

2003 ENGINE COOLING**Electric Cooling Fans - CTS****DESCRIPTION & OPERATION**

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in **GENERAL INFORMATION** before disconnecting battery.

COOLING FAN CONTROL (TWO FAN SYSTEM)

The engine cooling fan system consists of 2 electrical cooling fans and 3 fan relays. The relays are arranged in a series/parallel configuration that allows the Engine Control Module (ECM) to operate both fans together at low or high speeds. The cooling fans and fan relays receive battery positive voltage from the underhood fuse block. The ground path is provided at G104.

During low speed operation, the ECM supplies the ground path for the low speed fan relay through the low speed cooling fan relay control circuit. This energizes the low speed fan relay coil, closes the relay contacts, and supplies battery positive voltage from the low fan fuse through the cooling fan motor supply voltage circuit to the left cooling fan. The ground path for the left cooling fan is through the cooling fan s/p relay and the right cooling fan. The result is a series circuit with both fans running at low speed.

During high speed operation the ECM supplies the ground path for the low speed fan relay through the low speed cooling fan relay control circuit. After a 3 second delay, the ECM supplies a ground path for the high speed fan relay and the cooling fan s/p relay through the high speed cooling fan relay control circuit. This energizes the cooling fan s/p relay coil, closes the relay contacts, and provides a ground path for the left cooling fan. At the same time the high speed fan relay coil is energized closing the relay contacts and provides battery positive voltage from the high fan fuse on the cooling fan motor supply voltage circuit to the right cooling fan. During high speed fan operation, both engine cooling fans have there own ground path. The result is a parallel circuit with both fans running at high speed.

The ECM commands the low speed cooling fans ON under the following conditions:

- Engine coolant temperature exceeds approximately 202°F (94.5°C).
- A/C refrigerant pressure exceeds 210 psi (1447 kPa).

- After the vehicle is shut OFF if the engine coolant temperature at key-off is greater than 214°F (101°C) the low speed fans will run for a minimum of 60 seconds. After 60 seconds, if the coolant temperature drops below 214°F (101°C) the fans will shut OFF. The fans will automatically shut OFF after 3 minutes regardless of coolant temperature.

The ECM commands the high speed fans ON under the following conditions:

- Engine coolant temperature exceeds approximately 220°F (104.25°C).
- A/C refrigerant pressure exceeds approximately 265 psi (1824 kPa).
- When certain DTCs set.

At idle and very low vehicle speeds the cooling fans are only allowed to increase in speed if required. This insures idle stability by preventing the fans from cycling between high and low speed.

COOLING FAN CONTROL (THREE FAN SYSTEM)

The engine cooling fan system consists of 3 electrical cooling fans and 4 fan relays. The low speed, high speed, and s/p relays are arranged in a series/parallel configuration that allows the engine control module (ECM) to operate the left cooling fan and right cooling fan together at low or high speeds. The cooling fans and fan relays receive battery positive voltage from the underhood fuse block. The ground path is provided at G104.

During low speed operation, the ECM supplies the ground path for the low speed fan relay through the low speed cooling fan relay control circuit. This energizes the low speed fan relay coil, closes the relay contacts, and supplies battery positive voltage from the low fan fuse through the cooling fan motor supply voltage circuit to the left cooling fan. The ground path for the left cooling fan is through the cooling fan s/p relay and the right cooling fan. The result is a series circuit with both fans running at low speed.

During high speed operation the ECM supplies the ground path for the low speed fan relay through the low speed cooling fan relay control circuit. After a 3-second delay, the ECM supplies a ground path for the high speed fan relay and the cooling fan s/p relay through the high speed cooling fan relay control circuit. This energizes the cooling fan s/p relay coil, closes the relay contacts, and provides a ground path for the left cooling fan. At the same time the high speed fan relay coil is energized closing the relay contacts and provides battery positive voltage from the high fan fuse on the cooling fan motor supply voltage circuit to the right cooling fan. During high speed fan operation, both engine cooling fans have there own ground path. The result is a parallel circuit with both fans running at high speed.

The auxiliary cooling fan relay is located in the left rear fuse block and receives ignition No. 1 voltage from the underhood fuse block. The auxiliary cooling fan receives battery positive voltage from the left rear fuse block through the auxiliary cooling fan motor supply voltage circuit via the underhood fuse block.

During auxiliary cooling fan operation, the ECM supplies the ground path for the auxiliary cooling fan relay through the auxiliary cooling fan relay control circuit. This energizes the auxiliary cooling fan relay coil, closes the relay contacts, and supplies battery positive voltage from the 30 amp maxi-fuse through the auxiliary cooling fan motor supply voltage circuit. The ground path is provided at G104.

The ECM commands the low speed fans on under the following conditions:

- Engine coolant temperature exceeds approximately 202°F (94.5°C).
- A/C refrigerant pressure exceeds 210 psi (1447 kPa).
- After the vehicle is shut OFF if the engine coolant temperature at key-off is greater than 214°F (101°C) the low speed fans will run for a minimum of 60 seconds. After 60 seconds, if the coolant temperature drops below 214°F (101°C) the fans will shut OFF. The fans will automatically shut OFF after 4 minutes regardless of coolant temperature.

The ECM commands the high speed fans ON under the following conditions:

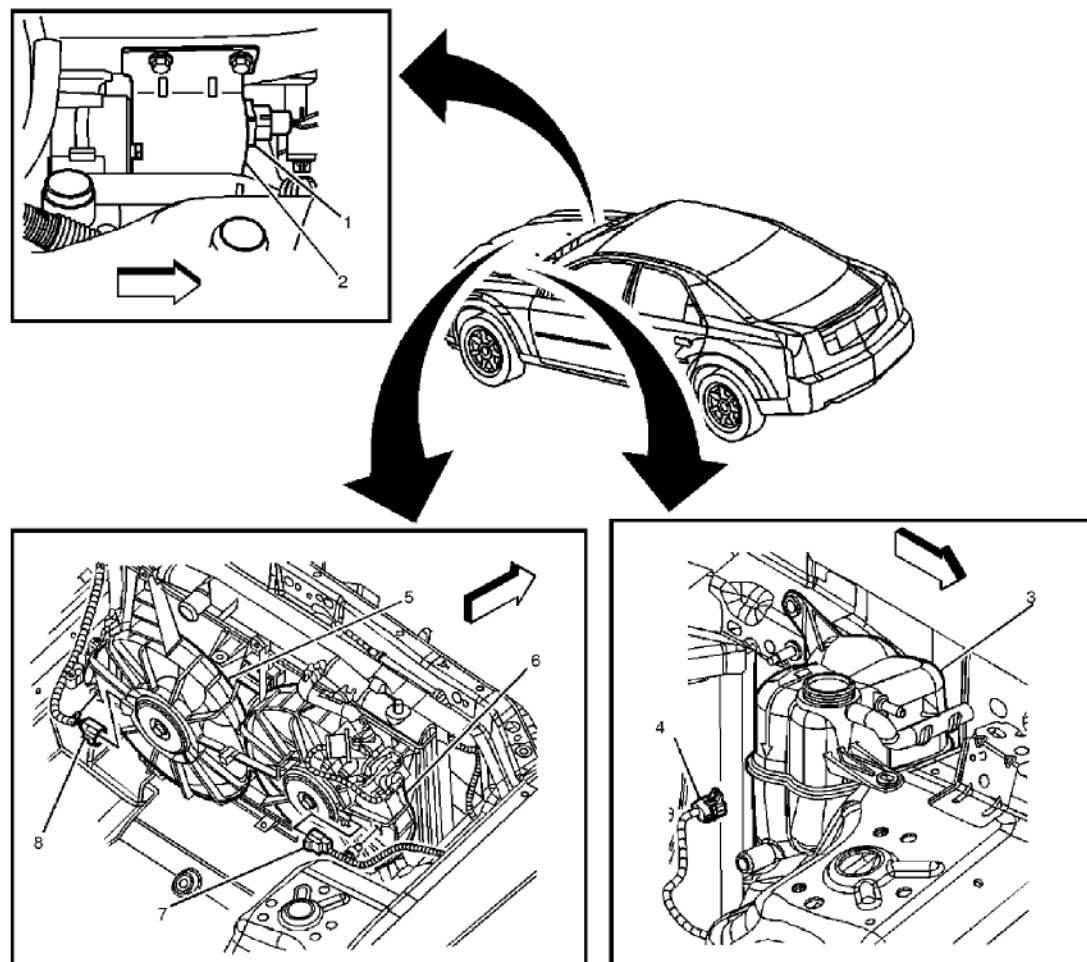
- Engine coolant temperature exceeds approximately 220°F (104.25°C).
- A/C refrigerant pressure exceeds 265 psi (1824 kPa).
- When certain DTCs set.

At idle and very low vehicle speeds the cooling fans are only allowed to increase in speed if required. This insures idle stability by preventing the fans from cycling between high and low speed.

The ECM commands the auxiliary cooling fan ON when the engine coolant temperature exceeds approximately 226°F (108°C).

COMPONENT LOCATIONS

For location of cooling fans, see **Fig. 1**.



- (1) After Boil Coolant Pump Connector
- (2) After Boil Coolant Pump
- (3) Coolant Surge Tank
- (4) Coolant Level Switch Connector
- (5) Cooling Fan - Left
- (6) Cooling Fan - Right
- (7) Cooling Fan Connector - Right
- (8) Cooling Fan Connector - Left

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Fig. 1: Exploded View Of Cooling System Components

Courtesy of GENERAL MOTORS CORP.

PROGRAMMING

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

ENGINE CONTROL MODULE

To program the engine control module (ECM), see **ENGINE CONTROL MODULE** under PROGRAMMING in SELF-DIAGNOSTICS article in FAULT ISOLATION in ENGINE PERFORMANCE.

TROUBLE SHOOTING

PRELIMINARY INSPECTION

Verify customer complaint by operating suspected system. Visually inspect for obvious signs of mechanical and electrical damage. Inspect for blown fuses and damaged relays. For fuse and/or relay identification, see **FUSES & CIRCUIT BREAKERS** article in ELECTRICAL. Inspect for loose or corroded connections, damaged wiring harnesses and/or switches. Check for a broken or partially broken wire inside insulation, which could cause system malfunction but prove good in a continuity/voltage check with system disconnected. Ensure any aftermarket electronic equipment is properly installed. If fault is found, repair as necessary. If no fault is found, perform self-diagnostics. See **SELF-DIAGNOSTIC SYSTEM**.

INTERMITTENT OR POOR CONNECTIONS

Intermittent faulty electrical connections or wiring may be the cause of intermittent conditions. Check for loose, bent or corroded terminals and terminal tension. Check for cut, bare or pinched wiring. Simulate the condition that is potentially causing intermittent connection, either by wiggling the connections or the wiring, test driving or performing other operations while observing scan tool, DVOM or other testing equipment.

