

# Engine Removal and Installation (L87 with ZR2)

## Single Use Fasteners and Components

- Accessory Drive Auxiliary Belt
- Accessory Drive Primary Belt
- Air Conditioning Compressor and Condenser Hose Seal [2x]
- Engine Mount Frame Side Bolt [3x]
- Engine Oil Cooler Gasket
- Engine Oil Cooler Retainer [2x]
- Exhaust System Seal [2x]
- Intake Manifold Gasket [8x]
- Oil Filter
- Water Pump Gasket [2x]

## Special Tools

### **Engine Heating and Cooling**

GE-47716 Vac-N-Fill Coolant Refill Tool

Equivalent regional tools: [Special Tools](#)

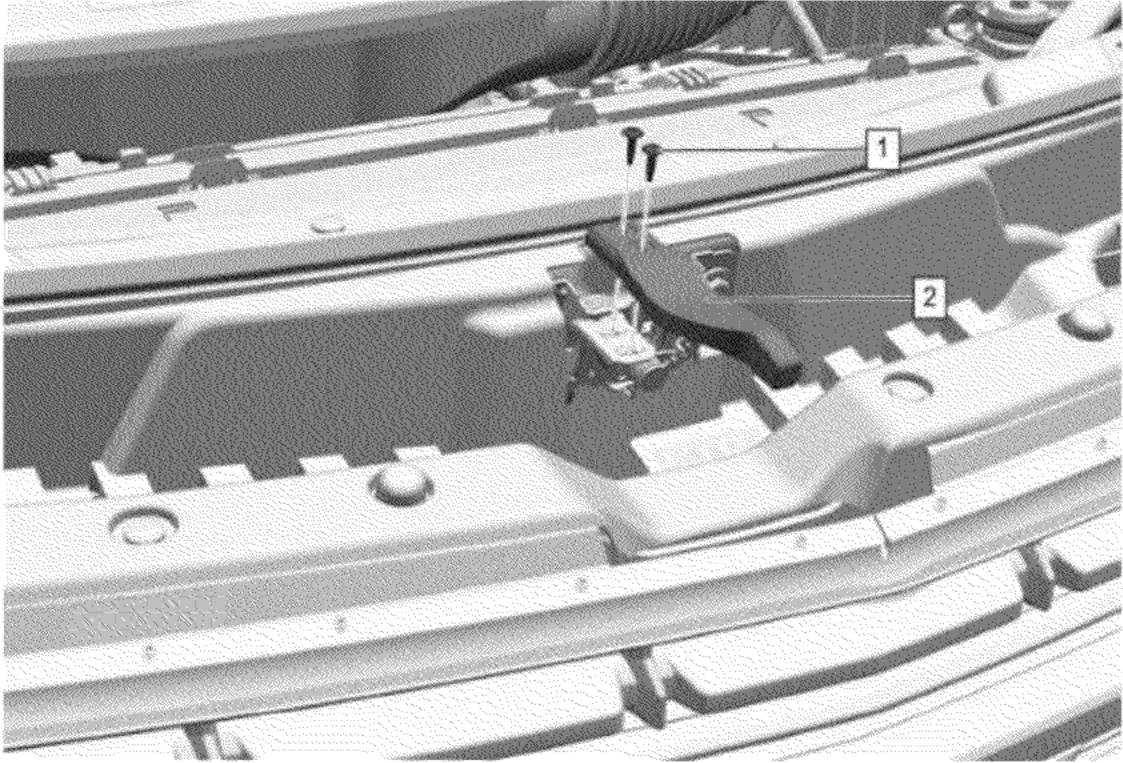
### **Engine Mechanical - 5.3L (L84) or 6.2L (L87)**

- DT-21366 Converter Holding Strap
- EN-36857 Engine Lift Bracket
- EN-51767 Stretchy Belt Installer
- EN-52059 Engine Support Fixture Adapter Bolt - M10

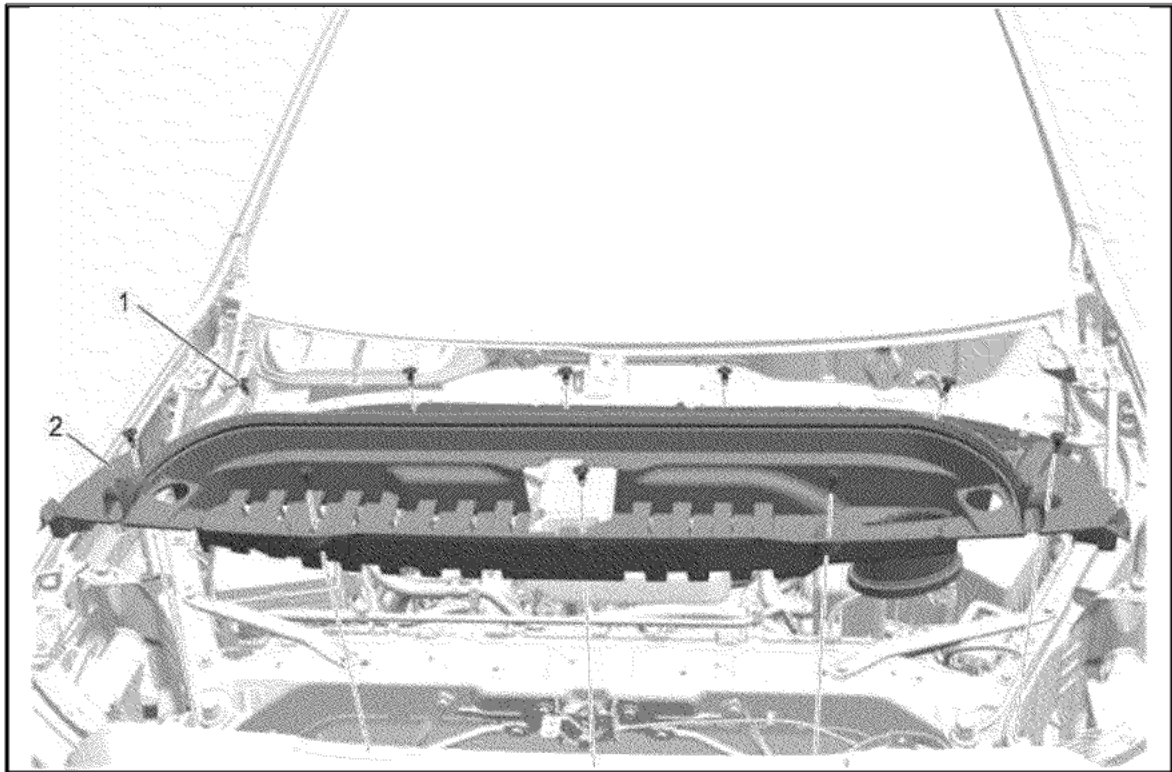
Equivalent regional tools: [Special Tools](#)

## Removal Procedure

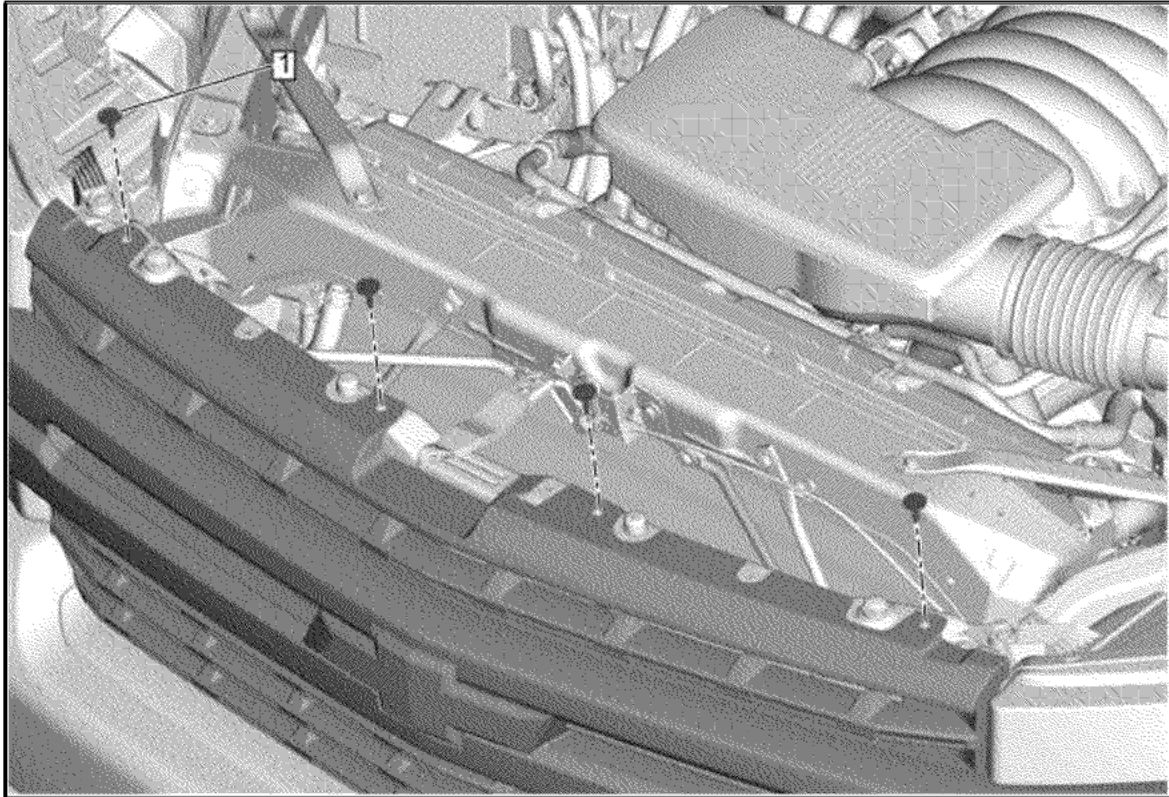
1. Recover the refrigerant. [Refrigerant Recovery and Recharging](#)
2. Relieve the fuel system pressure. [Fuel Pressure Relief](#)
3. Disconnect the battery negative cable. [Battery Negative Cable Disconnection and Connection](#)



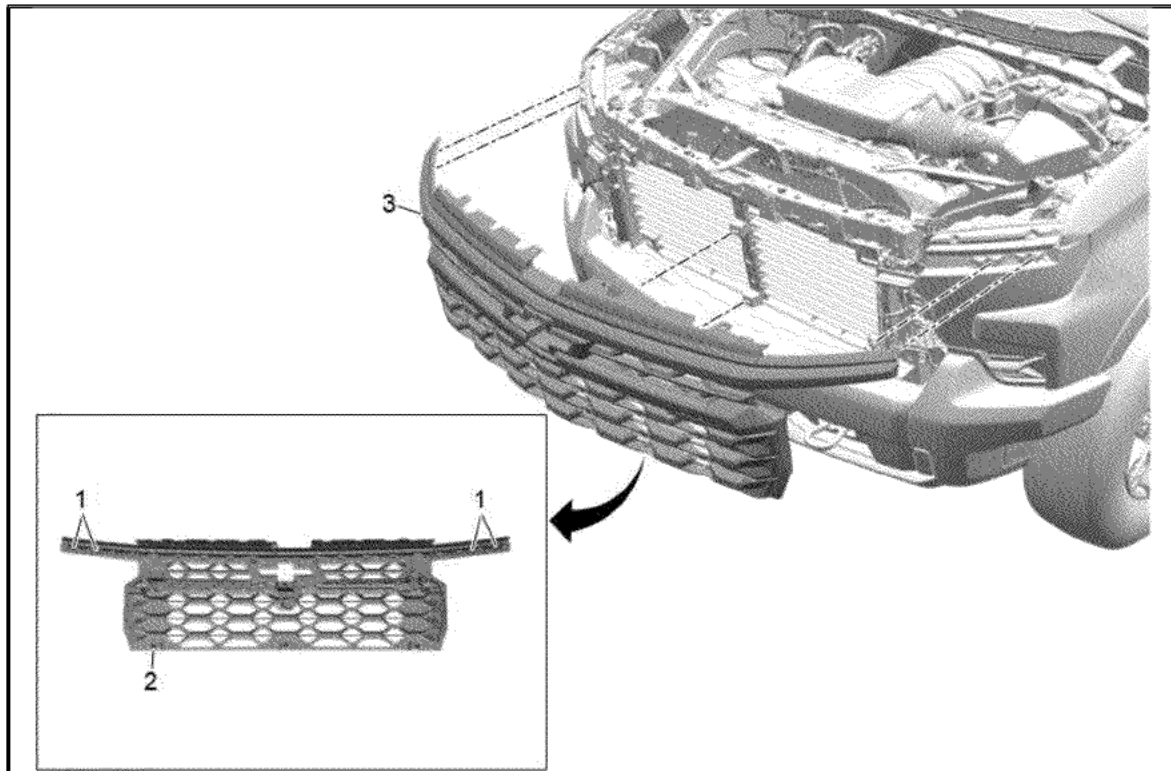
- 4. Hood Latch Actuator Bolt (1) » Remove [2x]
- 5. Hood Secondary Latch Release Handle (2) » Remove



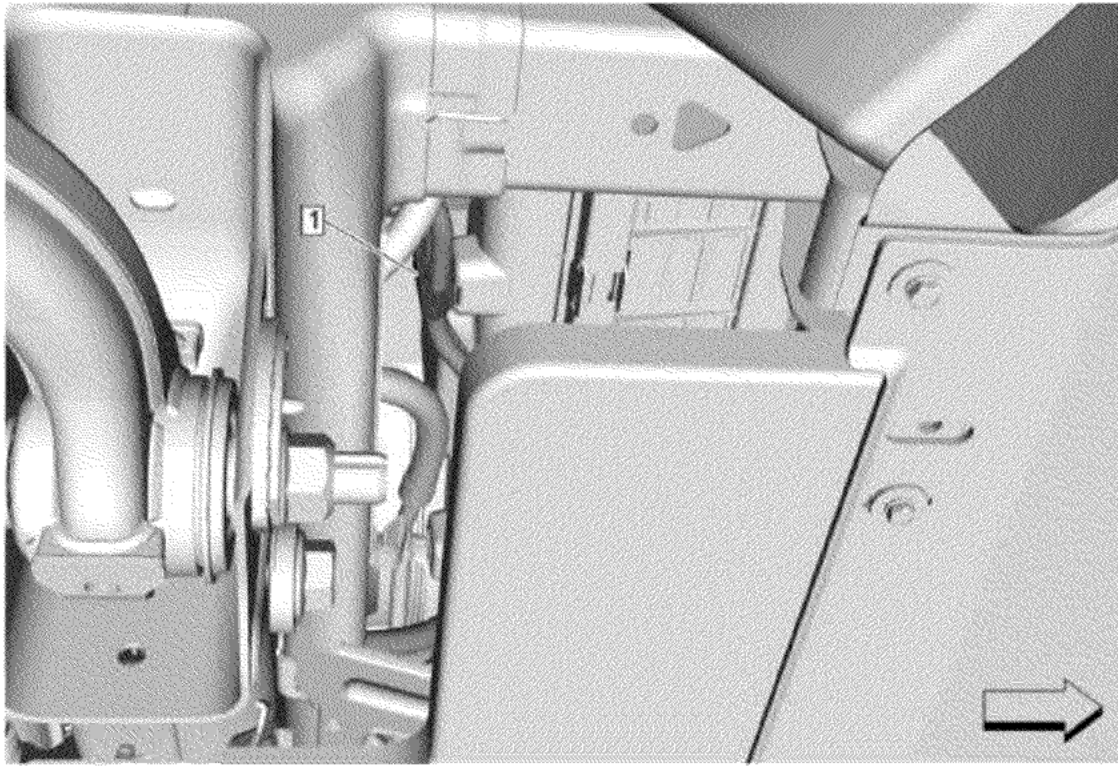
6. Intake Air Baffle Retainer (1) » Remove [10x]
7. Intake Air Splash Shield (2) » Remove
8. Front Wheelhouse Liner - Left Side and Right Side » Remove [2x] — Front Wheelhouse Liner Replacement



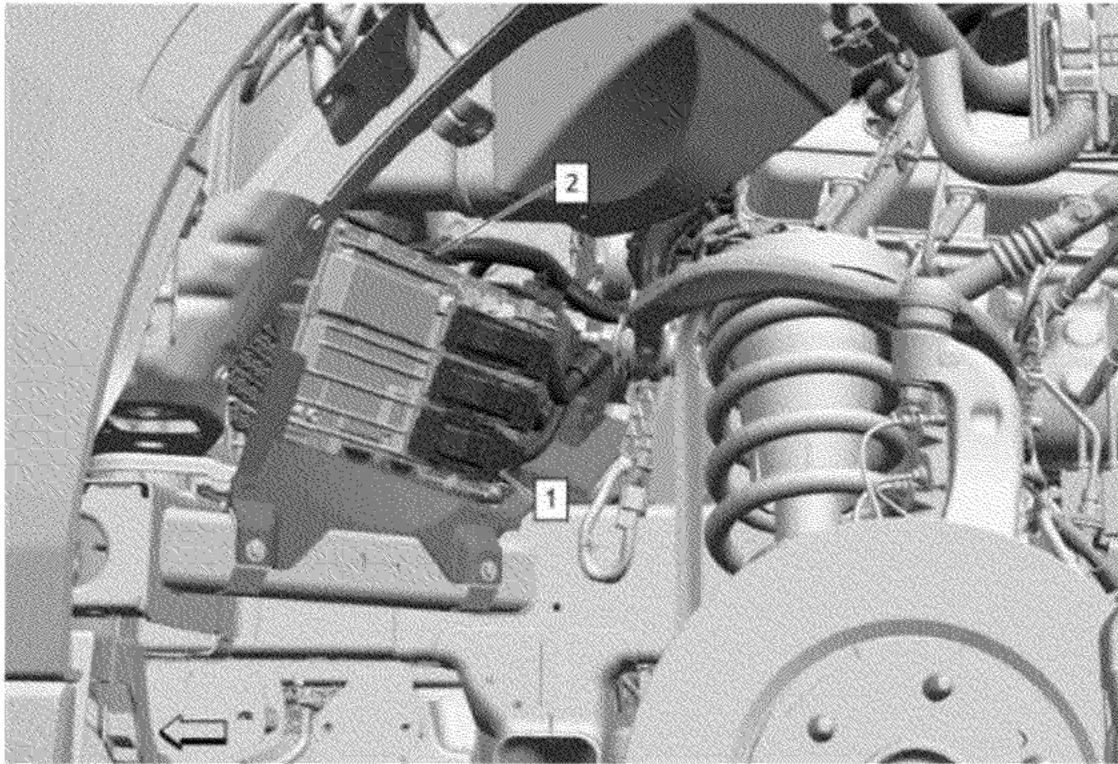
9. Front Grille Bolt (1) » Remove [4x]



10. Front Grille Retainer (1) » Release [4x]
11. Front Grille Clip (2) » Release [6x]
12. { If equipped } Disconnect the electrical connector.
13. { If equipped } Front View Driver Information Camera Nozzle Hose » Disconnect
14. Front Grille (3) » Remove
15. Remove underbody panels as necessary. [Underbody Panel Component Locator](#)



16. Engine Oil Cooler Hose Clip (1) » Release
17. Drain the coolant. [Cooling System Draining and Filling](#)
18. Drain the engine oil. [Engine Oil and Oil Filter Replacement](#)



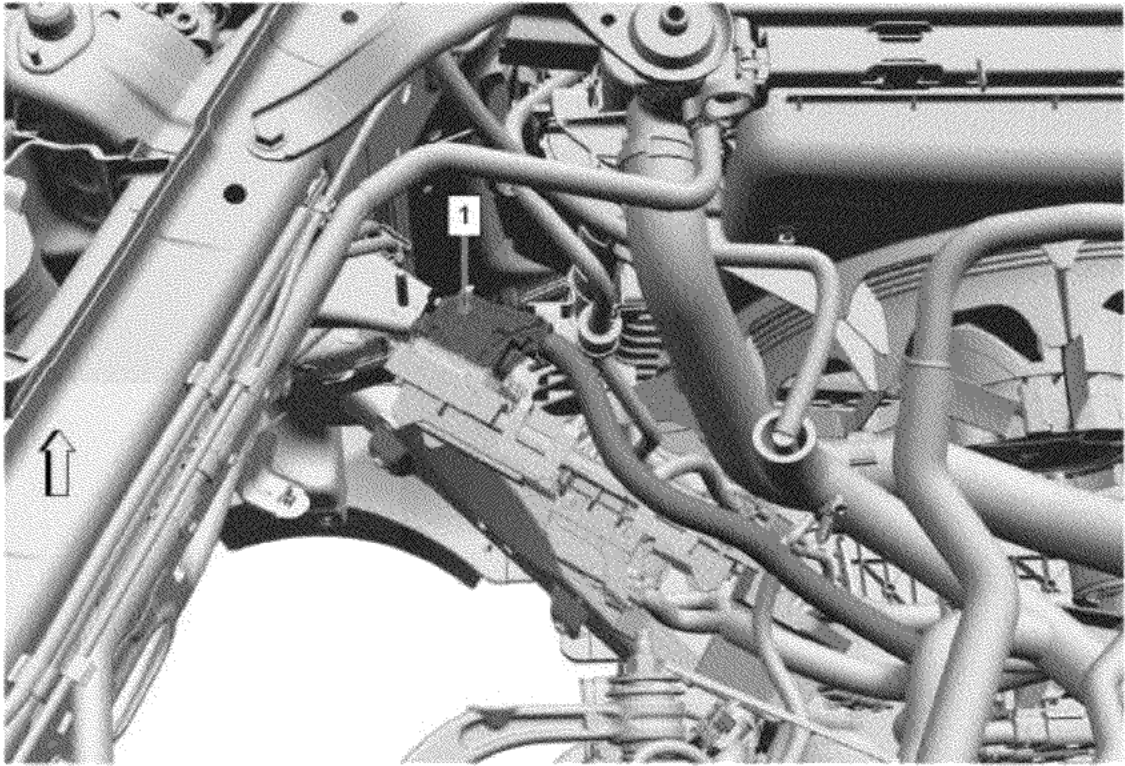
**Warning:** Refer to [Safety Glasses Warning](#).

**Caution:** Always turn the ignition off when installing or removing the ECM connectors in order to prevent damage to the components.

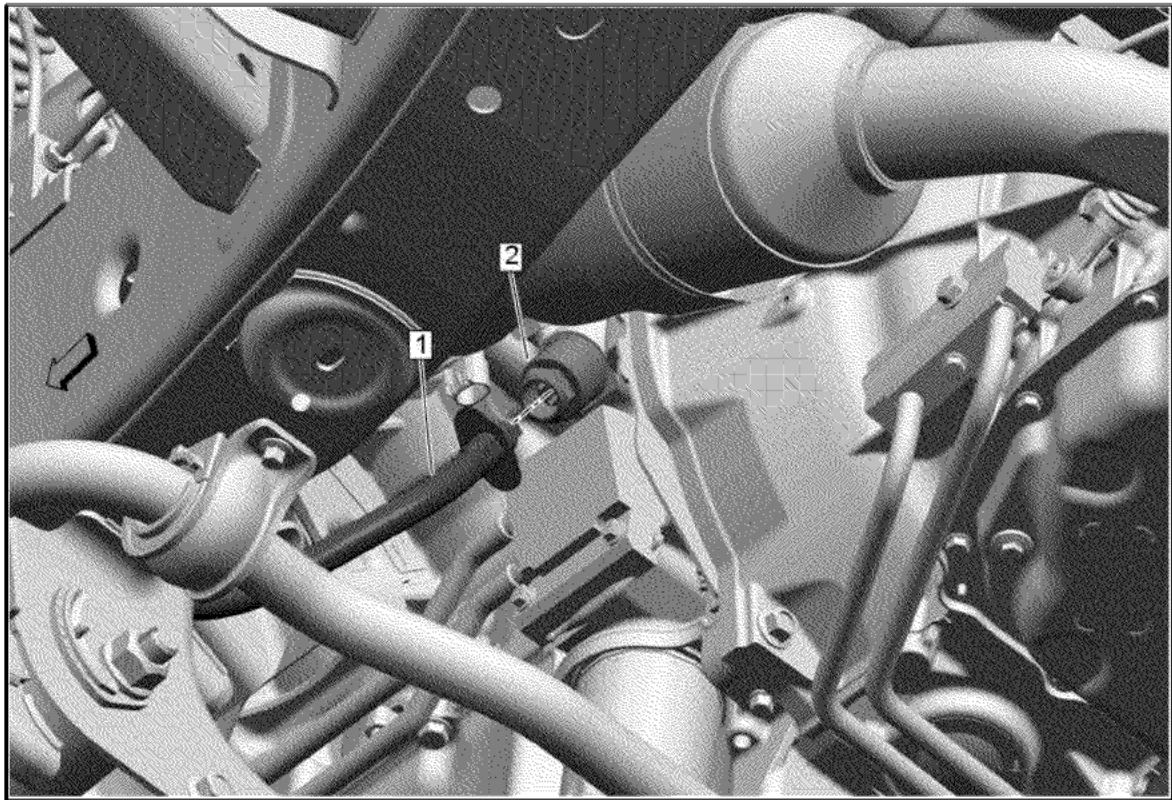
**Caution:**

- Turn the ignition OFF when installing or removing the control module connectors and disconnecting or reconnecting the power to the control module (battery cable, powertrain control module (PCM)/engine control module (ECM)/transaxle control module (TCM) pigtail, control module fuse, jumper cables, etc.) in order to prevent internal control module damage.
- Control module damage may result when the metal case contacts battery voltage. DO NOT contact the control module metal case with battery voltage when servicing a control module, using battery booster cables, or when charging the vehicle battery.
- In order to prevent any possible electrostatic discharge damage to the control module, do not touch the connector pins or the soldered components on the circuit board.
- Remove any debris from around the control module connector surfaces before servicing the control module. Inspect the control module connector gaskets when diagnosing or replacing the control module. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the control module.
- The replacement control module must be programmed.

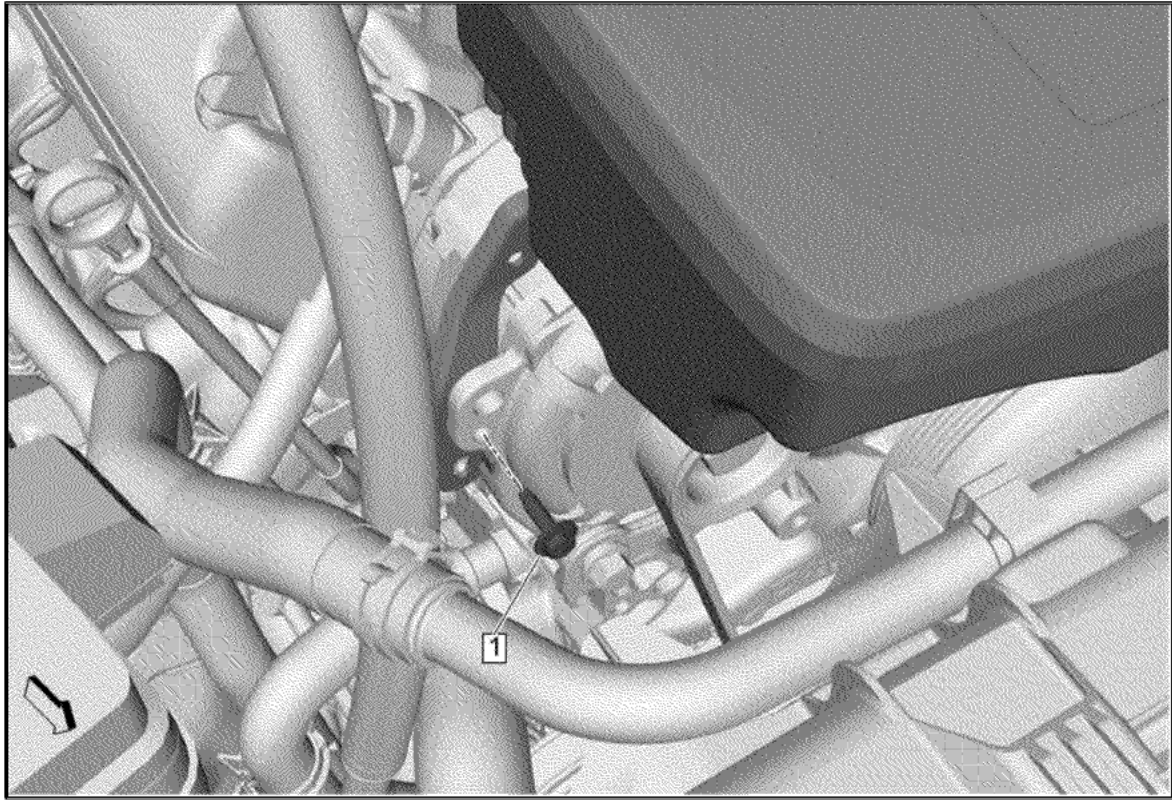
19. Disconnect the electrical connectors. (1)



**Note:** Parts removed from graphic for clarity.  
20. Disconnect the electrical connector. (1)



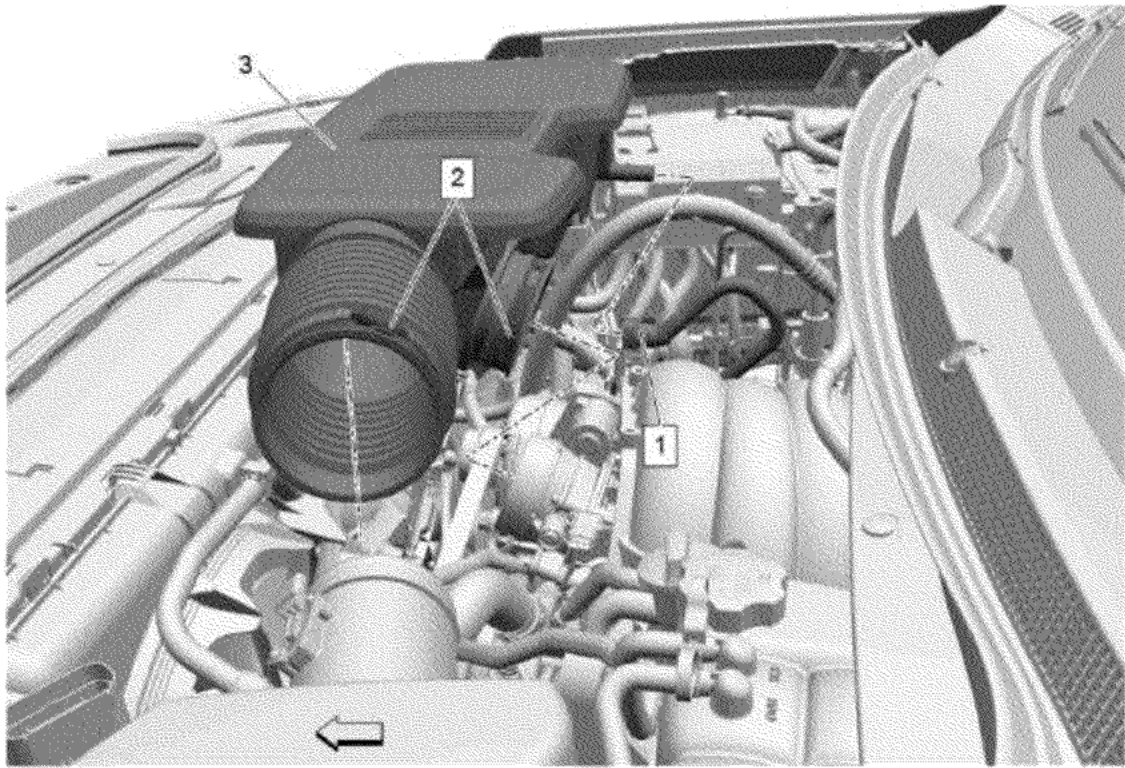
21. { If equipped } Engine Coolant Heater Cord (1) @ Engine Coolant Heater » Disconnect



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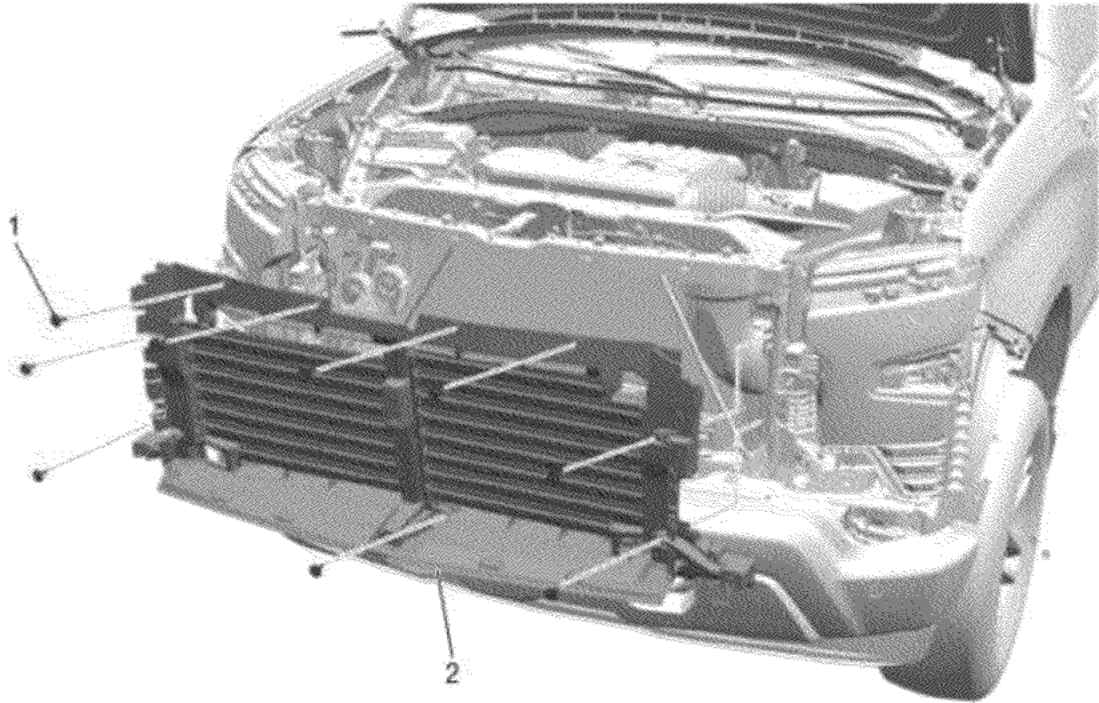
22. Air Cleaner Outlet Duct Bracket Bolt (1) » Remove

23. Engine Wiring Harness @ Air Cleaner Outlet Duct Bracket » Remove

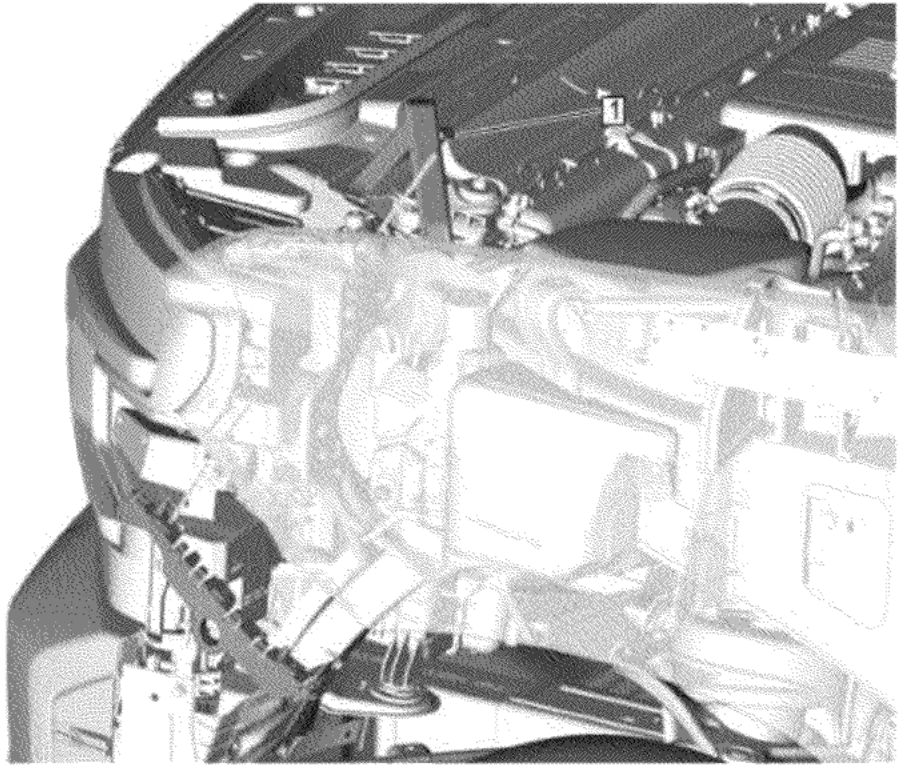


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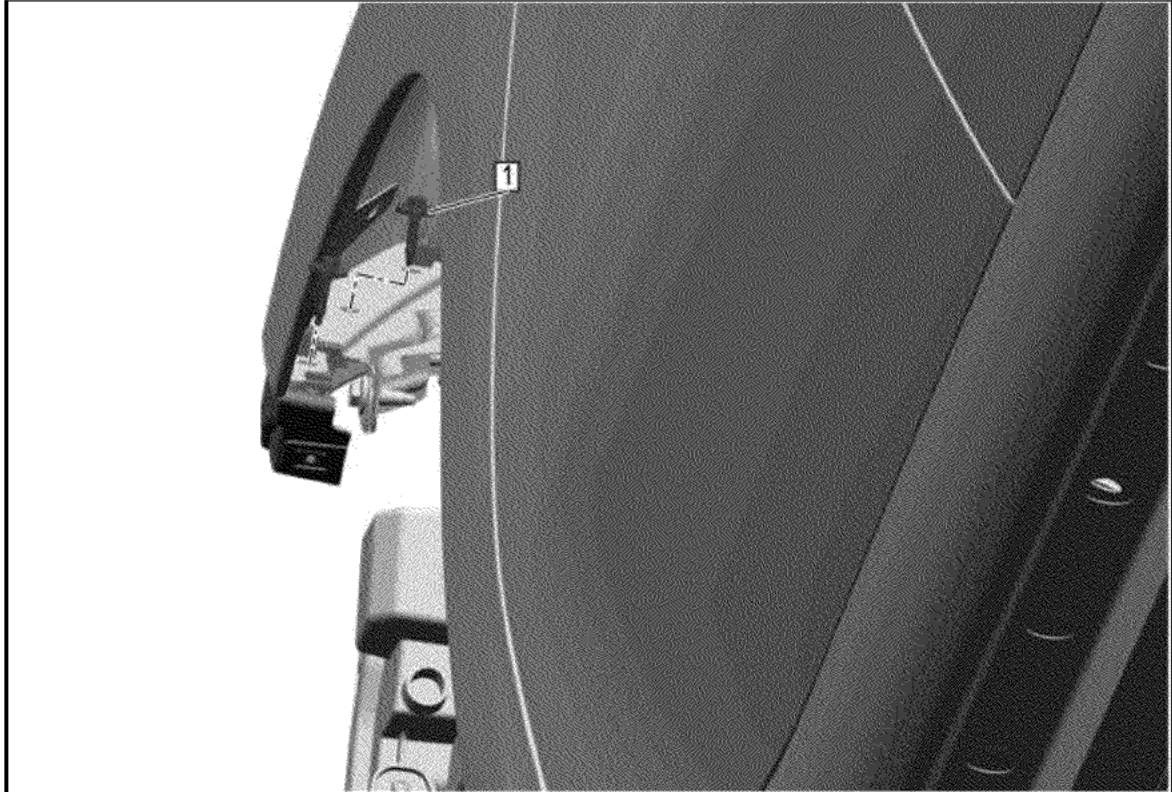
24. Air Cleaner Outlet Duct Clamp (2) » Loosen [2x]
25. Positive Crankcase Ventilation Fresh Air Tube (1) » Disconnect — [Plastic Collar Quick Connect Fitting Service](#)
26. Air Cleaner Outlet Duct (3) » Remove



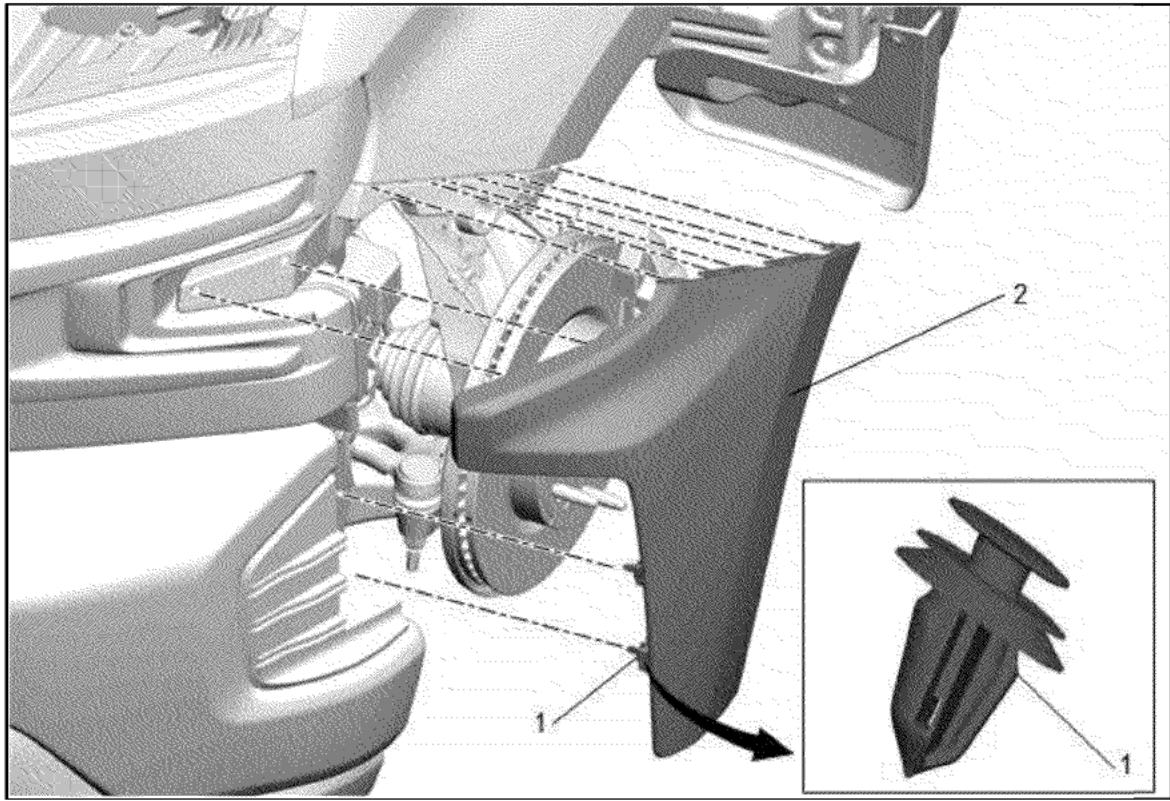
27. Front Bumper Shutter Bolt (1) » Remove [9x]
28. { If equipped } Release the 2 wiring harness retainers holding the camera nozzle hose.
29. { If equipped } Remove the front driver info camera wiring harness retainer.
30. Tip the top of the front bumper shutter (2) slightly forward and pull the shutter upward over the impact bar.
31. Disconnect the electrical connector.
32. { If equipped } Disconnect and reposition the lower shutter harness.



33. Loosen the left and right side front bumper fascia guide bolt (1) from the engine compartment.

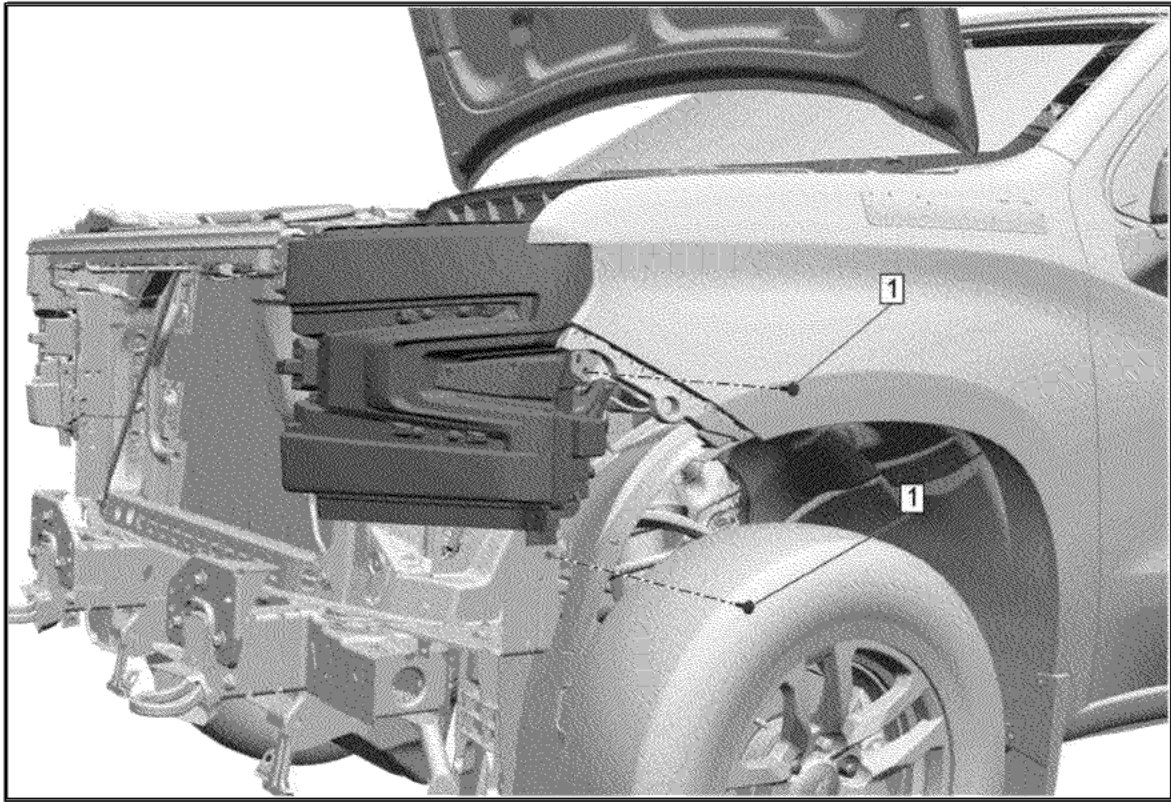


34. Loosen the remaining 4 left and right side front bumper fascia guide bolts (1).

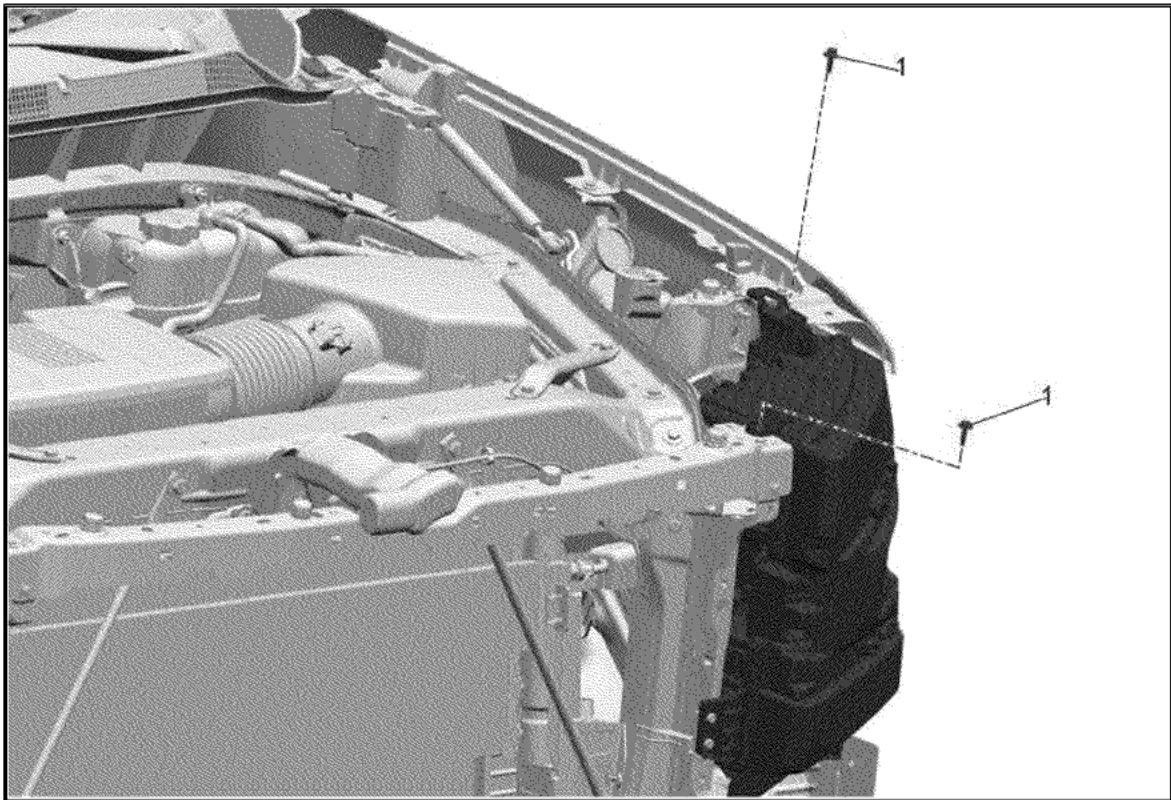


35. Front Bumper Outer Filler Retainer (1) » Release [8x]

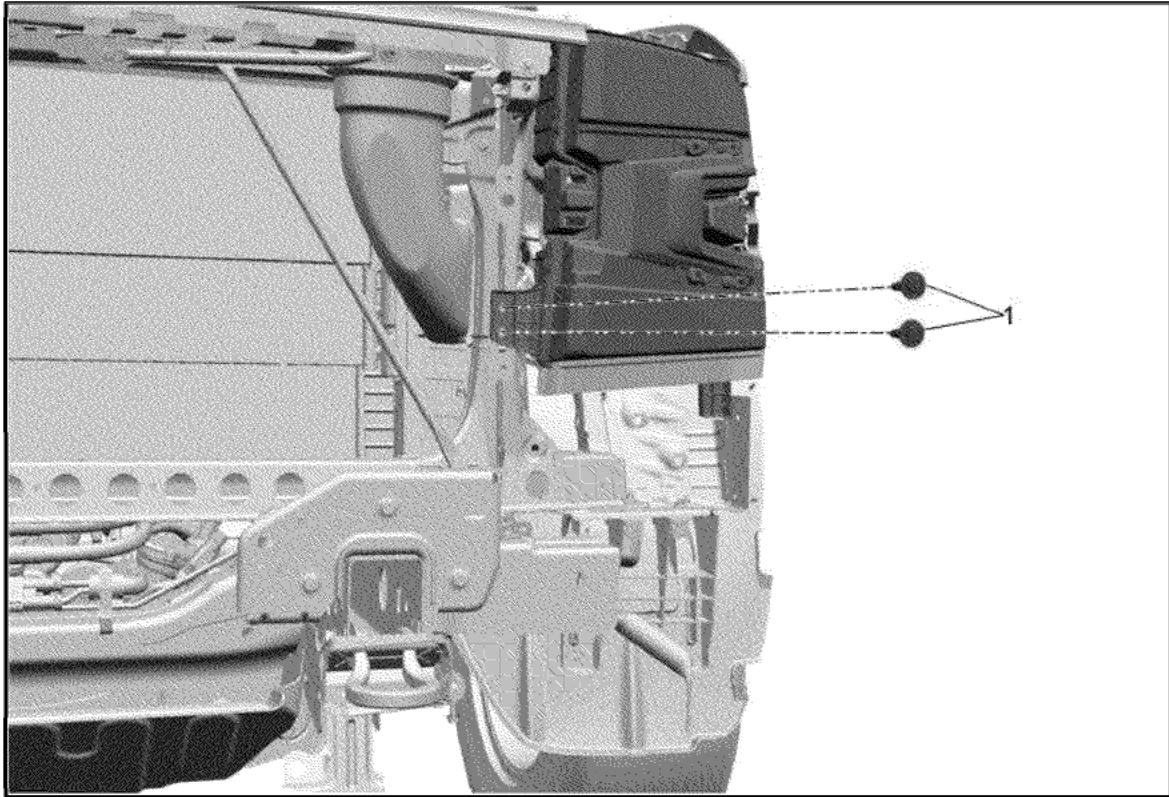
36. Front Bumper Outer Filler - Left Side and Right Side (2) » Remove [2x]



37. Headlamp Bolt - Left Side and Right Side (1) » Remove [4x]

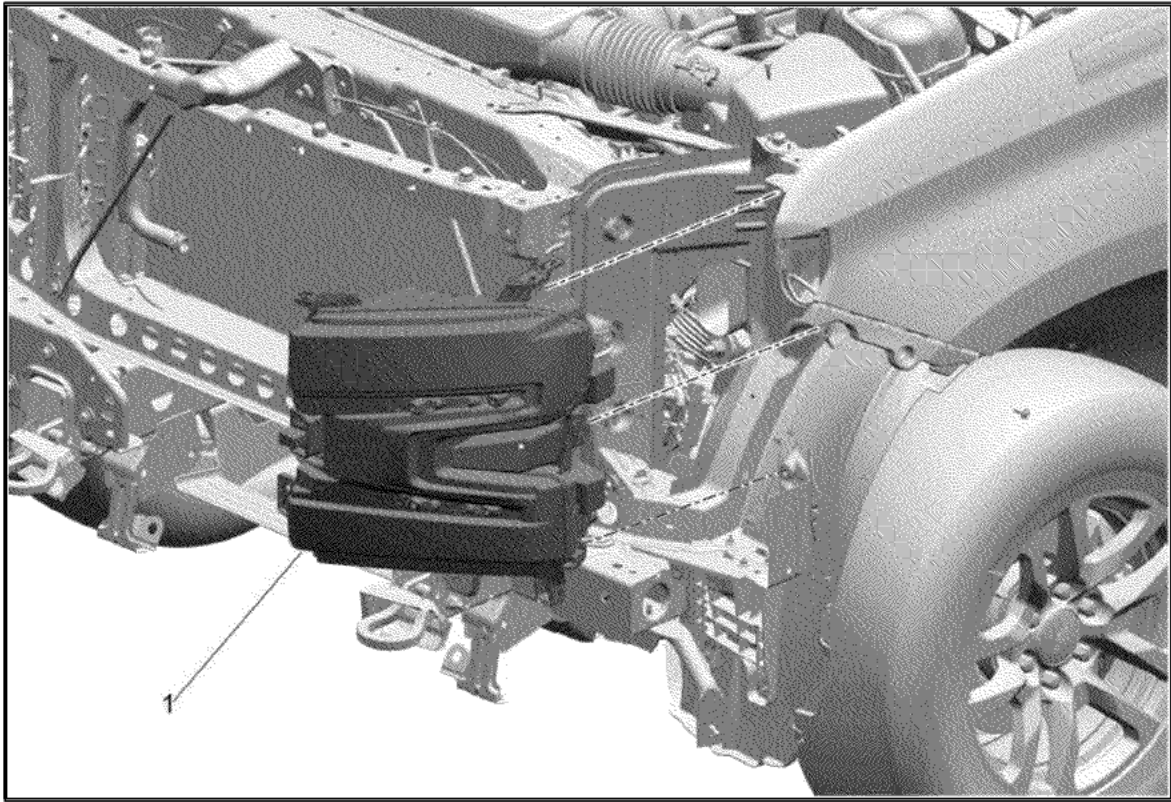


38. Headlamp Bolt - Left Side and Right Side (1) » Remove [4x]

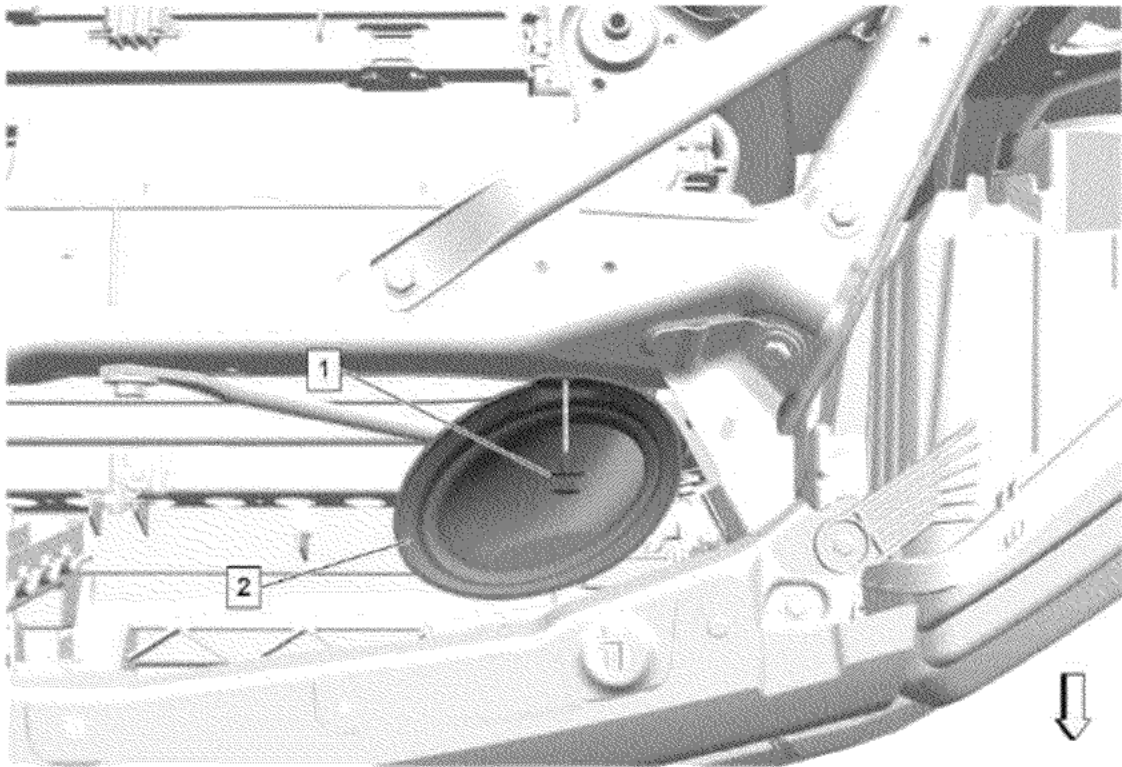


39. Headlamp Bolt - Left Side and Right Side (1) » Remove [4x]

40. Disconnect all electrical connectors.

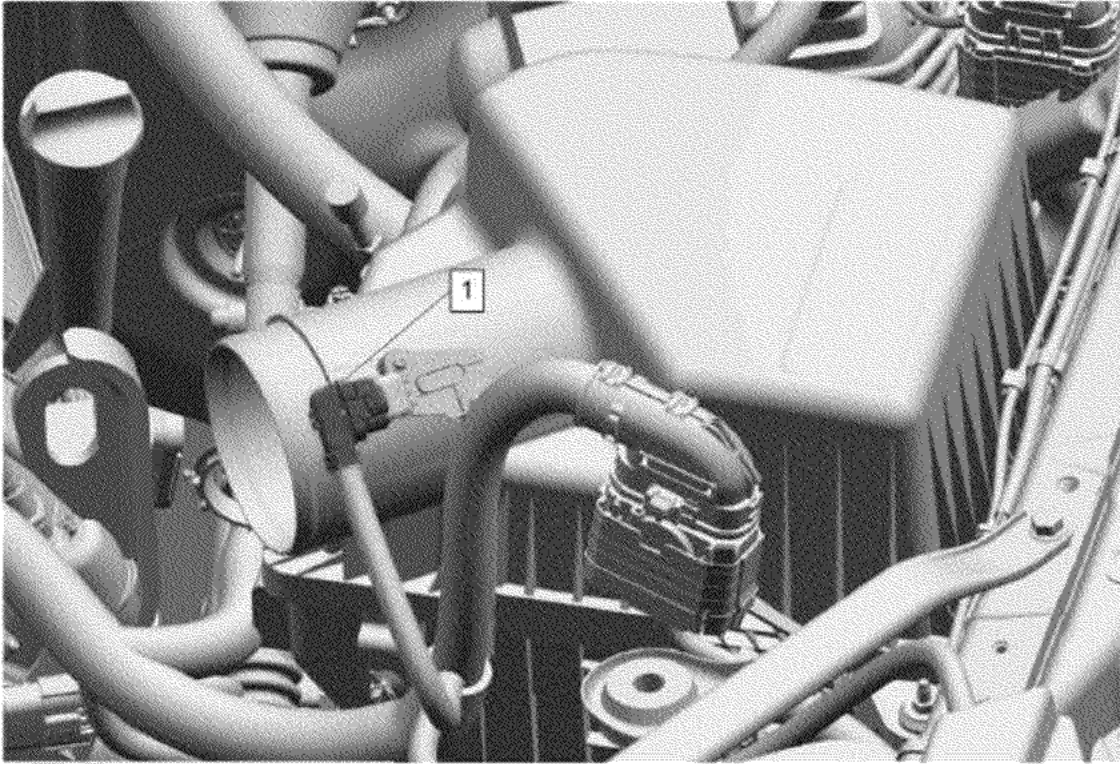


41. Headlamp - Left Side and Right Side (1) » Remove [2x]

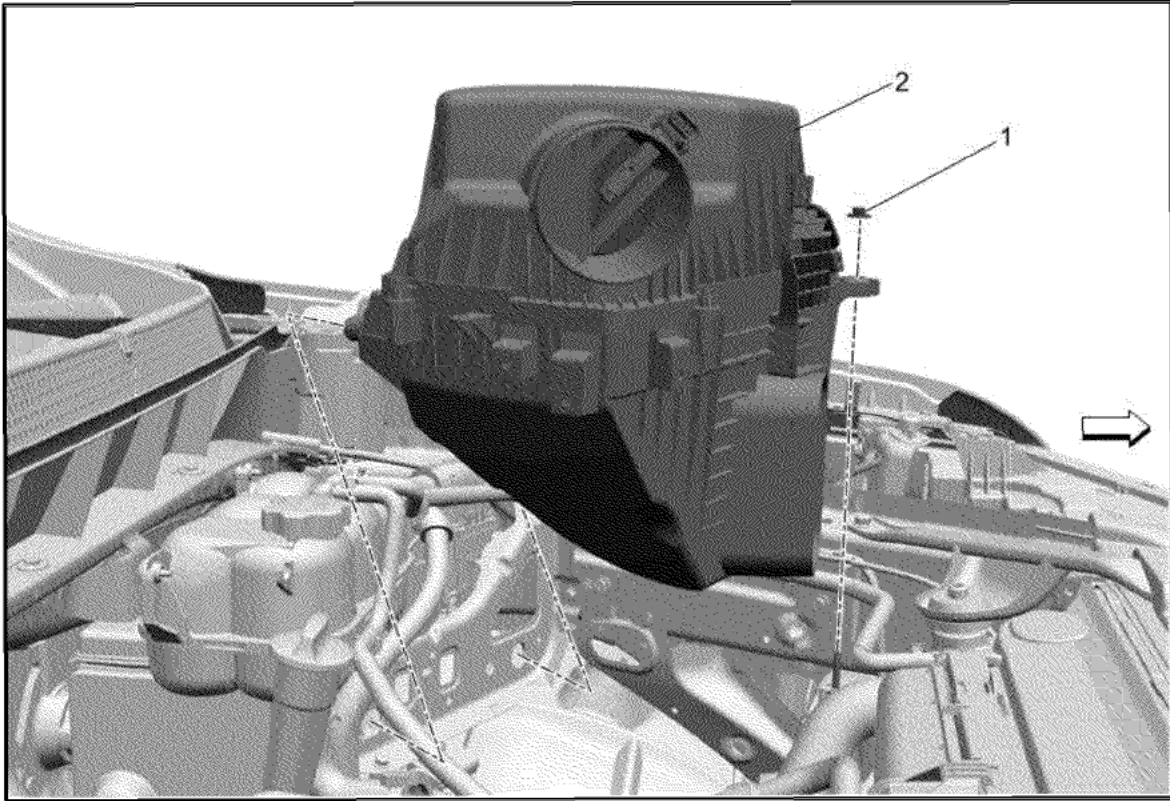


42. Intake Air Duct Retainer (1) » Remove

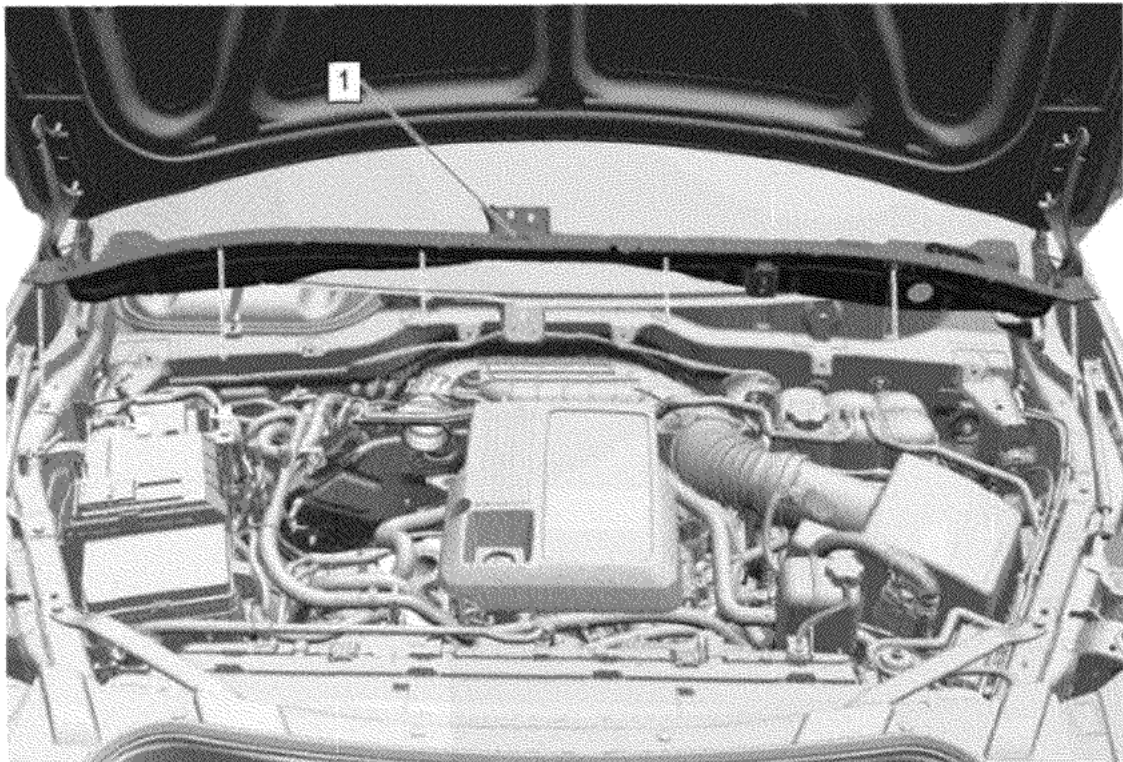
43. Intake Air Duct (2) » Remove



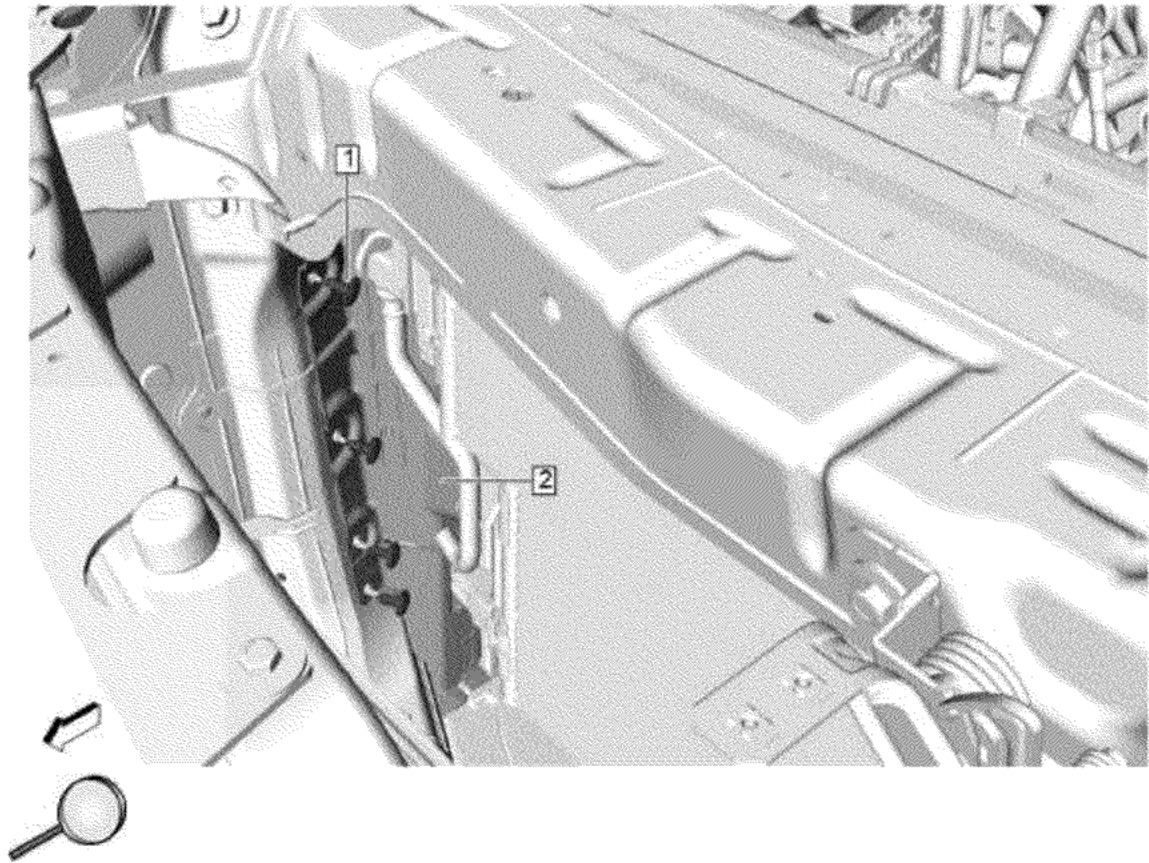
44. Disconnect the mass airflow sensor electrical connector (1) and remove all engine wiring harnesses from the air cleaner assembly.



- 45. Air Cleaner Nut (1) » Remove
- 46. Air Cleaner Assembly (2) » Remove



47. Plenum Front Panel Outer Reinforcement (1) » Remove — [Plenum Front Panel Outer Reinforcement Removal and Installation](#)

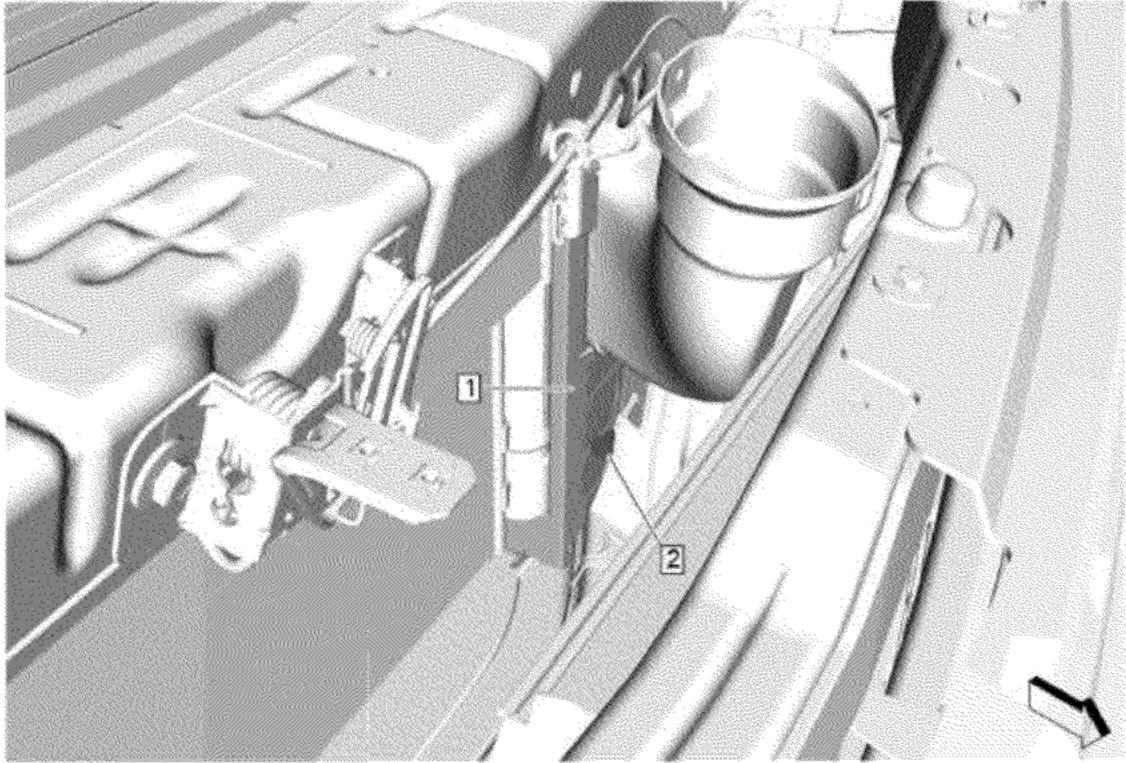


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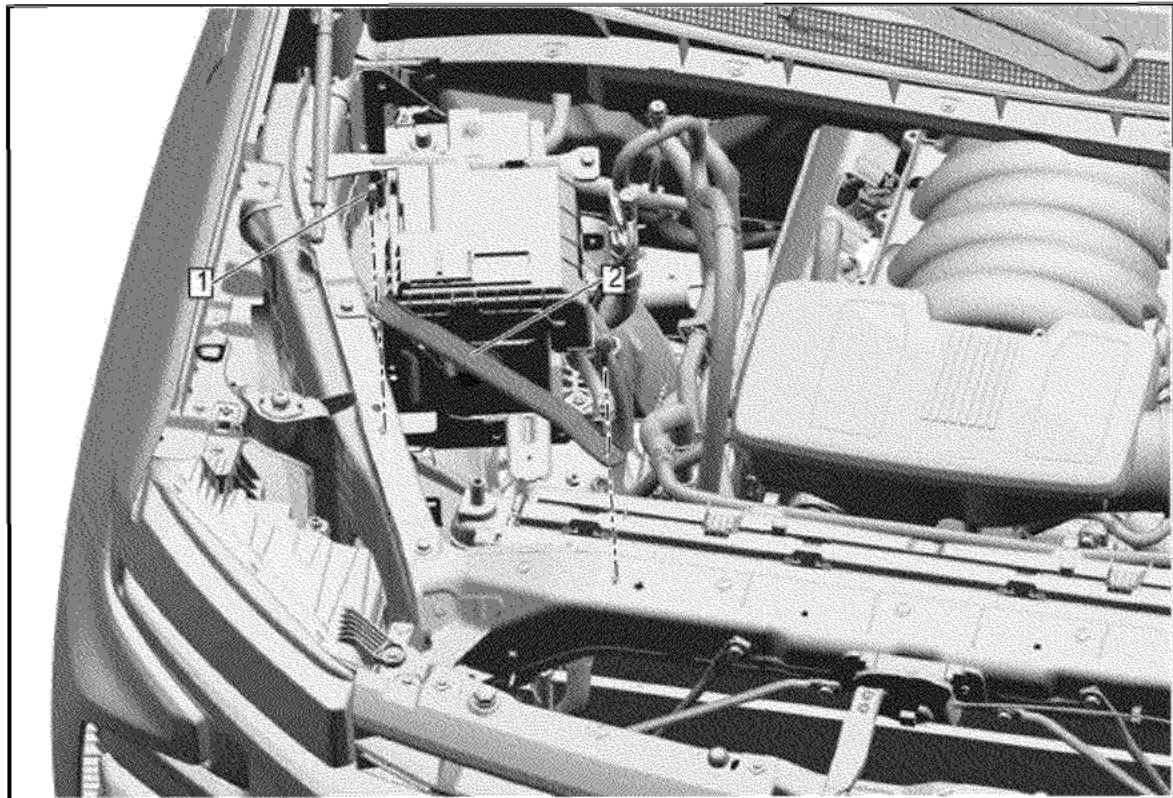
**Note:** Some components not shown for graphic clarity.

48. Radiator Air Side Baffle Retainer (1) » Remove [4x]

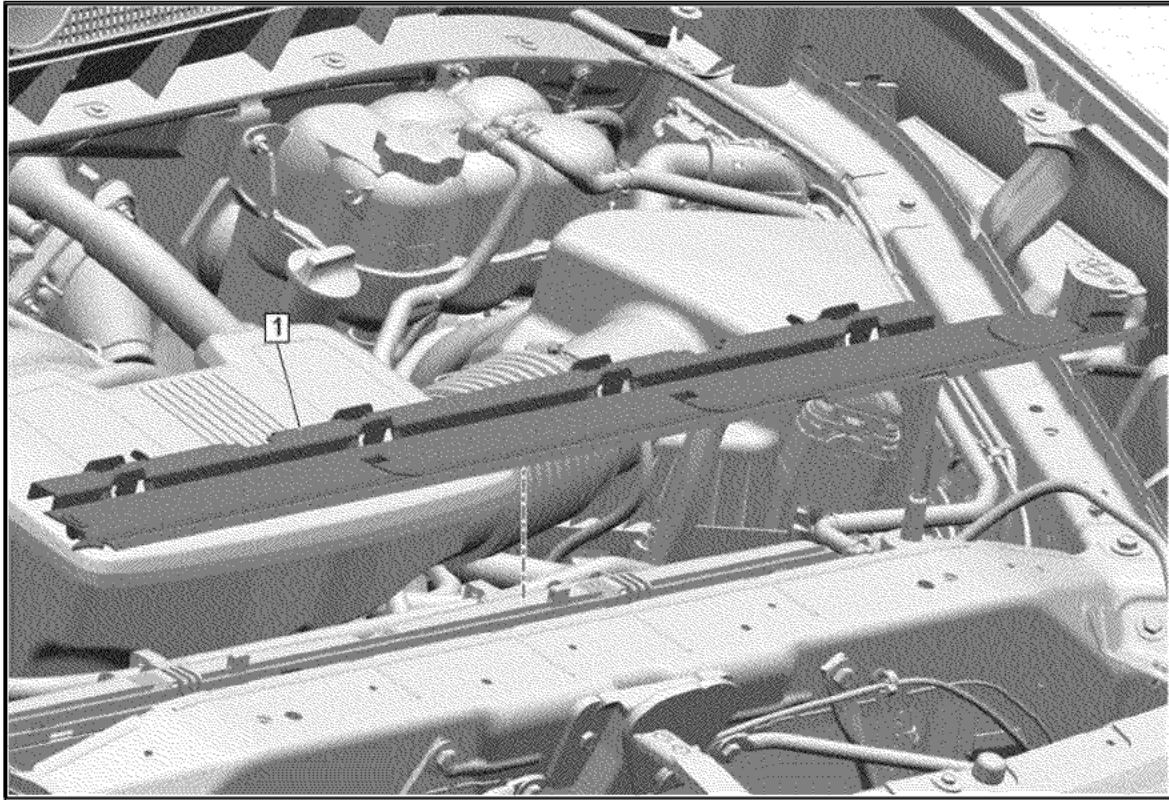
49. Radiator Air Side Baffle - Right Side (2) » Remove



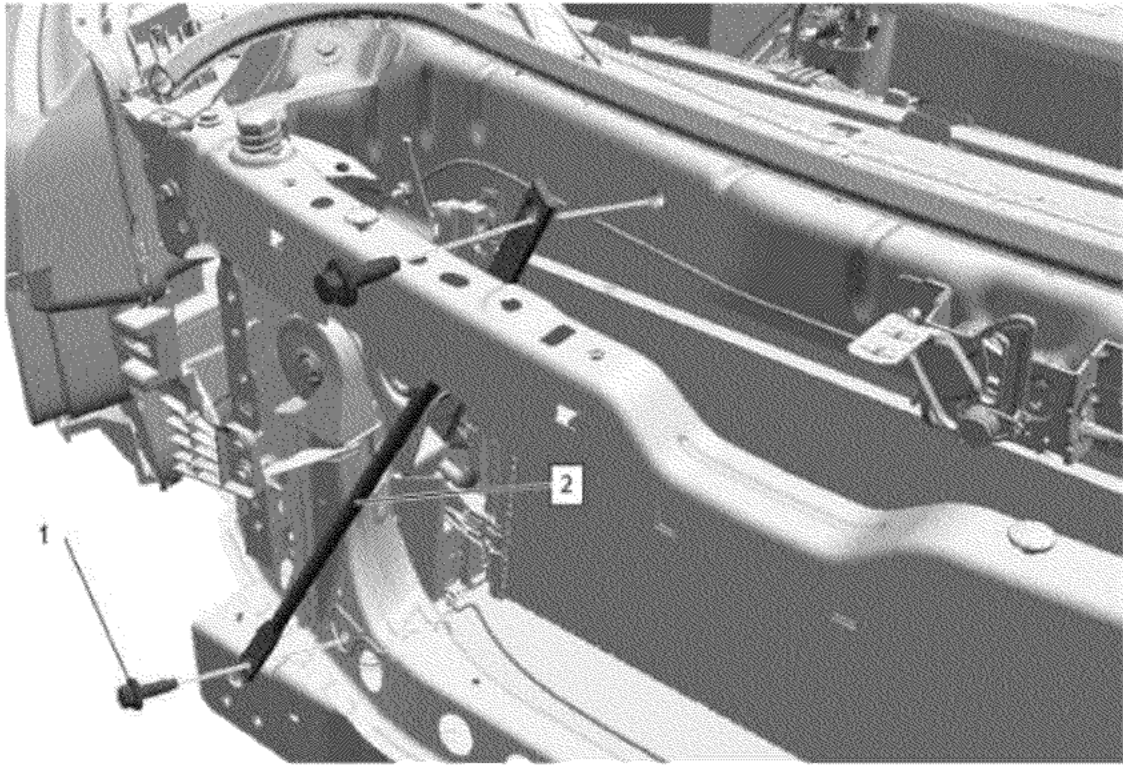
- 50. Radiator Air Side Baffle Retainer (2) » Remove
- 51. Radiator Air Side Baffle - Left Side (1) » Remove



52. Front End Sheet Metal Cross Brace Bracket Bolt - Left Side and Right Side (1) Remove [4x]
53. Front End Sheet Metal Cross Brace Bracket - Left Side and Right Side (2) » Remove [2x]



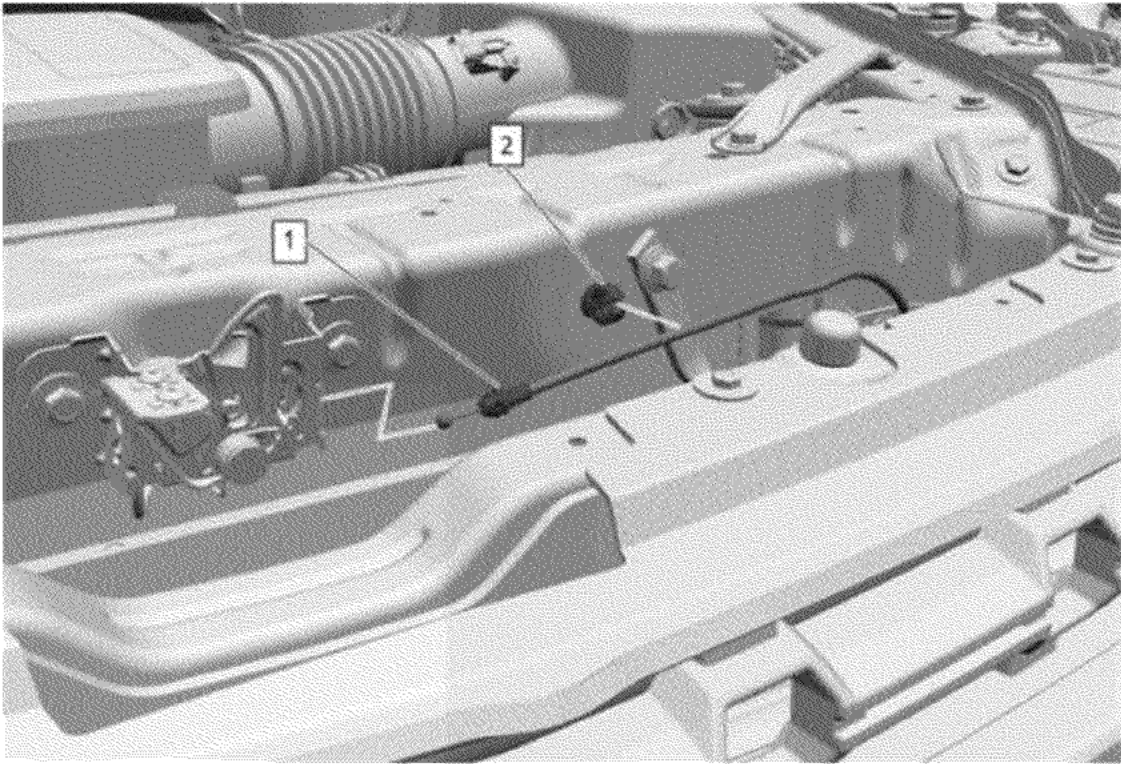
54. Radiator Air Upper Baffle (1) @ Radiator Air Side Baffle» Unclip
55. Radiator Air Upper Baffle (1) » Remove



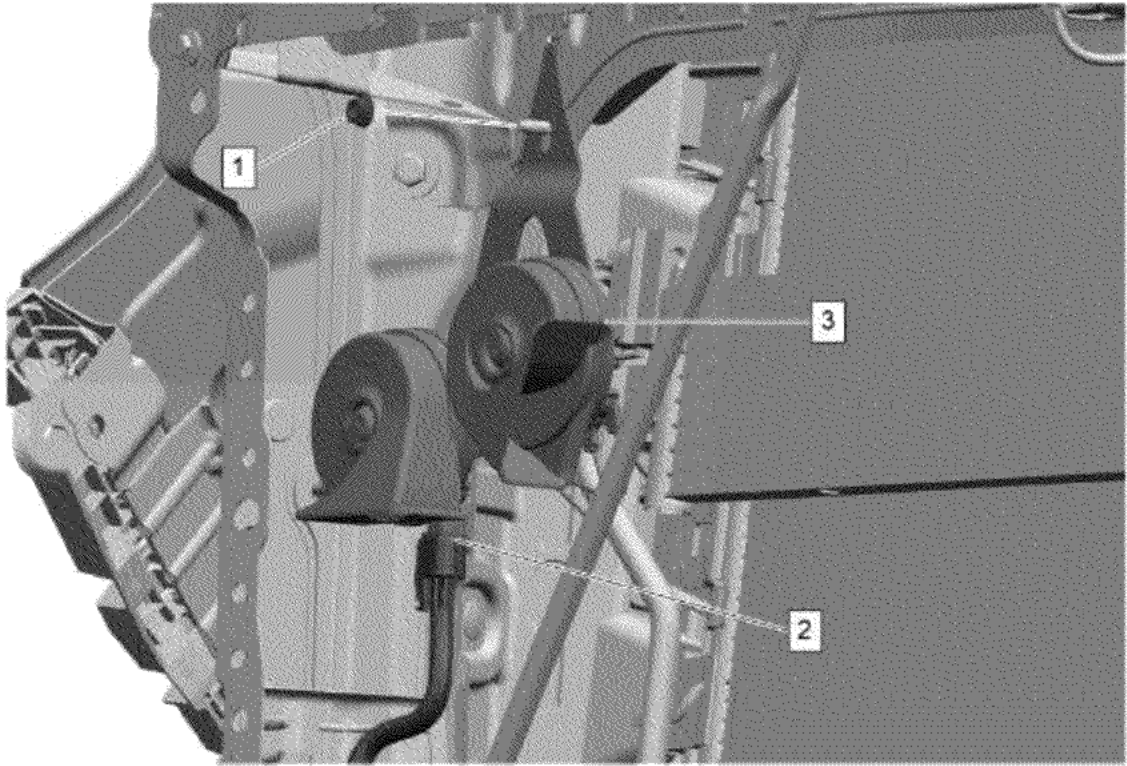
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**Note:** Right side shown, left side similar.

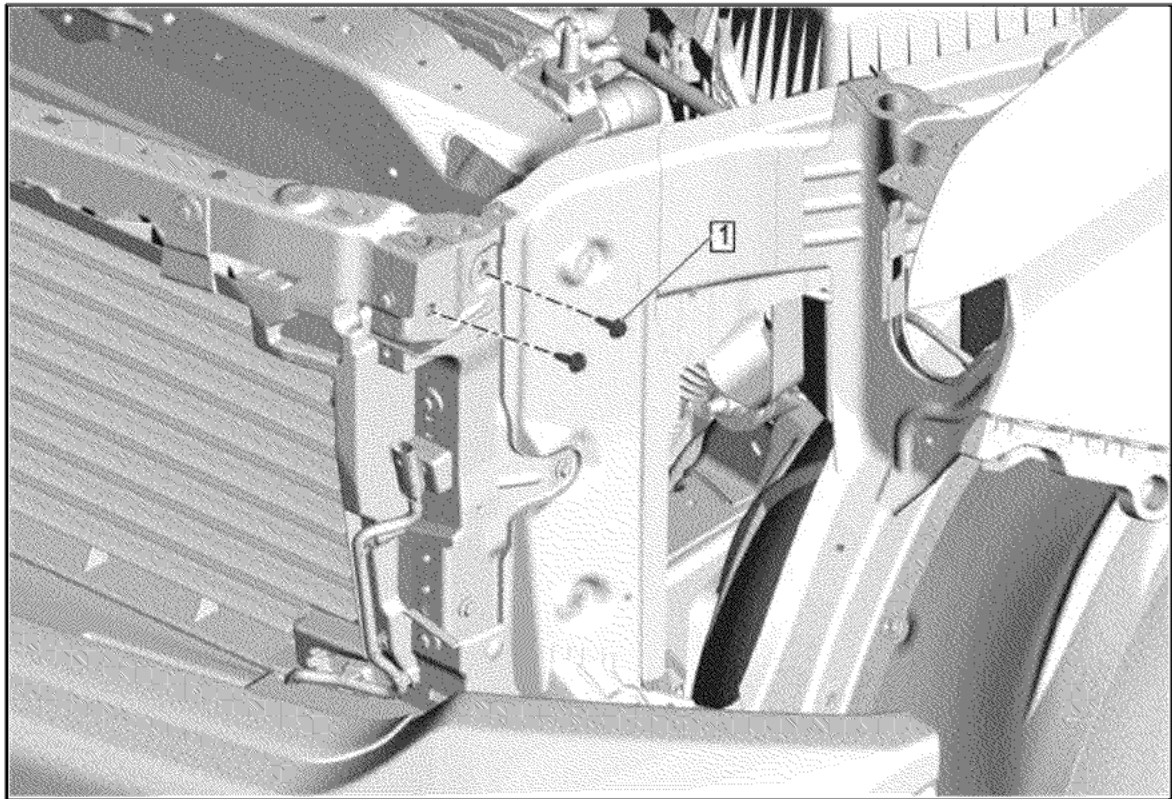
56. Front End Sheet Metal Diagonal Brace Bolt - Left Side and Right Side (1) @ Radiator Support  
» Remove [4x]
57. Front End Sheet Metal Diagonal Brace - Left Side and Right Side (2) @ Radiator Support  
» Remove [2x]



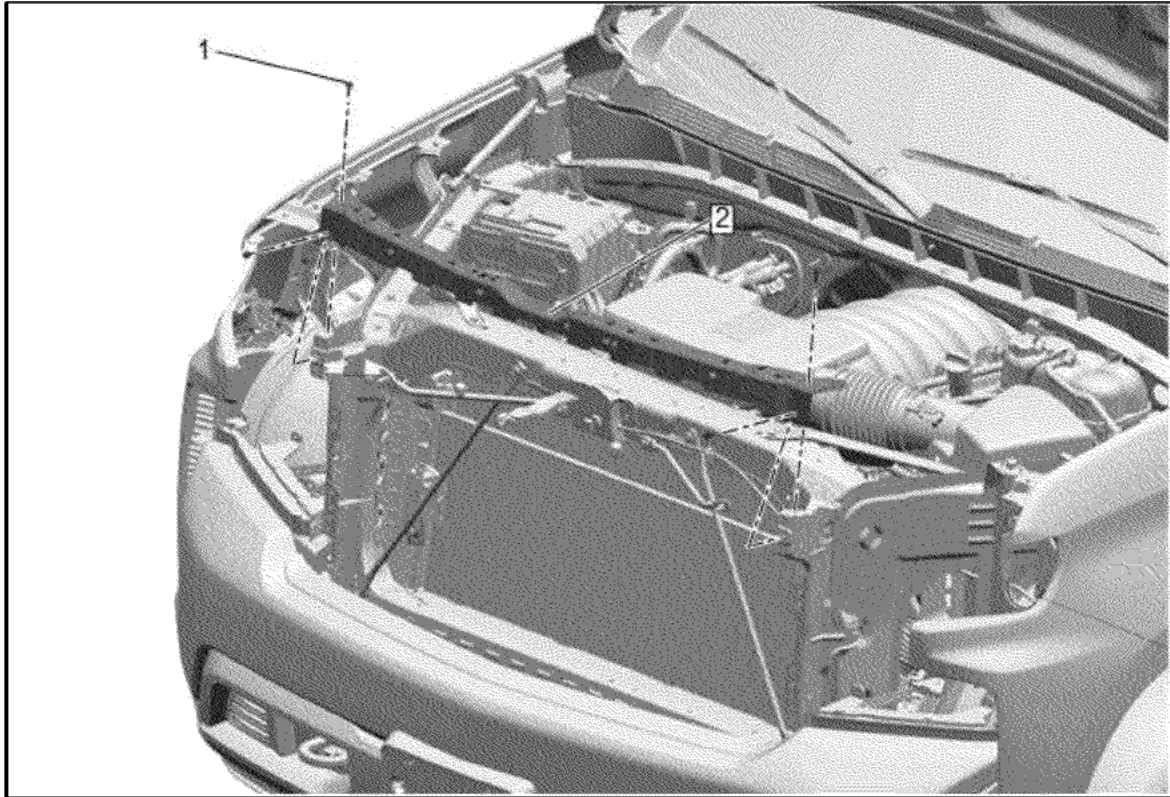
58. Reposition the hood primary latch release cable (1) from the upper tie bar retainer (2).
59. Hood Primary Latch Release Cable (1) » Disconnect @ Hood Primary Latch
60. Disconnect the electrical connector.



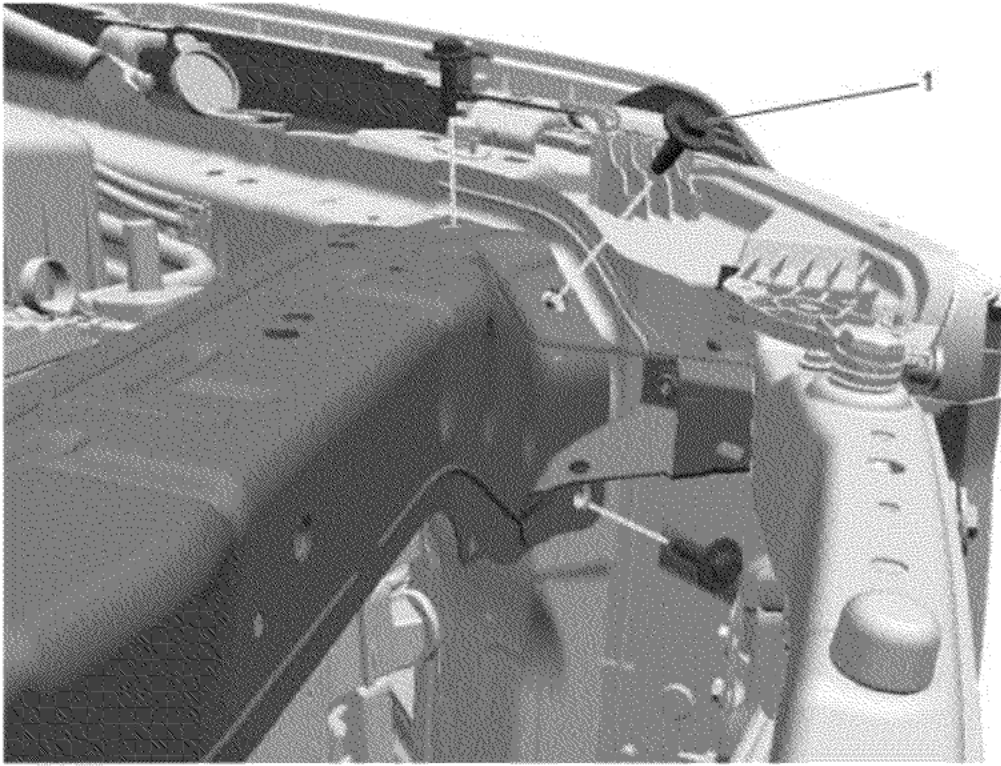
61. Electrical Connector (2) » Disconnect



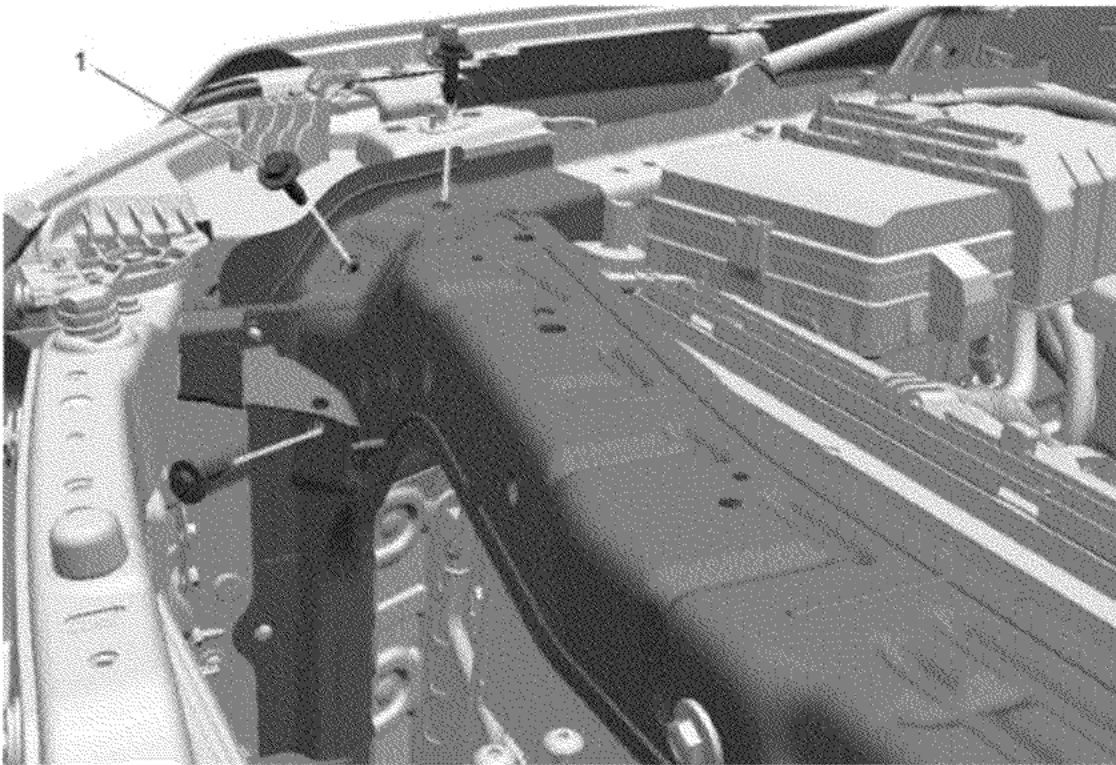
62. Front End Upper Tie Bar Bolt - Left Side and Right Side (1) @ Headlamp Bracket » Remove [4x]



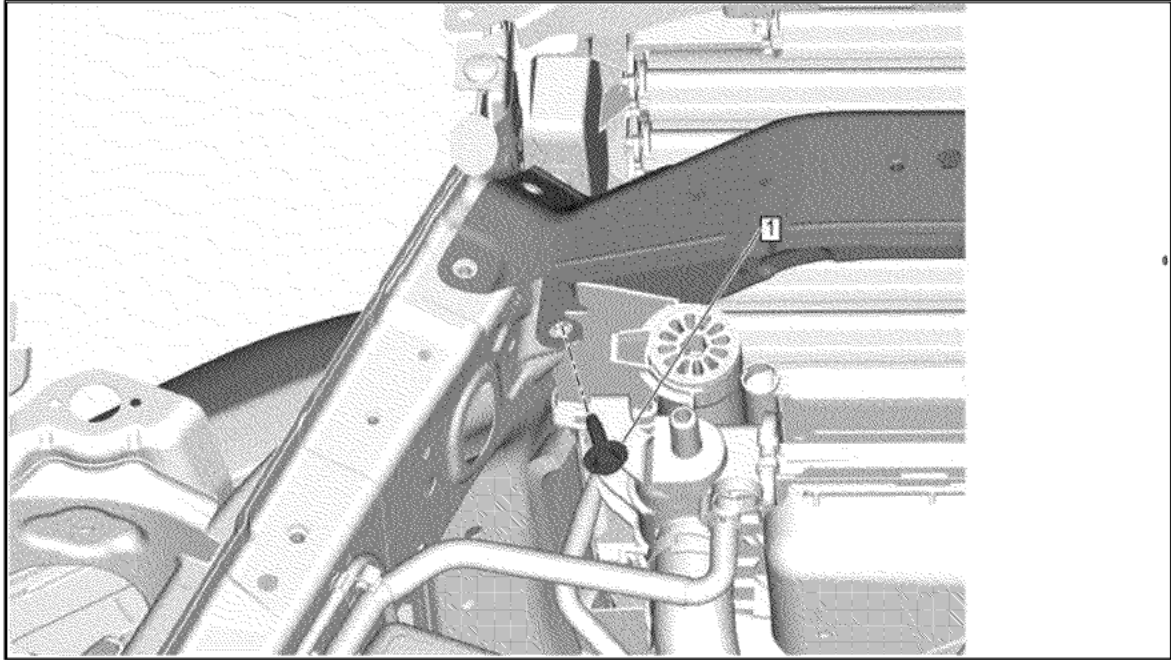
63. Front Bumper Fascia Center Support Bolt (1) » Remove [4x]  
64. Hood Front Bumper Bracket (2) » Remove  
65. Remove the wiring harness retainers from the front end upper tie bar and reposition the wiring harness as necessary.



