



Air Leak Testing for Leak Rate Determination of Powertrain Sealing Systems

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. This test procedure is used to evaluate the air leak integrity of Powertrain sealing test fixtures intended to contain oil, coolant, air and establishes if the test fixtures and test joints have been sufficiently sealed prior to the start of test, and if any leak path has been created at the end of test (EOT).

1.2 Applicability. This test procedure is suited to the evaluation of all Powertrain sealing systems using a test pressure up to 700 kPa (100 psi).

1.2.1 This test procedure can be used with water/soap mixture or a water tank to determine the location of a leak, as well as with a mass air flow meter to quantify the actual leak rate.

1.2.2 This test is often used with other sealing test procedures. See GMW3152 and GMW3155 as a check of seal integrity.

1.3 Remarks. Supplier Introduction. This test is a required General Motors Powertrain (GMPT) test for any design or process change made to all Powertrain sealing systems, and shall be run according to Section 4. The required test pressure and the maximum allowable leak rate will be specified by the GMPT development, validation, or release engineer who is responsible for the part being tested.

2 References

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

2.1 External Standards/Specifications.

ASTM E515 ISO 8573-1

2.2 GM Standards/Specifications.

9985283 GMW3152 GMW3155

2.3 Additional References.

- American Gas and Chemical Co., Ltd
- Cosmo Instruments Co., Ltd
- Ingersoll-Rand Public Limited Company
- Swagelok Company

3 Resources

3.1 Facilities. A suitable area or room for conducting testing with a stable and known environment.

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.

3.1.3 Air Supply. Either shop air or bottled gas, to perform the air leak test. In line oil and water filters/tanks adequate to keep the air dry and prevent residue from plugging and affecting the accuracy of flow meters. Supply line pressures are typically 413 kPa to 827 kPa (60 psig to 120 psig).

3.2 Equipment. See Appendix A, Figure A1.

3.2.1. In line Filter Units. Keep contaminants out of supply air and flow meters. See Figure 1.

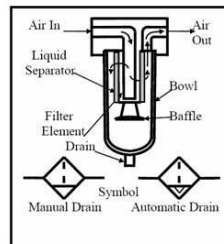


Figure 1: Air and Flow Meter

3.2.2 Desiccator Dryer Filter Unit. See Figure 2.



Figure 2: Dayton or Grainger Speedaire – ISO 8573-1 Class 2 or Class 3

3.2.3 Gas Flow Meter (GFM) Mass Flow Meters (Air/N₂). Tolerance - 1% Full Scale (FS). Gases are connected by means of 6.35 mm (0.75 in), 9.5 mm (0.375 in), 12.7 mm (0.50 in), compression fittings and 19 mm (0.75 in) Female National Pipe Thread (FNPT) fittings. All meters should have the same inlet/outlet fittings. These controllers may be used as bench top units or mounted by means of screws in the base. Shown with digital display. Mass flow meters that are listed have 6.35 mm (0.75 in) FNPT, fittings consisting of the following ranges to measure assembly leak rates. See Figure 3.

- **Sierra Model 822-13-0V1-PV1-V1-Range:** 0 Standard Cubic Centimeters per Minute (SCCM) to 20 SCCM, Tolerance: 1% FS.
- **Sierra Model 822-13-0V1-PV1-V1-MP/Range:** 0 SCCM to 200 SCCM, Tolerance: 1% FS.
- **Cole-Parmer Model EW-32660-12/Range:** 0 Standard Liters per Minute (SLPM) to 1 SLPM. Accuracy of $\pm 1.5\%$ of reading full scale; repeatability of $\pm 0.5\%$.
- **Cole-Parmer Model EU-32660-16/Range:** 0 SLPM to 5 SLPM. Accuracy of $\pm 1.5\%$ of reading full scale; repeatability of $\pm 0.5\%$.
- **Sierra Model 822-13-0V1-PV1-V1-MP/Range:** 0 SLPM to 20 SLPM.



Figure 3: GFM Mass Flow Meter

3.2.4 Calibrated Pressure Transducer. General Purpose Gage/Absolute Pressure Transducer, 0.5 psig/air to 60 000 psig/air ranges. Hermetically sealed. Illustration: Honeywell TJE/708, 0 kPa to 790 kPa; Tolerance: 3% full scale. See Figure 4.



Figure 4: Honeywell TJE/708, 0 kPa to 790 kPa; Tolerance: 3% Full Scale

3.2.5 Non venting final pressure regulators.

3.2.6 Air flow calibrator to calibrate designated air flow meters.

3.2.7 Immersion Tank. Acrylic plastic tank using 15 mm thick wall and base stock, 900 mm × 900 mm × 900 mm interior dimensions. Cover the top wall ends with a drip rail extension in aluminum flat channel segments welded together to prevent damage to the plastic and provide a lifting surface for the tank. Water surfactants are mixed with the water to minimize bubble formation on fixture surfaces. A drain plug or valve feature for the tank is recommended.

3.2.8 Industrial Lifting Device. Hoists rated to fully support a full engine or transmission fixture into and out of a test chamber or immersion tank. Trolley configurations for the hoist provide better transfer control of heavy objects. The chain hoist hook must permit a 360 degree rotation to assist in leak detection.

3.2.9 Liquid Leak Detectors. Soap and water has low sensitivity and tends to obscure small leaks by foaming when applied. See 3.2.9.1 through 3.2.9.2.

3.2.9.1 Leak-Tec Thin Film Bubble Testing Solution. Source: American Gas and Chemical Co., Ltd. Leak-Tec formulas consist of mixtures of stable synthetic surfactants with low surface tension and low interfacial tension on metals, whether clean, tarnished, and oily or covered with oxidation products. Solutions conform to ASTM E515.

Formulations:

- 72V for vacuum and high pressure from 2 °C to 77 °C (sensitivity: $5 \times 10^{-4} \text{ cm}^3/\text{s}$).
- 372E General Purpose use from 2 °C to 71 °C (sensitivity: $1 \times 10^{-5} \text{ cm}^3/\text{s}$).

3.2.9.2 Real Cool Snoop Liquid Leak Detector. Source: Swagelok, -54 °C to 93 °C.

3.2.10 Test stands for holding subassemblies or engines.

3.2.11 Optional Equipment.

3.2.12 Direct Current (DC) Electric or Air Powered Torque Wrench. Clutch controlled, double end spindle to tighten and remove fasteners. The wrench shall have torque capability greater than the value specified for the test fastener. Sockets shall be designed to avoid contact between socket and test part.

3.2.12.1 Torque Transducer (Mounted to Wrench). Measures the torque required to reach the load step by the fastener in Method B. (See 4.3.4).