SYMPTOMS - ENGINE COOLING

NOTE: Review the system operation in order to familiarize yourself with the system functions. See **DESCRIPTION & OPERATION**.

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the cooling system.
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Inspect the surge tank reservoir for the proper coolant level.

Symptom List

To diagnose the symptom, refer to symptom index. See **SYMPTOM INDEX** table.

SELF-DIAGNOSTIC SYSTEM

DIAGNOSTIC SYSTEM CHECK - ENGINE COOLING

1. Install a scan tool. If the scan tool powers up, go to next step. If the scan tool does not power up, see **SCAN TOOL DOES NOT POWER UP** under **SYSTEM TESTS** in appropriate **BODY CONTROL MODULES** article in **ACCESSORIES & EQUIPMENT**.
2. Turn ON the ignition, with the engine OFF. Attempt to establish communication with the following control modules:
 - Instrument cluster.
 - Engine control module (ECM).

If the scan tool communicates with the control modules, go to next step. If the scan tool does not communicate with the control modules, see **SCAN TOOL DOES NOT COMMUNICATE WITH CLASS 2 DEVICE** under **SYSTEM TESTS** in appropriate **BODY CONTROL MODULES** article in **ACCESSORIES & EQUIPMENT**.

3. Select the engine control module display DTCs function on the scan tool. If the scan tool displays any DTCs, go to next step. If the scan tool does not display any DTCs, go to **SYMPTOMS - ENGINE COOLING** under **TROUBLE SHOOTING**.
4. If the scan tool displays any DTCs which begin with a "U", see **SCAN TOOL DOES NOT COMMUNICATE WITH CLASS 2 DEVICE** under **SYSTEM TESTS** in appropriate **BODY CONTROL MODULES** article in **ACCESSORIES & EQUIPMENT**. If the scan tool does not display any DTCs which begin with a "U", go to **DIAGNOSTIC TROUBLE CODE DEFINITIONS**.

DIAGNOSTIC TROUBLE CODE DEFINITIONS

DIAGNOSTIC TROUBLE CODE DEFINITIONS

DTC ⁽¹⁾	Description
<u>P0480, P0481, P0691, P0692, P0693 Or P0694</u>	Cooling Fan Relay Control Circuit Open Or Short

(1) Perform appropriate test under **DIAGNOSTIC TESTS**. Codes listed in this table are only for testing covered in this article.

DIAGNOSTIC TESTS

DTC P0480, P0481, P0691, P0692, P0693 & P0694: COOLING FAN RELAY CONTROL CIRCU

CIRCUIT OPEN OR SHORT

Circuit Description

The Engine Control Module (ECM) controls the low speed cooling fan operation by grounding the low speed fan relay control circuit with an internal solid state device called a driver. For high speed cooling fan operation, the ECM grounds the high speed and s/p relay control circuit at the same time the low speed control circuit is grounded. Battery positive voltage is supplied to the low speed, high speed and s/p fan relays. When the ECM is commanding a fan relay ON, the voltage of the control circuit should be low, near 0 volts. When the ECM is commanding a fan relay OFF, the voltage potential of the control circuit should be high, near battery voltage.

The ECM monitors the relay control circuits for the following conditions:

- Short to ground.
- Short to voltage.
- An open circuit.

If the ECM detects an improper voltage level on the low or high speed driver circuits, then code P0480, P0481, P0691, P0692, P0693, or P0694, will set and the effected driver will be disabled.

Conditions For Running DTC

- The ignition voltage is between 8.0-18.0 volts.
- The engine speed is more than 40 RPM.
- The ECM driver transitions from ON to OFF or from OFF to ON.

Conditions For Setting DTC

The following conditions are present for 1 second.

- **P0480** - The ECM detects an open on the low speed cooling fan relay control circuit.
- **P0481** - The ECM detects an open circuit on the high speed cooling fan relay control circuit.
- **P0691** - The ECM detects a short to ground on the low speed cooling fan relay control circuit.
- **P0692** - The ECM detects a short to voltage on the low speed cooling fan relay control circuit.
- **P0693** - The ECM detects a short to ground on the high speed cooling fan relay control circuit.

- **P0694** - The ECM detects a short to voltage on the high speed cooling fan relay control circuit.

Action Taken When DTC Sets

- The ECM will illuminate the Malfunction Indicator Lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The ECM will store conditions which were present when the DTC set as Freeze Frame and Failure Records data.

Conditions For Clearing MIL/DTC

- The ECM will turn OFF the MIL during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- Use the scan tool Clear DTC Information function.

Diagnostic Aids

- If the condition is not present, test for intermittent and poor connections. See **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING.
- Review the Freeze/Failure Records vehicle mileage since the diagnostic test failed. This may help determine how often the condition that caused the DTC to be set occurs.

Test Procedure

1. If the Engine Cooling Diagnostic System Check was performed, go to next step. If the Engine Cooling Diagnostic System Check was not performed, go to **DIAGNOSTIC SYSTEM CHECK - ENGINE COOLING** under SELF-DIAGNOSTIC SYSTEM.
2. Install a scan tool. Turn ON the ignition, with the engine OFF. With a scan tool, command the Fans Low Speed ON and OFF. Listen for an audible click when the low speed fan relay operates. Repeat the commands as necessary. If the low speed fan relay turns ON and OFF with each command, go to next step. If the low speed fan relay does not turn ON and OFF with each command, go to step 4 .
3. With a scan tool, command the Fans High Speed ON and OFF. Listen for an audible click when the s/p and high speed fan relays operate. Repeat the commands as necessary. If the s/p and the high speed fan relays turn ON and OFF with each command, go to **DIAGNOSTIC AIDS** . If the relays do not turn ON and OFF with each command, go to step 6 .
4. Turn OFF the ignition. Disconnect the low speed fan relay. Turn ON the ignition, with the

engine OFF. Probe the ignition No. 3 voltage circuit of the low speed fan relay with a test light that is connected to a good ground. If the test light illuminates, go to next step. If the test light does not illuminate, go to step 16 .

5. Connect a test light between the control circuit of the low speed fan relay and the ignition No. 3 voltage circuit of the low speed fan relay. With a scan tool, command the Fans Low Speed ON and OFF. If the test light turns ON and OFF with each command, go to step 12 . If the test light does not turn ON and OFF with each command, go to step 9 .
6. Turn OFF the ignition. Disconnect the high speed fan relay. Turn ON the ignition, with the engine OFF. Probe the ignition No. 3 voltage circuit of the high speed fan relay with a test light that is connected to a good ground. If the test light illuminates, go to next step. If the test light does not illuminate, go to step 16 .
7. Connect a test light between the control circuit of the high speed fan relay and the ignition No. 3 voltage circuit of the high speed fan relay. With a scan tool, command the Fans High Speed ON and OFF. If the test light turns ON and OFF with each command, go to step 14 . If the test light does not turn ON and OFF with each command, go to next step.
8. Turn OFF the ignition. Disconnect the s/p fan relay. Turn ON the ignition with the engine OFF. Connect a test light between the control circuit of the s/p fan relay and the ignition No. 3 voltage circuit of the s/p fan relay. With a scan tool, command the Fans High Speed ON and OFF. If the test light turns ON and OFF with each command, go to step 13 . If the test light does not turn ON and OFF with each command, go to next step.
9. If the test light remains illuminated with each command, go to step 11 . If the test light does not remain illuminated with each command, go to next step.
10. Test the control circuit of the appropriate relay for a short to voltage or an open. See **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING. If problem was found and corrected, go to step 21 . If problem was not found, go to step 15 .
11. Test the control circuit of the appropriate relay for a short to ground. See **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING. If problem was found and corrected, go to step 21 . If problem was not found, go to step 15 .
12. Inspect for poor connections at the low speed fan relay. See **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING. If problem was found and corrected, go to step 21 . If problem was not found, go to step 17 .
13. Inspect for poor connections at the s/p fan relay. See **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING. If problem was found and corrected, go to step 21 . If problem was not found, go to step 18 .
14. Inspect for poor connections at the high speed fan relay. See **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING. If problem was found and corrected, go to step 21 . If problem was not found, go to step 19 .

15. Inspect for poor connections at the harness connector of the ECM. See **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING. If problem was found and corrected, go to step 21 . If problem was not found, go to step 20 .
16. Repair the ignition No. 3 voltage circuit for an open or high resistance. After completing repairs, go to step 21 .
17. Replace the low speed fan relay. After completing repairs, go to step 21 .
18. Replace the s/p fan relay. After completing repairs, go to step 21 .
19. Replace the high speed fan relay. After completing repairs, go to step 21 .

NOTE: Perform the programming procedure for the ECM. See **ENGINE CONTROL MODULE** under **PROGRAMMING** in **SELF-DIAGNOSTICS** article in **FAULT ISOLATION** in **ENGINE PERFORMANCE**.

20. Replace the ECM. See **ENGINE CONTROL MODULE** under **COMPUTERIZED ENGINE CONTROLS** in **REMOVAL & INSTALLATION** article in **ENGINE PERFORMANCE**. After completing repairs, go to next step.
21. Use the scan tool in order to clear the DTCs. Operate the vehicle within the **CONDITIONS FOR RUNNING DTC** as specified in the supporting text. If the DTC resets, go to step 2 . If the DTC does not reset, the system is okay.

SYSTEM TESTS

SYMPTOM INDEX

Symptom	Test
Cooling Fan Always On	<u>A</u>
Cooling Fan Inoperative	<u>B</u>
Auxiliary Cooling Fan Always On	<u>C</u>
Auxiliary Cooling Fan Inoperative	<u>D</u>

TEST A: COOLING FAN ALWAYS ON

NOTE: One or both engine cooling fan motors run continuously in high or low speed.

1. If the Engine Cooling Diagnostic System Check was performed, go to next step. If the Engine Cooling Diagnostic System Check was not performed, go to **DIAGNOSTIC**

SYSTEM CHECK - ENGINE COOLING under SELF-DIAGNOSTIC SYSTEM.

2. Turn ON the ignition, with the engine OFF. If both cooling fans are operating at low speed, go to step 4 . If both cooling fans are not operating at low speed, go to next step.
3. If the left cooling fan operates at high speed, go to step 5 . If the left cooling fan does not operate at high speed, go to **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING.
4. Remove the low speed fan relay. If the fans turn OFF, go to step 8 . If the fans do not turn OFF, go to step 6 .
5. Remove the high speed fan relay. If the left cooling fan turns OFF, go to step 9 . If the left cooling fan does not turn OFF, go to step 7 .
6. Repair the cooling fan motor supply voltage circuit of the right cooling fan for a short to voltage. After completing repairs, go to step 12 .
7. Repair the cooling fan motor supply voltage circuit of the left cooling fan for a short to voltage. After completing repairs, go to step 12 .
8. Inspect for poor connections at the low speed fan relay. See **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING. If problem was found and corrected, go to step 12 . If problem was not found, go to step 10 .
9. Inspect for poor connections at the high speed fan relay. See **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING. If problem was found and corrected, go to step 12 . If problem was not found, go to step 11 .
10. Replace the low speed fan relay. After replacement, go to step 12 .
11. Replace the high speed fan relay. After replacement, go to step 12 .
12. Operate the system in order to verify the repair. If problem was corrected, system is okay. If problem was not corrected, go to step 2 .

