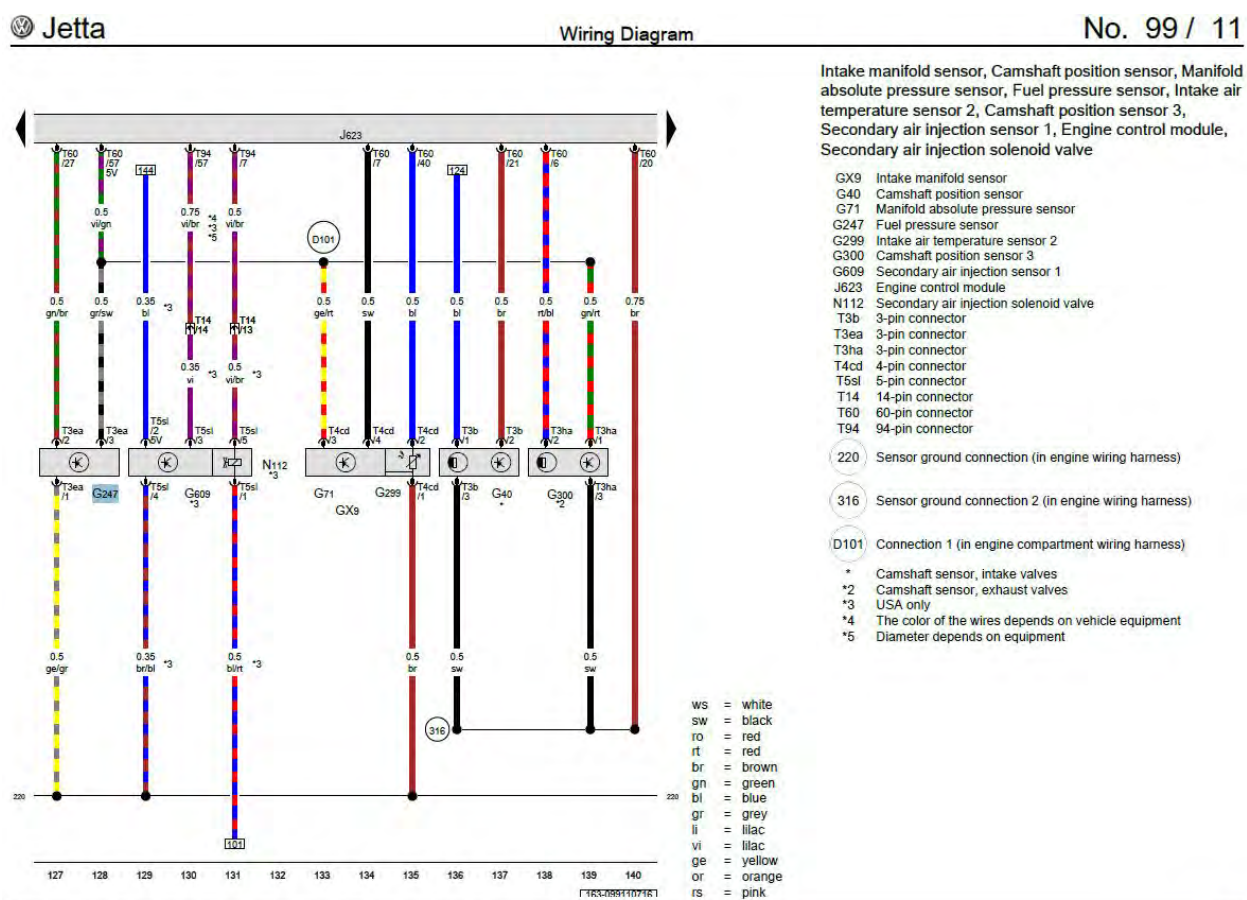
Upon information and belief, the ECM (J623) filters the output of the fuel rail pressure sensor (1 above); thereby it also filters out the pulses detected from the fuel rail pressure sensor to thereby filter the output of the fuel rail pressure sensor (1) in such a manner as to filter out pulses due to the opening and closing of the fuel injectors.

The ECM compares the fuel rail (actual) pressure to the set-point (target) fuel pressure and generates an error signal (Fault Code) P119A/004506 - Fuel Pressure Sensor (G247): Malfunction based upon the difference between the fuel rail pressure sensor output and the set-point fuel pressure calculated by the ECM.

Possible Causes

- Faulty Fuel Pressure Sensor (G247)
- Wiring and/or Connector(s) from/to Fuel Pressure Sensor (G247)
- Faulty HPFP
- Faulty (leaking) fuel injector

<http://wiki.ross-tech.com/wiki/index.php/P119A/004506>



07.2016

The raw output from the fuel pressure regulator valve (N276 (below)) reflects the pressure pulses of the fuel injectors, which are filtered by the ECM.

<http://wiki.ross-tech.com/wiki/index.php/P119A/004506>

Possible Causes

- Faulty Fuel Pressure Sensor (G247)
- Wiring and/or Connector(s) from/to Fuel Pressure Sensor (G247)
- Faulty HPFP
- Faulty (leaking) fuel injector

<http://wiki.ross-tech.com/wiki/index.php/P119A/004506>

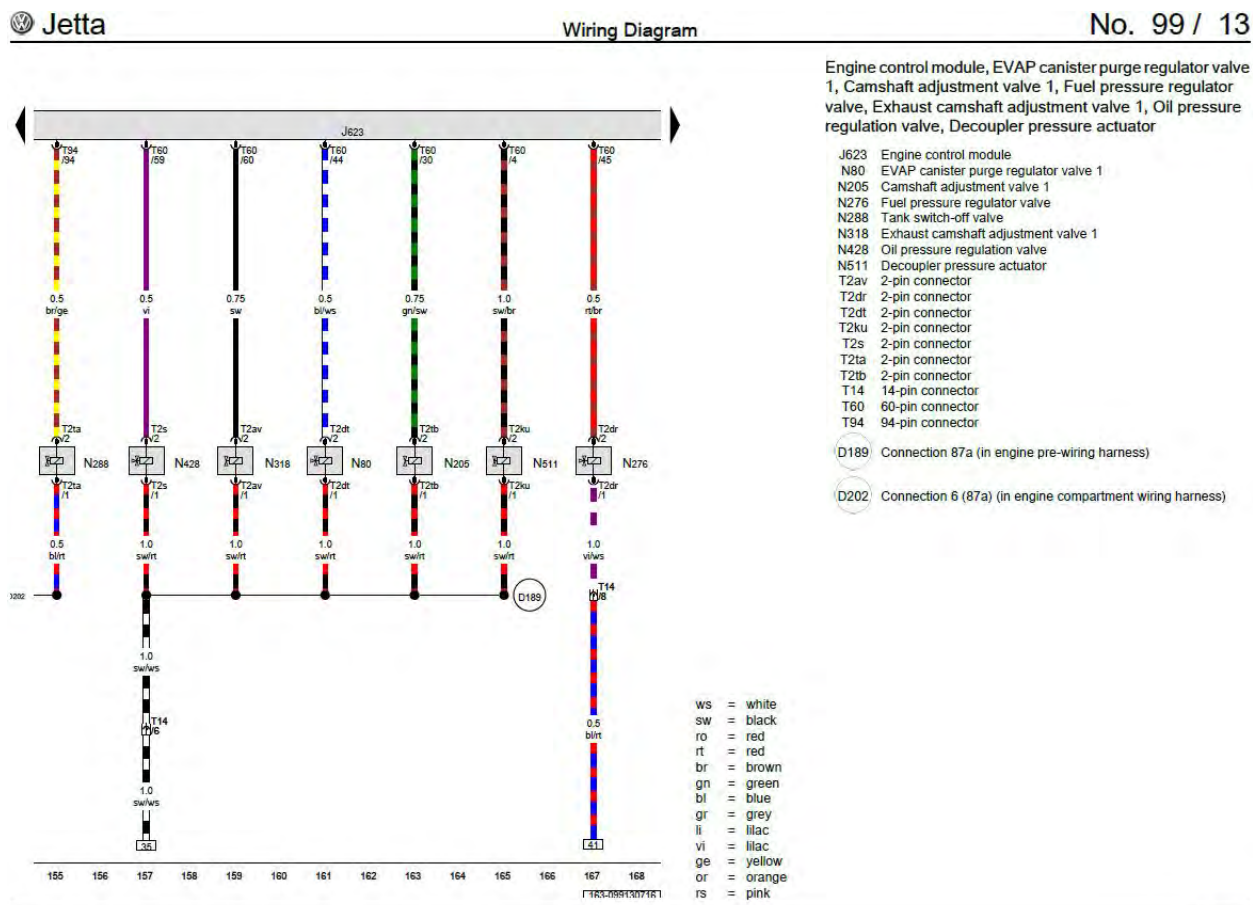



Figure 79



Ross-Tech
Diagnostic Software for European Automobiles

Ross-Tech, LLC
881 Sumneytown Pike
Lansdale PA 19446, USA
Tel: +1 267 638 2300
Fax: +1 215 893 3816

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P119A/004506

Contents [hide]

- 1 P119A/004506 - Fuel Pressure Sensor (G247) : Malfunction
 - 1.1 Possible Symptoms
 - 1.2 Possible Causes
 - 1.3 Possible Solutions
 - 1.4 Special Notes

P119A/004506 - Fuel Pressure Sensor (G247) : Malfunction

Possible Symptoms

- ✦ Malfunction Indicator Light (MIL) active
- ✦ Reduced fuel economy and engine performance


Possible Causes

- ✦ Faulty Fuel Pressure Sensor (G247)
- ✦ Wiring and/or Connector(s) from/to Fuel Pressure Sensor (G247)
- ✦ Faulty HPFP
- ✦ Faulty (leaking) fuel injector

Possible Solutions

- ✦ Replace Fuel Pressure Sensor (G247)
- ✦ Check Wiring and/or Connector(s) from/to Fuel Pressure Sensor (G247)
- ✦ Replace HPFP
- ✦ Check fuel injectors for leak-down

Special Notes

- ✦ The Fuel Pressure Regulator Valve (N276) or Fuel Metering valve (N290) on the HPFP can fail.
 - ✦ (N276) Fuel Pressure Regulating Valve resistance should be approximately 1 to 5 Ω
 - ✦ (N290) Fuel Metering valve resistance should be approximately 0.8 to 5 Ω
- ✦ If found with a TFSI engine and 16555/P0171/000369 - Fuel Trim; Bank 1: System Too Lean is also flagged, this could be caused by a failed rear main seal.
 - ✦ TFSI - Oil leak - TFSI - Oil leak - Not a VCDS related question? or is it? 


Category: [Fault Codes](#)

Categories

- [Main Page](#)
- [Diagnostic Procedures](#)
- [Common Procedures](#)
- [Fault Codes](#)
- [Retrofitting](#)
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Meta

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<http://wiki.ross-tech.com/wiki/index.php/P119A/004506>

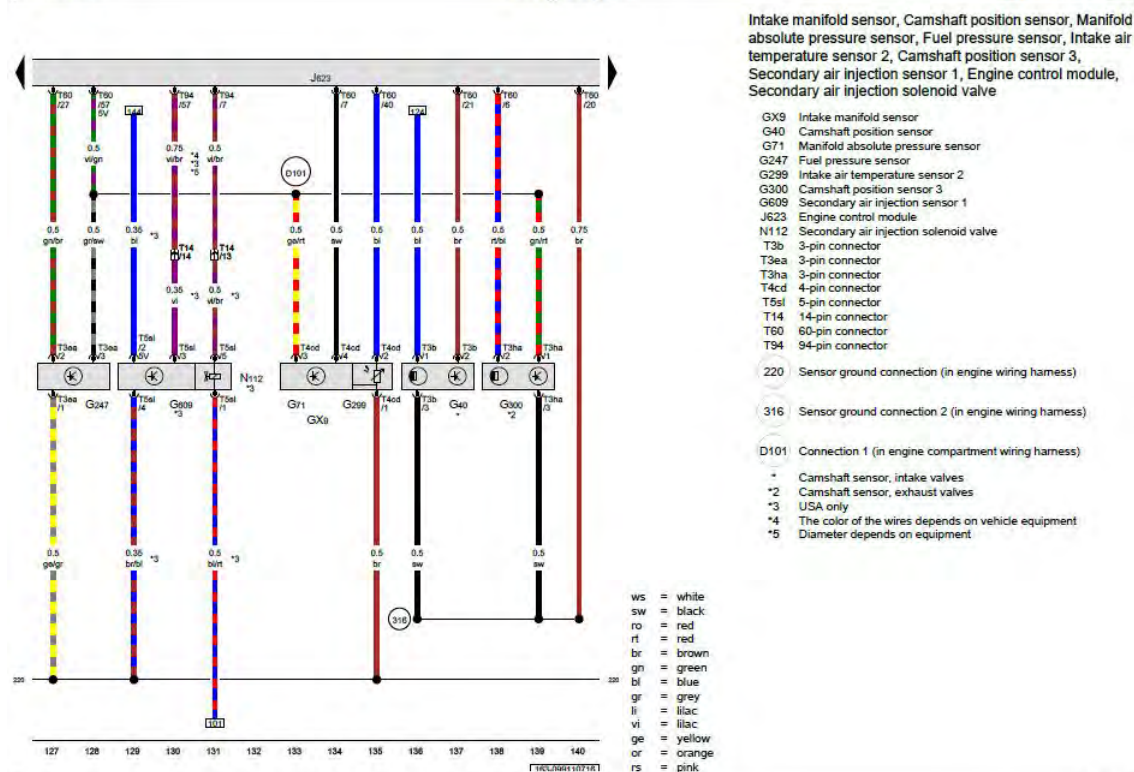
Figure 80

As demonstrated in the exemplary images below, the '574 patent Accused Instrumentalities modify a feed forward control signal via the ECM (J623) and /or CAN Bus when the fuel (rail) pressure sensor (G247) detects a fuel pressure different from the set-point fuel pressure and communicates that difference (error signal) to the ECM which in turn generates a control signal based upon that error signal to the fuel pump motor.

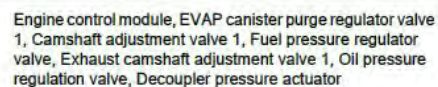
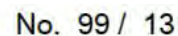
VW Jetta

Wiring Diagram

No. 99 / 11



The fuel (rail) pressure sensor (2) installed on the fuel cylinder (fuel rail) and the fuel pressure regulator valve (N276) deliver the modified feed forward control signal based upon the error signal (received from the ECM (J623)) thereby generating a motor controller signal and sending the motor control signal to the fuel pump motor controlled by the fuel pump motor control module (J538). This is accomplished via the fuel delivery unit (GX1) with the fuel pump control module (J538) controlling the fuel pump (G5).

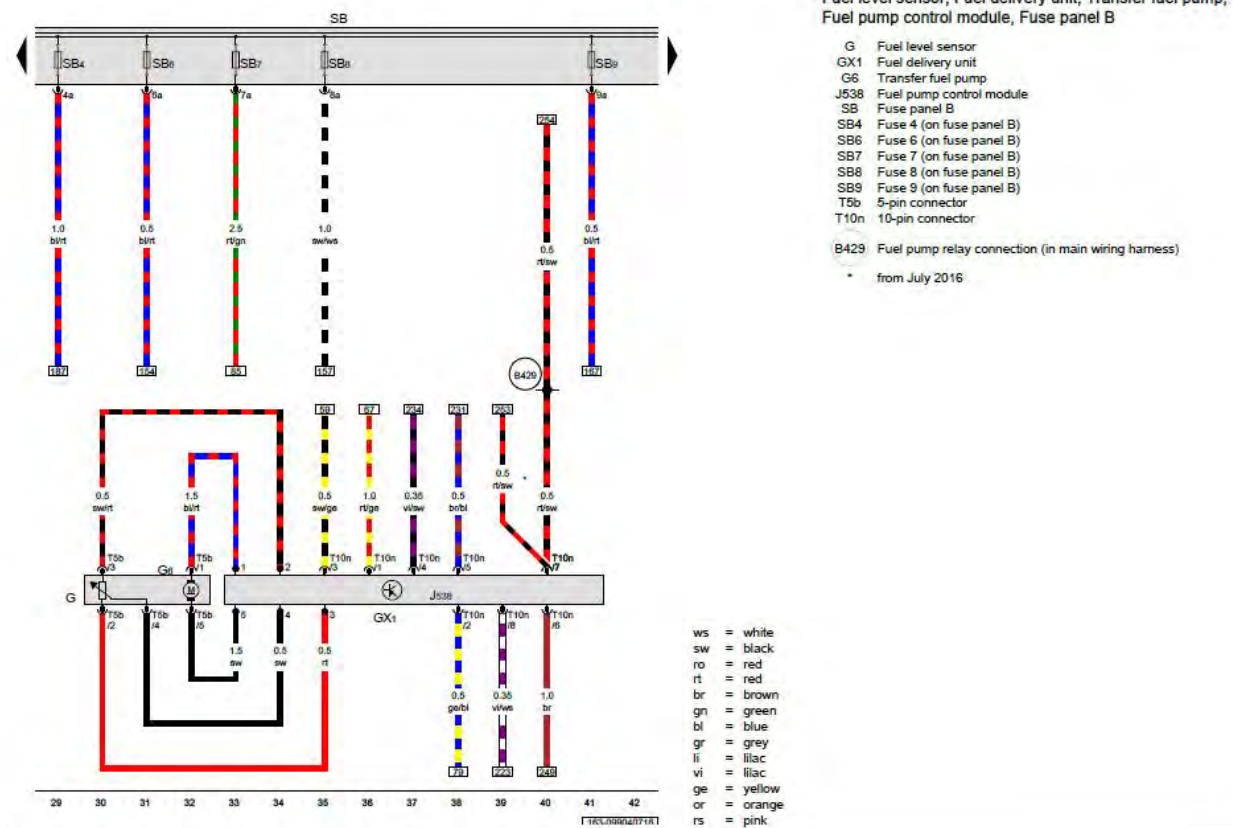


- | | |
|------|--|
| J623 | Engine control module |
| N180 | VACAP canister purge regulator valve 1 |
| N205 | Camshaft adjustment valve 1 |
| N276 | Fuel pressure regulator valve |
| N288 | Switch-off valve |
| N318 | Exhaust camshaft adjustment valve 1 |
| N428 | Oil pressure regulation valve |
| N511 | Deaerator pressure actuator |
| T2av | 2-pin connector |
| T2dr | 2-pin connector |
| T2dt | 2-pin connector |
| T2ku | 2-pin connector |
| T2s | 2-pin connector |
| T2ta | 2-pin connector |
| T2tb | 2-pin connector |
| T14 | 14-pin connector |
| T60 | 60-pin connector |
| T94 | 94-pin connector |

D189 Connection 87a (in engine pre-wiring harness)

D202 Connection 6 (87a) (in engine compartment wiring harness)

- ws = white
sw = black
ro = red
rt = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
vi = lilac
ge = yellow
or = orange
rs = pink



Based upon the totality of the foregoing evidence, and based further upon information and belief, the '574 patent Accused Instrumentalities practice “a method of controlling the fuel pressure within a fuel delivery system having a fuel pump which delivers fuel to a fuel rail of an internal combustion engine comprising: providing a set-point fuel pressure; providing the estimated average fuel flow through the system; generating a feed forward control signal based upon the set-point fuel pressure and the average fuel flow; measuring the fuel rail pressure with a fuel pressure sensor; filtering the output of the fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors; comparing the fuel rail pressure to the set-point fuel pressure and generating an error signal based upon the difference between the fuel rail pressure and the set-point fuel pressure; and modifying the feed forward control signal based upon the error signal thereby generating a motor controller signal and sending the motor control signal to the fuel pump motor.”

Figure 81

93. Claim 7 of the '574 patent recites a fuel delivery system comprising: a fuel rail adapted to deliver fuel to fuel injectors of an automotive vehicle, a fuel pump adapted to deliver fuel to said fuel rail, a fuel pressure sensor adapted to measure the fuel rail pressure, a low-pass filter adapted to filter the output of said fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors, and a fuel pump motor controller having: a feed

forward controller adapted to provide a feed forward signal having fuel pump motor control parameters based upon a set-point fuel pressure and the average fuel flow through said system; a first summing junction adapted to compare the fuel rail pressure to the set-point fuel pressure and to generate an error value based upon the difference between the fuel rail pressure and the set-point fuel pressure; a feed back controller adapted to receive the error value and to generate a feed back control signal; a second summing junction adapted to receive the feed back control signal from said feed back controller and the feed forward control signal from the feed forward controller and to modify the fuel pump motor control parameters of the feed forward control signal based upon the feed back control signal to generate a motor controller signal; and a fuel pump motor controller driver adapted to receive the motor controller signal and to control the speed of said fuel pump based upon the motor controller signal.

94. On information and belief, the '574 patent Accused Instrumentalities infringe claim 7 of the '574 patent. The '574 patent Accused Instrumentalities comprise a fuel delivery system (*Figure 82*) comprising: a fuel rail adapted to deliver fuel to fuel injectors of an automotive vehicle (*Figure 83*), a fuel pump adapted to deliver fuel to said fuel rail, a fuel pressure sensor adapted to measure the fuel rail pressure (*Figures 84-85*), a low-pass filter adapted to filter the output of said fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors (*Figure 86*), and a fuel pump motor controller (*Figure 87*) having: a feed forward controller adapted to provide a feed forward signal having fuel pump motor control parameters based upon a set-point fuel pressure and the average fuel flow through said system (*Figure 88*); a first summing junction adapted to compare the fuel rail pressure to the set-point fuel pressure and to generate an error value based upon the difference between the fuel rail pressure and the set-point fuel pressure (*Figure 89*); a feed back controller adapted to receive the error value and to generate a feed back control signal (*Figure 90*); a second summing junction

adapted to receive the feed back control signal from said feed back controller and the feed forward control signal from the feed forward controller and to modify the fuel pump motor control parameters of the feed forward control signal based upon the feed back control signal to generate a motor controller signal (*Figure 91*); and a fuel pump motor controller driver adapted to receive the motor controller signal and to control the speed of said fuel pump based upon the motor controller signal (*Figure 92*).

The '574 patent Accused Instrumentalities comprise a fuel delivery system.

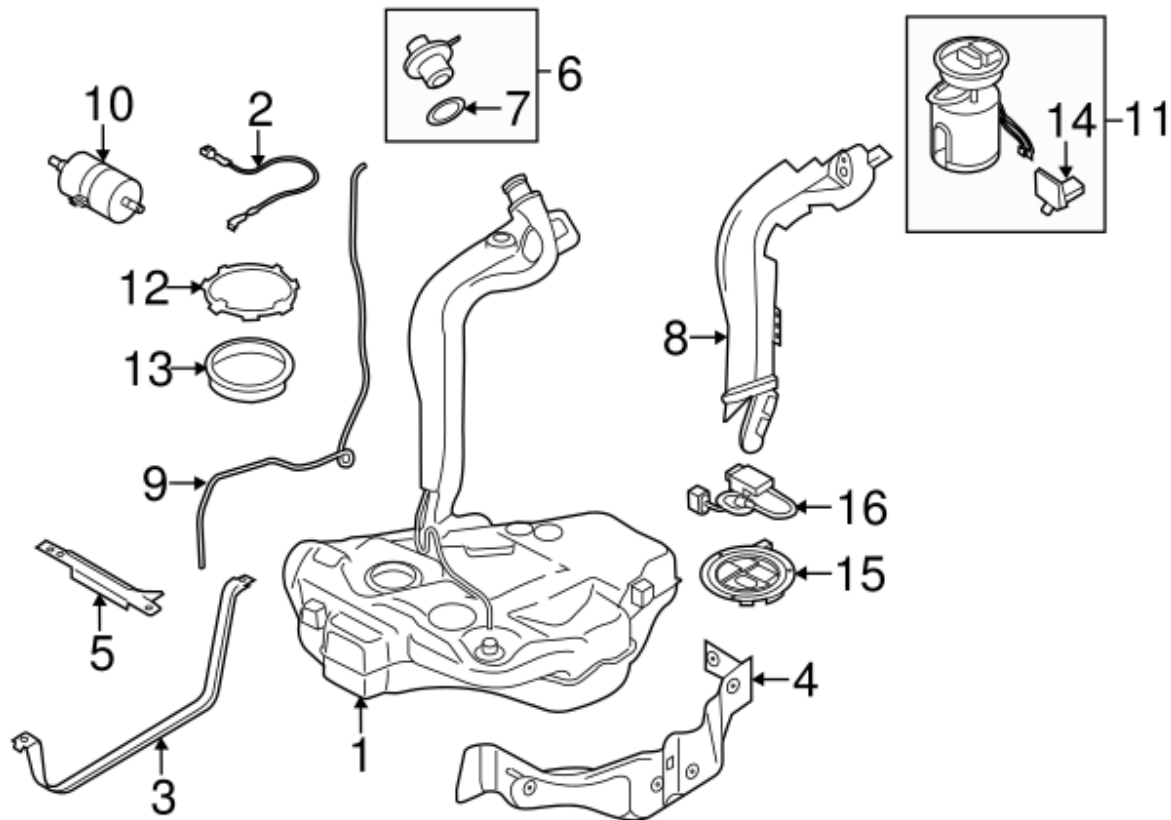


Figure 82

The '574 patent Accused Instrumentalities comprise a fuel delivery pipe (rail) adapted to deliver fuel to fuel injectors (8) of an automotive vehicle. *See below.*

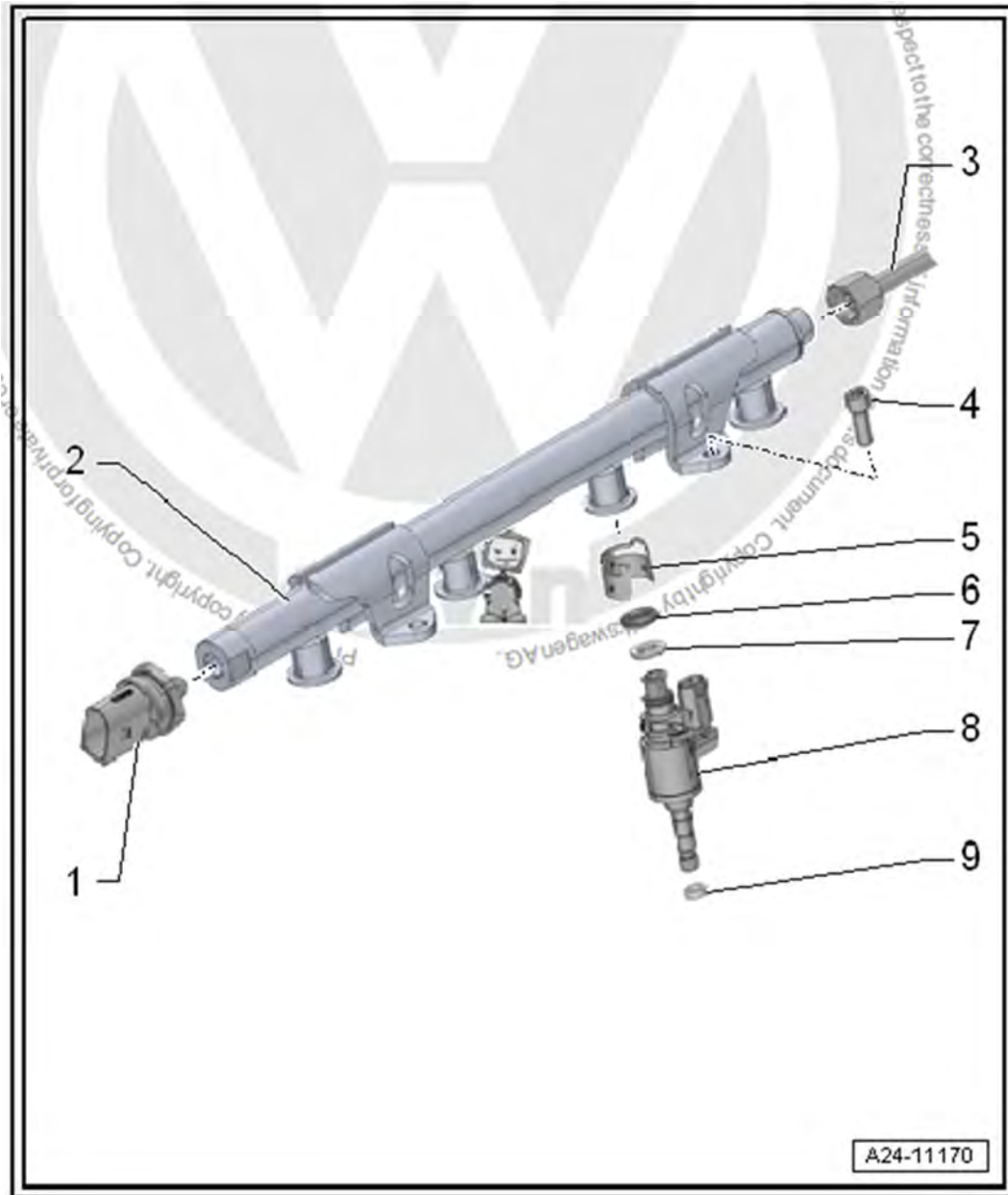


Figure 83

The '574 patent Accused Instrumentalities comprise a fuel pump (8) adapted to deliver fuel to said fuel rail (2). *See below.*

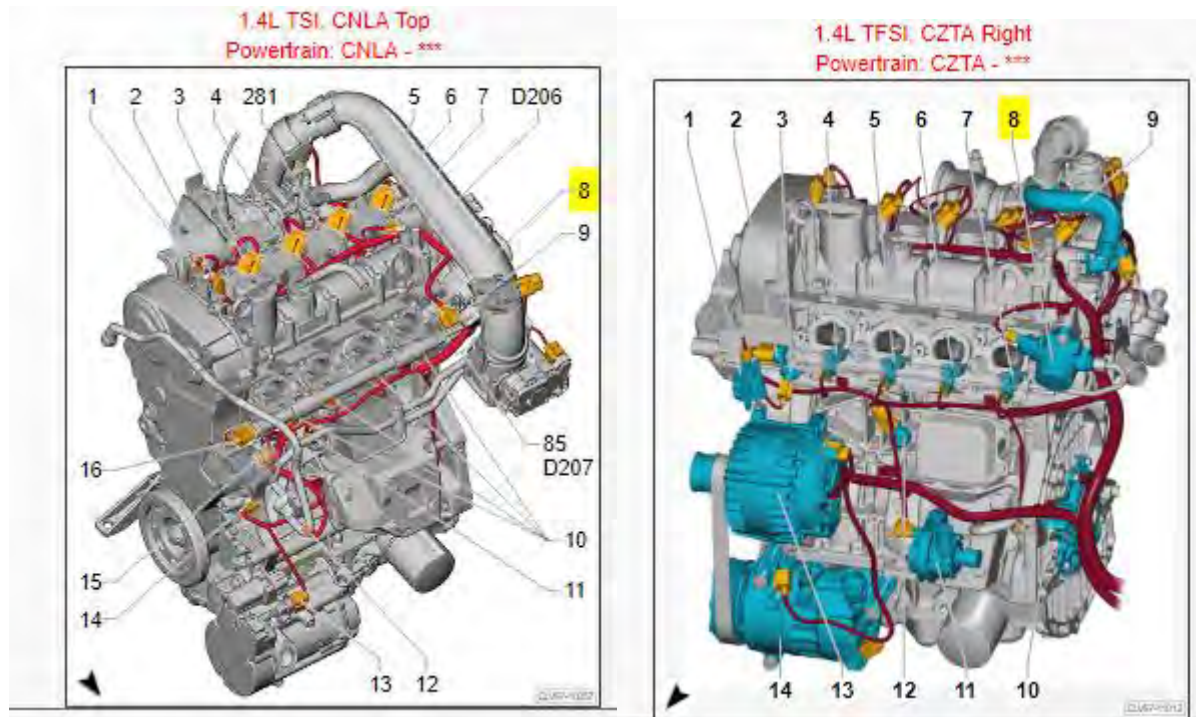
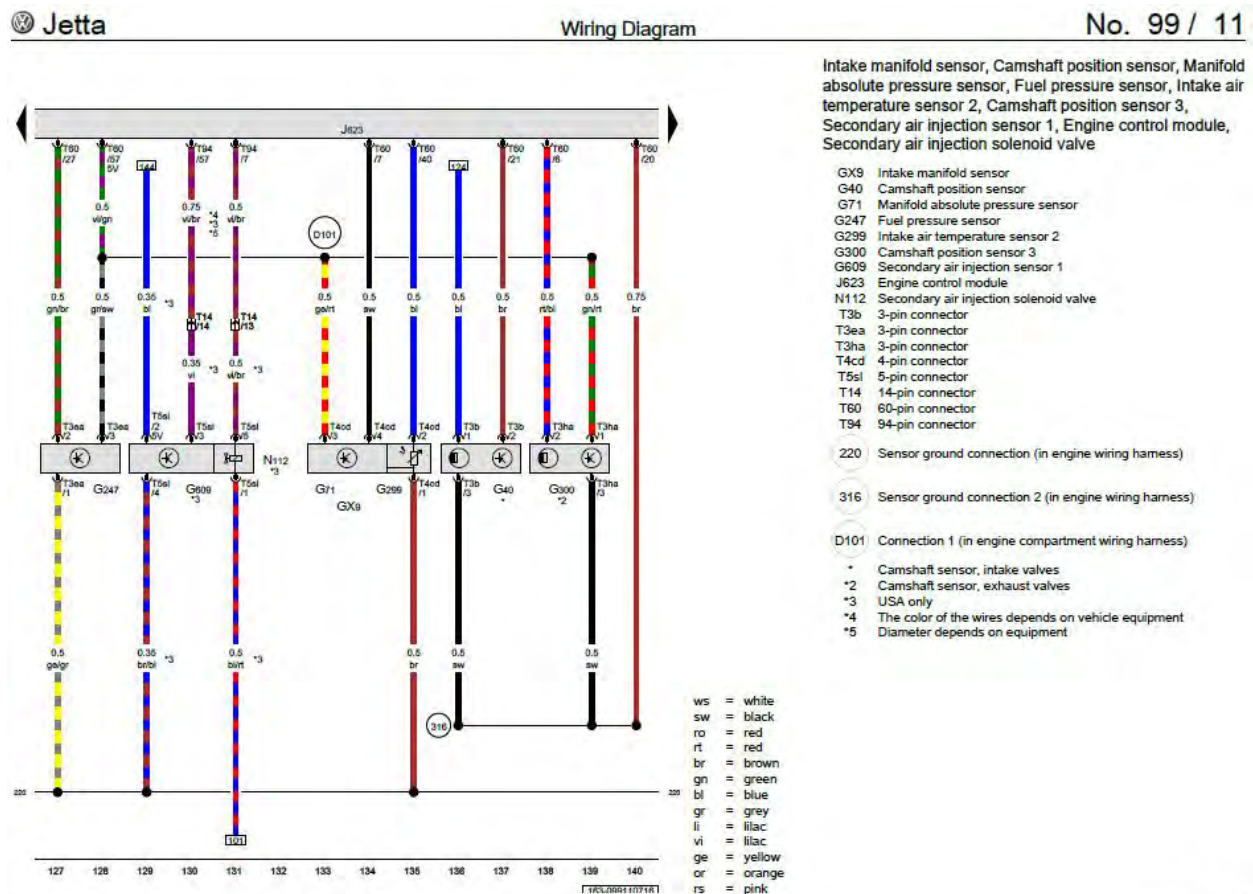


Figure 84

The '574 patent Accused Instrumentalities comprise a fuel pressure sensor (1; G247) adapted to measure the fuel rail pressure. *See below.*



07.2016

Figure 85

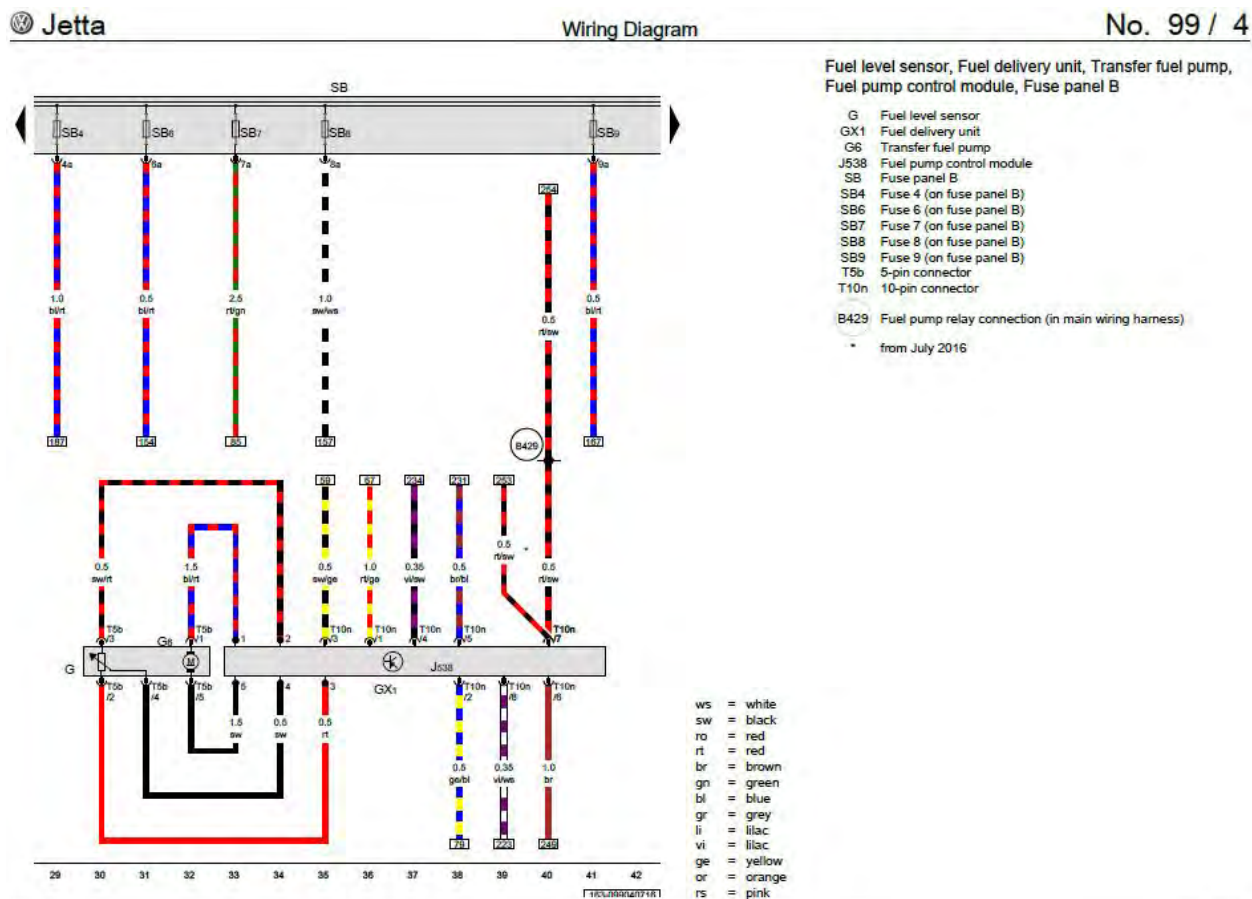
The '574 patent Accused Instrumentalities comprise a low-pass filter adapted to filter the output of said fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors.

Upon information and belief, the ECM (J623) filters the output of the fuel rail pressure sensor (1 below); thereby it also filters out the pulses detected from the fuel rail pressure sensor to thereby filter the output of the fuel rail pressure sensor (1) in such a manner as to filter out pulses due to the opening and closing of the fuel injectors.



