



# Standard Specification for Hot Water Sanitizing Commercial Dishwashing Machines, Multiple Tank, Rackless Conveyor Type<sup>1</sup>

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

## 1. Scope

1.1 This specification covers multiple tank, automatic rackless conveyor type, commercial dishwashing machines.

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

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

- A29/A29M Specification for Steel Bars, Carbon and Alloy, Hot-Wrought, General Requirements for
- A102 Specification for Ferrovandium
- A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
- A276 Specification for Stainless Steel Bars and Shapes
- A436 Specification for Austenitic Gray Iron Castings
- A554 Specification for Welded Stainless Steel Mechanical Tubing
- A582/A582M Specification for Free-Machining Stainless Steel Bars
- B43 Specification for Seamless Red Brass Pipe, Standard Sizes
- B75 Specification for Seamless Copper Tube
- B127 Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip
- F760 Specification for Food Service Equipment Manuals

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee F26 on Food Service Equipment and is the direct responsibility of Subcommittee F26.01 on Cleaning and Sanitation Equipment.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

### 2.2 Federal Regulation:<sup>3</sup>

OSHA Title 29

### 2.3 American National Standards:<sup>4</sup>

ANSI S1.4 Specification for Sound Level Meters

ANSI S1.13 Methods for the Measurement of Sound Pressure Levels

### 2.4 National Electrical Manufacturers Association Standards:<sup>5</sup>

NEMA ICS Industrial Controls and Systems

NEMA MG-1 Motor and Generators

### 2.5 National Fire Protection Association Standard:<sup>6</sup>

NFPA No. 70 National Electrical Code

### 2.6 NSF International Standards, Criteria, and Listings:<sup>7</sup>

NSF/ANSI 3 Commercial Warewashing Equipment

NSF 5 Commercial Hot Water Generating Equipment

NSF 29 Detergent/Chemical Feeders For Commercial Spray Type Dishwashing Machines

NSF Food Equipment and Related Products, Components, and Materials

### 2.7 Underwriters Laboratories Standard:<sup>8</sup>

UL 921 Commercial Electric Dishwashers

UL 1453 Electric Booster and Commercial Storage Tank Water Heaters

### 2.8 American Society of Sanitary Engineering Standards:<sup>9</sup>

ASSE 1004 Dishwashers

<sup>3</sup> Code of Federal Regulations, Chapter XVII, Part 1910, available from Superintendent of Documents, Government Printing Office, Washington, DC 20402.

<sup>4</sup> Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

<sup>5</sup> Available from National Electrical Manufacturers Assn., 2101 "L" Street, NW, Washington, DC 20037.

<sup>6</sup> Available from National Fire Protection Assn., Batterymarch Park, Quincy, MA 02269.

<sup>7</sup> Available from NSF International, 789 N. Dixboro Rd., Ann Arbor, MI 48105-9723.

<sup>8</sup> Available from Underwriters Laboratories, Inc., 333 Pfcngsten Road, Northbrook, IL 60062.

<sup>9</sup> Available from American Society of Sanitary Engineering, P. O. Box 9712, Bay Village, OH 44140.

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *commercial dishwashing machines, n*—machines that uniformly wash, rinse, and hot water–sanitize eating and drinking utensils.

3.1.1.1 *Discussion*—The machines shall be capable of removing physical soil from properly pre-scraped items and sanitizing multiple use eating and drinking utensils. These machines shall automatically convey soiled dishes through the treatment stages of the machine, conveying them out at the clean end of the machine. The dishwashing machines shall consist of the following principal parts: legs, wash chamber, rinse chamber, tank, door, spray assemblies, pump motors, controls, piping, valves, conveying mechanism, heating equipment, and accessories.

### 4. Classification

4.1 *General*—Dishwashing machines shall be of the following types, styles, classes, and groups, as specified.

#### 4.2 Types:

4.2.1 *Type I*—This machine shall be designed and supplied to accept the feeding of soiled tableware from the right side, when facing the front of the machine.

4.2.2 *Type II*—This machine shall be designed and supplied to accept the feeding of soiled tableware from the left side, when facing the front of the machine.

#### 4.3 Styles and Classes:

4.3.1 *Style 1 (Steam Heated)*—Low pressure steam 20 to 35 psi (137.8 to 241.3 kPa) flowing pressure at point of machine connection.

4.3.1.1 Class A—Injectors.

4.3.1.2 Class B—Heat exchange coils.

4.3.2 *Style 2 (Electrically heated)*.