TEST B: COOLING FAN INOPERATIVE

NOTE: One or both cooling fan motors are inoperative in either high, low, or both speeds.

1. If the Engine Cooling Diagnostic System Check was performed, go to next step. If the Engine Cooling Diagnostic System Check was not performed, go to **DIAGNOSTIC SYSTEM CHECK - ENGINE COOLING** under SELF-DIAGNOSTIC SYSTEM.
2. Install a scan tool. Turn ON the ignition, with the engine OFF. With a scan tool, command the Fans Low Speed ON and OFF. If the low speed engine cooling fans turn ON and OFF with each command, go to next step. If the low speed engine cooling fans do not turn ON and OFF with each command, go to step 4 .

NOTE: A 3 second delay occurs before the PCM changes the cooling fan speed.

3. With a scan tool, command the Fans High Speed ON and OFF. If the high speed engine cooling fans turn ON and OFF with each command, go to **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING. If the high speed engine fans do not turn ON and OFF with each command, go to step 6 .

NOTE: DO NOT remove the jumper wire that you will be connecting until your testing is completed. If the low speed fan fuse opens when you connect the jumper wire, repair the cooling fan motor supply voltage circuit of the right cooling fan motor for a short to ground.

4. Disconnect the low speed fan relay. Connect a jumper wire between the battery positive voltage circuit and the cooling fan motor supply voltage circuit of the low speed fan relay. If both cooling fans operate in low speed, go to step 14 . If both cooling fans do not operate in low speed, go to next step.
5. Disconnect the s/p fan relay. With a test light connected to a good ground, probe the cooling fan low reference circuit at the s/p fan relay. If the test light illuminates, go to step 9 . If the test light does not illuminate, go to step 8 .
6. If the right cooling fan operates at high speed, go to step 16 . If the right cooling fan does not operate at high speed, go to next step.
7. Inspect the ground circuit of the s/p fan relay for an open or high resistance. If problem was found and corrected, go to step 25 . If problem was not found, go to step 15 .
8. Install the s/p fan relay. Disconnect the right cooling fan electrical connector. With a test light connected to a good ground, probe the cooling fan motor supply voltage circuit at the right cooling fan motor connector. If the test light illuminates, go to step 12 . If the test light does not illuminate, go to step 13 .
9. Install the s/p fan relay. Disconnect the left cooling fan motor connector. With a test light connected to a good ground, probe the cooling fan motor supply voltage circuit at the left cooling fan connector. If the test light illuminates, go to step 11 . If the test light does not illuminate, go to next step.
10. Inspect the cooling fan motor supply voltage circuit for an open or high resistance. If problem was found and corrected, go to step 25 . If problem was not found, go to step 15 .
11. Inspect the ground circuit of the left cooling fan for an open or high resistance. If problem was found and corrected, go to step 25 . If problem was not found, go to step 18 .
12. Inspect the cooling fan low reference circuit for an open or high resistance. If problem was

- found and corrected, go to step 25 . If problem was not found, go to step 17 .
13. Inspect the cooling fan motor supply voltage circuit of the right cooling fan for an open or high resistance. If problem was found and corrected, go to step 25 . If problem was not found, go to step 19 .
 14. Inspect for poor connections at the low speed fan relay. See **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING. If problem was found and corrected, go to step 25 . If problem was not found, go to step 20 .
 15. Inspect for poor connections at the s/p fan relay. See **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING. If problem was found and corrected, go to step 25 . If problem was not found, go to step 21 .
 16. Inspect for poor connections at the high speed fan relay. See **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING. If problem was found and corrected, go to step 25 . If problem was not found, go to step 22 .
 17. Inspect for poor connections at the harness connector of the right cooling fan. See **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING. If problem was found and corrected, go to step 25 . If problem was not found, go to step 23 .
 18. Inspect for poor connections at the harness connector of the left cooling fan. See **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING. If problem was found and corrected, go to step 25 . If problem was not found, go to step 24 .
 19. Repair the battery positive voltage circuit for an open or high resistance. After repairs, to step 25 .
 20. Replace the low speed fan relay. After replacement, to step 25 .
 21. Replace the s/p fan relay. After replacement, to step 25 .
 22. Replace the high speed fan relay. After replacement, to step 25 .
 23. Replace the right cooling fan. See **ELECTRIC COOLING FAN MOTOR** under REMOVAL & INSTALLATION. After replacement, to step 25 .
 24. Replace the left cooling fan. See **ELECTRIC COOLING FAN MOTOR** under REMOVAL & INSTALLATION. After replacement, to next step.
 25. Operate the system in order to verify the repair. If problem was corrected, system is okay. If problem was not corrected, go to step 3 .

TEST C: AUXILIARY COOLING FAN ALWAYS ON

1. If the Engine Cooling Diagnostic System Check was performed, go to next step. If the Engine Cooling Diagnostic System Check was not performed, go to **DIAGNOSTIC SYSTEM CHECK - ENGINE COOLING** under SELF-DIAGNOSTIC SYSTEM.
2. If the auxiliary cooling fan is always ON, go to next step. If auxiliary cooling fan is not

always ON, go to **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING.

3. Disconnect the pusher cooling fan relay located in the left rear fuse block. If the auxiliary cooling fan turns OFF, go to step 5 . If the auxiliary cooling fan does not turn OFF, go to next step.
4. Repair the short to voltage in the auxiliary cooling fan motor supply voltage circuit. After completing repairs, go to step 11 .
5. Probe the control circuit of the auxiliary fan relay with a test light connected to battery positive voltage. If the test light illuminates, go to step 7 . If the test light does not illuminate, go to next step.
6. Inspect for poor connections at the pusher cooling fan relay. See **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING. If problem was found and corrected, go to step 11 . If problem was not found, go to step 9 .
7. Inspect the auxiliary cooling fan relay control circuit for a short to ground. If problem was found and corrected, go to step 11 . If problem was not found, go to next step.
8. Inspect for poor connections at the harness connector of the engine control module (ECM). See **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING. If problem is found and corrected, go to step 11 . If problem was not found, go to step 10 .
9. Replace the pusher cooling fan relay. After replacement, go to step 11 .

NOTE: Perform the programming procedure for the ECM. See **ENGINE CONTROL MODULE** under PROGRAMMING in SELF-DIAGNOSTICS article in FAULT ISOLATION in ENGINE PERFORMANCE.

10. Replace the ECM. See **ENGINE CONTROL MODULE** under COMPUTERIZED ENGINE CONTROLS in REMOVAL & INSTALLATION article in ENGINE PERFORMANCE. After repairs, go to next step.
11. Operate the system in order to verify the repair. If problem was corrected, the system is okay. If problem was not corrected, go to step 3 .

TEST D: AUXILIARY COOLING FAN INOPERATIVE

1. If the Engine Cooling Diagnostic System Check was performed, go to next step. If the Engine Cooling Diagnostic System Check was not performed, go to **DIAGNOSTIC SYSTEM CHECK - ENGINE COOLING** under SELF-DIAGNOSTIC SYSTEM.
2. Install a scan tool. Turn ON the ignition, with the engine OFF. With a scan tool, command the auxiliary cooling fan ON and OFF. If the auxiliary cooling fan turns ON and OFF with

each command, go to **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING. If the auxiliary cooling fans do not turn ON and OFF with each command, go to next step.

3. Disconnect the pusher fan relay. Install a jumper wire between the battery positive voltage circuit and the auxiliary cooling fan motor supply voltage circuit on the switch side of the pusher fan relay. If the fan operates, go to step 7 . If the fan does not operate, go to next step.
4. If the fuse opens when the jumper was installed, go to next step. If the fuse does not open when the jumper was installed, go to step 6 .
5. Inspect the auxiliary cooling fan supply voltage circuit for a short to ground. If problem was found and corrected, go to step 19 . If problem was not found, go to step 15 .
6. With the jumper wire still in place, unplug the auxiliary cooling fan. With a test light connected to a good ground probe the auxiliary cooling fan motor supply voltage circuit at the pusher relay. If the test light illuminates, go to step 19 . If the test light does not illuminate, go to step 12 .
7. With a test light connect to a good ground probe the battery positive voltage circuits at the pusher relay. If the test light illuminates, go to next step. If the test light does not illuminate, go to step 9 .
8. With a test light connected to battery positive, probe the auxiliary cooling fan relay control circuit at the pusher relay. With a scan tool, command the auxiliary cooling fan ON. If the test light illuminates, go to step [13](#) . If the test light does not illuminate, go to step 10 .
9. Repair the battery positive voltage circuit of the auxiliary fan relay for a short to ground or an open. After problem is found and corrected, go to step 19 .
10. Inspect the control circuit of the auxiliary fan relay for an open or high resistance. If problem was found and corrected, go to step 19 . If problem was not found, go to step 17 .
11. Repair the auxiliary cooling fan motor supply voltage circuit for an open or high resistance. After repairs, go to step 19 .
12. Inspect the auxiliary cooling fan motor ground circuit for an open or high resistance. If problem was found and corrected, go to step 19 . If problem was not found, go to step 15 .
13. Inspect for poor connections at the auxiliary fan relay. If problem was found and corrected, go to step 19 . If problem was not found, go to next step.
14. Replace the auxiliary fan relay. After replacement, go to step 19 .
15. Inspect for poor connections at the harness connector of the auxiliary cooling fan. If problem was found and corrected, go to step 19 . If problem was not found, go to next step.
16. Replace the auxiliary cooling fan. See **AUXILIARY COOLING FAN & MOTOR** under REMOVAL & INSTALLATION. After replacement, go to step 19 .

17. Inspect for poor connections at the engine control module (ECM). See **INTERMITTENT OR POOR CONNECTIONS** under TROUBLE SHOOTING. If problem was found and corrected, go to step 19 . If problem was not found, go to next step.

NOTE: Perform the programming procedure for the ECM. See **ENGINE CONTROL MODULE** under PROGRAMMING in SELF-DIAGNOSTICS article in FAULT ISOLATION in ENGINE PERFORMANCE.