Figure 86

The '574 patent Accused Instrumentalities comprise a fuel pump motor controller (J538). *See below.*



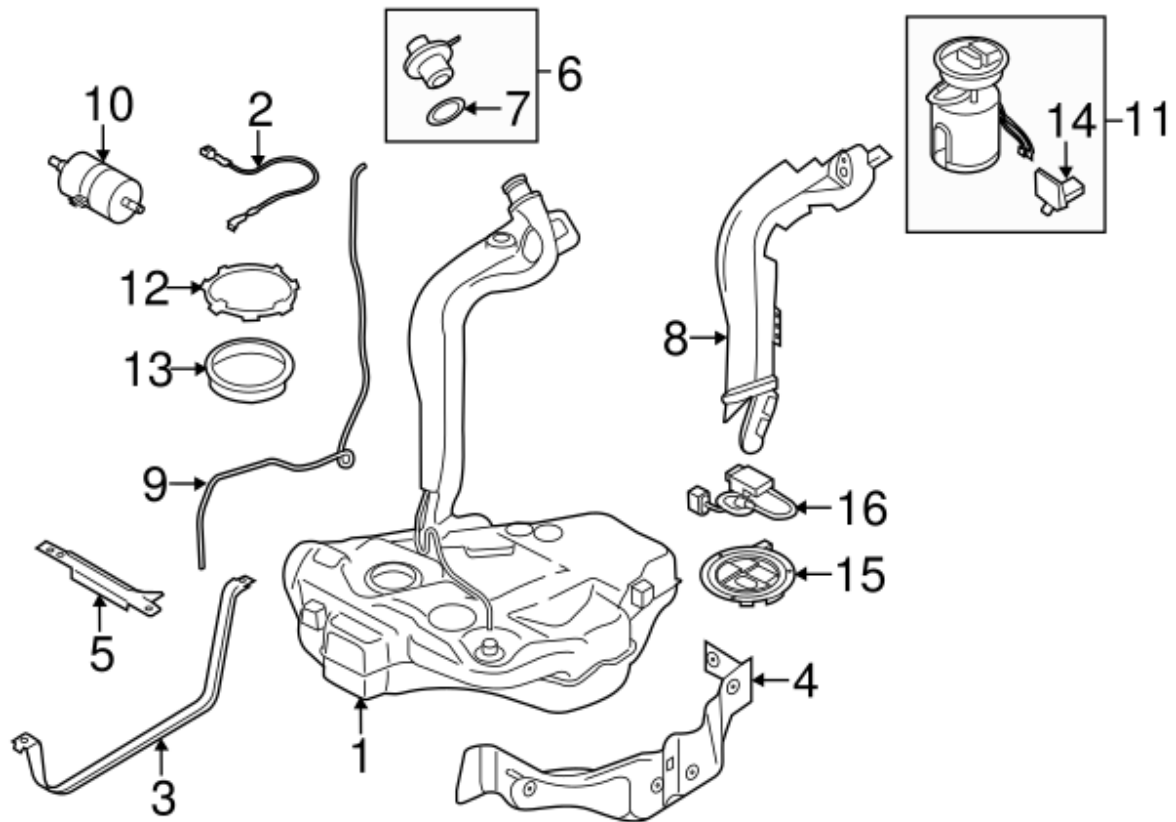
07.2016

Figure 87

The '574 patent Accused Instrumentalities comprise a feed forward controller adapted to provide a feed forward signal having fuel pump motor control parameters based upon a set-point fuel pressure and the average fuel flow through said system.

For example, the Engine Control Module (J623) and Fuel pump control module (J538) are feed forward controllers adapted to provide a feed forward signal having fuel pump motor control parameters based upon a set-point fuel pressure and the aver fuel flow through said system. *See below.*

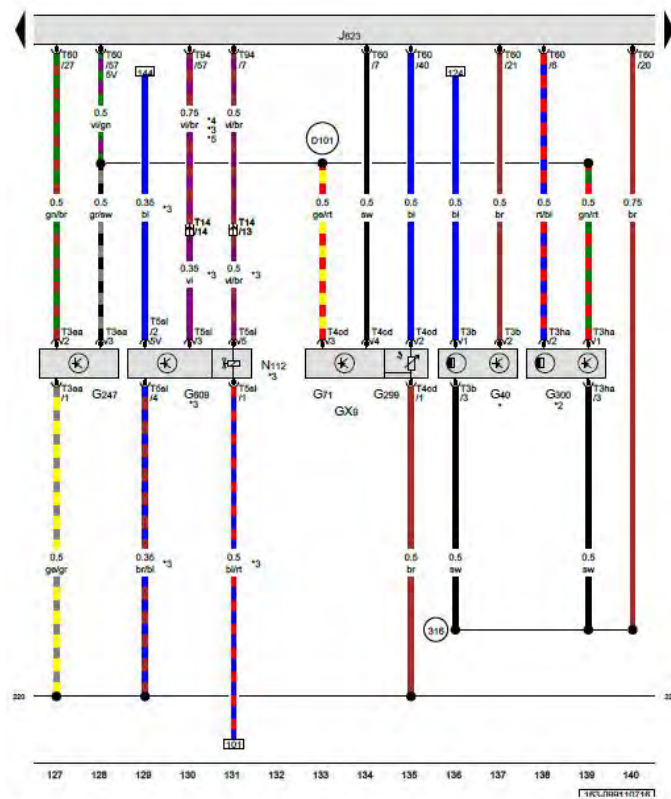
For example, the Fuel gauge sending unit (14) shown immediately below, sends fuel data to the ECM, which calculates the estimated average fuel flow through the system.



Jetta

Wiring Diagram

No. 99 / 11



Intake manifold sensor, Camshaft position sensor, Manifold absolute pressure sensor, Fuel pressure sensor, Intake air temperature sensor 2, Camshaft position sensor 3, Secondary air injection sensor 1, Engine control module, Secondary air injection solenoid valve

GX9 Intake manifold sensor
G40 Camshaft position sensor
G71 Manifold absolute pressure sensor
G247 Fuel pressure sensor
G299 Intake air temperature sensor 2
G300 Camshaft position sensor 3
G609 Secondary air injection sensor 1
J623 Engine control module
N112 Secondary air injection solenoid valve
T3b 3-pin connector
T3ea 3-pin connector
T3ha 3-pin connector
T4cd 4-pin connector
T5sl 5-pin connector
T14 14-pin connector
T60 60-pin connector
T94 94-pin connector

220 Sensor ground connection (in engine wiring harness)

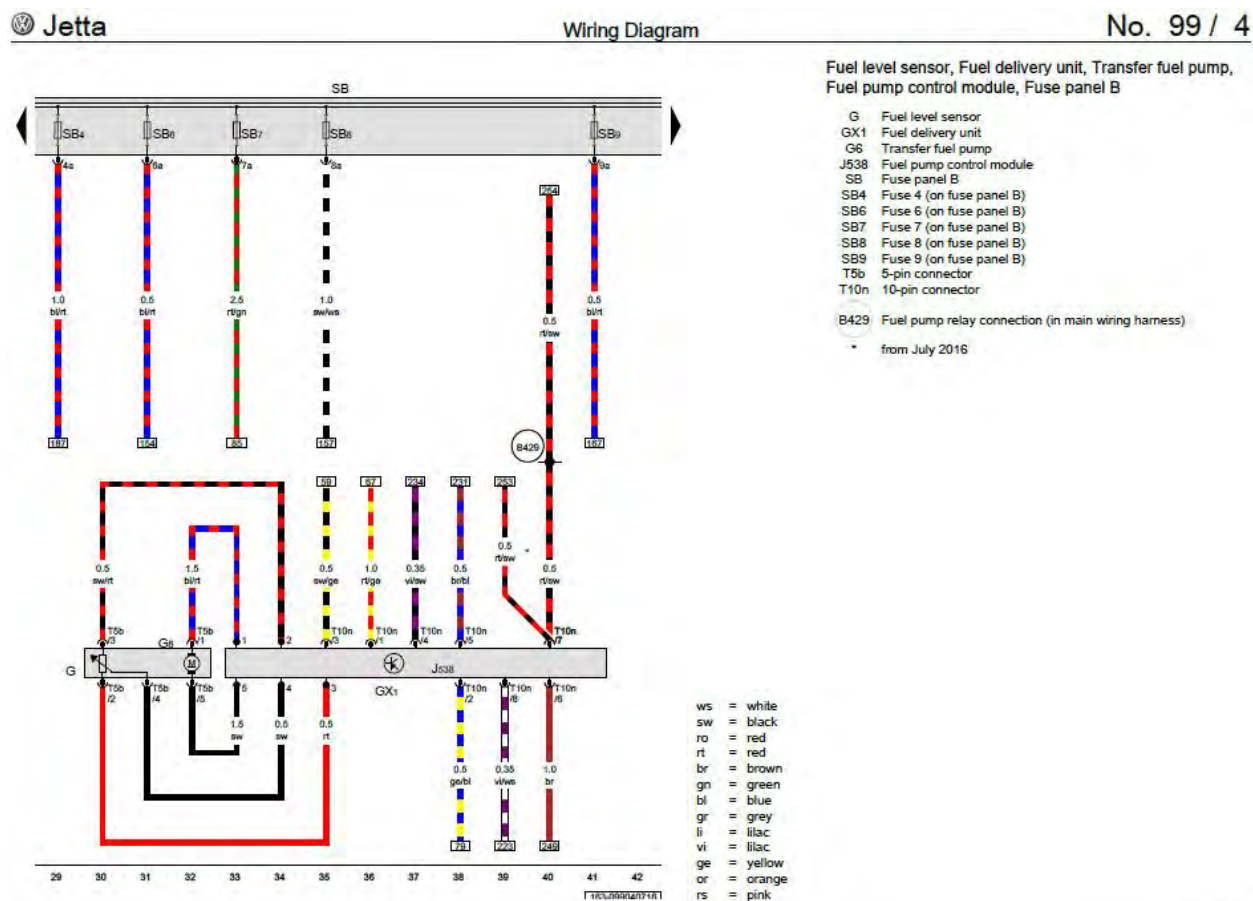
316 Sensor ground connection 2 (in engine wiring harness)

D101 Connection 1 (in engine compartment wiring harness)

* Camshaft sensor, intake valves
*2 Camshaft sensor, exhaust valves
*3 USA only
*4 The color of the wires depends on vehicle equipment
*5 Diameter depends on equipment

ws = white
sw = black
ro = red
rt = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
vi = lilac
ge = yellow
or = orange
rs = pink

07.2016



07.2016

Figure 88

The '574 patent Accused Instrumentalities comprise a first summing junction adapted to compare the fuel rail pressure to the set-point fuel pressure and to generate an error value based upon the difference between the fuel rail pressure and the set-point fuel pressure.

As shown immediately below, the fuel (rail) pressure sensor (1) generates a signal corresponding to the fuel rail pressure. The fuel rail pressure generated by the fuel (rail) pressure sensor is compared to the set point fuel (rail) pressure (calculated and generated by the ECM). When the fuel rail pressure and the set-point fuel pressure differ, an error value is generated based upon the difference.

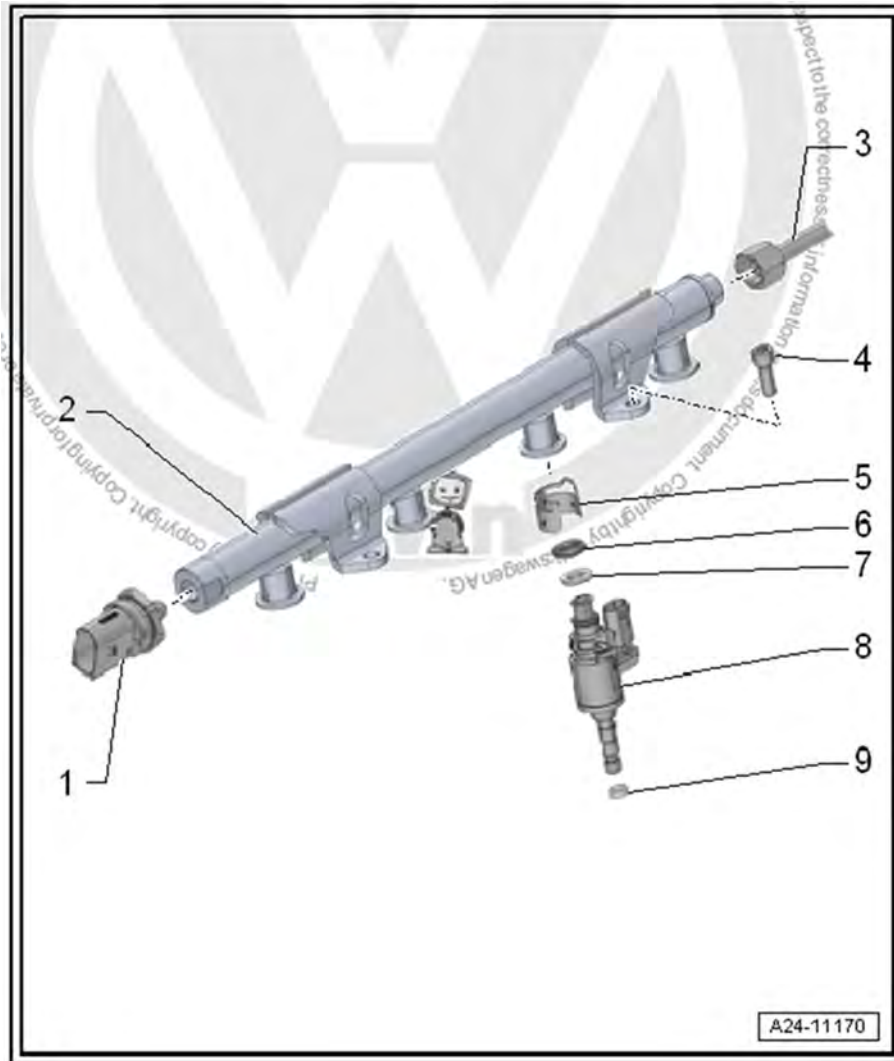


Figure 89

The '574 patent Accused Instrumentalities comprise a feed back controller adapted to receive the error value and to generate a feed back control signal.

For example, the ECM (J623) is a feed back controller) adapted to receive the error value and generate a feed back control signal.

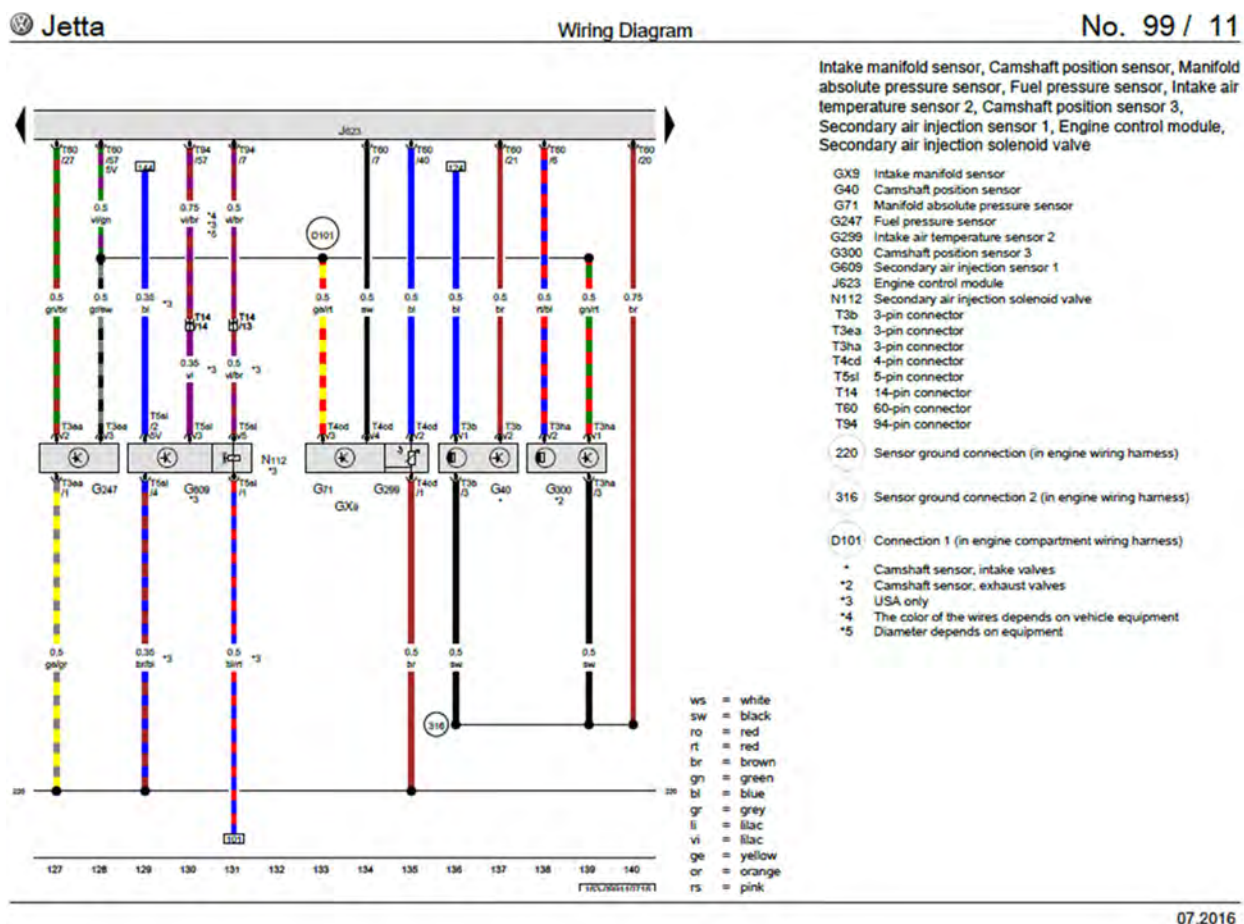
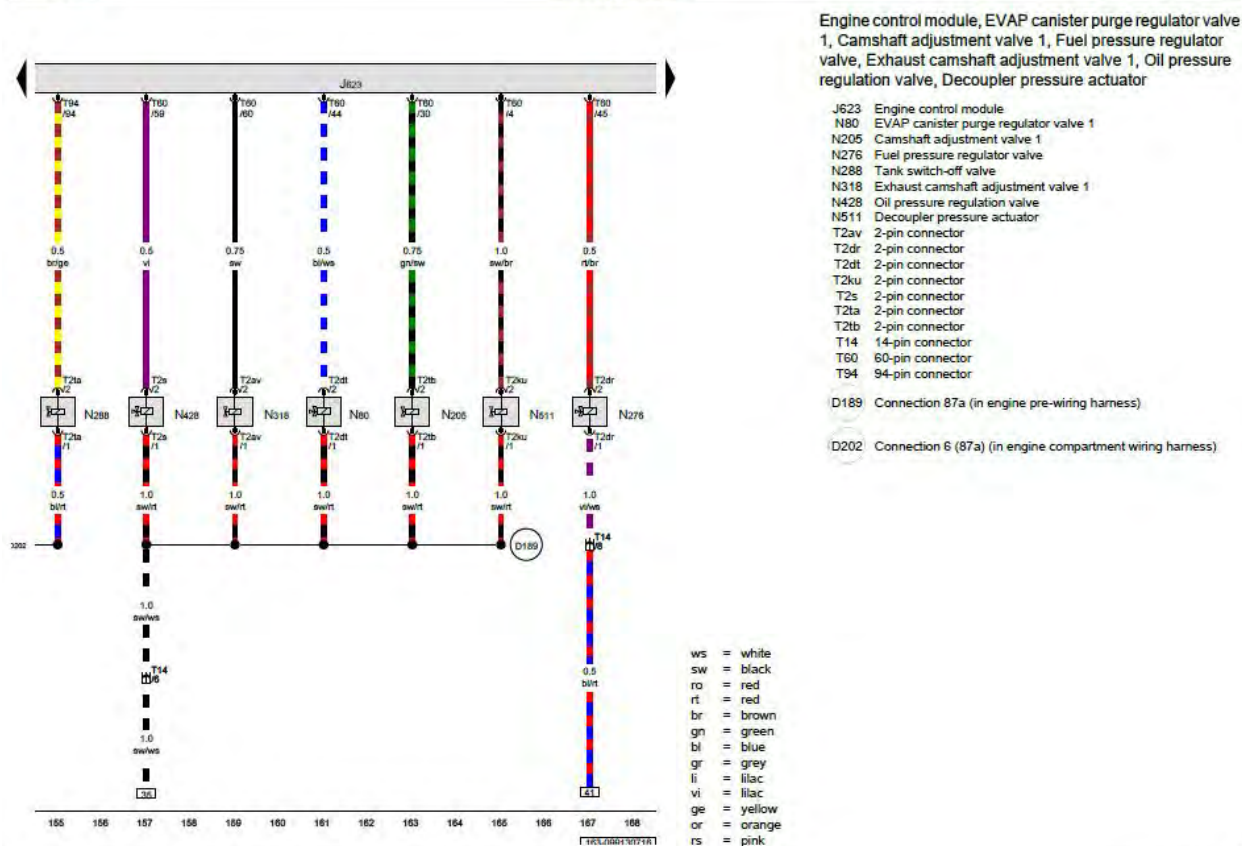


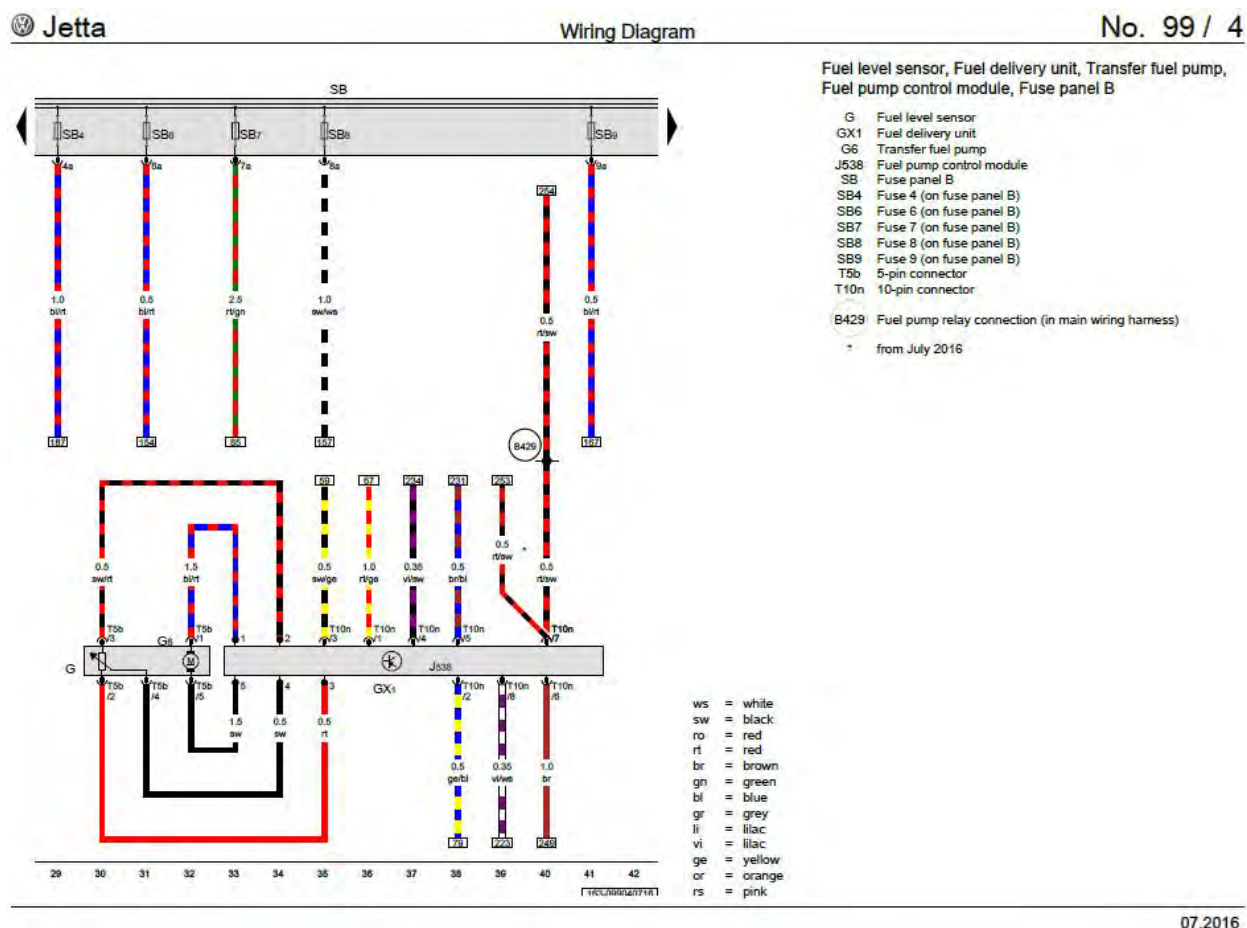
Figure 90

The '574 patent Accused Instrumentalities comprise a second summing junction adapted to receive the feed back control signal from said feed back controller and the feed forward control signal from the feed forward controller and to modify the fuel pump motor control parameters of the feed forward control signal based upon the feed back control signal to generate a motor controller signal.

For example, the ECM (J623) shown below is a feed back controller and a feed forward controller.



For example, as shown below, the fuel pump control module (J538) is a feed forward controller and a feed back controller which modifies the fuel pump motor control parameters of the feed forward control signal based upon the feed back control signal to generate a motor controller signal.

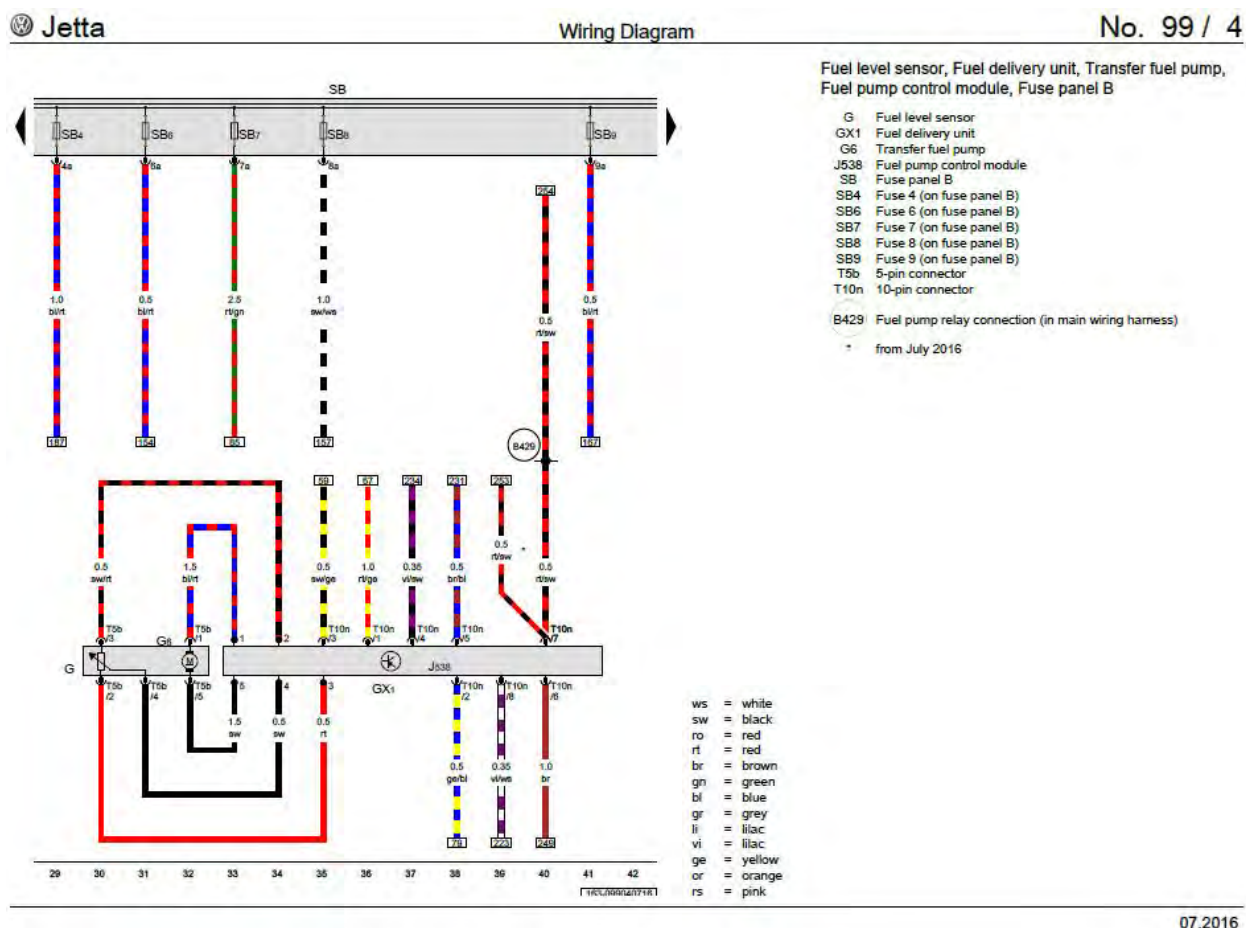


The fuel (rail) pressure sensor (2) installed on the fuel cylinder (fuel rail) and the fuel pressure regulator valve (N276) deliver the modified feed forward control signal based upon the error signal (received from the ECM (J623)) thereby generating a motor controller signal and sending the motor control signal to the fuel pump motor controlled by the fuel pump motor control module (J538). This is accomplished via the fuel delivery unit (GX1) with the fuel pump (G6) with the fuel pump control module (J538).

Figure 91

he '574 patent Accused Instrumentalities comprise a fuel pump motor controller driver adapted to receive the motor controller signal and to control the speed of said fuel pump based upon the motor controller signal.

For example, the fuel pump motor controller (J538) (shown below) driver is adapted to receive the motor controller signal (from the ECM (J623) shown above) and to control the speed of said fuel pump based on the motor control signal.



Based upon the totality of the foregoing evidence, and based further upon information and belief, the '574 patent Accused Instrumentalities include a fuel delivery system comprising: a fuel rail adapted to deliver fuel to fuel injectors of an automotive vehicle, a fuel pump adapted to deliver fuel to said fuel rail, a fuel pressure sensor adapted to measure the fuel rail pressure, a low-pass filter adapted to filter the output of said fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors, and a fuel pump motor controller having: a feed forward controller adapted to provide a feed forward signal having fuel pump motor control parameters based upon a set-point fuel pressure and the average fuel flow through said system; a first summing junction adapted to compare the fuel rail pressure to the set-point fuel pressure and to generate an error value based upon the difference between the fuel rail pressure and the set-point fuel pressure; a feed back controller adapted to receive the error value and to generate a feed back control signal; a second summing junction adapted to receive the feed back control signal from said feed back controller and the feed forward control signal from the feed forward controller and to modify the fuel pump motor control parameters of the feed forward control signal based upon the feed back control signal to generate a motor controller signal; and a fuel pump motor controller driver adapted to receive the motor controller signal and to control the speed of said fuel pump based upon the motor controller signal.

Figure 92

COUNT XIII – INFRINGEMENT OF U.S. PATENT NO. 6,609,497

95. The allegations set forth in the foregoing paragraphs 1 through 94 are incorporated into this Thirteenth Claim for Relief.

96. On August 26, 2003, U.S. Patent No. 6,609,497 (“the ’497 patent”), entitled “Method for Determining MBT Timing in an Internal Combustion Engine,” was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the ’497 patent is attached as Exhibit 13.

97. Plaintiff is the assignee and owner of the right, title and interest in and to the ’497 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

98. Upon information and belief, Defendants have directly infringed at least claim 1 of the ’497 patent by making, using, selling, importing and/or providing and causing to be used the 2012-2018 Tiguan, 2012-2018 Audi A3, 2012-2018 Audi A4, 2012-2018 Audi A5, 2012-2018 Audi A6, 2016-2018 Audi TT, 2015-2018 Audi S3, 2015-2018 VW Golf, 2012-2018 VW Golf GTI, 2015-2018 VW Golf R, 2015-2018 Golf Sportwagon, 2013-2018 Jetta GLI, 2014-2018 VW Jetta Sedan, 2014-2018 VW Passat, 2012-2017 WV CC, 2012-2018 VW Beetle, 2018 VW Atlas, 2015-2018 Audi Q3, 2012-2018 Audi Q5, and 2017-2018 Porsche Macan with the EA888 engines (the “’497 patent Accused Instrumentalities”).

99. In particular, claim 1 of the ’497 patent recites a method of controlling an internal combustion engine, said engine having at least one cylinder, said method comprising the steps of: measuring the combustion pressure in said at least one cylinder at at least two discrete times during a combustion cycle; calculating a net combustion pressure change in said at least one cylinder based on said measured combustion pressures; calculating the second derivative of said net combustion pressure change; calculating the maximum acceleration point of said net

combustion pressure change from said second derivative of said net combustion pressure change; and varying the spark timing of said engine until said maximum acceleration point is aligned with top dead center to achieve maximum braking torque spark timing.

100. On information and belief, the '497 patent Accused Instrumentalities infringe claim 1 of the '497 patent. The '497 patent Accused Instrumentalities practice a method of controlling an internal combustion engine (*Figure 93*), said engine having at least one cylinder (*Figure 93*), said method comprising the steps of: measuring the combustion pressure in said at least one cylinder at at least two discrete times during a combustion cycle (*Figure 94*); calculating a net combustion pressure change in said at least one cylinder based on said measured combustion pressures (*Figure 95*) calculating the second derivative of said net combustion pressure change (*Figure 96*); calculating the maximum acceleration point of said net combustion pressure change from said second derivative of said net combustion pressure change (*Figure 97*); and varying the spark timing of said engine until said maximum acceleration point is aligned with top dead center to achieve maximum braking torque spark timing (*Figure 98*).

eSelf-Study Program 920243



The Audi 1.8L and 2.0L Third Generation EA888 Engines

Audi Academy

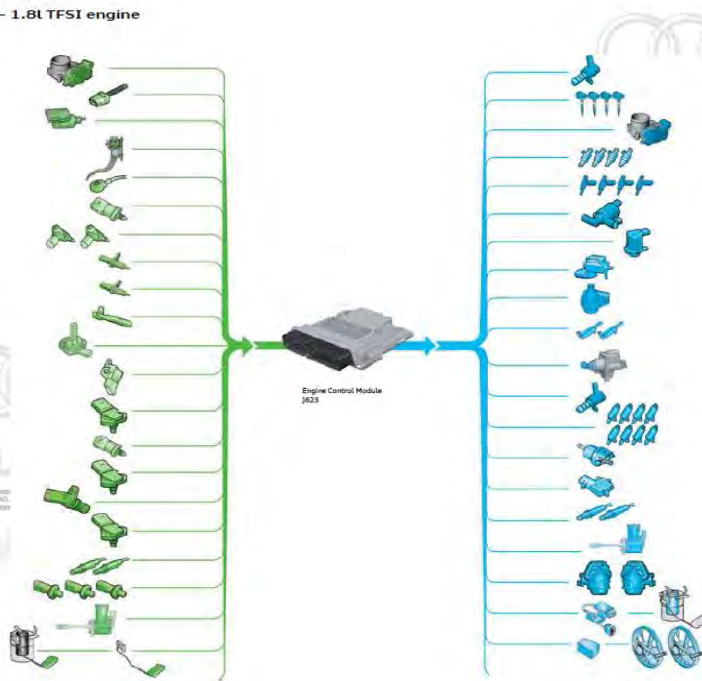


Engine management system

System overview example – 1.8L TFSI engine

Sensors

Throttle Valve Control Module J338
 EPC Throttle Drive Angle Sensors 1 & 2 C187, C188
 Brake Light Switch F
 Clutch Position Sensor G476
 Clutch Pedal Switch F36
 Clutch Pedal Starter Interlock Switch F194
 Accelerator Pedal Position Sensor C79
 Accelerator Pedal Position Sensor 2 C185
 Knock Sensor 1 C61
 Low Fuel Pressure Sensor G410
 Hall Sensor G40
 Hall Sensor 3 C300
 Engine Coolant Temperature Sensor G62
 Engine Coolant Temperature Sensor on Radiator Outlet G83
 Engine Speed Sensor C28
 Oil Level Thermal Sensor C266
 Intake Manifold Runner Position Switch C836
 Intake Air Temperature Sensor C42
 Manifold Absolute Pressure Sensor C71
 Fuel Pressure Sensor C247
 Charge Air Pressure Sensor C31
 Gear Recognition Sensor G604
 Brake Booster Pressure Sensor C294
 Heated Oxygen Sensor C39
 Oxygen Sensor after Three Way Catalytic Converter C130
 Oil Pressure Switch F22
 Reduced Oil Pressure Switch F378
 Oil Pressure Switch, Level 3 F447
 Charge Pressure Actuator Position Sensor C581
 Fuel Level Sensor C
 Fuel Level Sensor 2, C169
 Auxiliary signals:
 - Cruise control system
 - Speed signal
 - Start request for engine control module (keyless start 1 + 2)
 - Terminal 50
 - Crash signal from airbag control Module



Actuators

Piston Cooling Nozzle Control Valve N522
 Ignition Coils 1 - 4 with Output Stage
 N70, N127, N281, N292
 EPC Throttle Drive C186
 Injectors 2, cylinders 3 - 4 N532 - N535
 (ECU does not generate an actuator drive signal)
 Injector, cylinders 1 - 4 N30 - N33
 Transmission Coolant Valve N488
 Turbocharger Recirculation Valve N249
 Intake Manifold Runner Control Valve N316
 Coolant Recirculation Pump V50
 Camshaft Adjustment Valve 1 N205
 Exhaust Camshaft Adjustment Valve 1 N338
 (N338 only on 2.0L engines)
 Fuel Metering Valve N290
 Oil Pressure Regulation Valve N428
 Cam Adjustment Actuators 1 - 8, F366, F373
 (only on 2.0L engines)
 Carbon Canister Purge Regulator Valve N80
 Engine Temperature Control Actuator N493
 Oxygen Sensor Heater 219
 Heater for Oxygen Sensor 1 after Catalytic Converter 229
 Charge Pressure Actuator V465
 Left Electro-hydraulic Engine Mount Solenoid Valve N144
 Right Electro-hydraulic Engine Mount Solenoid Valve N145
 Fuel Pump Control Module J538
 Transfer Fuel Pump G6
 Coolant Fan Control Module J293
 Coolant Fan V7
 Coolant Fan 2 V127
 Auxiliary signals:
 - Dual Clutch Mechatronics Module / engine speed
 - ABS/ESP Control Module
 - A/C compressor
 - Starter control Module

As shown above, the Engine Management System including the Engine Control Module (ECM; J623) controls the Audi 1.8L and 2.0L Third Generation EA888 Engines (internal combustion engine). The '497 patent Accused Instrumentalities comprise the Audi 1.8L and 2.0L Third Generation EA888 Engines.

Figure 93

The '497 patent Accused Instrumentalities comprise a method of controlling an internal combustion engine, said engine having at least one cylinder, wherein said method comprises measuring the combustion pressure in said at least one cylinder at least at two discrete times during a combustion cycle. As shown below, DTC P03AF, Cylinder 3 Pressure Too High, utilizes the Knock Control Function to detect Knock Activity (cylinder pressure) at two discrete times during a combustion cycle; it detects (measures) knock in both the main knock window and the pre-knock window (two discrete times).

