

# SSPC: The Society for Protective Coatings

## ABRASIVE SPECIFICATION NO. 1

### Mineral and Slag Abrasives

#### 1. Scope

1.1 This specification defines the requirements for selecting and evaluating mineral and slag abrasives used for blast cleaning steel and other surfaces for painting and other purposes.

1.2 The abrasives covered by this specification are primarily intended for one-time use without recycling; reclaimed materials must again be tested against and meet the requirements of this specification. (See Note 7.1.)

#### 2. Description

2.1 The abrasives are categorized into two types, three classes and five grades as described below. Normally the user shall specify the types, classes and grades required. If no abrasive type is specified, then either Type I or Type II is considered acceptable. If no abrasive class is specified, then any class will be considered acceptable. If no abrasive profile grade is specified, the abrasive shall satisfy the requirements of any of the five grades listed.

2.2 The following abrasive types are included.

##### Type I - Natural Mineral Abrasives

These are naturally occurring minerals, including, but not limited to, quartz sands, flint, garnet, staurolite, and olivine.

##### Type II - Slag Abrasives

These are slag by-products of coal-fired power production or of metal (such as copper or nickel) smelting.

2.3 The following abrasive classes are included.

**Class A** - Crystalline silica less than or equal to 1.0%

**Class B** - Crystalline silica less than or equal to 5.0%

**Class C** - Unrestricted crystalline silica

The definition and requirements for Classes A, B and C are given in Section 4.2.

2.4 The abrasive grades and associated profile ranges are listed below:

- **Grade 1** - Abrasives which produce surface profiles of 0.5 to 1.5 mils (13 to 38 micrometers) when tested in accordance with Section 4.3.
- **Grade 2** - Abrasives which produce surface profiles of 1.0 to 2.5 mils (25 to 64 micrometers) when tested in accordance with Section 4.3.
- **Grade 3** - Abrasives which produce surface profiles of 2.0 to 3.5 mils (51 to 89 micrometers) when tested in accordance with Section 4.3.
- **Grade 4** - Abrasives which produce surface profiles of 3.0 to 5.0 mils (75 to 127 micrometers) when tested in accordance with Section 4.3
- **Grade 5** - Abrasives which produce surface profiles of 4.0 to 6.0 mils (102 to 152 micrometers) when tested in accordance with Section 4.3.

Other profile ranges may be designated by the purchaser.

#### 3. Reference Standards

3.1 The reference standards listed in Sections 3.4 and 3.5 form a part of this specification.

3.2 The latest issue, revision, or amendment of the referenced standards in effect on the date of invitation to bid shall govern unless otherwise stated.

3.3 If there is a conflict between the requirements of any of the cited reference standards and this specification, the requirements of this specification shall prevail.

##### 3.4 SSPC SPECIFICATIONS:

**VIS 1** Visual Standard for Abrasive Blast Cleaned Steel

**SP 10** Near-White Blast Cleaning

##### 3.5 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARDS:

**C 128** Test Method for Specific Gravity and Absorption of Fine Aggregates

**C 136** Test Method for Sieve Analysis of Fine and Coarse Aggregates

- C 566** Test Method for Total Moisture Content of Aggregate by Drying
- C 702** Method for Reducing Field Samples of Aggregate to Testing Size
- D 75** Method for Sampling Aggregates
- D 1125** Test Methods for Electrical Conductivity and Resistivity of Water
- D 4417** Test Method for Field Measurement of Surface Profile of Blast Cleaned Steel
- D 4940** Test Method for Conductimetric Analysis of Water Soluble Ionic Contaminants of Blasting Abrasives
- E 1132** Practice for Health Requirements Relating to Occupational Exposure to Quartz Dust

## 4. Requirements

**4.1 GENERAL PHYSICAL AND CHEMICAL PROPERTIES:** The abrasive shall meet all the requirements of paragraphs 4.1.1 through 4.1.6. These are summarized in Table 1.

**4.1.1 Specific Gravity:** The specific gravity shall be a minimum of 2.5 as determined by ASTM C 128.

**4.1.2 Hardness:** The hardness shall be a minimum of 6 on the Mohs scale when tested as follows: Examine the material under low-power microscope (10X) and if grains of different colors or character are present, select a few grains of each. Place in succession the grains thus differentiated between two glass microscope slides. While applying pressure, slowly move one slide over the other with a reciprocating motion for 10 seconds. Examine the glass surface, and if scratched, the material shall be considered as having a minimum hardness of 6 on the Mohs scale. If more than 25% of the grains by count fail to scratch the glass surface, the abrasive does not meet this specification.

