

2017 ACCESSORIES & EQUIPMENT

Bumpers and Fascias - CT6

SPECIFICATIONS

FASTENER SPECIFICATIONS

Reusable Threaded Fastener Tightening Specifications

NOTE:

All fasteners listed in this table can be reused after removal.

Application	Specification
	Metric (English)
Front Bumper Fascia Bolt	2.5 N.m (22 lb in)
Front Bumper Fascia Center Support Bolt	9 N.m (80 lb in)
Front Bumper Fascia Guide Bolt	2.5 N.m (22 lb in)
Front Bumper Fascia Lower Stiffener Bolt	2.5 N.m (22 lb in)
Front Bumper Fascia Screw	2.5 N.m (22 lb in)
Front Bumper Fascia Support Brace Bolt	9 N.m (80 lb in)
Front Bumper Impact Bar Bolt	25 N.m (18 lb ft)
Front Bumper Shutter Bolt	2.5 N.m (22 lb in)
Headlamp Bolt	2.5 N.m (22 lb in)
Radiator Air Upper Baffle Bolt	2.5 N.m (22 lb in)
Rear Bumper Fascia Bolt	2.5 N.m (22 lb in)
Rear Bumper Impact Bar Bolt	22 N.m (16 lb ft)
Rear Bumper Impact Bar Nut	22 N.m (16 lb ft)
Rear Bumper Valance Panel Bolt	2.5 N.m (22 lb in)

SCHEMATIC WIRING DIAGRAMS

ACTIVE GRILLE AIR SHUTTER WIRING SCHEMATICS

Active Grille Air Shutter

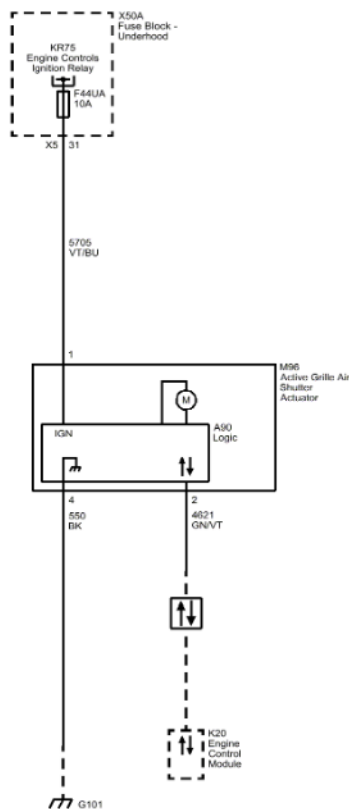


Fig. 1: Active Grille Air Shutter

Courtesy of GENERAL MOTORS COMPANY

DIAGNOSTIC INFORMATION AND PROCEDURES

DTC P059F OR P151E: ACTIVE GRILLE AIR SHUTTER

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P059F

Active Grille Air Shutter 1 Performance

DTC P151E

Active Grille Air Shutter Actuator 1 Signal Message Counter Incorrect

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	P059F, P151E	P059F, P151E	- -	- -
Local Interconnect Network Serial Data Bus	U1510	U1510	U1510	U1510
Ground	-	P059F, P151E	-	- -

Circuit/System Description

The active grille air shutter actuator closes louvers at the front bumper to enhance vehicle aerodynamics in driving situations where cooling and A/C loads are relatively low and high levels of front end airflow are not required. If high levels of airflow are required the active grille air shutter actuator opens the louvers. The Local Interconnect Network (LIN) Serial Data Bus signal from the engine control module, ignition and ground circuits enable the active grille air shutter actuator to operate. If the conditions for opening the louvers are reached the engine control module commands the active grille air shutter actuator to open the louvers.

Conditions for Running the DTC

- Ignition On/Vehicle in Service Mode.
- The battery voltage is greater than 10 V.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

- The DTC P059F will be set during a key cycle when the commanded louver position can not be achieved after 5 attempts are made to move the louver. The DTC will be stored as current for this key cycle but the malfunction indicator lamp (MIL) will not be illuminated. The malfunction indicator lamp will illuminate in the second key cycle after a failed movement attempt is made in each of two back to back key cycles.
- The DTC P151E will set if there is a serial data communication failure.

Action Taken When the DTC Sets

DTC P059F and P151E are type B DTCs.

Conditions for Clearing the DTC

DTC P059F and P151E are type B DTCs.

Reference Information

Schematic Reference

Active Grille Air Shutter Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Active Grille Air Shutter Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition On/Vehicle in Service Mode.
2. Verify DTC U1510 is not set.
 - **If DTC U1510 is set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** for further diagnosis.

- **If DTC U1510 is not set**

3. Verify the active grille air shutter position parameter changes from 0% (fully open) to 100% (fully closed) when using the scan tool ECM Active Grille Air Shutter Position control function.

- **If the louvers at the front bumper do not open and close**

Refer to Circuit/System Testing.

- **If the louvers at the front bumper open and close**

4. Verify none of the following conditions are present:

- Snow or ice packed in the front fascia which prevents the louvers from moving.
- Debris or foreign objects which prevent the louvers from moving.
- **If any of the conditions are present**

Clear any snow, ice or foreign objects from the front grille.

- **If none of the conditions are present**

5. All OK

Circuit/System Testing

1. Ignition/Vehicle Off and all vehicle systems Off, disconnect the harness connector(s) at the active grille air shutter actuator(s). It may take up to 2 minutes for all vehicle systems to power down.

2. Test for less than 10 Ω between the ground circuit and ground.

- **If 10 Ω or greater**

1. Ignition/Vehicle Off.

2. Test for less than 2 Ω in the ground circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , repair the open/high resistance in the ground connection.

- **If less than 10 Ω**

3. Ignition On/Vehicle in Service Mode.

4. Verify a test lamp illuminates between the ignition circuit and ground.

- **If the test lamp does not illuminate and the circuit fuse is good**

1. Ignition/Vehicle Off.

2. Test for less than 2 Ω in the ignition circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω verify the fuse is not open and there is voltage at the fuse. Refer to [Power Mode Mismatch \(Without HP9\)](#) and/or [Power Mode Mismatch \(With HP9\)](#).

- **If the test lamp does not illuminate and the circuit fuse is open**

1. Ignition/Vehicle Off.

2. Test for infinite resistance between the ignition circuit and ground.

- If less than infinite resistance, repair the short to ground on the circuit.

- **If the test lamp illuminates**

5. Ignition/Vehicle Off, disconnect the harness connector at the K20 Engine Control Module.

1. Test for infinite resistance between the LIN Serial Data Bus circuit and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance

2. Test for less than 2 Ω in the LIN Serial Data Bus circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω

3. Test for less than 1 V between the LIN Serial Data Bus circuit and ground.

- If 1 V or greater, repair the short to voltage on the circuit.
- If less than 1 V

6. Test or replace the M60A Active Grille Air Shutter 1 Motor Module.

7. Verify DTCs P059F, P151E or U1510 are not set while operating the vehicle under the conditions for setting the DTC.

- **If the DTC is set**

Replace the K20 Engine Control Module.

- **If the DTC is not set**

8. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

[Control Module References](#) for control module replacement, programming and setup.

