NSF International Standard / American National Standard

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Food Equipment Materials
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Foreword

The purpose of this Standard is to establish minimum food protection and sanitation requirements for the materials used in the construction of commercial food equipment.

By way of reference, this Standard will define the basic materials requirements for all equipment covered by NSF/ANSI Food Equipment Standards.

This Standard establishes requirements intended to ensure that a material is not formulated such that it may impart deleterious substances to food in its intended end use application. This Standard does not define specific extraction test methods or acceptance criteria to be used to assess the extent of chemical migration from food contact surfaces to food. Instead, the appropriate United States Federal Regulations have been cited as references upon which conformance with this Standard is based. Other NSF/ANSI Standards may establish extraction tests and acceptance criteria, as needed, for specific types of equipment based on the materials used in their construction and the nature of the food contact (i.e., beverage dispensing equipment, ice making equipment).

This Standard establishes cleanability, corrosion resistance, impact resistance, abrasion resistance, heat resistance, and coating adhesion ability requirements and testing methods for food equipment materials of construction, as applicable.

This edition of the Standard contains the following revisions:

Issue 14A

This revision affirms proposed changes and additions to 6.2.2.2 covering organic coatings on splash zone surfaces.

Issue 14B

This revision affirms proposed changes and additions to 6.2.2.4 and Table 6.1 covering organic coatings applied to splash zone surfaces.

Issue 15

This revision affirms proposed changes and additions to 6, regarding the use of organic non-stick coatings on blades of powered slicing equipment.

The Interpretations Annex contains responses to interpretation requests. The responses will be published in each version of the Standard until such time that the interpretation response is no longer applicable.

This Standard was developed by the NSF Joint Committee on Food Equipment using the consensus process of the American National Standards Institute.

Suggestions for improvement of this Standard are welcome. This Standard is maintained on a Continuous Maintenance schedule and can be opened for comment at any time. Comments should be sent to Chair, Joint Committee on Food Equipment at standards@nsf.org, or c/o NSF International, Standards Department, P.O. Box 130140, Ann Arbor, Michigan 48113-0140, USA.

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1 General

1.1 Purpose

This Standard establishes minimum public health and sanitation requirements for materials used in the construction of commercial food equipment. The requirements of this Standard are intended to ensure that the composition and surface finish of food equipment materials are such that a material will not adulterate food nor render food equipment difficult to clean and sanitize.

1.2 Scope

This Standard is applicable to the materials and finishes used in the manufacture of food equipment (e.g., broiler, beverage dispenser, cutting board, stock pot). The Standard is also applicable to components such as tubing, sealants, gaskets, valves, and other items intended for various food equipment applications.

These components shall meet the relevant design and construction requirements of the NSF Standard applicable to the type of food equipment on which the component is used.

The requirements of 4 of this Standard may also be applied separately to determine whether a material is suitable for use in a food zone based on its formulation alone. The other relevant requirements of this Standard, including those for cleanability and corrosion resistance, would apply to the finished product for which the material is used.

Materials other than those specifically mentioned in this Standard may be used provided that such materials meet the minimum requirements described herein.

1.3 Measurement

Decimal and SI conversions provided parenthetically shall be considered equivalent. Metric conversions and significant figure rounding have been made according to IEEE/ASTM SI 10.
2 Normative references

The following documents contain provisions that, through reference, constitute provisions of this NSF/ANSI Standard. At the time of publication, the editions listed below were valid. All Standards are subject to revision, and parties are encouraged to investigate the possibility of applying the recent editions of the documents indicated below. The most recent published edition of the document shall be used for undated references.

21 C.F.R. §§170-199, Food and Drug ³

21 U.S.C. §321 Definitions – generally (Food and Drugs)³

21 U.S.C. §348 Unsafe Food Additives (Food and Drugs)³


ANSI/UL 197 – 2010. Standard for Commercial Electrical Cooking Appliances⁵


NSF/ANSI 2. Food equipment

NSF/ANSI 170. Glossary of food equipment terminology

SAE Steel Numbering System⁸

3 Definitions

Terms used in this Standard that have special technical meaning are defined in NSF/ANSI 170.

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⁵ Underwriters Laboratories, Inc. 33 Pfingsten Road, Northbrook, IL 60062 <www.ul.com>.

⁶ ASTM International. 100 Barr Harbor Dr., West Conshohocken, PA 19428 <www.astm.org>.

⁷ British Standards. 389 Chiswick High Road, London W4 4AL, United Kingdom <www.sbsi.global.com>.

4 Material formulation

4.1 General requirements

4.1.1 Food zone materials shall be manufactured from or composed of substances that:

— may not reasonably be expected to result, directly or indirectly, in their becoming a component of food, or otherwise affecting the characteristics of food, including the imparting of a color, taste, or odor to food; or

— are generally recognized as safe or have received prior sanction for their intended use, as defined in the FD&C Act, Section 201(s) [21 U.S.C. 321 (s)]; or

— can be demonstrated to be safe for the intended use, subject to the FD&C Act, Section 409(h)(1) [21 U.S.C. 348(h)(1)]; or

— can be demonstrated to be safe for the intended use, subject to the FD&C Act, Section 409(h)(6) [21 U.S.C. 348(h)(6)]; or

— are regulated as indirect food additives under the provisions of the U.S. Code of Federal Regulations, Title 21, Sections 174 through 189 (21 CFR 174-189); or

— are exempt from regulation as food additives under the provisions of the U.S. Code of Federal Regulations, Title 21, Part 170.39. Threshold of regulation for substances used in food contact articles.