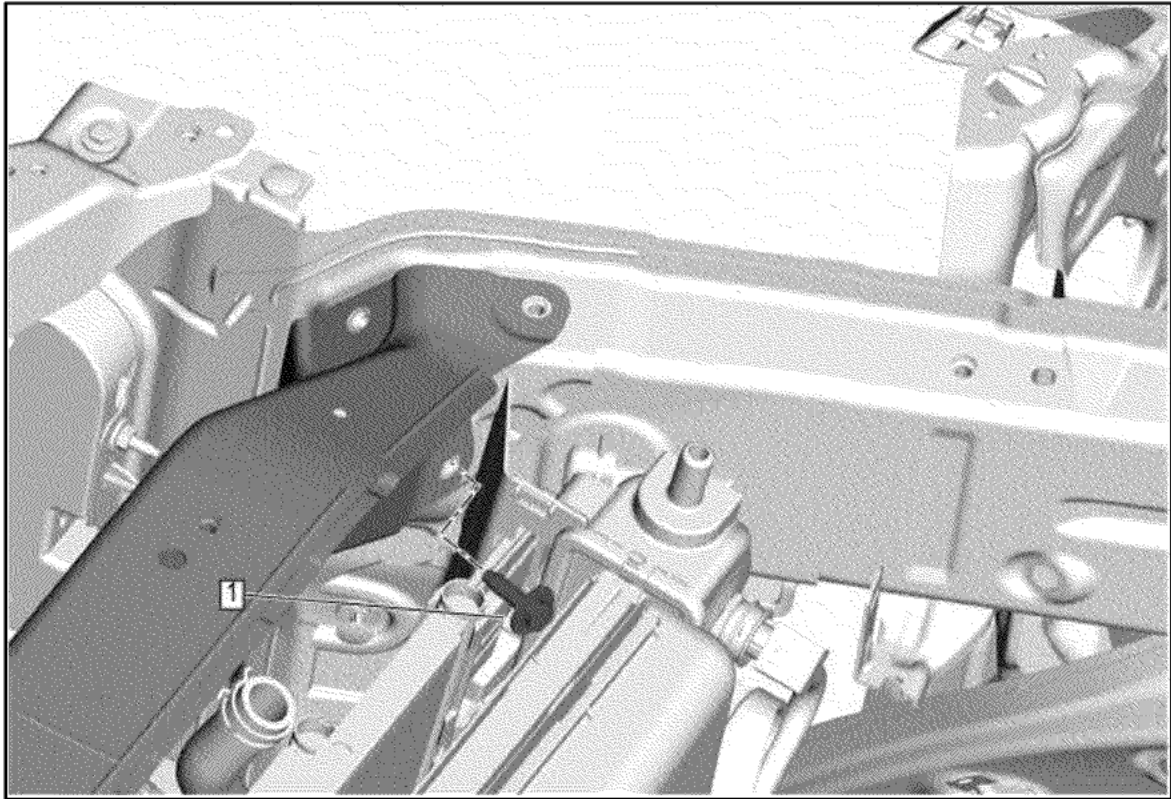
66. Front End Upper Tie Bar Bolt (1) » Remove [3x]



67. Front End Upper Tie Bar Bolt (1) » Remove [3x]

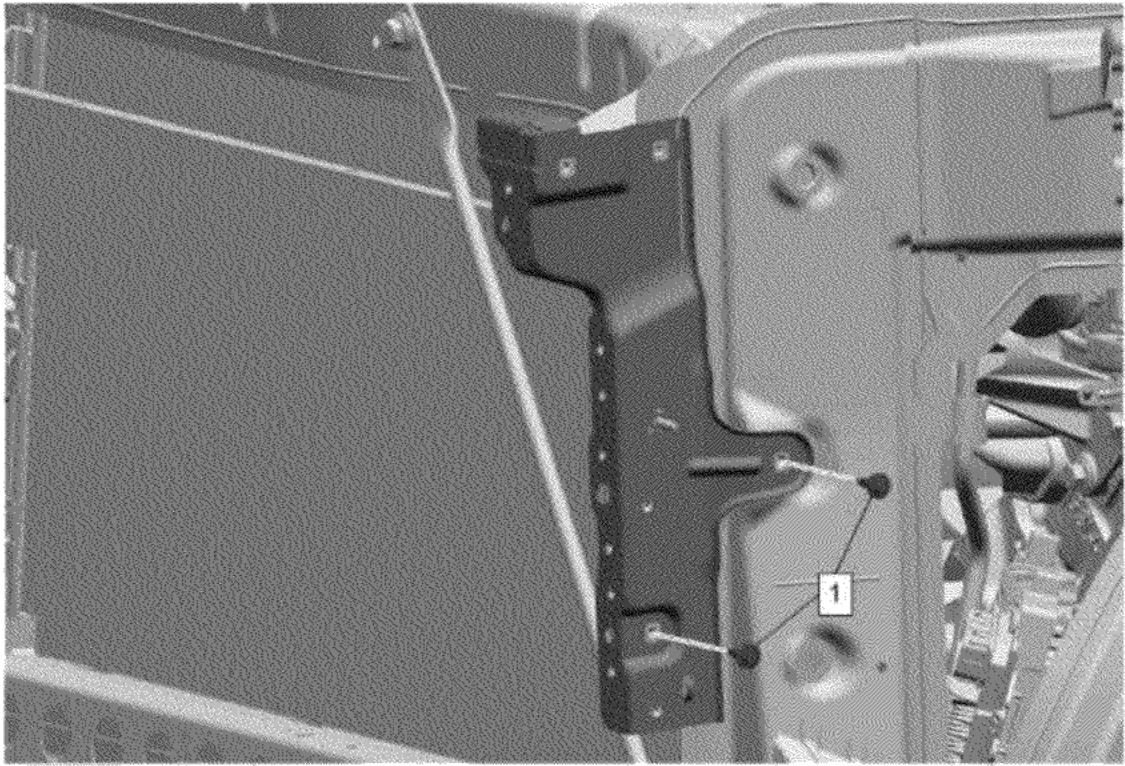


68. Front End Upper Tie Bar Bolt - Left Side (1) » Remove

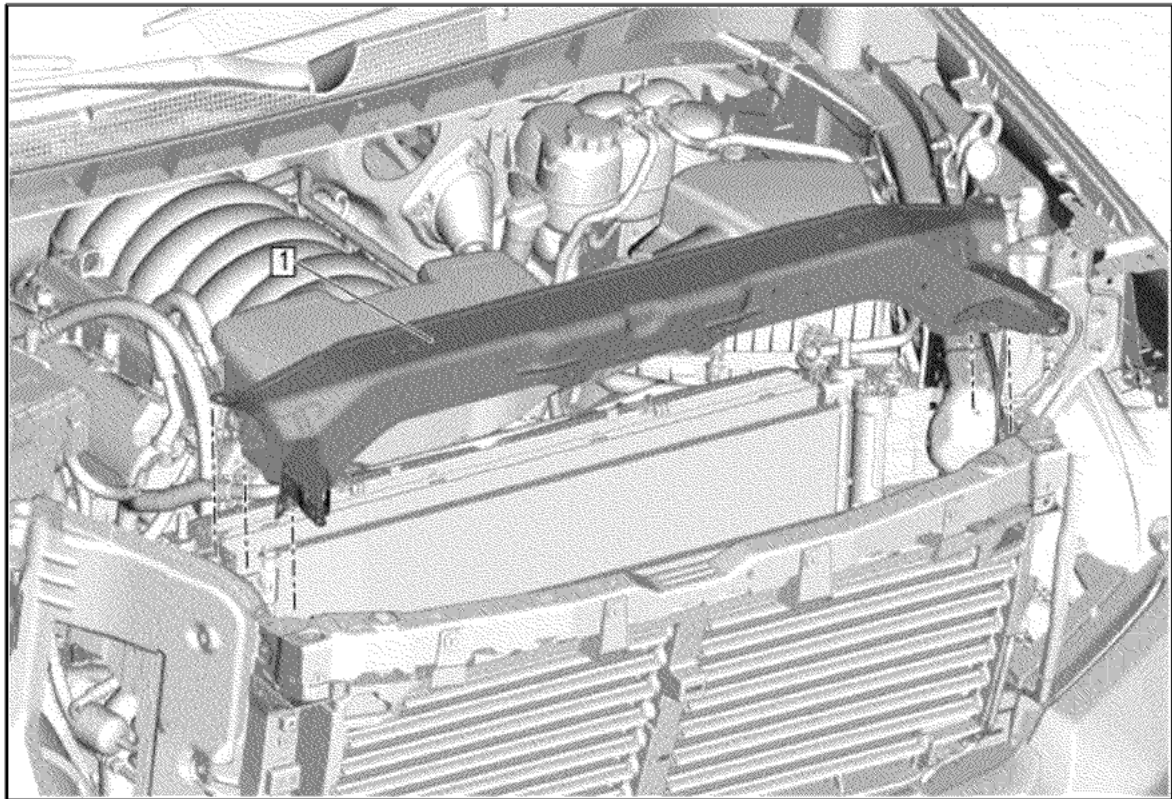


69. Front End Upper Tie Bar Bolt - Right Side (1) » Remove

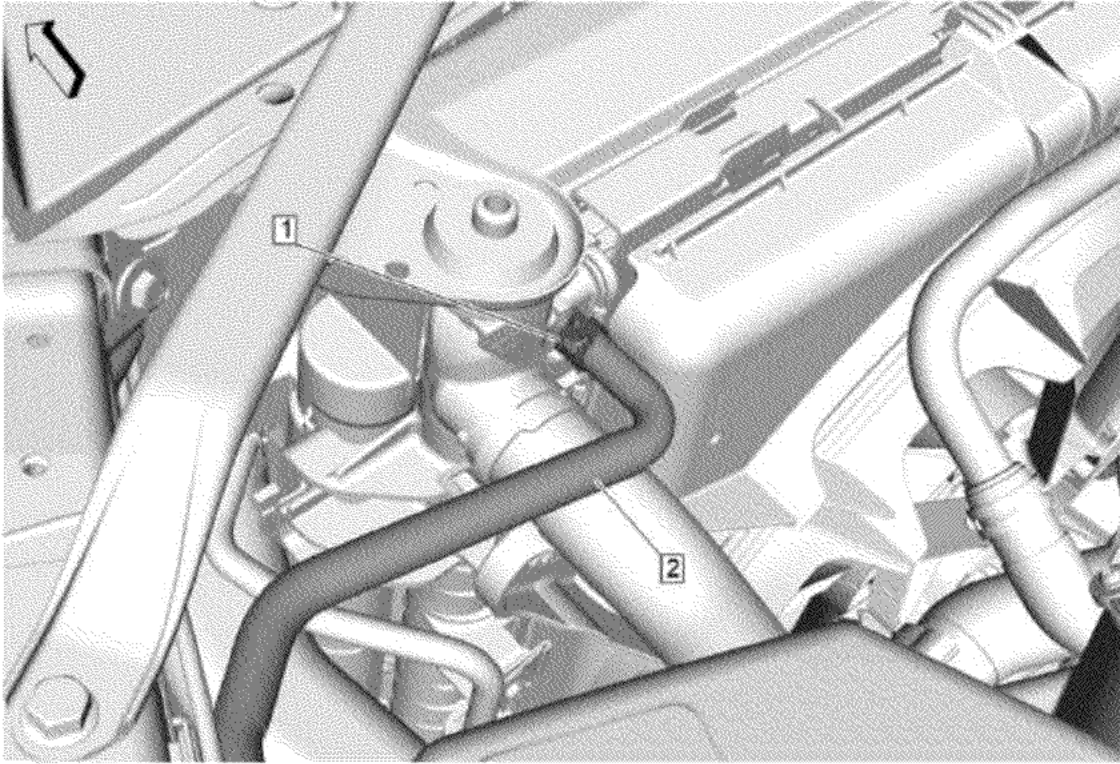
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70. Headlamp Bracket Bolt - Left Side and Right Side (1) » Loosen [4x]

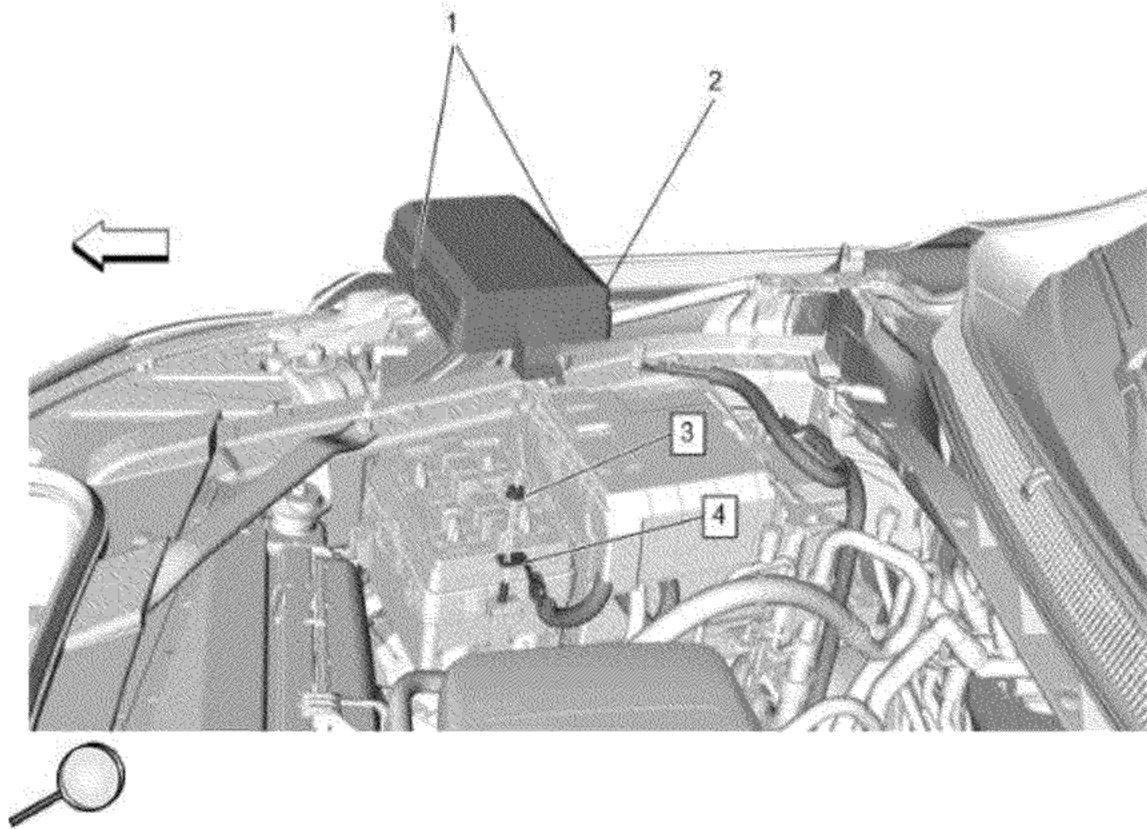


71. Front End Upper Tie Bar (1) » Remove
72. Disconnect the wiring harness.



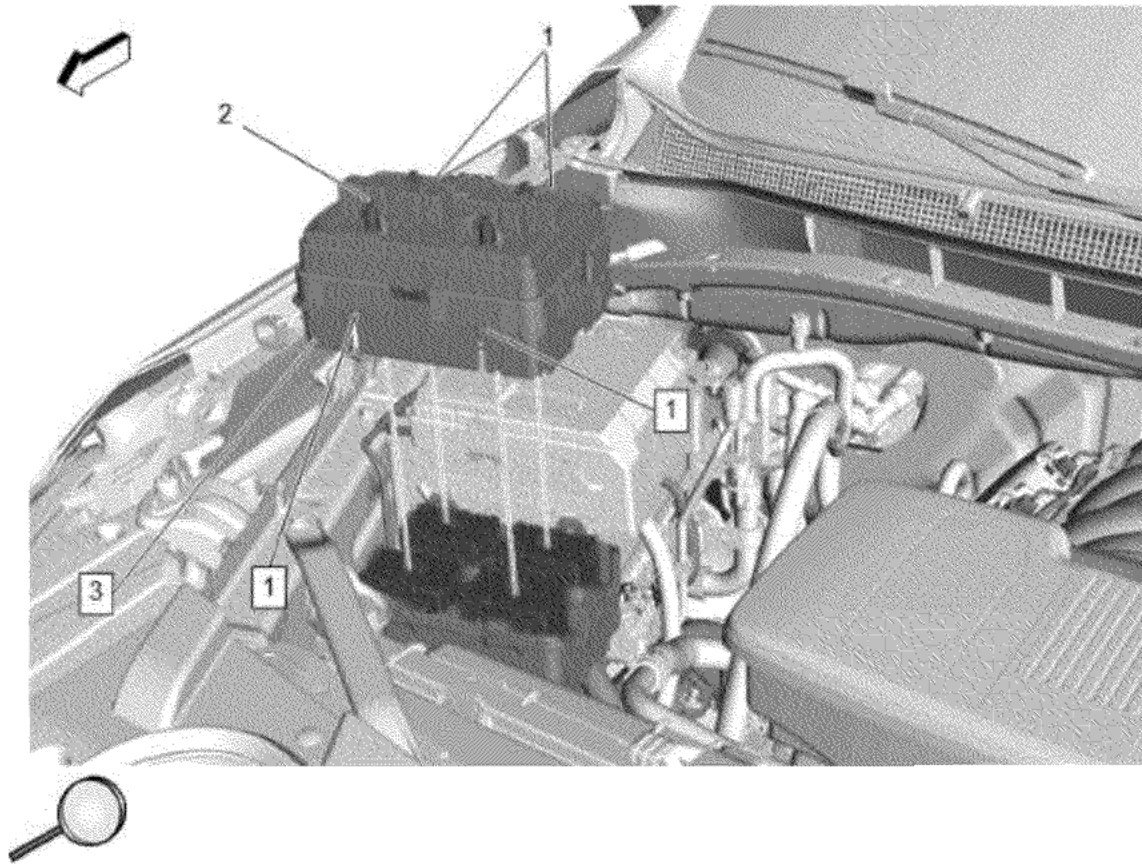
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73. Radiator Surge Tank Inlet Hose Clamp (1) » Disengage — [Hose Clamp Replacement Guidelines - Spring Type](#)
74. Radiator Surge Tank Inlet Hose (2) @ Engine Radiator » Remove and position aside



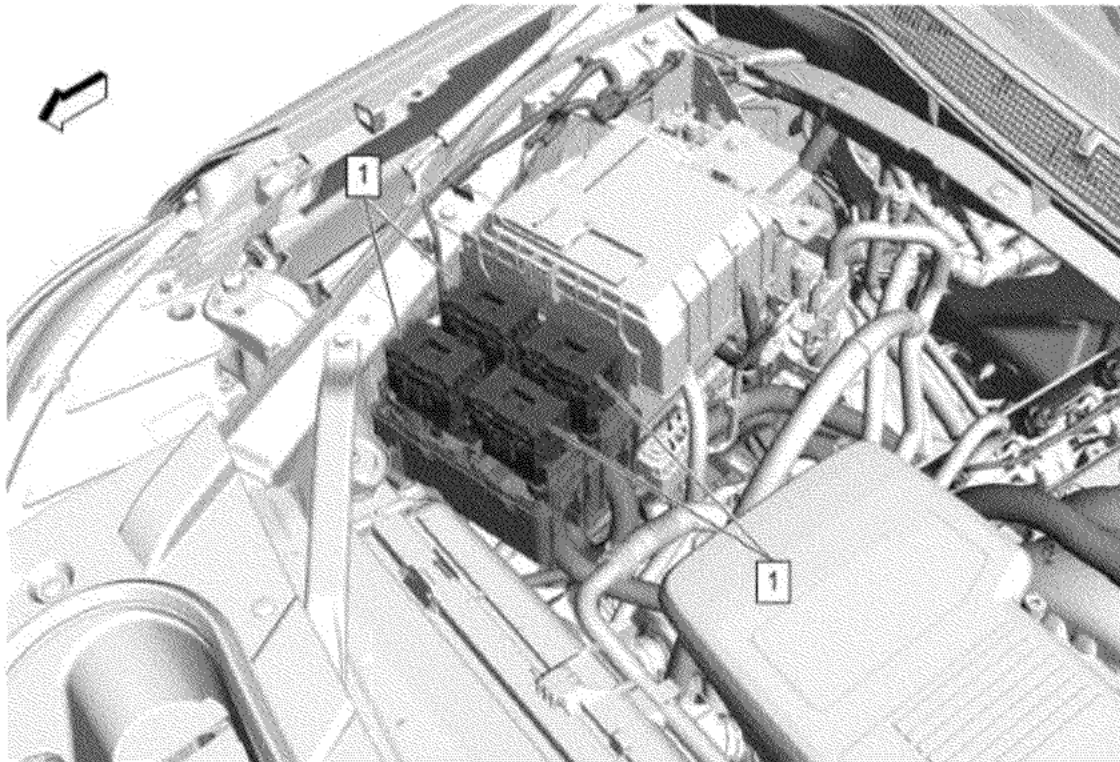
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- 75. Retaining Tab (1) » Disengage [2x]
- 76. Engine Wiring Harness Junction Block Cover (2) » Remove
- 77. Battery Positive Cable Nut (3) » Remove
- 78. Starter Solenoid Cable (4) » Remove

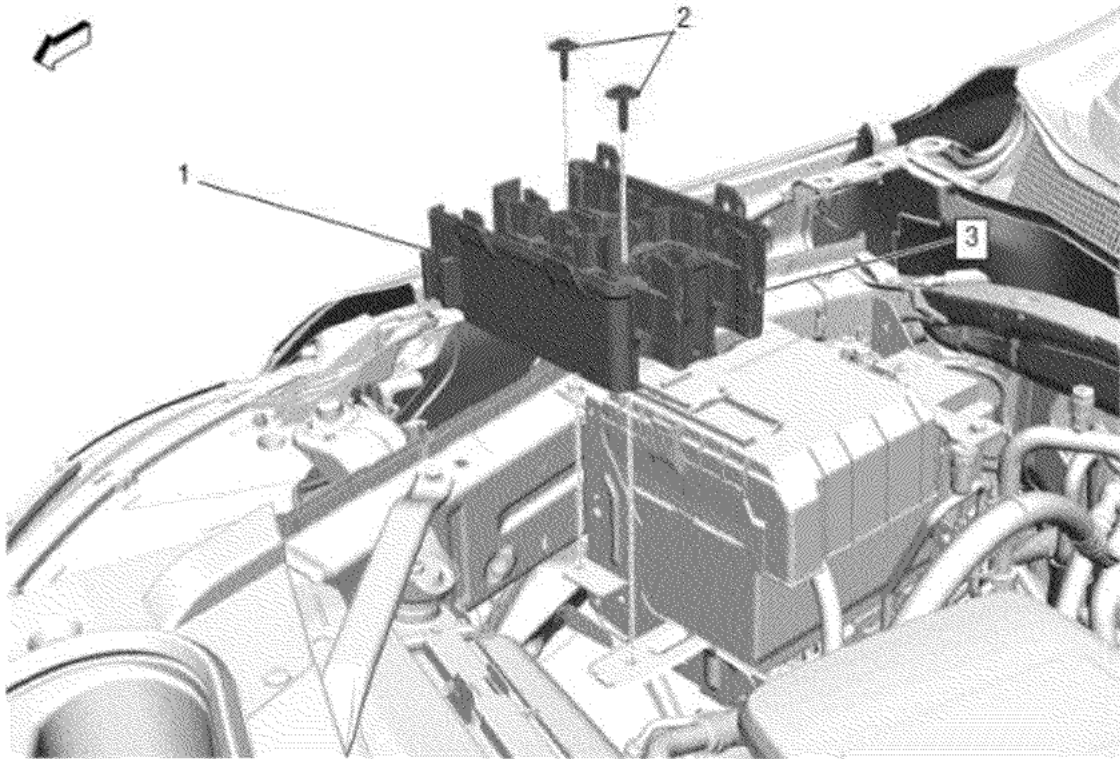


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- 79. Engine Wiring Harness Junction Block Bolt (2) » Loosen [4x]
- 80. Retaining Tab (1) » Disengage [4x]
- 81. Engine Wiring Harness Junction Block (3) » Remove

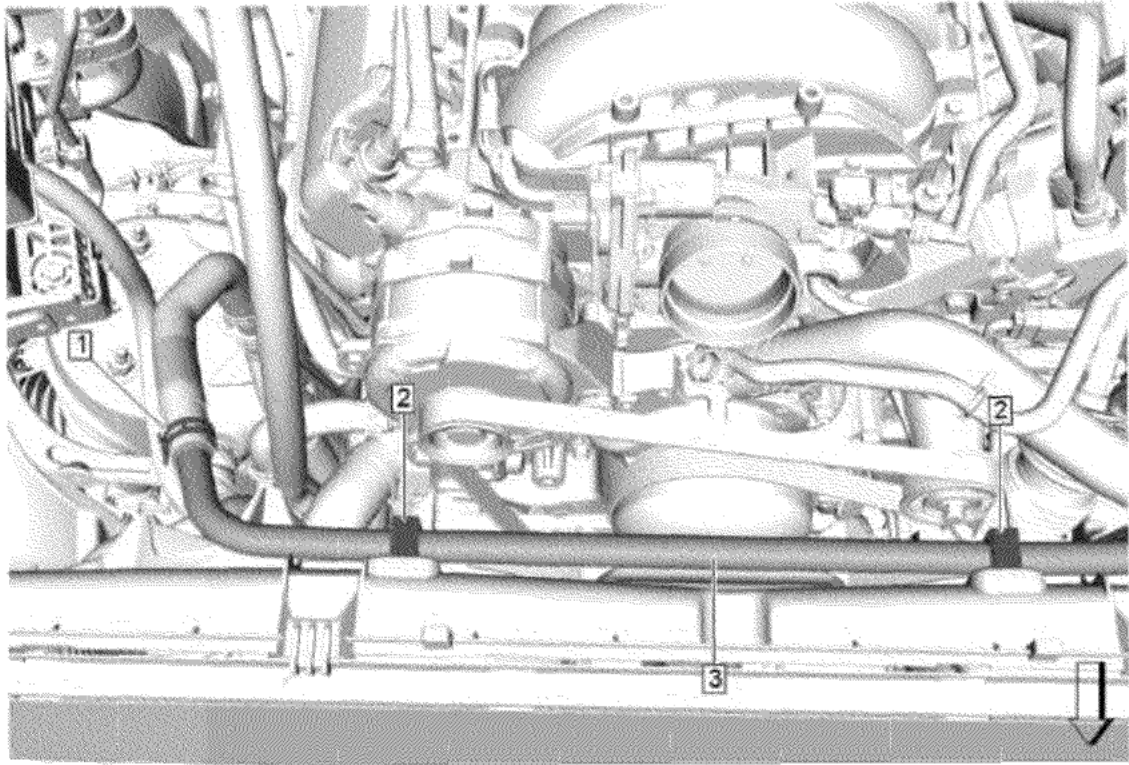


82. Electrical Connector (1) » Remove [4x]

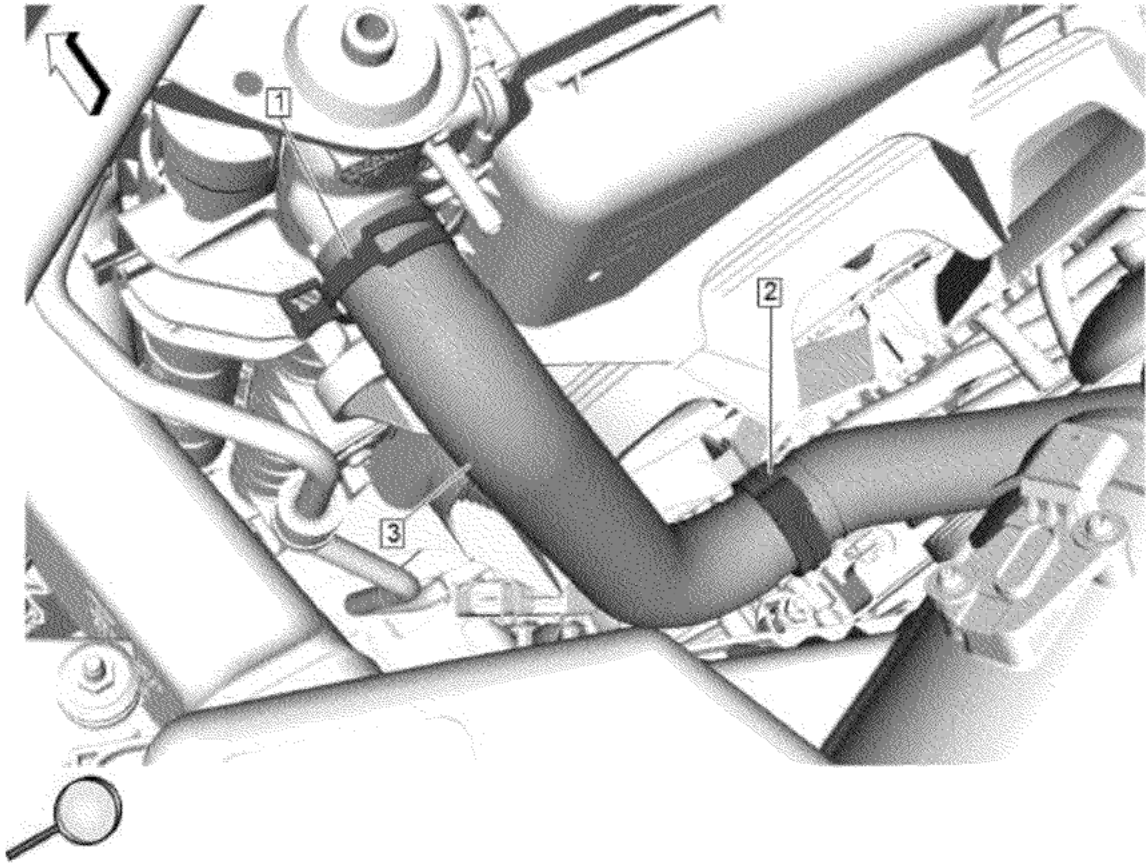


83. Engine Wiring Harness Fuse Block Bracket Bolt (2) » Remove [2x]

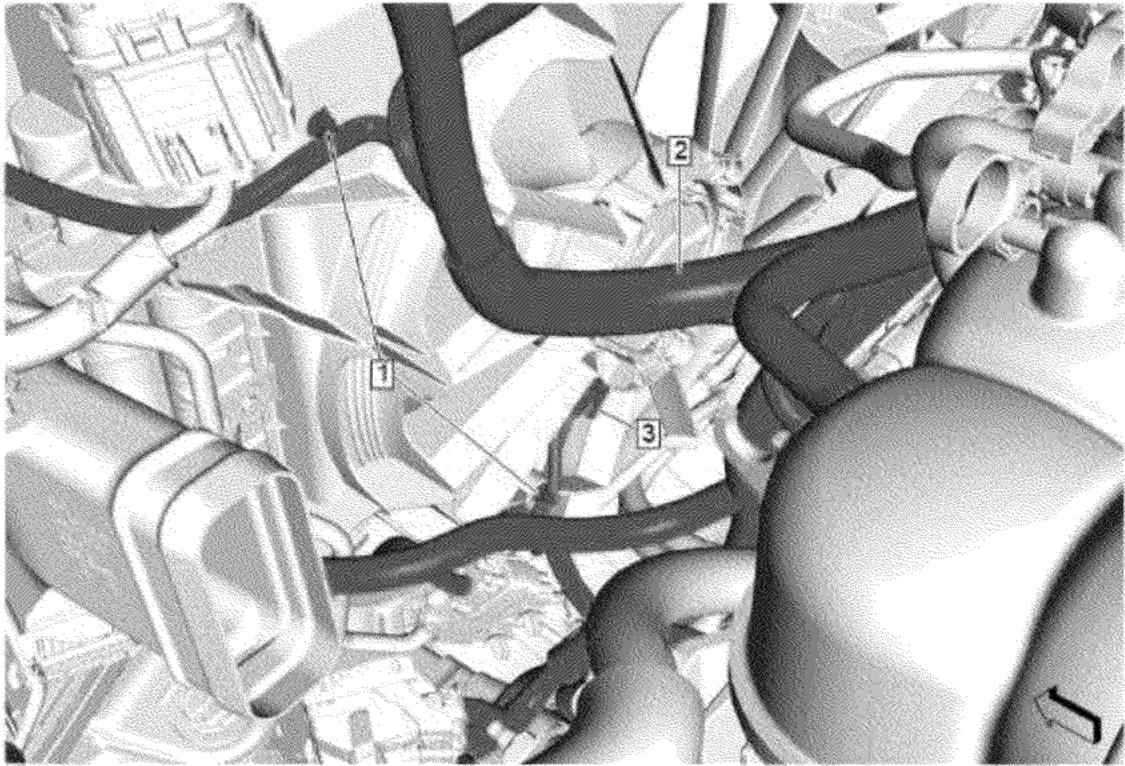
- 84. Retaining Tab (1) » Disengage
- 85. Engine Wiring Harness Fuse Block Bracket (3) » Remove



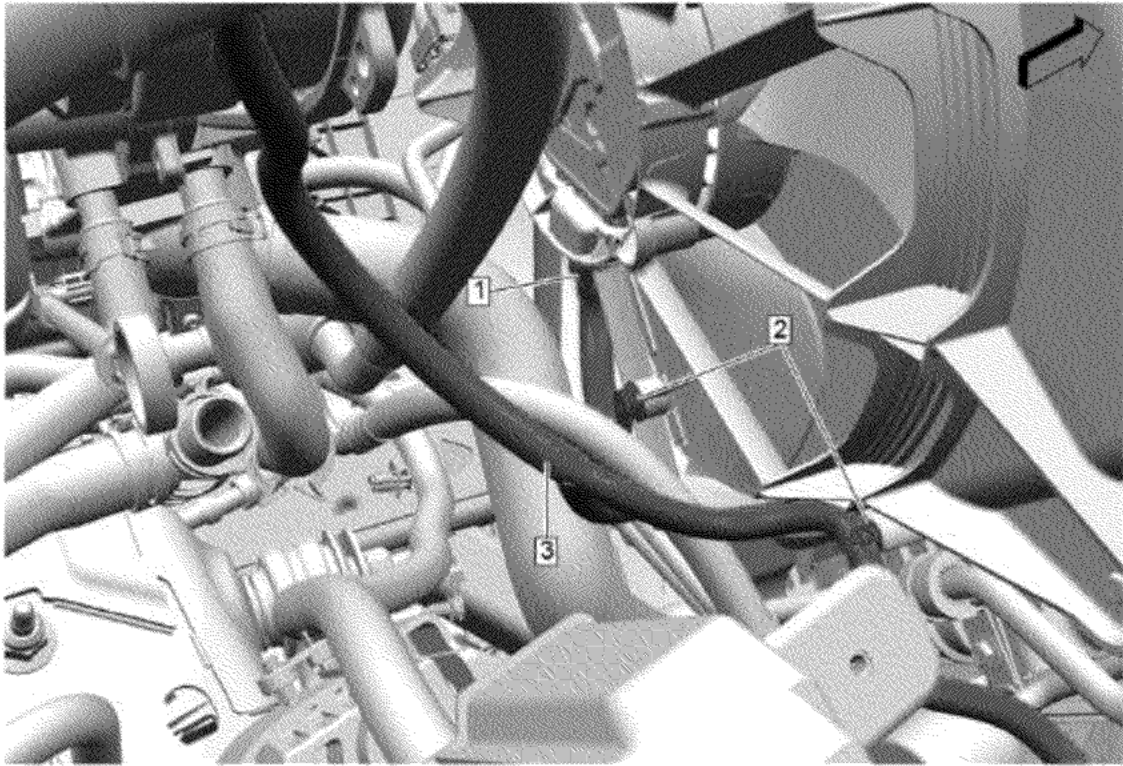
- 86. Heater Outlet Hose Clamp (1) » Disengage — Hose Clamp Replacement Guidelines - Spring Type
- 87. Radiator Surge Tank Outlet Hose Clip (2) » Remove [2x]
- 88. Radiator Surge Tank Outlet Hose (3) » Position aside



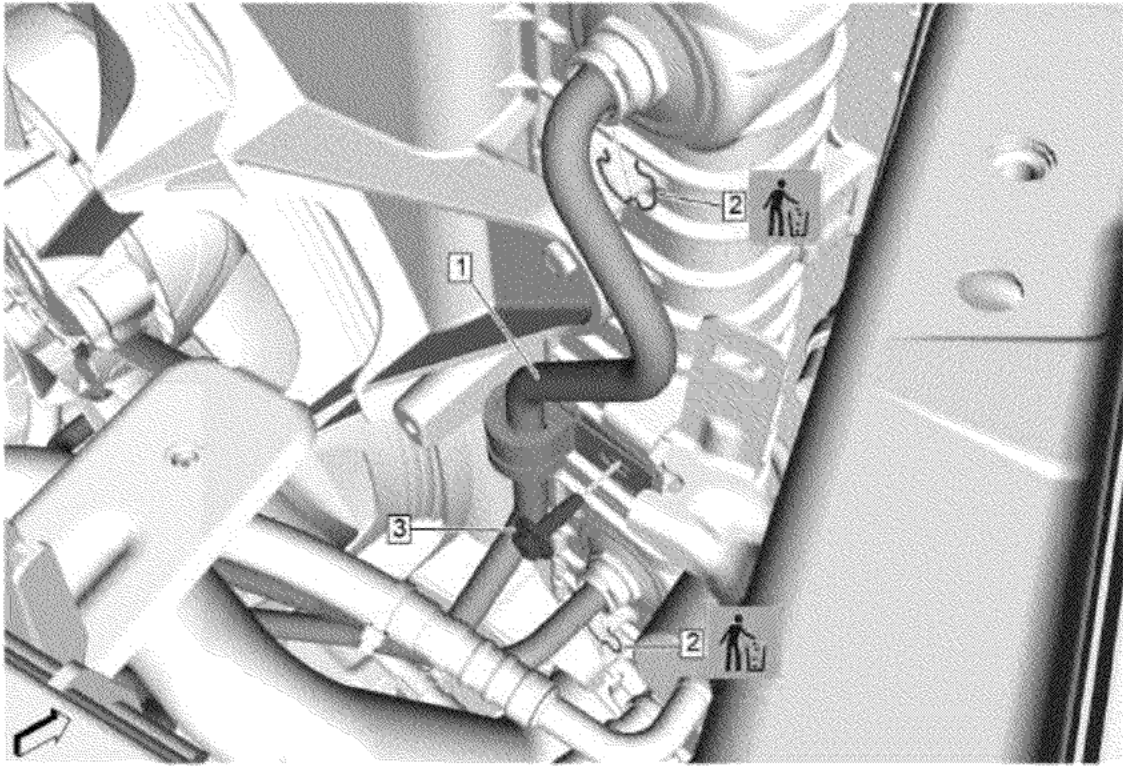
89. Radiator Inlet Hose Clip (2) » Remove
90. Radiator Inlet Hose Clamp (1) » Disengage — [Hose Clamp Replacement Guidelines - Spring Type](#)
91. Radiator Inlet Hose (3) @ Engine Radiator » Remove and position aside



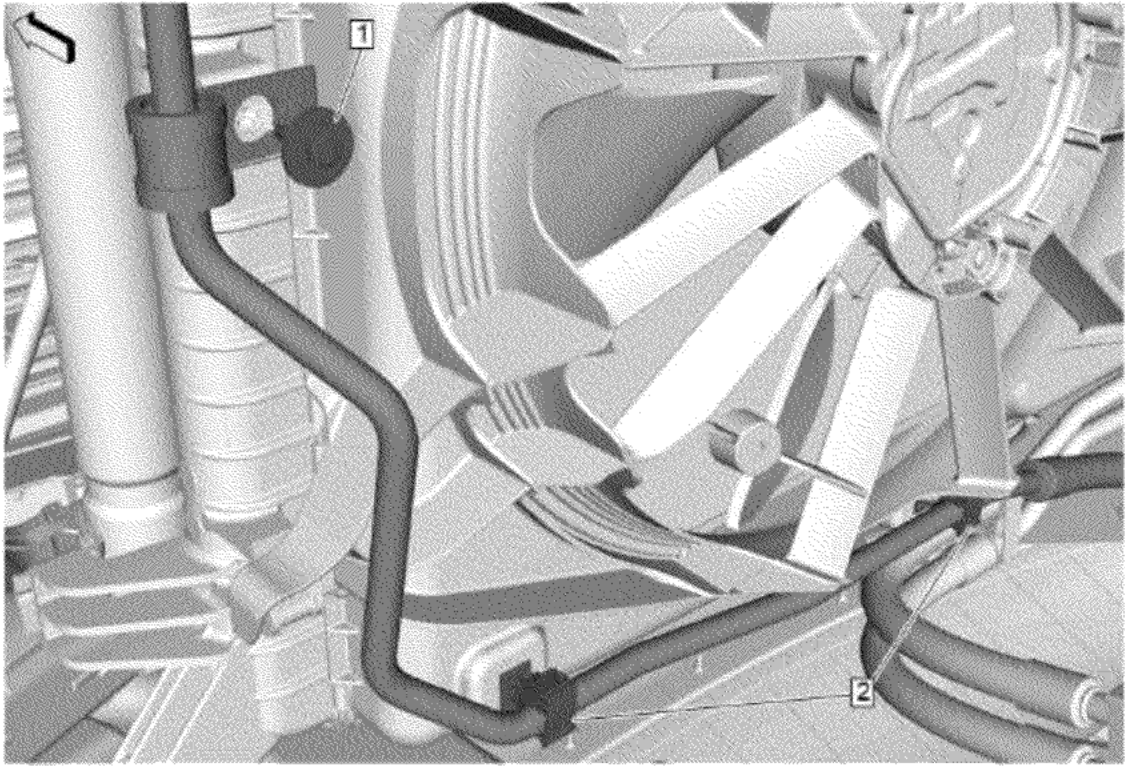
- 92. Wiring Harness Retainer (1) » Remove [2x]
- 93. Electrical Connector (3) » Disconnect
- 94. Wiring Harness (2) » Position aside



- 95. Wiring Harness Retainer (2) » Remove [2x]
- 96. Electrical Connector (1) » Disconnect
- 97. Wiring Harness (3) » Position aside

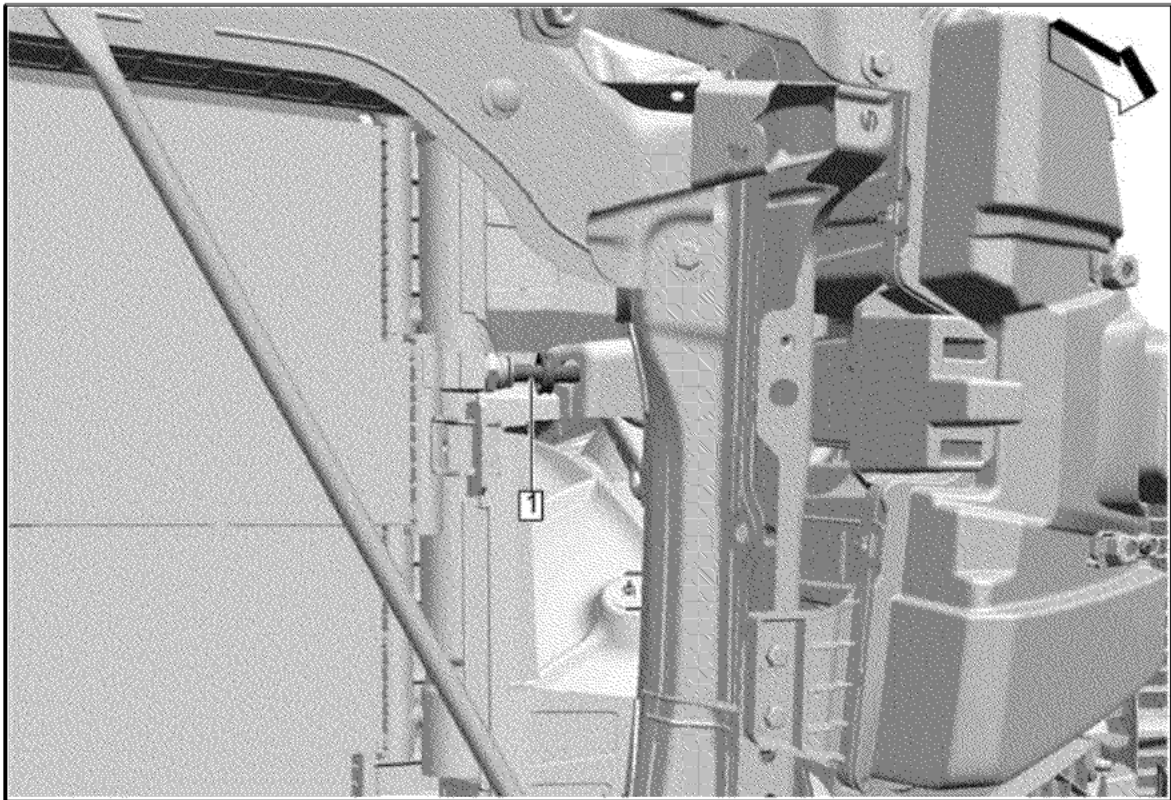


- 98. Engine Oil Cooler Retainer (2) » Remove and DISCARD [2x]
- 99. Engine Oil Cooler Pipe Bracket Bolt (3) » Remove
- 100. Engine Oil Cooler Hose (1) @ Engine Radiator » Remove [2x]

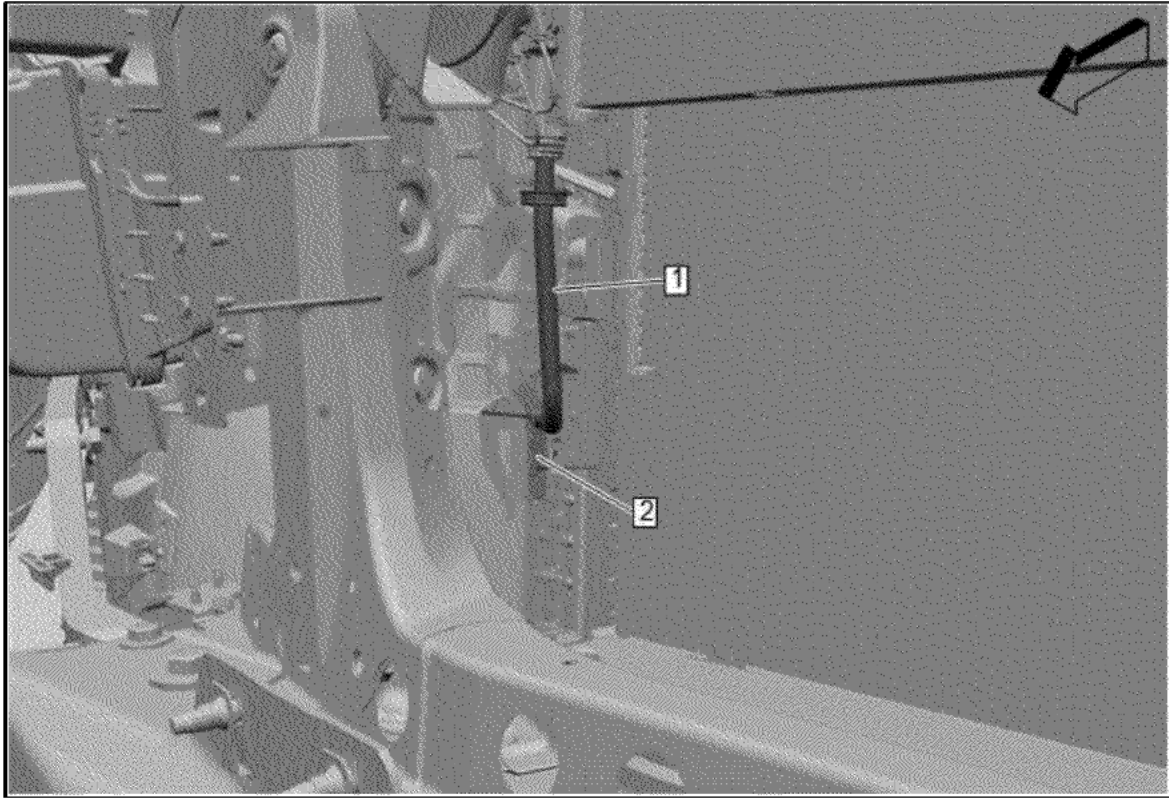


- 101. Transmission Fluid Cooler Pipe Bolt (1) » Remove
- 102. Transmission Fluid Cooler Pipe Clip (2) » Remove [2x]

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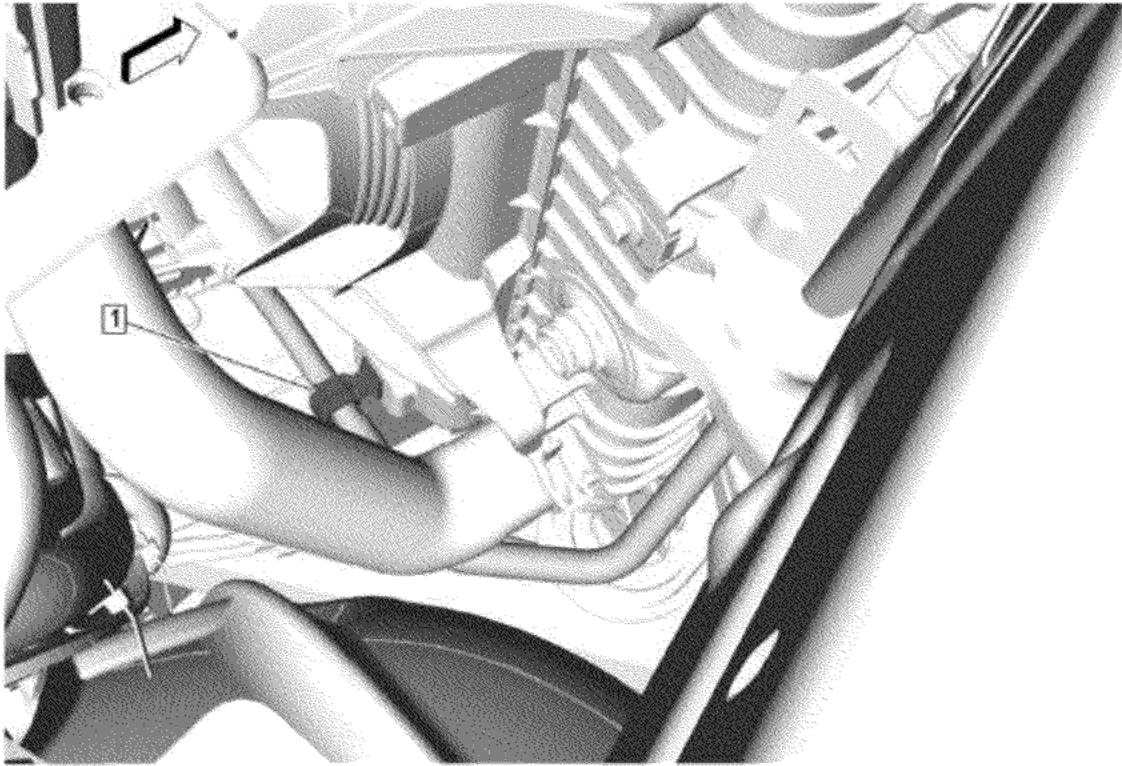


103. Transmission Fluid Cooler Inlet and Outlet Pipe (1) @ Transmission Fluid Auxiliary Cooler »  
Remove — Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection

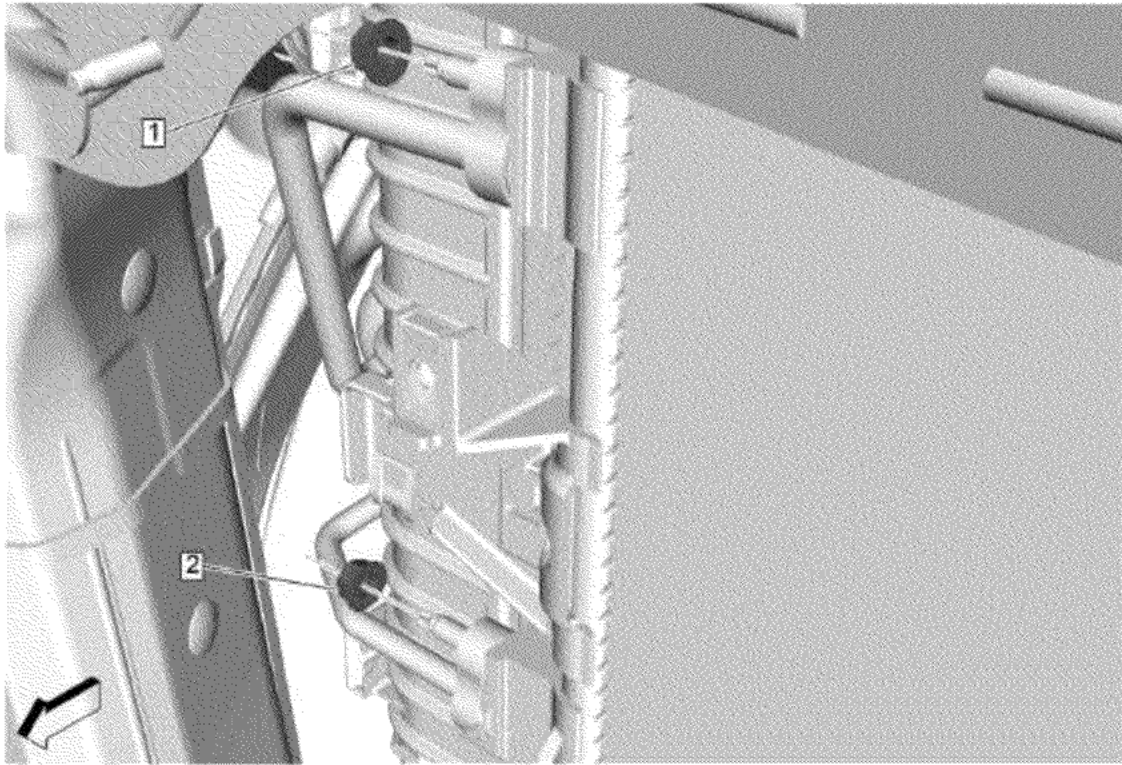


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104. Transmission Fluid Cooler Inlet and Outlet Pipe Bolt (2) @ Radiator » Remove
105. Transmission Fluid Cooler Inlet and Outlet Pipe (1) @ Transmission Fluid Auxiliary Cooler »  
Remove — Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection

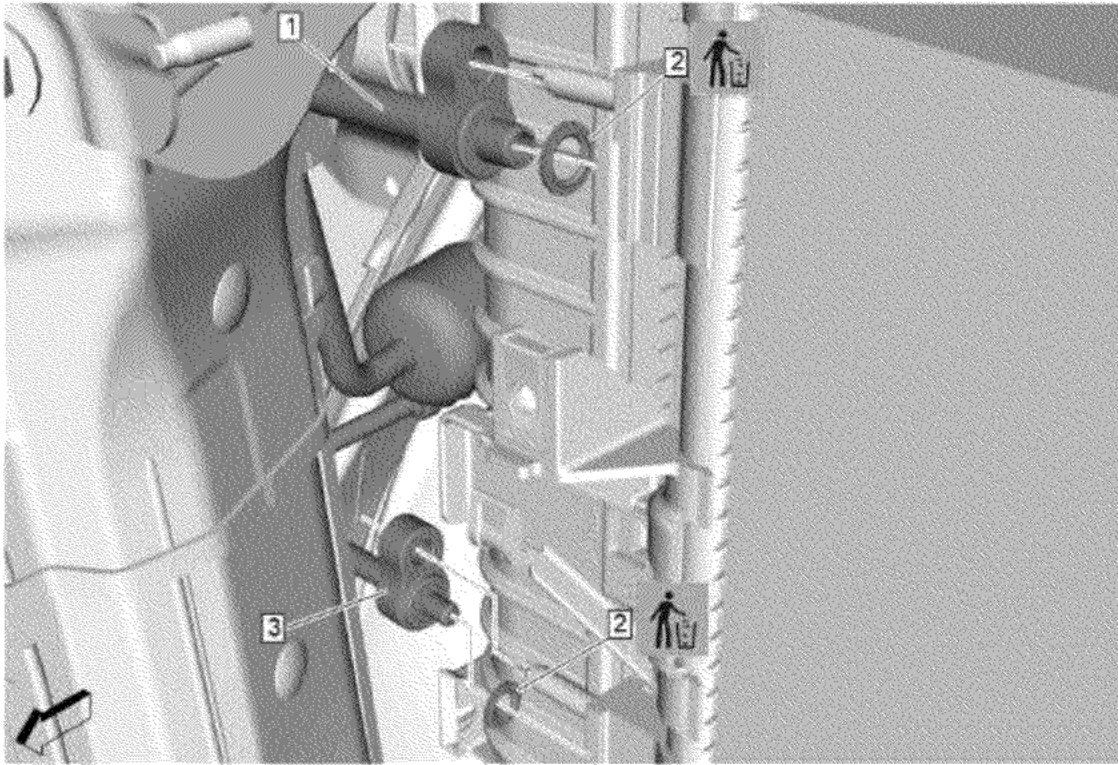


106. Transmission Fluid Cooler Pipe Clip (1) » Release



107. Air Conditioning Compressor and Condenser Hose Nut (1) » Remove

108. Air Conditioning Condenser and Evaporator Hose Nut (2) » Remove

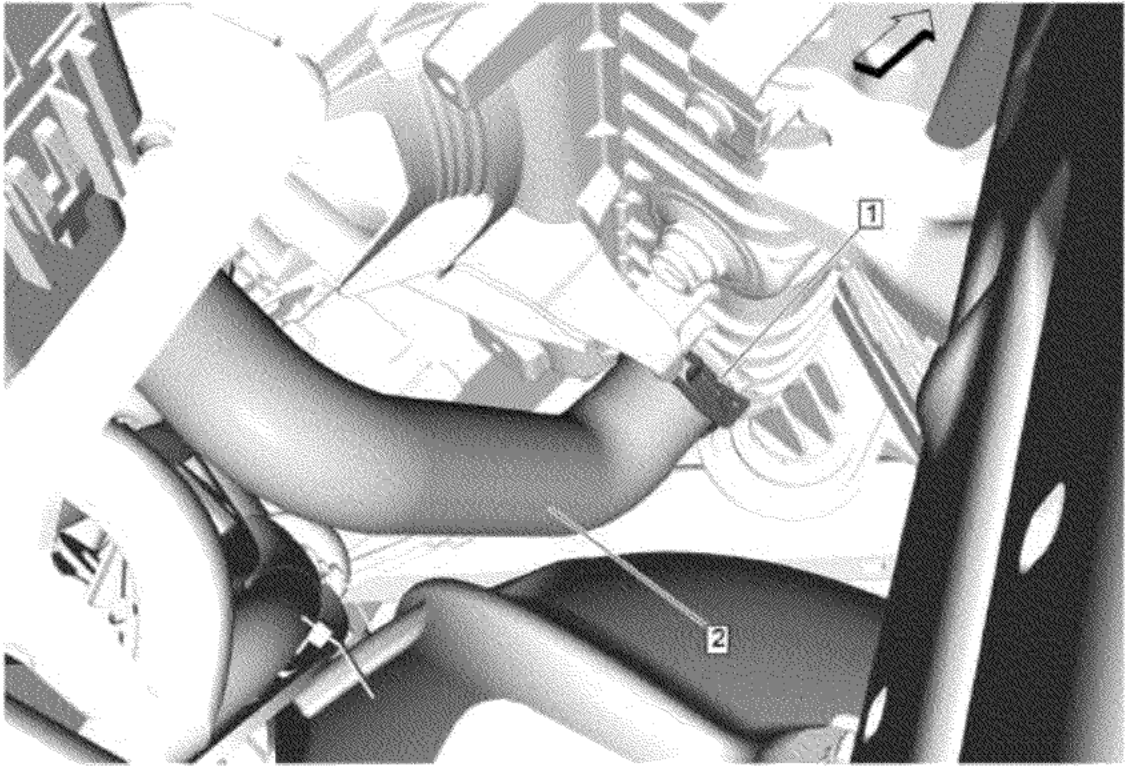


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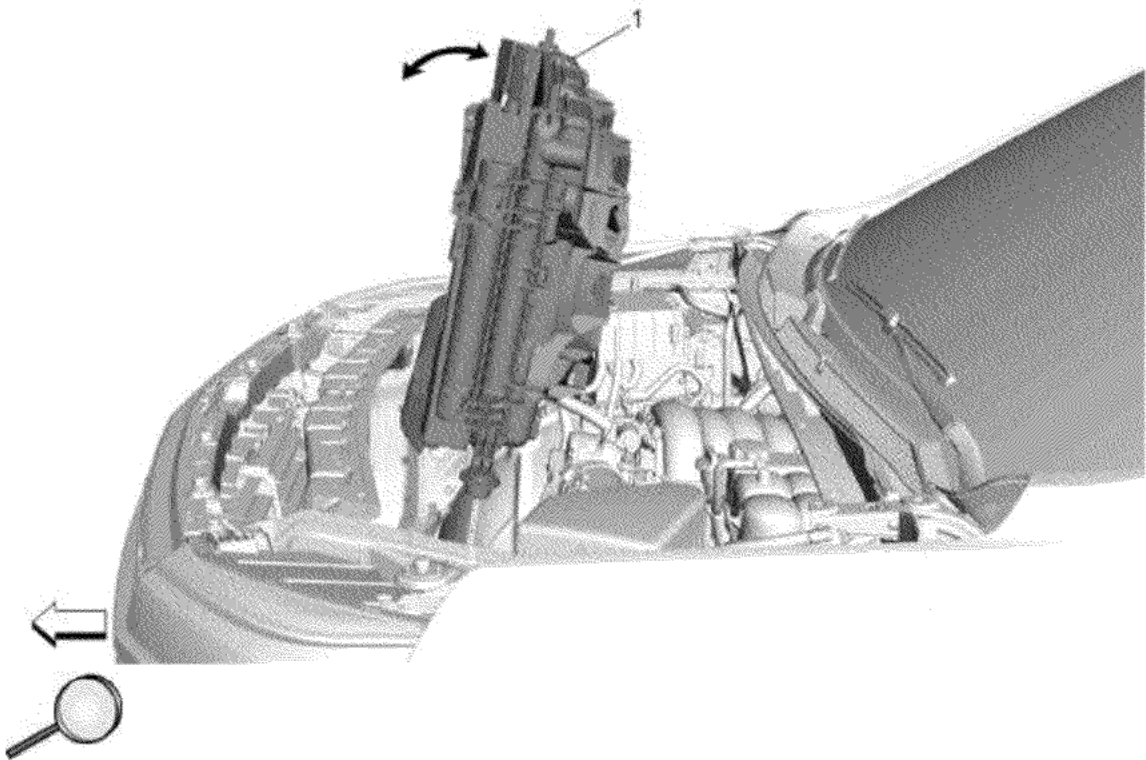
109. Air Conditioning Compressor and Condenser Hose (1) @ Air Conditioning Condenser » Remove

110. Air Conditioning Condenser and Evaporator Hose (3) @ Air Conditioning Condenser » Remove

111. Air Conditioning Compressor and Condenser Hose Seal (2) » Remove and DISCARD [2x]

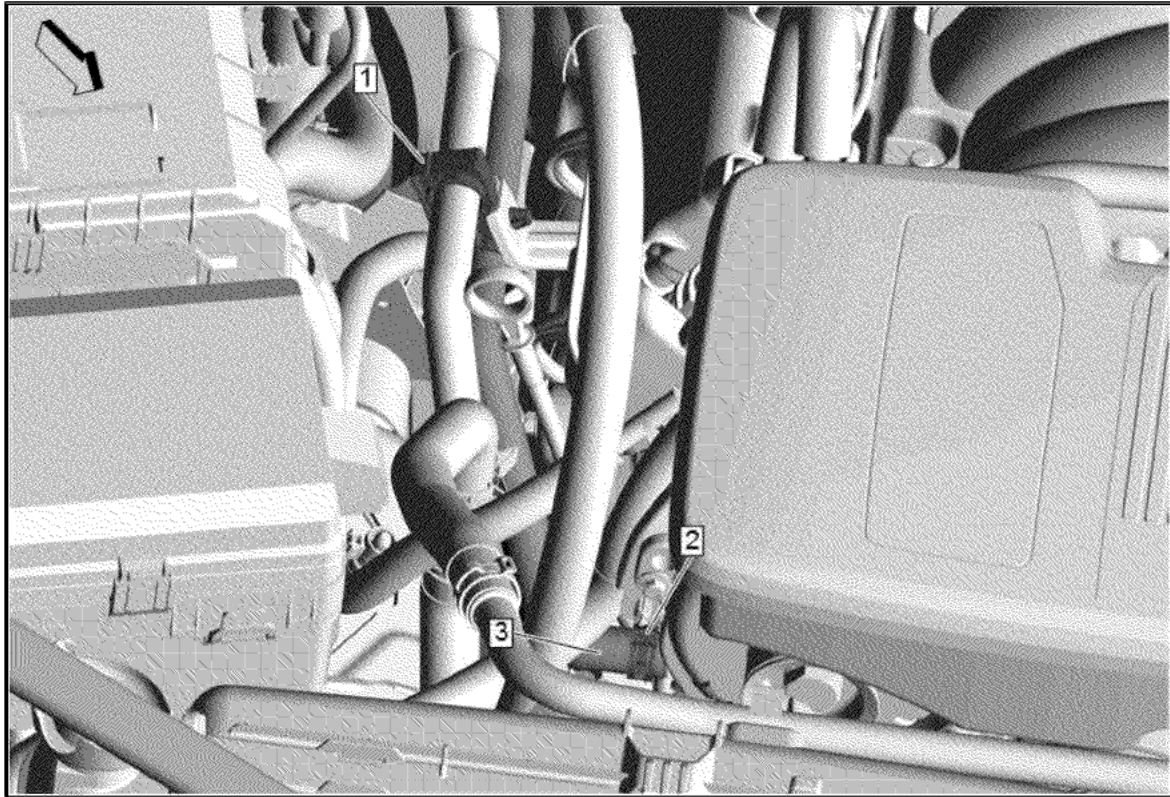


- 112. Radiator Inlet Hose Clamp (1) » Disengage — [Hose Clamp Replacement Guidelines - Spring Type](#)
- 113. Radiator Outlet Hose (2) @ Engine Radiator » Remove

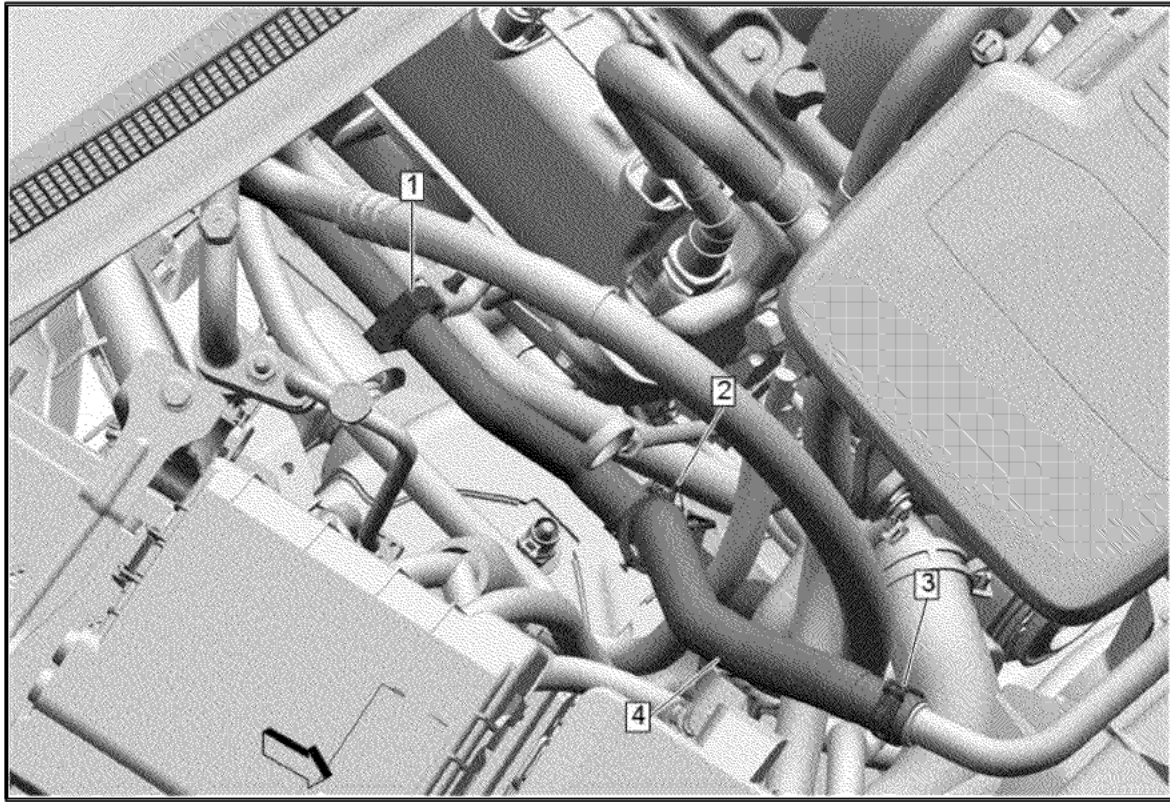


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114. Rotate the top of the condenser, fan and radiator assembly (1) rearward and lift it out of the engine compartment.



115. Heater Inlet Hose (3) @ Heater Inlet and Outlet Hose Clip (1) » Remove

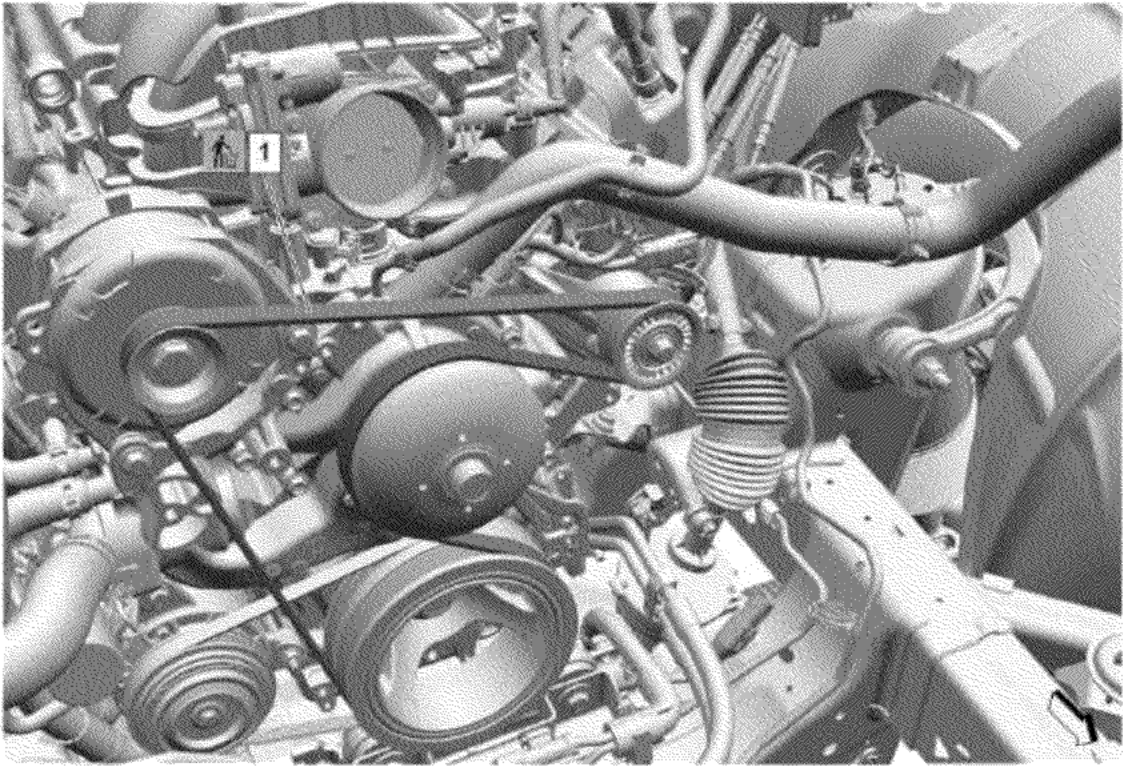


116. Engine Wiring Harness Clip (2) @ Heater Outlet Hose » Remove

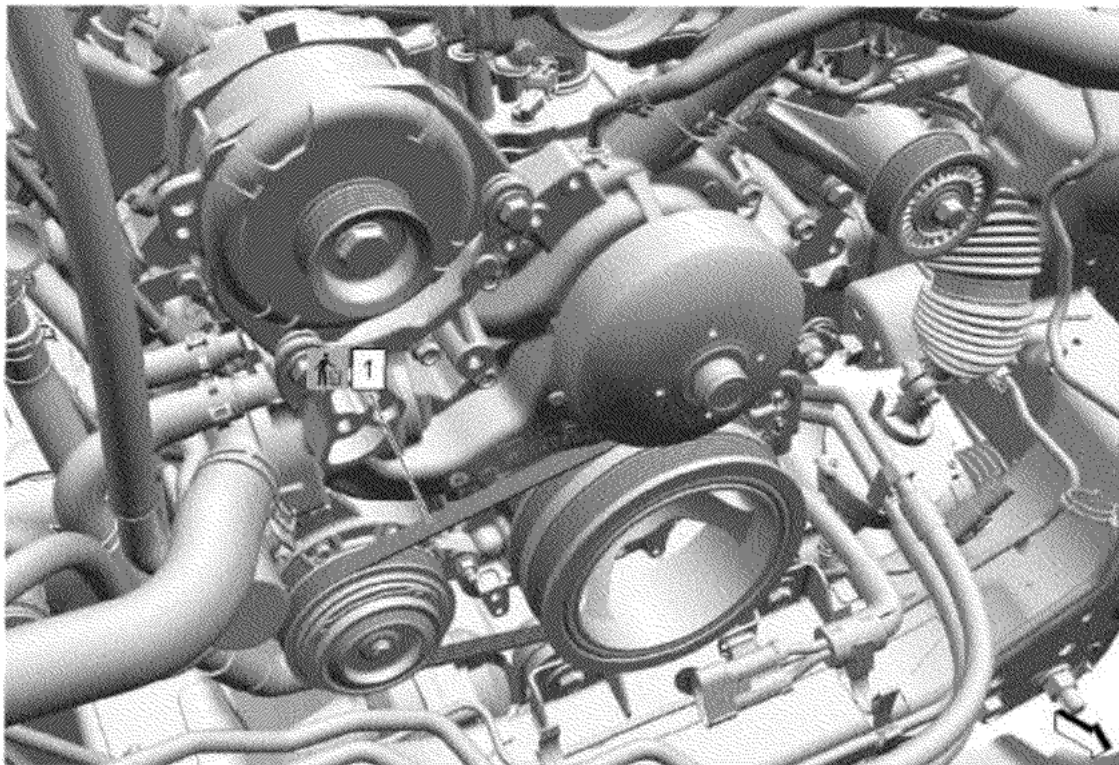
117. Heater Outlet Hose (4) @ Clip (1) » Remove

118. Heater Outlet Hose Clamp (3) » Disengage — [Hose Clamp Replacement Guidelines - Spring Type](#)

119. Heater Outlet Hose (4) @ Radiator Surge Tank Outlet Hose » Remove



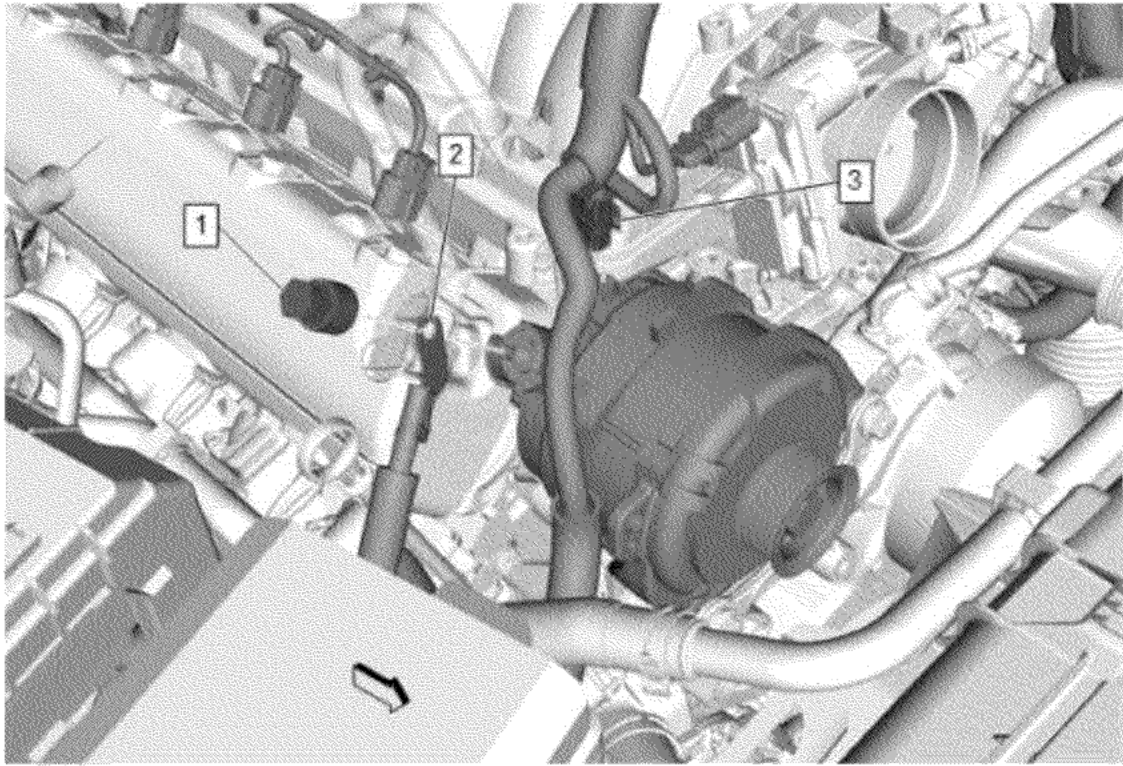
- Note:** The accessory drive primary belt is not reusable.
120. Using a suitable tool, cut the accessory drive primary belt (1).
  121. Accessory Drive Primary Belt (1) » Remove and DISCARD



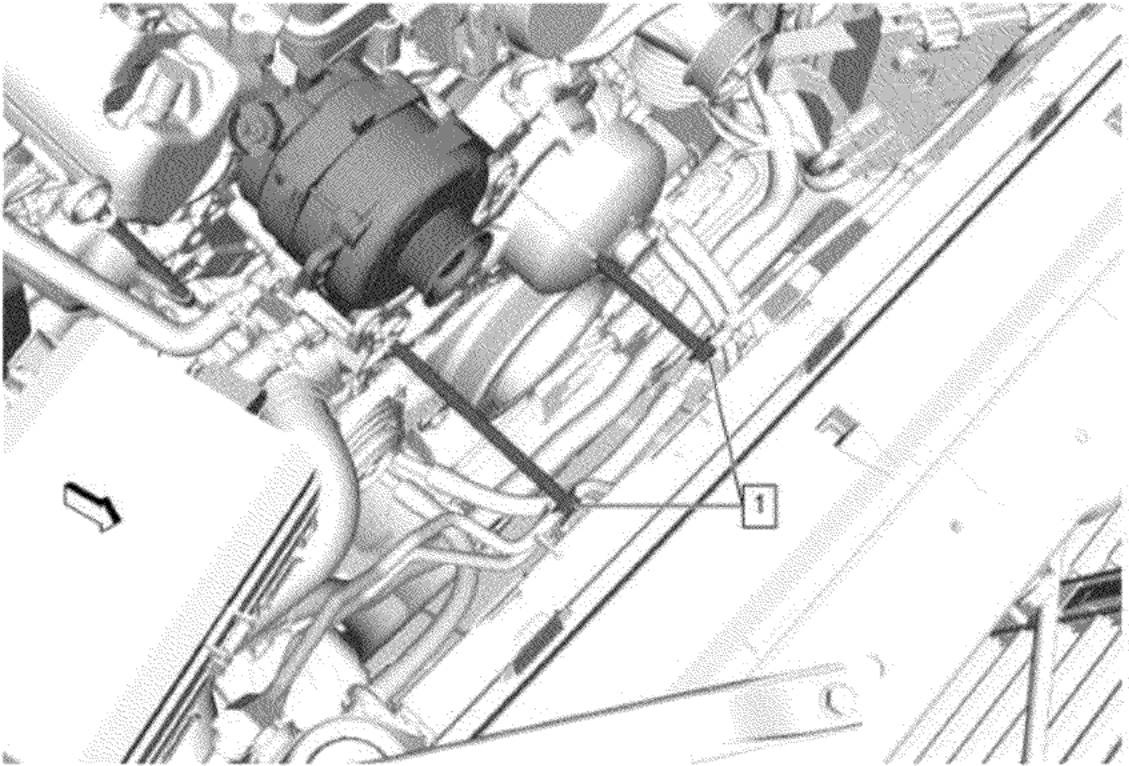
**Note:** The accessory drive auxiliary belt is not reusable.

122. Using a suitable tool, cut the accessory drive auxiliary belt (1).

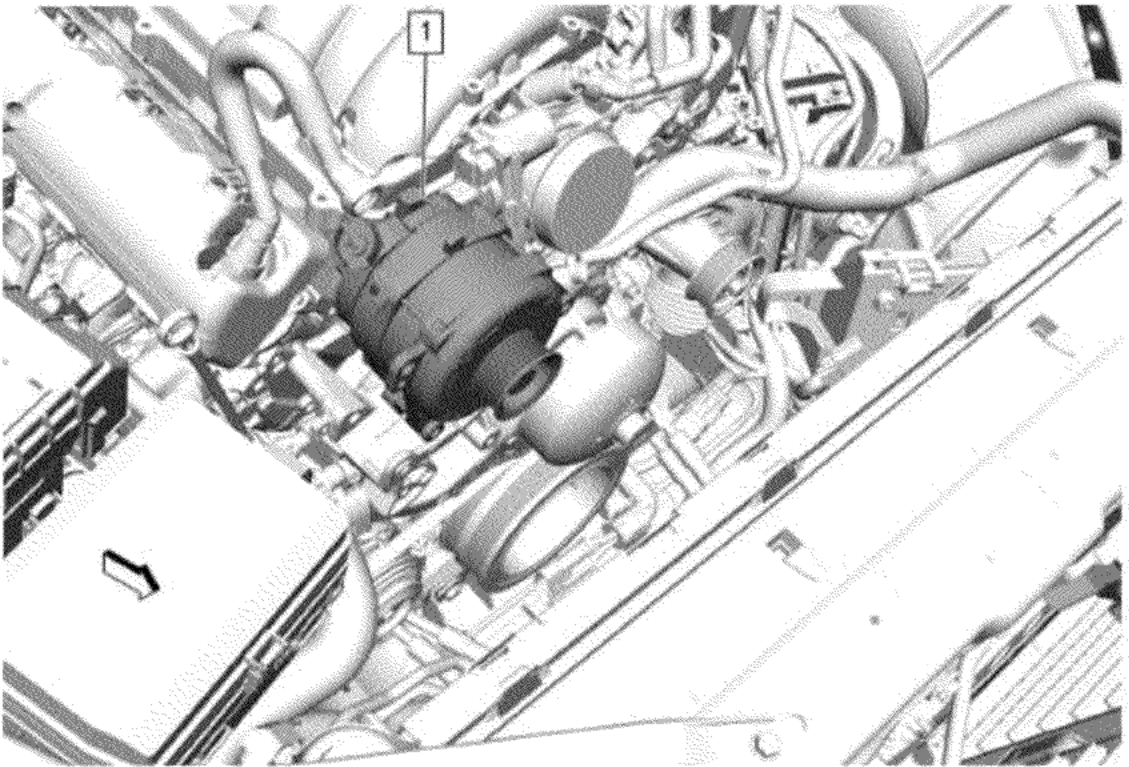
123. Accessory Drive Auxiliary Belt (1) » Remove and DISCARD



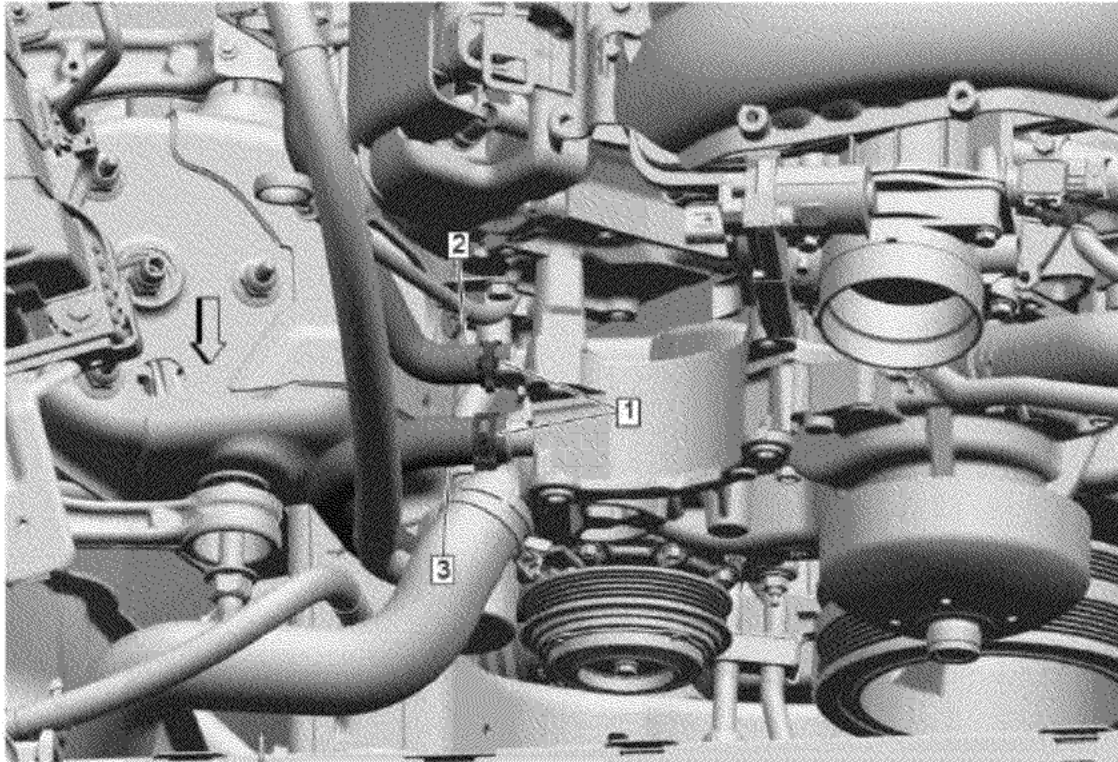
- 124. Battery Positive Cable Nut (1) » Remove
- 125. Starter Solenoid Cable (2) » Remove
- 126. Electrical Connector (3) » Disconnect



127. Generator Bolt (1) » Remove [2x]

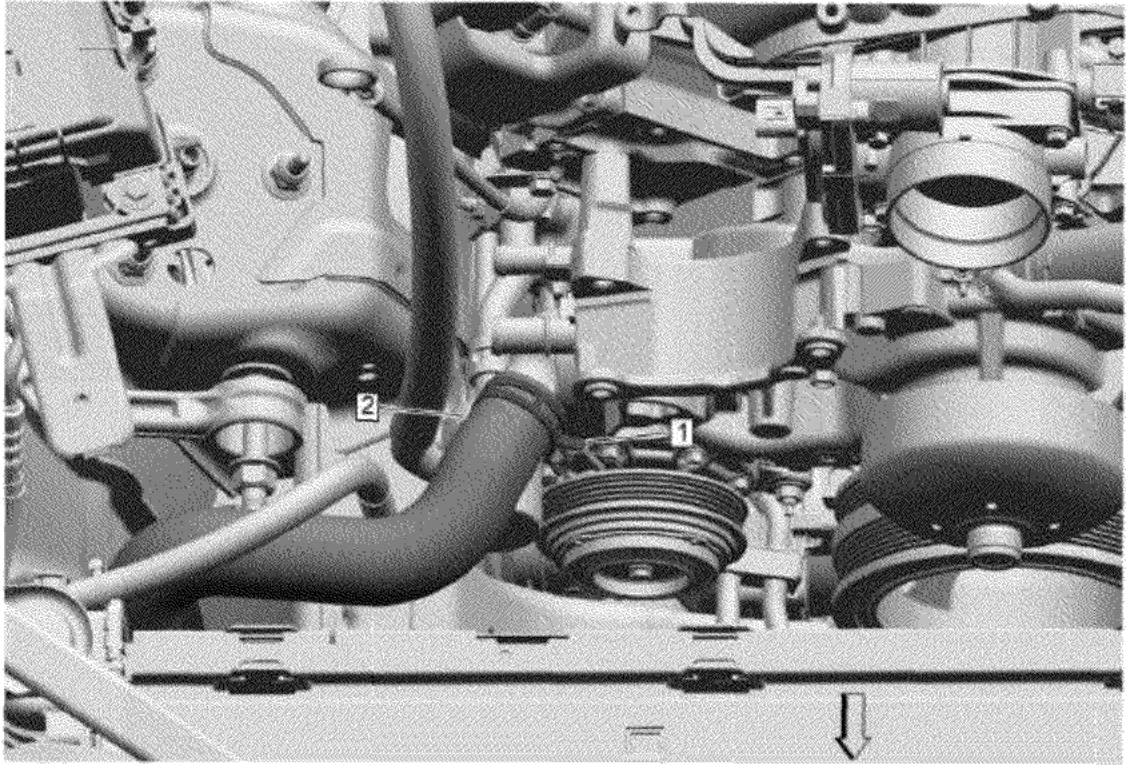


128. Generator (1) » Remove

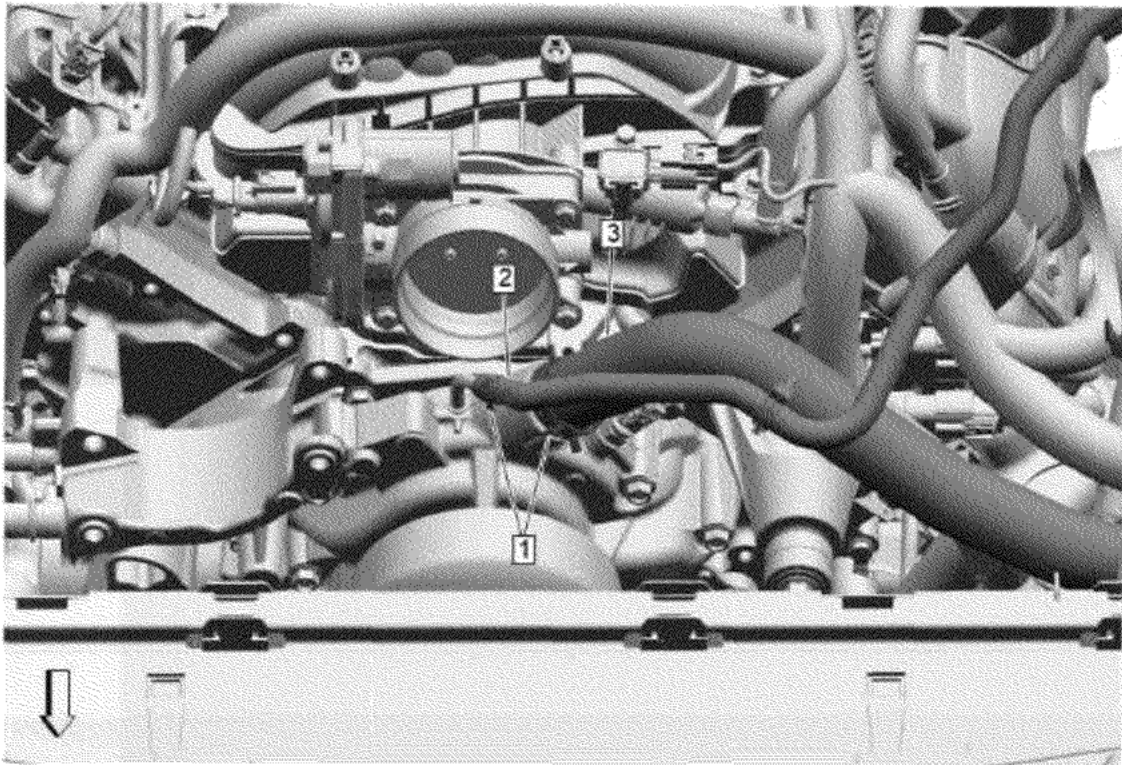


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- 129. Hose Clamp (1) » Disengage [2x] — [Hose Clamp Replacement Guidelines - Spring Type](#)
- 130. Heater Inlet Hose (2) @ Water Pump » Remove
- 131. Heater Water Auxiliary Pump Hose (3) @ Water Pump » Remove

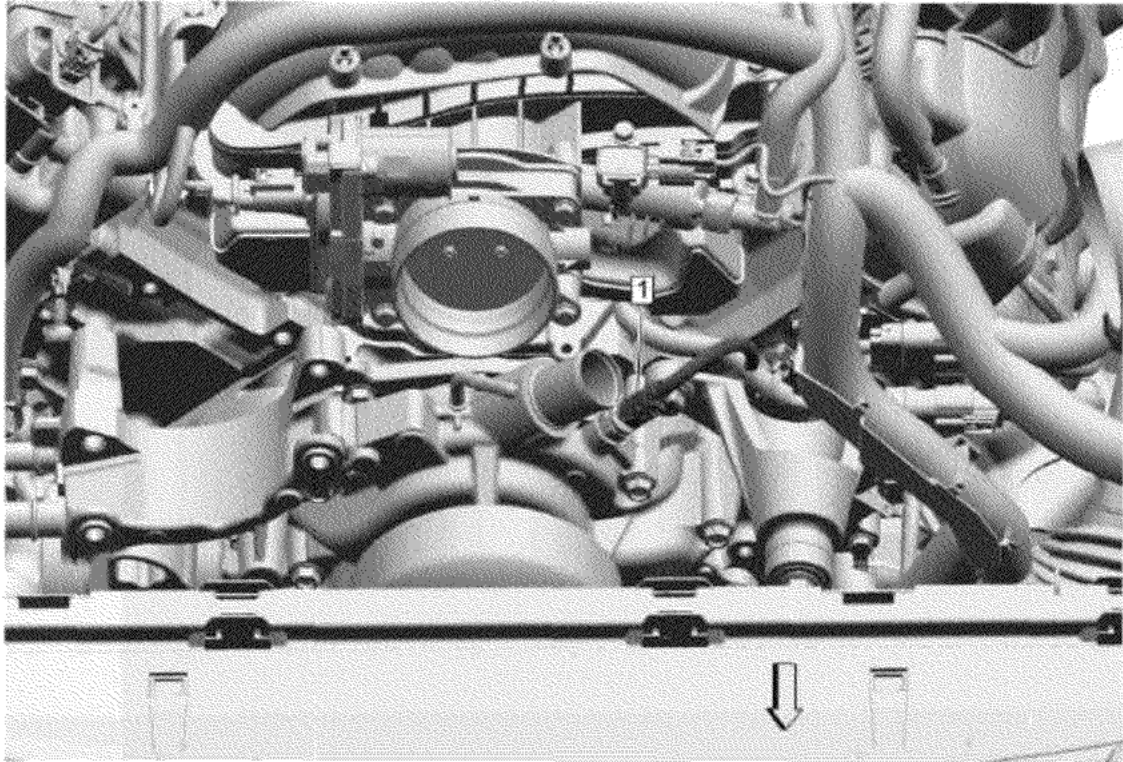


- 132. Radiator Outlet Hose Clamp (1) » Disengage — [Hose Clamp Replacement Guidelines - Spring Type](#)
- 133. Radiator Outlet Hose (2) @ Water Pump » Remove



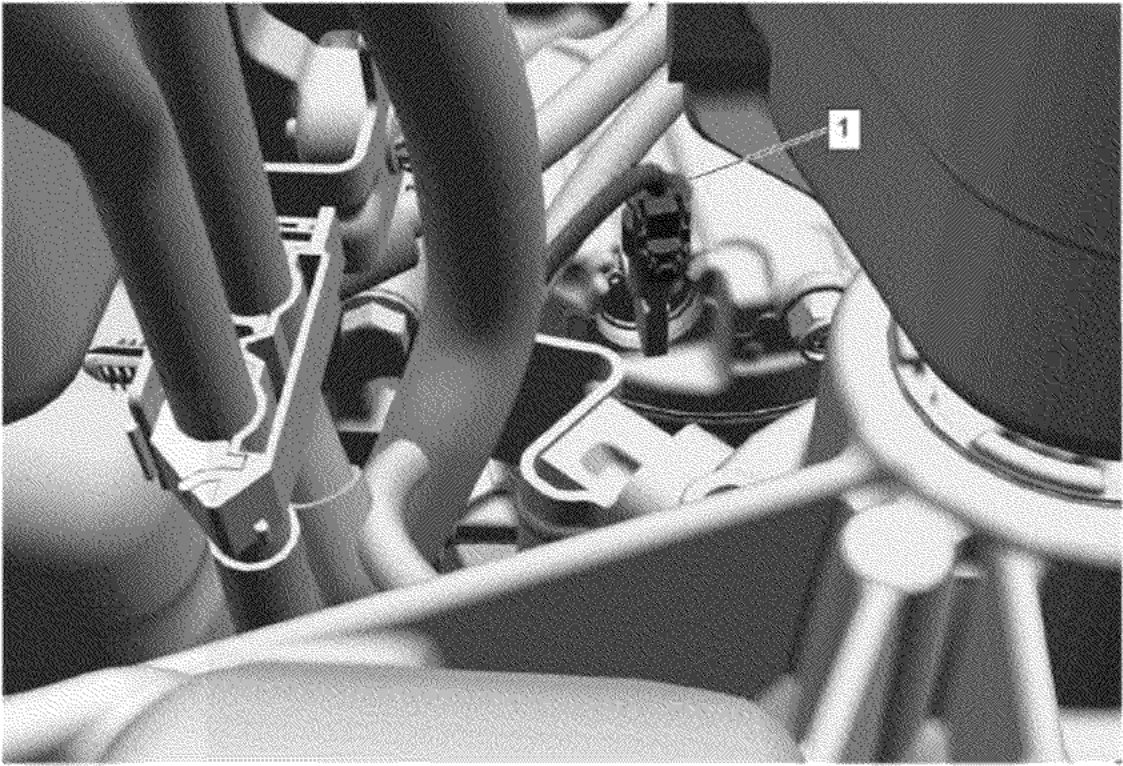
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- 134. Hose Clamp (1) » Disengage [2x] — [Hose Clamp Replacement Guidelines - Spring Type](#)
- 135. Engine Coolant Air Bleed Hose (2) @ Water Pump » Remove
- 136. Radiator Inlet Hose (3) @ Water Pump » Remove

