WaterSense® Draft Specification for Commercial Pre-Rinse Spray Valves

Version 1.0

February 7, 2013

WaterSense® Draft Specification for Commercial Pre-Rinse Spray Valves

1.0 Scope and Objective

This specification establishes the criteria for commercial pre-rinse spray valves labeled under the U.S. Environmental Protection Agency's (EPA's) WaterSense program. It applies to commercial PRSVs, which are defined as handheld devices designed and marketed for use with commercial dishwashing and warewashing equipment and applications that spray water on dishes, flatware, and other food service items for the purpose of removing food residue before cleaning the items.

This specification does not apply to spray fittings used for pot and kettle filling, pet grooming, grocery produce and meat cleaning, residential dish rinsing, and purposes other than those described in the definition above.

This specification is designed to ensure both sustainable, efficient water use and a high level of user satisfaction with pre-rinse spray valve performance.

2.0 General Requirements

2.1 The pre-rinse spray valve shall conform to applicable requirements in *ASME A112.18.1/CSA B125.1 Plumbing Supply Fittings*,[1] with the exception of the life cycle test requirements described in Section 4.2 below.

2.2 If the pre-rinse spray valve has more than one mode, all modes must meet the maximum flow rate requirement outlined in Section 3.1, and at least one mode, as specified by the manufacturer, must meet all of the requirements outlined in this specification.

2.3 The pre-rinse spray valve shall not be packaged, marked, or provided with instructions directing the user to an alternative water-use setting that would override the maximum flow rate, as established by this specification. Any instruction related to the maintenance of the product, including changing or cleaning the pre-rinse spray valve components, shall direct the user on how to return the product to its intended maximum flow rate.

[1] References to this and other standards apply to the most current version of those standards.

3.0 Water-Efficiency Requirements

3.1 The flow rate of the pre-rinse spray valve shall be tested in accordance with the procedures in *ASTM F2324 Standard Test Method for Prerinse Spray Valves*[2] and shall meet the following criteria:

3.1.1 The manufacturer shall specify a maximum flow rate value (e.g., rated flow rate) of the pre-rinse spray valve. This specified value must be equal to or less than 1.28 gallons per minute (gpm) (4.8 liters per minute [Lpm]).

3.1.2 The maximum flow rate shall be the highest value obtained through testing when evaluated in accordance with 10 CFR 429.51. The maximum flow rate shall not exceed the maximum flow rate value specified in Section 3.1.1.

4.0 Performance Requirements

4.1 The spray force of the pre-rinse spray valve shall be tested in accordance with the procedures in *ASTM F2324*[2] and shall meet the following criteria:

4.1.1 The minimum spray force shall not be less than 5.0 ounces (142 grams).

4.2 The life cycle of the pre-rinse spray valve shall be tested in accordance with the procedures in *ASME A112.18.1/CSA B125.1* and shall meet the following criteria:

4.2.1 The pre-rinse spray valves must perform for 500,000 cycles.

5.0 Marking

5.1 In addition to the marking requirements in *ASME A112.18.1/CSA B125.1*, the following markings shall apply:

5.1.1 The product shall be marked with the maximum flow rate value in gpm and Lpm as specified by the manufacturer, verified through testing, and in compliance with this specification.

5.1.2 The product packaging and/or product literature shall be marked with the maximum flow rate value in gpm and Lpm as specified by

[2] For the purpose of this draft specification, WaterSense is referring to a revised version of *ASTM F2324 Standard Test Method for Prerinse Spray Valves* (to include the new pre-rinse spray force performance test) that is currently in the balloting process. The draft test method is included as Appendix A of this draft specification for reference purposes only. WaterSense intends to reference the final, approved version of *ASTM F2324* in the final specification.

the manufacturer, verified through testing, and in compliance with this specification.

5.1.3 The product packaging and/or product literature shall be marked with the tested spray force, verified through testing, and in compliance with this specification.

5.1.4 The flow rate marking shall be in gpm and Lpm in three- and two-digit resolutions, respectively (e.g., 1.28 gpm [4.8 Lpm]).

5.1.5 The spray force marking shall be in ounces in two-digit resolution (e.g., 5.0 ounces).

6.0 Effective Date

This specification's effective date is on TBD.

7.0 Future Specification Revisions

EPA reserves the right to revise this specification should technological and/or market changes affect is usefulness to consumers, industry, or the environment. Revisions to the specification shall be made following discussions with industry partners and other interested stakeholders.

8.0 Definitions

Definitions within *ASME A112.18.1/CSA B125.1* and *ASTM F2324* are included by reference.

ASME: American Society of Mechanical Engineers

ASTM: ASTM International, formerly the American Society for Testing and Materials

CFR: Code of Federal Regulations

CSA: Canadian Standards Association

Appendix A: Draft *ASTM F2324 Standard Test Method for Prerinse Spray Valves*

For the purpose of this draft specification, WaterSense is referring to a revised, track changes version of ASTM F2324 Standard Test Method for Prerinse Spray Valves (to include the new pre-rinse spray force performance test) that is currently in the balloting process. WaterSense will not accept comments on this draft test method since it is being balloted through the ASTM International consensus-based process. WaterSense intends to reference the final, approved version of ASTM F2324 in the final specification.

Designation: F2324–03 (Reapproved 2009) An American National Standard

Include Ballot Rationale Here (Required for all Ballots)

Standard Test Method for Pre-Rinse Spray Valves[1]

This standard is issued under the fixed designation F2324; 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.

Include references for annex (10.2, 10.3)

1. Scope

1.1 This test method covers the water consumption flow rate and spray force of prerinse spray valves (here after referred to as spray valves). The food service operator can use this evaluation to select a spray valve and understand its water consumption and spray force.

1.2 The following procedures are included in this test method:

1.2.1 Water consumption (see 10.2).

1.2.2 Spray Force Test (see 10.3).

1.3 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.

1.4 *This test method may involve hazardous materials, operations, and equipment. It does not address all of the potential safety problems associated with its use. It is the responsibility of the users of this test method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to its use.*

2. Referenced Documents

2.1 ASME Documents: ASME A112.18.1/CSA B125.1

3. Terminology

3.1 *Definitions:*

3.1.1 *gpm*—gallons per minute.

3.1.2 *Pre-Rinse Spray Valve*, a handheld device containing a release to closed mechanism that is used to sprays water on dishes, flatware, and other food service items for the purpose of removing food residue before cleaning the items.[3]

3.1.2 *spray force*—the amount of force exerted onto the test plate (oz.)

3.1.3 *test method*—a definitive procedure for the identification, measurement, and evaluation of one or more qualities, characteristics, or properties of a material, product, system, or service that produces a test result.

3.1.4 *uncertainty*—measure of systematic and precision errors in specified instrumentation or measure of repeatability of a reported test result.

4. Summary of Test Method

4.1 The maximum flow rate of the pre-rinse spray valve is measured at a water pressure of 60 ± 2 psi (414 ± 14 kPa) and 60 ± 10°F (15.6 ± 2.6°C) to verify that the prerinse spray valve is operating at the manufacturer's rated flow rate. If the measured rate is not within 5 % of the rated maximum flow rate, all further testing ceases and the manufacturer is contacted. The manufacturer may make appropriate changes or adjustments to the prerinse spray valve. The prerinse spray valve

4.3 The spray force test is used to determine the amount of force exerted by the prerinse spray valve on the spray disk.

[1]This test method is under the jurisdiction of ASTM Committee F26 on Food Service Equipment and is the direct responsibility of Subcommittee F26.06 on Productivity and Energy Protocol.

