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FED. TEST METHOD STD. NO. 626

August 12, 1957

SUPERSEDING
Fed. Spec. DD-G-626a
April 23, 1953

FEDERAL TEST METHOD STANDARD

GLASSWARE; METHODS FOR SAMPLING AND TESTING

This standard was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies

Additional copies of this standard may be purchased from the General Services Administration, Business Service Center, Region 3, Seventh and D Streets SW., Washington 25, D. C., for 10 cents each

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INFORMATION SHEET

ON

FEDERAL TEST METHOD STANDARDS

This Federal Test Method Standard is issued in loose leaf form to permit the insertion or removal of new or revised sections and test methods.

All users of Federal Test Method Standards should keep them up to date by inserting revised or new sections and test methods as issued and removing superseded and canceled pages.

New and revised material and cancellations will be issued under Change Notices which will be numbered consecutively and will bear the date of issuance. Change Notices should be retained and filed in front of the Alphabetical Index of the Standard until such time as they are superseded by a reissue of the entire Standard.

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FEDERAL TEST METHOD STANDARD

GLASSWARE; METHODS FOR SAMPLING AND TESTING

Authority.—*This standard is issued pursuant to the Federal Property and Administrative Services Act of 1949, as amended, and its application to the purchase of commodities referred to herein is mandatory on all Federal agencies.*

1. SCOPE, CONTENTS, AND NUMBERING SYSTEM

1.1 Scope.—This standard covers the general requirements and methods of testing that are common to glassware covered by Federal specifications. This standard does not include test methods applicable only to a specific product. Such test methods are included in the detail specifications. In case of conflict between the provisions of the contract, the detail specifications, and this standard, the requirements of the contract, the detail specifications, and this standard shall prevail in the order named.

1.2 Contents.

Section	*Title*
1	Scope, Contents, and Numbering System.
2	Notes.
3	Alphabetical Index of Test Methods.
4	Numerical Index of Test Methods.
5	General Requirements.
	Test Methods
200	Physical Properties.
300	Chemical Durability.
400	Physical Durability.

1.3 Numbering system.—The various test methods are designated by numbers assigned in accordance with the following system:

1.3.1 *Class of tests.*—Any given class of tests is assigned a series of basic numbers covering one centenary. For example, the physical class of tests is designated by the numbers 200 to 299, inclusive.

1.3.2 *Type of tests.*—Any given type of tests is assigned a series of basic numbers covering one decade. For example, the softening point type of tests is designated by the numbers 200 to 209, inclusive.

1.3.3 *Revision of tests.*—The number of times any given test method has been revised is indicated by the number following the decimal point. For example, the method of test for softening point in this issue is designated as method No. 201; when this method is revised for the first time at some date in the future, it will be designated as method No. 201.1 and subsequent revisions will be numbered 201.2, 201.3, etc.

1.4 ASTM methods.—Those Federal test methods which have been found to be identical to corresponding ASTM methods are listed by title and number in the indexes of, but are not printed in, this Standard. Whenever a product specification cites any of those Federal test methods, the corresponding ASTM method should be followed in conducting the test required.

2. NOTES

2.1 (Activities outside the Federal Government may obtain copies of Federal Specifications and Standards as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

(Single copies of this specification and other product specifications required by activities outside the Federal Government for bidding purposes are available without charge at the General Services Administration Regional Offices in Boston, New York, Atlanta, Chicago, Kansas City, Mo., Dallas, Denver, San Francisco, Los Angeles, Seattle, and Washington, D. C.

(Federal Government activities may obtain copies of Federal Specifications and Standards and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

2.2 ASTM test methods covered by this Standard should be purchased by Federal agencies under Federal Supply Schedule, Class

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35, Part 1, Item No. 35–U–565–35, at prices and discounts established therein for ASTM methods referenced in Federal Specifications and Standards. ASTM publications are available for reference in most technical libraries, as well as some public libraries.

Notice.—When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

3. ALPHABETICAL INDEX OF TEST METHODS

Note.—Those Federal standard test methods listed in the index which have a corresponding ASTM standard are not printed in this publication. Whenever one of those Federal test methods is cited, the corresponding ASTM standard should be followed in conducting the test.

Method	Fed. Std. Method No.	Use ASTM No.[1]
Acid Attack at 121° C	340	C 225–54. (Method B–A).
Annealing Point	220	C 336–54T.
Coefficient of Expansion (Dilatometer Procedure)	240	C 337–54T.
Coefficient of Expansion (Interferometer Procedure)	241	
Softening Point	201	C 338–54T.
Solubility Test—Powder Method	320	C 225–54. (Method P–W).
Strain Examination—Polariscope	420	C 148–50.
Thermal Shock (Borosilicate Glass)	401	
Thermal Shock (Soda-Lime Glass)	402	C 149–50.
Water Attack at 121° C	330	C 225–54. (Method B–W).