**4.1.3 Weight Change on Ignition:** The maximum permissible loss on ignition is 1.0% and the maximum permissible gain is 5.0% when tested as follows: A representative portion of the sample shall be ground in an agate mortar and thoroughly dried at 220- 230°F (105-110°C) for one hour. Transfer approximately 1 gram of the dried sample to a tared crucible with cover and weigh to the nearest milligram. Cautiously heat the crucible with contents, at first partially covered, and then at approximately 1382 ± 90°F (750 ± 50°C) covered. Hold at 1382°F (750°C)

for 30 minutes, then cool in a dessicator and reweigh. The percent of weight change shall be computed as follows:

$$\% \text{ weight change} = \frac{(\text{final wt.} - \text{orig. wt.}) \times 100}{\text{orig. wt.}}$$

**4.1.4 Water Soluble Contaminants:** The conductivity of the abrasive shall not exceed 1000 microsiemen when tested in accordance with ASTM D 4940. (See Note 7.3.)

**4.1.5 Moisture Content:** The maximum moisture content shall be 0.5% by weight, when tested in accordance with ASTM C 566.

**4.1.6 Oil Content:** The sample, in water, when tested in 4.1.4, shall show no presence of oil, either on the surface of the water or as an emulsion in the water, when examined visually after standing for 30 minutes.

**4.2 CRYSTALLINE SILICA CONTENT:** All abrasives must be classed based on crystalline silica content (see Note 7.4). Abrasives designated as Class A or B must meet the requirements of paragraphs 4.2.1 or 4.2.2 respectively.

**4.2.1 Class A - Less Than 1% Crystalline Silica:** Abrasives shall contain no more than 1.0% by weight of crystalline silica when determined in accordance with procedures described in 4.2.4.

**4.2.2 Class B - Less than 5% Crystalline Silica:** Abrasives shall contain no more than 5.0% by weight of crystalline silica when determined in accordance with procedures described in 4.2.4.

**4.2.3 Class C - Unrestricted Crystalline Silica:** No restrictions on crystalline silica content.

**4.2.4 Crystalline Silica:** The crystalline silica content shall be determined by the use of infrared spectroscopy or by other analytical procedures, such as wet chemical or X-ray diffraction analyses.

**4.3 SURFACE PROFILE:** The average surface profile, when determined in accordance with the description below, shall be within the ranges specified in Section 2.4. A representative sample of the material shall be obtained in accordance with ASTM D 75 and used to abrasive blast a 2-foot by 2-foot by 1/4 inch (61 cm x 61 cm x 4 mm) mild steel plate of SSPC-VIS 1 Rust Grade A to a cleanliness of SSPC-SP 10 (Near-White Blast Cleaning). The blasting shall be done using a 3/8 in (9.5 mm) #6 venturi nozzle with a nozzle pressure of 95 ± 5 psig (670 ± 35 kilopascals) at a distance of 24 ± 6 inches (61 ± 15 cm) from the surface at an angle of 75 to 105 degrees. The resultant surface profile shall be measured at a minimum of five locations in accor-

dance with Method C of ASTM D 4417 (see Note 7.5). The average measured profile shall be within the ranges given in Section 2.4. Other methods of determining profile may be used if mutually agreeable between the contracting parties.

#### 4.4 PARTICLE SIZE DISTRIBUTION

**4.4.1** The abrasive supplier shall designate range(s) for maximum and minimum retention of each sieve size to meet the profile range(s) specified in Section 2.4 and determined in Section 4.3. The particle size distribution shall be measured in accordance with ASTM C 136 using the following U.S. standard sieves: 6, 8, 12, 16, 20, 30, 40, 50, 70, 100, 140, and 200. Upon request, the supplier shall substantiate that the specified size range will meet the required profile range. (See Note 7.6.)

**4.4.2** The designated sieve size distribution and ranges will become the acceptance standard for the specific abrasive submitted (see Section 5.4).

#### 4.5 HEALTH AND SAFETY REQUIREMENTS

**4.5.1** The abrasive material as supplied shall comply with all applicable federal, state, and local regulations (see Note 7.7).

**4.5.2** The manufacturer shall provide the purchaser with sufficiently detailed chemical analyses to allow the user to provide the protective engineering and administrative controls for blast cleaning identified in federal, state, and local codes.

**4.5.3** Material Safety Data Sheets shall be furnished for all abrasive materials supplied.

#### 4.6 OTHER REQUIREMENTS

**4.6.1** In addition to the requirements of Sections 4.1 through 4.5, the specifier may also stipulate performance tests to establish abrasive consumption rate, cleaning rate, and abrasive breakdown. As there are currently no standards for these tests, they are not a part of this specification. However, upon mutual agreement between supplier and purchaser, a performance test procedure can be established. Appendix A outlines a suggested procedure.

### 5. Qualification Testing and Conformance Testing

**5.1 RESPONSIBILITIES FOR TESTING:** The procurement documents should establish the specific responsibilities for qualification testing and conformance testing. Unless otherwise specified, the supplier is responsible for

performing and documenting the tests and inspections called for in this specification.

