

BMW Group

June 2, 2016

Mr. Linc Wehrly
Light-Duty Vehicle Center
Compliance Division
Office of Transportation and Air Quality
U.S Environmental Protection Agency
2565 Plymouth Road
Ann Arbor, MI 48105

**Subject: BMW Request for MY 2009-2013 Greenhouse Gas (GHG)
Off-Cycle Credits**

Dear Mr. Wehrly:

Pursuant to 40 CFR § 86.1869-12 (b), BMW requests GHG off-cycle credits for the following technologies used in 2009 to 2013 MY vehicles:

- Thermal control technology - glass/glazing (Enclosure A)
- Thermal control technology - active cabin ventilation (Enclosure B)
- Thermal control technology - active seat ventilation (Enclosure C)
- Active engine warmup (Enclosure D)
- High efficiency exterior lights (Enclosure E)

BMW requests EPA approval of the GHG credits based on BMW's decision to use EPA's values and methodology set forth in 40 CFR § 86.1869-12 (b) and the Joint Technical Support Document from August 2012. EPA previously reviewed these technologies and agreed that they meet the respective technology definitions and thus qualify for MY 2014 and later GHG off-cycle credits outlined in 40 CFR § 86.1869-12 (b) (1).

Technology Description:

See Enclosures A through E for a description of each technology and methodology.

Should you have any questions regarding this submission, please contact Stephen Sinkez of my staff at 201-571-5069 or stephen.sinkez@bmwna.com.

Sincerely yours,



Dr. Christian Cozzarini
Department Manager
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Enclosures

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Enclosure A: Thermal Control Technology - Glass/Glazing

Definition

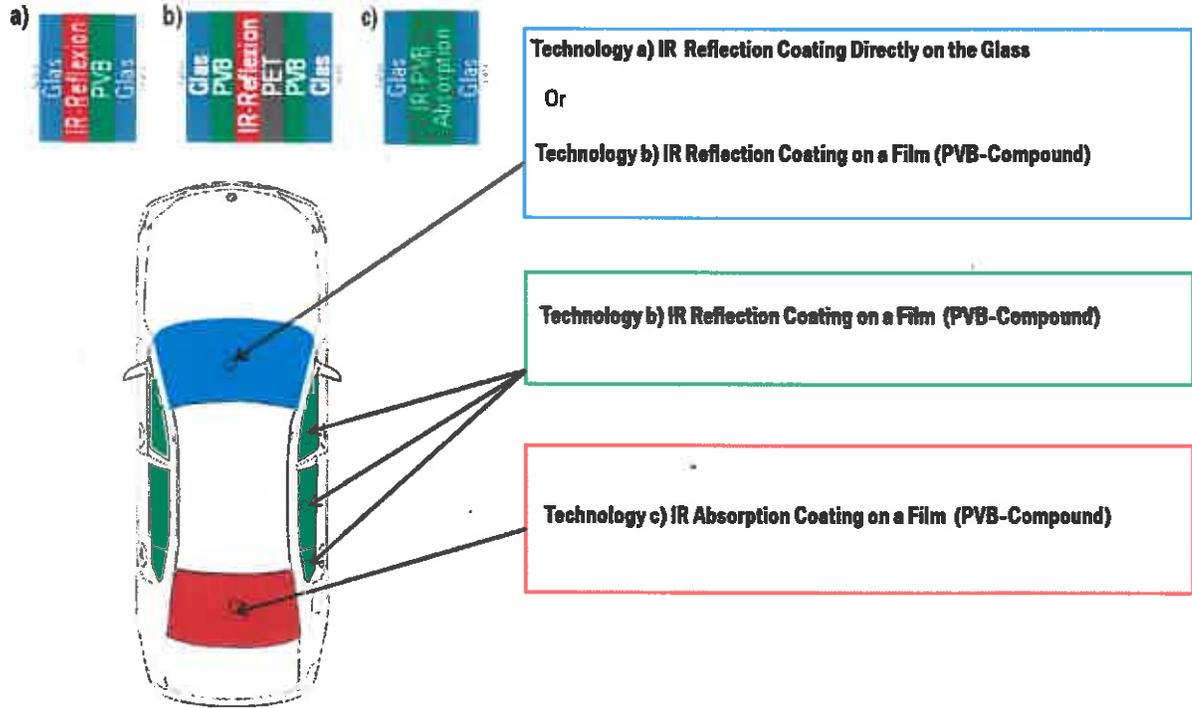
Glass/Glazing Technologies means those technologies which can reduce the amount of solar heat gain in the cabin by reflecting or absorbing some of the infrared solar energy. One measure of solar load-reducing potential for glazing is Total Solar Transmittance or T_s which expresses the percentage of solar energy which passes through the glazing (please see pages 5-101 of EPA's Joint Technical Support Document: Final Rulemaking for 2017-2025 Light Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standard).

Credits - 40 CFR § 86.1869-12 (b) (1) (viii) (A)

The maximum passenger automobile credit is 2.9 g/mile. The maximum light truck credit is 3.9 g/mile.

Description of BMW System

BMW uses glass with IR Reflection/ Absorption coating on certain high end passenger cars as series equipment.



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Enclosure A: Thermal Control Technology - Glass/Glazing (Continued)

Methodology

Glass or glazing credits are calculated using the following equation, and rounded to the nearest 0.1 grams/mile:

$$\text{Credit} = \left[Z \times \sum_{i=1}^n \frac{T_i \times G_i}{G} \right]$$

Where:

Credit = the total glass or glazing credits, in grams per mile rounded to the nearest 0.1 grams/mile. The credit may not exceed 2.9 g/mi for passenger automobiles or 3.9 g/mi for light trucks;

Z = 0.3 for passenger automobiles and 0.4 for light trucks;

G_i = the measured glass area of window i, in square meters and rounded to the nearest tenth;

G = the total glass area of the vehicle, in square meters and rounded to the nearest tenth;

T_i = the estimated temperature reduction for the glass area of window i, determined using the following formula:

$$T_i = 0.3987 \times (T_{tsbase} - T_{tsnew})$$

Where:

T_{tsnew} = the total solar transmittance of the glass, measured according to ISO 13837, "Safety glazing materials—Method for determination of solar transmittance" (incorporated by reference in § 86.1).

T_{tsbase} = 62 for the windshield, side-front, side-rear, rear-quarter, and backlite locations, and 40 for roofite locations.

The fleet credits are calculated based on credit for each type of vehicle, vehicle lifetime miles and U.S. sales volume for applicable 2009 and beyond model year products.

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Enclosure B: Thermal Control Technology - Active Cabin Ventilation

Definition

Active cabin ventilation means devices which mechanically move heated air from the cabin interior to the exterior of the vehicle.

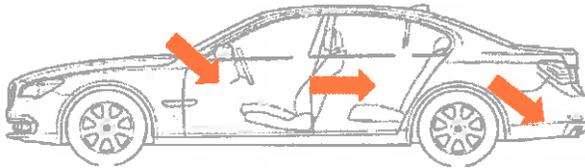
Credits - 40 CFR § 86.1869-12 (b) (1) (viii) (E)

The passenger automobile credit is 2.1 grams/mile. The light truck credit is 2.8 grams/mile.

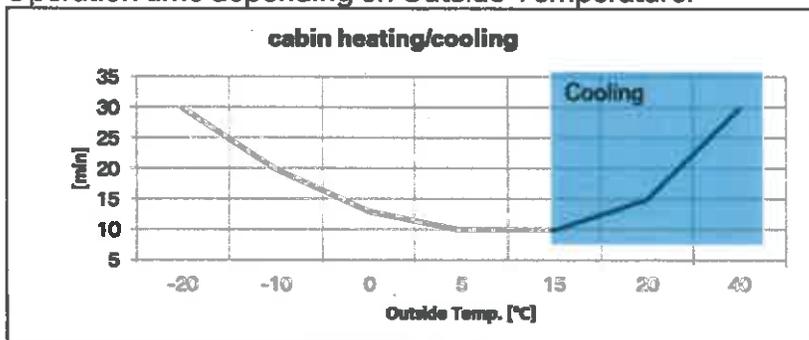
Description of BMW System

The ventilation system of the air-conditioning system is activated 30 minutes before programmed return time (and can be activated by a smart phone app) and runs another 5 minutes in case the driver is delayed. Ventilation time depends on the outside temperature.

