



Standard Test Method for Dust Erosion Resistance of Optical and Infrared Transparent Materials and Coatings¹

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1. Scope

1.1 This test method covers the resistance of transparent plastics and coatings used in aerospace windscreens, canopies, and viewports to surface erosion as a result of dust impingement. This test method simulates flight through a defined particle cloud environment by means of independent control of particle size, velocity, impact angle, mass loading, and test duration.

1.2 *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

- D618 Practice for Conditioning Plastics for Testing
- D1003 Test Method for Haze and Luminous Transmittance of Transparent Plastics
- D1193 Specification for Reagent Water
- E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves
- E168 Practices for General Techniques of Infrared Quantitative Analysis (Withdrawn 2015)³

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *mass loading, n*—the mass of dust per unit of total exposed surface area (including the sample holder) that impinges on the specimens.

3.1.2 *mean IR transmission, n*—for the purposes of this standard, the average percentage of light transmitted by a material in the 8- to 12- μ m bandwidth.

3.1.3 *sweep time, n*—the time required for one translation pass.

3.1.4 *translation pass, n*—the translation of the specimen platform from the vertical or horizontal limit to the corresponding vertical or horizontal limit.

3.1.5 *translation cycle, n*—the translation of the specimen platform from the vertical or horizontal limit to the corresponding vertical or horizontal limit and back to the initial vertical or horizontal limit. Two translation passes are equivalent to one translation cycle.

3.2 Symbols:

- A_s = reference surface area of specimen platform (cm^2),
- C_c = simulated cloud concentration (g/m^3),
- h_o = percent haze before exposure,
- h_e = percent haze after exposure,
- $\dot{m}_p$ = rate of particle mass impacting the reference surface area (g/min),
- $\dot{m}_i$ = incremental mass loading (g/cm^2),
- m_T = total mass loading (g/cm^2),
- N = number of increments,
- V_p = particle impact velocity (m/s),
- t_s = sweep time(s),
- T_e = optical or mean infrared (IR) transmission after exposure (%),
- T_o = optical or mean IR transmission before exposure (%),
- α = impact angle (normal incidence = 90°),
- Δt_i = exposure time (min) for loading increment i ,
- ϕ_i = incremental dust load (g/cm^2) for loading increment i ,

- Φ = total dust load (g/cm^2),
- Δh = change in percent haze, and
- ΔT = change in optical or IR transmission.

4. Summary of Test Method

4.1 This test method consists of: (1) measuring and recording the light transmission properties, at visual or infrared wavelengths, of test coupons; (2) mounting the coupons in a test fixture; (3) exposing the coupons to a dust particle stream;

¹ This test method is under the jurisdiction of ASTM Committee F07 on Aerospace and Aircraft and is the direct responsibility of Subcommittee F07.08 on Transparent Enclosures and Materials.

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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 The last approved version of this historical standard is referenced on www.astm.org.