4.1.2 Food zone materials shall not contain lead, arsenic, cadmium, or mercury as intentional ingredients. Brass and bronze materials may contain lead as permitted under 4.2.3.2.

4.1.3 Coatings containing lead as an intentional ingredient shall not be used on food equipment surfaces, including splash zones and nonfood zones. Coatings with an unintentional lead content (lead impurity) greater than 0.06% shall not be used.

4.2 Requirements for specific types of materials

This Section establishes limitations on the use of specific types of materials. All materials shall conform to the general requirements in 4 and 5 and to the additional material-specific requirements established in this Section.

4.2.1 Stainless steel

4.2.1.1 Stainless steel used in food equipment shall be of a type in the:

— SAE 200 series alloys;
— SAE 300 series alloys; or
— SAE 400 series alloys9.

4.2.1.2 When used in a food zone, stainless steel shall have a minimum chromium content of 16%. Stainless steel with a chromium content of less than 16% may be used for cutlery, blades, and similar applications requiring a sharp edge, provided that the alloy has been hardened or tempered by an appropriate post-heat treatment process.

9 Under the Unified Numbering System (UNS), these types are designated as S2xxxx, S3xxxx, and S4xxxx, respectively.
4.2.2 Aluminum alloys

When used in a food zone, aluminum alloys shall have one of the following Aluminum Association\textsuperscript{10} alloy designations or equivalent:

4.2.2.1 Wrought alloys (sheet and extrusion)

— 1xxx series alloys
— 3xxx series alloys
— 4xxx series alloys
— 5xxx series alloys
— 6xxx series alloys

4.2.2.2 Casting alloys

— 218.x
— 308.0
— 319.0
— 332.0
— 356.0
— 360.0
— 413.0
— B443.0
— 514.0
— 520.0
— 713.0

4.2.3 Copper and copper alloys

4.2.3.1 Copper and copper alloys shall not be used in a food zone or splash zone except where rendered corrosion resistant or where exposure to food is limited to potable, non-carbonated water under constant service pressure. Exceptions to this requirement are specified in 4.2.3.2 for brass and bronze and in 4.2.3.4 for copper-nickel alloys.

4.2.3.2 Brass and bronze may be used in a food zone or splash zone only where rendered corrosion resistant or where exposure to food is clearly and specifically limited to tea, coffee, or water.

4.2.3.3 Equipment having brass or bronze components in contact with tea, coffee, or water (as permitted in 4.2.3.2), which is intended for human consumption, shall be evaluated for weighted average lead content in accordance with NSF/ANSI 372 — Drinking Water System Components — Lead Content. The weighted average lead content of the water contact portion of the equipment shall be ≤ 0.25%.

NOTE 1 — If a coating (organic or metallic) is applied to the brass or bronze components, evaluation to NSF/ANSI 372 is still applicable.

NOTE 2 — Equipment such as, but not limited to, proofers, steamers, combination ovens and other systems with similar humidification and vaporization pathways shall be exempt from 4.2.3.3.

4.2.3.4 Copper-nickel alloys may be used in a food zone or splash zone only where rendered corrosion resistant or where exposure to food is clearly and specifically limited to non-acidic foods and beverages (i.e., food and beverages with a pH of 6.0 or greater).

4.2.4 Glass and glass-like materials

Glass and glass-like materials, including porcelain, porcelain enamels, and ceramic coatings, shall not be used on surfaces intended for direct food contact that are also subject to impact by hard objects during use (e.g., countertops, tabletops, cutting boards, cooking surfaces) except as permitted in 4.2.4.1.

4.2.4.1 Glass and glass-like materials may be used on grated cooking surfaces.

4.2.4.2 When used on splash zone and food zone non-direct food contact surfaces that may be subject to impact by hard objects during use, glass and glass-like coatings shall meet the impact resistance requirements in 10.3.

4.2.4.3 When used on direct food contact surfaces that are not subject to impact, glass and glass-like coatings shall meet the impact resistance requirements in 10.4. Glass-like coatings shall yield an adherence rating of 3 or better when tested according to ASTM B 916.

4.2.4.4 Glass, other than light fixtures, that may be subject to contact during use and routine maintenance and cleaning shall conform:

- to the impact test in ANSI Z97.1 for Class A glass; or
- to the impact test within ANSI/UL 197; or
- to the impact test within BS857:1967.

4.2.5 Wood

4.2.5.1 Wood shall not be used in a food zone, except in wood-top bakers tables and cutting boards conforming to NSF/ANSI 2.

4.2.5.2 When used for non-decorative purposes (i.e., structural), wood shall be totally encapsulated so as not to be exposed.

4.2.5.3 When used for decorative purposes, wood shall be sanded smooth and sealed with a sealant meeting the requirements of the zone of intended use. Decorative wood shall not be used on surfaces exposed to moisture or wear.

5 General materials requirements

5.1 Materials shall be smooth and easily cleanable.

If a material is textured so that it may hinder the removal of soil during cleaning, the material shall meet the surface cleanability requirements in 7.

