U. S. Gov't
Master
Specification
No. 248

DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
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CIRCULAR OF THE BUREAU OF STANDARDS, No. 206

[Issued April 16, 1925]

UNITED STATES GOVERNMENT MASTER SPECIFICATION FOR CALCINED GYPSUM

FEDERAL SPECIFICATIONS BOARD SPECIFICATION No. 248

This specification was officially promulgated by the Federal Specifications Board on November 5, 1924, for the use of the Departments and Independent Establishments of the Government in the purchase of calcined gypsum.

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I. CLASSES

Calcined gypsum (plaster of Paris) sold under this specification may be one of three classes: C, casting; G, general; F, finishing. The calcined gypsum of any class may be either retarded or unretarded.

II. MATERIAL AND WORKMANSHIP

Calcined gypsum (plaster of Paris) sold under this specification is a fine, white powder resulting from the partial dehydration of gypsum by means of heat.

III. GENERAL REQUIREMENTS

1. Chemical Composition.—Calcined gypsum shall contain not less than 60.5 per cent by weight of $CaSO_4.1/2H_2O$.

2. Tensile Strength.—The tensile strength of calcined gypsum shall be not less than 200 pounds per square inch.

3. Compressive Strength.—The compressive strength of calcined gypsum shall be not less than 1,000 pounds per square inch.

IV. DETAIL REQUIREMENTS

1. Fineness.—Class C calcined gypsum shall all pass a No. 14 sieve, and not less than 75 per cent shall pass a No. 100 sieve.

Class G calcined gypsum shall all pass a No. 14 sieve, and not less than 40 per cent nor more than 75 per cent shall pass a No. 100 sieve.

Class F calcined gypsum shall all pass a No. 14 sieve, and not less than 60 per cent shall pass a No. 100 sieve.

2. Time of Set.—Unretarded calcined gypsum shall set in not less than 10 nor more than 40 minutes.

Retarded calcined gypsum shall set in not less than 40 minutes nor more than 6 hours.

V. METHODS OF INSPECTION AND TESTS

1. Sampling.—At least 3 per cent of the packages shall be sampled. Samples shall be taken from both the surface and the center of the packages. The material so obtained shall be thoroughly mixed and quartered to provide a 15-pound sample. All laboratory samples shall be placed immediately in an air-tight container and sealed. Samples shall not be taken from broken packages.

2. Chemical Analysis.—Preparation of sample: Dry about 1 pound of the material, spread in a thin layer in a suitable dish, in an oven at about 45° C. for two hours. Cool in an atmosphere free from moisture. Grind about 10 g of this dried material until it all passes a No. 100 sieve, using extreme care that the material be not unduly exposed to moisture or overheating. Store in an air-tight container until used.

(*a*) *Calcium oxide.*—Place 0.5 g of the sample in a porcelain casserole. Add about 25 cc of 1 : 5 HCl and evaporate to apparent dryness on a hot plate. Cool, and add enough concentrated HCl to wet thoroughly. Add about 10 cc of water, boil, filter, and wash. Put the filtrate back in the same casserole. Evaporate to dryness and heat to about 120° C. for one hour. Cool. Add enough concentrated HCl to wet thoroughly. Add about 25 cc of water, boil, filter, and wash. Add a few drops of HNO_3 to the filtrate and boil to insure oxidation of the iron. Add 2 g NH_4Cl previously dissolved in water. Make alkaline with NH_4OH. Digest hot for a few minutes, until the precipitate coagulates. Filter and wash. To the filtrate add 5 g $(NH_4)_2C_2O_4$ dissolved in water. Digest hot for one-half hour, making sure that the filtrate is always alkaline with NH_4OH. Filter, wash, and ignite the precipitate in a platinum crucible over a strong blast to constant weight. Multiply this weight by 200 to find the per cent calcium oxide.

