



**Designation: C 404 – 9703**

## **Standard Specification for Aggregates for Masonry Grout<sup>1</sup>**

This standard is issued under the fixed designation C 404; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense.*

### **1. Scope**

1.1 This specification covers aggregate for use in grout for masonry.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 The following precautionary caveat pertains only to the test methods portion, Section 8 of the standard. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

### **2. Referenced Documents**

2.1 *ASTM Standards:*

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<sup>1</sup> This specification is under the jurisdiction of ASTM Committee C-12 on Mortars for Unit Masonry and is the direct responsibility of Subcommittee C12.04 on Specifications for Aggregates for Mortar.

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- C 33 Specification for Concrete Aggregates<sup>2</sup>
- C 40 Test Method for Organic Impurities in Fine Aggregates for Concrete<sup>2</sup>
- C 87 Test Method for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar<sup>2</sup>
- C 88 Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate<sup>2</sup>
- C 117 Test Method for Materials Finer Than 75- $\mu\text{m}$  (No. 200) Sieve in Mineral Aggregates by Washing<sup>2</sup>
- C 123 Test Method for Lightweight Pieces in Aggregate<sup>2</sup>
- C 127 Test Method for Specific Gravity and Absorption of Coarse Aggregate<sup>2</sup>
- C 128 Test Method for Specific Gravity and Absorption of Fine Aggregate<sup>2</sup>
- C 136 Test Method for Sieve Analysis of Fine and Coarse Aggregates<sup>2</sup>
- C 142 Test Method for Clay Lumps and Friable Particles in Aggregates<sup>2</sup>
- C 144 Specification for Aggregate for Masonry Mortar<sup>3</sup>
- C 270 Specification for Mortar for Unit Masonry<sup>3</sup>
- C 476 Specification for Grout for Masonry<sup>3</sup>
- D 75 Practice for Sampling Aggregates<sup>4</sup>
- D 448 Classification for Sizes of Aggregate for Road and Bridge Construction<sup>4</sup>

### 3. General Characteristics

3.1 Aggregates shall consist of natural sand or manufactured sand, used alone or in combination with coarse aggregate as described in this specification. Manufactured sand is the product obtained by crushing stone, gravel, or air-cooled iron blast-furnace slag. Coarse aggregate shall consist of crushed stone, gravel, or air-cooled iron blast-furnace slag specially processed to assure suitable particle shape as well as gradation.

### 4. Grading

4.1 Grading shall conform to the requirements in Table 1 or shall comply with the requirements of 4.2.

NOTE 1—Size No. 1 is that specified for concrete sand in Specification C 33; Size No. 2 is that specified for masonry mortar in Specification C 144; and Sizes 8 and 89 are standard sizes as given in Specification D 448.

4.2 Aggregates of gradations other than those covered by Table 1 are permitted if all of the requirements of 4.2.1, 4.2.2, and 4.2.3 are met.

4.2.1 One hundred percent of the fine aggregate shall pass the 9.5-mm ( $\frac{3}{8}$ -in.) sieve and no more than 5 % natural sand or 10 % for manufactured sand shall pass the 75-  $\mu\text{m}$  (No. 200) sieve.

4.2.2 One hundred percent of the coarse aggregate shall pass the 12.5-mm ( $\frac{1}{2}$ -in.) sieve and no more than 5 % shall pass the 600- $\mu\text{m}$  (No. 30) sieve.

4.2.3 The compressive strength of grout shall be specified and meet the requirements of Specification C 476.

### 5. Deleterious Substances

5.1 The amounts of deleterious substances in either fine or coarse aggregate shall not exceed the following:

<sup>2</sup> Annual Book of ASTM Standards, Vol 04.02.

<sup>3</sup> Annual Book of ASTM Standards, Vol 04.05.

<sup>4</sup> Annual Book of ASTM Standards, Vol 04.03.