4.3.3 *Style 3 (Gas heated)*.

4.3.3.1 Class C—Natural gas.

4.3.3.2 Class D—LP gas.

#### 4.4 Size and Capacity (see Specification F861):

4.4.1 *Group A*—Minimum conveyor width 22.5 in. (571.5 mm) with an operating capacity of 5000 dishes per hour minimum.

4.4.2 *Group B*—Minimum conveyor width 26.5 in. (673.1 mm) with an operating capacity of 8700 dishes per hour minimum.

4.4.3 *Group C*—Minimum conveyor width 31 in. (787 mm) with an operating capacity of 11 800 dishes per hour minimum.

4.5 All dishwashing machines of the same classification, model, or material list designation furnished with similar options under a specific purchase order; shall be identical to the extent necessary to ensure interchangeability of component parts, assemblies, accessories, and spare parts.

### 5. Ordering Information

5.1 Purchasers should select the preferred options permitted in this specification and include the following information in procurement documents:

5.1.1 Title, number, and date of this standard,

5.1.2 Type, style, class, and group machine required (see 4.1),

5.1.3 Length of load and unload sections (see 4.4),

5.1.4 Noise level requirements, if other than specified (see 11.2),

5.1.5 When a service-supply valve is required (see 7.5),

5.1.6 When a standard 40°F (22°C) temperature rise steam or electric, or gas booster is required, or stipulate if the required temperature rise is more than 40°F (22°C) (see 7.14),

5.1.7 Electrical power supply characteristics (current, voltage, phase, frequency) (see Section 8),

5.1.8 When a detergent feeder is required (see 7.15),

5.1.9 When a rinse agent feeder is required (see 7.16),

5.1.10 Accessory equipment, such as end cowls with vent opening, or spare and maintenance parts required, as suggested by manufacturer,

5.1.11 Treatment and painting if other than specified (see Section 10),

5.1.12 When energy consumption profiles, water consumption profiles, or productivity profiles are desired (see 12.3), and

5.1.13 Manufacturing certification when required (see Section 13).

### 6. Materials and Design

6.1 All materials shall be specified as follows:

6.1.1 Materials used shall be free from defects that would adversely affect performance or maintainability of individual component(s) of the overall assembly. The dishwashing machines shall meet the material design and construction requirements of NSF/ANSI 3.

6.1.2 *Corrosion-Resistant Steel*—Corrosion-resistant steel shall conform to the requirements of any 300 series stainless steel specified in 2.1.

6.1.3 *Corrosion Resisting Material*—Corrosion-resisting material is other than corrosion resistant steel that is equivalent in the dishwasher application.

6.1.4 *Nickel-Copper Alloy*—Nickel-Copper alloys shall conform to the requirements of Specification B127.

6.1.5 *Plastics*—All plastic materials and components used in the dish machine rinse system shall conform to NSF/ANSI 3.

### 7. Construction Requirements

7.1 The dishwashing machine shall be complete so that when connected to the specified source of power, water supply, heating means (steam, electric, or gas), drainage, detergent, and rinse agent feeder as applicable, the unit can be used for its intended function. Dishwashers shall be rigid, quiet in operation, free from objectionable vibration, and so constructed as to prevent objectionable splashing of water to the outside of the machine. The machine shall be equipped with splash curtains to prevent excessive splash and spray carryover. Parts requiring adjustment or service, or both, shall be readily accessible from the front and side of the machine. The machine shall be furnished with a loading and unloading section. The machine shall wash dishes by means of a water and detergent solution pumped from a tank and shall final rinse the dishes with fresh water from an outside source. The machine may include a pumped rinse prior to the final sanitizing rinse.

Provisions shall be made to fill the wash and rinse tank either directly from the regular hot water supply with a hand valve or through the booster or solenoid, or both. The dishwashing machine shall have a conveyor belt suitable for handling eating and drinking utensils, the conveyor belt shall be protected by an adjustable slip clutch or other device. Means shall be provided for releasing or disconnecting the driving power, or the drive, in case of jamming. The conveyor belt shall be driven by a motor-driven gear reduction unit. The wash, pumped rinse, and final rinse treatment shall be controlled by means of the conveyor speed as determined by NSF/ANSI 3 for multiple tank conveyor type machines. The final rinse spray control shall have a positive return to the “off” position when there is no tableware in process to ensure the conservation of final rinse water. The machine shall be provided with tracks of corrosion-resisting steel not less than 0.070 in. thick, or other corrosion-resisting material. Dishwashers shall have an inside working height of not less than 17½ in. (444.5 mm).

