



Standard Specification for Commercial Dishwashing Machines, Multiple-Tank, Continuous Oval-Conveyor Type, Heat Sanitizing¹

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

1. Scope

1.1 This specification covers commercial multiple-tank dishwashing machines of the continuous type, oval shaped, with horizontal table conveyor systems.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 The following safety hazards caveat pertains only to Section 12, Test Methods, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

- A240/A240M Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
- B127 Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip
- F760 Specification for Food Service Equipment Manuals
- F861 Specification for Commercial Dishwashing Racks
- F1920 Test Method for Performance of Rack Conveyor, Commercial Dishwashing Machines

2.2 Federal Regulations:³

- OSHA Title 29

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

³ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401.

2.3 NSF International Standards:⁴

- NSF/ANSI 3 Commercial Warewashing Equipment
- NSF/ANSI 5 Commercial Hot Water Generating Equipment⁵
- NSF/ANSI 14 Plastic Piping System Components and Related Materials
- NSF/ANSI 29 Detergent/Chemical Feeders for Commercial Spray-Type Dishwashing Machines
- NSF/ANSI 51 Food Equipment Materials
- NSF Listings—Food Equipment

2.4 Underwriters Laboratories Standard:⁶

- UL 921 Commercial Electric Dishwashers

2.5 ASSE International:⁷

- ASSE 1004 Dishwashers

2.6 Military Standard:⁸

- MIL-STD-129 Marking for Shipment and Storage

3. Terminology

3.1 Definitions:

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

3.1.1.1 *Discussion*—The machines shall be capable of removing physical soil from properly racked and prescrapped items, and sanitizing multiple-use eating and drinking utensils. The dishwashing machine and conveyor-table, when assembled, shall form an oval-shaped dish handling system. The machines shall automatically convey racks of soiled dishes through the treatment stages of the machine, conveying them out to the clean dish removal area of the conveyor. The dishwashing machines shall consist of the following principal parts: legs, recirculating pre-wash chamber, wash chamber, rinse chamber, tanks, doors, spray assemblies, pumps, motors,

⁴ Available from NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI 48113-0140.

⁵ NSF /ANSI 5 applies only if a booster heater is furnished.

⁶ Available from UL LLC, 333 Pfingsten Rd., Northbrook, IL 60062.

⁷ Available from ASSE International, 18927 Hickory Creek Drive, Suite 220, Mokena, IL 60448.

⁸ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098

controls, piping, valves, conveying mechanisms, horizontal conveyor tables, heating equipment, and accessories.

4. Classification

4.1 *General*—Dishwashing machines shall be of the types, styles, classes, arrangement, sizes, and capacity groups, as specified in 4.2 – 4.6.

4.2 Types:

4.2.1 *Type I-CW (clockwise) Rotation*—This machine shall be designed and supplied to accept the feeding of soiled tableware from the right side, when viewed from above.

4.2.2 *Type II-CCW (counterclockwise) Rotation*—This machine shall be designed and supplied to accept the feeding of soiled tableware from the left side, when viewed from above.

4.3 Styles and Classes:

4.3.1 *Style 1 (Steam Heated)*—Low-pressure steam [20 to 35 psi (137.9 to 241.3 kPa)] flowing pressure at point of machine connection.

4.3.1.1 *Class A*—Style 1 dishwashing machine that uses steam injectors.

4.3.1.2 *Class B*—Style 1 dishwashing machine that uses heat exchange steam 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 *Style 4 (Pre-Wash Unit)*—The dishwashing machine shall have a pump recirculated prewash unit. The automatic prewash unit shall be fitted to, or be a part of the dishwashing machine.

4.5 Arrangement:

4.5.1 *Arrangement A*—With tray rail and table-mounted garbage disposal machine.

4.5.2 *Arrangement B*—With food waste trough instead of tray rail; garbage disposal machine in center of trough.

4.5.3 *Arrangement C*—Same as Arrangement A, except disposal unit not furnished; food discharged to garbage can at disposal location.

4.5.4 *Arrangement D*—Same as Arrangement B, except disposal unit not furnished; food discharged to garbage can at disposal location.

4.6 *Capacity*—240 racks per hour minimum, 19-³/₄ by 19-³/₄ in. (501.6 by 501.6 mm) (nominal) or equivalent meeting capacity requirement.

5. Ordering Information

5.1 Purchasers should select the preferred options permitted in this specification and include the information in 5.1.1 and 5.1.2 in the procurement document.

5.1.1 Title, designation number, and date of this specification.

5.1.2 Type, style, class, and arrangement required (see 4.1),

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

5.1.4 Whether a service-supply valve is required (see 7.5),

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

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

5.1.7 Whether a detergent feeder is required (see 7.15),

5.1.8 Whether a rinse agent feeder is required (see 7.16),

5.1.9 Accessory equipment required, such as end cowls with vent openings, or spare and maintenance parts as suggested by the manufacturer.