18. Replace the ECM. See **ENGINE CONTROL MODULE** under COMPUTERIZED ENGINE CONTROLS in REMOVAL & INSTALLATION article in ENGINE PERFORMANCE. After repairs, go to next step.
19. Operate the system in order to verify the repair. If problem was corrected, system is okay. If problem was not corrected, go to step 2 .

REMOVAL & INSTALLATION

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See **COMPUTER RELEARN PROCEDURES** article in GENERAL INFORMATION before disconnecting battery.

NOTE: Use the correct fastener in the correct location. Replacement fasteners must be the correct part number for that application. Fasteners requiring replacement or fasteners requiring the use of thread locking compound or sealant are identified in the service procedure. DO NOT use paints, lubricants, or corrosion inhibitors on fasteners or fastener joint surfaces unless specified. These coatings affect fastener torque and joint clamping force and may damage the fastener. Use the correct tightening sequence and specifications when installing fasteners in order to avoid damage to parts and systems.

AUXILIARY COOLING FAN & MOTOR

Removal

NOTE: Tool Required: Transmission Cooler Quick Disconnect (J-44827).

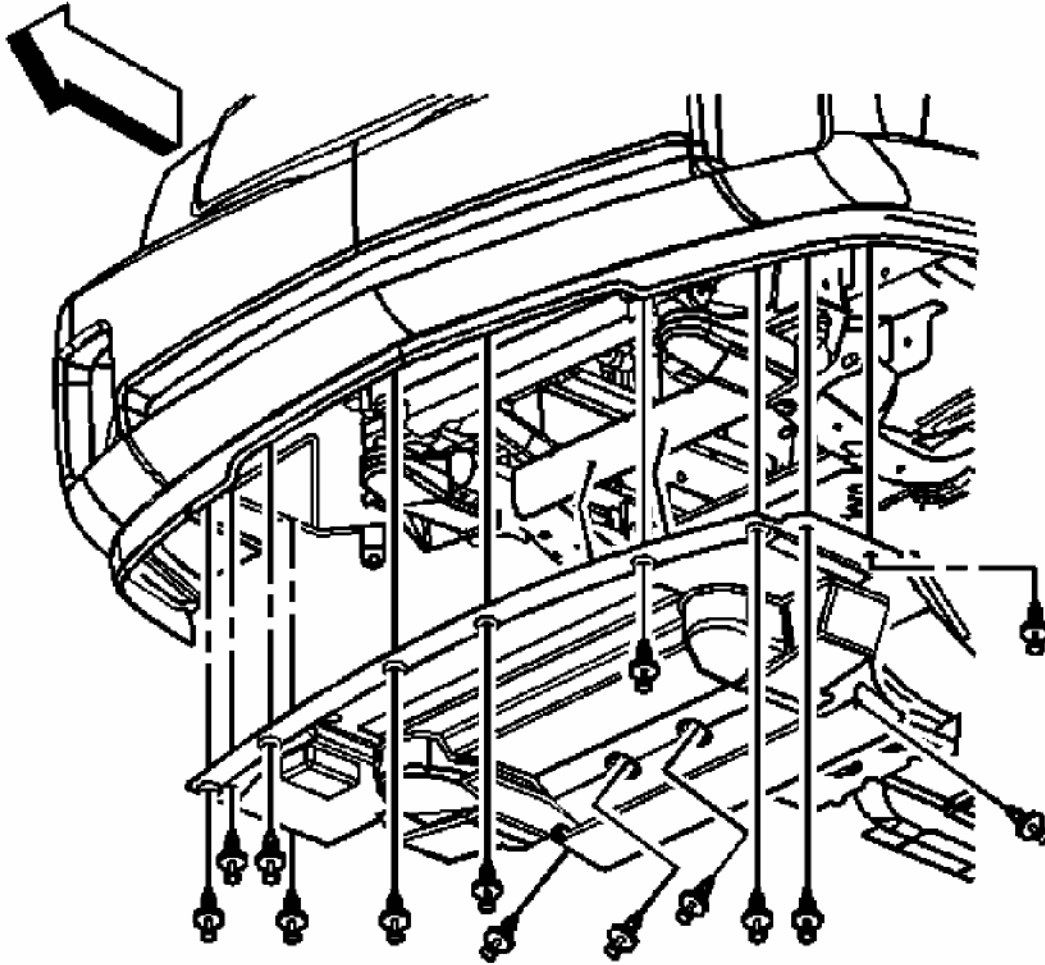
1. Remove the air deflector.
 - A. Raise and support the vehicle.
 - B. Remove the push-in retainers securing the air deflector to the vehicle. See **Fig. 2**.
 - C. Remove the front air deflector.
2. Disconnect the auxiliary cooling fan electrical connector. See **Fig. 3**.

CAUTION: The transmission oil cooler lines use a quick connect fitting at the radiator. The quick connect fitting must be removed using a special tool. Removing the transmission oil cooler lines without the tool will result in damage to the radiator and the transmission oil cooler, and may damage the transmission due to mixing of the transmission oil and coolant.

3. Using the Transmission Cooler Quick Disconnect, disconnect the auxiliary transmission cooler lines from the auxiliary cooler. Position the auxiliary cooler lines out of the way.
4. Remove the auxiliary cooling fan assembly bolts. See **Fig. 4**. Remove the lower left auxiliary cooling fan bolt.
5. Remove the auxiliary cooling fan assembly bolt. See **Fig. 5**. Remove the upper left auxiliary cooling fan bolt. Remove the auxiliary cooling fan assembly from the vehicle.

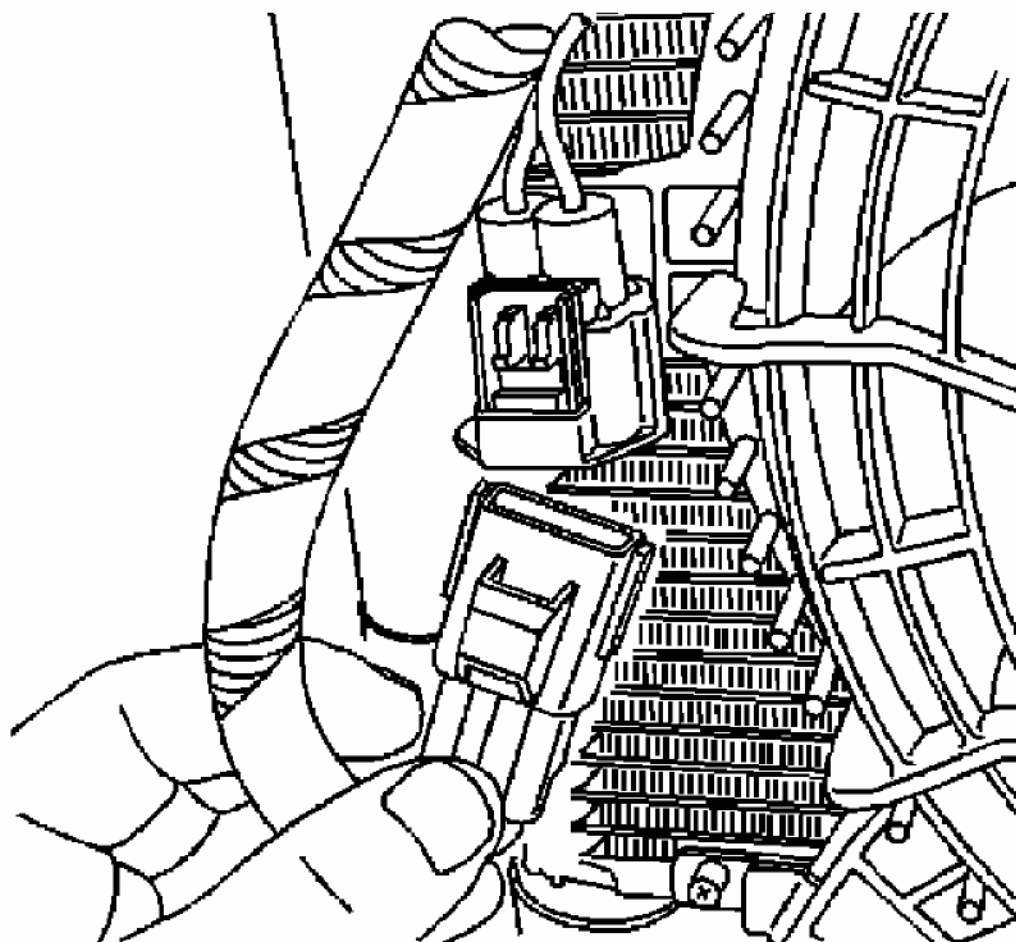
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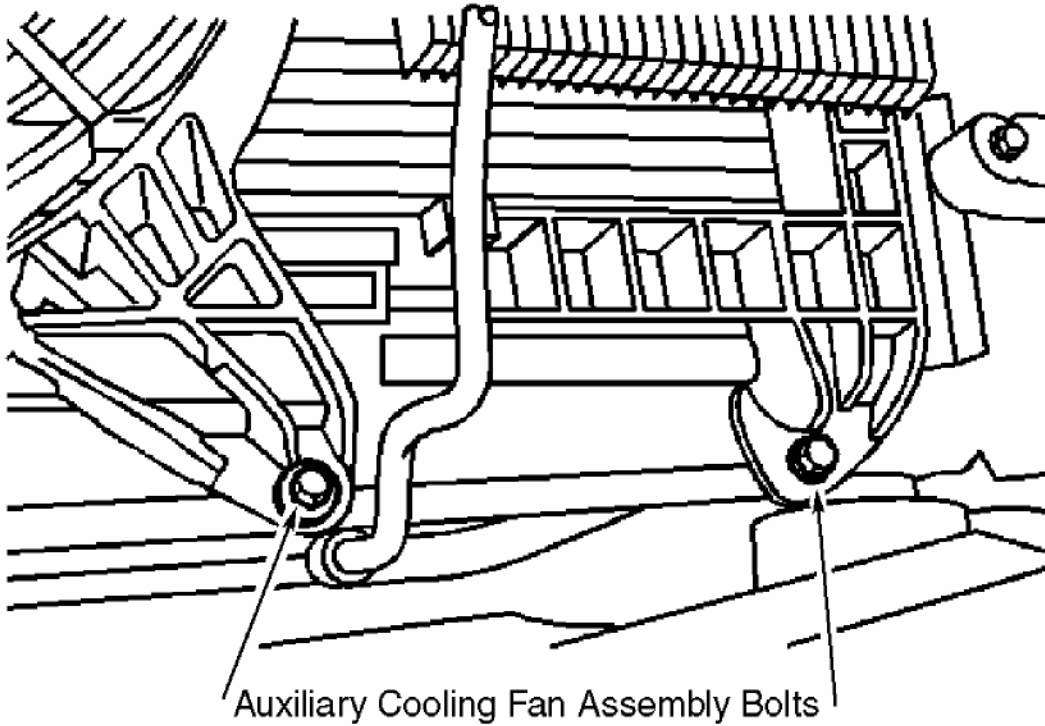
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Fig. 2: Removing Front Air Deflector
Courtesy of GENERAL MOTORS CORP.