Flow pattern in the vehicle:



Operation time depending on Outside Temperature:



Methodology

To be eligible for this credit, the BMW active cabin ventilation system must be installed in one or more vehicles.

The fleet credits are calculated based on credit for each type of vehicle, vehicle lifetime miles and U.S. sales volume for applicable 2009 and beyond model year products.

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Enclosure C: Thermal Control Technology - Active Seat Ventilation

Definition

Active seat ventilation means a device which draws air, pushes or forces air, or otherwise transfers heat from the seating surface which is in contact with the seat occupant and exhausts it to a location away from the seat. At a minimum, the driver and front passenger seat must utilize this technology for a vehicle to be eligible for credit.

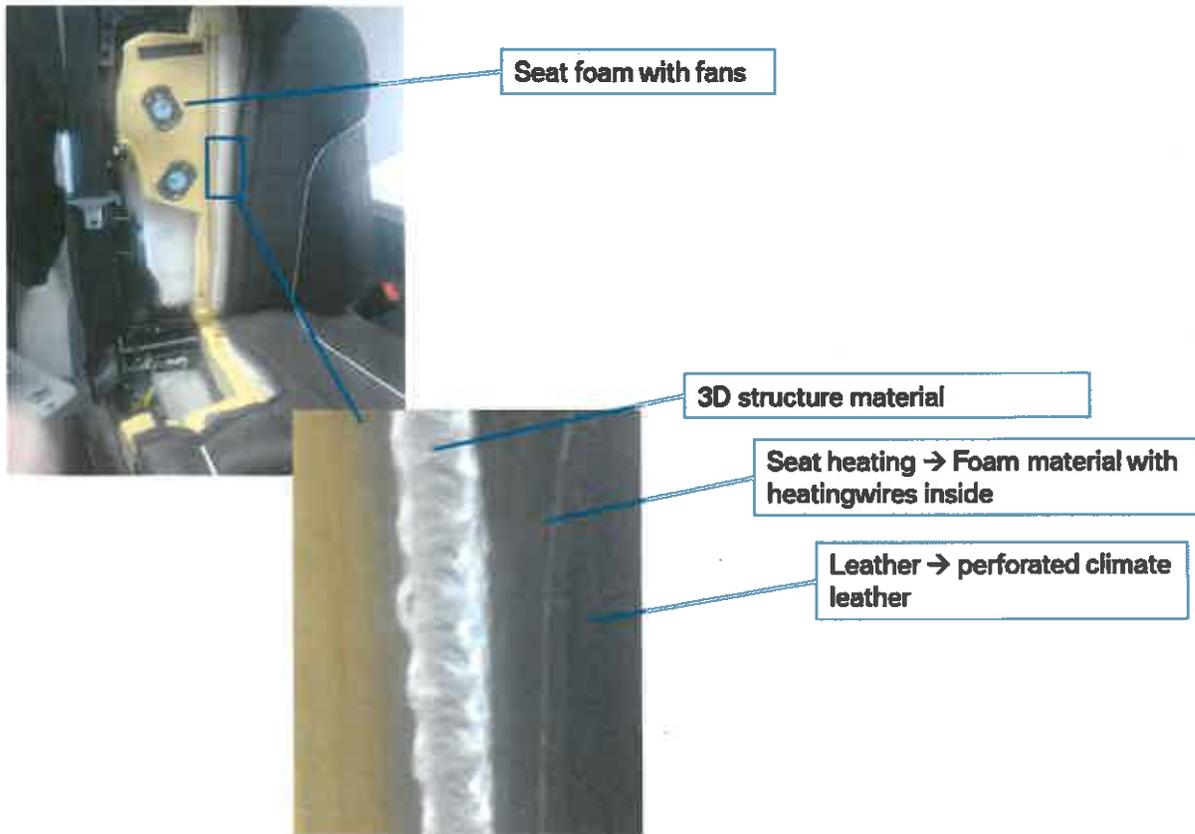
Credits – 40 CFR § 86.1869-12 (b) (1) (viii) (B)

The passenger automobile credit is 1.0 grams/mile. The light truck credit is 1.3 grams/mile.