Current edition approved May 1, 2009. Published August 2009. Originally approved in 2003. Last previous edition approved in 2003 as F2324 – 03. DOI: 10.1520/F2324-03R09.

[3] Definition take from ASME Standard A112 definition of commercial Pre-Rinse Spray Valve, A112-18-1_20111_mark_up_090712.docx

Deleted: ¶

Deleted: and cleanability

Deleted: cleaning effectiveness

Deleted: .

Formatted: Subsec1

Deleted: 1.2.2 Cleanability (see 10.3).¶

Formatted: Indent: Left: 0", First line: 0.2"

Deleted: *NSF Documents:*

Deleted: [2]¶

Deleted: NSF Listings Food Equipment and Related Products, Components and Materials, NSF International

Formatted: Font: Italic

Deleted: handheld device designed and marketed for use with commercial dishwashing and ware washing equipment that sprays water on dishes, flatware, and other food service items for the purpose of removing food residue before cleaning the items.

Deleted: 3.1.1 *cleanability*—the effectiveness of the prerinse spray valve to remove soil from the plate before it is placed in a dishwashing machine.¶

Deleted: 2

Deleted: 3

Deleted: ¶

Deleted: ¶ 3.2 ¶

Deleted: determined at

Deleted: the manufacturer's specified

Deleted: water pressure

Deleted: the spray valve

Deleted: the spray valve

Deleted: ¶ 4.2

Deleted: The spray valve

Deleted: 's water flow rate is measured at 60 ± 1 psi (2.9 ± 0.5 kPa) settings at a temperature of 120 ± 4°F (49 ± 2°C).

Deleted: the spray valve

Deleted: test

Formatted: Left

The prerinse spray valve5. Significance and Use

5.1 The flow rate test is used to confirm that the prerinse spray valve is operating at the manufacturer's rated flow rate at the specified water pressure. The result from this test would also assist the operator in estimating the water and sewer consumption of their prerinse operation.

5.2 The spray force is a measure of the impact from a prerinse spray valve on the target surface and can be used to select a model that meets an end-user's force profile.

5.3 Flow rate and spray force can be used along with spray pattern, coverage area, usage time, and flow control to select a prerinse spray valve that meets an end-user's performance requirements.

the prerinse spray valve6. Apparatus

6.1 *Analytical Balance Scale*, or equivalent, for measuring the weight of the plates and water container. It shall have a resolution of 0.01 lb. (5 g) and a measurement uncertainty of 0.01 lb. (5 g).

6.2 *Calibrated Exposed Junction Thermocouple Probes*, with a range from 50 to 200°F (10 to 93°C), with a resolution of 0.2°F (0.1°C) and a measurement uncertainty of 1.0°F (0.5°C), for measuring water line temperatures. Calibrated K-type 24-GA thermocouple wire with stainless steel sheath and ceramic insulation is the recommended choice for measuring the water line temperatures. The thermocouple probe can be fed through a compression fitting so as to submerse exposed junction in the water lines.

6.3 *Carboy*, or equivalent container, for measuring for weight of the water during the flow rate test. A 5-gal (19-L) carboy water bottle has been found to be suitable (the carboy is the standard water bottle that is used for water coolers).

NOTE 1—The 5-gal (19-L) carboy container is the preferred container. With a narrow opening, the carboy captures all the water during the test at higher water pressure which can result in excess splashing.

6.4 *Force Gage*, digital force gage with a maximum force between 500 and 1,000 grams (1.1 and 2.2 lbs) and an accuracy of ±2 grams (±0.071 oz.).

NOTE 2—When specifying a force gauge, kilograms and grams are the industry standard unit of measurement and will be used as an exception for this specific test method. For this reason, ounce and pounds equivalents are listed in parenthesis.

6.5 *Hot Water Temperature Control Valve*, to maintain and limit mixed hot water to the prerinse spray valve during testing. It shall have a double throttling design to control both the hot and cold water supply to the mixed outlet. The flow characteristics of the valve shall have a resolution temperature control of ±4°F (±2°C) combined with low pressure drop check valves in both the hot and cold water inlets to protect against cross flow.

6.6 *Pressure Gage*, for measuring pressure of water to the prerinse spray valve. The gage shall have a resolution of 0.5 psig (3.4 kPa) and a maximum uncertainty of 1 % of the measured value.

6.7 *Spray Disk*, 10-inch diameter disk made of acrylic or similar material, with a thickness of 0.08 ± 0.004 inches (2.0 ± 0.1 mm) and weighing 4.0 ± 0.4 ounces (114 ± 15 grams). The spray disk shall be rigidly attached to the force gage and used as a target during the force test.

6.8 *Spring-Style Pre-Rinse Unit, Deck-Mounted*, with a 36-in. (915-mm) flex hose which will have the testing sample spray valve attach at the end of the flex hose. See Fig. 5.

6.9 *Stopwatch*, with a 0.1-s resolution.

8. Sampling

8.1 *Prerinse Spray Valve*—three representative samples of each production models to be evaluated shall be selected for performance testing.

9. Preparation of Apparatus

9.1 Attach the prerinse spray valve to a 36-in., spring-style (flex tubing) prerinse unit in accordance with the manufacturer's instructions. The minimum flow rate of the flex tubing, with no spray valve connected, shall be 3.5 gpm (13.2 L/min) at a pressure of 60 ± 2 psi (414 ± 14 kPa).

NOTE 3—Specifying a minimum flow rate for the flex tubing ensures that the prerinse spray nozzle is performing to the manufacturer's specifications and prevents the flex tubing from dictating the flow rate of the prerinse valve.

Deleted: 4.3
Deleted: The spray valve
Deleted: 's cleanability (effectiveness) is
Deleted: the spray valve
Deleted: This
Deleted: controlling…stimating …the water and
Formatted
Deleted: measured
Formatted
Deleted: representative of the ability of a spray
Formatted
Deleted: 5.2 The cleanability test is used to verify
Formatted
Deleted: the spray valve
Deleted: 's effectiveness at cleaning the plates
Deleted: lb
Deleted: an
Deleted: lb
Deleted: an
Formatted
Formatted
Formatted
Formatted
Deleted: forge
Formatted
Formatted
Deleted: 4
Deleted: the spray valve
Deleted: ¶
Deleted: the spray valve
Deleted: " …inch diameter disk made of acrylic
Deleted: 7…*Spring-Style Pre-Rinse Unit, Deck*
Deleted: 8
Deleted: 6.9 *Temperature Sensor*, for measuring
Deleted: 7. Reagents and Materials¶
Deleted: 7.1 *Tomato Paste*, shall be 100 % pure
Deleted: A
Deleted: the spray valve
Deleted: 7
Formatted
Deleted: 26
Deleted: 2.9413.7 ± 0.5 13.8
Formatted

9.2 Insulate the entire length of the water pipe from the mixing valve to the inlet of the flex tubing with one-half inch foam insulation. The insulation material shall have a thermal resistance (R) value of not less than 4°F × ft^2 × h/Btu (0.7°K × m^2/W).

9.3 Connect the mixing valve to the municipal water supply and set the mixing valve to maintain an outlet water temperature of 60.0 ± 10.0ºF (15.6 ± 2.6ºC). The mixing valve shall be located within six feet of the inlet of the flex tubing.

9.4 Install a water line pressure regulator downstream of the mixing valve. Install a pressure gage at the base of the flex tubing. Adjust the pressure regulator so that the water line pressure to the prerinse valve can be maintained at 60 ± 2 psi (414 ± 14 kPa) when the water is flowing to the prerinse spray valve, as the lever is fully pressed.

