

below.

Method— Carry out the titration within 1 hour of removal of the containers from the autoclave.

Combine the liquids obtained from the containers, and mix. Introduce the prescribed volume indicated in *Table 3* into a conical flask. Place the same volume of *Carbon Dioxide-Free Water* into a second similar flask as a blank. Add 0.05 mL of *Methyl Red Solution* to each flask for each 25 mL of liquid. Titrate the blank with 0.01 M hydrochloric acid. Titrate the test liquid with the same acid until the color of the resulting solution is the same as that obtained for the blank. Subtract the value found for the blank titration from that found for the test liquid, and express the results in mL of 0.01 M hydrochloric acid per 100 mL. Express titration values of less than 1.0 mL to 2 decimal places and titration values of more than or equal to 1.0 mL to 1 decimal place.

Limits— The results, or the average of the results if more than one titration is performed, are not greater than the values stated in *Table 4*.

Table 4. Test Limits for Surface Glass Test

Filling Volume (mL)	Maximum Volume of 0.01 M HCl per 100 mL of Test Liquid (mL)	
	Types I and II	Type III
Up to 1	2.0	20.0
Above 1 and Up to 2	1.8	17.6
Above 2 and Up to 5	1.3	13.2
Above 5 and Up to 10	1.0	10.2
Above 10 and Up to 20	0.80	8.1
Above 20 and Up to 50	0.60	6.1
Above 50 and Up to 100	0.50	4.8
Above 100 and Up to 200	0.40	3.8
Above 200 and Up to 500	0.30	2.9
Above 500	0.20	2.2

Water Attack at 121°

Option— The *Water Attack at 121°* test can be used to qualify Type II glass. Rinse thoroughly 3 or more containers, selected at random, twice with *High-Purity Water*.

Procedure— Fill each container to 90% of its overflow capacity with *High-Purity Water*, and proceed as directed for *Procedure* under *Powdered Glass Test*, beginning with “Cap all flasks,” except that the time of autoclaving shall be 60 minutes instead of 30 minutes, and ending with “to prevent the formation of a vacuum.” Empty the contents from more containers into a 100-mL graduated cylinder, combining, in the case of smaller

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containers, the contents of several containers to obtain a volume of 100 mL. Place the pooled specimen in a 250-mL conical flask of resistant glass, add 5 drops of *Methyl Red Solution*, and titrate, while warm, with 0.020 N sulfuric acid. Complete the titration within 60 minutes after opening the autoclave. Record the volume of 0.020 N sulfuric acid used, corrected for a blank obtained by titrating 100 mL of *High-Purity Water* at the same temperature and with the same amount of indicator. The volume does not exceed that indicated in *Table 5*.

Table 5. Test Limit for Water Attack at 121°

Table of Test Limits for Water Attack at 121°				
Type	General Description ^a	Type of Test	Limits	
			Size, ^b mL	mL of 0.020 N Acid
II	Treated soda-lime glass	Water Attack	100 or less	0.7
			Over 100	0.2
^a The description applies to containers of this type of glass usually available.				
^b Size indicates the overflow capacity of the container.				

Arsenic

ARSENIC <211> — Use as the *Test Preparation* 35 mL of the water from one Type I glass container or, in the case of smaller containers, 35 mL of the combined contents of several Type I glass containers, prepared as directed for *Procedure* under *Water Attack at 121°* or *Surface Glass Test*: the limit is 0.1 µg per g.

¹ A suitable mortar and pestle is available (catalog No. H-17280) from Humboldt Manufacturing Co., 7300 West Agatite Avenue, Norridge, IL, 60706, www.humboldtmfg.com

² A suitable nuclear-grade resin mixture of the strong acid cation exchanger in the hydrogen form and the strong base anion exchanger in the hydroxide form, with a one-to-one cation to anion equivalence ratio, is available from the Millipore Corp, 290 Concord Road Billerica, MA, 01821, www.millipore.com; Barnstead International, 2555 Kerper Boulevard Dubuque, IA, 52004, www.barnsteadthermolyne.com; GE Water, 4636 Somerton Road Trevose, PA, 19053, www.gewater.com; Pall, 2200 Northern Boulevard East Hills, NY 11548, www.pall.com; Whatman, 200 Park Avenue Florham Park, NJ, 07932, www.whatman.com; Siemens Water Technologies, 14950 Heathrow Forest Pa, Houston, TX 77032, www.usfilter.com

Auxiliary Information— Please check for your question in the FAQs before contacting USP.

