



Standard Method for Measuring and Counting Particulate Contamination on Surfaces¹

This standard is issued under the fixed designation F 24; 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 method covers the size distribution analysis of particulate contamination, 5 μm or greater in size, either on, or washed from, the surface of small electron-device components. A maximum variation of two to one ($\pm 33\%$ of the average of two runs) should be expected for replicate counts on the same sample.

NOTE 1—For satisfactory results on clean parts, it is recommended that all procedures involved in sample preparation be conducted under a dust shield.

2. Terminology

2.1 Definitions:

2.1.1 *particulate contaminant*—a discrete quantity of matter that is either foreign to the surface on which it rests or may be washed from the surface on which it rests by the ultrasonic energy procedure herein described.

2.1.2 *particle size*—the maximum dimension of the particle.

2.1.3 *fibers*—particles longer than 100 μm with a length to width ratio of greater than 10:1.

2.1.4 *planar surface*—a surface that does not move out of the depth of field of the microscope when the area to be observed is traversed under the highest magnification to be used.

3. Summary of Method

3.1 The method comprises two procedures for preparing specimens for microscopical analysis: one for adhered particles on planar surfaces and the second for particulate contamination removed from irregular surfaces. A single optical analysis procedure is presented for particle enumeration in stated size ranges. For planar surfaces, the component is mounted on a suitable flat support and mounted on the microscope stage. For irregular surface components, the contamination is removed by subjecting the component to an ultrasonic cavitation field while immersed in water containing a detergent. The contamination is subsequently transferred to a membrane filter disk by

filtration and then examined microscopically. Microscopical analysis of the contaminant is conducted at two magnifications using a gating measurement technique with oblique incident lighting. Particles are counted in three size ranges: >100 μm, 25 to 100 μm, 5 to 25 μm, and fibers. For low-contamination levels on irregularly shaped components, a procedure for running a blank is described. The method required strict adherence to the procedures for cleaning apparatus.

4. Apparatus

4.1 *Microscope*, with mechanical stage, approximately 45 and 100×. For 100× magnification, the recommended objective is 10 to 12× (but a minimum of 6×) with a numerical aperture of 0.15 minimum. The optimum equipment is a binocular microscope with a micrometer stage. A stereomicroscope should not be used in this procedure.

4.2 *Ocular Micrometer*, B & L 31-16-10, or equivalent.

4.3 *Stage Micrometer*, B & L 31-16-99, or equivalent, having 0.1- to 0.01-mm calibration.

4.4 *Light Source*—An external incandescent high-intensity, 6-V, 5-A source with transformer.

4.5 *Microscope Slides*—Glass slides 50 by 75 mm.

4.6 *Plastic Film*²—Wash with membrane-filtered isopropyl alcohol.

4.7 *Solvent Filtering Dispenser*.³

4.8 *Membrane Filter Holder*, having 47-mm diameter and heat-resistant glass base.⁴

4.9 *Filter Flask*, 1 L.

4.10 *Membrane Filters*,⁵ having 47-mm diameter, 0.45-μm pore size, black, grid marked.

4.11 *Vacuum Source*—Pump or aspirator (tap recommended).

4.12 *Flat Forceps*, with unserrated tips.

4.13 *Plastic Petri Dishes*.⁶

² Saran plastic film or equivalent has been found satisfactory for this purpose.

³ Millipore Type XX 66 02500, manufactured by the Millipore Filter Corp., or equivalent, has been found satisfactory for this purpose.

⁴ Millipore XX 1004700 or equivalent has been found satisfactory for this purpose.

⁵ Millipore Type HABG 04700 manufactured by the Millipore Filter Corp., or equivalent, has been found satisfactory for this purpose.

⁶ Millipore PD 10 04700 or equivalent has been found satisfactory for this purpose.

¹ This method is under the jurisdiction of ASTM Committee E-21 on Space Simulation and Applications of Space Technology and is the direct responsibility of Subcommittee E21.05 on Contamination.

Current edition approved May 10, 2000. Published September 2000. Originally published as F 24 – 62 T. Discontinued January 1992 and reinstated as F 24 – 00.