SYMPTOMS - ACTIVE GRILLE AIR SHUTTER

NOTE: The following steps must be completed before using the symptom tables:

1. Perform the [Diagnostic System Check - Vehicle](#) before using the Symptom Tables in order to verify that all of the following are true:
 - There are no DTCs set.
 - The control modules can communicate via the serial data link.
2. Review the system operation in order to familiarize yourself with the system functions. Refer to [Active Grille Air Shutter Description and Operation](#).

Visual/Physical Inspection

- Inspect for aftermarket devices which may affect the operation of the system. Refer to [Checking Aftermarket Accessories](#).
- Inspect the easily accessible or visible system components for obvious damage or conditions which may cause the symptom.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to [Testing for Intermittent Conditions and Poor Connections](#).

Symptom List

[Active Grille Air Shutter 1 Malfunction](#)

ACTIVE GRILLE AIR SHUTTER 1 MALFUNCTION

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P059F

Active Grille Air Shutter 1 Performance

DTC P151E

Active Grille Air Shutter Actuator 1 Signal Message Counter Incorrect

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	P059F, P151E	P059F, P151E	- -	- -
Local Interconnect Network Serial Data Bus	U1510	U1510	U1510	U1510
Ground	-	P059F, P151E	-	- -

Circuit/System Description

The active grille air shutter actuator closes louvers at the front bumper to enhance vehicle aerodynamics in driving situations where cooling and A/C loads are relatively low and high levels of front end airflow are not required. If high levels of airflow are required the active grille air shutter actuator opens the louvers. The Local Interconnect Network (LIN) Serial Data Bus signal from the engine control module, ignition and ground circuits enable the active grille air shutter actuator to operate. If the conditions for opening the louvers are reached the engine control module commands the active grille air shutter actuator to open the louvers.

Conditions for Running the DTC

- Ignition On/Vehicle in Service Mode.
- The battery voltage is greater than 10 V.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

- The DTC P059F will be set during a key cycle when the commanded louver position can not be achieved after 5 attempts are made to move the louver. The DTC will be stored as current for this key cycle but the malfunction indicator lamp (MIL) will not be illuminated. The malfunction indicator lamp will illuminate in the second key cycle after a failed movement attempt is made in each of two back to back key cycles.
- The DTC P151E will set if there is a serial data communication failure.

Action Taken When the DTC Sets

DTC P059F and P151E are type B DTCs.

Conditions for Clearing the DTC

DTC P059F and P151E are type B DTCs.

Reference Information

Schematic Reference

Active Grille Air Shutter Schematics

Connector End View Reference

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Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Control Module References for scan tool information

Circuit/System Verification

1. Ignition On/Vehicle in Service Mode.
2. Verify DTC U1510 is not set.
 - **If DTC U1510 is set**

Refer to Diagnostic Trouble Code (DTC) List - Vehicle for further diagnosis.
 - **If DTC U1510 is not set**
3. Verify the active grille air shutter position parameter changes from 0% (fully open) to 100% (fully closed) when using the scan tool ECM Active Grille Air Shutter Position control function.
 - **If the louvers at the front bumper do not open and close**

Refer to Circuit/System Testing.
 - **If the louvers at the front bumper open and close**
4. Verify none of the following conditions are present:
 - Snow or ice packed in the front fascia which prevents the louvers from moving.
 - Debris or foreign objects which prevent the louvers from moving.
 - **If any of the conditions are present**

Clear any snow, ice or foreign objects from the front grille.
 - **If none of the conditions are present**
5. All OK

Circuit/System Testing

1. Ignition/Vehicle Off and all vehicle systems Off, disconnect the harness connector(s) at the active grille air shutter actuator(s). It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit and ground.
 - **If 10 Ω or greater**
 1. Ignition/Vehicle Off.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 10 Ω**
3. Ignition On/Vehicle in Service Mode.
4. Verify a test lamp illuminates between the ignition circuit and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition/Vehicle Off.
 2. Test for less than 2 Ω in the ignition circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , verify the fuse is not open and there is voltage at the fuse. Refer to Power Mode Mismatch (Without HP9) and/or Power Mode Mismatch (With HP9).
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition/Vehicle Off.
 2. Test for infinite resistance between the ignition circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - **If the test lamp illuminates**

5. Ignition/Vehicle Off, disconnect the harness connector at the K20 Engine Control Module.
1. Test for infinite resistance between the LIN Serial Data Bus circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 2. Test for less than 2 Ω in the LIN Serial Data Bus circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω
 3. Test for less than 1 V between the LIN Serial Data Bus circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
6. Test or replace the M60A Active Grille Air Shutter 1 Motor Module.
7. Verify DTCs P059F, P151E or U1510 are not set while operating the vehicle under the conditions for setting the DTC.
- **If the DTC is set**
- Replace the K20 Engine Control Module.
- **If the DTC is not set**
8. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

[Control Module References](#) for control module replacement, programming and setup.

