SAFETY COMPLIANCE TESTING FOR FMVSS 124L ACCELERATOR CONTROL SYSTEMS

FORD MOTOR CO.
2004 FORD FREESTAR, MPV
NHTSA NO. C40203

GENERAL TESTING LABORATORIES, INC.
1623 LEEDSTOWN ROAD
COLONIAL BEACH, VIRGINIA 22443

MAY 14, 2004

FINAL REPORT

PREPARED FOR

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
400 SEVENTH STREET, SW
ROOM 6115 (NVS-220)
WASHINGTON, D.C. 20590
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Prepared By:  

Approved By:  

Approval Date: 05/14/04

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted By:  

Acceptance Date: 5/13/04
Final Report of FMVSS 124 Compliance Testing of 2004 FORD FREESTAR, MPV
NHTSA No. C40203

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U.S. Department of Transportation
Enforcement
Office of Vehicle Safety Compliance (NVS-220)
400 7th Street, S.W., Room 6115
Washington, DC 20590

Compliance tests were conducted on the subject 2004 Ford Freestar MPV in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-124-06 for the determination of FMVSS 124 compliance.

Test failures identified were as follows: NONE

Compliance Testing
Safety Engineering
FMVSS 124

Copies of this report are available from NHTSA
NHTSA Technical Reference Div., Rm. 5108
(NAD-52)
400 7th St., S.W. Washington, DC 20590
Telephone No. (202) 366-4946

UNCLASSIFIED

UNCLASSIFIED
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<td></td>
<td>22</td>
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<td></td>
<td>39</td>
</tr>
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</table>
SECTION 1
PURPOSE OF COMPLIANCE TEST

FMVSS 124 specifies requirements for the return of a vehicle’s throttle to the idle position when the driver removes the actuating force from the accelerator control, or in the event of a severance or disconnection in the accelerator control system. The purpose of FMVSS 124 is to reduce deaths and injuries resulting from engine overspeed caused by malfunctions in the accelerator control system. This standard applies to passenger cars, multipurpose passenger vehicles (MPV’s), trucks and buses.
SECTION 2
TEST PROCEDURES AND DISCUSSION OF RESULTS

Compliance testing was conducted on a 2004 Ford Freestar, MPV, NHTSA No. C40203 in accordance with the National Highway Traffic Safety Administration (NHTSA) Laboratory Procedure TP-124-06.

Output from the vehicle throttle position sensor on the air throttle plate shaft was used to measure throttle position and data was recorded at 1000 HZ with GTL’s data acquisition system. Testing was conducted to simulate the normal removal of the driver’s foot from the accelerator pedal. Testing was performed with the vehicle in park and the engine running. Return to idle times were determined for four throttle plate positions with the accelerator control system complete and with each of the two throttle return springs on the throttle plate shaft independently disconnected. The severed linkage test was also performed by disconnecting the throttle cable from the throttle body. As the air throttle plate was mechanically linked to the accelerator pedal, no electrical disconnections were required.

This testing was to be performed at low ambient temperature of -40° C (-0 +5° C) in accordance with the NHTSA Test Procedure TP-124-06 however, due to the inability of prior test vehicles to start at this extreme temperature the test was performed at -13° C (-25° F).
SECTION 3
COMPLIANCE TEST DATA

Test data for this test can be found on the following pages. Photographs are found in Section 5 and Test Plots are found in Section 6.
DATA SHEET 1
VEHICLE DESCRIPTION

VEHICLE MY/MAKE/MODEL/BODY STYLE: 2004 FORD FREESTAR MPV
VEHICLE NHTSA NO.: C40203
VEHICLE VIN: 2FMZ50624BA08509
DATE OF TEST: MAY 5, 2004
TEST LAB: GENERAL TESTING LABORATORIES
VEHICLE ENGINE TYPE: V6
VEHICLE ENGINE SIZE: 3.9 L
GVWR: 2567 KG

VEHICLE ACCEL. CONTROL SYSTEM (ACS) (Air or Fuel Throttled): AIR
MAX. BHP ENGINE SPEED: UNK
MFR. IDLE RPM: COMPUTER CONTROLLED (750)
FUEL METERING DEVICE (Carburetor, fuel injection, etc): FUEL INJECTION

REMARKS:

RECORDED BY: [Signature]

