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Designation: C 862 – 91 (Reapproved 1997)

Standard Practice for Preparing Refractory Concrete Specimens by Casting[1]

This standard is issued under the fixed designation C 862; 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 (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the mixing and casting of castable refractory specimens using the tempering water determined in accordance with the consistency tests in Practices C 860. It does not apply to castable refractories intended primarily for gun application.

1.2 The values given in inch-pound units are to be regarded as the standard. The values given 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. Figs. 1-7*

2. Referenced Documents

2.1 *ASTM Standards:*

C 133 Test Methods for Cold Crushing Strength and Modulus of Rupture of Refractories[2]

C 192 Practice for Making and Curing Concrete Test Specimens in the Laboratory[3]

C 860 Practices for Determining and Measuring Consistency of Refractory Concretes[2]

3. Significance and Use

3.1 This practice is used in conjunction with the proper water content (Practices C 860) to further assure the production of uniform laboratory specimens with optimum properties for castable testing. The practice is used to standardize the mixing, mold conditions, placement and curing of refractory concrete specimens to be used for testing and evaluation under other test methods.

3.2 This practice, along with Practices C 860, standardizes laboratory conditions for producing refractory concrete specimens to minimize laboratory-to-laboratory variation and does not attempt to duplicate the conditions of field installations.

4. Apparatus and Conditions

4.1 *Laboratory Conditions*—The laboratory ambient should be controlled between 70 and 80°F (20 and 27°C) and from 40 to 60 % relative humidity for preconditioning materials and equipment, batching, mixing, casting test specimens, stripping molds, and testing specimens. Report laboratory temperature and relative humidity with physical test results if other than specified.

FIG. 1 Manually-Operated Mechanical Mixer

4.2 *Balances*, 100-lb (45-kg) capacity with sensitivity of 0.2 lb (90 g); 15-lb (6.8-kg) capacity with sensitivity of 0.02 lb (9 g); 4.5-lb (2-kg) capacity with sensitivity of 0.1 g.

4.3 *Castable Mixers*—Either a manually operated (Fig. 1) or an electrically operated mechanical mixer[4] may be used for preparing castable batches for casting specimens. A 2-ft ^{3}(56.6-dm^3) mixing bowl or a 2½-ft ^{3}(70.8-dm^3) concrete mixer has sufficient capacity to mix about 1 ft of refractory castable. The smallest batches required for casting 1-in. (25-mm) square bars can be mixed in 0.10-ft ^{3}(2.83-dm^3) bowl available with bench mixers. Size mixing bowl to contain from 50 to 75 % volume loading with the dry batch.

NOTE 1—Castable water requirement variation becomes more significant as dry volume loadings drop below 50 % because the water required

[1] This practice is under the jurisdiction of ASTM Committee C-8 on Refractories, and is the direct responsibility of Subcommittee C08.09 on Monolithic Refractories.

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[2] *Annual Book of ASTM Standards*, Vol 15.01.

[3] *Annual Book of ASTM Standards*, Vol 04.02.

[4] Suitable mixers having various capacities are available from the Hobart Manufacturing Co., Troy, OH.

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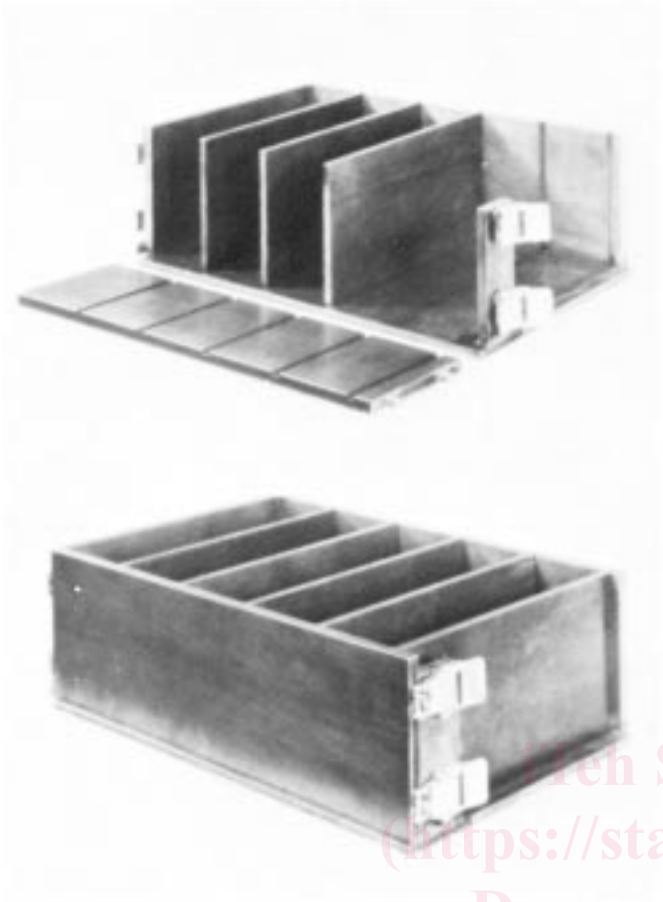

FIG. 2 Five-Brick Gang Mold for Castable Refractories

to wet the bowl surfaces changes more rapidly with decreasing volume loadings.

4.4 *Gang Molds*, metal, two or more sets, as shown in Fig. 2 and Fig. 3, for casting specimens to the size required for specific physical property testing (see Note 9). The front plate of the mold illustrated is held in place by quick-release clamps (50-lbf (222-N) pull exerted by each clamp) that permit emptying the mold by releasing the clamps and tapping the left end of the front plate, thereby parting all of the separator plates and loosening the cast-test specimens.[5]

4.4.1 As an alternative design for 1 in. (25-mm) square bars, individual molds may be constructed out of 16-gage (1.588-mm) stainless-steel sheet and ganged in groups of five with a large rubber band on a glass base-plate.

4.5 *Calipers*, suitable for measuring internal longitudinal mold dimensions and subsequent specimen length size to the nearest 0.01 in. (0.3 mm).

4.6 *Indentation Marker*, as described in Fig. 5, and shown in Fig. 6 and Fig. 7, for use in establishing initial linear dimension and subsequent linear changes.

4.7 *Steel Rule*, capable of measuring dimensional changes of an 8-in. (203-mm) span to the nearest 0.01 in. (0.3 mm).

[5] Drawings of the manual mixer and a list of materials and notes on construction of the 9-in. (230-mm) straight-brick gang molds are available at a nominal charge from the Refractories Research Center, Ohio State University, 2041 N. College Road, Columbus, OH 43210.

4.8 *Mold Lubricant*—Either paraffin or silicone-based oils can be used as a release or parting agent for coating molds.

4.9 *Strike-Off Bar*, 20-in. (510-mm) length of steel bar stock, 1½ by 3⁄16 in. (38 by 5 mm).

4.10 *Thermometer*, dial-type, metal, with a range from 0 to 180°F (−18 to 80°C).

4.11 *Timer*, signal-type, for periods up to 5 min.

4.12 *Trowels*, 6 in. pointing and 2 by 6 in. (51 by 152 mm) square, and a 10-in. (254-mm) stainless-steel spatula.

4.13 *Oven*, for curing and drying, preferably forced draft rather than natural convection, with a capacity to hold ten 9-in. (230-mm) straight brick.

5. Sampling

5.1 Sufficiently dry castable should be batched to obtain at least a 10 % excess of material required to fill the gang molds and to eliminate use of both tailings and scrapings.

5.2 At the time of use, the dry sample should be between 70 and 80°F (20 and 27°C). Measure the temperature by inserting the full length of the dial-thermometer stem into the material until the reading is constant. Record and report with physical test results.

NOTE 2—It is recommended that in referee tests involving more than one laboratory, the temperature of the dry refractory concrete mix and mixing water be the same, within the specified range, in all laboratories.

5.3 The contents of the container should be thoroughly mixed dry prior to water addition. When less than a full bag is required, reduce the contents of the sample container (Note 3) with a sample splitter to obtain a quartered sample of the desired batch size. Take precautions to prevent segregation.

NOTE 3—When the castable mix consists of more than one bag or container, the contents should be combined and mixed thoroughly before being quartered.

6. Molding Test Specimens

6.1 Prior to filling each mold, use the calipers to obtain a measurement of the internal length to the nearest 0.01 in. (0.3 mm). Record this value to provide the basis for determining linear change of cured, dried, and fired specimens. An optional procedure for establishing an initial reference point is described in 6.3.

6.2 Immediately after mixing, start the timer and begin filling the molds. Use a scoop for cutting into the batch to get a good section and half-fill each mold cavity. Consolidate the material in the molds by spading at close intervals with a square trowel or spatula held vertically, and with the blade turned to form an angle of 45° with the side of the mold. Spade along the length and then reverse the 45° angle for the next pass along the mold. Fill the molds with an excess of the mix and repeat the trowel-spading. Use the strike-off bar with a sawing motion to remove the excess mix, then smooth the exposed surface with a minimum amount of troweling. Complete the operation of filling the molds within 5 min or at the rate of 1 min per test specimen. Mechanical vibration should not be used.

