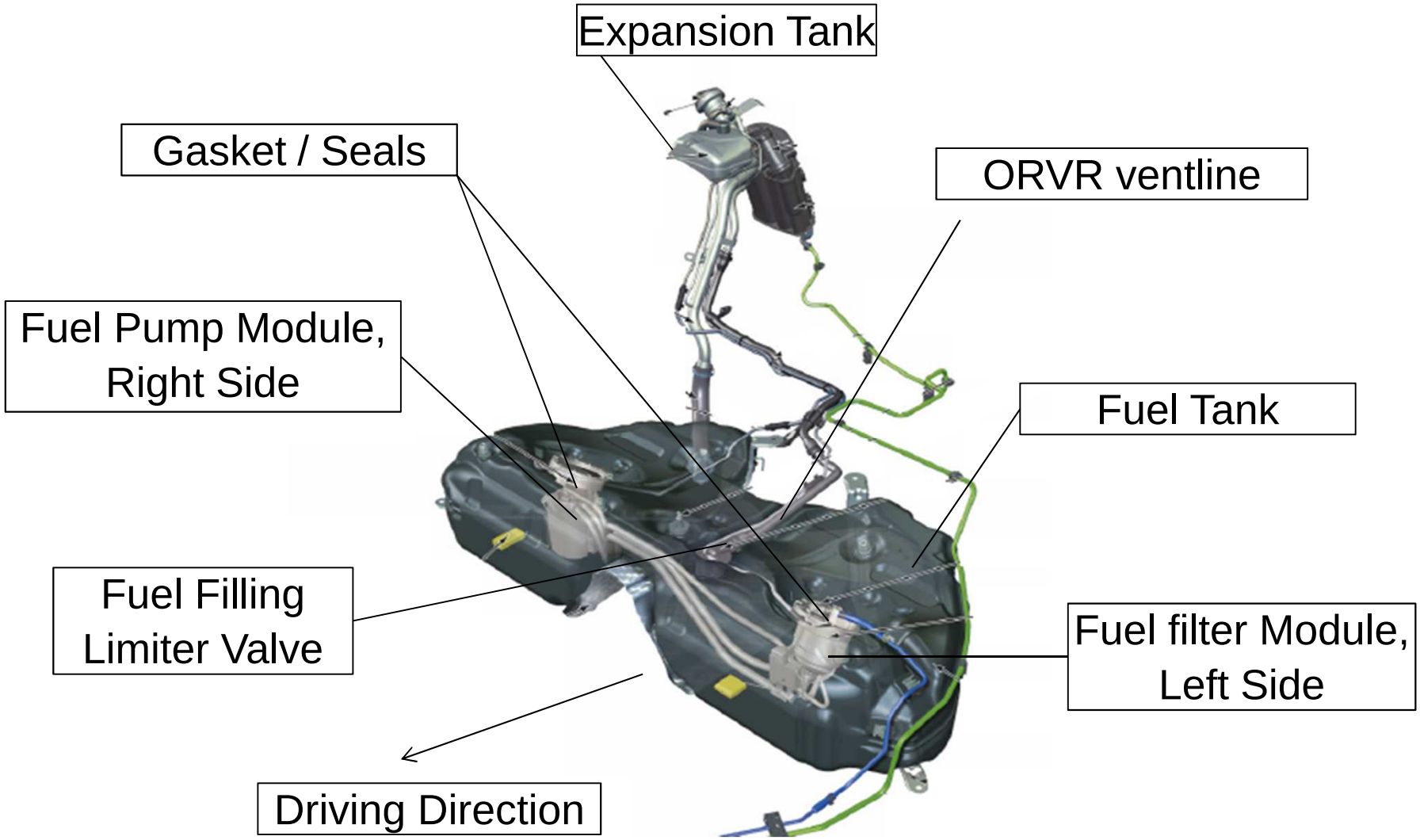
NHTSA Investigation EA13-003 Summary of Tests and Analysis

Mercedes-Benz

Contents

Overview W211 HDPE 80L Fuel Tank System



Tests and Analysis

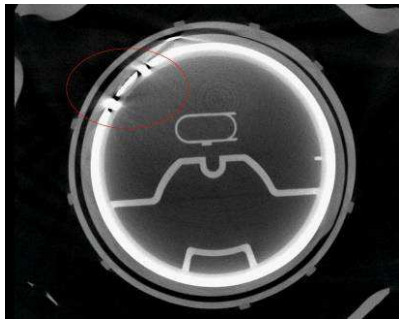
Four types of tests and analysis were performed:

- 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

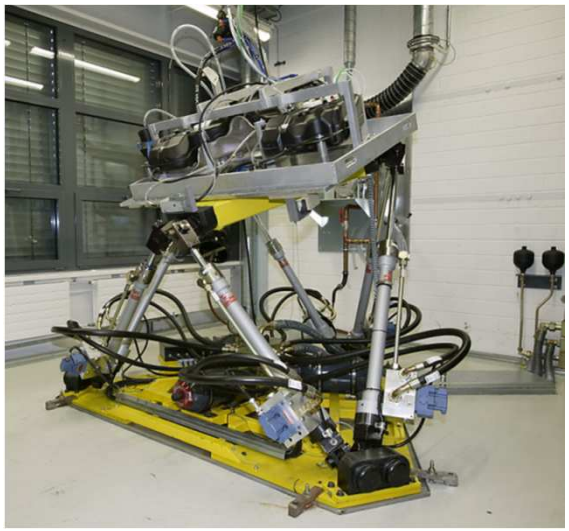
Leakage and Evaporation Rate Measurements

- 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