DATE: 05/05/04

APPROVED BY: [Signature]
DATA SHEET 2
NORMAL OPERATION TEST
(fully operational system)

VEHICLE MY/MAKE/MODEL/BODY STYLE: 2004 FORD FREESTAR, MPV
VEHICLE NHTSA NO.: C40203
DATE OF TEST: MAY 5, 2004

Check one:

SYSTEM CONDITION: COMPLETE (no modifications) Normal Operation

<table>
<thead>
<tr>
<th>ACCELERATOR POSITION</th>
<th>THROTTLE POSITION SENSOR READING</th>
<th>RPM</th>
<th>TEMPERATURE (°F)</th>
<th>THROTTLE POSITION SENSOR READING @ IDLE (BASELINE)</th>
<th>RETURN TIME TO IDLE (Msec)</th>
<th>PASS/FAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>% WIDE OPEN THROTTLE (WOT)</td>
<td>25%</td>
<td>25</td>
<td>4000</td>
<td>-25</td>
<td>6%</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>50</td>
<td>4000</td>
<td>-25</td>
<td>6%</td>
<td>232</td>
</tr>
<tr>
<td></td>
<td>75%</td>
<td>75</td>
<td>4000</td>
<td>-25</td>
<td>6%</td>
<td>314</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>100</td>
<td>4000</td>
<td>-22</td>
<td>6%</td>
<td>304</td>
</tr>
</tbody>
</table>

RETURN TIME REQUIREMENTS:
1 second (1000 ms) for vehicles less than 4536 kg.
2 seconds (2000 ms) for vehicles more than 4536 kg.
3 seconds (3000 ms) for vehicles exposed to -18°C or less

PASS _____ X _____ FAIL ___________

REMARKS:

RECORDED BY: [Signature] DATE: 05/05/04
APPROVED BY: [Signature]
DATA SHEET 3 (1 of 2)
FAIL-SAFE OPERATION DISCONNECTION

VEHICLE MY/MAKE/MODEL/BODY STYLE: 2004 FORD FREESTAR, MPV
VEHICLE NHTSA NO.: C40203
DATE OF TEST: MAY 5, 2004

Check one:


SYSTEM CONDITION: #1 SPRING DISCONNECTED

<table>
<thead>
<tr>
<th>ACCELERATOR POSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>% WIDE OPEN THROTTLE (WOT)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RPM</th>
<th>TEMPERATURE (°F)</th>
<th>THROTTLE POSITION SENSOR READING @ IDLE (BASELINE)</th>
<th>RETURN TIME TO IDLE (Msec)</th>
<th>PASS/FAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ENGINE COOLANT</td>
<td>AMBIENT</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 25%  | 25 | 114 | -22 | 6% | 30 | P   |
| 50%  | 50 | 114 | -22 | 6% | 40 | P   |
| 75%  | 75 | 114 | -22 | 6% | 34 | P   |
| 100% | 100| 114 | -22 | 6% | 41 | P   |

RETURN TIME REQUIREMENTS:

1 second (1000 ms) for vehicles less than 4536 kg.
2 seconds (2000 ms) for vehicles more than 4536 kg.
3 seconds (3000 ms) for vehicles exposed to -18° C or less

PASS X  FAIL ______

REMARKS:

RECORDED BY: [Signature]  DATE: 05/05/04
APPROVED BY: [Signature]
DATA SHEET 3 (2 of 2)
FAIL-SAFE OPERATION DISCONNECTION

VEHICLE MY/MAKE/MODEL/BODY STYLE: 2004 FORD FREESTAR, MPV
VEHICLE NHTSA NO.: C40203
DATE OF TEST: MAY 5, 2004

Check one:

Mid Temp. Test:   Low Temp. Test: X   High Temp. Test:   

SYSTEM CONDITION: #2 SPRING DISCONNECTED

<table>
<thead>
<tr>
<th>ACCELERATOR POSITION % WIDE OPEN THROTTLE (WOT)</th>
<th>THROTTLE POSITION SENSOR READING</th>
<th>RPM</th>
<th>TEMPERATURE (°F)</th>
<th>THROTTLE POSITION SENSOR READING @ IDLE (BASELINE)</th>
<th>RETURN TIME TO IDLE (Msec)</th>
<th>PASS/FAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>25%</td>
<td>25</td>
<td>4000</td>
<td>113</td>
<td>-21</td>
<td>6%</td>
<td>34</td>
</tr>
<tr>
<td>50%</td>
<td>50</td>
<td>4000</td>
<td>112</td>
<td>-21</td>
<td>6%</td>
<td>34</td>
</tr>
<tr>
<td>75%</td>
<td>75</td>
<td>4000</td>
<td>112</td>
<td>-21</td>
<td>6%</td>
<td>34</td>
</tr>
<tr>
<td>100%</td>
<td>100</td>
<td>4000</td>
<td>112</td>
<td>-21</td>
<td>6%</td>
<td>42</td>
</tr>
</tbody>
</table>

