



Designation: G35 – 23

Standard Practice for Determining the Susceptibility of Stainless Steels and Related Nickel-Chromium-Iron Alloys to Stress-Corrosion Cracking in Polythionic Acids¹

This standard is issued under the fixed designation G35; 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 practice covers procedures for preparing and conducting the polythionic acid test at room temperature, 22 °C to 25 °C (72 °F to 77 °F), to determine the relative susceptibility of stainless steels or other related materials (nickel-chromium-iron alloys) to intergranular stress corrosion cracking.

1.2 This practice can be used to evaluate stainless steels or other materials in the “as received” condition or after being subjected to high-temperature service, 482 °C to 815 °C (900 °F to 1500 °F), for prolonged periods of time.

1.3 This practice can be applied to wrought products, castings, and weld metal of stainless steels or other related materials to be used in environments containing sulfur or sulfides. Other materials capable of being sensitized can also be tested in accordance with this test.

1.4 This practice may be used with a variety of stress corrosion test specimens, surface finishes, and methods of applying stress.

1.5 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

1.6 *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. For more specific precautionary statements, see Section 7.*

1.7 *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.*

¹ This practice is under the jurisdiction of ASTM Committee G01 on Corrosion of Metals and is the direct responsibility of Subcommittee G01.06 on Environmentally Assisted Cracking.

Current edition approved June 1, 2023. Published June 2023. Originally approved in 1988. Last previous edition approved in 2015 as G35 – 98 (2015). DOI: 10.1520/G0035-23.

2. Referenced Documents

2.1 *ASTM Standards:*²

D1193 Specification for Reagent Water

G1 Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens

G28 Test Methods for Detecting Susceptibility to Intergranular Corrosion in Wrought, Nickel-Rich, Chromium-Bearing Alloys

G30 Practice for Making and Using U-Bend Stress-Corrosion Test Specimens

G193 Terminology and Acronyms Relating to Corrosion

3. Summary of Practice

3.1 Stressed test specimens are placed in the container along with a sensitized and stressed AISI Type 302 (UNS S30200) or Type 304 (UNS S30400) stainless steel control specimen. A sufficient amount of prepared polythionic acid solution is added to the container to immerse the test specimens. A cover is placed on the container and the test exposure is carried out at room temperature followed by inspection for cracks.

4. Significance and Use

4.1 Polythionic acids are chemically described as H₂S_xO₆, where x is usually 3, 4, or 5 (1)³ though can be more than 50 (2). These acid environments provide a way of evaluating the resistance of stainless steels and related alloys to intergranular stress corrosion cracking. Failure is accelerated by the presence of increasing amounts of intergranular precipitate. Results for the polythionic acid test have not been correlated exactly with those of intergranular corrosion tests (Test Methods G28). Also, this test may not be relevant to stress corrosion cracking in chlorides or caustic environments.

4.2 The polythionic acid environment may produce areas of shallow intergranular attack in addition to the more localized

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 boldface numbers in parentheses refer to a list of references at the end of this standard.