5.2 Corrosion resistance

5.2.1 Materials shall be corrosion resistant in the intended end use environment. Coatings conforming to 6, as applied, may be used to render a material corrosion resistant.

NOTE — Materials that are worked (e.g., bent, cut, sheared, extruded, drawn) during equipment manufacture may require additional treatment (i.e., passivation) following fabrication in order to render them corrosion resistant.
5.2.2  Storage shelving intended for wet environments

Storage shelving that is manufactured, in whole or in part, of metallic materials and is intended for use in refrigerator or freezer interiors or warewashing areas shall meet the corrosion resistance requirements in 8.

NOTE — Shelving shall not include non-removable parts of the refrigerator interior liner.

5.2.2.1  Shelving manufactured of stainless steel in the SAE 200 or 300 series or of aluminum of the alloy series / designations listed in 4.2.2.1 and 4.2.2.2 is exempt from corrosion resistance requirements.

5.2.2.2  Other requirements in this Standard, including the coating requirements in 6, shall also apply to storage shelving.

6  Coatings

Coatings that are a combination of metallic and organic coatings shall conform to the requirements for organic coatings.

6.1  Metallic coatings

6.1.1  Metallic coatings shall be applied in accordance with the appropriate ASTM Standard Specification, or equivalent.

Annex A identifies the appropriate ASTM Standard Specifications for metallic coating processes commonly used for food equipment materials. The coating thickness and designation shall be in accordance with the coating manufacturer’s specifications for the zone of intended use.

NOTE — Annex A is not all-inclusive.

6.1.2  Zinc coatings

6.1.2.1  Zinc coatings shall not be used in a food zone.

6.2  Organic coatings

6.2.1  Food zones

6.2.1.1  Organic coatings may be used on food zone surfaces.

6.2.1.1.1  Organic coatings shall not be used on food zone surfaces that are designed in purpose to be subject to cutting and chopping actions, except as permitted in 6.2.1.8.

6.2.1.2  Coated surfaces used in direct food contact shall have substrate materials that conform to the requirements of 4.

6.2.1.3  Organic coatings used on food zone direct food contact surfaces shall meet the abrasion resistance requirements in 9.1.

6.2.1.4  Organic coatings used on food zone direct food contact surfaces shall meet the impact resistance requirements in 10.1.
6.2.1.4.1 The impact resistance requirements in 10.2 shall apply to organic coatings used on food zone
direct food contact surfaces that are:
   — internal to a unit, machine, or component;
   — not subject to impact or wear by internal parts or mechanisms or by operators; and
   — not designed to be removed during routine cleaning or maintenance.

6.2.1.5 Organic coatings used on food zone direct food contact surfaces shall meet the heat resistance
requirements in 11.

6.2.1.6 Organic coatings used on food zone direct food contact surfaces shall meet the adhesion
requirements in 12.1.

6.2.1.7 Fluoropolymer coatings and other non-stick coatings used on heated food zones shall be
exempt from impact resistance, abrasion resistance, adhesion ability, and heat resistance performance
tests.

6.2.1.8 Fluoropolymer coatings and other non-stick coatings may be used on blades of powered slicing
equipment. All food zone direct food contact coating requirements shall apply.

6.2.1.9 Organic coatings used on food zone non-direct food contact surfaces shall meet the abrasion
resistance requirements in 9.2.

6.2.1.10 Organic coatings used on food zone non-direct food contact surfaces shall meet the impact
resistance requirements in 10.1.

6.2.1.11 Organic coatings used on heated food zone non-direct food contact surfaces shall meet the
heat resistance requirements in 11.

6.2.2 Splash zones

6.2.2.1 Organic coatings may be used on splash zone surfaces.

6.2.2.2 Organic coatings used on splash zone surfaces shall meet the abrasion resistance
requirements in 9.2. Organic coatings used on corrosion resistant substrates in a splash zone shall be
exempt from abrasion resistance testing.

6.2.2.3 Organic coatings used on splash zone surfaces shall meet the impact resistance requirements
in 10.2.

6.2.2.4 Heated organic coatings used on splash zone surfaces shall meet the heat resistance
requirements in 11.

6.2.3 Serving and display ware

6.2.3.1 Organic coatings may be used on serving and display ware surfaces.

6.2.3.2 Organic coatings used on serving and display ware shall meet the abrasion resistance
requirements in 9.3.

6.2.3.3 Organic coatings used on serving and display ware shall meet the impact resistance
requirements in 10.2.

6.2.3.4 Organic coatings used on serving and display ware surfaces shall meet the adhesion
requirements in 12.2.
6.2.3.5 Product literature shall be supplied by the manufacturer of coated serving and display ware expressly stating that the ware shall immediately be taken out of service and repaired or replaced if a fault in the coating occurs. The literature shall also state that the ware are not to be used for food preparation and are only for serving and display. The literature shall describe appropriate use environments, use limitations, and maintenance or care instructions. The literature shall also expressly state which utensil types are approved by the manufacturer for use on the ware.

6.2.3.6 Serving and display ware shall be marked (engraved, embossed, stamped, or otherwise) with the symbol “S” on the base of the equipment or surface or elsewhere when functionally or structurally necessary or where necessary for inspection. The marking shall be discernible and shall not adversely affect the cleanability, corrosion resistance, abrasion resistance, impact resistance, or heat resistance of the coating, or the adhesion of the coating to its substrate.