RETURN TIME REQUIREMENTS:

1 second (1000 ms) for vehicles less than 4536 kg.
2 seconds (2000 ms) for vehicles more than 4536 kg.
3 seconds (3000 ms) for vehicles exposed to -18° C or less

PASS X   FAIL  

REMARKS:

RECORDED BY: [Signature]   DATE: 05/05/04
APPROVED BY:  

DATA SHEET 4
FAIL-SAFE OPERATION SEVERED

VEHICLE MY/MAKE/MODEL/BODY STYLE: 2004 FORD FREESTAR, MPV
VEHICLE NHTSA NO.: C40203
DATE OF TEST: MAY 5, 2004

Check one:

SYSTEM CONDITION: SEVERANCE

<table>
<thead>
<tr>
<th>ACCELERATOR POSITION</th>
<th>THROTTLE POSITION SENSOR READING</th>
<th>RPM</th>
<th>TEMPERATURE (°F)</th>
<th>THROTTLE POSITION SENSOR READING @ IDLE (BASELINE)</th>
<th>RETURN TIME TO IDLE (Msec)</th>
<th>PASS/FAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>% WIDE OPEN THROTTLE (WOT)</td>
<td></td>
<td></td>
<td>ENGINE COOLANT</td>
<td>AMBIENT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25%</td>
<td>25</td>
<td>80</td>
<td>-24</td>
<td>6%</td>
<td>24</td>
<td>P</td>
</tr>
<tr>
<td>50%</td>
<td>50</td>
<td>116</td>
<td>-24</td>
<td>6%</td>
<td>24</td>
<td>P</td>
</tr>
<tr>
<td>75%</td>
<td>75</td>
<td>117</td>
<td>-24</td>
<td>6%</td>
<td>25</td>
<td>P</td>
</tr>
<tr>
<td>100%</td>
<td>100</td>
<td>117</td>
<td>-24</td>
<td>6%</td>
<td>31</td>
<td>P</td>
</tr>
</tbody>
</table>

RETURN TIME REQUIREMENTS:

1 second (1000 ms) for vehicles less than 4536 kg.
2 seconds (2000 ms) for vehicles more than 4536 kg.
3 seconds (3000 ms) for vehicles exposed to -18° C or less

PASS ___ X ___ FAIL ______

REMARKS:

RECORDED BY: ___________________________ DATE: 05/05/04
APPROVED BY: ___________________________
<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>DESCRIPTION</th>
<th>MODEL/ SERIAL NO.</th>
<th>CAL. DATE</th>
<th>NEXT CAL. DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTINUOUS RECORDER</td>
<td>OMEGA</td>
<td>55662</td>
<td>03/04</td>
<td>03/05</td>
</tr>
<tr>
<td>ENGINE RECORDING</td>
<td>FLUKE</td>
<td>7471026</td>
<td>03/04</td>
<td>03/05</td>
</tr>
<tr>
<td>ENGINE RECORDING</td>
<td>MONARCH</td>
<td>1444664</td>
<td>01/04</td>
<td>07/05</td>
</tr>
<tr>
<td>SOFTWARE</td>
<td>GTL</td>
<td>N/A</td>
<td>BEFORE USE</td>
<td>BEFORE USE</td>
</tr>
<tr>
<td>CHAMBER</td>
<td>GTL</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>EXHAUST DUCT</td>
<td>GTL</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
2004 FORD FREESTAR
NHTSA NO. C40203
FMVSS NO. 124L

FIGURE 5.4
CLOSE UP VIEW OF VEHICLE'S CERTIFICATION AND TIRE INFORMATION LABEL
2004 FORD FREESTAR
NHTSA NO. C40203
FMVSS NO. 124L

