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Standard Guide for Descaling and Cleaning Titanium and Titanium Alloy Surfaces¹

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This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This guide covers a cleaning and descaling procedure useful to producers, users, and fabricators of titanium and titanium alloys for the removal of ordinary shop soils, oxides, and scales resulting from heat treatment operations and foreign substances present as surface contaminants.

1.2 It is not intended that these procedures be mandatory for removal of any of the indicated soils but rather serve as a guide when titanium and titanium alloys are being processed in the wrought, cast, or fabricated form.

1.3 It is the intent that these soils be removed prior to chemical milling, joining, plating, fabrication, and in any situation where foreign substances interfere with the corrosion resistance, stability, and quality of the finished product.

1.4 Acid etching may be required following cleaning when the surface has an oxygen-contaminated layer or alpha case present.

1.5 The values stated in inch-pound units are to be regarded as the standard. The values in parentheses are for information only.

1.6 *This standard does not purport to address the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Processing Soil Removal

2.1 It is recommended that grease, oil, and lubricants employed in machining, forming, and fabricating operations on titanium and titanium alloys be removed by alkaline or emulsion soak-type cleaners and electrolytic alkaline cleaning systems. In the electrolytic system the work may be either anodic or cathodic polarity. Removal of these soils is recommended prior to heat treatment or application of acid treatment

designated in 4.2. When electrolytic systems are employed, the voltage should be controlled to prevent the occurrence of spark discharge and subsequent pitting.

3. Blast Cleaning

3.1 Mechanical descaling methods such as sandblasting, shot blasting, and vapor blasting may be used to remove hot work scales and lubricants from titanium surfaces if followed by thorough conditioning and cleaning as described in Section 4.

3.2 The sand used for blasting should be a high-grade, washed, iron-free, silica sand. If carbon or low-alloy steel products are sandblasted in the same facility, the sand used for cleaning these products should not be used on titanium surfaces and a separate sand supply should be provided.

3.3 Roughening of exposed surface areas may occur from grit or shot if cleaning of the entire surface is accomplished by blasting. Partial cleaning for preserving the surface finish is to be preferred in conjunction with proper pickling procedures.

3.4 Blast cleaning that utilizes steel grit or sand containing appreciable amounts of iron should be followed by acid pickling to remove any embedded steel particles on the surface of the titanium.

3.5 Any abrasive or shot blast cleaning may induce residual compressive stresses in the surface of the material or titanium structure. Warpage may occur in sections that are subsequently chemical milled or contour machined.

3.6 In most cases, blast cleaning is not intended to eliminate pickling procedures completely. Abrasives will not remove surface layers contaminated with interstitial elements such as carbon, oxygen, and nitrogen. When these elements are present in excessive amounts, they are preferably removed by controlled acid pickling in accordance with 4.3.

4. Pickling and Descaling

4.1 Recommended post treatment of shot or abrasive blasted titanium surfaces may include acid pickling as described in 4.3.2, to ensure complete removal of metallic iron, oxide, scale, and other surface contaminants. If the product is to be chemical milled for the removal of the oxygen-contaminated layer, salt

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