

November 13, 1926.

TESTING CLAY HOLLOW TILEIntroduction

There are certain precautions which should be observed in the conduct of compression, absorption, freezing and fire tests of hollow tile if the results obtained by different laboratories are to be uniform and comparable. The Bureau of Standards, in carrying out a general research program on the properties of this product, has made numerous tests to develop proper test methods, such as those given in the Standard Specifications and Tests for Hollow Burned-Clay Load-Bearing Wall Tile adopted by the American Society for Testing Materials and similar specifications prepared for adoption by the Federal Specifications Board.

Sampling

While the color of the product is not in general indicative of classification or quality, as applying to tile from any particular source it can be taken as an indication of the degree of burning, the darker or deeper shades indicating the harder tile. This can sometimes be used as an aid in selecting samples covering the range of hardness of the shipment considered. It is also advisable to select the samples so as to be representative of the lot as it concerns warping and cracking.

Weighing

All tile that are not kiln dry should be dried to constant weight before the dry weight is taken. Where it is not convenient to dry the whole tile they may be weighed and pieces weighing approximately one-half pound taken from each tile and dried to constant weight. The percentage loss in weight of the pieces deducted from the weight of the tile will give the dry weight.

Strength Tests

The specifications require that the tile shall be tested dry. While a small amount of moisture would have no effect larger amounts approaching saturation may lower the strength as much as 10 per cent.

The cap should be of some material that will harden prior to testing so that high spots on the tile can not cut through



and cause load concentrations. A mixture of three parts by volume of Portland cement and one part plaster of Paris (unretarded calcined gypsum) gives a mixture of very good working properties, the plaster of Paris giving the material a short time of initial set. Shellac is applied to the ends of the tile to obviate undue abstraction of water from the cap which would prevent proper set and hardening. It should be allowed to harden from three to seven days before testing. Tile capped with gypsum can be tested one hour after capping, but the strength to be expected would be less than for the Portland cement-gypsum cap, particularly for side construction tile. Hence, if tile so capped fail to pass specification requirements on the score of strength they should be retested using Portland-cement gypsum caps aged not less than three days. A vegetable or lard oil should be used for coating the capping plate as mineral oil is not satisfactory. It has been found best to mix the cement and plaster while dry and, while constantly stirring, add the dry mixture to the water until a consistency approaching that of thick cream is attained.

A spherical block of sufficient capacity should be placed centrally on top of the tile, the lower part of the block being suspended from the upper head of the testing machine by means of chains or other flexible supports. The upper part of the block should be rotated as the head of the testing machine comes to bearing to assist in securing even seating of the block, thus avoiding eccentric and lateral bending stresses in the tile.

### Absorption Tests

The samples for the absorption tests may consist of five individual tile or of three representative pieces from each tile or from those which have been tested in compression. It is advisable to take three pieces from the unit in that the burning of the ware is usually of such a nature as to give varying hardness within a unit. The rough edges of the absorption specimens must be ground off as these may be broken off during the absorption test. The specifications require that the specimens be saturated by boiling one hour. It was found\* that the weight of water absorbed by this method is about 25 per cent greater than by immersion in cold water for 3 days (72 hours), a method previously used and still specified by some building codes. The difference in results between boiling one hour and five hours is minor, so that boiling for the shorter period was adopted. It is important, however, that the specimens be allowed to cool while immersed before taking the saturated weight. In obtaining the saturated weight the specimens should be allowed to drain not more than one minute and the remaining superficial water removed with a damp cloth. A dry cloth would draw some of the water from the pores of the tile.

---

\* "Effectiveness of Different Methods of Making Absorption Determinations", Journal of the American Ceramic Society, Vol. 5, No. 11, 1922.



### Freezing Tests

The freezing period should be long enough to insure freezing temperatures throughout the specimens. This will generally require several hours. Thawing in water can be accomplished in much shorter time. The initial weighing and weighings for loss should be made on the oven dry tile as the alternate freezing and thawing causes gradual absorption of water that might mask minor weight losses from the freezing test. A freezing test will require from 40 to 100 days for completion.

The specifications provide for acceptance of well-burnt medium and hard tile as having adequate weathering resistance provided they meet the weight, strength, absorption and workmanship and finish requirements. This is based on freezing tests of a range of material which indicate\* that such a provision is justified. Some tile classed as soft by these tests also had good weathering resistance while others failed after 60 freezings. The weathering resistance of soft tile is therefore required to be proven in freezing tests. Inasmuch as weathering resistance depends mainly on the kind of clay and the proper degree of burning, freezing tests on well matured products from a given source would not have to be repeated very often.

### Fire Tests

The methods for conducting the fire tests are specified in Specifications C19-26T of the American Society for Testing Materials, Specifications for Fire Tests of Building Materials and Construction. The specimen for test is a wall not less than 100 square feet in area with no dimension less than 10 feet. The main conditions of acceptance are ability to support working load during the fire exposure and heat insulation sufficient to prevent temperature rise of over 250°F (139°C) on the unexposed side for the required periods. Fire resistance depends mainly on the type of clay and weight and design of the unit, and having been determined for product from a given source there should be no large change in this property if the clay deposit used and design of unit are not changed.

An investigation that is being conducted at the Bureau of Standards on the fire resistance of hollow tile from all representative sources is now nearing completion. Letter Circular 113 gives a summary of results. A recent paper describing the tests and giving results from the standpoint of public regulation of building construction is given in the Proceedings of the Building Officials' Conference for 1926, pp. 103-110.

---

\* Report of Committee C-10 For 1924, Proceedings American Society for Testing Materials. Vol. 24, Part 1, pp. 411-422.

"Strength, Absorption and Freezing Resistance of Hollow Tile", Journal of the American Ceramic Society, March 1924.





