



Test Method to Quantify Cleanliness of Engine and Transmission Components

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 document outlines two analytical test methods for determining the mass (and size or size distribution, if specified) of foreign material (e.g., sand, machining chips, blasting media, etc.) retained in or on any engine or transmission components.

Note: If no test method is specified, method A will apply.

1.1.1 Method A. Is typically applicable when measuring gross amounts of sediment such as foundry sand or in-process parts that are rough machined. This method may also be used when there is a need to provide faster results for a large number of components or to reduce costs.

1.1.2 Method B. Based on the ISO 16232 methodology for measuring debris. This method uses more rigorous procedures resulting in a tightly controlled and repeatable methodology. It is typically employed for parts that are finished machined with interior passageways that require a higher level of quality control through the use of qualification tests and blank values.

1.2 Applicability. These methods may be used to quantify foreign material present in or on engine and transmission components, including sub-assemblies and assemblies.

1.3 Remarks. These methods involve washing components with a fluid, collecting the fluid, filtering the solid materials from it, and determining the mass (and size or size distribution, if specified) of the solids present.

2 References

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

2.1 External Standards/Specifications.

ISO 16232 ISO 17025

2.2 GM Standards/Specifications.

None

3 Resources

3.1 Facilities. The cleanliness of the environment where the extraction is performed shall be consistent with the presumed cleanliness of the component to test. This may result in the test being carried out in a laboratory or controlled workplace for Method A. For Method B, the test procedure must be carried out in an enclosed and ventilated room or laboratory separate from the plant environment. This will protect the equipment and minimize the possibility of introducing extraneous foreign material to the components. Debris contamination from extraneous sources may require the use of sticky mats at the entrance to the room, personal gowns, hair nets, booties and gloves, positive air pressure, non-fibrous furniture and towels, minimizing fluid and sediment transfer, regular cleaning of any item that frequently leaves and enters the room such as carts or part storage containers. Food, drink, or other non-essential items may also contribute to false high debris measurements. Consideration should be given on whether or not these items are to be allowed in the room.

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

The suitability of the environment is recommended to be verified by performing the blank test per ISO 16232. The blank test is required when using Method B.

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.

Alternative test facilities and equipment may be considered for Method A upon agreement with GM Materials Engineering and Product Engineering Technical Specialist.

3.2 Equipment. Required equipment and materials for both Methods A and B are listed below. A list of additional equipment and materials which may be utilized in evaluating components for sediment levels is shown in Appendix A or in the case of Method B, the appropriate ISO 16232 standard. An example of the equipment setup is shown in Figure A2.

3.2.1 Drying oven with a thermometer (Figure 1).



Figure 1: Drying Oven with a Thermometer

3.2.2 Desiccator.

3.2.3 Analytical balance capable of reading to 0.1 mg (Figure 2).



Figure 2: Analytical Balance

3.2.4 Vacuum pump manifold and trap, if not already integrated into the purchased cleaning system (e.g., PALL cabinet).

3.2.5 Squeegee.

3.2.6 Drum pump or wash solution reservoir, if not already integrated into the purchased cleaning system (e.g., PALL cabinet).

3.2.7 Stainless steel rinse collection system which is washable and/or drainable, if not already integrated into the purchased cleaning system (e.g., PALL cabinet). See Figure 3 and Figure 4.



Figure 3: Example of Stainless Steel Rinse Collection Sink for Method A



Figure 4: Example of PALL Cabinet for Method A or B

3.2.8 Sidearm flask, filter funnel, beakers, and wash bottles. See Figure 5.



Figure 5: Side-arm Flask

3.2.9 The filter media is to be agreed upon between GM Materials Engineering, Product Engineering, and the supplier. The filter media must be compatible with the wash fluid and must be clearly stated in the test report. The default filter media for each method is listed below however alternative filter media is listed in Appendix A.

3.2.9.1 Default for Method A, 10 micron nylon filter membrane.

3.2.9.2 Default for Method B, 5 micron filter composed of either a PA 6.6 foam monolayer reinforced with integrated PET-fleece, Nitrocellulose, or PVDF.

3.2.9.3 Use of larger size (i.e., 44 or 150 micron) filter in series with the 10 or 5 micron filter is useful in reducing particle load. If sequential filters are used then a minimum separation must be maintained to prevent backpressure.

3.2.10 The wash fluid should contain less residual sediment than would be collected with the finest filter being used in the sediment test. The wash fluid should be a non-polar organic liquid with a flash point > 40 °C which

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