Table 6.1 – Performance requirements for coatings

<table>
<thead>
<tr>
<th>Coating type</th>
<th>Zone</th>
<th>Applicable performance test</th>
</tr>
</thead>
<tbody>
<tr>
<td>metallic</td>
<td>food zone – direct food contact</td>
<td>none</td>
</tr>
<tr>
<td>metallic</td>
<td>food zone – serving and display ware</td>
<td>none</td>
</tr>
<tr>
<td>metallic</td>
<td>splash zone</td>
<td>none</td>
</tr>
<tr>
<td>metallic</td>
<td>non-food zone</td>
<td>none</td>
</tr>
<tr>
<td>organic</td>
<td>food zone – direct food contact</td>
<td>9.1 abrasion resistance</td>
</tr>
<tr>
<td>organic</td>
<td>food zone – serving and display ware</td>
<td>9.3 abrasion resistance</td>
</tr>
<tr>
<td>organic</td>
<td>food zone – non-direct food contact</td>
<td>9.2 abrasion resistance</td>
</tr>
<tr>
<td>organic</td>
<td>splash zone</td>
<td>9.2 abrasion resistance</td>
</tr>
<tr>
<td>organic</td>
<td>non-food zone</td>
<td>none</td>
</tr>
<tr>
<td>organic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>glass and glass-like</td>
<td>food zone – direct food contact</td>
<td>10.4 impact resistance</td>
</tr>
<tr>
<td>glass and glass-like</td>
<td>food zone – serving and display ware</td>
<td>10.4 impact resistance</td>
</tr>
<tr>
<td>glass and glass-like</td>
<td>food zone – non-direct food contact</td>
<td>10.3 Impact resistance</td>
</tr>
<tr>
<td>glass and glass-like</td>
<td>splash zone</td>
<td>10.3 impact resistance</td>
</tr>
<tr>
<td>glass and glass-like</td>
<td>non-food zone</td>
<td>none</td>
</tr>
</tbody>
</table>
|              |                                           |                             | (heated organic coating surfaces only)
7 Surface cleanability

7.1 Test method

When required by this Standard, the surface cleanability of a textured material shall be determined by quantification of the amount of applied soil that remains on a material sample after cleaning. Four material test plaques (5.0 x 5.0 in [130 x 130 mm]) shall be washed with a non-ionic, low foaming, powdered mechanical washer detergent and water at 162 ± 2 °F (72 ± 1 °C) and shall be air dried. A standardized synthetic lard comprised of glycerol trioleate (62.5%), glycerol tristearate (37.5%), and trace amounts of 14C-labeled glycerol trioleate (0.845 µCi/g of synthetic lard) and 14C-labeled stearic acid (0.514 µCi/g of synthetic lard), shall be applied to the test plaques. The lard shall be heated to a liquid state, and 200 µL shall be applied to each of four equal quadrants on each test plaque. The lard shall be spread in a uniform layer onto the quadrants while under an infrared heat source to maintain the lard in a liquid state. The mass of soil on each quadrant shall be quantified using a beta radiation counting system; each quadrant shall have 20 ± 5 mg applied to its surface. The soiled test plaques shall be washed in a single-temperature, total-dump dishwashing machine having the following characteristics:

- no overhead spray;
- no detergent added;
- wash and rinse water temperature: 162 ± 2 °F (72 ± 1 °C);
- wash cycle time: 120 ± 2 s;
- total wash cycle volume: 2.3 ± 0.2 gal (8.7 ± 0.8 L);
- dwell cycle time: 30 ± 2 s;
- rinse cycle time: 30 ± 2 s; and
- total rinse cycle volume: 2.3 ± 0.2 gal (8.7 ± 0.8 L).

After washing, the residual soil on each of the sixteen quadrants shall be quantified using a beta radiation counting system. The average residual soil value shall be compared to the control value for the zone in which the material is located.

7.2 Acceptance criteria

The average residual soil on the quadrants shall not exceed the predetermined control value for the zone in which the material is located.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Control value</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>food zone</td>
<td>30 µg</td>
<td>stainless steel – No. 3 (100 grit) finish</td>
</tr>
<tr>
<td>heated food zone</td>
<td>1750 µg</td>
<td>cast iron</td>
</tr>
<tr>
<td>ice bin materials</td>
<td>650 µg</td>
<td>rotationally molded polyethylene</td>
</tr>
<tr>
<td>splash and nonfood zone</td>
<td>220 µg</td>
<td>hot rolled steel</td>
</tr>
</tbody>
</table>

8 Corrosion resistance

8.1 Test method

A complete shelf sample shall be placed in a salt fog chamber. The total exposed surface area of each sample shall be determined. Testing shall be conducted in accordance with ASTM B117. The period of exposure shall be 192 h. At the end of the test, samples shall be gently rinsed with a stream of clean running water at 73 ± 10 °F (23 ± 5 °C). Samples shall be allowed to air dry immediately at 73 ± 3 °F (23 ± 2 °C). Once dry, samples shall be examined.
8.2 Acceptance criteria

There shall be no visible evidence of base metal corrosion or corrosion of the coated surface, such as blistering, peeling, or cracking on any sample. There shall be no visible evidence of red corrosion products (red rust) on the surface of any sample. White corrosion products shall be limited to 5% or less of the total exposed surface area of any sample.