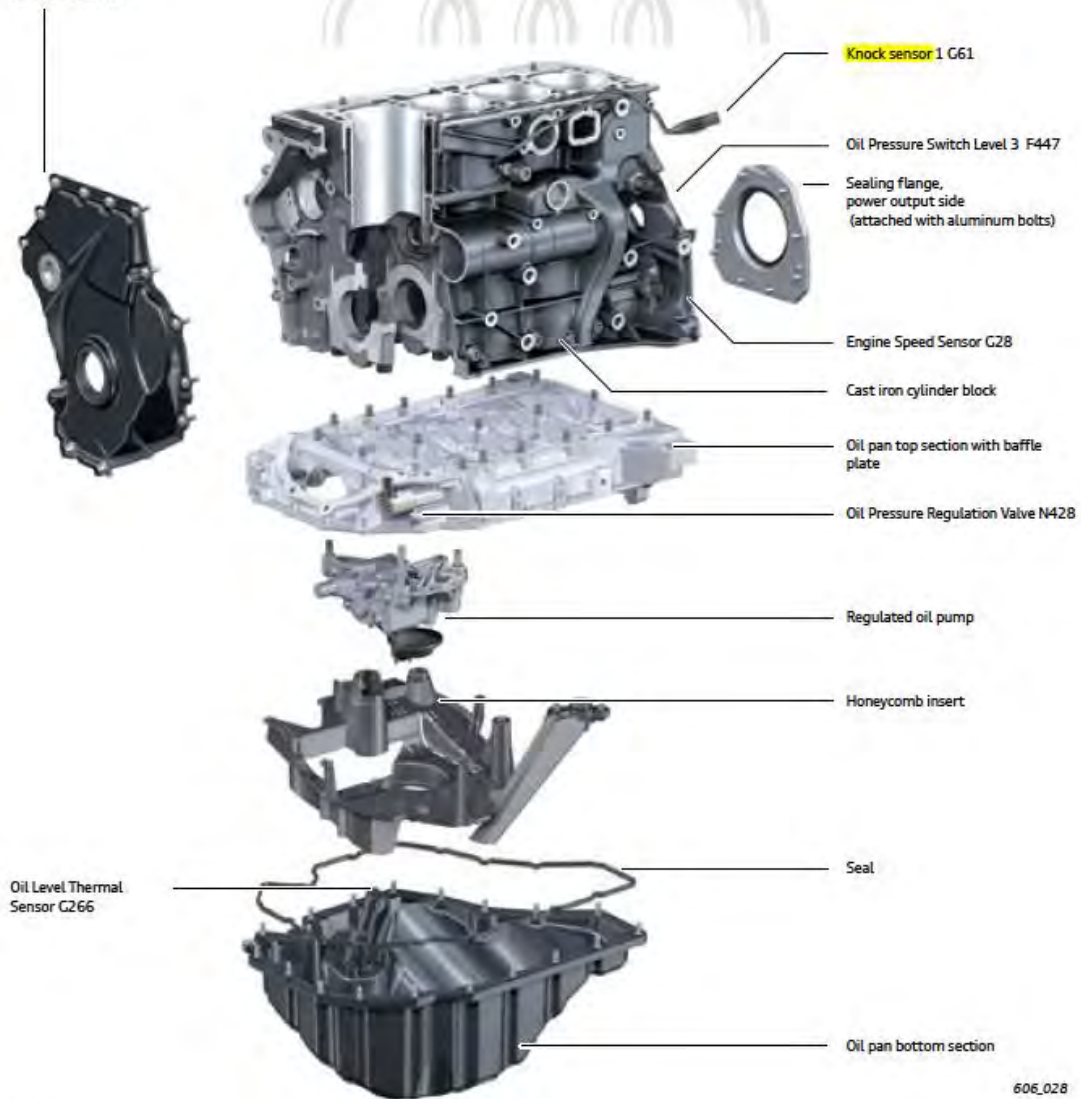
As shown below, the engine control system comprises the knock sensor. The PCM calculates cylinder combustion pressure as derived from the knock sensor input.

Engine Management

- ▶ Electronic engine management system with EPC
- ▶ Combined direct and port injection systems*
- ▶ Adaptive O₂ sensor control
- ▶ Mapped ignition with high voltage ignition coils
- ▶ Cylinder-selective adaptive knock control

Overview

Timing chain cover



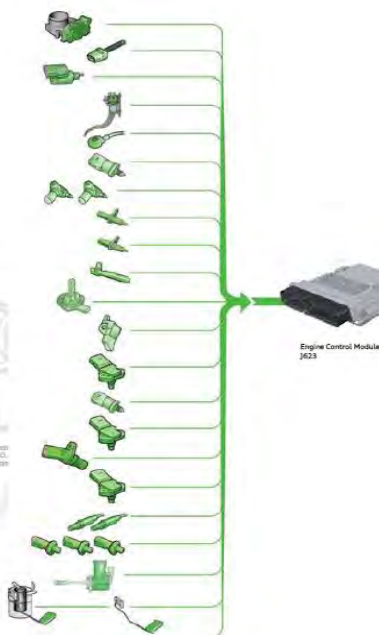
606_028

Engine management system

System overview example – 1.8L TFSI engine

Sensors

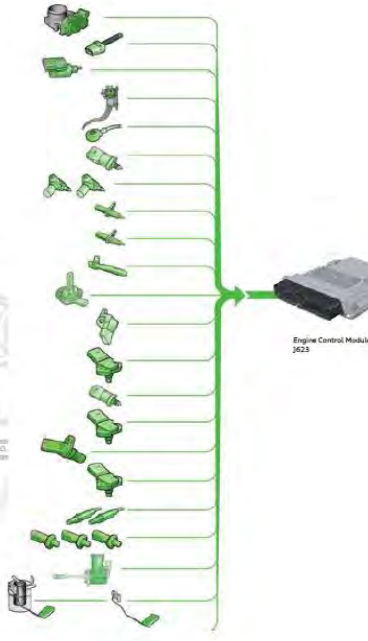
Throttle Valve Control Module J338
 EPC Throttle Drive Angle Sensors 1 & 2 C187, C188
 Brake Light Switch F
 Clutch Position Sensor C476
 Clutch Pedal Switch F36
 Clutch Pedal Starter Interlock Switch F194
 Accelerator Pedal Position Sensor C79
 Accelerator Pedal Position Sensor 2 C185
 Knock Sensor 1 C61
 Low Fuel Pressure Sensor C410
 Hall Sensor G40
 Hall Sensor 3 C300
 Engine Coolant Temperature Sensor C62
 Engine Coolant Temperature Sensor on Radiator Outlet C63
 Engine Speed Sensor C28
 Oil Level Thermal Sensor C266
 Intake Manifold Runner Position Switch C336
 Intake Air Temperature Sensor C42
 Manifold Absolute Pressure Sensor C71
 Fuel Pressure Sensor C247
 Charge Air Pressure Sensor C31
 Gear Recognition Sensor C604
 Brake Booster Pressure Sensor C294
 Heated Oxygen Sensor C39
 Oxygen Sensor after Three Way Catalytic Converter C130
 Oil Pressure Switch F22
 Reduced Oil Pressure Switch F378
 Oil Pressure Switch, Level 3 F447
 Charge Pressure Actuator Position Sensor C581
 Fuel Level Sensor C
 Fuel Level Sensor 2, C169
 Auxiliary signals:
 - Cruise control system
 - Speed signal
 - Start request to engine control module (keyless start 1 + 2)
 - Terminal 50
 - Crash signal from airbag control Module

**Engine management system**

System overview example – 1.8L TFSI engine

Sensors

Throttle Valve Control Module J338
 EPC Throttle Drive Angle Sensors 1 & 2 C187, C188
 Brake Light Switch F
 Clutch Position Sensor C476
 Clutch Pedal Switch F36
 Clutch Pedal Starter Interlock Switch F194
 Accelerator Pedal Position Sensor C79
 Accelerator Pedal Position Sensor 2 C185
 Knock Sensor 1 C61
 Low Fuel Pressure Sensor C410
 Hall Sensor G40
 Hall Sensor 3 C300
 Engine Coolant Temperature Sensor C62
 Engine Coolant Temperature Sensor on Radiator Outlet C63
 Engine Speed Sensor C28
 Oil Level Thermal Sensor C266
 Intake Manifold Runner Position Switch C336
 Intake Air Temperature Sensor C42
 Manifold Absolute Pressure Sensor C71
 Fuel Pressure Sensor C247
 Charge Air Pressure Sensor C31
 Gear Recognition Sensor C604
 Brake Booster Pressure Sensor C294
 Heated Oxygen Sensor C39
 Oxygen Sensor after Three Way Catalytic Converter C130
 Oil Pressure Switch F22
 Reduced Oil Pressure Switch F378
 Oil Pressure Switch, Level 3 F447
 Charge Pressure Actuator Position Sensor C581
 Fuel Level Sensor C
 Fuel Level Sensor 2, C169
 Auxiliary signals:
 - Cruise control system
 - Speed signal
 - Start request to engine control module (keyless start 1 + 2)
 - Terminal 50
 - Crash signal from airbag control Module

*eSelf-Study Program 920243*

As shown below, DTC P03AF corresponds to a condition where Cylinder 3 pressure is too high (implying that at least combustion pressure in Cylinder 3 is measured). The PCM calculates combustion pressure derived from the knock sensor input.

2014 Volkswagen Passat Sedan (A32) L4-1.8L Turbo (CPKA)

Vehicle » A L L Diagnostic Trouble Codes (DTC) » Testing and Inspection » P Code Charts » P03AF » Engine Control Module, 2015 MY

ENGINE CONTROL MODULE, 2015 MY**Engine Control Module, 2015 MY**

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		Case 2: Ratio between normalised engine roughness and misfire detection threshold \leq n.a. [-] Or Case 3: Ratio between filtered engine roughness and misfire detection threshold \leq n.a. [-] Or Ratio between normalised engine roughness and misfire detection threshold \leq n.a. [-]				
P03AF Cylinder 3 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time $\geq 9,000.0$ to $11,700.0^{\circ}$ CRK Or Ratio between knock sensor and	Engine running ECT @ cylinder block $> 60^{\circ}$ C Engine speed $1,216$ to $6,400$ RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk	900.0° CRK Continuous	2 DCY	Check the Knock Sensor 1 (G61). Refer to ⇒ Knock Sensor 1 (G61) Checking .

P03AF Cylinder 3 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] For time >= 5,760.0 to 6,840.0° CRK Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Dynamic engine speed not active Delay time n.a.	900.0° CRK Continuo us	2 DCV	Check the Knock Sensor (G61). Refer to ul. Knock Sensor (G61). Checklist.
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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitori ng Time Length	MIL Illumin ation	Component Diagnostic Procedure
		Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 12,960.0 to 16,740.0° CRK Or Torque limitation factor < 0.90 [-]				
		Fast detection: Ratio between knock sensor and knock threshold in main knock window > 1.50 to 2.50 [-] For time >= 540.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] For time >= 360.0° CRK Case 1: Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Misfire detection active Dynamic engine speed not active Delay time n.a.			

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	CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] For time >= 360.0° CRK Case 1) Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] Or	1,216 to 6,400 RPM Engine load n.s. % Mass air flow > 403.0 to 501.0 mg/stk Misfire detection active Dynamic engine speed not active Delay time n.s.			
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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		<p>Case 2: Ratio between normalised engine roughness and misfire detection threshold \leq n.a. Or Case 3: Ratio between filtered engine roughness and misfire detection threshold \leq n.a. Or Ratio between normalised engine roughness and misfire detection threshold \leq n.a. </p>				
P0389 Cylinder 8 Pressure Too High	Knock Control Function Check	<p>Slow detection: Ratio between knock sensor and knock threshold in main knock window > 7.0 to 3.0 For time \geq 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 For time \geq 5,760.0 to 6,840.0° CRK Or</p>	<p>Engine running ECT @ cylinder block $> 60^{\circ}$ C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Dynamic engine speed not active Delay time n.a.</p>	900.0° CRK Continuous	2 DCY	<p>Check the Knock Sensor 1 (G61) Refer to → <u>Knock sensor 1 (G61) Checking </u></p>

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ALLDATA

The ECM/PCM detects cylinder pressure as demonstrated by the Diagnostic Trouble Code (DTC) shown above. Based upon information and belief, the cylinder pressure is measured at least at two discrete times during a combustion cycle.

Figure 94

As shown below, DTC P03AF corresponds to a condition where Cylinder 3 pressure is too high (implying that at least combustion pressure in Cylinder 3 is measured). The PCM calculates combustion pressure derived from the knock sensor input. Additionally, the PCM calculates the cylinder pressure (combustion pressure) at two discrete times in both the main knock window and the pre-knock window, the net pressure (difference between second and first discrete combustion pressure measurements) is calculated.

2014 Volkswagen Passat Sedan (A32) L4-1.8L Turbo (CPKA)

Vehicle » A L L Diagnostic Trouble Codes (DTC) » Testing and Inspection » P Code Charts » P03AF » Engine Control Module, 2015 MY

ENGINE CONTROL MODULE, 2015 MY**Engine Control Module, 2015 MY**

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		Case 2: Ratio between normalised engine roughness and misfire detection threshold \leq n.a. [-] Or Case 3: Ratio between filtered engine roughness and misfire detection threshold \leq n.a. [-] Or Ratio between normalised engine roughness and misfire detection threshold \leq n.a. [-]				
P03AF Cylinder 3 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time $\geq 9,000.0$ to $11,700.0^{\circ}$ CRK Or Ratio between knock sensor and	Engine running ECT @ cylinder block $> 60^{\circ}$ C Engine speed $1,216$ to $6,400$ RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk	900.0° CRK Continuous	2 DCY	Check the Knock Sensor 1 (G61). Refer to ⇒ Knock Sensor 1 (G61) Checking .

P03AF Cylinder 3 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] For time >= 5,760.0 to 6,840.0° CRK Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Dynamic engine speed not active Delay time n.a.	900.0° CRK Continuo us	2 DCV	Check the Knock Sensor (IG61). Refer to ul. Knock Sensor (IG61). Checklist.)
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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitor ing Time Length	MIL Illumin ation	Component Diagnostic Procedure
		Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 12,960.0 to 16,740.0° CRK Or Torque limitation factor < 0.90 [-]				
		Fast detection: Ratio between knock sensor and knock threshold in main knock window > 1.50 to 2.50 [-] For time >= 540.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] For time >= 360.0° CRK Case 1: Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Misfire detection active Dynamic engine speed not active Delay time n.a.			

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	CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] For time >= 350.0° CRK Case 1: Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] Or	1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Misfire detection active Dynamic engine speed not active Delay time n.a.			
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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitor ing Time Length	MIL Illumin ation	Component Diagnostic Procedure
		Case 2: Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-] Or Case 3: Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-] Or Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-] Or				
P0389 Cylinder 4 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] For time >= 5,760.0 to 6,840.0° CRK Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Dynamic engine speed not active Delay time n.a.	900.0° CRK Continu us	2 DCY	Check the Knock Sensor 1 (G61) : Refer to [] Appendix 1 (G61) []

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ALLDATA

The ECM/PCM detects cylinder pressure as demonstrated by the Diagnostic Trouble Code (DTC) shown above. Based upon information and belief, the ECM/PCM calculates a net combustion pressure change based on measured combustion pressures in service of achieving maximum brake torque (MBT).

Figure 95

The '497 patent Accused Instrumentalities practice a method of controlling an internal combustion engine, said engine having at least one cylinder, wherein said method comprises calculating the second derivative of said net combustion pressure change.

2014 Volkswagen Passat Sedan (A32) L4-1.8L Turbo (CPKA)

Vehicle » A L L Diagnostic Trouble Codes (DTC) » Testing and Inspection » P Code Charts » P03AF » Engine Control Module, 2015 MY

ENGINE CONTROL MODULE, 2015 MY**Engine Control Module, 2015 MY**

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		Case 2: Ratio between normalised engine roughness and misfire detection threshold \leq n.a. [-] Or Case 3: Ratio between filtered engine roughness and misfire detection threshold \leq n.a. [-] Or Ratio between normalised engine roughness and misfire detection threshold \leq n.a. [-]				
P03AF Cylinder 3 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time $\geq 9,000.0$ to $11,700.0^{\circ}$ CRK Or Ratio between knock sensor and	Engine running ECT @ cylinder block $> 60^{\circ}$ C Engine speed $1,216$ to $6,400$ RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk	900.0° CRK Continuous	2 DCY	Check the Knock Sensor 1 (G61). Refer to ⇒ (Knock Sensor 1 (G61) Checking).

P03AF Cylinder 3 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] For time >= 5,760.0 to 6,840.0° CRK Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Dynamic engine speed not active Delay time n.a.	900.0° CRK Continuo us	2 DCV	Check the Knock Sensor 1 (G61). Refer to ul. Knock Sensor 1 (G61). Checklist.
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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitori ng Time Length	MIL Illumin ation	Component Diagnostic Procedure
		Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 12,960.0 to 16,740.0° CRK Or Torque limitation factor < 0.90 [-]				
		Fast detection: Ratio between knock sensor and knock threshold in main knock window > 1.50 to 2.50 [-] For time >= 540.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] For time >= 360.0° CRK Case 1: Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Misfire detection active Dynamic engine speed not active Delay time n.a.			

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		CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] For time >= 350.0° CRK Case 1: Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] Or	1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Misfire detection active Dynamic engine speed not active Delay time n.a.			
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Zoom

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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitori ng Time Length	MIL Illumin ation	Component Diagnostic Procedure
		Case 2: Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-] Or Case 3: Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-] Or Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-] Or				
P0389 Cylinder # Pressure Too High	#knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] For time >= 5,760.0 to 6,840.0° CRK Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Dynamic engine speed not active Delay time n.a.	900.0° CRK Continu us	2 DCY	Check the Knock Sensor 1 (G61) : Refer to [] Appendix 1 (G61) Troubleshooting

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ALLDATA

The ECM/PCM has the ability to detect cylinder pressure at two discrete times as demonstrated by the Diagnostic Trouble Code (DTC) shown above. Based upon information and belief, the ECM/PCM calculates a second derivative of said net combustion pressure change.

Figure 96

The '497 patent Accused Instrumentalities comprise a method of controlling an internal combustion engine, said engine having at least one cylinder, wherein said method comprises calculating the maximum acceleration point of said net combustion pressure change from said second derivative of said net combustion pressure change.

2014 Volkswagen Passat Sedan (A32) L4-1.8L Turbo (CPKA)

Vehicle » A L L Diagnostic Trouble Codes (DTC) » Testing and Inspection » P Code Charts » P03AF » Engine Control Module, 2015 MY

ENGINE CONTROL MODULE, 2015 MY**Engine Control Module, 2015 MY**

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		Case 2: Ratio between normalised engine roughness and misfire detection threshold \leq n.a. [-] Or Case 3: Ratio between filtered engine roughness and misfire detection threshold \leq n.a. [-] Or Ratio between normalised engine roughness and misfire detection threshold \leq n.a. [-]				
P03AF Cylinder 3 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time $\geq 9,000.0$ to $11,700.0^{\circ}$ CRK Or Ratio between knock sensor and	Engine running ECT @ cylinder block $> 60^{\circ}$ C Engine speed $1,216$ to $6,400$ RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk	900.0° CRK Continuous	2 DCY	Check the Knock Sensor 1 (G61). Refer to ⇒ Knock Sensor 1 (G61) Checking .

P03AF Cylinder 3 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] For time >= 5,760.0 to 6,840.0° CRK Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Dynamic engine speed not active Delay time n.a.	900.0° CRK Continuo us	2 DCV	Check the Knock Sensor 1 (G61). Refer to ul. Knock Sensor 1 (G61). Checklist.
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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitori ng Time Length	MIL Illumin ation	Component Diagnostic Procedure
		Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 12,960.0 to 16,740.0° CRK Or Torque limitation factor < 0.90 [-]				
		Fast detection: Ratio between knock sensor and knock threshold in main knock window > 1.50 to 3.50 [-] For time >= 540.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] For time >= 360.0° CRK Case 1: Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Misfire detection active Dynamic engine speed not active Delay time n.a.			

Zoom

Sized for Print

		CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] For time >= 350.0° CRK Case 1: Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] Or	1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Misfire detection active Dynamic engine speed not active Delay time n.a.			
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Zoom

Sized for Print

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitori ng Time Length	MIL Illumin ation	Component Diagnostic Procedure
		Case 2: Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-] Or Case 3: Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-] Or Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-] Or				
P0389 Cylinder # Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] For time >= 5,760.0 to 6,840.0° CRK Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Dynamic engine speed not active Delay time n.a.	900.0° CRK Continu us	2 DCY	Check the Knock Sensor 1 (G61) : Refer to [] Appendix 1 (G61) Troubleshooting

Zoom

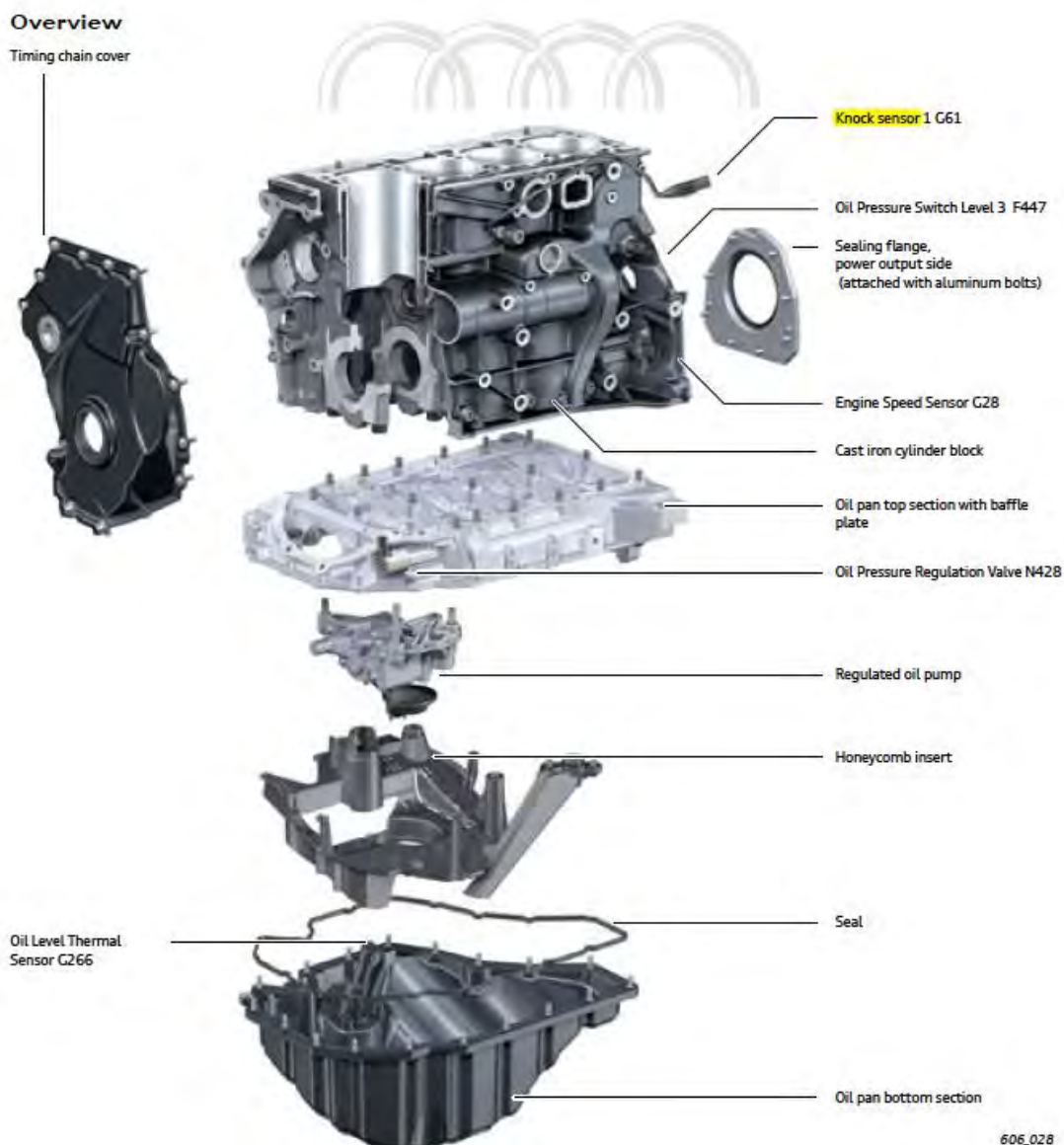
Sized for Print

ALLDATA

The ECM/PCM has the ability to detect cylinder pressure at two discrete times as demonstrated by the Diagnostic Trouble Code (DTC) shown above. Based upon information and belief, the ECM/PCM calculates a maximum acceleration point of a net combustion pressure change from said second derivative of said net combustion pressure change.

Figure 97

The '497 patent Accused Instrumentalities comprise a method of controlling an internal combustion engine, said engine having at least one cylinder, wherein said method comprises varying the spark timing of said engine until said maximum acceleration point is aligned with top dead center to achieve maximum braking torque spark timing.



The ECM has the ability to retard ignition timing (vary spark timing) based on knock detection as this has been the state of the art for quite some time. Based upon information and belief, the ECM varies the spark timing of the engine until the maximum acceleration point is aligned with top dead center to achieve maximum braking torque spark timing.

Figure 98

Based upon the totality of the foregoing evidence, and based further upon information and belief, the '497 patent Accused Instrumentalities practice "a method of controlling an internal combustion engine, said engine having at least one cylinder, said method comprising the steps of: measuring the combustion pressure in said at least one cylinder at at least two discrete times during a combustion cycle; calculating a net combustion pressure change in said at least one cylinder based on said measured combustion pressures; calculating the second derivative of said net combustion pressure change; calculating the maximum acceleration point of said net combustion pressure change from said second derivative of said net combustion pressure change;

and varying the spark timing of said engine until said maximum acceleration point is aligned with top dead center to achieve maximum braking torque spark timing.”

COUNT XIV – INVIOLATION OF U.S. PATENT NO. 6,571,157

101. The allegations set forth in the foregoing paragraphs 1 through 100 are incorporated into this Fourteenth Claim for Relief.

102. On May 23, 2003, U.S. Patent No. 6,571,157 (“the ’157 patent”), entitled “Oil Pressure Diagnostic Strategy for a Hybrid Electric Vehicle,” was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the ’157 patent is attached as Exhibit 14.

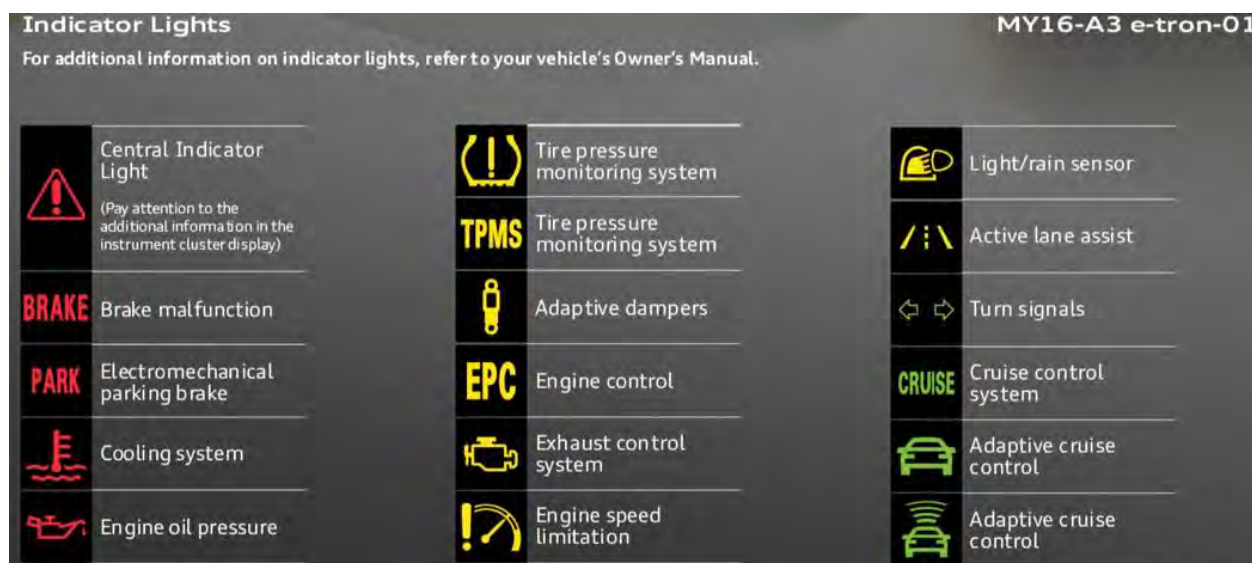
103. Plaintiff is the assignee and owner of the right, title and interest in and to the ’157 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

104. Upon information and belief, Defendants have directly infringed at least claims 1 and 14 of the ’157 patent by making, using, selling, importing and/or providing and causing to be used the 2013-2017 Volkswagen Jetta Hybrid and 2016-2018 Audi A3 Sportback e-tron (the “’157 patent Accused Instrumentalities”).

105. In particular, claim 1 of the ’157 patent recites a diagnostic system for controlling an engine low oil pressure indicator in a hybrid electric vehicle, comprising: a powertrain having an engine and an electric traction motor; an oil pressure sensor/sending unit mechanically connected to the engine; an engine speed sensor/sending unit mechanically connected to the engine; a controller having connections to the oil pressure sensor and engine speed sensor; a low oil pressure indicator electrically connected to the controller; a mode selector having modes for “off” and “run/start”; and the controller configured to prevent activation of the low oil pressure indicator when the mode selector is in the “run/start” mode and the engine is not running.

106. On information and belief, the '157 patent Accused Instrumentalities infringe claim 1 of the '157 patent. The '157 patent Accused Instrumentalities comprise a diagnostic system for controlling an engine low oil pressure indicator in a hybrid electric vehicle (*Figure 99*), comprising: a powertrain having an engine and an electric traction motor (*Figure 100*); an oil pressure sensor/sending unit mechanically connected to the engine (*Figure 101*); an engine speed sensor/sending unit mechanically connected to the engine (*Figure 102*); a controller having connections to the oil pressure sensor and engine speed sensor (*Figure 103*); a low oil pressure indicator electrically connected to the controller (*Figure 104*); a mode selector having modes for “off” and “run/start” (*Figure 105*); and the controller configured to prevent activation of the low oil pressure indicator when the mode selector is in the “run/start” mode and the engine is not running (*Figure 106*).

As demonstrated in the exemplary images below, the '157 patent Accused Instrumentalities comprise a data bus diagnostic interface, which controls an engine low oil pressure indicator via the CAN data Bus, Engine Control Module (ECM), and dash panel.



Audi eTron dashboard engine oil pressure indicator example from the owner's manual

4 Oil Filter/Oil Pressure Switch

⇒ "4.1 Overview - Oil Filter/Oil Pressure Switch", page 309

⇒ "4.3 Oil Pressure Switch F1 / Reduced Oil Pressure Switch F378, Removing and Installing", page 312

⇒ "4.2 Oil Pressure Switch F22, Removing and Installing", page 310

⇒ "4.4 Oil Pressure Regulation Valve N428, Removing and Installing", page 314

⇒ "4.5 Oil Pressure, Checking", page 314

4.1 Overview - Oil Filter/Oil Pressure Switch

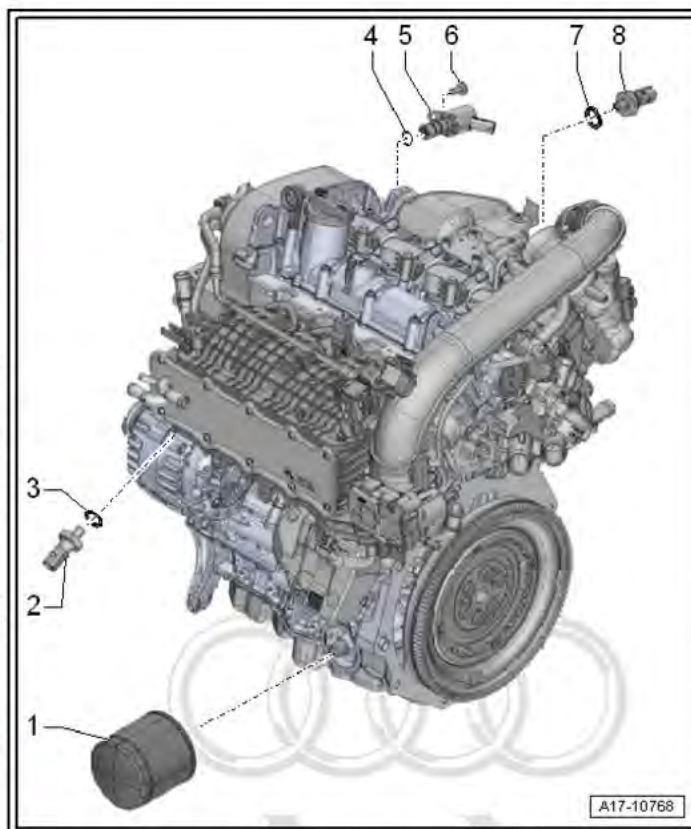
1 - Oil Filter

- ☐ See note. Refer to ⇒ [page 284](#) .
- ☐ Removing and installing. Refer to ⇒ Maintenance ; Booklet 821 .
- ☐ Secure loosened oil filter threaded connection. Refer to ⇒ [Fig. "Retainer Threaded Connection for the Oil Filter"](#), page 310 .

2 - Oil Pressure Switch

- ☐ 20 Nm
- ◆ 1.2L TFSI (without oil pressure regulation): Oil Pressure Switch - F1-
- ◆ 1.4L TFSI (with oil pressure regulation): Reduced Oil Pressure Switch - F378-
 - ☐ Switching pressure: 0.3 to 0.6 bar (4.351 to 8.702 psi)
 - ☐ Green insulation
 - ☐ Check in [Guided Fault Finding](#). Refer to Vehicle Diagnostic Tester .
 - ☐ Removing and installing. Refer to ⇒ ["4.3 Oil Pressure Switch F1 / Reduced Oil Pressure Switch F378, Removing and Installing"](#), page 312 .

3 - Seal



Internal combustion engine

The A3 Sportback e-tron uses the EA211 series 1.4l engine. Because the transmission is 2.26 in (57.5 mm) longer to accommodate the e-machine, the engine is mounted further to the right than in the standard A3 Sportback.

The main bearings, the connecting rod big end bearings and the piston rings of this engine have special coatings. In addition, piston backlash has been adapted and the cylinder liners are plasma-coated.

The Audi A3 Sportback e-tron can be driven in electric-only mode. This can result in periods of time during which the internal combustion engine is not in use.

During electric-only driving, the internal combustion engine can start in order to heat up the catalytic converter.

To ensure wear-free starting of the internal combustion engine after electric-only operation, clutch K0 closes and the e-machine turns the engine over until sufficient oil pressure is obtained.

In the U.S. market, the engine is also equipped with secondary air injection.

Figure 99

As demonstrated in the exemplary images below, the '157 patent Accused Instrumentalities comprise an electric traction motor (Electro-drive Drive Motor V141).

High voltage battery

Overview of hybrid components

The following high voltage components are installed in the Audi A3 Sportback e-tron:

Power electronics

It converts the direct current stored in the high voltage battery to alternating current for the e-machine. The power electronics are cooled by the low-temperature cooling circuit 2.

Engine

Four cylinder engine with turbocharger :
+ 1.4l TFSI 147 hp (110 kW)

Charging port

The all-purpose charging cable can be used to charge the high voltage battery at both household outlets and commercial outlets using an interchangeable connecting plug (120 V AC and 240 V AC).

Electric AC compressor

The electric AC compressor is integrated into the high voltage system and cools both the passenger compartment and Hybrid Battery Unit AX1 as required.

Electrical brake servo

The dependencies governing the utilization of braking torque lead to electrical deceleration fluctuations which have to be compensated hydraulically in accordance with the driver's wishes. The main focal points during the development of the electrical brake servo were fully utilizing the deceleration potential of the e-machine under driver initiated braking and extending the electric driving range of the e-machine.

PTC heater

High Voltage Heater (PTC) Z115 is connected to High Voltage Battery Charger 1 AX4 by a high voltage wire. It heats the coolant for the passenger compartment heat exchanger during electric driving and is also integrated in the stationary air conditioning function.

e-machine (Electro-drive Drive Motor V141)

The e-machine is connected to the transmission via clutch K0. It is able to generate a braking torque at the wheel in dependence on RPM, battery temperature and state of charge.

6-speed dual clutch transmission

S tronic
Consists of 2 sub-gearboxes engaged by multi-plate clutches K1 and K2. It is possible to select between 3 drive programs using the selector lever.



Information

All high voltage components are connected to the vehicle chassis via equipotential bonding. The equipotential bonding is a low-resistance wire or bolted connection, connecting the high voltage components to the vehicle chassis.

24

Figure 100

As demonstrated in the exemplary images below, the '157 patent Accused Instrumentalities comprise an oil pressure sensor/sending unit (# 2) mechanically connected to the engine.

4 Oil Filter/Oil Pressure Switch

⇒ "4.1 Overview - Oil Filter/Oil Pressure Switch", page 309

⇒ "4.3 Oil Pressure Switch F1 / Reduced Oil Pressure Switch F378, Removing and Installing", page 312

⇒ "4.2 Oil Pressure Switch F22, Removing and Installing", page 310

⇒ "4.4 Oil Pressure Regulation Valve N428, Removing and Installing", page 314

⇒ "4.5 Oil Pressure, Checking", page 314

4.1 Overview - Oil Filter/Oil Pressure Switch

1 - Oil Filter

- ☐ See note. Refer to [⇒ page 284](#).
- ☐ Removing and installing. Refer to ⇒ Maintenance ; Booklet 821.
- ☐ Secure loosened oil filter threaded connection. Refer to [⇒ Fig. "Retainer Threaded Connection for the Oil Filter", page 310](#).

2 - Oil Pressure Switch

- ☐ 20 Nm
- ◆ 1.2L TFSI (without oil pressure regulation): Oil Pressure Switch - F1-
- ◆ 1.4L TFSI (with oil pressure regulation): Reduced Oil Pressure Switch - F378-
- ☐ Switching pressure: 0.3 to 0.6 bar (4.351 to 8.702 psi)
- ☐ Green insulation
- ☐ Check in [Guided Fault Finding](#). Refer to Vehicle Diagnostic Tester.
- ☐ Removing and installing. Refer to [⇒ "4.3 Oil Pressure Switch F1 / Reduced Oil Pressure Switch F378, Removing and Installing", page 312](#).

3 - Seal

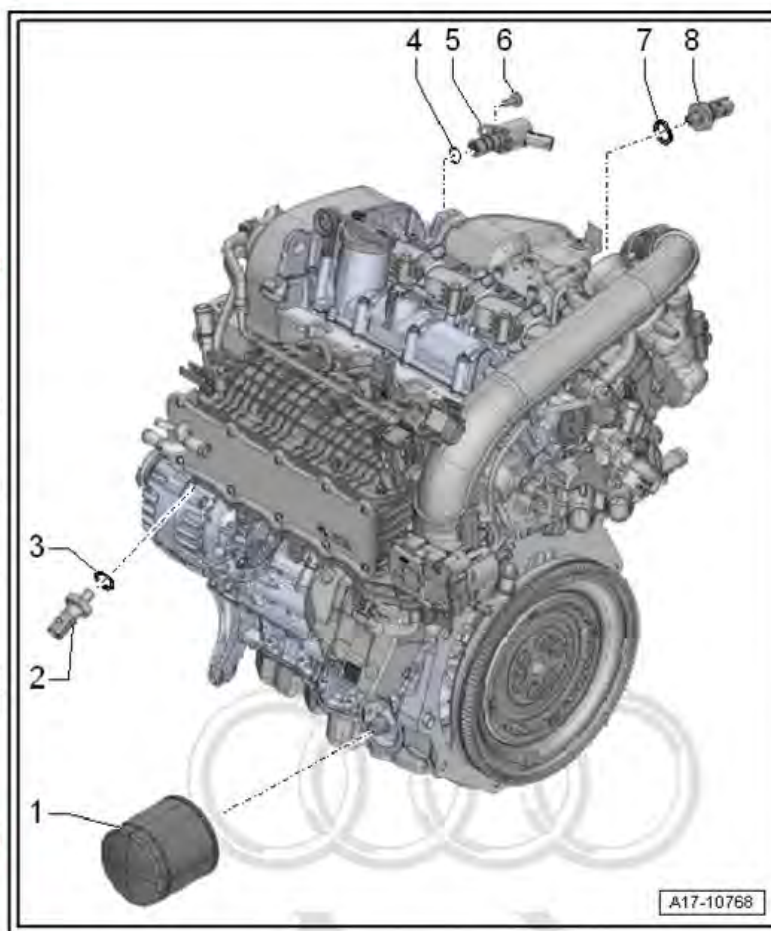


Figure 101

As demonstrated in the exemplary images below, the '157 patent Accused Instrumentalities comprise an engine speed sensor/sending unit (G28) mechanically connected to the engine.

1.1 Overview - Ignition System

1 - Bolt

- ☐ 20 Nm
- ☐ The tightening specifications affect function of the knock sensor

2 - Knock Sensor 1 - G61-

- ☐ Removing and installing. Refer to ["1.4 Knock Sensor 1 G61, Removing and Installing", page 543](#).

