REPORT NUMBER: 304-CAL-03 02

SAFETY COMPLIANCE TESTING FOR FMVSS 301
FUEL SYSTEM INTEGRITY

SAAB AUTOMOBILE AB
2003 SAAB 9-3
4-DOOR SEDAN

NHTSA NUMBER: C39510
VERIDIAN TEST NUMBER: 8655-P301-11

July 25, 2003

VERIDIAN ENGINEERING
P.O. BOX 400
BUFFALO, NEW YORK 14225

FINAL REPORT

PREPARED FOR:

U. S. Department of Transportation
National Highway Traffic Safety Administration
Safety Assurance
Office of Vehicle Safety Compliance
400 Seventh Street, S.W.
Room No. 6115 (NVS-220)
Washington, DC 20590
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Approval Date: August 11, 2003

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted By: 
Edward E. Allen

Acceptance Date: 8/21/03
Compliance tests were conducted on the subject 2003 Saab 9-3 4-Door Sedan in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-301-03 for the determination of FMVSS 301 compliance. For the purpose of acquiring information for applied research, two instrumented Anthropomorphic Test Devices (ATDs) were placed in the front occupant seating positions and various instrumentation was added to the test vehicle. Test failures identified were as follows:

The test vehicle appeared to comply with all requirements of FMVSS 301 "Fuel System Integrity."
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SECTION 1
PURPOSE OF COMPLIANCE TEST

This 30 mph rear moving barrier impact test is part of the Federal Motor Vehicle Safety Standard (FMVSS) 301 Compliance Test Program conducted for the National Highway Traffic Safety Administration (NHTSA) by Vehidian Engineering under Contract No. DTNH22-01-C-01025. The purpose of this test was to determine if the subject vehicle, a 2003 Saab 9-3 4-Door Sedan, meets the performance requirements of FMVSS No. 301, "Fuel System Integrity." This compliance test was conducted using the requirements found in the OVSC Laboratory Test Procedure No. TP-301-03, dated February 28, 2003.
SECTION 2

COMPLIANCE TEST RESULTS SUMMARY

A 1732.5 kg 2003 Saab 9-3 4-Door Sedan was impacted from the rear by an 1797 kg moving barrier at a velocity of 47.3 kph (29.4 mph). The test was performed by Veridian Engineering on July 25, 2003.

The test vehicle was equipped with a 62.1 liter fuel tank which was filled to 92.5 percent capacity with stoddard fluid prior to impact. For the purpose of acquiring information for applied research, one instrumented Part 572 E 50th percentile male Anthropomorphic Test Device (ATD) and one instrumented Part 572 O.5th percentile female ATD were placed in the driver and right front occupant seating positions respectively and various instruments were added to the test vehicle. Research data is presented in a separate report.

The crash event was recorded by ten high-speed cameras and one real-time camera. Camera locations and other pertinent camera information are found on pages 3-9 and 3-10 of this report. Pre- and post-test photographs of the vehicle can be found in Appendix A.

There was no fuel system fluid spillage following the impact or during any portion of the static rollover test. The average vehicle longitudinal crush was 237 millimeters. The vehicle appeared to comply with all the requirements of FMVSS No. 301 "Fuel System Integrity."
SECTION 3

COMPLIANCE TEST DATA
DATA SHEET 1

TEST VEHICLE SPECIFICATIONS

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 2003 Saab 9-3 4-Door Sedan
NHTSA No.: C30510; Color: Gray
Engine Data: 4 Cylinders; 2.0 L
Placement: Longitudinal or In-Line; Transverse or Lateral
Transmission Data: 4 Speeds; Manual; Automatic; Overdrive
Final Drive: Rear Wheel Drive; Front Wheel Drive; Four Wheel Drive
Major Options: A/C; Power Steering; Power Brakes
Power Windows; Power Door Locks; Tilt Wheel
Date Received: April 11, 2003; Odometer Reading: 217 km
Setting Dealer: The Dorschel Saab Country
Address: 3317 West Henrietta Road, Rochester, NY 14623

DATA FROM VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured by: Saab Automobile AB
Date of Manufacture: Feb 03
VIN: YS3HR18541032929
GVWR: 1950 kg; GAWR-FRONT: 1125 kg; GAWR-REAR: 1012 kg