(*b*) *Sulphur trioxide.*—Dissolve 0.5 g of the sample in 50 cc of 1 : 5 HCl. Boil. Add 100 cc of boiling water and continue boiling for five minutes. Filter immediately and wash thoroughly with hot water. Boil, and while boiling, add slowly 20 cc of a boiling 10 per cent solution of $BaCl_2$. Digest hot for one hour or until precipitate settles. Filter and wash. Dry carefully. Ignite over Bunsen burner at lowest heat possible until filter paper is burned off. Ignite at bright red heat for 15 minutes and weigh as $BaSO_4$. Multiply this weight by 68.67 to find per cent sulphur trioxide.

(*c*) *Combined water.*—Heat 1 g of the sample to constant weight in a covered crucible at 215 to 230° C. The loss of weight, multiplied by 100, gives the per cent combined water.

(*d*) *Calculation.*—Substitute the percentage found above in the equations $CaO : SO_3 : H_2O = 56 : 80 : 9$. It will be found that one, and probably two, of the ingredients is present in excess of the amount required to satisfy these equations. Select that ingredient which shows the greatest deficiency from the theoretical amount. If this ingredient is CaO, multiply the per cent CaO as found by 2.59 to find the per cent $CaSO_4.1/2H_2O$; if SO_3, multiply per cent SO_3 by 1.81; if H_2O, multiply per cent H_2O by 16.11.

3. Fineness.—Fineness shall be determined by screening 100 g of the dried sample through the sieves specified and weighing the amount of material retained on each sieve. The material shall be shaken through the sieve with as little abrasion as possible.

4. Testing Consistency.—Testing consistency shall be determined by means of the Southard viscosimeter shown in Figure 1.

See that the instrument is clean and adjusted so that the top plate is in a horizontal plane. Turn the crank until the top of the piston is brought flush with the surface of the plate. Crank 10

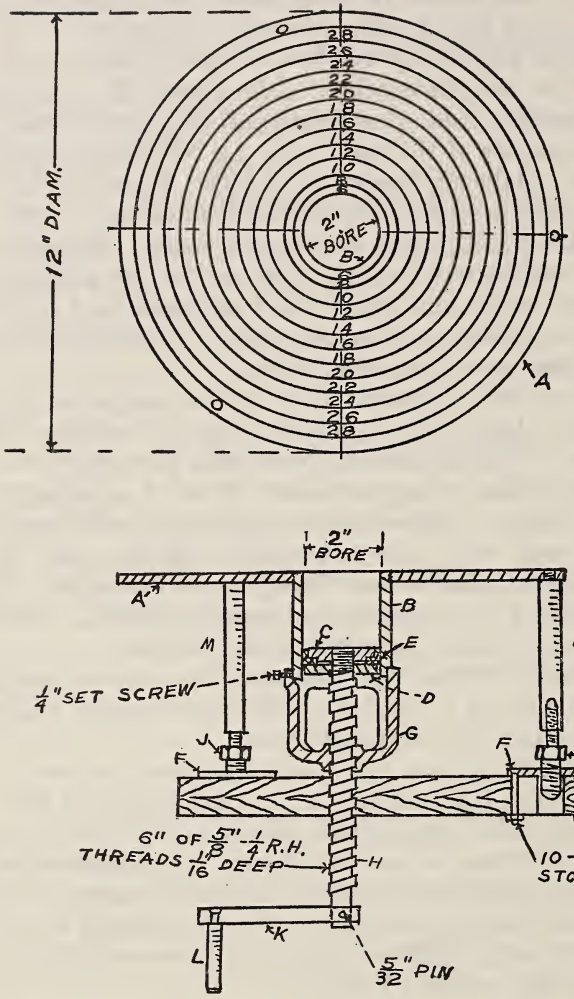

FIG. 1.—*Southard Viscosimeter*

A, 1/16-inch hard brass plate scale disk.
B, 2-inch Ex. H. seamless brass tube cylinder.
C, Brass piston top.
D, brass piston bottom.
E, Leather piston packing.
F, 1/16-inch by 1-inch flat bar steel support plate.
G, Brass cage (open on two sides).
H, 5/16-inch hard brass piston screw.
J, 1/2-inch hex. brass support stud.
K, 3/8-inch by 3/4-inch C. R. S. screw lever.
L, 3/8-inch diameter C. R. S. lever handle.
M, 1/2-inch diameter C. R. S. support rod.

turns in the reverse direction, so that the piston forms a well 2½ inches deep.