3 - Spark Plug

- ☐ Tightening specification. Refer to ["Maintenance", Booklet 821](#).
- ☐ Remove and install with the Spark Plug Removal Tool - 3122B-. Refer to ["Maintenance", Booklet 821](#).
- ☐ Replacement interval. Refer to ["Maintenance Intervals; Rep. Gr. 03"](#).

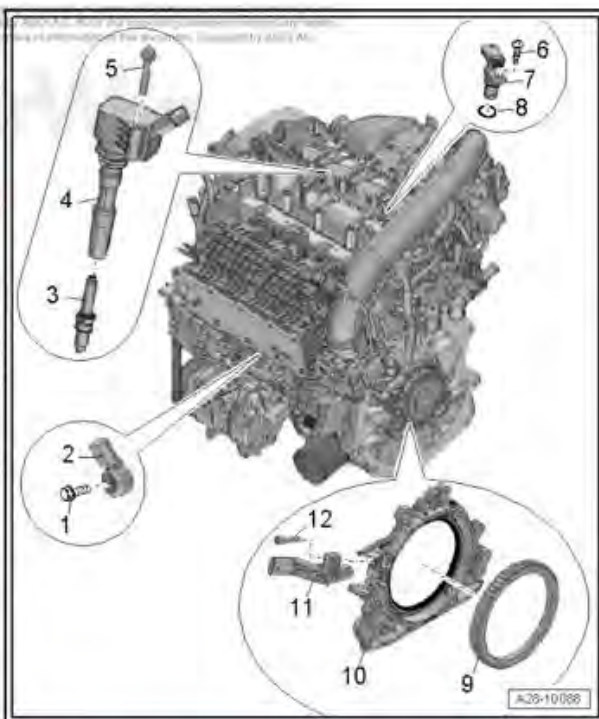
4 - Ignition Coil with Power Output Stage

- ◆ Ignition Coil 1 with Power Output Stage - N70-
- ◆ Ignition Coil 2 with Power Output Stage - N127-
- ◆ Ignition Coil 3 with Power Output Stage - N291-
- ◆ Ignition Coil 4 with Power Output Stage - N292-

- ☐ Removing and installing. Refer to ["1.3 Ignition Coils with Power Output Stages, Removing and Installing", page 541](#).


5 - Bolt

- ☐ 8 Nm



540

Rep. Gr.28 - Ignition/Glow Plug System

Audi A3 2013 ► , Audi A3 Sportback China 2014 ►
 4-Cylinder Direct Injection 1.2L; 1.4L 4V TFSI Engine (EA211) - Edition 03.2018 

6 - Bolt

- ☐ 8 Nm

7 - Camshaft Position Sensor - G40-

- ☐ Removing and installing. Refer to ["1.5 Camshaft Position Sensor, Removing and Installing", page 544](#).
- ☐ Engine codes CPTA, CZE4, CWLA, CSSA, CUKB, CXUA: also Camshaft Position Sensor 2 - G163-

8 - O-ring

- ☐ Replace if damaged

9 - Sensor Wheel

- ☐ For the Engine Speed Sensor - G28-
- ☐ Unit with sealing flange on the transmission side

10 - Transmission Side Sealing Flange

- ☐ Removing and installing. Refer to ["2.3 Sealing Flange, Removing and Installing, Transmission Side", page 111](#).

11 - Engine Speed Sensor - G28-

- ☐ Removing and installing. Refer to ["1.6 Engine Speed Sensor G28, Removing and Installing", page 547](#).

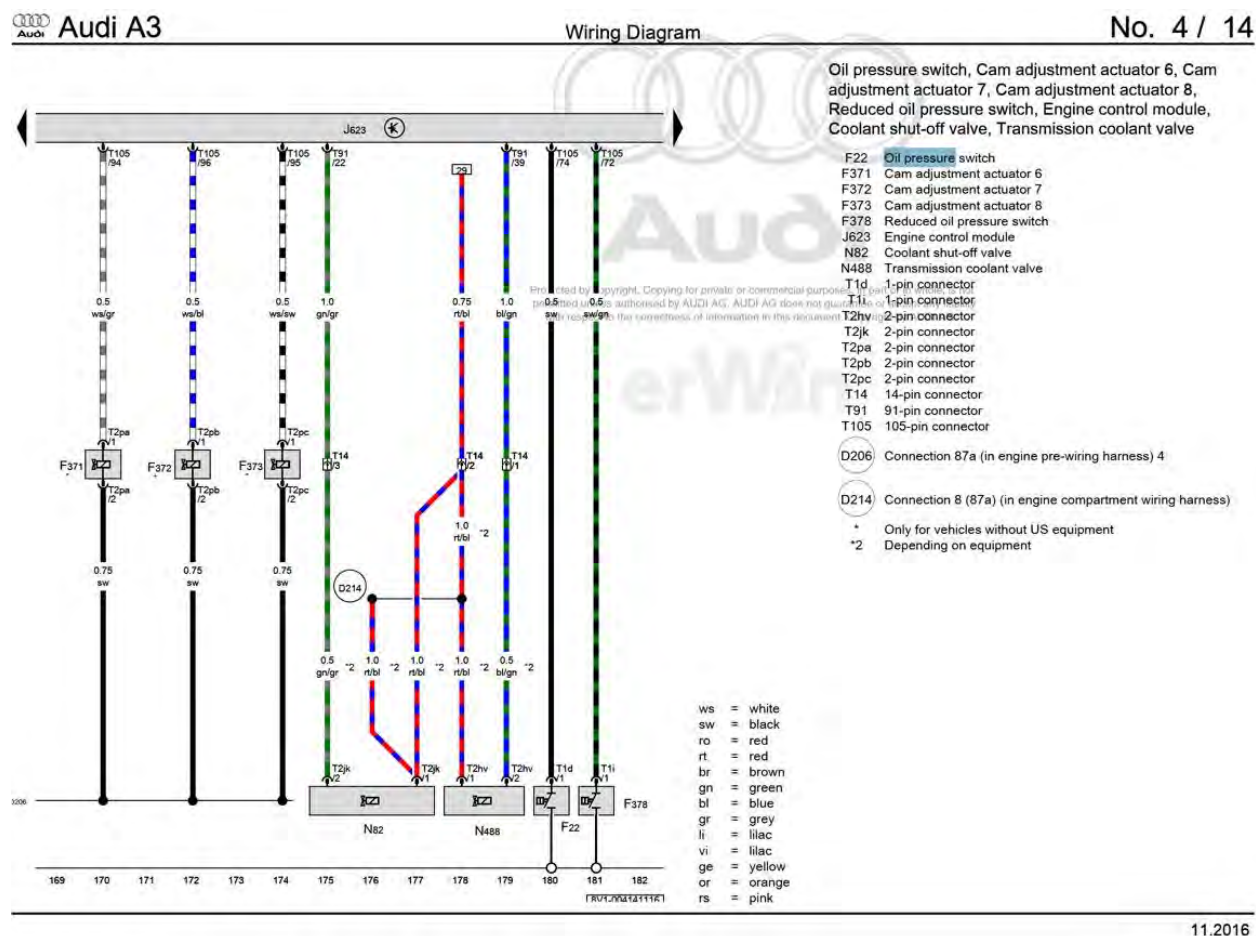
12 - Bolt

- ☐ 4.5 Nm

Figure 102

The '157 patent Accused Instrumentalities comprise a Controller Area Network (CAN), the ECM and have connections to the oil pressure sensor and the engine speed sensor via the ECM.

As implied in the exemplary image immediately below, the oil pressure sender is connected to the ECM (J623).



As implied in the exemplary image immediately below, the engine speed sensor is connected to the PCM which receives and evaluates signals and send those signals out on the Controller Area Network (CAN data bus).

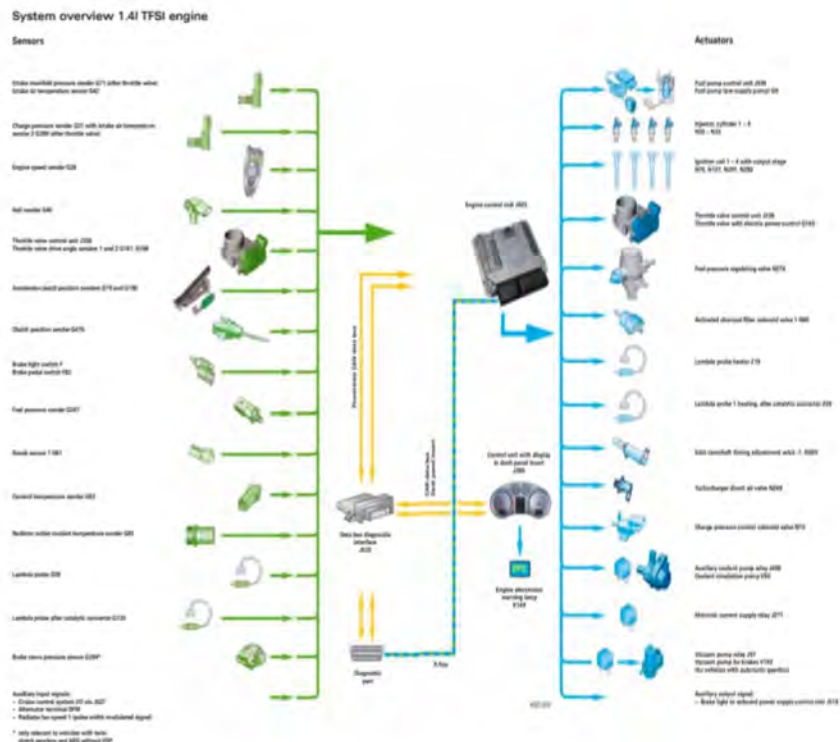


Figure 103

The '157 patent Accused Instrumentalities comprise the CAN data bus, which is a controller electrically connected to the low oil pressure indicator in the dash panel via the ECM, as shown in the exemplary images below.

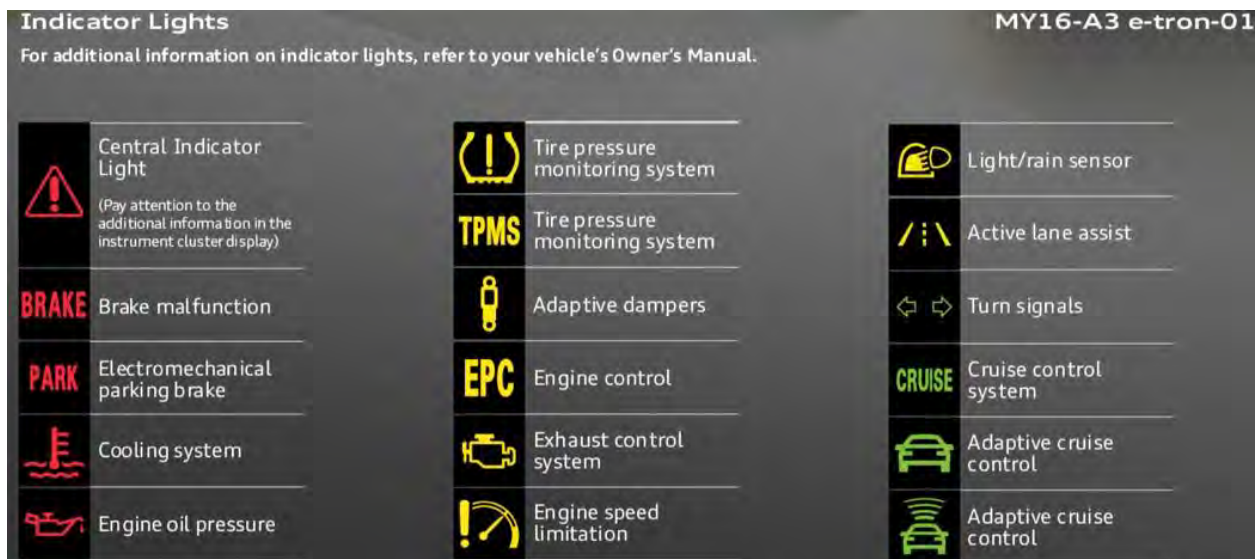
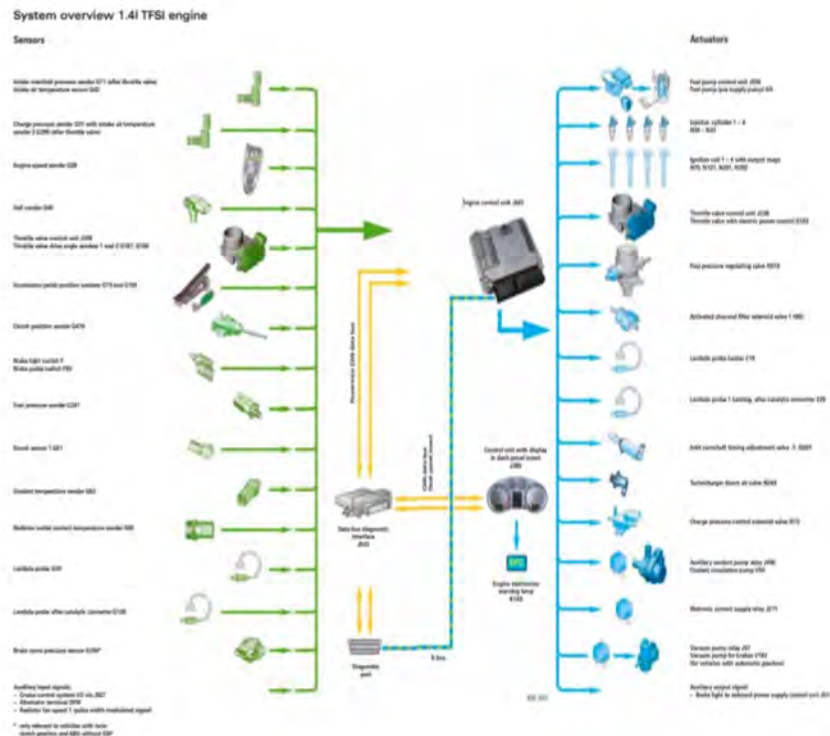
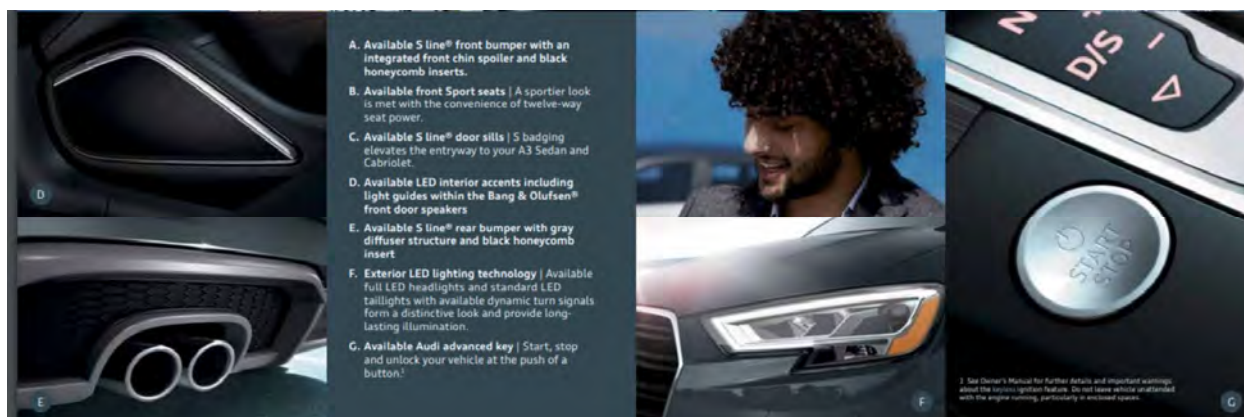


Figure 104

The '157 patent Accused Instrumentalities comprise a mode selector having modes for “off” and “run/start.



Audi A3 Owner's Manual

Figure 105

As demonstrated in the exemplary images below, the '157 patent Accused Instrumentalities comprise the Hybrid Manager software in the ECM J623 that prevents activation of the low oil pressure indicator when the vehicle comes to a stop (engine auto stop when vehicle in run/start mode) or during electric motor only driving.

Hybrid manager

The software of Engine Control Module J623 has been extended to include the hybrid manager function.

- ▶ Operating strategy.
- ▶ Torque distribution to Electro-drive Drive Motor V141 and the internal combustion engine.
- ▶ High voltage coordinator.
- ▶ Recuperation under braking and acceleration.
- ▶ Control of the coolant circuits.

The following hybrid-specific functions of the vehicle are controlled by the hybrid manager.

- ▶ Control of hybrid displays.
- ▶ Power meter.
- ▶ Display in dash panel insert.
- ▶ MMI energy flow diagrams.
- ▶ e-tron statistics.

Internal combustion engine

The A3 Sportback e-tron uses the EA211 series 1.4l engine. Because the transmission is 2.26 in (57.5 mm) longer to accommodate the e-machine, the engine is mounted further to the right than in the standard A3 Sportback.

The main bearings, the connecting rod big end bearings and the piston rings of this engine have special coatings. In addition, piston backlash has been adapted and the cylinder liners are plasma-coated.

The Audi A3 Sportback e-tron can be driven in electric-only mode. This can result in periods of time during which the internal combustion engine is not in use.

During electric-only driving, the internal combustion engine can start in order to heat up the catalytic converter.

To ensure wear-free starting of the internal combustion engine after electric-only operation, clutch K0 closes and the e-machine turns the engine over until sufficient **oil pressure** is obtained.

In the U.S. market, the engine is also equipped with secondary air injection.

Engine start

The internal combustion engine is started by the e-machine. Unlike the Q5 hybrid quattro, there is no 12V starter motor. Engine Control Module J623 sends a start message to DSG Transmission Mechatronic Module J743. Clutch K0 is closed and connects the e-machine rotor to the internal combustion engine's crankshaft. The rotor brings the engine's crankshaft up to starting speed. J623 then enables the ignition and fuel injection and the engine starts.

If it is necessary for the internal combustion engine to start when the vehicle is running in electric-only mode, the torque from the e-machine is increased by the amount necessary to start the internal combustion engine when the clutch closes. This prevents judder. After starting, clutch K0 is opened and the internal combustion engine runs at no load. After the speed of the internal combustion engine has been adapted to that of the e-machine, clutch K0 is closed again.

Audi A3 Owner's Manual

Figure 106

107. Claim 14 of the '157 patent recites the diagnostic system of claim 1, wherein the low oil pressure indicator comprises a lamp.

108. On information and belief, the '157 patent Accused Instrumentalities infringe claim 14 of the '157 patent. The '157 patent Accused Instrumentalities comprise the diagnostic system of claim 1, wherein the low oil pressure indicator comprises a lamp (*Figure 107*).

As shown below, the '157 patent Accused Instrumentalities comprise a lamp to indicate low oil pressure.

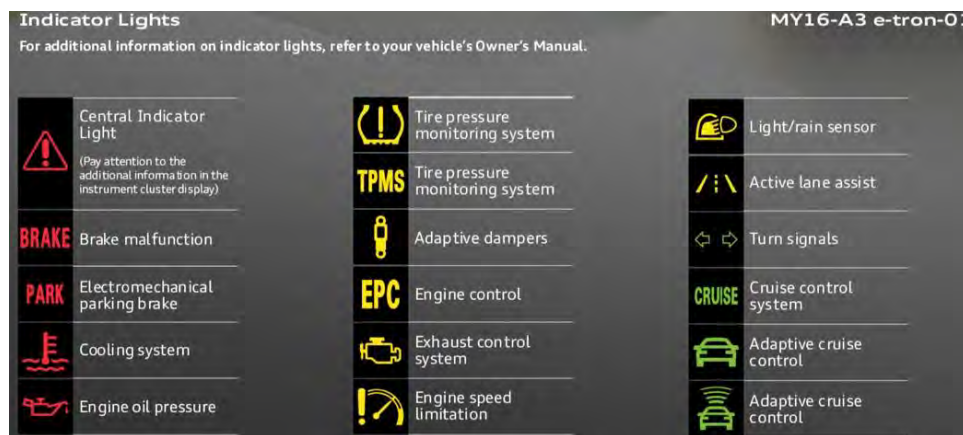


Figure 107

COUNT XV – INFRINGEMENT OF U.S. PATENT NO. 6,736,122

109. The allegations set forth in the foregoing paragraphs 1 through 108 are incorporated into this Fifteenth Claim for Relief.

110. On May 18, 2004, U.S. Patent No. 6,736,122 (“the ’122 patent”), entitled “Motor Vehicle Engine Synchronization,” was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the ’122 patent is attached as Exhibit 15.

111. Plaintiff is the assignee and owner of the right, title and interest in and to the ’122 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

112. Upon information and belief, Defendants have directly infringed at least claim 1 of the ’122 patent by making, using, selling, importing and/or providing and causing to be used the 2012-2018 Tiguan, 2012-2018 Audi A3, 2012-2018 Audi A4, 2012-2018 Audi A5, 2012-2018 Audi A6, 2016-2018 Audi TT, 2015-2018 Audi S3, 2015-2018 VW Golf, 2012-2018 VW Golf GTI, 2015-2018 VW Golf R, 2015-2018 Golf Sportwagon, 2013-2018 Jetta GLI, 2014-2018 VW Jetta Sedan, 2014-2018 VW Passat, 2012-2017 WV CC, 2012-2018 VW Beetle, 2018 VW Atlas, 2015-2018 Audi Q3, 2012-2018 Audi Q5, and 2017-2018 Porsche Macan with the EA888 (the “’122 patent Accused Instrumentalities”).

113. In particular, claim 1 of the ’122 patent recites an internal combustion engine, comprising a number of cylinders, the or each cylinder containing a four-stroke reciprocating piston, an exhaust conduit, one or more engine operating condition sensors including an exhaust gas sensor in the exhaust conduit for measuring the composition of the exhaust gas, a fuel injection system, and an engine management system for controlling the operation of the engine including the fuel injection system and the air/fuel ratio for at least one cylinder, wherein the engine management system contains engine operation data, the engine operation data being related to expected engine operation with engine fueling on the correct stroke and/or engine fueling on an incorrect stroke, and the engine management system is arranged to: a) receive from said sensor(s) respective signal(s); b) oscillate the air/fuel ratio between a relatively rich level

and a relatively lean level, the exhaust gas composition varying depending on the air/fuel ratio; c) reverse the direction of change of the air/fuel ratio when the exhaust gas composition is sensed as being indicative of rich engine operation or lean engine operation; d) determine the temporal characteristics of the oscillation in the air/fuel ratio; and e) determine whether or not the engine is being fueled on the correct stroke by comparing said temporal characteristics with said relevant engine operation data.

114. On information and belief, the '122 patent Accused Instrumentalities infringe claim 1 of the '122 patent. The '122 patent Accused Instrumentalities comprise an internal combustion engine (*Figure 108*), comprising a number of cylinders (*Figure 108*), the or each cylinder containing a four-stroke reciprocating piston (*Figure 108*), an exhaust conduit (*Figure 109*), one or more engine operating condition sensors including an exhaust gas sensor in the exhaust conduit for measuring the composition of the exhaust gas (*Figure 110*), a fuel injection system (*Figures 110-111*), and an engine management system for controlling the operation of the engine including the fuel injection system and the air/fuel ratio for at least one cylinder (*Figure 112*), wherein the engine management system contains engine operation data, the engine operation data being related to expected engine operation with engine fueling on the correct stroke and/or engine fueling on an incorrect stroke (*Figure 112*), and the engine management system (*Figure 112*) is arranged to: a) receive from said sensor(s) respective signal(s) (*Figure 113*); b) oscillate the air/fuel ratio between a relatively rich level and a relatively lean level, the exhaust gas composition varying depending on the air/fuel ratio (*Figure 114*); c) reverse the direction of change of the air/fuel ratio when the exhaust gas composition is sensed as being indicative of rich engine operation or lean engine operation (*Figure 115*); d) determine the temporal characteristics of the oscillation in the air/fuel ratio (*Figure 115*); and e) determine

whether or not the engine is being fueled on the correct stroke by comparing said temporal characteristics with said relevant engine operation data (*Figure 115*).

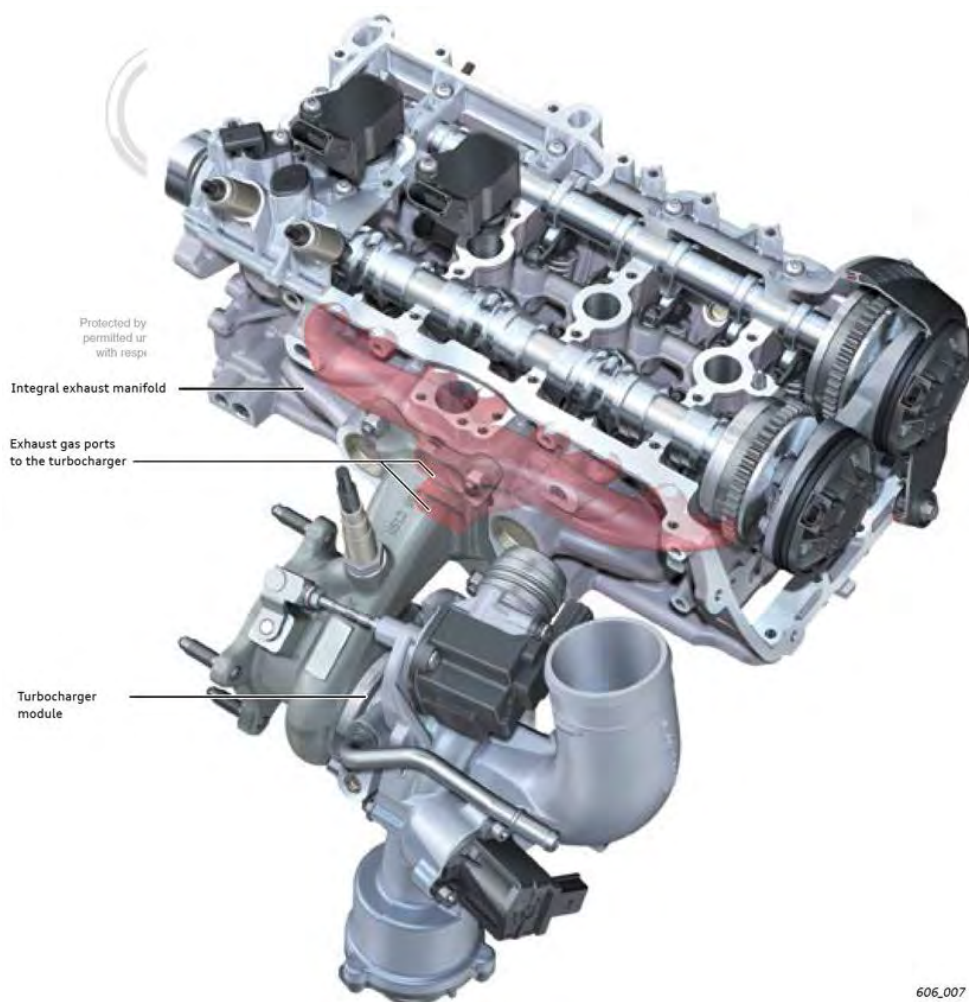
The '122 patent Accused Instrumentalities comprise an internal combustion engine, comprising a number of cylinders, the or each cylinder containing a four-stroke reciprocating piston.

The all-new 2018 Volkswagen Tiguan—the second-generation of the vehicle—is powered by the latest version of the EA888 four-cylinder engine, the 2.0L TSI EA888 Gen3 B-Cycle (Budack-cycle, earlier post), coupled with an 8-speed automatic. This is the only engine/transmission combination available in the Tiguan in the US. 4Motion with Active Control all-wheel drive system is optional. The core element of the new engine is a new combustion process combining short intake events with a high compression ratio.

<http://www.greencarcongress.com/2017/06/20170627-tiguan.html>

Figure 108

As depicted below, the integrated exhaust manifold is part of the exhaust conduit.



606_007

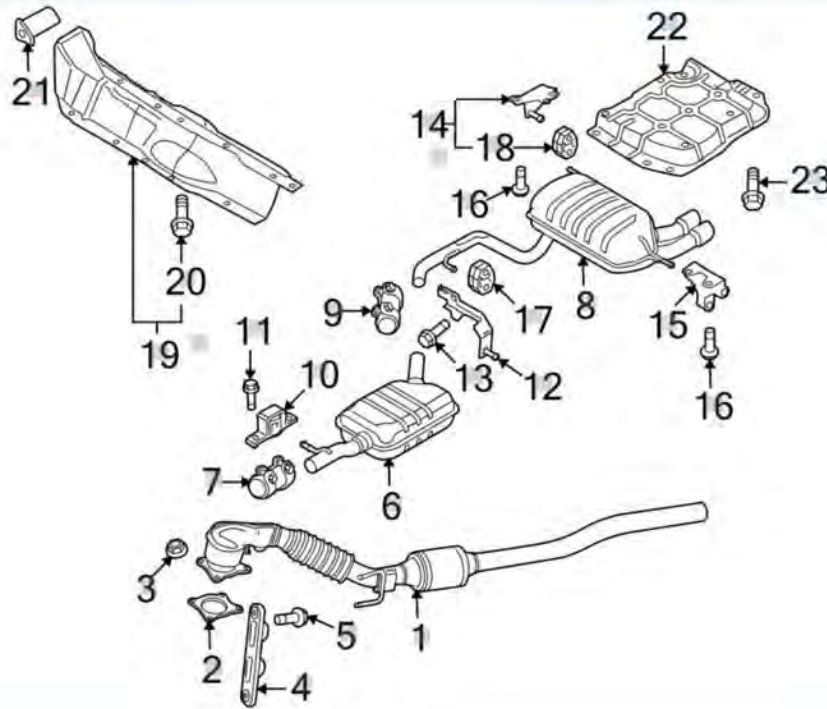
Home Volkswagen Tiguan 5N0254500SX EXHAUST COMPONENTS.

CATALYST, CATALYTIC CONVERTER, Converter & pipe., Q3, Tiguan, (5N0254500SX)
Tiguan Parts

EXHAUST COMPONENTS. (1/1)

This Fits Your Volkswagen Tiguan

MINIMIZE IMAGE



https://parts.vw.com/a/Volkswagen__Tiguan/48838109__5962725/EXHAUST-COMPONENTS/9245245.html

Figure 109

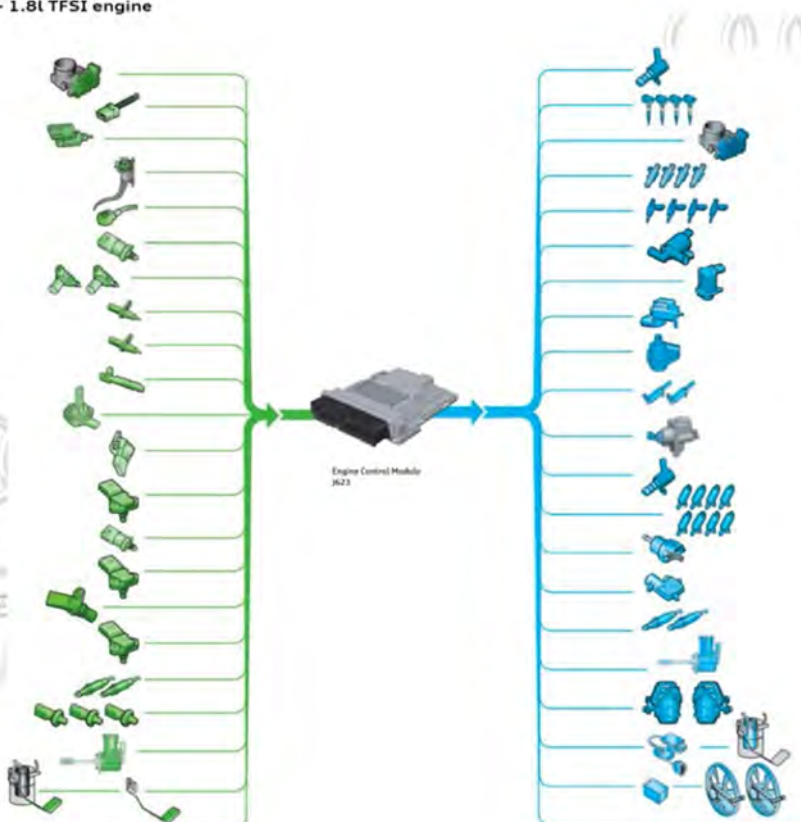
As shown below, the oxygen sensor is an exhaust gas sensor in the exhaust conduit for measuring the composition of the exhaust gas.

Engine management system

System overview example – 1.8l TFSI engine

Sensors

Throttle Valve Control Module J338
 EPC Throttle Drive Angle Sensors 1 & 2 G187, G188
 Brake Light Switch F
 Clutch Position Sensor G476
 Clutch Pedal Switch F36
 Clutch Pedal Starter Interlock Switch F194
 Accelerator Pedal Position Sensor G79
 Accelerator Pedal Position Sensor 2 G185
 Knock Sensor 1 G61
 Low Fuel Pressure Sensor G410
 Hall Sensor G40
 Hall Sensor 3 G300
 Engine Coolant Temperature Sensor G62
 Engine Coolant Temperature Sensor on Radiator Outlet G83
 Engine Speed Sensor G28
 Oil Level Thermal Sensor G266
 Intake Manifold Runner Position Switch G336
 Intake Air Temperature Sensor G42
 Manifold Absolute Pressure Sensor C71
 Fuel Pressure Sensor G247
 Charge Air Pressure Sensor G31
 Gear Recognition Sensor G66
 Brake Booster Pressure Sensor G294
 Heated Oxygen Sensor G39
 Oxygen Sensor after Three-Way Catalytic Converter G130
 Oil Pressure Switch F22
 Reduced Oil Pressure Switch F378
 Oil Pressure Switch, Level 3 F447
 Charge Pressure Actuator Position Sensor G581
 Fuel Level Sensor G
 Fuel Level Sensor 2, G189
 Auxiliary signals:
 - Cruise control system
 - Speed signal
 - Start request to engine control module (keyless start 1 + 2)
 - Terminal 50
 - Crash signal from airbag control Module



Actuators

Protein Cooling Nozzle Control Valve N522
 Ignition Coils 1 - 4 with Output Stage
 N70, N177, N291, N292
 EPC Throttle Drive G186
 Injectors 2, cylinders 3 - 4 N532 - N535
 All injectors generated in parallel with security
 in fuel assembly. Supplying N536, N537
 Injector, cylinders 1 - 4 N310 - N311
 Transmission Coolant Valve N488
 Turbocharger Recirculation Valve N249
 Intake Manifold Runner Control Valve N316
 Coolant Recirculation Pump V50
 Camshaft Adjustment Valve 1 N205
 Exhaust Camshaft Adjustment Valve 1 N318
 (N318 only on 2.0L engine)
 Fuel Metering Valve N290
 Oil Pressure Regulation Valve N428
 Cam Adjustment Actuators 1 - 8, F366, F373
 (only on 2.0L engine)
 Carbon Canister Purge Regulator Valve N80
 Engine Temperature Control Actuator N493
 Oxygen Sensor Heater Z19
 Heater for Oxygen Sensor 1 after Catalytic Converter Z29
 Charge Pressure Actuator V465
 Left Electro-hydraulic Engine Mount Solenoid Valve N144
 Right Electro-hydraulic Engine Mount Solenoid Valve N145
 Fuel Pump Control Module J538
 Transfer Fuel Pump G6
 Coolant Fan Control Module J293
 Coolant Fan V7
 Coolant Fan 2 V177
 Auxiliary signals:
 - Dual-clutch Mechatronic Module / engine speed
 - ABS/ESP Control Module
 - A/C compressor
 - Starter control Module

Figure 110

As shown below, the Multiport Fuel Injection System (MFI) is a fuel injection system.

Fuel system

System overview

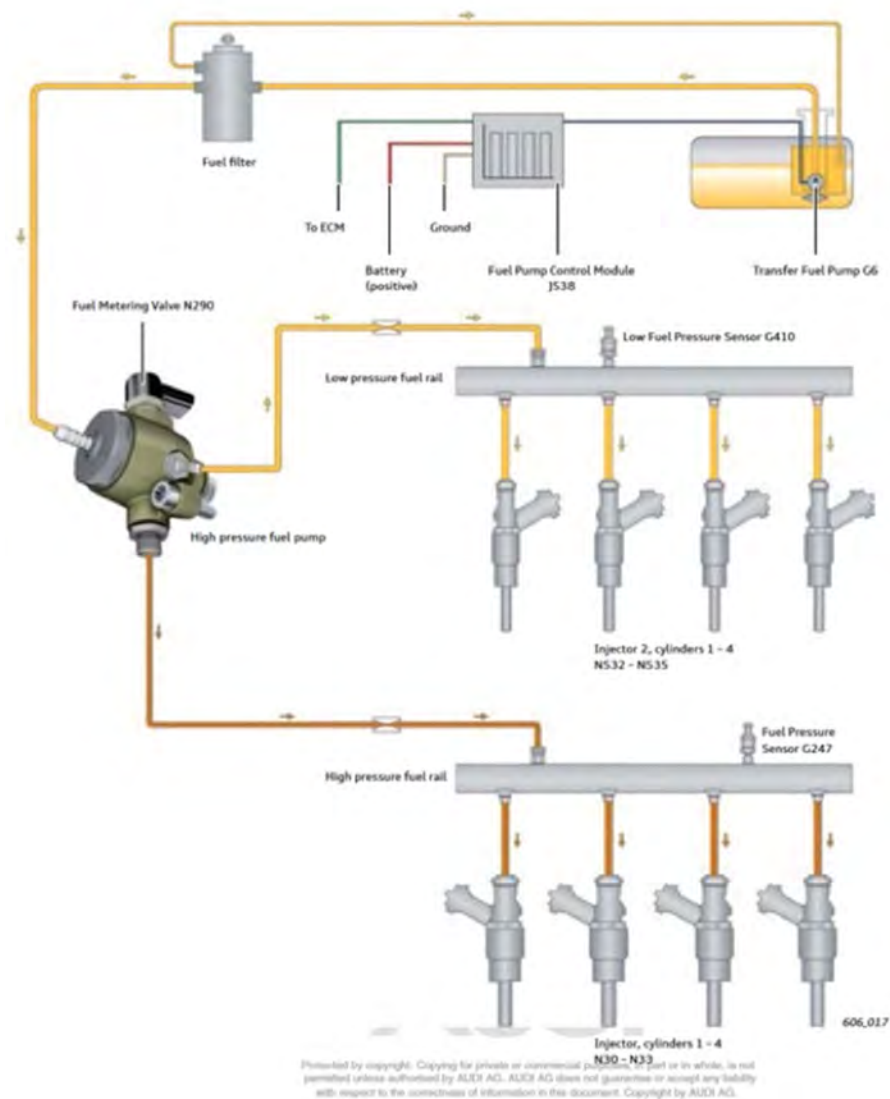


Figure 111

As shown below, the Engine Control Module (ECM) is an engine management system for controlling the operation of the engine including the fuel injection system and the air/fuel ratio for at least one cylinder. The PCM monitors and determines the air/fuel mixture. The sensors provide engine operation data to the engine management system. The engine operation data related to expected engine operation (whether or not proper combustion of the engine is achieved or not) with engine fueling on the correct stroke (i.e. combustion) and/or engine fueling (fuel injection time) on an incorrect stroke (monitored proper combustion) by the Engine Control Module (ECM).

