NSF/ANSI Standard for
Residential Equipment —

Residential dishwashers

1 General

1.1 Purpose

This Standard establishes minimum public health and sanitation requirements for the materials, design, construction, and performance of residential dishwashing equipment and their related components.

1.2 Scope

Equipment covered by this Standard includes all residential dishwashers.

This Standard does not establish equipment installation requirements. While the requirements of this Standard are intended to ensure equipment may be installed in a sanitary manner, proper installation of equipment shall be governed by the applicable codes.

1.3 Alternate materials, design, and construction

While specific materials, design, and construction may be stipulated in this Standard, equipment that incorporates alternate materials, design, or construction may be acceptable when such equipment meets the intent of the applicable requirements herein.

2 Normative references

The following documents contain provisions that, through reference, constitute provisions of this Standard. At the time this Standard was balloted, the editions listed below were valid. All documents are subject to revision, and parties are encouraged to investigate the possibility of applying the recent editions of the documents indicated.


ANSI/ASSE 1006/AHAM DW-2PR-1986 1992 Plumbing Requirements for Household Dishwashers

FDA 2004 2005 Code

1 Association of Home Appliance Manufacturers, 1111 19th Street NW, Suite 402, Washington, DC 20036

2 American Society of Safety Engineers, 1800 E. Oakon Street, Des Plaines, IL 60018

3 Center for Food Safety and Applied Nutrition, 5100 Paint Branch Parkway, College Park, MD 20740-3835, Report # PB2002-100849 National Technical Information Service NTIS, 5285 Port Royal Road, Springfield, VA 22161
3 Definitions

Terms used in this Standard that have special technical meaning are defined here.

3.1 accessible: Manufactured to be exposed for cleaning and inspection with the use of simple tools.

3.2 air gap: The unobstructed vertical distance through the free atmosphere between the lowest opening of any pipe or faucet supplying water to a tank, plumbing fixture, or other device, and the flood level rim of the receptacle.

3.3 cleaning: Physical removal of residues of food and other soiling material.

3.4 corrosion resistant: Capable of maintaining original surface characteristics under prolonged contact with the intended end-use environment and exposure to appropriate cleaning compounds and sanitizing solutions.

3.5 detergent: A chemical or mixture of chemicals added to wash water to aid in the removal of soil from dishes.

3.6 dishes: Reusable implements used in the preparation or service of food. This term includes, but is not limited to, plates, glasses, cups, bowls, utensils, and trays.

3.7 dish zone: Equipment surfaces intended to be in direct contact with dishes and equipment surfaces that water or condensate may contact and then drain, drip, or splash back onto dishes or surfaces that are intended to be in direct contact with dishes.

3.8 easily cleanable: Manufactured such that food and other soiling material may be removed by manual cleaning methods.

3.9 exposed: Open to view from at least one angle.

3.10 food zone: Equipment surfaces intended to be in direct contact with food and equipment surfaces that food or condensate may contact and then drain, drip, or splash back into food or onto surfaces that are intended to be in direct contact with food.

3.11 heat unit equivalent (HUE): A method for ascertaining the effect of the cumulative killing factors applied to dish surfaces from time and temperature exposure in dishwashers.

3.12 nesting: Placing objects compactly together or intertwining them.

3.13 portable dishwasher: A residential dishwashing machine that can be moved to various locations and has hose fittings to allow connection to a sink for fresh water supply and drain.

3.14 rack: A device upon which dishes are placed for insertion into a dishwashing machine.

3.15 readily accessible: Manufactured to be exposed for cleaning and inspection without the use of tools.

3.16 readily removable: Capable of being detached from the parent unit without the use of tools.

3.17 removable: Capable of being detached from the parent unit with the use of simple tools.
3.18 **residential dishwashing machine:** A machine designed and constructed to wash and sanitize dishes by means of a spray wash and a sanitizing rinse and having an intended use in a private home or other location that is not a food establishment as defined by section 1.201-10 (36) in the 2001 FDA Food Code.

3.19 **sanitization:** The application of cumulative heat, chemicals, or other approved agents on cleaned surfaces that is sufficient to reduce the population of disease organisms by 99.999% (5 log reduction).

3.20 **sanitizing rinse:** Water that is heated and sprayed onto cleaned dishes to achieve sanitization.

