

3-A[®] Sanitary Standards for Homogenizers and Reciprocating Pumps, Number 04-04

Formulated by
 International Association of Food Industry Suppliers (IAFIS)
 International Association for Food Protection (IAFP)
 United States Public Health Service (USPHS)
 The Dairy Industry Committee (DIC)

It is the purpose of the IAFIS, IAFP, USPHS, and DIC in connection with the development of the 3-A Sanitary Standards Program to allow and encourage full freedom for inventive genius or new developments. Homogenizers and reciprocating pump specifications heretofore or hereafter developed which so differ in design, materials, and fabrication or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAFIS, IAFP, USPHS, and DIC at any time. **NOTE:** Use current revisions or editions of all referenced documents cited herein. Standard English is the official language of 3-A Sanitary Standards and 3-A Accepted Practices.

A SCOPE

A1 These standards cover the sanitary aspects of homogenizers and reciprocating pumps for milk and milk products. These 3-A Sanitary Standards do not include drum pumps.

A2 In order to conform with these 3-A Sanitary Standards, homogenizers and reciprocating pumps shall comply with the following design, material, and fabrication criteria.

B DEFINITIONS

B1 *Product:* Shall mean milk and milk products.

B2 *Reciprocating Pump:* Shall mean a positive displacement pump that moves the product by the reciprocating motion of a plunger(s) or a piston(s) operating in a cylinder(s).

B3 *Homogenizer:* Shall mean a reciprocating pump which employs a specially designed homogenizing valve or valves for the purpose of blending the product ingredients and/or producing homogeneity of the product. The homogenizing valve or valves may be installed at the homogenizer and/or at a downstream location.

B4 Surfaces

B4.1 *Product Contact Surfaces:* Shall mean all surfaces which are exposed to the product and surfaces from which liquids may drain, drop, diffuse, or be drawn into the product.

B4.2 *Nonproduct Contact Surfaces:* Shall mean all other exposed surfaces.

B5 Surface Modification¹

B5.1 *Surface Treatments:* Shall mean a process whereby chemical compositions or mechanical properties of the existing surface are altered. There is no appreciable, typically less than 1 µm, build-up of new material or removal of existing material.

B5.1.1 Surface treatments include:

1. Mechanical (shot peening² glass beading, polishing)
2. Thermal (surface hardening laser, electron beam)
3. Diffusion (carburizing, nitriding)
4. Chemical (etching, oxidation)
5. Ion Implantation
6. Electropolishing

¹ Additional information on surface modification is contained in *Advanced Materials and Processes*, Volume 137(1), January 1990; "Coatings and Coating Practices" by H. Herman, p. 59; "Surface Modification" by F. A. Smidt, p. 61. ASM International, Materials Park, OH 44073 (216) 338-5151.

² MIL-S-13165C (1), November 1991, *Military Specification: Shot Peening of Metal Parts*. Available from Standardization, Document Order Desk (Department of Navy), 700 Robbins Avenue, Building 4, Section D, Philadelphia, PA 19111-5094 (215) 697-2179.

B5.2 **Coatings:** Shall mean the results of a process where a different material is deposited to create a new surface. There is appreciable, typically more than 1 µm, build-up of new material.

B5.2.1 Coating processes include:

1. Chemical (conversion coatings)
2. Electrodeposition³
3. Spraying (pneumatic, flame, plasma, arc spray)
4. Physical Vapor Deposition
5. Chemical Vapor Deposition

C MATERIALS

C1 Metals

C1.1 Product contact surfaces shall be of stainless steel of the American Iron and Steel Institute (AISI) 300 Series⁴ or corresponding Alloy Cast Institute⁵ (ACI) types (See Appendix, Section E.), or metal which under conditions of intended use is at least as corrosion resistant as stainless steel of the foregoing types, and is nontoxic and nonabsorbent, except that:

C1.1.1 Homogenizing valves, plungers, pistons, cylinders, valves, guides, seats, and their associated components made of the materials provided for in C1.1 may have their product contact surfaces modified by surface treatment or coating(s).

C1.1.2 Homogenizing valves, plunger, pistons, cylinders, valves, guides, seats, and their associated components may also be made of other nontoxic structurally suitable metal(s) that have their

³ Federal Specification #QQ-C-320B for Chromium Plating (Electrodeposited), June 1954 with Amendment 4 on April 10, 1987. Federal Specification #QQ-N-290A for Nickel Plating (Electrodeposited), November 12, 1971. Available from the General Services Administration, Federal Supply Services Bureau, Specification Section, 470 East L'Enfant Plaza, Suite 8100, Washington, DC 20407 (202) 755-0325.