Upon information and belief, information related to the terms “fueling on the correct stroke” or “fueling on an incorrect stroke” is not publicly available, and only in the possession of Volkswagen. However, in my opinion this element is highly likely present in the ’122 patent

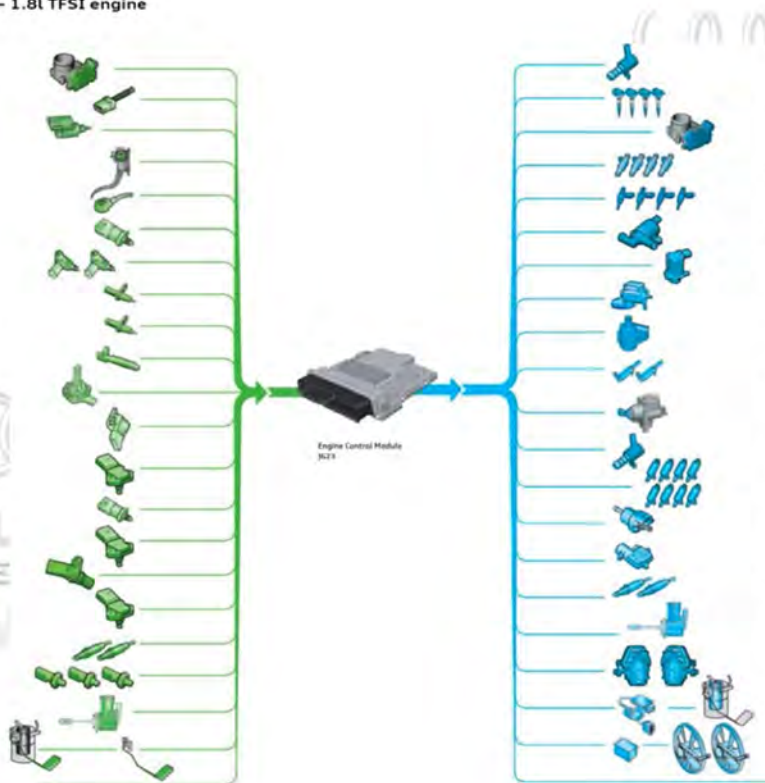
Accused Instrumentalities. This information is highly likely to be contained in the software from the ECM.

Engine management system

System overview example – 1.8l TFSI engine

Sensors

Throttle Valve Control Module J338
 EPC Throttle Drive Angle Sensors 1 & 2 G187, G188
 Brake Light Switch F
 Clutch Position Sensor G476
 Clutch Pedal Switch F346
 Clutch Pedal Starter Interlock Switch F394
 Accelerator Pedal Position Sensor G79
 Accelerator Pedal Position Sensor 2 G285
 Knock Sensor 1 G61
 Low Fuel Pressure Sensor G410
 Hall Sensor G40
 Hall Sensor 3 G300
 Engine Coolant Temperature Sensor G62
 Engine Coolant Temperature Sensor on Radiator Outlet G81
 Engine Speed Sensor G28
 Oil Level Thermal Sensor G266
 Intake Manifold Runner Position Switch G336
 Intake Air Temperature Sensor G42
 Manifold Absolute Pressure Sensor G71
 Fuel Pressure Sensor G267
 Charge Air Pressure Sensor G32
 Gear Recognition Sensor G406
 Brake Booster Pressure Sensor G294
 Heated Oxygen Sensor G39
 Oxygen Sensor after Three Way Catalytic Converter G130
 Oil Pressure Switch F22
 Reduced Oil Pressure Switch F378
 Oil Pressure Switch, Level 3 F447
 Charge Pressure Actuator Function Sensor G581
 Fuel Level Sensor G
 Fuel Level Sensor 2, G469
 Auxiliary signals:
 - Cruise control system
 - Speed signal
 - Start request to engine control module (keyless start 1 + 2)
 - Terminal 50
 - Crash signal from airbag control Module



Actuators

Protein Cooling Nozzle Control Valve N522
 Ignition Coils 1 - 4 with Output Stage
 N70, N127, N291, N292
 EPC Throttle Drive G186
 Injectors 2, cylinders 3 - 4 N532 - N535
 N532 also the (common) injector for cylinder 1 in the (common) Common Rail (CR) system
 Injector, cylinders 1 - 4 N530 - N531
 Transmission Coolant Valve N488
 Turbocharger Recirculation Valve N249
 Intake Manifold Runner Control Valve N316
 Coolant Recirculation Pump V50
 Camshaft Adjustment Valve 1 N205
 Exhaust Camshaft Adjustment Valve 1 N118
 (N318 only on 2.0l engines)
 Fuel Metering Valve N290
 Oil Pressure Regulation Valve N428
 Cam Adjustment Actuators 1 - 6, F366, F373
 (only on 2.0l engines)
 Carbon Canister Purge Regulator Valve N80
 Engine Temperature Control Actuator N493
 Oxygen Sensor Heater Z19
 Heater for Oxygen Sensor 1 after Catalytic Converter Z29
 Charge Pressure Actuator V465
 Left Electro-hydraulic Engine Mount Solenoid Valve N144
 Right Electro-hydraulic Engine Mount Solenoid Valve N145
 Fuel Pump Control Module J538
 Transfer Fuel Pump G6
 Coolant Fan Control Module J293
 Coolant Fan V27
 Coolant Fan 2 V177
 Auxiliary signals:
 - Dual clutch Mechatronic Module / engine speed
 - ABS/ESP Control Module
 - A/C compressor
 - Starter control Module

Figure 112

The '122 patent Accused Instrumentalities comprise an engine management system is arranged to receive from said sensor(s) respective signal(s).

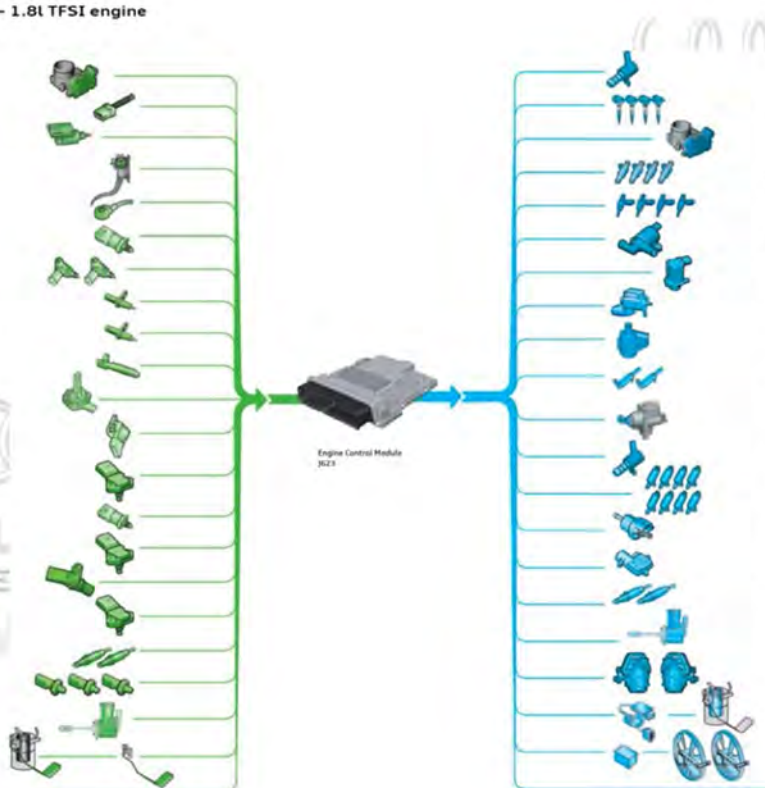
For example, as shown below, the ECM receives signals from the sensors.

Engine management system

System overview example – 1.8l TFSI engine

Sensors

Throttle Valve Control Module J338
 EPC Throttle Drive Angle Sensors 1 & 2 G187, G188
 Brake Light Switch F
 Clutch Position Sensor G476
 Clutch Pedal Switch F36
 Clutch Pedal Starter Interlock Switch F294
 Accelerator Pedal Position Sensor G79
 Accelerator Pedal Position Sensor 2 G185
 Knock Sensor 1 G61
 Low Fuel Pressure Sensor G410
 Hall Sensor G40
 Hall Sensor 3 G300
 Engine Coolant Temperature Sensor G62
 Engine Coolant Temperature Sensor on Radiator Outlet G81
 Engine Speed Sensor G28
 Oil Level Thermal Sensor G266
 Intake Manifold Runner Position Switch G336
 Intake Air Temperature Sensor G42
 Manifold Absolute Pressure Sensor G71
 Fuel Pressure Sensor G247
 Charge Air Pressure Sensor G31
 Gear Recognition Sensor G68
 Brake Booster Pressure Sensor G294
 Heated Oxygen Sensor G39
 Oxygen Sensor after Three-Way Catalytic Converter G130
 Oil Pressure Switch F22
 Reduced Oil Pressure Switch F378
 Oil Pressure Switch, Level 3 F447
 Charge Pressure Actuator Position Sensor G581
 Fuel Level Sensor G
 Fuel Level Sensor 2, G469
 Auxiliary signals:
 → Cruise control system
 → Speed signal
 → Start request to engine control module (keyless start 1 + 2)
 → Terminal 50
 → Crash signal from airbag control module



Actuators

Phosor Cooling Nozzle Control Valve N522
 Ignition Coils 1 - 4 with Output Stage N70, N127, N191, N292
 EPC Throttle Drive G186
 Injectors 2, cylinders 3 - 4 N532 - N535
 N532 does not function on request for N535
 in the 4-cylinder operating mode
 Injector, cylinders 1 - 4 N530 - N533
 Transmission Coolant Valve N488
 Turbocharger Recirculation Valve N249
 Intake Manifold Runner Control Valve N316
 Coolant Recirculation Pump V50
 Camshaft Adjustment Valve 1 N205
 Exhaust Camshaft Adjustment Valve 1 N318
 (N318 only on 2.0l engines)
 Fuel Metering Valve N290
 Oil Pressure Regulation Valve N428
 Cam Adjustment Actuators 1 - 4, N366, F373
 (only on 2.0l engines)
 Carbon Canister Purge Regulator Valve N80
 Engine Temperature Control Actuator N493
 Oxygen Sensor Heater Z19
 Heater for Oxygen Sensor 1 after Catalytic Converter Z29
 Charge Pressure Actuator V465
 Left Electro-hydraulic Engine Mount Solenoid Valve N144
 Right Electro-hydraulic Engine Mount Solenoid Valve N145
 Fuel Pump Control Module V538
 Transfer Fuel Pump G6
 Coolant Fan Control Module J293
 Coolant Fan V17
 Coolant Fan 2 V177
 Auxiliary signals:
 → Dual clutch Mechanism Module / engine speed
 → ABS/ESP control module
 → A/C compressor
 → Starter control module

Figure 113

For example, as shown below, the engine management system oscillates the air/fuel ratio (the PCM increases or decrease fuel injection duration) depending on the air/fuel ratio (measured by the oxygen sensor in the exhaust stream) as measured by the exhaust gas oxygen sensors (8 & 9).

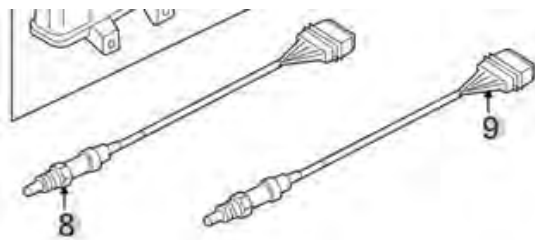


Figure 114

As exemplified below, the PCM reverses the direction of change of the air/fuel ration (from rich to lean, or lean to rich) when the exhaust gas composition sensed (measured by the oxygen sensor in the exhaust stream) as being indicative of rich engine operation or lean engine operation (detects a wide range of air fuel ratios; closed-loop fuel control operation changes direction between rich and lean). When this occurs at too slow of a rate from rich to lean, the PCM sets DTC P0139. The temporal characteristics (the measured amplitude versus the

amplitude of a slow sensor) of the oscillation in the air/fuel ratio (oscillates between rich and lean). The PCM monitors the switch rate frequency of the exhaust gas oxygen sensors between rich and lean and vice versa and is capable of determining when the frequency is not correct.

2015 Volkswagen Tiguan 4Motion (5N2) L4-2.0L Turbo (CCTA)

Vehicle » A L L Diagnostic Trouble Codes (DTC) » Testing and Inspection » P Code Charts » P0139 » Engine Control Module, 2015 MY

ENGINE CONTROL MODULE, 2015 MY

Engine Control Module, 2015 MY

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			For time > 10.0 Sec General : Engine running Dew point exceeded Lambda set value > 0.995			
P0139 O2 Sensor Circuit Slow Response Bank 1 Sensor 2	O2 Sensor Circuit Slow Response Bank 1 Sensor 2	EWMA filtered transient time at fuel cutoff > 0.0 s In voltage range of 201 - 401 mV Number of checks, >= 3	Rich voltage enable > = 547.9 mV Lean voltage < = 201.2 mV Fuel cutoff active O2S rear ready Modeled exhaust gas temp > 400 °C Front HO2S sensor lambda signal > 2.00 V	100.0 s	1 DCY	Check the Oxygen Sensor 1 After Catalytic Converter (GX7) . Refer to ⇒ Oxygen Sensor 1 After Catalytic Converter (GX7) . Checking I.

Upon information and belief, a determination whether or not the engine is being fueled on the correct stroke is determined by the ECM and the MFI wherein temporal characteristics (shown above) are compared with relevant engine operation data (shown above).

Based upon the totality of the foregoing evidence, and based further upon information and belief, the '122 patent Accused Instrumentalities include "an internal combustion engine, comprising a number of cylinders, the or each cylinder containing a four-stroke reciprocating piston, an exhaust conduit, one or more engine operating condition sensors including an exhaust gas sensor in the exhaust conduit for measuring the composition of the exhaust gas, a fuel injection system, and an engine management system for controlling the operation of the engine including the fuel injection system and the air/fuel ratio for at least one cylinder, wherein the engine management system contains engine operation data, the engine operation data being related to expected engine operation with engine fueling on the correct stroke and/or engine fueling on an incorrect stroke, and the engine management system is arranged to: a) receive from said sensor(s) respective signal(s); b) oscillate the air/fuel ratio between a relatively rich level and a relatively lean level, the exhaust gas composition varying depending on the air/fuel ratio; c) reverse the direction of change of the air/fuel ratio when the exhaust gas composition is sensed as being indicative of rich engine operation or lean engine operation; d) determine the temporal characteristics of the oscillation in the air/fuel ratio; and e) determine whether or not the engine is being fueled on the

correct stroke by comparing said temporal characteristics with said relevant engine operation data.”

Figure 115

COUNT XVI – INFRINGEMENT OF U.S. PATENT NO. 6,757,149

115. The allegations set forth in the foregoing paragraphs 1 through 114 are incorporated into this Sixteenth Claim for Relief.

116. On Jun. 29, 2004, U.S. Patent No. 6,757,149 (“the ’149 patent”), entitled “Method for Controlling Fuel Injector Valve Solenoid Current,” was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the ’149 patent is attached as Exhibit 16.

117. Michigan Motor is the assignee and owner of the right, title and interests in and to the ’149 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

118. Upon information and belief, Defendants have directly infringed at least claim 1 of the ’149 patent by making, using, selling, importing and/or providing and causing to be used at least the 2013-2017 Volkswagen Jetta Hybrid and 2016-2018 Audi A3 e-tron Sportback (the “’149 patent Accused Instrumentalities”).

119. In particular, claim 1 of the ’149 patent recites a method of controlling a fuel injector valve solenoid comprising: generating a set-point signal to model a desired current profile flowing through the valve solenoid; providing a current controller adapted to regulate the current flowing through the valve solenoid; and regulating the current flowing through the valve solenoid such that the current flowing through the valve solenoid closely matches the set point signal.

120. On information and belief, the '149 patent Accused Instrumentalities infringe claim 1 of the '149 patent. The '149 patent Accused Instrumentalities practice a method of controlling a fuel injector valve solenoid (*Figure 116*) comprising: generating a set-point signal to model a desired current profile flowing through the valve solenoid (*Figure 117*); providing a current controller adapted to regulate the current flowing through the valve solenoid (*Figure 117*); and regulating the current flowing through the valve solenoid such that the current flowing through the valve solenoid closely matches the set point signal (*Figure 117*).

For example, as shown below, the Engine Control Module (ECM) are microcontrollers which practice a method of controlling a fuel injector valve solenoid.

System overview 1.4l TFSI engine

Sensors

Intake manifold pressure sender G27 (after throttle valve)
Intake air temperature sender G42

Charge pressure sender G31 with intake air temperature sender 2 G289 (after throttle valve)

Engine speed sender G28

Hall sender G40

Throttle valve control unit J238
Throttle valve drive angle senders 1 and 2 G187, G188

Accelerator pedal position senders G79 and G185

Clutch position sender G476

Brake light switch F
Brake pedal switch F63

Fuel pressure sender G247

Knock sensor 1 G81

Coolant temperature sender G62

Radiator outlet coolant temperature sender G83

Lambda probe G39

Lambda probe after catalytic converter G130

Brake servo pressure sender G294*

Auxiliary input signals:
- Cruise control system I/O via J527
- Alternator terminal DPM
- Radiator fan speed 1 (pulse width modulated signal)

* only relevant to vehicles with torque-clutch gearbox and ABS without ESP

Actuators

Fuel pump control unit J538
Fuel pump (pre supply pump) G6

Injector, cylinder 1 - 4
N30 - N33

Ignition coil 1 - 4 with output stage
N70, N127, N291, N292

Throttle valve control unit J238
Throttle valve with electric power control G186

Fuel pressure regulating valve N276

Activated charcoal filter solenoid valve 1 N89

Lambda probe heater Z19

Lambda probe 1 heating, after catalytic converter Z29

Inlet camshaft timing adjustment valve -1 N205

Turbocharger divert air valve N249

Charge pressure control solenoid valve N75

Auxiliary coolant pump relay J486
Coolant circulation pump V50

Motoric current supply relay J271

Vacuum pump relay J57
Vacuum pump for brakes V192
(for vehicles with automatic gearbox)

Auxiliary output signal:
- Brake light to onboard power supply control unit J519

Audi 1.4L TFSI SSP 432

Figure 116

For example, as shown below, a set point signal is generated by the ECM to model a desired current profile flowing through the valve solenoid with a peak of up to 12 amperes and a holding current of 2.6 amperes.

The solenoid injectors are opened by the engine control unit with a voltage of 65V. Electrical current peaks of up to 12 amperes can occur. The holding current is approx. 2.6 amperes. The injectors are attached to the base of the intake manifold, in which the fuel distributor is also integrated.



432_057

Audi 1.4L TFSI SSP 432

Upon information and belief a current controller associated with the ECM and the valve solenoid regulates the current flowing through the valve solenoid such that the current flowing through the valve solenoid closely matches the set point signal.

Figure 117

COUNT XVII – INFRINGEMENT OF U.S. PATENT NO. 7,116,081

121. The allegations set forth in the foregoing paragraphs 1 through 120 are incorporated into this Seventeenth Claim for Relief.

122. On Oct. 3, 2006, U.S. Patent No. 7,116,081 (“the ’081 patent”), entitled “Thermal Protection Scheme for High Output Vehicle Alternator,” was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the ’081 patent is attached as Exhibit 17.

123. Michigan Motor is the assignee and owner of the right, title and interests in and to the ’081 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

124. Upon information and belief, Defendants have directly infringed at least claim 1 of the '081 patent by making, using, selling, importing and/or providing and causing to be used the 2013-2017 Volkswagen Jetta Hybrid and 2016-2018 Audi A3 e-tron Sportback (the "'081 patent Accused Instrumentalities").

125. In particular, claim 1 of the '081 patent recites a thermal protection system for a high output vehicle alternator, said system comprising: a duty cycle control system; an alternator having a temperature limit and at least one rotor speed limit, said alternator operably connected to said duty cycle control system; a field current supply to said alternator; an alternator rotor speed sensor in communication with said duty cycle control system for determining an alternator rotor speed; and an alternator temperature sensor in communication with said duty cycle control system, for determining an alternator temperature, wherein said duty cycle control system regulates said field current supply to said alternator based on said alternator rotor speed and said alternator temperature in order to maintain said alternator temperature below said temperature limit and prevent excess heat from being generated.

126. On information and belief, the '081 patent Accused Instrumentalities infringe claim 1 of the '081 patent. The '081 patent Accused Instrumentalities comprise a thermal protection system for a high output vehicle alternator (*Figure 118-119*), said system comprising: a duty cycle control system (*Figure 120*); an alternator having a temperature limit and at least one rotor speed limit, said alternator operably connected to said duty cycle control system (*Figure 121*); a field current supply to said alternator (*Figure 122*); an alternator rotor speed sensor in communication with said duty cycle control system for determining an alternator rotor speed (*Figure 123*); and an alternator temperature sensor in communication with said duty cycle control system, for determining an alternator temperature, wherein said duty cycle control system regulates said field current supply to said alternator based on said alternator rotor speed and said

alternator temperature in order to maintain said alternator temperature below said temperature limit and prevent excess heat from being generated (*Figure 123*).

The drive motor serves as a high output alternator during regeneration in generator mode.

There exists a Drive Motor Temperature Sensor G712 and Drive Motor Rotor Position Sensor G713 and DTCs P0A2B, P0A2C and P0A2D that show a monitoring of an alternator thermal protection system.

Overview

Power transmission is provided by the front wheel drive, six-speed DDD 5 tronic (DSG) transmission.

The integrated Electro-drive Drive Motor V141 (e-machine) is a permanently excited synchronous machine that develops up to 102 hp (75 kW) of power. It is capable of delivering approximately 243 lb ft (330 Nm) of torque to the transmission. V141 provides electric-only drive-away from standstill and electric-only driving as well as starting the internal combustion engine via clutch K0. (see page 10).

If necessary, in Boost mode, the (e-machine) and internal combustion engine are connected via clutch K0 and deliver the maximum system power to the transmission.

In generator mode, V141 is driven by the internal combustion engine using the vehicle's propulsion energy (recuperation) or through the closed K0 clutch. The electric drive motor supplies power to the entire vehicle.

Clutches K1 and K2 (see page 16, page 17) transfer the entire power generated by both drives to sub-gearboxes 1 and 2.

All 3 of clutches K0, K1 and K2 are wet-type clutches and are controlled by the DSG Transmission Mechatronic Module J743.

The transmission has only one ATF supply. Approximately 7.3 qt (7 l) of ATF supply both the transmission hydraulics and the sub-gearbox. Both sub-transmissions form the manual transmission of the transmission.

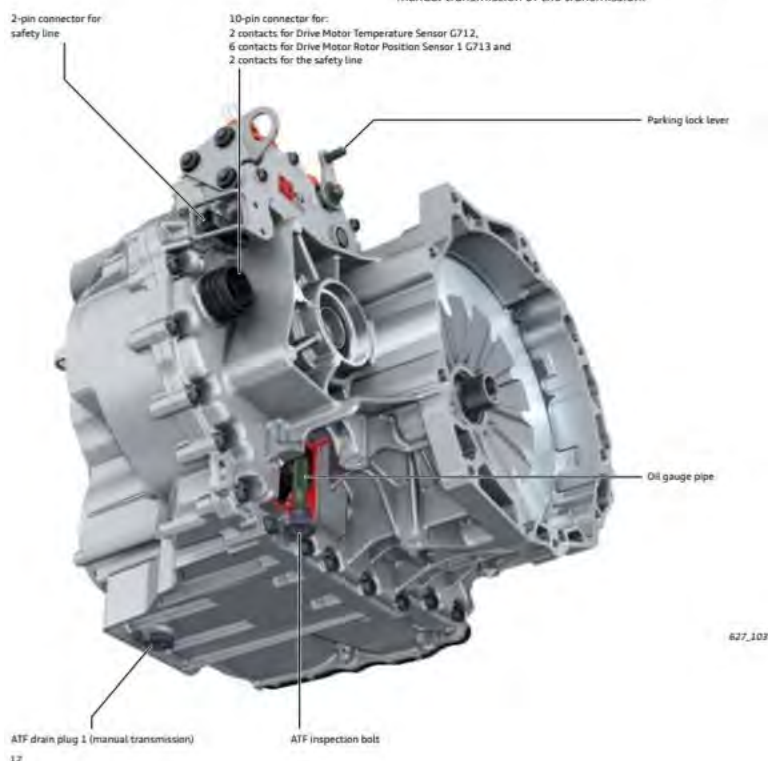


Figure 118

P0A2 B	Drive Motor "A" Temperature Sensor Circuit Range/Performance	<ul style="list-style-type: none"> Stator temperature - average rating from IGBT-phase temperatures > 23 – 50 K Stator temperature jump to high > 12 K 	<ul style="list-style-type: none"> Engine off time > 6.0 hr System state drive 	<ul style="list-style-type: none"> De-bounce time = 2,500.0 ms 	<ul style="list-style-type: none"> 2 DCY Once / DCY
P0A2 C	Drive Motor "A" Temperature Sensor Circuit Low	<ul style="list-style-type: none"> Stator temperature too high > + 196° C 		<ul style="list-style-type: none"> De-bounce time = 800.0 ms 	<ul style="list-style-type: none"> 2 DCY Continuous
P0A2 D	Drive Motor "A" Temperature Sensor Circuit High	<ul style="list-style-type: none"> Stator temperature too low < -50° C 		<ul style="list-style-type: none"> De-bounce time = 800.0 ms 	<ul style="list-style-type: none"> 2 DCY Continuous
P0A3 F	Drive Motor "A" Position Sensor Circuit	<ul style="list-style-type: none"> Internal fault detected true none 		<ul style="list-style-type: none"> Continuous 	<ul style="list-style-type: none"> 0 DCY Continuous
		<ul style="list-style-type: none"> Difference between current and previous calculated Position sensor angle is greater than > 48.4° 		<ul style="list-style-type: none"> Continuous 	
		<ul style="list-style-type: none"> Difference between Position sensor frequency and from angle calculated frequency is greater than > 200 Hz 		<ul style="list-style-type: none"> De-bounce time = 50.0 ms 	

Figure 119

The DTC P0A3F implies a duty cycle control system in its reference to frequency. The captured code from a live vehicle shows duty cycle control for battery charging.

P0A2 B	Drive Motor "A" Temperature Sensor Circuit Range/Performance	<ul style="list-style-type: none"> Stator temperature - average rating from IGBT-phase temperatures > 23 – 50 K Stator temperature jump to high > 12 K 	<ul style="list-style-type: none"> Engine off time > 6.0 hr System state drive 	<ul style="list-style-type: none"> De-bounce time = 2,500.0 ms 	<ul style="list-style-type: none"> 2 DCY Once / DCY
P0A2 C	Drive Motor "A" Temperature Sensor Circuit Low	<ul style="list-style-type: none"> Stator temperature too high > + 196° C 		<ul style="list-style-type: none"> De-bounce time = 800.0 ms 	<ul style="list-style-type: none"> 2 DCY Continuous
P0A2 D	Drive Motor "A" Temperature Sensor Circuit High	<ul style="list-style-type: none"> Stator temperature too low < -50° C 		<ul style="list-style-type: none"> De-bounce time = 800.0 ms 	<ul style="list-style-type: none"> 2 DCY Continuous
P0A3 F	Drive Motor "A" Position Sensor Circuit	<ul style="list-style-type: none"> Internal fault detected true none Difference between current and previous calculated Position sensor angle is greater than > 48.4° Difference between Position sensor frequency and from angle calculated frequency is greater than > 200 Hz 		<ul style="list-style-type: none"> Continuous Continuous De-bounce time = 50.0 ms 	<ul style="list-style-type: none"> 0 DCY Continuous

C6 Batt. Chrg.

Block

Code:

```
;SW:5QE-915-682-AF HW:5QE-915-682-AF --- Batt. Chrg.
;Component:OBC KOSTAL H31 4013, Coding:115068223000
;EV_OBCSinglPhaseKLOMQB12P,001001,EV_OBCSinglPhaseKLOMQB12P.rod
;Thursday,02,August,2018,08:21:18:50490
;VCDS Version: Release 18.2.1 (x64) Data version: 20180518 DS287.1
;VCID: 116A6A14C0AC40CCB8-8044

Group,Description,Actual
IDE00019,Voltage terminal 30,13.0, V
IDE00030,Status of actuator test,not active,
IDE00322,Status of basic setting,was not yet started,
IDE00323,Security Access: Number of invalid keys,0,
IDE00637,Intermediate circuit voltage,403.4, V
IDE00767,No. of unscheduled ECU resets,00,
IDE02486,Data logger triggering,not active,
IDE06805,Status of voltage freedom,High voltage power off not recognized,
IDE06954,HV charge current: act. value,9, A
IDE06955-ENG114223,HV charge current: spec. value-Charger HV current commanded_value,8.8, A
IDE07975,Remote control for charge function of H-V battery,not activated,
IDE08421-IDE05431,Power outlet A for battery charging-Locking for H-V charge plug,locked,
IDE08421-MAS07220,Power outlet A for battery charging-Status connect. recognition,present,
IDE08421-MAS07221,Power outlet A for battery charging-Connector locking requirement,00000000 ,
IDE08421-MAS07222,Power outlet A for battery charging-Connector unlocking requirement,00000000 ,
IDE08421-MAS07223,Power outlet A for battery charging-Max. current of charge connector,20, A
IDE08421-MAS07565,Power outlet A for battery charging-Activation charge cover lock charge socket A,not requested,
IDE08421-MAS07567,Power outlet A for battery charging-Status charge cover lock charge socket A,not locked,
IDE08421-MAS10983,Power outlet A for battery charging-Activation charge cover unlock charge socket A,not requested,
IDE08421-MAS12565,Power outlet A for battery charging-Charge socket temperature sensor AC,27.0, °C
IDE08421-MAS12566,Power outlet A for battery charging-Charge sensor temperature sensor DC,0.0, °C
IDE08422-IDE05431,Power outlet B for battery charging-Locking for H-V charge plug,not locked,
IDE08422-MAS07220,Power outlet B for battery charging-Status connect. recognition,Not Present,
```

C6 Batt. Chrg.

Block

Code:

```

IDE08422-MAS07220,Power outlet B for battery charging-Status connect. recognition,Not Present,
IDE08422-MAS07221,Power outlet B for battery charging-Connector locking requirement,00000000,
IDE08422-MAS07222,Power outlet B for battery charging-Connector unlocking requirement,00000000,
IDE08422-MAS07223,Power outlet B for battery charging-Max. current of charge connector,0, A
IDE08422-MAS07224,Power outlet B for battery charging-Temp. of charge socket,27.0, °C
IDE08422-MAS07566,Power outlet B for battery charging-Activation charge cover lock charge socket B,not requested,
IDE08422-MAS07568,Power outlet B for battery charging-Status: chg. cover lock. device: chg. socket B,not locked,
IDE08423-MAS02949,Control signal for power outlet A for battery charging-Frequency,1000, Hz
IDE08423-MAS02952,Control signal for power outlet A for battery charging-Control voltage,5759, mV
IDE08423-MAS03873,Control signal for power outlet A for battery charging-Duty cycle,33.5, %
IDE08423-MAS04136,Control signal for power outlet A for battery charging-Current,20.2, A
IDE08423-MAS07227,Control signal for power outlet A for battery charging-Signal recognized,00000001,
IDE08424-MAS02949,Control signal for power outlet B for battery charging-Frequency,0, Hz
IDE08424-MAS02952,Control signal for power outlet B for battery charging-Control voltage,0, mV
IDE08424-MAS03873,Control signal for power outlet B for battery charging-Duty cycle,0.0, %
IDE08424-MAS04136,Control signal for power outlet B for battery charging-Current,0.0, A
IDE08424-MAS07262,Control signal for power outlet B for battery charging-Signal recognized,00000000,
IDE08425-MAS07225,Indicator lamps for power outlet A for battery charging-Status: indicator light 1,OFF,
IDE08425-MAS07226,Indicator lamps for power outlet A for battery charging-Status: indicator light 2,Blinking,
IDE08425-MAS07227,Indicator lamps for power outlet A for battery charging-Status: indicator light 3,OFF,
IDE08425-MAS07228,Indicator lamps for power outlet A for battery charging-Intensity: indicator light 1,100, %
IDE08425-MAS07229,Indicator lamps for power outlet A for battery charging-Intensity: indicator light 2,100, %
IDE08425-MAS07230,Indicator lamps for power outlet A for battery charging-Intensity: indicator light 3,100, %
IDE08425-MAS07231,Indicator lamps for power outlet A for battery charging-Period duration: indicator light 1,2000, ms
IDE08425-MAS07232,Indicator lamps for power outlet A for battery charging-Period duration: indicator light 2,2000, ms
IDE08425-MAS07233,Indicator lamps for power outlet A for battery charging-Period duration: indicator light 3,2000, ms
IDE08425-MAS07582,Indicator lamps for power outlet A for battery charging-Intensity: activation 4,0, %
IDE08425-MAS07590,Indicator lamps for power outlet A for battery charging-Period duration: activation 4,0, ms
IDE08425-MAS13012,Indicator lamps for power outlet A for battery charging-Status: indicator light 4,OFF,
IDE08426-MAS07225,Indicator lamps for power outlet B for battery charging-Status: indicator light 1,OFF,
IDE08426-MAS07226,Indicator lamps for power outlet B for battery charging-Status: indicator light 2,OFF,
IDE08426-MAS07227,Indicator lamps for power outlet B for battery charging-Status: indicator light 3,OFF,

```

C6 Batt. Chrg.

Block

Code:

```

IDE08426-MAS07227,Indicator lamps for power outlet B for battery charging-Status: indicator light 3,OFF,
IDE08426-MAS07228,Indicator lamps for power outlet B for battery charging-Intensity: indicator light 1,100, %
IDE08426-MAS07229,Indicator lamps for power outlet B for battery charging-Intensity: indicator light 2,100, %
IDE08426-MAS07230,Indicator lamps for power outlet B for battery charging-Intensity: indicator light 3,100, %
IDE08426-MAS07231,Indicator lamps for power outlet B for battery charging-Period duration: indicator light 1,2000, ms
IDE08426-MAS07232,Indicator lamps for power outlet B for battery charging-Period duration: indicator light 2,2000, ms
IDE08426-MAS07233,Indicator lamps for power outlet B for battery charging-Period duration: indicator light 3,2000, ms
IDE08426-MAS07582,Indicator lamps for power outlet B for battery charging-Intensity: activation 4,0, %
IDE08426-MAS07590,Indicator lamps for power outlet B for battery charging-Period duration: activation 4,0, ms
IDE08426-MAS13012,Indicator lamps for power outlet B for battery charging-Status: indicator light 4,OFF,
IDE08427-MAS07237,Statistics of power outlet A for battery charging-No. of connections,1485,
IDE08427-MAS07238,Statistics of power outlet A for battery charging-No. of lockings,1824,
IDE08428-MAS07237,Statistics of power outlet B for battery charging-No. of connections,0,
IDE08428-MAS07238,Statistics of power outlet B for battery charging-No. of lockings,0,
IDE08430,Cause of cancellation of charge procedure,not active,
IDE08431,Remaining time for charge procedure,40, min
IDE08432-MAS02158,Button for battery charging-Actuation condition,not activated,
IDE08432-MAS04737,Button for battery charging-Indicator lamp,On,
IDE08505-MAS07220,Power outlet for quick charging of HV battery-Status connect. recognition,present,
IDE08638-MAS04721,SOC limits: set by customer-Minimum charge level,1, %
IDE08638-MAS04722,SOC limits: set by customer-Maximum charge level,0, %
IDE08639,max. loading power,3300, W
IDE08640,Spec. mode: load mgmt.,AC main charge,
IDE08649-IDE06971,Ready to charge-Operational readiness in B-V system,active,
IDE08649-MAS07214,Ready to charge-Status charge readiness: engine,ready for operation,
IDE08649-MAS07215,Ready to charge-Status charge readiness charge mgmt.,ready for operation,
IDE08657-MAS01424,Current at DC charg. stat.-max.value,0, A
IDE08657-MAS07236,Current at DC charg. stat.-Act.val.,0, A
IDE08658-MAS01424,Voltage at DC charg. stat.-max.value,0, V
IDE08658-MAS07236,Voltage at DC charg. stat.-Act.val.,0, V
IDE08659-MAS07237,Statistic of DC charger for battery charging-No. of connections,0,
IDE08659-MAS07238,Statistic of DC charger for battery charging-No. of lockings,0,

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C6 Batt. Chrg.

Block

Code:

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IDE08659-MAS07238,Statistic of DC charger for battery charging-No. of lockings,0,
IDE08659-MAS07239,Statistic of DC charger for battery charging-No. of charging process.,0,
IDE08677-MAS07258,Load mode-Stat.: charge mode,AC main charge,
IDE08677-MAS07259,Load mode-Chg. type,Imm. chrg.,
IDE08717,Status mains voltage,present,
IDE08718-MAS06699,Chademo version-Vehicle,0,
IDE08718-MAS07395,Chademo version-Chg. statn.,0,
IDE08719-IDE08720,Values from battery mgmt system-Current condition of battery mgmt. system,External Charging,
IDE08719-MAS01420,Values from battery mgmt system-Limit for charge current,N/A---,
IDE08719-MAS04059,Values from battery mgmt system-Battery temperature,30.0, °C
IDE08719-MAS07289,Values from battery mgmt system-A/C requirement,Med. cooling reqmnt.,
IDE08719-MAS07396,Values from battery mgmt system-Act. voltage HV battery,N/A---,
IDE08719-MAS07397,Values from battery mgmt system-Act. current HV battery,N/A---,
IDE08719-MAS07407,Values from battery mgmt system-Max. battery charging voltage,N/A---,
IDE08751-MAS02158,Load button-Actuation condition,not activated,
IDE08751-MAS04737,Load button-Indicator lamp,OFF,
IDE08751-MAS07596,Load button-Locating illum. charge button,OFF,
IDE08938,Chrg cooling reqmnt,Med. cooling reqmnt.,
IDE08985,AC line current: actual val,15.0, A
IDE08986,AC line voltage: actual val,226, V
IDE09039,HV charger - current output voltage,368, V
IDE09057,HV battery charge state,74.5, %
IDE11570-ENG30068,Activation periods of charging cover locking-raw value in develop by_ODXauthor,00,
IDE11571-ENG30068,Voltage terminal 30 battery data module-raw value in develop by_ODXauthor,A3,
MAS00464-MAS00106,Standard - ambient data 1-Year,2000,
MAS00464-MAS00107,Standard - ambient data 1-Month,1,
MAS00464-MAS00108,Standard - ambient data 1-Day,2,
MAS00464-MAS00109,Standard - ambient data 1-Hours,0,
MAS00464-MAS00110,Standard - ambient data 1-Minutes,2,
MAS00464-MAS00111,Standard - ambient data 1-Seconds,40,
MAS00464-MAS00468,Standard - ambient data 1-Unlearning counter,147,
MAS00464-MAS00711,Standard - ambient data 1-Odometer reading,30904, km

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C6 Batt. Chrg.

Block

Code:

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MAS00464-MAS00711,Standard - ambient data 1-Odometer reading,30904, km
MAS06335-ENG30068,Voltage low voltage side DCDC - converter-raw value in develop by_ODXauthor,84,
MAS07392-MAS07393,Control signal DC charge-Control signal 1,00000000,
MAS07392-MAS07394,Control signal DC charge-Control signal 2,00000001,
MAS07396-ENG30068,Act. voltage HV battery-raw value in develop by_ODXauthor,05 D5,
MAS07407-ENG30068,Max. battery charging voltage-raw value in develop by_ODXauthor,01 90,
MAS07558,Spec. op. condition charge unit,AC main charge,
MAS07559,Act.. op. condition charge unit,AC main charge,
MAS07563,Function limitation charging due to temp. charge socket,not active,
MAS07564,Function limitation charging due to temp. charge unit,not active,
MAS12397-ENG30068,Number of lockings: charge cover A-raw value in develop by_ODXauthor,14 70,
ENG125865,AC maximum input current value,16.0, A
ENG125867,AC network frequency,50.0, Hz
ENG125873,charger coolant temperature,40, °C
ENG123145-ENG123175,Charging Connector Locking Parameter-delocking request time_CAN,0, ms
ENG123145-ENG123173,Charging Connector Locking Parameter-delocking time lag,0, ms
ENG123145-ENG123174,Charging Connector Locking Parameter-locking delay time,0, ms
ENG123145-ENG123176,Charging Connector Locking Parameter-locking time lag,0, ms
ENG123142,charging process request,AC Charging Request,
ENG123144,charging status,Charging,
ENG125862,current voltage protection,not active,
ENG123148,ekk air condition current,0.0, A
ENG125863,error status battery charger,not active,
ENG126556,gate driver voltage DCDC,15.9, V
ENG126555,gate driver voltage PFC,15.9, V
ENG126544,high voltage activation request,requested,
ENG123143,max HV DC voltage obc,394, V
ENG123146,permission to charge lm,00000000,
ENG125870,power efficiency,95.0, %
ENG125869,power loss battery charger,140, W
ENG123147,ptc heater current,0.0, A
ENG07647,temperature_battery_charger_PFC_coil,50, °C

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ENG07647,temperature_battery_charger_PFC_coil,50, °C
ENG125871,temperature_battery_charger_system_board,61, °C
ENG125872,temperature_DCDC_coil,45, °C
ENG125876,temperature_DCDC_powerline,51, °C
ENG125864,warning_status_battery_charger,no warning,

```

Elapsed Time: 00:07

[https://forums.ross-tech.com/showthread.php?15151-2017-Audi-A3-1-4-TFSI-E-TRON-CUKB-\(Germany\)/page3](https://forums.ross-tech.com/showthread.php?15151-2017-Audi-A3-1-4-TFSI-E-TRON-CUKB-(Germany)/page3)

Upon information and belief, the element “duty cycle control system” is present in the ’081 patent Accused Instrumentalities. As shown above, duty cycle control is used in charging the battery and is referenced in the DTC. This information is contained in the C6 Battery Charging Module software and hardware architecture.