3.21 **sanitizing rinse cycle:** As defined by the manufacturer, the period of time during which sanitization occurs as a result of the sanitizing rinse.

3.22 **sealed:** Manufactured without openings to prevent entry or leakage of liquid or moisture.

3.23 **seam:** The resultant intersection of joining members.

3.24 **simple tools:** Hand-held tools commonly available to maintenance and cleaning personnel, such as screwdrivers, pliers, open-end wrenches, and Allen wrenches.

3.25 **smooth:** Free of pits, pinholes, cracks, crevices, inclusions, rough edges, and other surface imperfections detectable by visual and tactile inspection.

3.26 **tub:** The internal area of the machine where washing, rinsing, and sanitizing occur.

3.27 **washing:** Subjecting all surfaces of dishes to sprays of hot water and detergent solution for the purpose of removing food, grease, and other soiling materials.

4 **Materials**

The requirements in this section are intended to ensure that the materials used in the construction of dishwashers resist wear and penetration by vermin. The materials used should not be compromised by the effects of foods, cleaning compounds, and other substances that may be present in the intended use environment.

4.1 **General material requirements**

Materials in the dish zone shall not contain arsenic, cadmium, lead, or mercury as an intentional ingredient, with the following exception: The lead content of brass and bronze components shall not exceed 8.0%.

4.2 **Corrosion resistance**

Exposed surfaces shall be corrosion resistant. Surfaces, other than interior surfaces exposed to wash and rinse water, may be rendered corrosion resistant by the application of a coating or coatings. Coatings shall conform to the requirements in 4.4.

4.3 **Smoothness and cleanability**

Exterior surfaces exposed after installation shall be smooth and easily cleanable. Interior surfaces repeatedly exposed to wash water, rinse water, or both, are not required to be smooth.

4.4 **Coatings**

4.4.1 Coatings in the dish zone containing lead as an intentional ingredient shall not be used. Coatings with an unintentional lead content (lead impurity) greater than 0.06% shall not be used.
4.4.2 Coatings shall not peel or crack under use conditions.

4.5 Solder

Solder containing lead as an intentional ingredient shall not be used in the dish zone.

4.6 Copper water lines

Copper water lines shall not pass through a machine tub. They shall not be used in any recirculating system or be in contact with solutions of detergents or other chemicals. Copper water lines on the exterior of machines are exempt from the corrosion resistance requirement in 4.2.

5 Design and construction

This section contains design and construction requirements that apply to the various types of residential dishwashing equipment covered by this Standard.

5.1 General design and construction requirements

5.1.1 Sanitary design

5.1.1.1 Equipment shall be designed and constructed to prevent the harborage of vermin and the accumulation of dirt and debris.

5.1.1.2 The interior surfaces of the machine exposed to wash water, rinse water, routine splashes, spills, or other soiling shall be accessible and cleanable.

5.1.2 Joints and seams

5.1.2.1 Joints and seams in a tub shall be sealed and smooth. Tubs shall be of integral construction or integrally welded.

5.1.2.2 Joints and seams that result from the installation of functional parts and accessories, or from the joining of machine components, shall be accessible and cleanable.

5.1.3 Angles and corners

Exposed angles and corners on the exterior of a machine to be installed under a counter shall be fastened and smooth.

5.1.4 Solder

Solder and other fillet material shall be smooth and securely bonded to the substrate. All flux and catalytic material shall be removed.

5.1.5 Veneers

When applied to panels and equipment surfaces, veneers shall be securely fastened.

5.1.6 Hinges

Hinges shall be easily cleanable while in place.

5.1.7 Tracks and guides
Tracks and guides for dish racks shall be cleanable and exposed to wash and rinse water.

5.1.8 Plumbing requirements

The residential dishwasher shall comply with ANSI/ASSE 1006/AHAM DW-2PR.

5.1.9 Door gaskets

Exposed surfaces of door gaskets shall be easily cleanable.

5.1.10 Louvers

Louvers shall be free of sharp edges and burrs and shall have spaces large enough to allow for easy cleaning. Louvers that may be subject to splashes, spills, and overhead drips shall be of a drip deflecting design or be readily removable and the space behind the louver easily cleanable.

