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SURFACE VEHICLE RECOMMENDED PRACTICE

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Air Cleaner Test Code

***Foreword*—**The basic performance characteristics of greatest interest are airflow restriction or pressure drop, dust collection efficiency, dust capacity, and air cleaner structural integrity. This test code, therefore, addresses itself to the measurement of these parameters.

The objective of the test code is to provide a uniform means for evaluating the performance characteristics of air cleaners on bench test equipment. The data collected by this test code can be used to establish standards of performance for air cleaners tested in this manner. The actual field operating conditions (humidity, vibration, contaminant, etc.) are difficult to duplicate. However, by use of these standard test methods, the test conditions are controlled, and comparisons of lab performance of filters may be made with a high degree of confidence.

The equipment specified in these standard tests assures that all particles of test dust are evenly dispersed, eliminating agglomerates, to a degree not possible in prior standard tests. For this reason, apparent filtration efficiency and dust capacity by these tests can be significantly lower than if the same filter were tested by the older methods. These results are more repeatable and reliable than the earlier test methods and correlations among the laboratories using these methods are now possible.

To simplify and improve the clarity of this test code, Section 1, covers general information and definitions applicable to all air cleaner testing covered in this test code. Section 4 covers the testing of dry type air cleaners normally used on automobile internal combustion engines. Section 5 covers the testing of industrial dry type air cleaners and precleaners for mobile and stationary internal combustion engines. Section 5 covers the testing of oil bath air cleaners used for mobile and stationary internal combustion engines.

***1. Scope*—**The air cleaner test code has been established to cover dry type and oil bath air cleaners used on internal combustion engines and to present a uniform method of determining and reporting air cleaner performance.

1.1 Purpose—The purpose of this test code is to establish and specify uniform testing procedures, conditions, equipment, and a performance report to permit the direct laboratory performance comparison of dry type and oil bath type air cleaners, respectively.

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1.2 Measurement Accuracy

1.2.1 Measure the airflow rate within 2% of the actual value.

1.2.2 Measure the pressure drop and restriction within 0.25 mbar (0.025 kPa) of the actual value.

1.2.3 Measure the temperature within 0.5 °C of the actual value.

1.2.4 Measure the weight within 1% of the actual value except where noted.

1.2.4.1 Weigh the absolute filter(s) to ± 0.01 g.

1.2.5 Measure the relative humidity with an accuracy of 2% R.H.

1.2.6 Measure the barometric pressure within 3 mbar (0.3 kPa).

1.2.7 The measurement equipment shall be calibrated at regular intervals to ensure the required accuracy.

1.3 Test Conditions and Material

1.3.1 The test dust contaminant shall be standardized and shall be of two grades labeled FINE and COARSE. The following chemical analysis (Table 1) is typical:

TABLE 1—CHEMICAL ANALYSIS OF TEST DUST

Chemical	% of Weight
SiO_2	65 – 76
Al_2O_3	11 – 17
Fe_2O_3	2.5 – 5.0
Na_2O	2 – 4
CaO	3 – 6
MgO	0.5 – 1.5
TiO_2	0.5 – 1.0
V_2O_3	0.10
ZrO	0.10
BaO	0.10
Loss on Ignition	2 – 4

1.3.1.1 Before using the test dust, a quantity sufficient to cover test requirements shall be mixed in a sealed container for a minimum of 15 min. This test dust shall then be dried to a constant mass at a temperature of 105 °C ± 5 °C. The test dust shall then be allowed to become acclimatized to a constant mass under the prevailing test conditions.

NOTE— To ensure a constant rate of dust feed with some dust feeders, it may be found necessary to heat the dust prior to being fed to the injector.

1.3.2 The particle size distribution by volume as measured with an L & N Microtrac Analyzer shall be as follows in Table 2:

TABLE 2—PARTICLE SIZE DISTRIBUTION BY VOLUME, %

Size, Microns	Fine Grade (% less than)	Coarse Grade (% less than)
5.5	38 ± 3	13 ± 3
11	54 ± 3	24 ± 3
22	71 ± 3	37 ± 3
44	89 ± 3	56 ± 3
88	97 ± 3	84 ± 3
176	100	100

1.3.2.1 (Reference Only)—The particle size distribution by mass as measured by the Andreason method is given in Table 3:

TABLE 3—PARTICLE SIZE DISTRIBUTION, ANDREASON METHOD PERCENTAGE BY MASS

Size μm	Fine Grade %	Coarse Grade %
< 125	----	98.5 ± 1.5
< 75	98 ± 2	84.5 ± 5.5
< 40	84 ± 3	51 ± 2
< 20	67 ± 3	32 ± 2
< 10	49 ± 3	19.5 ± 1.5
< 5	35 ± 3	10 ± 1
< 2	17.5 ± 2.5	----

1.3.2.2 (Reference Only)—The particle size distribution as measured by a Roller analyzer and described in % weight is given in Table 4.

TABLE 4—PARTICLE SIZE DISTRIBUTION BY WEIGHT, %

Size, Microns	Fine Grade	Coarse Grade
0 – 5	39 ± 2	12 ± 2
5 – 10	18 ± 3	12 ± 3
10 – 20	16 ± 3	14 ± 3
20 – 40	18 ± 3	23 ± 3
40 – 80	9 ± 3	30 ± 3
80 – 200	----	9 ± 3

1.3.2.3 Test Dust (Coarse and Fine) is manufactured by Powder Technology Inc. Dust capacity differences may occur between different dust batches. Therefore, it is recommended that comparison testing of filters be performed using a single batch of dust per test program whenever possible.

1.3.3 ABSOLUTE FILTER MATERIALS—The absolute filter shall consist of fiberglass media with a minimum thickness of 12.7 mm and a minimum density of 9.5 kg/m^3. The fiber diameter shall be 0.76 to 1.27 μm and the moisture absorption shall be less than 1% by weight after exposure of 49 °C and 95% relative humidity for 96 h. The filter shall be installed with nap side facing upstream in an airtight holder that adequately supports the media. The face velocity shall not exceed 50 m/min to maintain media integrity.

To reduce any subsequent errors in the measurements caused by loss of fibers or materials, the absolute filter shall be subject to a flow of at least 110% of the rated flow of ambient air for 15 min before the test weighings.

1.3.4 ABSOLUTE FILTER WEIGHT—The absolute filter shall be weighed to the nearest 0.01 g after the weight has stabilized and while in a ventilated oven at 105 °C ± 5 °C.

NOTE— If stabilization cannot be determined, a minimum time of 4 h is required.