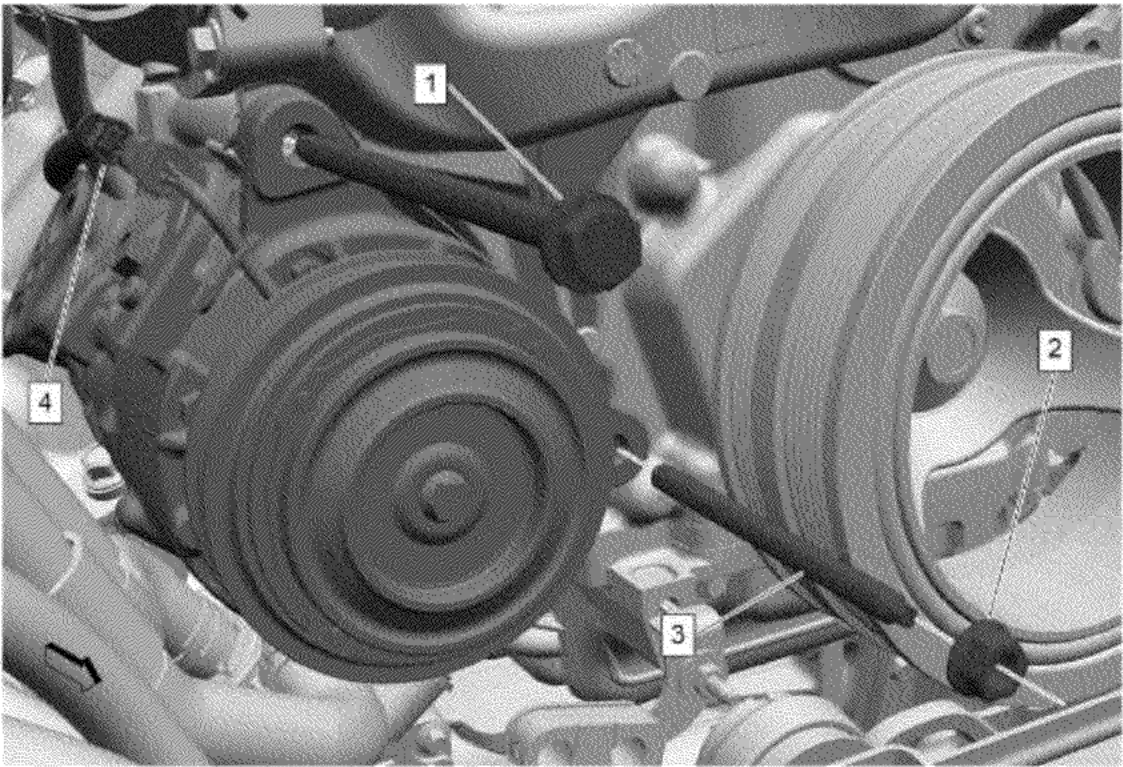


- 137. Engine Coolant Temperature Sensor Electrical Connector (1) » Disconnect

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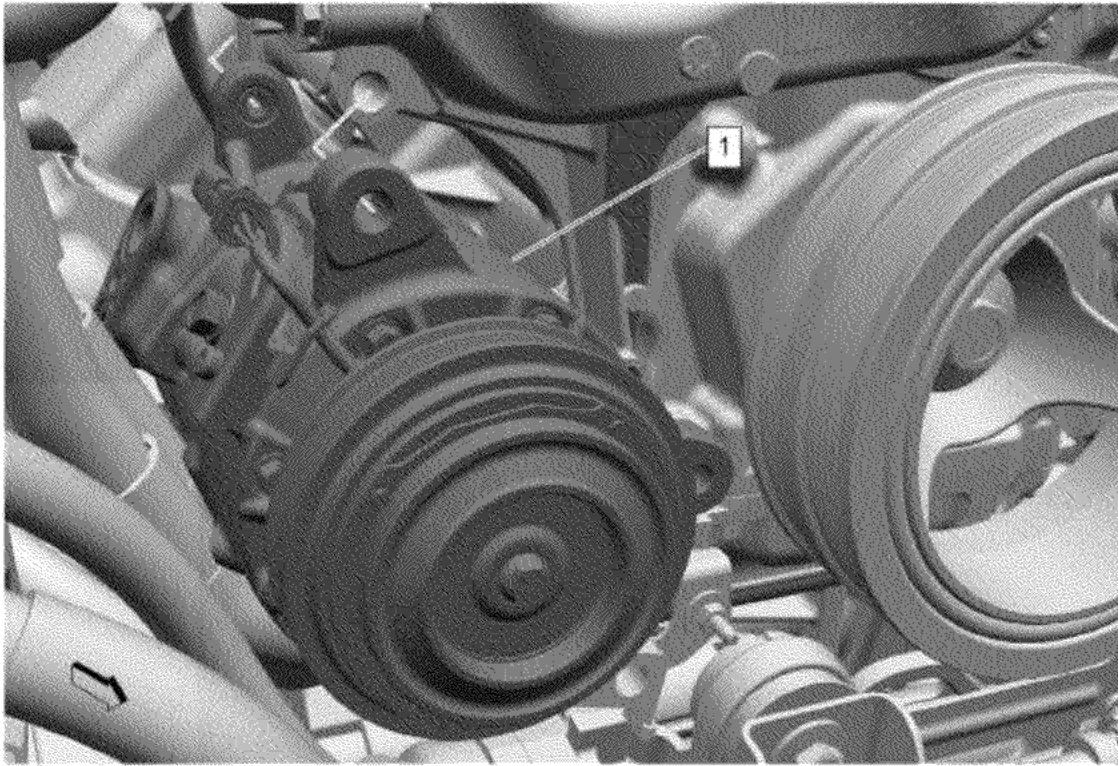
138. Electrical Connector (1) @ Air Conditioning Compressor » Disconnect



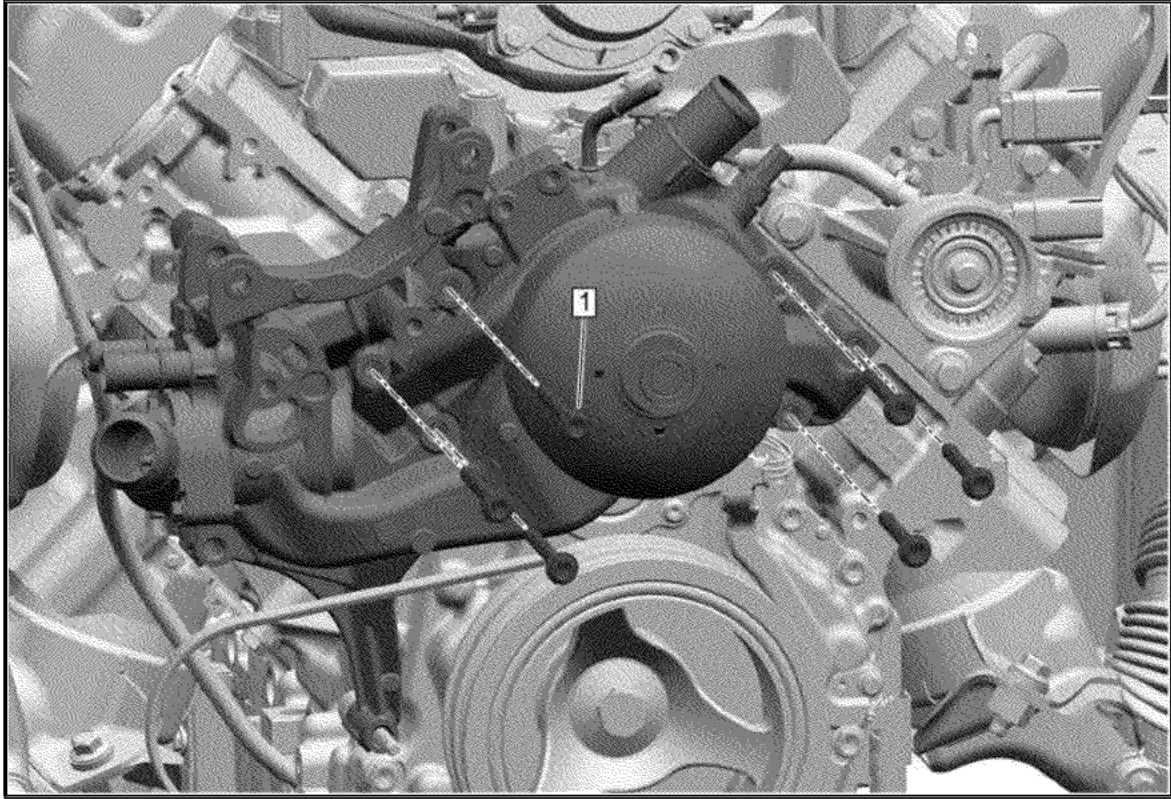
139. Air Conditioning Compressor Bolt (1) » Remove

140. Air Conditioning Compressor Nut (2) » Remove

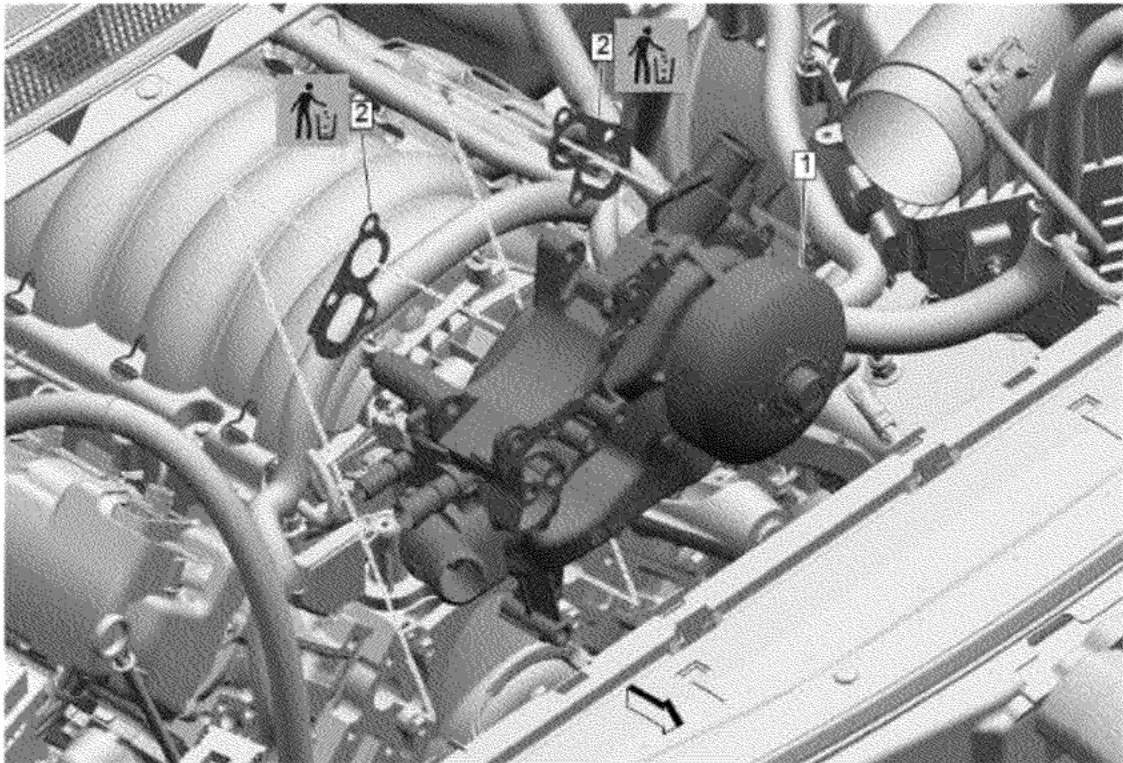
141. Air Conditioning Compressor Stud (3) » Remove



142. Air Conditioning Compressor (1) » Position aside

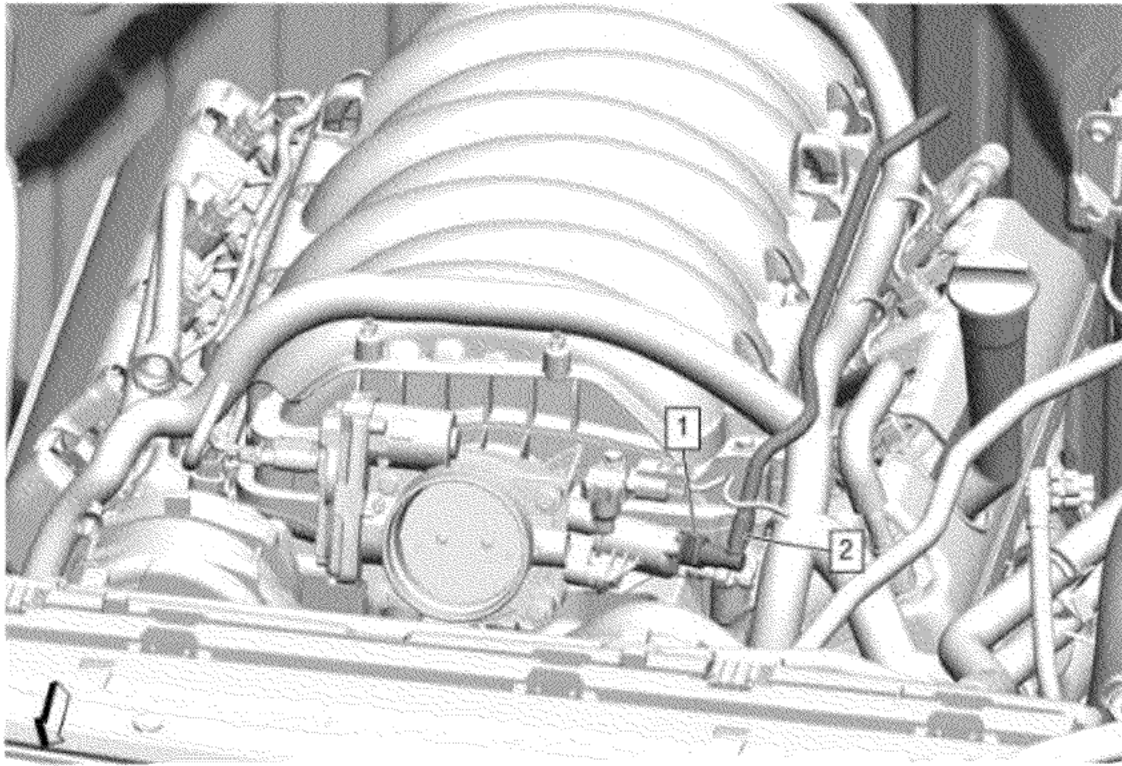


143. Water Pump Housing Bolt (1) » Remove [6x]



144. Water Pump (1) » Remove

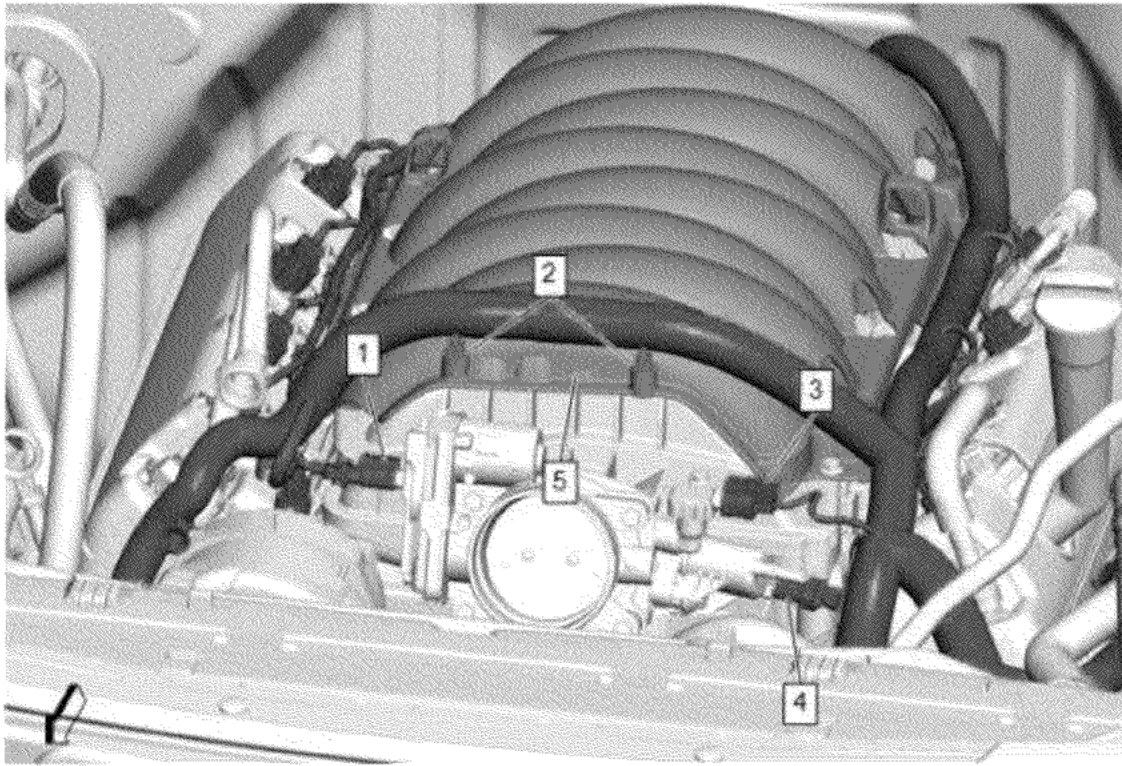
145. Water Pump Gasket (2) » Remove and DISCARD [2x]



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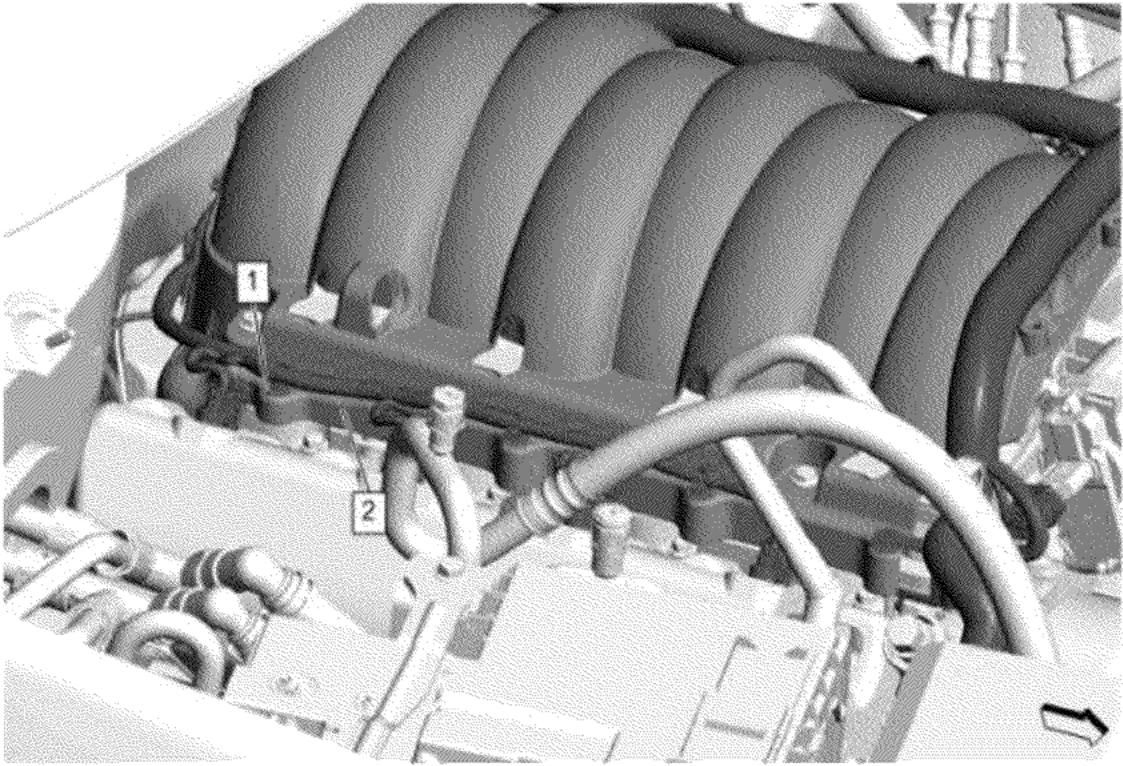
146. Evaporative Emission Canister Purge Tube Connector (1) @ Evaporative Emission Canister Purge Solenoid Valve » Disengage — Plastic Collar Quick Connect Fitting Service

147. Evaporative Emission Canister Purge Tube (2) @ Evaporative Emission Canister Purge Solenoid Valve » Remove and position aside

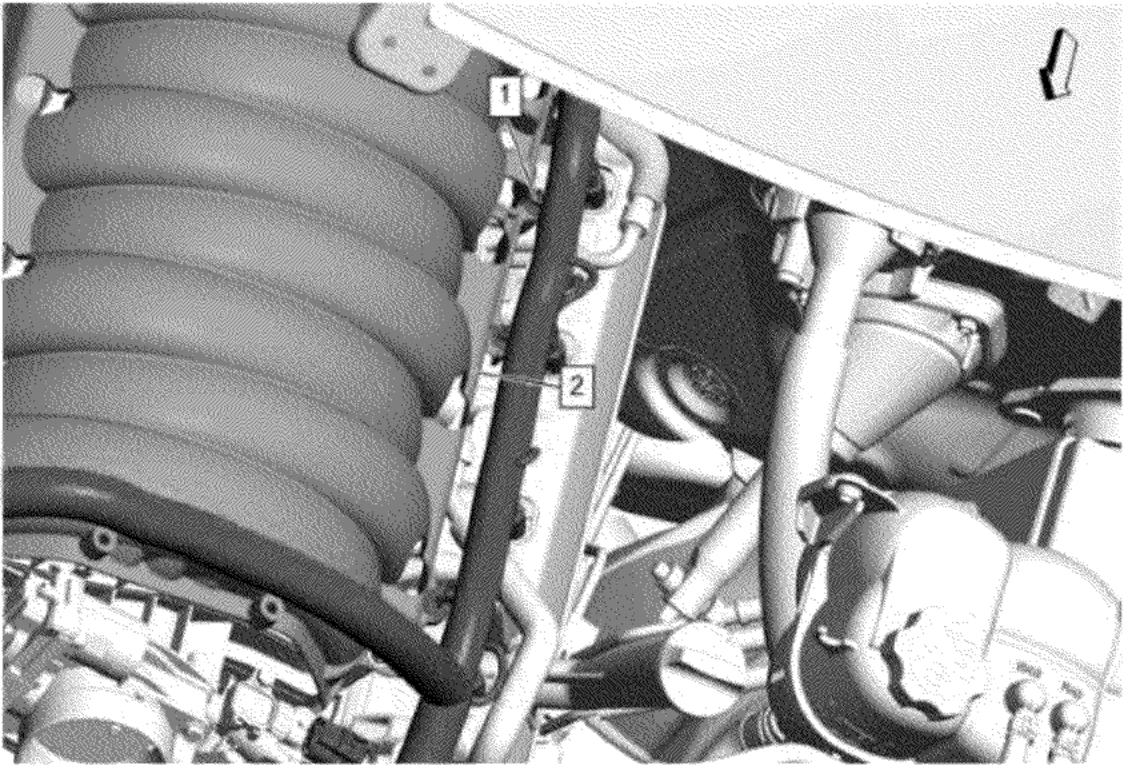


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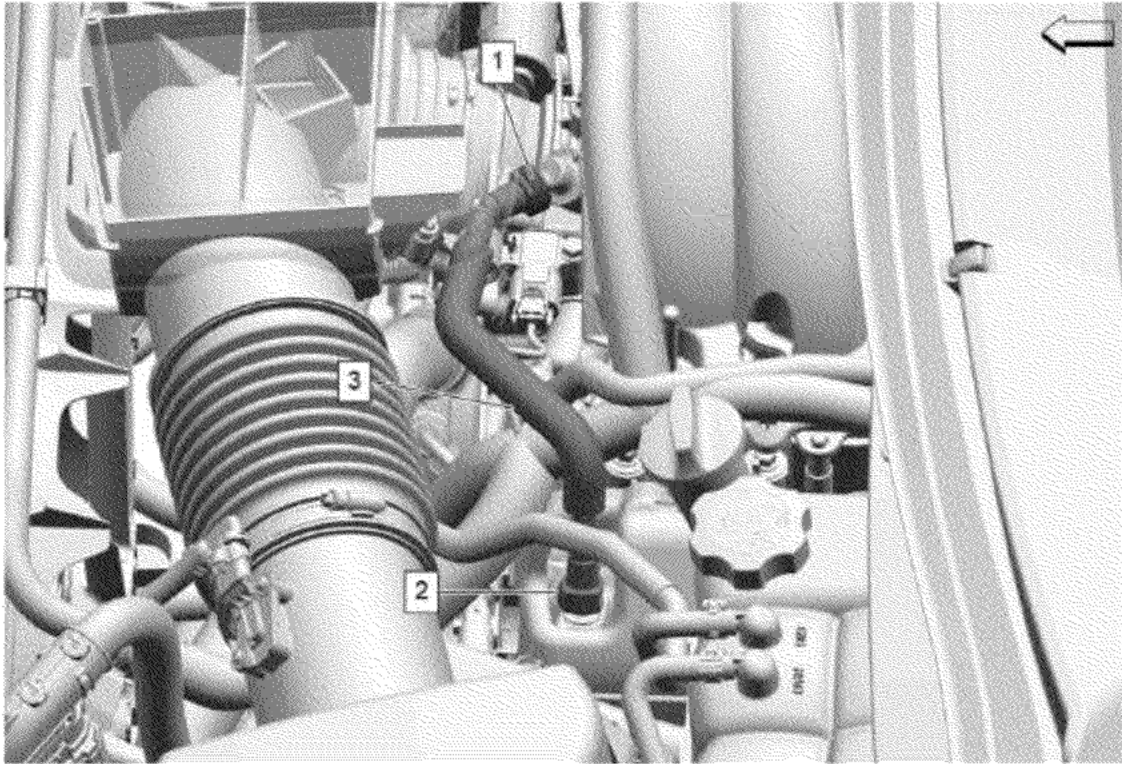
- 148. Engine Wiring Harness Connector (1) @ Throttle Body » Disconnect
- 149. Engine Wiring Harness Retainer (2) @ Intake Manifold Cover » Remove [2x]
- 150. Engine Wiring Harness Connector (3) @ Manifold Absolute Pressure Sensor » Disconnect
- 151. Engine Wiring Harness Connector (4) @ Evaporative Emission Canister Purge Solenoid Valve » Disconnect



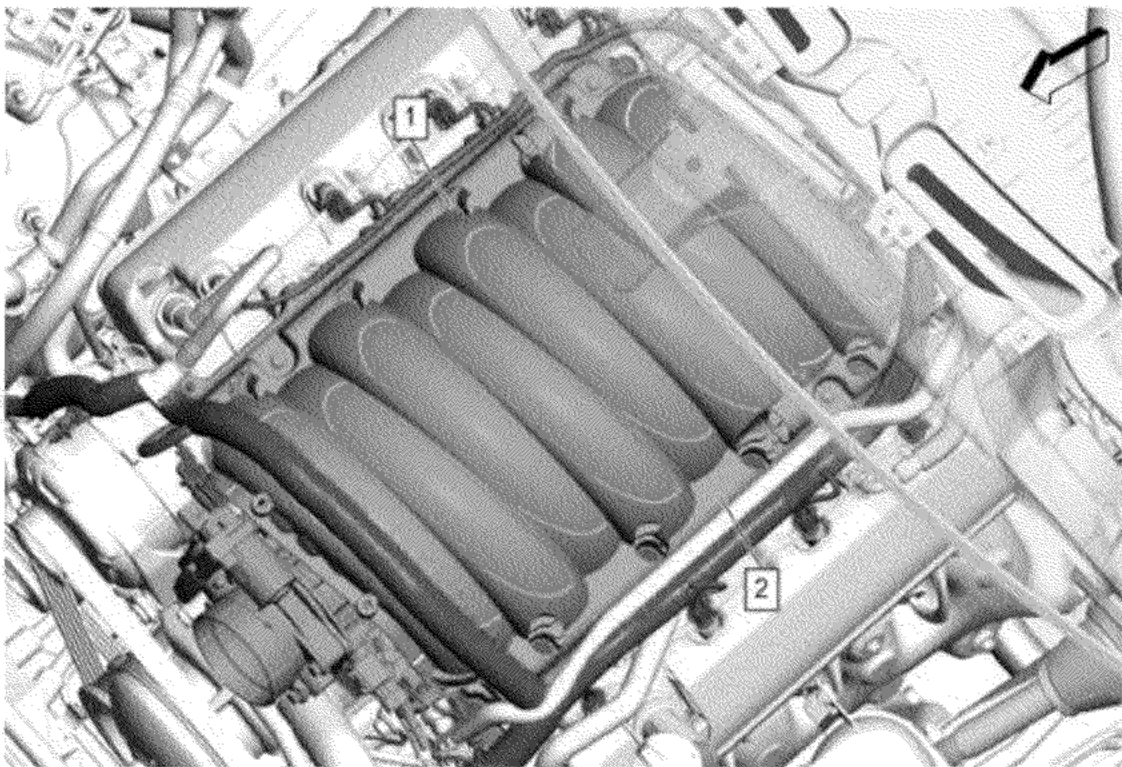
152. Engine Wiring Harness Retainer (1) @ Intake Manifold Cover (2) » Remove [4x]



153. Engine Wiring Harness Retainer (1) @ Intake Manifold Cover (2) » Remove [3x]



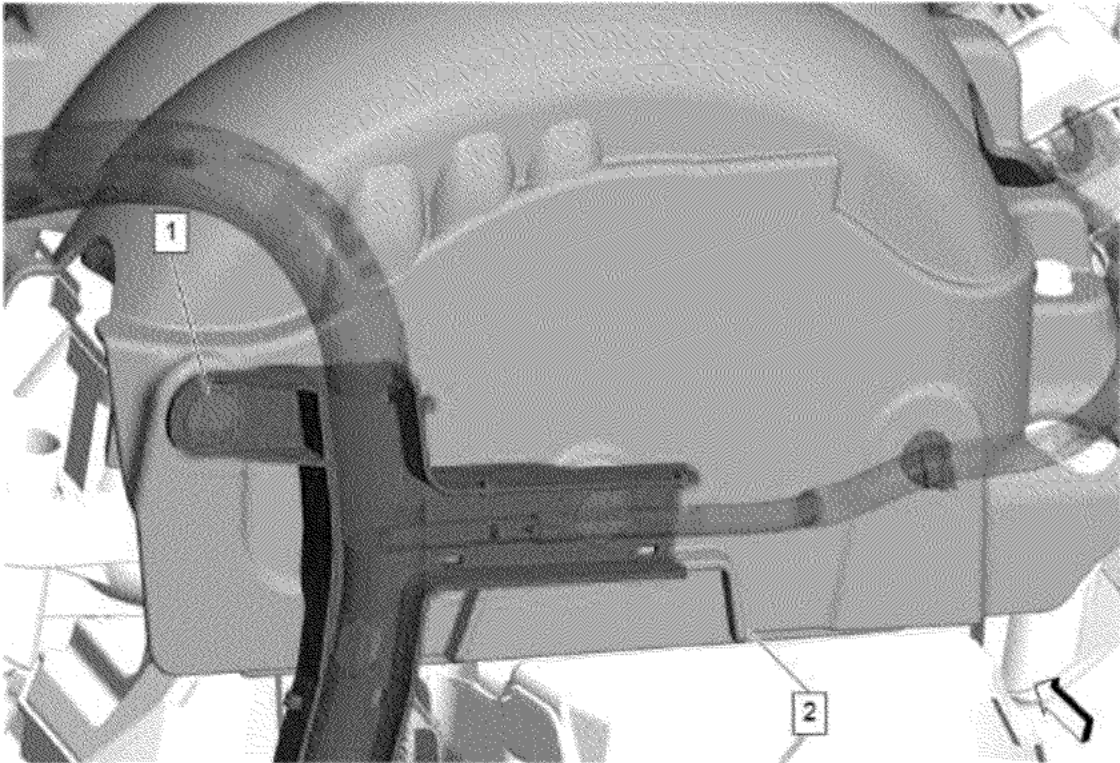
154. Positive Crankcase Ventilation Tube Connector (1) @ Intake Manifold » Disconnect and reposition — [Plastic Collar Quick Connect Fitting Service](#)



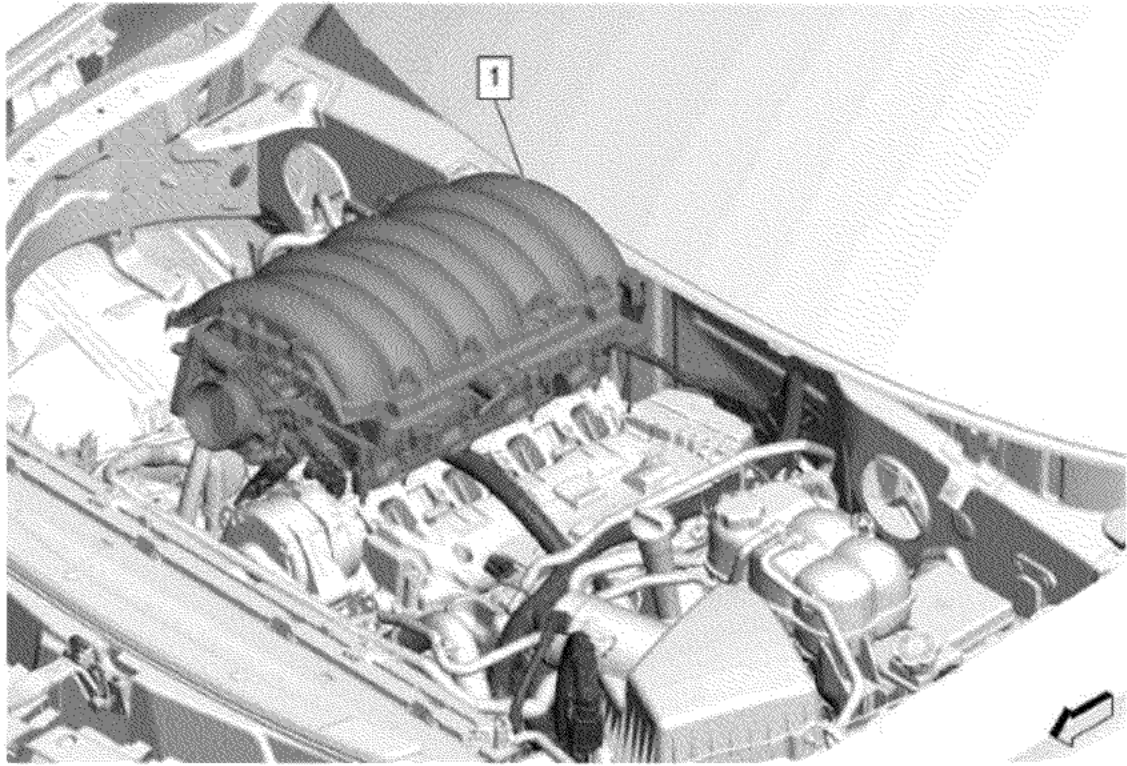
**Note:** Some components not shown for graphic clarity.

155. Loosen the 10 intake manifold bolts (1) until the bolts are no longer threaded into the cylinder heads.

156. Move the intake manifold and intake manifold cover (2) forward enough to gain access to the rear engine wiring harness retainers.



157. Engine Wiring Harness Retainer (1) @ Intake Manifold Cover (2) » Remove [4x]

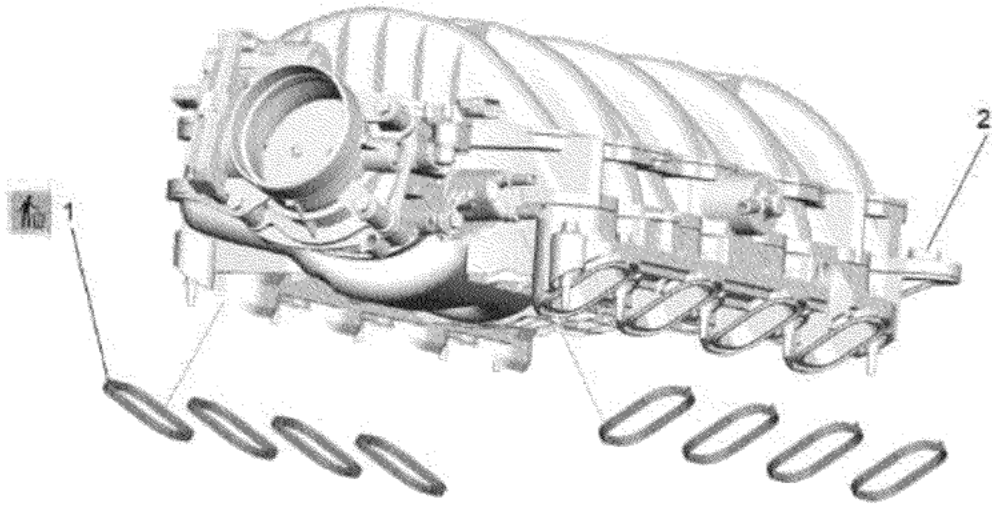


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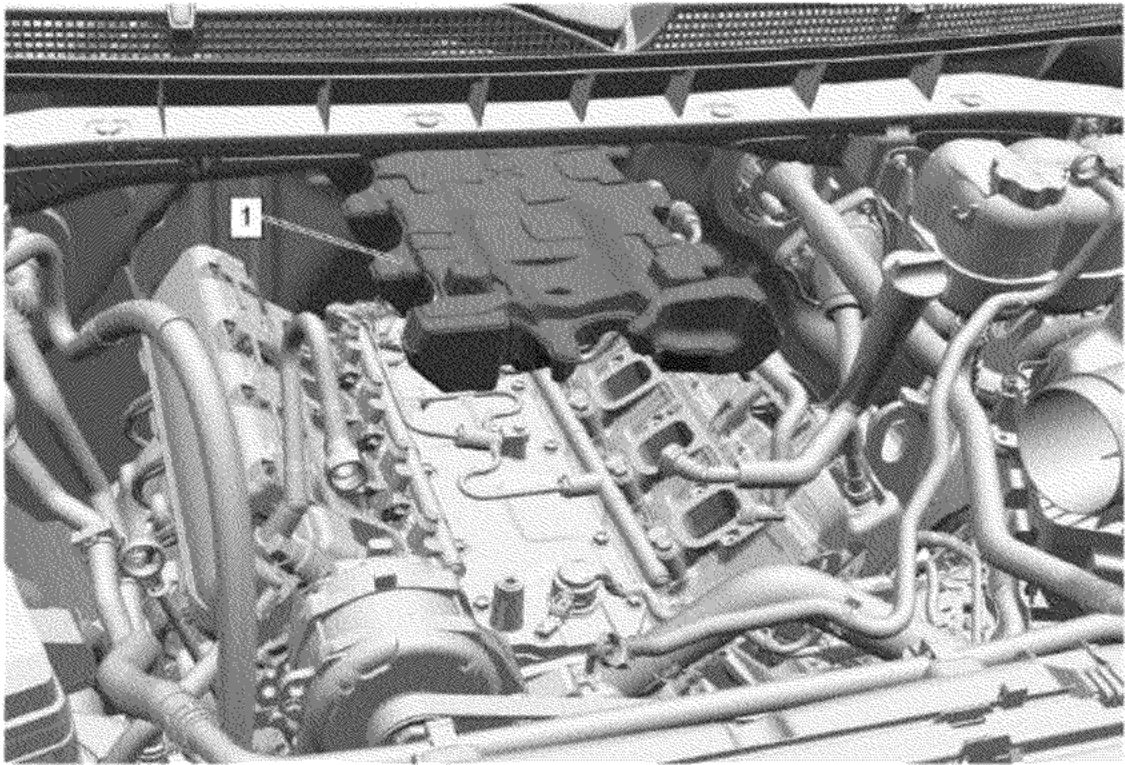
**Note:** The aid of an assistant may be helpful in holding the engine harness up out of the way so the upper intake manifold cover does not get caught against the engine harness.

158. Remove the intake manifold and intake manifold cover (1) as an assembly.

159. Cover the cylinder head passages in order to prevent dirt or debris from entering the passages.

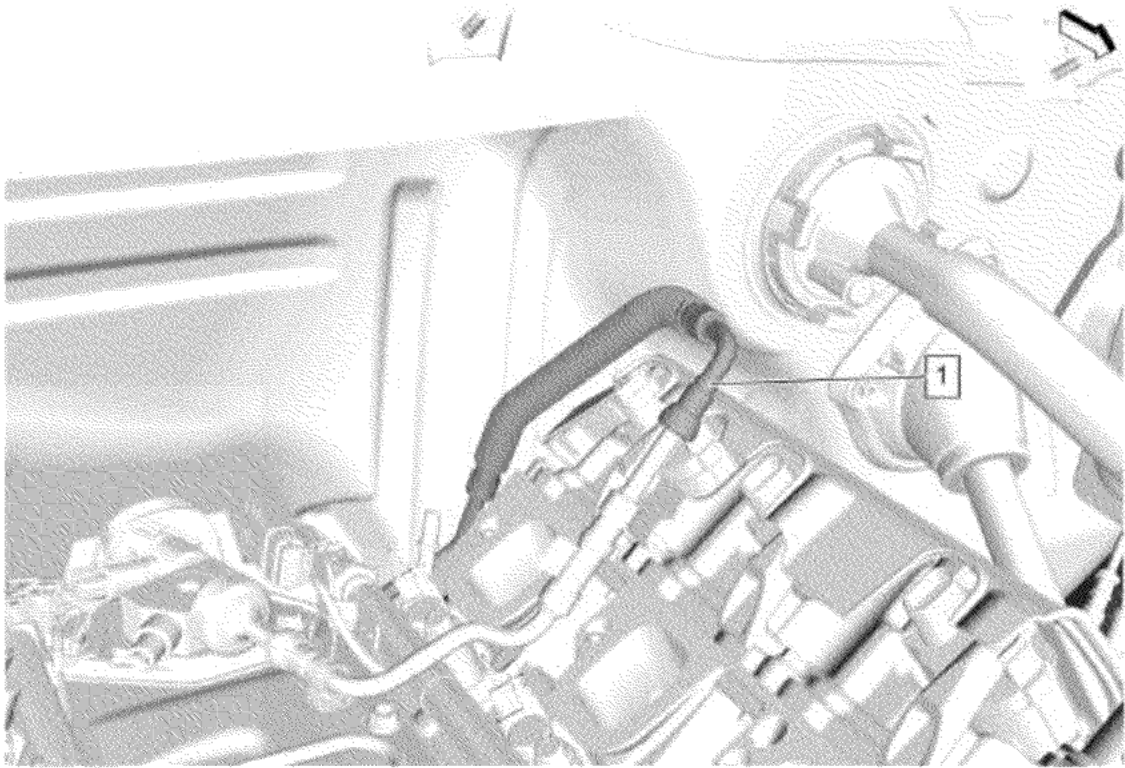


160. Intake Manifold Gasket (1) » Remove and DISCARD [8x]



**Danger:** The noise cancelling foam component **MUST** be replaced if it has been exposed to engine fluids. Failure to replace the noise canceling foam component that has been exposed to engine fluids may result in an engine fire resulting in catastrophic engine damage, and possible injury or death.

161. Fuel Pump Insulator (1) » Remove

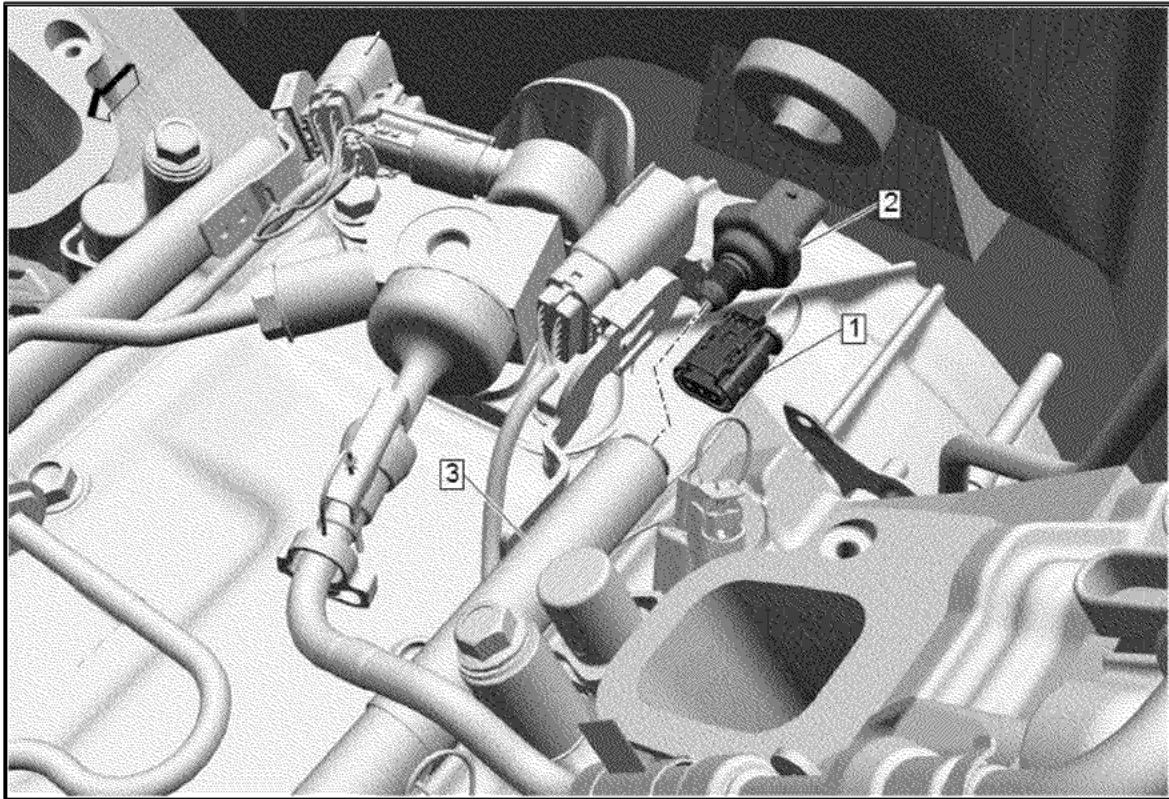


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**Warning:** Refer to Diesel/Gasoline Vapors Warning.

162. Fuel Feed Pipe (1) » Disconnect — Metal Collar Quick Connect Fitting Service

163. Fuel Feed Pipe (1) » Reposition



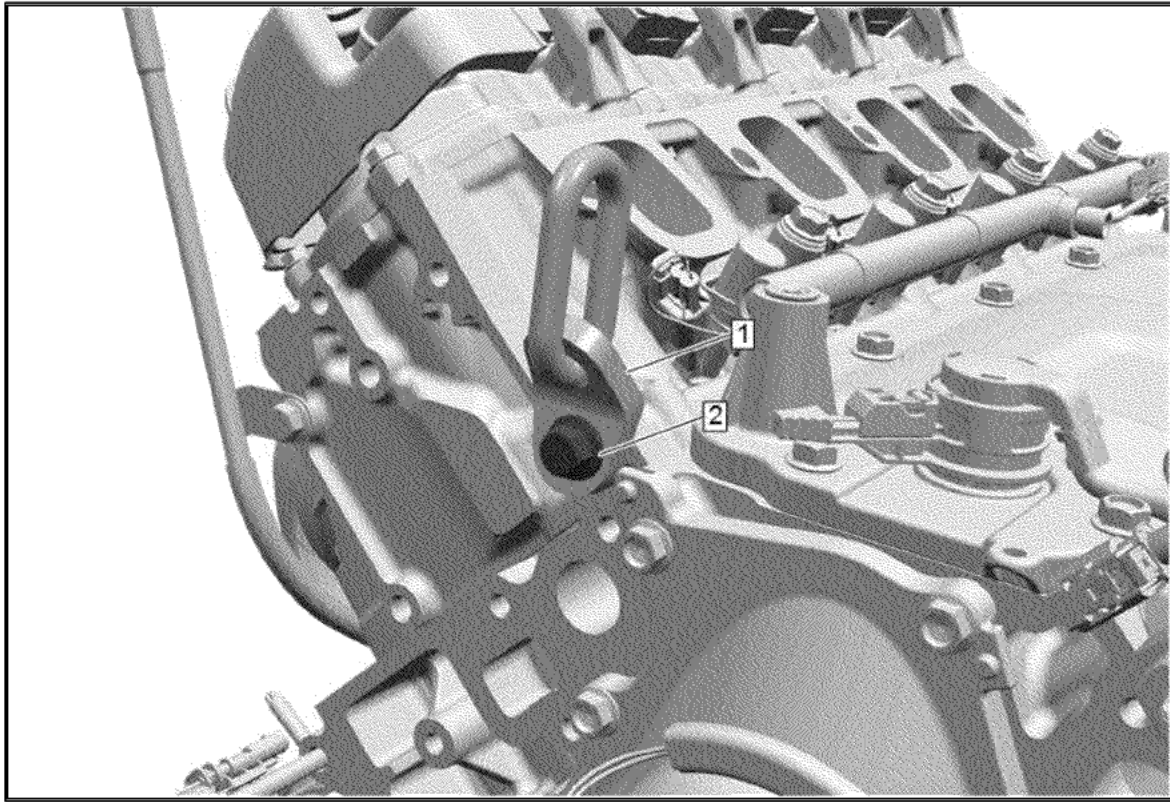
**Caution:** Refer to [Fuel and Evaporative Emission Hose/Pipe Connection Cleaning Caution](#).

**Caution:** To tighten or loosen the fuel injection fuel rail fuel pressure sensor, apply force **ONLY** to the attached hexagon. Applying force to the plastic housing of the sensor may damage the sensor.

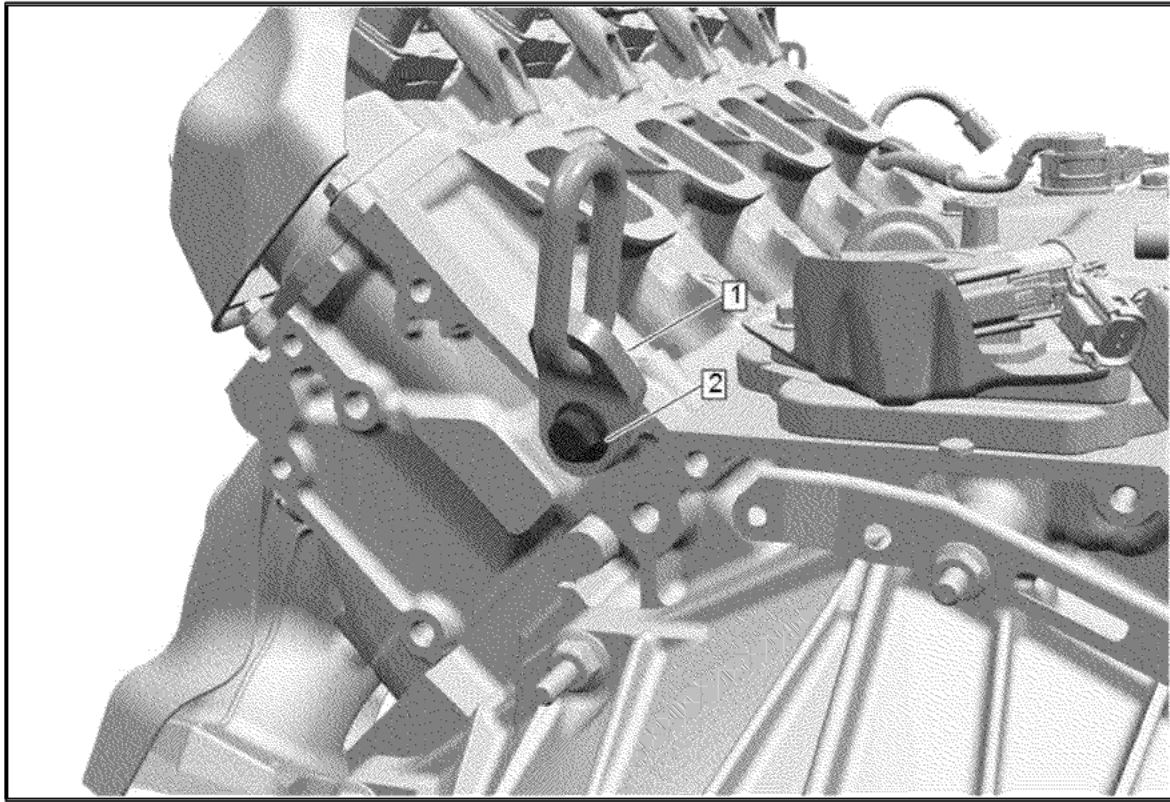
164. Electrical Connector (1) @ Fuel Rail Pressure Sensor (2) » Disconnect

**Note:** Some fuel may leak from the fuel rail pressure sensor orifice after the sensor is removed. Dry the area around this orifice after the removal of the sensor using a lint free cloth and inspect the fuel rail pressure sensor sealing surface. The surface should be free of fuel, debris, and burrs.

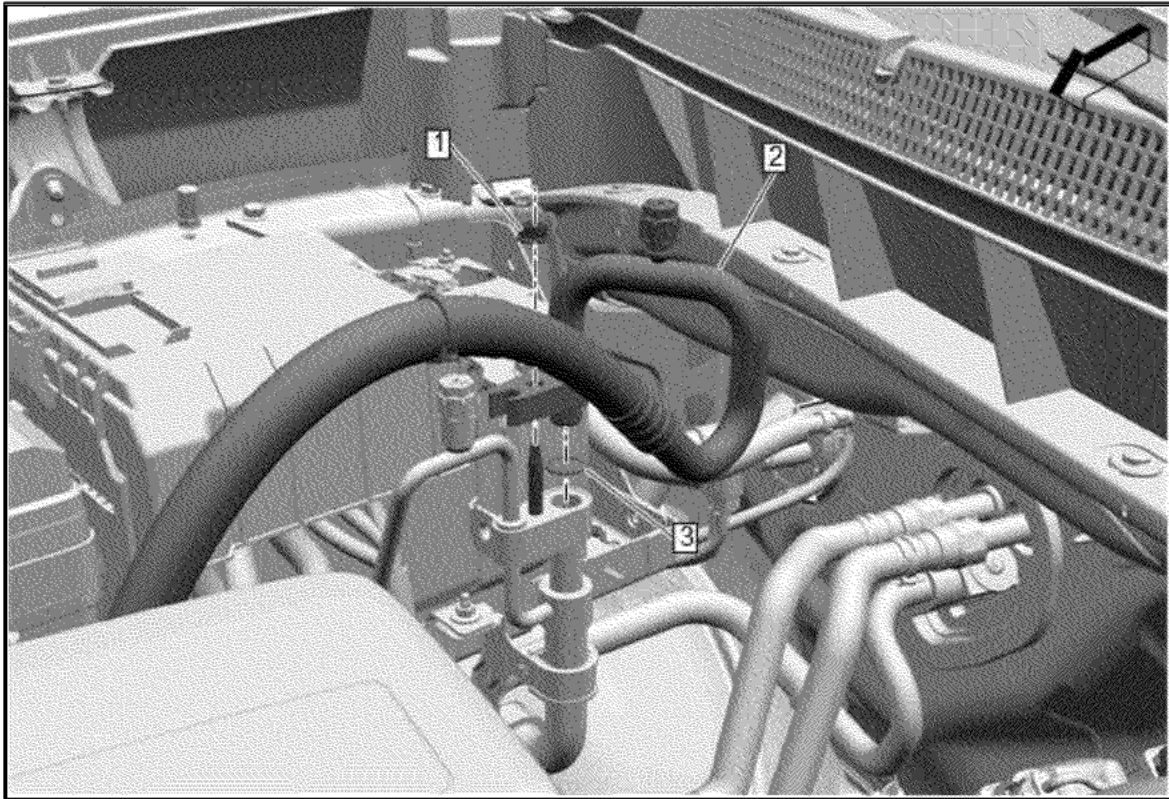
165. Fuel Rail Pressure Sensor (2) @ Fuel Injection Fuel Rail (3) » Remove



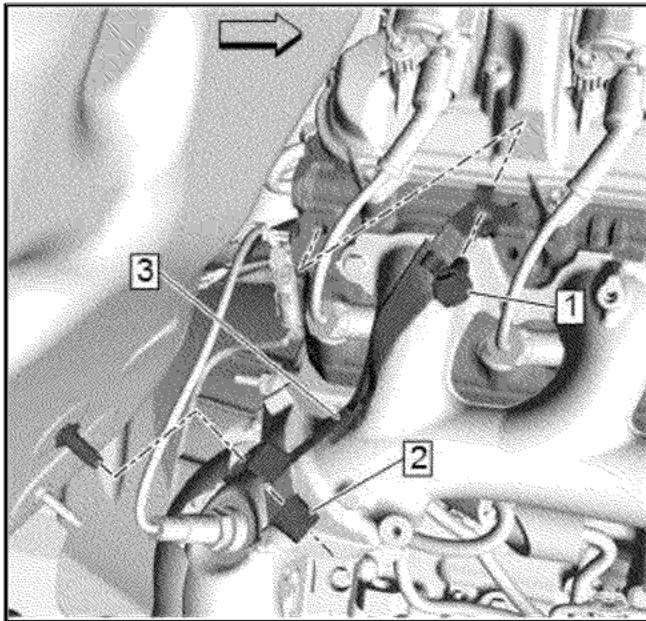
166. Install the *EN-36857* Engine Lift Bracket (1) using the *EN-52059* Engine Support Fixture Adapter Bolt - M10 (2) to the cylinder head and hand tighten.



167. Install the *EN-36857* Engine Lift Bracket (1) using the *EN-52059* Engine Support Fixture Adapter Bolt - M10 (2) to the cylinder head and hand tighten.

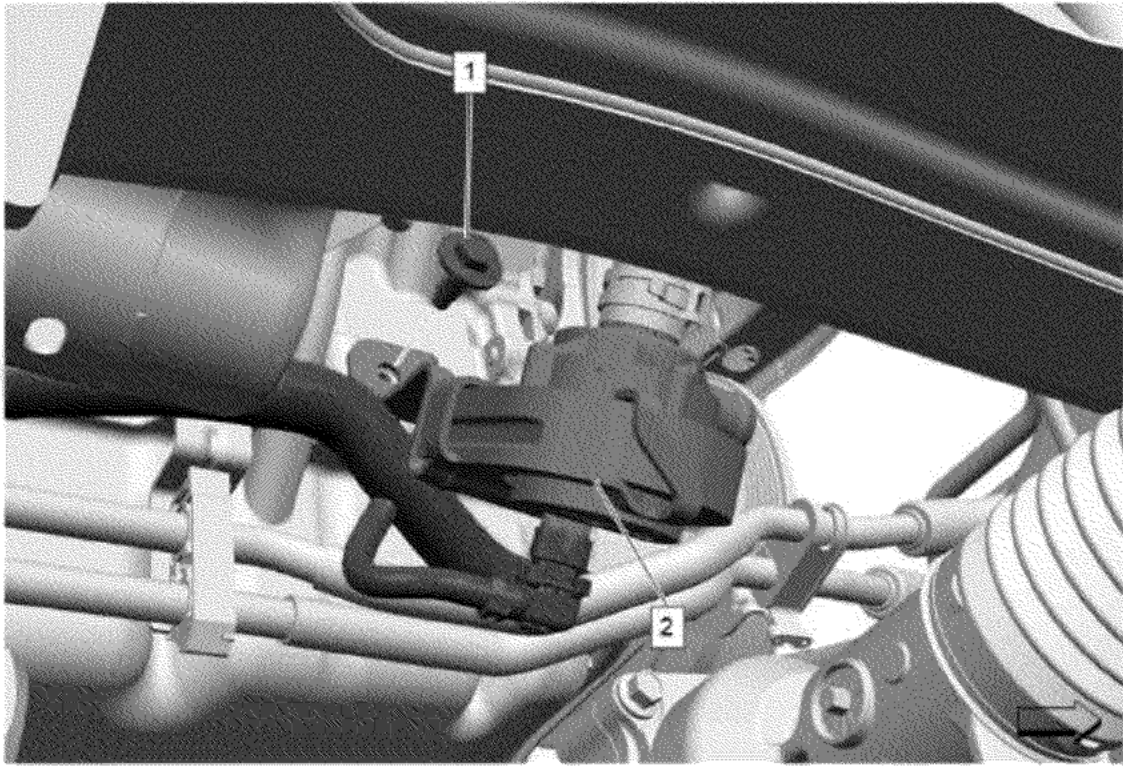


168. Air Conditioning Compressor and Condenser Hose (2) » Position aside



169. Engine Wiring Harness Ground Bolt (1) @ Engine Block » Remove

170. Battery Negative Cable Extension Cable Strap (3) @ Engine Block » Remove

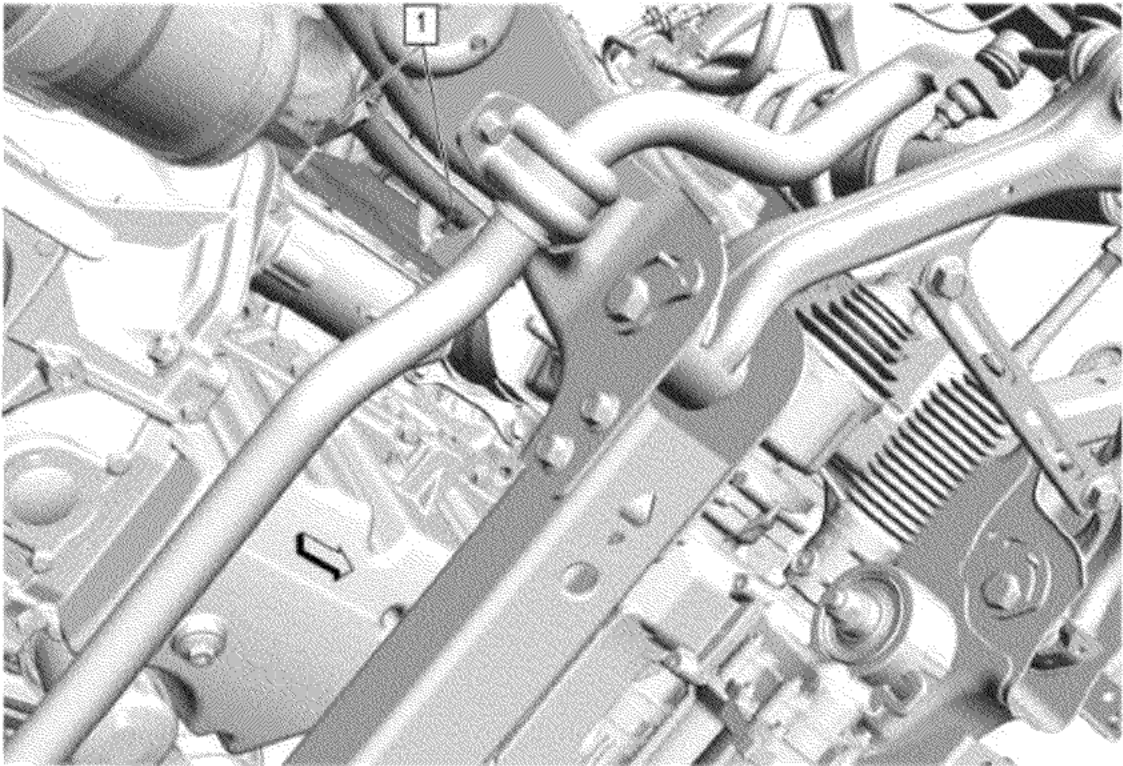


**Note:** Some components not shown for graphic clarity.

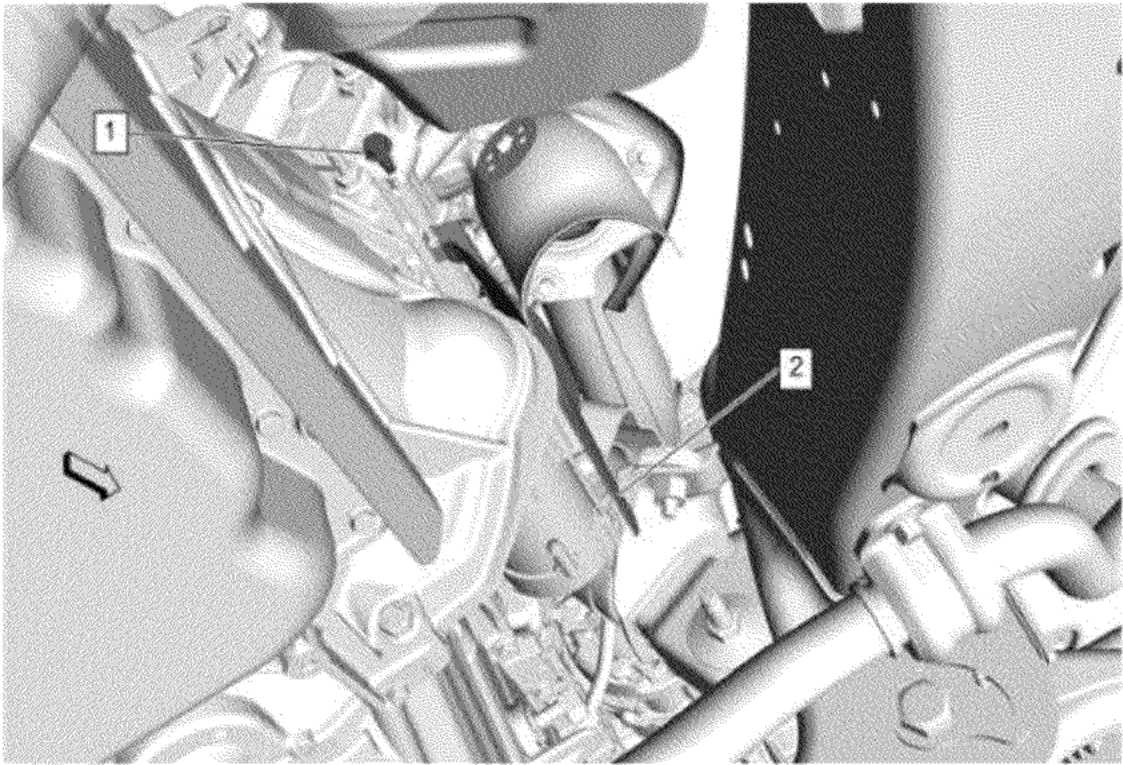
171. Electrical Connector @ Heater Coolant Pump (2) » Disconnect

172. Heater Water Auxiliary Pump Bolt (1) » Remove

173. Remove the heater coolant pump and heater water auxiliary pump bracket (2) as assembly and position aside.

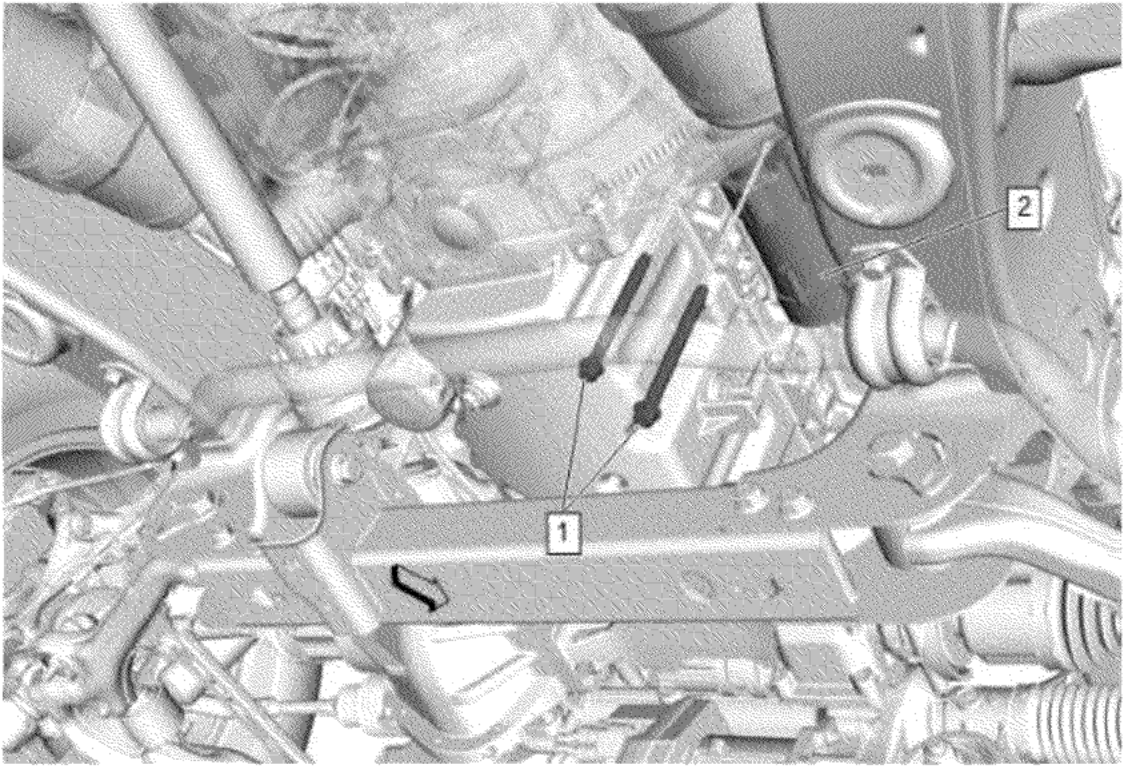


174. Starter Heat Shield Bolt (1) » Remove [2x]



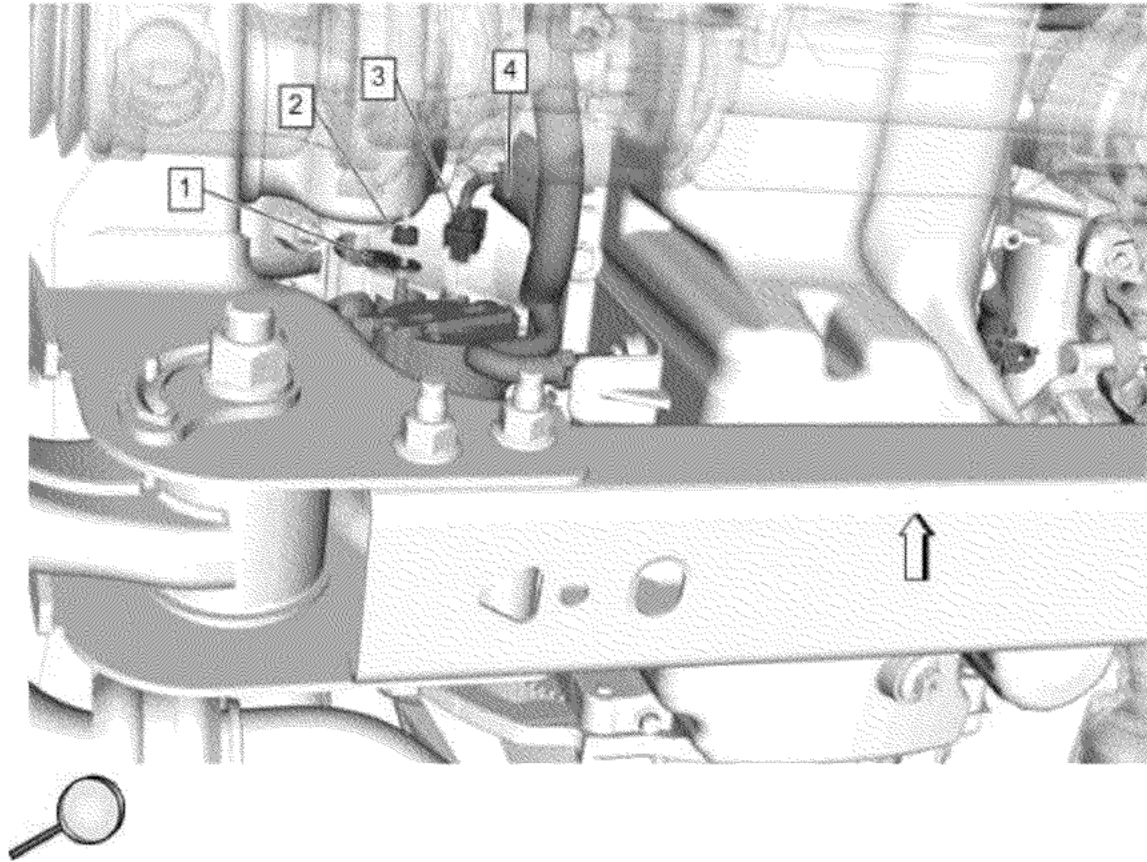
175. Starter Heat Shield Bolt (1) » Remove

176. Starter Heat Shield (2) » Remove



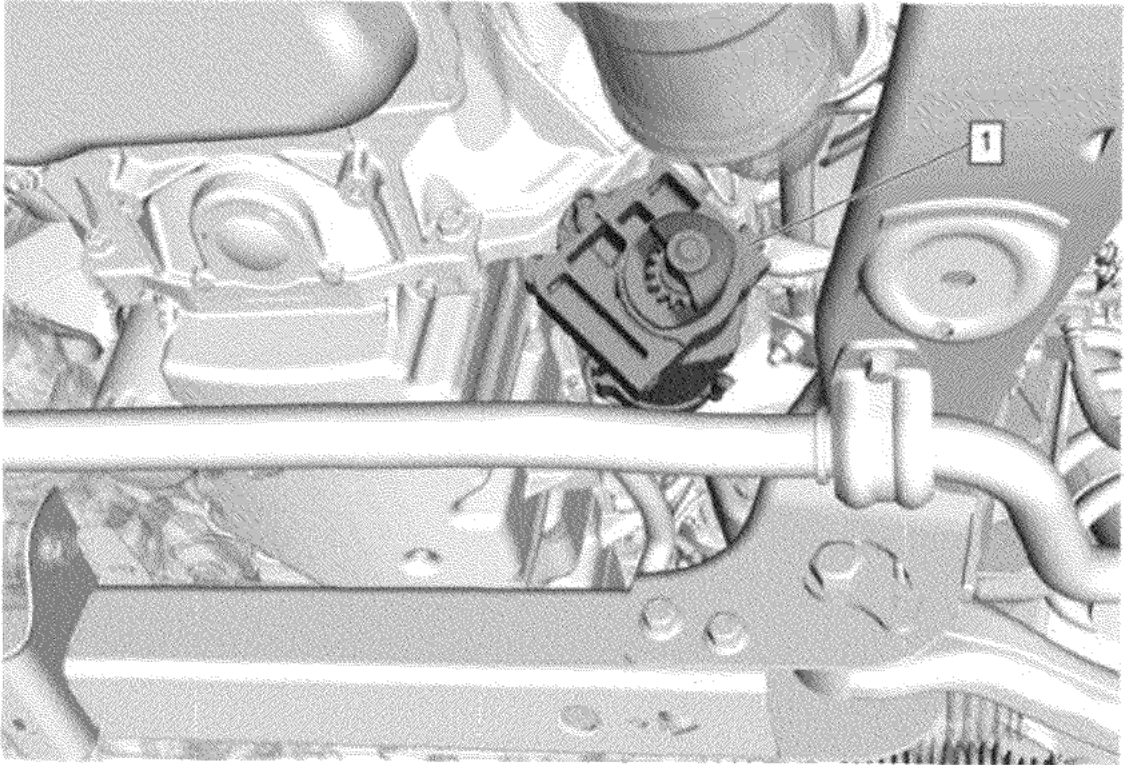
177. Starter Bolt (1) » Remove [2x]

178. Reposition the starter (2) to access the electrical connections.

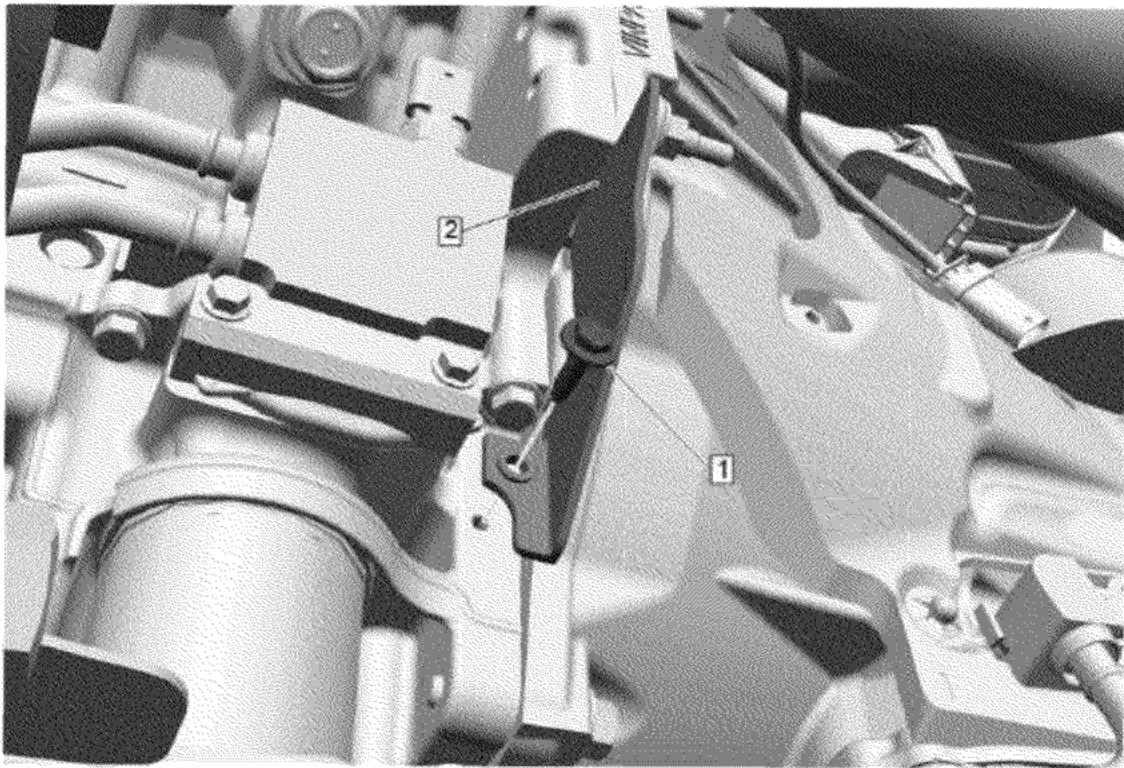


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- 179. Protective Sleeve (4) » Reposition
- 180. Starter Solenoid Cable Nut (2) » Remove
- 181. Starter Solenoid Cable (1) » Remove
- 182. Electrical Connector (3) » Disconnect

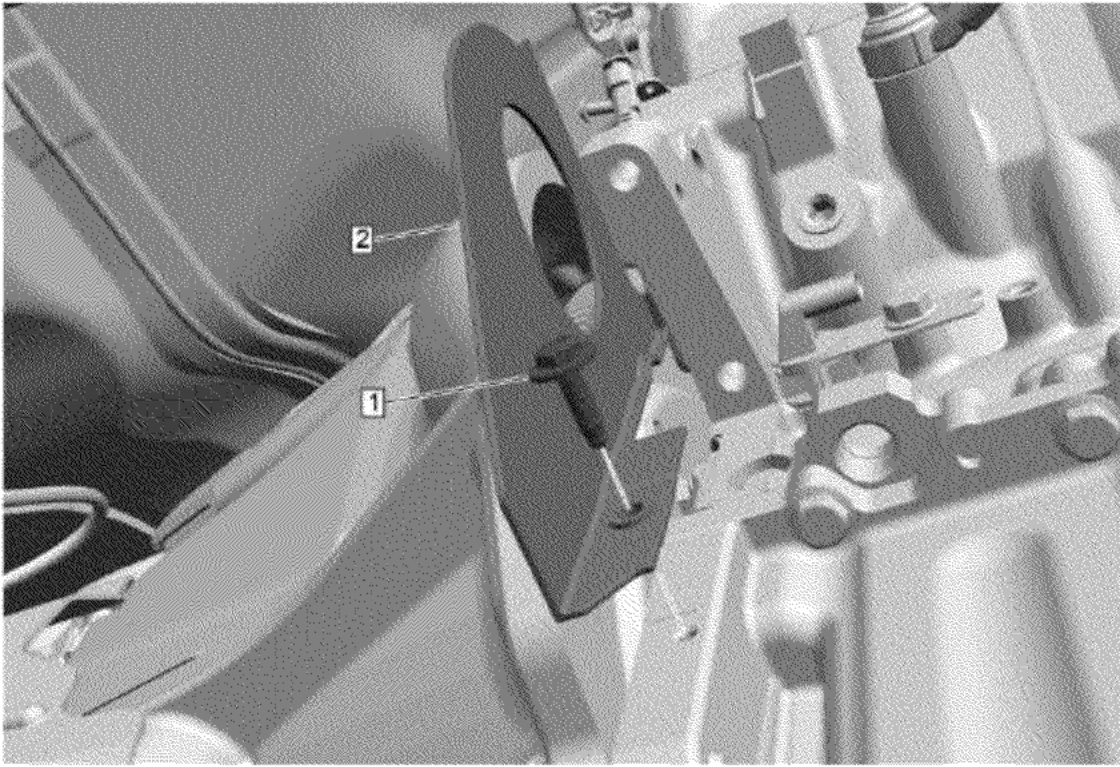


183. Starter (1) » Remove



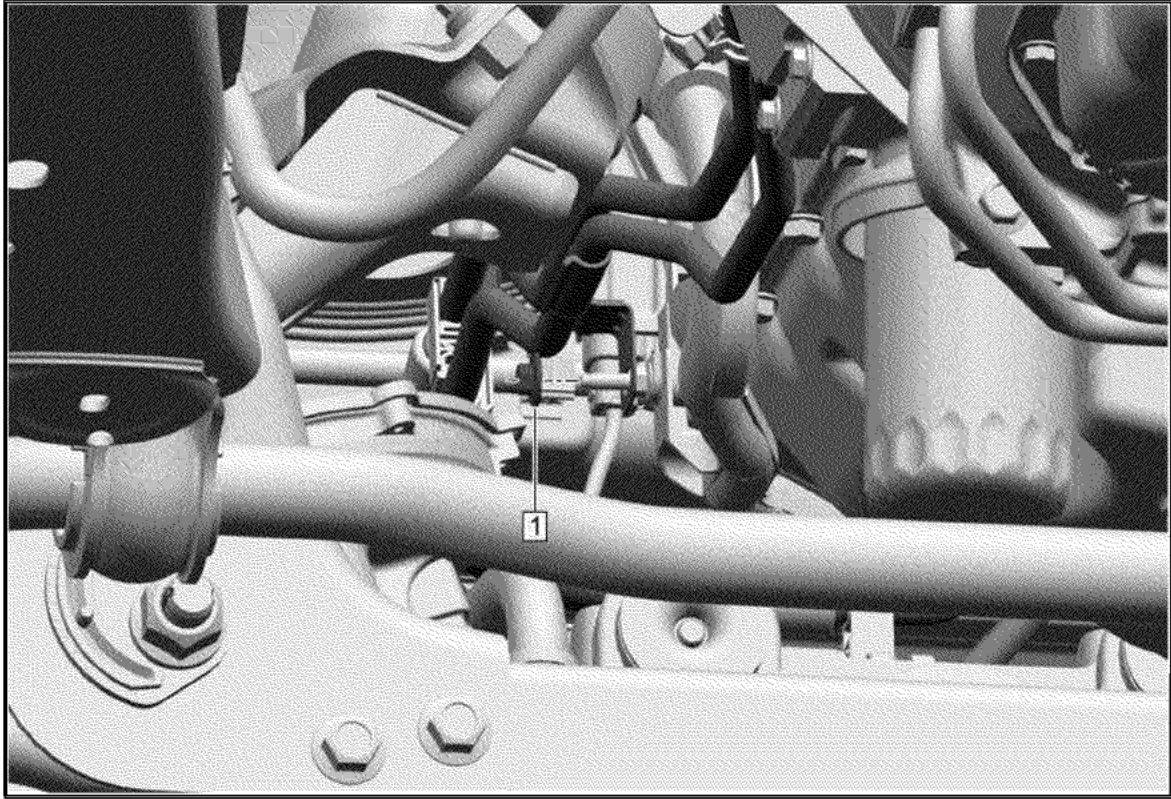
184. Torque Converter Cover Bolt - Left Side (1) » Remove

185. Transmission Converter Cover - Left Side (2) » Remove

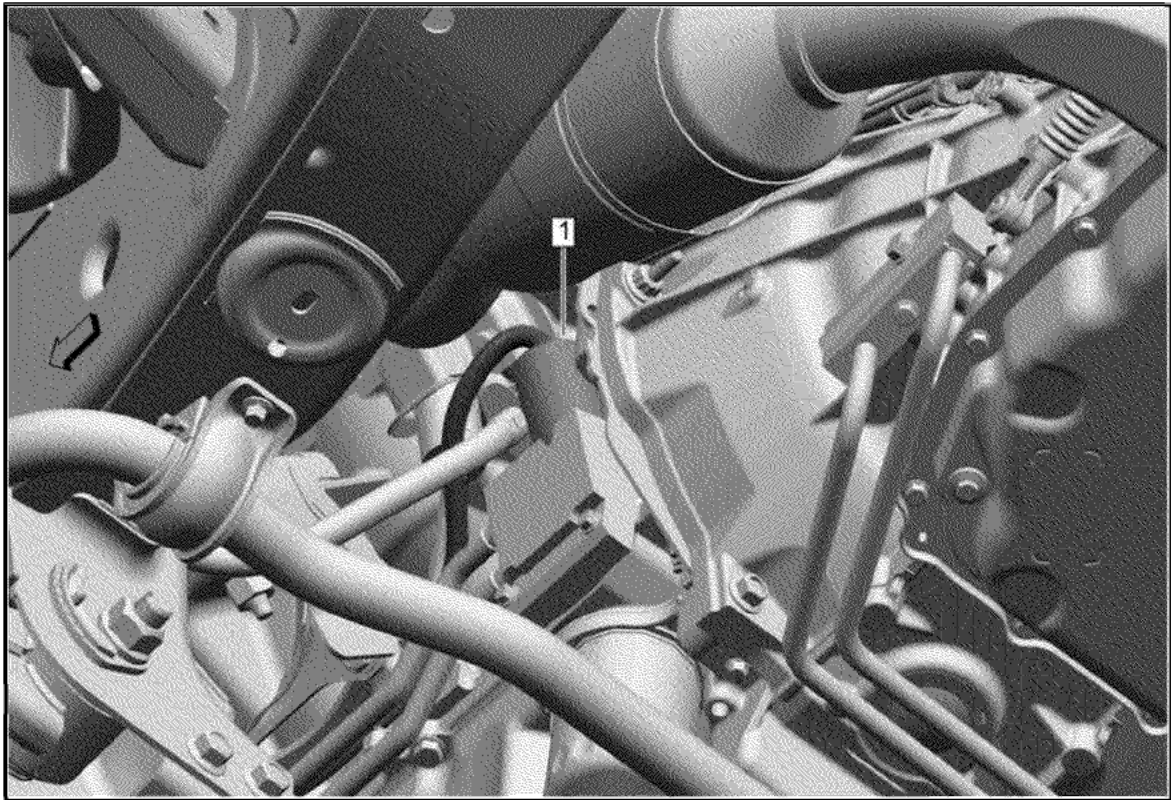


186. Torque Converter Cover Bolt - Right Side (1) » Remove

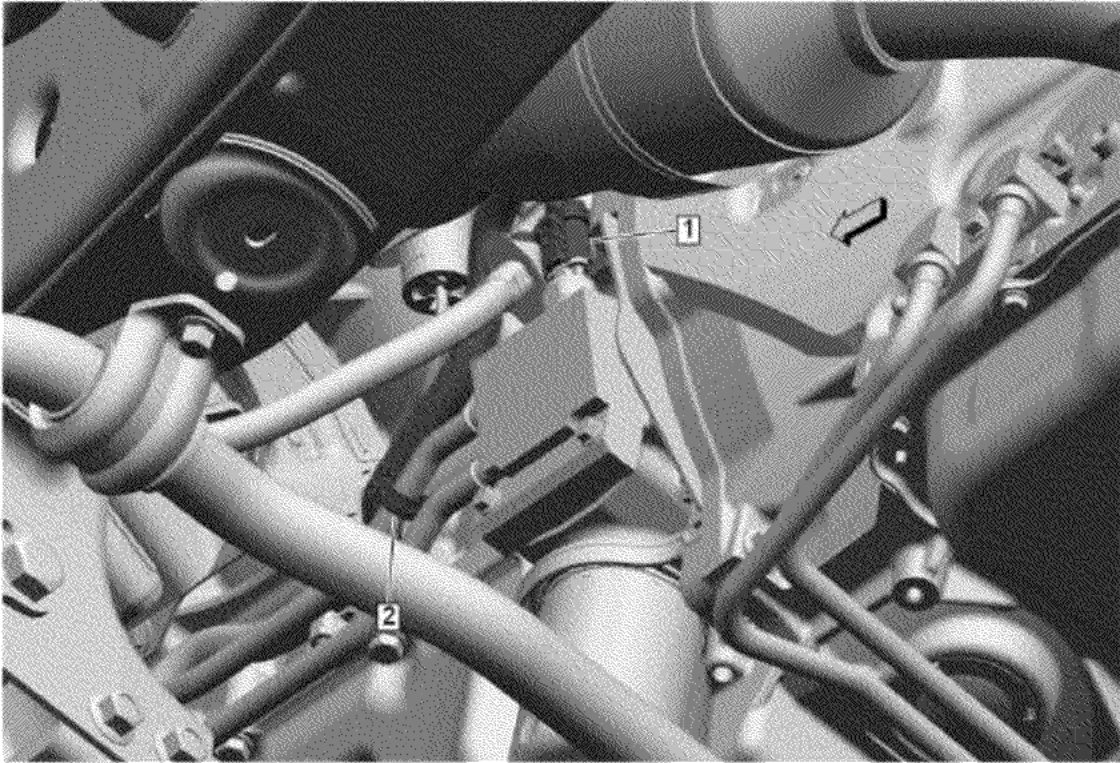
187. Transmission Converter Cover - Right Side (2) » Remove



188. Engine Oil Cooler Hose Bracket Nut (1) » Remove

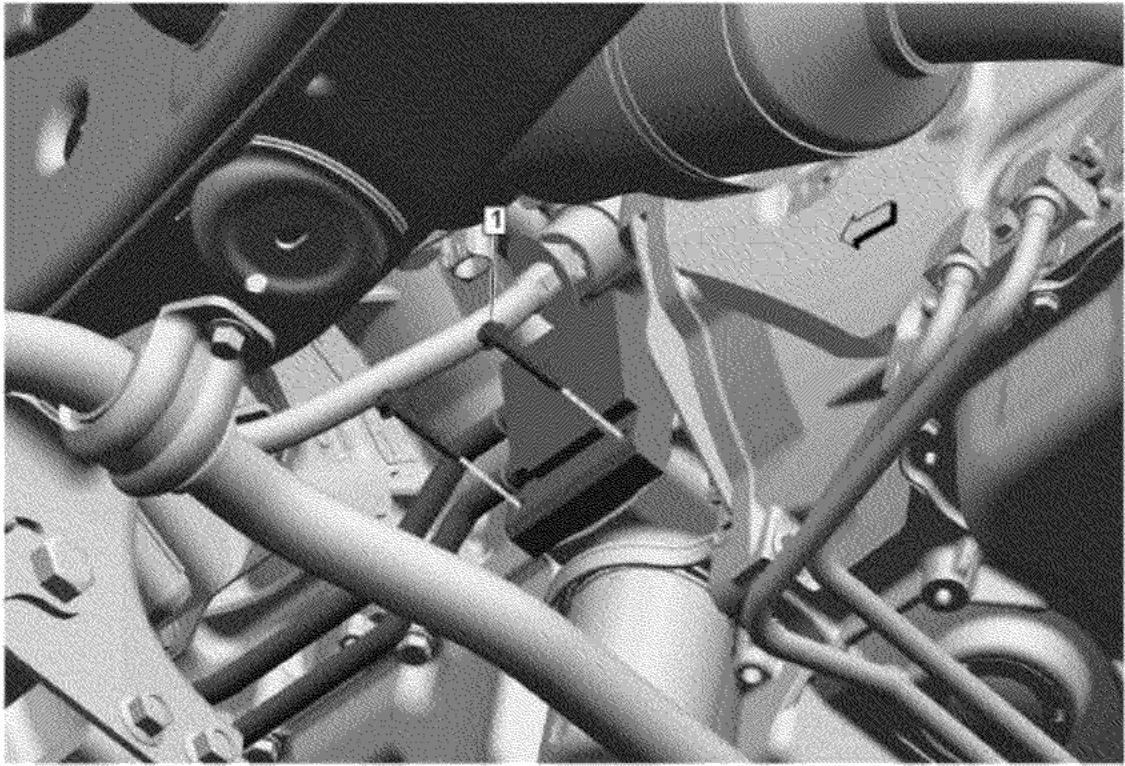


189. Engine Oil Pressure Sensor Sleeve (1) » Remove

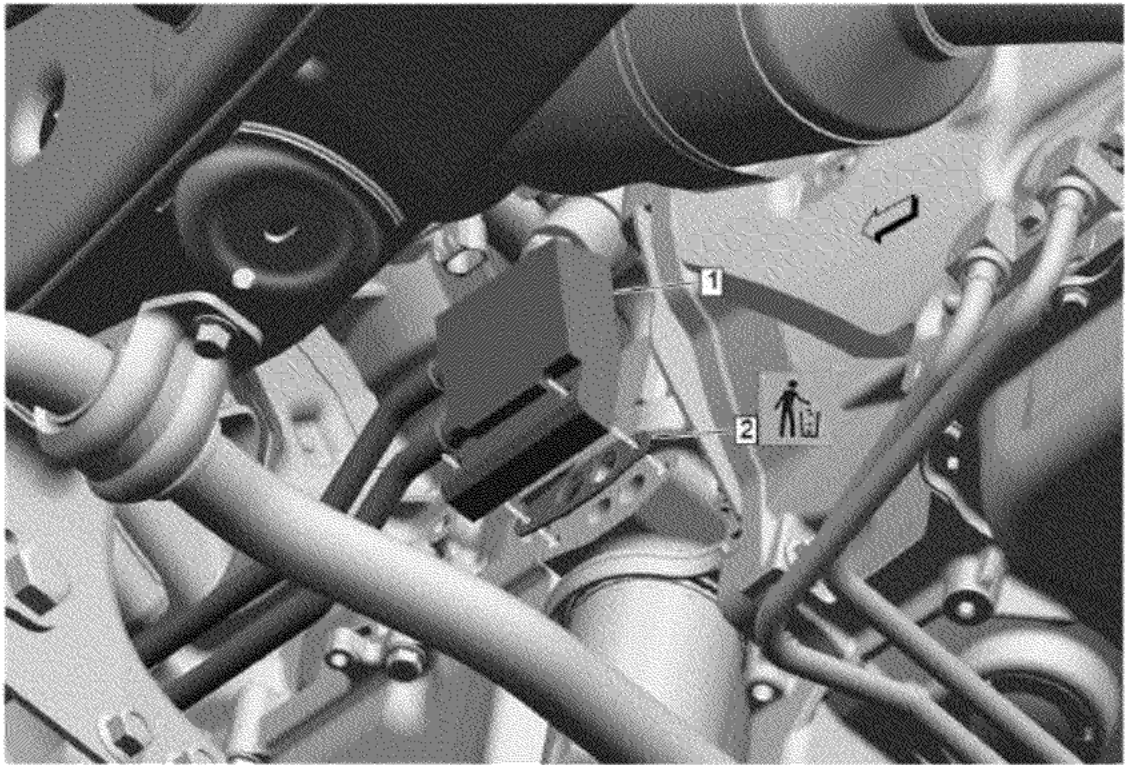


190. Electrical Connector (1) @ Engine Oil Pressure Sensor » Disconnect

191. Wiring Harness Retainer (2) @ Engine Oil Cooler Hose » Remove

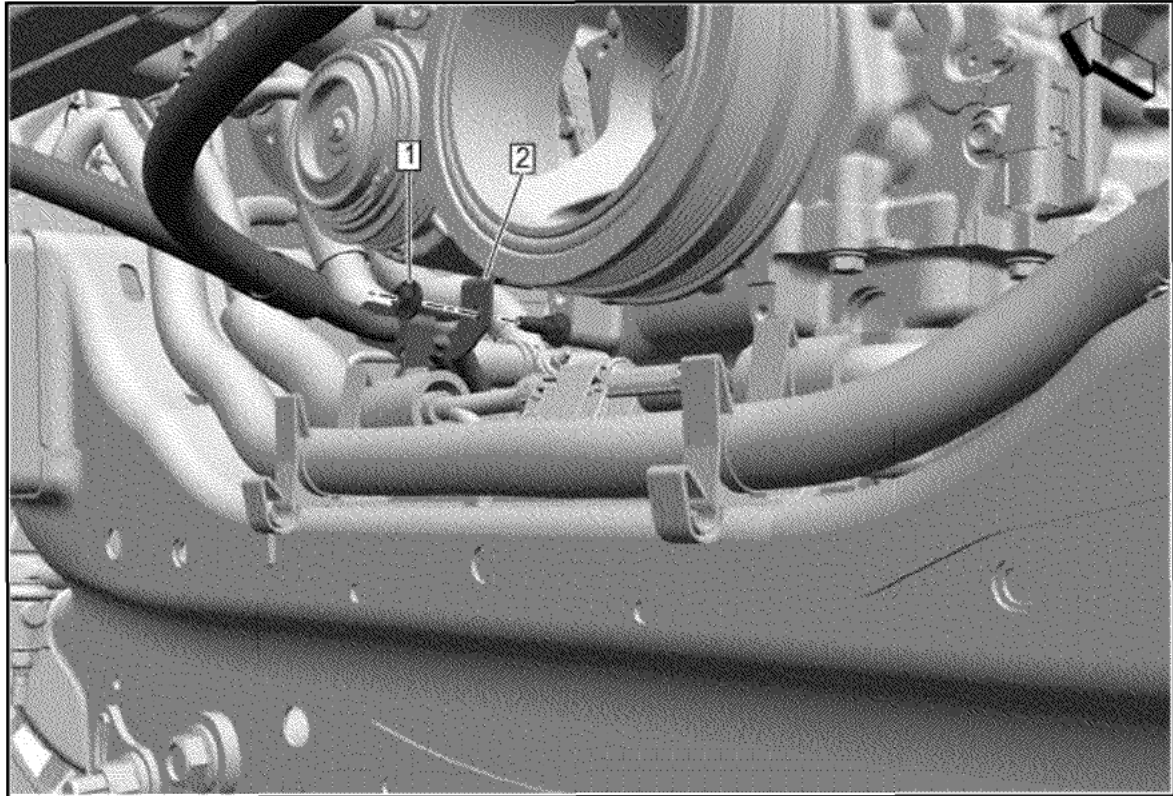


192. Engine Oil Cooler Coolant Hose Bolt (1) » Remove [2x]



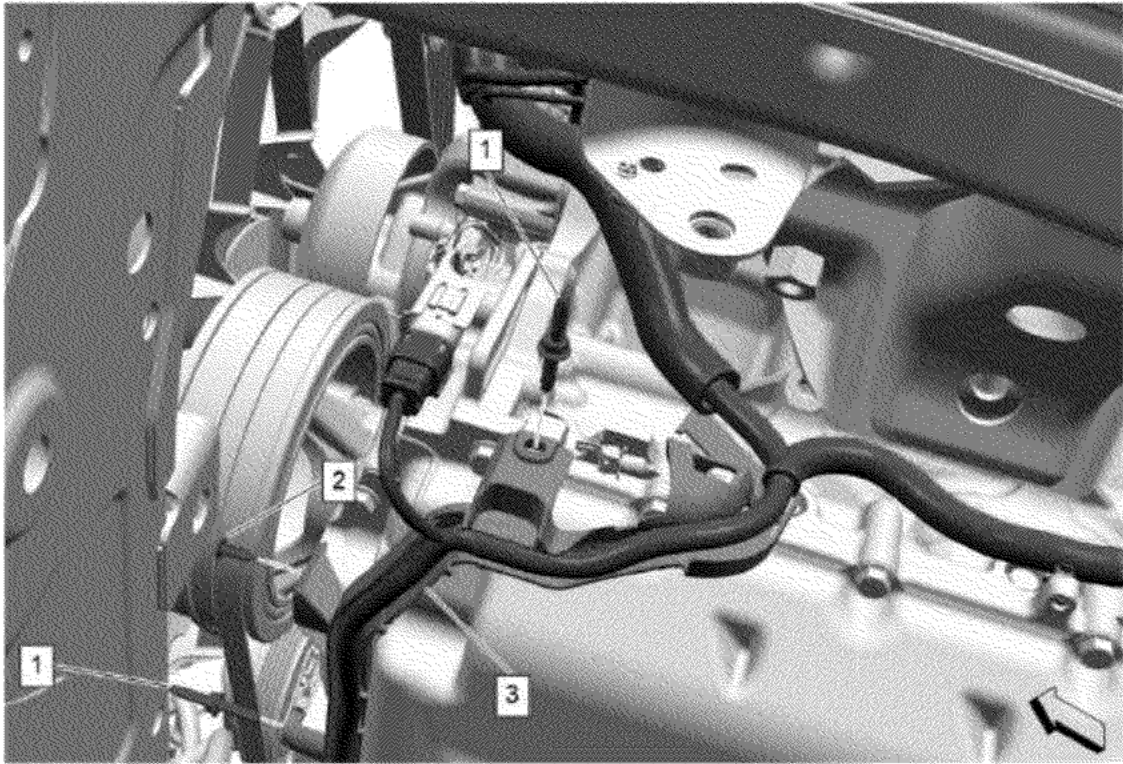
193. Engine Oil Cooler Hose (1) @ Oil Pan » Reposition

## 194. Engine Oil Cooler Gasket (2) » Remove and DISCARD

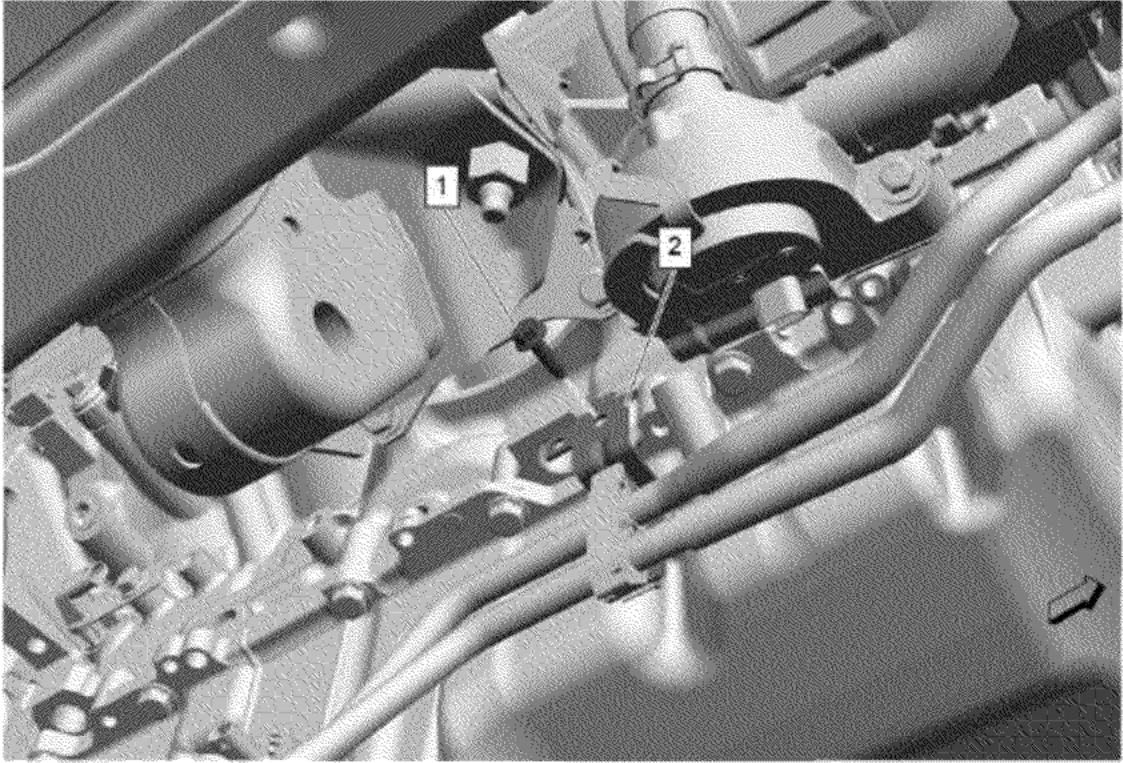


195. Remove the transmission fluid auxiliary cooler pipe bracket nut (1).

196. Remove the transmission fluid cooler inlet and outlet pipe bracket (2).



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197. Engine Wiring Harness Retainer (2) » Remove  
198. Engine Wiring Harness Ground Stud (1) » Remove [2x]  
199. Engine Wiring Harness (3) @ Oil Pan » Reposition

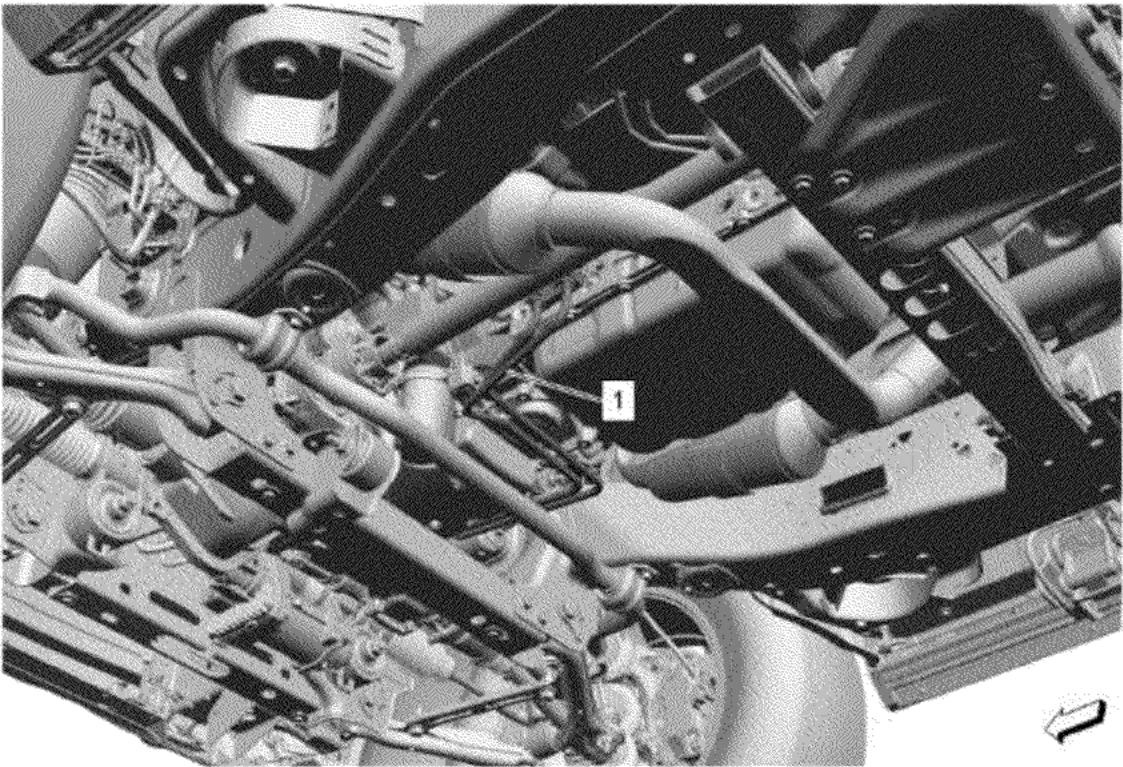


200. Transmission Fluid Cooler Pipe Clip Bolt (1) @ Oil Pan » Remove

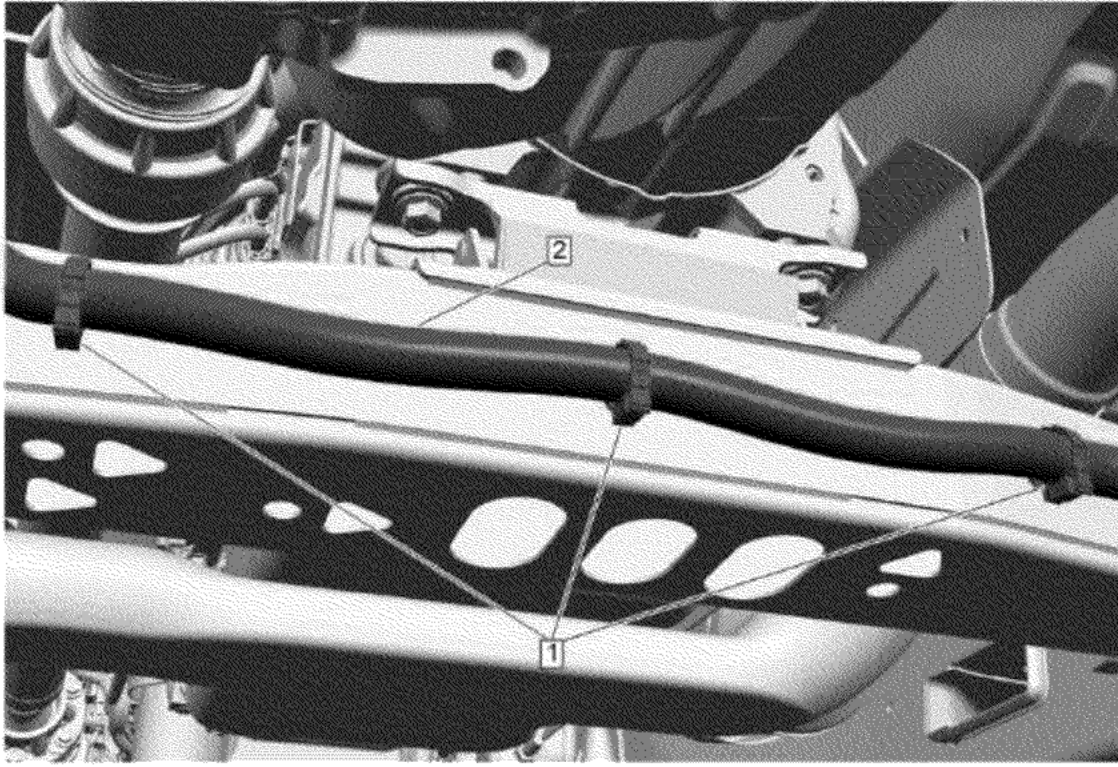
**Note:** Components removed in graphic to better illustrate service parts.