DATA FROM VEHICLE'S TIRE LABEL:

Location of Placard on Vehicle: Driver Door
Recommended Tire Size: P215/55R16 93 H
Recommended Cold Tire Pressure: FRONT: 240 kPa; REAR: 220 kPa

DATA FROM TIRE SIDEWALL:

Size of Tires on Test Vehicle: P215/55R16 93 H
Manufacturer: Pirelli
Tire Pressure with Maximum Capacity Vehicle Load: FRONT: 300 kPa; REAR: 300 kPa
Type of Spare Tire: T125/85R16 99M

VEHICLE CAPACITY DATA:

Type of Front Seats: Bench; X Bucket; Split Bench
Number of Occupants: 2 Front; 3 Rear; 5 Total
Vehicle Capacity Weight (VCW) = 421 kg
No. of Occupants x 68.04 kg = 340.2 kg
Rated Cargo/Luggage Weight (RCLW) = 80.8 kg

* Tire pressure used for test
DATA SHEET 2

PRE-TEST DATA

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (with maximum fluids) = UDW:

Right Front = 453.5 kg
Left Front = 468.5 kg
TOTAL FRONT = 922 kg

Right Rear = 281.5 kg
Left Rear = 308.5 kg
TOTAL REAR = 590 kg

TOTAL DELIVERED WEIGHT = 1512 kg

% of Total Front of Vehicle Weight = 61.0% of Total Rear Weight = 39.0%

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Total Delivered Weight = 1512 kg
Rated Cargo/Luggage Weight (RCLW) = 80.8 kg
Weight of 2 p.372 Dummies, 74.4 kg
TARGET TEST WEIGHT = 1741.6 kg

WEIGHT OF TEST VEHICLE WITH TWO DUMMIES AND 71.7 KG OF CARGO WEIGHT:

Right Front = 512.0 kg
Left Front = 546.0 kg
TOTAL FRONT = 1068 kg

Right Rear = 321.5 kg
Left Rear = 343.0 kg
TOTAL REAR = 664.5 kg

TOTAL TEST WEIGHT = 1732.5 kg

% of Total Front of Vehicle Weight = 61.6% of Total Rear Weight = 38.4%

* Weight of Ballast Secured in Vehicle Trunk Area = 0 kg

Type of Ballast: None

Method of Securing Ballast: Not Applicable

Vehicle Components Removed for Weight Reduction: Vehicle battery

VEHICLE ATTITUDE (all dimensions in millimeters):

AS DELIVERED: RF 594 LF 686 RR 687 LR 683

AS TESTED: RF 670 LF 660 RR 678 LR 674

Vehicle's Wheel Base: 1275 mm

Location of Vehicle's C.G.: 1026 millimeters rearward of front wheel center.

FUEL SYSTEM DATA:

Fuel System Capacity From Owner's Manual = 62.1 liters

Usable Capacity Figure Furnished by CCTR = 62.1 liters

Test Volume Range (91 to 94% of Usable Capacity) = 56.51 to 58.37 liters

ACTUAL TEST VOLUME = 57.4 liters (with entire fuel system filled)

* Ballast weight includes the RCLW, the weight of drained vehicle fluids and the weight of any removed vehicle components less the weight of onboard instrumentation, cameras, and hardware.
### DATA SHEET 2 (continued)

#### PRE-TEST DATA

**FUEL SYSTEM DATA (continued):**

<table>
<thead>
<tr>
<th>Test Fluid Type</th>
<th>Stoddard Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Fluid Specific Gravity</td>
<td>0.764</td>
</tr>
<tr>
<td>Test Fluid Kinematic Viscosity</td>
<td>0.96</td>
</tr>
<tr>
<td>Test Fluid Color</td>
<td>Orange</td>
</tr>
<tr>
<td>Type of Vehicle Fuel Pump</td>
<td>Electric</td>
</tr>
</tbody>
</table>

**Electric Fuel Pump Operation with Ignition Switch ON and Engine OFF:**

Fuel pump operated.

**Details of Fuel System:** The fuel tank is centered ahead of the rear axle with the fuel lines running inboard of the right frame stiffener. The fuel door is on the right side of the vehicle behind the rear axle.

**Comments:** None
DATA SHEET 3

MOVING BARRIER DATA

WEIGHT OF MOVING BARRIER:

Right Front = 504.9 kg  Right Rear = 393.7 kg
Left Front = 499.9 kg  Left Rear = 398.3 kg
TOTAL FRONT = 1004.8 kg  TOTAL REAR = 792.0 kg
TOTAL BARRIER WEIGHT = 1796.8 kg

MOVING BARRIER DIMENSIONS:

Barrier Face Height: 1524 mm
Barrier Face Width: 1981 mm
Barrier Face Ground Clearance: 127 mm
Tread Width: 1511 mm
Wheel Base: 3048 mm
Location of C.G.:
X: 1344 mm rearward of front wheel center.
Y: 0 mm from longitudinal-vertical plane of symmetry.
Z: 414 mm above ground.

MOVING BARRIER TIRES:

Manufacturer: Classic
Model: Poly IV
Size: 215/75D15
Recommended Max Pressure: 240 kPa

MOVING BARRIER ABORT SYSTEM:

Type: Trailing cable
DATA SHEET 4

POST TEST DATA

TYPE OF TEST:
Type of Test: Rear Barrier
Impact Angle: 0°

Test Date: July 25, 2003
Time: 13:17
Temperature: 25.5 °C

Vehicle NHTSA No.: C30510
VIN: YS31B49843033297

Required Impact Velocity Range: 46.51 to 48.12 kph

BARRIER IMPACT VELOCITY: (Speed traps within 5 feet of impact plane.)
Trap No. 1 = 47.3 kph; Trap No. 2 = 47.3 kph
Average Impact Speed = 47.3 kph

VEHICLE STATIC CRUSH:
Vehicle Length:

Pro-Test Left = 4520; C/L = 4630; Right = 4520
Post-Test Left = 4285; C/L = 4390; Right = 4285
Crush Left = 235; C/L = 240; Right = 235
Average = 237 millimeters
**DATA SHEET 4 (continued)**

**POST TEST DATA**

**TEST VEHICLE NHSTA NO.:** C30510  
**TEST DATE:** July 25, 2003  
**Vehicle Mfr./Make/Model:** 2003 Saab 9-3 4-Door Sedan

Test vehicle fuel tank filled to 91% to 94% of manufacturer's "usable" capacity and with electric fuel pump operating (if it will operate without engine operation). Part 572 test dummies located at each front designated seating position.

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**TEST VEHICLE IMPACT TYPE:**

- Frontal (42.28 kph target velocity)
- Oblique (42.28 kph target velocity) with ______° barrier face first contacting _______ (driver/passenger) side
- X Rear Moving Barrier (42.28 kph target velocity)
- Lateral Moving Barrier (32.19 kph target velocity)

---

**FUEL SPILLAGE MEASUREMENT:**

1. From impact until vehicle motion ceases
   - **ACTUAL** 0  
   - **MAX ALLOWED** 28 g

2. For five minute period after vehicle motion ceases
   - **ACTUAL** 0  
   - **MAX ALLOWED** 28 g

3. For next 25 minutes
   - **ACTUAL** 0  
   - **MAX ALLOWED** 28 g/min

---

**SOLVENT SPILLAGE DETAILS:**

None
### Data Sheet 5

**Static Rollover Test Data**

Table 7: FMVSS No. 301 - Static Rollover Data Sheet

Vehicle: 2003 Saab 9-3 4 Door Sedan  
NHTSA No.: C30510

#### I. Determination of Solvent Collection Time Period:

<table>
<thead>
<tr>
<th>Rollover Stage</th>
<th>Rotation Time (spec. 1-3 min)</th>
<th>FMVSS 301 Hold Time</th>
<th>Total Time</th>
<th>Next Whole Minute Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°–90°</td>
<td>1 minute</td>
<td>15 seconds</td>
<td>5 minutes</td>
<td>15 seconds</td>
</tr>
<tr>
<td>90°–180°</td>
<td>3 minutes</td>
<td>06 seconds</td>
<td>5 minutes</td>
<td>6 minutes</td>
</tr>
<tr>
<td>180°–270°</td>
<td>3 minutes</td>
<td>01 seconds</td>
<td>5 minutes</td>
<td>6 minutes</td>
</tr>
<tr>
<td>270°–360°</td>
<td>3 minutes</td>
<td>08 seconds</td>
<td>5 minutes</td>
<td>8 minutes</td>
</tr>
</tbody>
</table>

