Designation: F 91 – 70 (Reapproved 2001)ε1

Standard Practice for Testing for Leaks in the Filters Associated With Laminar Flow Clean Rooms and Clean Work Stations by Use of a Condensation Nuclei Detector[1]

This standard is issued under the fixed designation F 91; 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.

ε[1] NOTE—Keywords were added editorially July 2001.

1. Scope

1.1 This practice covers the testing of the integrity of high-efficiency particulate air (HEPA) filters installed in laminar flow clean rooms of the ceiling to floor or wall to wall type, and laminar flow clean work stations. The recommended practice may be used to detect faults or voids in the filter media itself or in the joints between the filter and the room or work station structure. The determination of filter media efficiency is not within the scope of this practice.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *This standard does not purport to address all of the safety concerns 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. Terminology

2.1 *Definitions:*

2.1.1 *condensation nuclei*—particles within the size range from 0.001 to 0.1-μm radius.

2.1.2 *HEPA filter*—high-efficiency particulate air filter.

2.1.3 *laminar flow*—airflow in which the air confined within the walls of a room or a smaller work station moves as an isovelocity front along parallel flow lines.

2.1.4 *leak*—a gap or void in the filter media, or in the associated gaskets, which permits unfiltered room air to penetrate the clean room or clean work station.

3. Summary of Practice

3.1 This recommended practice takes advantage of the fact that a HEPA filter retains a high percentage of the condensation nuclei found in ordinary room air. In this recommended practice a nuclei counting apparatus is arranged to sample small areas at the filter surface and the joints at the filter edges. The HEPA filter effluent normally shows a low nuclei count (<100 particles/cm^3). When a leaking filter area is encountered, an increase of at least ten-fold in the particle count is noticed within the 2-s response time of the nuclei counter.

4. Apparatus

4.1 *Condensation Nuclei Counter*[2,3].

4.2 *Plastic Tubing*[4], ⅜ in. (9.5 mm) in outside diameter; ¼ in. (6.5 mm) in inside diameter; of suitable length, not to exceed 5 ft. (1.5 m).

4.3 *Glass Laboratory Funnel*, 50 mm in outside diameter, 7 mm in stem diameter, 80 mm over-all length.

4.4 *Double-Pole Single-Throw Relay*, 115 V, 8 A.

5. Preparation for Test

5.1 Assemble the apparatus by slipping one end of the plastic hose over the funnel stem, and the other end over the nuclei counter input nipple.

5.2 Turn on the electrical supply to the nuclei counter and allow 30 min warm up time with the input tube sampling the effluent from a HEPA filter.

5.3 Measure the nuclei concentration at the intake to the HEPA filter. A concentration of less than 1000 particles/cm^3 indicates a concentration insufficient for conveniently detecting leaks in the filter or its gaskets.

5.3.1 In the event that a nuclei concentration of less than 1000 particles/cm^3 occurs when sampling a clean work station, move the work station into a room having a less clean ambient such as a room not supplied with filtered air.

5.3.2 In the event that the intake nuclei concentration of less than 1000 particles/cm^3 occurs in a laminar flow room of the

[1] This practice is under the jurisdiction of ASTM Committee E21 on Space Simulation and Applications of Space Technology and is the direct responsibility of Subcommittee E21.05 on Contamination.

Current edition approved Oct. 2, 1970. Originally issued 1968. Replaces F91 – 68 T. Published December 1970. Originally published as F91 – 68 T. Last previous edition F91 – 60 T.

[2] Rich, T. A., "A Continuous Recorder for Condensation Nuclei," *Geofisica Pura e Applicata*, Milano, Vol 50 1961 III, pp 46–52.

[3] General Electric Co., Schenectady, NY, Model No. 112L482G1 has been found satisfatory.

[4] Tygon tubing or equivalent has been found satisfactory for this purpose.