



NHTSA Investigation EA13-003 Summary of Tests and Analysis



Mercedes-Benz

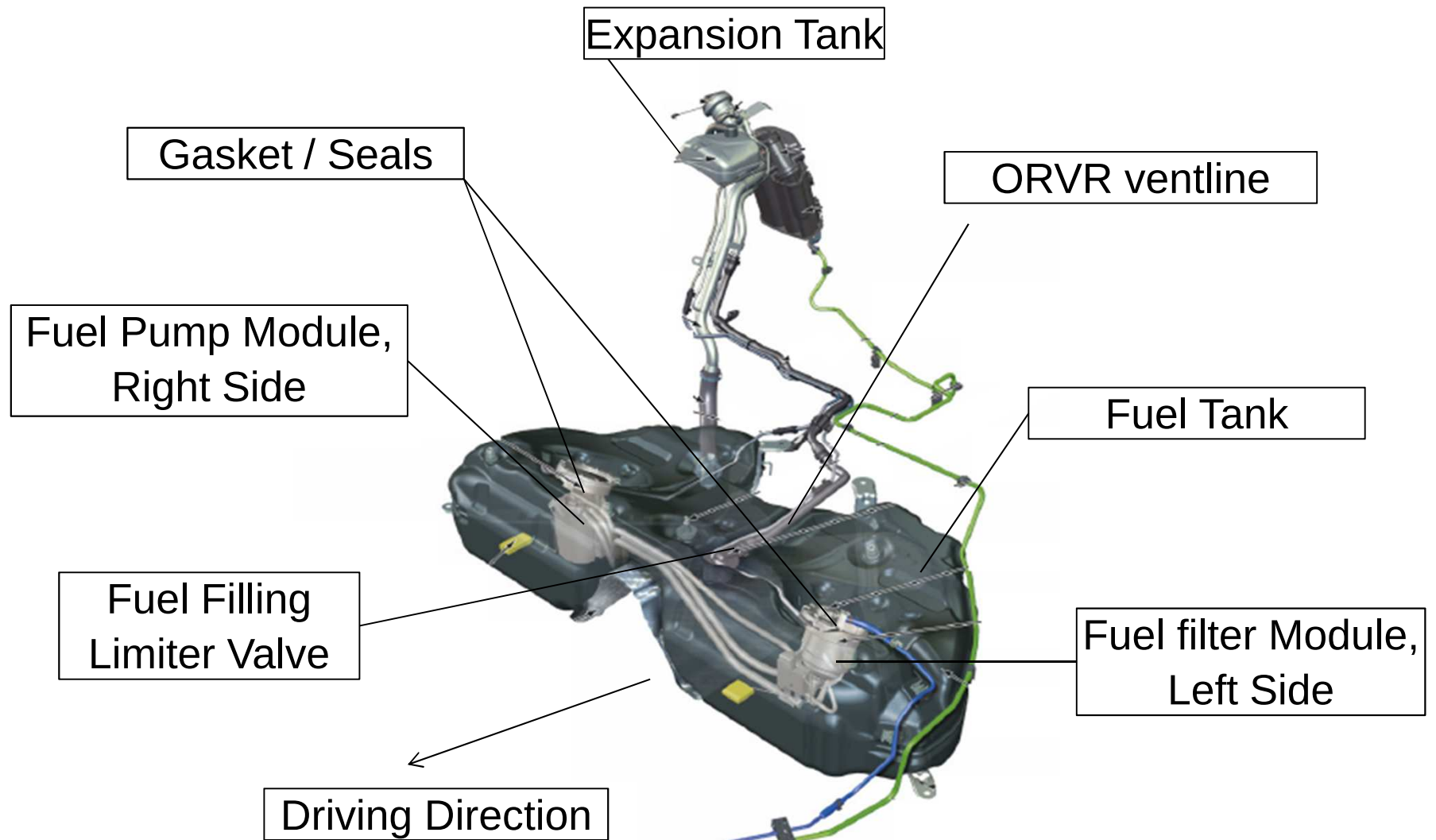
Contents

Overview of Fuel Tank System

Tests and Analysis

Conclusion

Overview W211 HDPE 80L Fuel Tank System



Tests and Analysis

Four types of tests and analysis were performed:

- ☐ Investigation of leak sources
- ☐ Analysis of potential for fuel to reach the ground
- ☐ Investigation of sealing performance of access cover
- ☐ No potential for ignition

Investigation of Leak Sources

Review of Service and Field Information

- ❑ Service records were studied and x-ray CT scans used to identify improper installation of fuel system components during service that may lead to leakage



Pinched wires (CT)



Broken ring nut,
probably resulting
from over-torquing

Investigation of Leak Sources

Review of Service and Field Information (continued)

- ❑ Review indicated a number of different improper service techniques and ways these techniques can lead to leak conditions
 - Over-torquing ring nut
 - Insufficient tightening of ring nut
 - Failure to replace seal
 - Use of wrong ring nut
 - Damage to service cover port seals

Investigation of Leak Sources

Vehicle Study

- ☐ Detailed analysis of 14 vehicles with customer complaints of fuel leakage or fuel odor
- ☐ Tests were performed to quantify leak sizes and volumes
- ☐ Tests show leakage rates are extremely small and are mainly associated with odor complaints