FIGURE 5.7
THROTTLE RETURN SPRING #1
2004 FORD FREESTAR
NHTSA NO. C40203
FMVSS NO. 124L

FIGURE 5.10
VEHICLE IN TEST CHAMBER
SECTION 6
PLOTS
FMVSS 124  THROTTLE RETURN TEST
124 COLD/ NORMAL/ 25% WOT  1:37:53 PM  5/5/04

NHTSA C40203 FORD FREESTAR

Channel: Throttle Position

Y1:  30.645 %
t1:  -34585.671 ms

Y2:  2.972 %
t2:  -34512.671 ms

dt:  0.073 s
f:  13.699 Hz
FMVSS 124 THROTTLE RETURN TEST
124 COLD/ NORMAL/ 50% WOT
1:40:05 PM 5/5/04

NHTSA C40203 FORD FREESTAR

V % RPM

TRIGGER

THROTTLE POSITION %

RPM

13:33:41.5 13:33:42.0 13:33:42.5
h:min:s

-- TRIGGER [V] -- Throttle Position [%] -- Engine RPM [RPM]

Channel: Throttle Position

Y1: 52.948 %  Y2: 5.674 %
t1: -23084.671 ms  t2: -22852.671 ms
dt: 0.232 s  f: 4.310 Hz
FMVSS 124 THROTTLE RETURN TEST
124 COLD/ NORMAL/ 75% WOT
1:41:46 PM 5/5/04

NHTSA C40203 FORD FREESTAR

Channel: Throttle Position
Y1: 73.171 %
t1: -13752.671 ms
Y2: 5.796 %
t2: -13438.671 ms
dt: 0.314 s
f: 3.185 Hz
FMVSS 124 THROTTLE RETURN TEST
124 COLD/ NORMAL/ 100% WOT

NHTSA C40203 FORD FREESTAR

Channel/Throttle Position

Y1: 103.334 %  Y2: 5.922 %
\( t1: -5563.671 \text{ ms} \) \( t2: -5258.671 \text{ ms} \)
\( dt: 0.304 \text{ s} \) \( f: 3.299 \text{ Hz} \)
FMVSS 124 THROTTLE RETURN TEST
124 COLD/Spring 1/25% WOT
2:07:15 PM 5/5/04

NHTSA C40203 FORD FREESTAR

V % RPM

THROTTLE POSITION %

TRIGGER

Channel: Throttle Position
Y1: 44.924 %  Y2: 5.239 %
t1: -45181.662 ms  t2: -45151.662 ms
dt: 0.030 s  f: 33.333 Hz
FMVSS 124 THROTTLE RETURN TEST
124 COLD/SPRING 1/50% WOT 2:08:38 PM 5/5/04

NHTSA C40203 FORD FREESTAR

Channel: Throttle Position

Y1: 58.681 %
t1: -34091.662 ms
c1: 0.040 s

Y2: 5.605 %
t2: -34051.662 ms
f: 25.000 Hz
FMVSS 124 THROTTLE RETURN TEST
124 COLD/ SPRING 1/75% WOT  2:09:50 PM  5/5/04

NHTSA C40203 FORD FREESTAR

Channel Throttle Position

Y1:  62.416 %  
Y2:  5.650 %  

t1: -23943.662 ms  
t2: -23909.662 ms  

dt:  0.034 s  
f:  29.412 Hz
FMVSS 124 THROTTLE RETURN TEST
124 COLD/ SPRING 1/100% WOT

NHTSA C40203 FORD FREESTAR

V % RPM

THROTTLE POSITION %

Channel: Throttle Position
Y1: 103.513 %
t1: -6571.662 ms
dt: 0.041 s
Y2: 5.715 %
t2: -6530.662 ms
f: 24.990 Hz
FMVSS 124 THROTTLE RETURN TEST
124 COLD/ SPRING 2 /25% WOT
2:19:58 PM 5/5/04

NHTSA C40203 FORD FREESTAR

Channel: Throttle Position
Y1: 42.438 %  Y2: 5.454 %
t1: -34265.061 ms  t2: -34231.061 ms
dt: 0.034 s  f: 29.412 Hz
FMVSS 124 THROTTLE RETURN TEST
124 COLD/ SPRING 2/50% WOT
2:22:00 PM 5/5/04