REPAIR INSTRUCTIONS

FRONT BUMPER IMPACT BAR REPLACEMENT

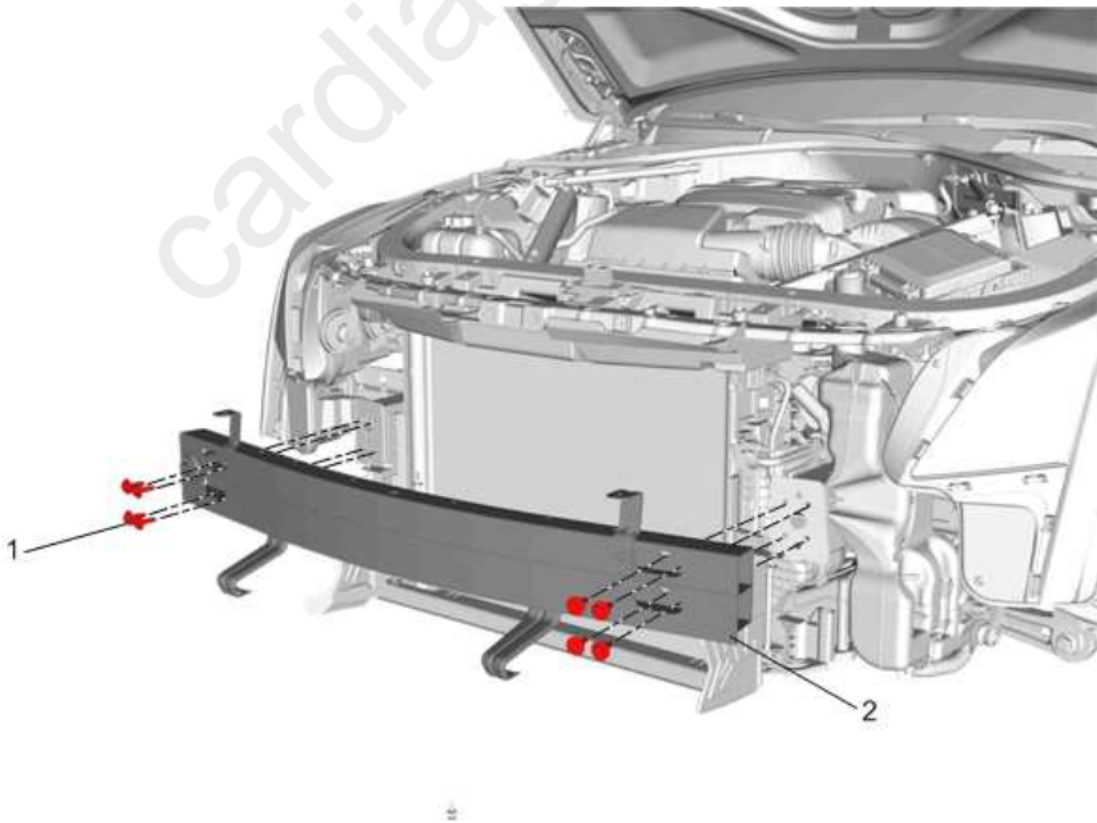


Fig. 2: Front Bumper Impact Bar

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
Preliminary Procedure 1. Remove the 2 radiator side air upper baffle bolts. Refer to Radiator Air Side Upper Baffle Replacement (LGW LGX LTG - Left Side) , Radiator Air Side Upper Baffle Replacement (LGW LTG - Right Side) and/or Radiator Air Side Upper Baffle Replacement (LGX - Right Side) 2. Remove the 2 radiator air side lower baffle retainers. Refer to Radiator Air Side Lower Baffle Replacement (LGW LGX LTG - Left Side) and/or Radiator Air Side Lower Baffle Replacement (LGW LGX LTG - Right Side) 3. Remove the front bumper fascia support brace bolt at the impact bar. Refer to Front Bumper Fascia Support Brace Replacement	
1	Front Bumper Impact Bar Bolt [8x] CAUTION: Refer to Fastener Caution . Tighten 25 N.m (18 lb ft)
2	Front Bumper Impact Bar Procedure 1. Disconnect the electrical connectors. 2. Transfer components as necessary.

FRONT BUMPER FASCIA REPLACEMENT (WITHOUT UV3)

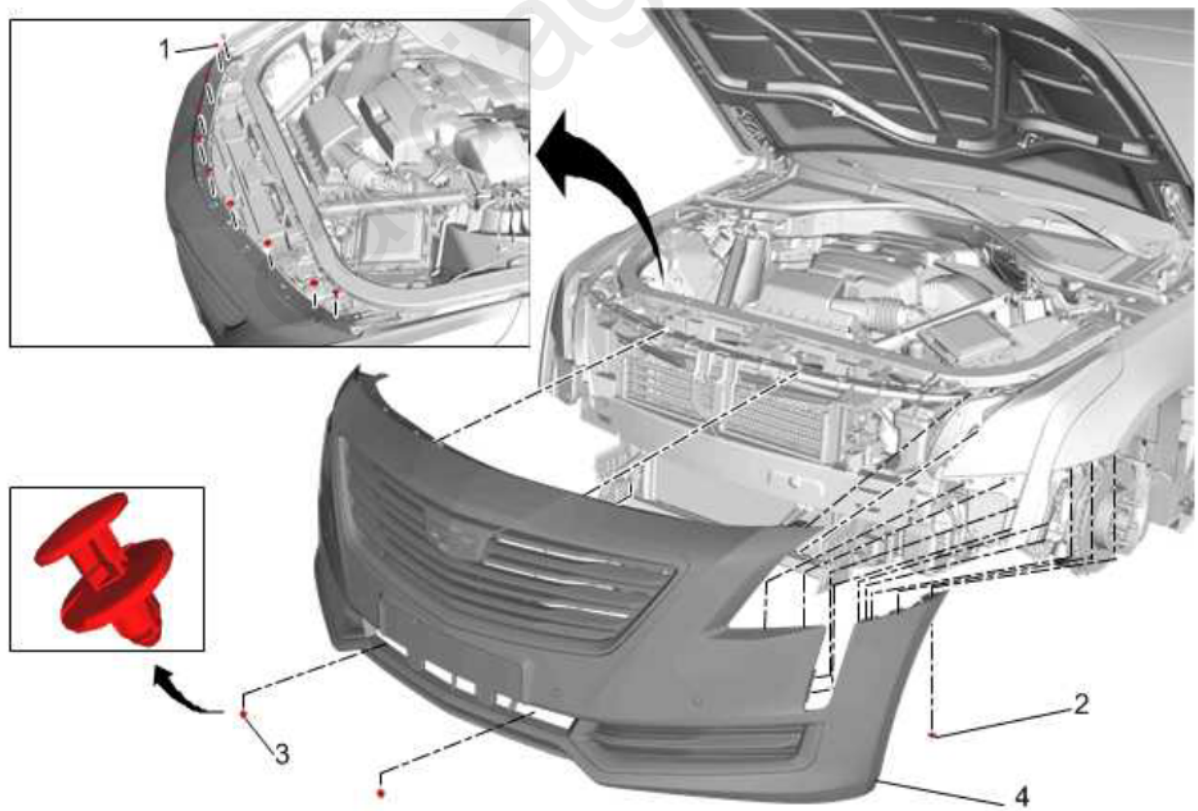


Fig. 3: Front Bumper Fascia
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
Preliminary Procedure <u>Front Compartment Front Sight Shield Replacement</u> <u>Front Wheelhouse Liner Replacement</u> <u>Front Bumper Fascia Lower Stiffener Replacement</u>	
1	Front Bumper Fascia Bolt [10x] CAUTION: Refer to <u>Fastener Caution</u> . Tighten 2.5 N.m (22 lb in)
2	Front Bumper Fascia Screw [2x] Tighten 2.5 N.m (22 lb in)
3	Front Bumper Fascia Retainer [2x]
4	Front Bumper Fascia Procedure - Carefully push a small nylon wedge between the fascia and the front fascia guide. Insert a small flat-bladed tool into the fascia slot and depress the snaps one at a time and pull on the fascia at the same time to gradually remove the fascia from the front fascia guide. - Disconnect the electrical connectors. - Transfer components as necessary.

FRONT BUMPER FASCIA REPLACEMENT (WITH UV3)