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Fig. 3: Disconnecting Auxiliary Cooling Fan Electrical Connector
Courtesy of GENERAL MOTORS CORP.



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Fig. 4: Removing Auxiliary Cooling Fan Assembly Lower Bolts
Courtesy of GENERAL MOTORS CORP.

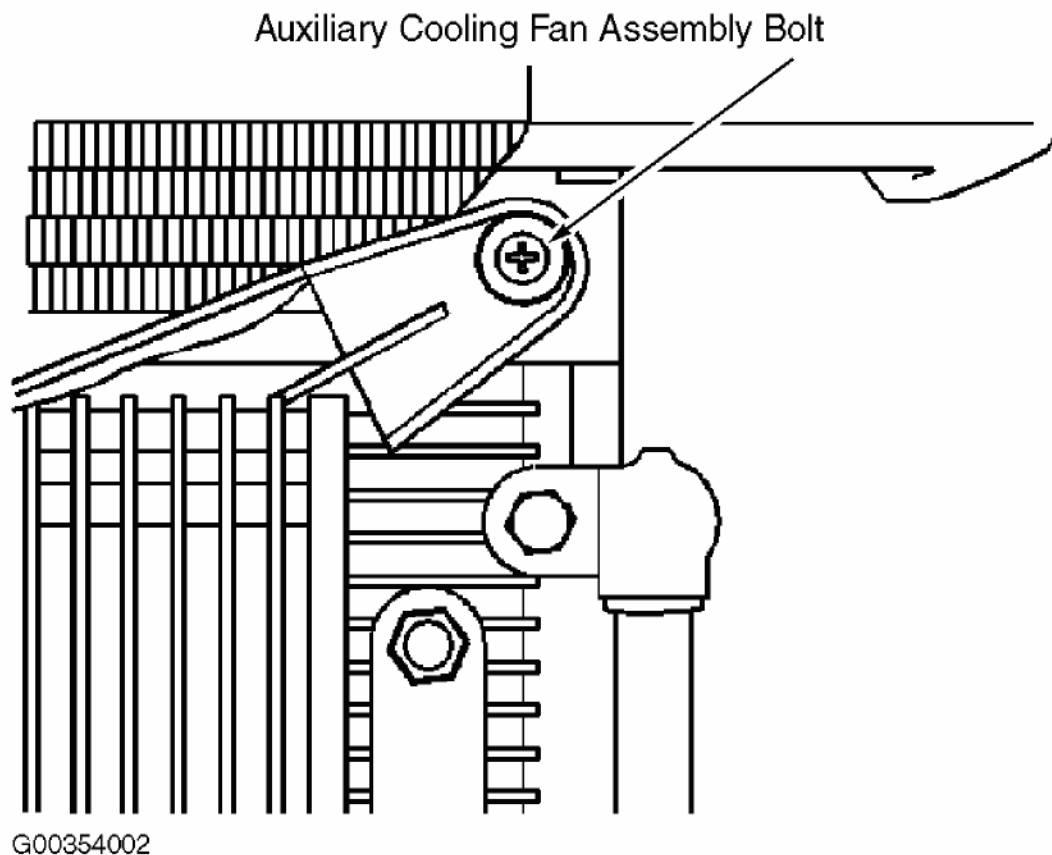


Fig. 5: Removing Auxiliary Cooling Fan Assembly Bolt
Courtesy of GENERAL MOTORS CORP.

Installation

1. Position the auxiliary fan assembly into the vehicle.
2. Install the auxiliary cooling fan lower bolts. See **Fig. 4** . Tighten the bolts to specification. See **TORQUE SPECIFICATIONS** .
3. Install the fan assembly bolt. See **Fig. 5** . Tighten the bolt to specification. See **TORQUE SPECIFICATIONS** .
4. Install the remaining auxiliary cooling fan bolts. Tighten the bolts to specification. See **TORQUE SPECIFICATIONS** .
5. Push the auxiliary transaxle oil cooler line into the cooler until you hear it engage. Gently tug out on the transmission oil cooler line to verify that the line is engaged into position.
6. Connect the auxiliary fan electrical connector. See **Fig. 3** .

7. Install the air deflector.
 - A. Position the front air deflector to the vehicle. Install the push-in retainers to secure the air deflector to the engine cradle.
 - B. Install the push-in retainers to secure the front of the air deflector to the fascia. See **Fig. 2** . Lower the vehicle.
8. Inspect the transmission fluid level. See **FLUID CONDITION & LEVEL CHECK** under LUBRICATION in SERVICING - CTS article in AUTOMATIC TRANSMISSION in TRANSAXLE/TRANSMISSION.

ELECTRIC COOLING FAN

WARNING: An electric fan under the hood can start up even when the engine is not running and can injure you. Keep hands, clothing and tools away from any underhood electric fan.

WARNING: To help avoid personal injury or damage to the vehicle, a bent, cracked, or damaged fan blade or housing should always be replaced.

NOTE: Required Tool: Hose Clamp Pliers (J-38185).

Removal

1. Disconnect the battery negative cable.
2. Drain the cooling system.
3. Disconnect the surge tank hose. See **Fig. 6** . Remove the fan shroud to radiator bolt. Remove the fan shroud to air plenum bolt. Remove remaining fan shroud to radiator bolts.
4. Using Hose Clamp Pliers, disconnect the upper radiator hose at the radiator. See **Fig. 7** .
5. Remove the coolant bypass valve bolt. Reposition the coolant bypass valve. Release the coolant bypass solenoid from the fan shroud.
6. Remove the air cleaner assembly.
 - A. Remove the Mass Air Flow (MAF) or intake Air Temperature (IAT) sensor.
 - Disconnect the electrical connector from the MAF or IAT sensor.
 - Disconnect the air intake duct hose from MAF or IAT sensor.

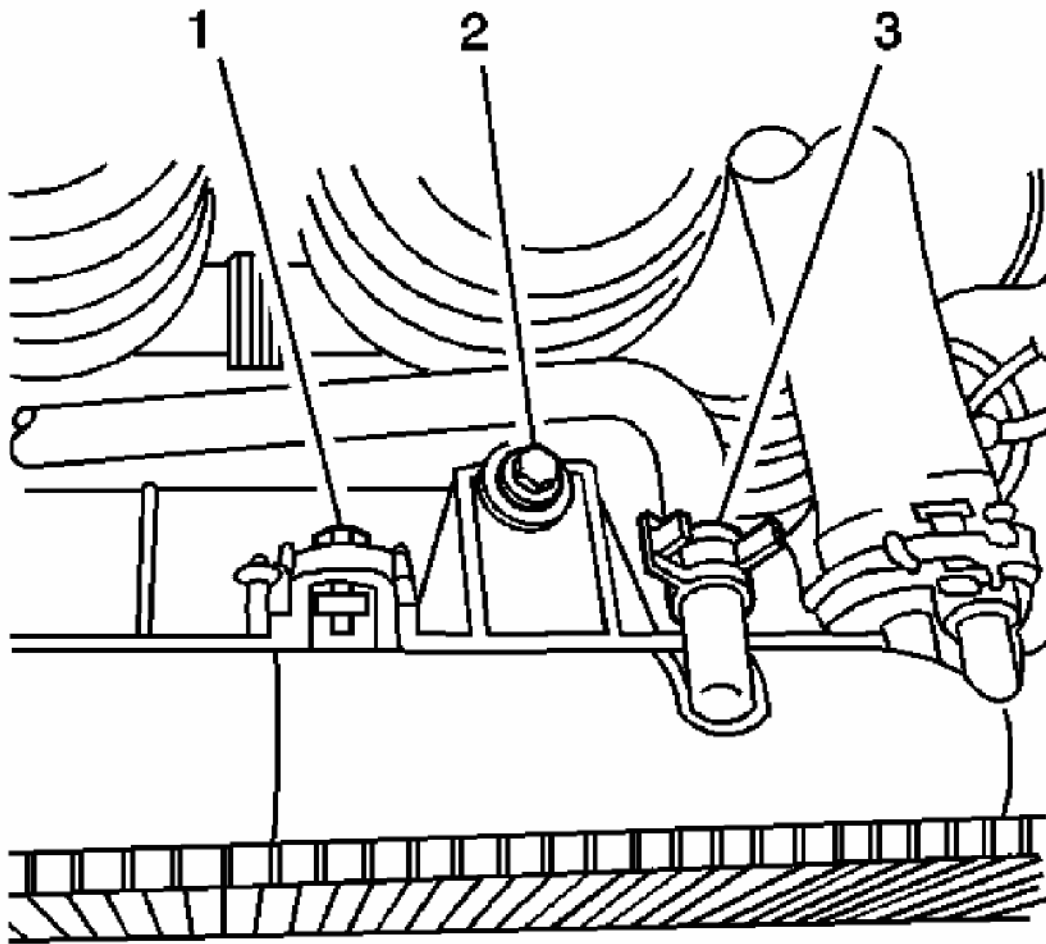
CAUTION: Handle the MAF sensor carefully. DO NOT drop the MAF sensor in order to prevent damage to

the MAF sensor. DO NOT damage the screen located on the air inlet end of the MAF. DO NOT touch the sensing elements. DO NOT allow solvents and lubricants to come in contact with the sensing elements. Use a small amount of a soap based solution in order to aid in the installation.

- Remove the 2 screws securing the MAF or IAT sensor to the air cleaner assembly.
 - Discard the MAF sensor seal.
- B. Remove the 3 bolts securing the air cleaner assembly to the shock tower and upper tie bar. Remove the air cleaner assembly from the vehicle.
7. Remove the screw from the A/C line retaining clip. See **Fig. 8** . Rotate the retaining clip.
 8. Remove the electric fan harness clip. See **Fig. 9** . Disconnect the fan motor electrical connectors. Separate the wiring harness from the fan shroud.
 9. Using Hose Clamp Pliers, remove the coolant bypass hose from the radiator. See **Fig. 10** .
 10. Remove the right fan shroud bolt. Remove the left fan shroud bolt.

