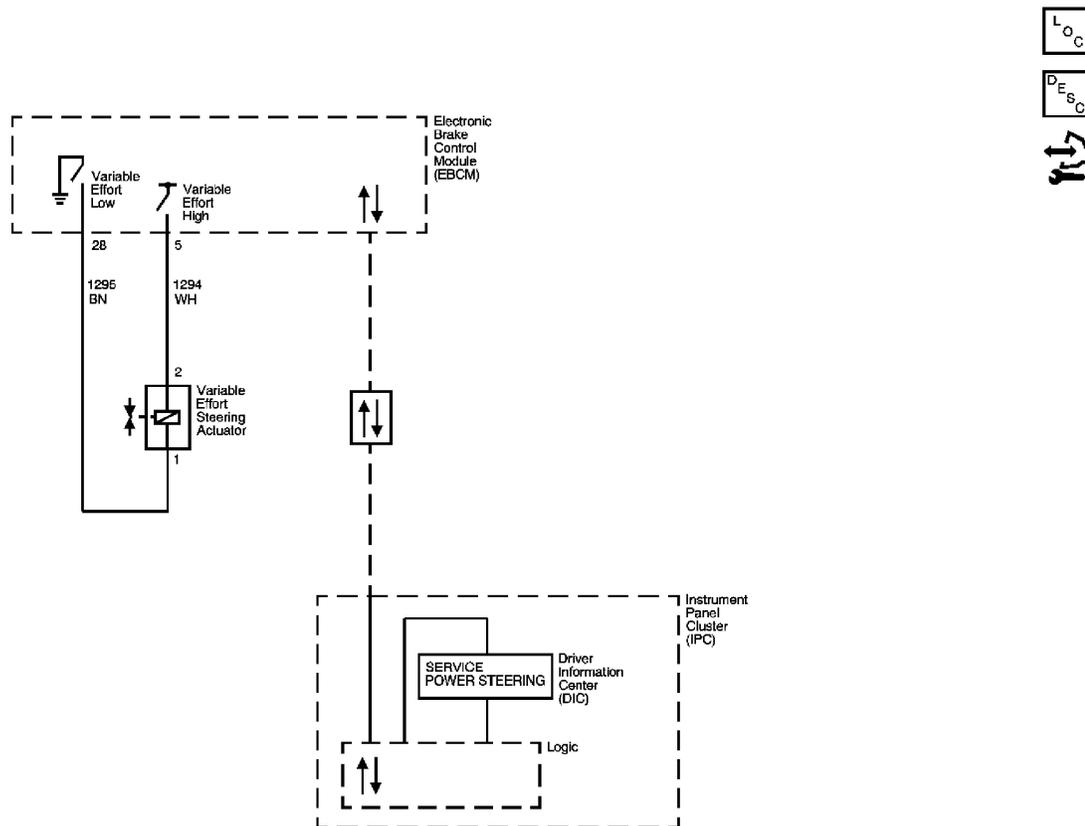


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### Variable Effort Steering - Outlook