#### II. FMVSS 301 Requirements: (Maximum allowable solvent spillage):

<table>
<thead>
<tr>
<th>First 5 minutes from onset of rotation</th>
<th>6th min.</th>
<th>7th min.</th>
<th>8th min. (if required)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 g</td>
<td>28 g</td>
<td>28 g</td>
<td>28 g</td>
</tr>
</tbody>
</table>

#### III. Actual Test Vehicle Solvent Spillage:

<table>
<thead>
<tr>
<th>Rollover Stage</th>
<th>First 5 minutes from onset of rotation (g)</th>
<th>6th min. (g)</th>
<th>7th min. (g)</th>
<th>8th min. (if required) (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°–90°</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>90°–180°</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>180°–270°</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
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<tr>
<td>270°–360°</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Note: Record spillage for whole minute intervals only as determined above.

#### IV. Solvent Spillage Location(s):

<table>
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<tr>
<th>Rollover Stage</th>
<th>Spillage Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°–90°</td>
<td>None</td>
</tr>
<tr>
<td>90°–180°</td>
<td>None</td>
</tr>
<tr>
<td>180°–270°</td>
<td>None</td>
</tr>
<tr>
<td>270°–360°</td>
<td>None</td>
</tr>
</tbody>
</table>
DATA SHEET 6
HIGH SPEED CAMERA LOCATIONS

REAL TIME CAMERA

NO STEEL GRATING ALLOWED OVER PHOTO PIT

CONCRETE PAD
TOW ROAD

TOP VIEW

MOVING BARRIER

PHOTO PIT

LEFT SIDE VIEW
DATA SHEET 6 (continued)

HIGH SPEED CAMERA LOCATIONS

NHTSA No.: C30510   Vehicle: 2003 Saab 9-3 4-Door Sedan

<table>
<thead>
<tr>
<th>CAMERA NO.</th>
<th>VIEW</th>
<th>CAMERA POSITIONS (mm)*</th>
<th>ANGLE** (degrees)</th>
<th>LENS (mm)</th>
<th>SPEED (fps)</th>
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<tbody>
<tr>
<td>1</td>
<td>Real-Time Camera</td>
<td></td>
<td></td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>2</td>
<td>Right Side View</td>
<td>17323</td>
<td>1958</td>
<td>1138</td>
<td>35</td>
</tr>
<tr>
<td>3</td>
<td>Left Side View</td>
<td>16439</td>
<td>1222</td>
<td>1300</td>
<td>35</td>
</tr>
<tr>
<td>4</td>
<td>Vehicle Front Underbody View</td>
<td>0</td>
<td>2600</td>
<td>-1956</td>
<td>90</td>
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<tr>
<td>5</td>
<td>Vehicle Mid-Section Underbody View</td>
<td>0</td>
<td>1825</td>
<td>-1956</td>
<td>90</td>
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<tr>
<td>6</td>
<td>Vehicle Rear Underbody View</td>
<td>0</td>
<td>755</td>
<td>-1956</td>
<td>90</td>
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<td>7</td>
<td>Moving Barrier View</td>
<td>0</td>
<td>0</td>
<td>2515</td>
<td>-105</td>
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<td>8</td>
<td>Overhead Overall View</td>
<td>-508</td>
<td>0</td>
<td>9804</td>
<td>-90</td>
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<td>9†</td>
<td>Onboard Driver View</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>10†</td>
<td>Onboard Passenger View</td>
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<td>-</td>
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</tbody>
</table>

* X = film plane to monorail centerline (+ to left of rail)
  Y = film plane to impact location (+ ahead of impact location)
  Z = film plane to ground (+ above ground)

** = referenced to horizontal plane

† Research cameras.
Appendix A

PHOTOGRAPHS
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<td>POST-TEST RIGHT SIDE VIEW</td>
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<td>ROLLOVER 180°</td>
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<td>ROLLOVER 270°</td>
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<tr>
<td>A-22</td>
<td>ROLLOVER 360°</td>
<td>A-24</td>
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