9.5 Install a temperature sensor in the water line downstream from the mixing valve. The sensors should be installed with the probe immersed in the water. See Figure 1 for a schematic of the setup for the water supply, mixing valve, pressure regulator, and gage that are used for testing the prerinse spray valves.

NOTE 4—Install the thermocouple probes described in 9.5 into water outlets for the prerinse. The thermocouple probe must be installed so that the thermocouple probe is immersed in the incoming water. A compression fitting should be first installed into the plumbing inlets. A junction fitting may need to be installed in the plumbing line that would be compatible with the compression fitting.

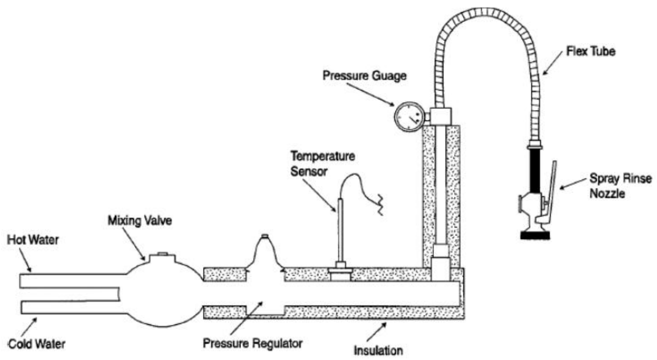


Figure 1. Schematic of Water Lines and Test Setup

9.6 Force Test Apparatus

9.6.1 Rigidly attach a 10 ± 0.25 inches (254 ± 6 mm) diameter disc (spray disc) to the force gage. An example of a suitable rigid connection is illustrated in Figure 2, where a flat top 'tip' is glued to the center of the spray disc. The disc shall have the following characteristics:

a. A thickness of 0.08 ± 0.004 inches (2.0 ± 0.1 mm),
b. A mass of 4.0 ± 0.4 ounces (114 ± 15 grams), and
c. Be made of acrylic or equivalent material with similar properties (i.e. flexural strength, surface finish, hardness, etc.)

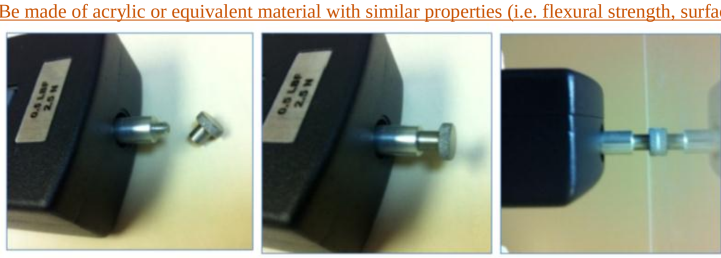


Figure 2. Attaching the Force Gage to Spray Disc

9.6.2 Securely mount the force gage and spray disc apparatus such that the spray disc is positioned in a vertical orientation.

9.6.3 The use of a splash guard is not necessary but may be included to help protect the force gage from splashing water. A splash guard of any design may be used, as long as the guard does not interfere with the operation of the force test rig. An example of a suitable splash guard is as follows:

- **Deleted:**
- **Deleted:** 120 ± 4°F (49 ± 2°C)
- **Deleted:**
- **Deleted:** 2.9 ± 0.5
- **Deleted:** the spray valve
- **Deleted:**
- **Formatted:** Not Highlight
- **Deleted:** .
- **Deleted:** 3
- **Deleted:** the spray valve
- **Formatted**
- **Formatted:** Centered
- **Deleted:**
- **Formatted:** Font: 10 pt
- **Formatted:** Normal, Justified, Space After: 0 pt
- **Formatted:** Justified
- **Formatted:** Justified, Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.25" + Indent at: 0.5"
- **Formatted:** Normal, Justified, Space After: 0 pt, Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.25" + Indent at: 0.5"
- **Formatted** ...
- **Formatted:** Font: 9 pt, Check spelling and grammar
- **Formatted:** Centered
- **Formatted:** Font: 9 pt, Check spelling and grammar
- **Formatted:** Font: 9 pt, Bold
- **Formatted:** Normal, Justified, Space After: 0 pt
- **Formatted:** Left

a. An acrylic sheet 24 × 24 inches (61 × 61 mm) in size with a thickness of 0.08 inches (2.0 mm). The sheet has a 1-inch (25mm) hole in the center of the sheet, and a 0.5 inches (12 mm) wide slot cut in the sheet from one edge of the sheet to the center hole. The slot enables the proper positioning of the force gage and 10-inch disc without the need to de-couple the disc from the gage (see Figure 3).

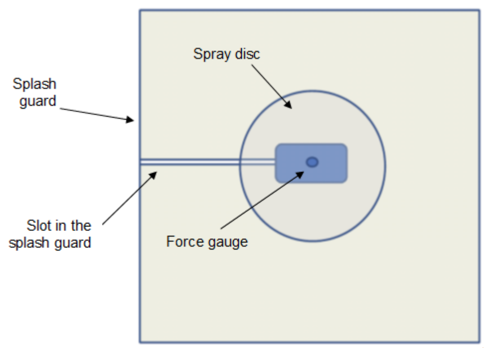


Figure 3. Force Test Apparatus Diagram (front view)

b. Install force gage and spray disc apparatus such that the spray disc is positioned in a vertical orientation on the “wet” side of the splash guard, while the force gage is mounted securely on the “dry” side of the splash guard.

9.6.4 Mount the pre-rinse spray valve such that:

a. The spray disc surface and pre-rinse spray valve faceplate are parallel and vertical.
b. The center of the spray disc and center of the pre-rinse spray valve faceplate are aligned at 8.0 ± 0.025 inches (200 ± 5 mm) apart. See figure 4.

9.6.5 Adjust the pre-rinse spray valve such that the center of the spray pattern aligns with the center of the force target.

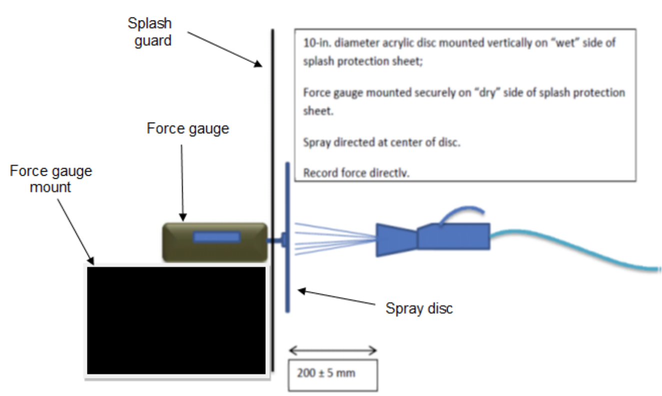


Figure 4. Force Test Apparatus Diagram (side view)

Formatted: Justified
Formatted: Justified, Indent: Left: 0.5", No bullets or numbering
Formatted: Centered, Indent: Left: 0.5", No bullets or numbering
Formatted: Font: 10 pt, Check spelling and grammar
Formatted: Font: 9 pt
Formatted: Indent: Left: 0.5", No bullets or numbering
Formatted: Justified
Deleted: <#>Mount the pre-rinse spray valve such that:¶
Formatted: Normal, Justified, Space After: 0 pt
Formatted: Justified
Formatted: Normal, Justified, Space After: 0 pt
Formatted: Normal, Centered, Space After: 0 pt
Formatted: Font: 9 pt
Formatted: Note, Space After: 6 pt
Formatted: Left

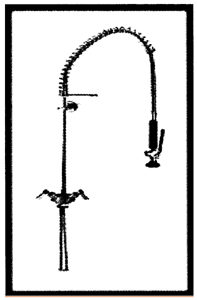


FIG. 5 Illustration of Spring-Style, Deck-Mounted Prerinse Unit

10. Procedure

10.1 *General*:

10.1.1 The following shall be obtained and recorded for each run of every test:
10.1.1.1 Water temperature,
10.1.1.2 Water pressure,
10.1.1.3 Time, and
10.1.1.4 Water flow rate.