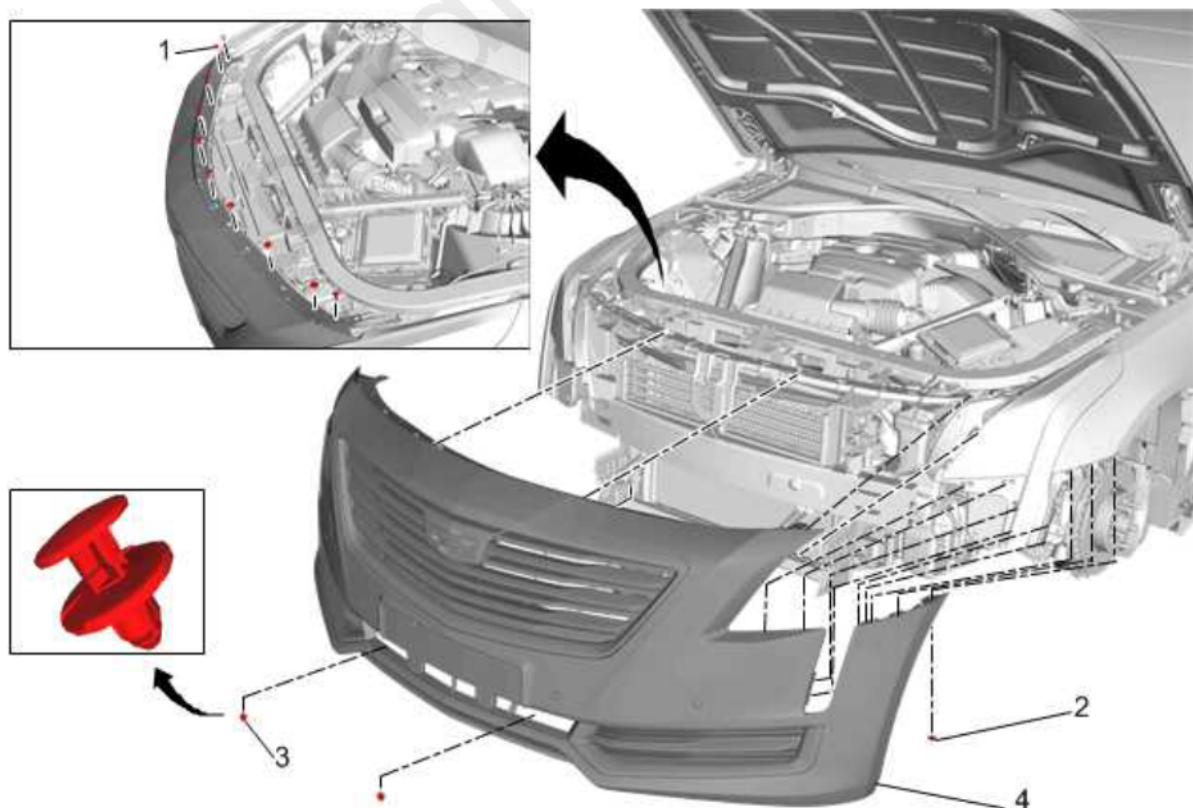


Fig. 4: Front Bumper Fascia
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Front Compartment Front Sight Shield Replacement 2. Front Wheelhouse Liner Replacement 3. Front Bumper Fascia Lower Stiffener Replacement	
1	Front Bumper Fascia Bolt [10x] CAUTION: Refer to Fastener Caution . Tighten 2.5 N.m (22 lb in)
2	Front Bumper Fascia Screw [2x] Tighten 2.5 N.m (22 lb in)
3	Front Bumper Fascia Retainer [2x]
4	Front Bumper Fascia Procedure 1. Carefully push a small nylon wedge between the fascia and the front fascia guide. Insert a small flat-bladed tool into the fascia slot and depress the snaps one at a time and pull on the fascia at the same time to gradually remove the fascia from the front fascia guide. 2. Disconnect the electrical connectors. 3. Disconnect the night vision camera washer hose. 4. Transfer components as necessary.

FRONT BUMPER FASCIA GUIDE REPLACEMENT

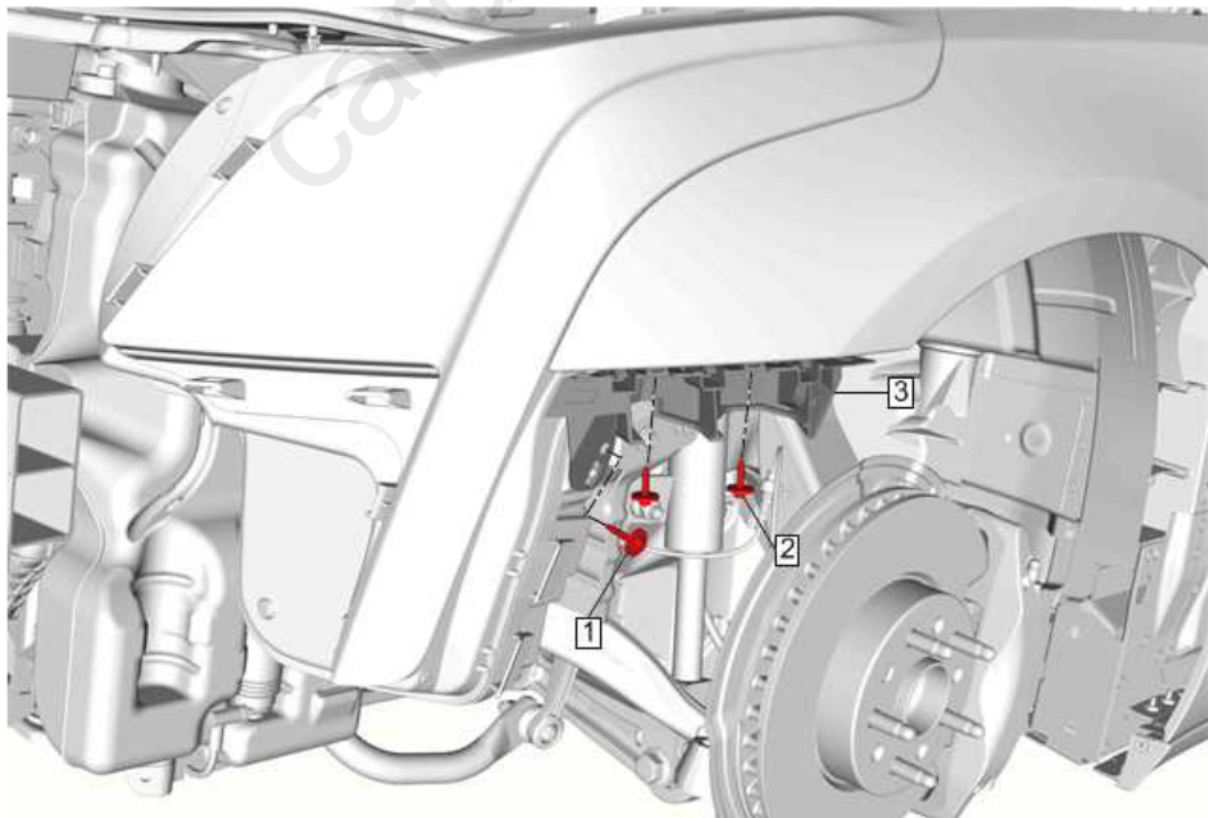


Fig. 5: Front Bumper Fascia Guide
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Front Bumper Fascia Replacement (Without UV3) Front Bumper Fascia Replacement (With UV3)	
1	Headlamp Bolt CAUTION: Refer to Fastener Caution . Tighten 2.5 N.m (22 lb in)
2	Front Bumper Fascia Guide Bolt [2x] Tighten 2.5 N.m (22 lb in)
3	Front Bumper Fascia Guide

