Designation: F3150 – 15

Standard Specification for HEPA Filtration System Performance of Residential and Commercial Vacuum Cleaners[1]

This standard is issued under the fixed designation F3150; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification defines industry acceptable test methods and approaches for evaluating residential and commercial vacuum cleaner filtration systems to HEPA filtration performance levels.

1.2 This specification defines the minimum filtration efficiency requirements for achieving HEPA performance for filtration systems of residential and commercial vacuum cleaners.

1.3 This specification applies only to residential and commercial vacuum cleaning products that are used in non-critical applications. Non-critical applications refers to applications not requiring the removal of hazardous dust as defined per IEC 60335-2-69.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F1977 Test Method for Determining Initial, Fractional, Filtration Efficiency of a Vacuum Cleaner System

F2608 Test Method for Determining the Change in Room Air Particulate Counts as a Result of the Vacuum Cleaning Process

F395 Terminology Relating to Vacuum Cleaners

2.2 *European Standards:*[3]

EN 1822–5 High Efficiency Air Filters (EPA, HEPA, and ULPA) – Part 5: Determining the Efficiency of Filter Elements

2.3 *IEST Standards:*[4]

IEST-RP-CC0001.5 HEPA and ULPA filters

IEST-RP-CC0007.2 Testing ULPA Filters

IEST-RP-CC0034 HEPA and ULPA Filter Leak Tests

2.4 *IEC Standard:*[5]

IEC 60335–2–69, Edition 4.0 Particular Requirements for Wet and Dry Vacuum Cleaners for Commercial use, Clause 3.104

3. Terminology

3.1 *Definitions:*

3.1.1 *commercial vacuum cleaner*—a vacuum cleaner suitable for the heavy duty and sometimes continuous cleaning tasks encountered in establishments such as hotels, motels, office buildings, churches, clubs, etc.

3.1.2 *filtration system*—refers to the filtration efficiency performance of the vacuum cleaner's dust capturing system minus any motor emissions. Motor emissions are not included in determining filtration system efficiency performance since motor emissions are generated independently of the cleaning process and are not a part of the dust and debris being removed from the floor surface. Motor emissions are addressed under Test Method F2608.

3.1.3 *HEPA (High Efficiency Particulate Air)*—refers to a level of filtration performance in terms of particulate efficiencies.

3.1.4 *residential vacuum cleaner*—a vacuum cleaner suitable for the normal cleaning tasks encountered in residences and family households, in contrast to a commercial vacuum cleaner.

4. Sampling

4.1 A minimum of three units of the same model vacuum cleaner selected at random in accordance with good statistical practice shall constitute the population sample.

[1] This specification is under the jurisdiction of ASTM Committee F11 on Vacuum Cleaners and is the direct responsibility of Subcommittee F11.23 on Filtration.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from British Standards Institution (BSI), 389 Chiswick High Rd., London W4 4AL, U.K., http://www.bsigroup.com.

[4] Available from Institute of Environmental Sciences and Technology (IEST), Arlington Place One, 2340 S. Arlington Heights Rd., Suite 100, Arlington Heights, IL 60005-4516, http://www.iest.org.

[5] Available from International Electrotechnical Commission (IEC), 3, rue de Varembé, P.O. Box 131, CH-1211 Geneva 20, Switzerland, http://www.iec.ch.

4.2 To determine if the population of the vacuum cleaner model being tested meets the minimum filtration efficiency requirements for HEPA, each of the three sample units of a given model shall be evaluated by performing three test runs. The results from each test run of each sample unit must meet the minimum filtration efficiency defined for HEPA established per Option 1 or 2 of this standard.

5. Test Methods

5.1 Two test options are available for determining whether or not the filtration efficiency of a vacuum cleaner achieves HEPA performance.

5.1.1 *Option 1*—A vacuum cleaner is defined as HEPA if it meets both of the following criteria provided in Table 1 below. There are two steps required for this option.

5.1.1.1 *Step 1*—The primary filter is tested first per one of the cited standards (IEST or EN) listed in Table 1 and found to comply with the minimum HEPA efficiency requirements as cited by the respective standard. The test flow rate for this filter testing must be the same flow rate as specified in Test Method F1977 for the complete vacuum under test.

5.1.1.2 *Step 2*—The complete vacuum is to be tested per Test Method F1977 for leak testing, and the filtration efficiency (minus motor emissions) is found to be ≥99.97 % at the 0.3 to 0.5 µm particulate range.

NOTE 1—The rationale for this two-step definition is based on the IEST-RP-CC0001.5, Table E2, in which a HEPA vacuum is defined as having a filter that meets HEPA class A, B, H, I, C, J, K and passes a leak test with a mean size of 0.3 µm per IEST-RP-CC0034.

5.1.2 *Option 2*—A vacuum cleaner is defined as HEPA if the complete vacuum is tested per Test Method F1977, but modified for the particulate challenge and instrumentation of one of the cited HEPA standards (IEST or EN) in Table 2, and the filtration efficiency (minus motor emissions) is found to be greater than or equal to the minimum filtration efficiency requirements for HEPA as cited by the respective standard.

NOTE 2—Vacuum cleaners defined as HEPA have a single class. There are no multiple levels for HEPA vacuum cleaners at this time.

6. Keywords

6.1 efficiency; filtration; HEPA; vacuum cleaner

TABLE 1

Step/Description	Method/Standard	Flow	Challenge	Particle Size range, µm	Requirement
1 – filter alone	IEST-RP-CC0001, IEST-RP-CC0007, or EN 1822–5	Same as full vacuum flow rate per Test Method F1977	As specified in the cited methods—typically oil aerosol or latex spheres	Per the cited methods	Per cited method
2 – full vacuum	Test Method F1977	Per Test Method F1977	KCl (neutralized)	0.3 to 0.5 µm	≥99.97 %

TABLE 2

Flow Loop	Sampling	Time and Sequence	Challenge	Particle Size Range	HEPA Methods	Requirement
Test Method F1977	Test Method F1977	Test Method F1977	Per the cited HEPA methods—typically oil aerosol or latex spheres	Per the cited methods	IEST-RP-CC0001, IEST-RP-CC0007, or EN 1822–5	Per cited method