Description of BMW System

The BMW system uses eight air fans to push air of the inner climate condition of the vehicle through the seat. The cooling effect is achieved by an improved micro climate between the occupant and the seat. The reduced hot and wet temperature in the contact area leads to a noticeable physiological cooling of the skin. This system is part of the BMW “Multifunction Seat” which is an optional equipment.

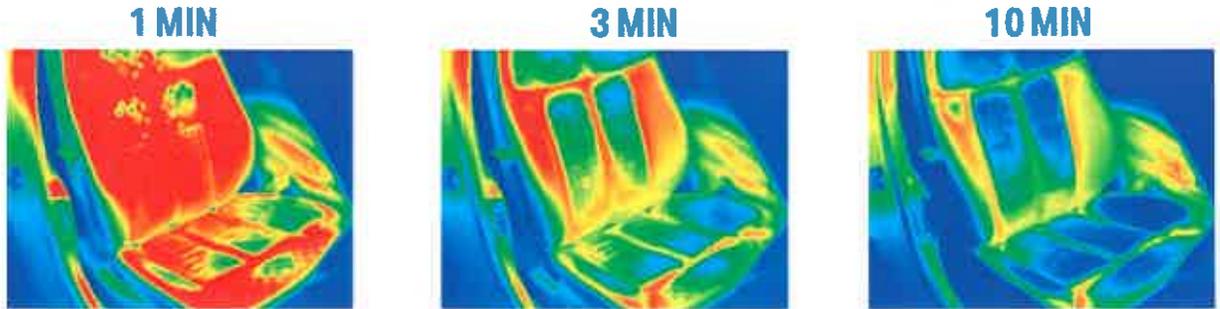
Profile of the BMW system:



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Enclosure C: Thermal Control Technology - Active Seat Ventilation (Continued)

Thermographic pictures of a “Multi Function Seat” after activating the seat ventilation:



Methodology

To be eligible for this credit, the BMW active seat ventilation system must be installed in one or more vehicles.

The fleet credits are calculated based on credit for each type of vehicle, vehicle lifetime miles and U.S. sales volume for applicable 2009 and beyond model year products.

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Enclosure D: Active Engine Warmup

Definition

Active engine warmup means a system that uses waste heat from the vehicle to warm up targeted parts of the engine so that it reduces engine friction losses and enables the closed-loop fuel control more quickly. It allows a faster transition from cold operation to warm operation, decreasing CO₂ emissions, and increasing fuel economy.

Credits – 40 CFR § 86.1869-12 (b) (1) (vii)

The passenger automobile credit is 1.5 grams/mile. The light truck credit is 3.2 grams/mile.

Description of BMW System

BMW engines are optimized for improved engine warmup using a combination of a map-controlled thermostat and an electric water pump or flow-controlled mechanical water pump.

