



Designation: **F859—15 F859 – 21**

An American National Standard

# Standard Specification for Heat-Sanitizing Commercial Dishwashing Machines, Multiple Tank, Conveyor Rack Type<sup>1</sup>

This standard is issued under the fixed designation F859; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

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

## 1. Scope

1.1 This specification covers multiple tank automatic rack-type commercial dishwashing ~~machines~~machines, including 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 the test methods portion, Section 12, 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

ASTM F859-21

<https://standards.iteh.ai/catalog/standards/sist/3338352a-4d8e-4a3a-a251-841423daa985/astm-f859-21>

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

[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 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 Regulation:

[OSHA Title 29<sup>3</sup>](#)

### 2.3 NSF International Standards:<sup>4</sup>

[NSF/ANSI 3 Commercial Warewashing Equipment](#)

[NSF/ANSI 5 Commercial Hot Water Generating Equipment](#)

<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.

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

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<sup>4</sup>~~

2.4 *Underwriters Laboratories Standard*.<sup>5</sup>  
 UL 921 Commercial Electric Dishwashers  
 2.5 *ASSE International Standards*.<sup>6</sup>  
 ASSE 1004 Dishwashers  
 2.6 *Military Standard*.<sup>7</sup>  
 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 heat sanitize eating and drinking utensils. ~~The machines shall be capable of removing physical soil from properly racked and pre-scraped items, and sanitizing multiple-use eating and drinking utensils. These machines shall automatically convey racks of 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, tanks, doors, spray assemblies, pumps, motors, controls, piping, valves, conveying mechanisms, heating equipment, and accessories.~~

##### 3.1.1.1 Discussion—

The machines shall be capable of removing physical soil from properly racked and pre-scraped items and sanitizing multiple-use eating and drinking utensils. These machines shall automatically convey racks of 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, tanks, doors, spray assemblies, pumps, motors, controls, piping, valves, conveying mechanisms, heating equipment, and accessories. For continuous oval conveyor type, when assembled, the conveyor table shall form an oval-shaped dishrack handling system. The dishwashing machines shall include horizontal conveyor tables.

### 4. Classification

4.1 *General*—Dishwashing machines shall be of the following categories, types, styles, classes, sizes, and capacity groups, as specified and arrangements as specified in 4.2 – 4.8.

#### 4.2 Category:

4.2.1 *Category A*—Base machine. This model is not provided with a continuous oval conveyor.

4.2.2 *Category B*—Continuous oval conveyor. This model is provided with a continuous horizontal oval conveyor for loading and unloading racks.

#### 4.3 Types:

4.3.1 *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.

4.3.2 *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.

#### 4.4 Styles and Classes:

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

<sup>5</sup> Available from UL LLC, 333 Pfingsten Rd., Northbrook, IL 60062.

<sup>6</sup> Available from ASSE International, 18927 Hickory Creek Drive, Suite 220, Mokena, IL 60448.

<sup>7</sup> Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

4.4.1.1 *Class A*—Injectors.

4.4.1.2 *Class B*—Heat exchange coils.

4.4.2 *Style 2* (~~Electrically heated~~)Electrically heated.

4.4.3 *Style 3* (~~Gas-heated~~)Gas-heated.

4.4.3.1 *Class C*—Natural Gas.

4.4.3.2 *Class D*—LP Gas.

4.5 *Style 4* (~~Pre-Wash Unit~~)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.

4.6 *Size and Capacity,*

4.6.1 *Group A*—19¾ by 19¾-in. (501.6 by 501.6 mm) (nominal) racks at 100 per hour minimum.

4.6.2 *Group B*—19¾ by 19¾-in. (501.6 by 501.6 mm) (nominal) racks at 234 per hour minimum.

4.6.3 *Group C*—19¾ by 19¾-in. (501.6 by 501.6 mm) (nominal) racks at 330 per hour minimum.

4.7 *Arrangement – for continuous oval conveyor Category B models:*

4.7.1 *Arrangement A*—With tray rail and table-mounted garbage disposal machine or pulper.

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

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

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

4.8 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 the procurement document:

5.1.1 Title, number, and date of this specification,

5.1.2 ~~Type, Category, type, style, class, group, and group~~arrangement machine required (see 4.1),

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

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

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

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

- 5.1.7 When a detergent feeder is required (see 7.15),
- 5.1.8 When a rinse agent feeder is required (see 7.16),
- 5.1.9 Accessory equipment, such as end cowls with vent opening, or spare and maintenance parts required, 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), and
- 5.1.12 Manufacturer's certification, when required (see Section 13).
- 5.1.13 Whether a flatware soak sink is required (see 7.18).

## 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 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, where applicable.

6.1.2 *Corrosion-Resistant Steel*—Corrosion resistant steel shall conform to the requirements of any 200, 300, or 400 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 dishwashing machine 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, electric, or gas), and 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 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. The final rinse spray may be pumped or fresh water rinse. Provisions shall be made to fill the wash and rinse tank either directly from the regular hot water supply or through the booster, or both. The fill shall be controlled with a hand valve or solenoid, or both. The dishwashing machine shall have a conveyor for handling 19¾ by 19¾-in. (501.6 by 501.6 mm) (nominal) racks. The conveyor shall be protected by an adjustable slip clutch or other equivalent 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 driven gear reduction unit. 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. (1.8 mm) or equivalent die-formed material of 0.059 in. (1.5 mm). Dishwashers shall have an inside working height of not less than 17½ in. (444.5 mm) above the track.

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

7.2.1 *Conveyor Table(s)*—The conveyor table, when provided, shall be constructed of not less than 0.070 in. (1.78 mm) thick 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 9.5 ft/min (1.8 to 2.9 m/min). The conveyor tables shall be furnished in the arrangement selected (see 4.7). The conveyor table may 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, whenever possible, on the exterior of the machine.

7.4 *Piping and Fittings*—Water and 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. Backflow 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.

7.5 *Valves*—~~Steam~~ When specified, 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. All spray assemblies shall be removable without the use of tools and shall be easy to clean. Final sanitizing rinse spray assemblies or components, or both, shall be removable for deliming, descaling, and similar maintenance.

7.7 *Tank*—The tank shall be constructed of not less than 0.050 in. (1.3 mm) thick corrosion-resistant steel, Type 302, in accordance with Specification A240/A240M, 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. (1.1 mm) thick, or other corrosion-resistant 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 as close as practical to the size of the scrap tray opening.

7.10 *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 0.044 in. (1.1 mm) of corrosion-resistant steel or other corrosion-resisting material, shall be rigid and stiffened as necessary. Door safety catch(s) shall be provided for maximum operator safety on sliding doors. Doors shall be splashproof 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.

7.11 *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.

7.12 *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*—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 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 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 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 or 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).

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

7.13.3 *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 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.

7.14 *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 (82.2°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 temperatures shall be controlled by an automatic thermostat 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 (82.2°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.

7.14.3 *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 (82.2°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.

7.15 *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.

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

7.17 *Garbage Disposal Machine*—When Arrangement A or B (4.7) is specified, a garbage disposal or pulper shall be furnished with each unit, not necessarily from the warewash manufacturer.

7.18 Flatware Soak Sink—When specified (see 5.1), a portable, caster-mounted soak sink for flatware shall be furnished, not necessarily by the warewash manufacturer. 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  $34 \pm 1$  in. ( $863.63 \pm 25.4$  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, Steam, and Gas Equipment Requirements

8.1 The electrical and gas 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 be adequate to meet the 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  $115 \pm 9^\circ\text{F}$  ( $46 \pm 5^\circ\text{C}$ ).

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.

8.5 *Control Enclosure*—The user interface controls shall be mounted by the manufacturer in an accessible location. The enclosure 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 and conveyor drive motor and shall be accessible in the control enclosure. Exception: inherent motor protection need not be located in the control enclosure.

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.

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

8.5.4 *Garbage Disposal Shutoff Delay*—An automatic shutoff delay device shall be furnished to continue operation of the garbage disposal machine or pulper, and its water supply after the dishwasher has been stopped. This delay period is adjustable from 0 to 5 min. The shutoff delay device may be supplied by the garbage disposal or pulper manufacturer.

## 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 and gas booster heaters, when specified, shall conform to NSF/ANSI 5.