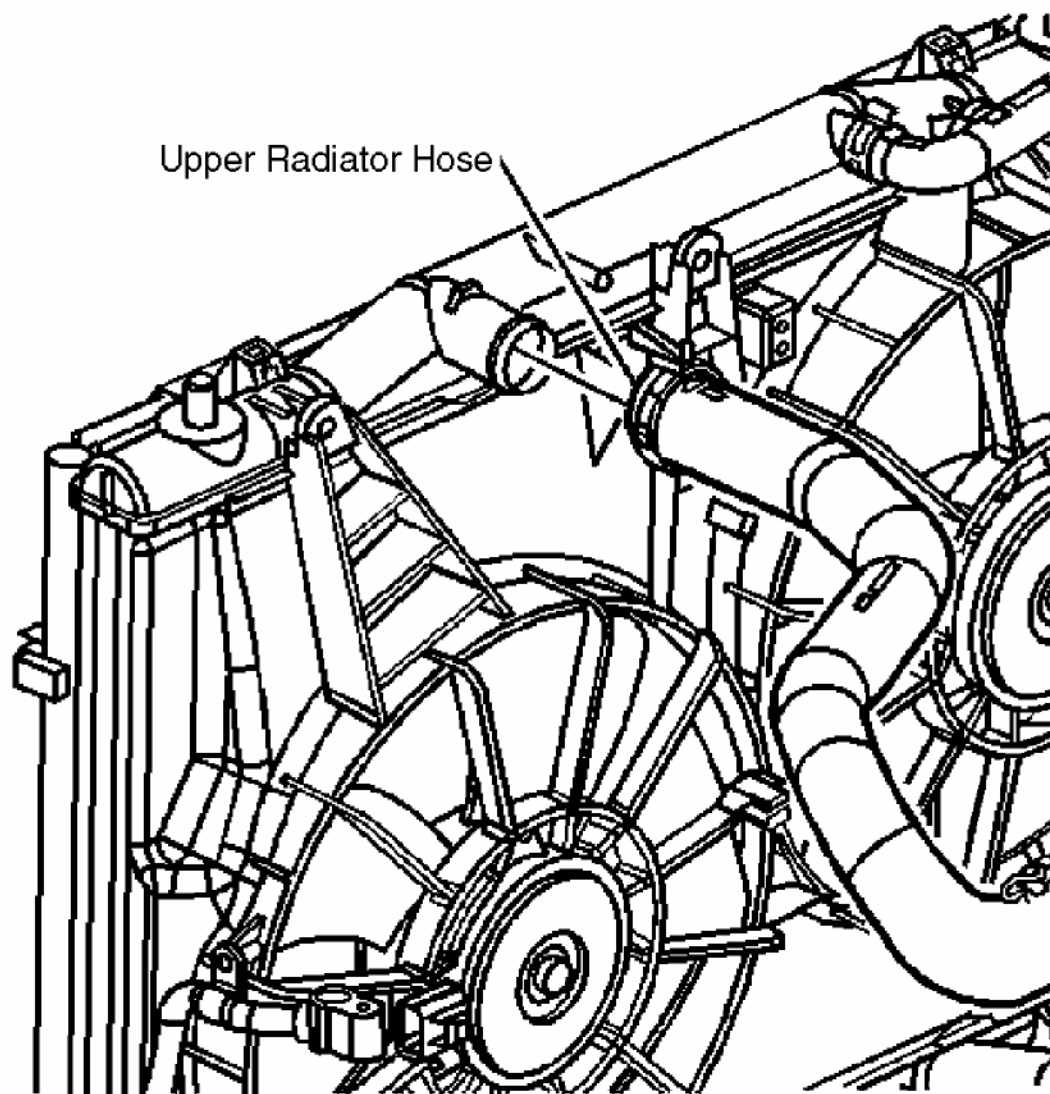
CAUTION: Carefully remove the electric cooling fan assembly from the vehicle, to protect the radiator core.

11. Pull upward on the fan assembly, removing the assembly from the vehicle.



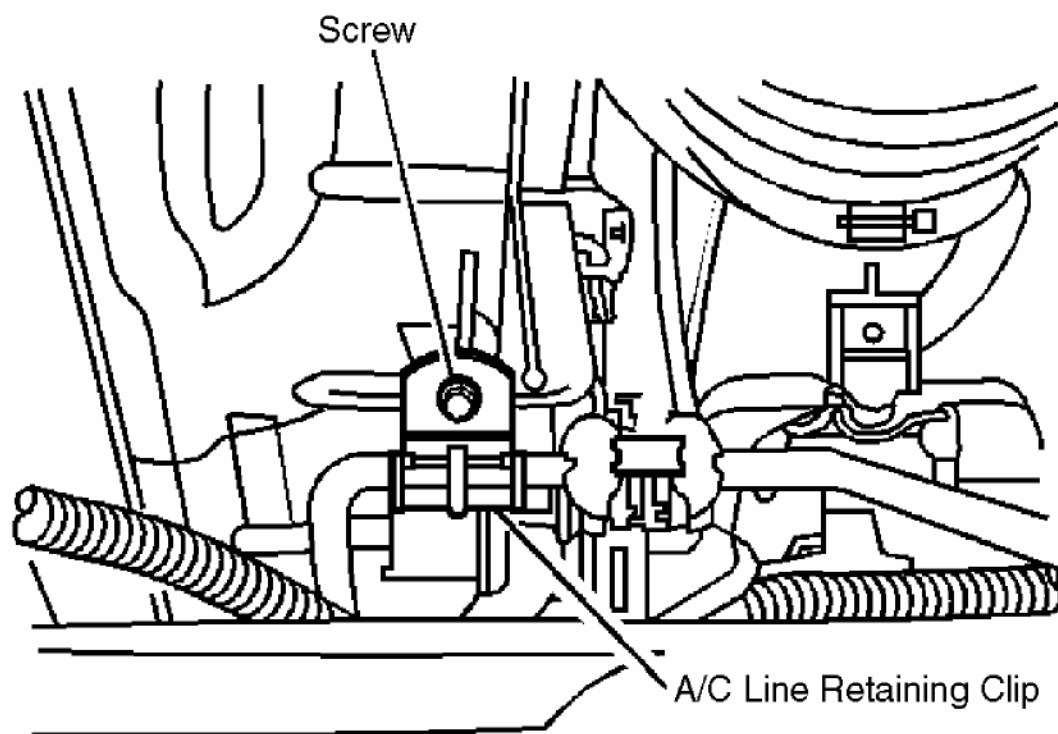
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Fig. 6: Removing Surge Tank Hose & Fan Shroud Bolts
Courtesy of GENERAL MOTORS CORP.



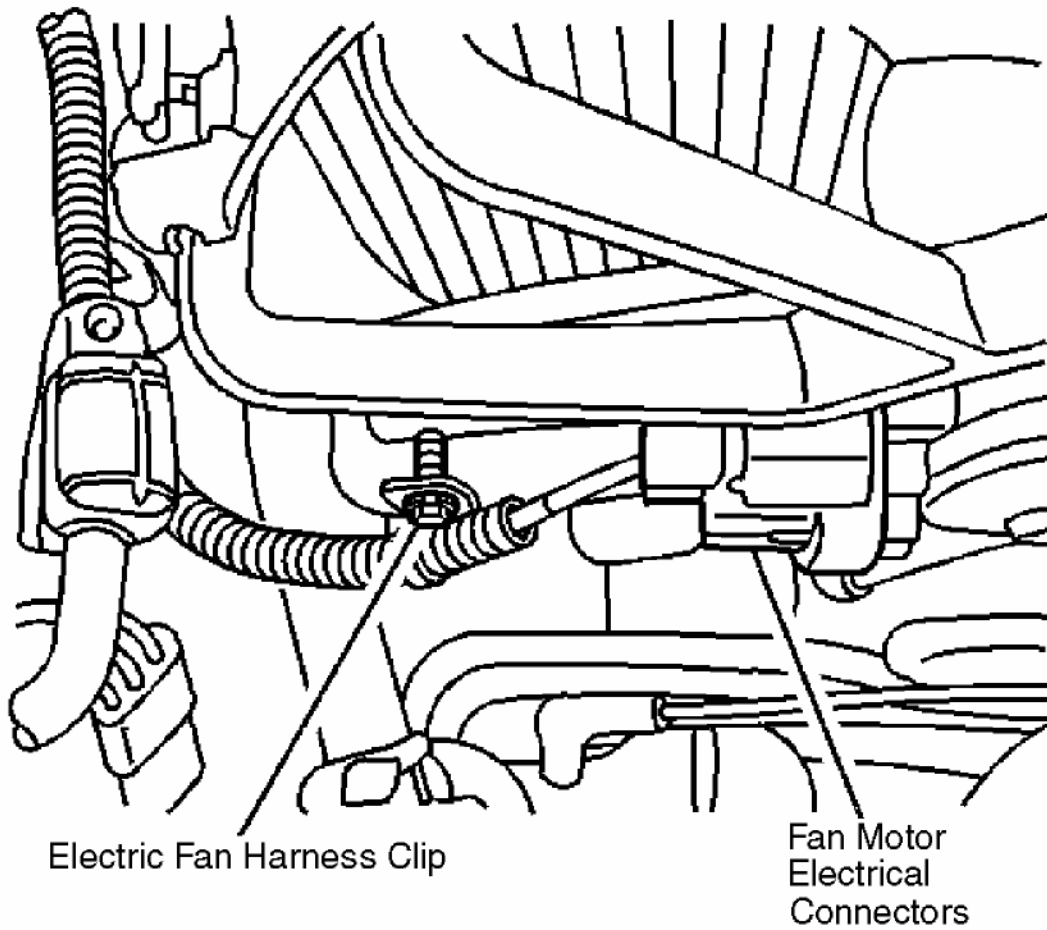
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Fig. 7: Disconnecting Upper Radiator Hose
Courtesy of GENERAL MOTORS CORP.



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Fig. 8: Removing A/C Line Retaining Clip
Courtesy of GENERAL MOTORS CORP.