10.2 *Prerinse Spray Valve Flow Rate Test*:

10.2.1 This procedure is comprised of a minimum of three separate test runs on three different samples of the same model of prerinse spray valve at the specified water temperature and pressure. Additional test runs for the individual samples may be necessary to obtain the required precision for the reported test results as defined in Annex A1. The reported values of the flow rate test shall be the average of the test runs.

10.2.2 Ensure water is supplied at 60 ± 2 psi (414 ± 14 kPa) and 60.0 ± 10.0ºF (15.6 ± 2.6ºC).

10.2.3 Weigh and record the weight of the carboy prior to testing (or equivalent 5-gal (19-L) container).

10.2.4 Hold the prerinse spray valve over the opening of the carboy container. Squeeze the prerinse spray valve handle to allow maximum flow and begin recording the time elapsed. At the end of one minute, stop the water flow and record the weight of the water and container and subtract the weight of the container.

NOTE 5—maximum flow may not occur when the handle is fully depressed.

10.2.5 Repeat 10.2.2–10.2.4 two additional times for each sample for a total of three test runs per sample. Additional tests may be needed on an individual sample to obtain an uncertainty less than 10% by following the calculations in Annex A1.

10.3 Spray Force Test

10.3.1 This procedure is comprised of a minimum of three separate test runs of each sample at the specified water temperature and pressure. The reported values of the force test for each sample shall be the average of the test runs.

10.3.2 Test the pre-rinse spray valve for force at a flowing water pressure of 60.0 ± 2.0 psi (413.7 ± 13.8 kPa) (while the pre-rinse spray valve is at its maximum flow rate) and an average outlet water temperature of 60.0 ± 10.0ºF (15.6 ± 2.6ºC). Measure the water pressure at the location downstream from the mixing valve.

10.3.3 Prior to testing, calibrate the force gauge using the manufacturer's recommendations. The margin of error in compression mode should not exceed ±2grams (0.071 oz.). If the unit is out of calibration, make the necessary adjustments to the force gauge.

10.3.4 To begin the force test, initiate the flow of water from the pre-rinse spray valve toward the center of the test disk.

10.3.5 Maintain water flow from the pre-rinse spray valve for at least 5 seconds or until force readings stabilize.

10.3.6 After the pre-rinse spray valve has flowed for at least 5 seconds, record the average force gage measurement over the next 15 seconds to the nearest 0.025 ounce (0.7 gram).

Formatted: Normal, Centered, Space After: 0 pt
Deleted: ¶
Formatted: Subsec1
Deleted: ¶
Deleted: three
Deleted: 2.9413.7 ± 0.513.8
Deleted: 120 ± 4°F (49 ± 2°C)
Deleted: the spray valve
Deleted: the spray valve
Formatted: Font: 9 pt
Formatted: Subsec1
Formatted: Font: 8 pt
Formatted: Font: 9 pt
Deleted: for the remaining test runs
Formatted: Subsec1
Formatted: Font: Italic
Formatted: Subsec1
Deleted: 3
Deleted: 4
Deleted: 5
Formatted: Left

10.3.7 If the pre-rinse spray valve has multiple settings, force shall be tested in accordance with this test procedure for each setting.

10.3.8 Repeat 10.3.2-10.3.6 an additional two times. Additional tests may be needed to obtain an uncertainty less than 10% by following the calculations in Annex A1.

10.3.9 The average force shall be determined from the test data collected from the required sample size.

the prerinse spray valve11. Calculation and Report

11.1 *Test Prerinse Spray Valve*—Summarize the physical and operating characteristic of the prerinse spray valve.

11.2 *Apparatus and Procedure*—Confirm that the testing apparatus conformed to all of the specifications in Section 9. Describe any deviations from those specifications.

11.3 *Flow Rate Test*:

11.3.1 Calculate and report the nozzle flow rate based on:

$$Q_{nozzle} = \frac{W_{water}}{8.337\frac{\text{lb}}{\text{gal}}\left(1.000\frac{\text{kg}}{\text{L}}\right)} \quad (1)$$

where:

Q_{nozzle}	=	nozzle flow rate, gpm (L/min), and
W_{water}	=	weight of the water collected in 1 min, lb (kg).

11.3.2 Report the water temperature and water line pressure.

11.4 Force Test

11.4.1 Report the force obtained from the digital force gage in ounces for each replicate of the prerinse spray valves tested

11.4.2 Calculate and report the average force of the nozzles tested (oz.) to the nearest 0.1 oz (2.8 grams).

12. Precision and Bias

12.1 *Precision*:

12.1.1 *Repeatability* (within laboratory, same operator and equipment)— The percent uncertainty in each result has been specified to be no greater than ±10%, based on at least three test runs.

12.1.2 *Reproducibility* (multiple laboratories)—The inter-laboratory precision of the procedure in this test method for measuring each reported parameter is being determined.

12.2 *Bias*—No statement can be made concerning the bias of the procedures in this test method because there are no accepted reference values for the parameters reported.

13. Keywords

13.1gallons per minute; prerinse spray valve; test method

Deleted: 6

Deleted: modes

Deleted: mode

Deleted: 7

Deleted: 10.3 *Preparation of the Plates for the Cleanability Test*:¶
¶
10.3.1 Prepare 60 plates with one leveled tablespoon of tomato sauce on each plate.¶
10.3.2 The plates are to be dry and stabilized at a room temperature of 75 ± 5°F (24 ± 3°C) before the tomato sauce is portioned onto the plate.¶
10.3.3 Apply one level tablespoon (15 mL) of tomato sauce as described in 7.3 to a plate, and evenly distribute the tomato sauce around the plate by shaking and turning the plate. Portion out the tomato sauce one plate at a time. Make sure that the tomato sauce is not distributed onto the rim/lip of the plate. In addition, do not use a spoon or other utensil to spread the tomato sauce, as this will leave ridges in the sauce on the plate, altering test times. Using a utensil will also pickup some of the sauce and make the amount of sauce on each plate different. See Fig. 4 for an illustration of the preparation of the plates.¶
10.3.4 Place the plates with the tomato sauce in a dish rack to let the tomato sauce dry on the plates at room temperature (75 ± 5°F (24 ± 3°C)). See Fig. 5.¶
Note 5—This can be accomplished by storing the dish loads in a room with an ambient temperature of 75 ± 5°F (24 ± 3°C). Avoid any circumstances tha ...

Deleted: the spray valve

Deleted: s to the top of the plate of 11 ± 1 in. (279 ± 25 mm) and 14 ± 1 in. (356 ± 25 mm) from the bottom of the plate. Mark the location of the plate ...

Formatted: Subsec1

Deleted: the spray valve

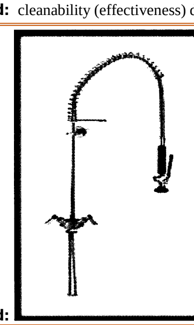
Deleted: 11.4 *Cleanability (Effectiveness) Test*:¶
¶ ...