201. Transmission Fluid Cooler Pipe Clip Bracket (2) @ Oil Pan » Remove

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202. Reposition the transmission cooler inlet and outlet pipe (1) as necessary.

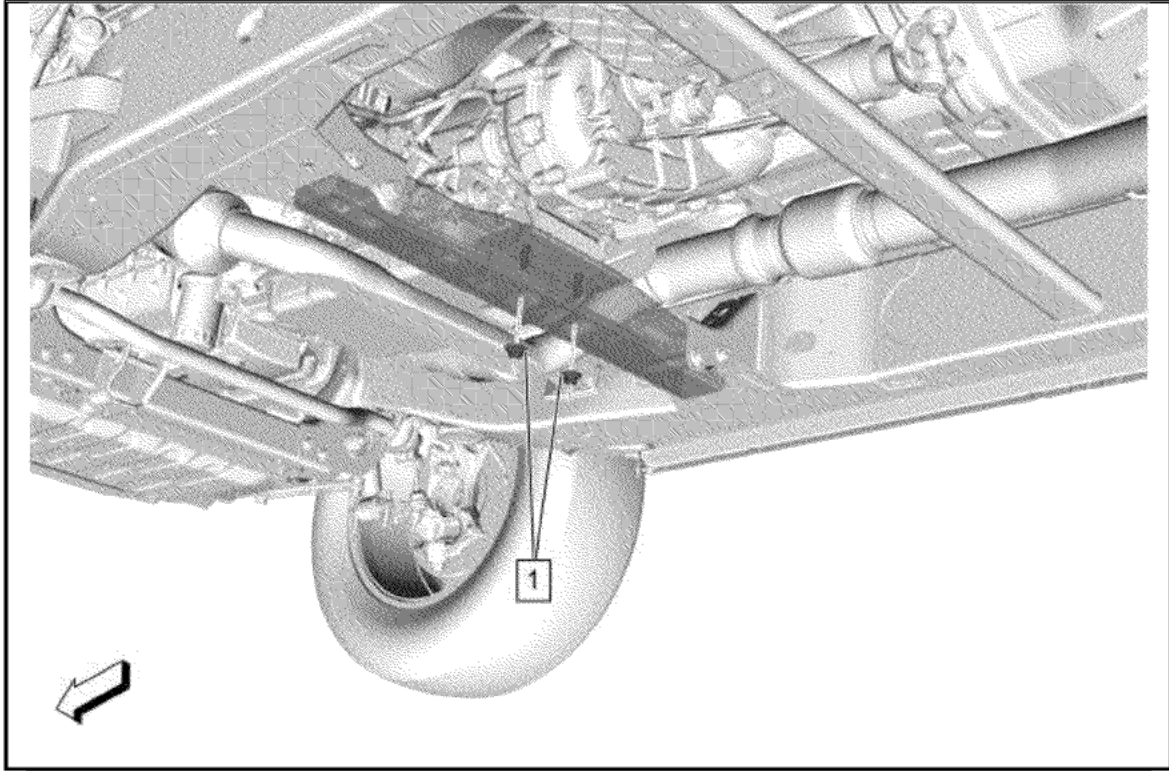


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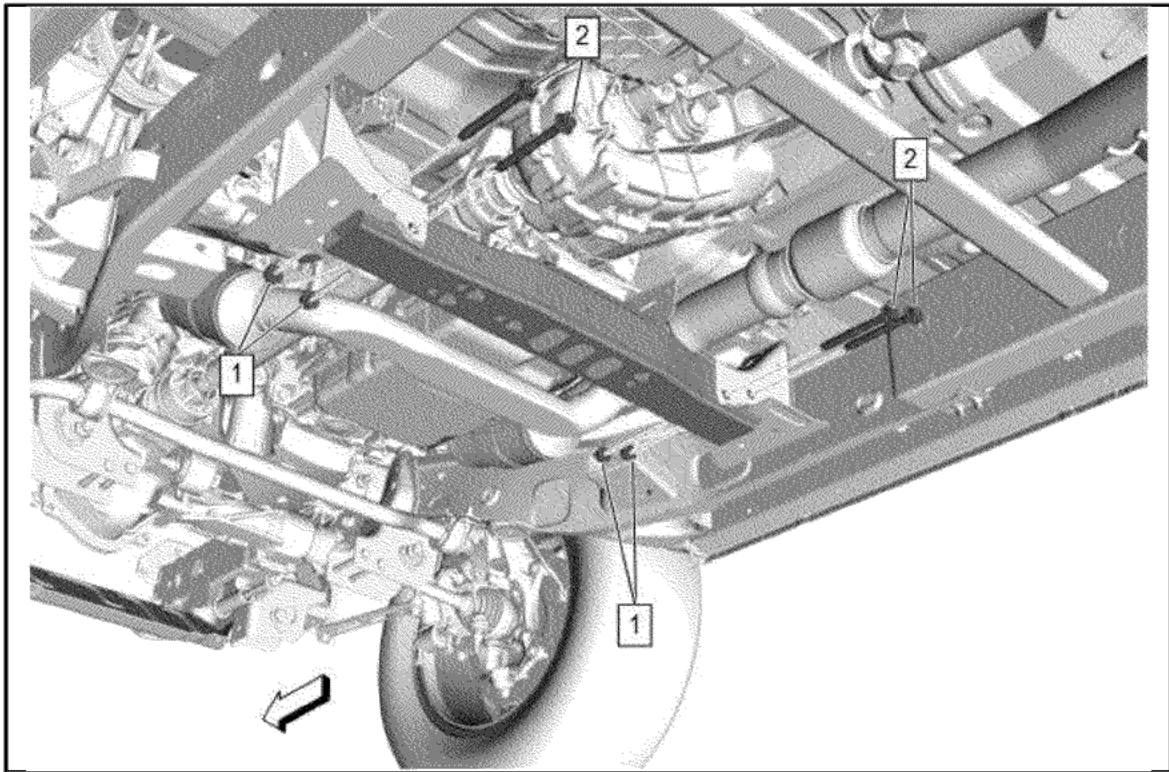
203. { If equipped } Remove the 3 wiring harness retainers (1) from the transmission support crossmember, and reposition the wiring harness (2) as necessary.

204. Support the transmission with a suitable jack.

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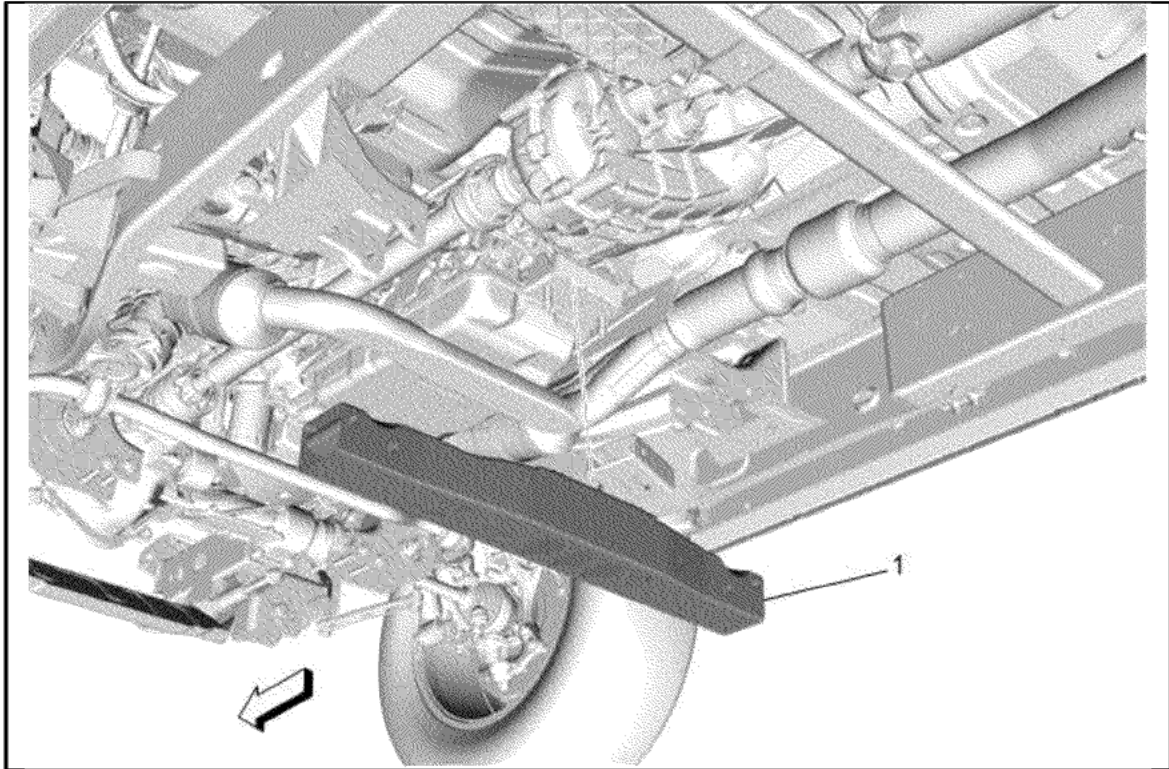


205. Transmission Mount Nut (1) » Remove [2x]

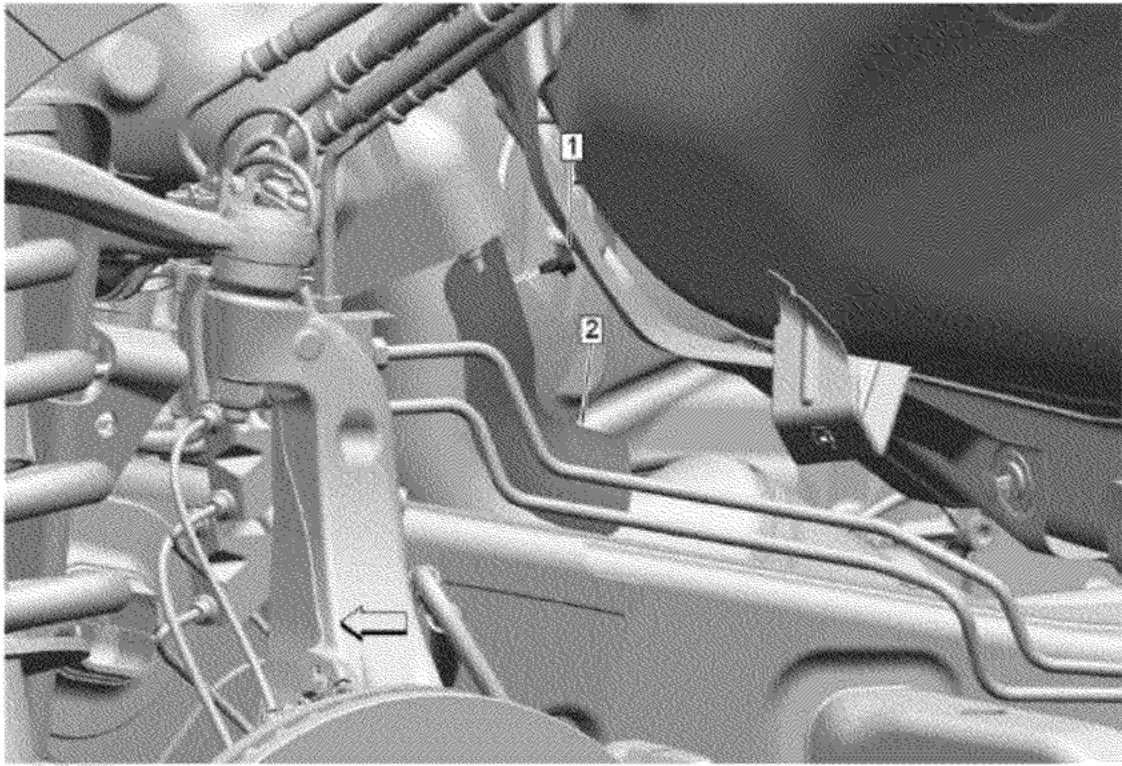


206. Transmission Support Crossmember Nut (1) » Remove [4x]

207. Transmission Support Crossmember Bolt (2) » Remove [4x]

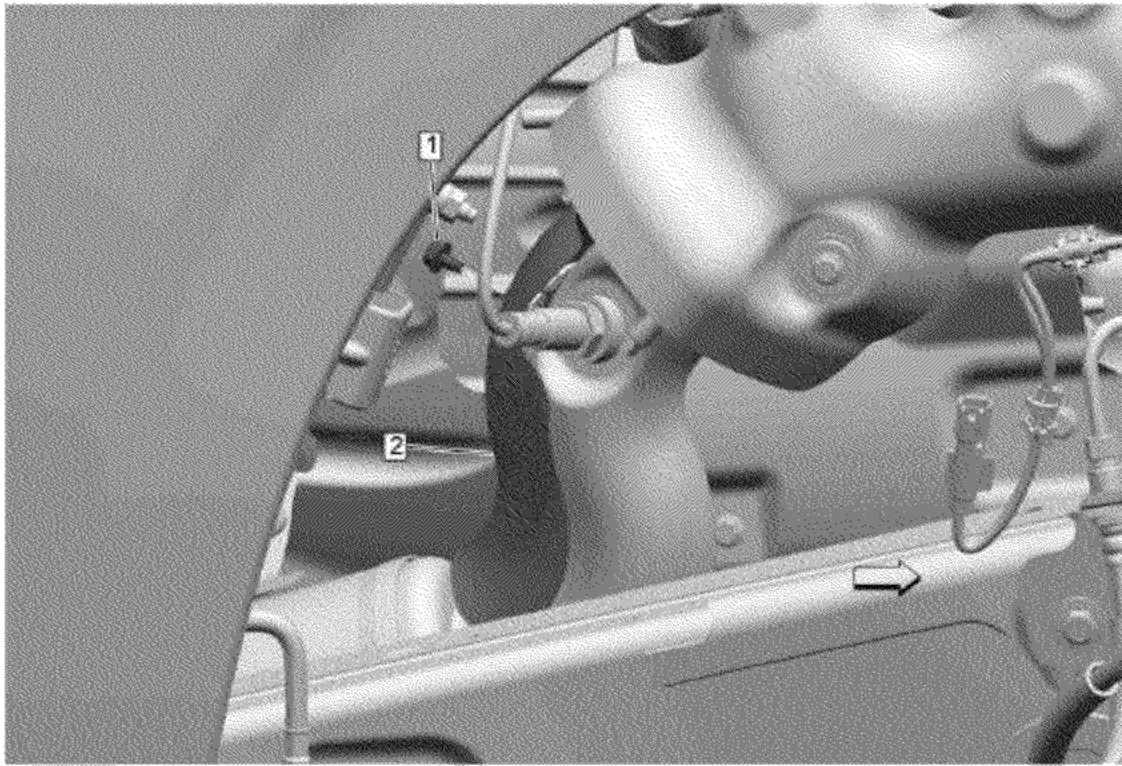


208. Transmission Support Crossmember (1) » Remove



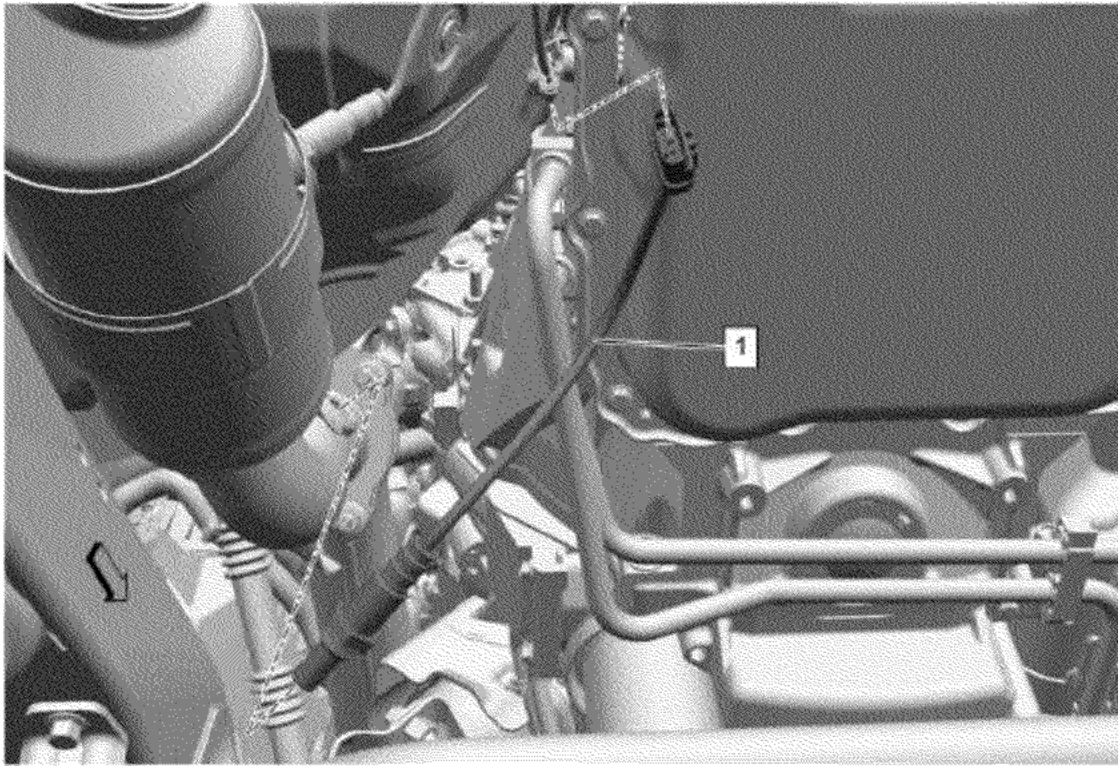
- 209. Exhaust Heat Shield Bolt - Left Side (1) » Remove
- 210. Exhaust Front Pipe Heat Shield - Left Side (2) » Remove

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211. Exhaust Heat Shield Bolt - Right Side (1) » Remove

212. Exhaust Front Pipe Heat Shield - Right Side (2) » Remove



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**Warning:** Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.

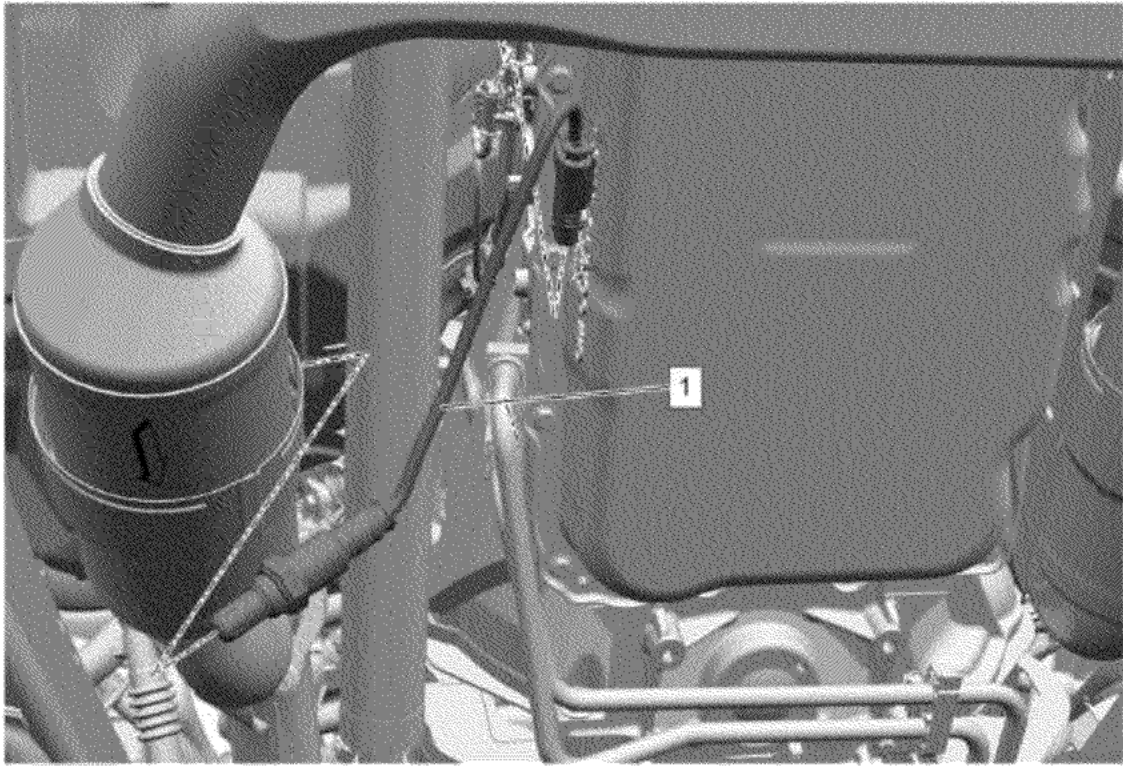
**Caution:** Refer to Heated Oxygen and Oxygen Sensor Caution.

**Note:**

- The heated oxygen sensor in-line connector and louvered end MUST be kept clear of all grease, dirt, and other contaminants. Do NOT use cleaning solvents of any type. Do NOT drop or roughly handle the heated oxygen sensor (1).
- The heated oxygen sensor (1) MAY be difficult to remove when the engine temperature is less than 48°C (120°F).

213. Electrical Connector @ Heated Oxygen Sensor - Bank 1 Sensor 1 » Disconnect

214. Using a suitable tool, remove the heated oxygen sensor (1).

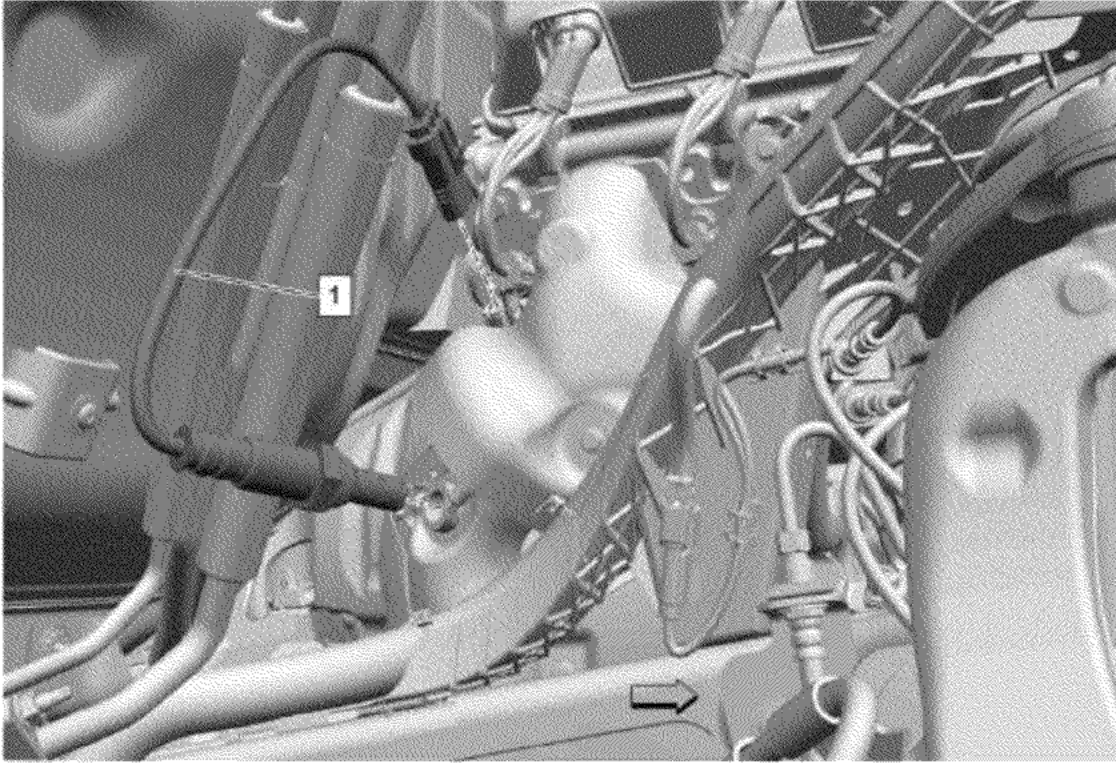


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**Warning:** Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.

**Caution:** Refer to Heated Oxygen and Oxygen Sensor Caution.

215. Electrical Connector @ Heated Oxygen Sensor - Bank 1 Sensor 2 » Disconnect



**Warning:** Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.

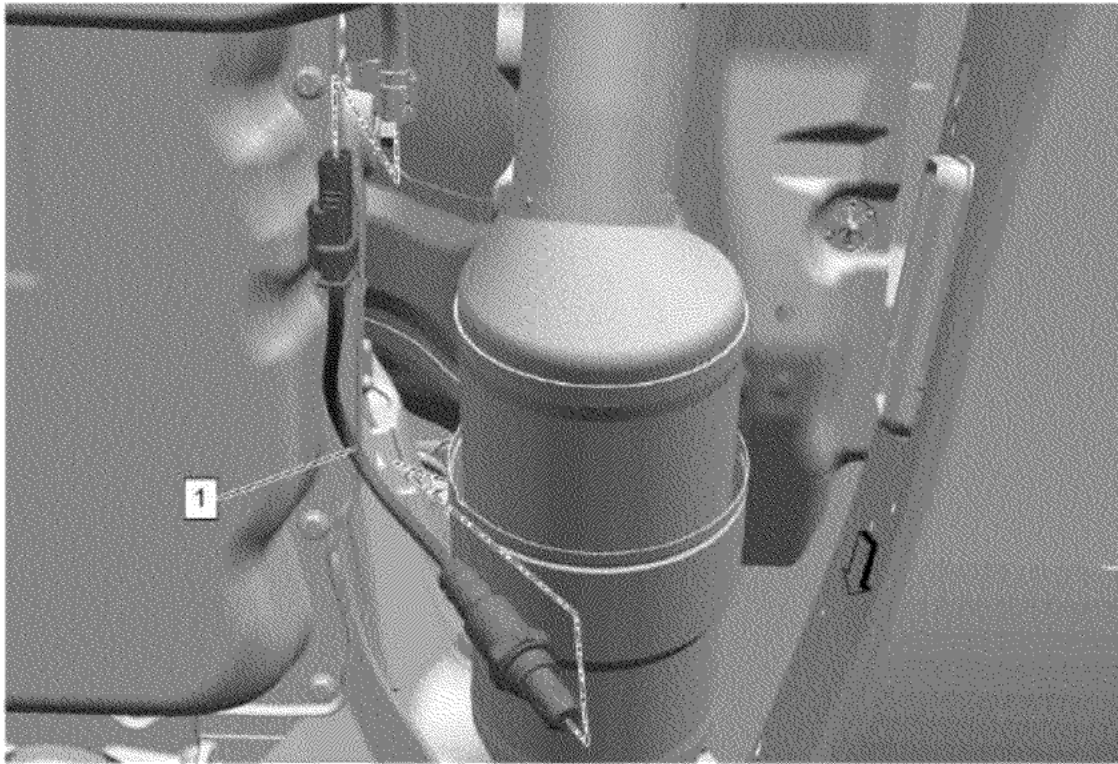
**Caution:** Refer to Heated Oxygen and Oxygen Sensor Caution.

**Note:**

- The heated oxygen sensor in-line connector and louvered end MUST be kept clear of all grease, dirt, and other contaminants. Do NOT use cleaning solvents of any type. Do NOT drop or roughly handle the sensor.
- The heated oxygen sensor MAY be difficult to remove when the engine temperature is less than 48°C (120°F).

216. Electrical Connector @ Heated Oxygen Sensor - Bank 2 Sensor 1 » Disconnect

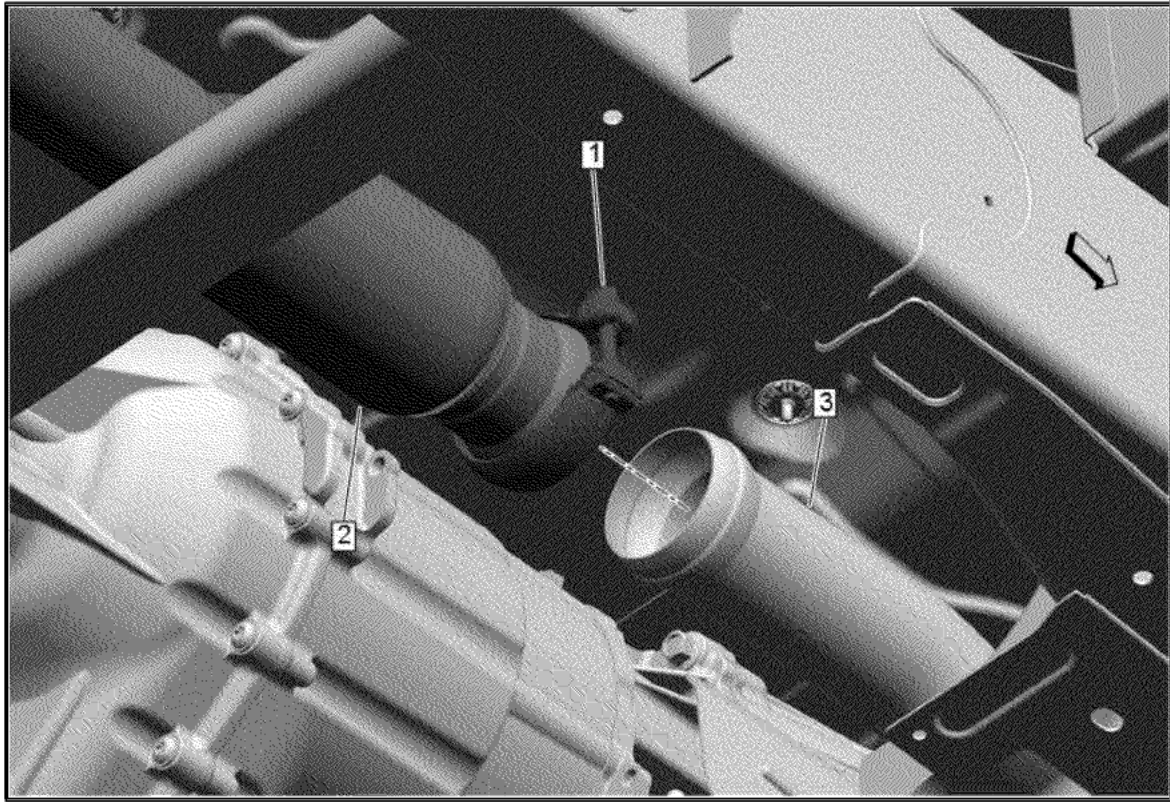
217. Using a suitable tool, remove the heated oxygen sensor (1).



**Warning:** Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.

**Caution:** Refer to Heated Oxygen and Oxygen Sensor Caution.

218. Electrical Connector @ Heated Oxygen Sensor - Bank 2 Sensor 2 » Disconnect

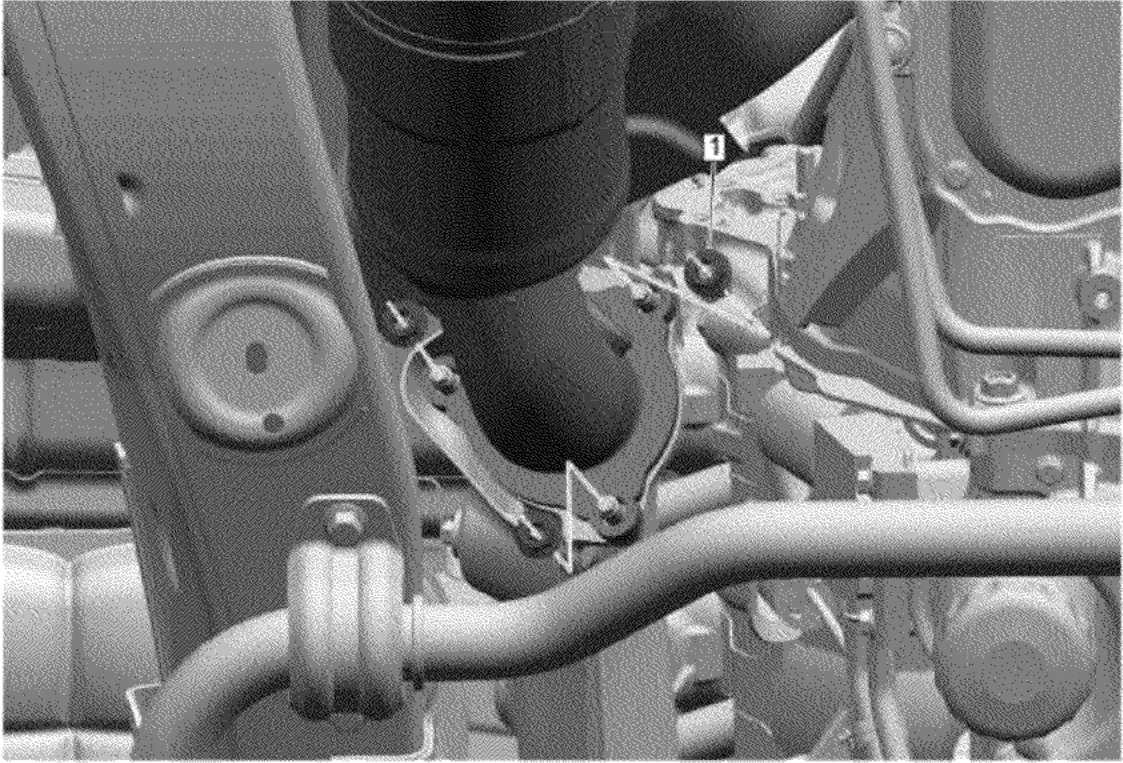


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**Warning:** Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.

219. Exhaust Pipe Clamp (1) » Loosen

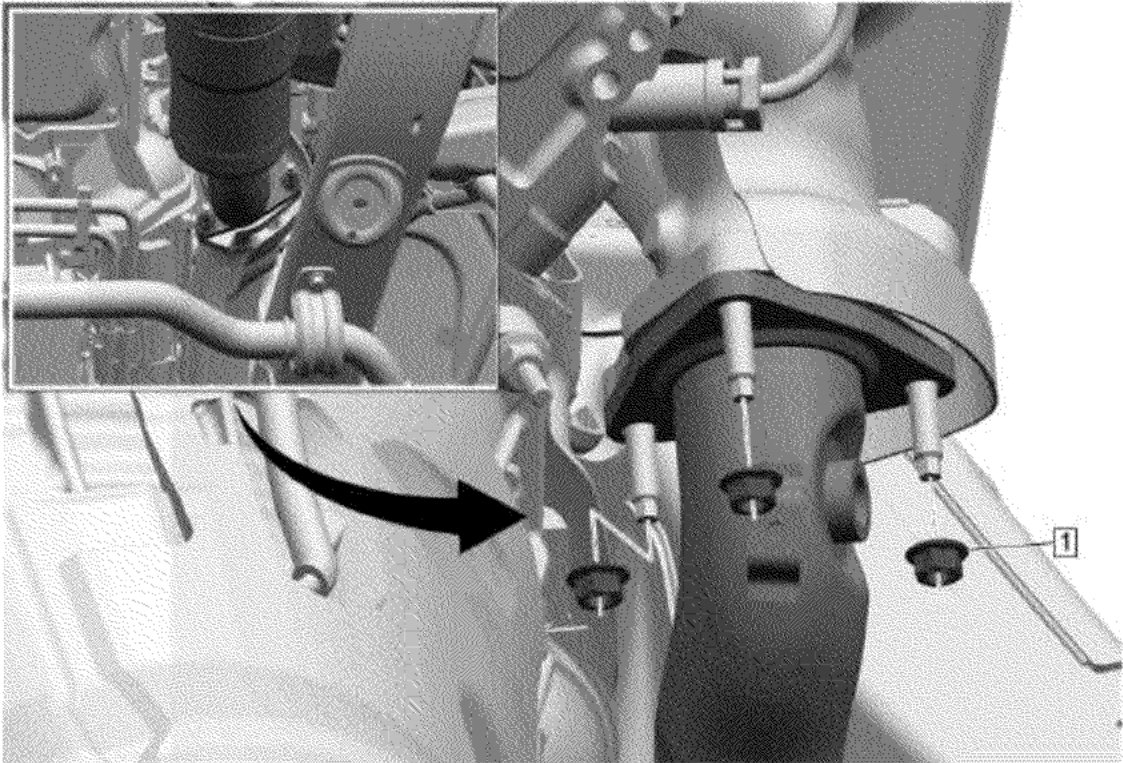
220. Exhaust Muffler (2) @ Three-Way Catalytic Converter (3) » Separate



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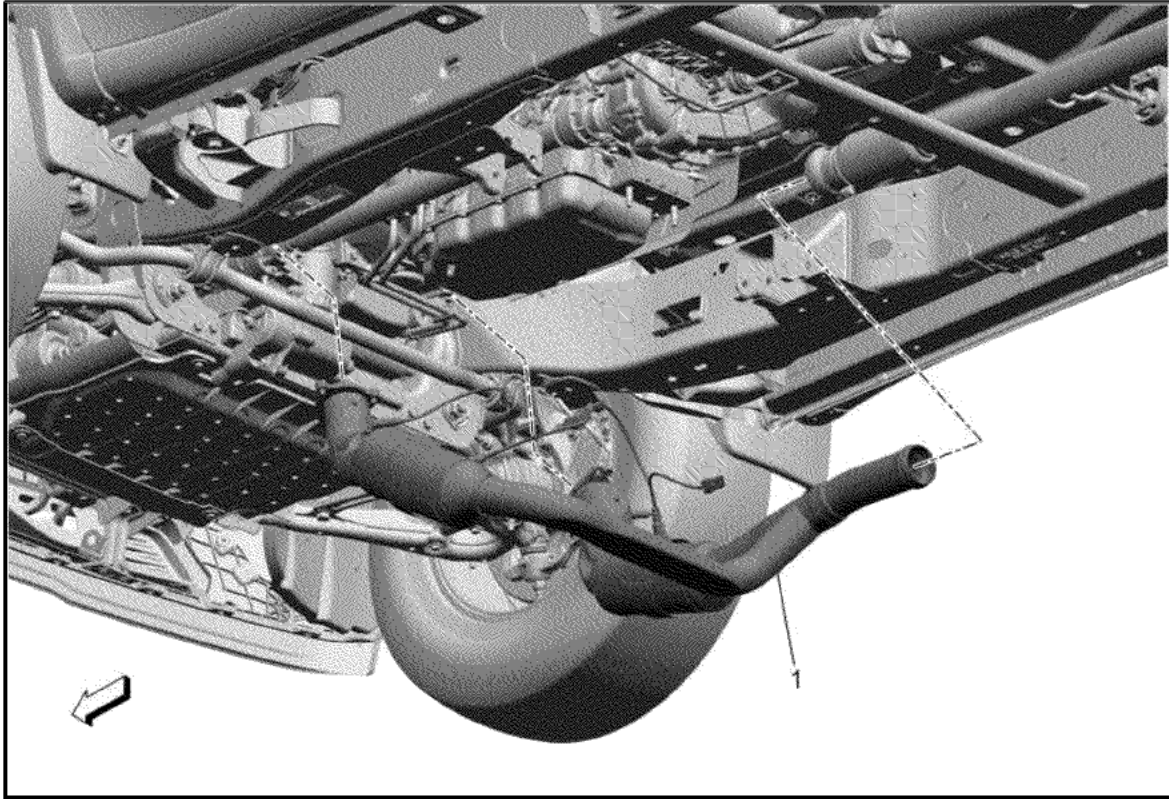
**Warning:** In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool.

221. Exhaust Front Pipe Nut - Left Side (1) » Remove [3x]



**Warning:** In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool.

222. Exhaust Front Pipe Nut - Right Side (1) » Remove [3x]

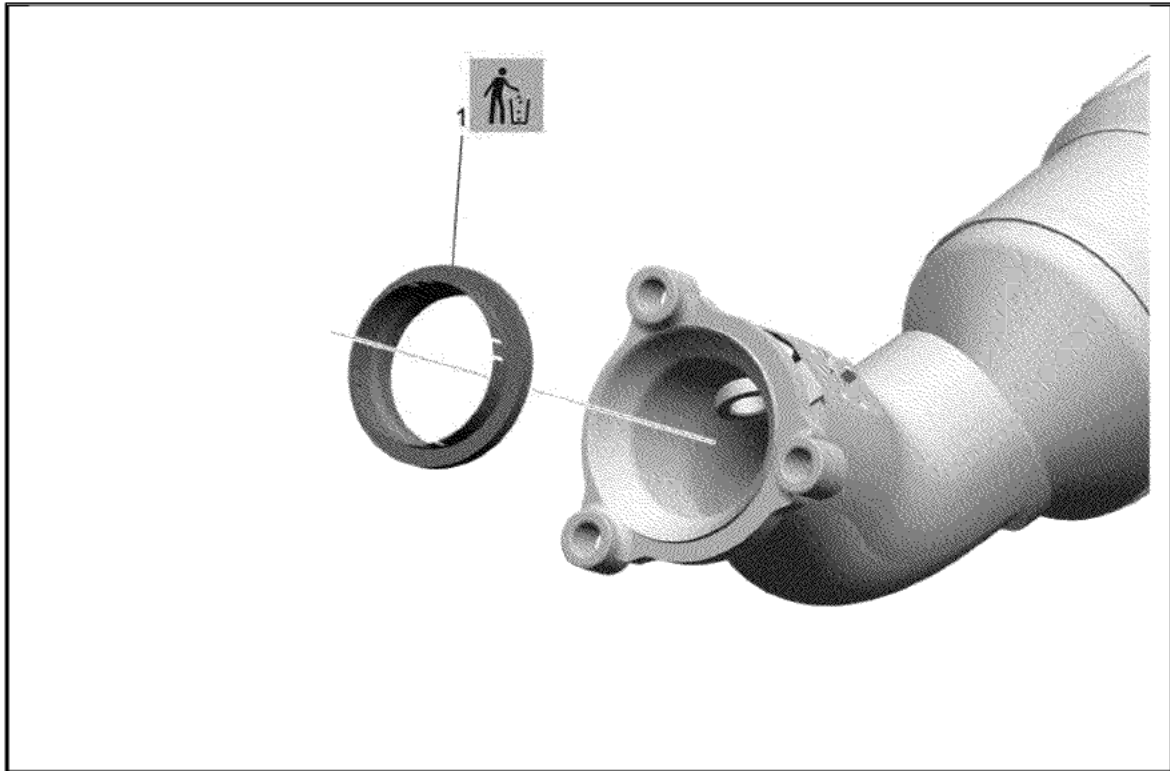


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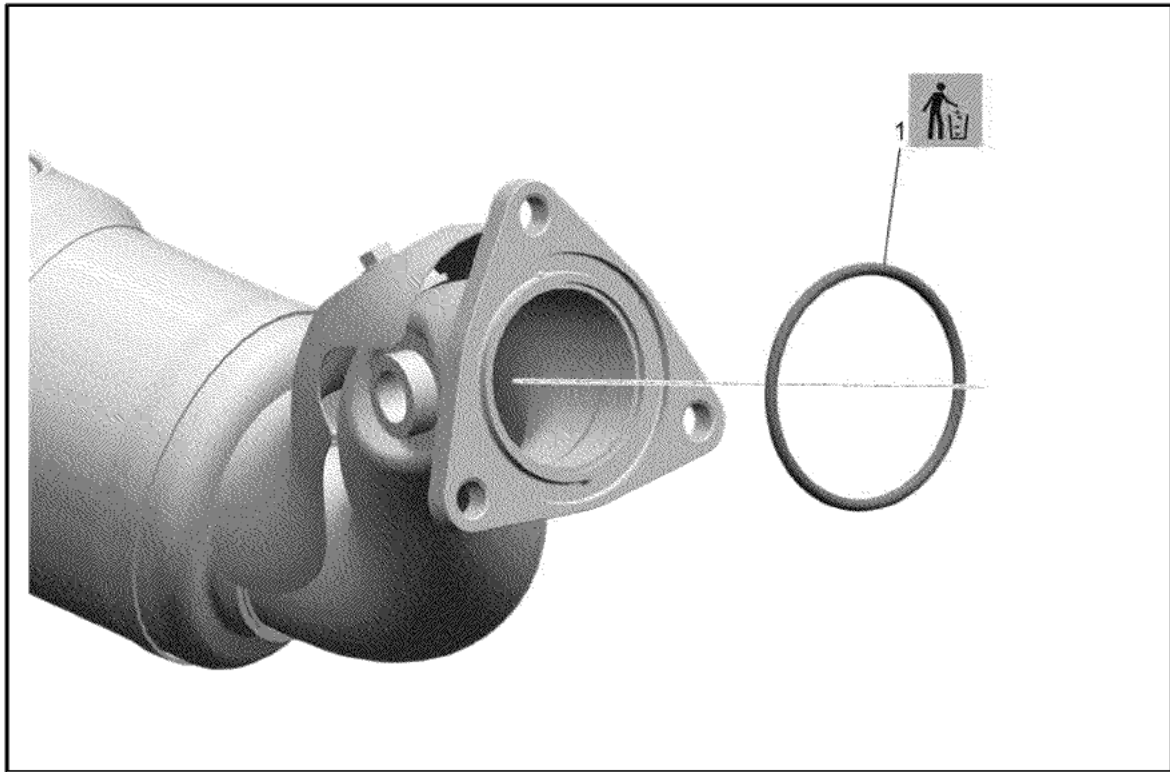


**Warning:** Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.

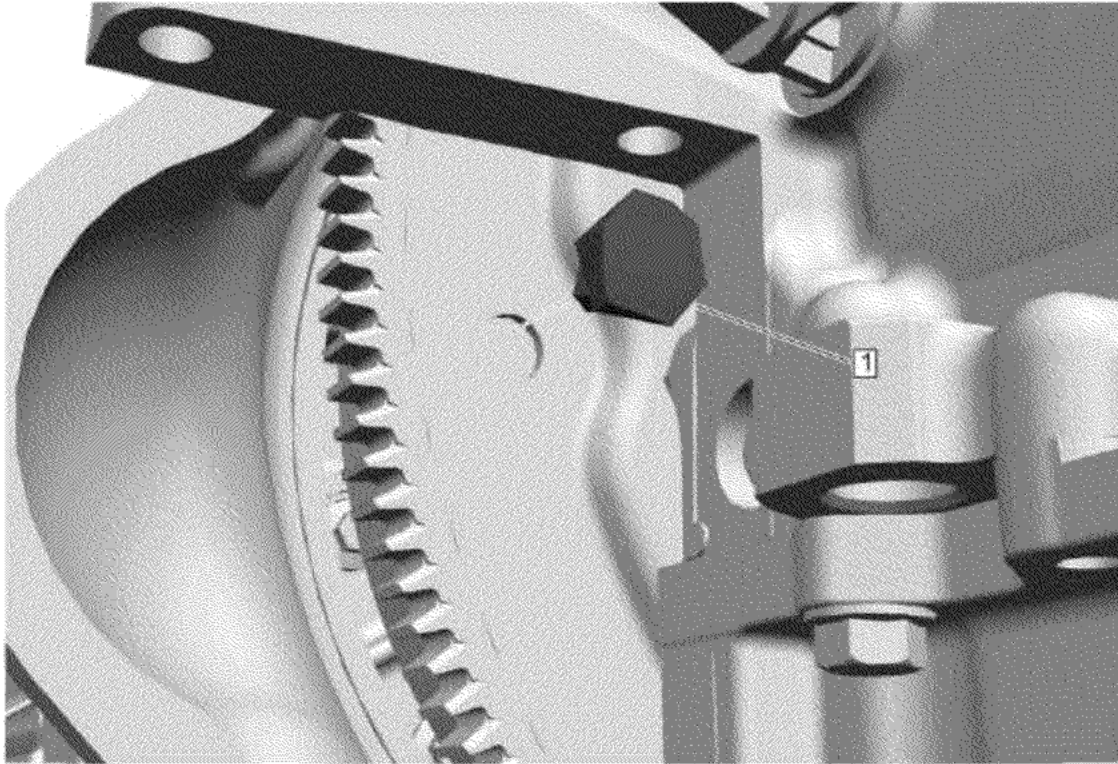
223. Three-Way Catalytic Converter (1) » Remove



224. Exhaust System Seal (1) » Remove and DISCARD



225. Exhaust System Seal (1) » Remove and DISCARD

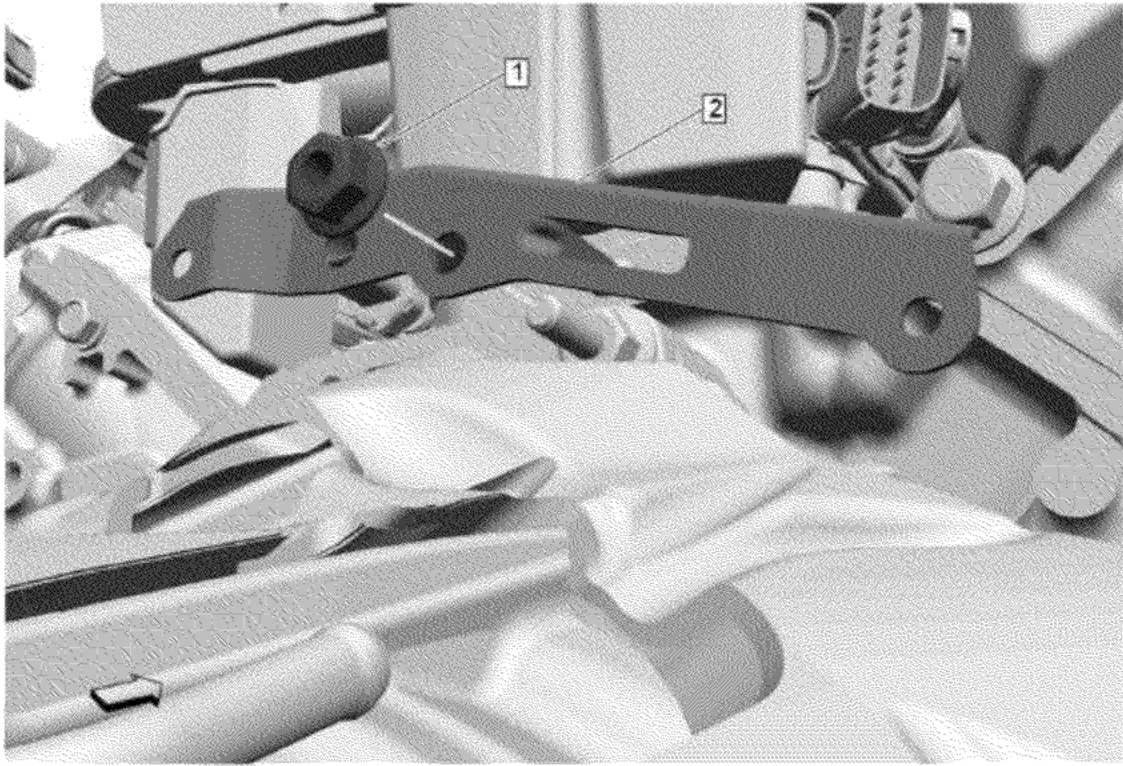


226. Repeat the following steps for all torque converter bolts (1):

226.1. Rotate the harmonic balancer center bolt clockwise ONLY, to align the torque converter bolt with the starter opening.

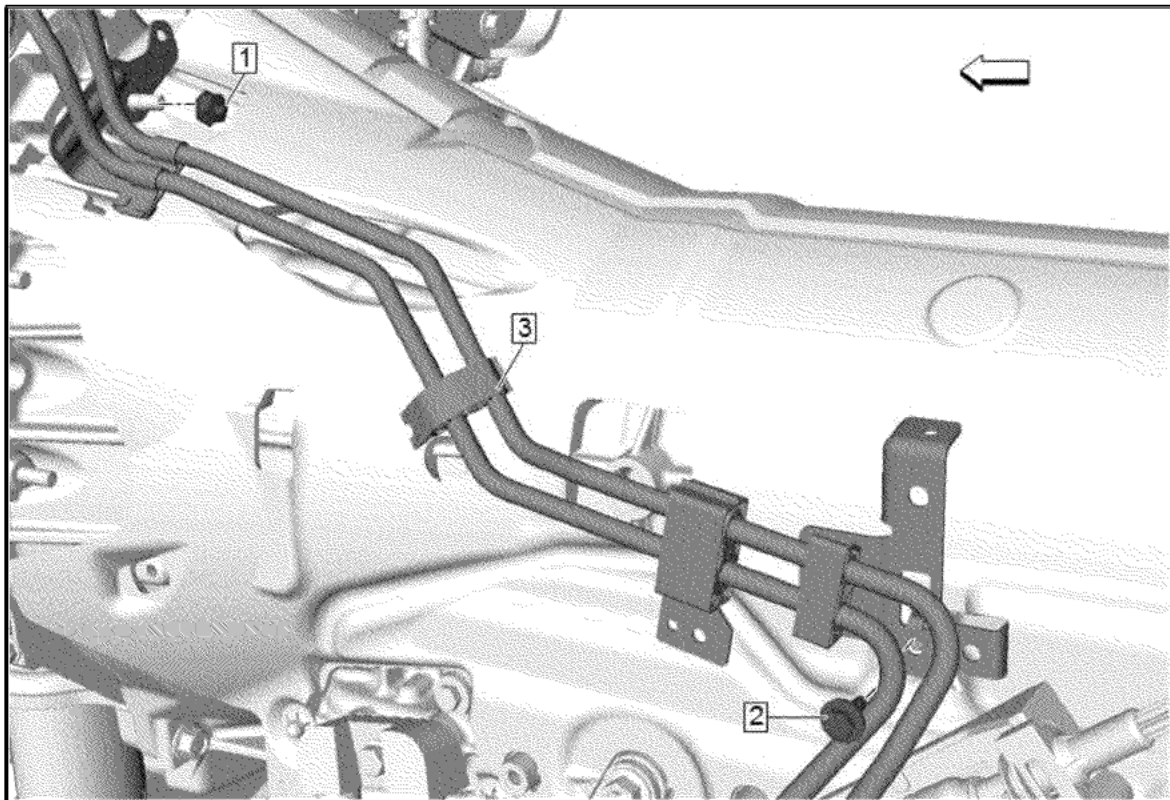
226.2. Torque Converter Bolt (1) » Remove [6x]

227. Lower the transmission to gain access to the top and sides of the transmission.

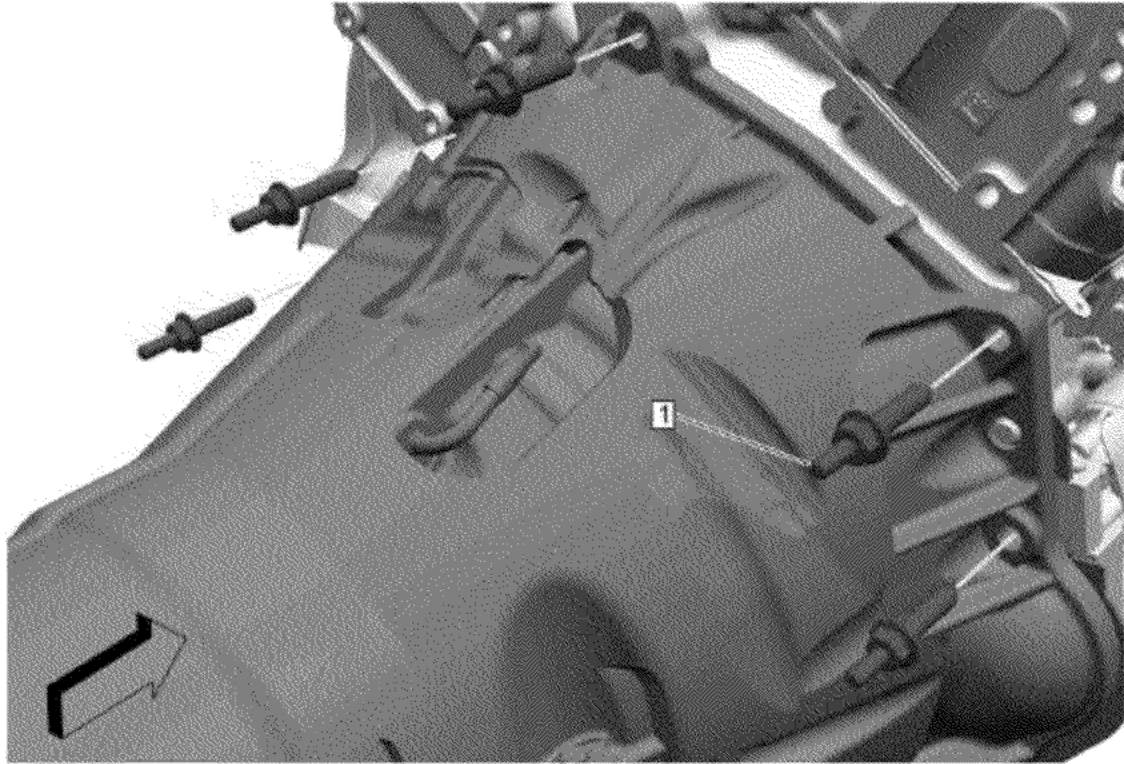


228. Remove the transmission vent hose clip bracket nut (1).

229. Remove the transmission vent hose clip bracket (2) from the transmission.



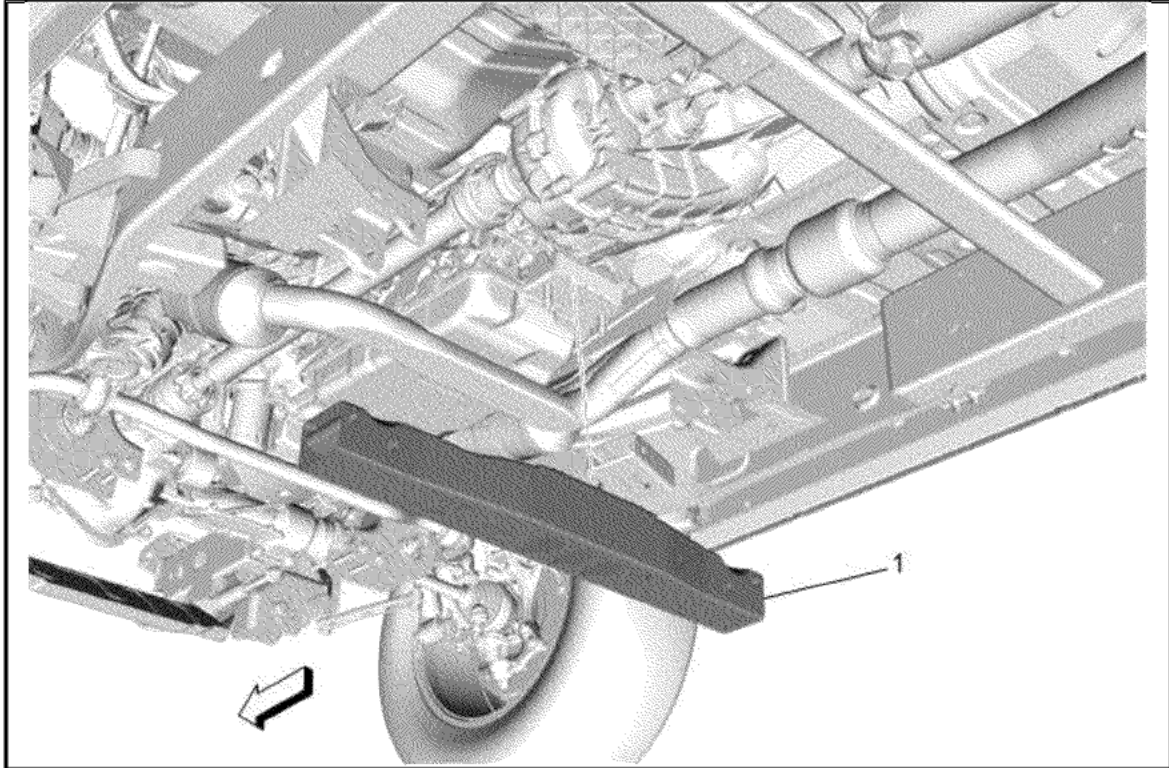
230. Remove the fuel feed and return front hose bracket nut (1).
231. Remove the fuel feed and return front hose bracket bolt (2).
232. Reposition the fuel feed and return front hose (3) as necessary.



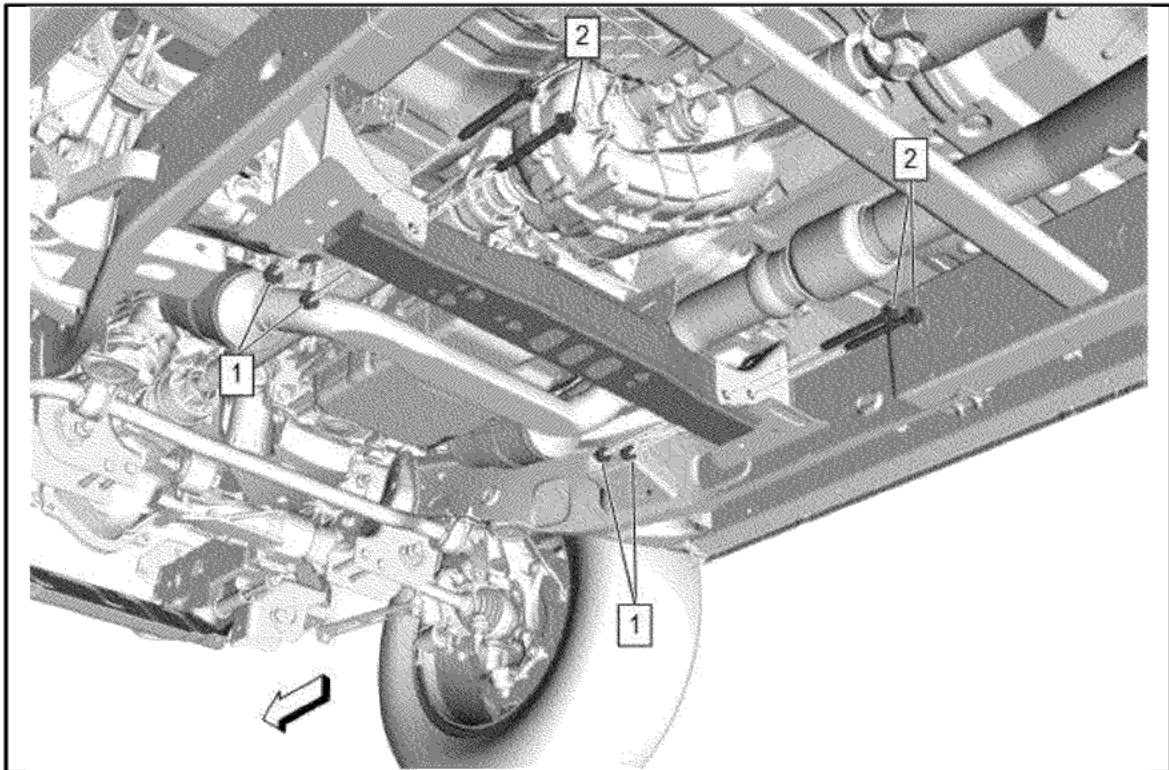
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233. Transmission Stud (1) » Remove [5x]
234. Raise the transmission to the original installation position.

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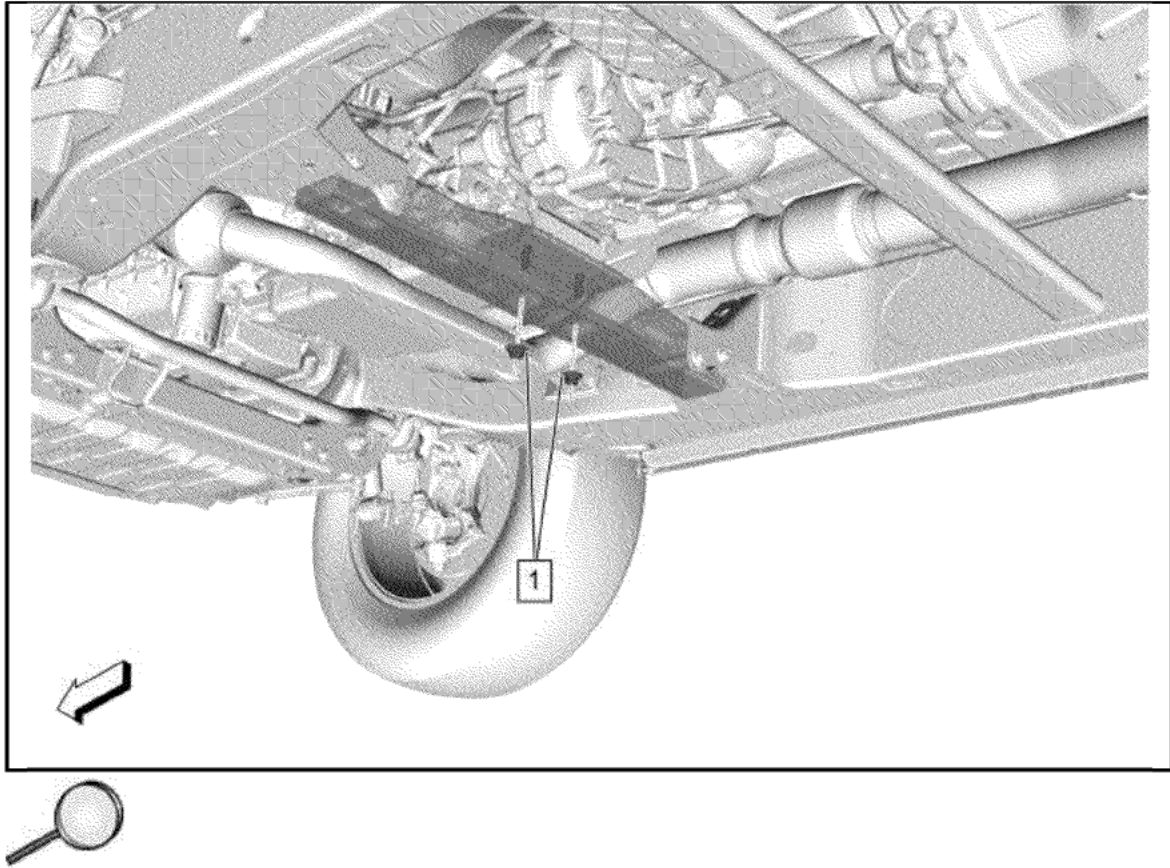


235. Transmission Support Crossmember (1) » Install



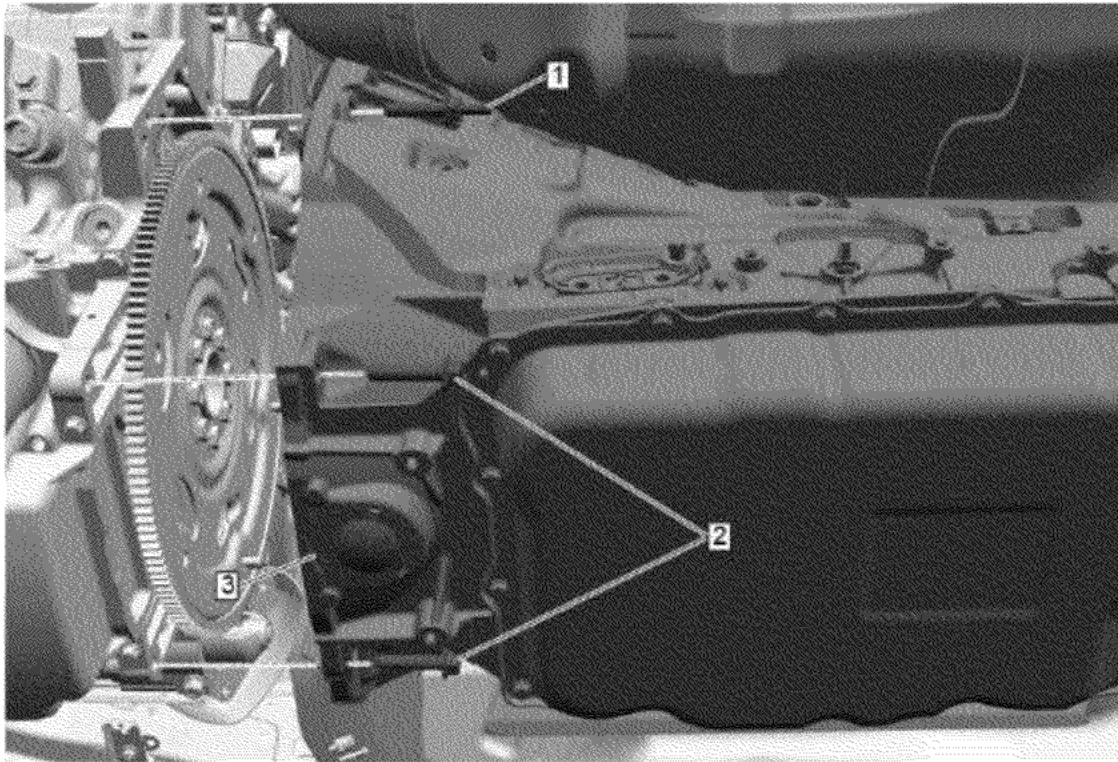
236. Transmission Support Crossmember Bolt (2) » Install [4x]

237. Transmission Support Crossmember Nut (1) » Install and hand tighten [4x]



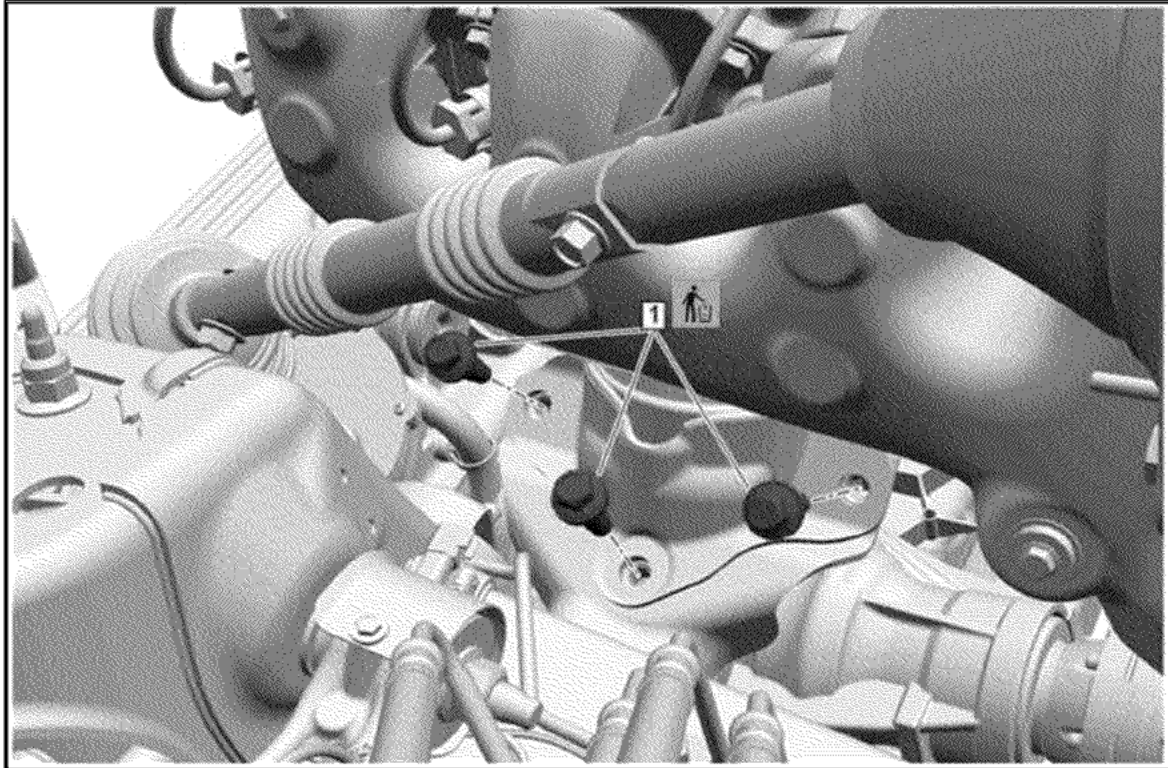
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238. Transmission Mount Nut (1) » Install and hand tighten [2x]



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239. Transmission Stud (1) » Remove
240. Transmission Bolt (2) » Remove [2x]
241. Disconnect the electrical connectors from the transmission assembly, then position the wiring harness on the engine assembly.
242. Remove the support and lower the vehicle.

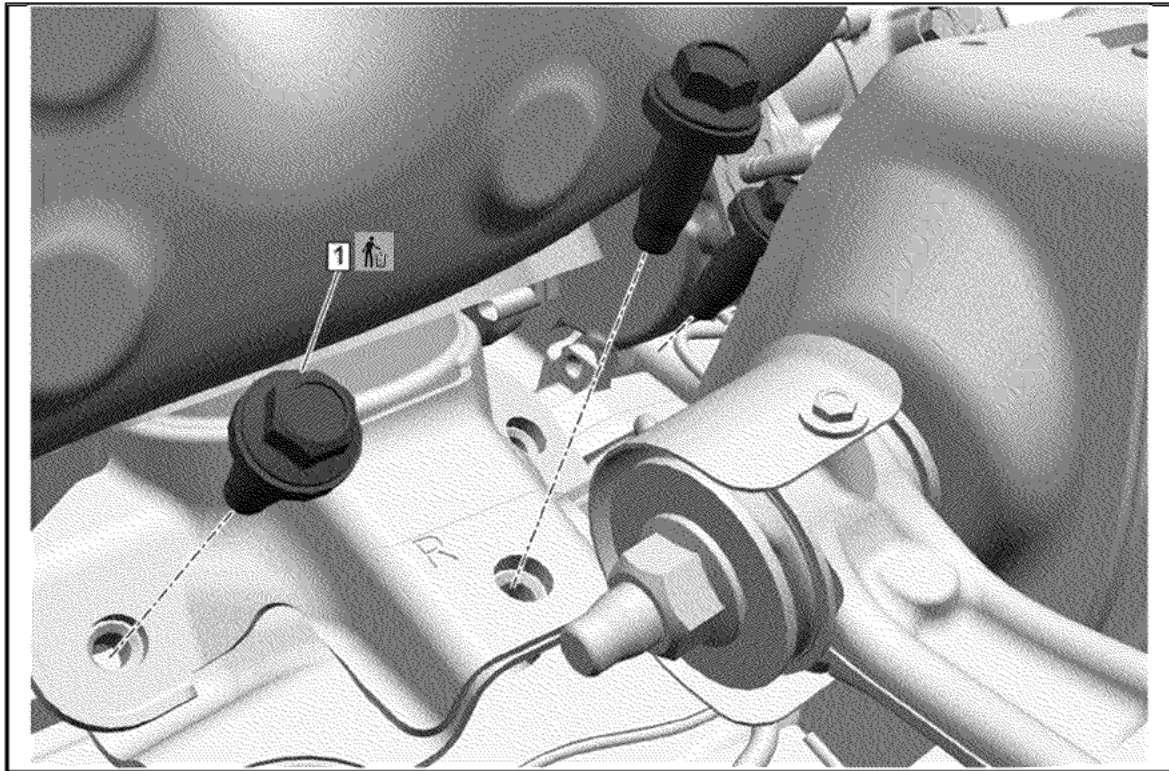


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**Caution:** Broken engine mountings can cause misalignment of certain drive-train components. Misalignment of drive-train components causes eventual destruction of the drive-train components.  
If one engine mount breaks, the rest of the engine mounts will have increased stress put on them. This could cause the rest of the engine mounts to break.

**Note:** Work through the front wheelhouse opening to access the 3 engine mount frame side bolts (1).

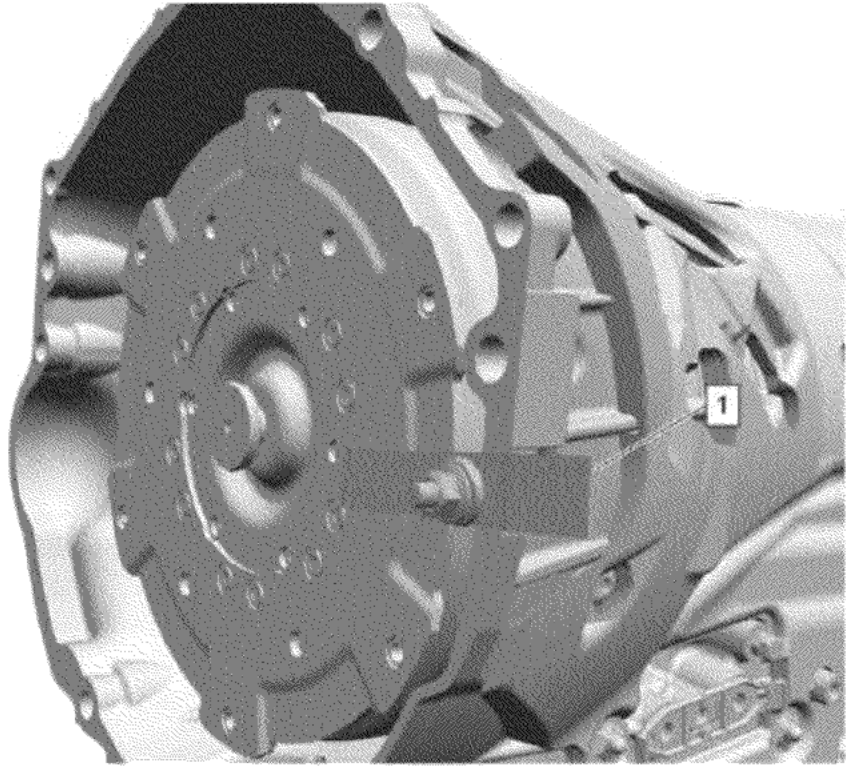
243. Engine Mount Frame Side Bolt - Left Side (1) » Remove and DISCARD [3x]



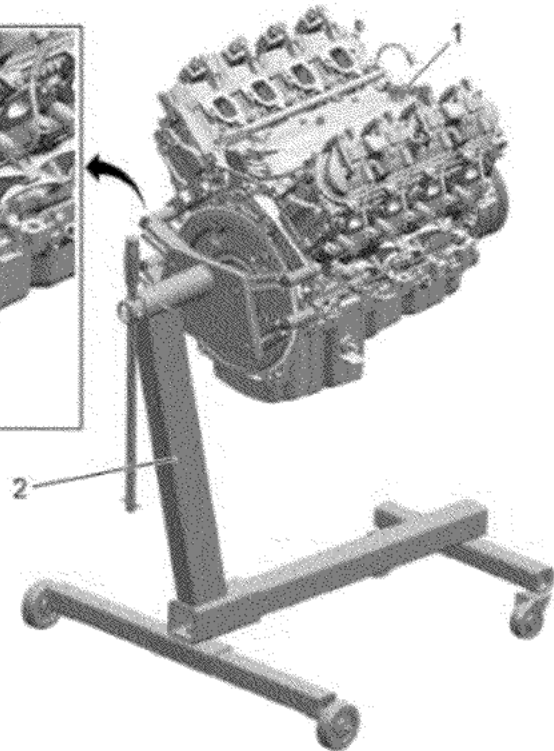
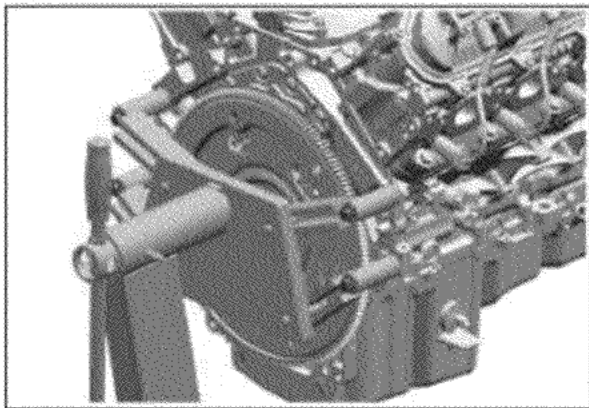
**Caution:** Broken engine mountings can cause misalignment of certain drive-train components. Misalignment of drive-train components causes eventual destruction of the drive-train components.  
If one engine mount breaks, the rest of the engine mounts will have increased stress put on them. This could cause the rest of the engine mounts to break.

**Note:** Work through the front wheelhouse opening to access the 3 engine mount frame side bolts (1).

244. Engine Mount Frame Side Bolt - Right Side (1) » Remove and DISCARD [3x]
245. Install a suitable chain to the two engine lift brackets to support the engine.
246. Use a suitable stand to support the transmission.
247. Disconnect the remaining electrical connectors, retainers and reposition the wiring harness.
248. Using a suitable engine lifting device, remove the engine from the vehicle.

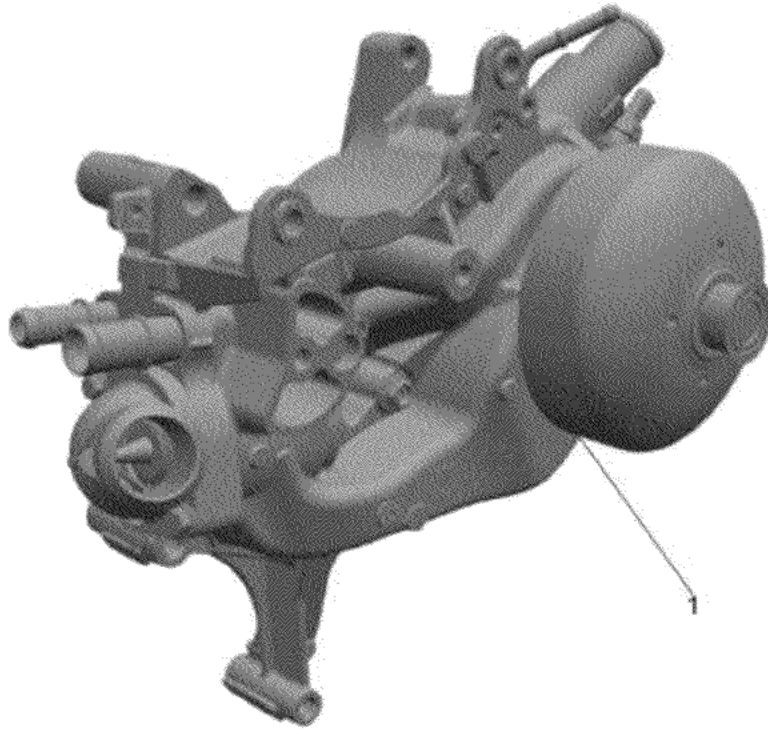


249. Install the *DT-21366* Converter Holding Strap (1) onto the transmission to retain the torque converter.



250. Mount the engine (1) onto the engine stand (2).

### Cleaning and Inspection Procedure - Required

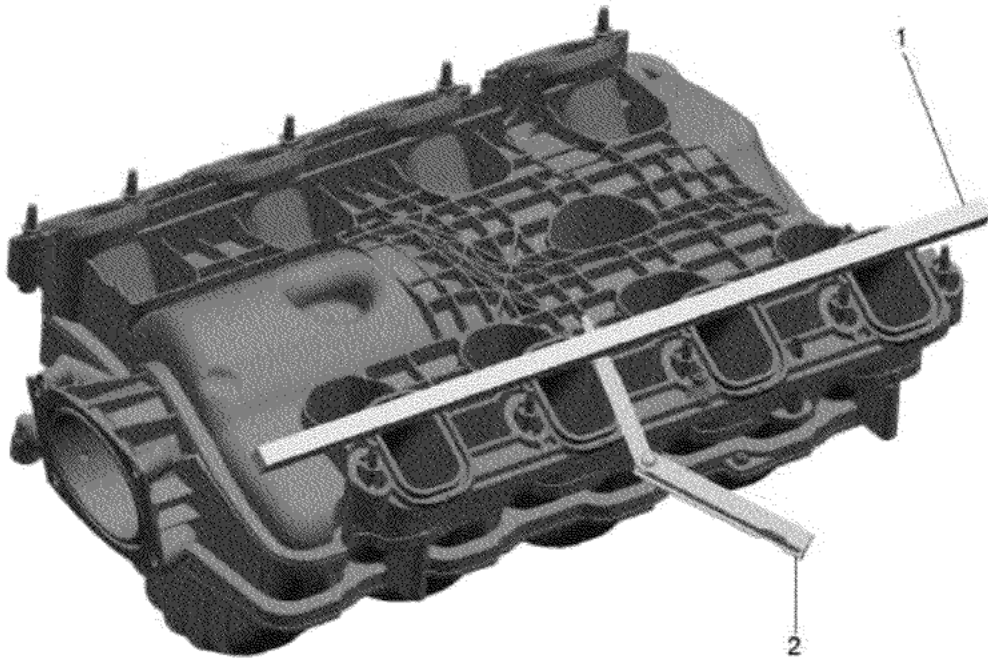


1. Clean all excess dirt and debris from the water pump (1).
2. Inspect the water pump (1) for the following conditions:
  - 2.1. Water pump gasket and hose sealing surfaces for excessive scratches or gouging
  - 2.2. Restrictions within the internal coolant passages
  - 2.3. Excessive side-to-side play in the pulley shaft
  - 2.4. Leakage at the water inlet housing or rear cover
  - 2.5. Leakage at the water outlet housing or water pump outlet
  - 2.6. Leakage at the water pump vent hole

A stain around the vent hole is acceptable. If leakage or dripping occurs with the engine running and the cooling system pressurized, replace the water pump (1).
  - 2.7. Wear or damage in the belt tracking area of the water pump pulley

### Cleaning and Inspection Procedure - Conditional

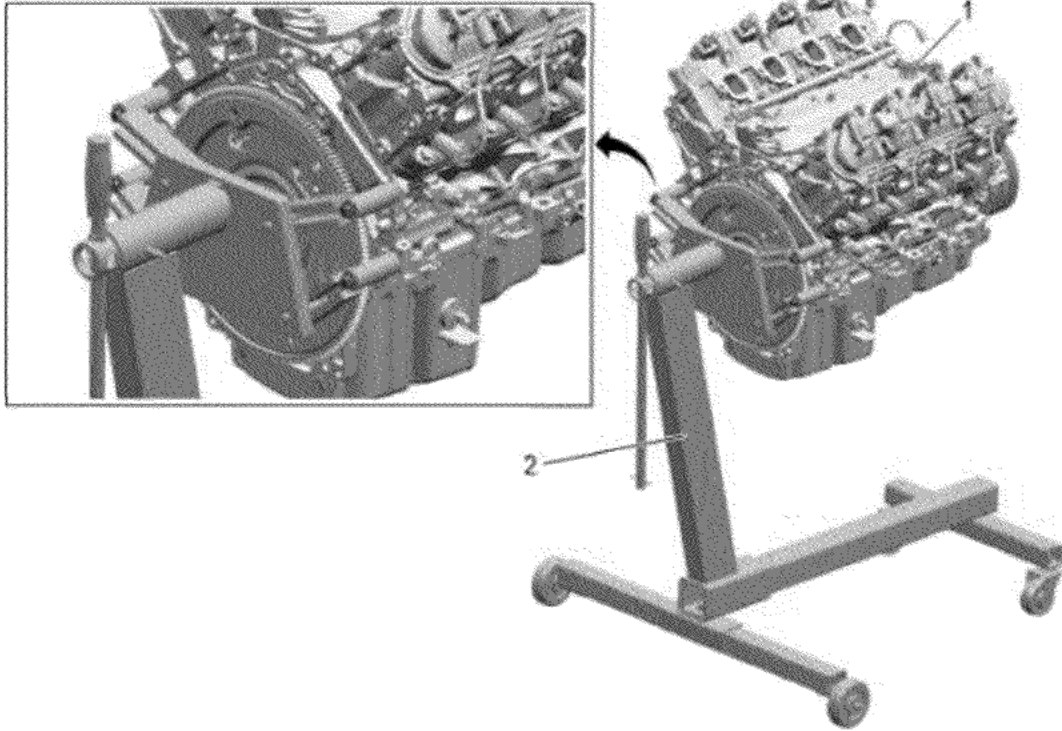
**Note:** The following cleaning and inspection and/or overhaul steps are ONLY to be performed as determined necessary based on the condition of the part being removed with the intention of reinstallation.



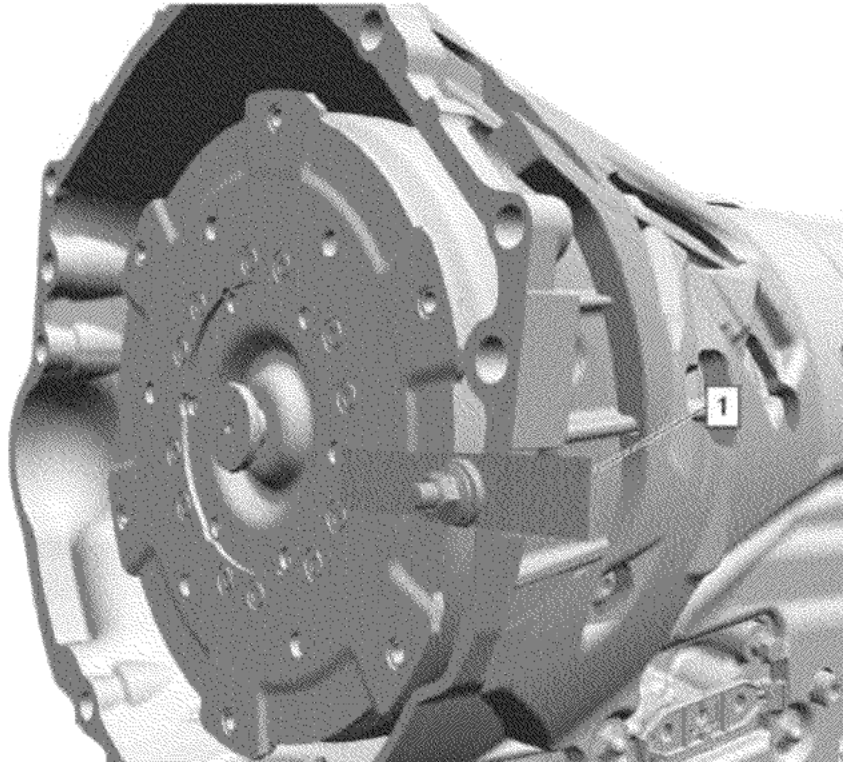
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1. Clean all sealing surfaces.
2. Dry the intake manifold with compressed air.
3. Inspect the intake manifold cylinder head deck for warpage.
4. Place a straight edge (1) across the intake manifold cylinder head deck surface.
5. Inspect the intake manifold for the following conditions:
  - 5.1. Inspect for loose threaded inserts or studs.
  - 5.2. Inspect for damaged or broken vacuum fitting.
  - 5.3. Inspect the intake manifold assembly for cracks or other damage.
  - 5.4. Inspect for damaged intake manifold gasket sealing surfaces.
6. Position the straight edge (1) across a minimum of two runner port openings and check for warpage using a feeler gage. [Engine Mechanical Specifications](#)
7. Inspect the ventilation system passages for restrictions.