NHTSA C40203 FORD FREESTAR

V % RPM

TRIGGER

THROTTLE POSITION %

RPM


TRIGGER [V] Throttle Position [%] Engine RPM [RPM]

h:min:s

Channel: Throttle Position

Y1: 63.893 % Y2: 5.991 %
t1: -24359.061 ms t2: -24325.061 ms
dt: 0.034 s f: 29.412 Hz
FMVSS 124 THROTTLE RETURN TEST
124 COLD/ SPRING 2 /75% WOT
2:23:45 PM 5/5/04

NHTSA C40203 FORD FREESTAR

Channel: Throttle Position
Y1: 78.450 %  
Y2: 5.401 %

tf: -12952.061 ms  
t2: -12918.061 ms

t: 0.034 s  
f: 29.412 Hz
FMVSS 124 THROTTLE RETURN TEST
124 COLD/SEVERED/25% WOT

NHTSA C40203 FORD FREESTAR

Channel: Throttle Position

Y1: 26.583 %
t1: -34656.924 ms

Y2: 6.158 %
t2: -34542.924 ms
dt: 0.024 s

f: 41.667 Hz
FMVSS 124 THROTTLE RETURN TEST
124 COLD/ SEVERED/ 50% WOT

NHTSA C40203 FORD FREESTAR

Channel: Throttle Position

Y1: 36.269 %
Y2: 5.410 %
t1: -24980.924 ms
t2: -24956.924 ms
dt: 0.024 s
f: 41.667 Hz
FMVSS 124 THROTTLE RETURN TEST
124 COLD/SEVERED/75% WOT
1:56:51 PM 5/5/04

NHTSA C40203 FORD FREESTAR

Channel: Throttle Position
Y1: 38.865 %
Y2: 6.085 %
t1: 13937.924 ms
t2: -13912.924 ms
dt: 0.025 s
t: 40000 Hz
SECTION 7
MANUFACTURER'S DRAWINGS
VEHICLE INFORMATION/TEST SPECIFICATIONS
FMVSS 124 - Accelerator Control Systems
2004 Ford Freestar

Requested Information:

1.) A sketch of the driver operated accelerator control system (ACS) starting from the accelerator pedal up to and including the fuel metering device (carburetor, fuel injectors, fuel distributor, or fuel injection pump).

The sketch is attached. The ACS is a mechanical system.

2.) For Normal ACS operation, the method utilized to determine the engine idle state (air throttle plate position, fuel delivery rate, other).

Throttle plate position.

3.) For Fail-Safe operation of the ACS (disconnection or severance), the method utilized to determine return of engine power to the idle state (air throttle plate position, fuel delivery rate, air intake, engine rpm, other)

Throttle plate position is monitored during testing to determine if the throttle plate has returned to idle.

4.) Is the vehicle ACS equipped with any of the following:
   A. Accelerator Pedal Position Sensor (APS)
   B. Throttle Plate Position Sensor (TPS)
   C. Electronic Control Module (ECM)
   D. Air throttle plate actuator motor

It is equipped with a TPS.

5.) If air throttle plate equipped, is there a procedure which can be utilized by the test laboratory to measure the position of the throttle plate by tapping into the TPS or ECM? If so, please describe.

Yes, the certification laboratory taps into the TPS signal. The output of the TPS is sent to a Gould chart recorder data acquisition system through appropriate signal conditioning, which records all throttle movement.

6.) Point(s) chosen to demonstrate compliance with FMVSS 124 for single point disconnect and severance.

The accelerator cable is removed during a portion of certification testing to simulate the end slug pulling off the core wire.
7.) Where applicable, were connections in the ACS beyond the ECM such as the fuel injectors tested for disconnection and severance. If yes, provide details.

No.

8.) Where applicable, were idle return times tested for electrical severance accompanied by shorting to ground? If yes, please provide details.

No.

9.) All sources of return energy (springs) for the accelerator pedal and if applicable, the air throttle plate.

The ACS has a torsion spring mounted on the throttle body and a secondary extension spring positioned between the throttle cam and accelerator bracket. During testing, only the torsion spring is initially disconnected and the system tested. Following that, only the extension spring is disconnected and the test repeated.

10.) If fuel delivery rate is used to demonstrate return to idle state, provide:
   A. The method used to measure this signal i.e. connection to standard SAE J1587 data bus.
   B. Equipment required to measure signal.
   C. Fuel rate signal output range at the idle state.

Not applicable.

11.) Is the ACS equipped with a limp home mode? If yes, provide operation description.

No.