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National Highway  
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2005 AUG 31 P 12:38

# Memorandum

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OFFICE OF DEFECTS INVESTIGATION

Subject: FINAL MEMORANDUM REPORT VRTC-DCD5093  
(EA05-006) "Alternator Failures and Stalling  
on 2003-2004 Nissan Murano Vehicles"

Date: AUG 30 2005

From: Michael W. Monk, Director  
VRTC

Reply to  
Attn. Of:

To: Kathleen C. DeMeter, Director  
Office of Defects Investigation

Attached are four copies of the subject report. This completes the requirements for this program.

Attachments

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DOT AUTO SAFETY HOTLINE  
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VRTC-DCD5093 (EA05-006)

**ALTERNATOR FAILURES AND STALLING  
ON 2003-2004 NISSAN MURANO VEHICLES**

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**1.0 INTRODUCTION**

This program was performed at the Vehicle Research and Test Center (VRTC) in response to a request by the Office of Defects Investigation (ODI) of the National Highway Traffic Safety Administration (NHTSA). Subject vehicles can experience a broken rotor coil within the alternator that will prevent the battery from charging. Operation of the vehicle after the alternator fails causes the battery to discharge. After a period of time, the vehicle will go into a condition that limits the vehicle's speed, and subsequently stop running. The purpose of this project was to assess what warnings were provided to the vehicle operator and how long the subject vehicles would continue to operate after a failure of the alternator occurred.

**2.0 TEST PROCEDURE**

**2.1 Test Vehicles**

Two 2003 Nissan Muranos (VIN: JN8AZ08W73W226268 and VIN: JN8AZ08WX3W1 [REDACTED]) were leased for testing. Both were equipped with a 3.5L V6 engine, automatic transmission, and automatic climate control.

**2.2 Vehicle Preparation**

A switch was installed that allowed the alternator to be easily disconnected to simulate an alternator failure.

Selected vehicle parameters were monitored and recorded during the test runs using a commercially available "Car Chip" brand data logger. This is a small solid-state device that plugged into the vehicle's diagnostic port and recorded up to five selected vehicle parameters every 5 seconds. The data was then downloaded to a PC for analysis. The five parameters monitored during these tests were: vehicle speed, battery voltage, engine speed, engine load, and throttle position.

### 2.3 Test Conditions

Each test consisted of driving the test vehicle to the High Speed Test Track (HSTT) with the alternator functioning properly. After entering the HSTT, the vehicle was stopped, the alternator was disconnected to simulate a failure using the installed switch, and the vehicle was then operated per the various designated test procedures described below until the engine stopped running due to lack of sufficient battery voltage. A booster battery was carried in each vehicle so that after the engine quit running, the alternator could be switched back on, the booster battery could be connected, and the vehicle could be started and driven back to the lab.

### 2.4 Test Parameters

Testing was performed with both test vehicles essentially following the same test procedure and operating in pairs. All tests were performed with the headlights, air conditioning, radio, and navigation system (where available) turned on. Each vehicle was tested in the condition and following the test procedures as listed below:

Test No.	Battery	Battery Condition	Test Procedure
1	Orig.	As-rec'd	Steady 50 mph
2	Orig.	Quick Recharge	Steady 50 mph
3	Orig.	Slow Recharge	Steady 50 mph
4	New	As-rec'd	Steady 50 mph
5	New	Slow Recharge	Steady 50 mph
6	New	Quick Recharge	30 mph with stop every mile
7	New	Quick Recharge	Driven approx. 16 miles @ 50 mph, parked overnight without recharge, then driven @ 30 - 35 mph until engine quit.
8	New	Slow Recharge	35 mph with stop every mile
9	New	Slow Recharge	35 mph with stop every mile
10	New	Quick Recharge	Driven approx. 8 mi @ 35 mph, parked for 3 hours without recharge, then driven @ 35 mph until engine quit.
11	New	Quick Recharge	25 mph with stop every 1/2 mile
12	Orig.	No Recharge	25 mph with stop every 1/2 mile

### **3.0 SUMMARY OF TEST RESULTS**

The following items summarize the results of the tests conducted during this test program:

- The "battery" and "brake" warning lights on the instrument panel illuminated as soon as the alternator was disabled. Both remained illuminated until the engine later stopped running. Except for these warning lamps being illuminated, the vehicles operated normally until the battery voltage reached approximately 10.5 volts.
- The time and distance that the vehicle could be driven after a simulated failure of the alternator was dependant on how the vehicle was driven. The distance traveled with normal operation varied between 2.2 and 60 miles. The duration of normal operation varied between 8 and 75 minutes. Compared to steady-state highway driving, stop and go driving at slower speeds significantly decreased both the time and distance available for operation of the vehicle.
- When the battery voltage reached approximately 10.5 volts, the vehicle entered the "limited speed" mode. When this occurred, the anti-lock brake system (ABS) warning lamp, the windshield washer level warning lamp, and the supplemental restraint system (SRS) warning lamp all began to flash, the A/C fan stopped running, and the vehicle slowed dramatically. The average speed in the limited speed mode was 4 mph and never exceeded 7 mph. The average distance traveled in limited speed mode was  $\frac{3}{4}$  mile and never exceeded 1.6 miles. The average duration of limited speed mode operation was  $5\frac{1}{2}$  minutes and never exceeded 14 minutes.
- The engine stopped running when the battery voltage reached approximately 7 volts.

