



Designation: C 1444 – 00

## Standard Test Method for Measuring the Angle of Repose of Free-Flowing Mold Powders<sup>1</sup>

This standard is issued under the fixed designation C 1444; 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.

### 1. Scope

1.1 Particle size, shape, and bulk density will affect the flowability of powder material. This test method is used for the determination of the angle of repose of free-flowing mold powders. At angles greater than this value this material will flow.

1.2 The values stated in inch-pound units and degrees are to be regarded as standard. The values stated in parentheses are for information only.

1.3 *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:

- E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method<sup>2</sup>
- E 1169 Guide for Conducting Ruggedness Tests<sup>2</sup>

### 3. Significance and Use

3.1 This test method indicates the ability of a mold powder to flow freely.

3.2 The property of powder flow is an important property for the correct functioning of a mold powder. Good powder flow properties help to ensure complete coverage of the molten steel in the mold by the mold powder providing, in addition to other benefits, insulation of the molten steel.

### 4. Apparatus

4.1 *Funnel*, with a discharge spout opening between 0.25 in. (0.64 cm) and 0.38 in. (0.97 cm) with a capacity to hold approximately 0.25 lb (113.5 g) to 0.50 lb (227.2 g) of mold powder.

4.2 *Ring Stand*, with one ring, sized to hold the funnel.

4.3 *Stopper*, sized to fit the funnel discharge spout opening.

4.4 *Base Plate*, flat, rigid, wooden or metal, at least 12 in. (30.5 cm) by 12 in. (30.5 cm).

4.5 *Glazed Paper*,

4.6 *Calculator*, with trigonometric functions.

4.7 *Calipers*, with measuring range up to 12 in. (30.5 cm) to  $\pm 0.01$  in. (0.025 cm).

4.8 *Block*, with height of 1.5 in. (3.81 cm).

### 5. Procedure

5.1 Obtain approximately a 1-lb (454 g) sample of the mold powder. The sample should be homogeneous and representative of the bulk material. Place in a jar container 30 to 50 % larger than the sample to allow for remixing.

5.2 Measure the internal diameter of the funnel discharge spout in inches to the nearest 0.01 in. (0.025 cm).

5.3 Place the ring stand with funnel on a sheet of glazed paper on the base plate. Level the base plate along two perpendicular horizontal axes.

5.4 Place the height block in position under the funnel, adjust the funnel until the nozzle contacts the height block, lock the funnel in position, and remove the height block.

5.5 Insert the stopper into the funnel nozzle.

5.6 Feed the mold powder into the funnel until nearly full.

5.7 Remove the stopper from the funnel and continue adding the mold powder into the funnel at a rate similar to its discharge rate. When the tip of the mold powder cone forming on the base plate enters the funnel nozzle, stop feeding the mold powder into the funnel.

5.8 Using the calipers, measure the diameter of the cone in four places to the nearest 0.05 in. (0.13 cm). Average these four test observations and record this test determination to the nearest 0.05 in. (0.13 cm).

5.9 Return the tested specimen to the jar container and remix to homogenize. Repeat 5.2-5.8 two more times and record the three test determinations as  $D_1$ ,  $D_2$ , and  $D_3$ .

### 6. Calculation

6.1 Calculate the test result as follows:

$$\text{Angle of repose} = \tan^{-1} [2H/(D_A - d)] \quad (1)$$

where:

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee C08 on Refractories and is the direct responsibility of Subcommittee C08.03 on Physical Properties.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 14.02.