9 Abrasion resistance

9.1 Method I (for organic coatings used on food zones direct food contact surfaces)

9.1.1 Test method

Abrasion resistance shall be evaluated using three coated test plaques that represent the finished product. The coated test plaques shall be conditioned for at least 24 h at 73 ± 3 °F (23 ± 2 °C) and 50 ± 5% relative humidity and weighed to the nearest milligram. The samples shall be mounted on a Taber® Abraser, or equivalent apparatus, with No. CS-17 standardized abrasion test wheels and a total applied load of 4.4 lb (2.0 kg). Samples shall undergo 1000 wear cycles. The final mass of each sample shall be recorded and subtracted from its initial weight. Each sample shall be inspected for substrate exposure.

9.1.2 Acceptance criteria

The mass of coating lost from each test sample shall be less than 100 mg, and the substrate or base or primer coating layer(s) shall not be exposed on any of the samples.

9.2 Method II (for organic coatings used on splash zones and food zone non-direct food contact surfaces)

9.2.1 Test method

Abrasion resistance shall be evaluated using three coated test plaques that represent the finished product. The coated test plaques shall be conditioned for at least 24 h at 73 ± 3 °F (23 ± 2 °C) and 50 ± 5% relative humidity and weighed to the nearest milligram. The samples shall be mounted on a Taber® Abraser, or equivalent apparatus, with No. CS-10 standardized abrasion test wheels and a total applied load of 4.4 lb (2.0 kg). Samples shall undergo 500 wear cycles. The final mass of each sample shall be recorded and subtracted from its initial weight. Each sample shall be inspected for substrate exposure.

9.2.2 Acceptance criteria

The mass of coating lost from each test sample shall be less than 100 mg, and the substrate or base or primer coating layer(s) shall not be exposed on any of the samples.

---

9.3  Method III (for organic coatings used on serving and display wares)

9.3.1  Test method

Abrasion resistance shall be evaluated using three coated test plaques that represent the finished product. The coated test plaques shall be conditioned for at least 24 h at 73 ± 3 °F (23 ± 2 °C) and 50 ± 5% relative humidity and weighed to the nearest milligram. The samples shall be mounted on a Taber® Abraser, or equivalent apparatus, with No. CS-10 standardized abrasion test wheels and a total applied load of 4.4 lb (2.0 kg). Samples shall undergo 1000 wear cycles. The final mass of each sample shall be recorded and subtracted from its initial weight. Each sample shall be inspected for substrate exposure.

9.3.2  Acceptance criteria

The mass of coating lost from each test sample shall be less than 100 mg, and the substrate or base or primer coating layer(s) shall not be exposed on any of the samples.

10  Impact resistance

10.1  Method I (for organic coatings used on food zones direct food contact and non-direct food contact surfaces)

10.1.1  Test method

Impact resistance shall be evaluated per ASTM D2794 using three coated test plaques that represent the finished product. The coated test plaques shall be conditioned for at least 24 h at 73 ± 3 °F (23 ± 2 °C) and 50 ± 5% relative humidity. Each of the samples shall be subjected to a single impact force of 60 in-lbs (0.7 m-kg) delivered with a 2.0 lb (0.9 kg) weight and a 1/2 in (0.500 in, 12.7 mm) diameter hemispherical-head steel punch. Samples shall be supported by a platform consisting of a 1/4 in (0.25 in, 6.4 mm) thick neoprene rubber pad with a durometer hardness value of 60 ± 5 that is secured to an anvil (a die shall not be used). The samples shall be secured to the platform; the neoprene pad shall not be compressed by the securing mechanism (i.e., clamping).

10.1.2  Acceptance criteria

The samples shall not exhibit any cracking, chipping, or peeling at the impact site.

10.2  Method II (for organic coatings used on splash zones, serving and display wares, and specific internal machine surfaces)

10.2.1  Test method

Impact resistance shall be evaluated using three coated test plaques that represent the finished product. The coated test plaques shall be conditioned for at least 24 h at 73 ± 3 °F (23 ± 2 °C) and 50 ± 5% relative humidity. Each of the samples shall be subjected to a single impact force of a 1.0 in (25 mm) diameter stainless steel ball weighing 0.15 ± 0.01 lb (68 ± 5 g) dropped from a height of 200 ± 1 in (5.1 m ± 25 mm). At the time of impact, test samples shall be supported by a 1/4 in (0.25 in, 6.4 mm) thick neoprene rubber pad with a durometer hardness value of 60 ± 5.

10.2.2  Acceptance criteria

The samples shall not exhibit any cracking, chipping, or peeling at the impact site. If the substrate is coated on both sides, neither side of each test sample shall exhibit any cracking, chipping, or peeling at the impact site.
10.3 Method III (for specific glass and glass-like coatings used on splash zone surfaces)

10.3.1 Test method

The impact resistance of a glass-like coating shall be evaluated using samples of the coating applied to three test plaques of the intended substrate. The coated test plaques shall be conditioned for at least 24 h at 73 ± 3 °F (23 ± 2 °C) and 50 ± 5% relative humidity. Each of the samples shall be subjected to a single impact force of a 1.5 in (38 mm) diameter stainless steel ball weighing 0.5 ± 0.01 lb (230 ± 5 g) dropped from a height of 15 in (38 cm). At the time of impact, test samples shall be supported by and secured to a 3/4 in (0.75 in, 19 mm) thick, 45 lb/ft³ (720 kg/m³) nominal density particle board.