**TABLE 1 Grading Requirements**

| Sieve Size                    | Amounts Finer than Each Laboratory Sieve (Square Openings), weight % |              |                  |            |             |
|-------------------------------|--|--------------|------------------|------------|-------------|
|                               | Fine Aggregate   |              | Coarse Aggregate |            |             |
|                               | Size No. 1   | Size No. 2   |                  | Size No. 8 | Size No. 89 |
|                               | Natural  | Manufactured |                  |            |             |
| 12.5-mm ( $\frac{1}{2}$ -in.) | ...  | ...          | ...              | 100        | 100         |
| 9.5-mm ( $\frac{3}{8}$ -in.)  | 100  | ...          | ...              | 85 to 100  | 90 to 100   |
| 4.75-mm (No. 4)               | 95 to 100  | 100          | 100              | 10 to 30   | 20 to 55    |
| 2.36-mm (No. 8)               | 80 to 100  | 95 to 100    | 95 to 100        | 0 to 10    | 5 to 30     |
| 1.18-mm (No. 16)              | 50 to 85   | 70 to 100    | 70 to 100        | 0 to 5     | 0 to 10     |
| 600- $\mu\text{m}$ (No. 30)   | 25 to 60   | 40 to 75     | 40 to 75         | ...        | 0 to 5      |
| 300- $\mu\text{m}$ (No. 50)   | 10 to 30   | 10 to 35     | 20 to 40         | ...        | ...         |
| 150- $\mu\text{m}$ (No. 100)  | 2 to 10  | 2 to 15      | 10 to 25         | ...        | ...         |
| 75- $\mu\text{m}$ (No. 200)   | 0 to 5   | 0 to 5       | 0 to 10          | ...        | ...         |

| Deleterious Substances  | Permissible<br>Content, max,<br>weight % |
|---|--|
| Friable particles   | 1.0                                      |
| Lightweight particles, floating on liquid<br>having a specific gravity of 2.0 | 0.5 <sup>A</sup>                         |

<sup>A</sup> This requirement does not apply to blast-furnace slag aggregate.

## 6. Organic Impurities

6.1 The fine aggregate shall be free from injurious amounts of organic impurities. Except as herein provided, aggregates subjected to the test for organic impurities and producing a color darker than the standard shall be rejected.

6.2 Fine aggregate failing in the test may be used, provided that the discoloration is due principally to the presence of small quantities of coal, lignite, or similar discrete particles.

6.3 A fine aggregate failing in the test may be used, provided that, when tested for the effect of organic impurities on strength of mortar, the relative strength at 7 days calculated in accordance with Section 11 of Test Method C 87 is not less than 95 %.

## 7. Soundness

7.1 Except as herein provided, either fine or coarse aggregates subjected to 5 cycles of the soundness test shall show a loss, weighted in accordance with the grading of a sample complying with the limitations prescribed in Section 4, not greater than 10 % when sodium sulfate is used or 15 % when magnesium sulfate is used.

7.2 Aggregate failing to meet the requirements of 7.1 may be accepted, provided that grout of comparable properties made from similar aggregate from the same source has been exposed to weathering, similar to that to be encountered, for a period of more than 5 years without appreciable disintegration.

## 8. Test Methods for Sampling and Testing

8.1 Sample and test the aggregate in accordance with the following standards, except as otherwise provided in this specification:

8.1.1 *Sampling*—Practice D 75.

8.1.2 *Grading*—Test Method C 136.

8.1.3 *Amount of Material Finer Than 75- $\mu$ m (No. 200) Sieve*—Test Method C 117.

8.1.4 *Organic Impurities*—Test Method C 40.

8.1.5 *Effect of Organic Impurities on Strength*—Test Method C 87.

8.1.6 *Friable Particles*—Test Method C 142.

8.1.7 *Lightweight Constituents*—Test Method C 123.

8.1.8 *Soundness*—Test Method C 88.

8.1.9 *Density*—Determine the density of the fine aggregate in accordance with Test Method C 128 and the density of the coarse aggregate in accordance with Test Method C 127. ~~Use the bulk specific gravity (saturated surface dry-SSD) determined in the calculation of the air content of the mortars, as required by Specification C 270. C 127.~~

## 9. Keywords

9.1 aggregate; coarse aggregate; fine aggregate; grout; masonry; sand; soundness

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