Designation: D 4333 – 99

Standard Test Method for the Compatibility Resistance of Mechanical Pump Dispenser Components[1]

This standard is issued under the fixed designation D 4333; 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.

1. Scope

1.1 This test method covers testing of the components of mechanical pump dispensers (spray or flow types) for compatibility with consumer-type products.

1.2 *This standard may involve hazardous materials, operations, and equipment. 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 consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods[2]

3. Significance and Use

3.1 This test method identifies the compatibility of the mechanical pump dispenser components with consumer-type products.

4. Apparatus

4.1 *Balance*, accurate to 1 mg.

4.2 *Micrometers*, or calipers or other appropriate instruments, capable of measuring dimensions of test specimens to 0.025 mm (0.001 in.).

4.3 *Glass Containers*, with covers, suitable for immersing test specimens in test products.

4.4 *Oven*, with chamber capable of maintaining temperature within ±2°C (±3.6°F) of the specified test temperatures.

5. Test Specimen

5.1 At least three individual components should be used for each part tested with each product involved at each test condition.

5.2 At least three individual components are used as controls at each test condition.

5.3 Individual unassembled components shall be clean and previously unused.

6. Conditioning

6.1 Condition test specimens at 23 ± 3°C (73.4± 5.4°F) for at least 4 h prior to testing. If test specimen conditioning is not possible, the environmental conditioning of the test specimens tested should be included in the report (see 8.1).

6.2 Test conditions shall be an elevated temperature of 45 ± 3°C (113 ± 5.4°F) and an ambient room temperature of 23 ± 3°C (73.4 ± 5.4°F).

7. Procedure

7.1 *Dimensional Changes*:

7.1.1 Prior to immersion into the product, measure the thickness or overall length of the part to the nearest 0.025 mm (0.001 in.) of each component depending on which of these dimensions are most important (for example, thickness for a gasket or liner, and overall length for a molded component). Optionally, measure a diameter of the part to its nearest 0.025 mm (0.001 in.). Report the data as initial dimension D1 (see 8.1). This data is reported as a mean value of the dimension for the components measured for that particular part.

7.1.2 Maintain at least three test specimens as visual comparison controls. Do not immerse these control test specimens in any solution and store at each test condition. Label the storage container of these test specimens as control.

7.1.3 Place the test specimens in appropriate containers for the solutions being used and allow the test specimens to be totally immersed in fresh test product for 7 days in each test condition. Several test specimens of a given material may be immersed in the same container provided sufficient product is available for the total surface area exposed. Cover the container.

NOTE 1—When the components being tested are of the same type but of different material, it is recommended that separate glass containers are used for each material for the purpose of eliminating unplanned material interactions and for ease of identification.

7.1.4 After 7 days, remove all glass containers of test specimens from the 45°C environment, and allow the test specimens to equilibrate to room temperature (23°C) for a minimum of 4 h.

7.1.5 Carefully remove each test specimen from the glass container, wipe dry, and remeasure the dimension(s) on each

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[2] *Annual Book of ASTM Standards*, Vol 14.02.

part as they were measured in 7.1.1. Be careful not to damage or distort the parts during removal. Measure parts immediately. Report the mean value of the dimensions measured at this time as D2 (see 8.1).

7.1.6 Observe the appearance of each test specimen after exposure to the test product and compare the test specimens to the controls described in 7.1.2. Observe and report appearance on the basis of examination for loss of gloss, developed texture, decomposition, discoloration, swelling, clouding, tackiness, rubberiness, crazing, bubbling, cracking, solubility, and so forth.

7.1.7 Return test specimens to the test products and allow exposure in their respective environments for an additional 21 days.

7.1.8 After a total exposure of 28 days, remove the test specimens and repeat 7.1.5 and 7.1.6. Report the mean value of the final dimensions as D3 (see 8.1).

8. Report

8.1 The report shall include the following:

8.1.1 Complete identification of the material tested including type, source, manufacturer's code, and information as appropriate,

8.1.2 Temperature of tests,

8.1.3 Test product(s),

8.1.4 Duration of immersion,

8.1.5 D1 data, that is, initial thickness, overall length, or diameter(s), or a combination thereof, to the nearest 0.025 mm (0.001 in.),

8.1.6 D2 data, that is, thickness, overall length, or diameter(s), or a combination thereof, after immersion to the nearest 0.025 mm (0.001 in.),

8.1.7 D3 data, that is, final thickness, overall length, or diameter(s), or a combination thereof, after immersion to the nearest 0.025 mm (0.001 in.),

8.1.8 The percentage dimensional change for the first 7 days to the nearest 0.1 %, as calculated based upon the formula (D2-D1)/D1× 100 in which positive percentages signify swell and negative outcomes signify shrinkage,

8.1.9 The percentage dimensional change for the 28 days to the nearest 0.1 %, as calculated based upon the formula (D3-D1)/D1× 100 in which positive percentages signify shrinkage and negative outcomes signify swell, and

8.1.10 General appearance of test specimens after immersion along with the appearance of the product.

9. Precision and Bias

9.1 *Precision*—The precision of Test Method D 4333 is highly dependent on the particular component material and contents tested. One laboratory has investigated one particular polyethylene pump gasket and a hair spray product with three replicate tests, yielding the results given in Table 1. Other pumps and contents will have other averages of dimensional changes due to chemical compatibility and will have more or less variability between replicate tests. Users of this test method are encouraged to reference historical files of previous tests of similar pump components and contents for an estimate of within-laboratory repeatability. Because of this strong product and component material dependency, further investigation of repeatability and reproducibility is not practicable.

9.2 *Bias*—Test Method D 4333 has no bias because an accepted reference or referee value is not available.

10. Keywords

10.1 chemical resistance; compatibility; mechanical pump dispenser components

TABLE 1 Interlaboratory Test Results

	Thickness					Diameter				
	Average, in.	Shrink or Swell, %	Standard Deviation, in.	Maximum, in.	Minimum, in.	Average, in.	Shrink or Swell, %	Standard Deviation, in.	Maximum, in.	Minimum, in.
Initial	0.0613	. . .	0.0006	0.062	0.061	0.8548	. . .	0.002	0.8566	0.8530
7-day	0.0613	0	0.0006	0.062	0.061	0.8546	0.02 shrink	0.002	0.8566	0.8526
28-day	0.0623	1.63 swell	0.0006	0.063	0.062	0.8556	0.09 swell	0.006	0.8573	0.8539