FRONT BUMPER SHUTTER REPLACEMENT

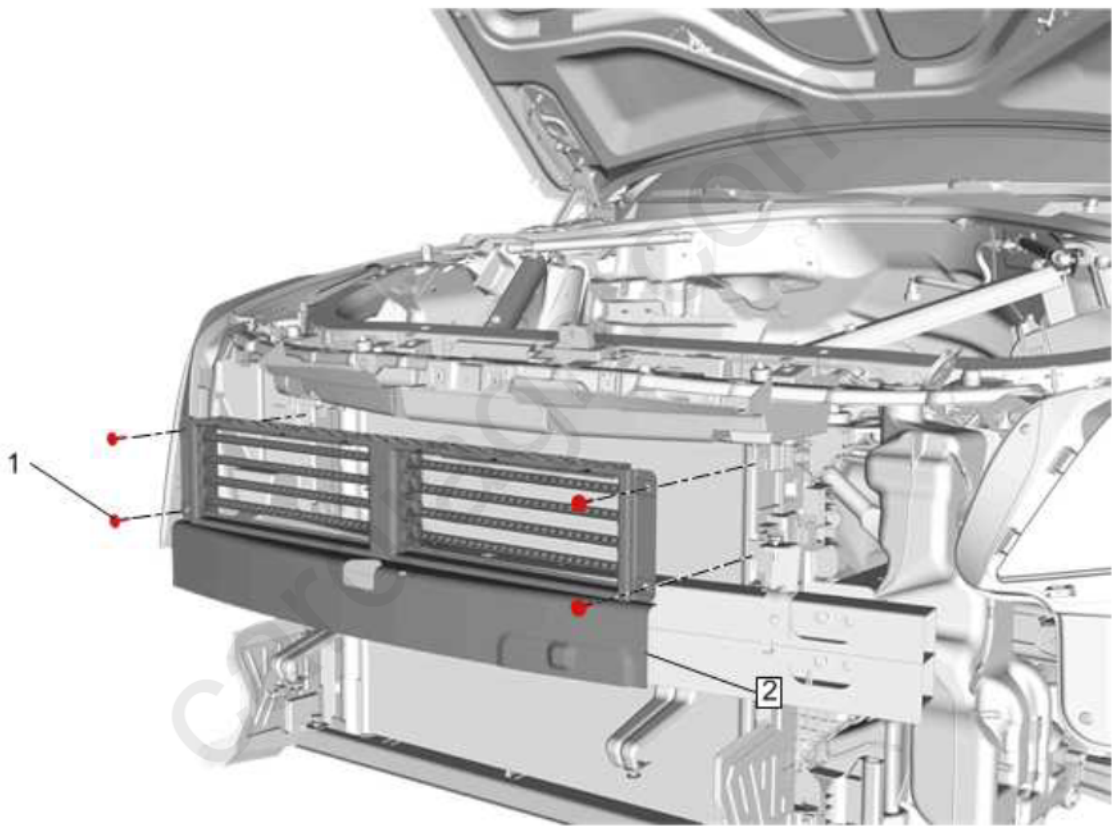


Fig. 6: Front Bumper Shutter
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Front Bumper Fascia Support Brace Replacement	
1	Front Bumper Shutter Bolt [4x] CAUTION: Refer to Fastener Caution . Tighten 2.5 N.m (22 lb in)

Callout	Component Name
2	Front Bumper Shutter Procedure 1. Disconnect the electrical connector. 2. Transfer components as necessary.

FRONT BUMPER FASCIA SUPPORT REPLACEMENT

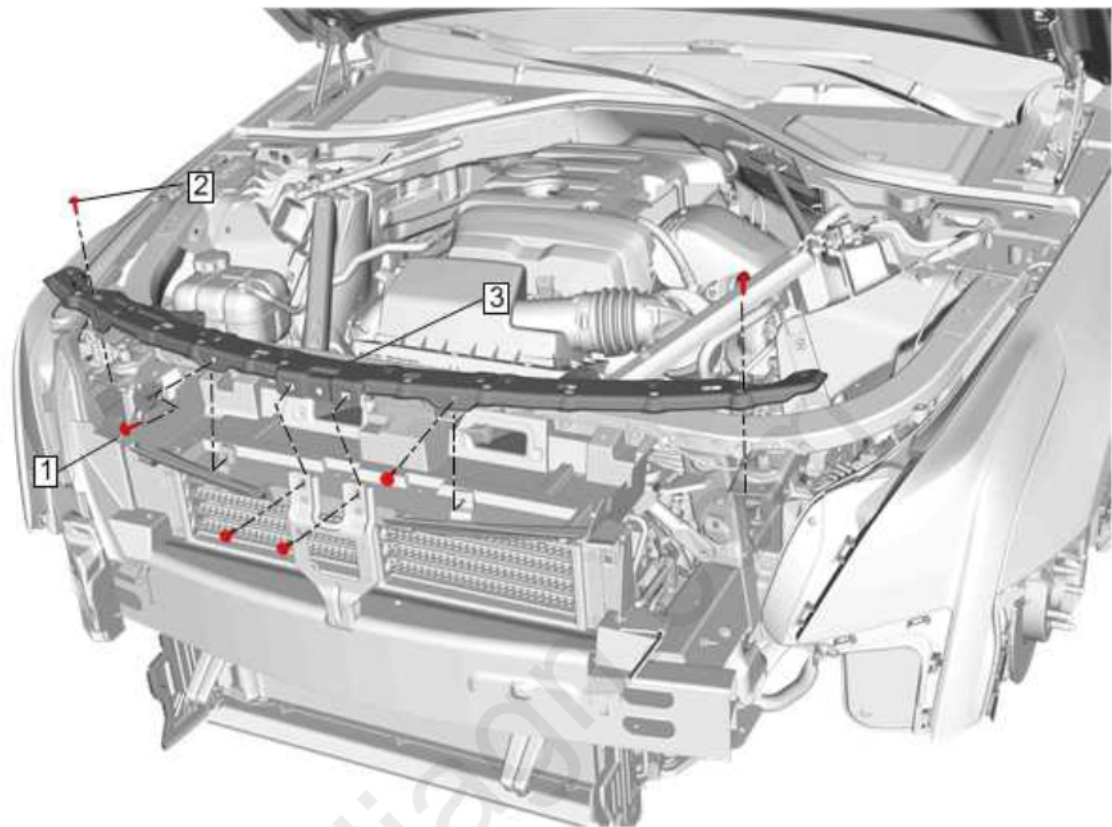


Fig. 7: Front Bumper Fascia Support
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures Front Bumper Fascia Replacement (Without UV3) Front Bumper Fascia Replacement (With UV3)	
1	Radiator Air Upper Baffle Bolt [2x] CAUTION: Refer to Fastener Caution . Tighten 2.5 N.m (22 lb in)
2	Front Bumper Fascia Center Support Bolt [4x] Tighten 9 N.m (80 lb in)
3	Front Bumper Fascia Center Support