## SCHEMATIC AND ROUTING DIAGRAMS

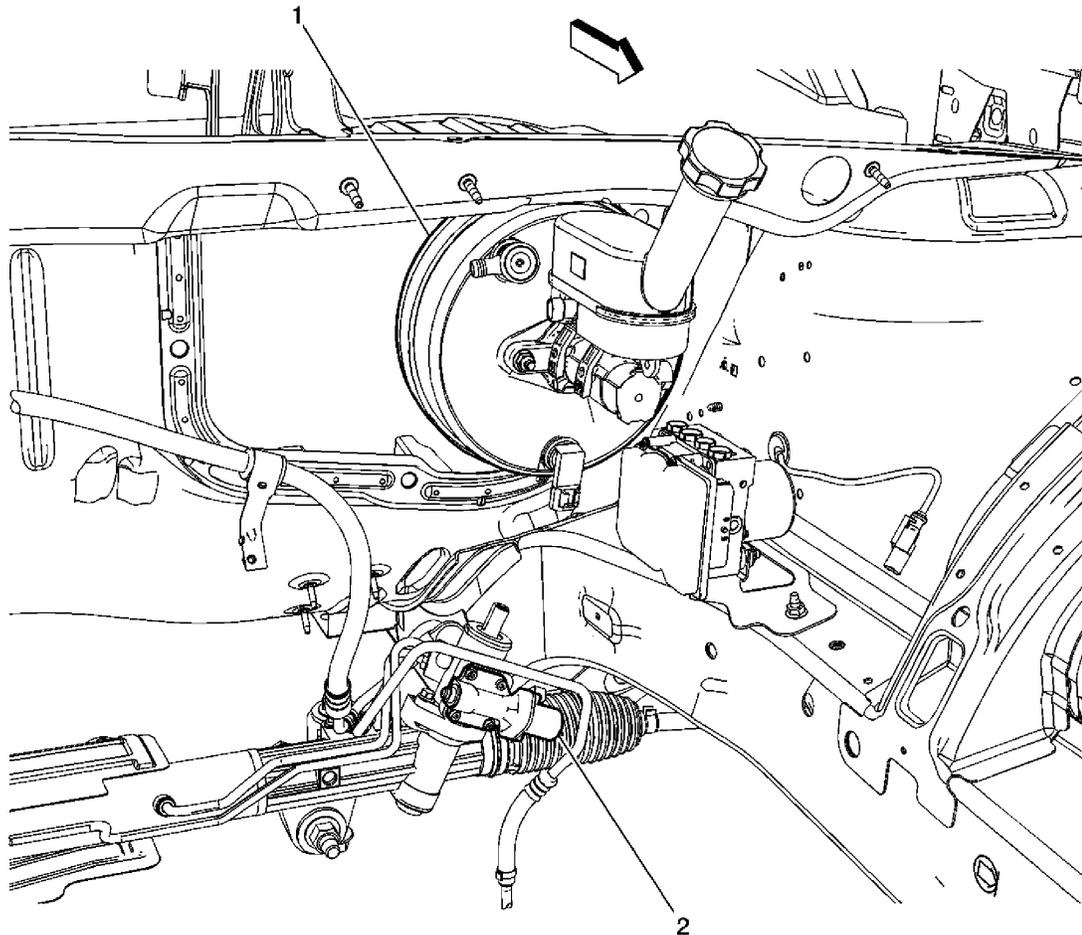
### STEERING ASSIST SCHEMATICS



**Fig. 1: NV7 - Wiring Schematic**  
Courtesy of GENERAL MOTORS CORP.

### COMPONENT LOCATOR

### STEERING ASSIST COMPONENT VIEWS



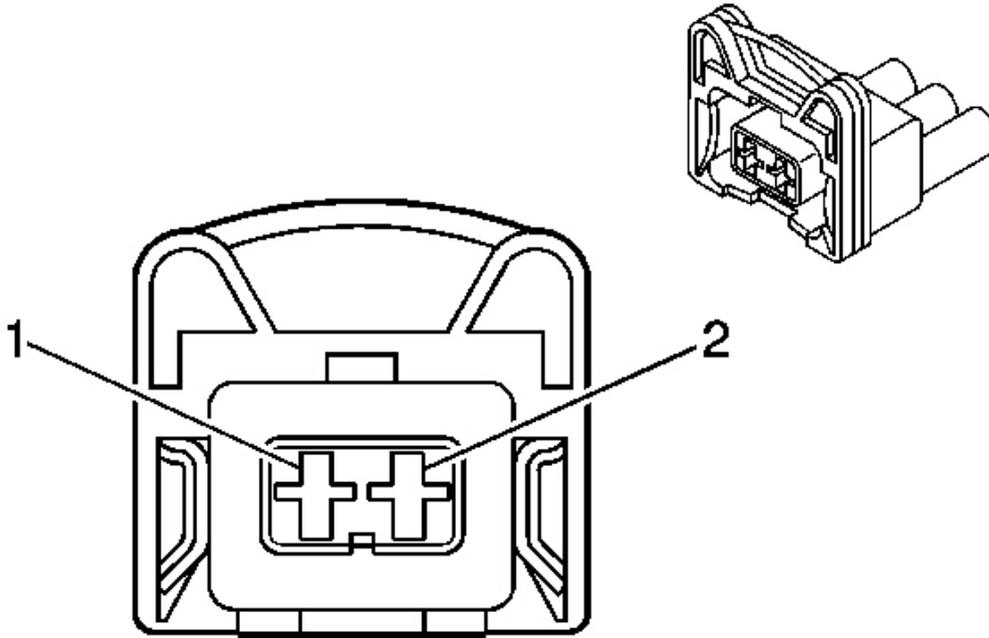
**Fig. 2: Identifying Steering Rack Components (NV7)**  
Courtesy of GENERAL MOTORS CORP.