### **Installation Procedure**

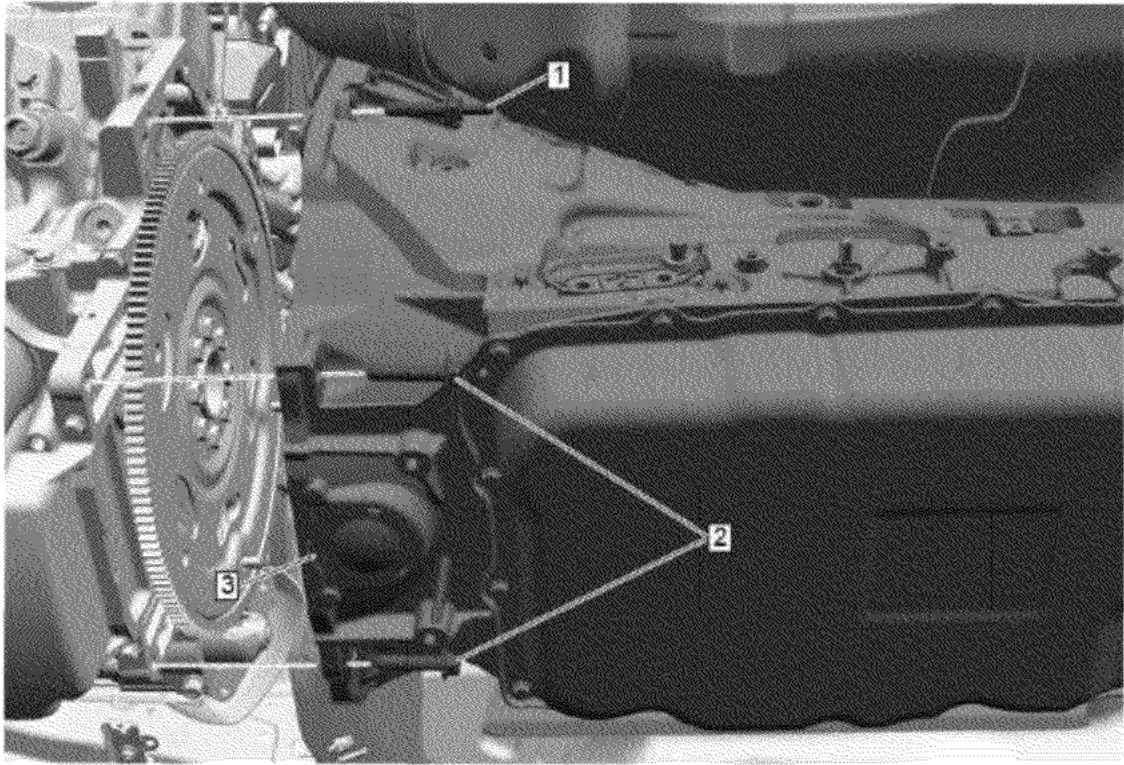


1. Using a suitable engine lifting device, remove the engine (1) from the engine stand (2).



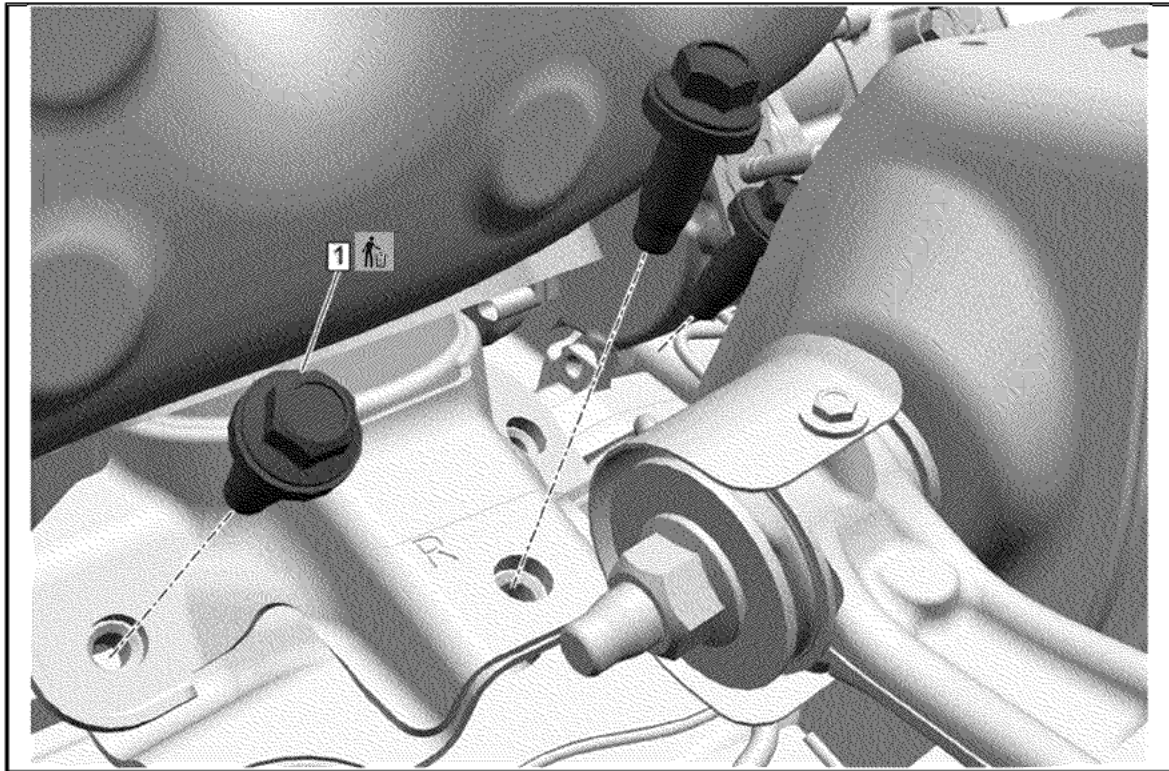
2. Remove the *DT-21366* Converter Holding Strap (1) from the transmission which is retaining the torque converter.

3. Position the engine to the transmission assembly.

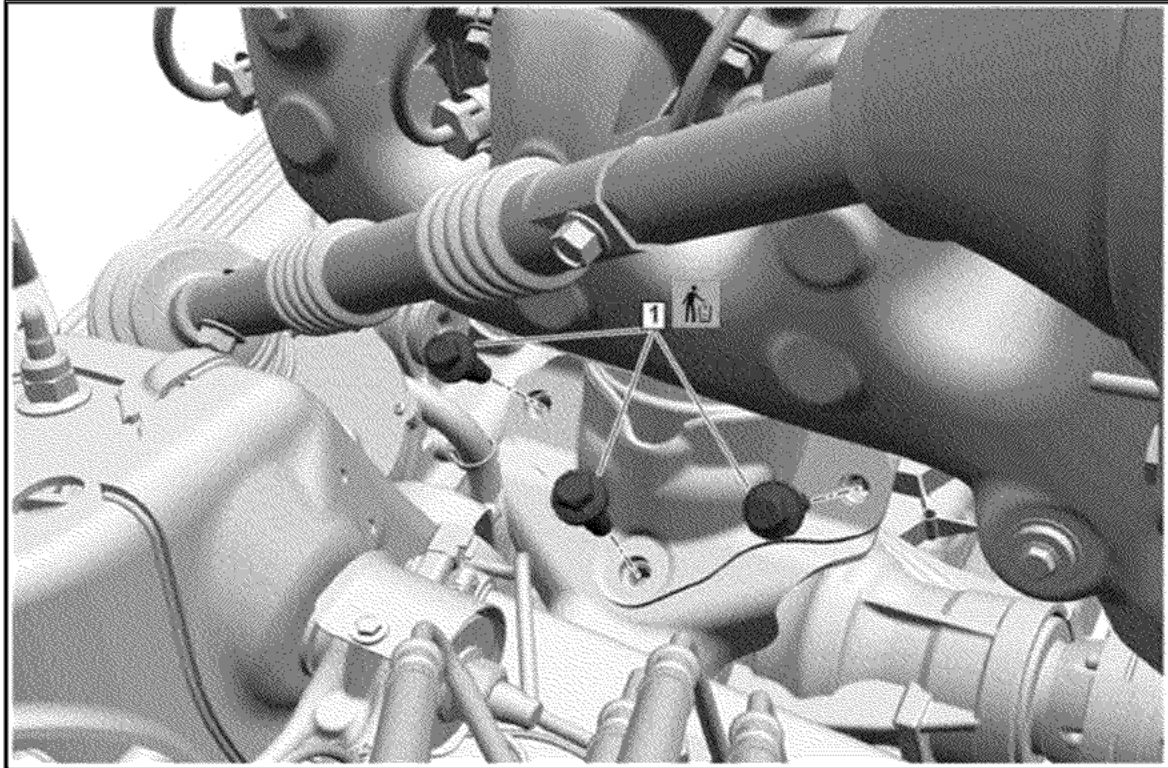


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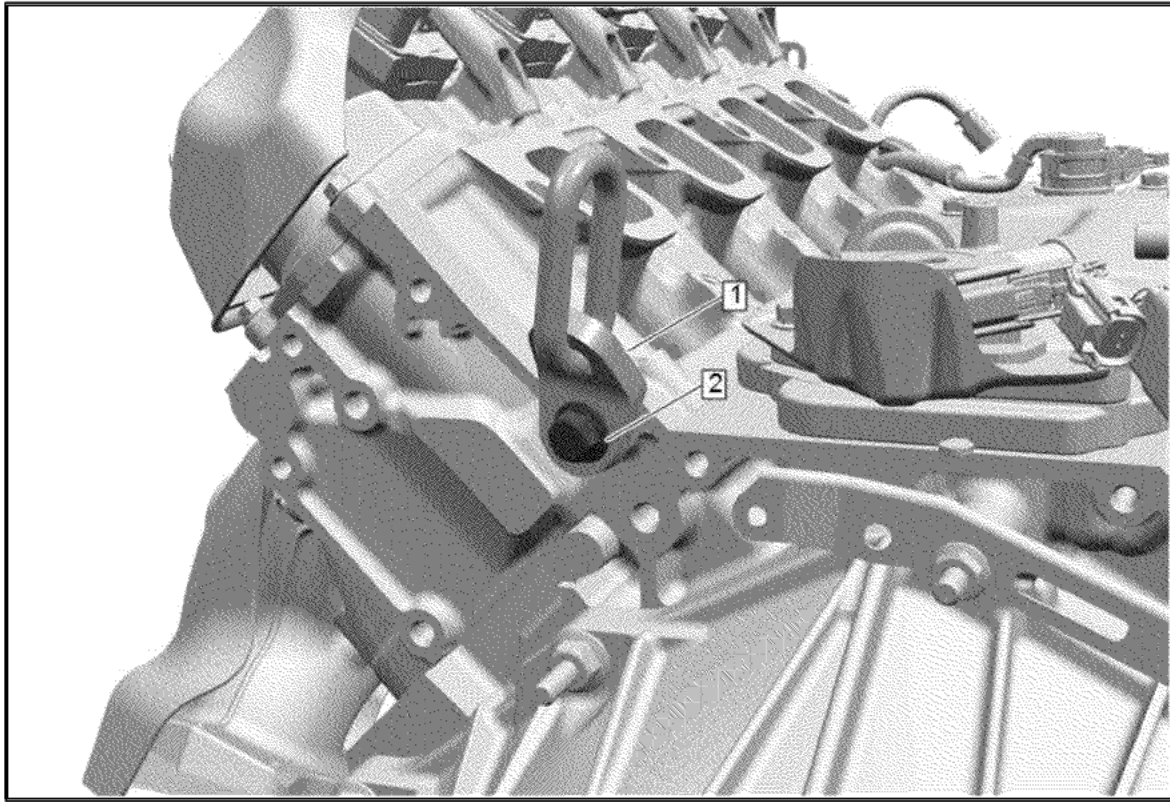
4. Transmission Bolt (2) » Install and tighten [2x] — [Fastener Specifications](#)
5. Transmission Stud (1) » Install and tighten — [Fastener Specifications](#)
6. Connect the required electrical connectors, retainers and reposition the wiring harness.



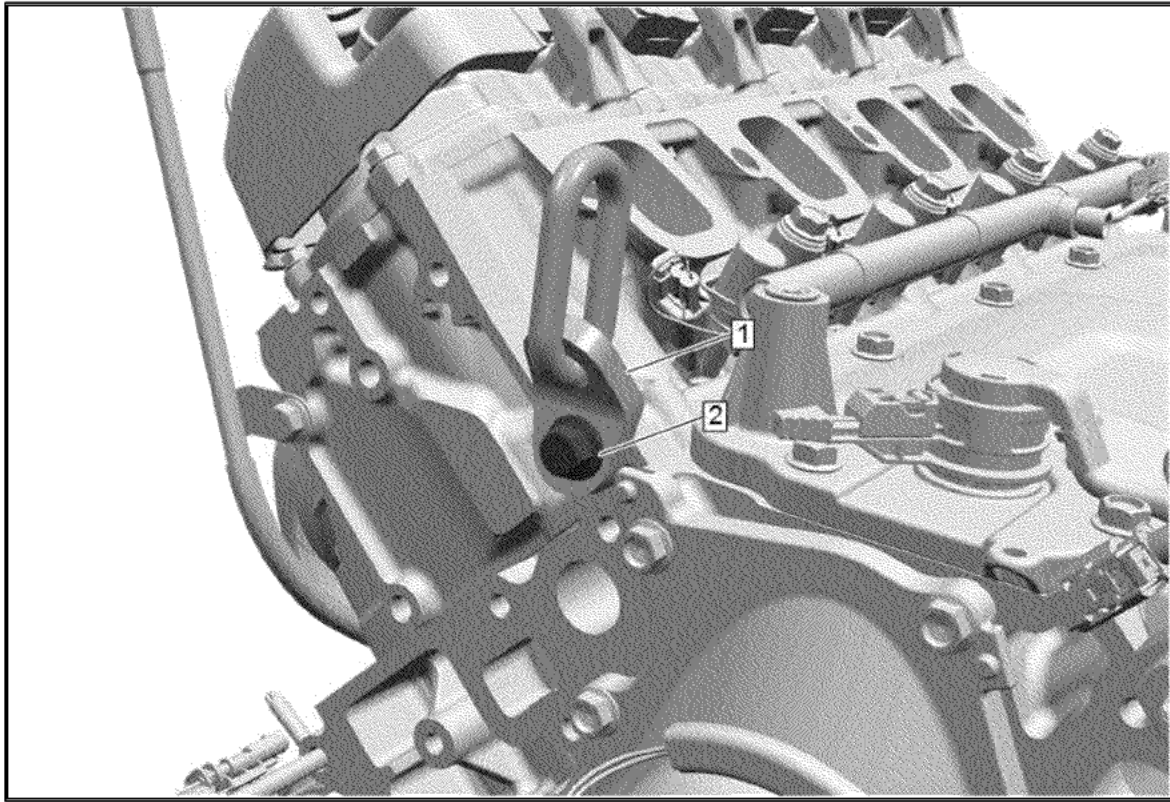
7. If NEW threaded components are being installed, loosen the adhesive using a metal pick or similar tool before proceeding. If threaded components are reused, prepare the threaded components using the following steps:
  - 7.1. Remove any loose cured adhesive from the external threads of the components using a lint free cloth.
  - 7.2. Thread the cleaned components into the internal mating threads and remove to loosen trapped cured adhesive.
  - 7.3. Remove loose debris from internal and external threads using compressed air.
  - 7.4. Apply liquid thread locking adhesive in a strip along half of the length of the external threads, starting at the tip, just prior to installation. Adhesives, Fluids, Lubricants, and Sealers
8. Engine Mount Frame Side Bolt - Right Side (1) » Install NEW and hand tighten [3x]
9. Engine Mount Frame Side Bolt - Right Side (1) » Tighten in sequence [3x] — Fastener Specifications



10. If NEW threaded components are being installed, loosen the adhesive using a metal pick or similar tool before proceeding. If threaded components are reused, prepare the threaded components using the following steps:
  - 10.1. Remove any loose cured adhesive from the external threads of the components using a lint free cloth.
  - 10.2. Thread the cleaned components into the internal mating threads and remove to loosen trapped cured adhesive.
  - 10.3. Remove loose debris from internal and external threads using compressed air.
  - 10.4. Apply liquid thread locking adhesive in a strip along half of the length of the external threads, starting at the tip, just prior to installation. Adhesives, Fluids, Lubricants, and Sealers
11. Engine Mount Frame Side Bolt - Left Side (1) » Install NEW and hand tighten [3x]
12. Engine Mount Frame Side Bolt - Left Side (1) » Tighten in sequence [3x] — Fastener Specifications
13. Remove the engine lift and chains that are supporting the engine.

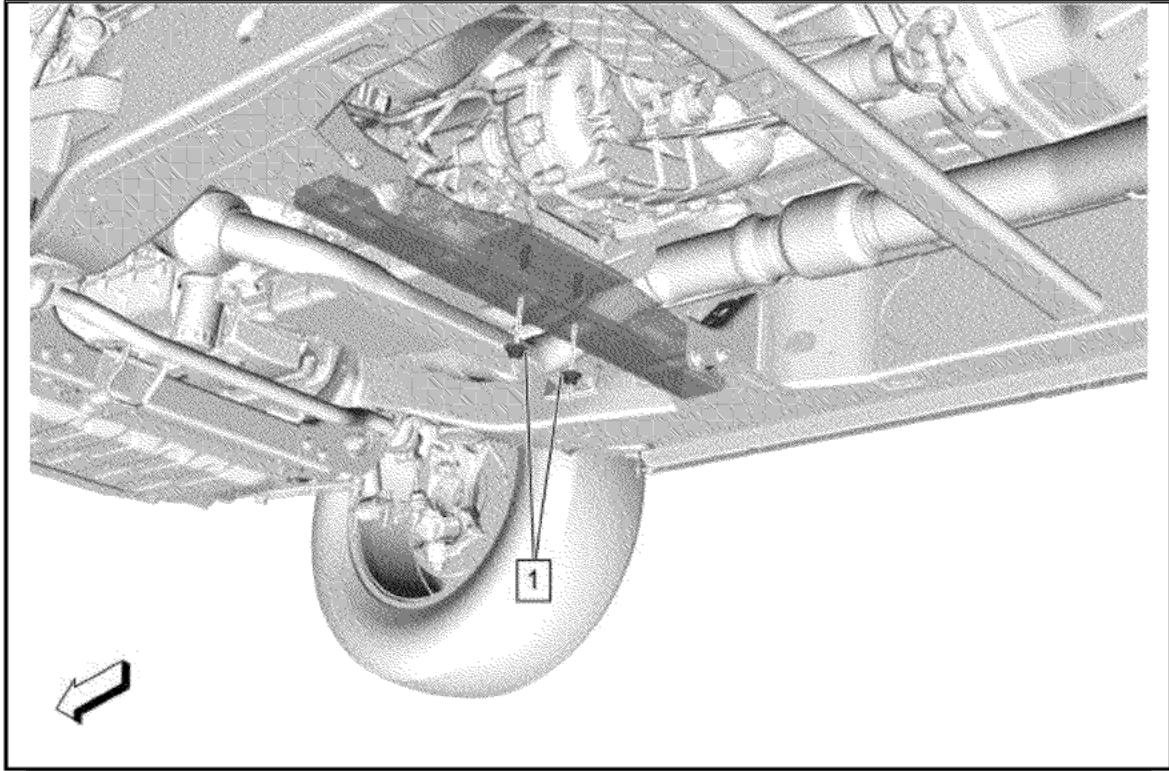


14. Remove the *EN-36857* Engine Lift Bracket (1) and the *EN-52059* Engine Support Fixture Adapter Bolt - M10 (2) from the cylinder head.

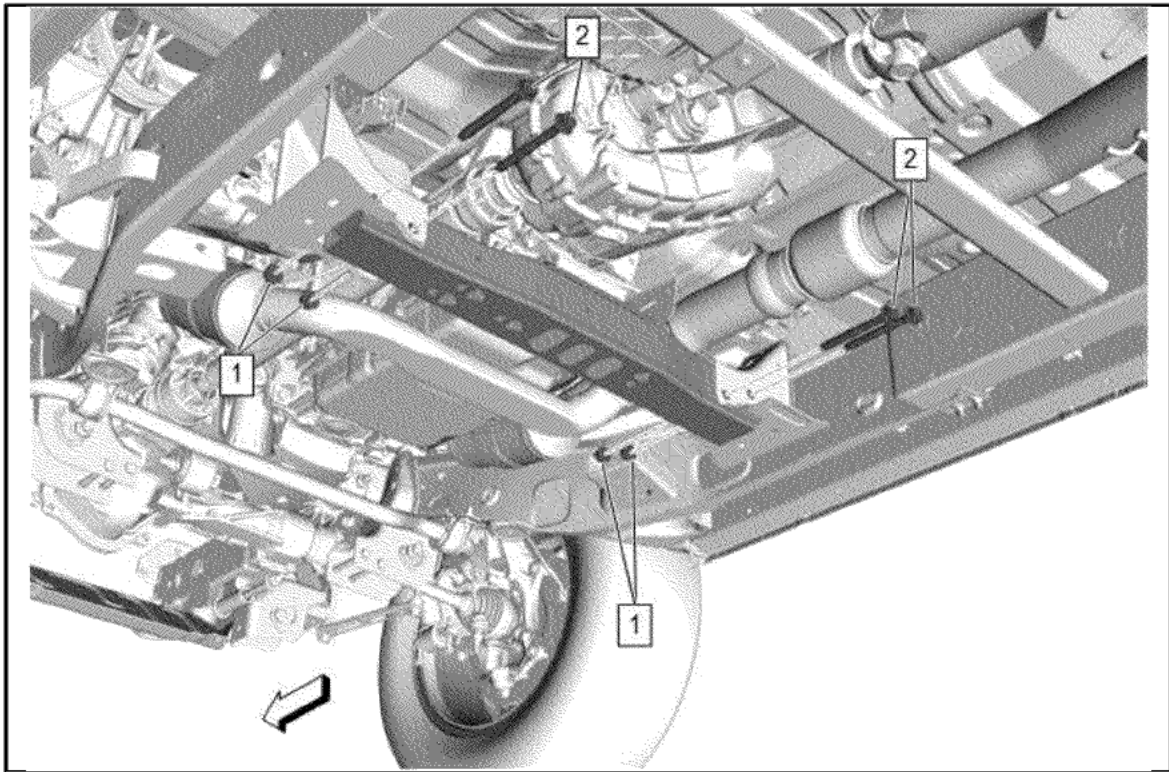


15. Remove the *EN-36857* Engine Lift Bracket (1) and the *EN-52059* Engine Support Fixture Adapter Bolt - M10 (2) from the cylinder head.
16. Support the transmission with a suitable jack.

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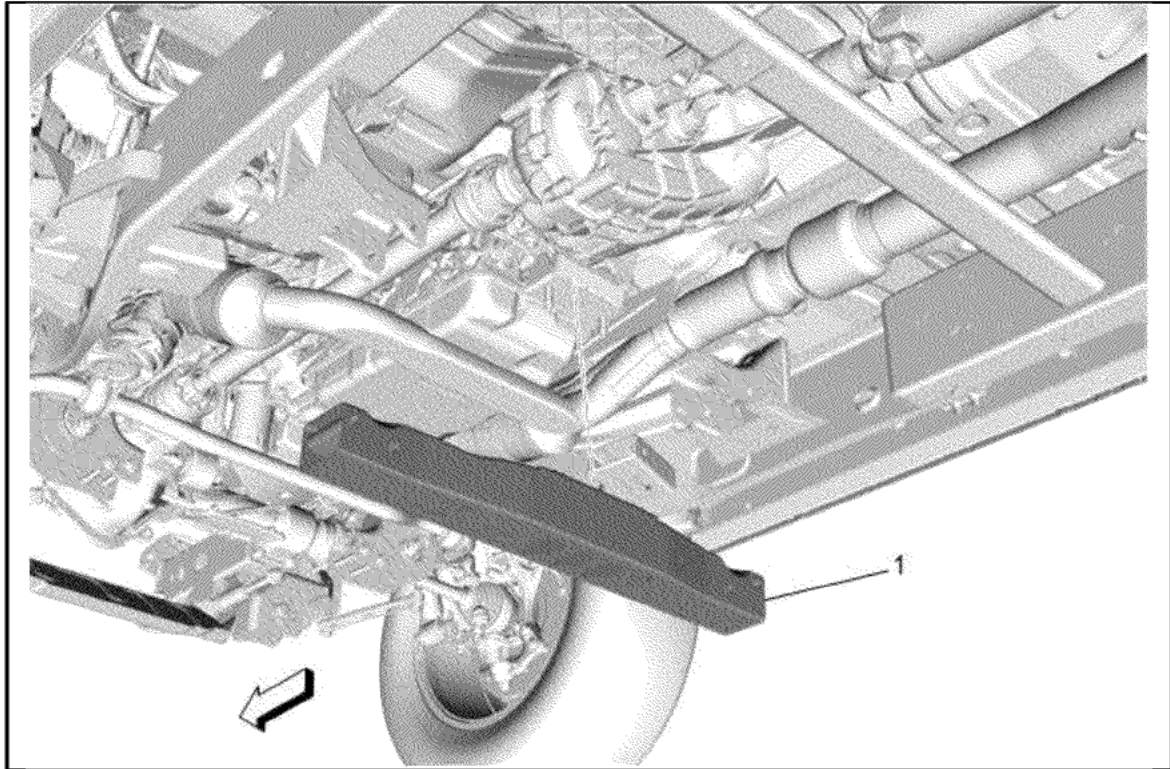


17. Transmission Mount Nut (1) » Remove [2x]



18. Transmission Support Crossmember Nut (1) » Remove [4x]

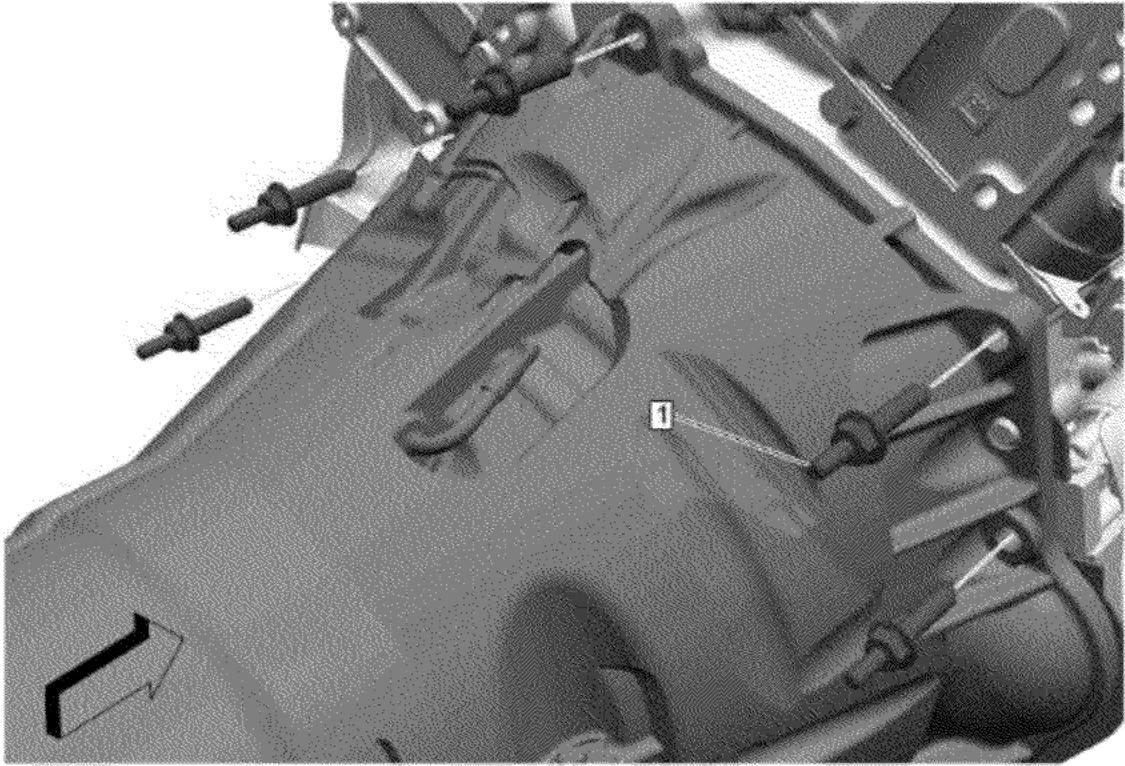
19. Transmission Support Crossmember Bolt (2) » Remove [4x]



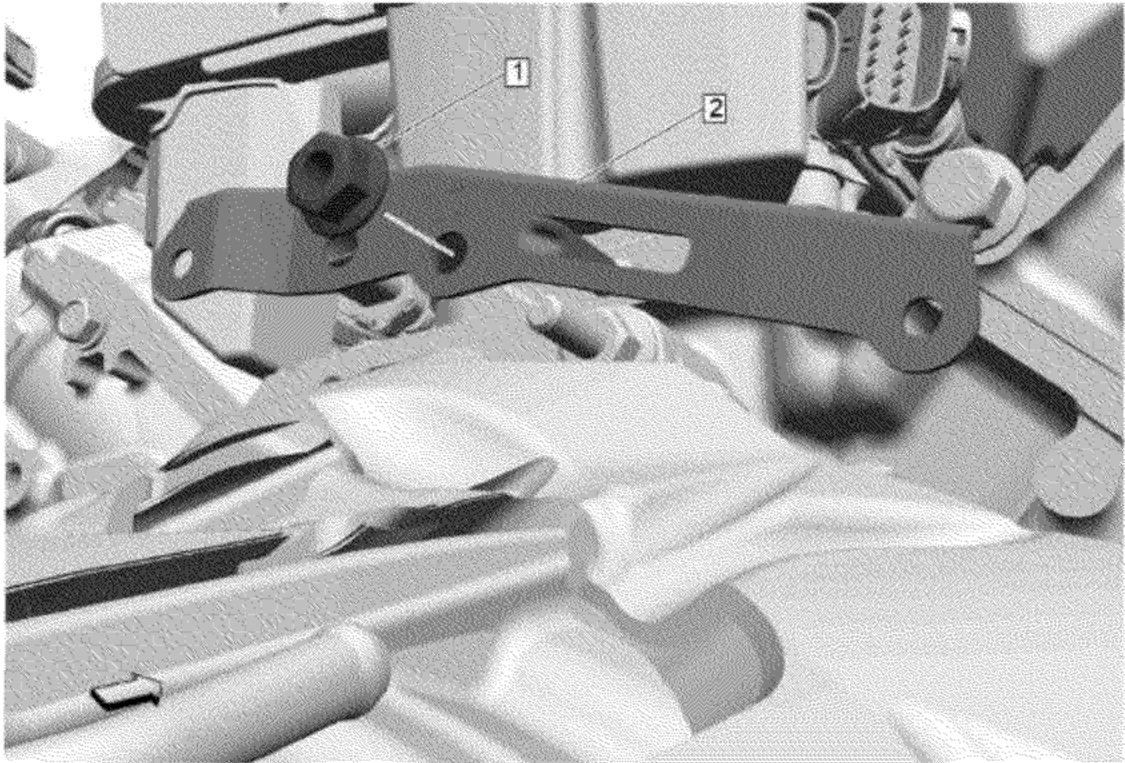
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20. Transmission Support Crossmember (1) » Remove

21. Lower the transmission to gain access to the top of the transmission.

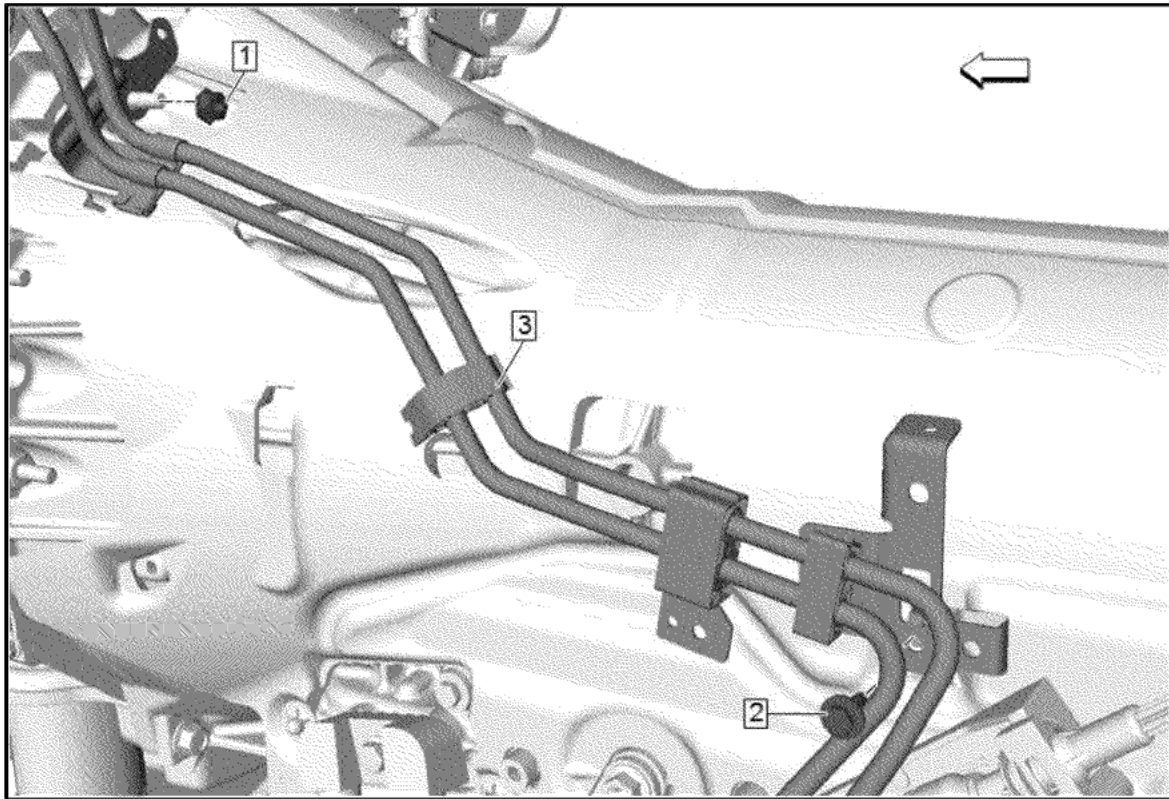


22. Transmission Stud (1) » Install and tighten [5x] — [Fastener Specifications](#)



23. Install the transmission vent hose clip bracket (2) to the transmission.

24. Install and tighten the transmission vent hose clip bracket nut (1). [Fastener Specifications](#)

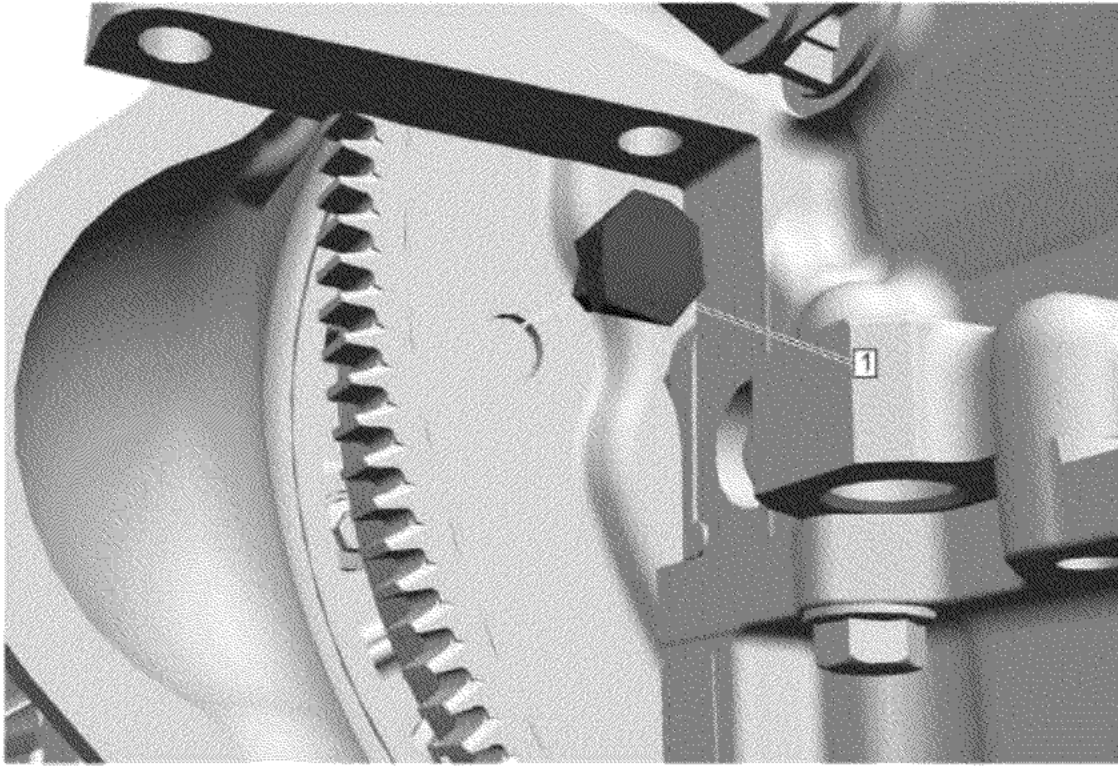


25. Install the fuel feed line assembly (3) on the transmission stud.

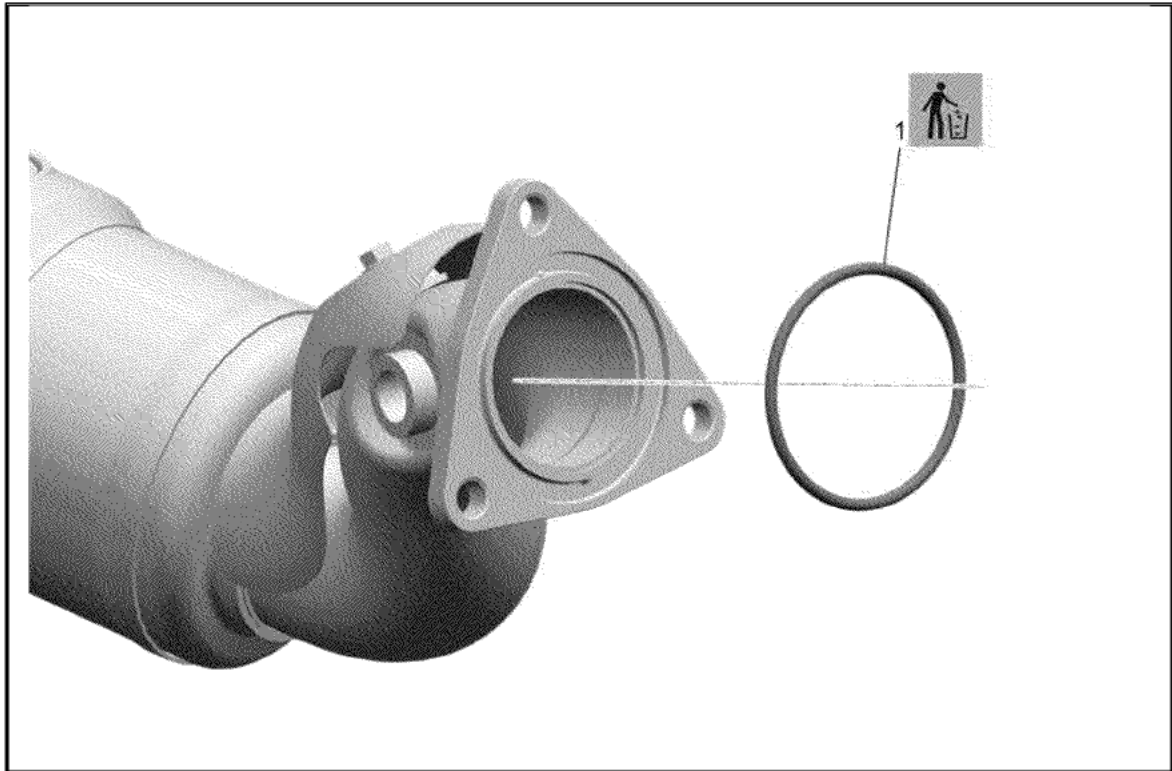
26. Install and tighten the fuel feed and return front hose bracket nut (1). [Fastener Specifications](#)

27. Install and tighten the fuel feed and return front hose bracket bolt (2). [Fastener Specifications](#)

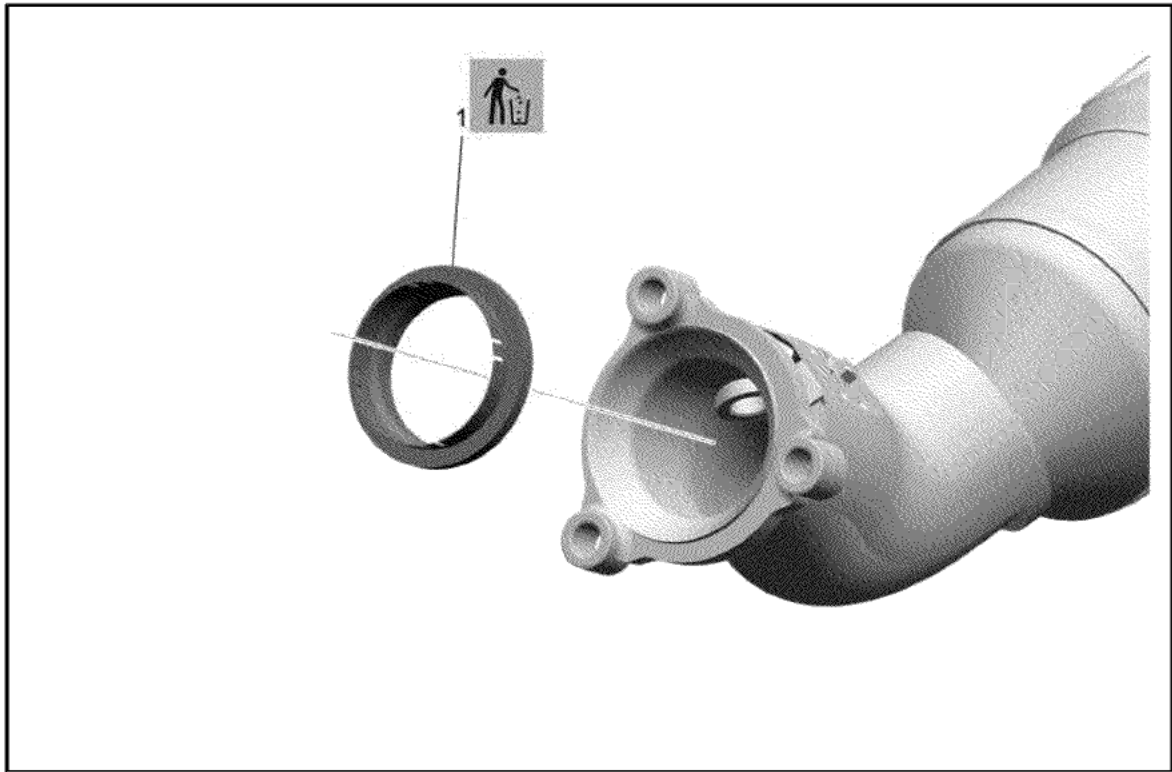
28. Install and connect the transmission electrical harness connector retainers and electrical connectors.



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29. If NEW threaded components are being installed, loosen the adhesive using a metal pick or similar tool before proceeding. If threaded components are reused, prepare the threaded components using the following steps:
- 29.1. Remove any loose cured adhesive from the external threads of the components using a lint free cloth.
  - 29.2. Thread the cleaned components into the internal mating threads and remove to loosen trapped cured adhesive.
  - 29.3. Remove loose debris from internal and external threads using compressed air.
  - 29.4. Apply liquid thread locking adhesive in a strip along half of the length of the external threads, starting at the tip, just prior to installation. Adhesives, Fluids, Lubricants, and Sealers
- Note:**
- For proper alignment of all torque converter bolts, install the first torque converted bolt in the oval shaped hole.
  - Rotate the harmonic balancer center bolt clockwise ONLY, to align the torque converter bolt with the starter opening.
30. Torque Converter Bolt (1) » Install and tighten [6x] — Fastener Specifications

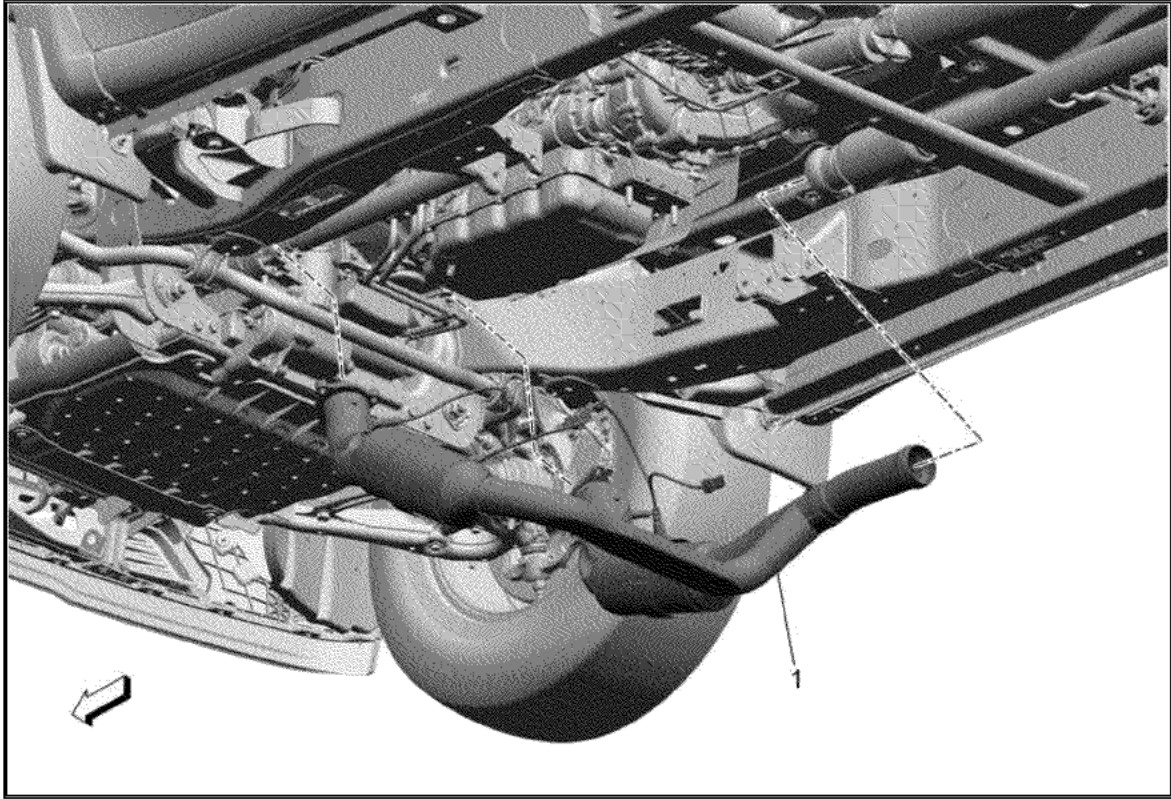


31. Exhaust System Seal (1) » Install NEW

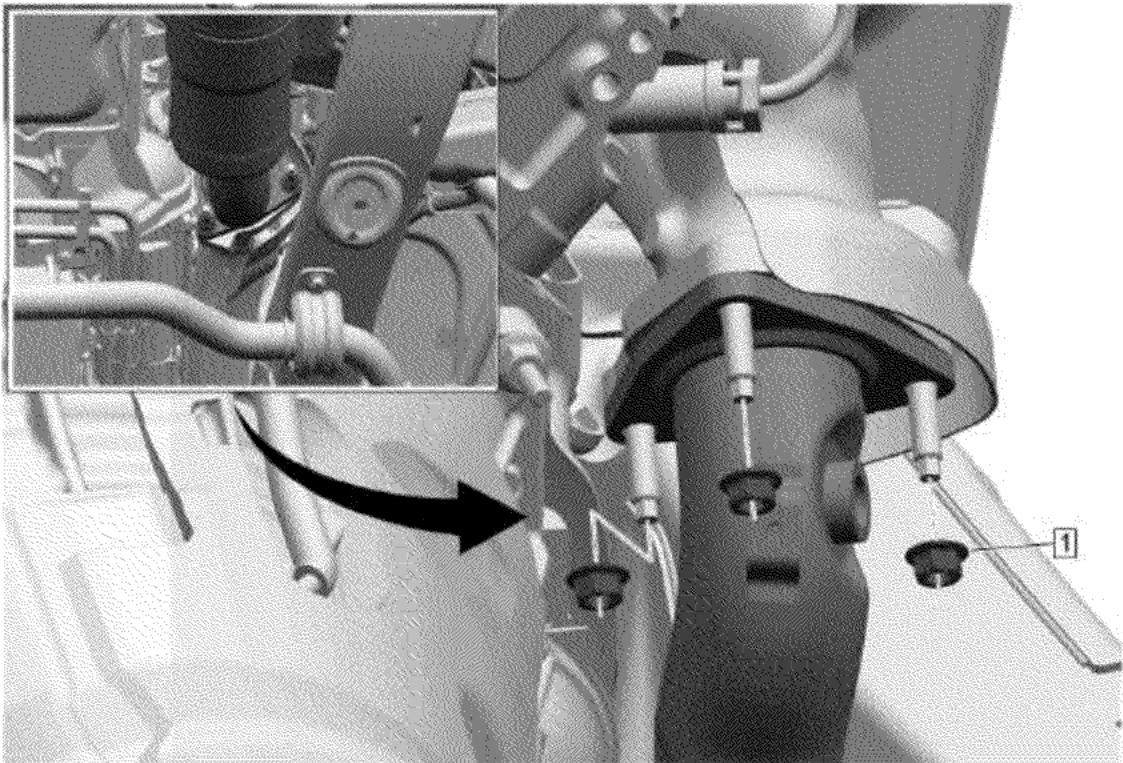


32. Exhaust System Seal (1) » Install NEW

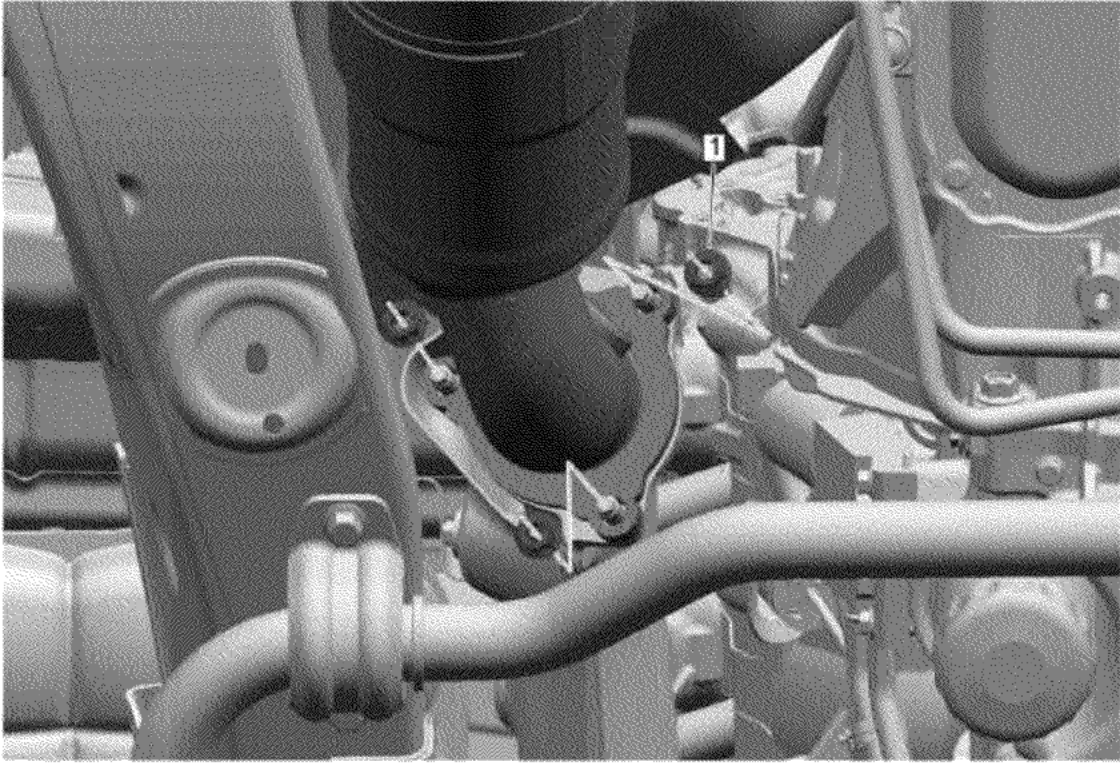
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33. Three-Way Catalytic Converter (1) » Install

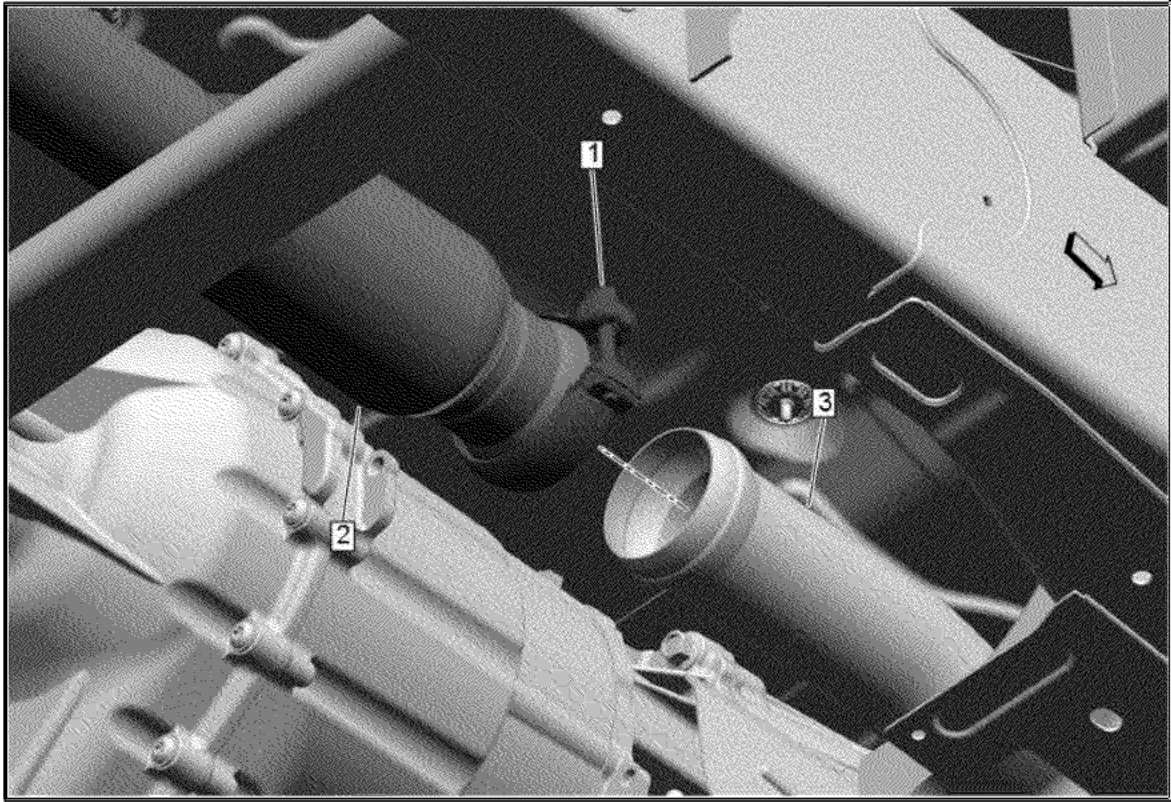


34. Exhaust Front Pipe Nut - Right Side (1) » Install and hand tighten [3x]
35. Exhaust Front Pipe Nut - Right Side (1) » Tighten [3x] — [Fastener Specifications](#)



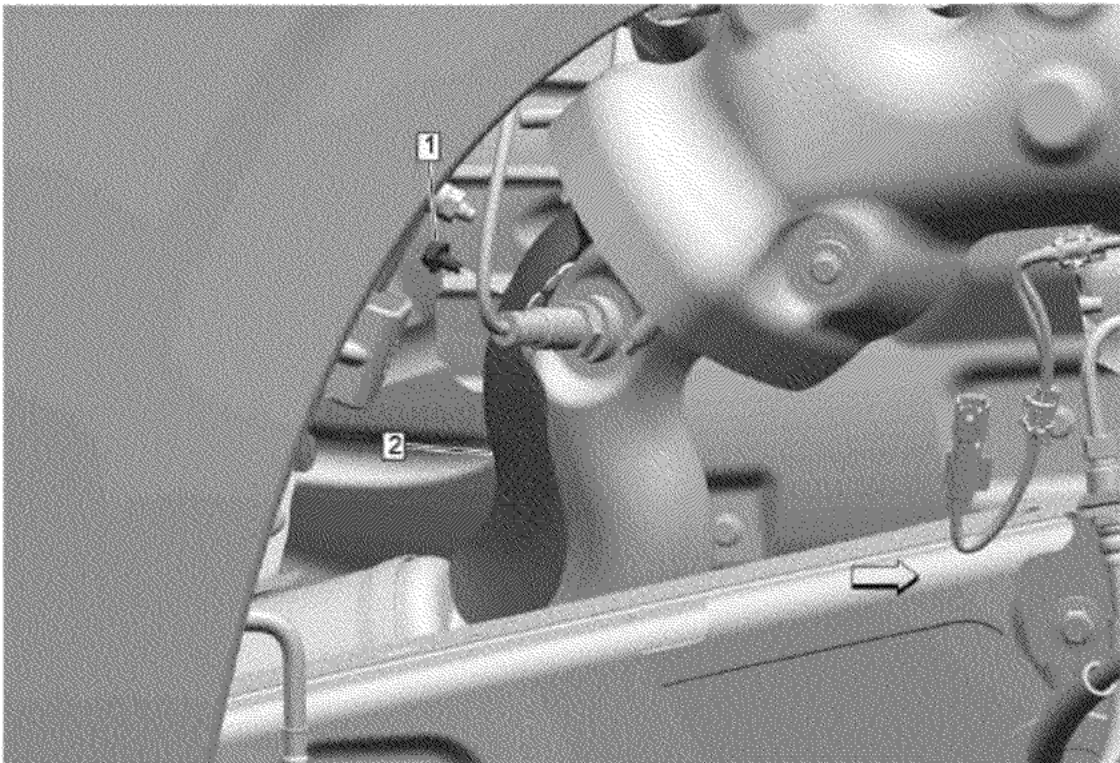
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36. Exhaust Front Pipe Nut - Left Side (1) » Install and hand tighten [3x]
37. Exhaust Front Pipe Nut - Left Side (1) » Tighten [3x] — [Fastener Specifications](#)



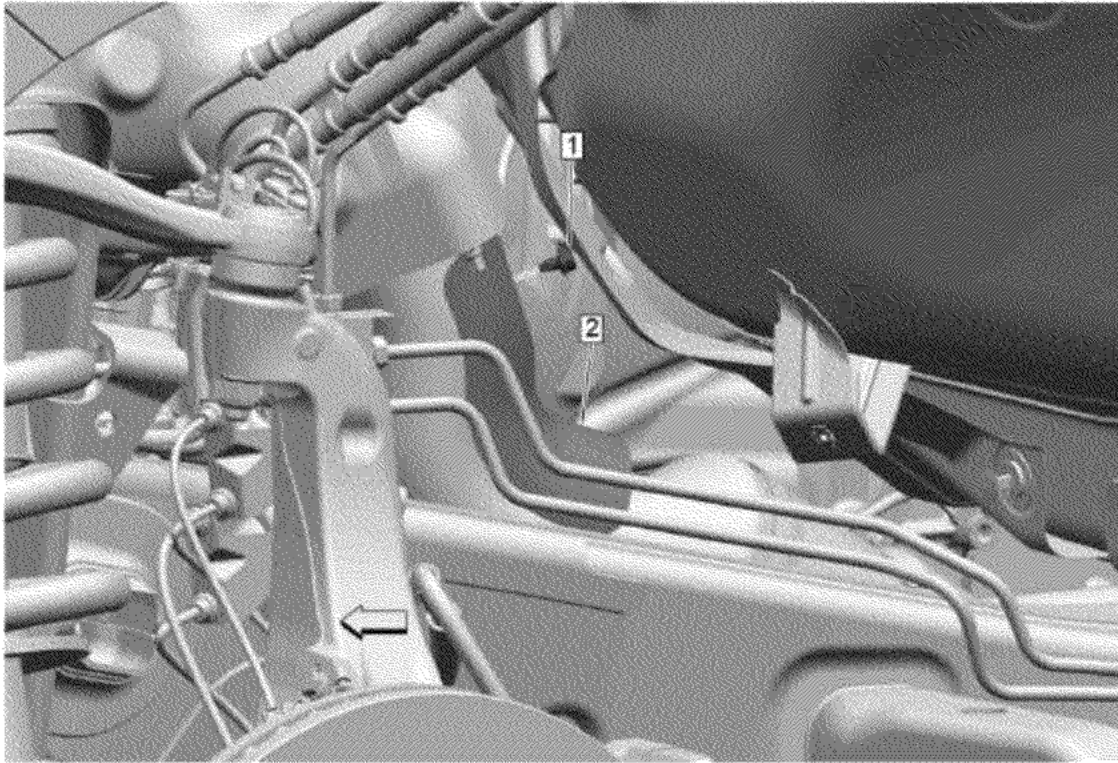
- 38. Exhaust Muffler (2) @ Three-Way Catalytic Converter (3) » Connect
- 39. Exhaust Pipe Clamp (1) » Tighten — [Fastener Specifications](#)

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40. Exhaust Front Pipe Heat Shield - Right Side (2) » Install

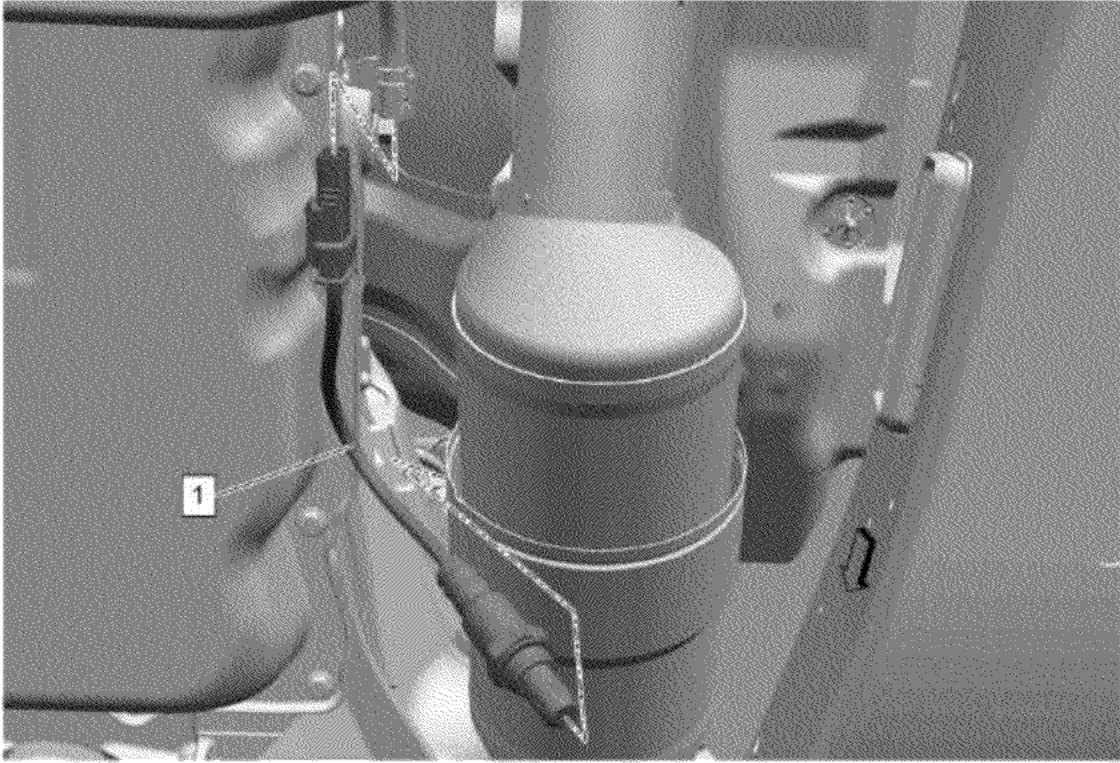
41. Exhaust Heat Shield Bolt - Right Side (1) » Install and tighten — [Fastener Specifications](#)



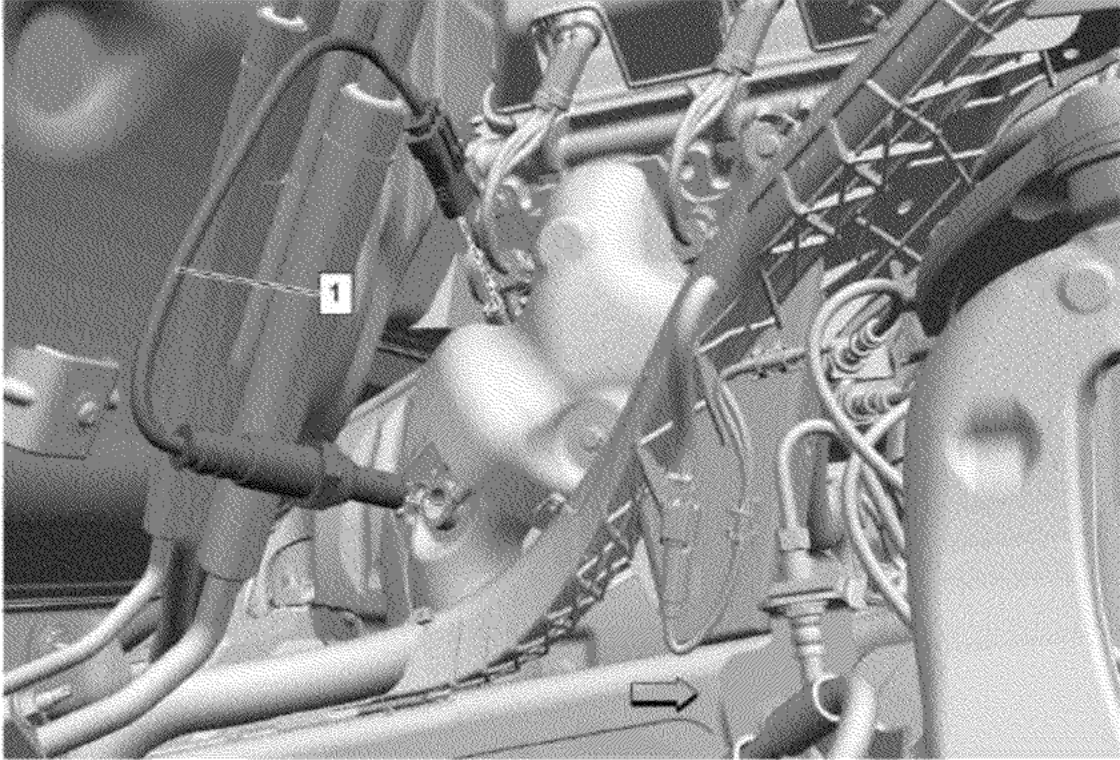
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42. Exhaust Front Pipe Heat Shield - Left Side (2) » Install

43. Exhaust Heat Shield Bolt - Left Side (1) » Install and tighten — [Fastener Specifications](#)



44. Electrical Connector @ Heated Oxygen Sensor - Bank 2 Sensor 2 » Connect

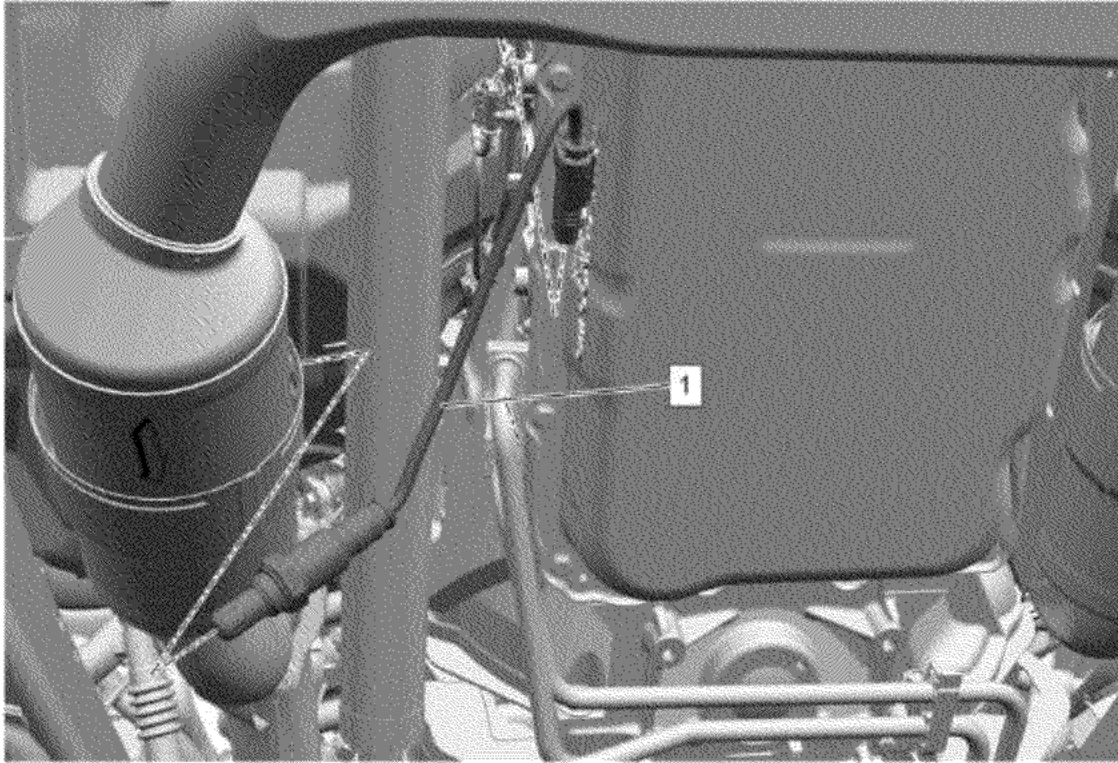


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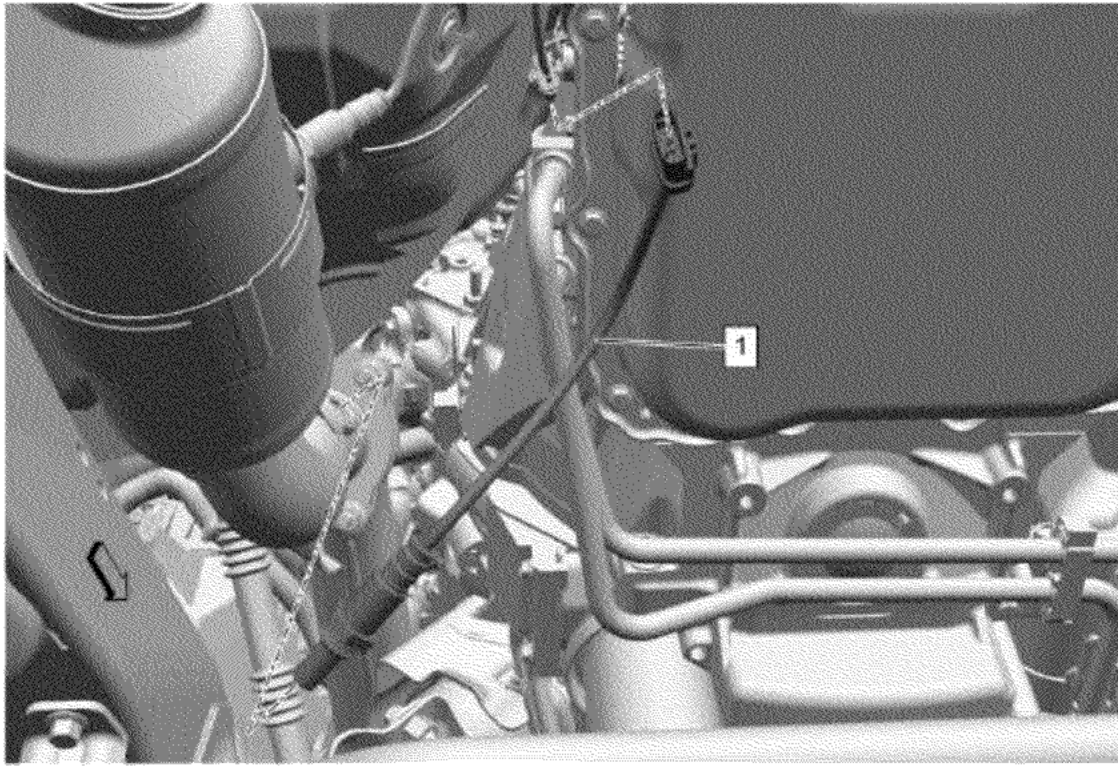
**Note:** A special anti-seize compound is used in the HO2S threads. The compound consists of liquid graphite and glass beads. The graphite tends to burn away, but the glass beads remain, making the sensor easier to remove. New, or service replacement sensors already have the compound applied to the threads. If the sensor is removed from an exhaust component and if for any reason the sensor is to be reinstalled, the threads must have anti-seize compound applied before reinstallation. Adhesives, Fluids, Lubricants, and Sealers

45. Using a suitable tool, install and tighten the heated oxygen sensor (1). Fastener Specifications

46. Electrical Connector @ Heated Oxygen Sensor - Bank 2 Sensor 1 » Connect



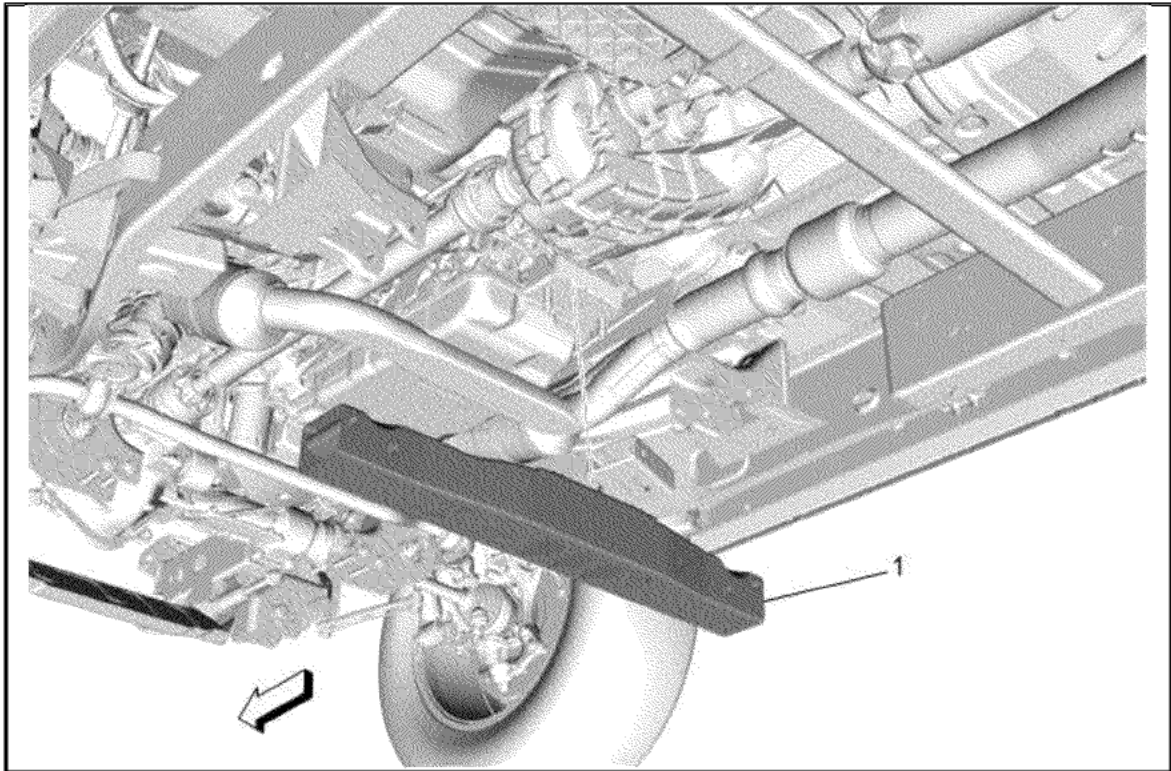
47. Electrical Connector @ Heated Oxygen Sensor - Bank 1 Sensor 2 » Connect



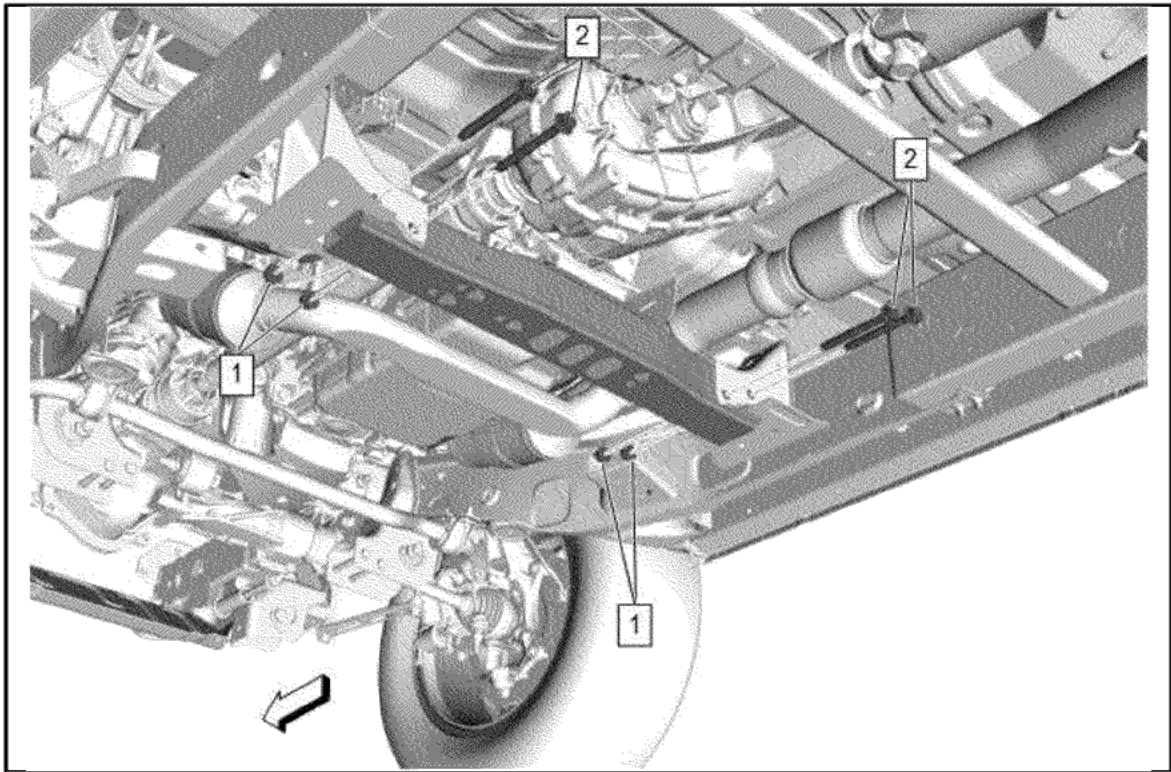
**Note:** A special anti-seize compound is used in the HO2S threads. The compound consists of liquid graphite and glass beads. The graphite tends to burn away, but the glass beads remain, making the sensor easier to remove. New, or service replacement sensors already have the compound applied to the threads. If the sensor is removed from an exhaust component and if for any reason the sensor is to be reinstalled, the threads must have anti-seize compound applied before reinstallation. Adhesives, Fluids, Lubricants, and Sealers

48. Using a suitable tool, install and tighten the heated oxygen sensor (1). Fastener Specifications
49. Electrical Connector @ Heated Oxygen Sensor Bank 1 Sensor 1 - Bank 1 Sensor 1 Connect

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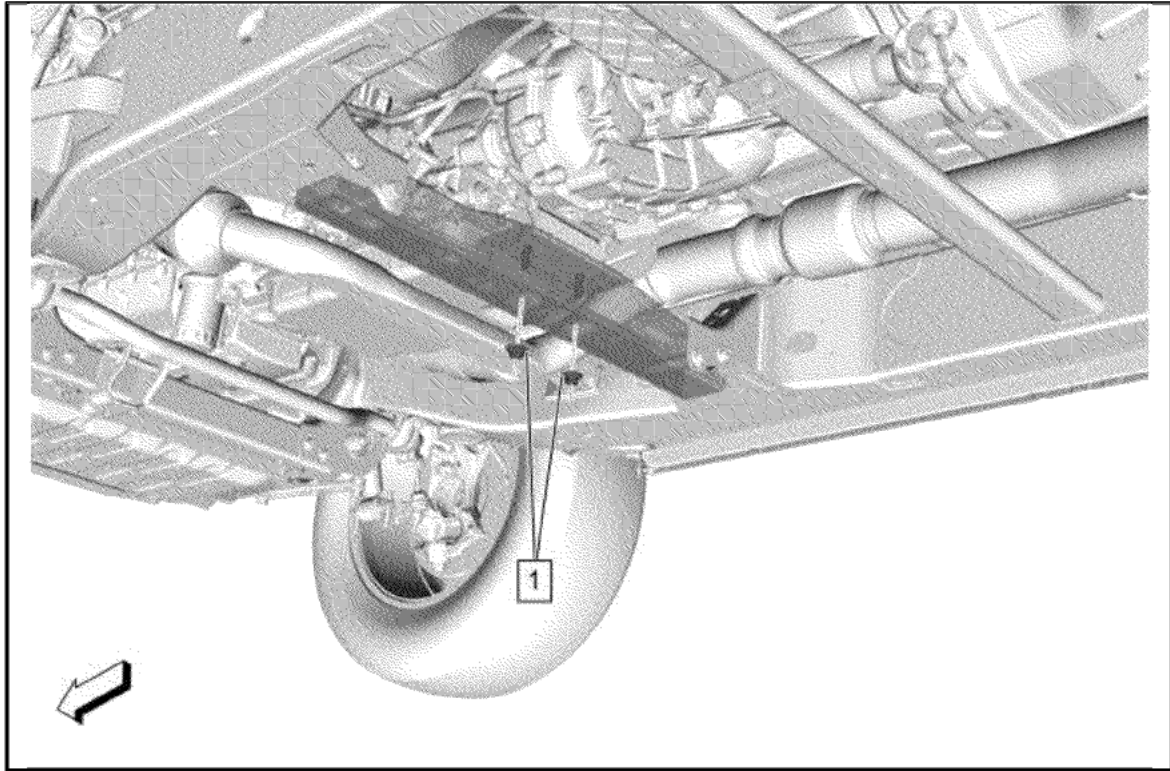


50. Transmission Support Crossmember (1) » Install



51. Transmission Support Crossmember Bolt (2) » Install [4x]

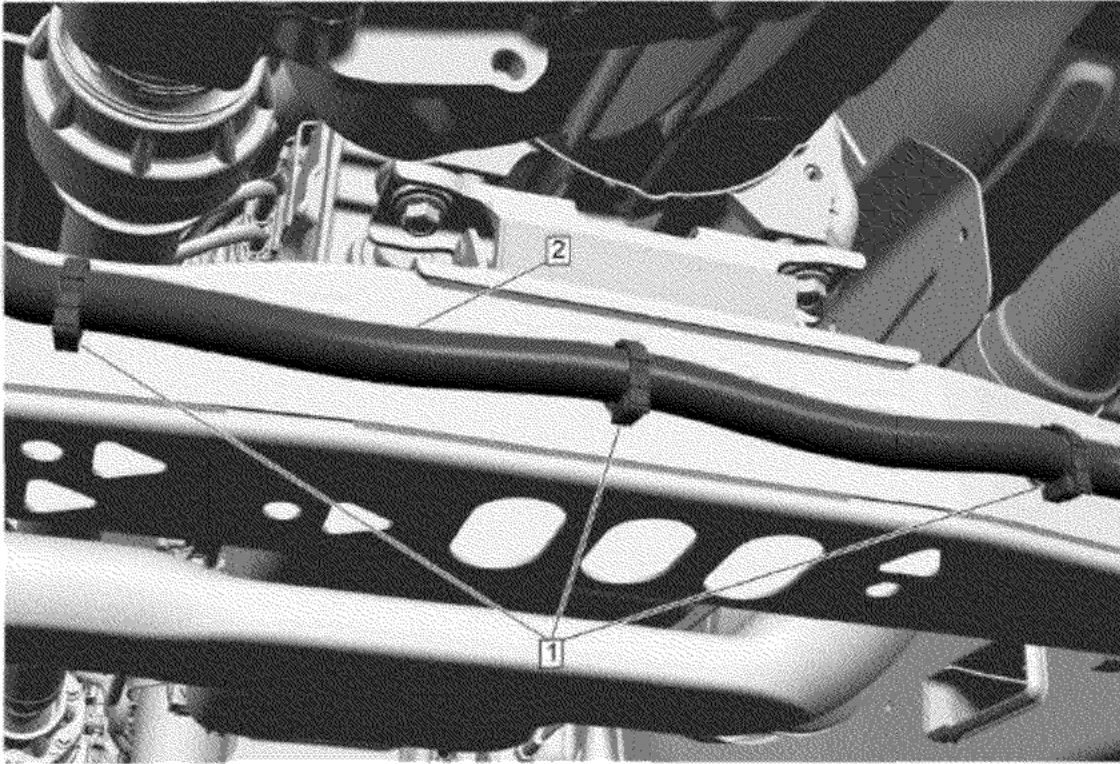
52. Transmission Support Crossmember Nut (1) » Install and tighten [4x] — Fastener Specifications



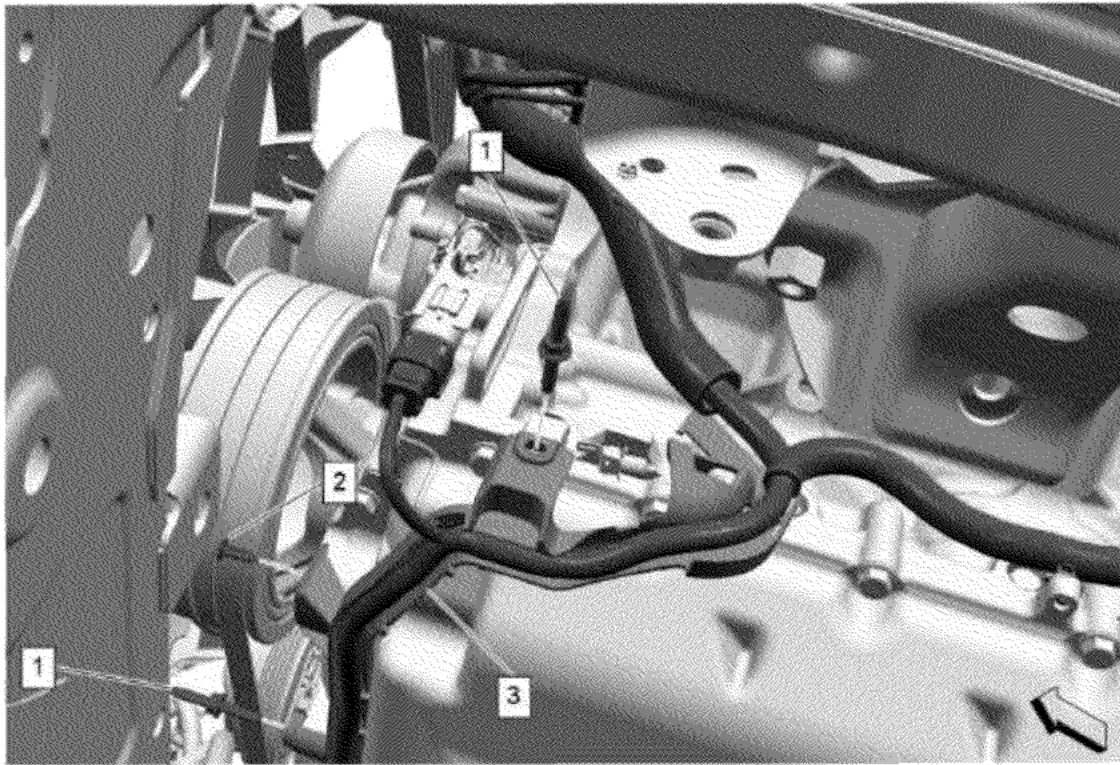
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53. Transmission Mount Nut (1) » Install and tighten [2x] — Fastener Specifications

54. Remove the transmission jack.



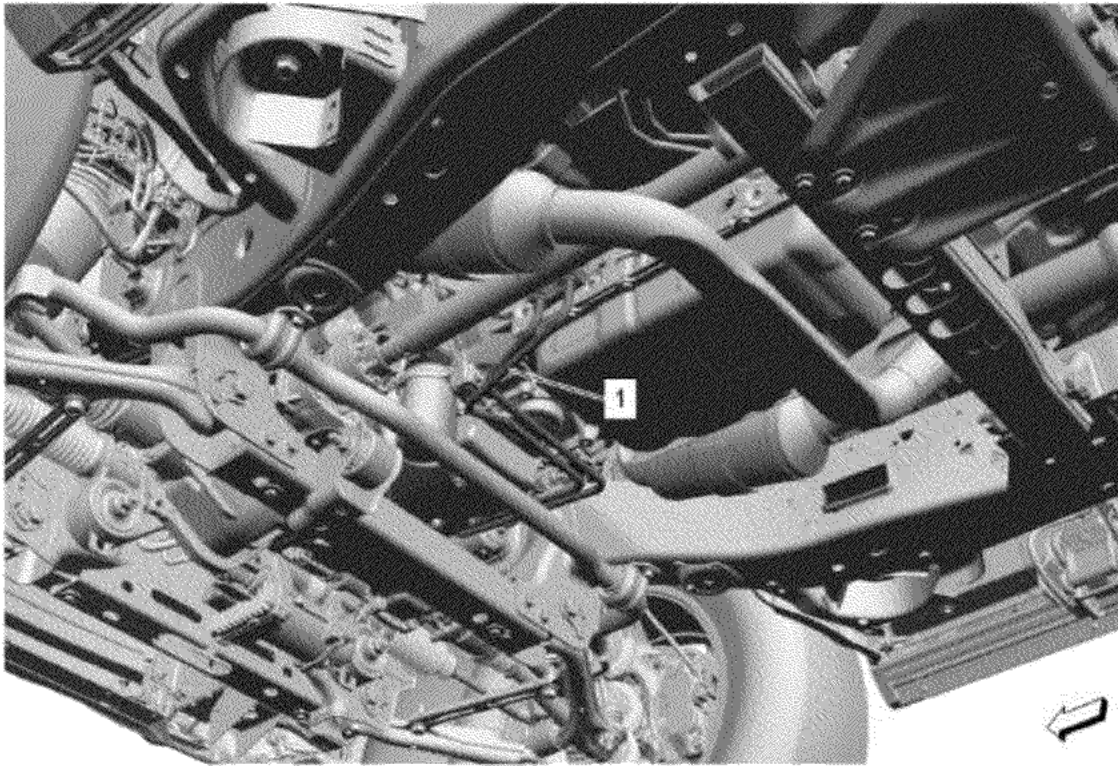
55. { If equipped } Install the wiring harness (2) as necessary and install the harness retainers (1) into the transmission support crossmember.



56. Engine Wiring Harness (3) » Install

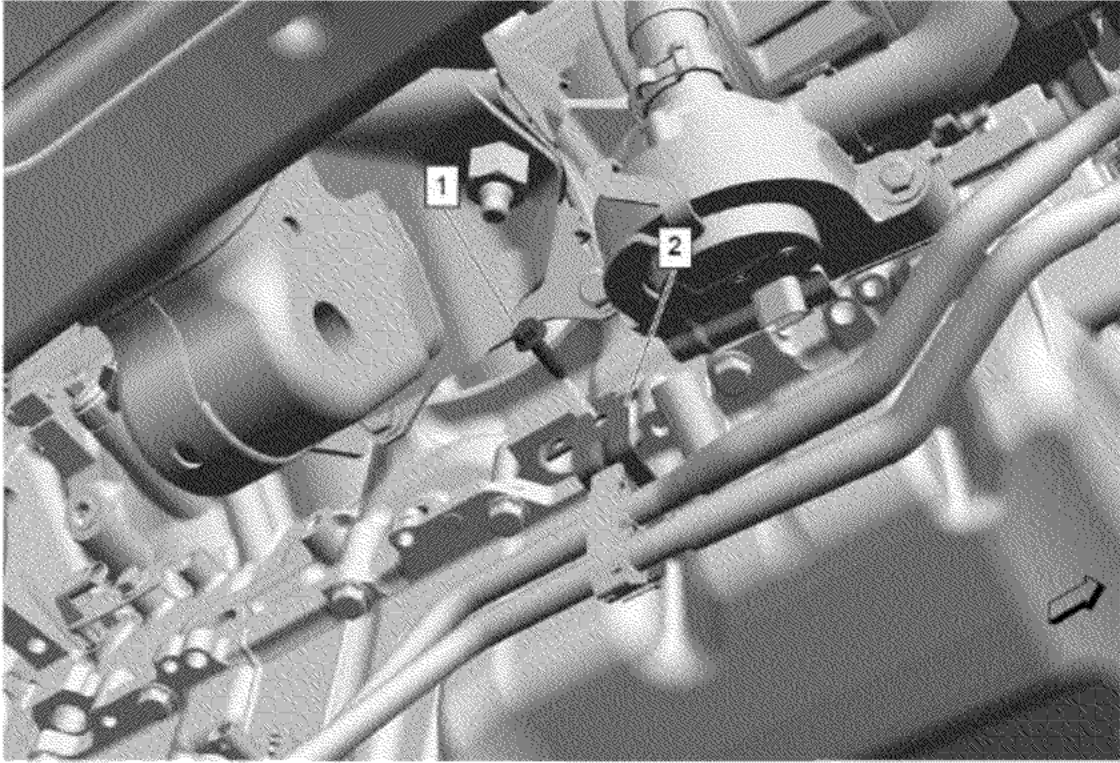
57. Engine Wiring Harness Retainer (2) » Install

58. Engine Wiring Harness Ground Stud (1) » Install and tighten [2x] — [Fastener Specifications](#)



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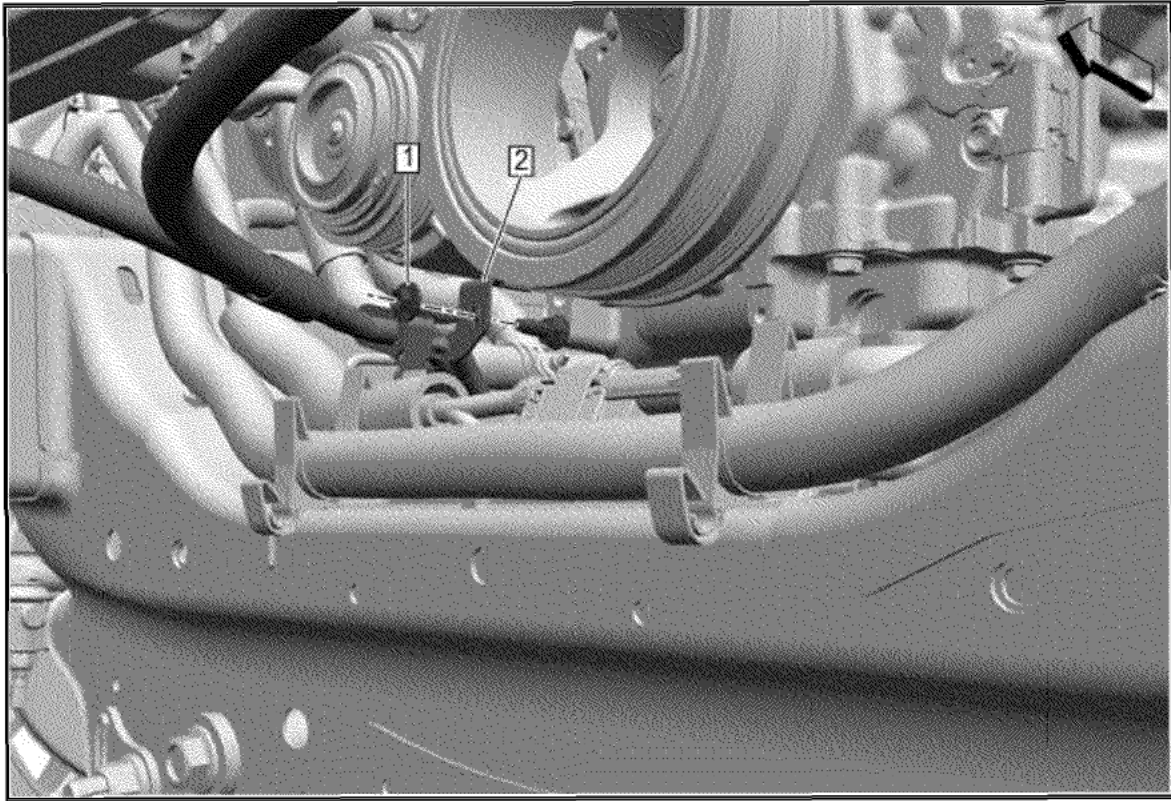
59. Reposition the transmission cooler inlet and outlet pipe (1) as necessary.



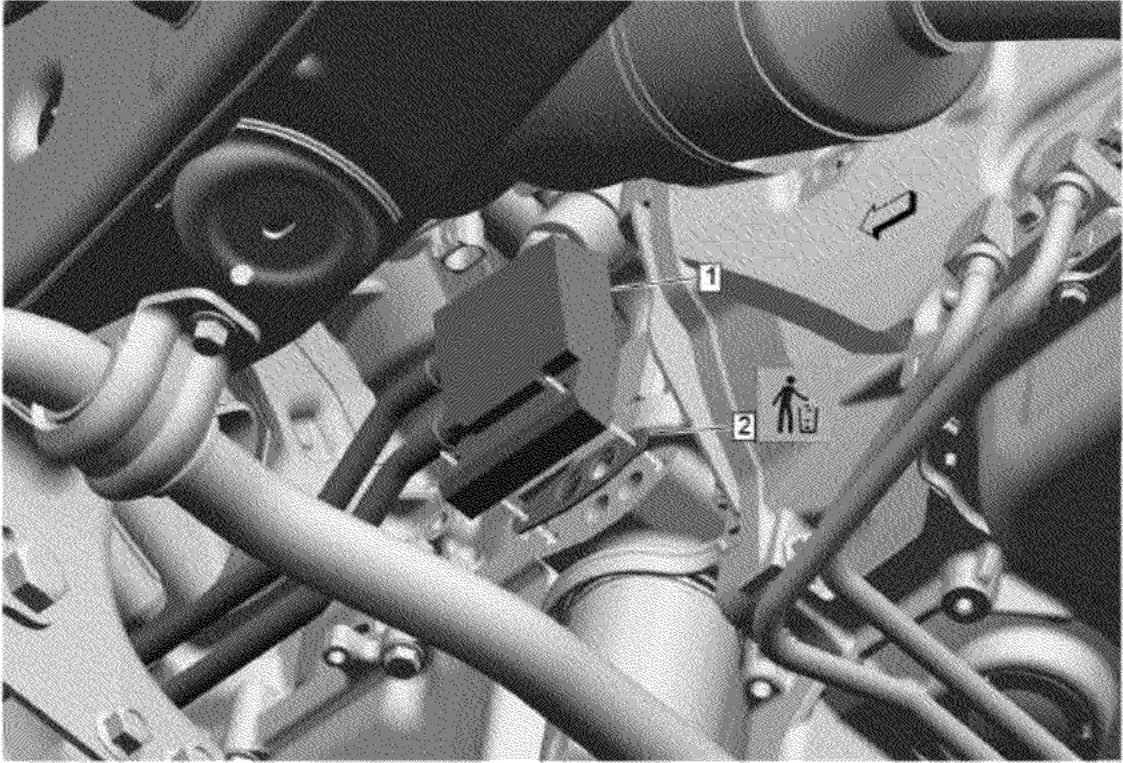
**Note:** Components removed in graphic to better illustrate service parts.