[1] ASTM test methods covered by this Standard should be purchased by Federal agencies under Federal Supply Schedule, Class 35, Part 1, Item No. 35–U–565–35, at prices and discounts established therein for ASTM methods referenced in Federal Specifications and Standards.

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5.2.3.2 Copies of the results of all chemical and physical tests which are directly connected with the material to be furnished.

5.2.4 *Facilities furnished by contractor.*—When inspection is at the place of manufacture, the contractor shall furnish the inspector, without expense to the Government such samples, testing, inspection, and other facilities including suitable office space and office furniture as may be necessary for the performance of his work.

5.2.5 *Inspector's access to plant.*—The inspector and his assistants shall have free access at all reasonable times to all parts of any manufacturing plant, warehouse, or loading point, which concern the manufacture, storage, or shipment of the material ordered.

5.2.6 *Identity.*—When material is inspected by batch at the place of manufacture, the contractor shall so arrange his working, handling, and marking of the material that at all times throughout its manufacture and inspection, the inspector can identify with certainty any or all portions.

5.2.7 *Affidavit.*—The manufacturer shall furnish an affidavit that the material submitted for test is made from the same materials under the same or equivalent conditions as those used in the manufacture of the delivered articles.

5.2.8 *Defective materials.*—Under any conditions of inspection, if material which has been accepted contains inherent defects subsequently exposed, the contractor shall, if required, replace the defective material without expense to the Government.

5.3 **Inspector's stamp.**—In the case of small articles packed in bulk, or in the case of material which would be injured by stamping, the necessary stamp mark shall be applied by the inspector to the boxing or packaging material of the article or to tags securely wired or attached thereto. The removal of any inspector's official stamped markings or any other Government markings from material prior to its final acceptance, without authority or permission of the inspector, shall be a sufficient cause for the rejection of such material.

5.4 **Selection of samples and test specimens.**—Samples shall be obtained if possible from the products to be tested, taken at random, and in such case shall be taken in accordance with the requirements of the specification covering the particular material. In case the samples for the physical properties tests are taken at the point of manufacture, they shall be taken by the manufacturer under the supervision of a Government inspector in such a way as to be representative of the batch of glass from which the fabricated articles delivered to the Government will be made. The number of specimens to be tested in each type of test shall be as specified in the material specification; if not so specified, at least five specimens shall be tested.

5.5 **Apparatus.**—Unless otherwise specified, properties shall be determined in any standard type of testing equipment properly calibrated and accurate to one percent in the range used.

5.6 **Test reports.**—The report on each test shall include the following:

(1) The name of the Government agency requesting the test.
(2) The name of the contractor and the number and date of the contract covering the material or parts.
(3) The title, number, and date, of the applicable material specification.
(4) Description of the material, including thickness, type, source, manufacturer's code numbers, etc.
(5) Type and dimensions of specimens.
(6) Location of specimens in the original sample.
(7) Temperature, humidity, and length of conditioning period.
(8) Such additional data as is specified under the individual test methods.
(9) Such additional data as may be required under the material specification.
(10) Any further information which may be considered pertinent, particularly with reference to unexpected behavior.
(11) A brief description of the testing apparatus, sufficient to identify it.

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4. NUMERICAL INDEX OF TEST METHODS

Note.—Those Federal Standard test methods listed in the index which have a corresponding ASTM standard are not printed in this publication. Whenever one of those Federal test methods is cited, the corresponding ASTM standard should be followed in conducting the test.

Method	Fed. Std. Method No.	Use ASTM No.[1]
Physical Properties Tests (200 Class)		
Softening Point	201	C 338–54T
Annealing Point	220	C 336–54T.
Coefficient of Expansion (Dilatometer Procedure)	240	C 337–54T.
Coefficient of Expansion (Interferometer Procedure)	241	
Chemical Durability Tests (300 Class)		
Solubility Test—Powder Method	320	C 225–54 (Method P–W).
Water Attack at 121° C	330	C 225–54. (Method B–W).
Acid Attack at 121° C	340	C 225–54. (Method B–A).
Physical Durability Tests (400 Class)		
Thermal Shock (Borosilicate Glass)	401	
Thermal Shock (Soda-Lime Glass)	402	C 149–50.
Strain Examination—Polariscope	420	C 148–50.

[1] ASTM test methods covered by this Standard should be purchased by Federal agencies under Federal Supply Schedule, Class 25, Part 1, Item No. 25-U-665-35, at prices and discounts established therein for ASTM methods referenced in Federal Specifications and Standards.

5. GENERAL REQUIREMENTS.

5.1 Sampling, inspection, and test procedures.—As specified in the invitation for bids, purchases shall be inspected and samples for test taken either at the point of manufacture, the point of delivery, or at any suitable point in transit.