5.1.11 Equipment mounting

Under-counter machines shall be designed to be able to be moved from under the counter to facilitate inspection and service.

5.1.12 Insulation

Insulation shall be installed so as to prevent it from separating, settling, or becoming damaged under use conditions.

5.2 Specific equipment design and construction requirements

5.2.1 Sanitization indication device

The dishwasher shall be equipped with a device that indicates the dishwasher has successfully completed the sanitization cycle, as defined in 6.2, when a sanitization cycle is selected.

It shall be demonstrable that if the cycle does not successfully complete sanitization, when tested in accordance with 6.2, the indicating device shall not indicate that sanitization has occurred.

5.2.2 Thermostatic control

5.2.2.1 A thermostatic control (thermister or thermostat) shall be provided in combination with a control device to assure that the water temperature of the sanitizing rinse of the normal cycle with a sanitization cycle shall reach a minimum of 150 °F (66 °C).

5.2.2.2 A machine designed to heat water shall be equipped with a temperature regulator for maintaining the proper water temperature.

5.2.3 Separation of residual food waste

A dishwasher shall have a readily accessible and readily removable screen if it does not have a back flush system. If the dishwasher does have a back flush system, the screen is not required to be removable. The minor dimensions of the openings in and around the device through which water passes shall be smaller than the minor dimensions of the openings on the wash or pumped rinse spray assemblies.
5.2.4 Spray assemblies

5.2.4.1 Exposed surfaces of spray assemblies shall be removable and cleanable or shall be easily cleanable while in place.

5.2.4.2 Slot and jet openings on all spray assemblies shall be adequate in size and number to deliver the spray volume and pressure necessary to meet the performance requirements in 6. The openings shall be sized to prevent clogging.

5.2.4.3 Spray assemblies shall be located and directed so that the spray is distributed over all dishes in the wash or rinse area. Spray assemblies shall be designed to ensure that they are reassembled in the proper alignment.

5.2.5 Racks

Racks shall be designed and constructed to minimize the obstruction or masking of sprays. Racks shall conform to the requirements of this Standard but shall be exempt from the coating restrictions of 4.2 and may be rendered corrosion resistant by the application of a coating or coatings.

5.2.6 Final sanitizing rinse

The supply water to the final sanitizing rinse shall not contain recycled water from previous machine cycles.

5.2.7 Cutting boards

Cutting boards shall comply with the requirements of NSF/ANSI 2.

5.2.8 Sinks

If the dishwasher functions as a sink or is equipped with an adjacent sink, the sink shall comply with the following requirements:

5.2.8.1 Dishwashers that function as a sink shall be designed to drain prior to being operated as a dishwasher.

5.2.8.2 Exposed surfaces of sink bowls and partitions shall conform to the food zone requirements of NSF/ANSI 2 for design and construction. Dishwasher pumps, dispensers, recirculation components, and all other exposed surfaces (as installed) shall conform to splash zone requirements of NSF/ANSI 2, but shall be exempt from the requirement to be smooth. The sink bowl shall be self draining.

5.2.8.3 Drains shall be a minimum of 1½ in Iron Pipe Size (IPS) or equal. Strainer baskets, if provided, shall be readily removable.

5.3 Additional design and construction requirements for specific machines

5.3.1 Portable machine

5.3.1.1 Fasteners shall not be used in food zone areas.

5.3.1.2 If used, casters, rollers, and gliders shall be easily cleanable.

5.3.1.3 Insulated space shall be sealed to protect it from condensation, spills, and seepage. Tight fitting, readily removable plugs complying with the zone-specific material requirements may be used to seal off openings to insulated spaces.

5.3.1.4 Counter top units will be treated as portable units.
5.3.1.5 Drain connections shall be of approved materials subject to the same requirements as listed in 4. The connection made to a faucet shall leave room for an air gap.

6 Performance

6.1 Soil removal

6.1.1 Performance requirement

When operated in accordance with the manufacturer's instructions, a dishwasher shall render dishes free of soil and detergents.

6.1.2 Test method

The soil removal efficacy of a residential dishwasher shall be evaluated by observing its ability to remove test soil from dishes, glasses, and utensils. The test soil used to assess the soil removal of the residential dishwashing equipment shall be cultured buttermilk with 1% milk-fat content.

