



Crankcase NOx Measurement

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. Nitrogen Oxide/Oxides of Nitrogen (NO/NOx) gases are a product of combustion and are driven into the engine crankcase as a result of blowby. Concentration of NOx in the engine crankcase can react with fuel and oil components to form sludge. The main purpose of this test is to evaluate the ventilation system's ability to remove NO/NOx gases from the crankcase.

1.2 Applicability. All General Motors Powertrain internal combustion engines with a ventilation system.

1.3 Remarks. The engine vent system is used to remove a mixture of harmful vapors from the crankcase. These vapors are delivered to the intake system from the crankcase due to the pressure differential between the intake system and crankcase. In the advent of a less than optimal design, an unacceptable level of combustion gases may be retained in the crankcase. This test procedure has been developed to measure the amount of NO/NOx gases retained in the crankcase under various engine operating conditions.

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.

- Anstalt für Verbrennungskraftmaschinen List (AVL), an Austrian based automotive engineering consulting firm, www.avl.com
- Moroso Performance Products, based out of Guilford, Connecticut, www.moroso.com
- Ventilation Subsystem Technical Specification (SSTS) Target 3.2, Crankcase NOx level target in SSTS performance file

3 Resources

3.1 Facilities. Engine or vehicle dynamometer cell, with a dynamometer capable of simulating road load.

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 AVL emissions bench or other approved gas analysis device capable of measuring NO and NOx emissions in parts per million (ppm).

3.2.2 Heated oil filtration unit.

3.2.3 Appropriate adapters to seal test bench lines to dipstick tube and fill cap openings.

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May 2014

Page 1 of 6

3.2.4 Heated (heater blanket or other) flexible braided steel tubing to connect the test port to the filter, and from the filter to the emissions bench.

3.2.5 Air/oil separation unit equivalent in size/performance to Moroso Performance Products Part Number (P/N) 85496.

3.2.6 Air/oil separation unit for vacuum pump, equivalent in size/performance to Moroso Performance Products P/N 85495.

3.2.7 Peristaltic pump and catch jar (see Figure 1).

3.2.8 Stopwatch or equivalent (if taking data point without automatic sampling capability).

3.3 Test Vehicle/Test Piece.

3.3.1 Obtain versions of the latest design intent engine, whether an engine alone or an engine in a test vehicle.

3.3.2 Correct ventilation hardware must be installed and left active for this test. This includes foul/fresh air orifice(s), air/oil separator(s), ventilation lines, flow control orifice, Positive Crankcase Ventilation (PCV) valve, pressure regulating valve, etc.

3.3.3 Service fill (production intent for model year of system being tested) engine oil must be used.

3.4 Test Time.

Calendar time: 1 day

Test hours: 7 hours

Coordination hours: 2 hours

3.5 Test Required Information.

3.5.1 The intended location, routing, and functionality of both the foul and fresh air engine ventilation system.

3.5.2 The correct service fill amount of oil for the engine. Consult with the Design Release Engineer (DRE) for the correct oil amount.

Note: Service fill is the amount of oil when added to the engine after a filter change that will bring the oil level to the maximum mark on the dip stick.

3.5.3 Determine what, if any, changes of parts on the engine were previously done which may influence the functionality of the ventilation system and/or the production of NO/NO_x emissions (e.g., fuel system, engine calibration, PCV valves, etc.) Insure these changes are intended for the production application.

3.6 Personnel/Skills.

3.6.1 A qualified test cell technician with the latest training should be utilized to run this test. Technician knowledge should also include operation of the emissions bench being used. Test technician (or other appropriate personnel) should also be trained in set up and configuration of emissions equipment being used.

4 Procedure

4.1 Preparation.

4.1.1 Insure that all components in the crankcase ventilation circuit on the engine being tested are of the latest design-intent configuration. If it is necessary to do this test with deviating parts (e.g., Mule car, Alpha engine, Beta engine, etc.), the deviation shall be noted.

4.1.2 The position of the engine must be verified to be within ± 0.1 degrees of the intended engine installed position, whether the procedure is being performed on an engine alone or on an engine installed in a vehicle.

4.1.3 The appropriate test measurement location on the engine (oil fill cap, dipstick tube, foul ventilation port, etc.) must be connected to the emission bench test line via a sealed coupler. A heated filter must be installed in line with this measurement circuit to protect the emission bench from oil contamination. Refer to Figure 1 for an outline of test equipment setup.

4.1.4 The bench test lines must be heated to prevent water condensation from occurring, which can invalidate the test results.

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Page 2 of 6