10.3.2 Acceptance criteria

The test samples shall not exhibit any fractures at the impact site.

10.4 Method IV (for glass and glass-like coatings intended for food zone direct food contact and food zone-serving and display ware)

10.4.1 Test method

Impact resistance of glass-like coatings shall be evaluated using samples of the coating applied to three test plaques of the intended substrate. The coated test plaques shall be conditioned for at least 24 h at 73 ± 3 °F (23 ± 2 °C) and 50 ± 5% relative humidity. Each of the samples shall be subjected to a single impact force of a 1.5 in (38 mm) diameter stainless steel ball weighing 0.5 ± 0.01 lb (230 ± 5 g) dropped from a height of 60.0 in (152 cm). At the time of impact, test samples shall be supported by and secured to a 3/4 in (0.75 in, 19 mm) thick, 45 lb/ft³ (720 kg/m³) nominal density particle board.

10.4.2 Acceptance criteria

The test samples shall not exhibit any fractures at the impact site.

11 Heat resistance

11.1 Test method

Heat resistance shall be evaluated using three coated test plaques that represent the finished product. The coated test plaques shall be conditioned for at least 24 h at 73 ± 3 °F (23 ± 2 °C) and 50 ± 5% relative humidity. Three unpolished carbon steel washers (outer diameter: 2.0 in [50 mm]; inner diameter: 13/16 in [0.81 in, 21 mm]; thickness: 1/8 in [0.13 in, 3.2 mm]) shall be heated for 30 min in an oven at 400 ± 5 °F (204 ± 3 °C). Upon removal from the oven, one heated washer shall be placed at the center of each test plaque. Lying flat, the plaques and washers shall be allowed to cool to room temperature. The plaques shall be slanted to a 45° angle, and any movement of the washers shall be observed.

11.2 Acceptance criteria

Each washer shall slide freely along the surface of the test plaque, and the coating shall not exhibit blistering or other visible degradation.
12 Adhesion ability

12.1 Method I (For organic coatings used on food zone – Direct food contact surfaces)

12.1.1 Test method

Adhesion ability shall be evaluated using three coated test plaques that represent the finished product. The coated test plaques shall be conditioned for at least 24 h at 73 ± 3 °F (23 ± 2 °C) and 50 ± 5% relative humidity. The plaques shall be evaluated using Method B of ASTM D3359. One evaluation shall be performed per sample plaque.

12.1.2 Acceptance criteria

For each sample plaque, the grid area shall be classified as 5B per ASTM D3359, or the edges of the cuts shall be completely smooth and none of the squares of the lattice shall be detached.

12.2 Method II (for organic coatings used on serving and display wares)

12.2.1 Test method

Adhesion ability shall be evaluated using three coated test plaques that represent the finished product. The coated test plaques shall be conditioned for at least 24 h at 73 ± 3 °F (23 ± 2 °C) and 50 ± 5% relative humidity. With a straightedge used as a guide, the coated test plaques shall be scored in a grid pattern using a Stanley® type 11-921 utility knife blade, or equivalent, by making two horizontal and two vertical cuts in the coating 1.5 in (38 mm) long and 1.0 in (25 mm) apart. The incisions shall be made through the coating to the substrate with one steady motion. The incisions shall be inspected to establish that the coating has been penetrated to the substrate. A new blade shall be used for each test.

NOTE — If the substrate has not been reached, another grid pattern shall be made in a different location. Do not deepen a previous cut by rescoring.

The test plaques shall then be conditioned for 4 h completely submerged in a 212 ± 5 °F (100 ± 2 °C) water bath. The samples shall then be removed from the bath and allowed to cool to room temperature. The surface of the test plaque shall be cleaned. When dry, using a cyanoacrylate adhesive, a 3/4 in (0.75 in, 19 mm) diameter steel dolly (pull stub) shall be affixed to the test plaque in the center of the scored grid on the plaque. The adhesive shall be allowed to cure for at least 24 h at 73 ± 3 °F (23 ± 2 °C) and 50 ± 5% relative humidity.

The test plaques shall then be securely mounted and a load of 500 ± 25 psi (70 ± 2 kg/cm²) shall be applied to the dolly utilizing a loadframe, or equivalent apparatus. Tensile load shall be applied normal to the surface of the test plaque. Increasing tensile load shall be applied at a constant rate of 0.040 ± 0.010 in/min (0.017 ± 0.004 mm/s).

12.2.2 Acceptance criteria

For each sample, the grid square shall remain affixed when the complete load has been applied.