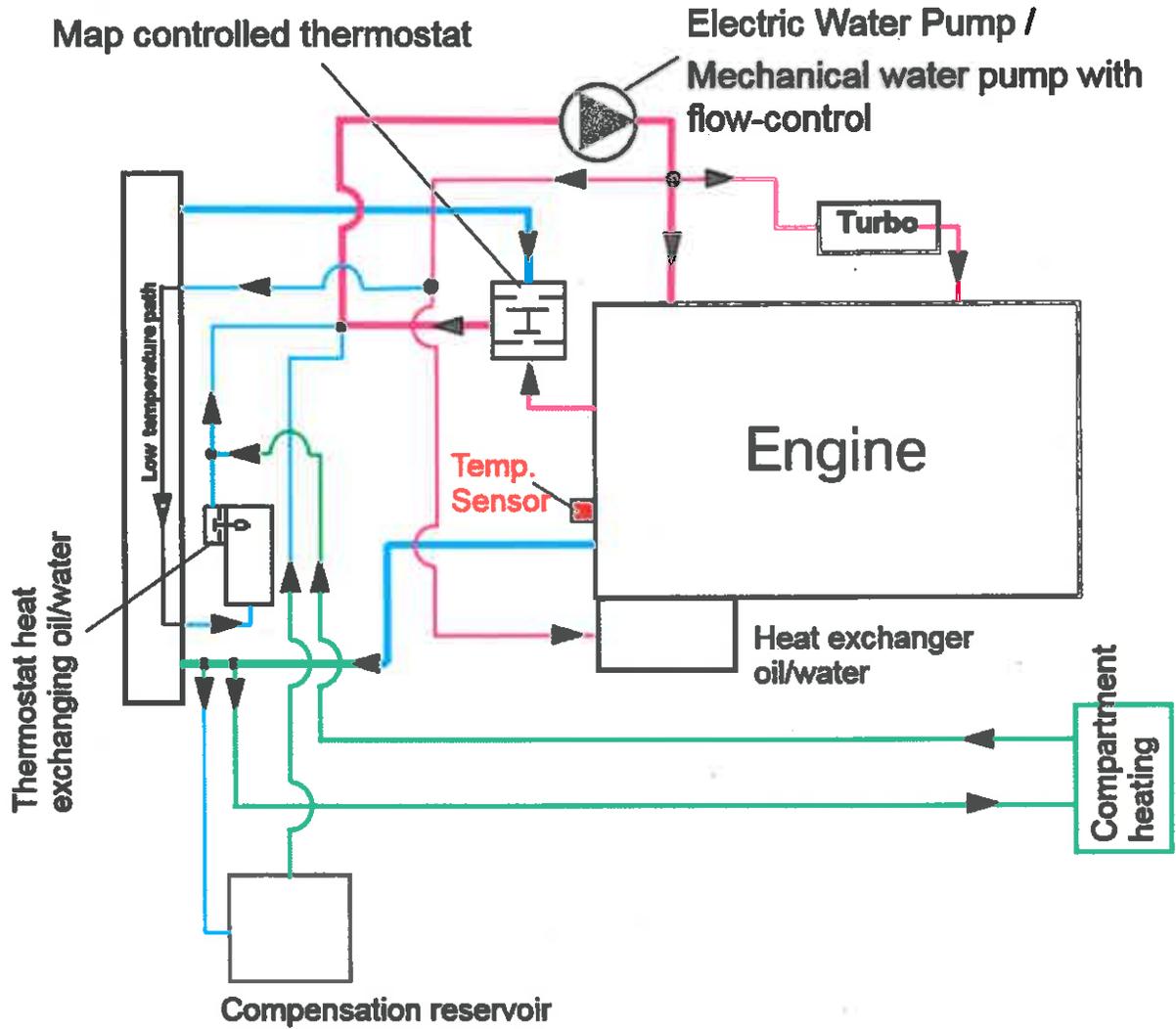
Technologies in BMW engines:

- (a) Map controlled thermostat reduces engine friction by increasing coolant temperature at partial load conditions.
- (b) Electric water pump improves engine warmup by minimizing or stopping coolant flow at warmup conditions. Under partial load conditions, the coolant flow is also reduced to increase cylinder-wall temperatures in order to reduce engine friction. Coolant flow is increased during mountain driving to avoid/reduce radiator fan workload.
- (c) Flow control (temperature-controlled mechanical water pump) is a temperature-dependent cross-section control within the water pump. It improves engine warmup by minimizing coolant flow during warmup conditions. Under partial load conditions, the coolant flow is also reduced to increase cylinder-wall temperature in order to reduce engine friction.

