



# Standard Test Method for Pitting or Crevice Corrosion of Metallic Surgical Implant Materials<sup>1</sup>

This standard is issued under the fixed designation F746; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method covers the determination of resistance to either pitting or crevice corrosion of metals and alloys from which surgical implants will be produced. It is a modified version of an established test<sup>2</sup> and is used as a screening test to rank surgical implant alloys in order of their resistance to localized corrosion.

1.2 This test method applies only to passive metals and alloys. Nonpassive alloys (other than noble alloys) are susceptible to general corrosion and are not normally suitable for implant use.

1.3 This test method is intended for use as a laboratory screening test for metals and alloys which undergo pitting or crevice corrosion, or both.

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.5 *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:*<sup>3</sup>

**D1193** Specification for Reagent Water

**F86** Practice for Surface Preparation and Marking of Metallic Surgical Implants

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee F04 on Medical and Surgical Materials and Devices and is the direct responsibility of Subcommittee F04.15 on Material Test Methods.

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<sup>2</sup> Syrett, B. C., *Corrosion*, Vol 33, 1977, p. 221.

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

**F2129** Test Method for Conducting Cyclic Potentiodynamic Polarization Measurements to Determine the Corrosion Susceptibility of Small Implant Devices

**G3** Practice for Conventions Applicable to Electrochemical Measurements in Corrosion Testing

**G5** Reference Test Method for Making Potentiodynamic Anodic Polarization Measurements

**G15** Terminology Relating to Corrosion and Corrosion Testing (Withdrawn 2010)<sup>4</sup>

## 3. Summary of Test Method

3.1 A cylindrical specimen fitted with an inert tapered collar is immersed in a phosphate buffered saline electrolyte at 37°C for 1 h to establish a corrosion potential. Pitting (or crevice corrosion) is then stimulated by potentiostatically polarizing the specimen to a potential much more noble than the corrosion potential. Stimulation of pitting (or crevice corrosion) will be marked by a large and generally increasing polarizing current.

3.2 Immediately after the stimulation step, the potential is decreased as rapidly as possible to one of several preselected potentials at, or more noble than, the corrosion potential. If the alloy is susceptible to pitting (or crevice corrosion) at the preselected potential, the polarizing current will remain at relatively high values and will fluctuate or increase with time. A post-test examination of the metal specimen establishes whether localized corrosion has occurred by pitting of the exposed surface or by preferential attack at the crevice formed by the tapered collar, or both.

3.3 If the pit (or crevice) surface repassivates at the preselected potential and localized corrosion is halted, the polarizing current will drop to values typical for passive surfaces and the current will decrease continuously. The parameter of interest, the critical potential for pitting (or crevice corrosion), is defined as the highest (most noble) pre-selected potential at which pit (or crevice) surfaces repassivate after the stimulation step.

## 4. Significance and Use

4.1 This test method is designed solely for determining comparative laboratory indices of performance. The results

<sup>4</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).