To a known volume of water add a known weight of the sample. Sift the sample into the water by shaking it through a No. 8 sieve. Let soak for two minutes. Stir to an even fluidity, and transfer immediately to the well in the viscosimeter.

Turn the crank of the viscosimeter 10 revolutions at the rate of one revolution per second. The upward motion of the piston will cause the mixture to overflow in the form of a circular pat on the plate of the instrument. Average the quadrant measurements of the diameter of this pat. If this diameter is greater or less than that required for "testing consistency," repeat, using fresh materials throughout, and varying the ratio of calcined gypsum to water.

The mixture is of testing consistency when the average diameter of the pat is 9.7 cm.

5. Time of Set.—Mix 200 g of the sample with enough water to make a paste of "testing consistency." For quantity of water and directions for mixing see preceding section. Test with a Vicat needle. Clean the needle from particles of adhering plaster after each test. Set is considered complete when the needle no longer penetrates to the bottom of the specimen. Unretarded calcined gypsum shall be tested every two minutes until set. If the material is retarded, it need not be tested until 20 minutes before its specified time of set, and shall be tested every two minutes thereafter until set.

For this test it is absolutely essential that all dishes and utensils be clean. Especially must they be free from all traces of set gypsum. Distilled water must be used.

6. Tensile Strength.—Mix 500 g of the sample with enough water to make a paste of "testing consistency." For quantity of water and directions for mixing see Section V, 4 above. Pour into a five-gang briquet mold, moving the containing vessel back and forth over the mold while pouring. Work slightly to remove air bubbles and strike off level. Remove the briquets from the mold as soon as they are hard enough to handle. Store in the air at a temperature between 60 and 100° F. Weigh once a day. Test when the weight has become constant within 0.1 per cent.

In computing the average strength, any briquet whose strength varies more than 15 per cent from the average may be discarded. In case three or more briquets vary more than 15 per cent from the average, the results shall be discarded and the test repeated.

7. Compressive Strength.—Mix 2,000 g of the sample with enough water to make a paste of "testing consistency." For quantity of water and directions for mixing see Section V, 4 above. Pour into five cylinder molds, 2 inches in diameter by 4 inches high, mov-

ing the containing vessel back and forth over the molds while pouring. Work slightly to remove air bubbles and strike off level. Remove the cylinders from the molds as soon as they are hard enough to handle. Store in the air at a temperature between 60 and 100° F. Weigh once a day. Test when the weight has become constant within 0.1 per cent.

In computing the average strength, any cylinder whose strength varies more than 15 per cent from the average may be discarded. In case three or more cylinders vary more than 15 per cent from the average the results shall be discarded and the test repeated.

VI. PACKING AND MARKING

1. Packing.—Calcined gypsum is shipped in packages.

2. Marking.—Each package of calcined gypsum shall be legibly marked with a description of the contents, the name of the manufacturer, the brand (if any), and the net weight of the contents; also with some means of identification stating the particular contract on which the purchase and shipment were made.

VII. ADDITIONAL INFORMATION

Class C calcined gypsum is designed to be used in casting ornamental work "on the bench," the casts to be later mounted in place. This class may also be used for running moldings in place. It is known to the trade as "casting or molding plaster."

Class G calcined gypsum is intended for general structural purposes, such as preparing the setting mortar for gypsum block, pointing gypsum wall board, etc.

Class F calcined gypsum is intended for use as an addition to lime putty for the finishing coat of plaster.

The color of calcined gypsum of classes C and F is sometimes stressed, but it is believed that its importance is usually psychological rather than real.

Manufacturers can furnish calcined gypsum having any desired time of set within the limits specified.

VIII. GENERAL SPECIFICATIONS

No details.

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