

Tech Hotline

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All Sands Are NOT Created Equal

All sands have individual properties that define them and determine their suitability for a particular purpose in construction. Several different ASTM specifications are available for sand. The specification that applies is determined by the product being made with the sand. Four specifications that are common in the construction industry include:

- ASTM C 33, *Standard Specification for Concrete Aggregates*
- ASTM C 35, *Standard Specification for Inorganic Aggregates Used in Gypsum Plaster*
- ASTM C 144, *Standard Specification for Aggregates Used in Masonry*
- ASTM C 897, *Standard Specification for Aggregates Used in Portland Cement Plaster*

Why so many specifications? Are they really that different?

The different specifications are necessary because small differences in the sand's physical characteristics can result in significant differences in application and final properties of the end product. The size and shape of sand particles influence how much water will be required to produce a usable mixture. Stucco, mortar and concrete all have different desired consistencies, and a particular sand may not have the physical characteristics that are required to produce the different consistencies. Each industry developed specifications that address the characteristics that are relevant to its use of sand.

In short, specifications for sand cover two main topics: the chemical make-up of the sand and its particle size characteristics. Chemical make-up is specified to verify that the sand is compatible with the other materials being used and will produce a durable end product. The size distribution, or "gradation", affects the mixing and application characteristics of the end-product.

The primary differences in the specifications are the different gradations that are specified. These differences are what field personnel and specifiers must be aware of to obtain the desired end-product. The best advice is to seek sand that provides a gradation which meets the specification that applies to the end-product being produced. In other words, for stucco sand specify and obtain ASTM C 897 sand; for masonry specify and obtain ASTM C 144 sand.

One common question is the interchangeability of ASTM C 144 and ASTM C 897 sand for use in portland cement stucco. Some stucco manufacturers call for ASTM C 144, but others specify ASTM C 897. Masonry construction is very common, and therefore ASTM C 144 sand is usually readily available. Many people see stucco as simply masonry mortar spread onto a flat wall surface instead of sandwiched between bricks or blocks. Thus, it is not unusual to request or accept ASTM C 144 sand for a stucco project. However, masonry sand is allowed to contain a significantly larger percentage of fine particles than stucco sand. Stucco made with fine masonry sand has a much higher water demand than stucco made with the same proportion of ASTM C 897 stucco sand. The increased water demand results in a weaker end product with less durability and more shrinkage and cracking potential.

It is important to recognize that the ASTM C 897 and ASTM C 144 gradation ranges have a significant amount of overlap (see Figure 1), but one sand cannot comply with both specifications.

If an aggregate's gradation does not meet the ASTM C 897 allowable range, it is not necessarily excluded from use. Its size properties will definitely affect how the mixture works, but ASTM allows acceptance based on field performance experience. If an aggregate has a history of successful usage it may be accepted based on the judgment of the specifier.

An engineer or technician that is experienced at reading gradation charts can often make judgments about the suitability of "borderline" sand. Gradation information can also be used to assist in evaluating a field problem with the stucco mixture. In extreme cases or where a contractor wants to optimize workability two sands may be blended to produce an aggregate with the desired gradation. This practice is common in the ready-mix concrete industry, but unusual for the production of stucco.

Figure 1