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12 The Stanley Works. 1000 Stanley Drive, New Britain, CT 06053 <www.stanleyworks.com>.
Annex A
(informative)

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Table A.1 – ASTM\(^1\) Standard specifications for common metallic coating processes

<table>
<thead>
<tr>
<th>Coating type</th>
<th>ASTM specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coated steel sheet</td>
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</tr>
<tr>
<td>electrolytic zinc (electrogalvanized)(^2)</td>
<td>A879–00</td>
</tr>
<tr>
<td>electrolytic zinc/nickel(^2)</td>
<td>A918–00</td>
</tr>
<tr>
<td>hot dip zinc (galvanized)(^2)</td>
<td>A653/A653M–01</td>
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<tr>
<td>hot-dip 55% aluminum-zinc alloy (Galvalume®)(^2,3)</td>
<td>A792/A792M–01</td>
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<tr>
<td>hot-dip aluminum</td>
<td>A463/A463M–01</td>
</tr>
<tr>
<td>hot-dip zinc-5% aluminum alloy (Galfan®)(^2,4)</td>
<td>A875/A875M–01</td>
</tr>
<tr>
<td>Metallic coated articles</td>
<td></td>
</tr>
<tr>
<td>autocatalytic (electroless) nickel-phosphorus</td>
<td>B733–97</td>
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<tr>
<td>electrodeposited chromium</td>
<td>B650–95</td>
</tr>
<tr>
<td>electrodeposited nickel</td>
<td>B689–97</td>
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<tr>
<td>electrodeposited nickel plus chromium</td>
<td>B456–95</td>
</tr>
<tr>
<td>electrodeposited tin</td>
<td>B545–97e1</td>
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<tr>
<td>electrodeposited tin-nickel alloy</td>
<td>B605–95a(1999)</td>
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<td>electrodeposited zinc(^2)</td>
<td>B633–98e1</td>
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<tr>
<td>mechanically deposited zinc(^2)</td>
<td>B695–00</td>
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</table>

\(^1\) ASTM International. 100 Barr Harbor Dr., West Conshohocken, PA 19428 <www.astm.org>.

\(^2\) Zinc-coated materials are not considered acceptable for direct food contact (see 6.1.2).


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Annex B
(informative)

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### Food Equipment Joint Committee

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<th>Name</th>
<th>Company / organization</th>
<th>Interest category</th>
</tr>
</thead>
<tbody>
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<td>Bhatt, Swati</td>
<td>Los Angeles County</td>
<td>Regulatory</td>
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<tr>
<td>Bortolotti, Stefano</td>
<td>Carpigiani</td>
<td>Industry</td>
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<td>Brady, Jim*</td>
<td>Wawa, Inc.</td>
<td>User</td>
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<tr>
<td>Brandt, Rex*</td>
<td>Taylor Company</td>
<td>Industry</td>
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<tr>
<td>Brania, Jonathan*</td>
<td>Underwriters Laboratories, Inc.</td>
<td>User</td>
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<tr>
<td>Brasseur, Eric</td>
<td>Little Caesars Enterprises</td>
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<td>Burton-Zick, Sara*</td>
<td>DuPage County Health Department</td>
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<td>Dye, Shayna</td>
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<td>Dyer, Randy, PhD</td>
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<td>Gagliardi, Tony*</td>
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<td>User</td>
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<td>Hall, Jon</td>
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<tr>
<td>Hipp, Joel*</td>
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<tr>
<td>Leonard, James, MPH, LEHP</td>
<td>Princess Cruises</td>
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<td>Liggans, Girvin, PhD</td>
<td>Food and Drug Administration</td>
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<td>McNeil, Thomas, RS</td>
<td>U.S. Army</td>
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<tr>
<td>Negandhi, Dipak*, PE, CFSP-1</td>
<td>Manitowoc Foodservice</td>
<td>Industry</td>
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<td>Neshan, Massoud</td>
<td>Southern CaseArts</td>
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<td>Northcutt, Kirk</td>
<td>Auto-Chlor System</td>
<td>Industry</td>
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<td>Perez, Michael*</td>
<td>Baring Industries</td>
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<td>Peterson Jr., James</td>
<td>C.i.i. Food Service Design</td>
<td>User</td>
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<td>Rodriguez, Luis, MS</td>
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<td>Samarya-Timm, Michèle</td>
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<td>Scanlon, John*</td>
<td>Hatco Corporation</td>
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<td>Schaefer, Stephen</td>
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<td>Sickles, Willard*, PE</td>
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<td>Tackitt, Steve*</td>
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<tr>
<td>Webb, Timothy</td>
<td>Navy and Marine Corps Public Health Center</td>
<td>Regulatory</td>
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</table>

Joint Committee Secretariat: Al Rose


* Committee or task group chair

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13 Food Equipment Joint Committee members on the date of publication – subject to change. 5/30/2018
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Interpretation Annex
(informative)

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Section 4.2. Requirements for specific types of materials

Requestor’s Interpretation of the Section

4.2.3.1 Copper and copper alloys shall not be used in a food zone or splash zone except where rendered corrosion resistant or where exposure to food is limited to potable, non-carbonated water under constant service pressure. Exceptions to this requirement are specified in 4.2.3.2 for brass and bronze and in 4.2.3.4 for copper-nickel alloys.

Are brass and bronze meant to be included under the initial sentence “Copper and copper alloys shall not be used in a food zone or splash zone except where rendered corrosion resistant or where exposure to food is limited to potable, non-carbonated water under constant service pressure”? For example, if brass material is in contact with only potable, non-carbonated water under constant service pressure, would evaluation under NSF/ANSI 372 be required?

