

STEEL FOUNDERS' SOCIETY OF AMERICA

Standard Specification for **WASHED AND DRIED SAND**

SFSA DESIGNATION: 12-6 1

Issued: 1961

REPRINTED: 1967

This Specification has been approved by the Society's Specifications Committee and reviewed by the material producers. Suggestions for revisions 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.

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 the sand shall not exceed 0.5 0 percent.

4.2 Sand Temperature

4.2.1 The temperature of the 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 clay substances (particles less than 20 microns) shall not exceed 0.75 percent for sand classified as AFS Fineness No. 80 and coarser.

4.3.2 The clay substances (particles less than 20 microns) shall not exceed 1.5 0 percent for sand classified as an AFS Fineness number greater than 80 and less than 110.

4.4 Composition Limitations on Sands of AFS Fineness No. 110 and Coarser.

4.4.1 SiO₂ — 96.00 percent min

4.4.2 Fe₂O₃ — 0.5 0 percent max (dried sample)

4.4.3 CaO — 0.60 percent max (dried sample)

4.4.4 Loss on ignition 0.50 percent

4.5 Screen Analysis (see Note 2)

4.5.1 A screen analysis shall be made on a 100-gram sample of sand.

4.5.2 The sizes of screens shall be in accordance with the National Bureau of Standards series as given in ASTM E1 1.

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	0.008 3
100	0.0059
140	0.0041
200	0.0029
270	0.002 1
Pan	

4.6 Classification of Sand (washed and dried)

4.6.1 Screen classification and limitation

4.6.1.1 For 3-screen distribution

SFSA No. 1 Sieve Nos.	20 - 30 - 40
SFSA No. 2 Sieve Nos.	30 - 40 - 50
SFSA No. 3 Sieve Nos.	40 - 50 - 70
SFSA No. 4 Sieve Nos.	50 - 70 - 100
SFSA No. 5 Sieve Nos.	70 - 100 - 140
SFSA No. 6 Sieve Nos.	100 - 140 - 200

4.6.1.2 Distribution limitations for 3-screen sand

4.6.1.2.1 Maximum retained on one screen — 60 percent

4.6.1.2.2 Minimum retained on 3 adjacent screens — 75 percent

4.6.1.2.3 Minimum retained on each of 3 adjacent screens — 10 percent

4.6.1.3 For 4-screen distribution

SFSA No. 11 Sieve Nos.	20 - 30 - 40 - 50
SFSA No. 12 Sieve Nos.	30 - 40 - 50 - 70
SFSA No. 13 Sieve Nos.	40 - 50 - 70 - 100
SFSA No. 14 Sieve Nos.	50 - 70 - 100 - 140
SFSA No. 15 Sieve Nos.	70 - 100 - 140 - 200

4.6.1.4 Distribution limitations for 4-screen sands

4.6.1.4.1 Minimum retained on 4 adjacent screens — 80 percent

4.6.1.4.2 Minimum retained on 2 adjacent screens — 40 percent

4.6.1.4.3 Minimum retained on each of 4 adjacent screens — 10 percent

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

5.1 Moisture Content

5.1.1 Weigh 5 grams of the sample into a weighed, ignited porcelain crucible. Heat to 105 degrees C for one hour in a drying oven. 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 Temperature 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 (Note 3).

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.

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

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

NOTE 3.—Observe precautions in using perchloric acid.

5.5 Ferric Oxide (Fe_2O_3)

5.5.1 Procedure:

Dissolve a 0.5 00-gram sample with 30 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 4). 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 5). 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 6). 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 :

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

5.5.3 Chemical Solutions

5.5.3.1 *Titrating Solution:* 1 50 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 150 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.

NOTE 4.—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 5.—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 6.—Sodium diphenylamine sulphonate indicator can be used in place of diphenylamine.

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 3) and 5 ml hydrofluoric acid by heating until fumes of perchloric acid reflux on side of flask. Cool and dilute to 80 ml. Make the solution ammoniacal with ammonium hydroxide (see Note 7). 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 #30) 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:

$$\frac{\text{Ml of Standard} \times 0.0005}{\text{Weight of Sample}} \times 100 = \text{Percent CaO}$$

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.

NOTE 7.—A slight precipitation of iron and aluminum hydroxide does not interfere with the determination.

5.6 Loss on Ignition

5.6.1 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.

5.6.2 Calculations:

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

6. Shipping

6.1 Shipments shall be accomplished in such a manner as to insure that the washed and dried sand is not exposed to moisture and is protected against losses (Note 8).

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.

NOTE 8.—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.