



Designation: A380/A380M – 25

Standard Practice for Cleaning, Descaling, Pickling, and Passivation of Stainless Steel Parts, Equipment, and Systems¹

This standard is issued under the fixed designation A380/A380M; 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 (ϵ) indicates an editorial change since the last revision or reapproval.

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

1. Scope*

1.1 This practice covers recommendations and precautions for cleaning, descaling, and passivating of stainless steel parts, assemblies, equipment, and installed systems. These recommendations are presented as procedures for guidance when it is recognized that for a particular service it is desired to remove surface contaminants that may impair the normal corrosion resistance, or result in the later contamination of the particular stainless steel grade, or cause product contamination. The selection of procedures from this practice to be applied to the parts may be specified upon agreement between the supplier and the purchaser. For certain exceptional applications, additional requirements which are not covered by this practice may be specified upon agreement between the supplier and the purchaser. Although they apply primarily to materials in the composition range of stainless steel, the practices described may also be useful for cleaning other metals if due consideration is given to corrosion and possible metallurgical effects.

1.2 This practice does not cover decontamination or cleaning of equipment or systems that have been in service, nor does it cover descaling and cleaning of materials at the mill. On the other hand, some of the practices may be applicable for these purposes. While the practice provides recommendations and information concerning the use of acids and other cleaning and descaling agents, it cannot encompass detailed cleaning procedures for specific types of equipment or installations. It therefore in no way precludes the necessity for careful planning and judgment in the selection and implementation of such procedures.

1.3 These practices may be applied when contaminant iron, oxide scale, rust, grease, oil, carbonaceous or other residual chemical films, soil, particles, metal chips, dirt, or other

nonvolatile deposits might adversely affect the metallurgical or sanitary condition or stability of a surface, the mechanical operation of a part, component, or system, or contaminate a process fluid. The degree of cleanliness required on a surface depends on the application. In some cases, no more than degreasing or removal of gross contamination is necessary. Others, such as food-handling, pharmaceutical, aerospace, and certain nuclear applications, may require extremely high levels of cleanliness, including removal of all detectable residual chemical films and contaminants that are invisible to ordinary inspection methods.

NOTE 1—The term “iron,” when hereinafter referred to as a surface contaminant, shall denote contaminant iron.

1.4 Attainment of surfaces that are free of iron, metallic deposits, and other contamination depends on a combination of proper design, fabrication methods, cleaning and descaling, and protection to prevent recontamination of cleaned surfaces. Meaningful tests to establish the degree of cleanliness of a surface are few, and those are often difficult to administer and to evaluate objectively. Visual inspection is suitable for the detection of gross contamination, scale, rust, and particulates, but may not reveal the presence of thin films of oil or residual chemical films. In addition, visual inspection of internal surfaces is often impossible because of the configuration of the item. Methods are described for the detection of contaminant iron and transparent chemical and oily deposits.

1.5 This practice provides definitions and describes practices for cleaning, descaling, and passivation of stainless steel parts. Qualitative tests with acceptance criteria to demonstrate that the passivation procedures have been successful are listed in 8.2.5 and 8.3.4, and can also be found in Specification A967/A967M.

1.6 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

¹ This practice is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.14 on Methods of Corrosion Testing.

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*A Summary of Changes section appears at the end of this standard

1.7 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 safety precautions see 8.2.5.3, 8.3.4, Section 9, A1.7, and A2.11.)

1.8 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 ASTM Standards:²

A941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

A967/A967M Specification for Chemical Passivation Treatments for Stainless Steel Parts

D1193 Specification for Reagent Water

F21 Test Method for Hydrophobic Surface Films by the Atomizer Test

F22 Test Method for Hydrophobic Surface Films by the Water-Break Test

2.2 ISO Standards:³

ISO 14644-1 Cleanrooms and Associated Controlled Environments—Part 1: Classification of Air Cleanliness by Particle Concentration

ISO 14644-2 Cleanrooms and Associated Controlled Environments—Part 2: Monitoring to Provide Evidence of Cleanroom Performance Related to Air Cleanliness by Particle Concentration

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this standard, refer to Terminology **A941**.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *alloyed iron, n*—iron that is inherent to the composition of the alloy, especially at the metal surface where it is available to undergo oxidation.

3.2.1.1 *Discussion*—The removal of alloyed iron from the surface of stainless steel will typically enhance the corrosion resistance to some degree. “Oxidation” in the above context refers to both conversion to iron oxide on the surface (corrosion) and the removal of iron from the surface by conversion into ions released into the acid solution (passivation treatment).

3.2.2 *contaminant iron, n*—iron, especially non-stainless steel, deposited onto a metal surface from a separate and external source; also known as free iron.

3.2.2.1 *Discussion*—Contaminant iron is likely to corrode, irrespective of the properties of the substrate material. Contaminant iron that is deeply embedded in the surface is often more difficult to remove. Contaminant iron can be introduced through many routes, including, but not limited to the following: atmospheric deposition such as iron dust; use of blasting media, grinding media, fabrication equipment, or other tooling that has been used with or was in contact with nonstainless steels; contact by steel hooks, chains, forks or tools; nearby grinding or other work on non-stainless steels; residual-iron salts from pickling solutions; iron deposits in welds; embedded iron; and iron oxide.

3.2.3 *descaling, n*—the removal of undesirable superficial scale, contaminants, impurities, etc., from a metal surface; including heavy, tightly adherent oxide films or other similar surface conditions, typically resulting from hot-forming, heat-treatment, welding, and other high-temperature operations.

3.2.3.1 *Discussion*—Common descaling methods include abrasive blasting, power brushing, sanding, grinding, chipping, chemical methods (see also: *pickling*), and electrochemical methods.

3.2.3.2 *Discussion*—Surface scale or discoloration formed during heat treatment, annealing, welding, and other high temperature processes, may contain a higher amount of chromium with a corresponding chromium-depleted layer having been created underneath. Removal of the scale or discoloration must also include removal of the chromium-depleted layer, in order to attain a properly corrosion-resistant surface. In some circumstances, this may require a second descaling process via another method, such as when the chromium-depleted layer is resistant to removal via typical passivation and pickling acid solutions. A full discussion of this phenomenon is outside the scope of this standard.

3.2.4 *passivation, n*—the chemical treatment of a stainless steel with a nitric acid or citric acid solution, or other chemical solutions or electrochemical treatments capable of producing similar results, for the purpose of the removal of any combination of contaminant iron, alloyed iron, and possibly other foreign matter from the surface, resulting in an increase of the corrosion resistance of the surface via enabling the formation of a better passive metal oxide film.

3.2.4.1 *Discussion*—In the broadest sense, passivation is any process through which a metal surface is rendered passive, which is to say, inactive and resistant to further chemical reactions, especially corrosion. The term passivation is commonly applied to several distinctly different operations or processes relating to stainless steels. In order to avoid ambiguity in the setting of requirements, it is necessary to define precisely the intended meaning of passivation in this standard. In this specification, passivation, unless otherwise specified, is defined as above. Passivation is also described in a general way in 7.2.11 and defined precisely in 7.4 with further reference to the requirements of **Annex A2** and Part II of **Table A2.1**. (See also Specification **A967/A967M**.) Some of the various meanings associated with the term passivation that are in common usage include the following:

3.2.4.2 *Discussion*—The formation of the protective passive

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

³ Available from International Organization for Standardization, ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland.