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An American National Standard

Standard Specification for Heat-Sanitizing Commercial Dishwashing Machines, Multiple Tank, Conveyor Rack Type[1]

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 (ε) 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.

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.

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 Regulation:*

OSHA Title 29[3]

2.3 *NSF International Standards:*

NSF/ANSI 3 Commercial Warewashing Equipment[4]

NSF/ANSI 5 Commercial Hot Water Generating Equipment[4]

NSF/ANSI 14 Plastic Piping System Components and Related Materials[4]

NSF/ANSI 29 Detergent/Chemical Feeders for Commercial Spray-Type Dishwashing Machines[4]

NSF/ANSI 51 Food Equipment Materials[4]

NSF Listings-Food Equipment[4]

2.4 *Underwriters Laboratories Standard:*

UL 921 Commercial Electric Dishwashers[5]

2.5 *ASSE International Standards:*

ASSE 1004 Dishwashers[6]

2.6 *Military Standard:*

MIL-STD-129 Marking for Shipment and Storage[7]

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-scrapped 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.

4. Classification

4.1 *General*—Dishwashing machines shall be of the following types, styles, classes, sizes, and capacity 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.

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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] *Code of Federal Regulations*, Chapter XVII, Part 1910 available from Superintendent of Documents, Government Printing Office, Washington, DC 20402.

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

[5] Available from UL LLC, 333 Pfingsten Rd., Northbrook, IL 60062.

[6] Available from ASSE International, 18927 Hickory Creek Drive, Suite 220, Mokena, IL 60448.

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

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) (137.9 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 *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 *Size and Capacity,*

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

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

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

4.6 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, style, class, and group 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).

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.

7.3 *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 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.

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 ± 9°F (46 ± 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/ANSI 29. Electric and gas 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 servicing, shall not exceed 80 dB 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 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*—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, acceptable to the user.

13.3 *NSF Listing*—Acceptable evidence of meeting the requirements of NSF/ANSI 3 shall be the NSF Certification Mark on the finished dishwashing machine and listing in the NSF Listing-Food Equipment, or a certified test report from a recognized independent testing laboratory, 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 and service 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. 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 commercial multiple tank rack conveyor dishwasher; dishwashing machine; warewasher

SUPPLEMENTARY REQUIREMENTS

When specified in the purchase order, supplementary requirements shall apply when this standard is used in government procurement of heat-sanitizing commercial dishwashing machines. Where provisions of these Supplementary Requirements conflict with Specification F859, these Supplementary Requirements shall prevail.

S1. First Article

S1.1 When specified the contractor shall furnish a complete dishwashing machine for *first article* inspection and approval.

S1.2 When a *first article* inspection is required, the item will be tested and should be a first production item or it may be a standard production item from the contractor's current inventory. The *first article* should consist of one dishwashing machine. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examination, test, and approval of the *first article*.

S1.3 If the manufacturer has successfully furnished the same article on the previous contract within the past three years, upon manufacturer's certification further inspection will not be required.

S2. Alternate Certification

S2.1 Instead of the certification specified in Section 13 acceptable evidence of meeting the requirements of the standards will be a certified test report from a nationally recognized independent testing laboratory approved by the contracting officer or for NSF certification acceptable to the medical department of the service for which the dishwashing machines are being acquired attesting that a dishwashing machine identical in all respects to the units being supplied under this specification has been examined and tested, and meets all requirements of the applicable standards. When authorized in writing by the contracting officer, such examination and tests for alternate certification may be conducted by the manufacturer at the manufacturer's plant when the cognizant inspection authority has determined that adequate facilities and instrumentation are available for conducting the required tests.

S3. Preparation for Delivery

S3.1 *Preservation, Packaging, and Packing*—As specified.

S3.1.1 *Preservation and Packing*—When specified, preservation and packing shall be in accordance with the requirements of dishwashing machines with the level of preservation and packing as specified.

S3.2 *Marking*—In addition to any special marking required by the contract or order, packages and shipping containers shall be marked in accordance with MIL-STD-129.

S4. Ordering Data

S4.1 Purchasers should exercise any desired options offered herein and acquisition documents should specify the following:

S4.1.1 When a *first article* is required for inspection and approval,

S4.1.2 When safety and health requirements are different, specify and fully describe,

S4.1.3 When nonmagnetic materials are required,

S4.1.4 Noise level requirements, if other than specified,

S4.1.5 A steam booster is required. Valves and regulators shall be accessible and regulated from the front of the dishwasher,

S4.1.6 If machine is to be electrically heated an electric booster with controls is required; furnish electric power characteristics,

S4.1.7 Whether detergent dispenser is to be machine mounted or packed separate for bulkhead mounting,

S4.1.8 Whether rinse injector is to be machine mounted or packed separate for bulkhead mounting,

S4.1.9 Tank drains shall be manifolded for single discharge connection,

S4.1.10 Motors shall be totally enclosed,

S4.1.11 Controls shall be furnished packed separately for bulkhead mounting,

S4.1.12 Whether fungus resistance treatment is required,

S4.1.13 Whether electromagnetic interference suppression is required, and

S4.1.14 When racks and cylinders are required, specify type and quantity. A quantity of two cleanout brushes is required.

S5. Shipboard Operation

S5.1 The Navy has specific design criteria for shipboard operation to compensate for pitch and roll, conserve potable water for extended periods, provide on board spare parts, use direct current electric supply on board some ships, and use nonmagnetic equipment for special applications, avoid any necessity for cutting through the hull or internal structures for access in replacing the dishwashing machine. The provisions for shipboard operation are as indicated herein.

S5.1.1 The dishwasher shall be capable of satisfactory performance when inclined 15° from the horizontal in any direction. When electric heat is specified, a positive low water cutoff shall be provided in each tank. The cutoff shall be designed to prevent interruption of electric power to the dishwasher during pitch and roll.

S5.1.2 Adequate baffles shall be provided to prevent water from splashing out of the entrance and exit of dishwashers, and intermingling of wash and rinse water during pitch and roll (on multiple-tank machines only).

S5.1.3 Conveyors shall be roller-chain type with positive lug.

S5.1.4 Pumps and other components of dishwashing machines shall be constructed of nonmagnetic materials when specified. The contractor shall submit a design for approval prior to furnishing the equipment unless approval has been granted within the last three years.

S5.1.5 Feet and legs shall be constructed of stainless steel. Feet shall be capable of being adequately and securely attached to the deck. Feet, legs, and frame shall be adequately constructed to withstand a horizontal force equivalent to 20 times the acceleration due to gravity (20 g) without permanent distortion.

S5.1.6 Due to a limited supply of potable water on board ship, the final rinse consumption shall not exceed 360 gal/h (1363 L/h).

S5.1.7 Control center may be furnished separate from the dishwasher for mounting on the bulkhead. Control center wash and rinse thermometers may be furnished separate from dishwasher for mounting on bulkhead. When capillary style thermometers are used the capillary shall be not less than 72 in. (1828.8 mm) long.

S5.1.8 Manufacturer's publication shall include an approved drawing containing a complete layout of the dishwasher, dimensions, weight, capacity, conveyor speed, material listing, method of deck mounting, and a list of recommended spare and maintenance parts.

S5.1.9 Machines shall be furnished with two conveyor chains, one of which shall contain lugs.

S5.1.10 *Machine Wash System*, shall consist of scaling nozzles or slots installed in a spray manifold system coming from the wash discharge line arranged in horizontal and vertical planes for scaling or flushing the soil.

S5.1.11 *Exhaust System Duct Adapters*—Machine shall be furnished with vent system duct adapters attached to the machine at wash and rinse ends of the machine, extending completely around the sides and top of the wash and rinse openings with an internal baffle system to efficiently direct exhaust vapors and be furnished with ¾ in.-IPT or NPT condensate drains on each side. The vent system duct adapters shall be complete and ready for connection to the exhaust system.

S5.1.12 Machines shall be specified for production capacity: 60, 85, 135, 185, or 250 racks per hour.

S5.1.13 Dishwashing machines for shipboard use shall be designed and constructed so that all preventive and corrective maintenance actions, including required lubrication, can be performed from the front of the machine and shall not require demounting the machine. For surface ship use the dimensional design shall be such that the machine will pass through a 26 by 66-in. (660 by 1676 mm) hatch opening without disassembly of major components. In addition, each machine shall be capable of field disassembly and self-aligning reassembly such that the overall length of any module shall not exceed 46 in.