60. Transmission Fluid Cooler Pipe Clip Bracket (2) @ Oil Pan » Install

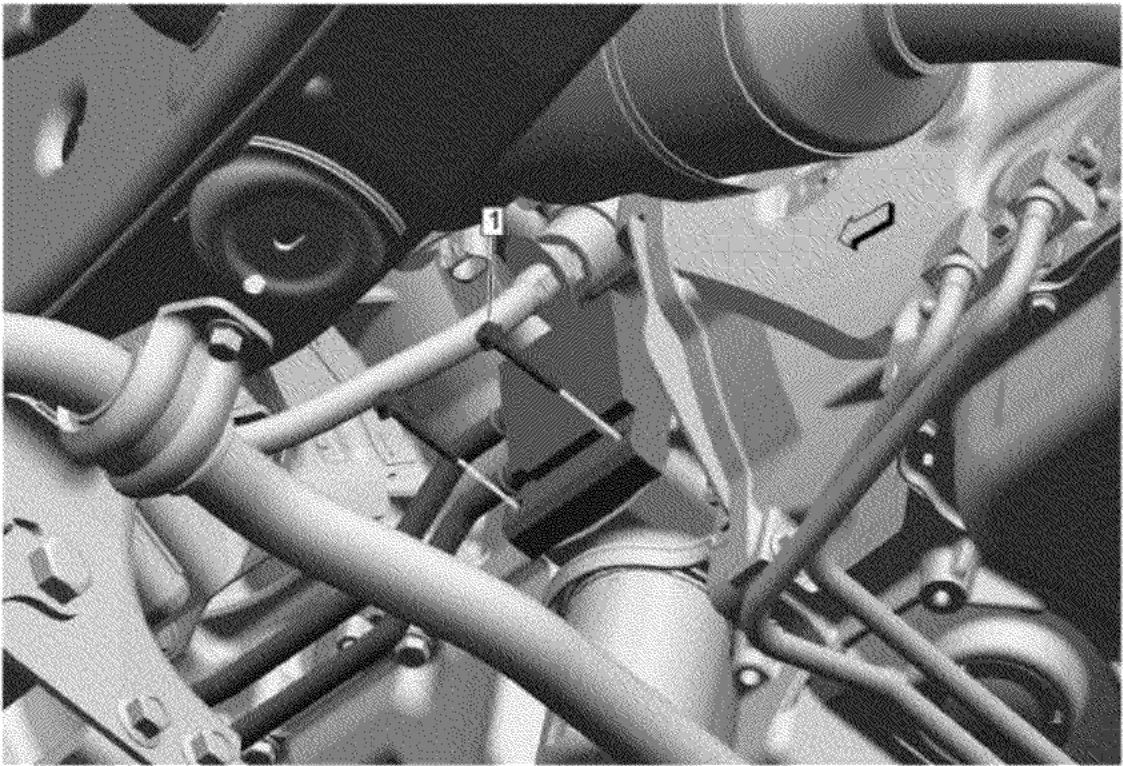
61. Transmission Fluid Cooler Pipe Clip Bolt (1) @ Oil Pan » Install and tighten — Fastener Specifications



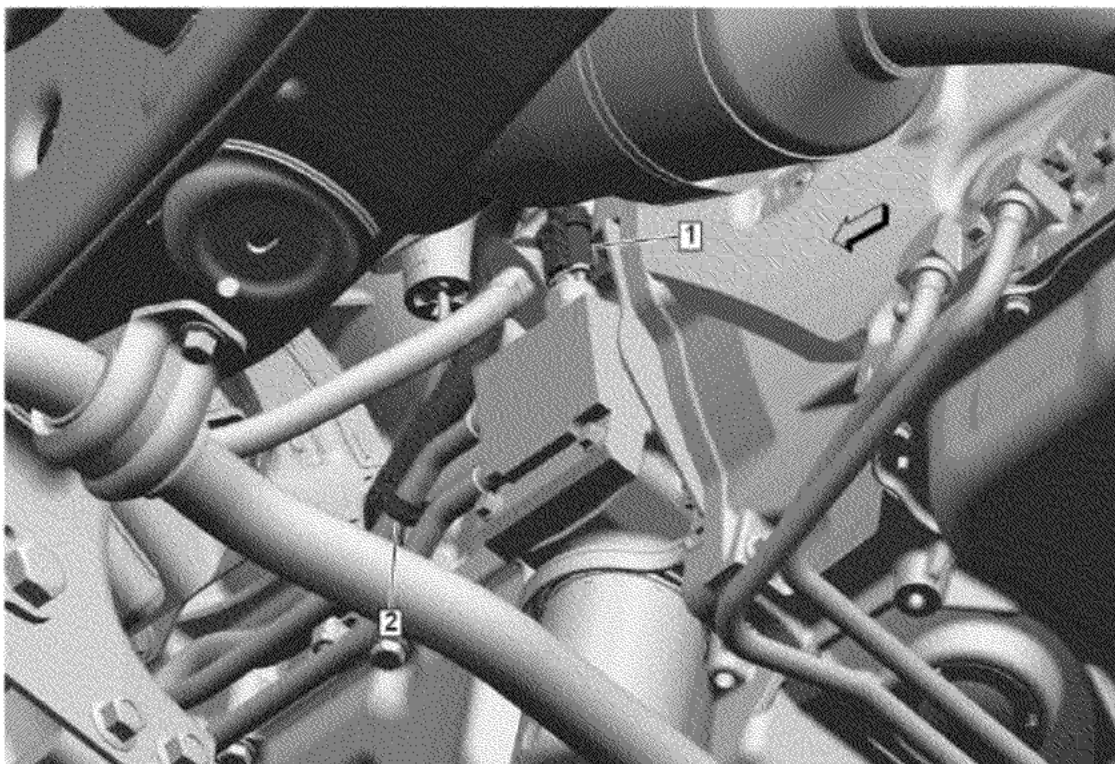
62. Position the transmission fluid cooler inlet and outlet pipe bracket (2).
63. Install and tighten the transmission fluid auxiliary cooler pipe bracket nut (1). [Fastener Specifications](#)

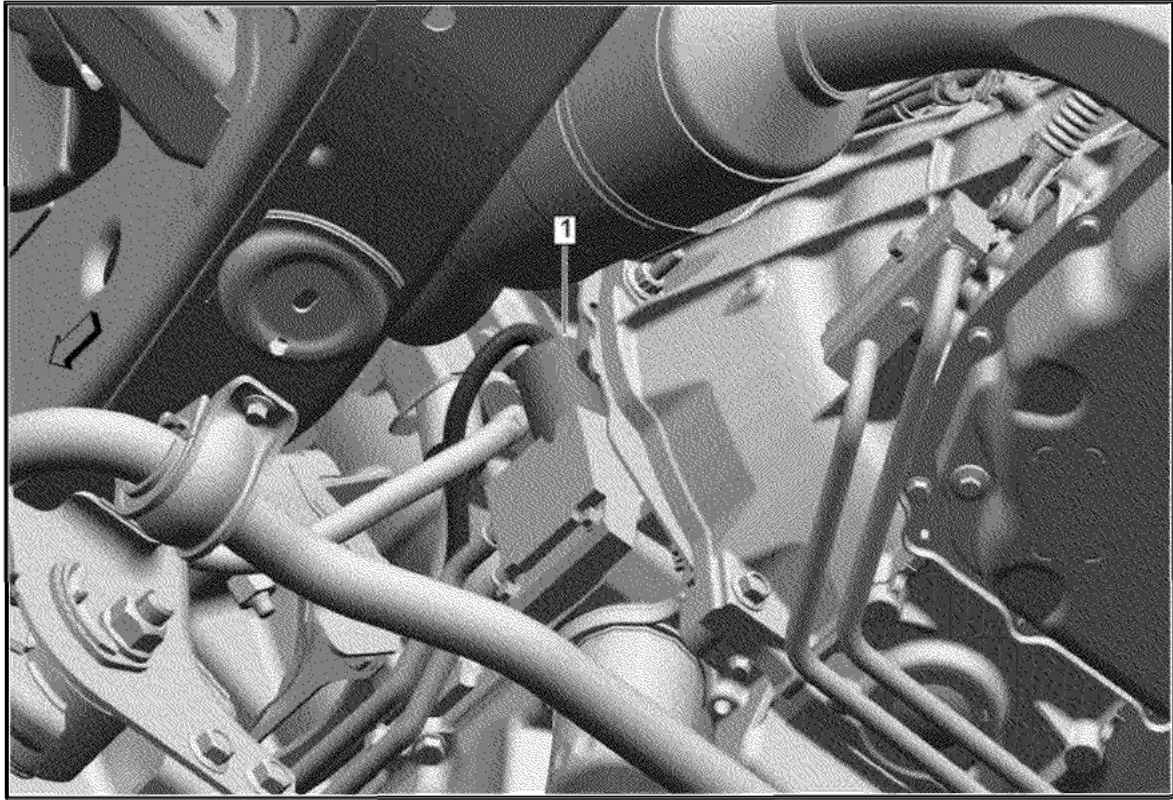


- 64. Engine Oil Cooler Gasket (2) » Install NEW
- 65. Engine Oil Cooler Hose (1) @ Oil Pan » Install

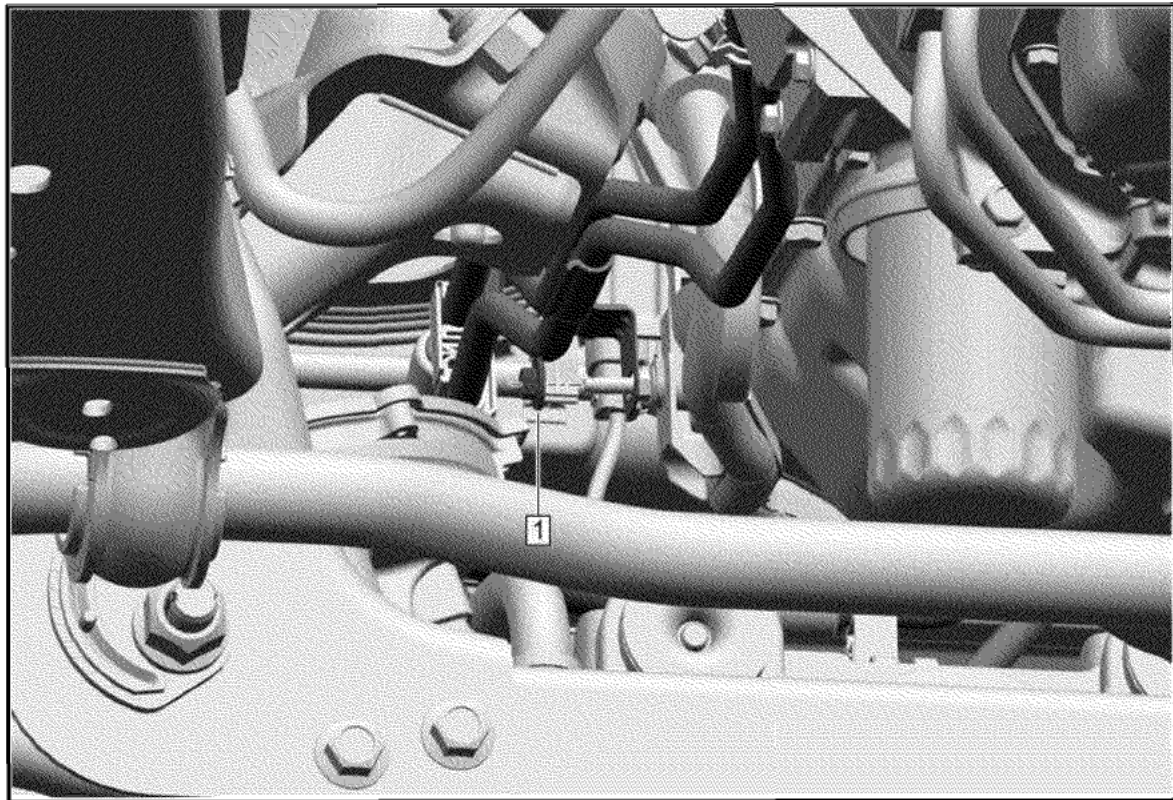


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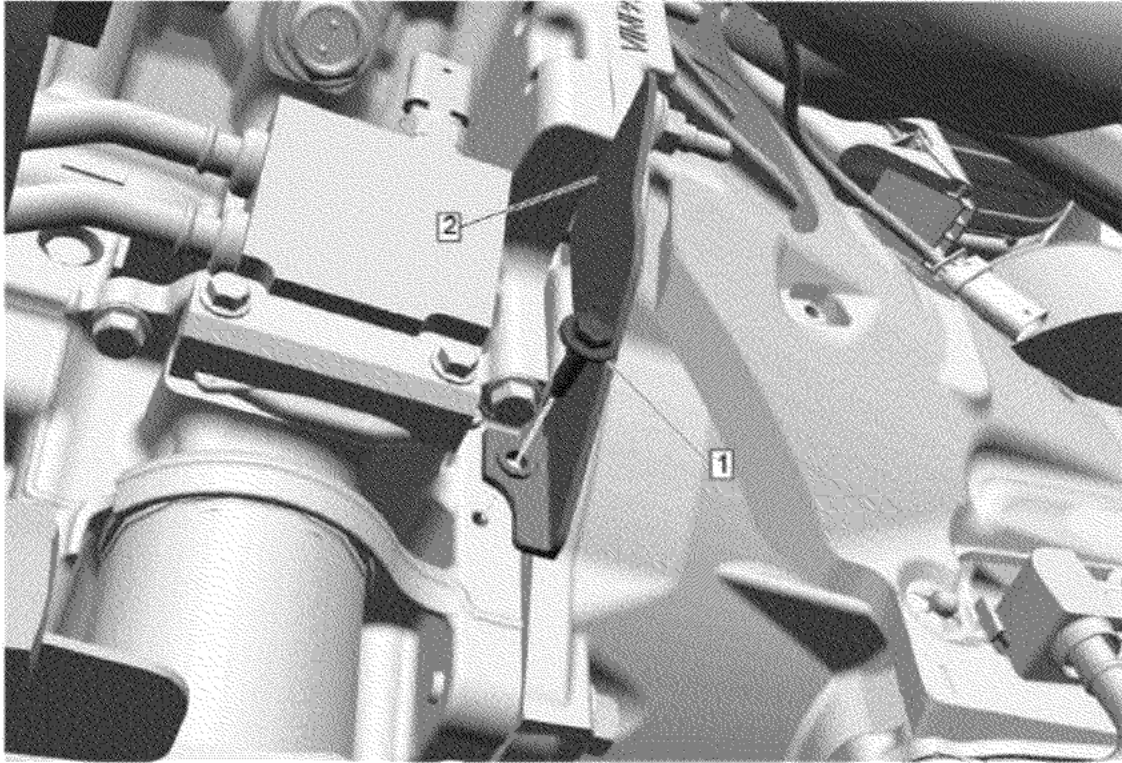
**66. Engine Oil Cooler Coolant Hose Bolt (1) » Install and tighten [2x] — [Fastener Specifications](#)****67. Electrical Connector (1) @ Engine Oil Pressure Sensor » Connect****68. Wiring Harness Retainer (2) @ Engine Oil Cooler Hose » Install**



69. Engine Oil Pressure Sensor Sleeve (1) » Install

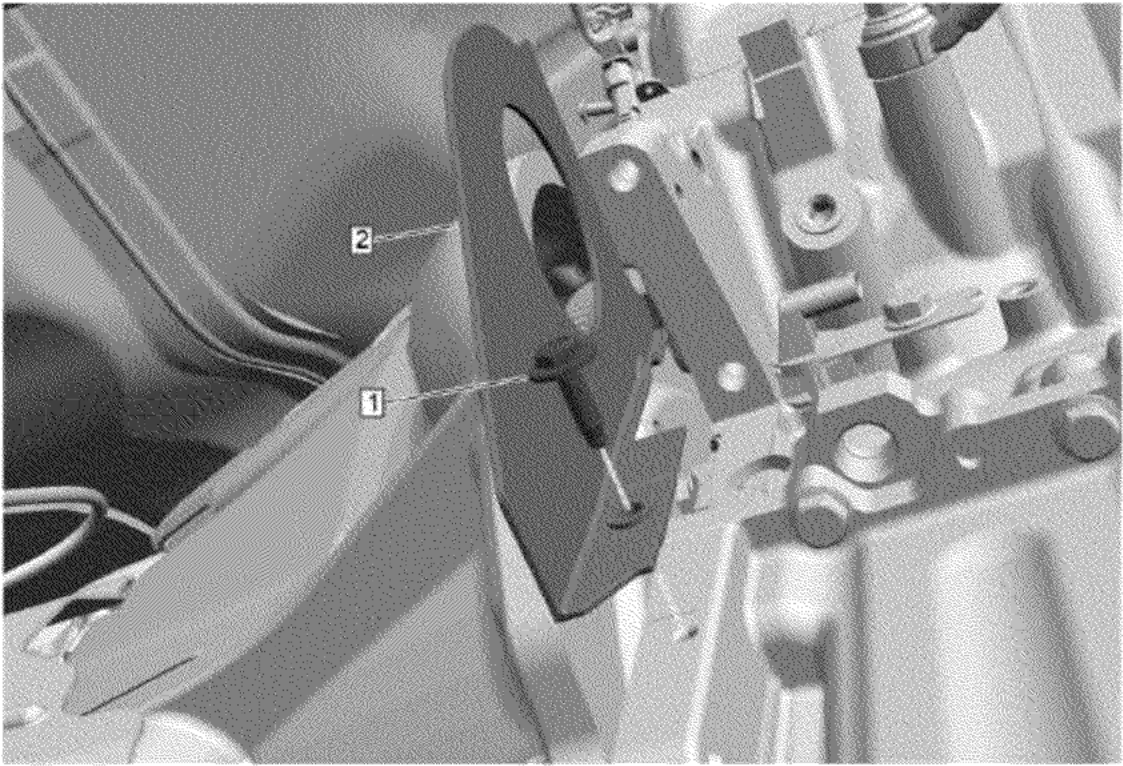


70. Engine Oil Cooler Hose Bracket Nut (1) » Install and tighten — [Fastener Specifications](#)



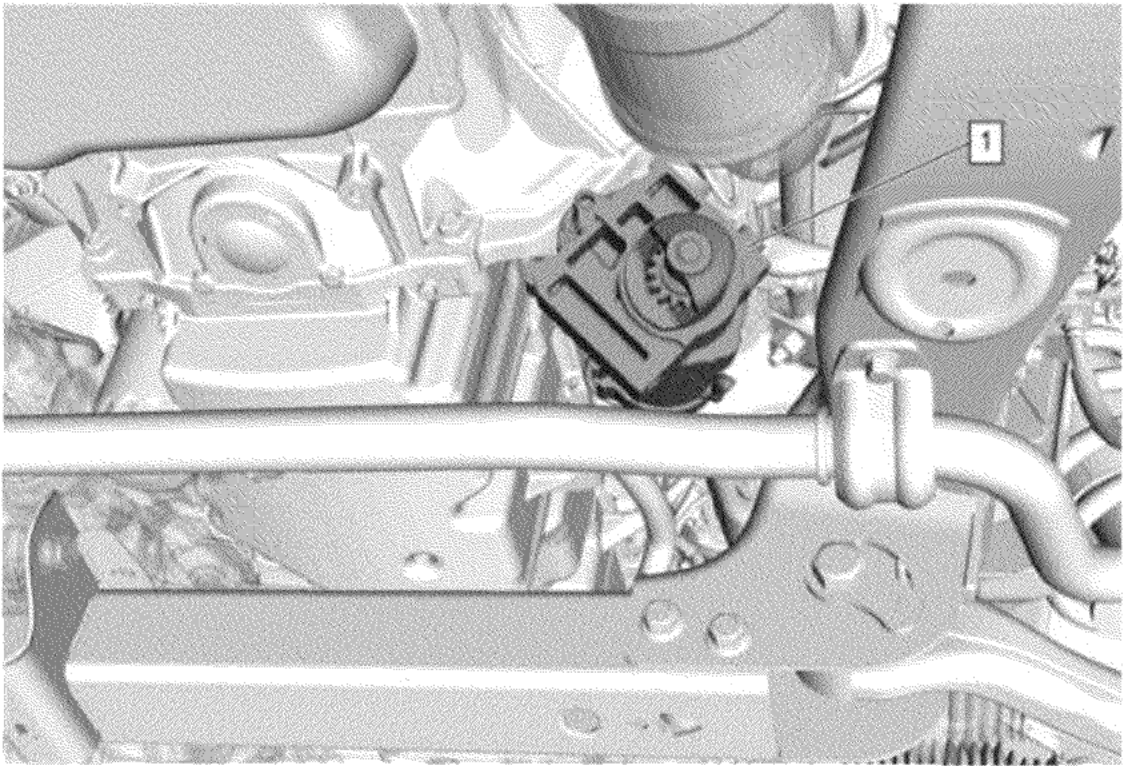
71. Transmission Converter Cover - Left Side (2) » Install

72. Torque Converter Cover Bolt - Left Side (1) » Install and tighten — [Fastener Specifications](#)

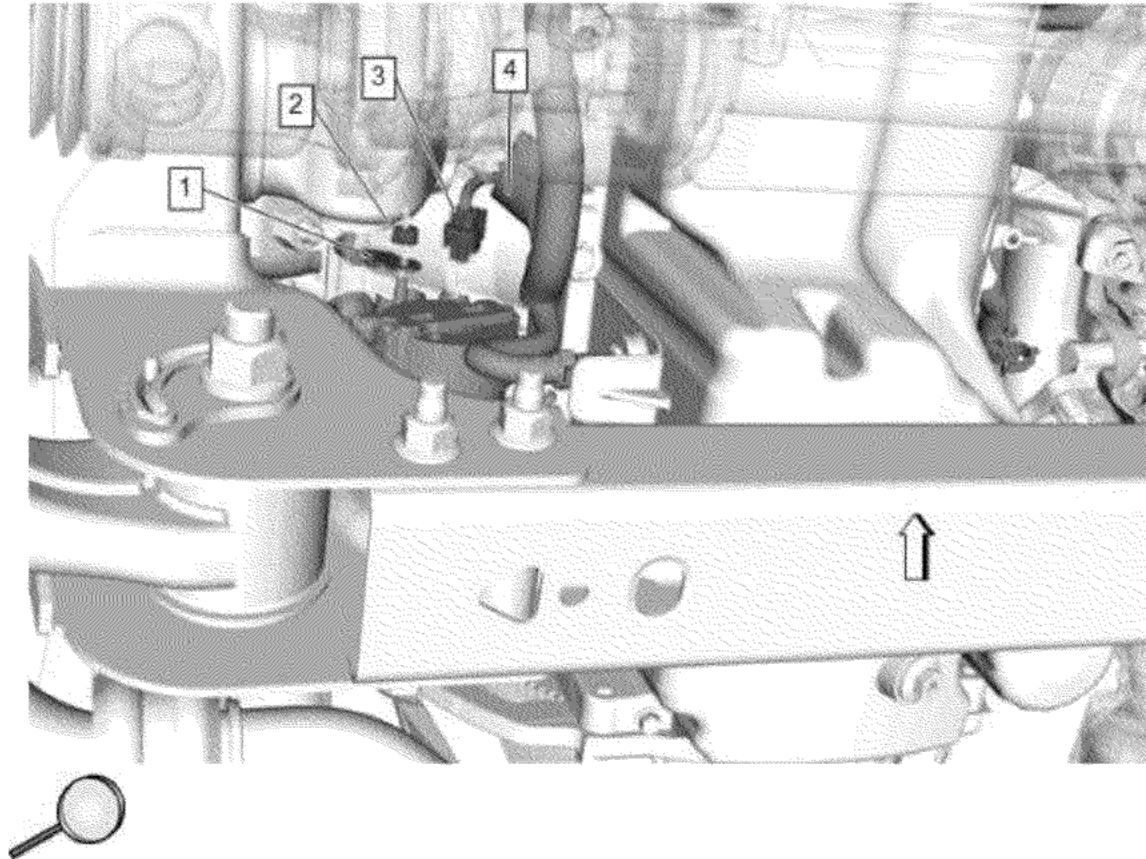


73. Transmission Converter Cover - Right Side (2) » Install

74. Torque Converter Cover Bolt - Right Side (1) » Install and tighten — [Fastener Specifications](#)



## 75. Starter (1) » Install



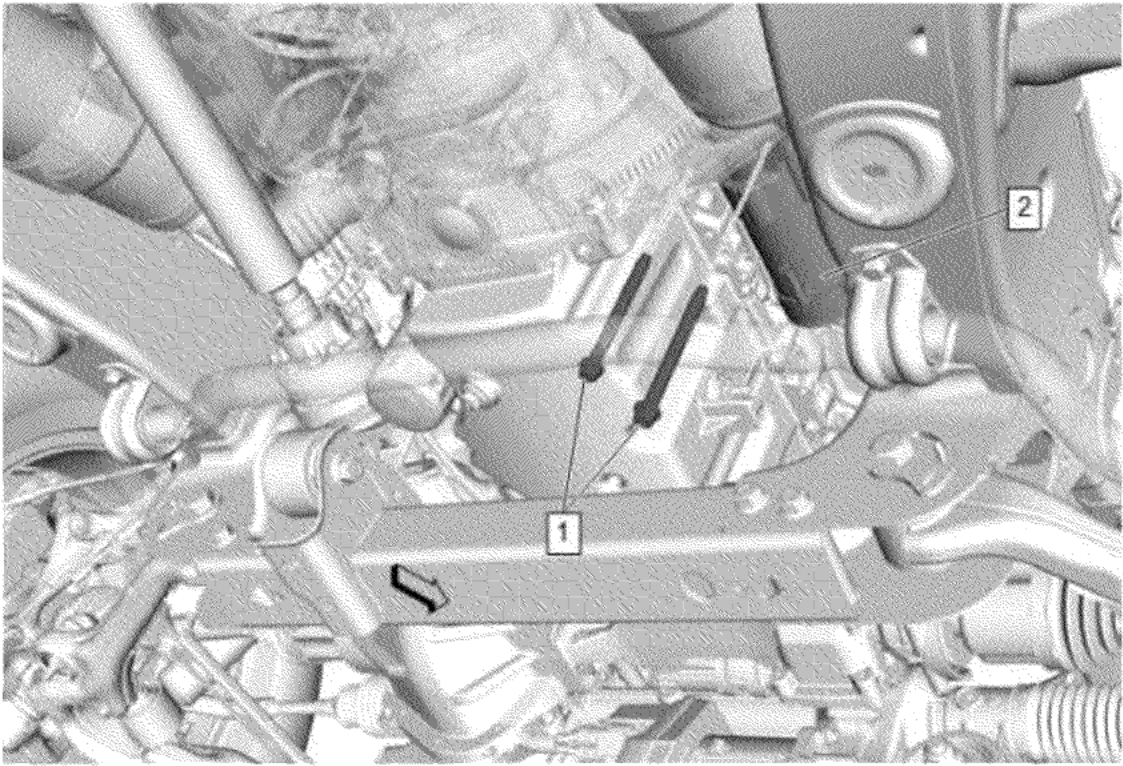
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76. Electrical Connector (3) » Connect

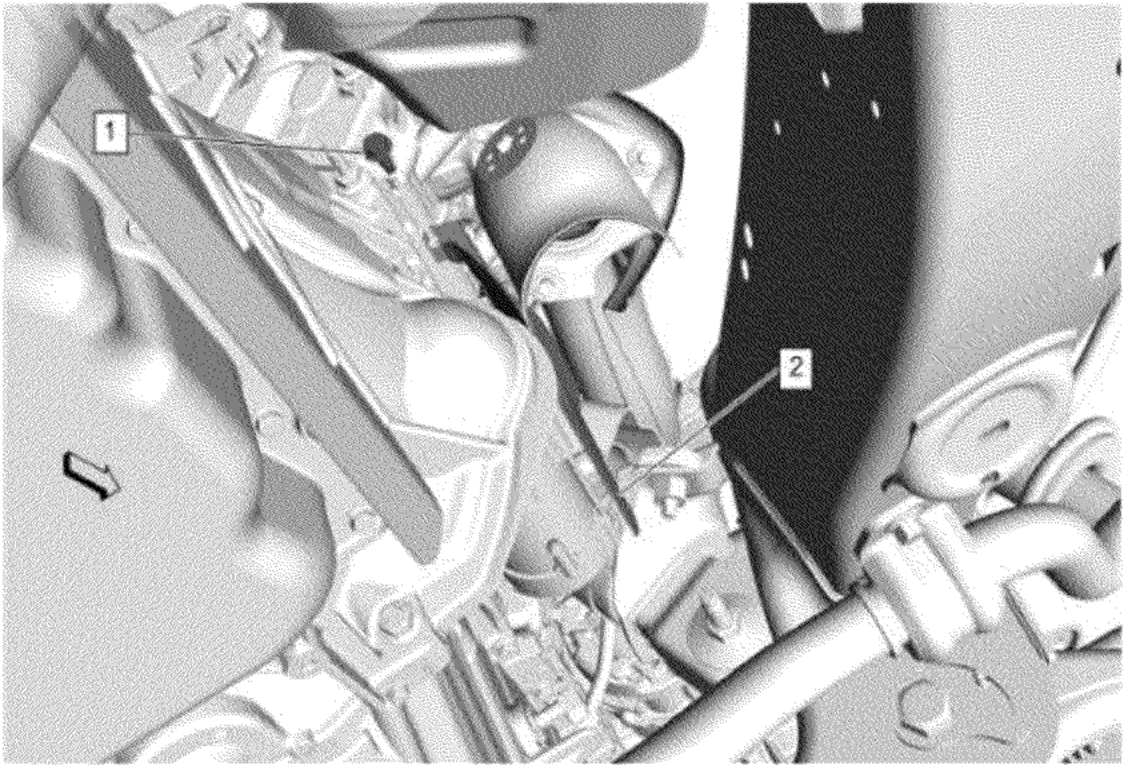
77. Protective Sleeve (4) » Install

78. Starter Solenoid Cable (1) » Install

79. Starter Solenoid Cable Nut (2) » Install and tighten — [Fastener Specifications](#)

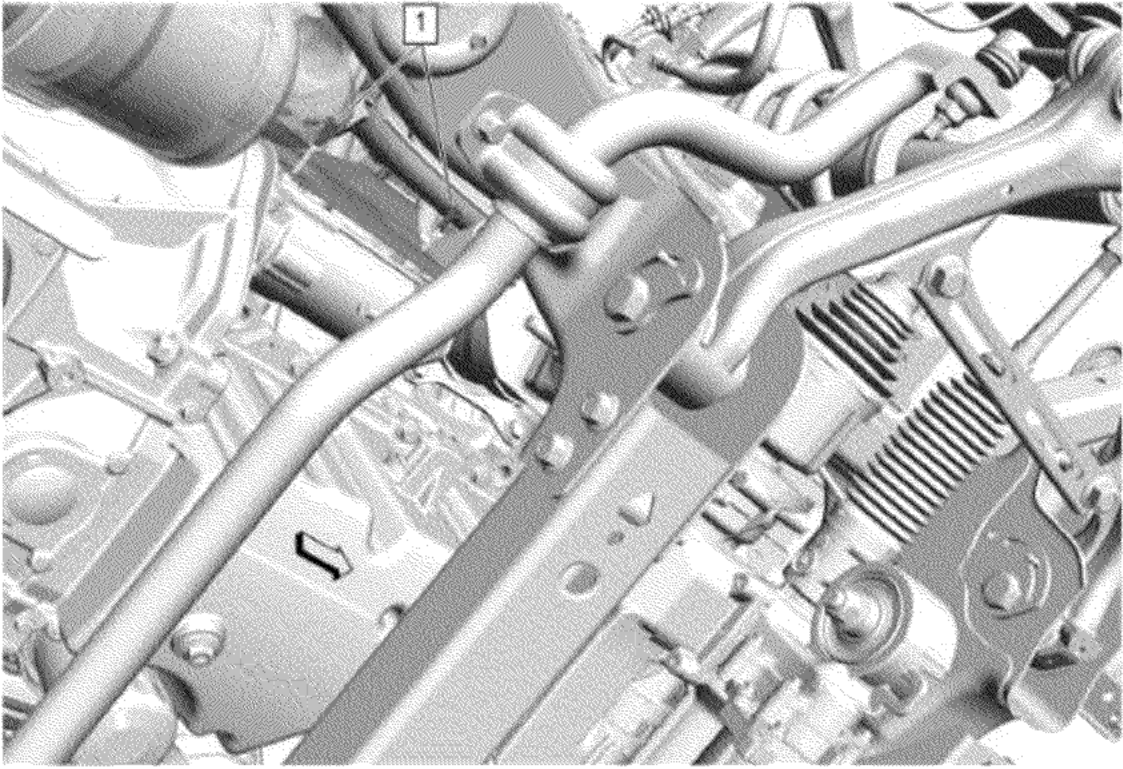


80. Starter Bolt (1) » Install and tighten [2x] — [Fastener Specifications](#)



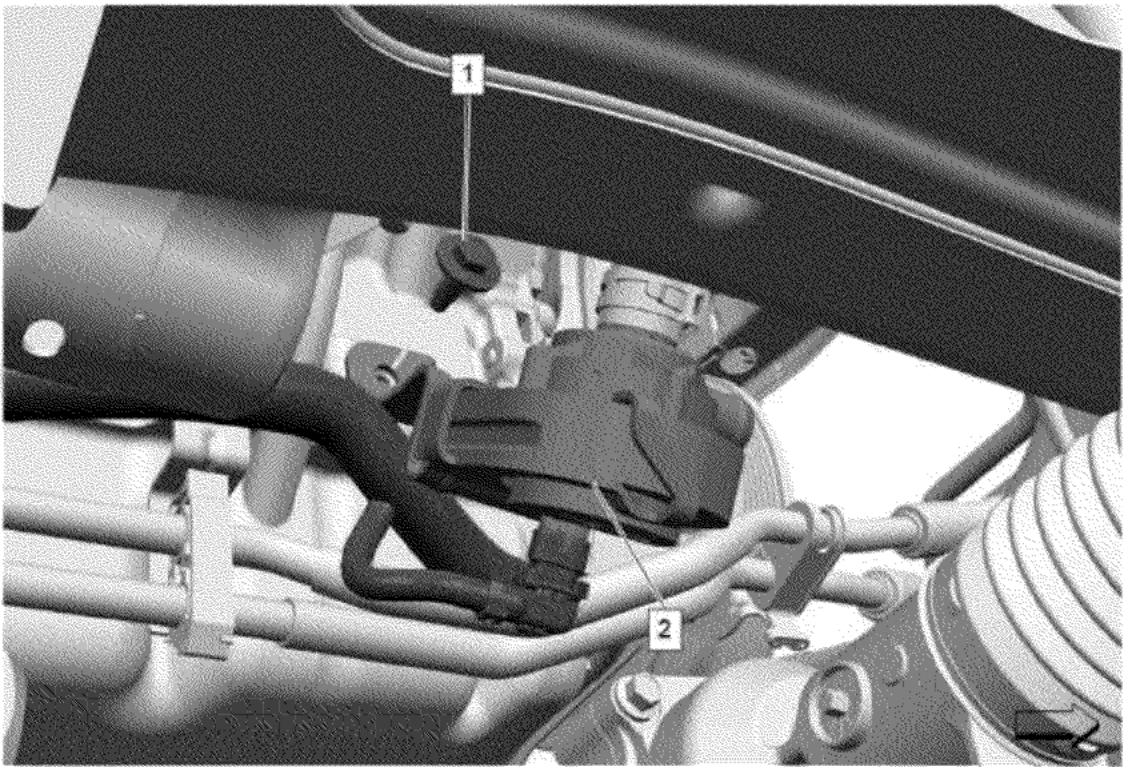
81. Starter Heat Shield (2) » Install

82. Starter Heat Shield Bolt (1) » Install and tighten — [Fastener Specifications](#)



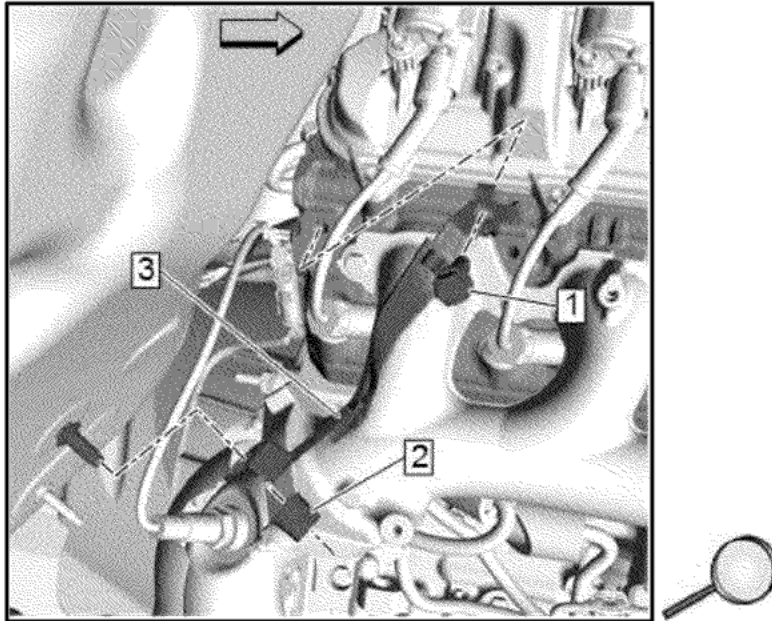
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83. Starter Heat Shield Bolt (1) » Install and tighten [2x] — [Fastener Specifications](#)

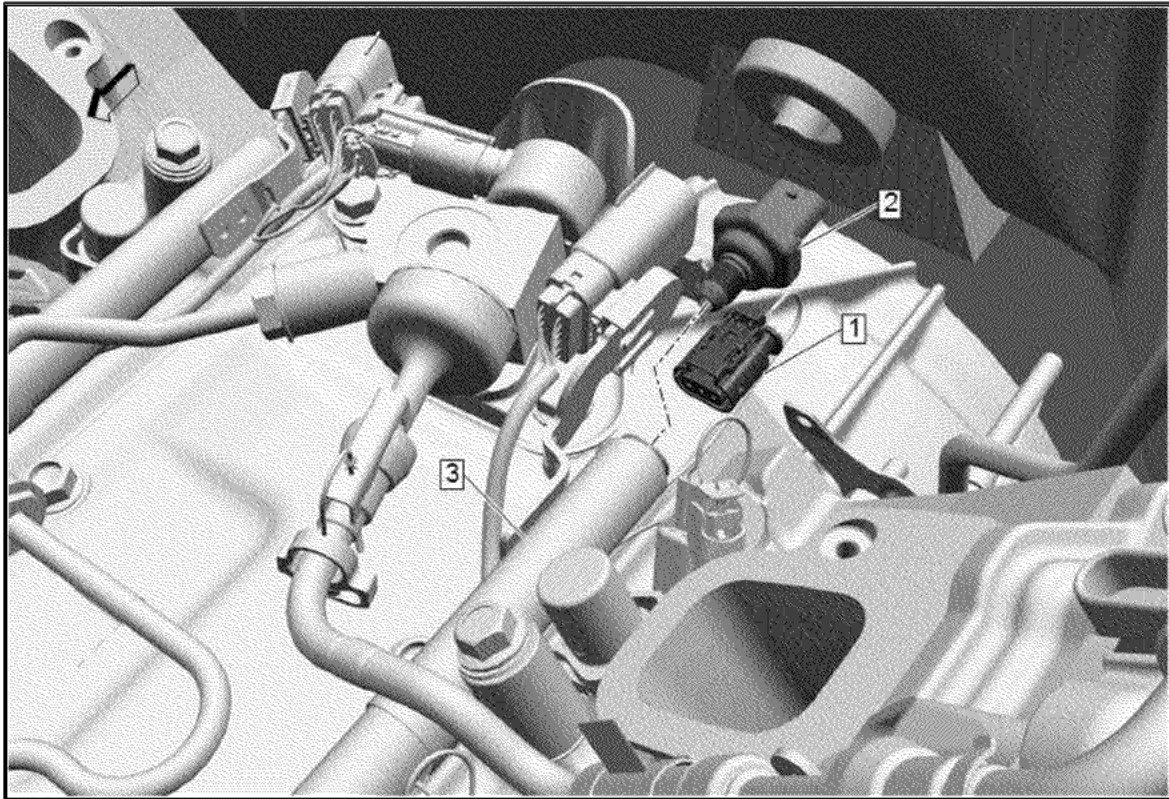


**Note:** Some components not shown for graphic clarity.

84. Install the heater coolant pump and heater water auxiliary pump bracket (2) as assembly.
85. Heater Water Auxiliary Pump Bolt (1) » Install and tighten — [Fastener Specifications](#)
86. Electrical Connector @ Heater Coolant Pump (2) » Connect



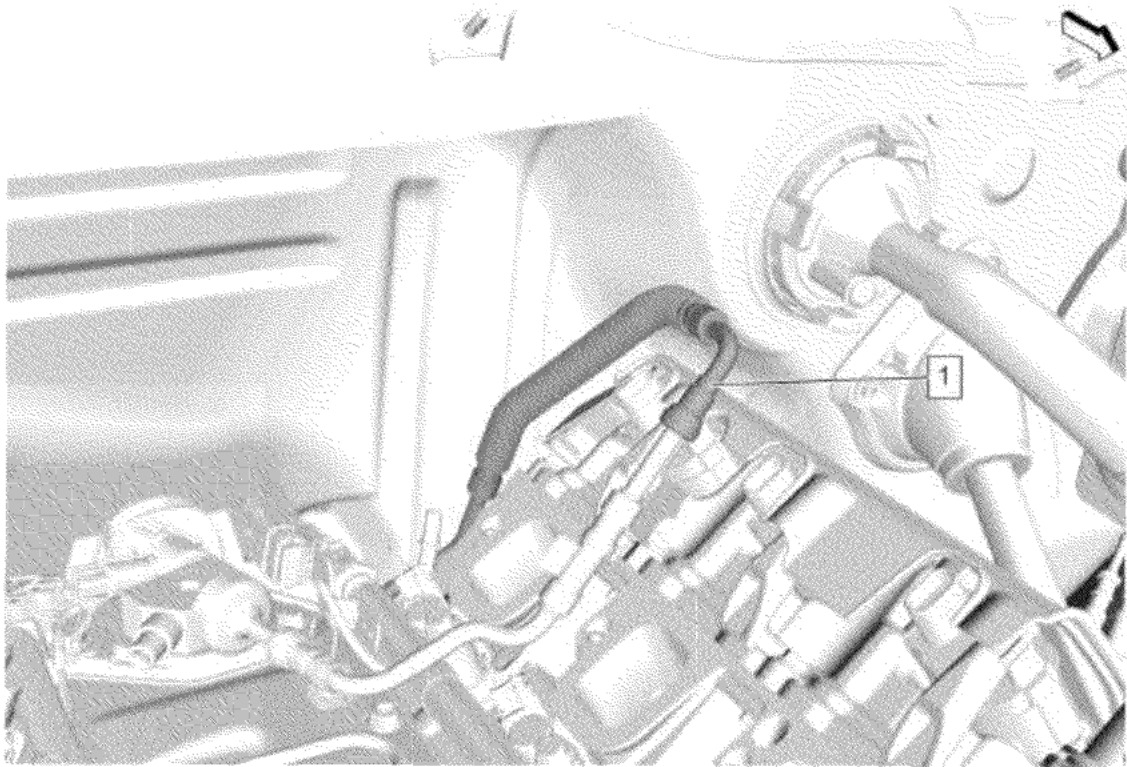
87. Battery Negative Cable Extension Cable Strap (3) @ Engine Block » Install
88. Engine Wiring Harness Ground Bolt (1) @ Engine Block » Install and tighten — [Fastener Specifications](#)



**Caution:** To tighten or loosen the fuel injection fuel rail fuel pressure sensor, apply force ONLY to the attached hexagon. Applying force to the plastic housing of the sensor may damage the sensor.

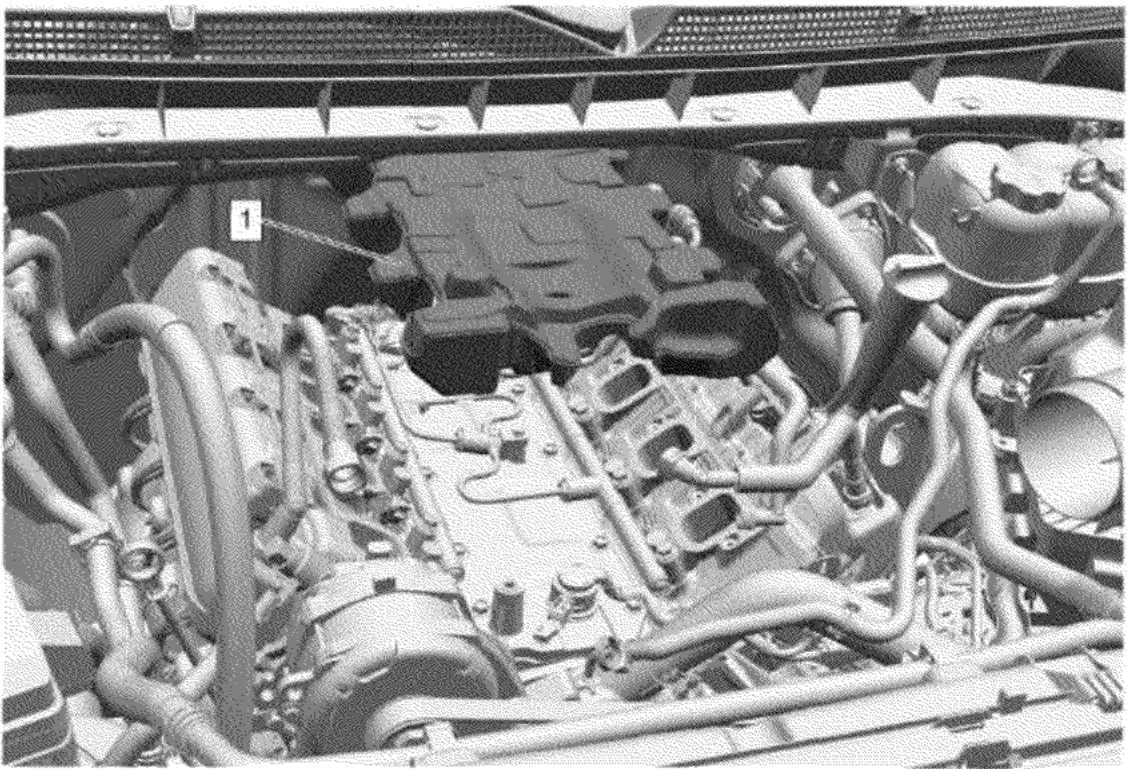
**Note:** Ensure the fuel rail threads are clean and free of any excess fuel, or the fuel rail pressure sensor will NOT seal properly.

89. Lubricate the threads and sealing surface of the fuel rail pressure sensor (2) with one drop of clean engine oil.
90. Install the fuel rail pressure sensor (2) and hand tighten.
91. Remove the fuel rail pressure sensor (2) from the fuel injection fuel rail (3) and re-lubricate with one drop of clean engine oil.
92. Fuel Rail Pressure Sensor (2) @ Fuel Injection Fuel Rail (3) » Install and tighten — [Fastener Specifications](#)
93. Electrical Connector (1) @ Fuel Rail Pressure Sensor (2) » Connect



94. Fuel Feed Pipe (1) » Install

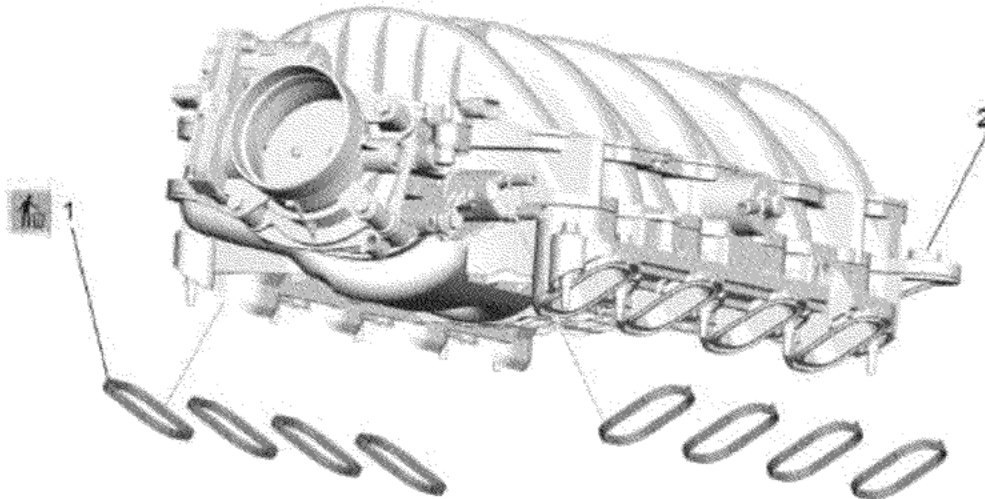
95. Fuel Feed Pipe (1) » Connect — [Metal Collar Quick Connect Fitting Service](#)



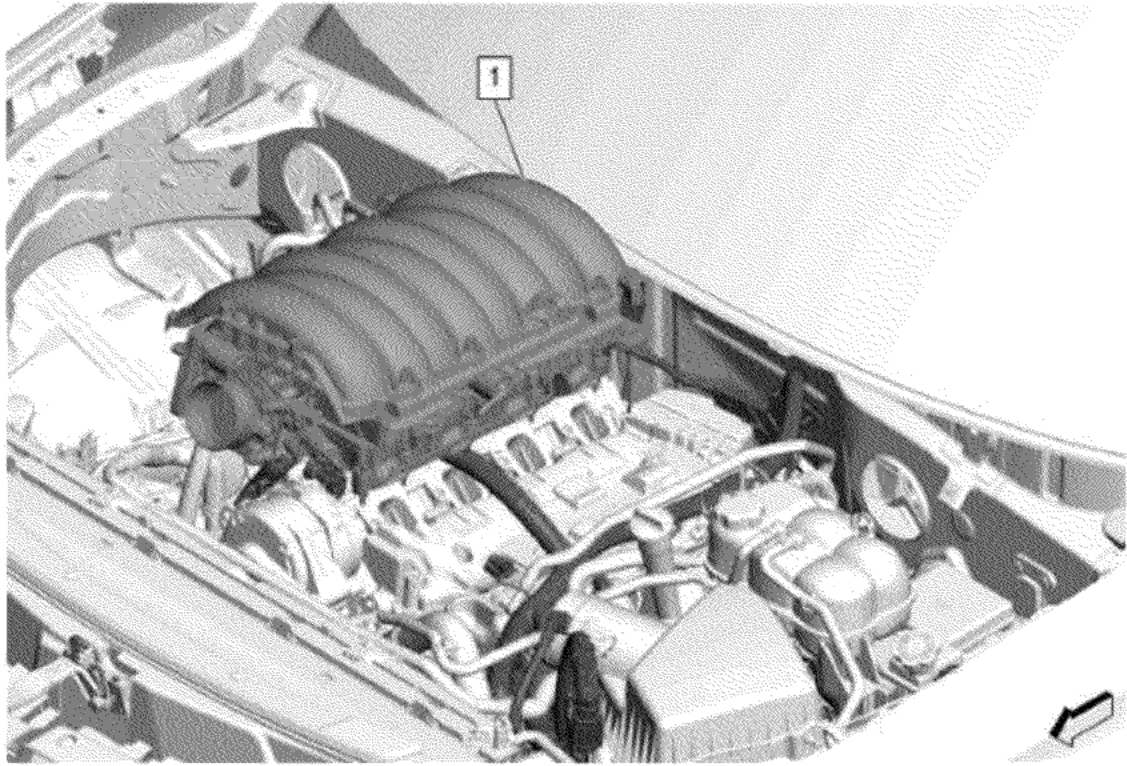
**Danger:** The noise cancelling foam component MUST be replaced if it has been exposed to engine fluids. Failure to replace the noise canceling foam component that has been exposed to engine fluids may result in an engine fire resulting in catastrophic engine damage, and possible injury or death.

96. Fuel Pump Insulator (1) » Install

97. Remove the covers from the cylinder head passages.



98. Intake Manifold Gasket (1) » Install NEW [8x]



99. Clean all sealing surfaces.

100. If NEW threaded components are being installed, loosen the adhesive using a metal pick or similar tool before proceeding. If threaded components are reused, prepare the threaded components using the following steps:

100.1. Remove any loose cured adhesive from the external threads of the components using a lint free cloth.

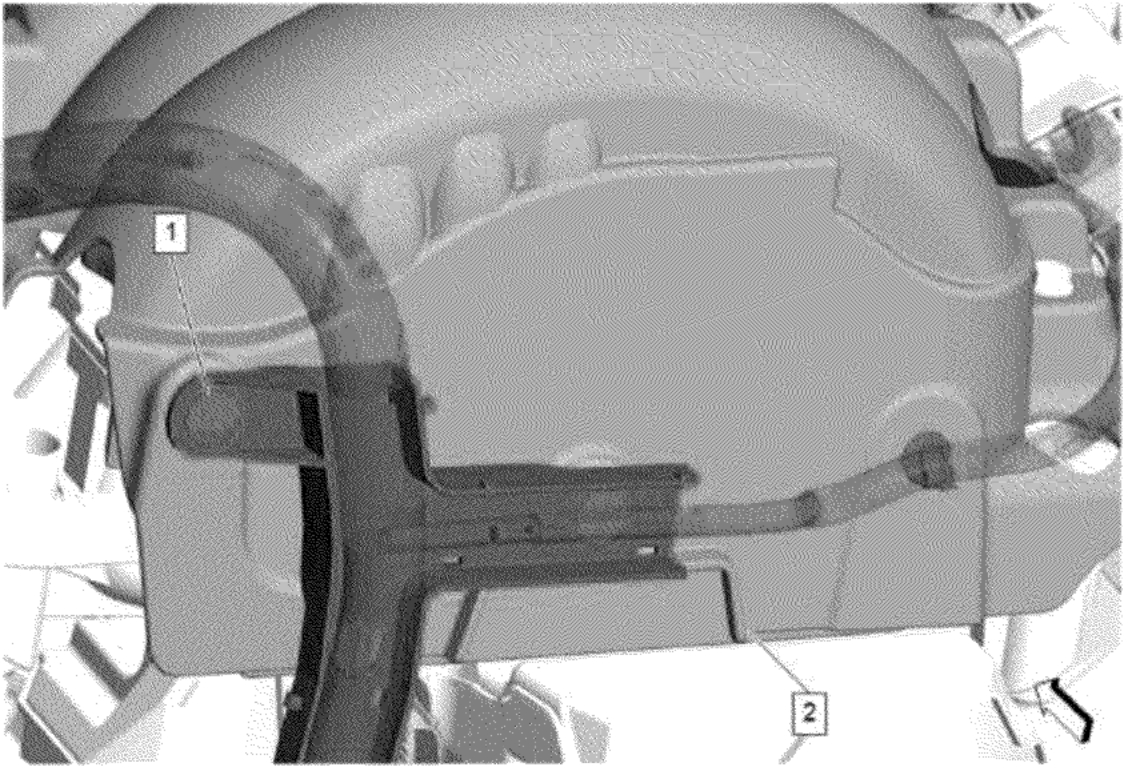
100.2. Thread the cleaned components into the internal mating threads and remove to loosen trapped cured adhesive.

100.3. Remove loose debris from internal and external threads using compressed air.

100.4. Apply liquid thread locking adhesive in a strip along half of the length of the external threads, starting at the tip, just prior to installation. Adhesives, Fluids, Lubricants, and Sealers

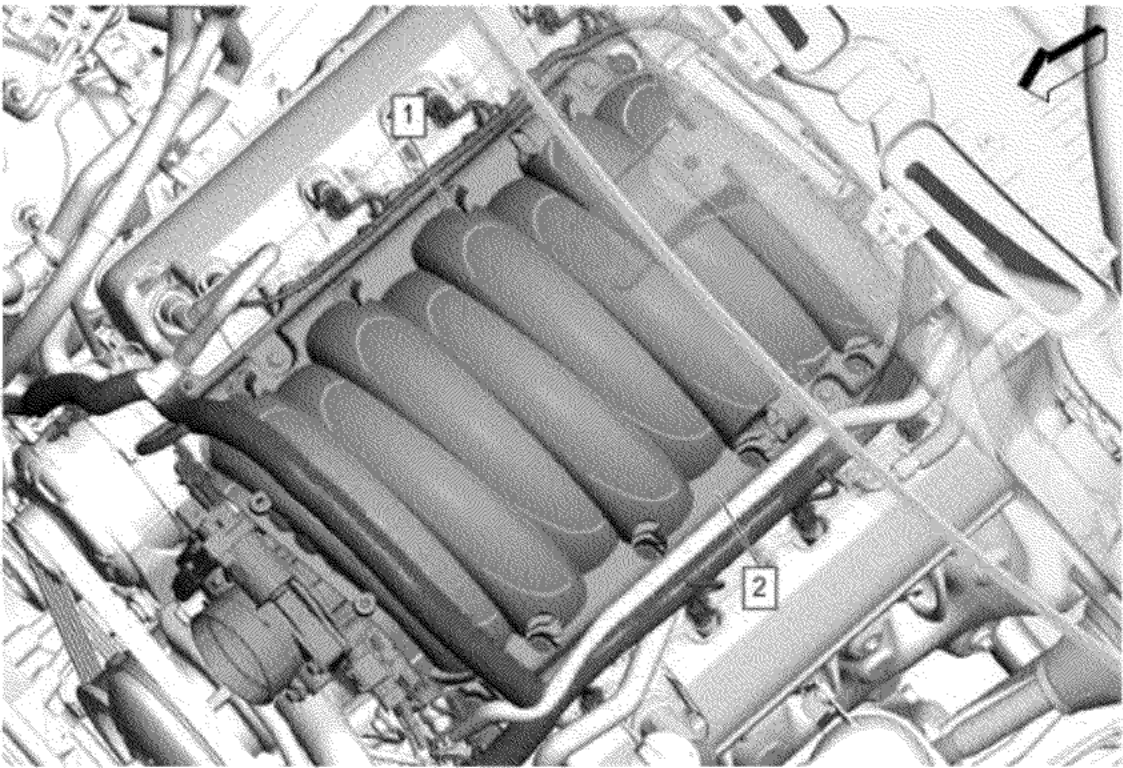
**Note:** The aid of an assistant may be helpful in holding the engine harness up out of the way so the upper intake manifold cover does not get caught against the engine harness.

101. Position the intake manifold and Intake manifold cover (1) to install harness retainers.



102. Engine Wiring Harness Retainer (1) @ Intake Manifold Cover (2) » Install [4x]

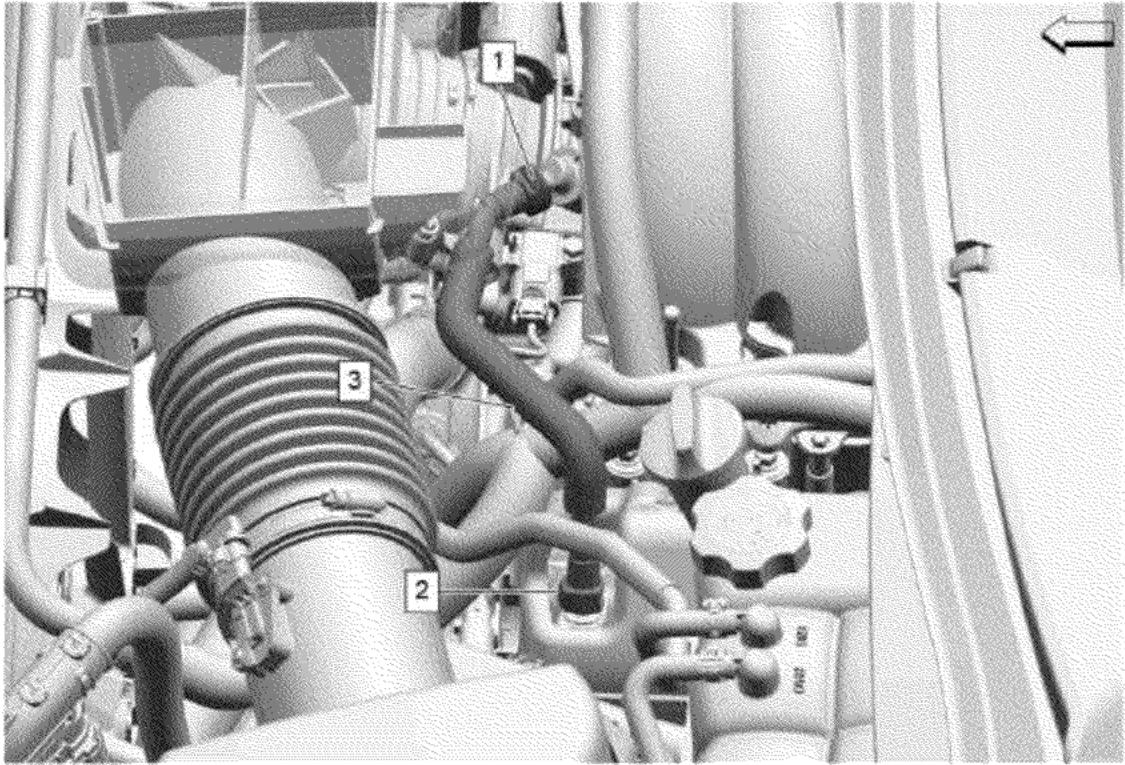
103. Move the intake manifold and intake manifold cover (2) into place.



**Note:** Some components not shown for graphic clarity.

104. Intake Manifold Bolt (1) » Hand tighten [10x]

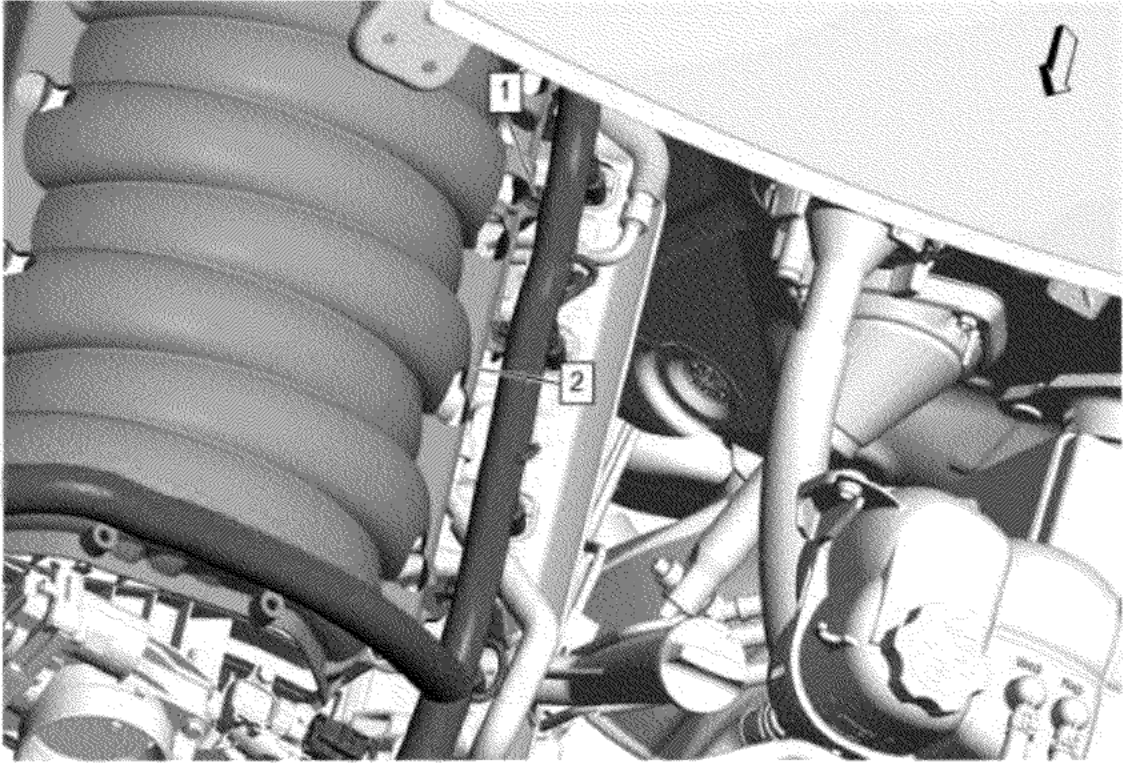
105. Intake Manifold Bolt (1) » Tighten in sequence [10x] — [Fastener Specifications](#)



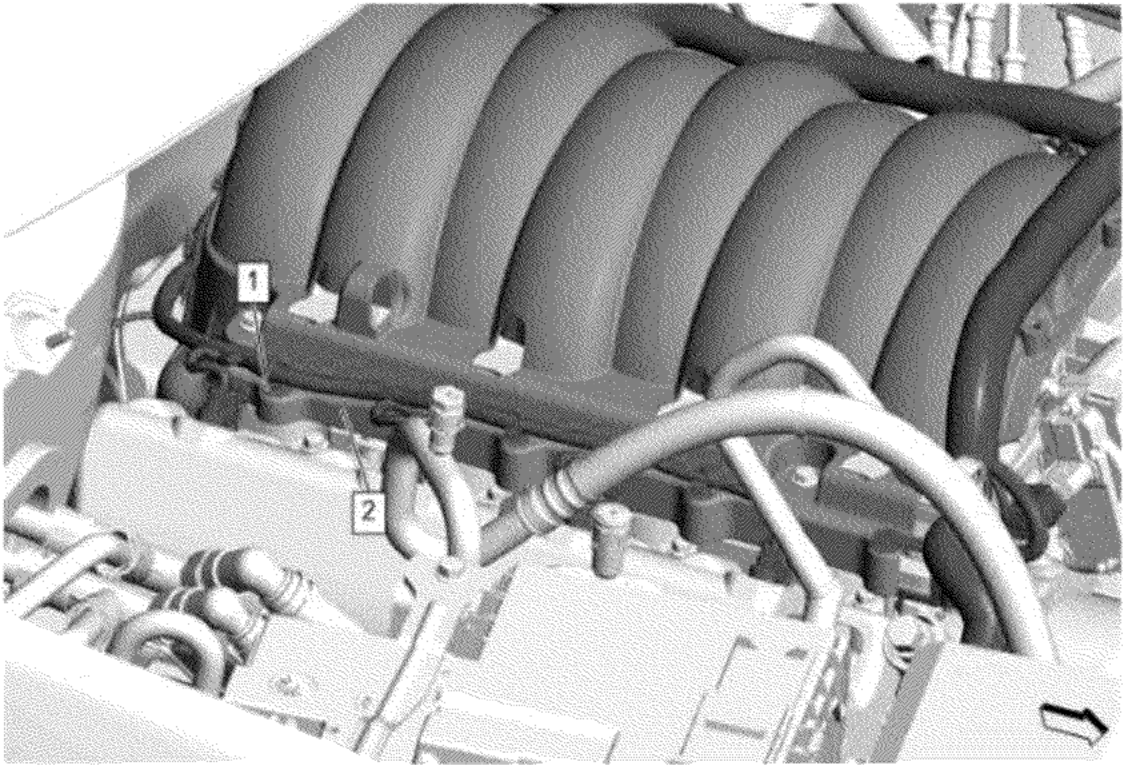
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106. Positive Crankcase Ventilation Tube Connector (1) @ Intake Manifold » Install — [Plastic Collar Quick Connect Fitting Service](#)

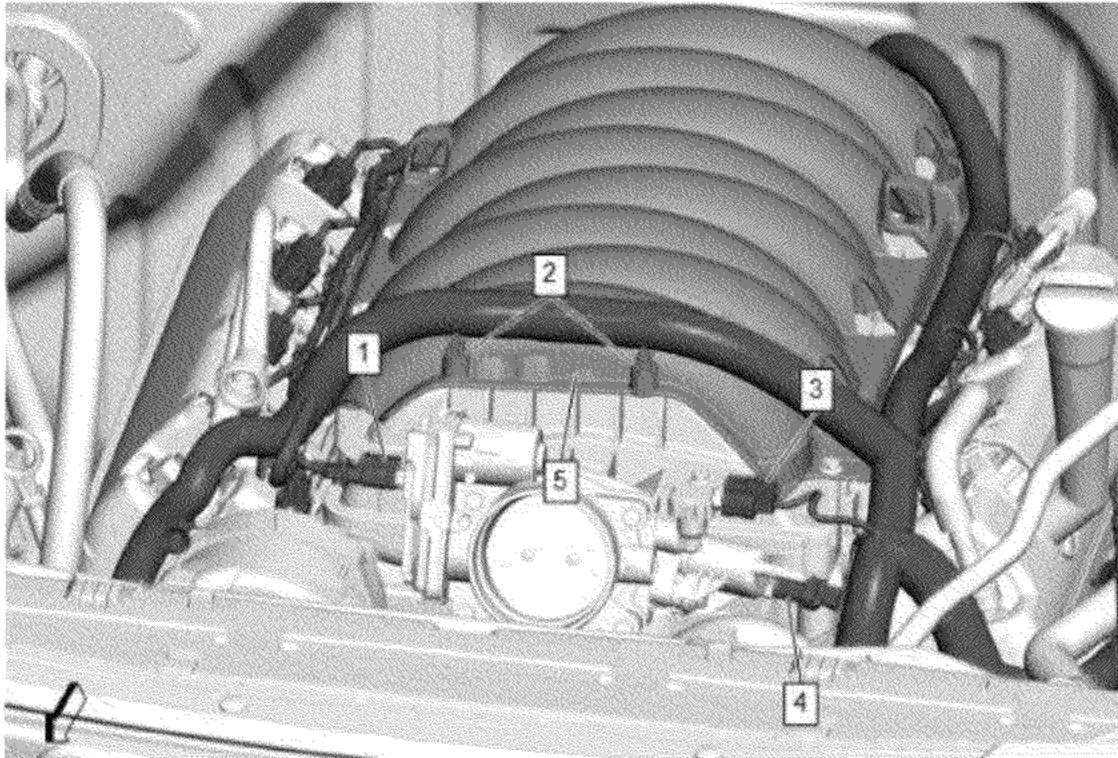


107. Engine Wiring Harness Retainer (1) @ Intake Manifold Cover (2) » Install [3x]



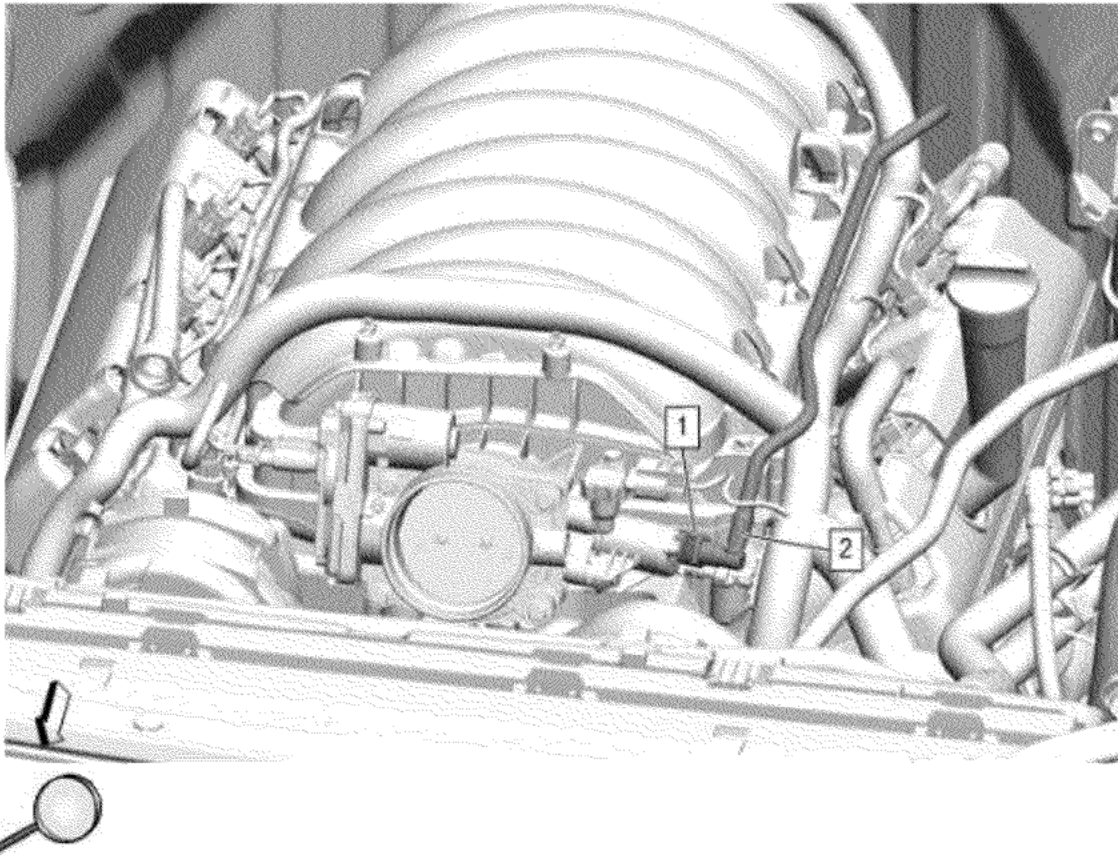
108. Engine Wiring Harness Retainer (1) @ Intake Manifold Cover (2) » Install [4x]

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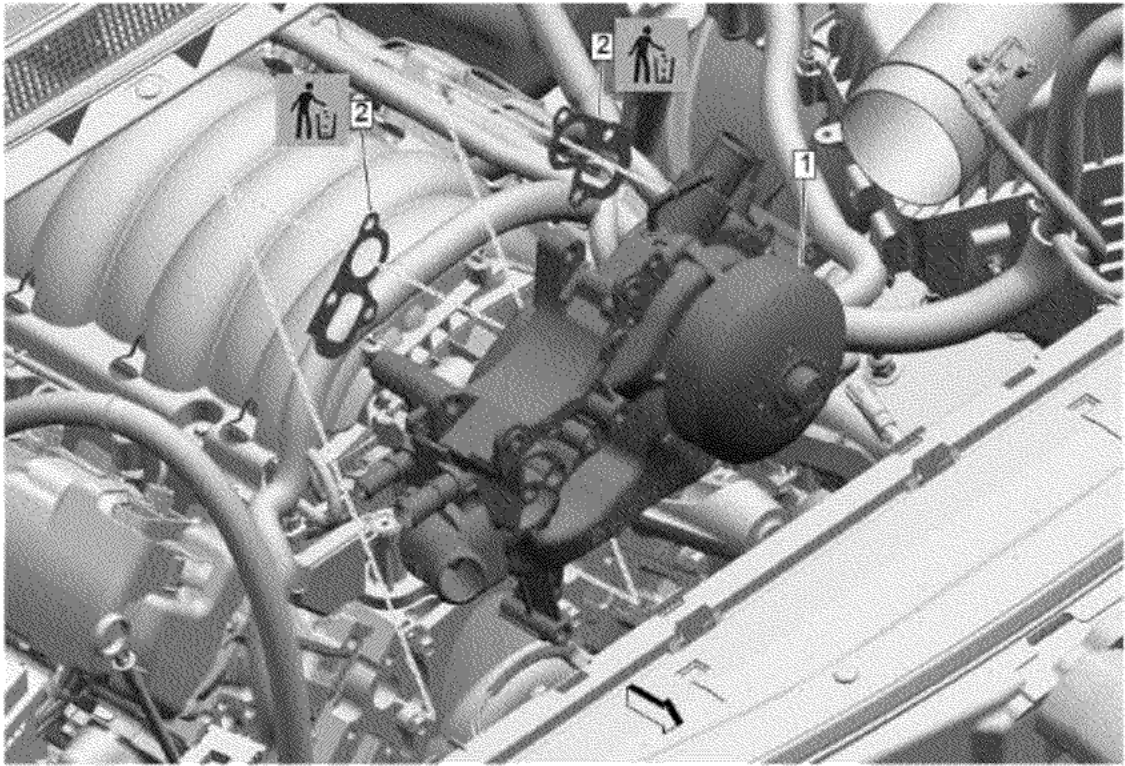
109. Engine Wiring Harness Connector (4) @ Evaporative Emission Canister Purge Solenoid Valve  
» Connect
110. Engine Wiring Harness Connector (3) @ Manifold Absolute Pressure Sensor » Connect
111. Engine Wiring Harness Retainer (2) @ Intake Manifold Cover » Install [2x]
112. Engine Wiring Harness Connector (1) @ Throttle Body » Connect



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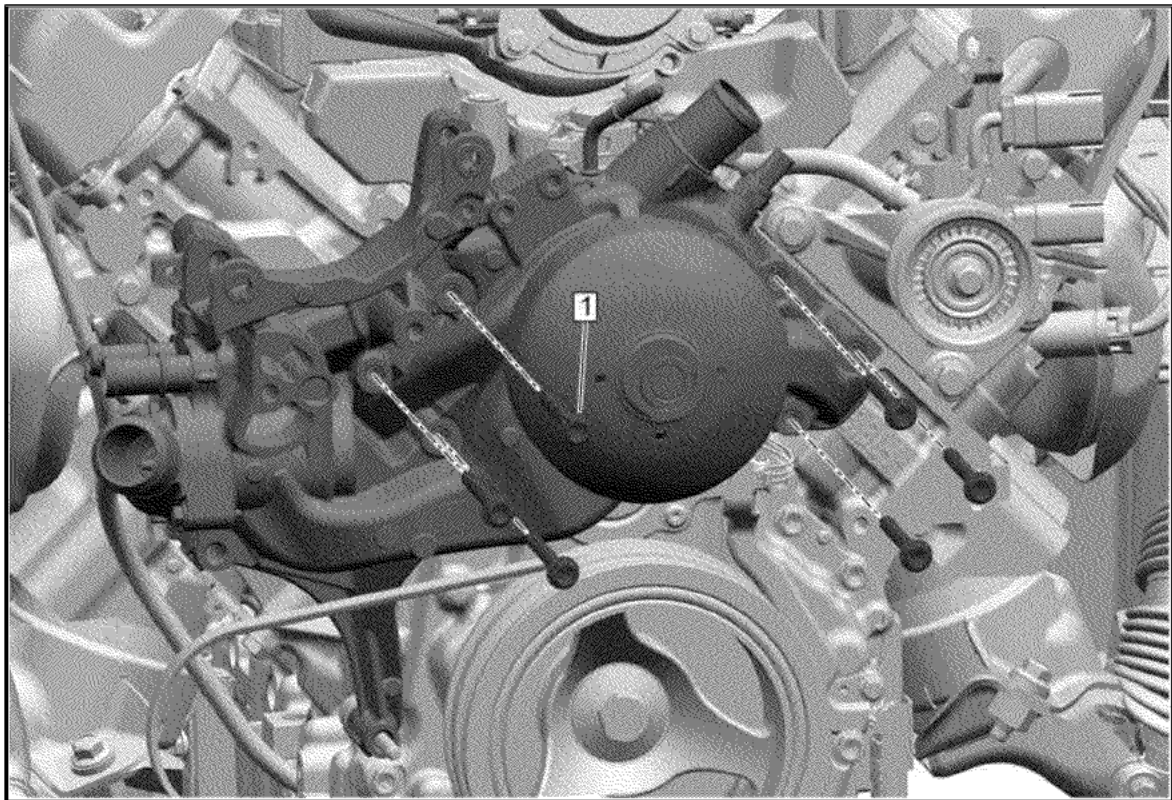
113. Evaporative Emission Canister Purge Tube (2) @ Evaporative Emission Canister Purge Solenoid Valve » Install

114. Evaporative Emission Canister Purge Tube Connector (1) @ Evaporative Emission Canister Purge Solenoid Valve » Engage — [Plastic Collar Quick Connect Fitting Service](#)

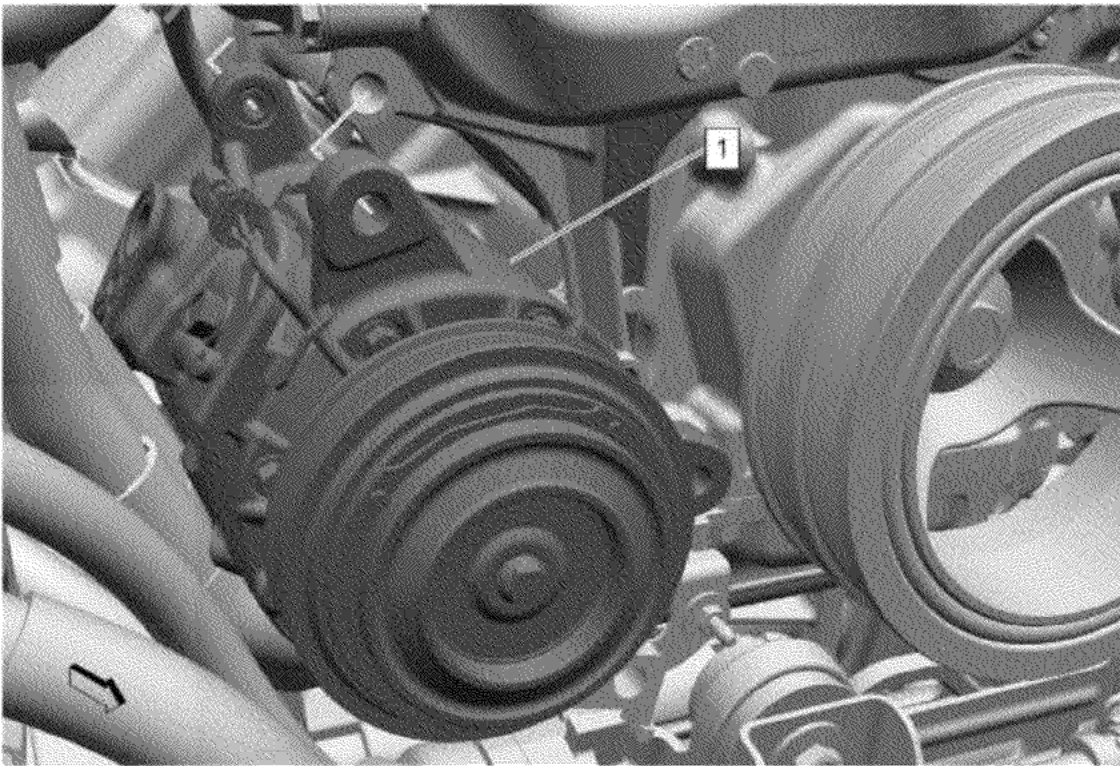


115. Water Pump Gasket (2) » Install NEW [2x]

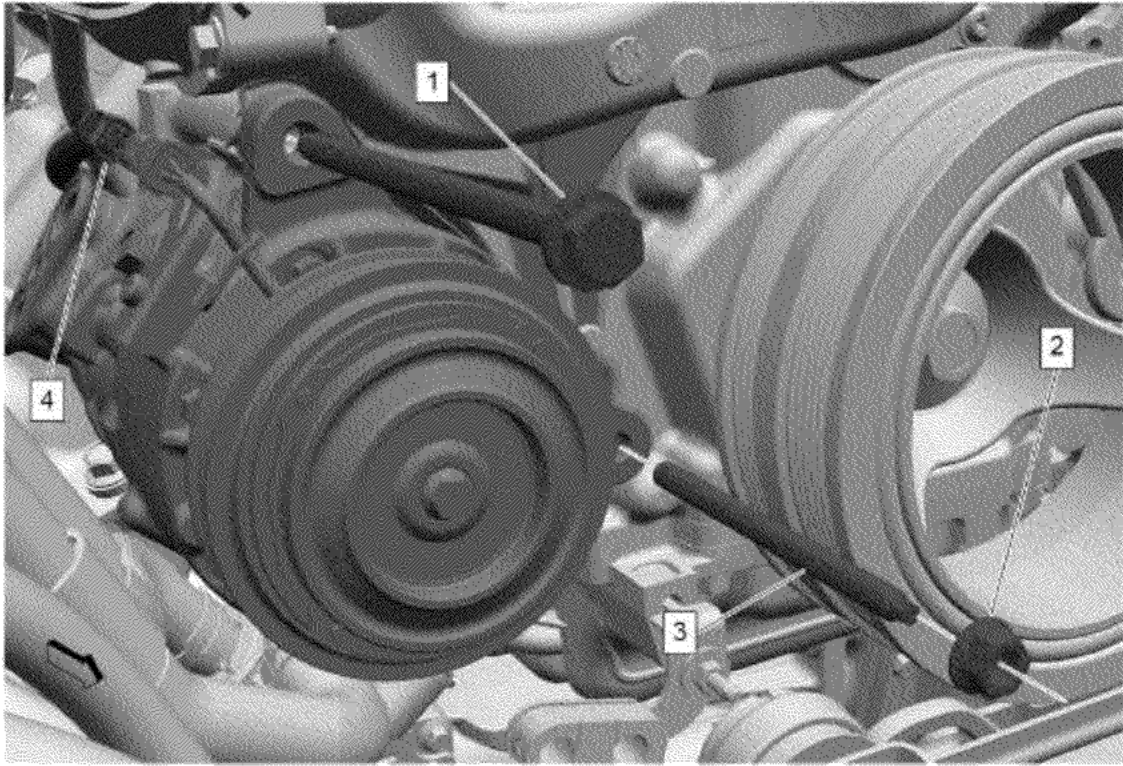
116. Water Pump (1) » Install



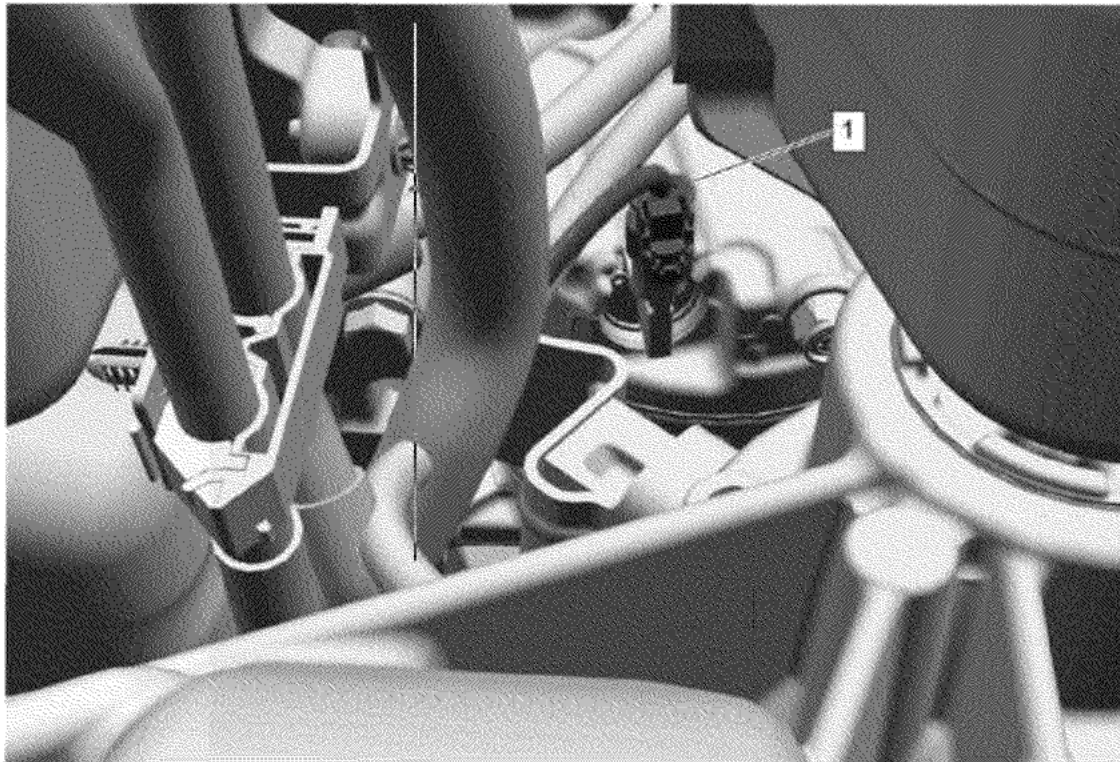
117. If NEW threaded components are being installed, loosen the adhesive using a metal pick or similar tool before proceeding. If threaded components are reused, prepare the threaded components using the following steps:
- 117.1. Remove any loose cured adhesive from the external threads of the components using a lint free cloth.
  - 117.2. Thread the cleaned components into the internal mating threads and remove to loosen trapped cured adhesive.
  - 117.3. Remove loose debris from internal and external threads using compressed air.
  - 117.4. Apply liquid thread locking adhesive in a strip along half of the length of the external threads, starting at the tip, just prior to installation. Adhesives, Fluids, Lubricants, and Sealers
118. Water Pump Housing Bolt (1) » Install and hand tighten [6x]
119. Water Pump Housing Bolt » Tighten in sequence [6x] — Fastener Specifications



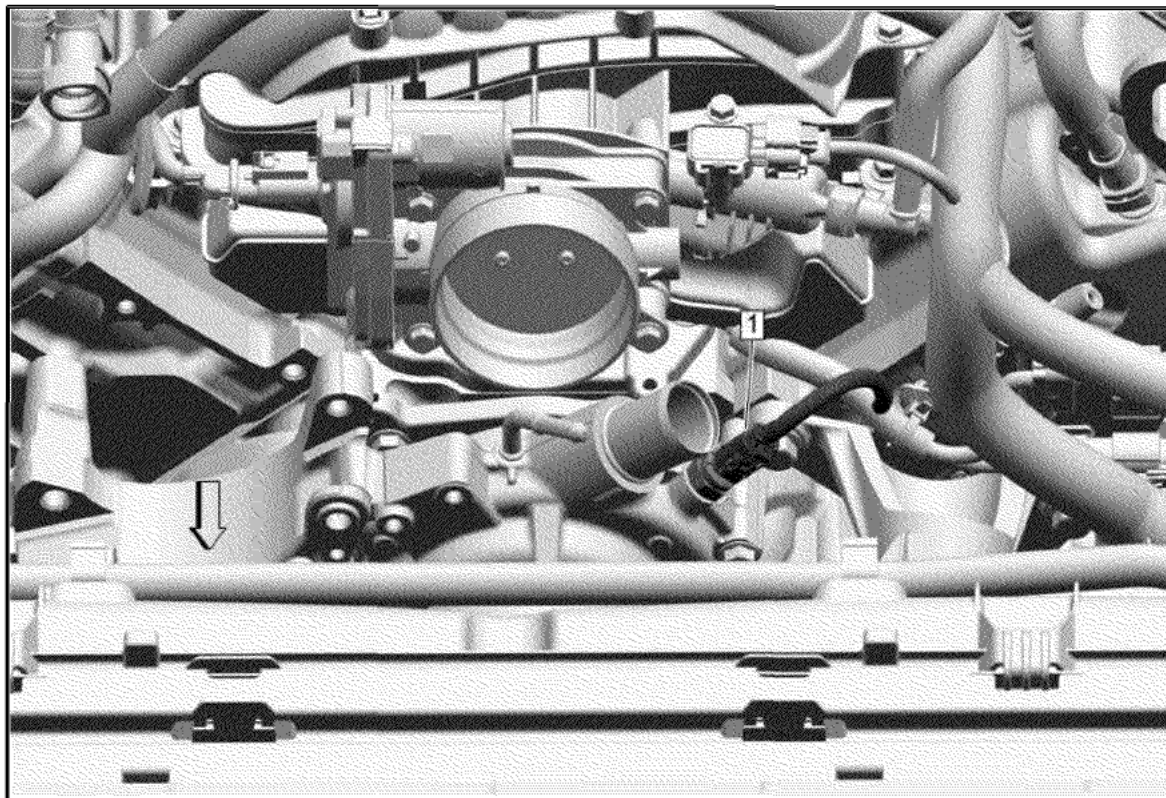
120. Air Conditioning Compressor (1) » Install



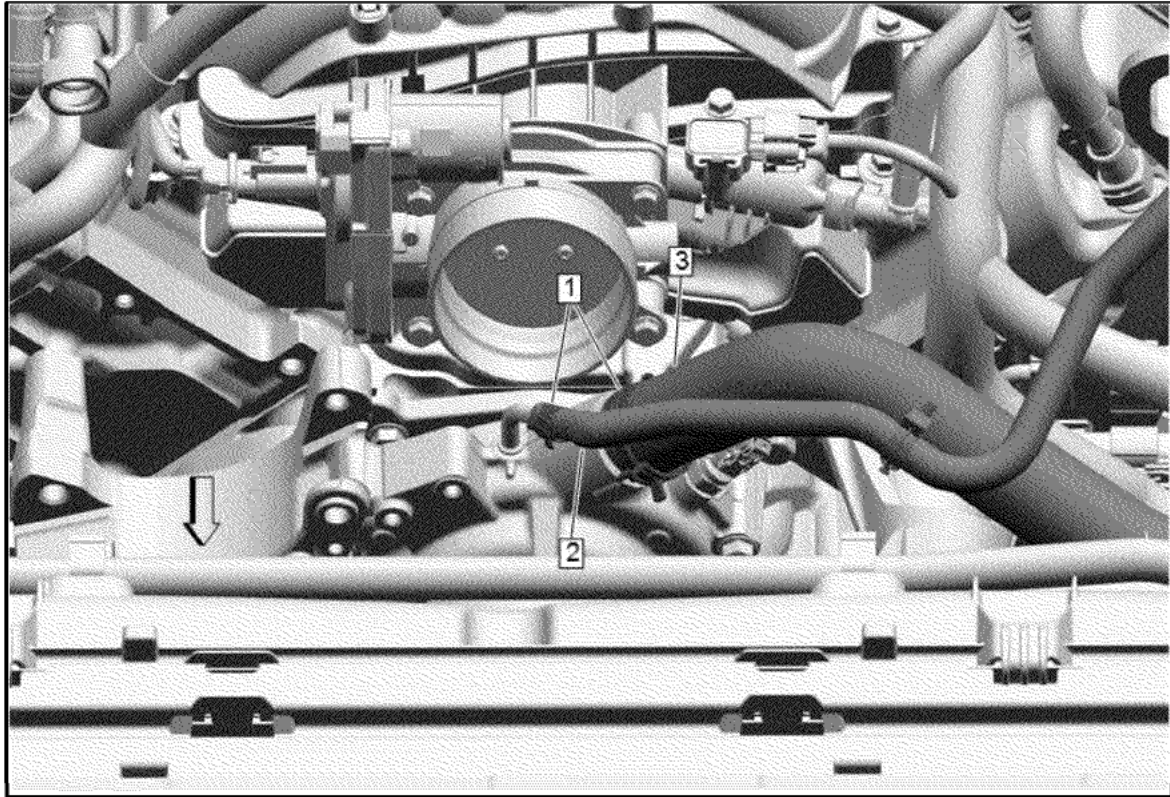
- 121. Air Conditioning Compressor Bolt (1) » Loosely install
- 122. Air Conditioning Compressor Stud (3) » Install and tighten — [Fastener Specifications](#)
- 123. Air Conditioning Compressor Bolt (1) » Tighten — [Fastener Specifications](#)
- 124. Air Conditioning Compressor Nut (2) » Install and tighten — [Fastener Specifications](#)



125. Electrical Connector (1) @ Air Conditioning Compressor » Connect



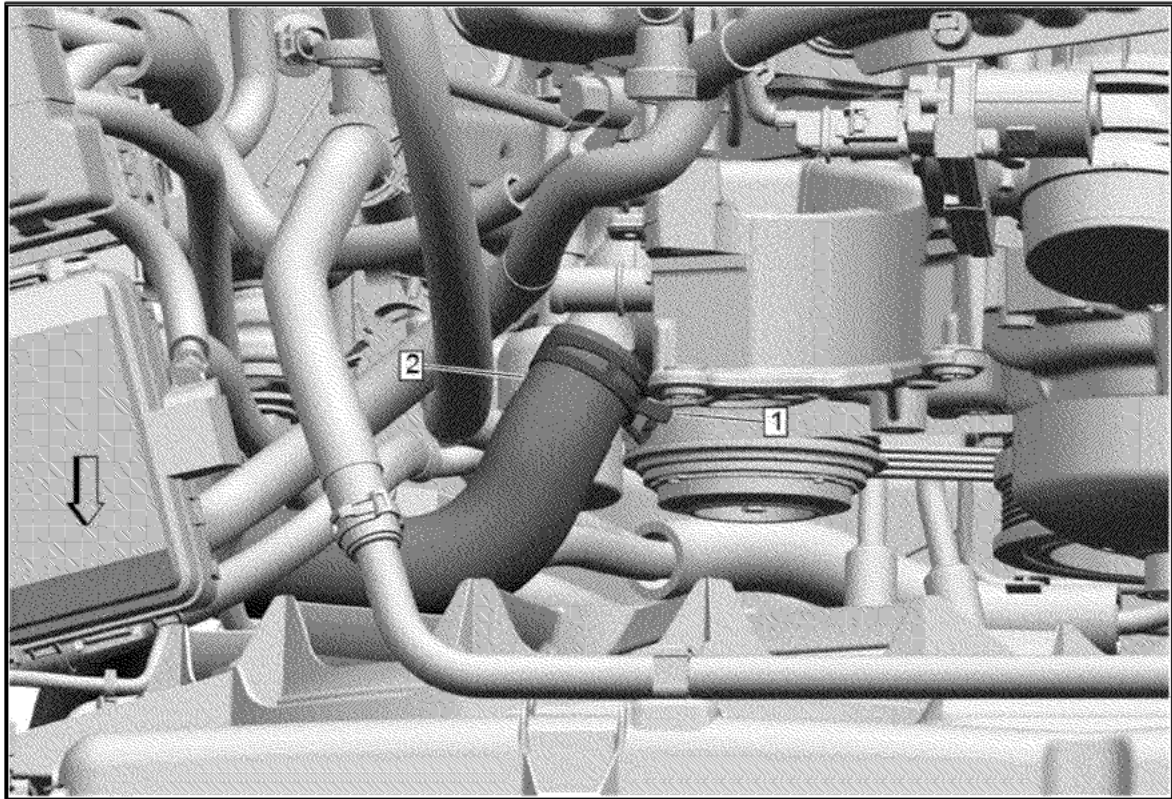
## 126. Engine Coolant Temperature Sensor Electrical Connector (1) » Connect



127. Radiator Inlet Hose (3) @ Water Pump » Install

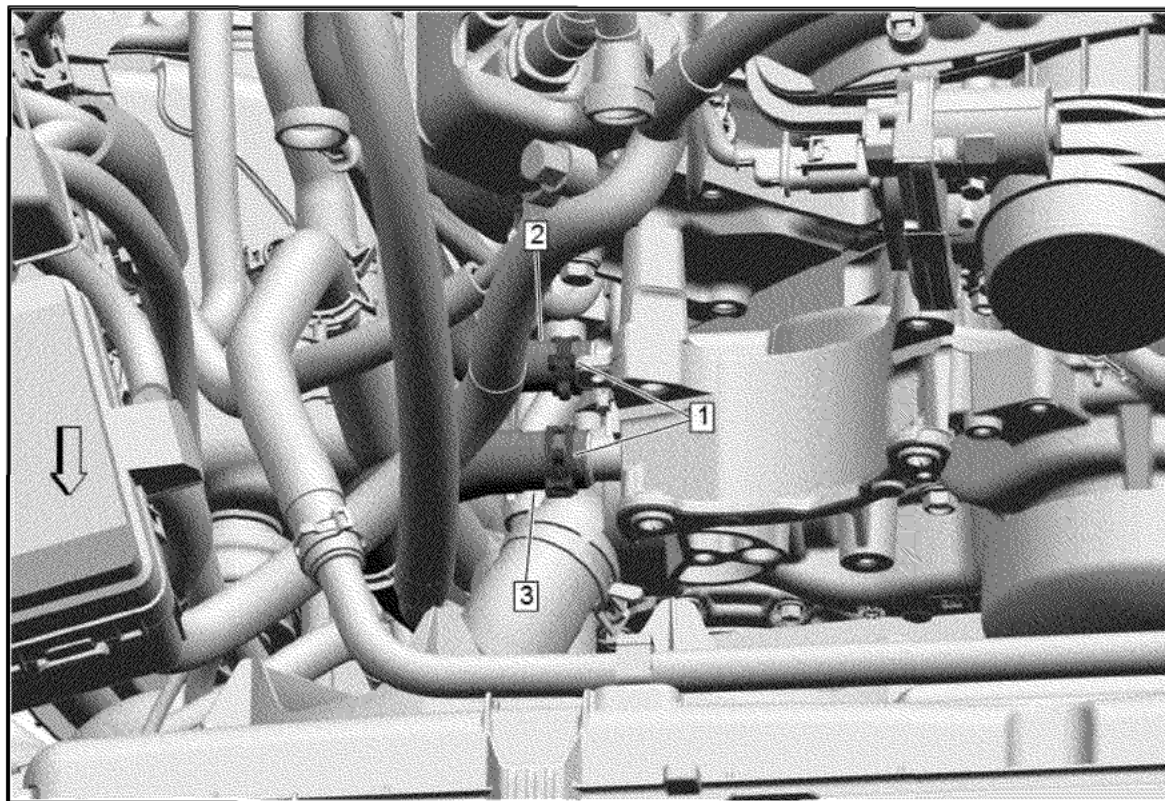
128. Engine Coolant Air Bleed Hose (2) @ Water Pump » Install

129. Hose Clamp (1) » Engage [2x] — [Hose Clamp Replacement Guidelines - Spring Type](#)

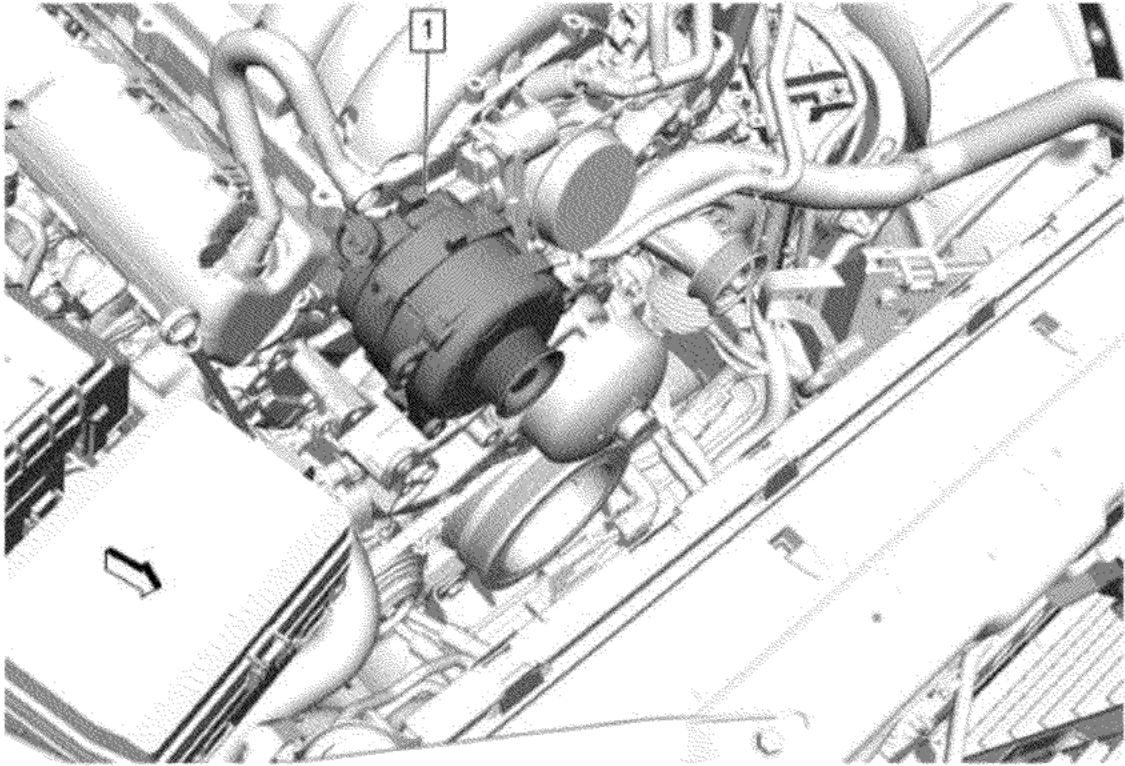


130. Radiator Outlet Hose (2) @ Water Pump » Install

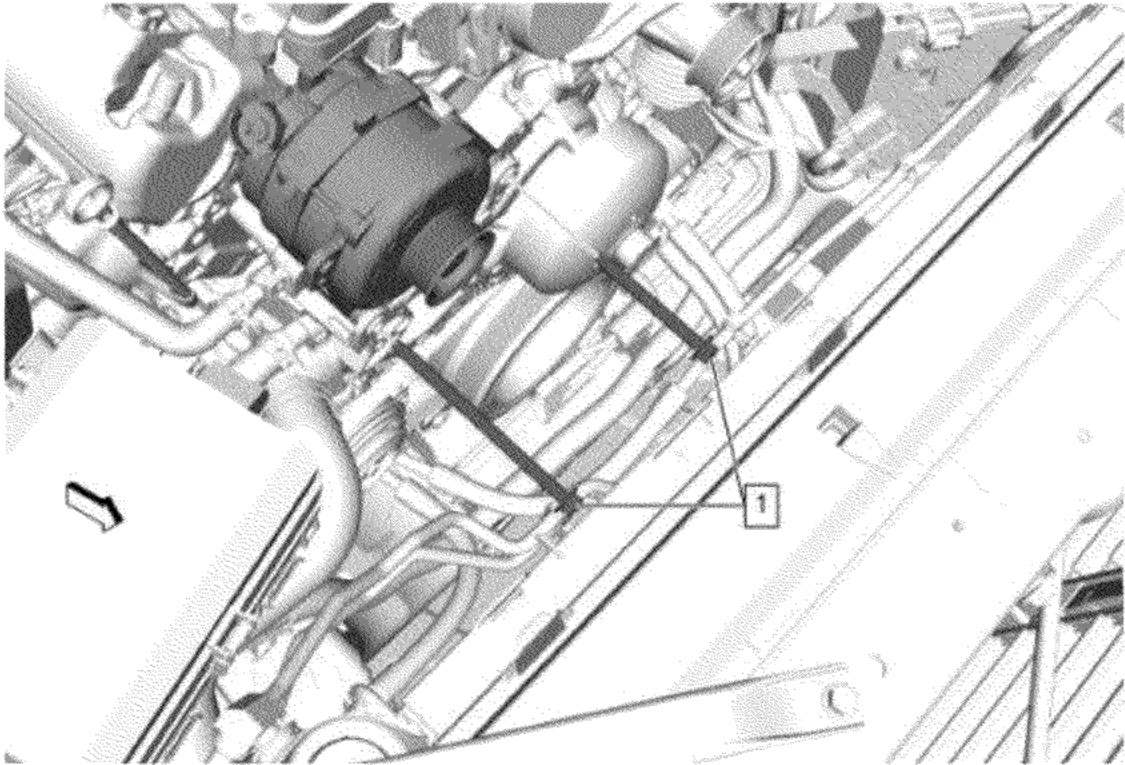
131. Radiator Outlet Hose Clamp (1) » Engage — [Hose Clamp Replacement Guidelines - Spring Type](#)



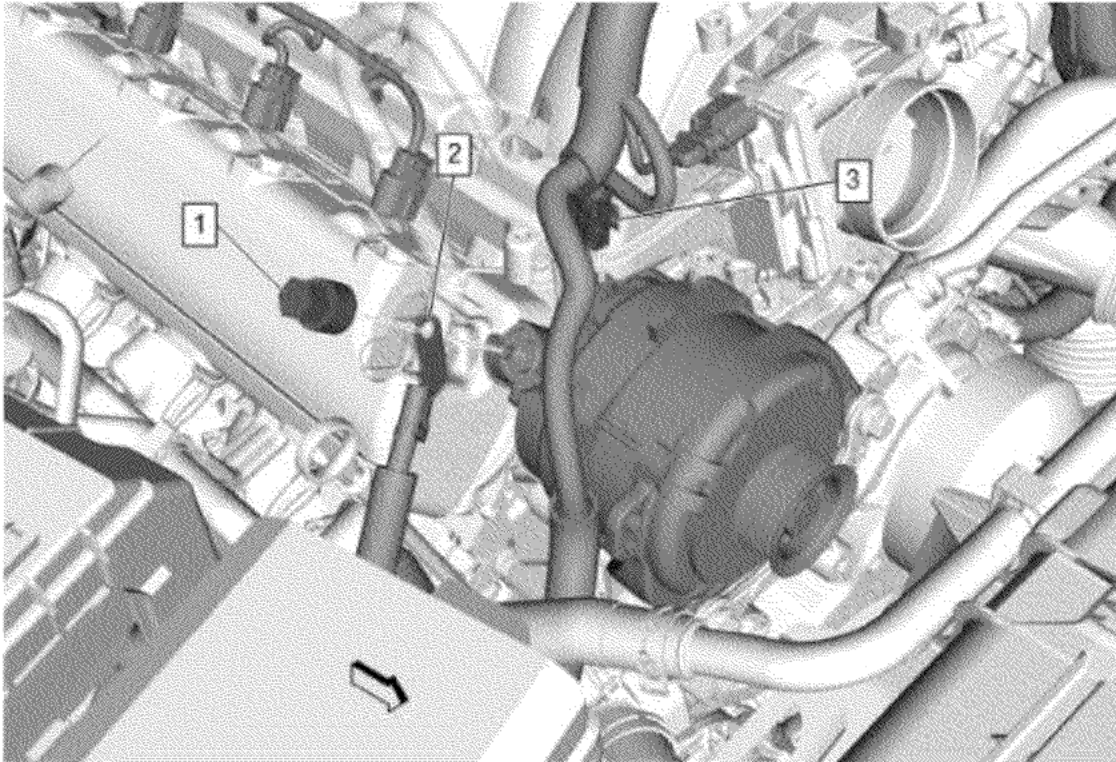
- 132. Heater Water Auxiliary Pump Hose (3) @ Water Pump » Install
- 133. Heater Inlet Hose (2) @ Water Pump » Install
- 134. Hose Clamp (1) » Engage [2x] — [Hose Clamp Replacement Guidelines - Spring Type](#)



135. Generator (1) » Install



136. Generator Bolt (1) » Install and tighten [2x] — [Fastener Specifications](#)

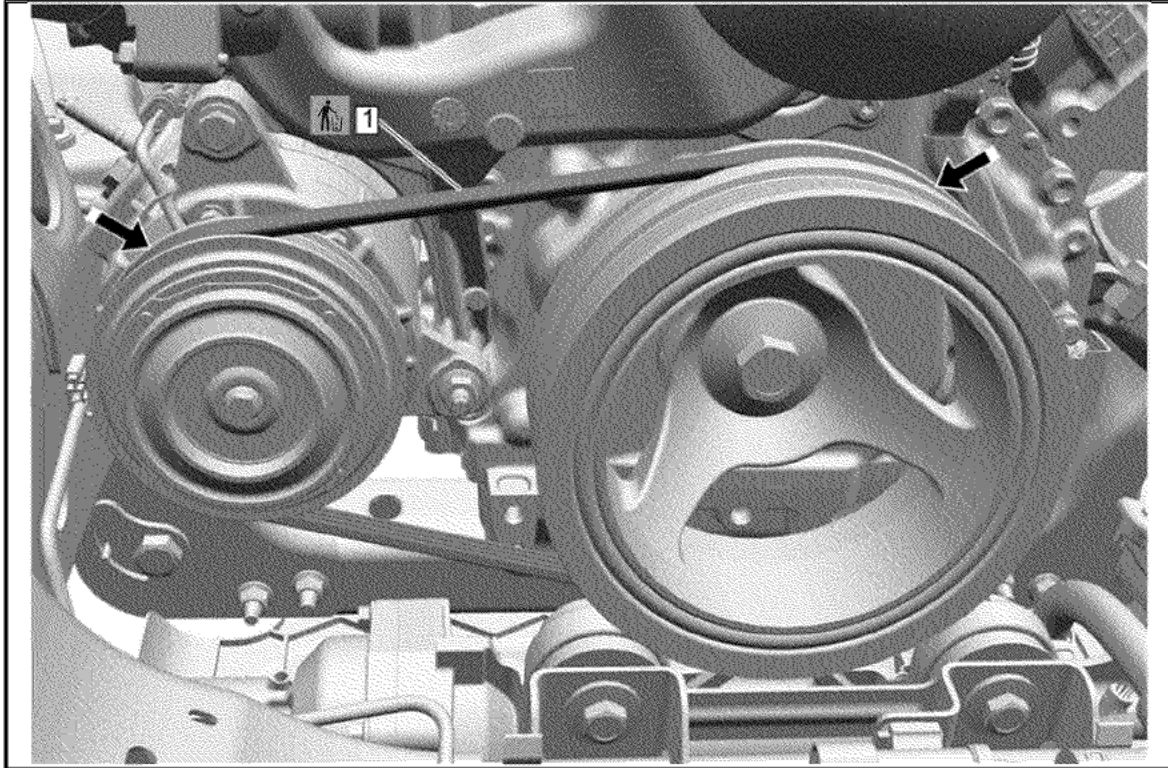


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137. Starter Solenoid Cable (2) » Install

138. Battery Positive Cable Nut (1) » Install and tighten — [Fastener Specifications](#)

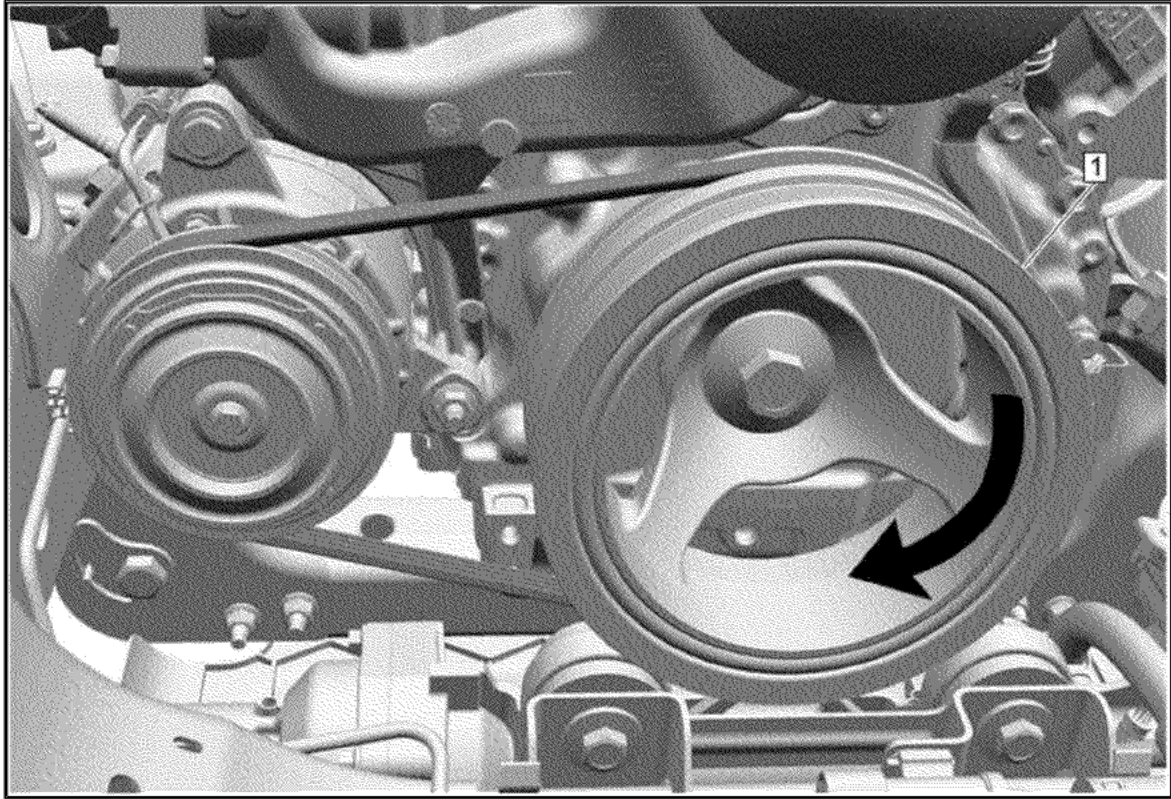
139. Electrical Connector (3) » Connect



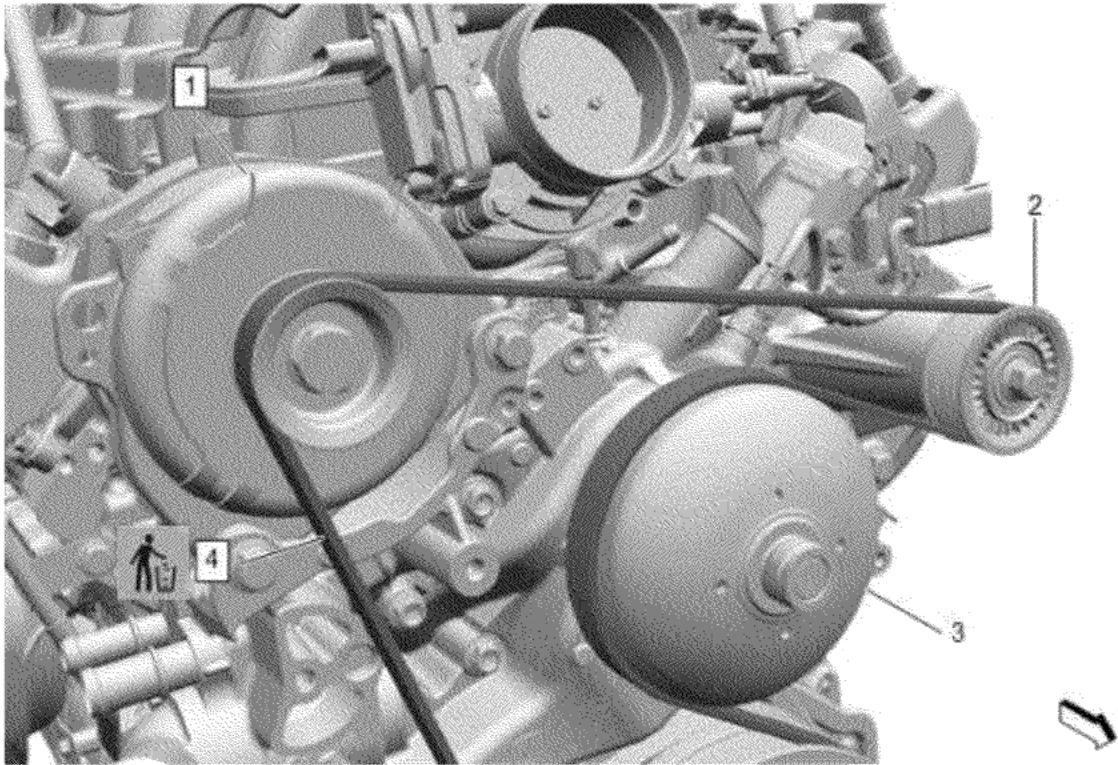
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**Note:** The OEM replacement accessory drive auxiliary belt (1) is packaged with a disposable installation tool and installation instructions.

