



Designation: F428 – 19

Standard Test Method for Intensity of Scratches on Aerospace Glass Enclosures¹

This standard is issued under the fixed designation F428; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope

1.1 This test method covers the visual inspection of scratches on the glass surface of aerospace transparent enclosures.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *This standard may involve hazardous materials, operations, and equipment. 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *Other Standards:*²

[Glass Scratch Visual Comparison Standard](#)

3. Summary of Test Method

3.1 A visual comparison is made between a set of graded scratch standards and the scratch on the glass aerospace transparency to determine the relative intensity of the scratch.

4. Significance and Use

4.1 Scratches exist on all glass surfaces. Often there are very fine scratches from cleaning operations that are not visible

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.

Current edition approved Nov. 1, 2019. Published November 2019. Originally approved in 1977. Last previous edition approved in 2014 as F428 – 09(2014). DOI: 10.1520/F0428-19.

² The sole source of supply of the Glass Scratch Visual Comparison Standard known to the committee at this time is Davidson Optronics, Inc., 2223 Ramona Blvd., West Covina, CA 91790. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.

when looking through the glass. Visible scratches may be distracting to the observer looking through the transparency. Therefore, a procedure to define the severity of scratches is useful. A visual standard is used because it is not practical to measure the dimensions of the fine scratches in the scope of this test method.

5. Reference Materials

5.1 *Glass Scratch Visual Comparison Standard* consists of a set of six hermetically sealed glass plates 38 mm square with scratches of graded intensity on the inside surface. The lightest scratch is identified as ASTM F428-3 and the heaviest as ASTM F428-8.³

6. Procedure

6.1 Place the part in a suitable inspection position. This shall be horizontal on a padded table, vertical against a neutral to dark background, or at an angle simulating the installed position. The scratched surface shall be toward the observer. The light level shall be a minimum of 80 lux. Either natural or artificial light shall be used. If possible, move the light until the scratch has the highest contrast against the background. Place the scratch in the visual comparison standard beside and parallel to the scratch in question. Rotate the part or viewing angle to get the best definition of the scratch. Disregarding the length of the scratch on the part and on the standard, select and record the standard that most closely matches the appearance of the scratch on the part. Measure and record the length of the scratch to the nearest 1 mm.

7. Interpretation

7.1 Customer specifications for aerospace glass surfaced transparent enclosures shall be used to detail allowable frequency, location, length, and ASTM standard scratch number for scratches, and they shall be used to assign maximum scratch limits for critical and noncritical optical viewing areas.

³ Originally an adjunct that contained seven scratches was used. The finest scratch (ASTM F428-2) was determined to be too difficult to use and manufacture. Subsequently, it has been discontinued. Continued use of the older, seven-piece set is acceptable.

8. Report

8.1 For each scratch within the scope of the glass scratch standard, report its ASTM standard number (for example, ASTM F428-5), length, frequency, and location.

9. Precision and Bias⁴

9.1 *Precision:*

⁴ Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:F07-1008. Contact ASTM Customer Service at service@astm.org.

9.1.1 The repeatability of judging the intensity of a scratch within one scratch value, for the same observer, is 90 % or better.

9.1.2 The reproducibility (between observers) of judging the intensity of a scratch within two scratch values is 87 % or better.

9.2 *Bias*—The procedure in this test method has no bias because the scratch intensity is defined only in terms of the test method.

10. Keywords

10.1 glass scratches; scratches; windscreen quality; windscreen scratches

APPENDIX

(Nonmandatory Information)

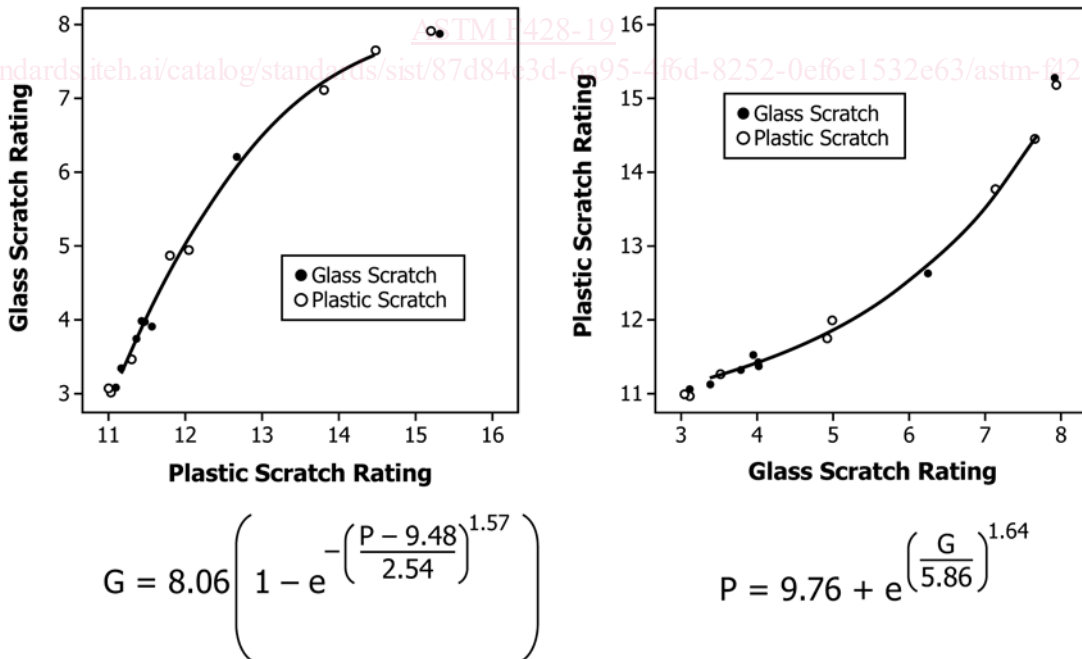
X1. COMPARISON OF GLASS AND PLASTIC SCRATCH RATINGS

X1.1 A study was performed to determine equivalent relationships between glass and plastic scratch adjuncts. This empirically derived relationship shall be used if needed when: (1) only glass adjuncts are available to judge the intensity of scratches in plastic, (2) only plastic adjuncts are available to judge the intensity of scratches in glass, or (3) it is desirable to convert between the glass and plastic scratch scales.

X1.2 Five trained observers rated eight glass and eight plastic test scratches. Each scratch was rated using both glass

and plastic adjuncts three times. The 96 trials for each observer were randomized with the constraint that there be at least five trials between replications of the same scratch and either glass or plastic adjunct.

X1.3 Fig. X1.1 contains the estimated relationship between the glass (G) and plastic (P) scratch ratings and between the plastic and glass ratings. Fig. X1.2 shows the number of trials for each observer and scratch having a particular scratch rating when compared with either glass or plastic adjunct.



NOTE 1—The 3 means near (P = 11, G = 3) and the 2 means near (P = 15, G = 8) were not used since they contained multiple trials where the glass rating was either 3– or 8+.

FIG. X1.1 Non-Linear Regression Fit of Mean Scratch Ratings (N = 15)