Designation: D 951 – 99

Standard Test Method for Water Resistance of Shipping Containers by Spray Method[1]

This standard is issued under the fixed designation D 951; 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 Department of Defense.

1. Scope

1.1 This test method covers the determination of the water resistance of shipping containers.

1.2 This test method is frequently used in conjunction with other tests made prior to or after the spray test, such as the drop test, vibration test, inclined impact test, or compression test.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 685 Practice for Conditioning Paper and Paper Products for Testing[2]

D 996 Terminology of Packaging and Distribution Environments[2]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminology D 996.

4. Significance and Use

4.1 This test method is used to determine the water resistance of shipping containers. It can be used to determine the ability of the container to resist deterioration caused by water or the ability of the container to protect the contents from water. It is frequently used in conjunction with other tests made prior to or after the spray test, such as the drop test, inclined impact test, vibration test or compression test.

5. Apparatus

5.1 The apparatus, illustrated schematically in Fig. 1, shall consist of the components described in 5.2-5.8. Modifications are permissible, such as the use of fresh tap water instead of a recirculating system, as long as the specified temperature and spray intensity are achieved.

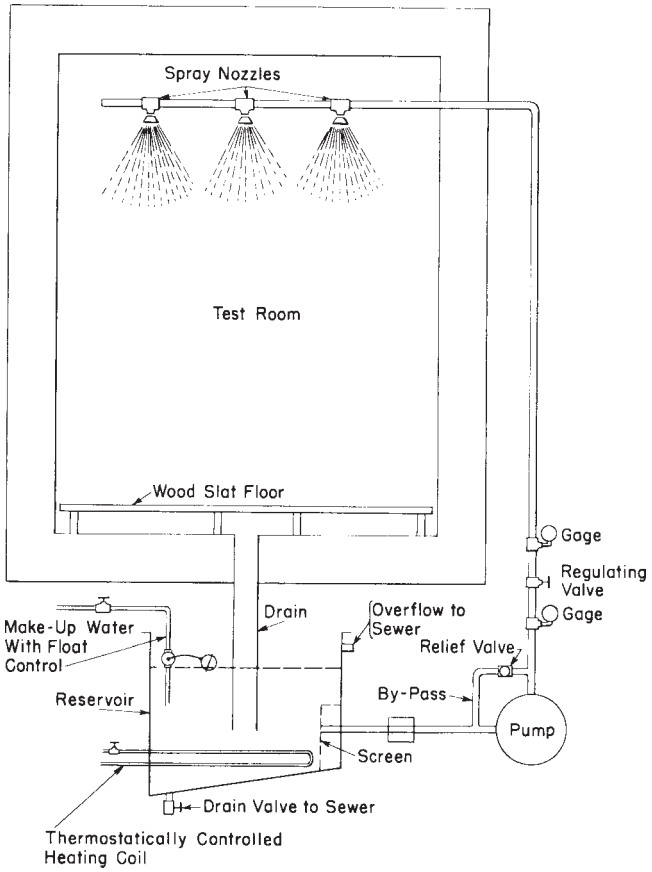

FIG. 1 Schematic Diagram of Spray Apparatus

5.2 *Test Room*—A test room or cabinet shall be of water-resistant construction, insulated and heated when necessary so that proper temperature control can be maintained. The bottom shall be covered with a false floor of slats and have an outlet drain.

5.3 *Sprays*—Spray nozzles shall be of such size and so spaced that the specified intensity of spray falls uniformly distributed over the floor area. The spray nozzles shall be so located that the droplets are falling from gravitational force only when they strike the specimens.

[1] This test method is under the jurisdiction of ASTM Committee D-10 on Packaging and is the direct responsibility of Subcommittee D10.23 on Natural Environment Test Methods.

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[2] *Annual Book of ASTM Standards*, Vol 15.09.

5.4 *Flow Control Valves*—Flow control valves, to control the intensity of the spray, are required.

5.5 *Circulating System*—A circulating system shall, where used, consist of a fine-mesh strainer, pump, relief by-pass, gages, and pressure regulating valve, together with the necessary piping between the flow control valves, spray nozzles, and water reservoir.