Figure 120

As shown below, the '081 patent Accused Instrumentalities comprise a method for an alternator (Electro-drive Drive Motor V141 in generator mode) having a temperature limit (Drive Motor Temperature Sensor G712) and at least one rotor speed limit (Drive Motor Rotor Position Sensor G713) connected to a duty cycle control system (Electro Drive Control Module J841) that uses pulse width modulated signals. Temperature limits are detailed in the Diagnostic Trouble Codes (DTCs P02AC & P02AD) also shown below.

Drive Motor Inverter A37

The drive motor inverter A37 is both a DC/AC converter and an AC/DC converter.

Electro-drive Drive Motor V141 (e-machine) as motor

In electric driving mode A37 converts the AC voltage of the Hybrid Battery Unit AX1 to a 3-phase AC voltage. The voltage is converted by pulse width modulation. There are six transistors in A37. Two for each of the three phases, U, V, and W. Each phase has a separate transistor for positive and negative.

When activated, the corresponding potential is connected. The transistors are activated by Electric Drive Control Module J841 using pulse width modulated signals. RPM is regulated by changing the frequency, and the torque of V141 by changing the activation times of the individual pulse widths.

Electro-drive Drive Motor V141 in generator mode

If V141 is running in generator mode A37 converts the generated 3-phase AC voltage to a 352 V DC voltage. The high voltage system is supplied with the generated DC voltage and the 12-volt electrical system is supplied through Voltage Converter A19.]

Overview

Power transmission is provided by the front wheel drive, six-speed DDD S tronic (DSG) transmission.

The Integrated Electro-drive Drive Motor V141 (e-machine) is a permanently excited synchronous machine that develops up to 102 hp (75 kW) of power. It is capable of delivering approximately 243 lb ft (330 Nm) of torque to the transmission. V141 provides electric-only drive-away from standstill and electric-only driving as well as starting the internal combustion engine via clutch K0. (see page 10).

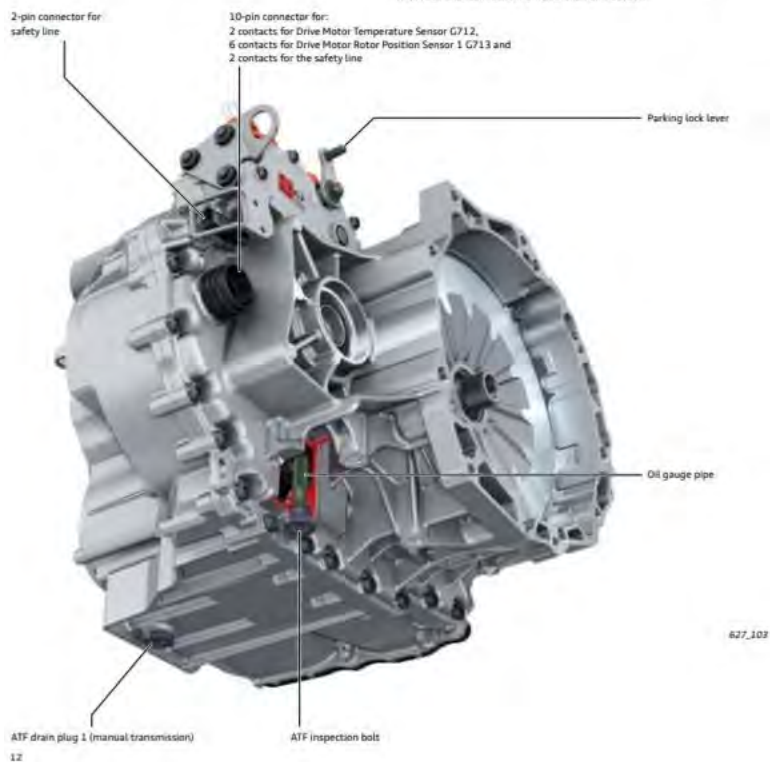
If necessary, in Boost mode, the (e-machine) and internal combustion engine are connected via clutch K0 and deliver the maximum system power to the transmission.

In generator mode, V141 is driven by the internal combustion engine using the vehicle's propulsion energy (recuperation) or through the closed K0 clutch. The electric drive motor supplies power to the entire vehicle.

Clutches K1 and K2 (see page 16, page 17) transfer the entire power generated by both drives to sub-gearboxes 1 and 2.

All 3 of clutches K0, K1 and K2 are wet-type clutches and are controlled by the DSG Transmission Mechatronic Module J743.

The transmission has only one ATF supply. Approximately 7.3 qt (7 l) of ATF supply both the transmission hydraulics and the sub-gearbox. Both sub-transmissions form the manual transmission of the transmission.



P0A2 B	Drive Motor "A" Temperature Sensor Circuit Range/Performance	<ul style="list-style-type: none"> Stator temperature - average rating from IGBT-phase temperatures > 23 – 50 K Stator temperature jump to high > 12 K 	<ul style="list-style-type: none"> Engine off time > 6.0 hr System state drive 	<ul style="list-style-type: none"> De-bounce time = 2,500.0 ms 	<ul style="list-style-type: none"> 2 DCY Once / DCY
P0A2 C	Drive Motor "A" Temperature Sensor Circuit Low	<ul style="list-style-type: none"> Stator temperature too high > + 196° C 		<ul style="list-style-type: none"> De-bounce time = 800.0 ms 	<ul style="list-style-type: none"> 2 DCY Continuous
P0A2 D	Drive Motor "A" Temperature Sensor Circuit High	<ul style="list-style-type: none"> Stator temperature too low < -50° C 		<ul style="list-style-type: none"> De-bounce time = 800.0 ms 	<ul style="list-style-type: none"> 2 DCY Continuous
P0A3 F	Drive Motor "A" Position Sensor Circuit	<ul style="list-style-type: none"> Internal fault detected true none 		<ul style="list-style-type: none"> Continuous 	<ul style="list-style-type: none"> 0 DCY Continuous
		<ul style="list-style-type: none"> Difference between current and previous calculated Position sensor angle is greater than > 48.4° 		<ul style="list-style-type: none"> Continuous 	
		<ul style="list-style-type: none"> Difference between Position sensor frequency and from angle calculated frequency is greater than > 200 Hz 		<ul style="list-style-type: none"> De-bounce time = 50.0 ms 	

Figure 121

As shown below, the 3-phase power cable supplies the “field” current to the SMG (alternator).

Upon information and belief, the Electro Drive Motor V141 in generator mode (alternator) Drive Motor Rotor Position Sensor G713 (rotor speed sensor) is in communication with the Electric Drive Control Module J841 which supplies the field current to the Electro Drive Motor V141 when running in generator mode.

Drive Motor Inverter A37

The drive motor inverter A37 is both a DC/AC converter and an AC/DC converter.

Electro-drive Drive Motor V141 (e-machine) as motor

In electric driving mode A37 converts the AC voltage of the Hybrid Battery Unit AX1 to a 3-phase AC voltage. The voltage is converted by pulse width modulation. There are six transistors in A37. Two for each of the three phases, U, V, and W. Each phase has a separate transistor for positive and negative.

When activated, the corresponding potential is connected. The transistors are activated by Electric Drive Control Module J841 using pulse width modulated signals. RPM is regulated by changing the frequency, and the torque of V141 by changing the activation times of the individual pulse widths.

Electro-drive Drive Motor V141 in generator mode

If V141 is running in generator mode A37 converts the generated 3-phase AC voltage to a 352 V DC voltage. The high voltage system is supplied with the generated DC voltage and the 12-volt electrical system is supplied through Voltage Converter A19.

Figure 122

As shown below, the Electro Drive Motor V141 in generator mode (alternator) Drive Motor Rotor Position Sensor G713 (rotor speed sensor) is in communication with the Electric Drive Control Module J841 (duty cycle control system) for determining the Electro Drive Motor V141 (alternator rotor) speed.

Moreover, as exemplified below, the '081 patent Accused Instrumentalities comprise a method for an alternator temperature sensor (Drive Motor Temperature Sensor G712) in communication with said duty cycle control system (Electro Drive Control Module J841), for determining an alternator temperature, wherein said duty cycle control system regulates said field current supply to said alternator (Electro-drive Drive Motor V141 in generator mode) based on said alternator temperature in order to maintain said alternator temperature below said temperature limit and prevent excess heat from being generated. The temperature limits for said alternator are detailed in the Diagnostic Trouble Codes (DTCs P02AC & P02AD) shown above.

Drive Motor Inverter A37

The drive motor inverter A37 is both a DC/AC converter and an AC/DC converter.

Electro-drive Drive Motor V141 (e-machine) as motor

In electric driving mode A37 converts the AC voltage of the Hybrid Battery Unit AX1 to a 3-phase AC voltage. The voltage is converted by pulse width modulation. There are six transistors in A37. Two for each of the three phases, U, V, and W. Each phase has a separate transistor for positive and negative.

When activated, the corresponding potential is connected. The transistors are activated by Electric Drive Control Module J841 using pulse width modulated signals. RPM is regulated by changing the frequency, and the torque of V141 by changing the activation times of the individual pulse widths.

Electro-drive Drive Motor V141 in generator mode

If V141 is running in generator mode A37 converts the generated 3-phase AC voltage to a 352 V DC voltage. The high voltage system is supplied with the generated DC voltage and the 12-volt electrical system is supplied through Voltage Converter A19.]

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Power transmission is provided by the front wheel drive, six-speed DDD S tronic (DSG) transmission.

The Integrated Electro-drive Drive Motor V141 (e-machine) is a permanently excited synchronous machine that develops up to 102 hp (75 kW) of power. It is capable of delivering approximately 243 lb ft (330 Nm) of torque to the transmission. V141 provides electric-only drive-away from standstill and electric-only driving as well as starting the internal combustion engine via clutch K0. (see page 10).

If necessary, in Boost mode, the (e-machine) and internal combustion engine are connected via clutch K0 and deliver the maximum system power to the transmission.

In generator mode, V141 is driven by the internal combustion engine using the vehicle's propulsion energy (recuperation) or through the closed K0 clutch. The electric drive motor supplies power to the entire vehicle.

Clutches K1 and K2 (see page 16, page 17) transfer the entire power generated by both drives to sub-gearboxes 1 and 2.

All 3 of clutches K0, K1 and K2 are wet-type clutches and are controlled by the DSG Transmission Mechatronic Module J743.

The transmission has only one ATF supply. Approximately 7.3 qt (7 l) of ATF supply both the transmission hydraulics and the sub-gearbox. Both sub-transmissions form the manual transmission of the transmission.

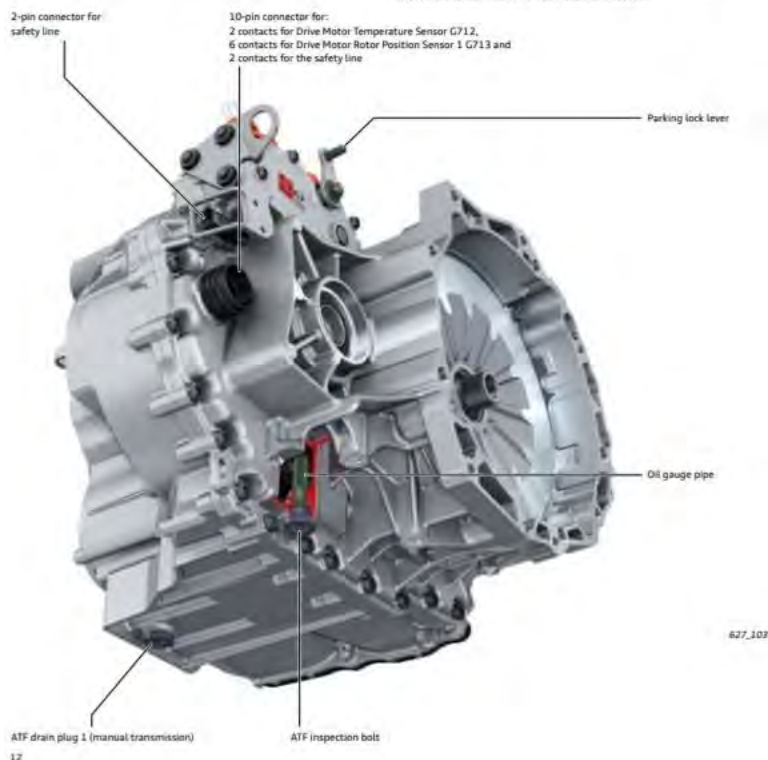


Figure 123

COUNT XVIII – INFRINGEMENT OF U.S. PATENT NO. 8,909,482

127. The allegations set forth in the foregoing paragraphs 1 through 126 are incorporated into this Eighteenth Claim for Relief.

128. On Dec. 9, 2014, U.S. Patent No. 8,909,482 (“the ’482 patent”), entitled “Device for Measuring Power Consumption and Performance Relative to the Environment of a Power-Consuming Unit,” was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the ’482 patent is attached as Exhibit 18.

129. Michigan Motor is the assignee and owner of the right, title and interests in and to the '482 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

130. Upon information and belief, Defendants have directly infringed at least claim 1 of the '482 patent by making, using, selling, importing and/or providing and causing to be used the 2013-2017 Volkswagen Jetta Hybrid and 2016-2018 Audi A3 Sportback e-tron (the "'482 patent Accused Instrumentalities").

131. In particular, claim 1 of the '482 patent recites a device for measuring power consumption and performance with respect to the environment of a power-consuming unit comprising a data introduction module, which receives at least one power consumption value, measured by a measurement apparatus of the power-consuming unit; an input device for inputting waste production data; a display screen; and a computer with a processor and a memory device having therein a plurality of instructions that, when executed by the processor, cause the processor to (a) receive the at least one power consumption value from the data introduction module, (b) receive the waste production data, (c) calculate an ecological parameter based on the at least one power consumption value and the waste production data, and (d) operate the display screen to display the calculated ecological parameter, wherein the calculated ecological parameter is an adjusted mean of the sum of the deviations of the at least one power consumption value with respect to a reference value corresponding to the at least one power consumption value.

132. On information and belief, the '482 patent Accused Instrumentalities infringe claim 1 of the '081 patent. The '482 patent Accused Instrumentalities comprise a device for measuring power consumption and performance with respect to the environment of a power-consuming unit (*Figure 124*) comprising a data introduction module, which receives at least one

power consumption value, measured by a measurement apparatus of the power-consuming unit; an input device for inputting waste production data; a display screen; and a computer with a processor and a memory device having therein a plurality of instructions that, when executed by the processor, cause the processor to (a) receive the at least one power consumption value from the data introduction module, (*Figure 125*) (b) receive the waste production data (*Figures 125-126*), (c) calculate an ecological parameter based on the at least one power consumption value and the waste production data, and (*Figure 127*) (d) operate the display screen to display the calculated ecological parameter (*Figure 127*), wherein the calculated ecological parameter is an adjusted mean of the sum of the deviations of the at least one power consumption value with respect to a reference value corresponding to the at least one power consumption value (*Figure 127*).

As shown below, the Power Meter shows the power requested by the driver (device for measuring power consumption and performance). The indicator also shows power consumption and performance with respect to the environment (operation in Eco range) of the power consuming unit.

Also, exemplified below, the electric power meter shows the power available from the electric drive motor (device for measuring power consumption and performance). The electric power meter allows the driver to depress the accelerator pedal only so far that the output of 20 kW [motor] is not exceeded (shows power consumption and performance with respect to the environment). This allows the driver to prevent an unwanted start of the combustion engine.

Power meter

The power meter shows the power requested by the driver. If the indicator remains in the Eco range, then the vehicle is being moved efficiently and it is possible to drive electrically.



Electric power meter

The electric power meter shows the power available from the electric drive motor. The electric power meter allows the driver to depress the accelerator pedal only so far that the output of 20 kW is not exceeded. This allows the driver to prevent an unwanted start of the combustion engine.



Figure 124

As shown below, the engine control unit (ECU) J623 comprises a data introduction module, which receives at least one power consumption value (load requirements), measured by a measurement apparatus (hybrid CAN BUS and Powertrain CAN BUS) of the power-consuming unit (drivetrain) (shown above).

Upon information and belief, the operating strategy for the electric drive motor and combustion engine functions is integrated into the engine control unit (ECU) J623. The operating strategy automatically selects the optimal operating state for the drive train and thereby avoids operating ranges of the combustion engine with a low level of efficiency (The ECU is capable of identifying and inputting waste production data). Where only a low torque or power output is required, the engine is switched off.

High voltage system control

The operating strategy for the electric drive motor and combustion engine functions is integrated into the engine control unit J623. The operating strategy automatically selects the optimal operating state for the drive train and thereby avoids operating ranges of the combustion engine with a low level of efficiency. Where only a low torque or power output is required, the engine is switched off.



The engine control unit is connected to the high-voltage battery and the power electronics by the hybrid CAN bus. The state of the high-voltage components is sent to the engine control unit, which controls the electrical ready-to-drive mode. All other information which is required for electric driving or charging the high-voltage battery, such as the load requirements, air conditioning requirements, temperature, etc. are exchanged via the hybrid CAN bus and the powertrain CAN bus.

Figure 125

Upon information and belief, the operating strategy for the electric drive motor and combustion engine functions is integrated into the data introduction module of the engine control unit (ECU) J623 (the ECU practices is a computer with a processor and a memory device having therein a plurality of instructions). The operating strategy (plurality of instructions) automatically selects the optimal operating state for the drive train and thereby avoids operating ranges of the combustion engine with a low level of efficiency (power consumption value) - where only a low torque or power output is required, the engine is switched off. The ECU J623 receives input from the heated Oxygen Sensor G130 which is an indication of engine operating efficiency, or inefficiency, as in waste production, because it is located after the catalytic converter.

System overview 1.4l TFSI engine

Sensors

Intake manifold pressure sender G71 (after throttle valve)
Intake air temperature sender G42

Charge pressure sender G31 with intake air temperature
sender Z G299 (after throttle valve)

Engine speed sender G28

Hall sender G40

Throttle valve control unit J338
Throttle valve drive angle senders 1 and 2 G187, G188

Accelerator pedal position senders G79 and G185

Clutch position sender G475

Brake light switch F
Brake pedal switch F63

Fuel pressure sender G247

Knock sensor 1 G61

Coolant temperature sender G62

Radiator outlet coolant temperature sender G83

Lambda probe G39

Lambda probe after catalytic converter G130

Brake servo pressure sensor G294*

Auxiliary input signals:
- Cruise control system I/O via J527
- Alternator terminal DPM
- Radiator fan speed 1 (pulse width modulated signal)

* only relevant to vehicles with twin-clutch gearbox and ABS without ESP

Actuators

Fuel pump control unit J538
Fuel pump (pre-supply pump) G6

Injector, cylinder 1 - 4
N30 - N33

Ignition coil 1 - 4 with output stage
N70, N127, N291, N292

Throttle valve control unit J338
Throttle valve with electric power control G186

Fuel pressure regulating valve N276

Activated charcoal filter solenoid valve 1 N30

Lambda probe heater Z19

Lambda probe 1 heating, after catalytic converter Z29

Inlet camshaft timing adjustment valve -1- N205

Turbocharger divert air valve N249

Charge pressure control solenoid valve N75

Auxiliary coolant pump relay J496
Coolant circulation pump V50

Motoric current supply relay J271

Vacuum pump relay J57
Vacuum pump for brakes V192
(for vehicles with automatic gearbox)

Auxiliary output signal:
- Brake light to onboard power supply control unit J519

48

49



Jetta 2011 ►, Jetta 2015 ►

4-Cylinder Direct Injection (1.4L Engine, 4V, EA 211, Turbocharger, Hybrid) - Edition 12.2017

7 Heated Oxygen Sensor

► "7.1 Overview - Heated Oxygen Sensor", page 294

► "7.2 Heated Oxygen Sensor, Removing and Installing", page 296

7.1 Overview - Heated Oxygen Sensor



Note

- ◆ Coat the new heated oxygen sensors with an assembly paste. This paste must not get into the slots of the heated oxygen sensor body.
- ◆ Only the threads on a used heated oxygen sensor may be coated with hot bolt paste. This paste must not get into the slots of the heated oxygen sensor body. Hot bolt paste: Refer to the Parts Catalog.
- ◆ The oxygen sensor wire must always be attached at the same location when installing. Do not let the wire connection come in contact with the exhaust pipe.

1 - Bracket

- ☐ To plenum chamber
- ☐ Coupling point for the Oxygen Sensor 1 before Catalytic Converter - GX10-

2 - Oxygen Sensor 1 Before Catalytic Converter - GX10-

- ☐ 55 Nm
- ☐ Consists of:
 - Heated Oxygen Sensor - G39-
 - Oxygen Sensor Heater - Z19-

- ☐ Removing and installing. Refer to:
 - "7.2.2 Oxygen Sensor 1 before Catalytic Converter GX10, Removing and Installing", page 296.

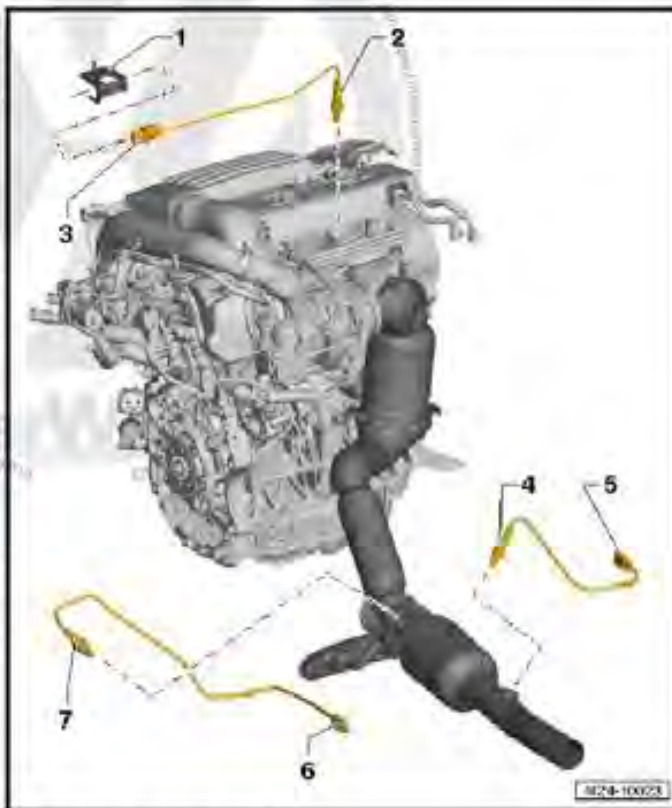
3 - Connector

- ☐ For the Oxygen Sensor 1 before Catalytic Converter - GX10-

4 - Oxygen Sensor 1 after Catalytic Converter - GX7-

- ☐ 55 Nm
- ☐ Consists of:
 - Oxygen Sensor after Catalytic Converter - G130-

Heater for Oxygen Sensor 2 after Catalytic Converter - Z30-



294

Rep. Gr.24 - Multiport Fuel Injection

Jetta 2011, Jetta 2015, 4-Cylinder Direct Injection (1.4L Engine, 4V, EA 211, Turbocharger Hybrid) Edition 12.2017

Repair Manual

Jetta 2011 ➤

Jetta 2015 ➤

4-Cylinder Direct Injection (1.4L Engine, 4V, EA 211, Turbocharger, Hybrid)

Engine ID	CNL A	CRJA							
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Edition 12.2017

Figure 126

The ECU J623 receives input from the heated Oxygen Sensor G130 which is an indication of engine operating efficiency, or inefficiency, and thus constitutes waste production data, because the heated Oxygen Sensor G130 is located after the catalytic converter. The ECU J623 calculates an ecological parameter (a particular mode of economic driving that results in the maximum operating efficiency and thus, minimal environmental impact) based on the at least one power consumption value (low level of engine efficiency) and the waste production data (oxygen sensor output).

High voltage system control

The operating strategy for the electric drive motor and combustion engine functions is integrated into the engine control unit J623. The operating strategy automatically selects the optimal operating state for the drive train and thereby avoids operating ranges of the combustion engine with a low level of efficiency. Where only a low torque or power output is required, the engine is switched off.



The engine control unit is connected to the high-voltage battery and the power electronics by the hybrid CAN bus. The state of the high-voltage components is sent to the engine control unit, which controls the electrical ready-to-drive mode. All other information which is required for electric driving or charging the high-voltage battery, such as the load requirements, air conditioning requirements, temperature, etc. are exchanged via the hybrid CAN bus and the powertrain CAN bus.

System overview 1.4i TFSI engine

Sensors

Intake manifold pressure sender G27 (after throttle valve)
Intake air temperature sender G42

Charge pressure sender G31 with intake air temperature sender 2 G299 (after throttle valve)

Engine speed sender G28

Hall sender G40

Throttle valve control unit J338
Throttle valve drive angle senders 1 and 2 G187, G188

Accelerator pedal position senders G79 and G185

Clutch position sender G476

Brake light switch F
Brake pedal switch F63

Fuel pressure sender G247

Knock sensor 1 G81

Coolant temperature sender G82

Radiator outlet coolant temperature sender G83

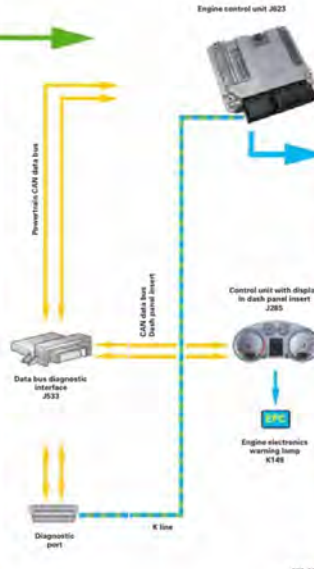
Lambda probe G29

Lambda probe after catalytic converter G130

Brake servo pressure sensor G294*

Auxiliary input signals:
- Cruise control system I/O via J527
- Alternator terminal DFM
- Radiator fan speed 1 (pulse width modulated signal)

* only relevant to vehicles with twin-clutch gearbox and ABS without ESP



Actuators

Fuel pump control unit J538
Fuel pump (pre-supply pump) G6

Injector, cylinder 1 - 4
N30 - N33

Ignition coil 1 - 4 with output stage
N70, N127, N291, N292

Throttle valve control unit J338
Throttle valve with electric power control G186

Fuel pressure regulating valve N276

Activated charcoal filter solenoid valve 1 N80

Lambda probe heater Z19

Lambda probe 1 heating, after catalytic converter Z29

Inlet camshaft timing adjustment valve - 1 N295

Turbocharger divert air valve N249

Charge pressure control solenoid valve N275

Auxiliary coolant pump relay J436
Coolant circulation pump V90

Metronic current supply relay Z271

Vacuum pump relay J57
Vacuum pump for brakes V192 (for vehicles with automatic gearbox)

Auxiliary output signal:
- Brake light to onboard power supply control unit J519

432_022

43

43

Power meter

The power meter shows the power requested by the driver. If the indicator remains in the Eco range, then the vehicle is being moved efficiently and it is possible to drive electrically.



Electric power meter

The electric power meter shows the power available from the electric drive motor. The electric power meter allows the driver to depress the accelerator pedal only so far that the output of 20 kW is not exceeded. This allows the driver to prevent an unwanted start of the combustion engine.





Jetta 2011 ➤ , Jetta 2015 ➤

4-Cylinder Direct Injection (1.4L Engine, 4V, EA 211, Turbocharger, Hybrid) - Edition 12.2017

7 Heated Oxygen Sensor

➤ "7.1 Overview - Heated Oxygen Sensor", page 294

➤ "7.2 Heated Oxygen Sensor, Removing and Installing", page 296

7.1 Overview - Heated Oxygen Sensor



Note

- ◆ Coat the new heated oxygen sensors with an assembly paste. This paste must not get into the slots of the heated oxygen sensor body.
- ◆ Only the threads on a used heated oxygen sensor may be coated with hot bolt paste. This paste must not get into the slots of the heated oxygen sensor body. Hot bolt paste. Refer to the Parts Catalog.
- ◆ The oxygen sensor wire must always be attached at the same location when installing. Do not let the wire connection come in contact with the exhaust pipe.

1 - Bracket

- ☐ To plenum chamber
- ☐ Coupling point for the Oxygen Sensor 1 before Catalytic Converter - GX10-

2 - Oxygen Sensor 1 Before Catalytic Converter - GX10-

- ☐ 55 Nm
- ☐ Consists of:
 - Heated Oxygen Sensor - G39-
 - Oxygen Sensor Heater - Z19-
- ☐ Removing and installing. Refer to ➤ "7.2.2 Oxygen Sensor 1 before Catalytic Converter GX10 - Removing and Installing", page 296.

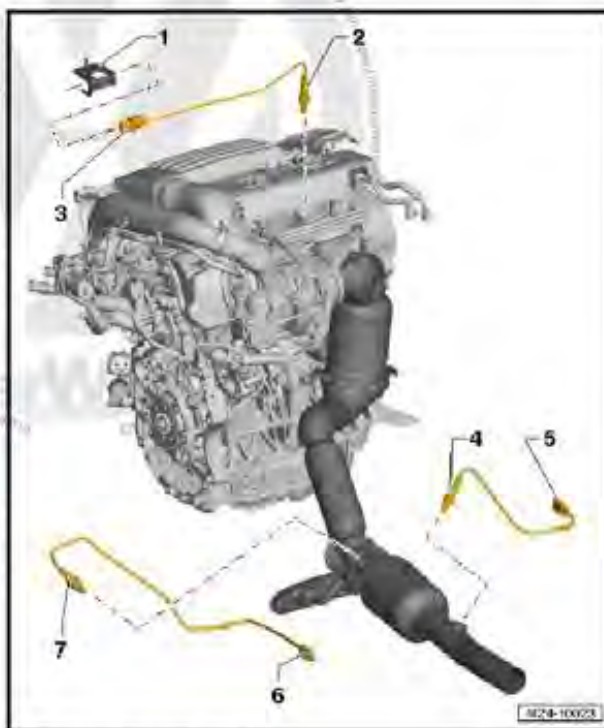
3 - Connector

- ☐ For the Oxygen Sensor 1 before Catalytic Converter - GX10-

4 - Oxygen Sensor 1 after Catalytic Converter - GX7-

- ☐ 55 Nm
- ☐ Consists of:
 - Oxygen Sensor after Catalytic Converter - G130-

Heater for Oxygen Sensor 2 after Catalytic Converter - Z30-



294

Rep. Gr 24 - Multiport Fuel Injection

Upon information and belief, the '482 patent Accused Instrumentalities calculate the ecological parameter is an adjusted mean of the sum of the deviations of the at least one power consumption value (low level of engine efficiency) with respect to a reference value corresponding to the at least one power consumption value.

Based upon the totality of the foregoing evidence, and based further upon information and belief, the '482 patent Accused Instrumentalities include "a device for measuring power consumption and performance with respect to the environment of a power-consuming unit comprising a data introduction module, which receives at least one power consumption value, measured by a

measurement apparatus of the power-consuming unit; an input device for inputting waste production data; a display screen; and a computer with a processor and a memory device having therein a plurality of instructions that, when executed by the processor, cause the processor to (a) receive the at least one power consumption value from the data introduction module, (b) receive the waste production data, (c) calculate an ecological parameter based on the at least one power consumption value and the waste production data, and (d) operate the display screen to display the calculated ecological parameter, wherein the calculated ecological parameter is an adjusted mean of the sum of the deviations of the at least one power consumption value with respect to a reference value corresponding to the at least one power consumption value.”

Figure 127

COUNT XIX – INFRINGEMENT OF U.S. PATENT NO. 6,557,540

133. The allegations set forth in the foregoing paragraphs 1 through 132 are incorporated into this Nineteenth Claim for Relief.

134. On May 6, 2003, U.S. Patent No. 6,557,540 (“the ’540 patent”), entitled “Method of Calculating a Valve Timing Command for an Engine,” was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the ’540 patent is attached as Exhibit 19.

135. Michigan Motor is the assignee and owner of the right, title and interests in and to the ’540 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

136. Upon information and belief, Defendants have directly infringed at least claims 1, 7, 11, and 14 of the ’540 patent by making, using, selling, importing and/or providing and causing to be used the 2011-2015 Volkswagen Jetta (2.0L) direct injection engine (the “’540 patent Accused Instrumentalities”).

137. In particular, claim 1 of the ’540 patent recites a method for calculating a valve timing command for an engine of a vehicle, comprising: obtaining an engine performance command; receiving an environmental conditions signal; determining a valve feedforward term based on the engine performance command and the environmental conditions signal; receiving

an engine performance feedback; calculating a valve feedback term based on the engine performance command and the engine performance feedback; and calculating a valve timing command based on the valve feedforward term and the valve feedback term.

138. On information and belief, the '540 patent Accused Instrumentalities infringe claim 1 of the '540 patent. The '540 patent Accused Instrumentalities practice a method for calculating a valve timing command for an engine of a vehicle, comprising (*Figure 128*): obtaining an engine performance command (*Figure 129*); receiving an environmental conditions signal (*Figure 130*); determining a valve feedforward term based on the engine performance command and the environmental conditions signal (*Figure 131*); receiving an engine performance feedback (*Figure 132*); calculating a valve feedback term based on the engine performance command and the engine performance feedback (*Figure 133*); and calculating a valve timing command based on the valve feedforward term and the valve feedback term (*Figure 134*).

As depicted below the Engine Control Module (ECM) calculates valve timing for an engine of a vehicle.

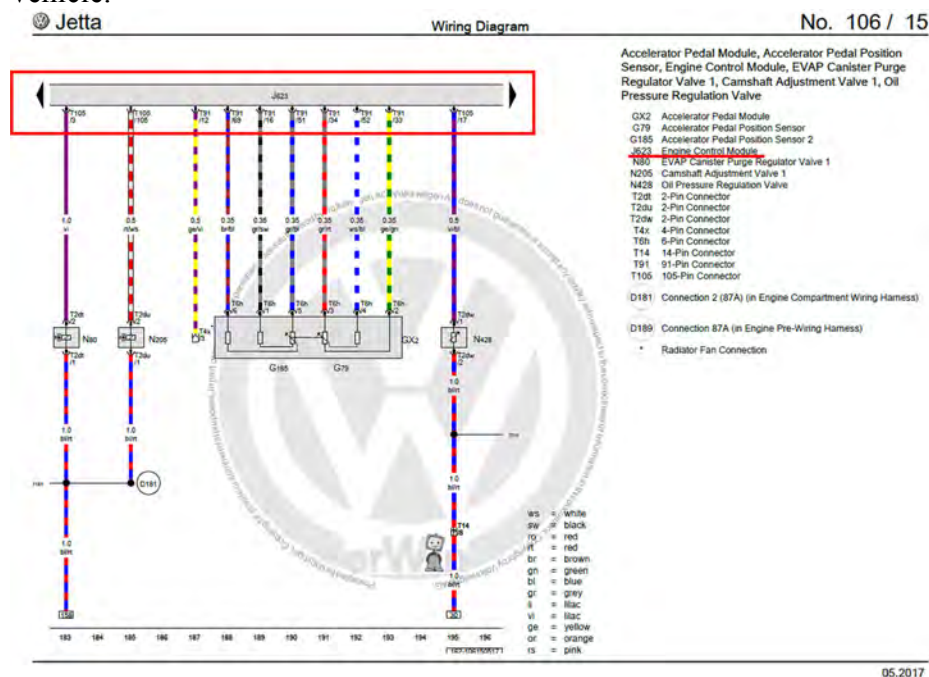
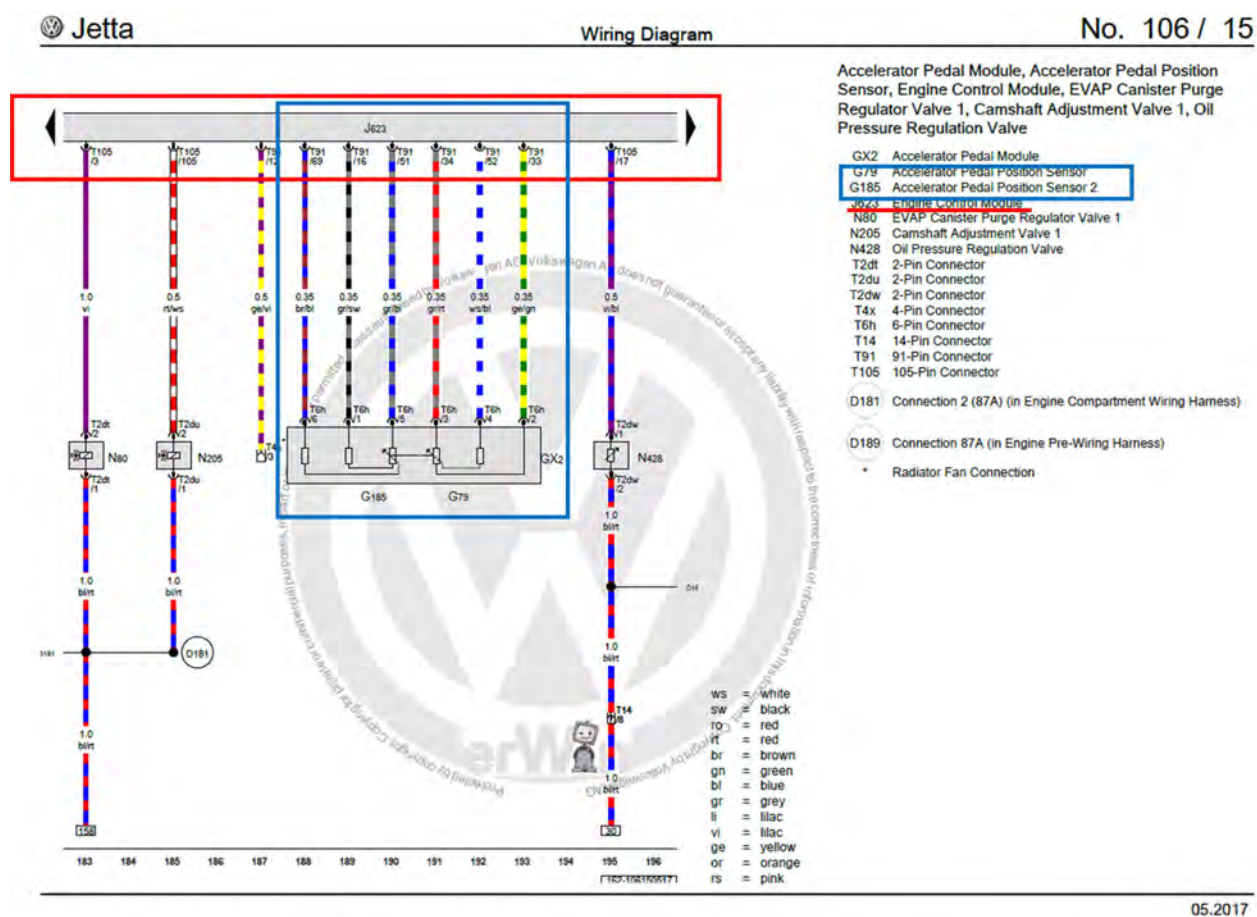
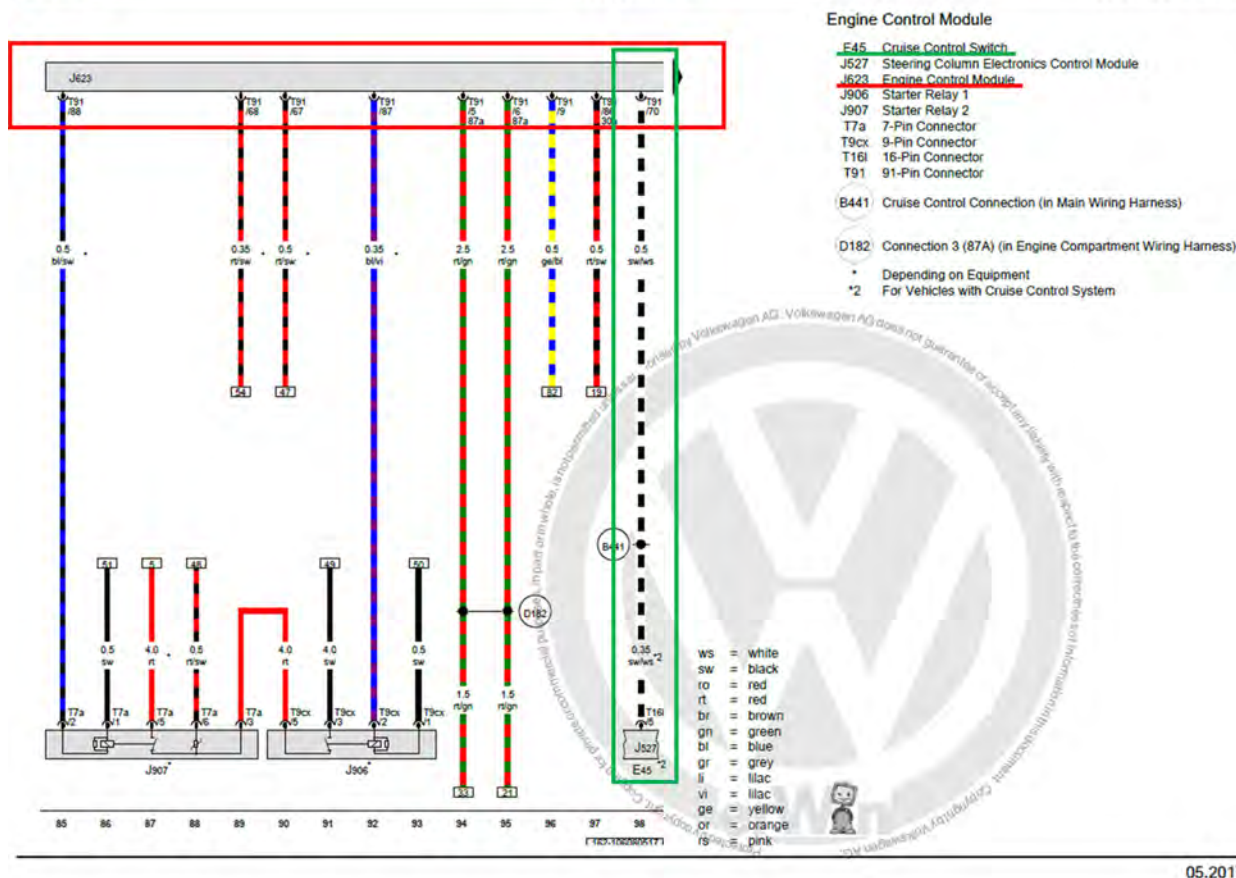


Figure 128

For example, as shown below, the Accelerator Pedal Position Sensor provides a signal to the ECM for the performance commands from the operator.