**7.2 Conveyor Belt**—The conveyor belt shall be of heavy duty construction adequately supported for added strength and rigidity. The conveyor belt shall be constructed of a suitable corrosion-resistant steel or corrosion-resisting material. The upright portion of the belt may be of corrosion-resistant steel or corrosion resisting material. When dishware contact surfaces occur, a nonmetallic, non-marking material shall be utilized. It shall be designed to accept dishes, cup and glass racks when used, and food service utensils. The conveyor will automatically stop if the operator should fail to remove sanitized items from the conveyor belt at the unload end.

**7.3 Piping, Tubing, Fittings, and Valves (Installation)**—Connections shall be readily accessible to facilitate installation and maintenance. Piping, tubing, and valves shall be located, whenever possible, on the exterior of the machine. See Specifications **A29/A29M**, **A102**, **A167**, **A276**, **A554**, **B43**, and **B75**.

**7.4 Piping and Fittings**—Water, steam piping, and fittings shall be of corrosion resisting material. Fresh water supply to the tank shall be discharged not lower than 2 in. (50.8 mm) above the maximum flood level rim, or an effective air gap or vacuum breaker shall be installed to prevent backflow. Back-flow protection shall be in accordance with ASSE 1004. The drain and other plumbing connections shall be standard pipe or tubing connections. Drainage piping shall be corrosion-resisting material, or suitable heat-resisting plastic tubing with fittings. Drains may be joined into a single trunk line requiring only one connection or arranged to permit individual connections to the waste line.

**7.5 Valves**—Steam valves shall be corrosion-resisting material designed for steam applications and for a saturated steam working pressure of 50 psi (345 kPa). When specified, a separately packed service supply valve shall be provided for closing the supply of water to the dishwasher. The drain valve shall be permanently marked to show “open” and “closed” position and shall be lever-operated or wheel operated, ruggedly designed for foot or hand operation except when drain valve closure is automatic. Fresh water rinse valves shall be

reliable and fully automatic and suitable for 210°F (98.9°C) water. The manually operated valves, when used, shall be identified.

**7.6 Spray Assemblies**—All spray nozzles and spray arm manifolds shall be corrosion-resisting materials (see Specification **A582/A582M**). All spray assemblies shall be removable without the use of tools and shall be easily cleanable or easily cleanable in place. Final sanitizing rinse spray assemblies, components, or both shall be removable for delimiting, descaling, and similar maintenance.

**7.7 Tank**—The tank shall be constructed of not less than 0.055 in. corrosion-resistant steel or other corrosion-resisting material.

**7.8 Overflow**—The dishwashers shall have a readily accessible overflow drain in the tank. The overflow unit, or cover, when provided, shall be readily removable for cleaning.

**7.9 Scrap Trays (Strainers)**—Scrap trays of corrosion-resistant steel, not less than 0.044 in. thick, or other corrosion-resisting material shall be provided to prevent insoluble matter and large pieces of food residue from passing into the tank. The ledges on which the scrap trays rest shall be so designed that surfaces beneath the ledges are easily accessible for cleaning when the trays are removed. Any opening around or between scrap trays shall be held to a minimum and shall be as close as is practical to the size of the scrap tray opening.

**7.10 Access Door(s)**—Access door(s) shall be provided for ease of machine cleanout. The door(s) shall be constructed of not less than 0.044 in. thick corrosion resisting material shall be rigid and stiffened as necessary. Door safety catch(es) or equivalent means shall be provided to retain the door in the open position. The dishwasher shall automatically stop if the machine is in operation at the time the access doors are opened. For maximum operator safety, the door handles, when provided, shall be of insulated handle design. Doors shall be splash-proof and their exposed edges shall be smooth and formed to prevent canting or warping. One door assembly shall be furnished for each tank.

**7.11 Legs (Feet)**—The machine shall be rigidly constructed and have four or more legs (feet) made of corrosion-resisting material. Legs shall be adjustable, so that the height of the track may be varied from 34 to 35 in. (863.6 to 889 mm) above the floor.

**7.12 Pump and Motor Assemblies:**

**7.12.1 Assemblies**—The pump and motor assembly shall be mounted on the tank or on a rigid steel base. Rotary seals shall be provided for pump shafts and shall be removable for servicing.