NOTE 4—The cited procedure is applicable when filling deep molds, that is, brick molds as shown in Fig. 2 or larger. Hand placement of the castable can be used to fill and consolidate the material in shallow molds

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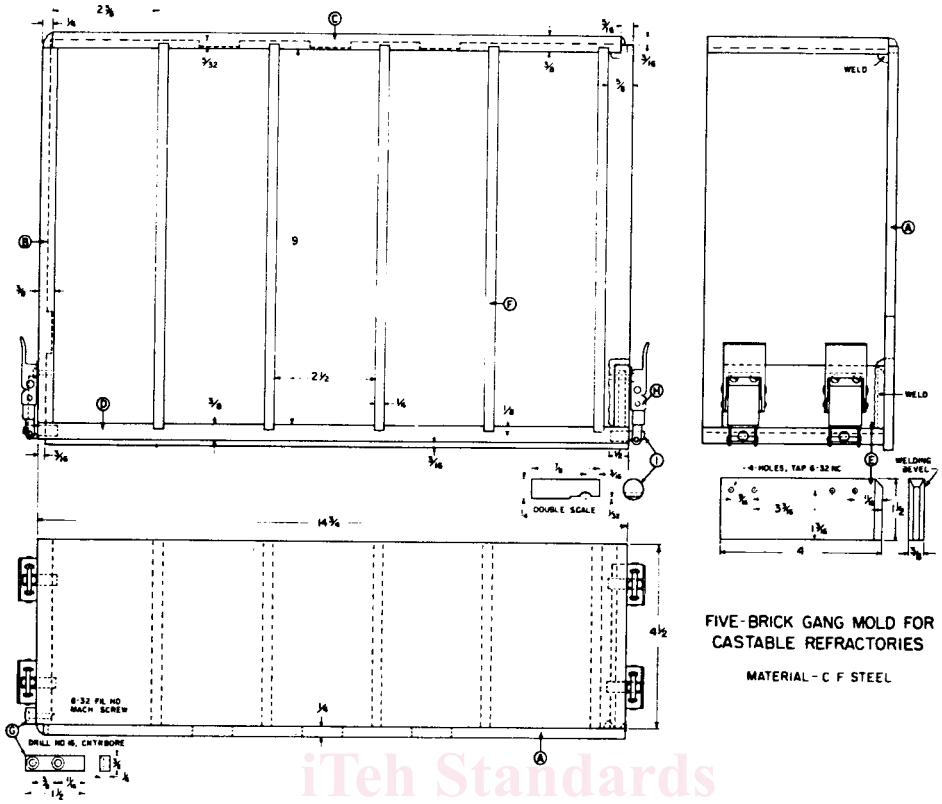
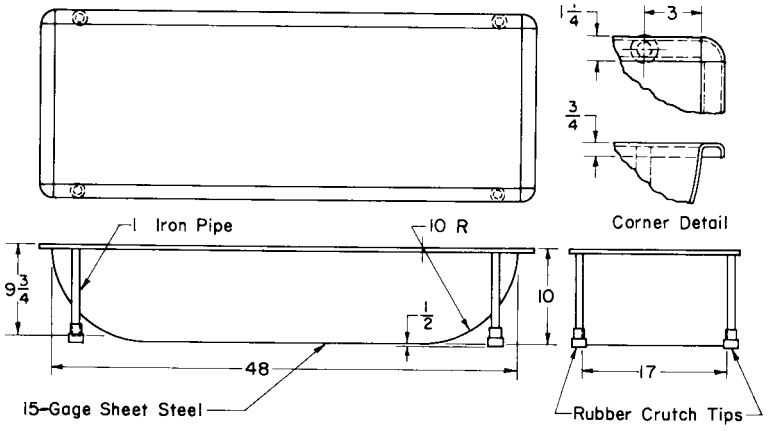


Metric Equivalents

in.	1/32	1/8	5/32	3/16	1/4	5/16	3/8	1/2	9/16	5/8	11/16
mm	0.8	3	4	5	6	8	10	13	14	16	17
in.	7/8	1 3/16	1 1/2	2 1/2	2 5/8	3 3/16	4	4 1/2	9	14 3/4	
mm	22	30	38	65	67	81	102	114	230	375	

NOTE 1—Sizes other than 9-in. straights commonly used for physical testing are: 2½ by 4½ by 4½ in. (65 by 114 by 114 mm); 2 by 2 by 7 or 9 in. (51 by 51 by 178 or 230 mm); 1½ by 1½ by 4½ in. (38 by 38 by 114 mm); or 1 by 1 by 6 or 7 in. (25 by 25 by 152 or 178 mm). Dimensions are in inches.

FIG. 3 Detail Drawing for Gang Mold



NOTE 1—Dimensions are in inches.

FIG. 4 Mixing Box

(normally 2 in. (50 mm) deep or less). Appropriate spading with the spatula should be used with finger tamping to ensure consolidation of the material into the mold corners.

6.3 Impress two or four reference marks into the troweled surface as the specimen begins to set (generally from 5 to 20 min). Use the calibrated marking device with knife edges at a known separation, for example, 8.00 in. (200 mm) for a 9-in.

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