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

5.1.11 When energy consumption profiles, water consumption profiles, or productivity profiles are desired (see 12.3).

5.1.12 Manufacturer's certification, when required (see Section 13),

5.1.13 Whether a flatware soak sink is required (see 7.16).

6. Materials

6.1 All materials shall be specified as follows:

6.1.1 Materials used shall be free from defects that would affect the performance or maintainability of individual components 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 200, 300, or 400 series stainless steel.

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

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

6.1.5 *Plastics*—All plastic materials and components used in the dishwashing rinse system shall conform to NSF/ANSI 14 or NSF/ANSI 51.

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 or electric) and drainage, detergent and rinse agent feeder as applicable, the unit can be used for its intended function. Dishwashers shall be quiet in operation, free from 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 wash dishes by means of a water and detergent solution pumped from a tank and shall pump rinse the dishes under pump pressure prior to the final rinse of fresh water from an outside source. 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, provided the water temperatures comply with the provisions of NSF/ANSI 3. The dishwashing machine shall have a conveyor for handling 19-³/₄ by 19-³/₄ in. (501.6 by 501.6 mm) (nominal) racks, or equivalent meeting capacity requirement. The conveyor shall be protected by an adjustable slip clutch or other device.

Means shall be provided for releasing or disconnecting the drive power, or the drive in case of jamming. The conveyor shall be driven by a separate motor. The final rinse spray control shall have a positive return to the OFF position when there are no racks in process to ensure the conservation of final rinse water. The machine shall be provided with tracks of corrosion-resistant steel or other corrosion-resisting material not less than 0.070 in. (1.78 mm) or equivalent die formed, not less than 0.059 in. (1.5 mm) thick. Dishwashers shall have an inside working height of not less than 17.5 in. (444.5 mm) above the track.

7.2 Conveyor—The conveyor shall be of heavy-duty construction, and of suitable corrosion-resisting material. It shall be designed to convey racks conforming to Specification **F861** through the dishwasher automatically.

7.2.1 Conveyor Clutch System—An automatic trouble free clutch system, spring-loaded, or adjustable slip clutch, and of the automatic re-engaging type, shall be furnished to shut down the conveyor in case of a jam or other mechanical malfunction(s).

7.2.2 Conveyor Table(s)—The conveyor table shall be constructed of not less than 0.070 in. thick (1.78 mm) corrosion-resistant steel or other corrosion-resisting material. The legs shall be preassembled with suitable cross bracing and shall be furnished with NSF certified adjustable feet. The table shall include a mechanical conveyor system designed to continuously transfer dishes or racks at the rate of 6 to 8 ft/min (1.8 to 2.4 m/min). The conveyor tables shall be furnished in the arrangement selected (see **4.5**). The conveyor table shall be sectioned for shipment.

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, when ever possible, on the exterior of the machine.

7.3.1 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 No. 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.

7.3.2 Valves—When specified, steam valves shall be of 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.

7.4 Spray Assemblies—All spray nozzles and spray arm manifolds shall be corrosion-resisting materials. All spray assemblies shall be removable without the use of tools and shall be easy to clean. Final sanitizing rinse spray assemblies, components, or both shall be removable for delimiting, descaling, and similar maintenance.

7.5 Tank—The tank shall be constructed of not less than 0.048 in. (1.219 mm) thick corrosion-resistant steel, Type 302 in accordance with Specification **A240/A240M**.

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

7.7 Scrap Trays (Strainers)—Scrap trays of corrosion-resistant steel, not less than 0.048 in. (1.219 mm) thick in accordance with Specification **A240/A240M** 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 ledge are easily accessible for cleaning when the trays are removed. Any opening around or between scrap trays shall be held to a minimum, and as close as practical to the size of the scrap tray opening.

7.8 Access Door(s)—Access door(s) shall be provided for ease of machine clean-out. The door(s) shall be constructed of not less than 0.048 in. (1.219 mm) thick, corrosion-resistant steel in accordance with Specification **A240/A240M**, and shall be rigid and stiffened as necessary. Door safety catches shall be provided for maximum operator safety on sliding doors. 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. A common door may be furnished for adjacent tanks, if such door is of sufficient width to provide the required access. Doors shall be provided with an interlock mechanism to prevent the spray of wash or rinse water when the door is opened.

7.9 Legs (Feet)—The machine shall be rigidly constructed and have four or more legs (feet) made of corrosion-resistant steel, or other 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.

7.10 Pump and Motor Assemblies:

7.10.1 Assemblies—The pump and motor assembly shall be mounted on the tank or on a rigid base fabricated of corrosion-resistant steel. Rotary seals shall be provided for pump shafts.

7.10.2 Pump—Pump casings shall be cast iron or corrosion-resisting material and shall have a removable cover or inspection plate, or be of such design as to permit ease of 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 pump suction intake shall be provided with a corrosion-resistant strainer or shroud.