FRONT BUMPER FASCIA SUPPORT BRACE REPLACEMENT

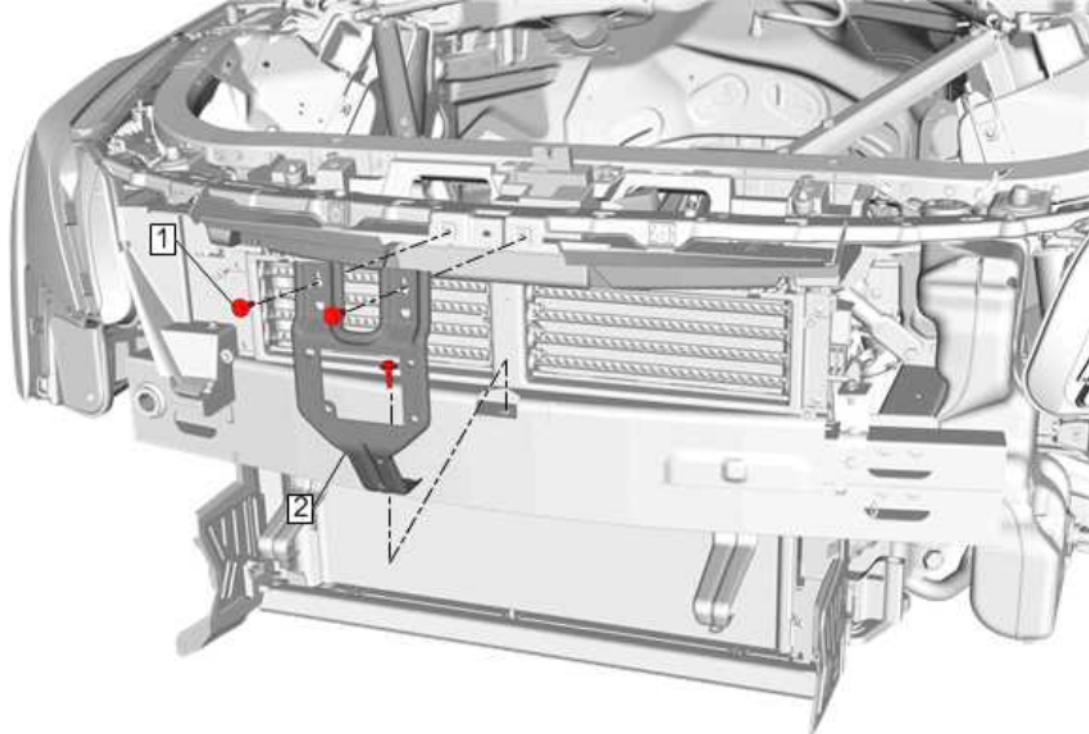


Fig. 8: Front Bumper Fascia Support Brace
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Front Bumper Fascia Replacement (Without UV3) Front Bumper Fascia Replacement (With UV3)	
1	Front Bumper Fascia Support Brace Bolt [3x] CAUTION: Refer to Fastener Caution . Tighten 9 N.m (80 lb ft)
2	Front Bumper Fascia Support Brace Procedure 1. {If equipped} Disconnect the electrical connector. 2. Slide the front bumper fascia support brace from the radiator air upper deflector. 3. Transfer components as necessary.

FRONT BUMPER FASCIA LOWER STIFFENER REPLACEMENT

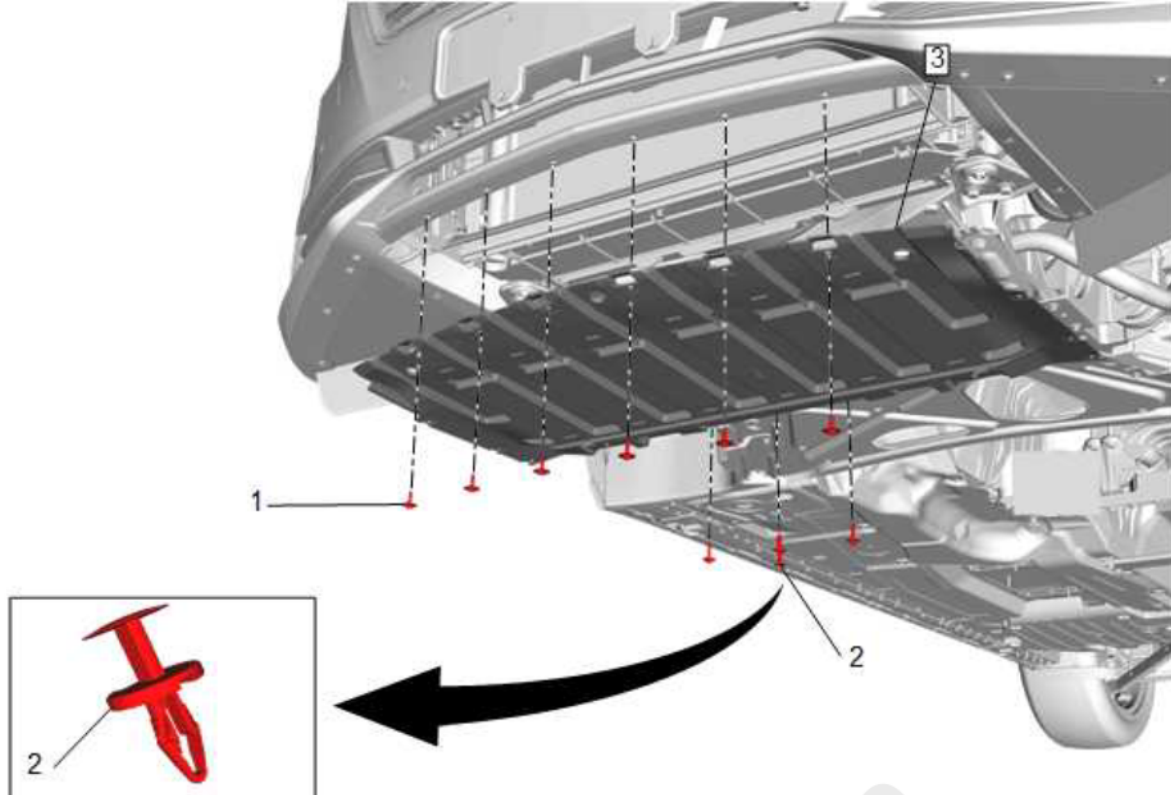


Fig. 9: Front Bumper Fascia Lower Stiffener
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Front Tire Front Air Deflector Replacement Underbody Front Air Deflector Replacement	
1	Front Bumper Fascia Lower Stiffener Bolt [12x] CAUTION: Refer to Fastener Caution . Tighten 2.5 N.m (22 lb in)
2	Front Bumper Fascia Lower Stiffener Retainer
3	Front Bumper Fascia Lower Stiffener