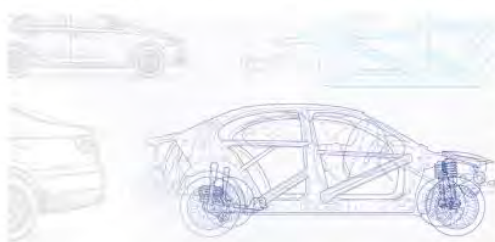
For example, as shown below, the Cruise Control Switch provides a signal to the ECM for the performance commands based on the cruise control settings.



For example, as shown below, an engine performance command (traction control signal and acceleration signal) is obtained by the ECM.

How does Volkswagen Electronic Stability Control work?

During the 2009 model year Volkswagen made the decision to add Electronic Stability Control as a safety feature on its entire lineup, a full three years before it became required on all [new vehicles](#) for 2012. You won't find a new vehicle without this feature in much the same way you can expect the safety features to always include airbags, but what is it and **how does Volkswagen Electronic Stability Control work?**



Many people are already aware of the anti-lock brake feature, which prevents wheels from locking up when braking, and traction control, which is meant to prevent wheels from spinning. Electronic stability control (ESC) uses the same hardware as these other safety features, but also uses a yaw rate, steering angle and acceleration sensors to detect whether the vehicle is headed in the direction the driver is attempting to make it go in. Whether the road conditions are slippery or you're driving at high speeds, when the ESC system detects a slip, brakes are automatically applied to just the wheels that aren't going in the right direction.

[Read More: VW Technology & Features](#)

<https://www.newcenturyvw.com/blog/how-does-volkswagen-electronic-stability-control-work/>

For example, as shown below, the electronic stability program (ESP) sensor unit (G419), and ABS control module and wheel speed sensors obtain engine performance commands.

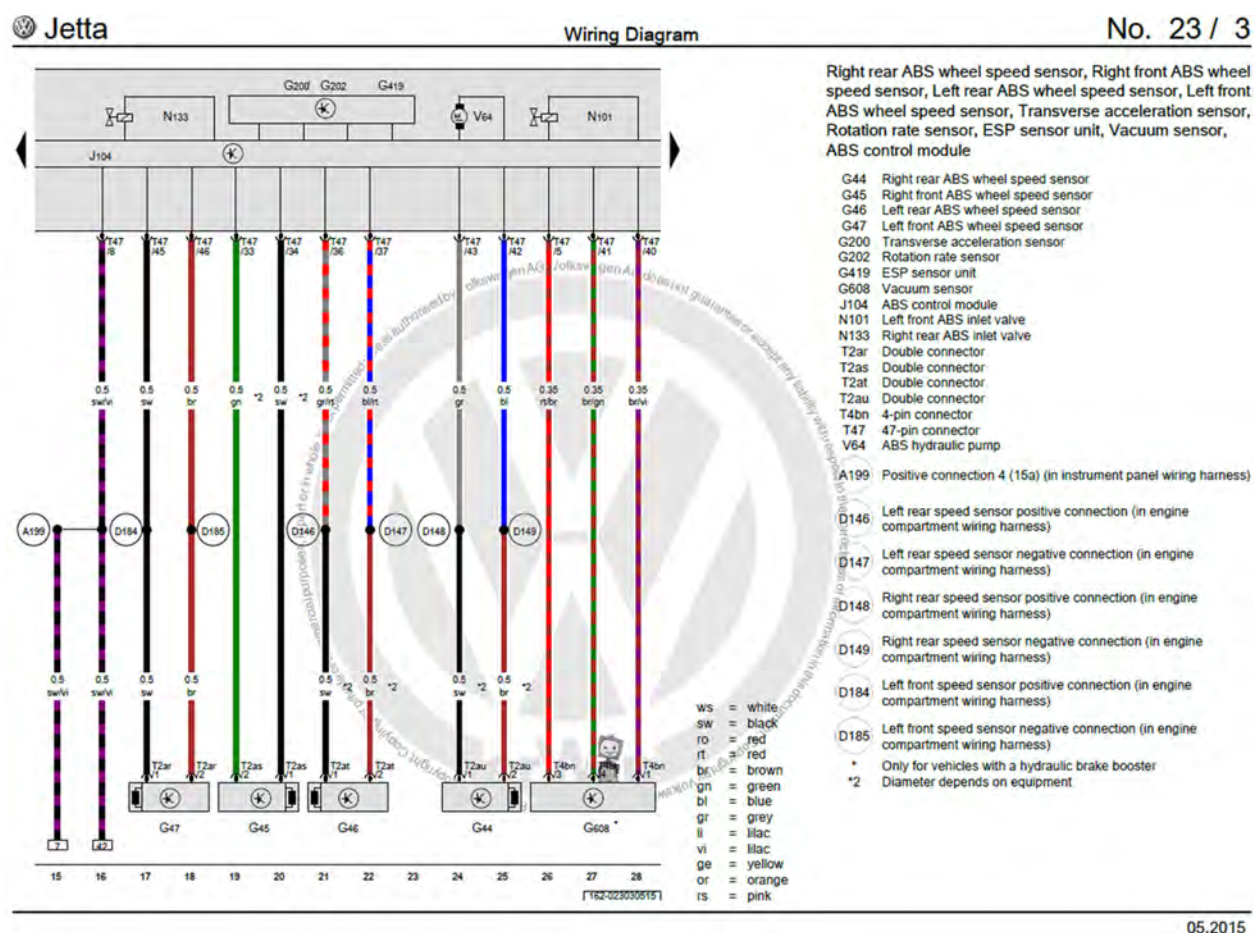


Figure 129

For example, as depicted below, the Manifold Absolute Pressure (MAP) sensors (G71) measure barometric pressure during key on, engine off (KOEO) which is received by the ECM (J623). Also, the Intake Air Temperature Sensor (IATS; G42) senses the temperature of the incoming air which is received by the ECM (J623).

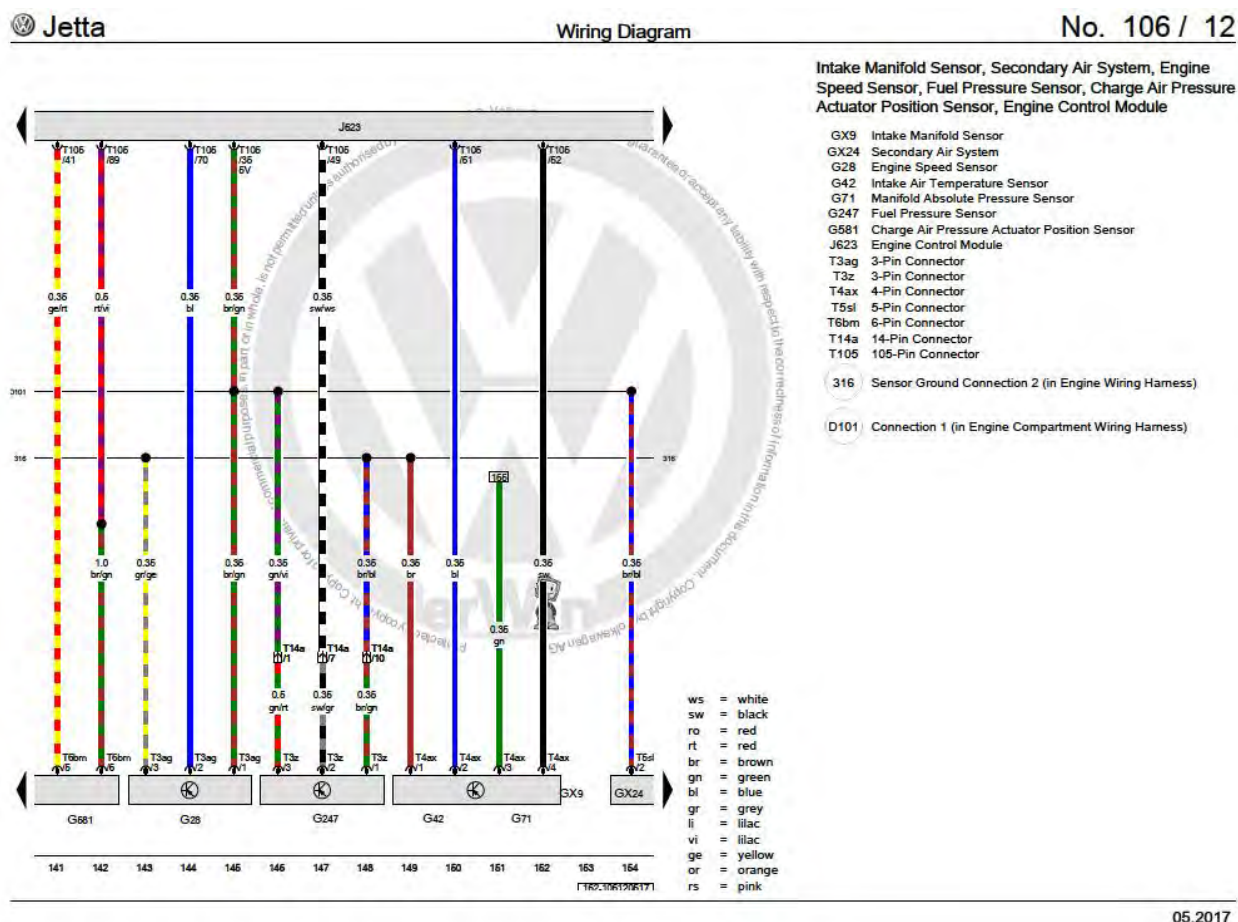


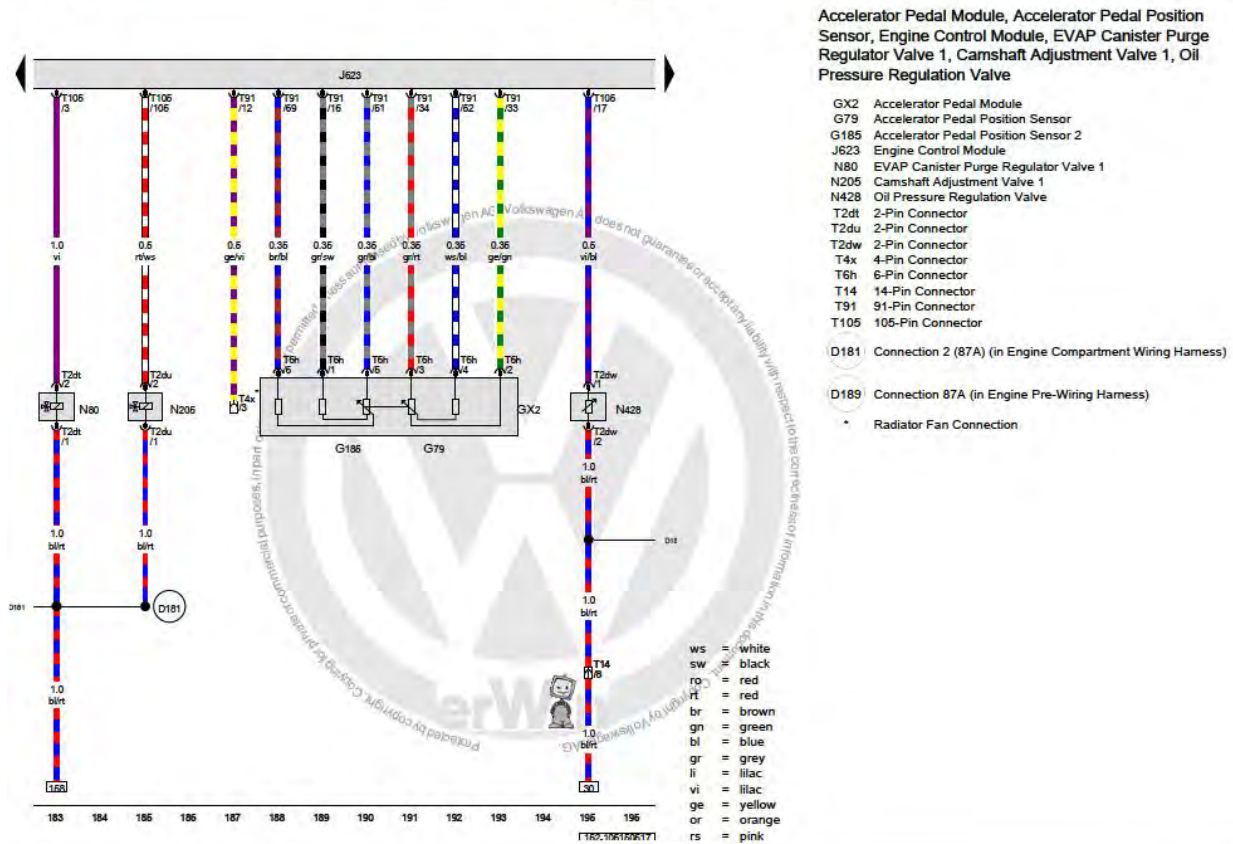
Figure 130

For example, using the Accelerator Pedal Module (GX2), which controls the Accelerator Pedal Position Sensor (G79) and the Accelerator Position Sensor 2 (G185), engine performance commands are sent, via the Engine Control Module (ECM; J623) and the environmental conditions signal(s) are sent using environmental commands from the IATS and MAPS (shown above) which send the environmental conditions signals to the ECM to determine a valve feed forward term.

Jetta

Wiring Diagram

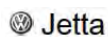
No. 106 / 15



05.2017

Figure 131

For example, the Engine Control Module (ECM; J623) receives engine performance feedback from various sensors including the engine speed sensor (G28) shown below.



Wiring Diagram

No. 48 / 12

Engine speed sensor, Intake air temperature sensor,
Manifold absolute pressure sensor, Engine control module,
EVAP canister purge regulator valve 1

G28 Engine speed sensor
G42 Intake air temperature sensor
G71 Manifold absolute pressure sensor
J623 Engine control module
N80 EVAP canister purge regulator valve 1
T2dt Double connector
T3ag 3-pin connector
T4ax 4-pin connector
T4x 4-pin connector
T14 14-pin connector, near the battery
T60 60-pin connector
T94 94-pin connector

(D101) Connection 1 (in engine compartment wiring harness)

* Coolant fan connection
*2 Depending on equipment
*3 The color of the wires depends on vehicle equipment

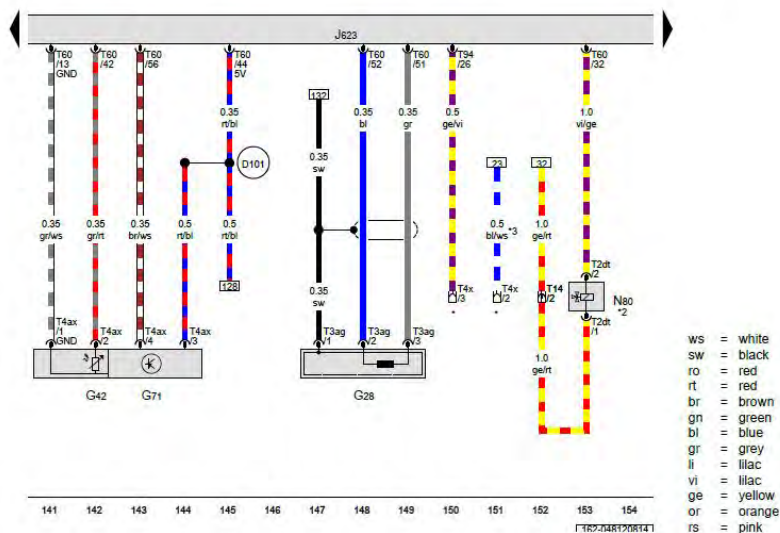


Figure 132

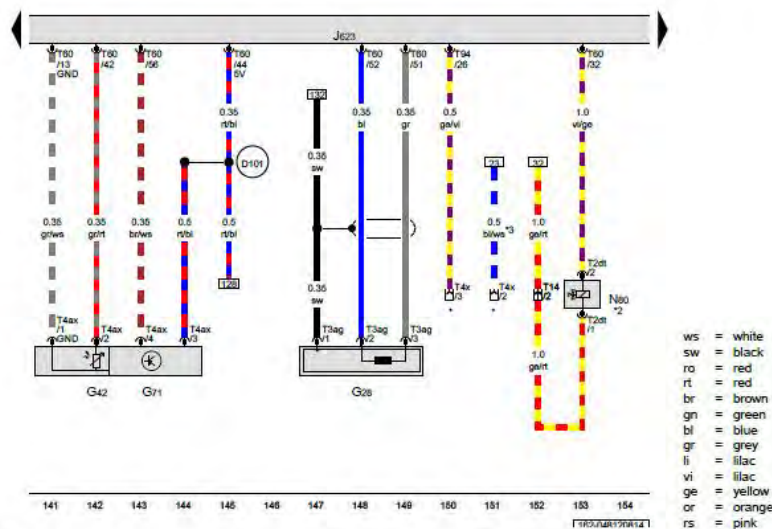
For example, as shown below the ECM (J623) calculates a valve feedback term which is communicated to the camshaft adjustment valve (N205) capable of advancing or retarding the camshaft (adjusting itself) based on a performance command (i.e. from the Accelerator Pedal Module) and the performance feedback (i.e. engine speed sensor (G28 (shown above))).

Engine speed sensor, Intake air temperature sensor,
Manifold absolute pressure sensor, Engine control module,
EVAP canister purge regulator valve 1

G28 Engine speed sensor
G42 Intake air temperature sensor
G71 Manifold absolute pressure sensor
J623 Engine control module
N80 EVAP canister purge regulator valve 1
T2dt Double connector
T3ag 3-pin connector
T4ax 4-pin connector
T4x 4-pin connector
T14 14-pin connector, near the battery
T60 60-pin connector
T94 94-pin connector

D101 Connection 1 (in engine compartment wiring harness)

* Coolant fan connection
*2 Depending on equipment
*3 The color of the wires depends on vehicle equipment



08.2014

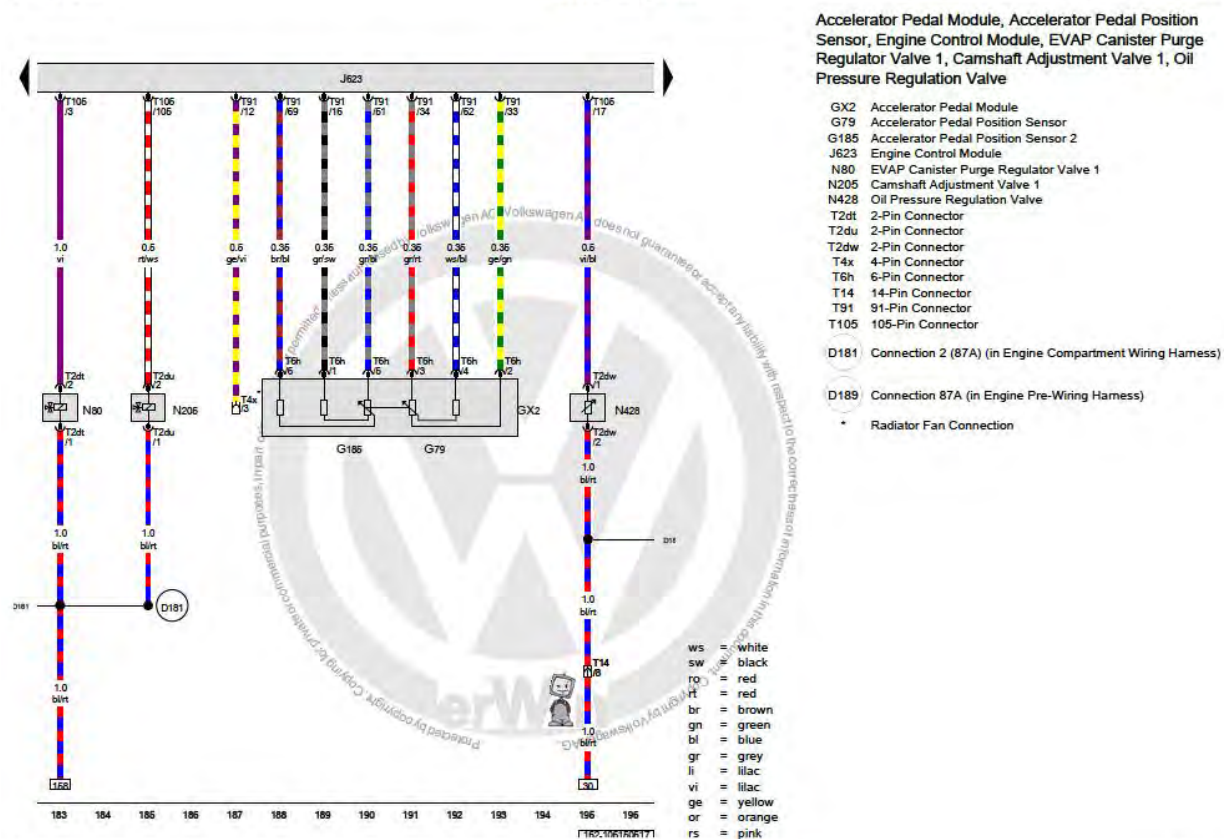
Figure 133

For example, as shown below the ECM (J623) calculates a valve timing command which is communicated to the camshaft adjustment valve (N205) based on data from sensors such as the Accelerator Pedal Position Sensor (G79) and Accelerator Pedal Position Sensor 2 (G185) and the Accelerator Pedal Module (GX2)(feedforward term) and the engine performance based on engine speed sensor input (G28 (shown above)) (valve feedback term).

Jetta

Wiring Diagram

No. 106 / 15



05.2017

Figure 134

139. In particular, claim 7 of the '540 patent recites the method of claim 1 wherein said receiving an engine performance feedback includes receiving engine speed data.

140. On information and belief, the '540 patent Accused Instrumentalities infringe claim 7 of the '540 patent. The '540 patent Accused Instrumentalities practice the method of claim 1 wherein said receiving an engine performance feedback includes receiving engine speed data (Figure 135).

As shown below, the engine speed sensor (G28) provides engine performance feedback that is sent to the ECM (J623).

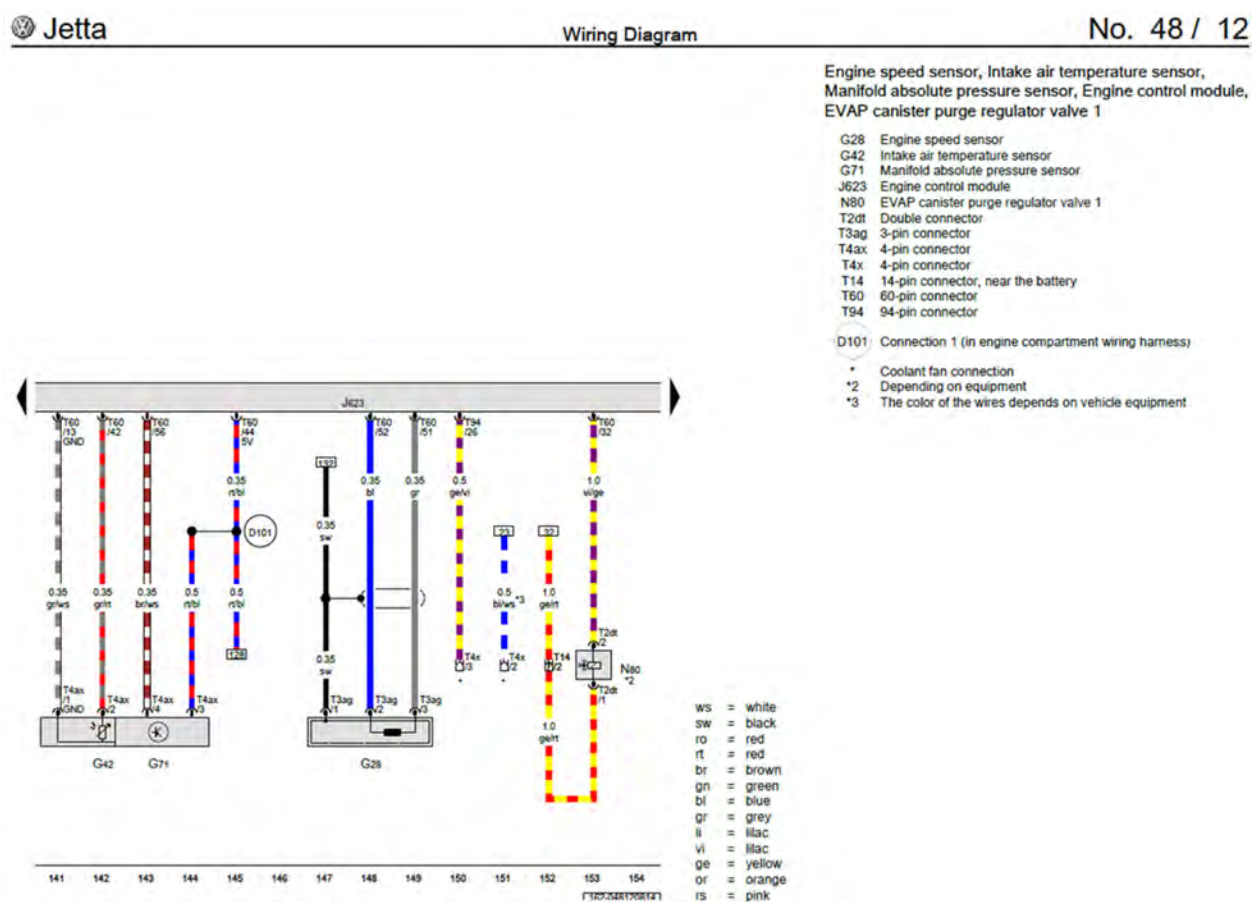
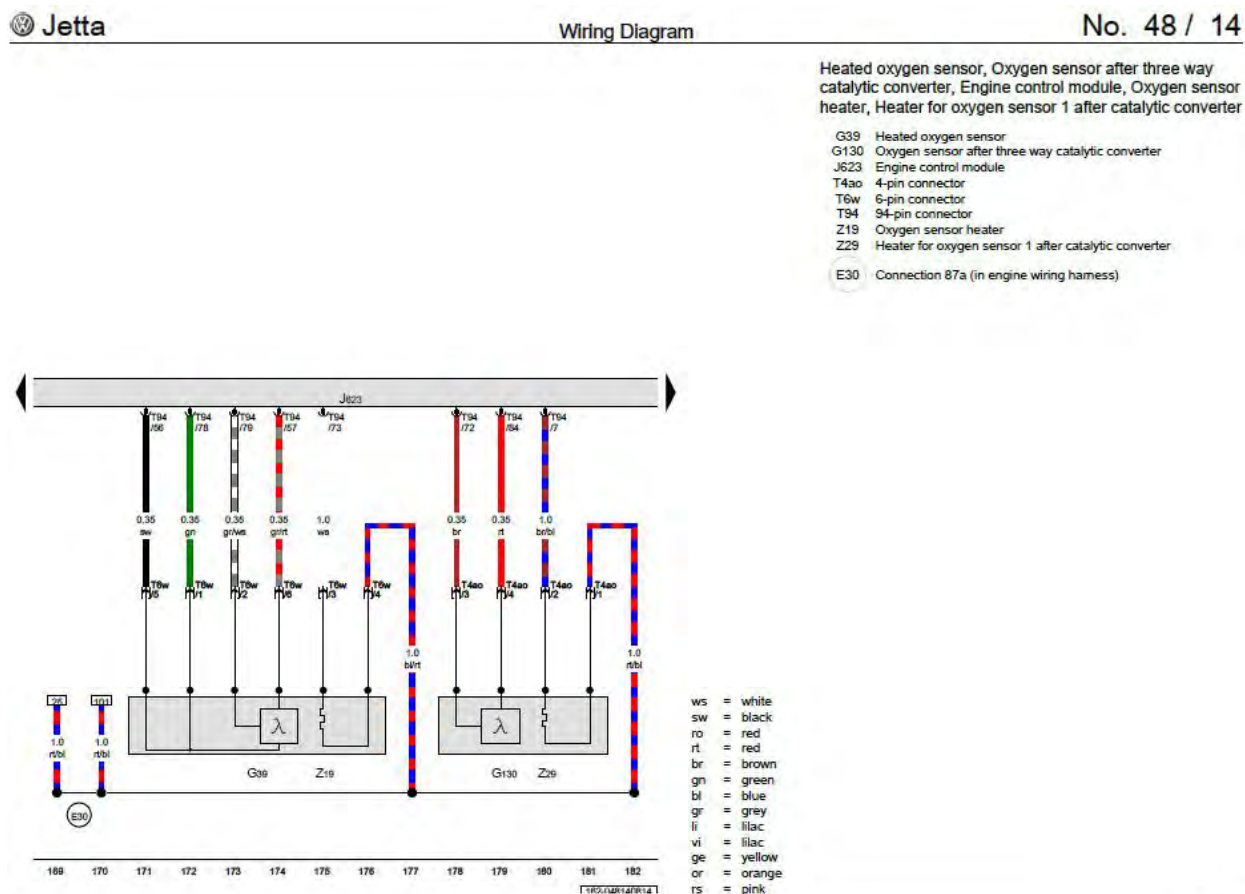


Figure 135

141. In particular, claim 11 of the '540 patent recites the method of claim 1 further comprising receiving fuel conversion data.

142. On information and belief, the '540 patent Accused Instrumentalities infringe claim 11 of the '540 patent. The '540 patent Accused Instrumentalities practice the method of claim 1 further comprising receiving fuel conversion data (*Figure 136*).

For example, the Heated Oxygen Sensor (G39) and the Oxygen sensor after three-way catalytic converter (G130) send fuel conversion data to the ECM (J623).



08.2014

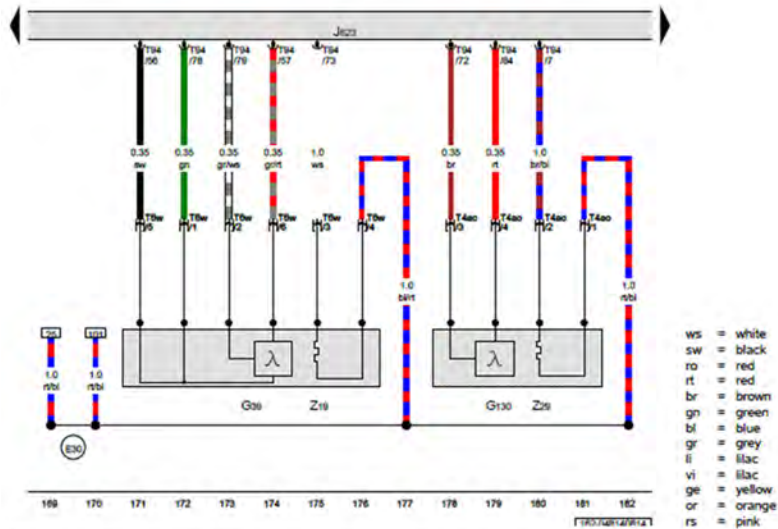
Figure 136

143. In particular, claim 14 of the '540 patent recites the method of claim 1 further comprising receiving engine emissions data.

144. On information and belief, the '540 patent Accused Instrumentalities infringe claim 14 of the '540 patent. The '540 patent Accused Instrumentalities practice the method of claim 1 further comprising receiving engine emissions data. (Figure 137).

Heated oxygen sensor, Oxygen sensor after three way catalytic converter, Engine control module, Oxygen sensor heater, Heater for oxygen sensor 1 after catalytic converter

G39 Heated oxygen sensor
G130 Oxygen sensor after three way catalytic converter
J623 Engine control module
T4ao 4-pin connector
T6w 6-pin connector
T94 94-pin connector
Z19 Oxygen sensor heater
Z29 Heater for oxygen sensor 1 after catalytic converter
E30 Connection 87a (in engine wiring harness)



08.2014

Figure 137

Based upon the totality of the foregoing evidence, and based further upon information and belief, the '540 patent Accused Instrumentalities practice "a method for calculating a valve timing command for an engine of a vehicle, comprising: obtaining an engine performance command; receiving an environmental conditions signal; determining a valve feedforward term based on the engine performance command and the environmental conditions signal; receiving an engine performance feedback; calculating a valve feedback term based on the engine performance command and the engine performance feedback; and calculating a valve timing command based on the valve feedforward term and the valve feedback term."

COUNT XX – INFRINGEMENT OF U.S. PATENT NO. 6,345,604

145. The allegations set forth in the foregoing paragraphs 1 through 144 are incorporated into this Twentieth Claim for Relief.

146. On Feb. 12, 2002, U.S. Patent No. 6,345,604 ("the '604 patent"), entitled "Electronically Controlled Throttle Valve with Commanded Default Position for the Throttle Valve of an Internal Combustion Engine," was duly and legally issued by the United States

Patent and Trademark Office. A true and correct copy of the '604 patent is attached as Exhibit 20.

147. Michigan Motor is the assignee and owner of the right, title and interests in and to the '604 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

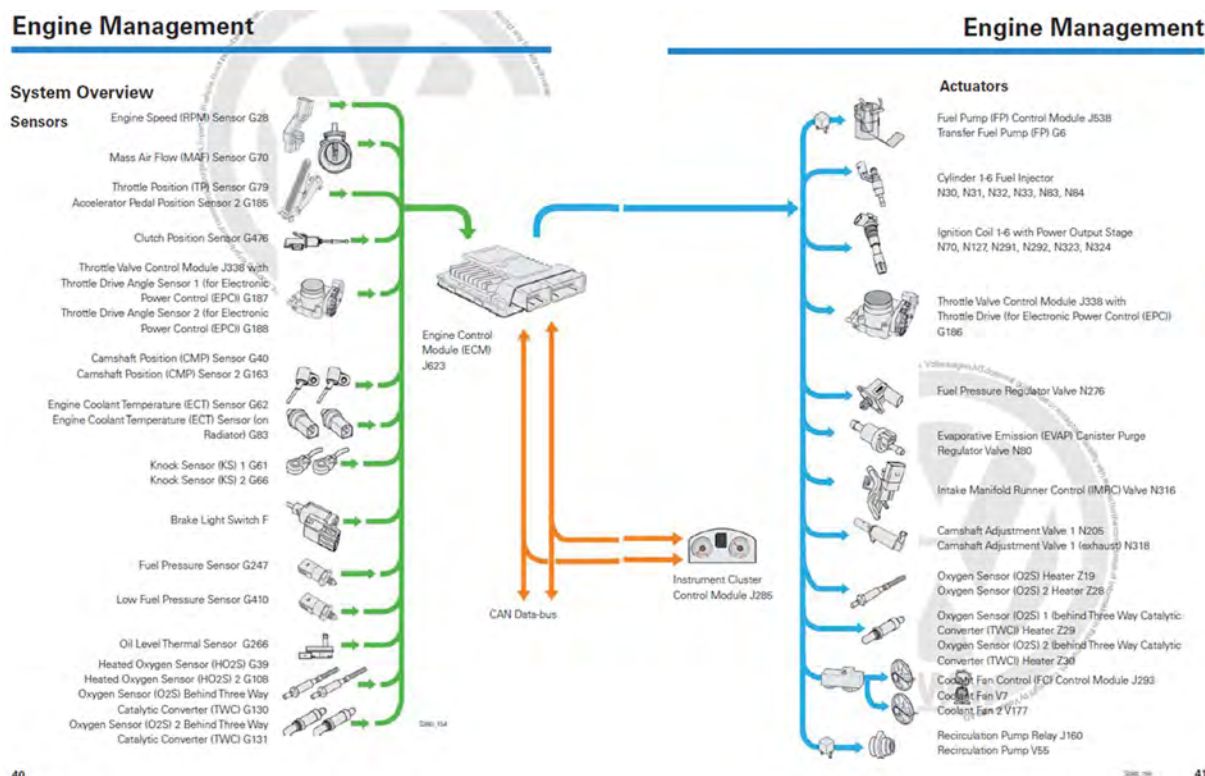
148. Upon information and belief, Defendants have directly infringed at least claim 1 of the '604 patent by making, using, selling, importing and/or providing and causing to be used the 2013-2018 Passat Sedan, 2012-2016 CC, 2012-2017 Touareg, 2018-2019 Atlas, and 2012-2016 Porsche Cayenne (the "'604 patent Accused Instrumentalities").

149. In particular, claim 1 of the '604 patent recites a throttle controller for an internal combustion engine having a throttle body including an adjustable throttle valve in an intake air passage; a throttle valve actuator motor connected to the throttle valve for activating the throttle valve between a closed position and a full-open position; a throttle position sensor connected to the throttle valve for developing a position signal indicating the actual throttle valve position; an ignition switch for initiating engine startup and engine shutdown and for developing an engine shutdown signal; an accelerator pedal and an accelerator position sensor for developing an actual accelerator pedal position signal; and an electronic microprocessor comprising an input signal conditioning circuit receiving the engine shutdown signal, the electronic microprocessor including means for developing a throttle valve actuator motor control signal responsive to the presence of an engine shutdown signal whereby the throttle valve actuator motor adjusts the throttle plate to a throttle plate position between the closed position and the fully open position to prevent throttle plate freezing when the engine is shut down.

