

Standard Specification for

CRUDE SAND

SFSA DESIGNATION: 14 - 6 1

This Standard Specification has been approved by the Society's Specifications Committee. Tentative Specification 14T-61 has been advanced to Standard Specification 14-61 without change. Comments on this Specification should be addressed to the Steel Founders' Society at Westview Towers, 21010 Center Ridge Road, Rocky River, Ohio 44116.

1. scope

1.1 This specification covers sand for use in steel foundries either as a molding medium for the production of steel castings or for the production of cores.

2. Acknowledgment

2.1 When specified by the foundry, a vendor shall indicate this specification number in all quotations and acknowledgments of purchase orders.

3. Sampling

3.1 Procedure

3.1.1 The vendor shall furnish the foundry with a representative sand sample of the railroad car shipment when requested by the foundry in its purchase order or contract.

3.1.2 The sample shall be taken by completely cutting the sand stream several times with a slotted pipe or similarly designed sampler as the car is loaded.

3.1.3 The size of the sample shall be not less than 5 pounds.

3.1.4 The sample of sand shall be placed in a tight cloth bag and attached to the inside of the railroad car, so that it will not swing.

3.1.5 An identification tag shall be attached to the sand sample indicating pertinent information relative to the shipment.

3.2 Reduction of Vendor's Sample

3.2.1 Reduction of the sample shall be done by quartering until a pint sample is obtained.

3.2.2 An alternate method for reducing the vendor's sample is by using a sample splitter. This procedure is described in the AFS "Foundry Sand Handbook," Sixth Edition, Section III, paragraph 26.

4. Technical Requirements

4.1 Moisture Content (see Note 1)

4.1.1 The moisture content of dried crude sand shall not exceed 1.0 percent.

4.2 Sand Temperature

4.2.1 The temperature of dried crude sand shall not exceed 150 degrees F unless mutually agreed upon by the consumer and the producer.

4.3 AFS Clay Content

4.3.1 The AFS clay substance (particles less than 20 microns) shall not exceed 3.0 percent.

4.4 Composition Limitations

4.4.1 SiO₂ — 90.0 percent min.

4.4.2 Fe₂O₃ — 2.0 percent max. (dried sample).

4.4.3 CaO - 1.50 percent max. (dried sample).

4.4.4 Loss on ignition 1.75 percent (dried sample).

4.5 Screen Analysis (see Note 2)

4.5.1 The screen analysis shall be made in accordance with AFS Standard Procedure for clay bearing sands. AFS "Foundry Sand Handbook," Sixth Edition, Section III, paragraphs 36 - 44.

4.5.2 The sizes of screens shall be in accordance with the National Bureau of Standards series as given in ASTM E11.

4.5.3 The U.S. Standard sieve numbers to be used in the screen analyses shall be as follows:

Screen Nos.	Diameter in Inches
20	0.0331
30	0.0232
40	0.0165
50	0.0117
70	0.0083
100	0.0059
140	0.0041
200	0.0029
270	0.0021
Pan	

4.6 Classification of Sand (damp and dried)

4.6.1 Screen limitations

4.6.1.1 The producer and the consumer are to agree on an average sand classification depending on what the producer expects to furnish.

4.6.1.2. The maximum variation of the sample obtained on the No. 70 sieve cannot be more than 20 percent of the established average agreed upon by the producer and consumer.

4.6.1.3 The sand grains on the No. 20 sieve shall not exceed three percent of the total sample.

4.6.1.4. The sand grains through the No. 270 sieve shall not exceed three percent of the total sample.

NOTE 1.—The moisture content requirement is limited to shipments made in closed equipment, such as boxcars, covered hopper cars or closed trucks.

NOTE 2.—It is recommended that the foundry use a new set of standard screens for the sole purpose of checking the screen analysis of a shipment subject to rejection,

5. Acceptance Tests (see Note 3)

5.1 Moisture Content

5.1.1 Weigh 5 grams of the sample into a weighed, ignited porcelain crucible. Heat to 105 degrees C in a drying oven and hold one hour. Remove crucible, cool in a desiccator and weigh.