5.2 Duties and responsibilities of the contractor.

5.2.1 The contractor shall be responsible for compliance with all the requirements of the contract and specifications, whether the material is manufactured by him or a sub-contractor.

5.2.2 *Manufacturing method.*—The means and methods for executing the work will be determined by the contractor, but the obligation is on the contractor to satisfy the purchaser as to full compliance with the requirements of the specifications and the contract.

5.2.3 *Information furnished by the contractor.*—When specified or requested by the inspector, the contractor shall inform the inspector when work will be commenced and of the general plans and methods that he intends to follow. During the progress of the work, the contractor shall furnish the inspector, or such of the assistants as he may designate, the following information:

5.2.3.1 Notification of the time when each operation which the inspector is to witness is to take place shall be given sufficiently in advance to enable the inspector to be present.

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This method is a part of Fed. Test Method Std. No. 626
(formerly Fed. Spec. DD-G-626a)

Method 241

August 12, 1957

COEFFICIENT OF EXPANSION (INTERFEROMETER PROCEDURE)

1. APPARATUS

1.1 **Furnace.**—A sectional view of the electric furnace containing the interferometer is given in figure 241A. A porcelain tube F, 5 cm. in diameter and 30 cm. long, wound spirally with a heating coil K, is mounted vertically in sheetiron jacket and surrounded with insulating material. A small porcelain tube E, which extends from the base to about 3 cm. from the center of the furnace, supports the porcelain disk D, the intervening space below this disk being filled with an insulating material. A stainless steel cup C with a cover H acts as a container for the interferometer ASB (figure 241B). The upper end of the furnace is closed by another porcelain tube containing two fused quartz or Vycor windows W_1 and W_2. A sheet of asbestos with a glass window W_3 covers the entire furnace.

1.2 A small double-bore porcelain tube containing a calibrated thermocouple T passes through the base of the furnace, the disk D, and the bottom of the container C, the tip of the thermocouple being adjusted so that it nearly touches the lower interferometer plate.

1.3 **Pulfrich apparatus.**—The Pulfrich apparatus is represented by P, figure 241A. This viewing instrument contains a helium lamp for illuminating the interferometer and the optical arrangement necessary for measuring the displacement of the fringes.

2. PROCEDURE

2.1 Prepare a sample in the shape of a ring, a T, a tripod, or consisting of three individual pyramids. The samples are ground until they are of uniform height of about 5 mm., with bearing points, top and bottom, in the first three instances, about 120° apart and with the material cut away to a slight extent between the bearing points where necessary. As soon as the bearing points are of equal height as indicated by a micrometer caliper, the sample is set up as indicated in figure 241B between two fused quartz or Vycor plates A and B. (The height is actually the distance between the two quartz plates, A and B.)

2.2 The base quartz or Vycor plate B is polished true plane on the upper surface, while the lower surface is left in a fine ground condition to avoid regular reflection from it. Both surfaces of A are polished true planes and adjusted to make an angle of 20 minutes with each other so that light reflected from the upper surface can be diaphragmed out of the viewing apparatus. The circle E, 1 mm. in diameter, is ruled on the lower surface of A to constitute a reference mark.

2.3 The ASB setup (figure 241B) is then placed in the stainless steel cup C (figure 241A) and under the viewing apparatus at the same height at which it will rest in the furnace. The height of the bearing points are then adjusted on a hone until 5 to 8 fringes are visible across the plate. As soon as this adjustment is complete, the steel cup containing the sample is placed in the furnace, being careful not to disturb it.

2.4 As soon as the sample and container have assumed the temperature of the furnace (30 minutes), the fraction of the fringe is read to the nearest tenth. The current is then turned on and the furnace allowed to heat up fairly rapidly to almost 300° C., keeping account of the number of fringes passing the reference point. The rate of heating is then decreased and the furnace maintained at 300° C. until thermal equilibrium is reached at this tem-

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perature (1 hour). The final reading is then made to the nearest tenth of a fringe.

From the results so obtained, the expansion can be calculated as follows:

$$\Delta L=\frac{0.5876F}{2}+L\times 10^4\,(0.0003)\,273\left(\frac{1}{T_1}-\frac{1}{T_2}\right)$$

microns,

where ΔL=the expansion,
F=number of fringes,
L=length of sample in centimeters,
T_1=absolute temperature at the start, and
T_2=absolute temperature at which the expansion is desired.

0.5876 is the wavelength in microns of the yellow radiation of helium which is used to illuminate the interferometer.

0.0003 is the refractive index minus one for air under standard conditions of pressure and temperature.