150. On information and belief, the '604 patent Accused Instrumentalities infringe claim 1 of the '604 patent. The '604 patent Accused Instrumentalities comprise a throttle

controller for an internal combustion engine having a throttle body including an adjustable throttle valve in an intake air passage (*Figure 138*); a throttle valve actuator motor connected to the throttle valve for activating the throttle valve between a closed position and a full-open position (*Figure 139*); a throttle position sensor connected to the throttle valve for developing a position signal indicating the actual throttle valve position (*Figure 140*); an ignition switch for initiating engine startup and engine shutdown and for developing an engine shutdown signal (*Figure 141*); an accelerator pedal and an accelerator position sensor for developing an actual accelerator pedal position signal (*Figure 142*); and an electronic microprocessor comprising an input signal conditioning circuit receiving the engine shutdown signal (*Figure 143*), the electronic microprocessor including means for developing a throttle valve actuator motor control signal responsive to the presence of an engine shutdown signal whereby the throttle valve actuator motor adjusts the throttle plate to a throttle plate position between the closed position and the fully open position to prevent throttle plate freezing when the engine is shut down (*Figure 144*).

The '604 patent Accused Instrumentalities comprise a Throttle Valve Control Module (J338) which communicates with the Engine Control Module (ECM; J623).



The throttle body includes an adjustable throttle valve in an intake air passage.

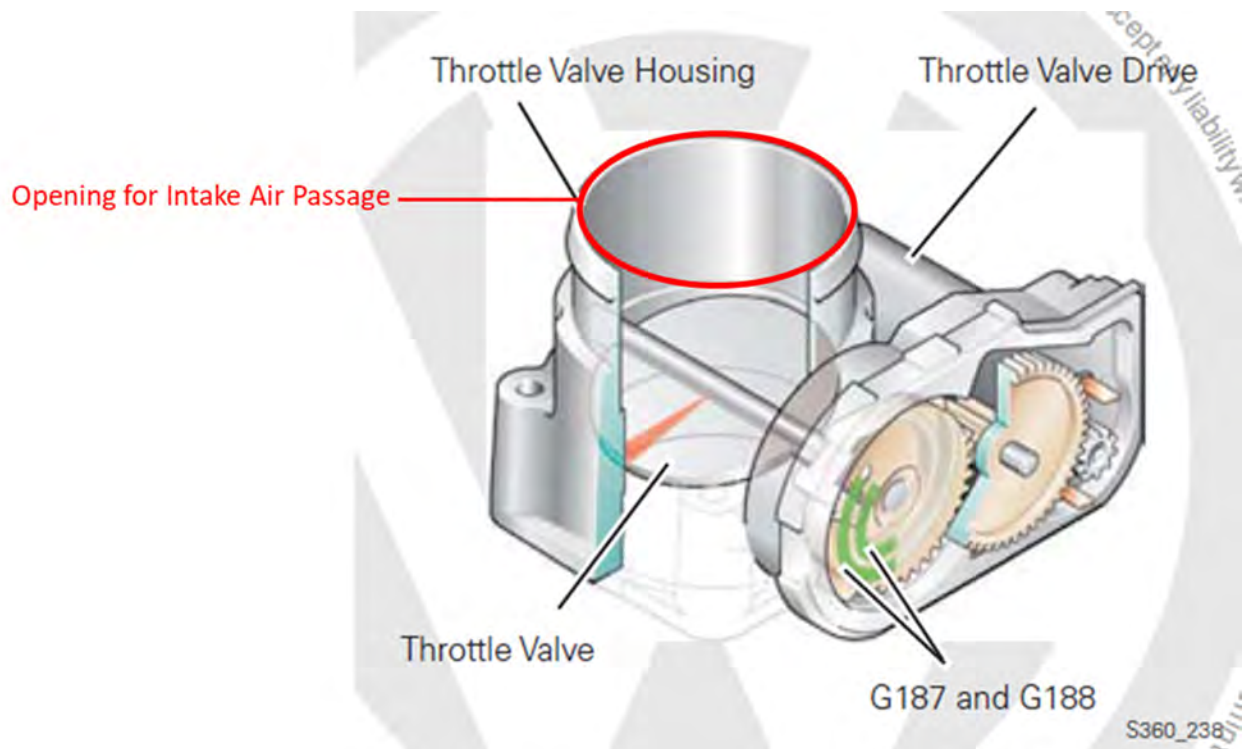
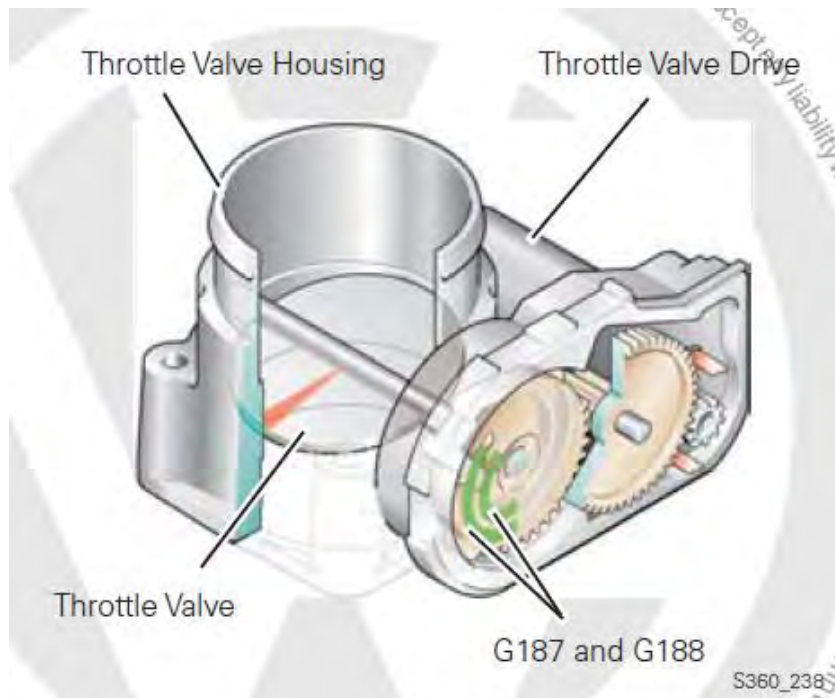
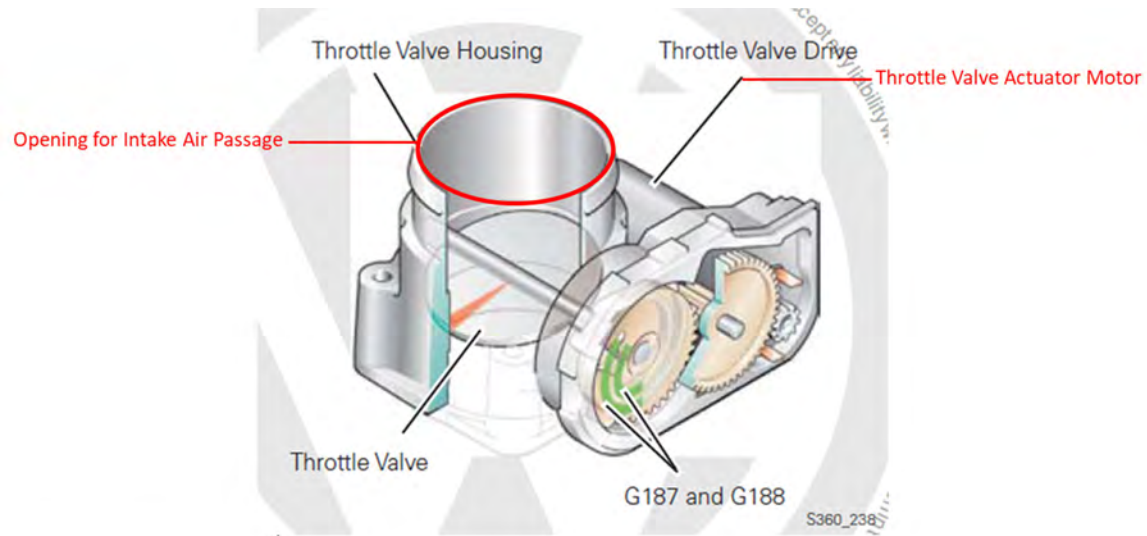


Figure 138

The Throttle Valve Drive is a throttle valve actuator motor connected to the throttle valve for activating the throttle valve between a closed position and a full-open position.



<https://www.youtube.com/watch?v=sOKJ72HnL14>

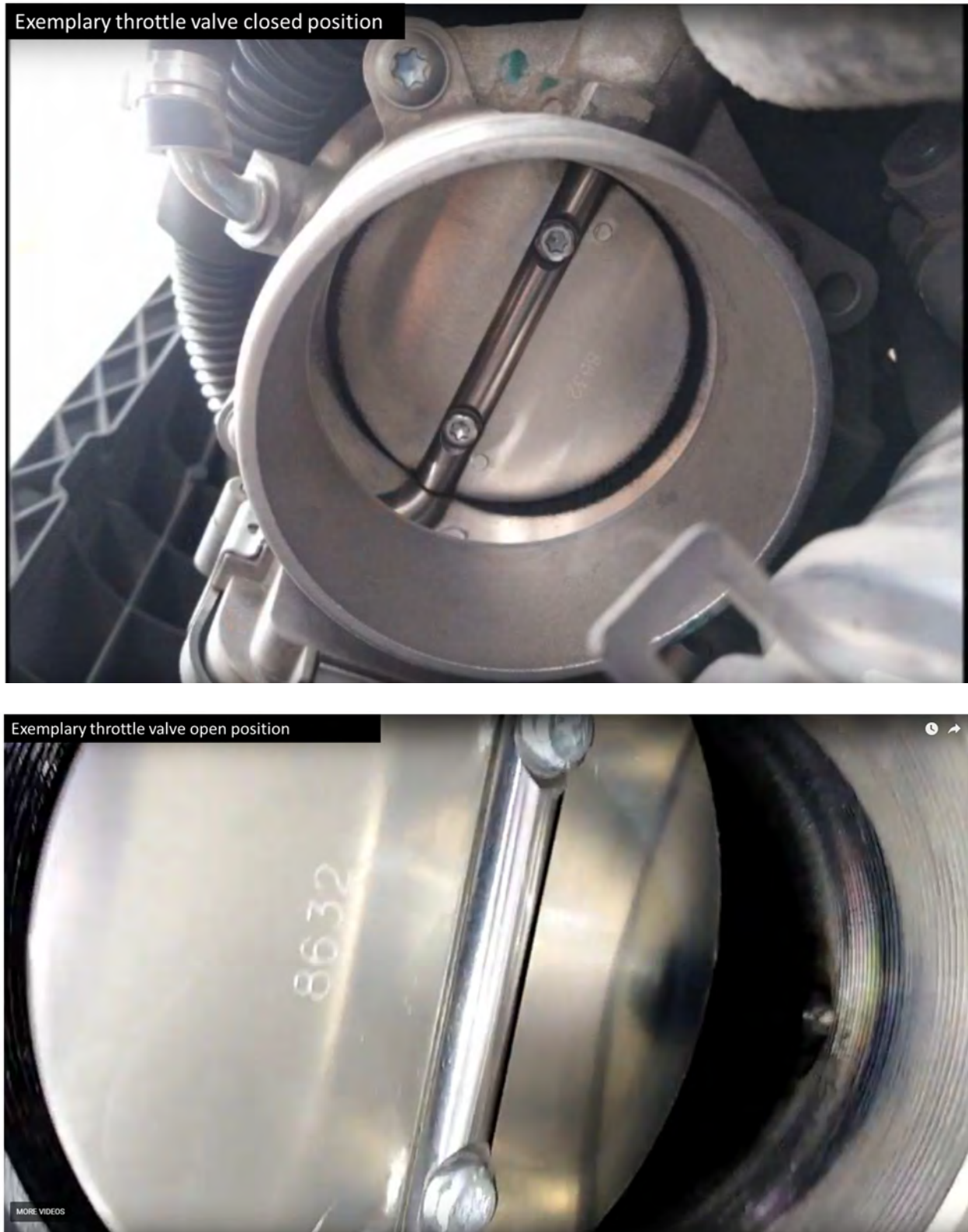


Figure 139

For example, as demonstrated in the exemplary images below, the '604 patent Accused Instrumentalities comprise a Throttle Drive Angle Sensor 1 (G187) and Throttle Drive Angle Sensor 2 (G188) connected to the Throttle Valve Control Module (J338) and develop a position signal indicating the actual throttle valve position.

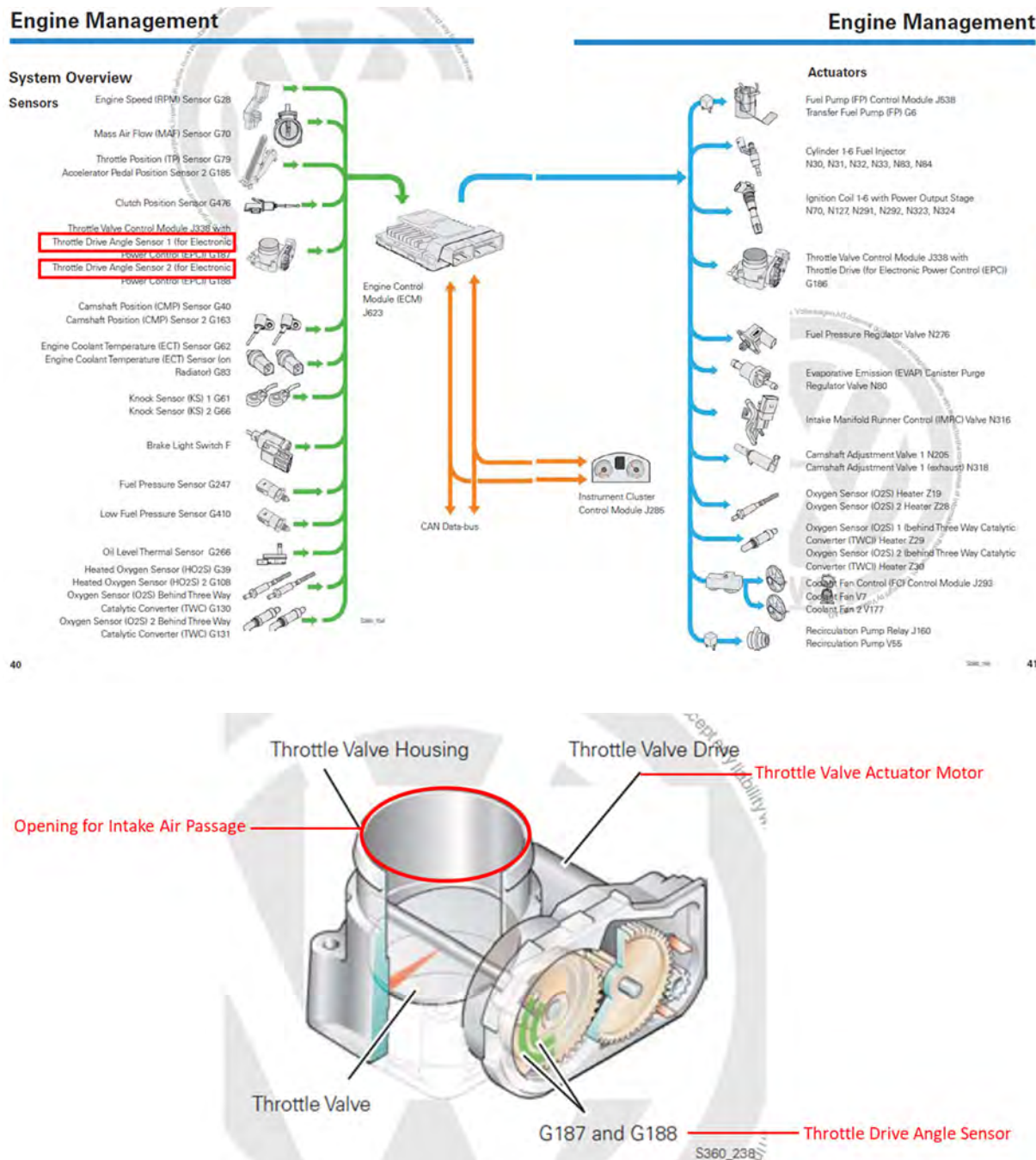


Figure 140

The ignition switch initiates engine start up (being switched on) and engine shutdown (being switched off).

Vehicle key positions in the ignition switch



Fig. 111 In the ignition switch: Vehicle key positions.

⚠ Please first read and note the introductory information and heed the WARNINGS ⚠

If there is no vehicle key in the ignition, the steering column is locked.

Vehicle key position → Fig. 111

- (0) Ignition switched off. Steering column lock engaged. The vehicle key can be removed.
- (1) Ignition switched off. Steering column lock disengaged. Vehicle key can be removed.
- (2) Ignition is switched on. Vehicle key can be removed from ignition switch.
- (3) Start the engine. Once the engine has started, the vehicle key stays in this position. To remove the vehicle key, push it fully into the ignition switch. When released, the vehicle key returns to position (1) the engine is switched off.

If you use the wrong key

If an unauthorized vehicle key has been inserted into the ignition switch, it can be removed as follows:

- **Automatic transmission:** The vehicle key cannot be removed from the ignition unless both the key and the selector lever have been moved to the correct position. Press the release button on the transmission selector lever, move the selector lever to the Park (P) position, and release the button. The vehicle key can now be removed.
- **Manual transmission:** Pull out the vehicle key.

As evidenced by the vehicle notice below, once the engine has been switched off a signal is sent to the radiator fan to sufficiently cool the engine, the '604 patent Accused Instrumentalities comprise a n ignition switch for initiating engine startup and engine shutdown and for developing an engine shutdown signal.

! NOTICE

If the vehicle has been driven hard for a long time, the engine could overheat when it is stopped. To reduce the risk of engine damage, let the engine idle in Neutral for about 2 minutes before you switch off the ignition.



If the ignition is switched on or the engine is running and the driver door is opened, a chime sounds. The chime is also a reminder to switch off the engine and turn off the ignition before leaving and locking the vehicle from the outside.



On vehicles with automatic transmissions, the vehicle key can only be removed from the ignition when the transmission is in Park (P).



After the engine has been switched off, the radiator fan in the engine compartment may keep running for several minutes, or may start running after the vehicle has been parked for a while, even if the ignition is switched off and the vehicle key has been removed. The radiator fan shuts off automatically when the engine has cooled down enough.

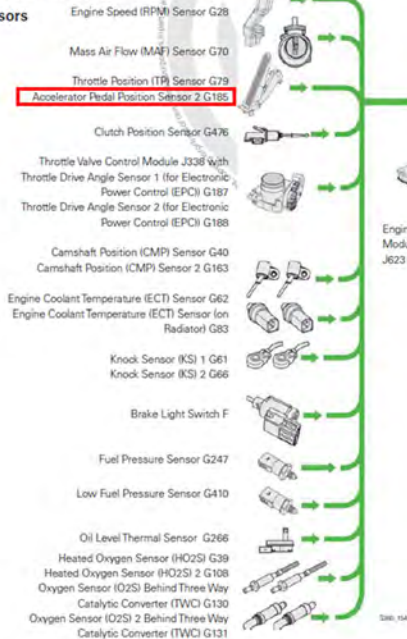
Figure 141

For example, as demonstrated in the exemplary images below, the '604 patent Accused Instrumentalities comprise an accelerator pedal and an Accelerator Pedal Position Sensor 2 (G185) for developing an actual accelerator pedal position signal.

Engine Management

System Overview

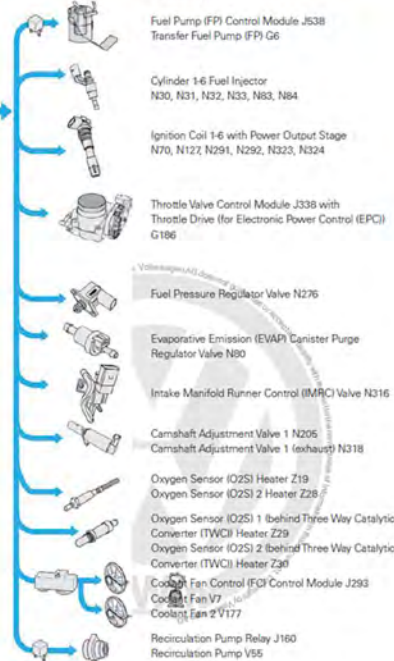
Sensors



40

Engine Management

Actuators



41

Engine Management

The Throttle Position (TP) Sensor G79 and the Accelerator Pedal Position Sensor 2 G185

The two throttle position sensors are part of the accelerator pedal module and are contact-free sensors.

The ECM detects the driver's request from these sensor signals.

Signal Utilization

The ECM uses the signals from the Throttle Position Sensor to calculate the fuel injection volume.

Effects of a Signal Failure

If one or both sensors fails, an entry is made in the DTC memory and the error light for electronic power control is switched on. Comfort functions such as cruise control or engine drag torque control are switched off.

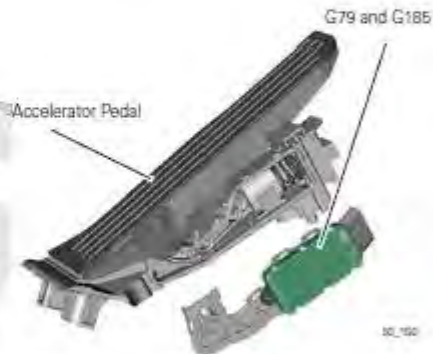


Figure 142

The '604 patent Accused Instrumentalities comprise an Engine Control Module (ECM; J623), which is an electronic microprocessor comprising an input signal conditioning circuit receiving the engine shutdown signal. The ignition shutdown signal informs the ECM that the throttle should be in a closed position.

Engine Management

The Throttle Drive Angle Sensor 1 G187 and Throttle Drive Angle Sensor 2 G188 in the Throttle Valve Control Unit

These sensors determine the current position of the throttle valve and send this information to the ECM.

Signal Utilization

The ECM recognizes the position of the throttle valve from the angle sensors signals. The signals from the two sensors are redundant, meaning that both sensors provide the same signal.

Effects of a Signal Failure

Example 1

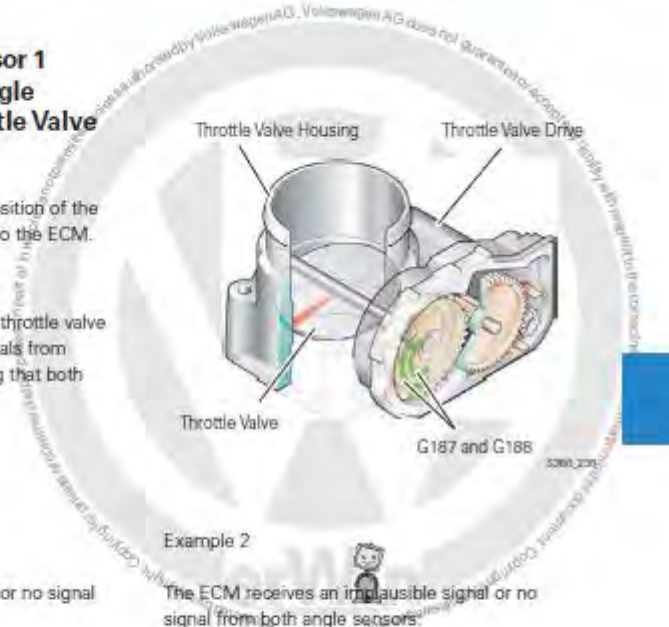
The ECM receives an implausible signal or no signal at all from an angle sensor:

- An entry is made in the DTC memory and the error light for electric throttle operation is switched on
- Systems which affect torque, (e.g. cruise control system or engine drag torque control), are switched off
- The load signal is used to monitor the remaining angle sensor
- The accelerator pedal responds normally

Example 2

The ECM receives an implausible signal or no signal from both angle sensors:

- An entry is made for both sensors in the DTC memory and the error light for electric throttle operation is switched on
- The throttle valve drive is switched off
- The engine runs only at an increased idle speed of 1,500 RPM and no longer reacts to the accelerator pedal



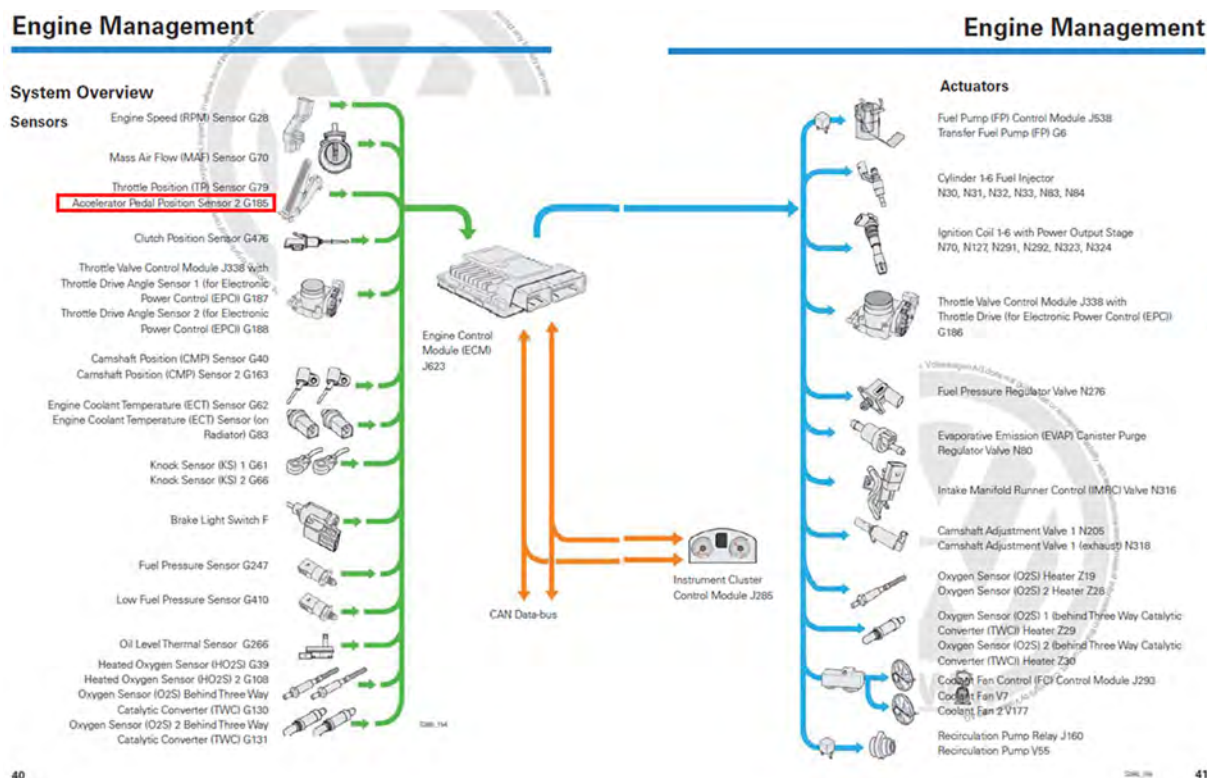
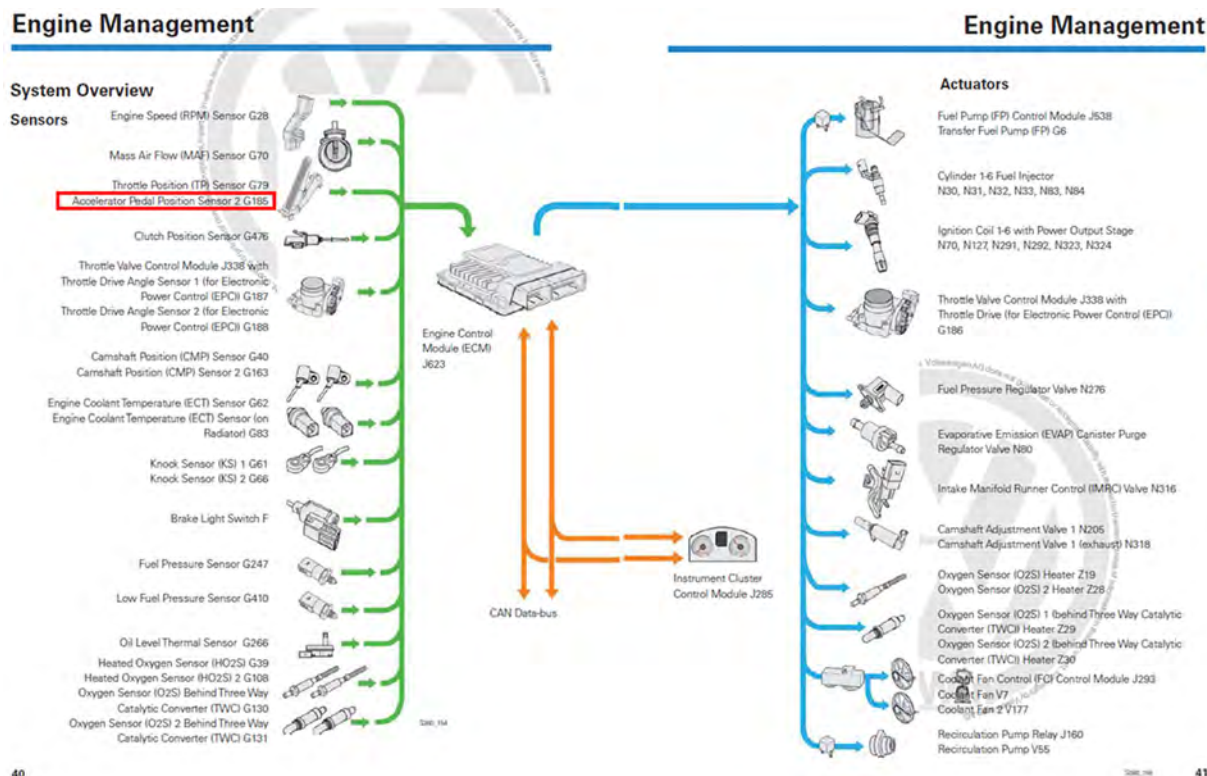


Figure 143

For example, as evidenced by the figures below, the Engine Control Module (ECM; J623) is an electronic microprocessor.



And the ECM includes a means for developing a throttle valve actuator motor control signal responsive to the presence of an engine shutdown.

Engine Management

The Throttle Drive Angle Sensor 1 G187 and Throttle Drive Angle Sensor 2 G188 in the Throttle Valve Control Unit

These sensors determine the current position of the throttle valve and send this information to the ECM.

Signal Utilization

The ECM recognizes the position of the throttle valve from the angle sensors signals. The signals from the two sensors are redundant, meaning that both sensors provide the same signal.

Effects of a Signal Failure

Example 1

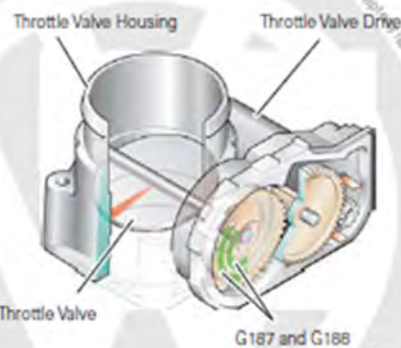
The ECM receives an implausible signal or no signal at all from an angle sensor:

- An entry is made in the DTC memory and the error light for electric throttle operation is switched on
- Systems which affect torque, (e.g. cruise control system or engine drag torque control), are switched off
- The load signal is used to monitor the remaining angle sensor
- The accelerator pedal responds normally

Example 2

The ECM receives an implausible signal or no signal from both angle sensors:

- An entry is made for both sensors in the DTC memory and the error light for electric throttle operation is switched on
- The throttle valve drive is switched off
- The engine runs only at an increased idle speed of 1,500 RPM and no longer reacts to the accelerator pedal



Whereby the Throttle Drive for Electronic Power Control (EPC) motor adjusts the throttle plate to a throttle plate position between closed (idle) to fully open (wide-open throttle position). As evidenced by DTC P0638 if the engine shutoff time is greater than five seconds there are three checks. The checks are indicative of an engine shutdown signal.

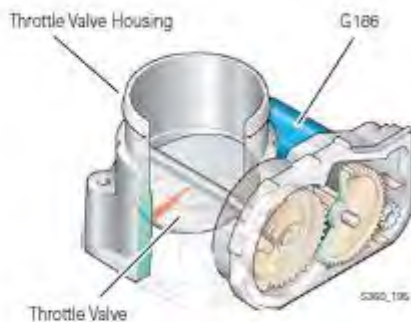
Throttle Drive for Electronic Power Control (EPC) G186

The Throttle Drive for Electronic Power Control is an electrical motor which operates the throttle valve through a gear mechanism.

The range of adjustment is stepless from idle to the wide-open throttle position.

Effects of a Failure

If the throttle drive fails, the throttle valve is automatically pulled to the emergency running position. An entry is made in the DTC memory and the error lamp for electronic power control is switched on.



The throttle plate adjustment described above is performed to prevent throttle plate freezing when the engine is shut down.

2013 Volkswagen Passat Sedan (A32) V6-3.6L (CDVB)

Vehicle » ALL Diagnostic Trouble Codes (DTC) » Testing and Inspection » P Code Charts » P0638 » Engine Control Module, 2012 - 2014 MY

ENGINE CONTROL MODULE, 2012 - 2014 MY

Engine Control Module, 2012 - 2014 MY

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0638 Throttle Actuator Control Range/Performance Bank 1	Throttle Actuator Control Rationality check close movement	Time to close to reference point > 0.6 s and reference point 2.88%	Engine speed 0 RPM Vehicle speed 0 MPH ECT > 5.0° C IAT @ manifold > 5.0° C CASE 1: Ignition on CASE 2: Engine shut-off-time > 5.0 s number of checks 3.00	5.00 s Multiple	2 DCY	Check the Throttle Valve Control Module (GX3) . Refer to Throttle Valve Control Module (GX3) Checking .
	Signal range check @ mechanical stop low	TPS 1 signal voltage "NOT 0.40 - 0.80 V OR TPS 2 signal voltage "NOT 4.20 - 4.60 V	Engine speed 0 RPM Vehicle speed 0 MPH CASE 1: Ignition on ECT 5.0 - 115° C IAT @ manifold 5.0 - 143° C CASE 2: Engine shut-off-time > 5.0 s ECT 5.0 - 115° C IAT @ manifold 5.0 - 143° C	0.30 s Multiple		

Figure 144

Based upon the totality of the foregoing evidence, and based further upon information and belief, the '604 patent Accused Instrumentalities include "a throttle controller for an internal combustion engine having a throttle body including an adjustable throttle valve in an intake air passage; a throttle valve actuator motor connected to the throttle valve for activating the throttle valve between a closed position and a full-open position; a throttle position sensor connected to the throttle valve for developing a position signal indicating the actual throttle valve position; an ignition switch for initiating engine startup and engine shutdown and for developing an engine shutdown signal; an accelerator pedal and an accelerator position sensor for developing an actual accelerator pedal position signal; and an electronic microprocessor comprising an input signal conditioning circuit receiving the engine shutdown signal, the electronic microprocessor including means for developing a throttle valve actuator motor control signal responsive to the presence of an engine shutdown signal whereby the throttle valve actuator motor adjusts the throttle plate to a throttle plate position between the closed position and the fully open position to prevent throttle plate freezing when the engine is shut down."

DIRECT INFRINGEMENT, INDIRECT INFRINGEMENT,

DAMAGES AND WILLFUL INFRINGEMENT

151. The allegations set forth in the foregoing paragraphs 1 through 150 are incorporated into this Twenty-First Claim for Relief.

152. Defendants were made aware of the patents-in-suit at least as early as March 4, 2015, when it was provided notice of the patents via letter.

153. Upon information and belief Defendants' conduct in making, using, selling, offering to sell and/or importing the Accused Instrumentalities directly infringes at least claim 1 of the '260 patent; claim 1 of the '128 patent; claim 1 of the '565 patent; claim 1 of the '281 patent; claims 1 and 11 of the '804 patent; claim 1 of the '680 patent; claim 1 of the '166 patent; claim 1 of the '031 patent; claim 1 of the '287 patent; claims 1 and 17 of the '761 patent; claims 1-3 and 7 of the '115 patent; claims 1 and 7 of the '574 patent; claim 1 of the '497 patent; claims 1 and 14 of the '157 patent; claim 1 of the '122 patent; claim 1 of the '149 patent; claim 1 of the '081 patent; claim 1 of the '482 patent; claims 1, 7, 11, and 14 of the '540 patent; and claim 1 of the '604 patent pursuant to 35 U.S.C. § 271(a). Infringement of these representative claims is alleged solely for illustrative pleading purposes. Michigan Motor reserves the right to assert infringement of additional claims of the Patents-in-Suit as this action proceeds.

154. Upon information and belief, since at least the time of receiving this Amended Complaint, Defendants have induced and continue to induce others to infringe at least claim 1 of the '260 patent; claim 1 of the '128 patent; claim 1 of the '565 patent; claim 1 of the '281 patent; claims 1 and 11 of the '804 patent; claim 1 of the '680 patent; claim 1 of the '166 patent; claim 1 of the '031 patent; claim 1 of the '287 patent; claims 1 and 17 of the '761 patent; claims 1-3 and 7 of the '115 patent; claims 1 and 7 of the '574 patent; claim 1 of the '497 patent; claims 1 and 14 of the '157 patent; claim 1 of the '122 patent; claim 1 of the '149 patent; claim 1 of the '081 patent; claim 1 of the '482 patent; claims 1, 7, 11, and 14 of the '540 patent; and claim 1 of the '604 patent under 35 U.S.C. § 271(b) by, among other things, and with specific intent or willful blindness, actively aiding and abetting others to infringe, including but not limited to Defendant's partners and customers, whose use of the Accused Instrumentalities constitutes direct infringement of at least the aforementioned claims. Infringement of these representative claims is alleged solely for illustrative pleading purposes. Michigan Motor reserves the right to assert infringement of additional claims of the Patents-in-Suit as this action proceeds.

155. In particular, Defendants' actions that aid and abet others such as their partners and customers to infringe include distributing the Accused Instrumentalities and providing materials and/or services related to the Accused Instrumentalities. On information and belief, the Defendants have engaged in such actions with specific intent to cause infringement or with willful blindness to the resulting infringement because Defendants have had actual knowledge of the patents-in-suit and that its acts were inducing infringement of said patents since at least the time of receiving this Amended Complaint.

156. Upon information and belief, each Defendant is liable as a contributory infringer of the Patents-in-Suit under 35 U.S.C. § 271(c) by offering to sell, selling and importing into the United States the Accused Instrumentalities to be especially made or adapted for use in

infringement of the Patents-in-Suit. The Accused Instrumentalities are material components for use in practicing the Patents-in-Suit and are specifically made and are not a staple article of commerce suitable for substantial non-infringing use.

157. On information and belief, since Defendants received notice of the patents, Defendants' infringement has been and continues to be willful.

158. Michigan Motor has been harmed by the Defendants' infringing activities.

JURY DEMAND

Pursuant to Rule 38 of the Federal Rules of Civil Procedure, Plaintiff demands a trial by jury on all issues triable as such.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff demands judgment for itself and against Defendants as follows:

A. An adjudication that Defendants have infringed the '260, '128, '565, '281, '804, '680, '166, '031, '287, '761, '115, '574, '497, '157, 122, '149, '081, '482, '540, and '604 patents;

B. An award of damages to be paid by Defendants adequate to compensate Plaintiff for Defendants' past infringement of the '260, '128, '565, '281, '804, '680, '166, '031, '287, '761, '115, '574, '497, '157, 122, '149, '081, '482, '540, and '604 patents;

C. and any continuing or future infringement through the date such judgment is entered, including interest, costs, expenses and an accounting of all infringing acts including, but not limited to, those acts not presented at trial;

D. A declaration that this case is exceptional under 35 U.S.C. § 285, and an award of Plaintiff's reasonable attorneys' fees; and

E. An award to Plaintiff of such further relief at law or in equity as the Court deems just and proper.

Dated: April 29, 2019

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