7.11 Heating—Style 1 and Style 2 machines shall be capable of maintaining required temperature levels in the tanks.

7.11.1 Style 1—Style 1 machines shall be suitable for operation with a steam supply flow pressure from 20 to 35 psi (137.9 to 241.3 kPa). Temperature regulators (thermostats)

shall be provided for maintaining the proper water temperature in the tanks. Low water protection shall be provided. Steam heat will be provided by tube type heat exchangers, steam injectors, or a combination of both. Check valves or vacuum breakers must be used on all injector-type heating units to prevent back siphoning. The minimum operating pressure shall be specified by the manufacturer and the maximum operating pressure shall not exceed 35 psi (241.3 kPa).

7.11.2 *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 (thermostats) for maintaining the proper water temperature in the tanks. Low water protection shall be provided.

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

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

7.12.1 *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 (82.2°C). The steam booster shall automatically maintain the required final rinse water temperature without producing steam within the water supply piping from the 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 thermostat controlling the input of steam to the steam booster.

7.12.2 *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 (82.2°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.

7.12.3 *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 (82.2°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.

7.13 *Detergent Feeder*—When specified, an electric or electronic automatic detergent feeder conforming to NSF/ANSI 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 operation for one meal period.

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

7.15 *Garbage Disposal Machine*—When Arrangement A or B (4.5) is specified, a garbage disposal machine shall be furnished with each unit, the motor shall be rated at not less than 3 horsepower.

7.16 *Flatware Soak Sink*—When specified (see 5.1), a portable, caster-mounted soak sink for flatware shall be furnished. The sink shall be designed to accommodate standard flatware racks and shall be approximately 22 by 22 in. (558.8 by 558.8 mm) with a 6-in. (152.4-mm) minimum depth. The sink shall be fitted with a drain hose. The sink and dolly-stand shall be of corrosion-resistant steel construction or other corrosion-resisting material. The height to the top of the sink shall be 34 ± 1 in. (863.63 ± 25.4 mm) from the floor. Casters shall be of the swivel type with wheels not less than 4 in. (101.6 mm) in diameter. When a soak sink is specified, two flatware racks shall be furnished with each sink.

8. Electrical and Steam Equipment Requirements

8.1 The electrical equipment shall meet the requirements of UL 921. The dishwasher shall operate on the power characteristics (current, voltage, phase, frequency) specified.

8.2 *Motors*—Motors shall comply with applicable requirements of UL 921. The horsepower ratings of the motors shall meet the pump requirements of NSF/ANSI 3.

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

8.4 *Wiring and Control 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.

8.5 *Control Console*—The control console shall be mounted by the manufacturer in a readily accessible location. The console shall contain all controls necessary to permit proper operation of the system, including but not limited to those in 8.5.1 – 8.5.4.

8.5.1 *Thermal Overload Protection*—Individual thermal overload protection shall be furnished for each pump motor, conveyor drive motor, and shall be readily accessible in the

control console. Exception: inherent motor protection need not be located in the control console.

8.5.2 *Energy Saver Device*—An energy-saving device shall be furnished to shut down the machine pump motors and conveyor when soiled ware is not entering or going through the machine. This device will conserve electrical energy, detergents, wetting agents, and final rinse water usage.

8.5.3 *Remote Start/Stop Station*—A minimum of two remote start/stop manual switches shall be furnished. One each positioned at the load and unload stations around the periphery of the conveyor tables.

8.5.4 *Garbage Disposal Time Delay*—An automatic time delay device shall be furnished to operate the garbage disposal machine, and its water supply after the system has been stopped. This time delay period is adjustable from 0 to 5 min.

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/ANSI 29. Electric booster heaters, when specified, shall conform to NSF/ANSI 5.

11.2 *Noise Level*—Unless otherwise specified, the noise level of the dishwasher only when operating, exclusive of loading, unloading, and serving, shall not exceed 80 dBA at loading and unloading stations, measured at 5 ft (1.52 m) above the floor and 2 ft (0.61 m) away from the dishwasher.

12. Test Methods

12.1 *Operational*—Each machine shall be thoroughly tested in accordance with the manufacturer's instructions to determine compliance with the 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*—See Test Method [F1920](#).

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 that is acceptable to the user.

13.3 *NSF Listing*—Acceptable evidence of meeting the requirements of NSF/ANSI 3, NSF/ANSI 5, or NSF/ANSI 29 shall be the NSF Certification Mark on the finished dishwashing machine and listing in the NSF Listings—Food Equipment, or a certified test report from a recognized independent testing laboratory that is acceptable to the user. Certification specified under [11.1](#) will be accepted as evidence of compliance.

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, 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 the wash, pumped rinse, 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 procedures, and

15.1.4 Service parts list. Service parts list may be supplied separately.

15.2 Manuals shall be in accordance with Specification [F760](#).

16. Supplementary Requirements

16.1 When specified in the purchase order, supplementary requirements shall apply when this specification is used in government procurement of heat-sanitizing commercial dishwashing machines.

17. Quality Assurance

17.1 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.

18. Keywords

18.1 commercial multiple tank oval rack conveyor dishwasher; dishwashing machine; warewasher

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