



Validation of Static Body Air Leakage

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. Determination and categorization of the air leakage from the passenger compartment of complete vehicles.

1.2 Applicability. For all passenger vehicles with enclosed passenger compartments.

1.3 Remarks. To provide information about air leakage in passenger compartments prior to conducting tests such as:

- HVAC validation.
- Body dust-infiltration.
- Carbon monoxide intrusion.
- Wind noise.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

None

2.3 Additional References.

- Test report.
- Vehicle Technical Specification (VTS).

3 Resources

3.1 Facilities. Any area able to contain the vehicle to be tested and the necessary test equipment.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 General.

3.2.1.1 One (1) airflow measurement device capable of measuring and producing ≥ 215 L/s.

3.2.1.2 One (1) laboratory temperature measuring instrument capable of measuring (0 to +50) °C.

3.2.1.3 One (1) laboratory pressure measurement device capable of measuring (0 to 110) kPa (atmospheric pressure).

3.2.1.4 One (1) laboratory pressure measurement device capable of measuring ± 300 Pa (body pressure).

3.2.1.5 Flexible tubing with diameters of 100 mm minimum (air flow equipment) and 7 mm minimum (pressure measurement).

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3.2.1.6 Side window insert with an opening for the flexible tubes noted in 3.2.1.5.

3.2.1.7 Interior pressure tap piezometer ring (see suggested design in Figure A1, Appendix A) for measuring interior body pressure.

3.2.1.8 Tape and 50 L or larger plastic bags for sealing leakage areas.

3.3 Test Vehicle/Test Piece. Passenger vehicle with HVAC system.

3.4 Test Time.

Calendar time:	1 d
Test time:	2 h
Coordination time:	3 h

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Test technician familiar with test facilities and equipment.

4 Procedure

4.1 Preparation. The vehicle shall be prepared and equipped with devices according to 3.2 and 4.1.

4.1.1 One (1) of the vehicle front windows shall be opened, a cardboard window insert shall be made and sealed into the window opening.

4.1.2 The flexible tube $\approx$ 100 mm, from airflow machine shall be installed through front side of cardboard window insert and the tube shall be sealed at the insert opening.

4.1.3 The interior pressure tap shall be installed in an area where pressure tap is not influenced by airflow (location to be documented on Data Sheet B1, Appendix B). The preferred location is across the 2nd row seat. The flexible tubing $\approx$ 7 mm, shall be installed from the interior pressure tap through the window insert and sealed at insert opening. The tubing shall be connected to the body pressure sensing device (interior body pressure).

4.1.4 The path in the rear of the vehicle to and from the Pressure Relief Valve (PRV) should be design intent. Special care should be taken with any acoustic treatments which could be out of position in development vehicles.

4.1.5 Care shall be taken to unseal all taped openings and sealed areas when the testing is complete.

4.2 Conditions.

4.2.1 Environmental Conditions. Temperature: (+10 to +30) °C.

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

4.3 Instructions.

4.3.1 Test Method.

4.3.1.1 Ensure that all vehicle doors and windows are closed.

4.3.1.2 Seal up the air inlet metal hole opening at the cowl Blower Air Inlet (BAI) with tape.

4.3.1.3 Pressurize the body to the desired test pressure and determine the leakage rate. This is the total body leakage rate as received.

4.3.1.4 Repeat 4.3.1.3 in the following manner:

- #1 (left or upper) pressure relief valve taped.
- Both pressure relief valves taped.
- #2 (left or upper) pressure relief valve un-taped.
- Both pressure relief valves un-taped.

Number

Note: There may be situations where a different quantity of PRVs are part of the vehicle design. Adjust the procedure accordingly.

4.3.1.5 Complete calculations for rows F, G, and H before proceeding (Appendix B).

4.3.1.6 Check that row A and E are approximately the same value. If not: Uncover the source of the test instability.

4.3.1.7 Check that rows G and H total to approximately row F. If not: Uncover the source of the test instability.

4.3.1.8 Repeat 4.3.1.3 through 4.3.1.7 if other cabin air pressures are intended to be run (optional).

4.3.1.9 If required, determine the leakage rate through or around such areas as doors, windows, deck lids, trim panels, exterior handles, etc. This is done by sealing one area and determining the change in leakage rate.

Note: Depending on the test objective, leakage through specific areas can be determined by first sealing all leakage areas. Then the seals can be removed from each area.

Note: Use an airflow worksheet (Excel, see responsible VPO) or the sheet in Appendix B can be printed.

4.3.2 Measuring Values and Data to be Recorded.

4.3.2.1 Pressure in Pa.

- Atmospheric.
- Interior.

4.3.2.2 Airflow in L/s.

- Airflow at test conditions.
- Use corrected values such as Standard Liters Per Second (SLPS) when available.

4.3.2.3 Temperatures in Degrees C.

- Ambient (test conditions).

4.3.2.4 Relative Humidity in Percent.

- Relative humidity at test conditions.

4.3.2.5 Further Measurement Data.

- Vehicle data, mileage and description of the system to be validated.
- Test number and date.
- Name of the person in charge of the test.
- List of calibrated test equipment (Data Sheet C1, Appendix C).

5 Data

5.1 Calculations.

5.1.1 Total Pressure Relief Valve Flow (Controlled Leakage).

$$F = A - C$$

Where:

Letters in the equations correspond to rows in the Appendix B chart. Only calculate between the same column (test pressure).

5.1.2 Individual Relief Valve Flow.

- Determine the average change from both sealing and unsealing each PRV:

$$G \text{ (\#1 PRV Flow)} = ((A - B) + (D - C)) / 2$$

$$H \text{ (\#2 PRV Flow)} = ((B - C) + (A - D)) / 2$$

5.2 Interpretation of Results.

5.2.1 The targets are defined by the Vehicle Technical Specification (VTS).

5.2.2 The results can be used in diagnosis of air balance issues (examples: defogging rear windows, temperature imbalance during cooling or heating tests, acoustic insulator blockage).

5.2.3 An imbalance between PRVs does not necessarily indicate an issue in vehicle performance. Use virtual analysis tools or physical tests to uncover vehicle performance issues.

5.3 Test Documentation. With reference to this test procedure the results of the measurements shall be presented in a test report.