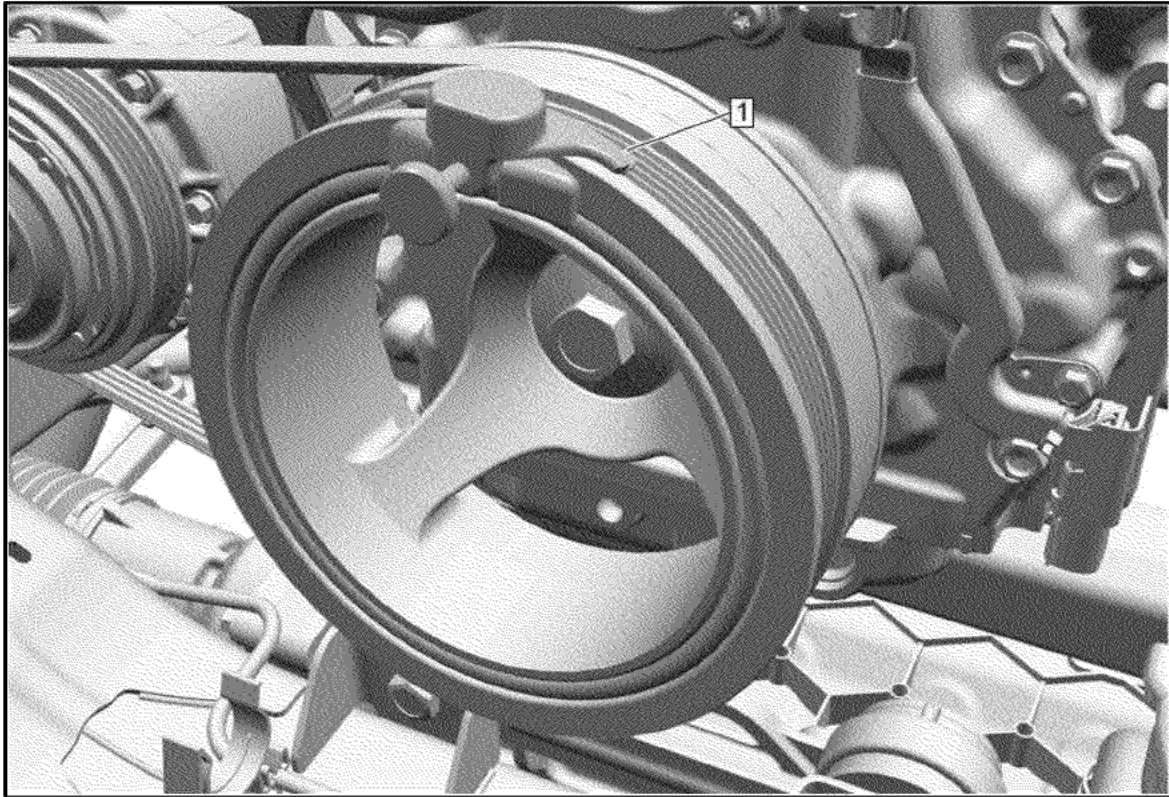
140. Install the accessory drive auxiliary belt (1) following the instructions included with the accessory drive auxiliary belt.
141. Inspect the accessory drive auxiliary belt (1) for proper installation and alignment.



142. Rotate the crankshaft balancer (1) an additional 360 degrees to ensure proper accessory drive auxiliary belt installation.

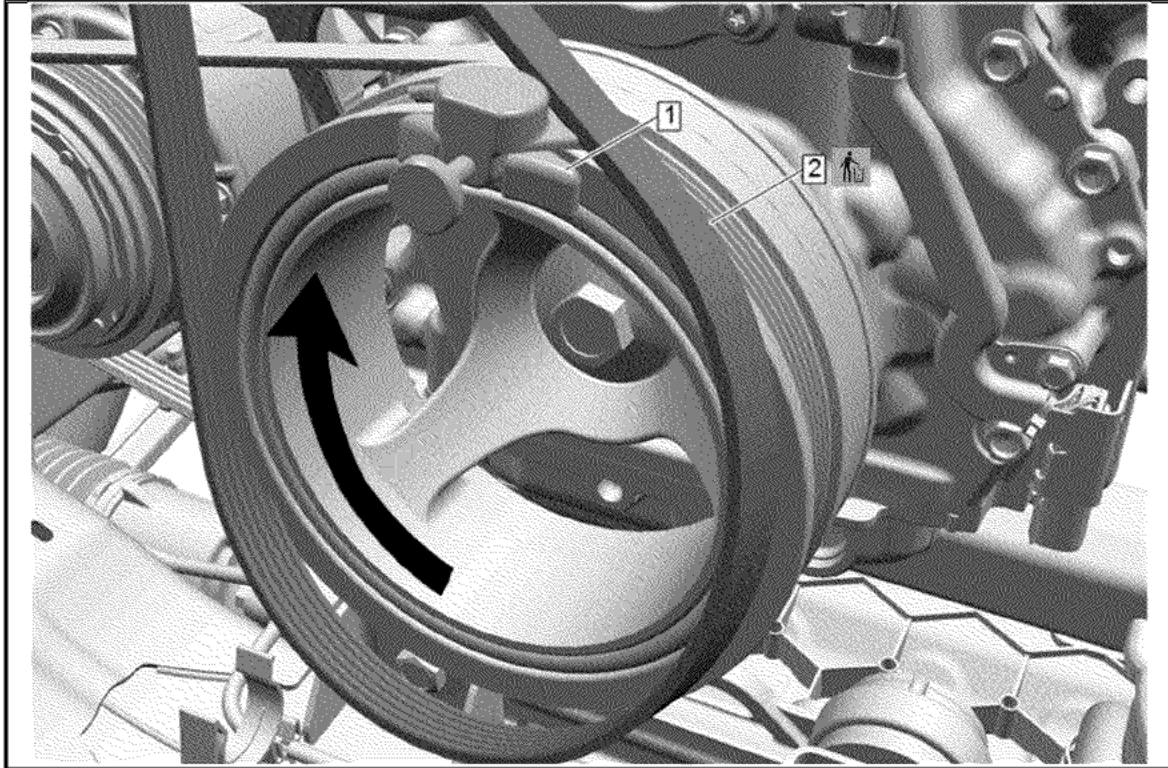


143. Position the accessory drive primary belt (4) on the belt idler pulley (2), fan and water pump pulley (3) and generator (1).



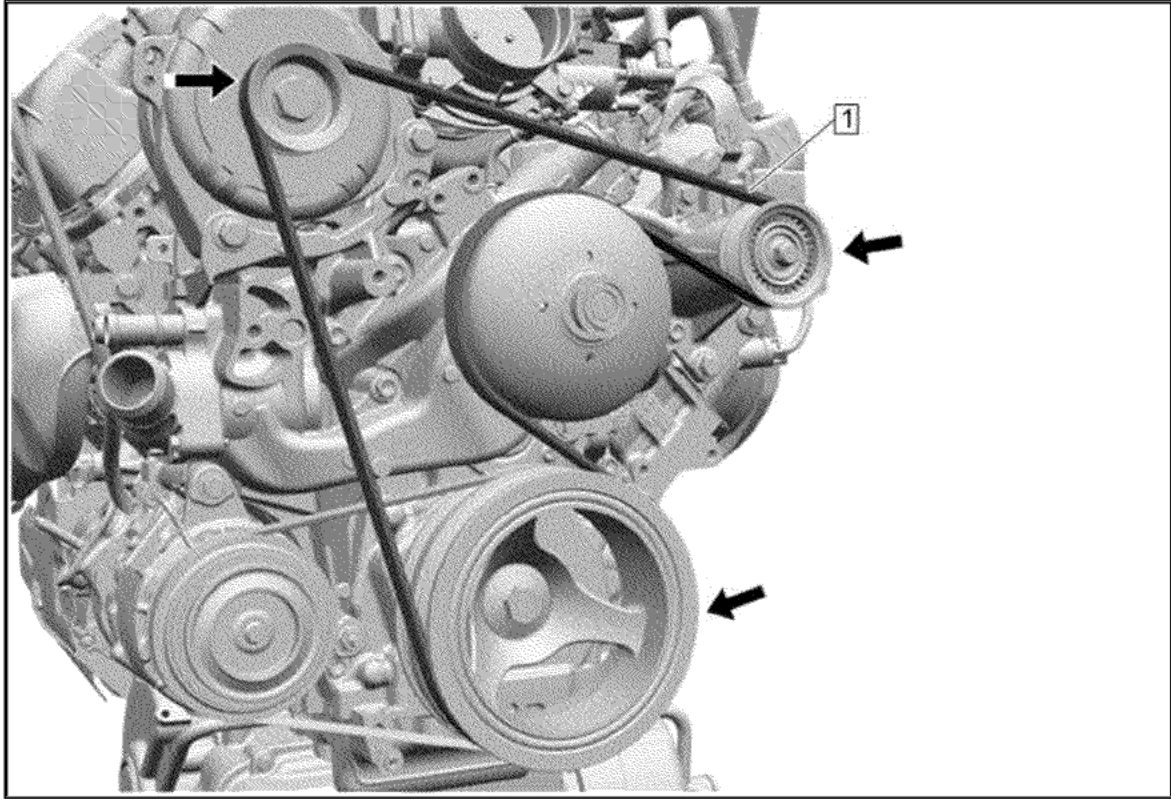
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144. Install the *EN-51767-2* Stretchy Belt Installer (1) onto the crankshaft balancer.

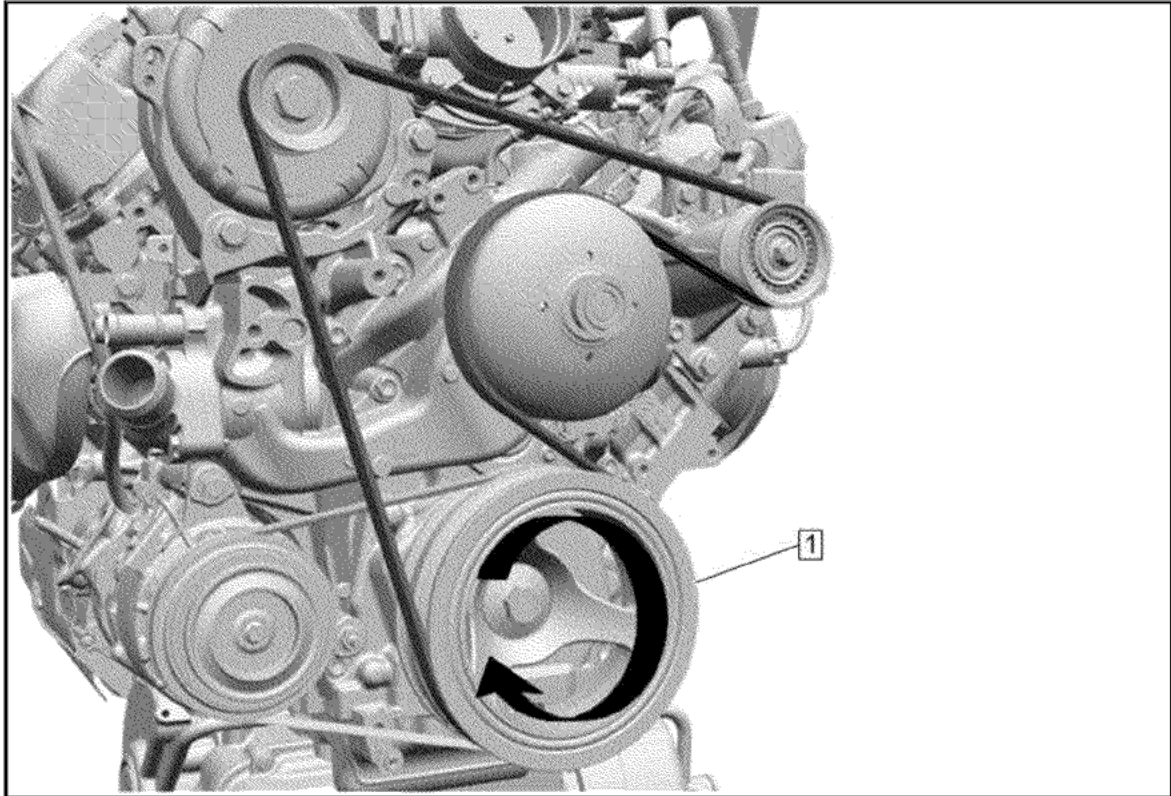


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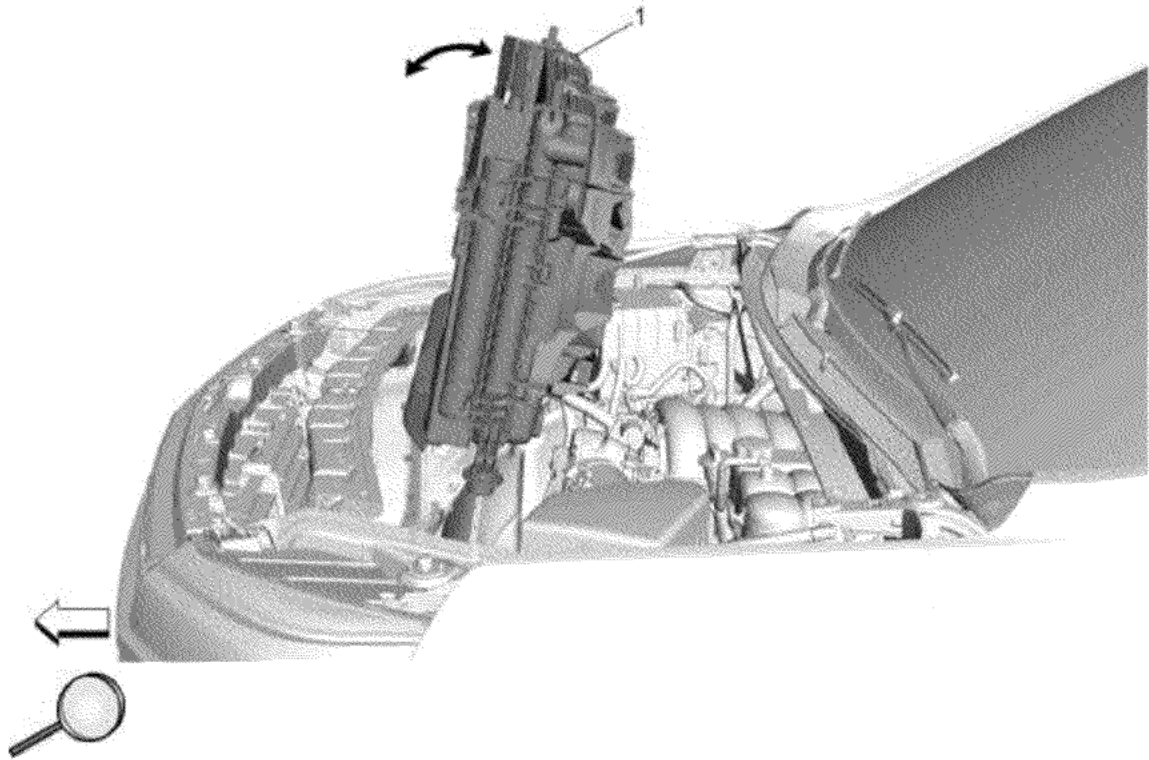
145. Position the accessory drive primary belt (2) on the crankshaft balancer.
146. Slowly rotate the crankshaft balancer in a clockwise direction until the accessory drive primary belt (2) fully seats on the crankshaft balancer.
147. Remove the *EN-51767-2* Stretchy Belt Installer (1) from the crankshaft balancer.



148. Inspect the accessory drive primary belt (1) for proper installation and alignment.

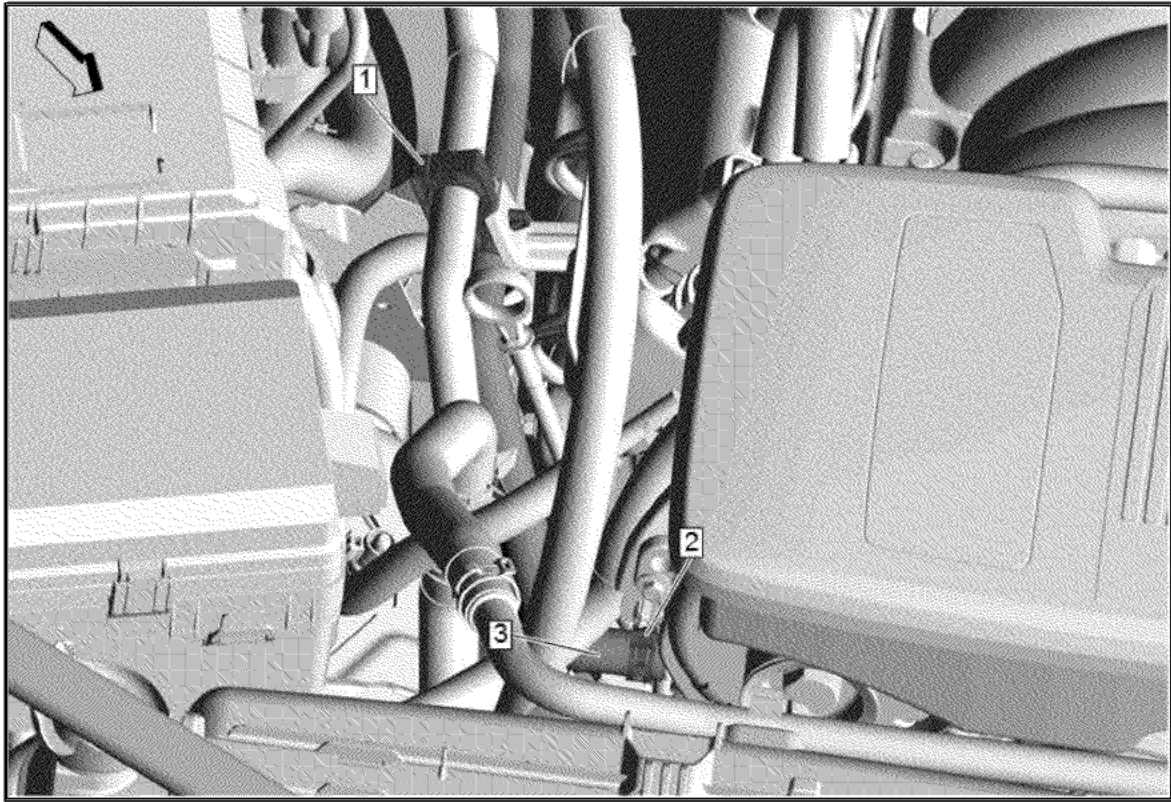


149. Rotate the crankshaft balancer (1) and additional 360 degrees to ensure proper accessory drive primary belt installation.

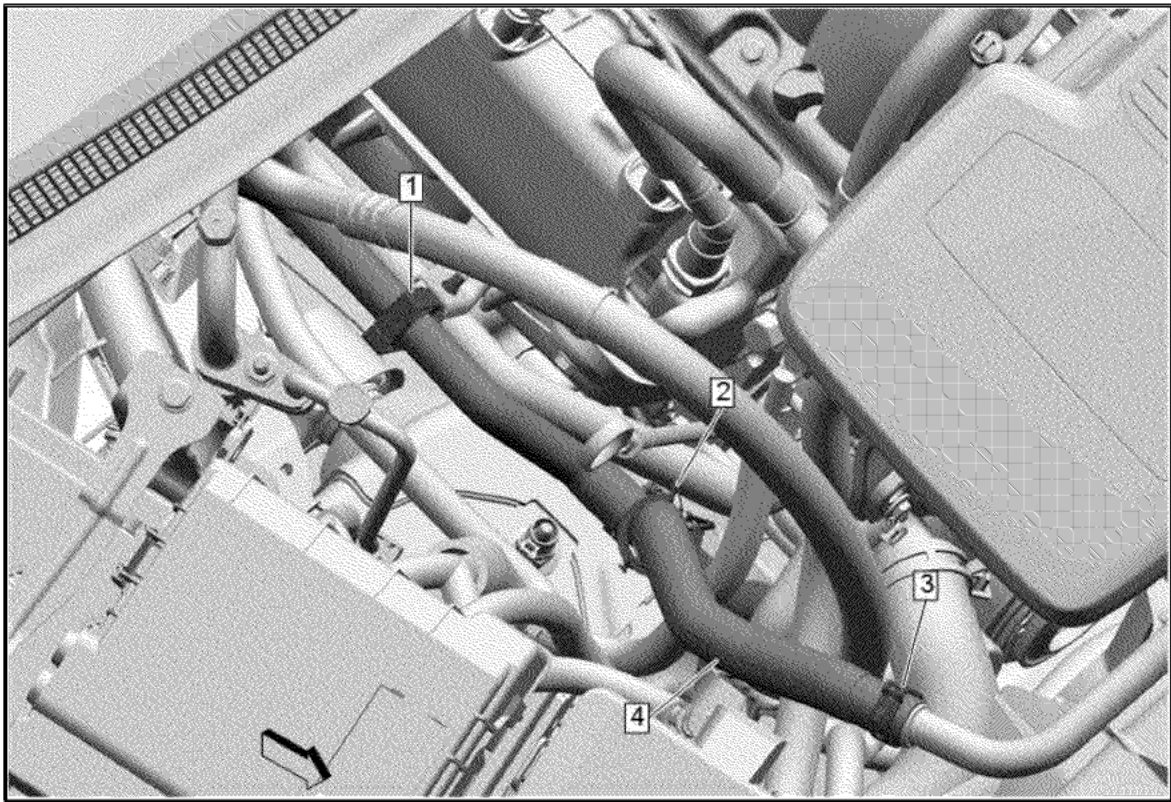


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150. Install the condenser, fan and radiator assembly (1) into its mounts and rotate forward into place.

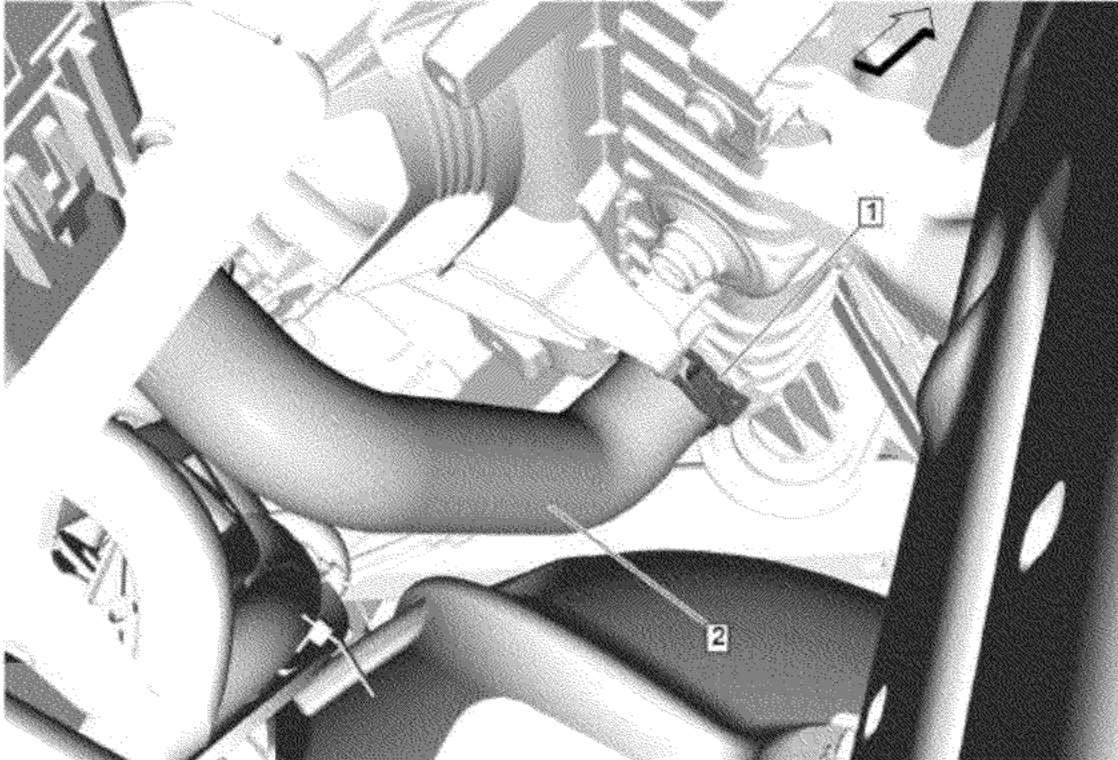


151. Heater Inlet Hose (3) @ Heater Inlet and Outlet Hose Clip (1) » Install



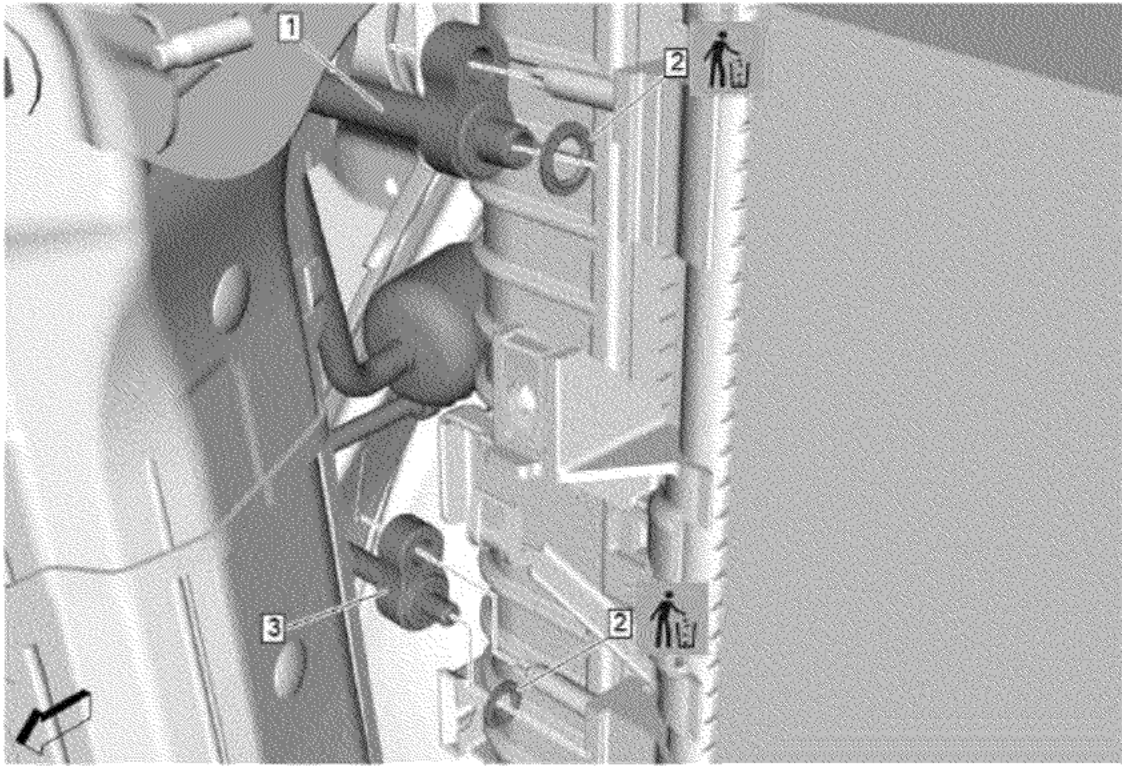
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- 152. Heater Outlet Hose (4) @ Radiator Surge Tank Outlet Hose » Install
- 153. Heater Outlet Hose Clamp (3) » Engage — [Hose Clamp Replacement Guidelines - Spring Type](#)
- 154. Heater Outlet Hose (4) @ Clip (1) » Install
- 155. Engine Wiring Harness Clip (2) @ Heater Outlet Hose » Install



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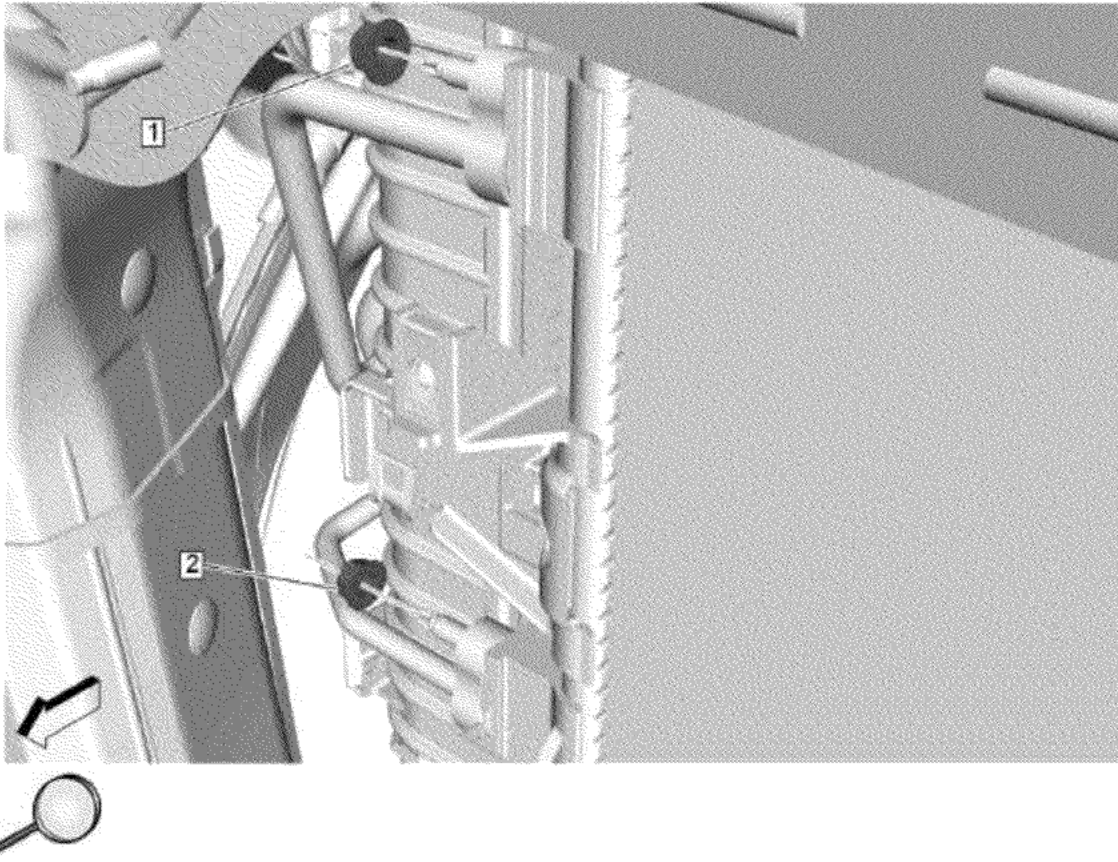
- 156. Radiator Outlet Hose (2) @ Engine Radiator » Install
- 157. Radiator Inlet Hose Clamp (1) » Engage — [Hose Clamp Replacement Guidelines - Spring Type](#)



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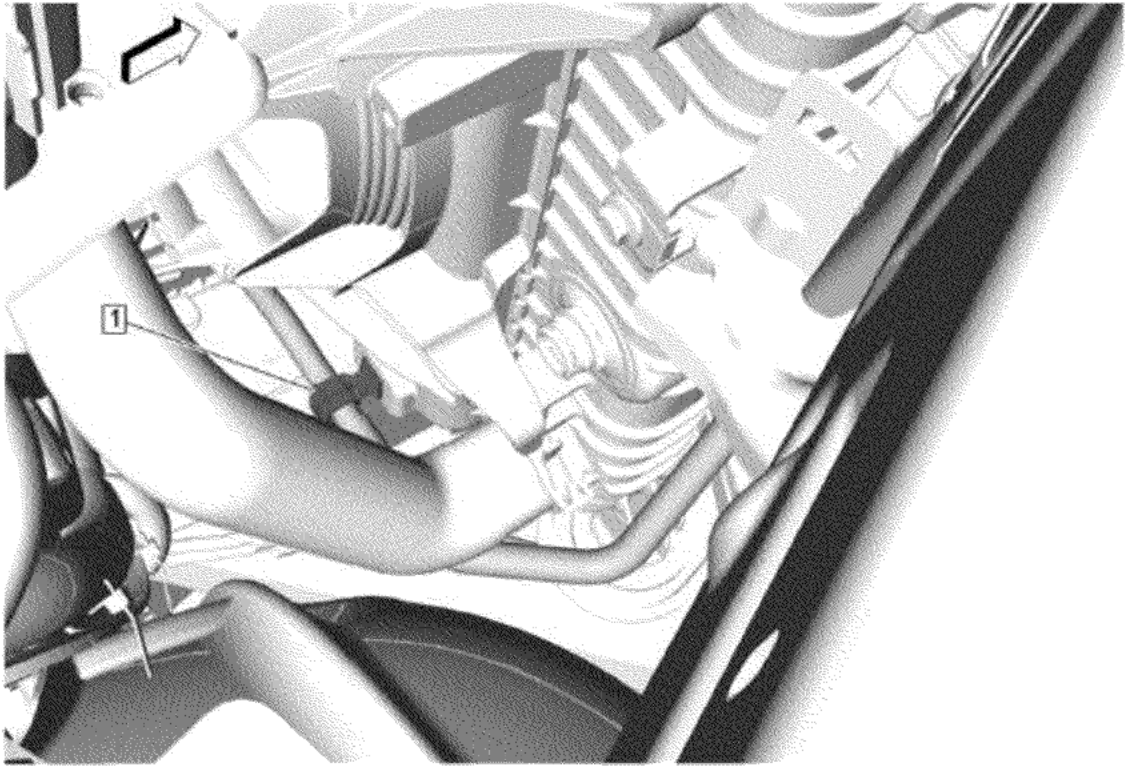


- Caution:** Refer to [Air Conditioning Sealing Washers Oil or Lubricant Exposure Caution](#).
- 158. Air Conditioning Compressor and Condenser Hose Seal (2) » Install NEW [2x]
  - 159. Air Conditioning Condenser and Evaporator Hose (3) @ Air Conditioning Condenser » Install
  - 160. Air Conditioning Compressor and Condenser Hose (1) @ Air Conditioning Condenser » Install

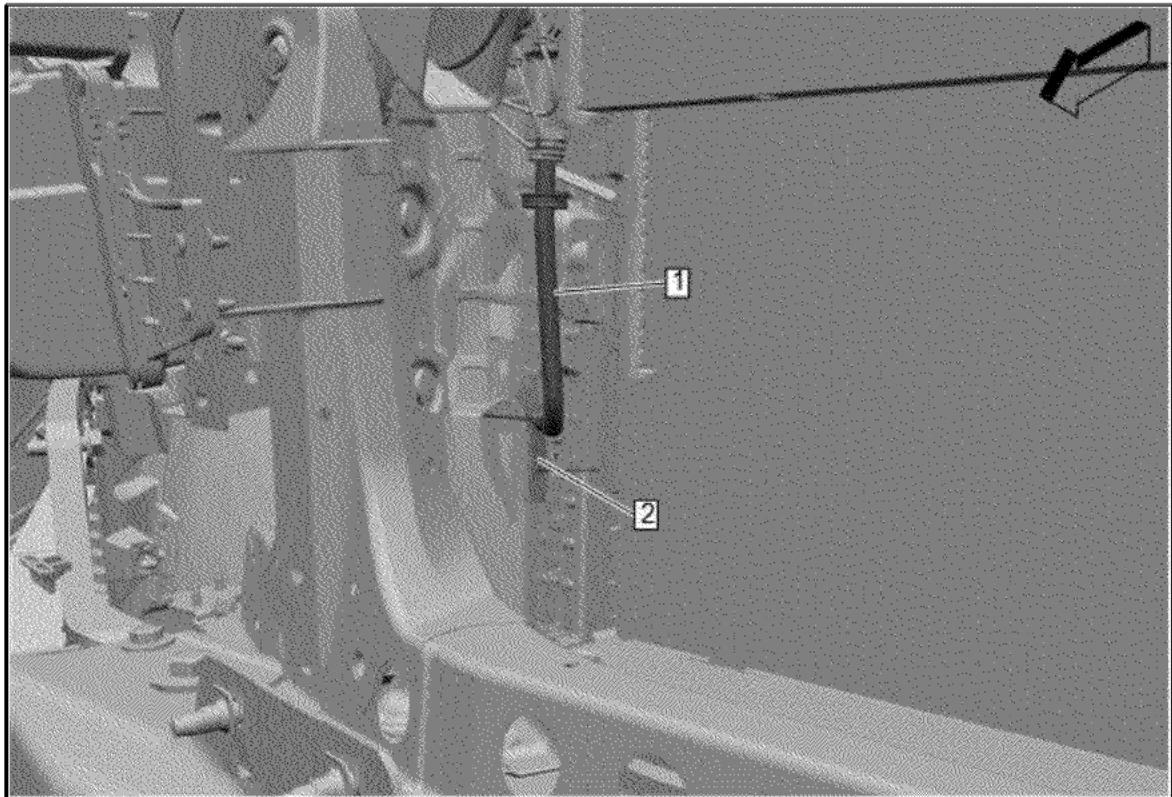


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161. Air Conditioning Condenser and Evaporator Hose Nut (2) » Install and tighten — [Fastener Specifications](#)
162. Air Conditioning Compressor and Condenser Hose Nut (1) » Install and tighten — [Fastener Specifications](#)

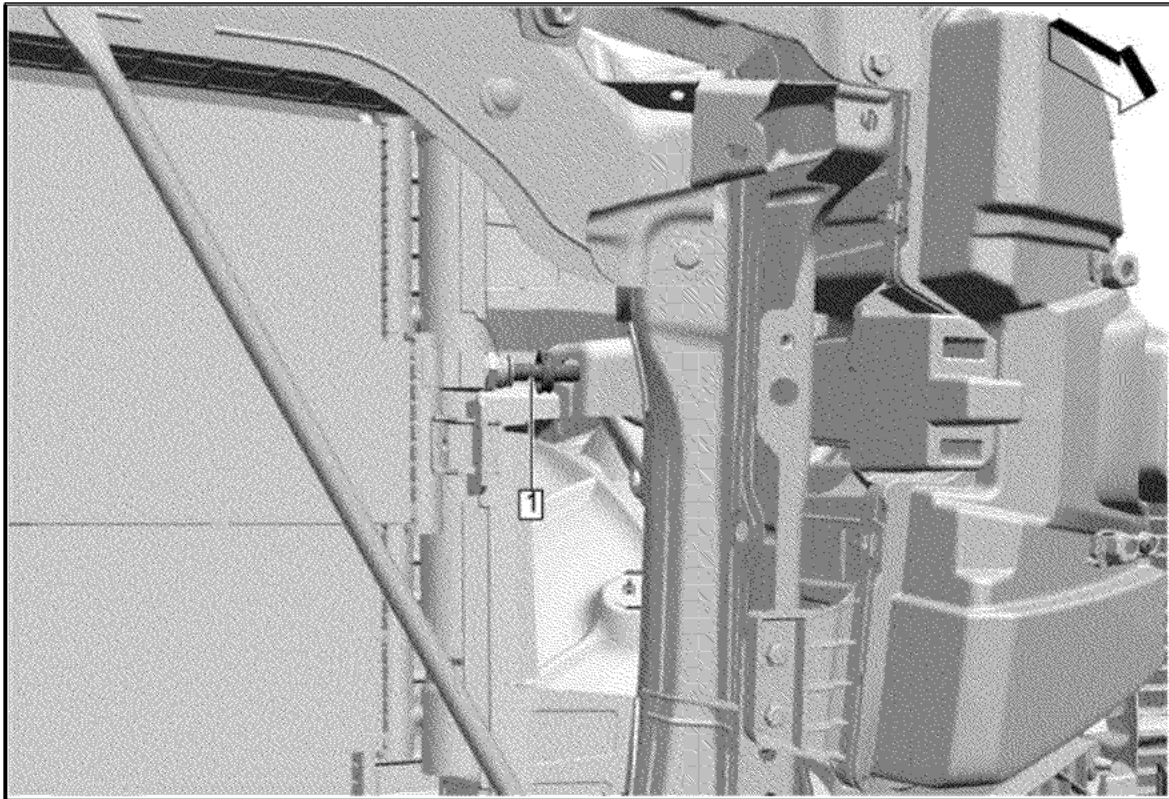


163. Transmission Fluid Cooler Pipe Clip (1) » Secure

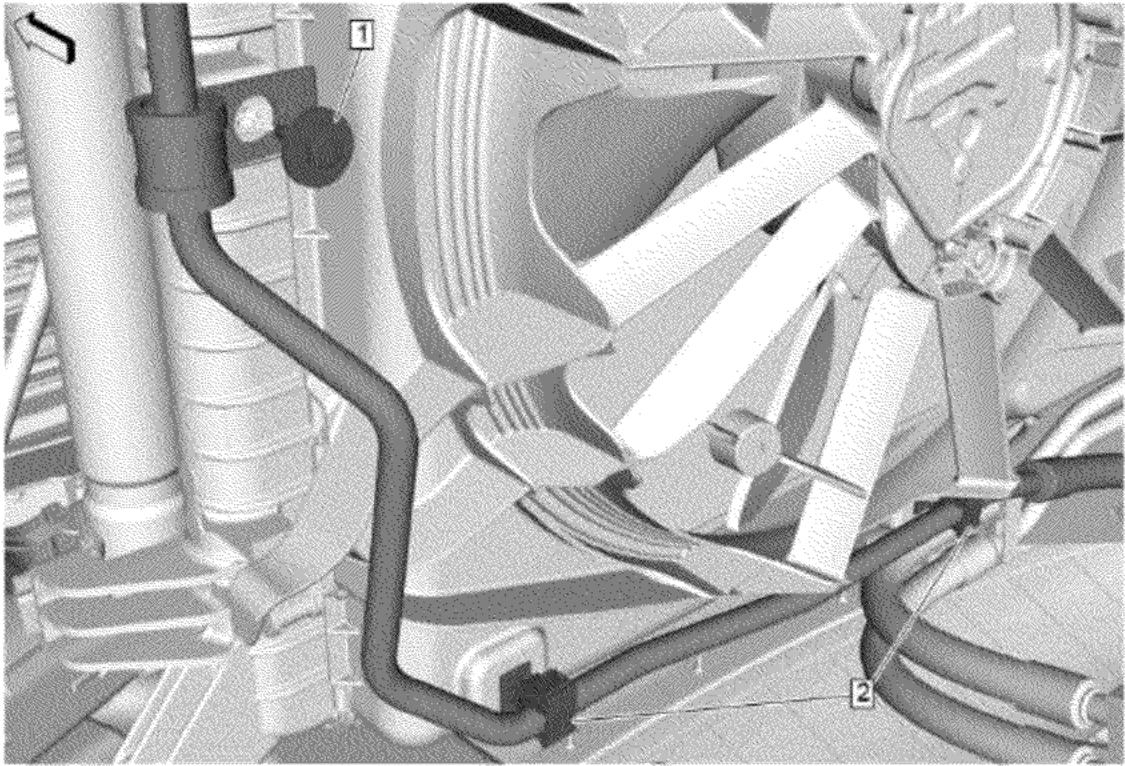


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- 164. Transmission Fluid Cooler Inlet and Outlet Pipe (1) @ Transmission Fluid Auxiliary Cooler » Install — Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection
- 165. Transmission Fluid Cooler Inlet and Outlet Pipe Bolt (2) @ Radiator » Install and tighten — Fastener Specifications

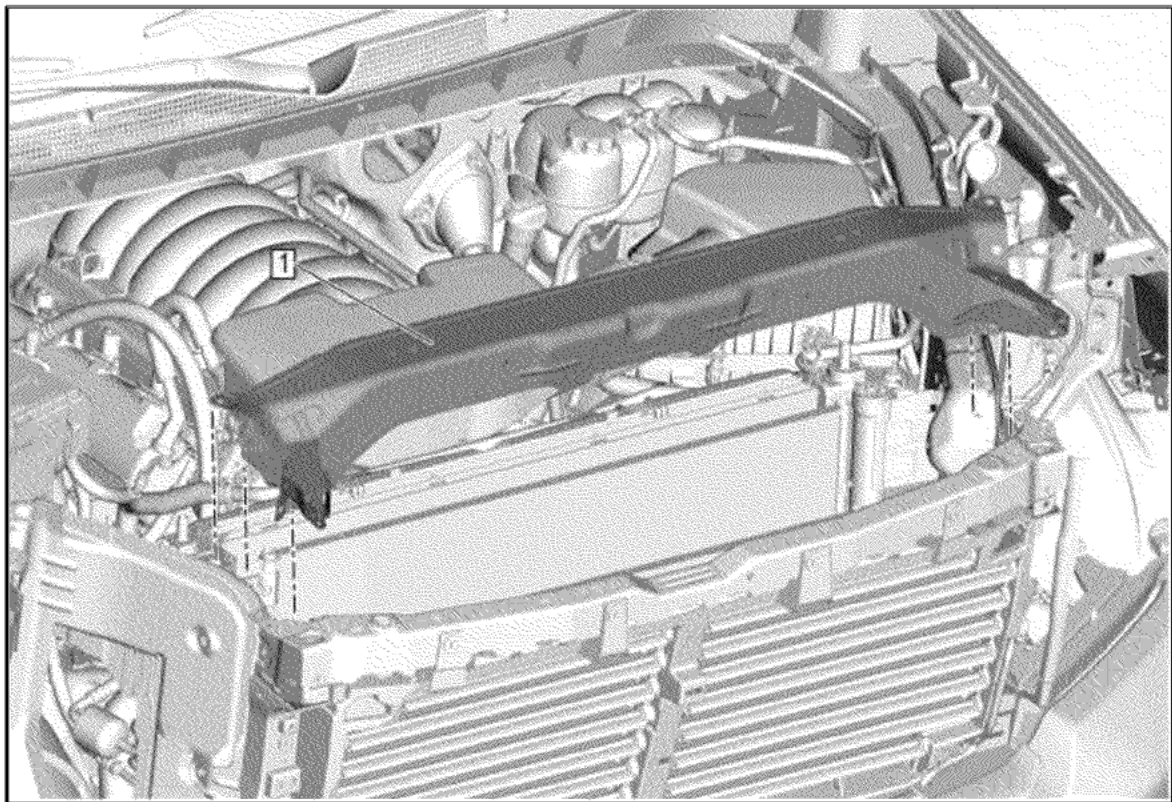


- 166. Transmission Fluid Cooler Inlet and Outlet Pipe (1) @ Transmission Fluid Auxiliary Cooler » Install — Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection



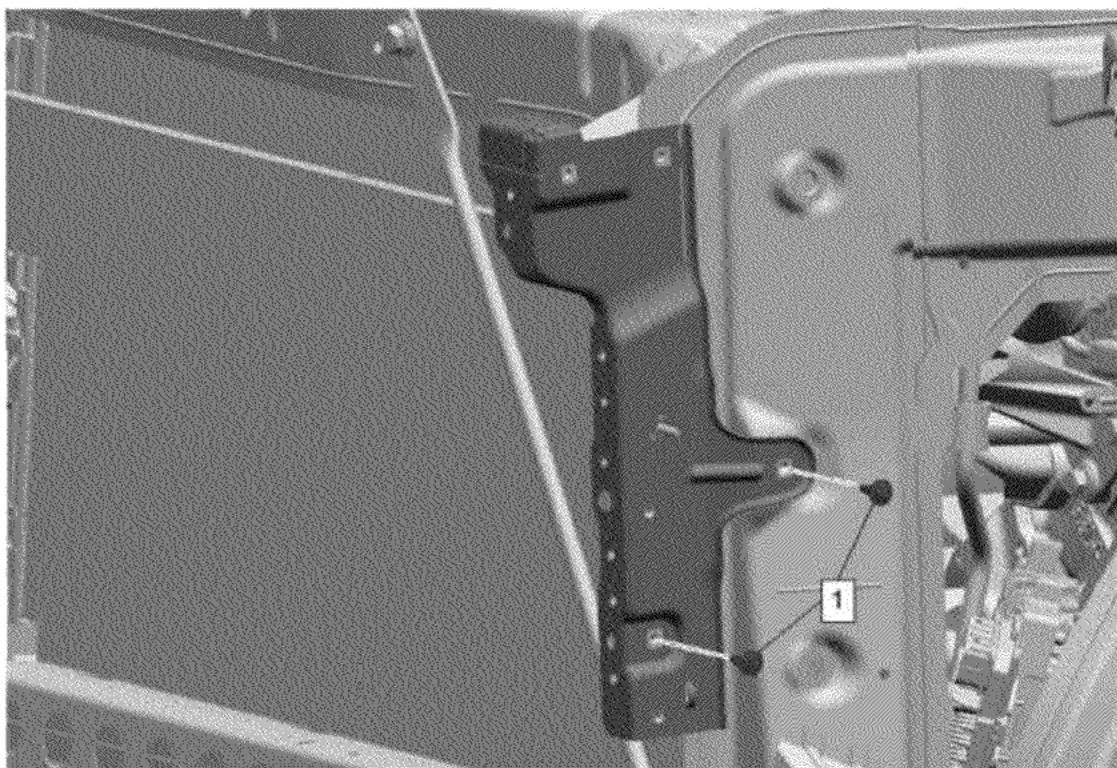
167. Transmission Fluid Cooler Pipe Clip (2) » Install [2x]

168. Transmission Fluid Cooler Pipe Bolt (1) » Install and tighten — [Fastener Specifications](#)



169. Front End Upper Tie Bar (1) » Install

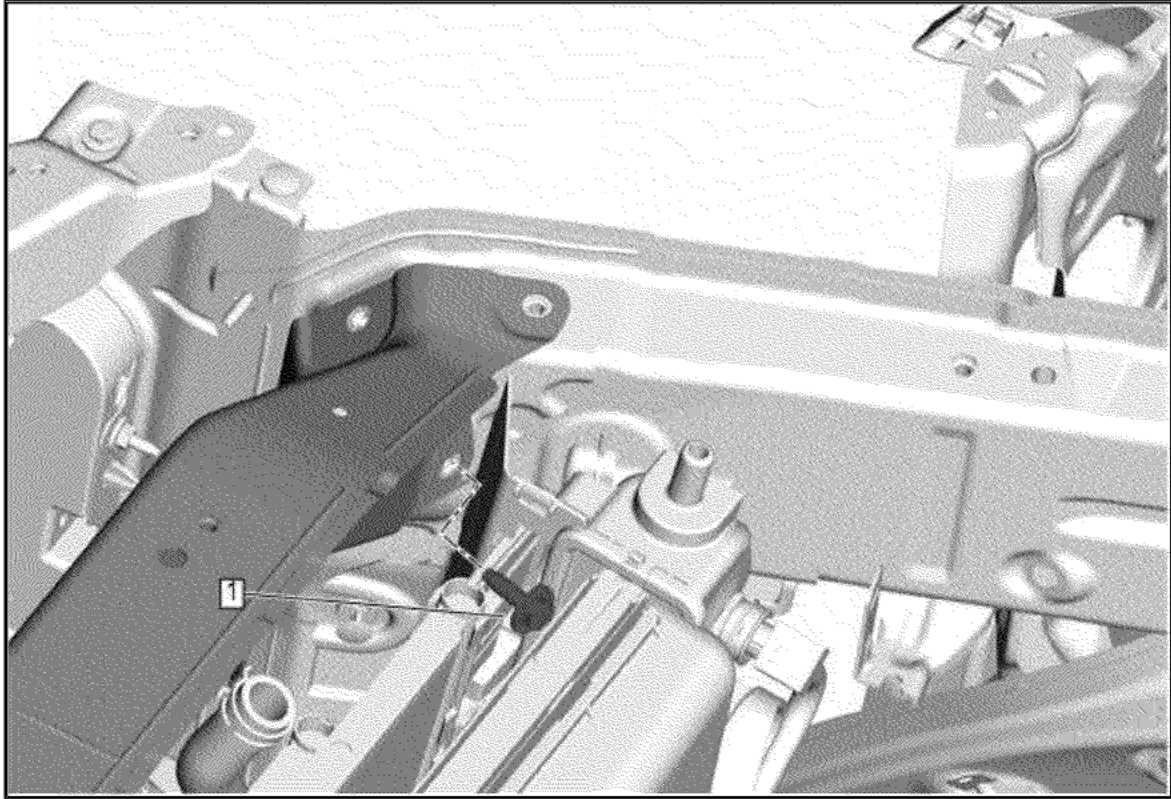
170. Install the wiring harness.



**Note:** Left side shown, right side similar.

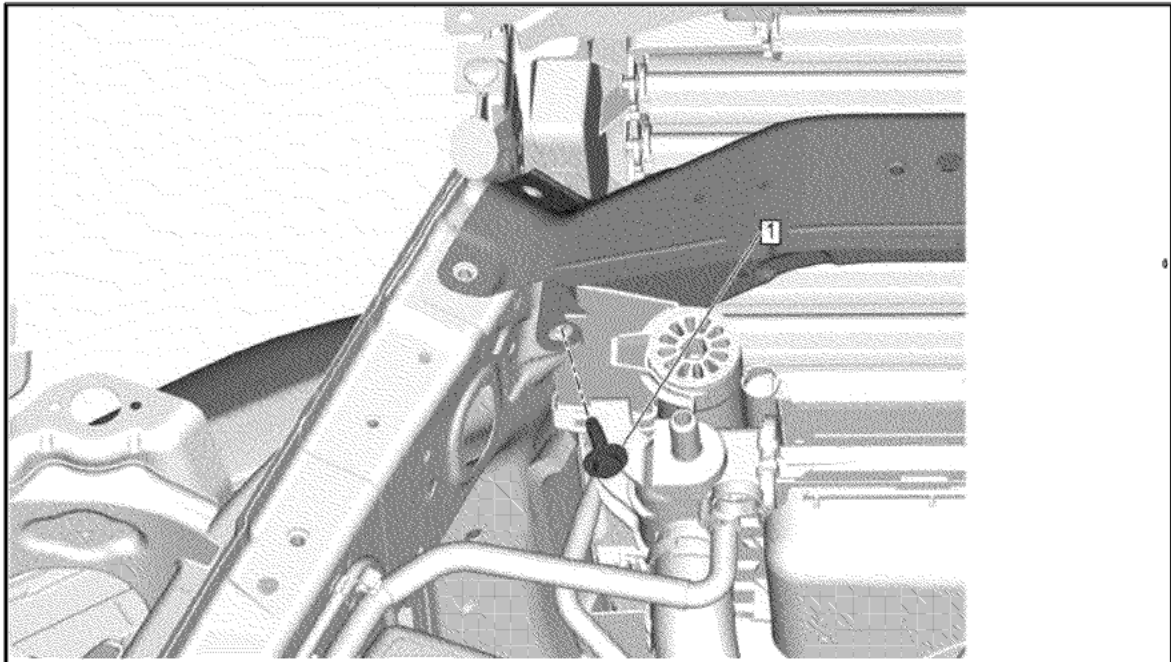
171. Headlamp Bracket Bolt - Left Side and Right Side (1) » Tighten [4x] — Fastener Specifications

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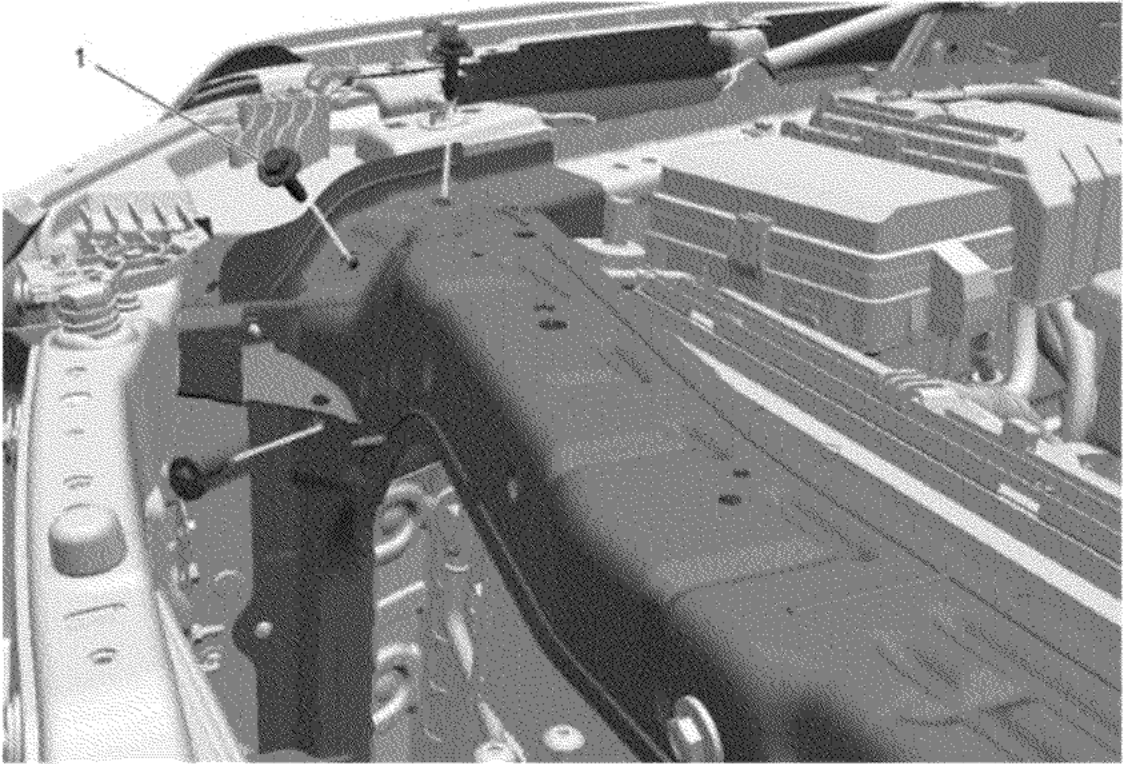


**Caution:** Refer to [Fastener Caution](#).

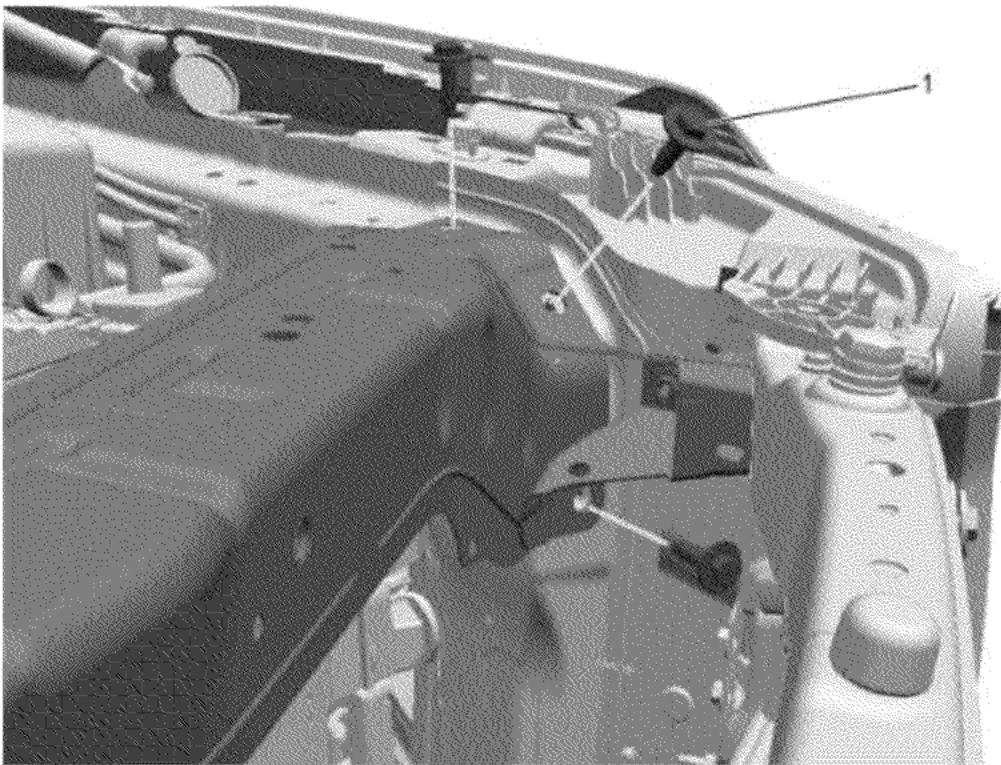
172. Front End Upper Tie Bar Bolt - Right Side (1) » Install and tighten — [Fastener Specifications](#)



173. Front End Upper Tie Bar Bolt - Left Side (1) » Install and tighten — [Fastener Specifications](#)

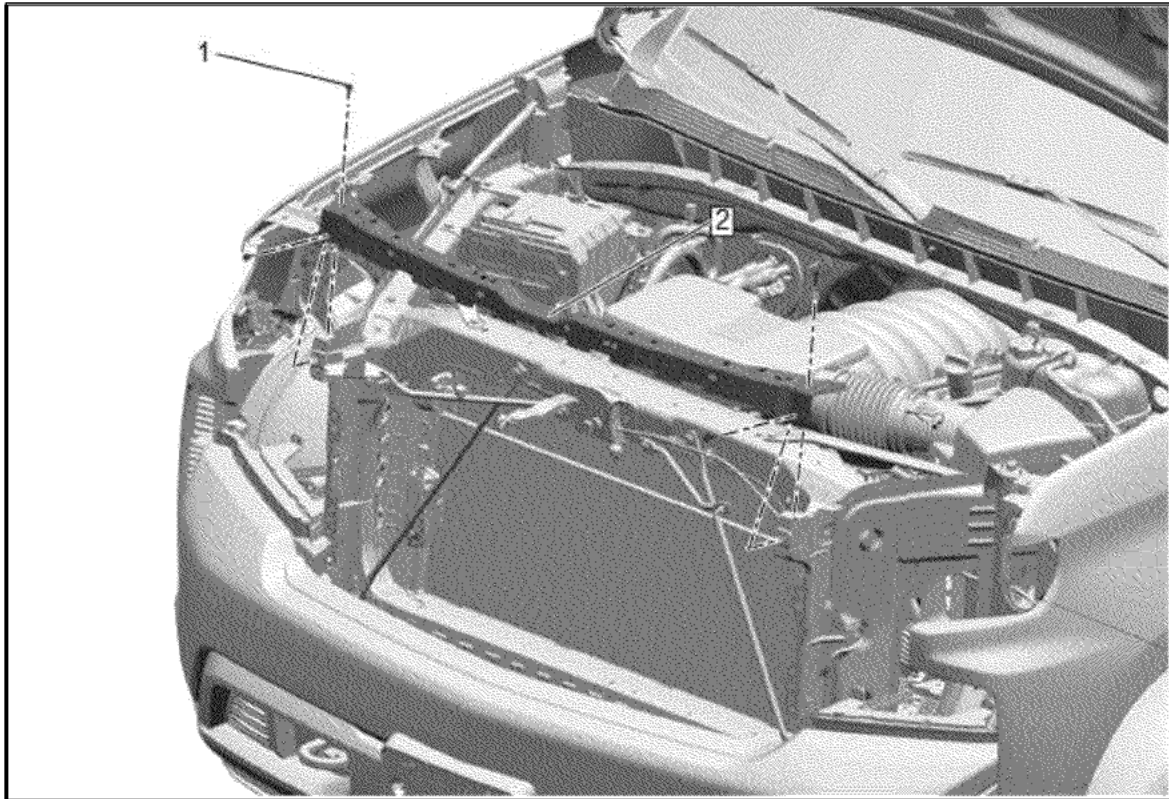


174. Front End Upper Tie Bar Bolt - Right Side (1) » Install and tighten [3x] — [Fastener Specifications](#)



175. Front End Upper Tie Bar Bolt - Left Side (1) » Install and tighten [3x] — [Fastener Specifications](#)

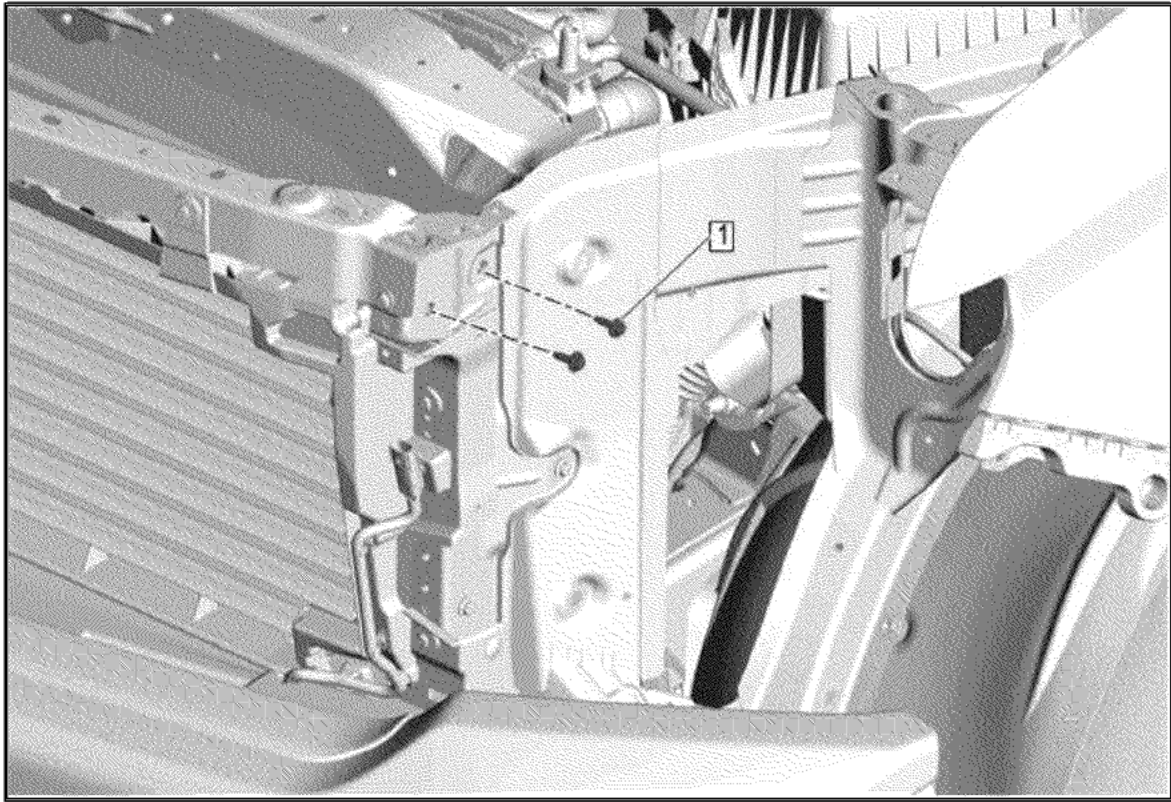
176. Position the wiring harness and install the wiring harness retainers onto the front end upper tie bar.



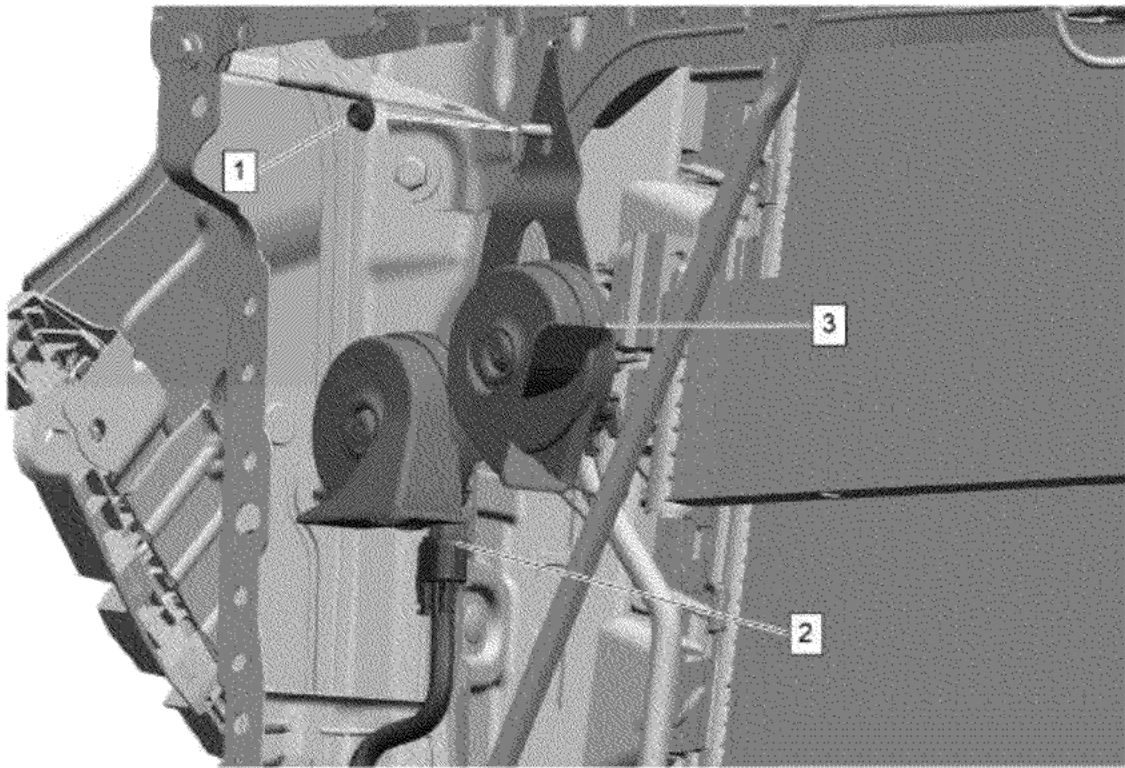
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177. Hood Front Bumper Bracket (2) » Install

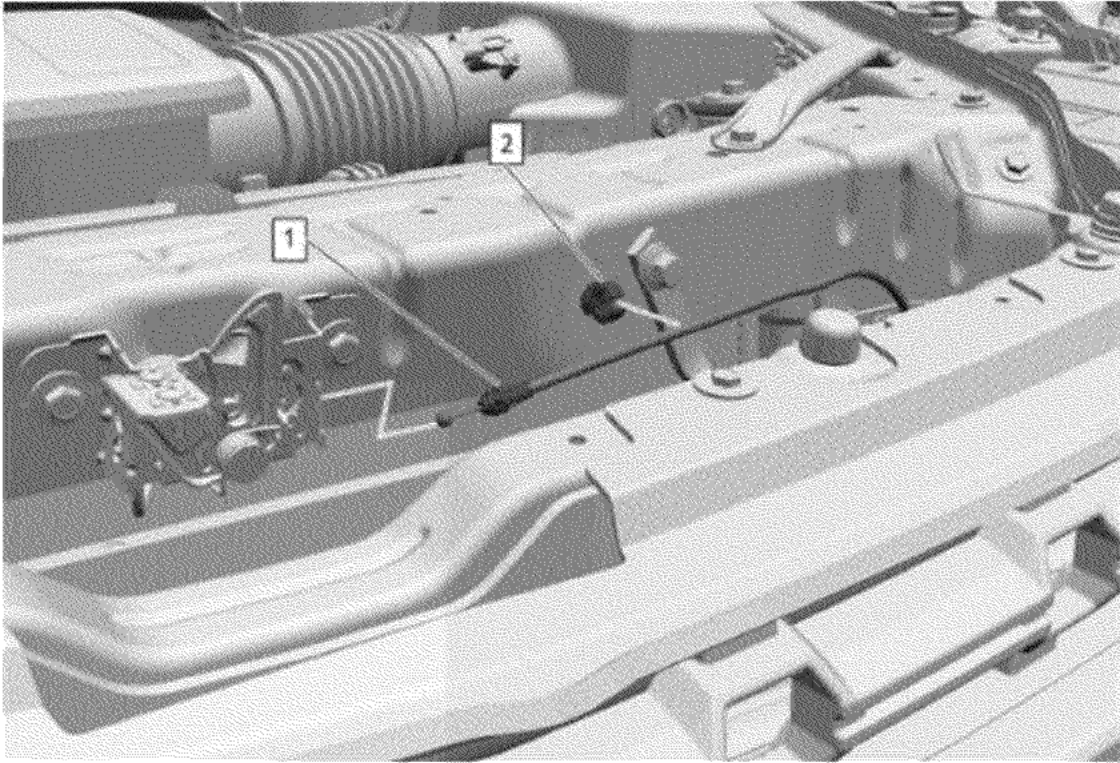
178. Front Bumper Fascia Center Support Bolt (1) » Install and tighten [4x] — [Fastener Specifications](#)



179. Front End Upper Tie Bar Bolt - Left Side and Right Side (1) @ Headlamp Bracket » Install and tighten [4x] — [Fastener Specifications](#)



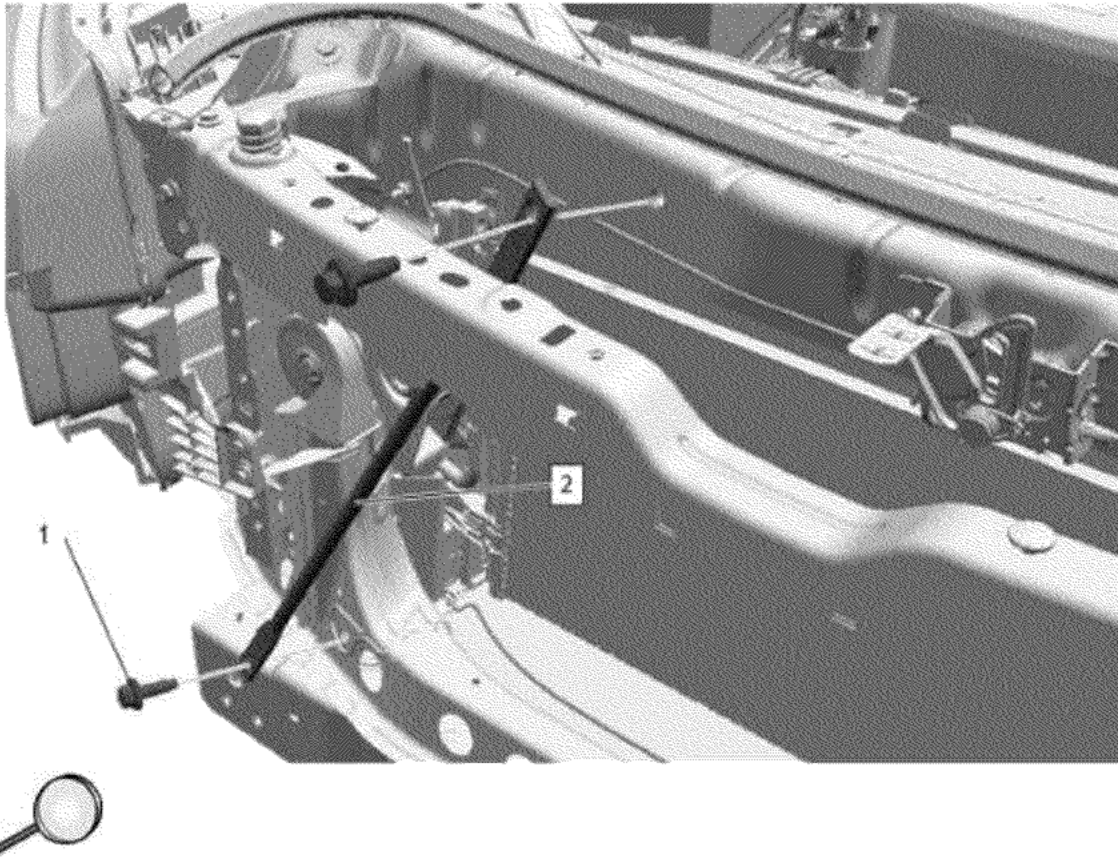
180. Electrical Connector (2) » Connect



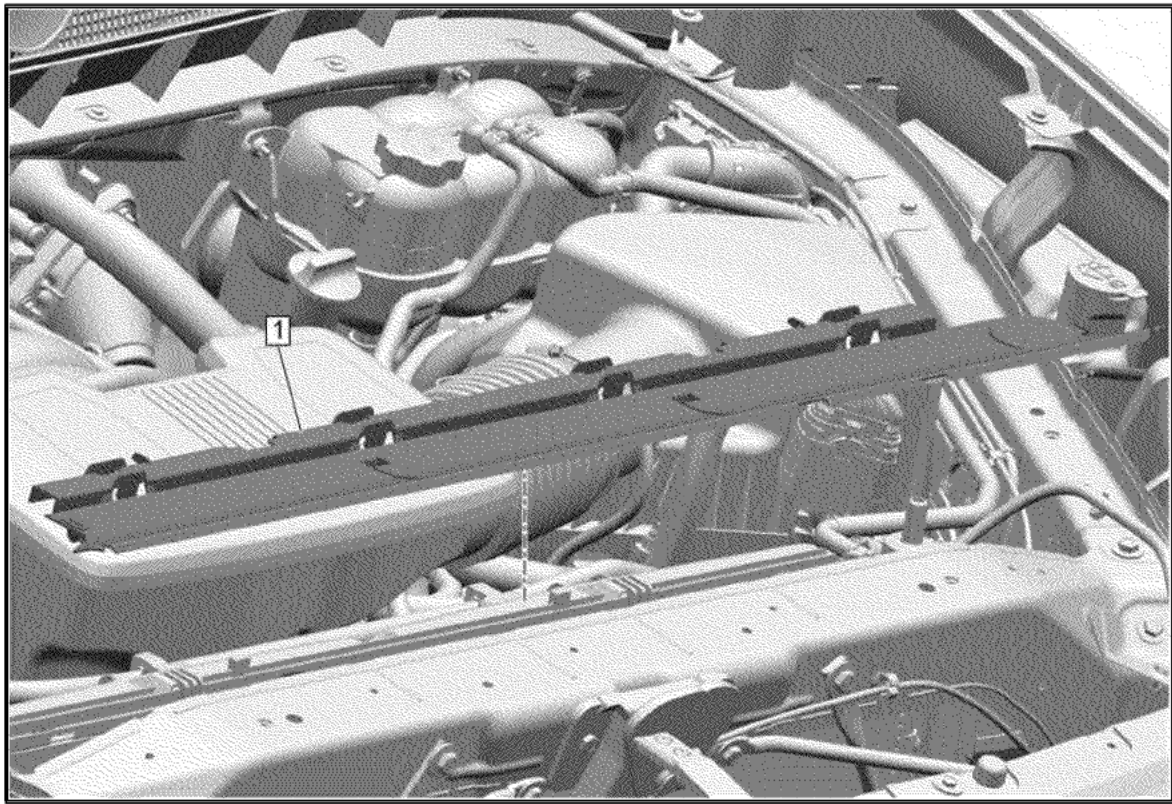
181. Connect the electrical connector.