5.6 *Reservoir*—A reservoir for storage and conditioning of the spray water shall, where used, be equipped with an overflow to a sewer and with a drain to facilitate changing the water at the start of each test. Make-up water, regulated by a float control, shall also discharge into this tank.

5.7 *Water Temperature Control*—A thermostatically controlled means of heating for maintaining the supply water at the desired temperature is required.

5.8 *Conditioning Apparatus*—Adequate facilities shall be provided for conditioning test specimens at proper humidity and temperature prior to test.

6. Test Specimens

6.1 Test at least three containers, closed and sealed as for shipping. Select as test specimens samples that are representative of the containers being tested. For some purposes (such as for checking leakage alone) the containers may be tested empty. Normally, however, the containers shall be packed with the contents designed to be shipped in them or with a material of similar character.

7. Conditioning

7.1 Condition the test specimens sufficiently, after closing and sealing, so that any adhesives, protective coatings, glued flaps, and the like, will have reached their final normal condition, and shall be at the same temperature as the test room before being placed in it. Condition fibreboard containers in accordance with Practice D 685.

8. Procedure

8.1 Weigh each sample after conditioning and prior to test.

8.2 Adjust spray nozzles and flow control valves to the required spray intensity. See Appendix X1.

8.3 Start and operate the water sprays until the entire system, including the test room, has reached equilibrium. Unless otherwise specified, the standard temperature of the spray water and test room shall be 73.4 ± 3.6°F (23 ± 2°C), maintained by thermostatic control.

8.4 Place each sample to be tested on the false floor of the test room in normal stacking position or in any other position specifically called for in the test. Be certain the distance between adjacent samples is not less than 6 in. (150 mm). Operate the water sprays continuously at the specified intensity for the duration of the test. (The duration of the test is to be determined by the user.)

8.5 Immediately at the conclusion of the spray test, remove any liquid water from the exterior surfaces of each sample using a squeegee or other suitable means, and weigh the samples.

8.6 Immediately following the weighing of the container, make any required examination to determine the condition of the containers and their contents. Observe location and extent of any leakage into the container where the test is being performed to determine the ability of the container to protect the contents from water. Immediately follow this examination with any subsequent tests that are required.

9. Report

9.1 The report shall include the following:

9.1.1 Identification of container, including data on closure, liners, etc.

9.1.2 Identification of contents.

9.1.3 Temperature at which the test was conducted.

9.1.4 Intensity of the spray.

9.1.5 Duration of test.

9.1.6 Position of containers during test.

9.1.7 Data on condition of the container liners, and contents at the completion of the spray test. These comparative data shall be as detailed and specific as the nature of the container and its contents will permit and shall include, when possible, changes in mass, water leakage determined by measurement or estimated by visual examination, amount of product spoilage, etc.

9.1.8 Initial and final weight.

9.1.9 Data on any previous or subsequent tests to which the test containers are submitted.

10. Precision and Bias

10.1 No statement is made about either the precision or bias of this test method since the result merely states whether there is conformance to the criteria for success specified by the user(s) of this test procedure, and because the results depend on the precision and bias of other tests carried out following this test.

11. Keywords

11.1 container; water resistance; water spray

APPENDIX

(Nonmandatory Information)

X1. SPRAY INTENSITIES

X1.1 The following intensities have been used in carrying out the water spray test.

X1.1.1 *High Intensity*, 4 ± 1 in./h (100 ± 25 mm/h)—This intensity is useful to simulate tropical or subtropical conditions.

X1.1.2 *Medium Intensity*, 2 ± ½ in./h (100 ± 25 mm/h)—This intensity is useful to simulate temperate zone or protected storage conditions. The International Atomic Energy Agency (IAEA) uses this intensity for package testing.

X1.1.3 *Low Intensity*, 1 ± ½ in./h (25 ± 10 mm/h)—This intensity is useful to simulate protected storage conditions where incidental exposure to weather may occur during loading and unloading from covered transport into the covered storage.