Investigation of Leak Sources

Field Return Parts Study

- ☐ Tightness testing conducted on fuel filters returned from the field
- ☐ Designed to identify worst case leakage rates
- ☐ Results showed very small leak sizes in most parts; size limited so that most of fuel can be captured in depression on top of filter

Analysis of Potential for Fuel to Reach Ground

Containment Well Capacity Analysis

- ☐ Measurement of holding capacity of fuel system areas in which any leaking fuel could collect

Analysis of Potential for Fuel to Reach Ground

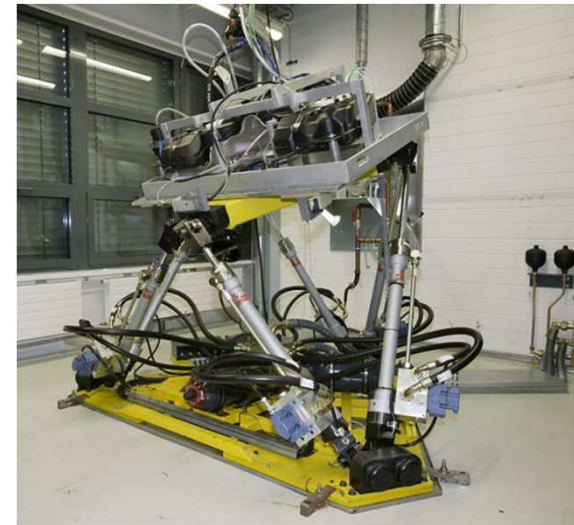
Leakage and Evaporation Rate Measurements

- ☐ Leakage rates were established for typical and large leak sizes, based on field data
- ☐ Evaporation rates were determined for fuel in containment well while driving
- ☐ Evaporation significantly reduces accumulation of fuel on top of tank
- ☐ Leakage rate for nearly all fuel filter module leaks is less than evaporation rate for fuel
- ☐ Therefore no significant accumulation of fuel on top of tank

Analysis of Potential for Fuel to Reach Ground

Driving Simulations – worst case filter modules

- ☐ Tanks filled with different amounts of fuel were tested
- ☐ 2 different driving cycles: city and mountain driving
- ☐ Tests show extreme conditions necessary for fuel to move out of containment well
- ☐ Additionally in real world driving situations evaporation significantly reduces accumulation



Analysis of Potential for Fuel to Reach Ground

Fuel Path Investigation

- ☐ Theoretical flow of liquid from the top of the fuel tank investigated
- ☐ Findings: liquid moves from top, down side, to underbody cover
- ☐ No possible path to exhaust system

Analysis of Potential for Fuel to Reach Ground

Underbody Cover Containment Analysis

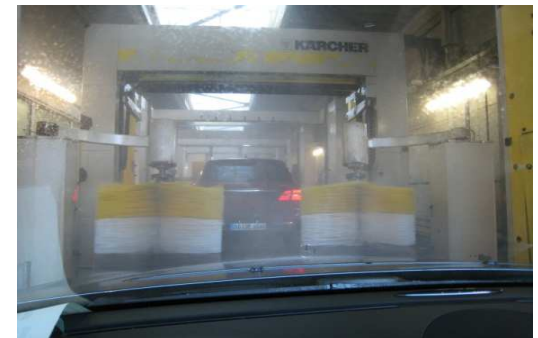
- ☐ Containment capacity of underbody cover measured
- ☐ Significant amount of liquid will be contained in underbody cover
- ☐ Liquid in cover subject to further evaporation



Investigation of Sealing Performance of Access Cover

Tests performed to test tightness of access cover plates over fuel tank

- ❑ Tests included:
 - Water-jet sprayer test
 - Car wash station test
 - High-pressure steam cleaner test
 - Heavy rain simulation test in SHED chamber
 - Vapor intrusion test in SHED chamber



Investigation of Sealing Performance of Access Cover

Tests performed to test tightness of access cover plates over fuel tank

- ❑ Tests included:
 - Test of potential wicking effect of fuel along wiring harness
 - Cabin pressure differential test



Investigation of Sealing Performance of Access Cover

Tests performed to test tightness of access cover plates over fuel tank

☐ Test results:

- Leak proof sealing performance of cover plates confirmed, even under worst-case conditions
- No wicking of fuel up wiring harness into passenger compartment
- No pressure differential

☐ Conclusion:

- No possibility for fuel or fuel vapors to enter passenger compartment through access cover plates

No Potential for Ignition

Heat shields separating exhaust system from fuel tank analyzed

- ☐ Maximum temperatures on top of shield and below heat shield measured
- ☐ Hottest temperatures fuel from on top of tank can reach are well below ignition temperatures of liquid fuel

No Potential for Ignition

Other potential ignition sources analyzed

- ☐ Mechanical sparks
- ☐ Electrical sparks
- ☐ Electrostatic discharge

Conclusion: Analysis shows no sources of potential ignition

Field data also shows no fire cases

Conclusion

No Safety issue caused by potential leaks because:

- Small quantity of leak, primarily fuel odor, generally consistent with evaporation rate
- Leaks are contained and evaporation rates are high
- Effective warnings provided by OBD system
- No fuel leaks into passenger compartment, unless seals or access covers are improperly reinstalled during service
- No risk of fire
- Complaints generally associated with overfilling or refueling process