It was noted during testing that once the engine quit running, the electric windows ceased to function.

Detailed test results are provided in on the following page.

## Murano #1

VIN: JNBAZ08W73W				Total Distance	Normal Operation			Limp Mode			Voltage			Test Parameters
Test #	Date	Start	Duration		Time (min)	Norm. Spd	Dist.	Time (min)	Speed	Dist.	Start	Safe Mode	Quit	
1	8/28/2005	9:47AM	1:18:58	46.7	42	50	N/D	14	7	N/D	11.5	10.3	7.4	50 mph until quit, battery as rec'd
2	8/28/2005	1:48 PM	1:12:30	53.7	86	58	62.8	10	4	0.8	12.2	10.3	7.5	58 mph until quit, battery recharged
3	8/29/2005	7:58 AM	1:00:27	49.0	55	55	48.7	3	4	0.8	12.3	10.8	7.5	55 mph until quit, battery recharged overnight
4	8/29/2005	1:24 PM	0:54:44	40.2	51	54	40.0	3	4	0.2	11.7	10.5	8.3	54 mph until quit, w/ new battery as rec'd
5	8/30/2005	7:27 AM	1:09:54	56.7	58	57	56.5	2	5	0.2	12.1	10.8	7.6	57 mph until quit, new battery recharged
6	8/30/2005	10:08 AM	0:15:59	4.8	11	30 S&G	4.3	3	4	0.3	12.0	10.5	7.5	30 mph with stop every mile
7	8/30/2005	1:39 PM	0:62:48	22.7	36	50/35	22.5	6	3	0.2	12.4	10.5	7.0	* (See explanation below)
8	7/5/2005	8:49 AM	0:34:45	14.8	29	35 S&G	14.5	5	4	0.3	12.0	10.5	7.0	35 mph with stop every mile
9	7/8/2005	7:45 AM	0:48:52	21.6	40	35 S&G	21.2	7	5	0.4	12.6	10.5	7.9	35 mph with stop every mile
10	7/8/2005	10:33 AM	0:58:07	24.8	48	35	24.2	8	4	0.8	12.7	10.5	7.6	*** (See explanation below)
11	7/7/2005	8:42 AM	0:38:11	11.7	31	25 S&G	11.1	8	5	0.8	12.0	10.6	7.1	25 mph with stop every 1/2 mile
12	7/7/2005	10:54 AM	0:11:34	2.4	8	25 S&G	2.2	4	4	0.2	11.1	10.6	8.8	25 mph with stop every 1/2 mile w/ orig battery

## Murano #2

VIN: JNBAZ08WX3V				Total Distance	Normal Operation			Limp Mode			Voltage			Test Parameters
Test #	Date	Start	Duration		Time (min)	Norm. Spd	Dist.	Time (min)	Speed	Dist.	Start	Safe Mode	Quit	
1	8/28/2005	9:13AM	53:15	31.8	30	55	N/D	5	4	N/D	11.5	10.5	7.7	55 mph until quit, battery as rec'd
2	8/28/2005	1:53 PM	56:58	43.1	52	50	N/D	3	5	N/D	11.9	10.0	8.7	50 mph until quit, battery recharged
3	8/29/2005	8:02 AM	1:20:47	61.4	75	50	80.2	4	7	1.2	12.0	10.5	8.7	50 mph until quit, battery recharged overnight
4	8/29/2005	1:27 PM	1:01:49	42.4	57	50	40.8	4	7	1.6	11.7	10.5	6.7	50 mph until quit, w/ new battery as rec'd
5	8/30/2005	7:31 AM	1:05:38	46.7	59	50	45.5	5	7	1.2	11.9	10.4	6.8	50 mph until quit, new battery recharged
6	8/30/2005	10:07 AM			Data collection failed								30 mph with stop every mile	
7	8/30/2005	1:45 PM	0:34:23	16.8	24	50/30	16.0	5	5	0.8	12.3	10.5	7.0	** (See explanation below)
8	7/5/2005	1:17 PM	0:30:19	11.0	23	35 S&G	9.9	5	6	1.1	12.0	10.5	7.5	35 mph with stop every mile
9	7/8/2005	7:44 AM	0:28:45	10.1	21	35 S&G	8.9	8	5	1.2	12.4	10.5	6.7	35 mph with stop every mile
10	7/8/2005	10:32 AM	0:28:02	11.5	20	35	11.8	3	5	0.6	12.0	10.5	7.5	*** (See explanation below)
11	7/7/2005	8:40 AM	0:28:33	7.5	20	25 S&G	7.0	7	6	0.5	11.8	10.5	7.5	25 mph with stop every 1/2 mile
12	7/7/2005	10:40 AM	0:17:48	4.4	11	25 S&G	3.4	4	5	0.4	12.0	10.1	6.7	25 mph with stop every 1/2 mile w/ orig battery

\* - ~16 miles @ 50 mph, parked overnight without recharging battery, driven @ 35 mph the next day until engine quit.

\*\* - ~16 miles @ 50 mph, parked overnight without recharging battery, driven @ 30 mph the next day until engine quit.

\*\*\* - ~8 mi @ 35 mph, parked for 3 hours without charging the battery, then driven @ 35 mph until engine quit.