REAR BUMPER VALANCE PANEL REPLACEMENT

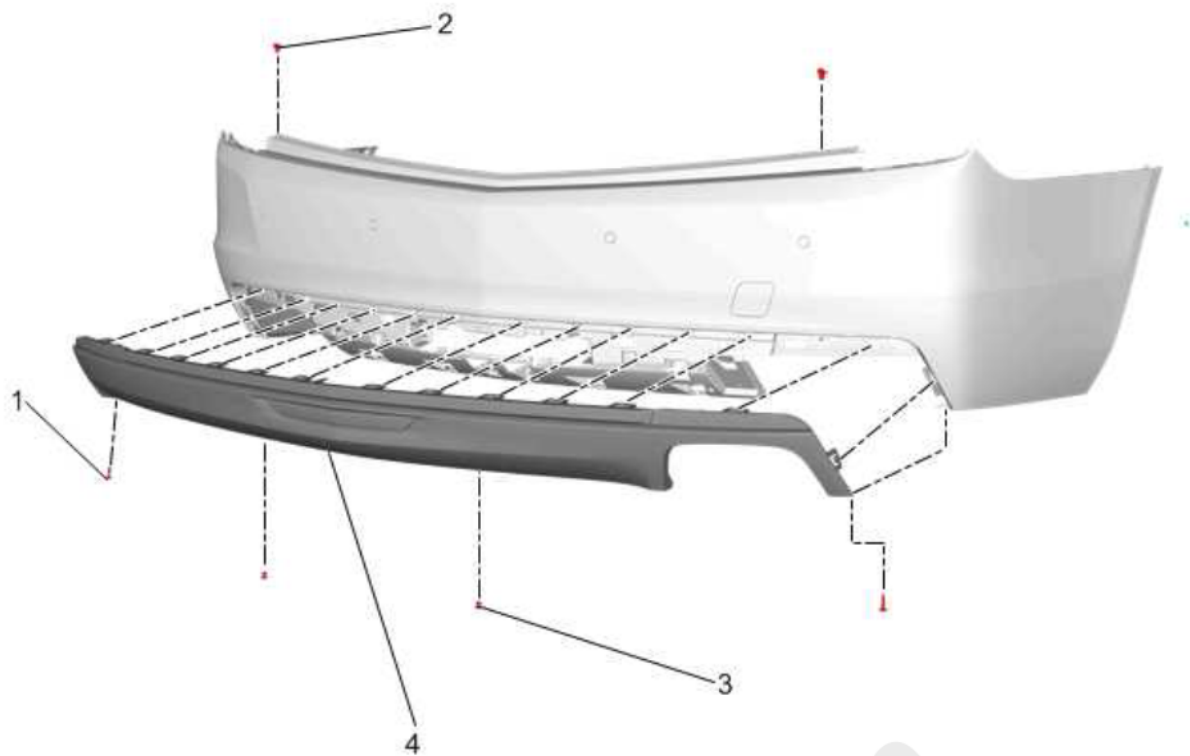


Fig. 10: Rear Bumper Valance Panel

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Underbody Rear Air Rear Deflector Replacement (Without HP9) Underbody Rear Air Rear Deflector Replacement (With HP9)</u> <u>Underbody Rear Air Outer Deflector Replacement (without HP9) Underbody Rear Air Outer Deflector Replacement (with HP9)</u>	
1	Rear Bumper Valance Panel Bolt [2x] CAUTION: Refer to <u>Fastener Caution</u> . 2.5 N.m (22 lb in)
2	Rear Bumper Valance Panel Procedure - Carefully push a small nylon wedge between the fascia and the rear bumper valance panel. Insert a small flat-bladed tool into the fascia slot and depress the snaps one at a time and pull on the fascia at the same time to gradually remove the fascia from the rear bumper valance panel. - Transfer components as necessary.

REAR BUMPER FASCIA REPLACEMENT

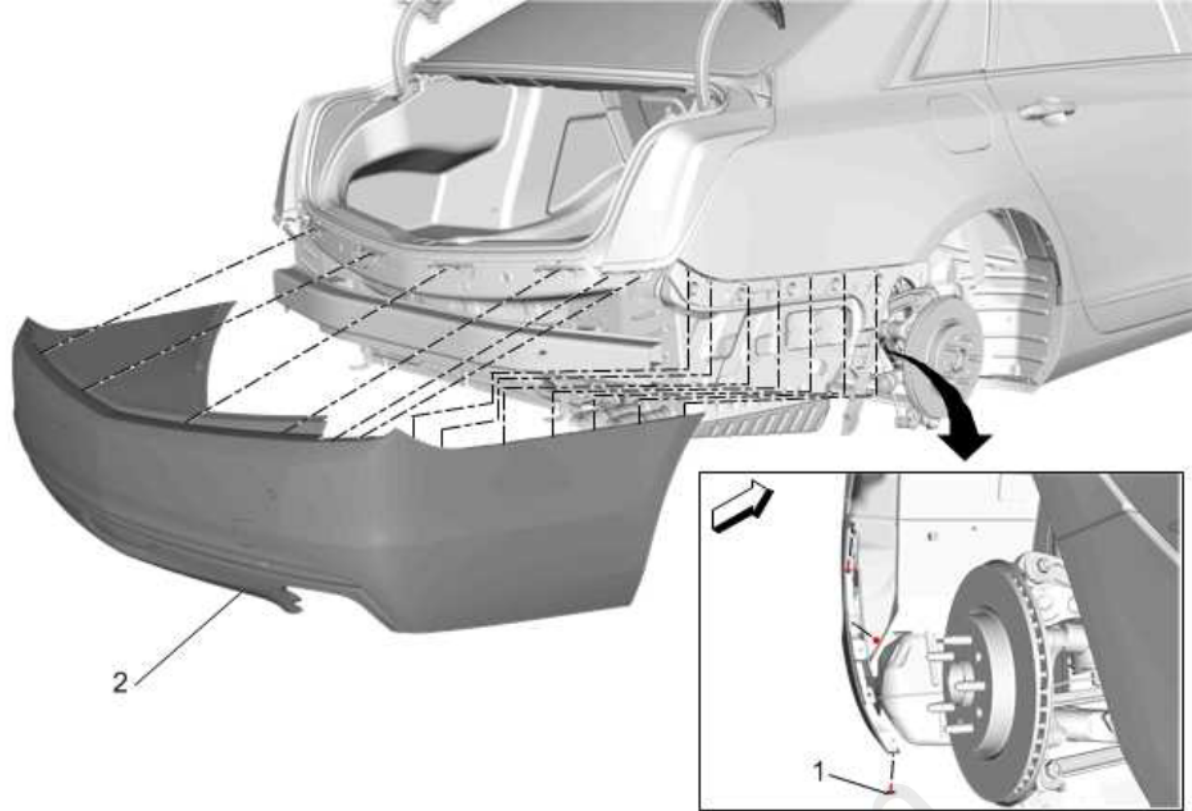


Fig. 11: Rear Bumper Fascia

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures <u>Rear Wheelhouse Liner Replacement (LTG) Rear Wheelhouse Liner Replacement (LGX, LGW)</u> <u>Underbody Rear Air Rear Deflector Replacement (Without HP9) Underbody Rear Air Rear Deflector Replacement (With HP9)</u> <u>Underbody Rear Air Outer Deflector Replacement (without HP9) Underbody Rear Air Outer Deflector Replacement (with HP9)</u>	
1	Rear Bumper Fascia Bolt [8x] CAUTION: Refer to <u>Fastener Caution</u> . Tighten 2.5 N.m (22 lb in)
2	Rear Bumper Fascia Procedure - Carefully push a small nylon wedge between the fascia and the rear fascia guide. Insert a small flat-bladed tool into the fascia slot and depress the snaps one at a time and pull on the fascia at the same time to gradually remove the fascia from the rear fascia guide. - Disconnect all electrical connectors. - Transfer components as necessary.