5.1.2 Calculations

$$\frac{\text{Loss in Weight}}{\text{Weight of Sample}} \times 100 = \text{Percent Moisture}$$

5.2 Sand Temperature

5.2.1 The temperature of the sand shall be measured with a mercury or dial-type thermometer. In case of a dispute, only a mercury-type thermometer shall be used.

5.3 AFS Clay Substance

5.3.1 The procedure is given in the AFS "Foundry Sand Handbook," Sixth Edition, Section V, paragraphs 25 - 35, pp 35 - 38.

5.4 Silica Content

5.4.1 Procedure:

Weigh **0.500-gram** sample into a 25 0 ml beaker, add 10 ml of water. Shake well to prevent caking, and heat to boiling. Add 10 ml concentrate hydrochloric acid, 15 ml of 60 percent perchloric acid, 5 ml of concentrated nitric acid. Roil to copious perchloric acid fumes (see Note 4).

Cool, add 5 ml of concentrated hydrochloric acid, boil for 3 minutes and add 50 ml of hot water. Filter through an open quantitative paper, using suction if necessary. Wash alternately twice with hot 1: 1 hydrochloric acid and hot water and then 3 times with hot water. Ignite in a weighed

porcelain crucible, cool and weigh. Determine weight of precipitate.

$$\text{Weight of precipitate} \times 2 \times 100 = \text{Percent SiO}_2$$

5.4.2 Umpire analysis procedure shall be according to ASTM C-18-52

5.5 Ferric Oxide (Fe_2O_3)

5.5.1 Procedure:

Dissolve a 0.500-gram sample with 3 0 ml concentrated hydrochloric acid and 15 to 25 drops of hydrofluoric acid in a 200 ml Erlenmeyer flask. Wash down the sides of the flask and then add a 2.5 percent potassium permanganate solution until a distinct pink or brownish color appears (see Note 5). While hot, add a stannous chloride solution drop by drop until the color of the ferric iron is discharged; then add **just one more drop** (see Note 6). Cool. Add at one stroke 10 ml of saturated mercuric chloride. Stir, wash down the sides of the flask with cold water and allow to stand 2 to 5 minutes. Titrate the iron with standard potassium dichromate as follows:

Transfer to a 500 ml beaker containing 300 to 350 ml of water. Add 25 ml of titrating solution and add 3 drops of diphenylamine indicator solution (see Note 7). Titrate with standard potassium dichromate solution to a permanent end point. Near the end point the green color deepens to a blue-green or gray-blue. Now add the dichromate drop by drop until the color changes to an intense violet-blue. Note ml of standard dichromate used. Run blank on reagents.

5.5.2 Calculations:

$$\frac{\text{Ml of K}_2\text{Cr}_2\text{O}_7 \times 0.002}{\text{Weight of Sample}} \times 100 = \text{Percent Fe}_2\text{O}_3$$

5.5.3 Chemical Solutions

5.5.3.1 Titrating Solution: 150 ml sulfuric acid, 150 ml phosphoric acid; dilute to 1000 ml. In preparing titrating solution, add the sulfuric acid slowly and with stirring to 500 ml of water, add the syrupy phosphoric acid and then dilute to one liter.

5.5.3.2 **Stannous Chloride:** dissolve 15 0 grams of stannous chloride in 300 ml of hydrochloric acid and dilute to 1 liter with water.

5.5.3.3 Mercuric Chloride is a saturated solution of mercuric chloride in water.

5.5.3.4 **Diphenylamine Indicator:** dissolve 1 gram of the reagent in 100 ml of sulfuric acid.

5.5.3.5 Standard Dichromate Solution: dissolve 1.2260 grams of pure recrystallized potassium dichromate in water and dilute to exactly 1000 ml. 1 ml is equivalent to 0.0020 grams Fe_2O_3 .