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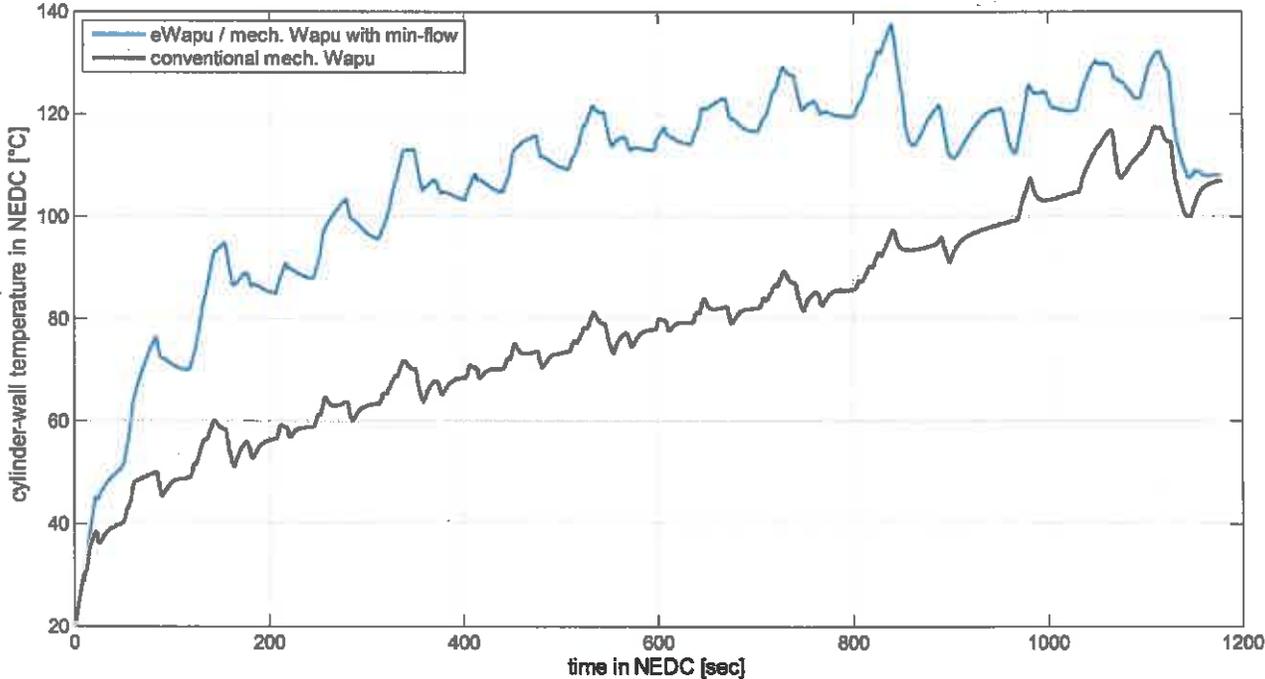
Enclosure D: Active Engine Warmup (Continued)

Schematic diagram:



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Enclosure D: Active Engine Warmup (Continued)



Electric Water Pump versus Mechanical Water Pump 528i

Methodology:

The fleet credits are calculated based on credit for each type of vehicle, vehicle lifetime miles and U.S. sales volume for applicable 2009 and beyond model year products.

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Enclosure E: High Efficiency Exterior Lights

Definition

High efficiency exterior lighting means a lighting technology that, when installed on the vehicle, is expected to reduce the total electrical demand of the exterior lighting system when compared to conventional lighting systems. To be eligible for this credit, the high efficiency lighting must be installed in one or more of the following lighting components: low beam, high beam, parking/position, front and rear turn signals, front and rear side markers, taillights, backup/ reverse lights, and/or license plate lighting.

Credits -40 CFR § 86.1869-12 (b) (1) (ii)

If all lighting locations in the table are equipped with high efficiency lighting, the total credit for high efficiency lighting shall be 1.0 grams/mile.

Description of BMW System

BMW uses energy efficient light-emitting diode (LED) lamps. Although more expensive, LEDs are much more durable than conventional bulbs. In addition, BMW uses Xenon low and high beam lamps in certain model variants which are also extremely energy efficient (e.g., low beam: 26 watts less when compared to Halogen; high beam: 136 watts less when compared to Halogen).

Methodology

High efficiency lighting credits in grams/mile for the following components will be added per BMW vehicle:

Low beam	0.38	LED or Xenon
High beam	0.05	LED or Xenon
Parking/position	0.10	LED
Turn signal, front	0.06	LED
Side marker, front	0.06	LED
Tail	0.10	LED
Turn signal, rear	0.06	LED
Side marker, rear	0.06	LED
License plate	0.08	LED

The fleet credits are calculated based on credit for each type of vehicle, vehicle lifetime miles and U.S. sales volume for applicable 2009 and beyond model year products.