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Fig. 9: Removing Electric Fan Harness Clip & Fan Motor Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

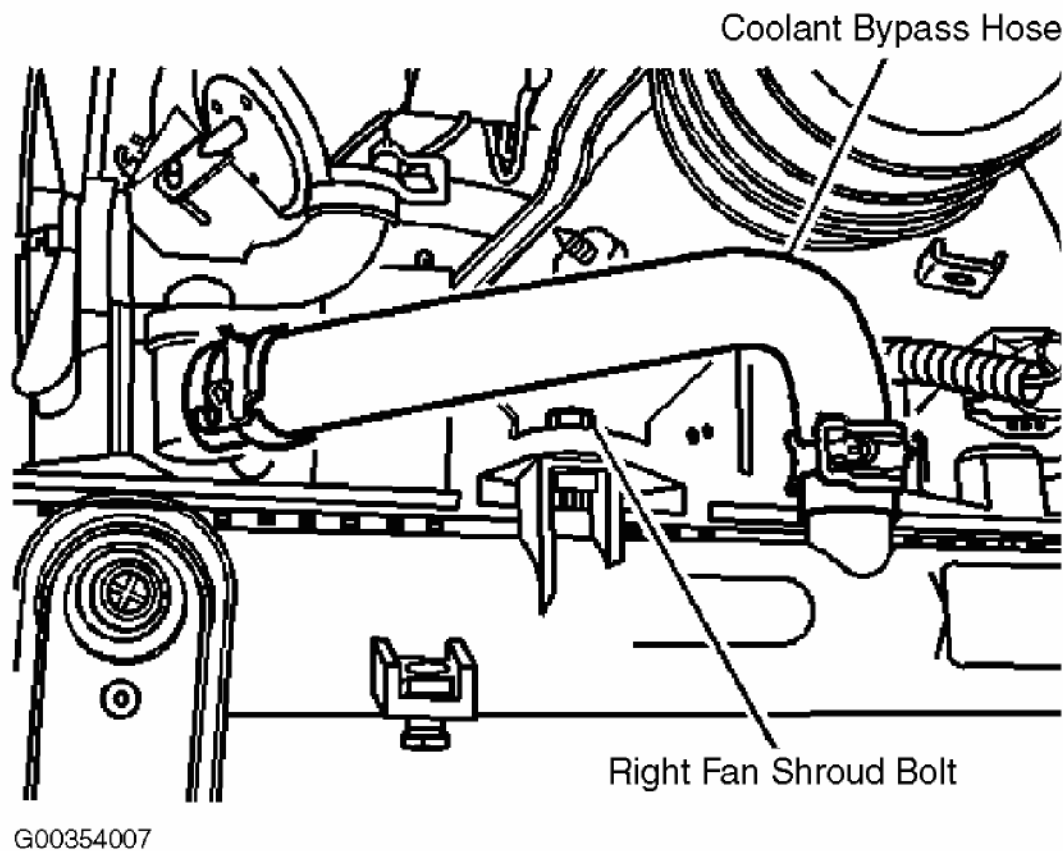


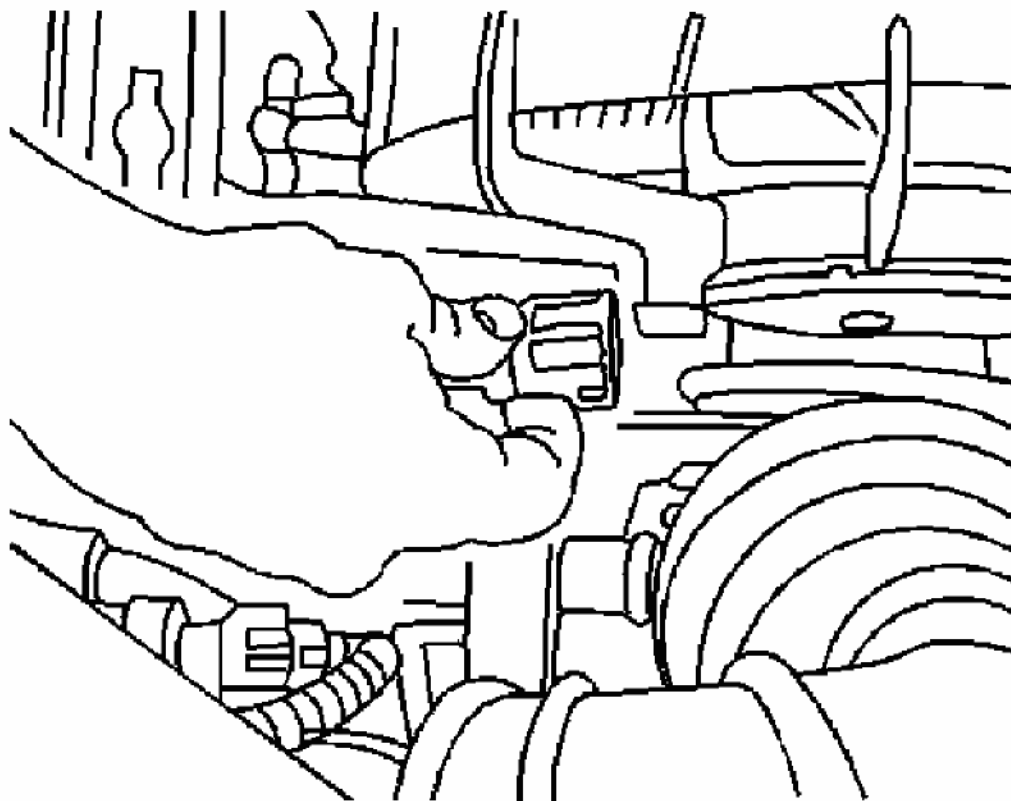
Fig. 10: Removing Coolant Bypass Hose & Right Fan Shroud Bolt
Courtesy of GENERAL MOTORS CORP.

Installation

CAUTION: Carefully install the electric cooling fan assembly into the vehicle, to protect the radiator core.

1. Install the cooling fan assembly to the vehicle. Ensure that the electric cooling fan is in the lower attaching points.
2. Install the upper fan shroud to radiator mounting bolts. Tighten the bolts to specification. See **TORQUE SPECIFICATIONS** .
3. Install the electric cooling fan shroud to plenum mounting bolt. See **Fig. 6** . Tighten the bolt to specification. See **TORQUE SPECIFICATIONS** .
4. Connect the surge tank hose to radiator.

5. Connect the wiring harness electrical connectors to the cooling fan motors. See **Fig. 11** .
6. Connect the fan electrical harness retainers to the fan assembly. See **Fig. 9** . Attach the remaining wiring harness retaining clips to the fan shroud.
7. Install the A/C line retaining clip screw to the fan shroud. See **Fig. 8** . Tighten the screw to specification. See **TORQUE SPECIFICATIONS** .
8. Position the radiator hose with the mark facing up. Position Hose Clamp Pliers to the clamp and position the clamp on the radiator hose. See **Fig. 7** .
9. Using Hose Clamp Pliers, install the coolant bypass hose at the radiator. See **Fig. 10** .
10. Fill the cooling system.
11. Install the air cleaner assembly.
 - A. Position the air cleaner assembly into the engine compartment.
 - B. Install the 3 bolts securing the air cleaner assembly to the shock tower and upper tie bar. Tighten the air cleaner assembly bolts to specification. See **TORQUE SPECIFICATIONS** .
 - C. Install the mass air flow MAF or IAT sensor.
 - a. Install a NEW MAF sensor seal. Insert the MAF or IAT sensor into the air cleaner assembly with the connector terminal orientated upward.
 - b. Install the 2 screws securing the MAF or IAT sensor to the air cleaner assembly. Tighten the MAF or IAT sensor screws to specification. See **TORQUE SPECIFICATIONS** .
 - c. Connect the air intake duct hose to MAF or IAT sensor. Connect the electrical connector to the MAF or IAT sensor.
12. Connect the battery negative cable.



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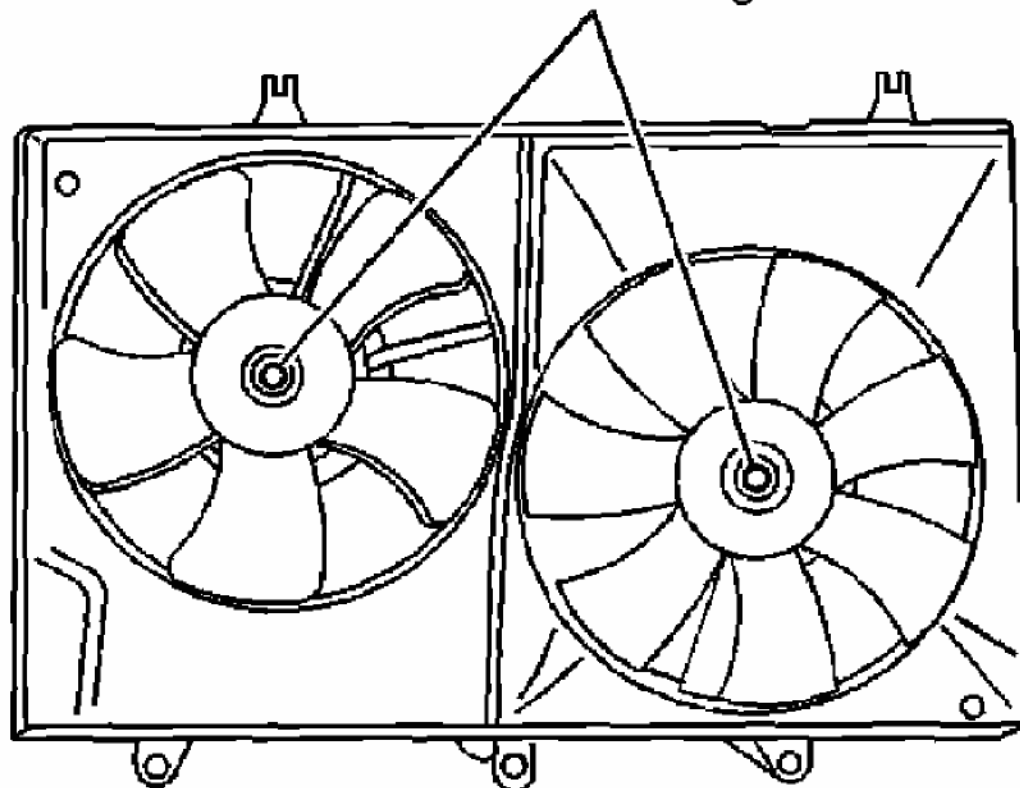
Fig. 11: Connecting Cooling Fan Motor Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

ELECTRIC COOLING FAN MOTOR

Removal

1. Remove the cooling fan assembly. See **ELECTRIC COOLING FAN** .
2. Remove the fan blade retaining nut from the motor. See **Fig. 12** .
3. Remove the fan blade from the motor shaft.
4. Remove the motor retaining screws. See **Fig. 13** .
5. Remove the motor from the shroud.

