



Designation: **C332—09 C332 – 17**

# Standard Specification for Lightweight Aggregates for Insulating Concrete<sup>1</sup>

This standard is issued under the fixed designation C332; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

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

## 1. Scope\*

1.1 This specification covers lightweight aggregates intended for use in concrete not exposed to the weather, in which the prime consideration is the thermal insulating property of the resulting concrete.

1.2 The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.3 With regard to sieve size and the size of aggregate as determined by the use of testing sieves, the values in inch-pound units are shown for the convenience of the user; however, the standard sieve designation shown in parentheses is the standard value as stated in Specification **E11**.

1.3.1 With regard to other units of measure, the values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 The following precautionary caveat pertains only to the test method portion, Section **67**, of the specification: *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.*

1.5 This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

**C29/C29M** Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate

**C125** Terminology Relating to Concrete and Concrete Aggregates

**€136C136/C136M** Test Method for Sieve Analysis of Fine and Coarse Aggregates

**C177** Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

**D75D75/D75M** Practice for Sampling Aggregates

**E11** Specification for Woven Wire Test Sieve Cloth and Test Sieves

## 3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this specification, refer to Terminology **C125**.

## 4. Classification

4.1 Two general types of lightweight aggregate are covered by this specification as follows:

4.1.1 *Group I*—Aggregates prepared by expanding products such as perlite or vermiculite.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee **C09** on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee **C09.21** on Lightweight Aggregates and Concrete.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

\*A Summary of Changes section appears at the end of this standard

NOTE 1—These aggregates generally produce concrete having a density from 15 to 50 lb/ft<sup>3</sup> (240 to 800 kg/m<sup>3</sup>), the thermal conductivity of which may be expected to range from 0.45 to 1.50 Btu-in/h-ft<sup>2</sup> · °F (0.065 to 0.22 W/m·K).

4.1.2 *Group II*—Aggregates prepared by expanding, calcining, or sintering products such as blast-furnace slag, clay, diatomite, fly ash, shale, or slate; and aggregates prepared by processing natural materials, such as pumice, scoria, or tuff.

NOTE 2—These aggregates generally produce concrete having a density from 45 to 90 lb/ft<sup>3</sup> (720 to 1440 kg/m<sup>3</sup>), the thermal conductivity of which may be expected to range from 1.05 to 3.00 BTU-in/h-ft<sup>2</sup> · °F (0.15 to 0.43 W/m·K).

4.2 The aggregate shall be composed predominantly of lightweight cellular and granular inorganic material.

## 5. Physical Properties

5.1 *Insulating Properties*—The thermal insulating properties of concrete made from the lightweight aggregate under test shall conform to the following limits:

Maximum Average 28-Day Oven-Dry Bulk Density, lb/ft <sup>3</sup> (kg/m <sup>3</sup> )	Maximum Average Thermal Conductivity, Btu-in/h-ft <sup>2</sup> · °F (W/m·K)
50 (800)	1.50 (0.22)
90 (1440)	3.00 (0.43)

5.2 *Grading*—The grading shall conform to the requirements shown in **Table 1**.

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**TABLE 1 Grading Requirements for Lightweight Aggregates for Insulating Concrete**

Nominal Size Designa- tion	Percentages (Mass) Passing Sieves Having Square Openings								
	19.0-mm (¾-in.)	12.5-mm (½-in.)	9.5-mm (⅜-in.)	4.75-mm (No. 4)	2.36-mm (No. 8)	1.18-mm (No. 16)	600-µm (No. 30)	300-µm (No. 50)	150-µm (No. 100)
<b>Group I</b>									
Perlite	...	...	...	100	85 to 100	40 to 85	20 to 60	5 to 25	0 to 10
Vermiculite <sup>A</sup> (Coarse)	...	...	100	98 to 100	60 to 100	30 to 85	2 to 45	1 to 20	0 to 10
Vermiculite (Fine)	...	...	...	...	100	85 to 100	35 to 85	2 to 40	0 to 10
<b>Group II</b>									
Fine aggregate: 4.75-mm (No. 4) to 0	...	...	100	85 to 100	...	40 to 80	...	10 to 35	5 to 25
Coarse Aggregate: 12.5 to 4.75-mm (½-in. to No. 4)	100	90 to 100	40 to 80	0 to 20	0 to 10	...	...	...	...
9.5 to 2.36-mm (⅜-in. to No. 8)	...	100	80 to 100	5 to 40	0 to 20	...	...	...	...
4.75 to 2.36-mm (No. 4 to No. 8)	...	...	100	90 to 100	0 to 20	...	...	...	...
Combined Fine and Coarse Aggregate: 12.5-mm (½-in.) to 0	100	95 to 100	...	50 to 80	...	...	...	5 to 20	2 to 15
9.5-mm (⅜-in.) to 0	...	90 to 100	65 to 90	35 to 65	...	...	10 to 25	5 to 15	...
	100								

<sup>A</sup> Attention is directed to the need for adjustment in water content and air entrainment to achieve comparable oven-dry unit weights for the two gradings.