**Callouts For Fig. 2**

Callout	Component Name
1	Brake Vacuum Booster
2	Variable Effort Steering Actuator (NV7)

**STEERING ASSIST CONNECTOR END VIEWS**

Variable Effort Steering Actuator (NV7)



**Fig. 3: Variable Effort Steering Actuator (NV7) Connector End View**  
 Courtesy of GENERAL MOTORS CORP.

**Variable Effort Steering Actuator (NV7) Connector Parts Information**

**Connector Part Information**

- OEM: 85202-1
- Service: See Catalog
- Description: 2-Way F JPT Series (BK)

**Terminal Part Information**

- Terminal/Tray: 4-964286-1/16
- Core/Insulation Crimp: E/1
- Release Tool/Test Probe: 12093647/J-35616-4A (PU)

**Variable Effort Steering Actuator (NV7) Connector Terminal Identification**

Pin	Wire	Circuit No.	Function

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1	0.5 BN	1295	Variable Effort Steering Actuator Control
2	0.5 WH	1294	Variable Effort Steering Actuator Supply Voltage

## DIAGNOSTIC INFORMATION AND PROCEDURES

### DIAGNOSTIC STARTING POINT - VARIABLE EFFORT STEERING

Begin the system diagnosis with the **Diagnostic System Check - Vehicle** . The Diagnostic System Check will provide the following information:

- The identification of the control modules which command the system
- The ability of the control modules to communicate through the serial data circuit
- The identification of any stored DTCs and their status

The use of the Diagnostic System Check will identify the correct procedure for diagnosing the system and where the procedure is located.

### SCAN TOOL OUTPUT CONTROLS

#### Scan Tool Output Controls

Scan Tool Output Control	Additional Menu Selections	Description
VES actuator	VES test	The Electronic Brake Control Module (EBCM) can be commanded using the scan tool to perform a self-test varying steering effort from more firm, to less firm, to more firm, then back to normal.

### SCAN TOOL DATA LIST

#### Scan Tool Data List

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
<b>Operating Conditions: Ignition ON/engine ON/no vehicle speed present.</b>			
ABS Reference Speed	VES Data	mph	0
LF Wheel Speed	VES Data	mph	0
LR Wheel Speed	VES Data	mph	0
RF Wheel Speed	VES Data	mph	0

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RR Wheel Speed	VES Data	mph	0
Ignition Voltage	VES Data	Volts	13.25
Switched System Battery Voltage	VES Data	Volts	13.25
VES Failed	VES Data	Yes/No	No
VES Indicator Message	VES Data	On/Off	Off

#### SCAN TOOL DATA DEFINITIONS

##### **ABS Reference Speed**

The scan tool displays 0-255 km/h (0-159 mph). The average speed of all four wheel speed sensors.

##### **Ignition Voltage**

The scan tool displays 0-17 volts. The amount of ignition voltage available at the Electronic Brake Control Module (EBCM).

##### **LF Wheel Speed**

The scan tool displays 0-255 km/h (0-159 mph). The actual speed of the left front wheel.

##### **LR Wheel Speed**

The scan tool displays 0-255 km/h (0-159 mph). The actual speed of the left rear wheel.

##### **RF Wheel Speed**

The scan tool displays 0-255 km/h (0-159 mph). The actual speed of the right front wheel.

##### **RR Wheel Speed**

The scan tool displays 0-255 km/h (0-159 mph). The actual speed of the right rear wheel.

##### **Switched System Battery Voltage**

The scan tool displays 0-17 volts. The amount of voltage available to the VES actuator when the ABS relay is activated.

##### **VES Failed**

The scan tool displays Yes or No. Yes indicates a malfunction has been detected within the VES system. No indicates the VES system is operating to specification.