**7.12.2 Pump (see Specification A436)**—Pump casings shall be cast iron or corrosion-resisting material and shall have a removable cover or inspection plate, or be of such a design as to permit accessibility for inspection and removal of foreign items from the impeller and interior. The pump shall either be self-draining or equipped with means for draining. The shaft shall be of corrosion-resistant steel, properly aligned and supported. The impeller shall be corrosion-resisting material or iron alloy and shall be in dynamic balance. The pump shall

have at least two ball or roller bearings, except that when the pump and motor are mounted on the same shaft, at least two ball or roller bearings shall be provided for the motor and pump. The pump suction intake shall be provided with a corrosion-resistant strainer or shroud.

7.13 *Heating*—Style 1, 2, and 3 machines shall be capable of maintaining required temperature levels in the tanks.

7.13.1 *Style 1*—Style 1 machines shall be suitable for operation with a steam supply flow pressure of from 15 to 25 psi (137.8 to 241.3 kPa) flowing. Temperature regulators shall be provided for maintaining the proper water temperature in the tank. Low water protection shall be provided. Steam heat will be provided by tube type heat exchangers, steam injectors, or a combination of both. The minimum operating pressure shall be specified by the manufacturer and the maximum operating pressures shall not exceed 50 psi (103.4 kPa).

7.13.2 *Style 2*—Style 2 machines shall be equipped with electric heater elements and sheaths of 300 series corrosion-resistant steel or other corrosion-resisting material. They shall be provided with temperature regulators for maintaining the proper water temperature in the tank. Low water protection shall be provided.

7.13.3 *Style 3*—Style 3 machines shall be equipped with a gas burner assembly including safety pilots (or equivalent), shut-off valves, and flue suitable for operation with type of gas specified. They shall be provided with temperature regulators for maintaining the proper water temperature in the tank. Low water protection shall be provided.

7.14 *Final Rinse Booster*—Final rinse booster heater will not be furnished as a part of the machine unless specified.

7.14.1 *Steam Booster*—When specified, the dishwasher shall be provided with an adjustable, automatic steam booster to raise the temperature of the final rinse water from 140°F (60°C) to at least 180°F (82.22°C). The steam booster shall automatically maintain the required final rinse water temperature without producing steam within either the steam booster or the water supply piping from the steam booster to the machine. The steam booster shall be securely mounted as an integral part of the machine in a position that does not interfere with operation and permits attachment of tables or counters. Otherwise, the steam booster shall be furnished separately, mounted on its own legs, and equipped with suitable fittings for connection into the final rinse water lines. Required valves and the temperature regulator shall be accessible and adjustable from the front of the machine. Valve and pipe unions shall be installed on the steam booster where the steam and water lines enter the unit. The final rinse water temperature shall be controlled by an automatic regulator controlling the input of steam to the steam booster.

7.14.2 *Electric Booster*—When specified, the dishwasher shall be provided with an electric booster having all necessary controls for automatic operation to raise the temperature of the final rinse water from 140°F (60°C) to at least 180°F (82.22°C). The booster shall be designed to operate with the electric power characteristics specified. The electric booster shall be securely mounted as an integral part of the machine in a position that does not interfere with operation and permits attachment of tables or counters. Otherwise, the electric

booster shall be furnished separately, mounted on its own legs and equipped with suitable fittings for connection into the final rinse water lines. Required valves and the temperature regulator shall be accessible and adjustable from the front of the machine.

7.14.3 *Gas Booster*—When specified, the dishwasher shall be provided with a gas booster having all the necessary controls for automatic operation to raise the temperature of the final rinse water from 140°F (60°C) to at least 180°F (82.22°C). The booster shall be designed to operate with the type of gas specified. It shall be equipped with suitable fittings for connection to the gas line and final rinse water lines. Required valves and the temperature regulator shall be accessible and adjustable from the front of the machine.

7.15 *Detergent Feeder*—When specified, an electric or electronic automatic detergent feeder conforming to NSF 29 shall be separately packed with the dishwasher. The reservoir of the feeder shall be capable of holding a supply of dishwashing detergent adequate in normal dishwashing operations for one meal period.

7.16 *Rinse Agent Feeder*—When specified, a separately packed rinse agent feeder conforming to requirements of NSF 29 shall be supplied with the dishwasher.

## 8. Electrical, Steam, and Gas Equipment Requirements

8.1 The electrical, steam, and gas equipment shall meet the requirements of UL 921. The dishwasher shall operate on the power characteristics (current, voltage, phase, frequency) specified (see NFPA No. 70).