Deleted:

Deleted: The repeatability of each reported parameter is being determined.

Deleted:

Deleted: cleanability (effectiveness) dishrack;

Deleted:  ¶ ...

Formatted: Left

ANNEX

(Mandatory Information)

A1. PROCEDURE FOR DETERMINING THE UNCERTAINTY IN REPORTED TEST RESULTS

NOTE A1.1—This procedure is based on the ASHRAE method for determining the confidence interval for the average of several test results (ASHRAE Guideline 2-1986(RA90)). It should only be applied to test results that have been obtained within the tolerances prescribed in this method (for example, thermocouples calibrated, appliance operating within 5 % of rated input during the test run).

A1.1 For the flow rate test results, the uncertainty in the averages of at least three test runs is reported. For each test run, the uncertainty of the flow rate test must be no greater than ±5 % before any of the parameters for that flow rate test run can be reported.

A1.2 The uncertainty in a reported result is a measure of its precision. If, for example, the gpm flow rate for the prerinse spray valve is 1.6 gpm at 60 psi, the uncertainty must not be greater than ±0.08 gpm. Thus, the true gpm flow rate is between 1.52 and 1.68 gpm. Therefore, interval is determined at the 95 % confidence level, which means that there is only a 1 in 20 chance that the true gpm flow rate could be outside of this interval.

A1.3 Calculating the uncertainty not only guarantees the maximum uncertainty in the reported results, but is also used to determine how many test runs are needed to satisfy this requirement. The uncertainty is calculated from the standard deviation of three or more test results and a factor from Table A1.1, which lists the number of test results used to calculate the average. The percent uncertainty is the ratio of the uncertainty to the average expressed as a percent.

A2.1 For the force test results, the uncertainty in the averages of at least three test runs is reported using the same formulas in A1.4.1-1.4.10.5. For each test run, the uncertainty of the flow rate test must be no greater than ±10 % before any of the parameters for that flow rate test run can be reported.

A1.4 *Procedure*:

NOTE A1.2—Section A1.5 shows how to apply this procedure.

A1.4.1 *Step 1*—Calculate the average and the standard deviation for the test results (gpm flow rate or force) using the results of the first three test runs, as follows:

A1.4.1.1 The formula for the average (three test runs) is as follows:

$$Xa_3 = (1/3) \times (X_1 + X_2 + X_3) \qquad (A1.1)$$

where:

Xa_3	=	average of results for three test runs, and
X_1, X_2, X_3	=	results for each test run.

A1.4.1.2 The formula for the sample standard deviation (three test runs) is as follows:

$$S_3 = (1/\sqrt{2}) \times \sqrt{(A_3 - B_3)} \qquad (A1.2)$$

where:

S_3	=	standard deviation of results for three test runs,
A_3	=	$(X_1)^2 + (X_2)^2 + (X_3)^2$, and
B_3	=	$(1/3) \times (X_1 + X_2 + X_3)^2$.

NOTE A1.3—The formulas may be used to calculate the average and sample standard deviation. However, a calculator with statistical function is recommended, in which case be sure to use the sample standard deviation function. The population standard deviation function will result in an error in the uncertainty.

Deleted:
Deleted:
Deleted: the spray valve
Deleted:
Deleted: ¶
Deleted: ¶
Formatted: Subsec1
Deleted: ¶
Formatted: Subsec1
Deleted: ¶
Formatted: Left

NOTE A1.4—The "*A*" quantity is the sum of the squares of each test result, and the "*B*" quantity is the square of the sum of all test results multiplied by a constant (1/3 in this case).

A1.4.2 *Step 2*—Calculate the absolute uncertainty in the average for each parameter listed in Step 1. Multiply the standard deviation calculated in Step 1 by the uncertainty factor corresponding to three test results from Table A1.1.

A1.4.2.1 The formula for the absolute uncertainty (three test runs) is as follows:

$$U_3 = C_3 \times S_3 \qquad \text{(A1.3)}$$

,

$$U_3 = 2.48 \times S_3$$

where:

U_3	=	absolute uncertainty in average for three test runs, and
C_3	=	uncertainty factor for three test runs (Table A1.1).

A1.4.3 *Step 3*—Calculate the percent uncertainty in each parameter average using the averages from Step 1 and the absolute uncertainties from Step 2.

A1.4.3.1 The formula for the percent uncertainty (three test runs) is as follows:

$$\%U_3 = (U_3/Xa_3) \times 100\ \% \qquad \text{(A1.4)}$$

where:

$\%U_3$	=	percent uncertainty in average for three test runs,
U_3	=	absolute uncertainty in average for three test runs, and
Xa_3	=	average of three test runs.

A1.4.4 *Step 4*—If the percent uncertainty, $\%U_3$, is not greater than ±5 % for the gpm flow rate or ±10% for force, report the average for these parameters along with their corresponding absolute uncertainty, U_3, in the results reporting page in the following format:

$$Xa_3 \pm U_3$$

If the percent uncertainty is greater than required precision, proceed to Step 5.

A1.4.5 *Step 5*—Run a fourth test for the gpm flow rate or force test if the percent uncertainty was greater than ±5 % for the gpm flow rate or ±10% for force.

A1.4.6 *Step 6*—When a fourth test is run, calculate the average and standard deviation for test results using a calculator or the following formulas:

A1.4.6.1 The formula for the average (four test runs) is as follows:

$$Xa_4 = (1/4) \times (X_1 + X_2 + X_3 + X_4) \qquad \text{(A1.5)}$$

where:

Xa_4	=	average of results for four test runs, and
X_1, X_2, X_3, X_4	=	results for each test run.

A1.4.6.2 The formula for the standard deviation (four test runs) is as follows:

$$S_4 = (1/\sqrt{3}) \times \sqrt{(A_4 - B_4)} \qquad \text{(A1.6)}$$

where:

S_4	=	standard deviation of results for four test runs,
A_4	=	$(X_1)^2 + (X_2)^2 + (X_3)^2 + (X_4)^2$, and
B_4	=	$(1/4) \times (X_1 + X_2 + X_3 + X_4)^2$.

Deleted: ¶
Deleted: ¶
Deleted: ¶ ¶
Formatted: Subsec1
Deleted: ¶
Deleted: 10
Deleted: ±10 %
Deleted: for the gpm flow rate
Deleted: greater than ±10 %.
Deleted: for a given gpm flow rate
Formatted: Subsec1
Deleted: ¶
Formatted: Subsec1
Deleted: ¶
Formatted: Left

A1.4.7 *Step 7*—Calculate the absolute uncertainty in the average for each parameter listed in Step 1. Multiply the standard deviation calculated in Step 6 by the uncertainty factor for four test results from Table A1.1.

A1.4.7.1 The formula for the absolute uncertainty (four test runs) is as follows:

$$U_4 = C_4 \times S_4 \qquad \text{(A1.7)}$$

$$U_4 = 1.59 \times S_4$$

where:

U_4	=	absolute uncertainty in average for four test runs, and
C_4	=	uncertainty factor for four test runs (Table A1.1).

A1.4.8 *Step 8*—Calculate the percent uncertainty in the parameter averages using the averages from Step 6 and the absolute uncertainties from Step 7.

A1.4.8.1 The formula for the percent uncertainty (four test runs) is as follows:

$$\%U_4 = (U_4/Xa_4) \times 100\ \% \qquad \text{(A1.8)}$$

where:

$\%U_4$	=	percent uncertainty in average for four test runs,
U_4	=	absolute uncertainty in average for four test runs, and
Xa_4	=	average of four test runs.