It is advantageous to make up a table of the values of the expression,

$$10^4(0.0003)\,273\left(\frac{1}{T_1}-\frac{1}{T_2}\right)$$

for uniform steps of temperature previous to making expansion of determinations. These values times the length of the sample in centimeters gives the total air correction.

2.5 The coefficient of expansion C is then calculated from the expression,

$$C=\frac{\Delta L\times 10^{-4}}{L(T_2-T_1)}\text{ centimeters/centimeter/°C.}$$

Notes.—(1) When three individual pyramids are used as the sample, it is well to place an extra weight over one of them. This tends to prevent tilting which often causes trouble with this type of sample by multiplying, or causing the disappearance, of the fringes. Tapping the furnace also often causes the effect of tilting to disappear.

(2) It is a good idea, before proceeding with the observations, to heat the furnace containing the interferometer to 200° to 250° C. and allow it to cool overnight. By this means air films between the plates and the bearing points are driven off or at least reduced.

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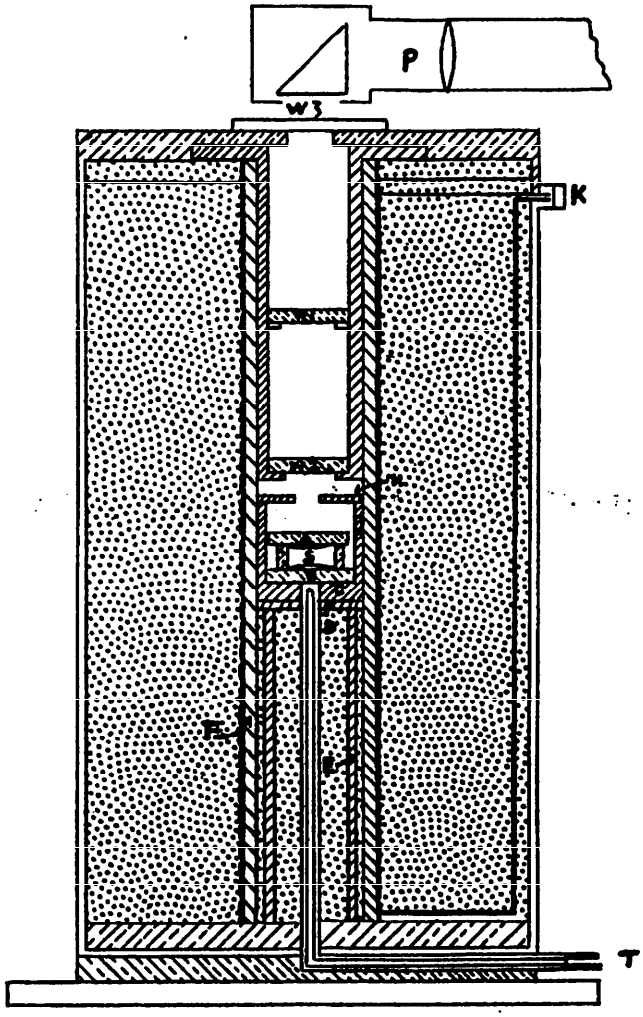

FIGURE 241A.—Electric furnace.

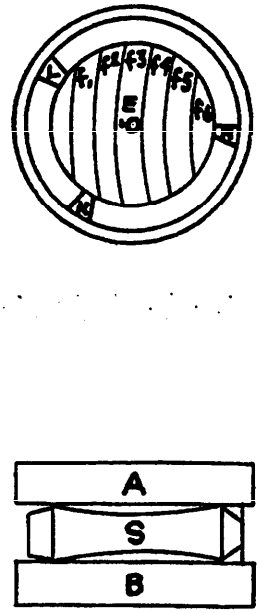

FIGURE 241B.—Interferometer.

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(formerly Fed. Spec. DD-G-626a)

Method 401

August 12, 1957

THERMAL SHOCK (BOROSILICATE GLASS)

1. APPARATUS

1.1 The apparatus consists essentially of an oven and an ice bath. The oven shall have a temperature range from 35° to 180° C. and shall be of the air circulating type for temperature uniformity. It shall be provided with a thermostat capable of maintaining the temperature constant within plus or minus 1° C.

1.2 The ice bath shall be maintained at a temperature of 3° to 5° C.

2. PROCEDURE

The samples of ware taken for test shall be divided into 2 equal lots. One lot shall be placed in an oven previously heated to the temperature given in the commodity specification and allowed to remain therein 30 minutes. The samples shall then be removed by means of tongs with rubber or asbestos covered tips, one at a time, and quenched with a scooping motion in the ice bath, care being exercised that the samples do not strike the ice. During the test, the apparatus shall be protected from drafts in a sheltered area.

If the samples of the first lot fail to meet the requirements of the commodity specification in the above test, the second lot shall be tested in the same manner. In that case, the combined sample (original test plus retest) must meet the requirements given in the commodity specification.

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