8.2 *Motors (see NEMA ICS)*—Motors shall comply with applicable requirements of UL 921. The horsepower ratings of the motors shall be adequate to meet the pump requirements of NSF/ANSI 3.

8.3 *Controls (see NEMA MG-1)*—All control equipment shall conform to UL 921 and be capable of operation in an ambient room temperature of 115°F ± 9°F (46°C ± 5°C).

8.4 *Wiring and Circuit Safety Devices*—All wiring and circuit safety devices shall be in conformance with UL 921. All wiring between the dishwashing machine components shall have provisions for completion at a recognized junction on the machine, except electric heaters and booster heaters requiring connections to the main electrical power supply.

## 9. Lubrication Requirement

9.1 Means for effective and adequate lubrication shall be provided when required. Lubricating points shall be readily accessible and the dishwasher shall be lubricated with the proper amount of lubricant prior to delivery.

## 10. Treatment and Painting Requirements

10.1 Unless otherwise specified, the dishwashers shall be treated and painted in accordance with the manufacturer's standard practice. All surfaces of the machine other than corrosion resisting materials shall be protected against corrosion in the use environment and shall present a neat appearance.

## 11. Performance Requirements

11.1 *Performance Standards Compliance*—Dishwashing machines shall conform to the requirements of OSHA, UL 921, and NSF/ANSI 3. Detergent and rinse agent feeders, when specified, shall comply with NSF 29. Electric and gas booster heaters, when specified, shall conform to NSF 5. Electric booster heaters shall conform to UL 1453.

11.2 *Noise Level*—Unless otherwise specified, the noise level of the dishwasher only, when operating, exclusive of loading, unloading, and servicing, shall not exceed 80 dB at loading and unloading stations, measured at 5 ft above the floor and 2 ft away from the dishwasher (see ANSI S1.4 and ANSI S1.13).

## 12. Test Methods

12.1 *Operational*—Each machine shall be thoroughly tested in accordance with manufacturer's instructions to determine compliance with requirements of NSF/ANSI 3 and UL 921.

12.2 *Leakage*—No leakage shall occur, when tested at pressures up to 125% of the manufacturer's recommended supply line pressure.

12.3 *Performance Profiles*—A new standard is to be developed for energy consumption, water consumption, and productivity profiles.

## 13. Certification

13.1 Certification of compliance with the standards cited in this specification shall be provided to the purchaser if required in the purchase document.

13.2 *UL Listing*—Acceptable evidence of meeting the requirements of UL 921 shall be UL listing or UL label, or a certified test report from a recognized independent testing laboratory, acceptable to the user.

13.3 *NSF Listing*—Acceptable evidence of meeting the requirements of NSF/ANSI 3 shall be a listing in the NSF Food Equipment and Related Products, Components, and Materials and the NSF mark on the finished dishwashing machine, or a

certified test report from a recognized independent testing laboratory acceptable to the user.

## 14. Product Marking

14.1 *Machine Identification*—Identification shall be permanently and legibly marked directly on the dishwashing machine or on a corrosion-resisting material securely attached to the machine at the source of manufacture. Identification shall include the manufacturer's model number, serial number, name, and trademark to be readily identifiable. In addition, information required by NSF/ANSI 3 and UL 921 shall be included on the dishwasher or on the data plate.

14.2 *Instruction Plate*—An instruction plate of corrosion-resisting material shall be attached to each machine at a height readily visible to the operator. The instruction plate shall list the maximum conveyor speed and water temperatures for pumped wash and final rinse.

## 15. Machine Manuals

15.1 The following information shall be supplied in the manuals:

- 15.1.1 Installation instructions,
- 15.1.2 Operating guide,
- 15.1.3 Maintenance and service procedures, and
- 15.1.4 Service parts list.

15.2 Manuals shall be in accordance with Specification **F760**.

## 16. Quality Assurance


16.1 Unless otherwise specified in the contract or purchase order, the manufacturer is responsible for the performance of all requirements as specified in this specification. Except as otherwise specified in the contract or order, the manufacturer may use his own or any other facility suitable for the testing of the machine requirements specified herein.

## 17. Keywords

17.1 automatic; commercial; conveyor; dishwasher; dishwashing; flight type; hot water; multiple tank; rackless; sanitizing; warewashing

## SUPPLEMENTARY REQUIREMENTS

S1. When specified in the purchase order, supplementary requirements shall apply when this standard is used in government procurement of hot water sanitizing commercial dishwashing machines.

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