182. Hood Primary Latch Release Cable (1) » Install @ Hood Primary Latch

183. Install the hood primary latch release cable (1) to the upper tie bar retainer (2).

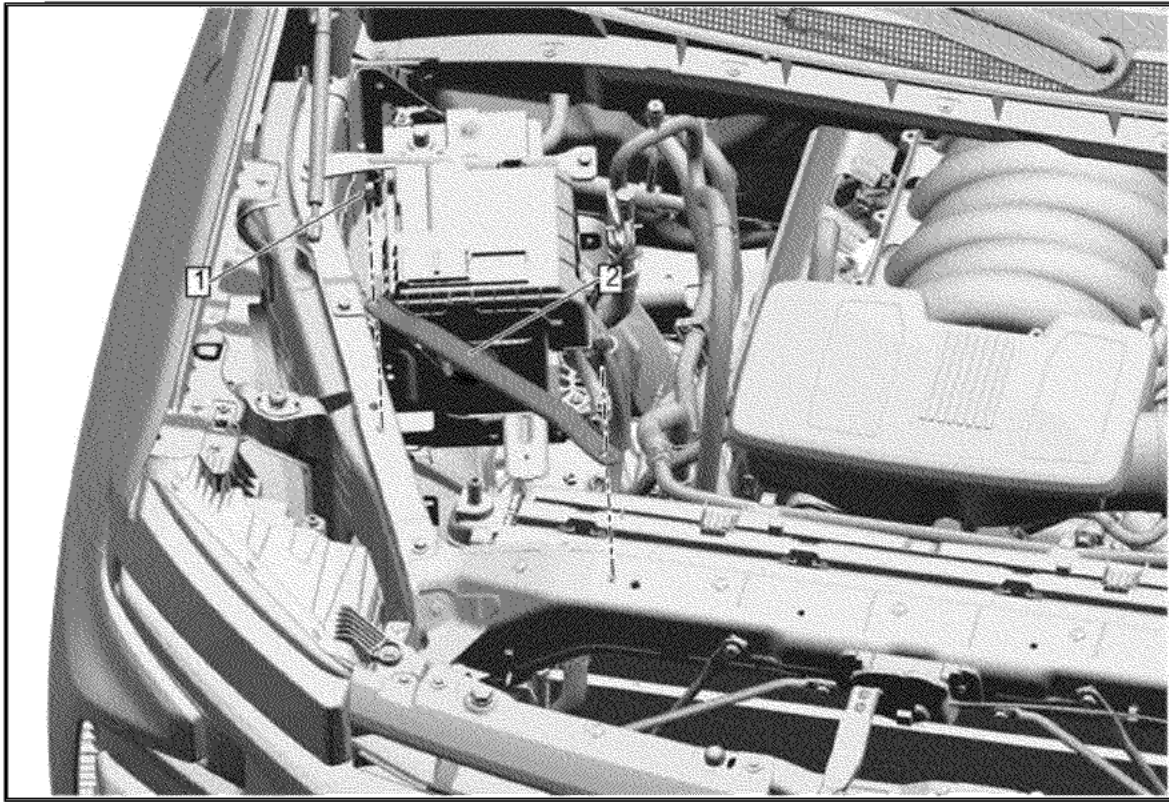


184. Front End Sheet Metal Diagonal Brace - Left Side and Right Side (2) @ Radiator Support » Install [2x]
185. If NEW threaded components are being installed, loosen the adhesive using a metal pick or similar tool before proceeding. If threaded components are reused, prepare the threaded components using the following steps:
- 185.1. Remove any loose cured adhesive from the external threads of the components using a lint free cloth.
  - 185.2. Thread the cleaned components into the internal mating threads and remove to loosen trapped cured adhesive.
  - 185.3. Remove loose debris from internal and external threads using compressed air.
  - 185.4. Apply liquid thread locking adhesive in a strip along half of the length of the external threads, starting at the tip, just prior to installation. Adhesives, Fluids, Lubricants, and Sealers
186. Front End Sheet Metal Diagonal Brace Bolt - Left Side and Right Side (1) » Install and tighten [4x] — Fastener Specifications



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- 187. Radiator Air Upper Baffle (1) @ Radiator Air Side Baffle» Install
- 188. Radiator Air Upper Baffle (1) @ Radiator » Install



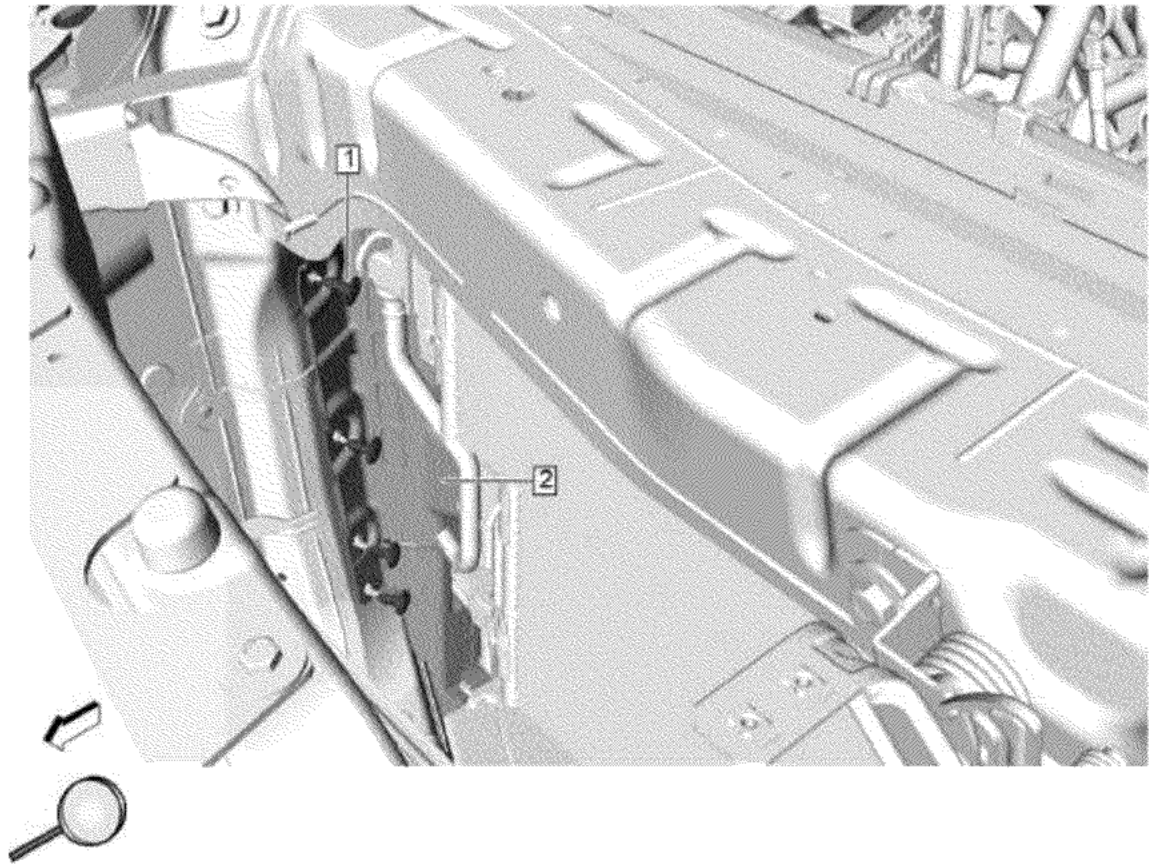
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189. Front End Sheet Metal Cross Brace Bracket - Left Side and Right Side (2) » Install [2x]

190. If NEW threaded components are being installed, loosen the adhesive using a metal pick or similar tool before proceeding. If threaded components are reused, prepare the threaded components using the following steps:

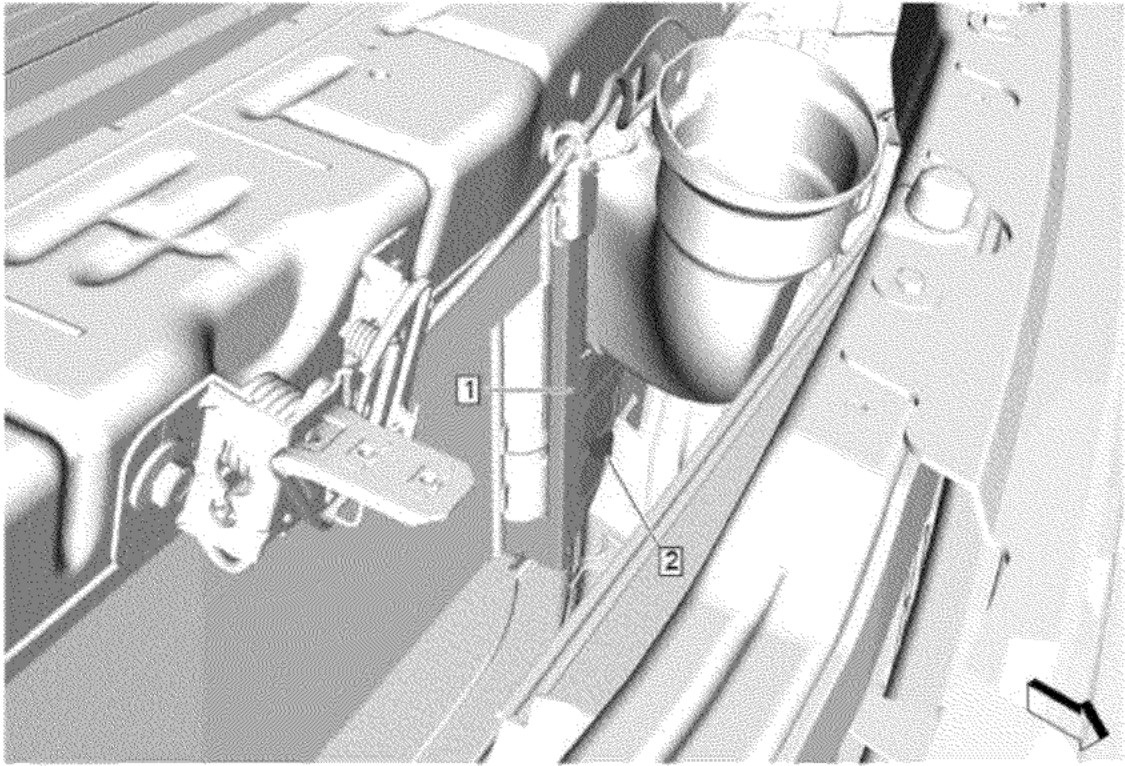
- 190.1. Remove any loose cured adhesive from the external threads of the components using a lint free cloth.
- 190.2. Thread the cleaned components into the internal mating threads and remove to loosen trapped cured adhesive.
- 190.3. Remove loose debris from internal and external threads using compressed air.
- 190.4. Apply liquid thread locking adhesive in a strip along half of the length of the external threads, starting at the tip, just prior to installation. Adhesives, Fluids, Lubricants, and Sealers

191. Front End Sheet Metal Cross Brace Bracket Bolt - Left Side and Right Side (1) » Install and tighten [4x] — Fastener Specifications



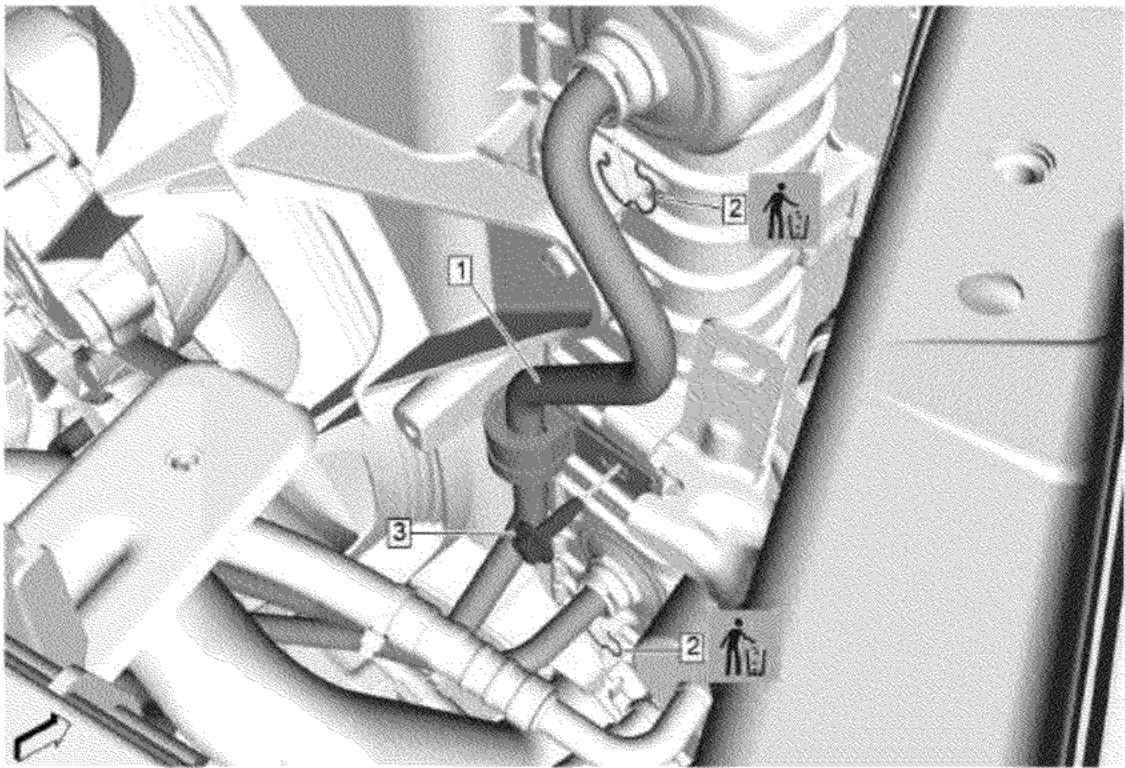
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- Note:** Some components not shown for graphic clarity.
- 192. Radiator Air Side Baffle - Right Side (2) » Install
  - 193. Radiator Air Side Baffle Retainer (1) » Install [4x]

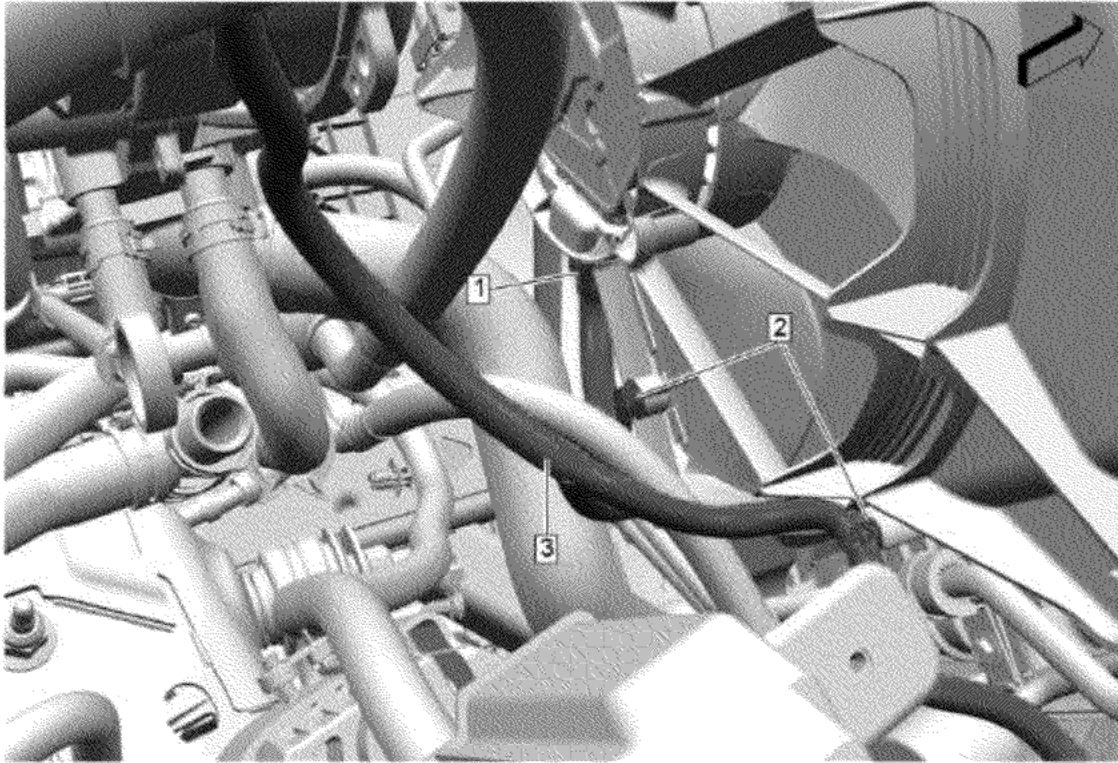


194. Radiator Air Side Baffle - Left Side (1) » Install

195. Radiator Air Side Baffle Retainer (2) » Install

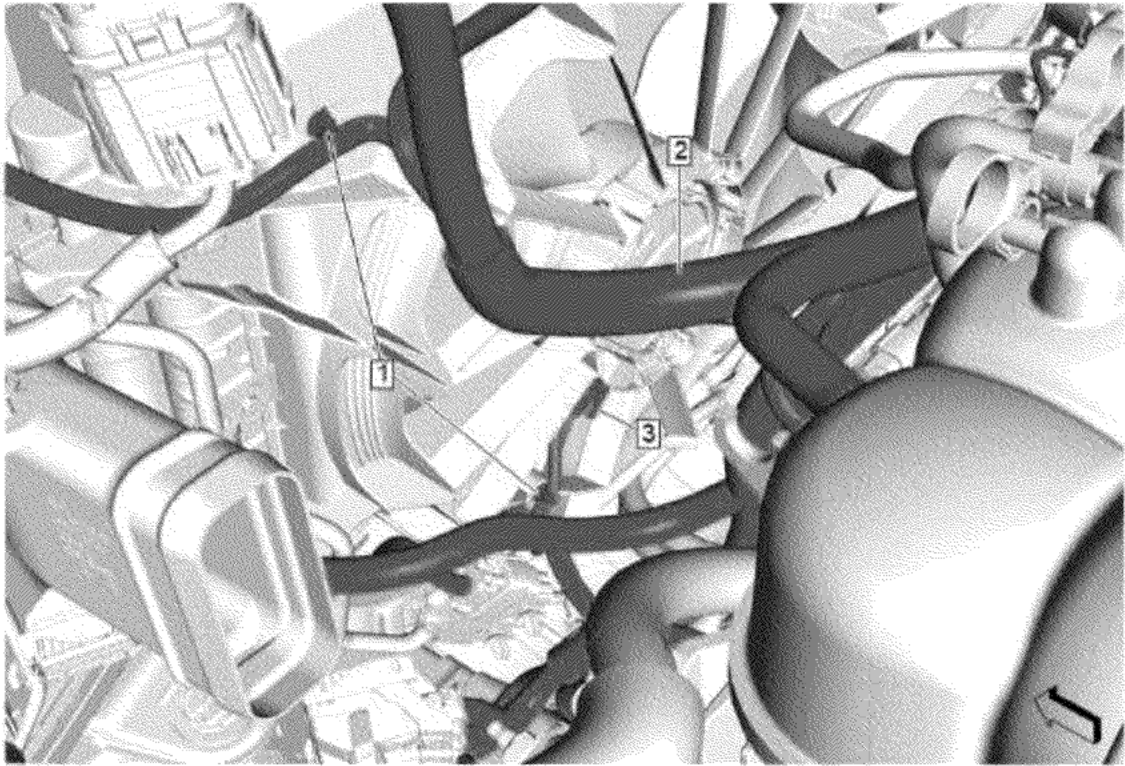


196. Engine Oil Cooler Hose (1) @ Engine Radiator » Install [2x]
197. Engine Oil Cooler Pipe Bracket Bolt (3) » Install and tighten — [Fastener Specifications](#)
198. Engine Oil Cooler Retainer (2) » Install NEW [2x]

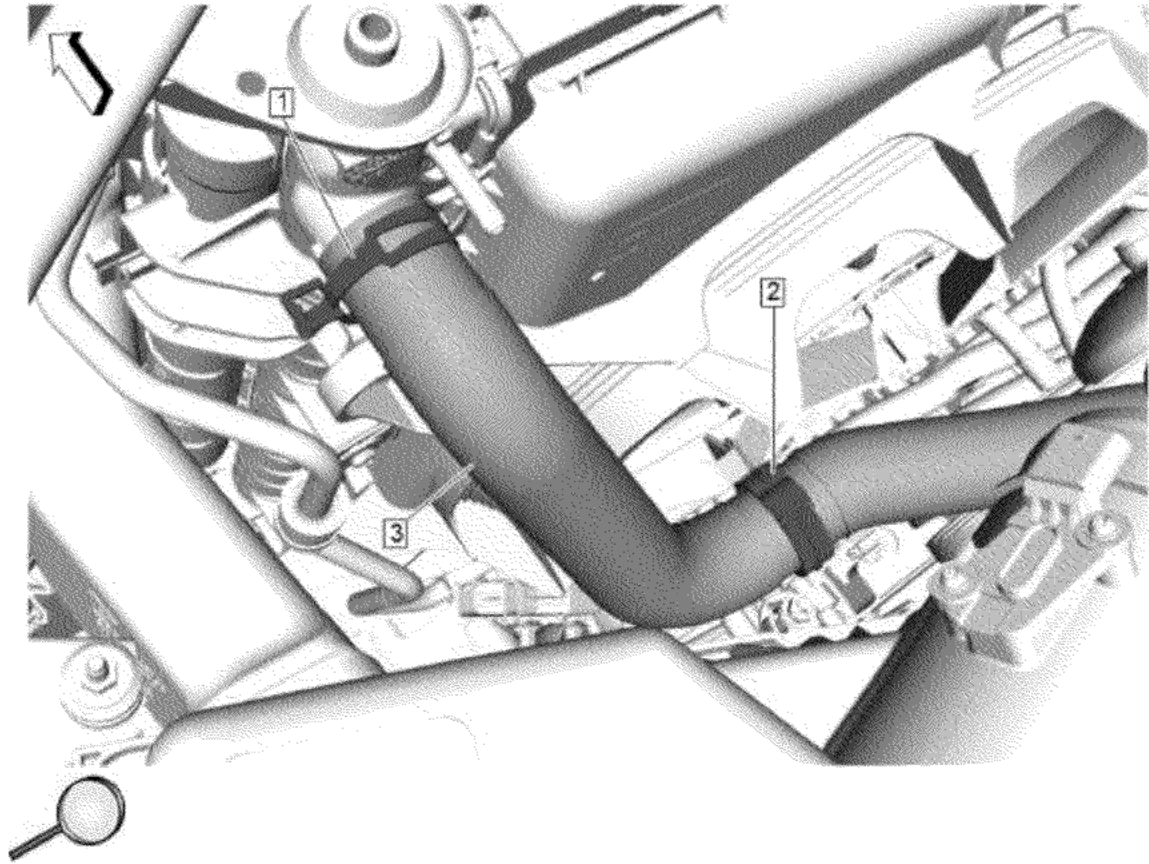


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199. Position the wiring harness. (3)
200. Electrical Connector (1) » Connect
201. Wiring Harness Retainer (2) » Install [2x]



- 202. Position the wiring harness. (2)
- 203. Electrical Connector (3) » Connect
- 204. Wiring Harness Retainer (1) » Install [2x]

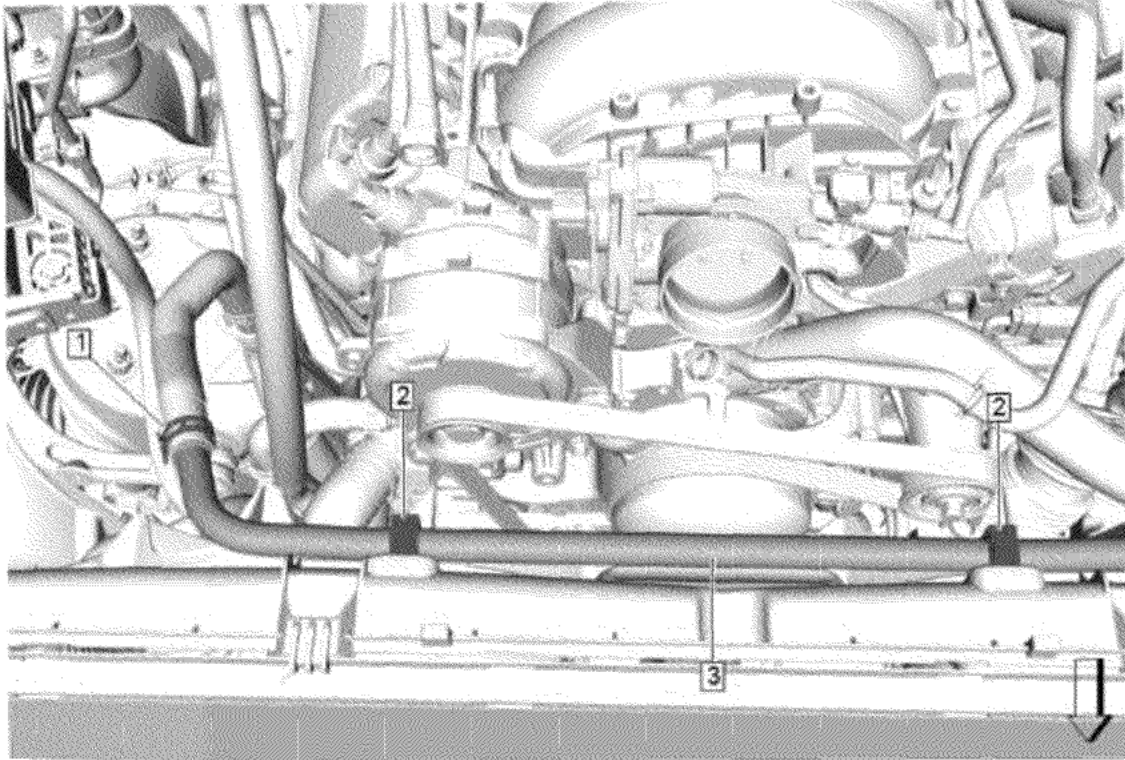


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205. Radiator Inlet Hose (3) @ Engine Radiator » Install

206. Radiator Inlet Hose Clamp (1) » Engage — [Hose Clamp Replacement Guidelines - Spring Type](#)

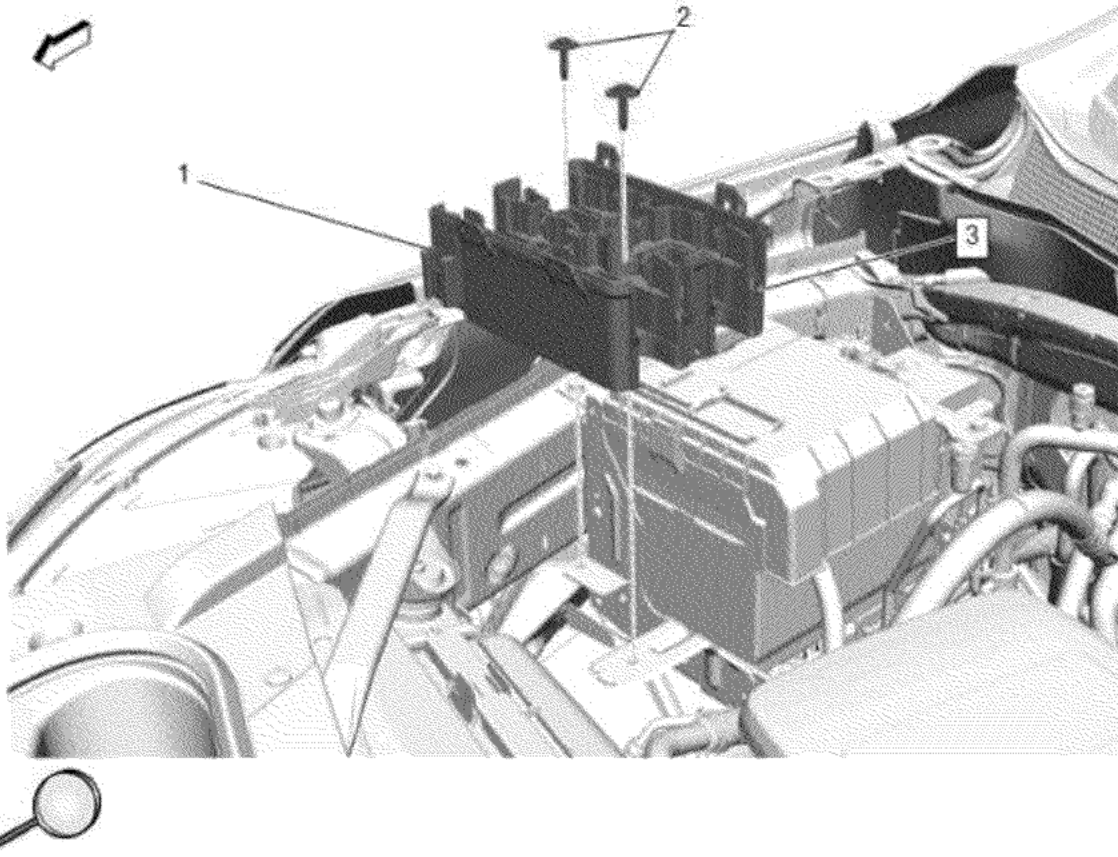
207. Radiator Inlet Hose Clip (2) » Install



208. Radiator Surge Tank Outlet Hose (3) » Install

209. Radiator Surge Tank Outlet Hose Clip (2) » Install [2x]

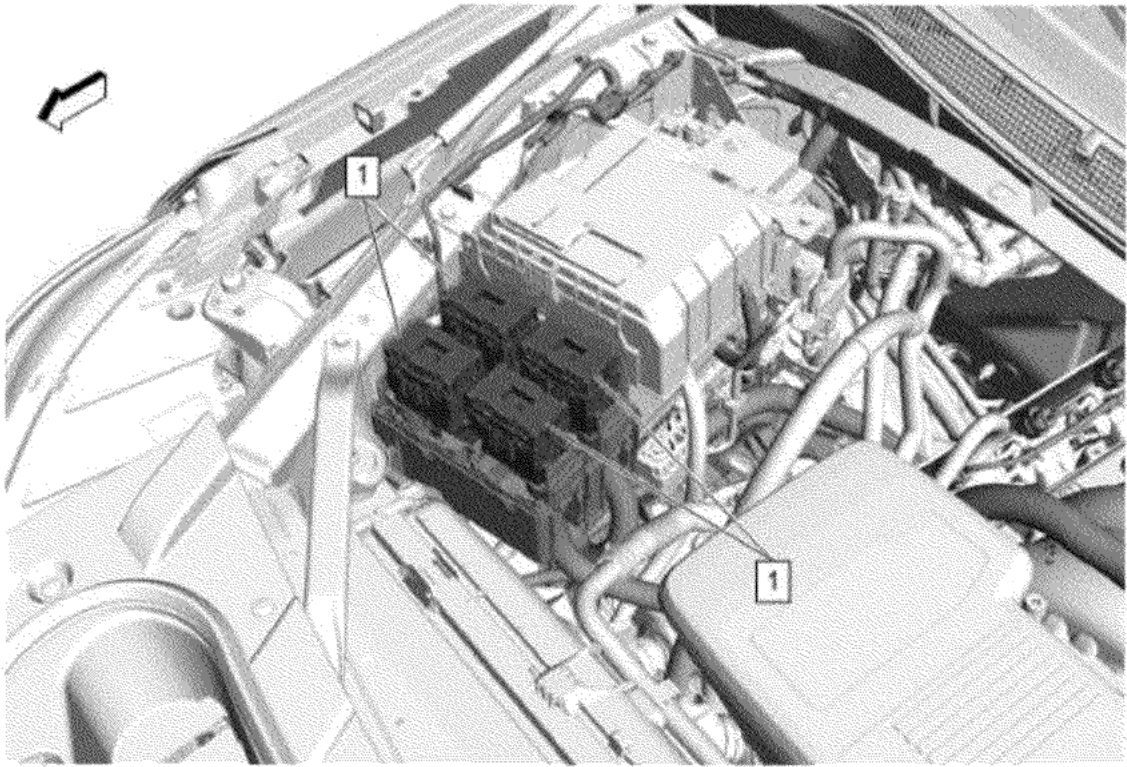
210. Heater Outlet Hose Clamp (4) » Engage — Hose Clamp Replacement Guidelines - Spring Type



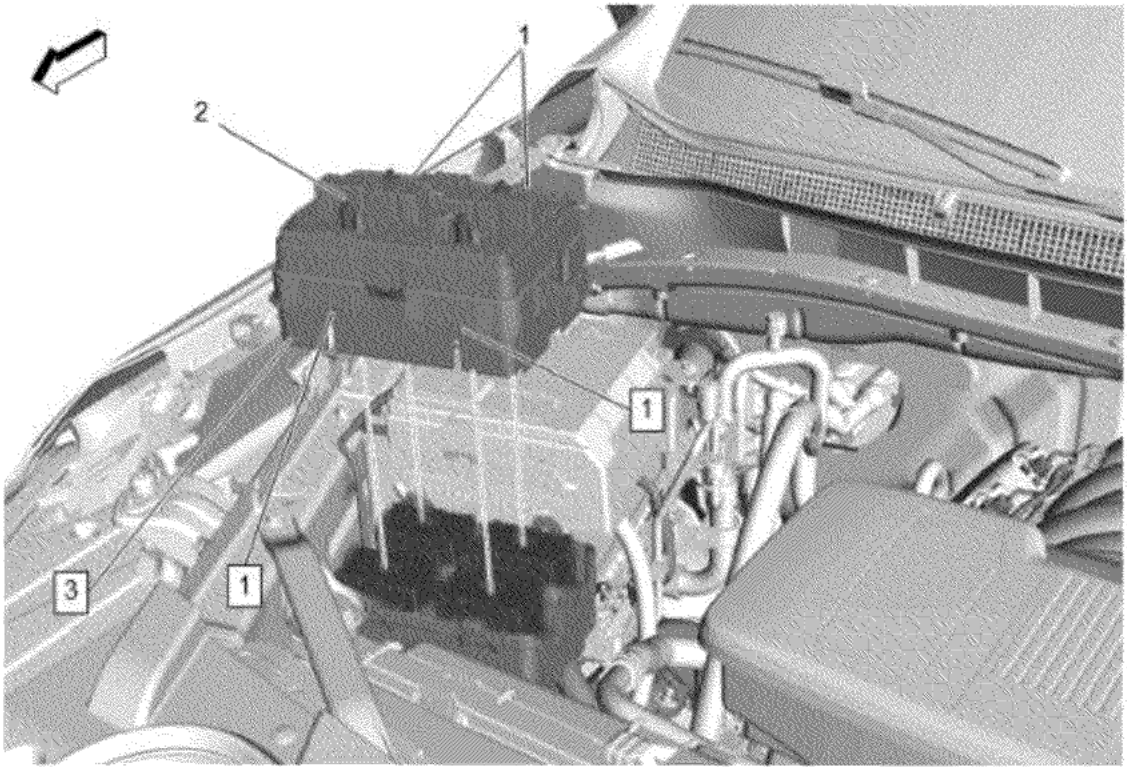
211. Engine Wiring Harness Fuse Block Bracket (3) » Install

212. Retaining Tab (1) » Engage

213. Engine Wiring Harness Fuse Block Bracket Bolt (2) » Tighten [2x] — [Fastener Specifications](#)



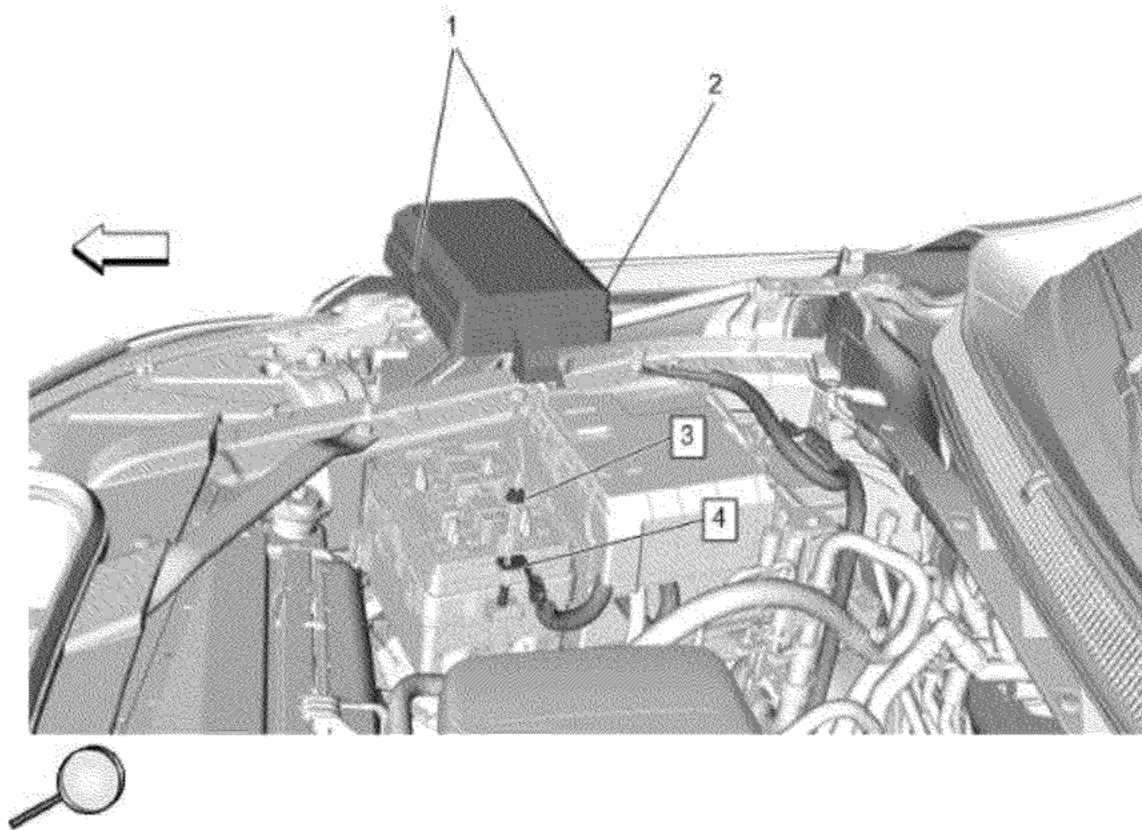
214. Electrical Connector (1) » Install [4x]



215. Engine Wiring Harness Junction Block (3) » Install

216. Retaining Tab (1) » Engage [4x]

217. Engine Wiring Harness Junction Block Bolt (2) » Tighten [4x] — [Fastener Specifications](#)



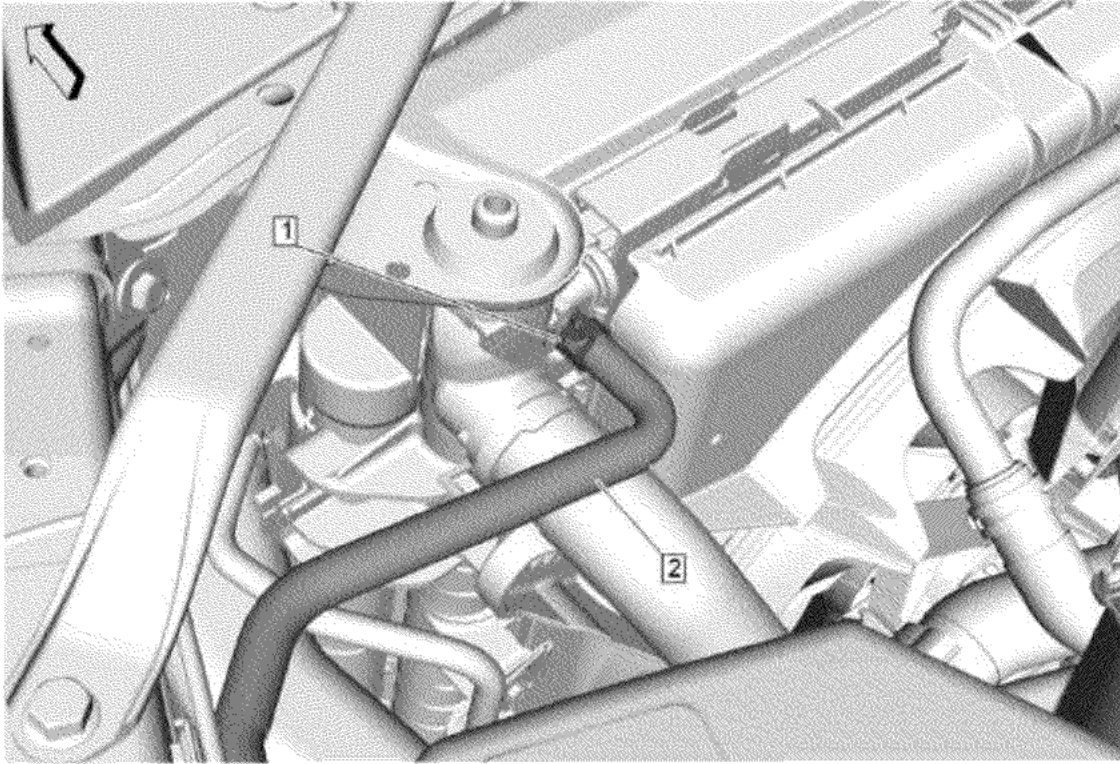
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218. Starter Solenoid Cable (4) » Install

219. Battery Positive Cable Nut (3) » Install and tighten — [Fastener Specifications](#)

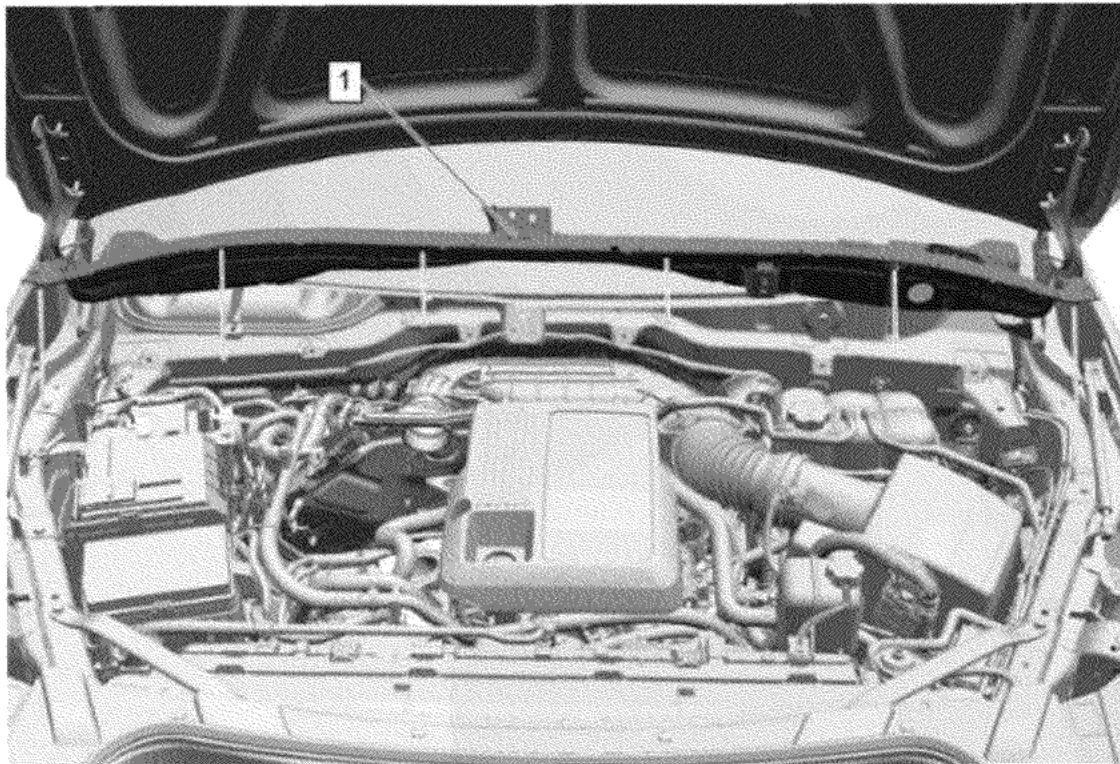
220. Engine Wiring Harness Junction Block Cover (2) » Install

221. Retaining Tab (1) » Engage [2x]



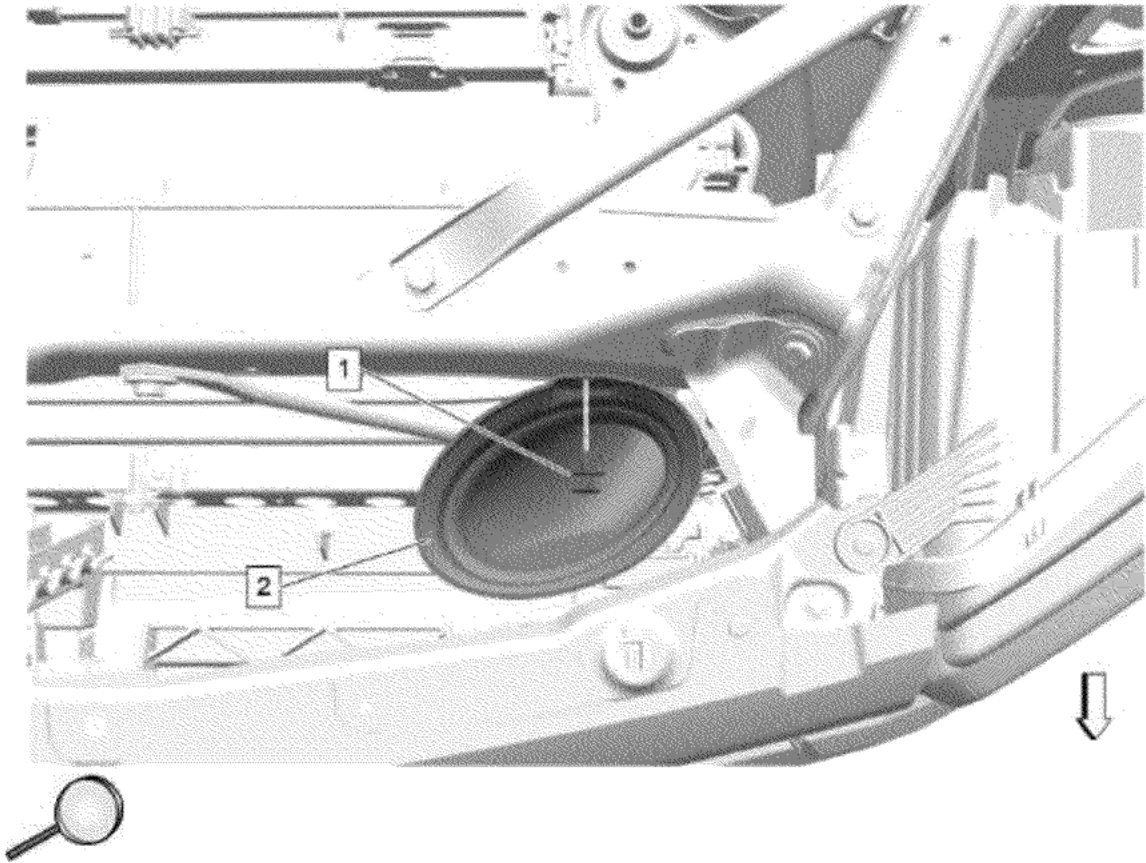
222. Radiator Surge Tank Inlet Hose (2) @ Engine Radiator » Install

223. Radiator Surge Tank Inlet Hose Clamp (1) » Engage — [Hose Clamp Replacement Guidelines - Spring Type](#)



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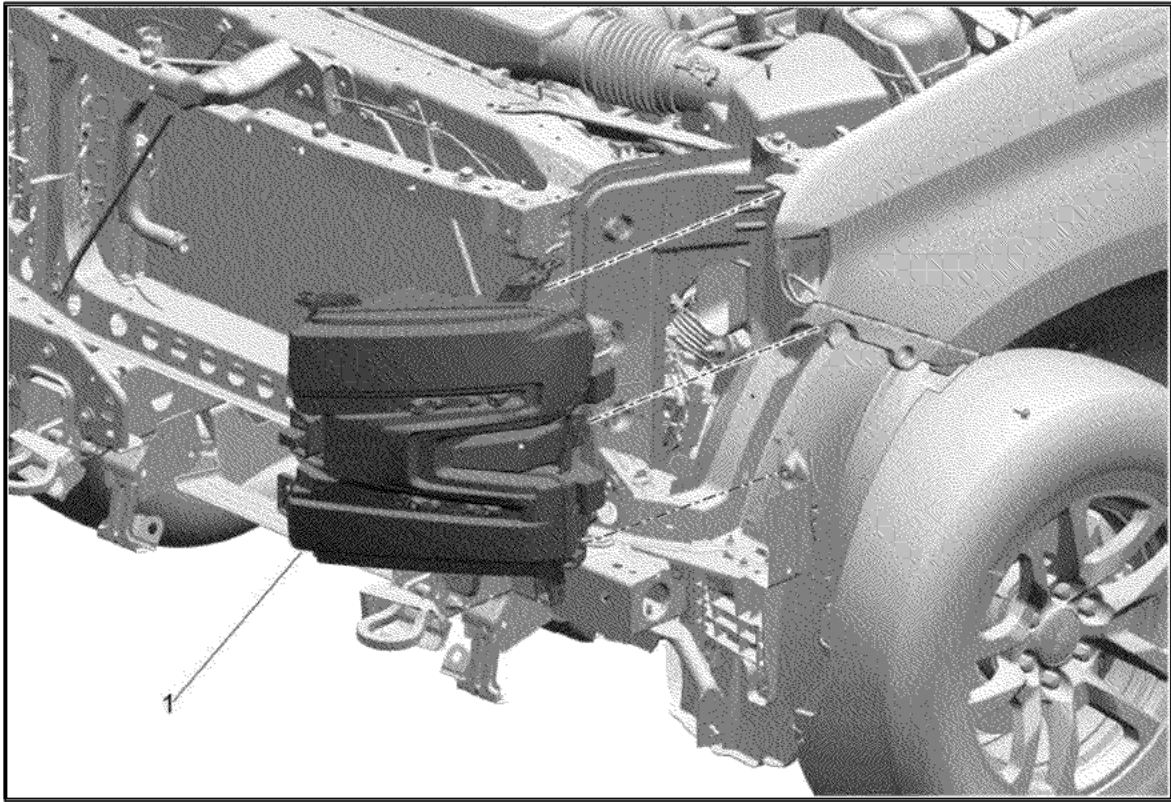
224. Plenum Front Panel Outer Reinforcement (1) » Install — Plenum Front Panel Outer Reinforcement Removal and Installation



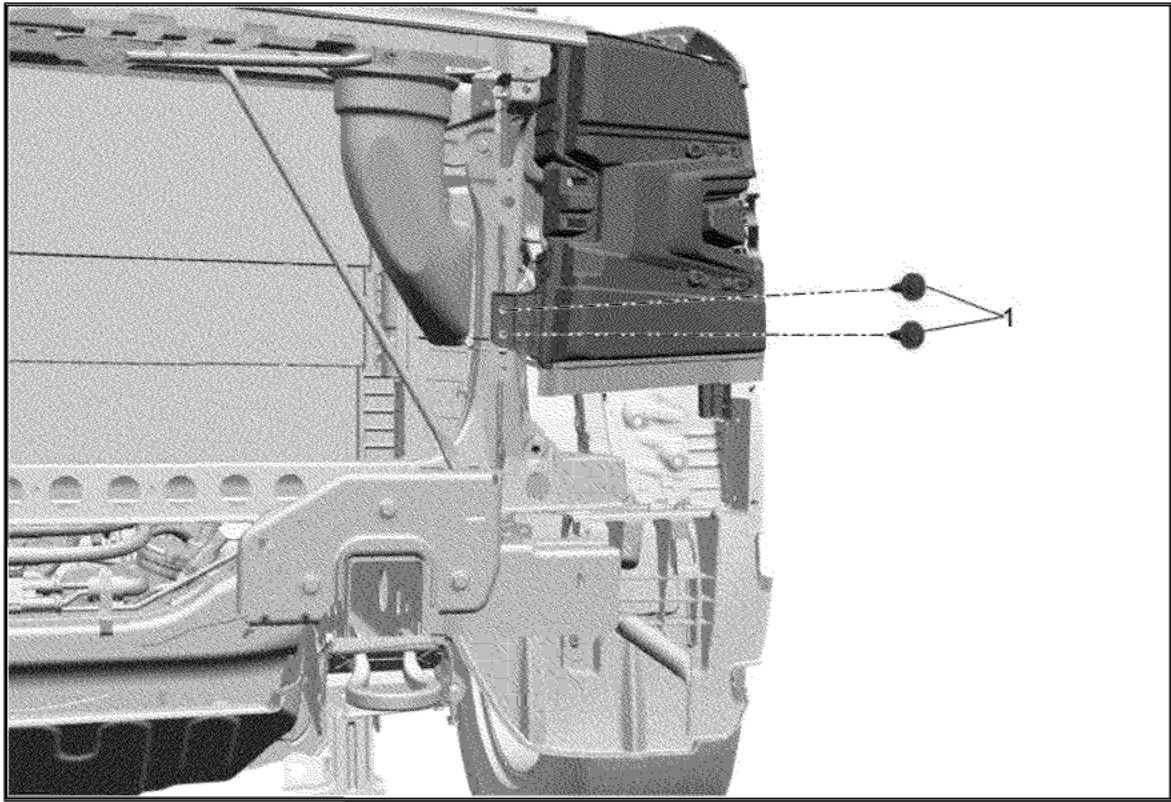
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225. Intake Air Duct (2) » Install

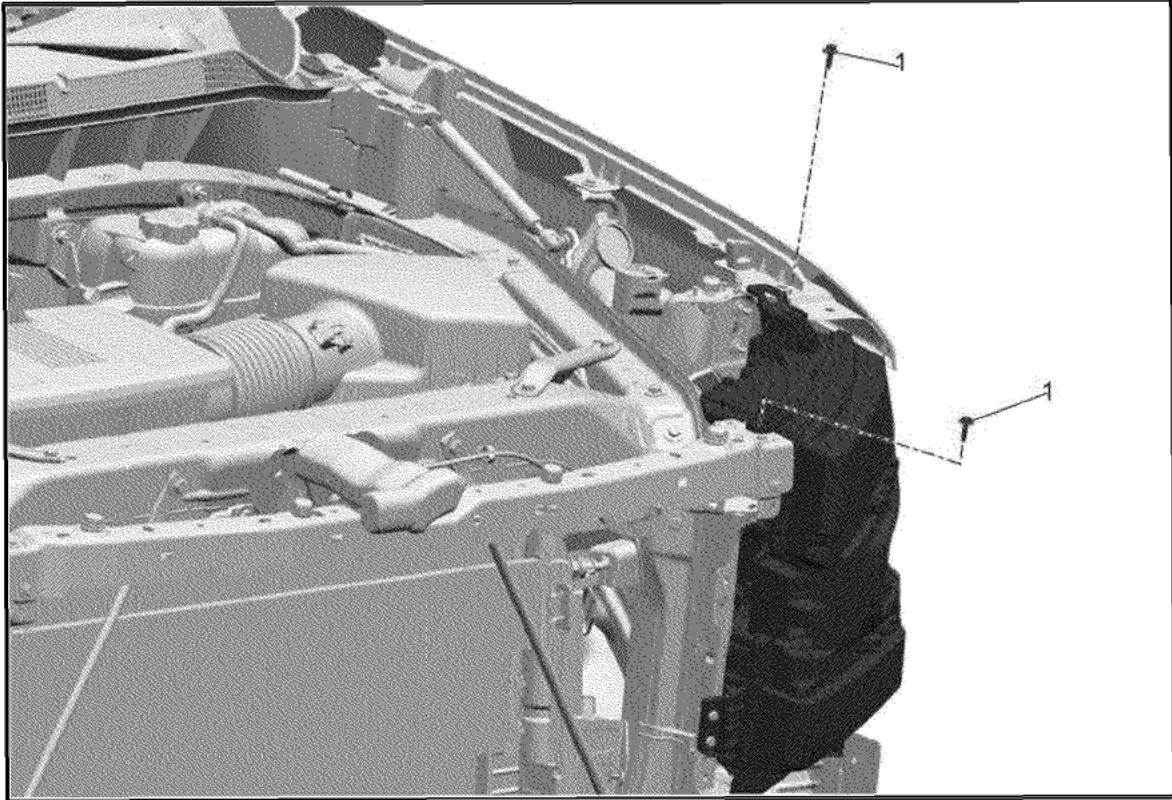
226. Intake Air Duct Retainer (1) » Install



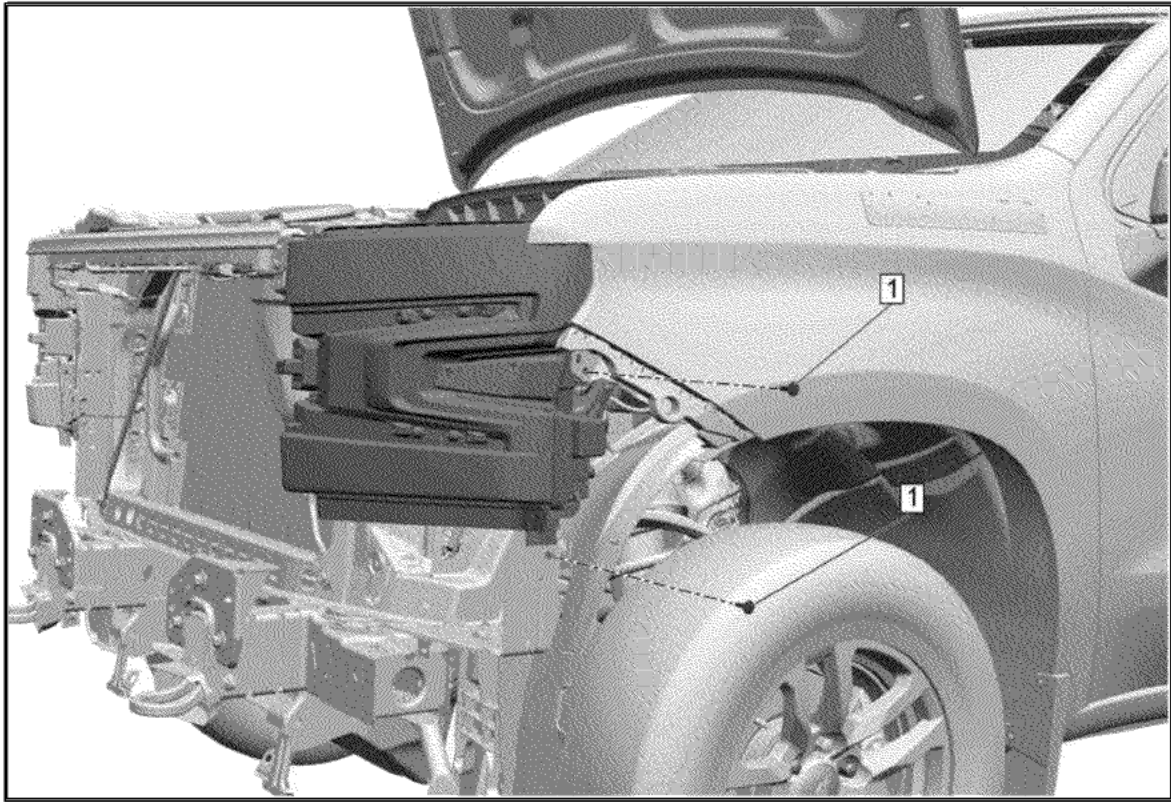
- 227. Headlamp - Left Side and Right Side (1) » Install [2x]
- 228. Connect the electrical connectors.



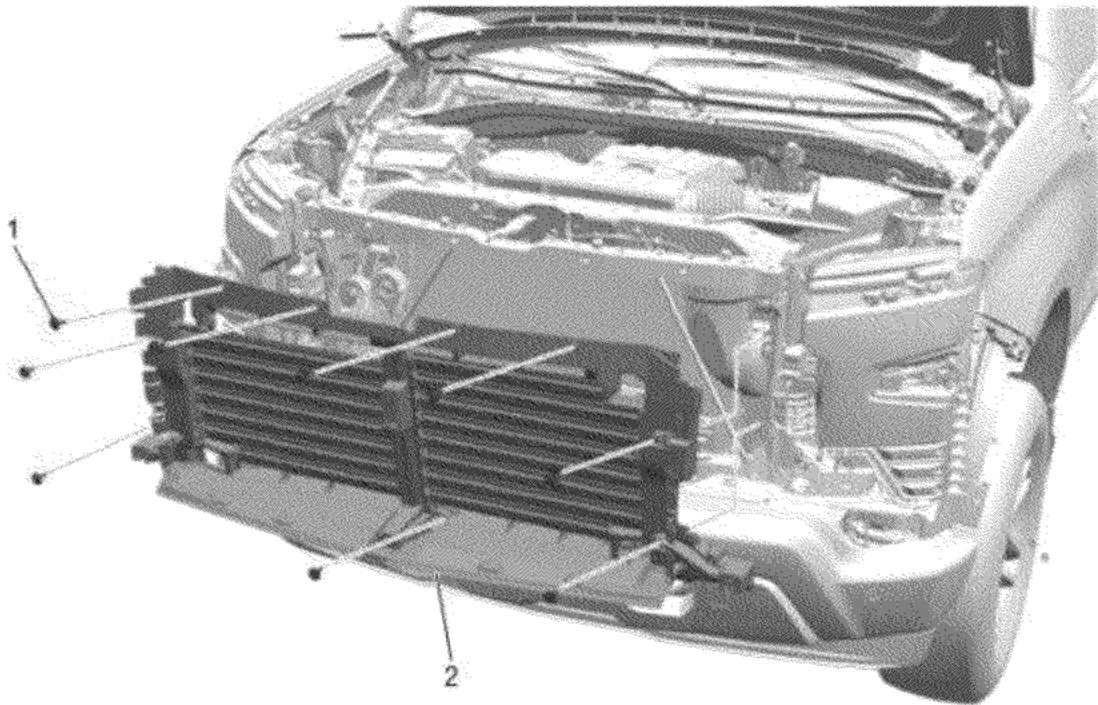
229. Headlamp Bolt - Left Side and Right Side (1) » Install and tighten [4x] — [Fastener Specifications](#)



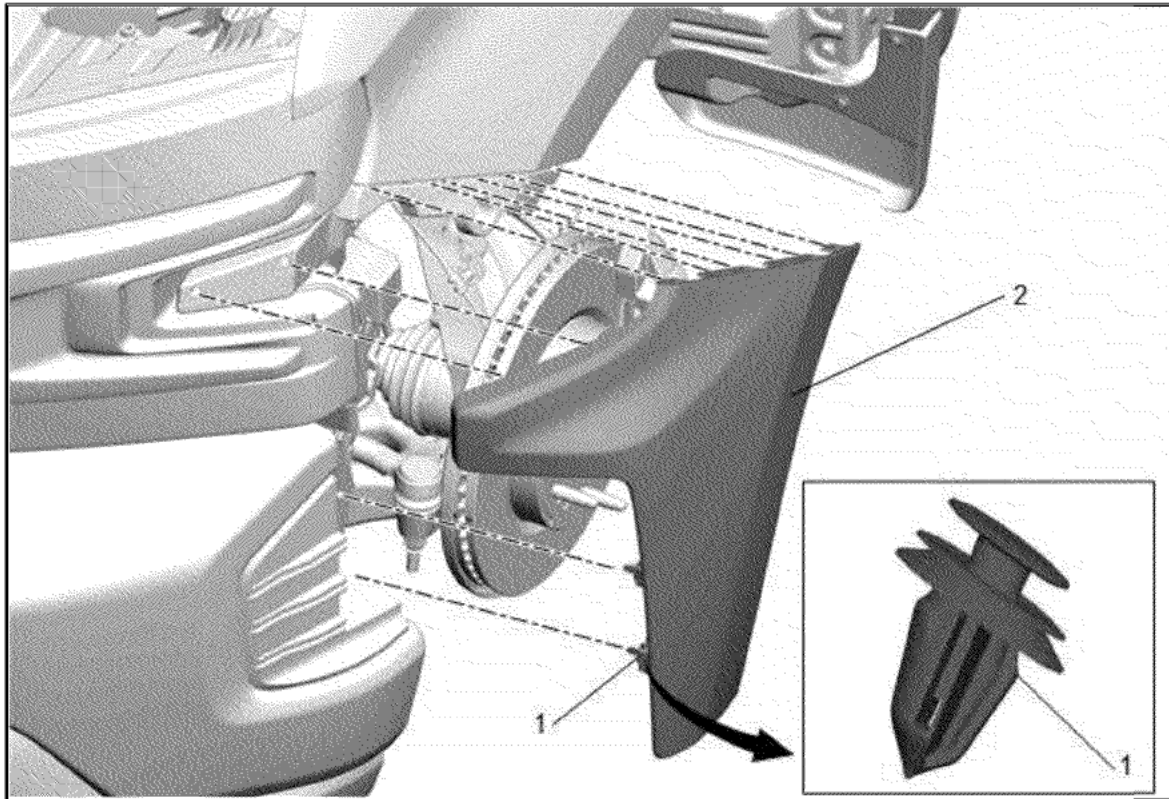
230. Headlamp Bolt - Left Side and Right Side (1) » Install and tighten [4x] — [Fastener Specifications](#)



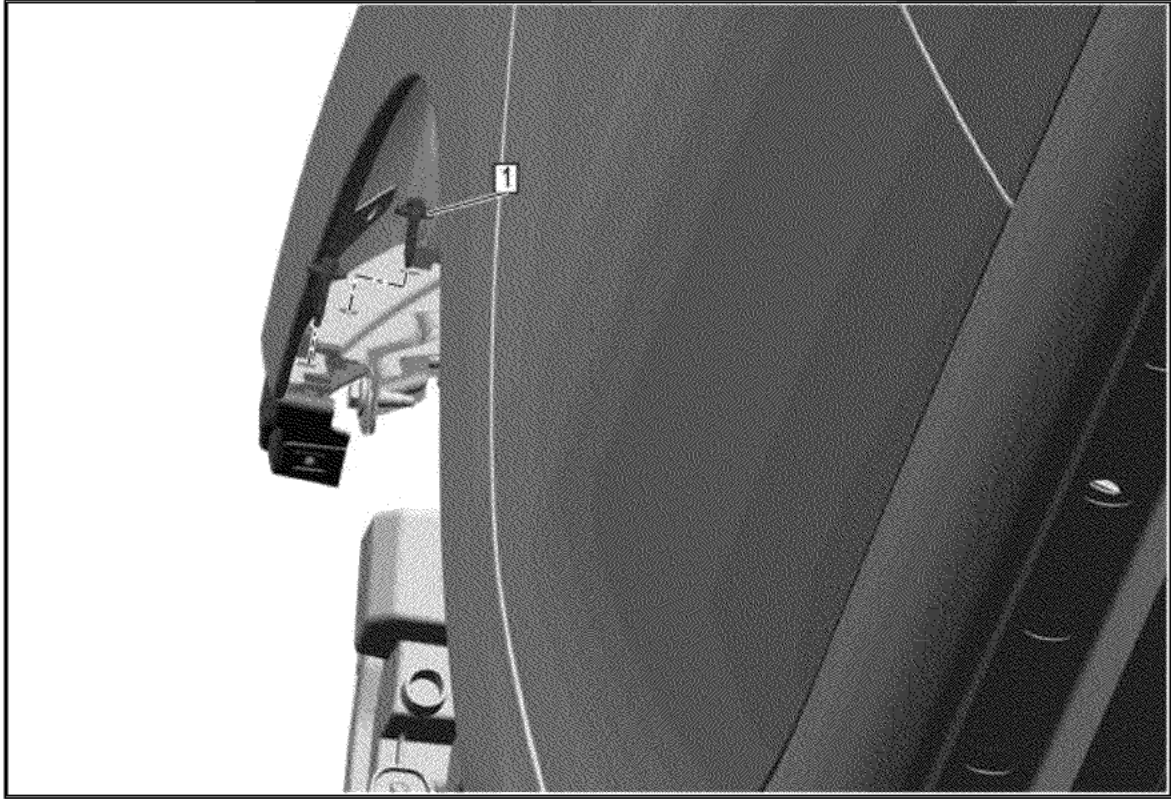
231. Headlamp Bolt - Left Side and Right Side (1) » Install and tighten [4x] — [Fastener Specifications](#)



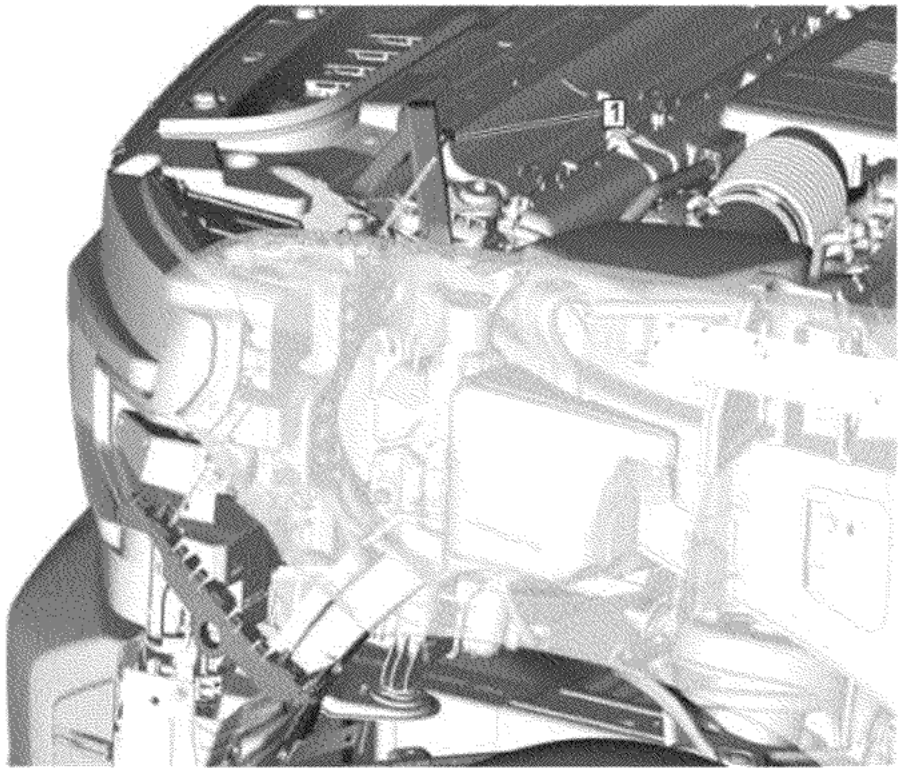
- 232. { If equipped } Connect and install the lower shutter harness.
- 233. Connect the electrical connector.
- 234. Front Bumper Shutter (2) » Install
- 235. { If equipped } Install the front driver info camera wiring harness retainer.
- 236. { If equipped } Connect the 2 wiring harness retainers onto the camera nozzle hose.
- 237. Front Bumper Shutter Bolt (1) Install and tighten [9x] — [Fastener Specifications](#)



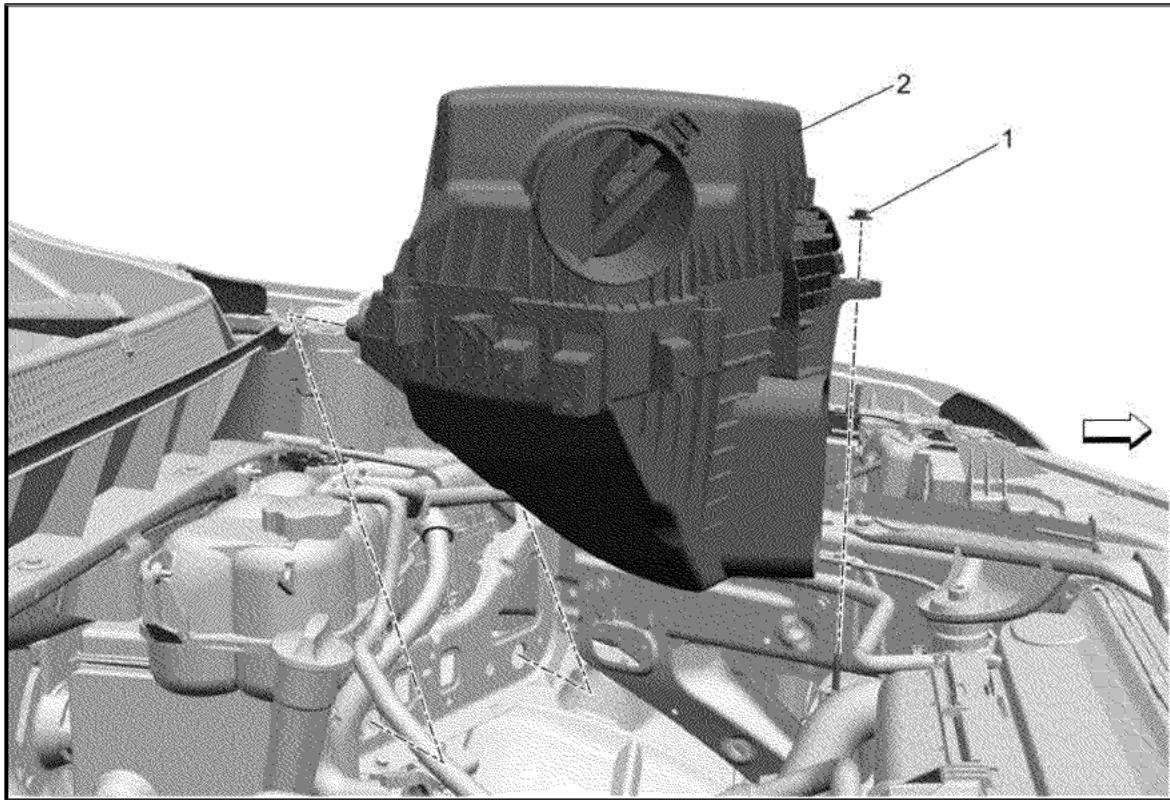
- 238. Front Bumper Outer Filler - Left Side and Right Side (2) » Install [2x]
- 239. Front Bumper Outer Filler Retainer (1) » Install [4x]



240. Front Bumper Fascia Guide Bolt - Left Side and Right Side (1) » Tighten [4x] — Fastener Specifications



241. Front Bumper Fascia Guide Bolt - Left Side and Right Side (1) » Tighten 0 [2x] — [Fastener Specifications](#)

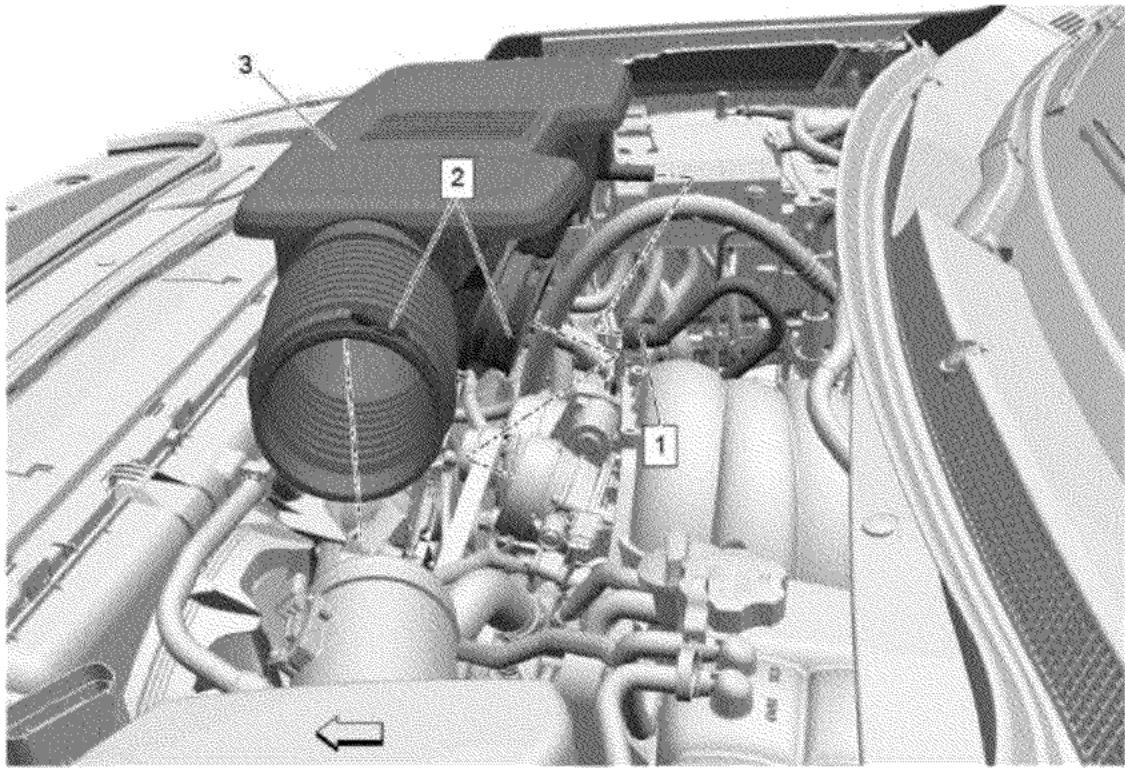


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242. Air Cleaner Assembly (2) » Install

243. Air Cleaner Nut (2) » Install and tighten — [Fastener Specifications](#)

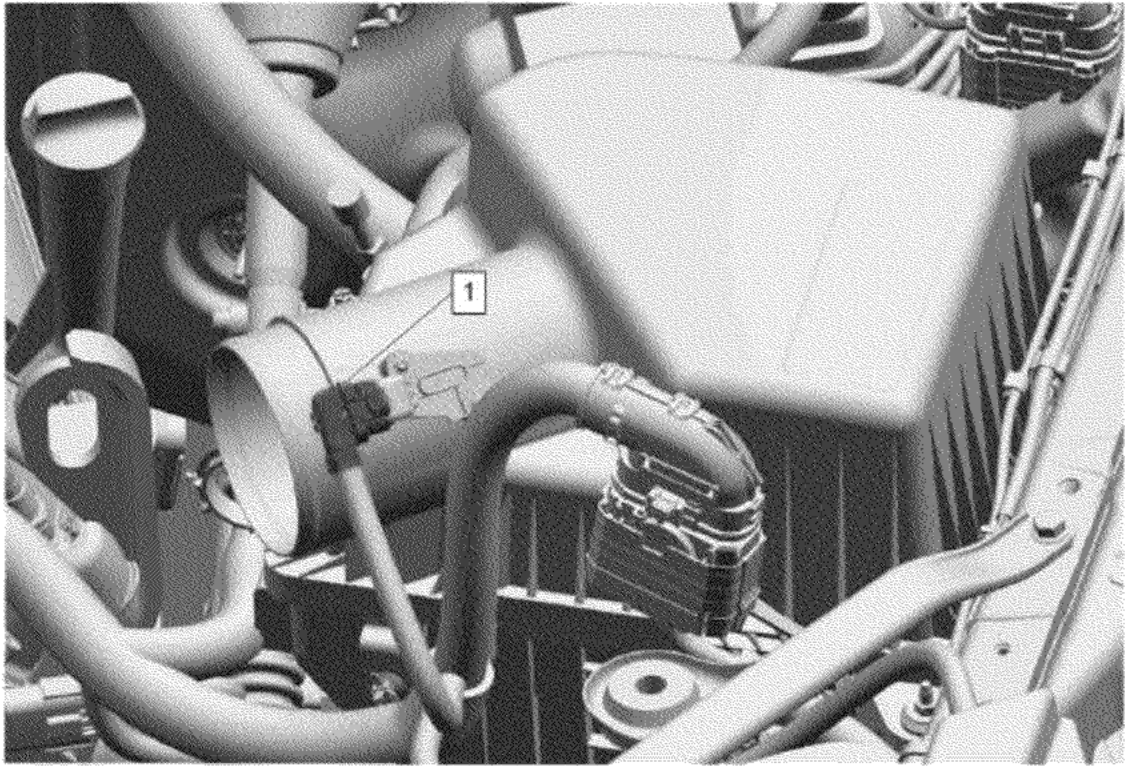


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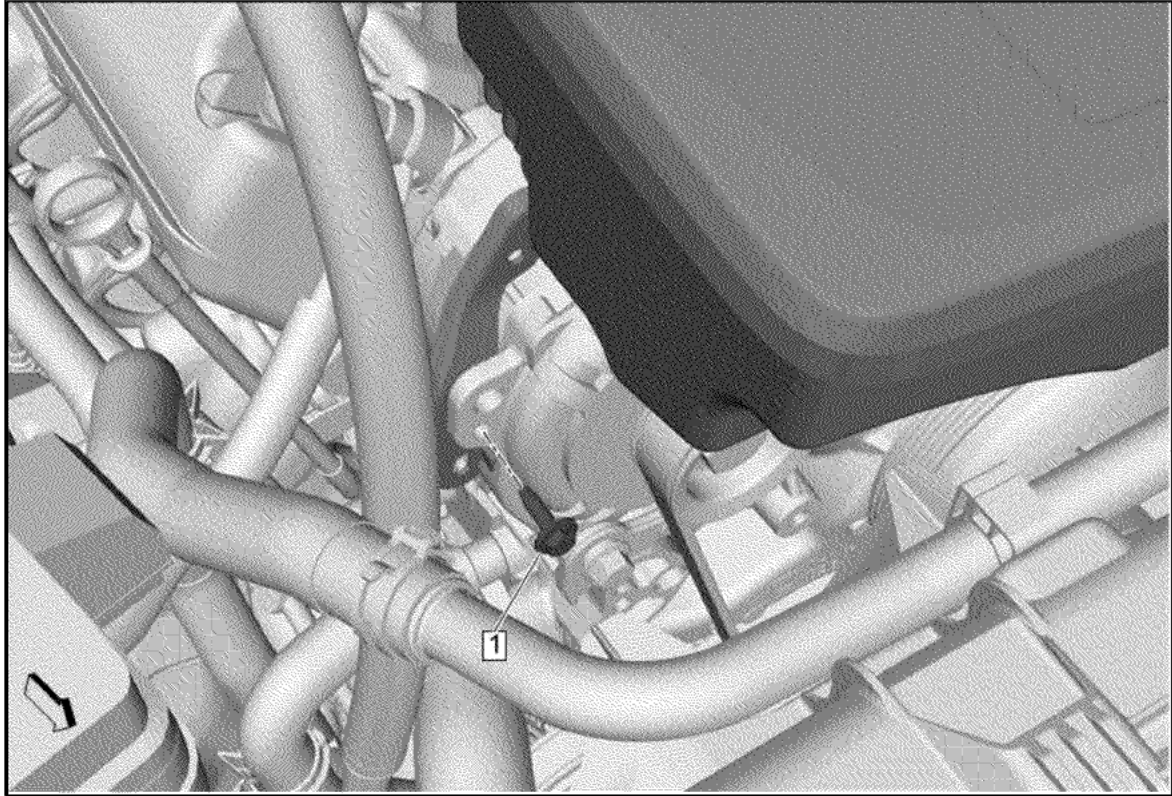
244. Air Cleaner Outlet Duct (3) » Install

245. Air Cleaner Outlet Duct Clamp (2) » Install and tighten [2x] — [Fastener Specifications](#)

246. Positive Crankcase Ventilation Fresh Air Tube (1) » Connect — [Plastic Collar Quick Connect Fitting Service](#)

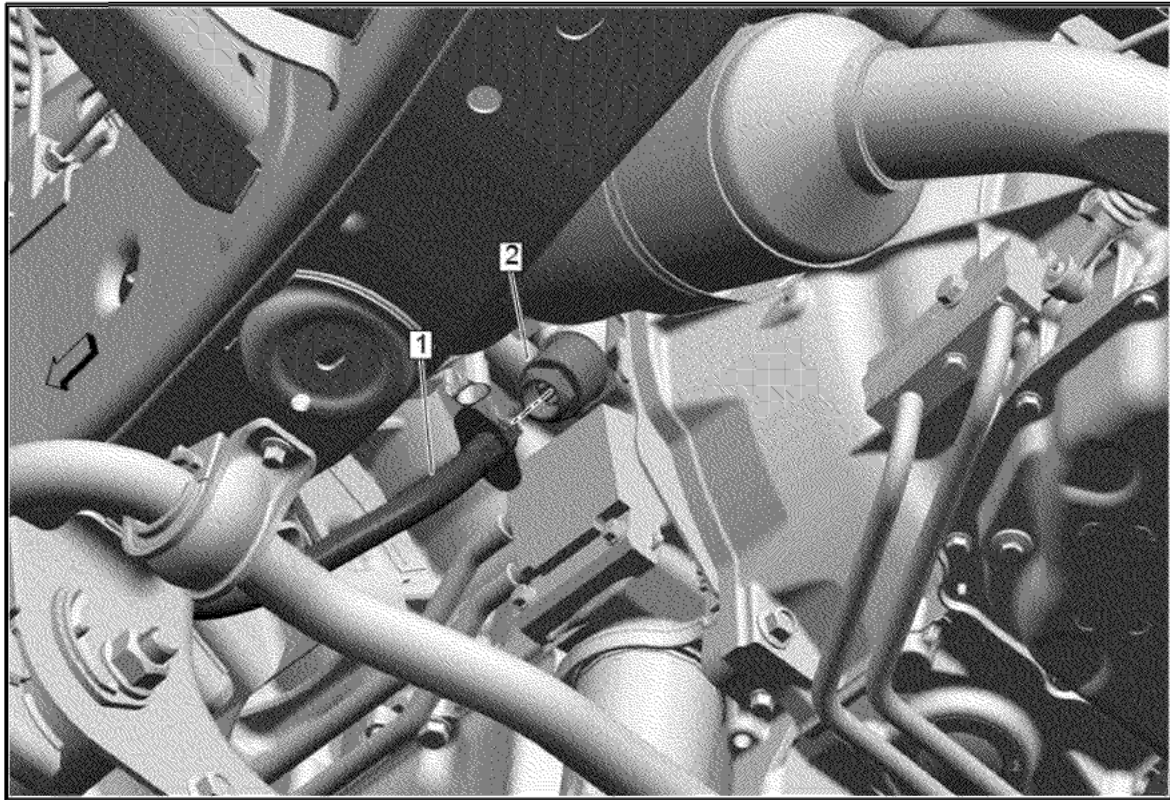


247. Connect the mass airflow sensor electrical connector (1) and install all engine wiring harnesses from the air cleaner assembly.



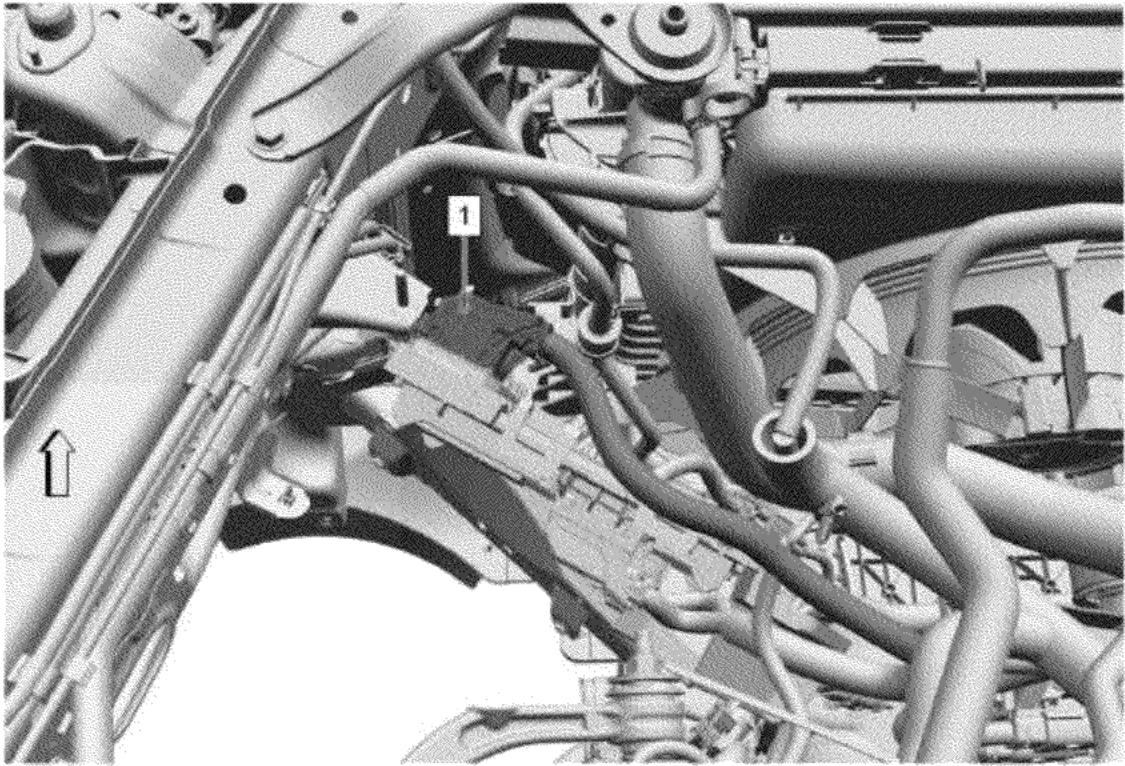
248. Air Cleaner Outlet Duct Bracket Bolt (1) » Install and tighten — [Fastener Specifications](#)

249. Engine Wiring Harness @ Air Cleaner Outlet Duct Bracket » Install

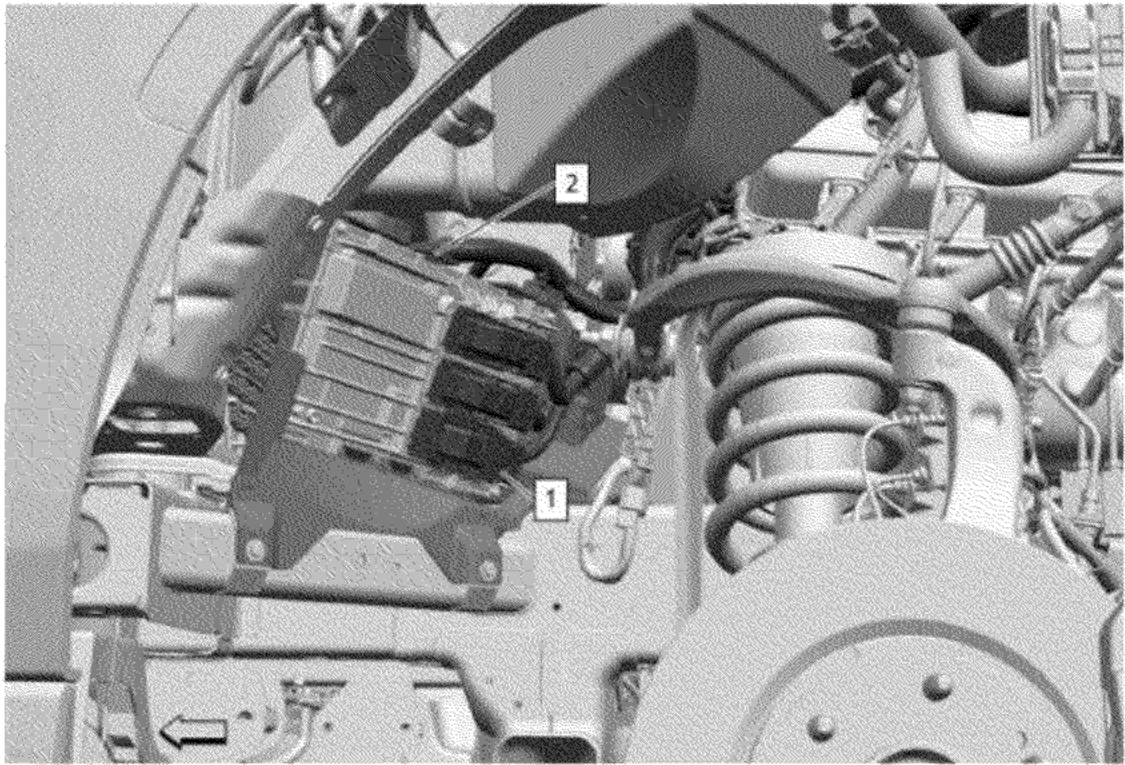


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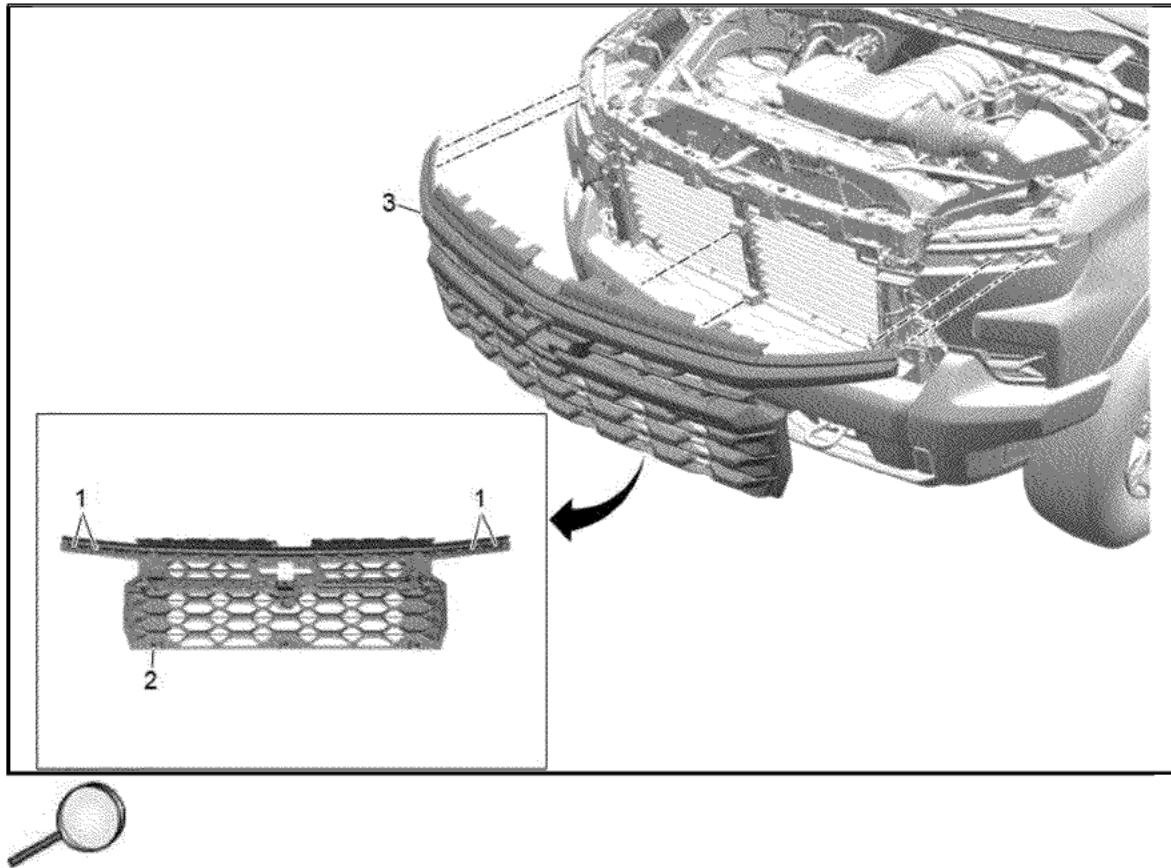
250. { If equipped } Engine Coolant Heater Cord (1) @ Engine Coolant Heater » Connect



251. Connect the electrical connector. (1)



252. Connect the electrical connectors. (1)



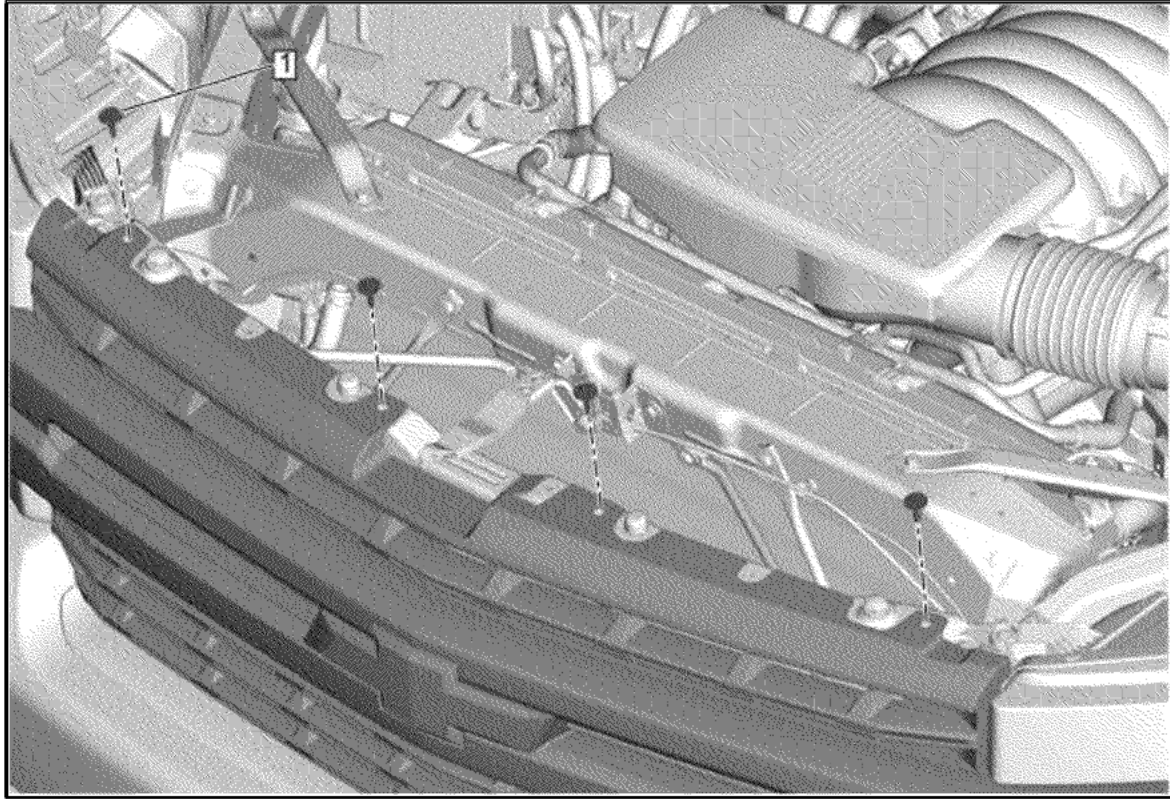
253. Front Grille (3) » Install

254. { If equipped } Front View Driver Information Camera Nozzle Hose » Connect

255. { If equipped } Connect the electrical connector.

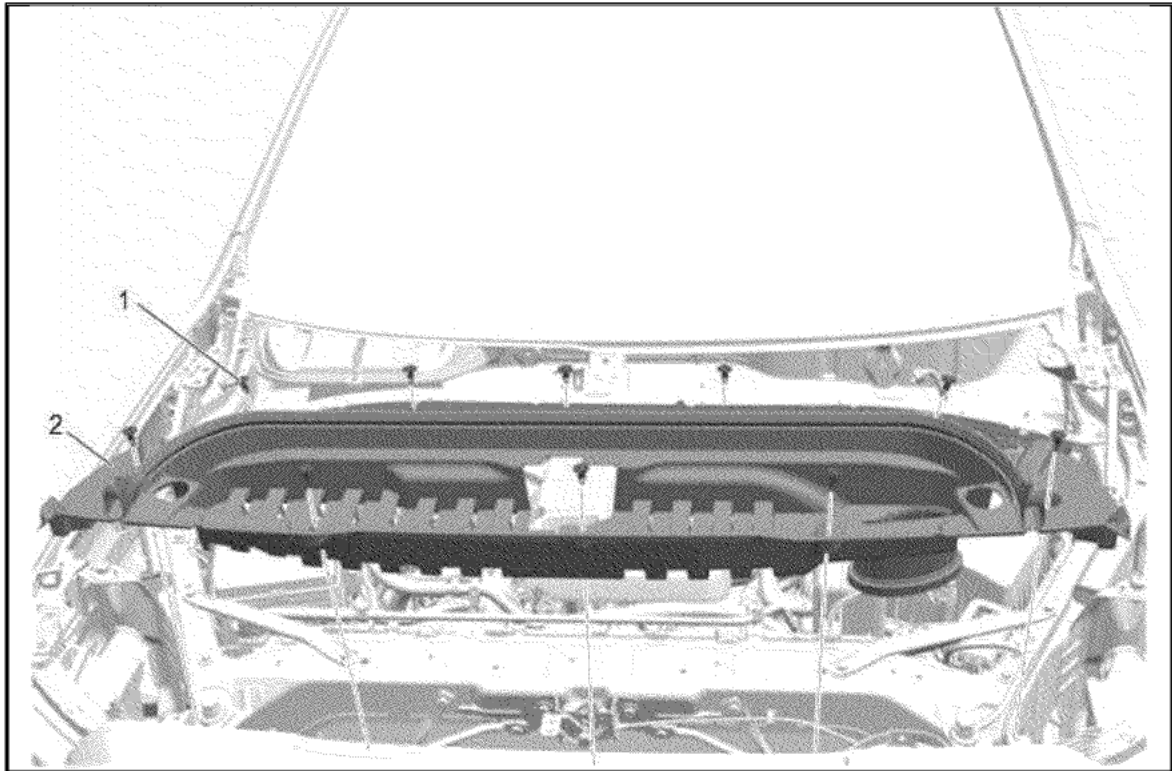
256. Front Grille Clip (2) » Install [6x]

257. Front Grille Retainer (1) » Install [4x]

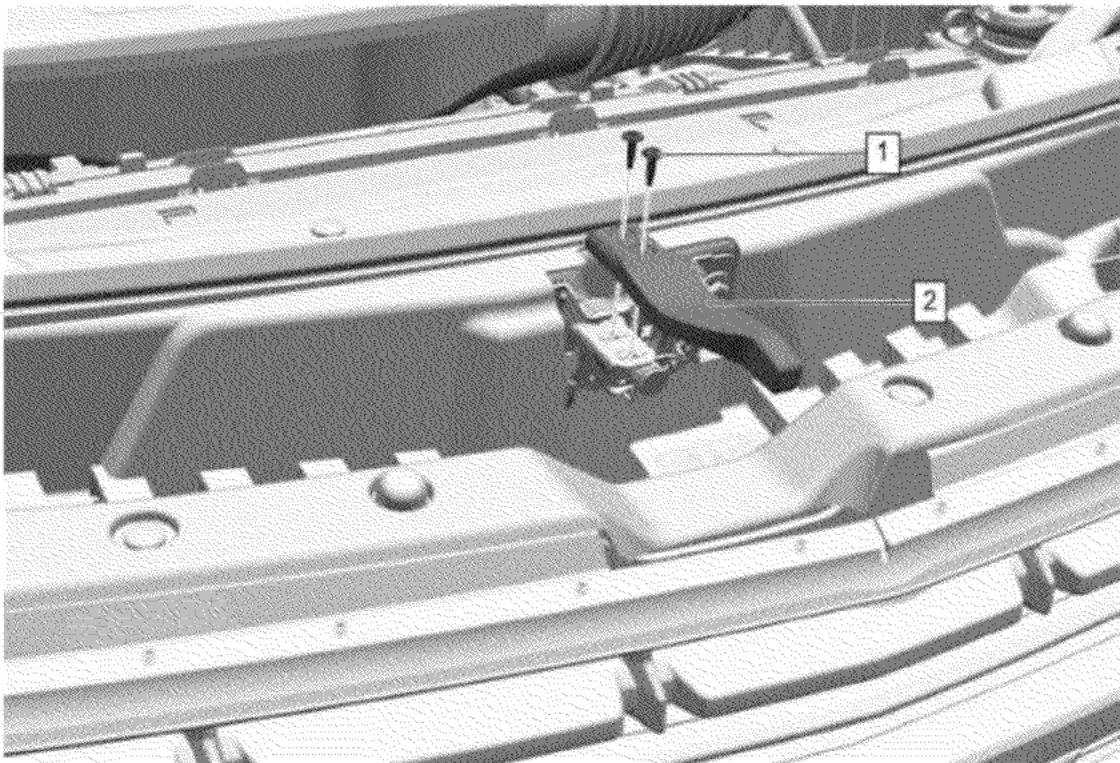


258. Front Grille Bolt (1) » Install and tighten [4x] — [Fastener Specifications](#)

259. Front Wheelhouse Liner - Left Side and Right Side (3) » Install [2x] — [Front Wheelhouse Liner Replacement](#)

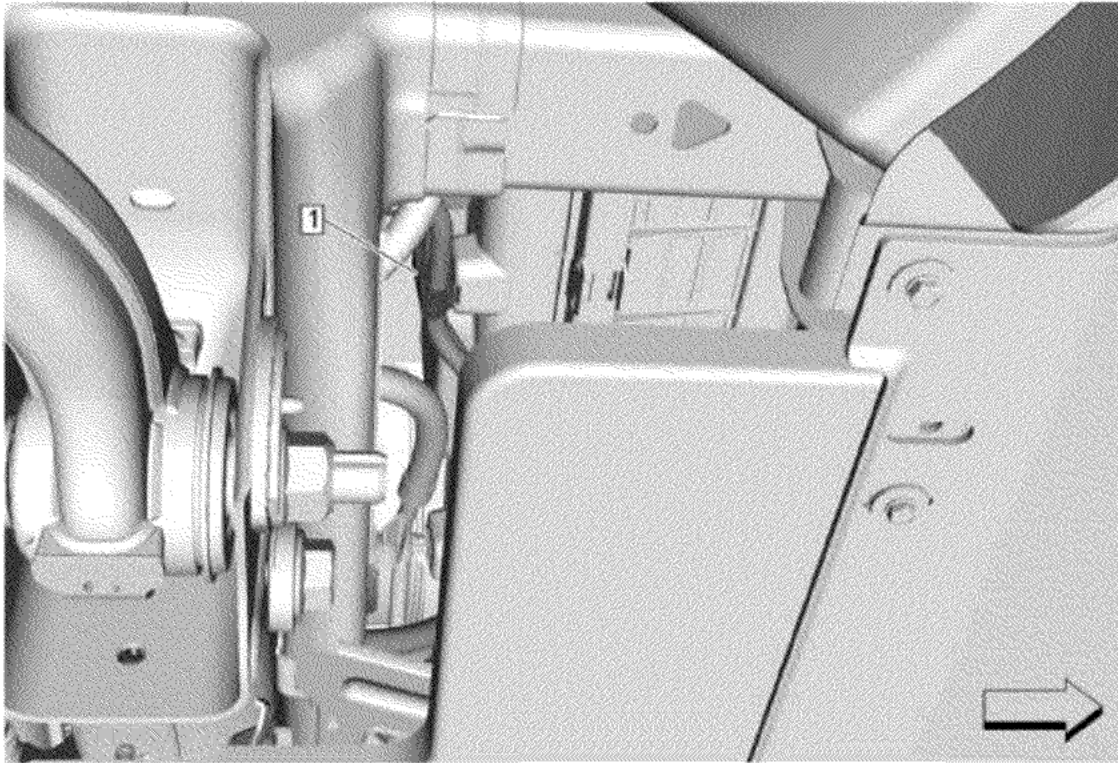


- 260. Intake Air Splash Shield (2) » Install
- 261. Intake Air Baffle Retainer (1) » Install [10x]



262. Hood Secondary Latch Release Handle (2) » Install

263. Hood Latch Actuator Bolt (1) » Install and tighten [2x] — [Fastener Specifications](#)



264. Engine Oil Cooler Hose Clip (1) » Secure

265. Install underbody panels as necessary. [Underbody Panel Component Locator](#)

266. Lower the vehicle.

267. Connect the battery negative cable. [Battery Negative Cable Disconnection and Connection](#)

268. Recharge the refrigerant. [Refrigerant Recovery and Recharging](#)

269. Inspect for refrigerant leaks.

270. Prelube is necessary if the engine is replaced or overhauled. [Engine Prelubing](#)

**Caution:** USE ONLY GE-47716 for Cooling System Draining and Filling. DO NOT USE Static Fill as it will result in damage to the engine.

271. Using the GE-47716 Vac-N-Fill Coolant Refill Tool procedure only, fill the coolant system. [Cooling System Draining and Filling](#)

272. Install the oil fill cap.

273. Start the engine and check for fuel leaks.

274. Run the engine speed at about 1,000 RPM until the engine has reached normal operating temperature. Check the vehicle oil pressure gauge and confirm that the engine has acceptable oil pressure, listen for unusual noises. If necessary, install an oil pressure gauge and measure the engine oil pressure.

275. Inspect for oil leaks.

276. Perform a final inspection for the proper engine oil and coolant levels.

277. Perform the throttle body idle air flow compensation reset procedure. [Throttle Body Idle Air Flow Compensation Reset](#)

278. Perform the crankshaft position variation learn. [Crankshaft Position Variation Learn](#)

**Caution:** Refer to [Heated Oxygen Sensor Resistance Learn Reset Caution](#).

279. If any of the heated oxygen sensors are replaced, perform the heated oxygen sensor heater resistance learned values reset. [HO2S Heater Resistance Learned Values Reset](#)

280. After installation, aim the front headlamps. [Front Headlamp Aiming](#)