REAR BUMPER IMPACT BAR REPLACEMENT (LTG)

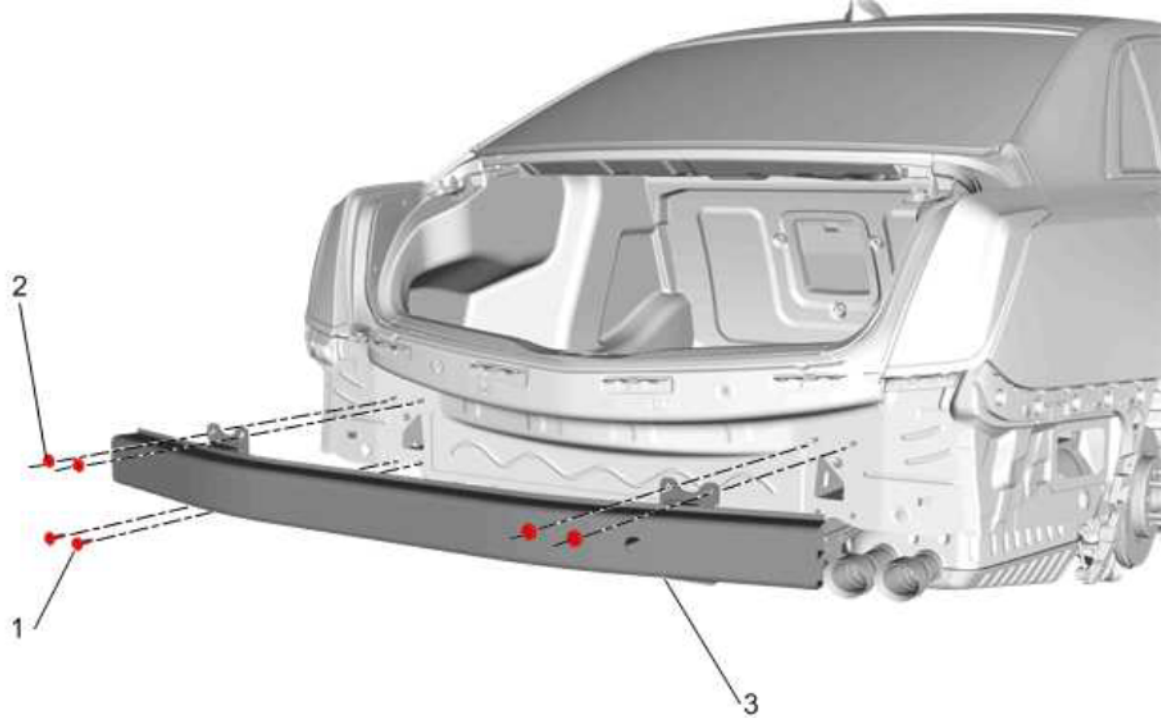


Fig. 12: Rear Bumper Impact Bar (LTG)
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures Rear Bumper Fascia Replacement Exhaust Rear Muffler Rear Hanger Replacement (LGW, LGX, LTG)	
1	Rear Bumper Impact Bar Bolt [2x] CAUTION: Refer to Fastener Caution . Tighten 22 N.m (16 lb ft)
2	Rear Bumper Impact Bar Nut [4x] Tighten 22 N.m (16 lb ft)
3	Rear Bumper Impact Bar Procedure Transfer components as necessary.

REAR BUMPER IMPACT BAR REPLACEMENT (LGW)

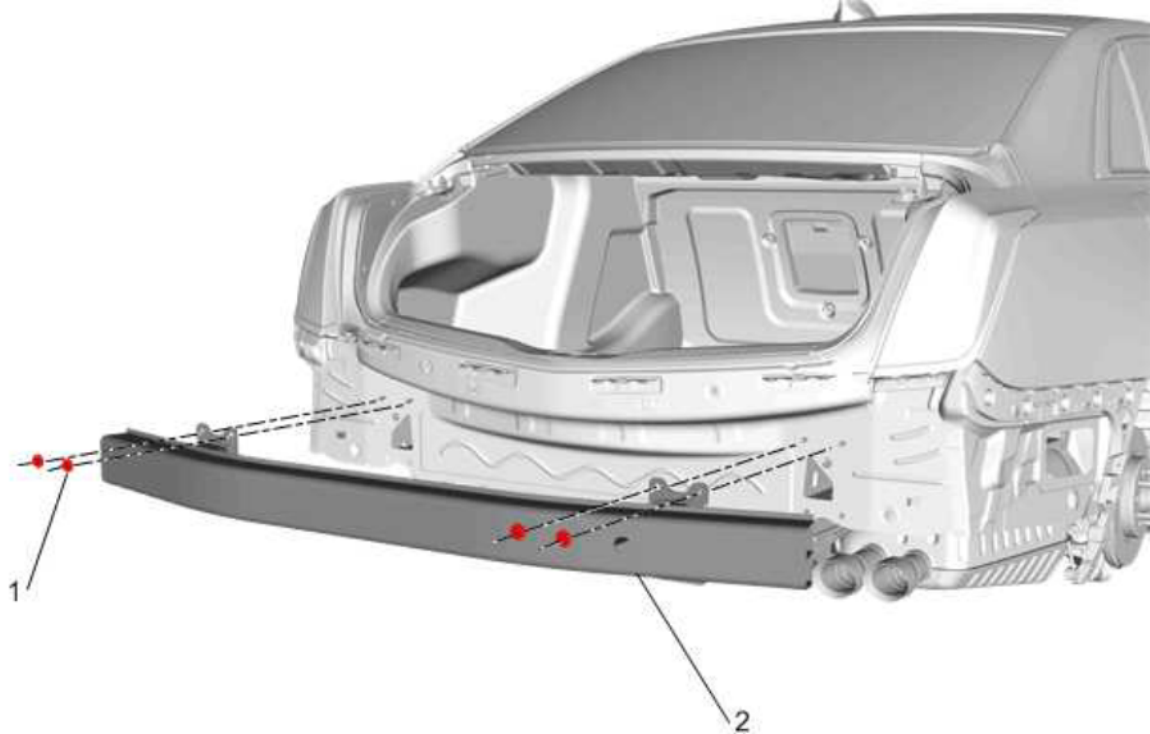


Fig. 13: Rear Bumper Impact Bar (LGW)
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Rear Bumper Fascia Replacement Exhaust Rear Muffler Rear Hanger Replacement (LGW, LGX, LTG)	
1	Rear Bumper Impact Bar Nut [4x] CAUTION: Refer to Fastener Caution . Tighten 22 N.m (16 lb ft)
2	Rear Bumper Impact Bar Procedure Transfer components as necessary.

DESCRIPTION AND OPERATION

ACTIVE GRILLE AIR SHUTTER DESCRIPTION AND OPERATION

The active grille air shutter system closes shutters in the front grille to enhance vehicle aerodynamics in driving situations where cooling and A/C loads are relatively low and high levels of front end airflow are not required. If high levels of airflow are required the active grille air shutter system will open one or both shutters. The control signal from the engine control module, ignition and ground circuits enable the active grille air shutter actuators to operate. If the conditions for opening the shutters are reached the engine control module commands the active grille air shutter actuators to open one or both shutters.

The dual active grille air shutter system consists of two aero shutter mechanisms located in the front grille for controlling the amount of air entering the engine compartment. It includes three wires; ground, power and a Local Interconnect Network (LIN) Bus serial data circuit from the engine control module to the shutter actuator. The engine control module determines shutter state based on various vehicle conditions such as vehicle speed, coolant temperature, fan state, refrigerant system pressure, A/C

compressor state and ambient temperature. The engine control module has the ability to command each shutter individually to the open or closed positions through communications on the LIN Bus.

The actuators are powered by an ignition circuit that is active when the key is in the RUN position. The vehicle may have to be driven for up to 13 minutes at speeds greater than 41 km/h (25 mph) before a shutter begins to move. If low ambient temperature is detected, the shutters will remain in the closed position.

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