A1.4.9 *Step 9*—If the percent uncertainty, $\%U_4$, is not greater than ±5 % for the gpm flow rate or ±10% for force, report the average for these parameters along with their corresponding absolute uncertainty, U_4, in the results reporting page in the following format:

$$Xa_4 \pm U_4$$

If the percent uncertainty is greater than ±5 % for the gpm flow rate or ±10% for force, proceed to Step 10.

A1.4.10 *Step 10*—The steps required for five or more test runs are the same as those previously described. More general formulas are listed as follows for calculating the average, standard deviation, absolute uncertainty, and percent uncertainty.

A1.4.10.1 The formula for the average (*n* test runs) is as follows:

$$Xa_n = (1/n) \times (X_1 + X_2 + X_3 + X_4 + ... + X_n) \qquad \text{(A1.9)}$$

where:

n	=	number of test runs,
Xa_n	=	average of results of *n* test runs, and
X_1, X_2, X_3, X_4 ... X_n	=	results for each test run.

A1.4.10.2 The formula for the standard deviation (*n* test runs) is as follows:

$$S_n = (1/\sqrt{(n-1)}) \times (\sqrt{A_n - B_n}) \qquad \text{(A1.10)}$$

where:

S_n	=	standard deviation of results for *n* test runs,
A_n	=	$(X_1)^2 + (X_2)^2 + (X_3)^2 + (X_4)^2 + ... + (X_n)^2$, and
B_n	=	$(1/n) \times (X_1 + X_2 + X_3 + X_4 + ... + X_n)^2$.

A1.4.10.3 The formula for the absolute uncertainty (*n* test runs) is as follows:

$$U_n = C_n \times S_n \qquad \text{(A1.11)}$$

Formatted: Subsec1

Deleted: ¶

Formatted: Subsec1

Deleted: ¶

Deleted: greater than ±10 % for the gpm flow rate

Deleted: greater than ±10 % for the gpm flow rate test

Formatted: Subsec1

Deleted: ¶ ¶

Formatted: Subsec1

Deleted: ¶

Formatted: Subsec1

Formatted: Left

where:

U_n	=	absolute uncertainty in average for *n* test runs, and
C_n	=	uncertainty factor for *n* test runs (Table A1.1).

A1.4.10.4 The formula for the percent uncertainty (*n* test runs) is as follows:

$$\%U_n = (U_n/Xa_n) \times 100\ \% \qquad \text{(A1.12)}$$

where:

$\%U_n$	=	percent uncertainty in average for *n* test runs,
U_n	=	absolute uncertainty in average for *n* test runs, and
Xa_n	=	average of *n* test runs.

A1.4.10.5 When the percent uncertainty, $\%U_n$, is less than or equal to ±5 % for the gpm flow rate or ±10% for force, report the average for these parameters along with their corresponding absolute uncertainty, U_n, in the results reporting page in the following format:

$$Xa_n \pm U_n$$

NOTE A1.5—The researcher may compute a test result that deviates significantly from the other test results. Such a result should be discarded only if there is some physical evidence that the test run was not performed according to the conditions specified in this method. For example, the water psi was out of calibration, the water temperature was not in the accepted range, or the plates with the dried tomato sauce had not dry long enough. To ensure all results are obtained under approximately the same conditions, it is good practice to monitor those test conditions specified in this method.

TABLE A1.1 Uncertainty Factors

Test Results, *n*	Uncertainty Factor, *Cn*
3	2.48
4	1.59
5	1.24
6	1.05
7	0.92
8	0.84
9	0.77
10	0.72

Deleted: ¶

Formatted: Subsec1

Deleted: ¶

Deleted: to

Deleted: ±10 %, for the gpm flow rate

Formatted: Subsec1

Formatted: Subsec1

Deleted: ¶

Deleted: ¶
A1.5 *Example of Determining Uncertainty in Average Test Result*:¶
¶
A1.5.1 Three test runs for the gpm flow rate yielded the following results:¶
¶
Test ...

Formatted: Subsec1

Formatted: Font: Times New Roman, 10 pt

Deleted: A1.5.2 *Step 1*—Calculate the average and standard deviation of the three test results for the gpm flow rate test.¶
A1.5.2.1 The average of the three test results is as follows:¶

$$Xa_3 = (1/3) \times (X_1 + X_2 + X_3)$$

$$Xa_3 = (1/3) \times (1.16 + 1.45 + 1.0$$

$$Xa_3 = 1.21 \text{ gpm}$$

¶
A1.5.2.2 The standard deviation of the three test results is as follows. First calculate "A_3" and "B_3":¶

$$A_3 = (X_1)^2 + (X_2)^2 + (X_3)^2$$

$$A_3 = (1.16)^2 + (1.45)^2 + (1.02)$$

$$A_3 = 4.48$$

$$B_3 = (1/3) \times [(X_1 + X_2 + X_3)^2]$$

$$B_3 = (1/3) \times [(1.16 + 1.45 + 1.02$$

$$B_3 = 4.39$$

¶
A1.5.2.3 The new standard deviation for the gpm flow rate is as follows:¶

$$S_3 = (1/\sqrt{2}) \times \sqrt{(4.48 - 4.39)} \qquad ($$

$$S_3 = 0.0636 \text{ gpm}$$

¶
A1.5.3 *Step 2*—Calculate the uncertainty in average.¶

$$U_3 = 2.48 \times S_3 \qquad (A$$

$$U_3 = 2.48 \times 0.0636$$

$$U_3 = 0.15 \text{ gpm}$$ ...

Formatted: Font: 9 pt

Formatted: Left

APPENDIX

(Nonmandatory Information)

X1. Cleanability Test

This Cleanability Test procedure has been removed from the main body of the test method to Appendix X1 and has been replaced by section 10.3 Spray Force Test.

The following procedure evaluates the time to clean dried tomato sauce from dinner plates. The intent of the test was to evaluate the pre-rinse spray valves cleanability (effectiveness) when removing a standardized soil from dinner plates and has served as a metric for evaluating prerinse spray valve efficacy in the absence of other performance ratings.

Subsequent research sponsored by WaterSense has shown that the tomato sauce cleaning times have little relation to user satisfaction or prerinse spray valve usage time. The tomato sauce test procedure is presented below for reference purposes only.

X1.1. Scope

X1.1.1 This test method covers the relative of cleanability of prerinse spray valves.

X1.3. Terminology

X1.3.1 *cleanability*—the effectiveness of the prerinse spray valve to remove a standardized soil from the plate before it is placed in a dishwashing machine.

X1.4. Summary of Test Method

X1.4.1 The prerinse spray valve's cleanability (effectiveness) is determined at 60 ± 1 psi (2.9 ± 0.5 kPa), with a water temperature of 120 ± 4°F (49 ± 2°C).

X1.5. Significance and Use

X1.5.1 The cleanability test is used to verify the prerinse spray valve's effectiveness at cleaning the plates before they are sent into the dishwashing machine.

X1.6. Apparatus

X1.6.1 *Calibrated Exposed Junction Thermocouple Probes*, with a range from 50 to 200°F (10 to 93°C), with a resolution of 0.2°F (0.1°C) and an uncertainty of 1.0°F (0.5°C), for measuring water line temperatures. Calibrated K-type 24-GA thermocouple wire with stainless steel sheath and ceramic insulation is the recommended choice for measuring the water line temperatures. The thermocouple probe can be fed through a compression fitting so as to submerse exposed junction in the water lines.

X1.6.2 *Measuring Spoons*, used to portion out one level tablespoon of tomato sauce on each plate for the cleanability test.

6.6 *Pressure Gage*, for measuring pressure of water to the prerinse spray valve. The gage shall have a resolution of 0.5 psig (3.4 kPa) and a maximum uncertainty of 1 % of the measured value.

X1.6.3 *Spring-Style Pre-Rinse Unit, Deck-Mounted*, with a 36-in. (915-mm) flex hose which will have the testing sample spray valve attach at the end of the flex hose. See Figure 6.

X1.6.4 *Stopwatch*, with a 0.1-s resolution.

X1.7. Reagents and Materials

X1.7.1 *Tomato Paste*, shall be 100 % pure and shall have a moisture content of 70 ± 2.5 %. Stabilize paste at room temperature (75 ± 5°F (24 ± 3°C)).

X1.7.1.1 Gravimetric moisture analysis shall be performed as follows: To determine moisture content, place a 1-lb sample of the test food on a dry, aluminum sheet pan and place the pan in a convection drying oven at a temperature of 220 ± 5°F

[5] This test method is under the jurisdiction of ASTM Committee F26 on Food Service Equipment and is the direct responsibility of Subcommittee F26.06 on Productivity and Energy Protocol.

Current edition approved May 1, 2009. Published August 2009. Originally approved in 2003. Last previous edition approved in 2003 as F2324 – 03. DOI: 10.1520/F2324-03R09.

Formatted: Intro, Space After: 6 pt, Bulleted + Level: 1 + Aligned at: 0" + Indent at: 0.25"
Formatted: Font: (Default) Times New Roman, 10 pt, Font color: Auto, Highlight
Formatted: Font: (Default) Times New Roman, 10 pt, Font color: Auto, Highlight
Formatted: Intro, Left, Space After: 6 pt
Formatted: Font: (Default) Times New Roman, 10 pt, Highlight
Formatted: Font: 10 pt
Formatted: Font: (Default) Times New Roman, 10 pt, Highlight
Formatted: Font: (Default) Times New Roman, 10 pt, Font color: Auto, Highlight
Formatted: Font: (Default) Times New Roman, 10 pt, Highlight
Formatted: Font: (Default) Times New Roman, 10 pt, Font color: Auto, Highlight
Formatted: Font: 10 pt, Highlight
Deleted: <#>The following procedure evaluates the prerinse spray valves cleanability (effectiveness) when removing tomato paste from clean plates. The results from applying this test will give the end user a quantified estimation on how effective a prerinse valve is in cleaning dirty plates.¶
Deleted: The food service operator can use this evaluation to select a spray valve and understand its cleaning effectiveness.
Deleted: The spray valve
Deleted: the spray valve
Deleted: the spray valve
Formatted: Left

for a period of 24 h. Weigh the sample before it is placed in the oven and after it is removed and determine the percent moisture content based on the percent weight loss of the sample. The sample must be spread evenly over the surface of the sheet pan in order for all of the moisture to evaporate during drying and it is permissible to spread the sample on top of baking paper in order to protect the sheet pan and simplify cleanup.

X1.7.2 *Tomato Sauce*, shall be comprised of tomato paste and water. Mix 6 oz (175 mL) tomato paste (see 7.1) with 10 oz (295 mL) of 75 ± 5°F (24 ± 3°C) water to form the tomato sauce. Stir until mixture becomes consistent.

NOTE X1.1—Testing at the Food Service Technology Center has found that a generic store brand such as "Safeway®" brand or "Albertson's®" brand tomato paste is the preferred test product. National brands tend to have excess tomato skins in the tomato paste, which makes repeatability difficult. Shown in Figure 7 are the two types of tomato paste. The "generic" store brand is on the left, and the "national" brand on the right. The dark spots in the photo on the right (nationals brand) are the tomato skin flecks, which are more difficult to remove.

X1.7.3 *Plates*, shall be 9-in. (229-mm), white ceramic glazed, with an inside flat diameter of 7-in. (178-mm), weighing an average of 1.3 ± 0.05 lb (590 ± 23 g) each. Sixty plates are required.

X1.7.4 *Dishracks*, to hold the plates with the dried tomato sauce for the cleanability test and in the preparation of the plates to dry the tomato sauce so that the plates can be dried vertically, or acceptable equivalent. Four Metro Mdl P2MO, 20 by 20-in. (508 by 508-mm), peg-type, commercial dishracks, each weighing 4.6 ± 0.1 lb (2.09 ± 0.04 kg).[6]

X1.8. Sampling

X1.8.1 *Prerinse Spray Valve*—three representative production models shall be selected for performance testing.

X1.9. Preparation of Apparatus

X1.9.1 Install the stest prerinse spray valve in accordance with 9.1-9.5.

X1.9.2 *Preparation of the Plates for the Cleanability Test*:

X1.9.2.1 Prepare 60 plates with one leveled tablespoon of tomato sauce on each plate.

X1.9.2.2 The plates are to be dry and stabilized at a room temperature of 75 ± 5°F (24 ± 3°C) before the tomato sauce is portioned onto the plate.

X1.9.2.3 Apply one level tablespoon (15 mL) of tomato sauce as described in 7.3 to a plate, and evenly distribute the tomato sauce around the plate by shaking and turning the plate. Portion out the tomato sauce one plate at a time. Make sure that the tomato sauce is not distributed onto the rim/lip of the plate. In addition, do not use a spoon or other utensil to spread the tomato sauce, as this will leave ridges in the sauce on the plate, altering test times. Using a utensil will also pickup some of the sauce and make the amount of sauce on each plate different. See Figure 9 for an illustration of the preparation of the plates.

X1.9.2.4 Place the plates with the tomato sauce in a dish rack to let the tomato sauce dry on the plates at room temperature (75 ± 5°F (24 ± 3°C)). See Figure 10.

NOTE X1.2—This can be accomplished by storing the dish loads in a room with an ambient temperature of 75 ± 5°F (24 ± 3°C). Avoid any circumstances that would result in some dishes being at different temperatures from others, such as being stored in the air path of an HVAC supply register.

X1.9.2.5 Repeat X1.9.2.1–X1.9.2.4 until all 60 plates are prepared. Allow plates to dry for 24 h before testing.

X1.10. Procedure

X1.10.1 *General*:

X1.10.1.1 The following shall be obtained and recorded for each run of every test:

X1.10.1.1.1 Water temperature,

X1.10.1.1.2 Water pressure,

X1.10.1.1.3 Time, and

[6] Inter-American® mdl #132 is within the specified weight range and is inexpensive.

Formatted: Left

X1.10.1.1.4 Water flow rate.
X1.10.2 *Cleanability Performance Test*:

X1.10.2.1 This procedure shall be performed at the specified water temperature and pressure. The reported values of the cleanability procedure shall be the average of the sixty plates measured in seconds per plate (s/plate).

NOTE X1.3—The test can be divided into 3 groups of 20-plate racks if sixty plates are not available.

