



EVAP System Test for Pressure-Pulse-Generated Noise

1 Introduction

Note: Nothing in this procedure supersedes applicable laws and regulations unless a specific exemption has been obtained.

Note: In there is a conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. This test procedure will measure the pressure-pulse-generated noise performance of the evaporative emission purge valve and system as installed on-vehicle.

The main purpose is to assess the noise levels and to optimize the design and requirements for the related powertrain and vehicle components.

1.2 Foreword. Two main types of noise are related to the evaporative emission purge valves: 1) pressure-pulse generated noise and 2) mechanical noise. This procedure addresses the testing and assessment of the pressure-pulse-generated noise.

Note: Test Procedure GMN3968TP addresses methods related to the mechanical noise.

Pressure pulses along the fuel vapor lines, are transmitted through structure and airborne paths into the passenger compartment and have been rated as unacceptable.

Due to system interaction, pressure-pulse-based noise tests must be conducted on vehicle.

Good correlation exists between objective SPL data, at the driving frequency of the purge valve, and subjective GMUTS ratings. See Appendix B Characterization tests of the system also revealed that the vibration levels along the purge line are a good indicator of structural transmissibility and GMUTS ratings. See Appendix C

1.3 Applicability. This test is applicable to all vehicles.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMN3968

2.3 Additional References.

GMPT Evaporative Emissions Subsystem Technical Specification (SSTS) section 3.2.1.8 – Noise and Vibration.

GMPT Evaporative Emissions Purge Valve Component Technical Specification (CTS) 03.92.1036, section 3.2.1.1.2 – Noise and Vibration.

3 Resources.

3.1 Facilities. Semi-anechoic vehicle test room with reflective floor. The room must be equipped with vehicle exhaust removal capability.

3.2 Equipment.

3.2.1 Multiple channel data recorder / digital acquisition unit (ex: Sony16 channel digital recorder) and storage media (tape)

3.2.2 Test piece (purge solenoid valve) in the nominal, on-vehicle configuration

3.2.3 Pressure transducers, (piezo-resistive, high frequency response), quantity = 2, (ex: Endevco 8520A)

3.2.4 Accelerometers (ground isolated light weight), quantity = 3, (ex: Endevco 2222c)

3.2.5 Binaural Head: microphones, or appropriate acoustic measuring device to be placed inside the passenger compartment (ex: Aachen Head)

3.2.6 Electrical "jumper" to access the voltage command signal to the valve.

3.2.7 Signal conditioners (appropriate signal conditioners for the transducers)

3.2.8 Hand tools necessary to install and remove valve(s) if required. Hand tools necessary to install and remove pressure transducers.

3.2.9 Adhesive to mount accelerometers (appropriate for accelerometers and mounting surface [e.g. super glue])



3.2.10 Schrader valve removal tool (optional), based on mounting locations of the pressure transducers.

3.3 Test Vehicle/Test Piece.

3.3.1 Representative vehicle with nominal evaporative system components including: fuel vapor lines, attachments to the vehicle and canister.

3.3.2 Purge solenoid valve

3.4 Test Time.

Calendar time: 2 days

Test hours: 10 hours

Coordination: 6 hours

3.5 Test Required Information. Information/instruction necessary to operate: the vehicle, purge solenoid valve, evaporative emission system components, test equipment and facilities.

3.6 Personnel/Skills. Test engineer or technician capable of setting up and operating the valve, vehicle, microphone, accelerometers, instrumentation, and process the data.

Personnel must be capable of making sound and vibration measurements and performing the calculations necessary to compare and assess performance.

4 Procedure

4.1 Preparation.

4.1.1 Calibration. Ensure that all test instrumentation is properly calibrated and functional.

4.1.2 Install the pressure transducers (quantity = 2) Both pressure transducers must be installed in the fuel vapor line, where they do not restrict or impede fluid flow.

The first transducer (1 of 2) should be mounted nearest the purge solenoid valve inlet. Note: The service port is an ideal location to mount this pressure transducer. Modifications to the plastic service port cap (hole drilled through the top) can be made to mount the pressure transducer. See Appendix A. Also, if this location is used, a schrader valve removal tool will be required.

The second transducer (2 of 2) should be mounted nearest the outlet of the purge canister.

4.1.3 Adhere the accelerometers (quantity = 3)

All accelerometers can be mounted with a low mass adhesive (ex: super glue). An ideal location for the 1st accelerometer is on the vapor line, in the engine compartment, near the purge

solenoid valve inlet. The 2nd accelerometer can be mounted along the underbody vapor lines. Finally, the 3rd should be mounted on the canister near the vapor line.

4.1.4 Place the binaural head inside the passenger compartment, preferably in the front passenger seat.

4.1.5 Install the electrical "jumper" to read the valve's voltage command signal. Note: Fabricating a jumper made from an available, spare harness with the appropriate connectors is preferred.

4.1.6 Set-up the multiple channel data recorder / digital acquisition unit (ex: SONY 16 channel digital recorder) to interface with the instrumentation. Ensure that the appropriate sensitivities, signal adjustments and channel definitions are entered and recorded on a data sheet.

4.2 Conditions.

4.2.1 Environmental Conditions. This test is to be performed at cell ambient conditions. Testing at temperatures considered "extreme" is not required.

4.2.2 Test Conditions. Deviations from the requirements of this test procedure shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.2.2.1 Operating conditions.

4.2.2.1.1 Fully assembled vehicle, with valve assembled to vehicle, including all valve mounting components and all purge vapor lines.

4.2.2.1.2 Vehicle hood closed, and all windows and doors completely closed.

4.2.2.2 Measurements.

4.2.2.2.1 Fluid (Vapor) Pressure: Measurements are to be made with the 2 pressure transducers mounted in the fuel vapor lines as referenced in 4.1.2. The typical measurement range is $\sim \pm 15$ kPa.

4.2.2.2.2 Vibration: Measurements are to be made with the 3 accelerometers referenced in 4.1.3. Measurement range is ~ 0 to 2 m/s^2

4.2.2.2.3 Sound Pressure: Measurements are to be made with the binaural head microphones inside the passenger compartment.

4.2.2.2.4 Command voltage: Record the command voltage from the electrical jumper.

4.3 Instructions. In order to assess the noise levels, and to isolate the contributing components, various system configurations should be tested.