The residential dishwasher shall be conditioned and operated according to sections 4.2, 4.3, 4.6, 4.7.1, and 4.7.2 of ANSI/AHAM DW-1. Water hardness shall be between 4 and 200 ppm. Where necessary a cation exchange water softener may be used to maintain water hardness at this level.

Dinner plates, glasses, and dinner forks shall conform to the requirements of Appendix A of ANSI/AHAM DW-1. Glasses shall be Libbey® glass 551 HT or equivalent. All plates, glasses, and forks shall be clean and dry before applying test soil. Two common stainless steel dinner forks will be used in proportion to each dinner plate used. The forks shall be immersed completely within the test soil, allowed to drain for 45 ± 5 min, and then transferred to a clean rack. Glasses shall be filled with the test soil, dumped, and then dipped so that 1 ± ¼ in (25 ± 3 mm) of the outside rim of the glass is coated. Glasses shall be inverted and allowed to drain for 45 ± 5 min and then transferred to a clean rack. Dinner plates shall have 2 ± 0.3 fluid oz (60 ± 10 mL) of test soil applied to each center. The plate shall be swirled to totally cover the inner portion, less the rim, placed in a rack to drain for 45 ± 5 min in an inclined position, then transferred to a clean rack. All plates, glasses, and forks shall be air dried for 17 ± 1 h at 100 ± 3 °F (38 ± 2 °C). For consistency, the soiled plates, glasses, and forks shall be oriented according to a specified pattern for each replicate trial. Plates and glasses shall be loaded so that no sides shall be touching. Forks shall be loaded so they are not nesting.

When testing dishwashers with two racks, enough plates shall be used to completely fill the lower rack of the dishwasher and enough glasses shall be used to completely fill the upper rack of the dishwasher. When testing dishwashers with only one rack, plates and glasses shall be used to completely fill the rack of the dishwasher in a pattern equivalent to the manufacturer’s instructions.

The detergent shall be loaded into the dishwasher following the manufacturer’s instructions. The detergent(s) used for assessing the soil removal shall be one of the following: Cascade®, Sunlight®, Electrasol®, or the equivalent. An equivalent detergent may be used if it is used by at least 25% of the U. S. domestic market during the past calendar year. The dishwasher shall be operated in accordance with the manufacturer’s instructions. When the dishwasher has completed washing and cleaning (specified cycle), the plates, glasses, and forks shall be observed for the presence of test soil.

4 Libbey, Inc., 300 Madison Avenue, Toledo, OH 43699-0060
5 Cascade®, Proctor and Gamble, Cincinnati, OH 45202
6 Sunlight®, Lever Brothers Company, Greenwich, CT 06836
7 Electrasol®, Benckiser Consumer Products, Inc., Greenwich, CT 06831
6.1.3 Acceptance criteria

The surfaces of all plates, glasses, and forks shall be free of visible soil and detergent. If the presence of soil or detergent on plates, glasses, or forks is found, a second trial shall be completed following the procedures contained in 6.1.2. The presence of soil or detergent on plates, glasses, or forks is not grounds for rejection unless soil or detergent is present following both the first and the second trial. Redeposit of buttermilk flakes is not considered unremoved soil and is not reason for failure.

6.2 Sanitization efficacy

6.2.1 Performance requirement

To ensure adequate sanitization, the rinse portion of one complete sanitizing wash cycle of a dishwasher shall deliver a minimum of 3600 HUEs at the surface of dishes.

6.2.2 Test method

The HUEs delivered by a dishwasher shall be quantified by continuously monitoring the temperature at the surface of three dinner plates in the lower rack and three glasses in the upper rack over the course of a complete dishwashing cycle. The residential dishwasher shall be conditioned and operated according to sections 4.2, 4.3, 4.6, and 4.7 of ANSI/AHAM DW-1. The machine tub shall return to room ambient temperature before beginning the test. After verifying proper dishwasher functioning, the lower rack shall contain the three monitored plates distributed as shown in figure 6.1. The rest of the lower rack shall be filled with unmonitored plates.
Figure 6.1 – Monitored plate and glass locations

Three monitored glasses shall be placed in the upper rack as shown in figure 6.1. The rest of the upper rack shall be filled with unmonitored glasses. The flatware tray shall be filled with unmonitored stainless steel dinner forks such that no nesting occurs. Dishwashers with only one rack shall be loaded in the same pattern as used in 6.1.2, with thermocouples located on two plates and one glass as shown in figure 6.1.