X1.10.2.2 Ensure that the water supply is at 60 ± 2 psi (2.9 ± 0.5 kPa) and 120 ± 4°F (49 ± 2°C) with the nozzle operating at maximum flow.
X1.10.2.3 Place an empty dishrack under the prerinse valve in the sink.
X1.10.2.4 Place a single plate with dried tomato sauce upright in the dishrack. The plate is to be placed in the dishrack at a distance from the tip of the prerinse spray valves to the top of the plate of 11 ± 1 in. (279 ± 25 mm) and 14 ± 1 in. (356 ± 25 mm) from the bottom of the plate. Mark the location of the plate in the dishrack, as this will be where all the testing plates will be placed. Figure 11 shows a drawing plate in the dishrack with the cleaning distances.
X1.10.2.5 Begin spraying the plate as time is recorded on the stopwatch. The plate is to be sprayed in a side to side motion from the top to the bottom of the plate. Repeat this spray pattern until all the tomato sauce has been rinsed from the plate. Record the amount of time required to clear the plate. Figure 12 demonstrates a cleanability test.
X1.10.2.6 Repeat X1.10.2.5 for the 59 remaining test plates.

X1.11. Calculation and Report

X1.11.1 Report the average cleaning time in seconds per plate.
X1.11.2 Report the water temperature and water line pressure.

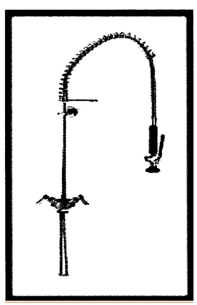


FIGURE. 6 Illustration of Spring-Style, Deck-Mounted Prerinse Unit

Deleted: the spray valve

Formatted: Centered

Formatted: Left

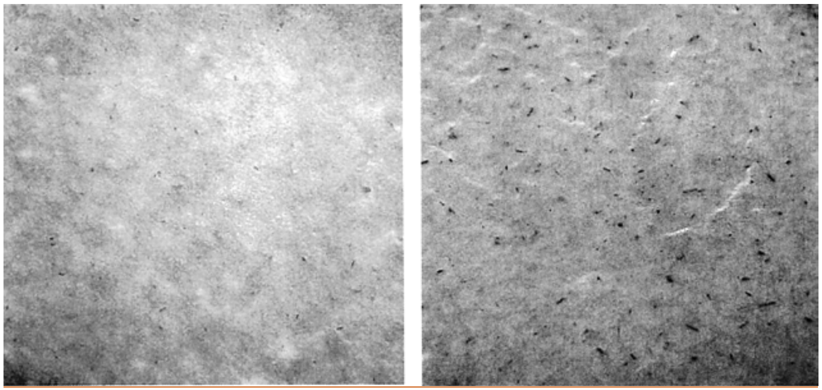


FIGURE. 7 Generic Brand on the Left and the National Brand on the Right

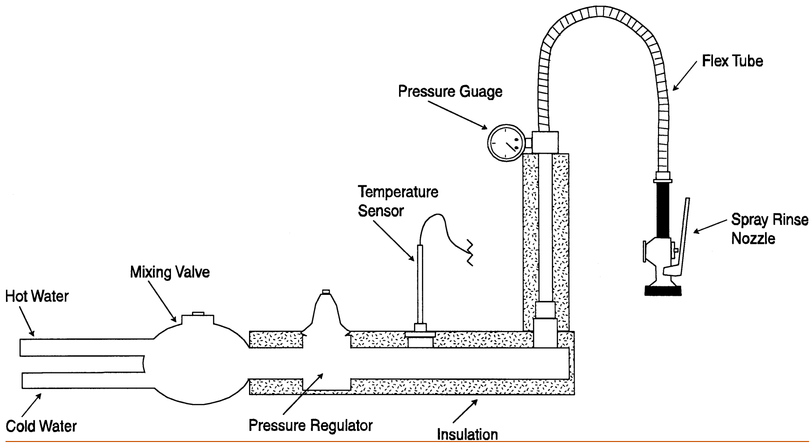


FIGURE. 8 Schematic of Water Lines and Testing Setup

Formatted: Left

FIGURE. 9 Plate Preparation

FIGURE. 10 A Rack of Plates Drying

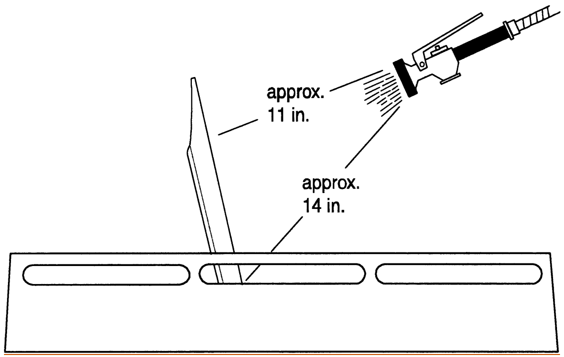


FIGURE. 11 Plate and Sprayer Distance

Formatted: Left

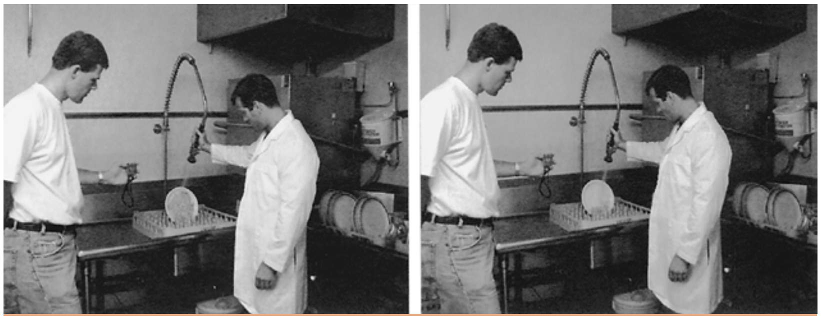


FIGURE. 12 Cleanability Test

Formatted: Left

RESULTS REPORTING SHEETS

Manufacturer:
Manufacturers rated flow rate, gpm (L/min):
Spray pattern (for example, blade or circular):
Carboy weight, lb (kg):
Tomato paste brand:
Date:
Test reference number (optional):

Flow Rate Test Nozzle 1		
Test	Water Weight, lb (kg)	Flow Rate, gpm (L/min)
Test # 1		
Test # 2		
Test # 3		
Flow Rate Test Nozzle 2		
Test	Water Weight, lb (kg)	Flow Rate, gpm (L/min)
Test # 1		
Test # 2		
Test # 3		
Flow Rate Test Nozzle 3		
Test	Water Weight, lb (kg)	Flow Rate, gpm (L/min)
Test # 1		
Test # 2		
Test # 3		
	Average Flow Rate (gpm):	

Spray Valve Force					
Spray Valve 1		Spray Valve 2		Spray Valve 3	
Replicate #	Force (oz.)	Replicate #	Force (oz.)	Replicate #	Force (oz.)
1		1		1	
2		2		2	
3		3		3	
4		4		4	
5		5		5	
6		6		6	
			Average Force (oz.)		

Deleted: ¶
Formatted Table
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted Table
Formatted
Deleted: *Nozzle …alve Cleanability Test*
Deleted: Plate
Deleted: Time (s)
Deleted: Plate
Deleted: Time, s
Deleted: Plate
Deleted: Time, s
Formatted Table
Deleted: Plate #1
Formatted
Deleted: Plate #21
Deleted: Plate #41
Deleted: Plate #2
Formatted
Deleted: Plate #22
Deleted: Plate #42
Deleted: Plate #3
Formatted
Deleted: Plate #23
Deleted: Plate #43
Deleted: Plate #4
Formatted
Deleted: Plate #24
Deleted: Plate #44
Deleted: Plate #5
Formatted
Deleted: Plate #25
Deleted: Plate #45
Deleted: Plate #6
Formatted
Deleted: Plate #26
Deleted: Plate #46
Formatted
Formatted Table
Deleted: Plate #7¶
Deleted: Plate #47
Deleted: Plate #8
Formatted