



STUCCO & MASONRY

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Stucco Sand and ASTM C 897 in Florida[©]

Providing a quality stucco job requires the use of quality ingredients, stucco cement, potable water and aggregate (sand). The failure of any one of these ingredients can lead to failures in the plaster coat. Therefore, ASTM developed standards for stucco (Portland Cement-Based Plaster) in the manufacturing, testing and installation of stucco cement, lath and accessories, and aggregates to be applied.

Project Specifications most often reference these standards:

- ASTM C 897, “Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters”
- ASTM C 926, “Standard Specification for Application of Portland Cement-Based Plaster”
- ASTM C 1063, “Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster”

And sometimes,

- ASTM C 1328, “Standard Specification for Plastic (Stucco) Cement”
- ASTM C 1787, “Standard Specification for Installation of Non-Metallic Plaster Bases (Lath) Used with Portland Cement-Based Plaster in Vertical Wall Applications.”

Aggregate Sizes

It is C 897, the aggregate specification that we need to address. Within C 897 there are significant requirements for the properties of the sand including, but not limited to, the gradation of the sand particles (see Table below) and the Fineness Modulus (FM). This is the area that creates most of the confusion. There are no naturally-occurring sands in Florida that will meet the gradation requirements of the standard.

Of course, natural sand can be modified with the addition of the required gradations of particles; but, this process is extremely costly and time consuming and may not be possible at the local sand sources. The only other alternative would be to use a factory blended sand. This process requires drying of all the ingredients and then running them through the a highly technical mixer apparatus. The process is exponentially more expensive and time consuming than even site blending at the mine. We, ASTM

Committee members, have addressed this problem in C 926 to allow for cases (like in Florida) where meeting the gradation requirements is not practicable. Section 5.4.1 of the application standard, ASTM C 926 states, as follows:

4.4.1 *Sand for Base Coats* – Specification C 897. Aggregates failing to meet the gradation limits in Specification C 897 shall be permitted to be used, provided the plaster made with this sand has an acceptable demonstrated performance record in similar construction and climate conditions.

Additionally, ASTM C 897 addresses the question similarly in Section 6.1.3:

6.1.3 Aggregates failing to meet only the gradation limits of this specification shall be permitted to be used, provided the supplier furnishes satisfactory documentation to the specifier that the plaster made with the aggregate has an acceptable demonstrated performance record.

The local sand source should be able to provide you with a letter certifying this performance criteria.

ASTM C897 Requirements and Selected Source Samples							
ASTM C897 Stucco Sand			Source A	Source B	Source C	Source D	Source E
Sieve #	Sieve (mm)	Required % Retained	% Retained	% Retained	% Retained	% Retained	% Retained
4	4.75	0	0.1	0	0	0	0
8	2.36	0-10	0.8	0	0	0	0.02
16	1.18	10-40	1.8	0.8	0.2	0	0.67
30	600µm	30-65	2.2	6.0	2.0	0.1	5.42
50	300µm	70-90	3.0	39.9	30.5	11.7	35.48
100	150µm	95-100	42.6	93.6	80.6	83.5	94.74
200	75µm	97-100	83.8	98.8	100	98.8	99.77
Fineness Modulus		2.05 - 3.05	.51	1.4	1.13	0.95	1.36

- **Red** = Out of tolerance

Mixing Concerns

Tables 2 and 3 of ASTM C 926 currently include 7 different base coat plaster mixes and 6 mixes for finish coats; all described by the blend of cementitious ingredients included. The tables go on to state that allowable aggregate volume per sum of the volumes of cementitious material (in Florida, we mostly use Stucco Cement, Type P or FP in the respective Tables). It is important to note, however, that regardless of the type used, the relative volume of aggregate has the same range: 2½ to 4 parts aggregate for scratch coats, 3 to 5 for brown coats and 1½ - 3 for finish coats. Looking more closely reveals that there is a common element in the ratios of aggregates per coat, 3. Neat packaged cements (those to which sand and water will be added at the site) in Florida are designed so that when mixed at a 1 part cement to 3 parts aggregate, they will function properly and fall within the requirements of the Standard.

Because the allowable ratios fall anywhere between 1½ and 5 parts aggregate, it is really difficult to get an out of spec mix on the site. Mixes with less than 1½ parts sand will be too rich in cement, will have little workability and tend to crack more due to shrinkage. Mixes with greater than 5 parts aggregate will be too sandy and may not stay on the wall or get hard enough to resist impacts of even minor force. Either way, the plasterer will reject the mix and send the mixer back to start over. For this reason, mix ratios are rarely a problem.

The more common and more important point about mixes is that at whatever ratio is used, it should be consistent throughout each coat. In general, a brown coat should have an aggregate volume equal to or greater than that of the scratch coat. Finish coats should have aggregate volumes equal to or lesser than the brown coat. Interestingly enough, a 3-part aggregate mix is both allowed and appropriate for all coats.

Jobsite Considerations

The best method for guarantying mix ratios is to employ a 1 cubic foot box in which to place the sand prior to adding to the mixer. Of course, these must be custom made; so, a more practical method is to calibrate a shovel to a common 5-gallon bucket. At the beginning of each day and again after lunch, count how many shovels of sand it takes to fill a 5 gal. bucket. A 5 gal. bucket is approximately 2/3 of a cubic foot. Therefore, each bag of stucco cement will require approximately 4½ buckets of sand. Multiply the number of shovels it took to fill the bucket by 4.5 and you'll have an idea of how many shovels are needed for each bag of cement. Then simply maintain that count through the day. It is my opinion that a fixed volume mechanism such as a bucket or box is the best method. I prefer buckets simply because they are readily available and significantly less weight (safety first).

All of the above supposes the use of Standard compliant aggregate, which we've already stated we don't have in Florida, and damp, loose sand as opposed to dried sand. Some adjustments must be made. Here are a few guiding principles to remember about sand particle size and the effect it has on mixing:

1. The finer the sand, the more individual particles or grains.
2. The more grains, the more cement it takes to coat the individual grains.
3. The more cement it takes to coat the particles, the more water it takes to hydrate (cure) the cement.
4. The more water in the mix, the higher the shrinkage, and therefore, cracking potential of the plaster.

The bottom line is this: mixes using finer sands should use fewer shovels per bag of cement.

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