



Standard Guide for Gravimetric Wear Assessment of Prosthetic Hip Designs in Simulator Devices¹

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1. Scope

1.1 This guide describes a laboratory method using a weight-loss technique for evaluating the wear properties of materials or devices, or both, which are being considered for use as bearing surfaces of human-hip-joint replacement prostheses. The hip prostheses are evaluated in a device intended to simulate the tribological conditions encountered in the human hip joint, for example, use of a fluid such as bovine serum, or equivalent pseudosynovial fluid shown to simulate similar wear mechanisms and debris generation as found *in vivo*, and test frequencies of 1 Hz or less.

1.2 Since the hip simulator method permits the use of actual implant designs, materials, and physiological load/motion combinations, it can represent a more physiological simulation than basic wear-screening tests, such as pin-on-disk (see Practice F732) or ring-on-disk (see ISO 6474).

1.3 It is the intent of this guide to rank the combination of implant designs and materials with regard to material wear-rates, under simulated physiological conditions. It must be recognized, however, that there are many possible variations in the *in vivo* conditions, a single laboratory simulation with a fixed set of parameters may not be universally representative.

1.4 The reference materials for the comparative evaluation of candidate materials, new devices, or components, or a combination thereof, shall be the wear rate of extruded or compression-molded, ultra-high molecular weight (UHMW) polyethylene (see Specification F648) bearing against standard counter faces [stainless steel (see Specification F138); cobalt-chromium-molybdenum alloy (see Specification F75); thermomechanically processed cobalt chrome (see Specification F799); alumina ceramic (see Specification F603)], having typical prosthetic quality, surface finish, and geometry similar

to those with established clinical history. These reference materials will be tested under the same wear conditions as the candidate materials.

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

2. Referenced Documents

2.1 ASTM Standards:²

D883 Terminology Relating to Plastics

F75 Specification for Cobalt-28 Chromium-6 Molybdenum Alloy Castings and Casting Alloy for Surgical Implants (UNS R30075)

F86 Practice for Surface Preparation and Marking of Metallic Surgical Implants

F136 Specification for Wrought Titanium-6Aluminum-4Vanadium ELI (Extra Low Interstitial) Alloy for Surgical Implant Applications (UNS R56401)

F138 Specification for Wrought 18Chromium-14Nickel-2.5Molybdenum Stainless Steel Bar and Wire for Surgical Implants (UNS S31673)

F370 Specification for Proximal Femoral Endoprosthesis (Withdrawn 2005)³

F565 Practice for Care and Handling of Orthopedic Implants and Instruments

F603 Specification for High-Purity Dense Aluminum Oxide for Medical Application

F648 Specification for Ultra-High-Molecular-Weight Polyethylene Powder and Fabricated Form for Surgical Implants

F732 Test Method for Wear Testing of Polymeric Materials Used in Total Joint Prostheses

F799 Specification for Cobalt-28Chromium-6Molybdenum

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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.