⁴ The data for this series are contained in the *AISI Steel Products Manual, Stainless & Heat Resisting Steels*, November 1990, Table 2-1, pp. 17-20. Available from the American Iron and Steel Society, 410 Commonwealth Drive, Warrendale, PA 15086 (412) 776-1535.

⁵ Steel Founders Society of America, Cast Metal Federation Building, 455 State Street, Des Plaines, IL 60016 (708) 299-9160.

product contact surfaces modified by surface treatment or coating(s), provided that the resulting surfaces are as corrosion resistant as the materials provided for in Section C1.1.

C1.1.3 Homogenizing valves, plungers, pistons, cylinders, valves, guides, seats, and their associated components may also be made of stainless steel of the AISI 400 Series⁴ that is made as corrosion resistant as AISI 300 Series by surface treatment or coating(s), or made of nontoxic, nonabsorbent metal that is as corrosion resistant, under the conditions of intended use, as stainless steel of the AISI 300 Series.

C1.2 Solder, when used, shall be silver bearing solder and shall be corrosion resistant, free of cadmium, lead, and antimony, nonabsorbent, and shall not impart any toxic substance to the product when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.

C2 Nonmetals

C2.1 Rubber and rubber-like materials may be used for gaskets, seals, O-rings and parts having the same functional purposes.

C2.1.1 Rubber and rubber-like materials when used for the above specified application(s) shall conform with the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Number 18-.

C2.2 Plastic materials may be used for gaskets, seals, O-rings, bushings, guides, coatings, and parts having the same functional purposes.

C2.2.1 Plastic materials when used for the above specified application(s) shall conform with the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20-.

C2.3 Rubber and rubber-like materials and plastic materials having product contact surfaces shall be of such composition as to retain their surface and conformational characteristics when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal

treatment or sterilization.

- C2.4 The final bond and residual adhesive, if used, on bonded rubber and rubber-like materials and bonded plastic materials shall be nontoxic⁶.
- C2.5 Where materials having certain inherent functional purposes are required for specific applications, such as plungers, pistons, pump valve parts, homogenizing valves, cylinders and their associated parts, carbon surface treatments or coatings, tungsten carbide, and/or ceramic materials may be used. These materials shall be inert, nonporous, nontoxic, nonabsorbent, insoluble, resistant to scratching, scoring, and distortion when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.
- C3 **Sterilization**
- C3.1 In a processing system to be sterilized by heat and operated at a temperature of 250°F (121°C) or higher, all materials having product contact surface(s) used in the construction of homogenizers and reciprocating pumps and nonmetallic component parts shall be such that they can be (1) sterilized by saturated steam or water under pressure (at least 15.3 psig or 106 kPa) at a temperature of at least 250°F (121°C) and (2) operated at the temperature required for processing.
- C4 **Nonproduct Contact Surfaces**
- C4.1 All nonproduct contact surfaces shall be of corrosion-resistant material or material that is rendered corrosion resistant. If coated, the coating used shall adhere. All nonproduct contact surfaces shall be relatively nonabsorbent, durable, and cleanable. Parts removable for cleaning having both product contact and nonproduct contact surfaces shall not be painted.

D **FABRICATION**

⁶ Adhesives shall comply with 21 CFR 175 - Indirect Food Additives: Adhesives and Components of Coatings. Document for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (202) 512-1800.

D1 **Surface Texture**

- D1.1 All product contact surfaces shall have a finish at least as smooth as a No. 4 ground finish on stainless steel sheets and be free of imperfections such as pits, folds and crevices in the final fabricated form. (See Appendix, Section F.)

D2 **Permanent Joints**

- D2.1 All permanent joints in metallic product contact surfaces shall be continuously welded, except that:
- D2.1.1 Where welding is impractical for replacement type valve seats, soldering, press-fitting or shrink-fitting may be employed, and may have a recessed chamfer.
- D2.1.2 Welding, press-fitting, shrink-fitting or soldering shall be finished to produce product contact surfaces which are at least as smooth as a No. 4 ground finish on stainless steel sheets and which are free of imperfections such as pits, folds and crevices. (See Appendix, Section G.)

D3 **Coatings**

- D3.1 Coatings, if used, shall be free from surface delamination, pitting, flaking, spalling, blistering and distortion when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.
- D3.2 The minimum thickness of electrodeposited coatings shall not be less than 0.002 in. (0.05 mm) for all product contact surfaces when used on stainless steel. When these surfaces are other than stainless steel, the minimum thickness of electrodeposited coatings shall not be less than 0.002 in. (0.05 mm).
- D3.3 Ceramic materials used as coatings shall be at least 0.003 in. (0.08 mm) thick.
- D3.4 Plastic materials, when used as a coating, shall be at least 0.005 in. (0.125 mm) thick.

D4 **Cleaning and Inspectibility**

- D4.1 All product contact surfaces shall be easily accessible for cleaning and inspection either when