The dishwasher shall then be subject to one complete sanitizing wash cycle. The temperature at the plate and glass surfaces shall be monitored by a calibrated thermocouple attached at the center of each monitored plate and the inside bottom surface of each monitored glass. The thermocouple shall have an accuracy of ± 1.0 °F (± 0.5 °C).

All temperature data points of 143 °F (62 °C) or greater shall be used to calculate the total HUEs delivered during the sanitization rinse cycle. Calculation of HUEs at each monitored plate and glass location shall be based on the information in annex A. Calculations will be based on HUEs gathered per 1-second intervals.

6.2.3 Acceptance criteria

Without interruption, a minimum of 3600 HUEs shall be accumulated at each of the monitored plate and glass locations in the dishwasher. If the temperature at any thermocouple location drops below 143 °F (62 °C), the accumulation of HUEs shall begin at zero once the temperature returns to 143 °F (62 °C). Sanitizing rinse temperatures shall meet or exceed 150 °F (66 °C).

7 Equipment labeling and literature requirements

7.1 Dataplate specifications

The manufacturer of a residential dishwasher shall specify the following on a permanently attached dataplate:

- manufacturer’s name; and
- manufacturer’s model number.

7.2 Product marking

Equipment certified to this Standard shall carry the following sentence, which is to be included in a line adjacent to the certifier’s mark, “Certified residential dishwashers are not intended for licensed food establishments.”

7.3 Manual specifications, care and use guidelines, and installation instructions

7.3.1 The manufacturer shall provide written instructions for the installation, operation, and maintenance of the machine. Where applicable, Manual Specifications, Care and Use Guidelines, and Installation Instructions shall carry this reminder: “Certified residential dishwashers are not intended for licensed food establishments.”

7.3.2 Manufacturer’s Care and Use Guidelines shall carry a warning that states that only sanitizing cycles have been designed to meet the requirements of 6 for soil removal and sanitization efficacy. There is no intention, either directly or indirectly, that all cycles on a certified machine have passed the sanitization performance test.
This page is intentionally blank.
Annex A
(normative)

Heat unit equivalent (HUE) values corresponding to temperature in degrees Fahrenheit