4.2.3.3 Equipment having brass or bronze components in contact with tea, coffee, or water (as permitted in 4.2.3.2), which is intended for human consumption, shall be evaluated for weighted average lead content in accordance with NSF/ANSI 372 – Drinking Water System Components – Lead Content. The weighted average lead content of the water contact portion of the equipment shall be ≤ 0.25%.

NOTE 1 — If a coating (organic or metallic) is applied to the brass or bronze components, evaluation to NSF/ANSI 372 is still applicable.

NOTE 2 — Equipment such as, but not limited to, proofers, steamers, combination ovens and other systems with similar humidification and vaporization pathways shall be exempt from 4.2.3.3.

Section 4.2.3.2 permits use of brass and bronze in a food/splash zone only where rendered corrosion resistant or where exposure to food is clearly and specifically limited to tea, coffee, or water. NSF 51 (clause 4.2.3.3) goes on to require equipment having brass or bronze components in contact with tea, coffee, or water to be evaluated under NSF/ANSI 372 with Note 1 specifying that evaluation to NSF/ANSI 372 is still applicable when coatings (organic or metallic) are applied to the brass or bronze components. If NSF 372 is therefore applicable to coated brass and bronze components, what could be used to render brass/bronze corrosion resistant that would not require evaluation under NSF 372 or is this a typo (clause should read, “…only where rendered corrosion resistant or where exposure to food is clearly and specifically limited…”)?

Interpretation Decision

Based on the organizational structure of Standard 51, all materials addressed in section 4.2.3 and corresponding sub-sections 4.2.3.1 through 4.2.3.4 are classified as copper or copper alloy materials. According to the requirements of 4.2.3.3, equipment containing brass/bronze components in contact with tea, coffee or water require NSF 372 evaluation whether coated or not. Note 2 stipulates the only exemption to this requirement.
Standards

The following Standards established and adopted by NSF as minimum voluntary consensus Standards are used internationally:

- Food equipment
- Commercial warewashing equipment
- Commercial cooking, rethermalization, and powered hot food holding and transport equipment
- Water heaters, hot water supply boilers, and heat recovery equipment
- Dispensing freezers
- Commercial refrigerators and freezers
- Commercial powered food preparation equipment
- Automatic ice making equipment
- Refuse processors and processing systems
- Plastics piping system components and related materials
- Manual food and beverage dispensing equipment
- Commercial bulk milk dispensing equipment
- Thermoplastic refuse containers
- Plumbing system components for recreational vehicles
- Vending machines for food and beverages
- Detergent and chemical feeders for commercial spray-type dishwashing machines
- High pressure decorative laminates (HPDL) for surfacing food service equipment
- Air curtains for entranceways in food and food service establishments
- Residential wastewater treatment systems
- Non-liquid saturated treatment systems
- Drinking water treatment units – Aesthetic effects
- Residential cation exchange water softeners
- Evaluation of components and devices used in wastewater treatment systems
- Biosafety cabinets: Design, construction, performance, and field certification
- Equipment for swimming pools, spas, hot tubs, and other recreational water facilities
- Food equipment materials
- Supplemental flooring
- Drinking water treatment units – Health effects
- Ultraviolet microbiological water treatment systems
- Reverse osmosis drinking water treatment systems
- Mobile food carts
- Drinking water treatment chemicals – Health effects
- Drinking water system components – Health effects
- Drinking water distillation systems
- Sustainable carpet assessment
- Special purpose food equipment and devices
- Glossary of food equipment terminology
- Dietary supplements
- Shower filtration systems – Aesthetic effects
- Personal care products containing organic ingredients
- Goldenseal root (Hydrastis canadensis)
- Sustainability assessment for resilient floor coverings
- Sustainability assessment for commercial furnishings fabric
- Sustainability assessment for wallcovering products
- Sustainability assessment for single ply roofing membranes
- Onsite residential and commercial water reuse treatment systems
- Onsite residential and commercial greywater treatment systems for subsurface discharge
- Polyethylene pipe and fittings for water-based ground-source “geothermal” heat pump systems
- Polypropylene pipe and fittings for water-based ground-source “geothermal” heat pump systems
- Cross-linked polyethylene (PEX) pipe and fittings for water-based ground-source (geothermal) heat pump systems
- Polyethylene of raised temperature (PE-RT) tubing and fittings for water-based ground-source (geothermal) heat pump systems
- Valves for crosslinked polyethylene (PEX) water distribution tubing systems
- Wastewater treatment systems – Field performance verification
- Good manufacturing practices (GMP) for pharmaceutical excipients
- Drinking water treatment system components – Lead content
- Sustainability assessment for water contact products
- Drinking water treatment units – Emerging compounds / incidental contaminants
- Sustainability assessment for water treatment chemical products
- Residential wastewater effluent filters longevity testing
- Public drinking water equipment performance – Filtration
- Environmental leadership and corporate social responsibility assessment of servers
- Sustainability leadership standard for photovoltaic modules
- Hygiene requirements for the design of meat and poultry processing equipment
- Hygiene requirements for the design of hand-held tools used in meat and poultry processing equipment
- Hygiene requirements for the design of mechanical belt conveyors used in meat and poultry processing equipment

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THE HOPE OF MANKIND rests in the ability of man to define and seek out the environment which will permit him to live with fellow creatures of the earth, in health, in peace, and in mutual respect.