5.5.4 Umpire analysis procedure shall be according to ASTM C-18-52.

5.6 Calcium Oxide (dried sample)

5.6.1 Procedure:

Weigh 0.500-gram sample and transfer to a 200 ml Erlenmeyer flask. Dissolve in 20 ml of 70 percent perchloric acid (see Note 4) and 5 ml hydrofluoric acid by heating until fumes of perchloric acid reflux on side of flask. Cool and dilute to 50 ml. Make the solution ammoniacal with ammonium hydroxide (see Note 8). Transfer solution to a clean 400 ml beaker and dilute to about 200 ml with hot water. Bring to boil and add 40 ml of ammonium oxalate slowly with constant stirring. Add 1 gram of solid oxalic acid and boil for 3 minutes. Let precipitate settle.

Filter off calcium oxalate through an open paper (Whitman #3 0) and wash free of acid with hot water. Wash precipitate back into original beaker and hang folded filter paper on edge of beaker. Add 30 ml of 1:1 sulfuric acid and dilute to 300 ml with hot water. Maintain solution at about 175 degrees F and titrate with standard potassium permanganate until the solution turns faintly pink. When end point is reached, drop folded filter paper into solution, break up paper, rinse down sides of beaker and quickly finish the titration. One ml of 0.0178 N standard potassium permanganate is equivalent to 0.0005 grams of calcium oxide.

Run blank on reagents.

5.6.2 Calculations

$$\frac{\text{Ml of } \text{KMnO}_4 \times 0.005}{\text{Weight of Sample}} \times 100 = \text{Percent CaO}$$

5.6.3 Solutions

5.6.3.1 *Ammonium Oxalate* saturated solution (4 percent).

5.6.3.2 *Standard Potassium Permanganate* dissolve 0.6000 grams of potassium permanganate in about 500 ml of hot water and let age 24 hours. Dilute to exactly 1000 ml. Standardize against Bureau of Standards sodium oxalate according to the directions accompanying it.

5.6.4 Umpire analysis procedure shall be according to ASTM C-18-52.

5.7 Loss on Ignition

5.7.1 Procedure:

Weigh accurately about 5 grams of sample into a weighed, ignited porcelain crucible. Heat to 1610 degrees F (875 degrees C) for 1 hour. Cool in a desiccator and weigh.

5.7.2 Calculations:

$$\frac{\text{Loss in Weight}}{\text{Weight of Sample}} \times 100 = \text{Percent Loss on Ignition}$$

NOTE 3-The limitation set forth in items 4.4.1 through 4.4.4 are based on the whole sample. Therefore, no separation of AFS sand and clay fractions is necessary. All the samples for chemical analysis should be crushed to pass a 100 mesh screen and then the sample should be dried at 220 - 230 degrees F for one hour.

NOTE 4—Observe precautions in using perchloric acid.

NOTE I—Always treat the solution with potassium permanganate before reducing the iron with stannous chloride because organic matter, if present, will reduce more or less of the ferric chloride causing high results.

NOTE 6—A large excess of stannous chloride will ruin the determination unless most of it is reoxidized. In case of doubt, the color of the ferric chloride must be restored by adding KMnO_4 and the reduction with stannous chloride repeated more carefully.

NOTE 7—Sodium diphenylamine sulphonate indicator can be used in place of diphenylamine.

NOTE 8—A slight precipitation of iron and aluminum hydroxide does not interfere with the determination.

6. Shipping

6.1 Shipments of dried sand when loaded in closed cars shall be accomplished in such a manner that the dried sand is not exposed to moisture and is protected against losses at the time of shipment.

NOTE P—Foundries which observe either a loss in shipment or damage to shipment, contaminants in the sand from unclean cars or the presence of excessive moisture prior to unloading the car of sand, should notify the railroad claim agent immediately.

7. Rejection

7.1 Material not conforming to the specification will be subject to rejection by the foundry and the supplier shall be notified immediately.