<table>
<thead>
<tr>
<th>Temperature</th>
<th>HUE value</th>
<th>Temperature</th>
<th>HUE value</th>
</tr>
</thead>
<tbody>
<tr>
<td>143.0</td>
<td>1.0</td>
<td>160.9 --</td>
<td>116.7</td>
</tr>
<tr>
<td>143.5 --</td>
<td>1.1</td>
<td>161.0 --</td>
<td>119.9</td>
</tr>
<tr>
<td>144.0 --</td>
<td>1.3</td>
<td>161.1 --</td>
<td>123.1</td>
</tr>
<tr>
<td>144.5 --</td>
<td>1.5</td>
<td>161.2 --</td>
<td>126.4</td>
</tr>
<tr>
<td>145.0 --</td>
<td>1.7</td>
<td>161.3 --</td>
<td>129.8</td>
</tr>
<tr>
<td>145.5 --</td>
<td>2.0</td>
<td>161.4 --</td>
<td>133.3</td>
</tr>
<tr>
<td>146.0 --</td>
<td>2.2</td>
<td>161.5 --</td>
<td>136.9</td>
</tr>
<tr>
<td>146.5 --</td>
<td>2.5</td>
<td>161.6 --</td>
<td>140.6</td>
</tr>
<tr>
<td>147.0 --</td>
<td>2.9</td>
<td>161.7 --</td>
<td>144.4</td>
</tr>
<tr>
<td>147.5 --</td>
<td>3.3</td>
<td>161.8 --</td>
<td>148.2</td>
</tr>
<tr>
<td>148.0 --</td>
<td>3.8</td>
<td>161.9 --</td>
<td>152.2</td>
</tr>
<tr>
<td>148.5 --</td>
<td>4.3</td>
<td>162.0 --</td>
<td>156.3</td>
</tr>
<tr>
<td>149.0 --</td>
<td>4.9</td>
<td>162.1 --</td>
<td>160.5</td>
</tr>
<tr>
<td>149.5 --</td>
<td>5.7</td>
<td>162.2 --</td>
<td>164.9</td>
</tr>
<tr>
<td>150.0 --</td>
<td>6.5</td>
<td>162.3 --</td>
<td>169.3</td>
</tr>
<tr>
<td>150.5 --</td>
<td>7.4</td>
<td>162.4 --</td>
<td>173.9</td>
</tr>
<tr>
<td>151.0 --</td>
<td>8.4</td>
<td>162.5 --</td>
<td>178.5</td>
</tr>
<tr>
<td>151.5 --</td>
<td>9.6</td>
<td>162.6 --</td>
<td>183.3</td>
</tr>
<tr>
<td>152.0 --</td>
<td>11.0</td>
<td>162.7 --</td>
<td>188.3</td>
</tr>
<tr>
<td>152.5 --</td>
<td>12.5</td>
<td>162.8 --</td>
<td>193.3</td>
</tr>
<tr>
<td>153.0 --</td>
<td>14.3</td>
<td>162.9 --</td>
<td>198.6</td>
</tr>
<tr>
<td>153.5 --</td>
<td>16.4</td>
<td>163.0 --</td>
<td>203.9</td>
</tr>
<tr>
<td>154.0 --</td>
<td>18.7</td>
<td>163.1 --</td>
<td>209.4</td>
</tr>
<tr>
<td>154.5 --</td>
<td>21.3</td>
<td>163.2 --</td>
<td>215.0</td>
</tr>
<tr>
<td>155.0 --</td>
<td>24.4</td>
<td>163.3 --</td>
<td>220.8</td>
</tr>
<tr>
<td>155.5 --</td>
<td>27.8</td>
<td>163.4 --</td>
<td>226.8</td>
</tr>
<tr>
<td>156.0 --</td>
<td>31.8</td>
<td>163.5 --</td>
<td>232.9</td>
</tr>
<tr>
<td>156.5 --</td>
<td>36.3</td>
<td>163.6 --</td>
<td>239.1</td>
</tr>
<tr>
<td>157.0 --</td>
<td>41.4</td>
<td>163.7 --</td>
<td>245.6</td>
</tr>
<tr>
<td>157.5 --</td>
<td>47.3</td>
<td>163.8 --</td>
<td>252.2</td>
</tr>
<tr>
<td>158.0 --</td>
<td>54.0</td>
<td>163.9 --</td>
<td>259.0</td>
</tr>
<tr>
<td>158.5 --</td>
<td>61.7</td>
<td>164.0 --</td>
<td>265.9</td>
</tr>
<tr>
<td>159.0 --</td>
<td>70.5</td>
<td>164.1 --</td>
<td>273.1</td>
</tr>
<tr>
<td>159.5 --</td>
<td>80.5</td>
<td>164.2 --</td>
<td>280.4</td>
</tr>
<tr>
<td>160.0 --</td>
<td>91.9</td>
<td>164.3 --</td>
<td>288.0</td>
</tr>
<tr>
<td>160.1 --</td>
<td>94.4</td>
<td>164.4 --</td>
<td>295.7</td>
</tr>
<tr>
<td>160.2 --</td>
<td>96.9</td>
<td>164.5 --</td>
<td>303.7</td>
</tr>
<tr>
<td>160.3 --</td>
<td>99.5</td>
<td>164.6 --</td>
<td>311.9</td>
</tr>
<tr>
<td>160.4 --</td>
<td>102.2</td>
<td>164.7 --</td>
<td>320.3</td>
</tr>
<tr>
<td>160.5 --</td>
<td>105.0</td>
<td>164.8 --</td>
<td>328.9</td>
</tr>
<tr>
<td>160.6 --</td>
<td>107.8</td>
<td>164.9 --</td>
<td>337.7</td>
</tr>
<tr>
<td>160.7 --</td>
<td>110.7</td>
<td>165.0*</td>
<td>346.8</td>
</tr>
<tr>
<td>160.8 --</td>
<td>113.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The maximum number of HUE cannot exceed 346.8 for any single point.