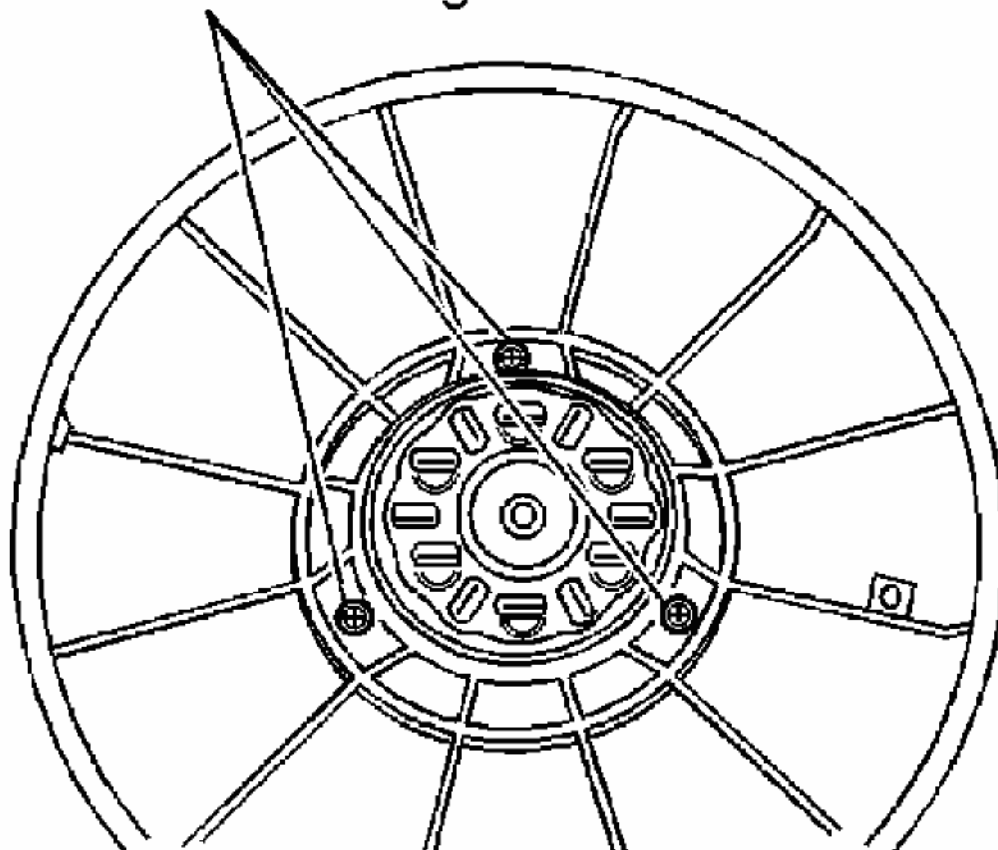
Fan Blade Retaining Nut



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Fig. 12: Removing Fan Blade Retaining Nut
Courtesy of GENERAL MOTORS CORP.

Motor Retaining Screws



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Fig. 13: Removing Cooling Fan Motor Retaining Screws
Courtesy of GENERAL MOTORS CORP.

Installation

1. Install the motor to the shroud.
2. Install the cooling fan motor retaining screws. See **Fig. 13** . Tighten the screws to specification. See **TORQUE SPECIFICATIONS** .
3. Install the fan blade to the motor shaft. Rotate the fan until the fan drops onto the shaft.
4. Install the fan blade retaining nut to the motor. See **Fig. 12** . Tighten the nut to

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specification. See **TORQUE SPECIFICATIONS** .

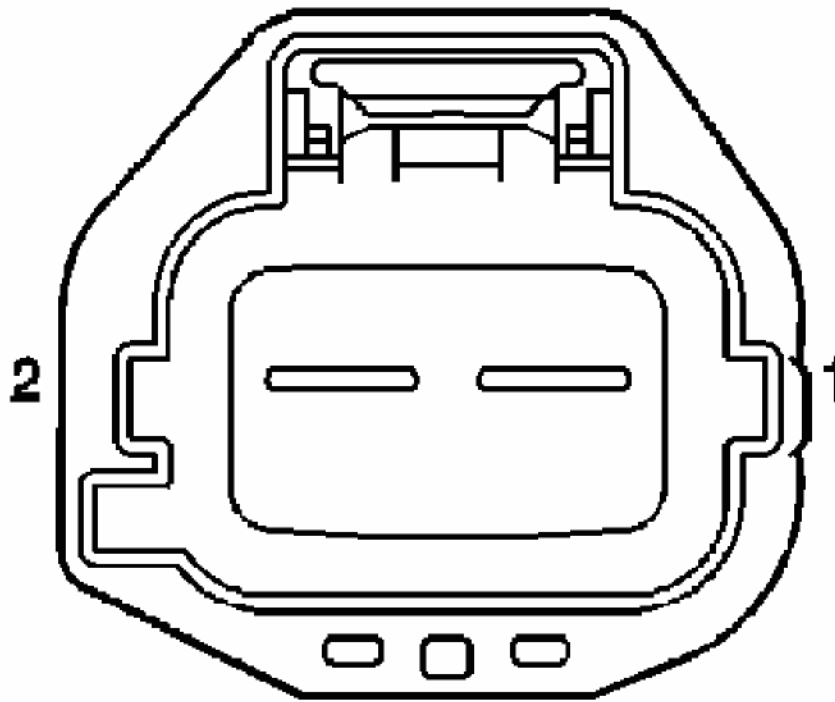
5. Install the cooling fan assembly. See **ELECTRIC COOLING FAN** .

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Battery Negative Cable-To-Battery	13 (17)
INCH Lbs. (N.m)	
A/C Line Retaining Clip-To-Fan Shroud Screw	9 (1)
Air Cleaner Assembly Bolts	80 (9)
Auxiliary Cooling Fan Bolts	58 (6.5)
Electric Cooling Fan Blade Retaining Nut-To-Motor	62 (7)
Electric Cooling Fan-To-Plenum Mounting Bolt	58 (6.5)
Electric Cooling Fan-To-Radiator Mounting Bolt	58 (6.5)
Electric Cooling Fan Motor Retaining Screws	44 (5)
Mass Air Flow (MAF)/Intake Air Temperature (IAT) Sensor Screws	20 (2.25)

CONNECTOR IDENTIFICATION



G00354013

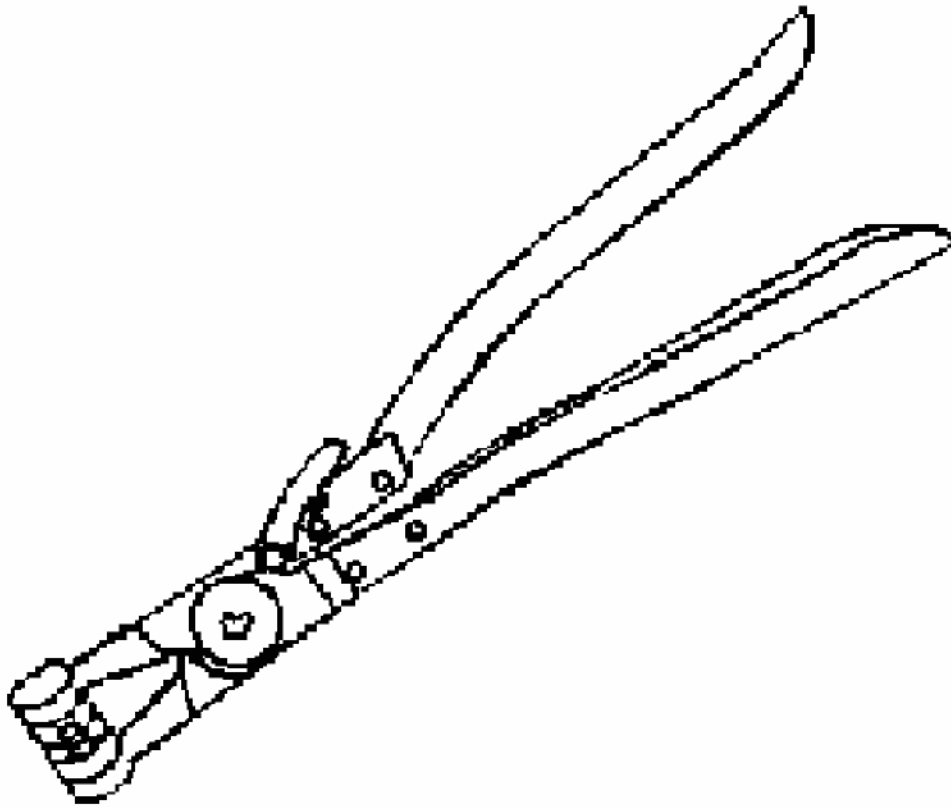
Fig. 14: Identifying Auxiliary Cooling Fan & Electric Cooling Fan Harness Connector Terminals

Courtesy of GENERAL MOTORS CORP.

WIRING DIAGRAMS

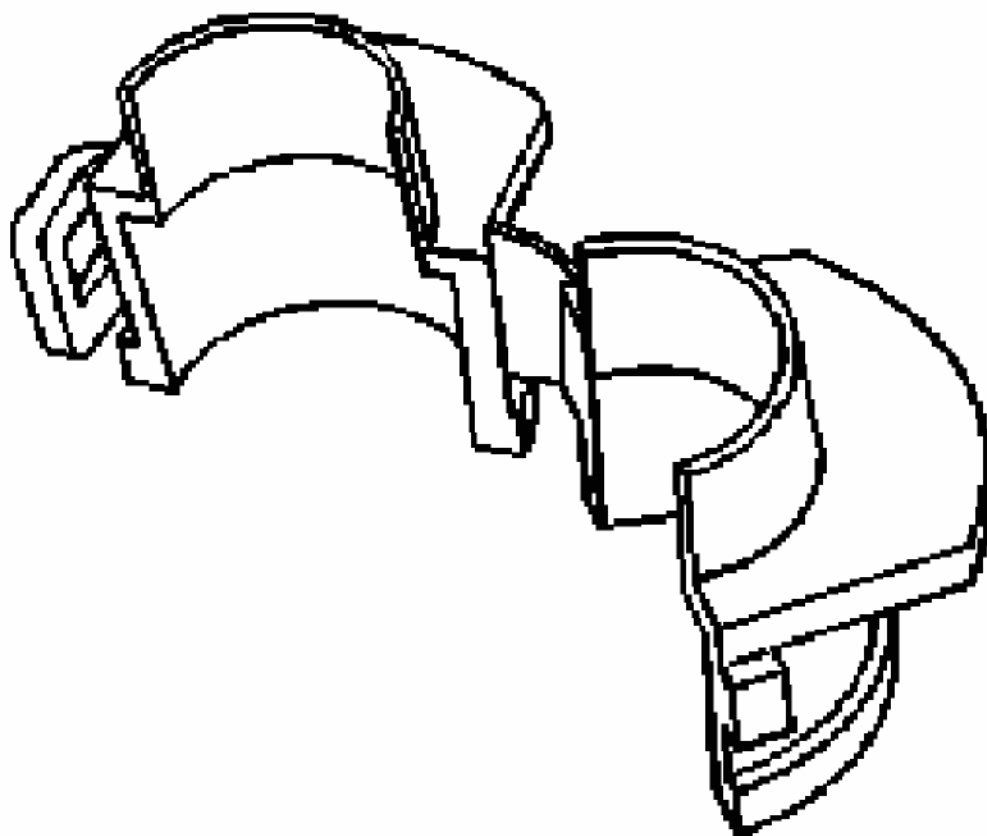
NOTE: See COOLING FAN in SYSTEM WIRING DIAGRAMS article in WIRING DIAGRAMS.

SPECIAL TOOLS



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Fig. 15: Hose Clamp Pliers (J-38185)
Courtesy of GENERAL MOTORS CORP.



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Fig. 16: Transmission Cooler Quick Disconnect (J-44827)
Courtesy of GENERAL MOTORS CORP.