Topic/Question	Contact	Expert Committee
General Chapter	Desmond G. Hunt, Ph.D. Senior Scientific Liaison 1-301-816-8341	(GCPS2010) General Chapters - Packaging Storage and Distribution



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applying the torque designated in the accompanying table when closing screw-capped containers. To each of the remaining 2 containers, designated *controls*, add a sufficient number of glass beads to attain a weight approximately equal to that of each of the *test containers*, and close, applying the torque designated in the accompanying table when closing screw-capped containers. Record the weight of the individual containers so prepared to the nearest 0.1 mg if the container volume is less than 20 mL; to the nearest mg if the container volume is 20 mL or more but less than 200 mL; or to the nearest centigram (10 mg) if the container volume is 200 mL or more; and store at $75 \pm 3\%$ relative humidity and a temperature of $23 \pm 2^\circ$. [NOTE—A saturated system of 35 g of sodium chloride with each 100 mL of water placed in the bottom of a desiccator maintains the specified humidity. Other methods may be employed to maintain these conditions.] After 336 ± 1 hours (14 days), record the weight of the individual containers in the same manner. Completely fill 5 empty containers of the same size and type as the containers under test with water or a noncompressible, free-flowing solid such as well-tamped fine glass beads, to the level indicated by the closure surface when in place. Transfer the contents of each to a graduated cylinder, and determine the average container volume, in mL. Calculate the rate of moisture permeability, in mg per day per L, by the formula:

$$(1000/14V)[(T_F - T_I) - (C_F - C_I)]$$

in which V is the volume, in mL, of the container; $(T_F - T_I)$ is the difference, in mg, between the final and initial weights of each *test container*; and $(C_F - C_I)$ is the difference, in mg, between the average final and average initial weights of the 2 *controls*. For containers used for drugs being dispensed on prescription, the containers so tested are *tight containers* if not more than 1 of the 10 *test containers* exceeds 100 mg per day per L in moisture permeability, and none exceeds 200 mg per day per L. For containers used for drugs being dispensed on prescription, the containers are *well-closed containers* if not more than 1 of the 10 *test containers* exceeds 2000 mg per day per L in moisture permeability, and none exceeds 3000 mg per day per L.

Table 1. Torque Applicable to Screw-Type Container

Closure Diameter ^a (mm)	Suggested Tightness Range with Manually Applied Torque ^b (inch-pounds)
8	5
10	6
13	8
15	5 - 9
18	7 - 10
20	8 - 12
22	9 - 14
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	10 - 18
28	12 - 21
30	13 - 23
33	15 - 25
38	17 - 26
43	17 - 27
48	19 - 30
53	21 - 36
58	23 - 40
63	25 - 43
66	26 - 45
70	28 - 50
83	32 - 65
86	40 - 65
89	40 - 70
100	45 - 70
110	45 - 70
120	55 - 95
132	60 - 95

^a The torque designated for the next larger closure diameter is to be applied in testing containers having a closure diameter intermediate to the diameters listed.

^b A suitable apparatus is available from SecurePak, PO Box 1210, Maumee, Ohio 43537-8210. MRA Model with indicators on both the removal and application sides available in the following ranges: 1) 0 - 25 inch lbs., read in 1-inch lb. increments, 2) 0 - 50 inch lbs., read in 2-inch lb. increments, and 3) 0 - 100 inch lbs., read in 5-inch lb. increments. For further detail regarding instructions, reference may be made to "Standard Test Method for Application and Removal Torque of Threaded or Lug-Style Closures" ASTM Method D3198-02, published by the American Society for Testing and Materials, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

Multiple-Unit Containers for Capsules and Tablets (Without Closure)

Polyethylene Container— Fit the containers with impervious seals obtained by heat-sealing the bottles with an aluminum foil - polyethylene laminate or other suitable seal.² Test the containers as specified under *Multiple-Unit Containers for Capsules and Tablets*: the high-density polyethylene containers so tested meet the requirements if the moisture permeability exceeds 10 mg per day per L in not more than 1 of the 10 test containers and exceeds 25 mg per day per L in none of them. The low-density polyethylene containers so tested meet the requirements if the moisture permeability exceeds 20 mg per day per L in

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