**DTC C0450****Diagnostic Instructions**

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

**DTC Descriptor****DTC C0450**

Steering Assist Control Solenoid/Motor/Actuator Circuit

**Circuit/System Description**

The electronic brake control module (EBCM) commands current from 0-1 amp to the variable effort steering (VES) actuator, depending on vehicle speed. At low speeds, 1-amp of current is commanded to the actuator and the actuator valve is fully closed. As speed increases, less current is commanded to the actuator and the valve opens, allowing pressure to bleed off through a power steering fluid orifice. The EBCM monitors and compares the Commanded and Feedback Current parameters to detect malfunctions in the VES system.

**Conditions for Running the DTC**

- Ignition voltage between 10.5-17 volts
- Off state test-Initial ignition ON, no engine RPM or vehicle speed present.
- On state test-If off state test passes, engine RPM and vehicle speed present.

**Conditions for Setting the DTC**

An open, short to ground or short to voltage in the VES actuator or the circuits to the actuator

**Action Taken When the DTC Sets**

- A DTC C0450 is stored in memory.
- The driver information center (DIC) displays the SERVICE STEERING SYSTEM warning message.
- The VES system is disabled for the remainder of the ignition cycle.

### Conditions for Clearing the DTC

- A current DTC will clear when the malfunction is no longer present.
- A history DTC will clear after 100 consecutive ignition cycles with the malfunction no longer present.

### Reference Information

#### Schematic Reference

### Steering Assist Schematics

#### Connector End View Reference

- Steering Assist Connector End Views
- Antilock Brake System Connector End Views

#### Description and Operation

### Variable Effort Steering System Description and Operation

#### Electrical Information Reference

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

#### Scan Tool Reference

- Scan Tool Data List
- Scan Tool Data Definitions
- Scan Tool Output Controls

#### Circuit/System Verification

Perform the VES Actuator test with a scan tool and turn the steering wheel, the effort should increase and decrease and then back to normal.

#### Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the VES actuator.

2. Test for less than 1 ohm of resistance between the signal circuit terminal and ground.
  - If greater than the specified value, test the signal circuit for an open or high resistance. If the circuit tests normal, replace the EBCM.
3. Connect a test lamp between the ignition circuit terminal and the signal circuit terminal.
  - If the test lamp does not illuminate, test the control circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
4. Command the VES actuator test with a scan tool. The test lamp should turn ON when commanded. If all circuits test normal, test or replace the VES actuator.

### Component Testing

#### Variable Effort Steering Actuator Test

1. Ignition OFF, disconnect the harness connector at the VES actuator.
2. Test for 5-10 ohms of resistance between the ignition terminal and the signal terminal.
  - If not within the specified range, replace the VES actuator.
3. Test for infinite resistance between each terminal and the VES actuator housing/case.
  - If not the specified value, replace the VES actuator.

### Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

**Control Module References** for EBCM replacement, setup and programming

## DESCRIPTION AND OPERATION

### VARIABLE EFFORT STEERING SYSTEM DESCRIPTION AND OPERATION

The Variable Effort Steering (VES) System varies the amount of effort to steer the vehicle as wheel speed changes or lateral acceleration occurs. The electronic brake control module (EBCM) controls an actuator located in the steering rack and pinion. The actuator consists of an electromagnetic coil and a normally open pintle valve. The valve regulates an orifice that bleeds inlet pressure through a return passage to regulate the amount of pressure available for steering assist. The EBCM commands current from 0-1 amp to the VES actuator which varies the amount of effort required to steer the vehicle. At low speeds, 1 amp of current is commanded to the VES actuator and the pintle valve is fully closed which provides maximum pressure and maximum steering assist for easy turning and parking maneuvers. As speed increases, current is decreased and the pintle valve opens the orifice, decreasing available pressure providing firmer steering

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(road feel) and directional stability. The VES system uses the steering wheel position sensor input to calculate lateral acceleration during abrupt driving maneuvers. The system also uses the antilock brake system (ABS) wheel speed sensor inputs to determine vehicle speed. The EBCM is constantly monitoring these inputs to achieve the desired current to the VES actuator. The EBCM has the ability to detect malfunctions in the VES actuator or the circuits to the actuator. Any malfunctions detected will cause the VES outputs to be disabled and the actuator will return to an open state. The EBCM will command the driver information center (DIC) to display the SERVICE STEERING SYSTEM warning message via a class 2 serial data circuit.