**5.2 CLASSIFICATION OF TESTING:** The tests given in Section 4 are classified as qualification tests or conformance tests, as defined below:

**5.2.1** Qualification tests are those tests which are run to initially qualify a material for this specification. Qualification tests are also required whenever a significant change has occurred in the source, method of processing, method of shipping or handling of the abrasives. The qualification tests include all the tests in Sections 4.1 through 4.6.

**5.2.2** Conformance tests are those tests which are performed to verify that the material being submitted has the same properties as the material which initially qualified. Conformance tests shall be conducted on each lot as required by the purchaser. The frequency and lot size for quality conformance testing shall be mutually agreed upon between the supplier and the purchaser. The required conformance tests are particle size distribution (Section 4.4), water soluble contaminants (Section 4.1.4), moisture content (Section 4.1.5) and oil content (Section 4.1.6).

#### 5.3 METHODS OF SAMPLING

##### 5.3.1 Sampling for Qualification Tests

**5.3.1.1 Bagged Abrasive:** Three or more sacks of abrasive shall be randomly selected from each inspection lot. The sacks shall be mixed and separated and a 50 kilogram (kg) (110 lb) composite sample prepared in accordance with ASTM C 702.

**5.3.1.2 Bulk Abrasive:** A 50 kg (110 lb) composite sample shall be obtained from the blended finished product in accordance with ASTM D 75. (See Note 7.8.)

##### 5.3.2 Sampling for Conformance Tests

**5.3.2.1 Bagged Abrasive:** One sack of abrasive shall be randomly selected from each inspection lot and a 2 kg (4 lb) composite sample prepared in accordance with ASTM C 702.

**5.3.2.2 Bulk Abrasive.** A 2 kg (4 lb) composite sample shall be obtained from the blended finished product in accordance with ASTM D 75.

**5.3.3** Other methods of sampling may be used if mutually agreeable between the contracting parties.

**5.4 DOCUMENTATION OF INSPECTION AND TESTING:** The supplier shall furnish all documentation required

to verify that he has completed the requirements of the qualification tests and conformance tests specified. At a minimum, the documentation shall include the following:

**5.4.1 List of tests performed:** This list shall include the title of the test, the appropriate standards used, any deviation from standard practice, and the numerical results of the testing.

**5.4.2 Testing facilities:** The documentation of facilities shall include the name and location of the laboratory, the responsible laboratory official, and laboratory certification or other evidence of qualification.

**5.4.3 Date of testing:** This shall include the date of original qualification (if applicable) and dates of completion and official approval of testing results.

**5.4.4 Affidavit:** The procurement documents should establish the responsibility for any required affidavit certifying compliance with this specification.

**5.5 FREQUENCY OF TESTING AND INSPECTION:** All materials supplied under this specification shall be subject to timely inspection by the purchaser or his authorized representative. The frequency and lot size of inspection shall be established by mutual agreement between the supplier and the purchaser.

**5.6 APPROVAL:** The purchaser shall have the right to reject any material supplied which is found to be defective under this specification. In case of dispute, the arbitration or settlement procedure, if any, established in the procurement documents shall be followed. If no arbitration procedure is established, the procedures specified by the American Arbitration Association shall be used.

## 6. Disclaimer

**6.1** While every precaution is taken to insure that all information furnished in SSPC specifications is as accurate, complete, and useful as possible, SSPC cannot assume responsibility nor incur any obligation resulting from the use of any materials or methods specified therein, or of the specification itself.

## 7. Notes\*

**7.1** Reclaimed abrasive may not meet the requirements of this specification because of particle degradation and retained contaminants. To confirm compliance, reclaimed abrasive shall be retested.

**7.2** Materials furnished under this specification which produce the required surface profile under standard test conditions may produce a different surface profile depending upon job condition, type of surface, blasting pressure, etc.

**7.3** The limitation for abrasive conductivity is based on pressure immersion testing and accelerated outdoor exposure tests performed by SSPC and the National Shipbuilding Research Program.

**7.4** Users of abrasives containing quartz (crystalline silica) should comply with the requirements of ASTM E 1132.

**7.5** Methods A and B of ASTM D 4417 or National Association of Corrosion Engineers RP02-87, "Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Using Replica Tape" may also be specified by agreement between purchaser and supplier.

**7.6** SSPC will maintain a list of abrasives and sieve sizes for which data on profile and other specified tests have been submitted. The data will not be verified by SSPC, but will be furnished upon request to those wishing to use this specification. It is anticipated that at a future date, specific size designations for individual abrasives will be incorporated into this or another SSPC specification.

**7.7** Disposal of abrasives should be in compliance with all applicable federal, state, and local regulations. It is noted that the spent abrasive may contain hazardous paint and other foreign matter.

**7.8** The importance of properly obtaining a sample cannot be over-emphasized. All subsequent analyses performed on the selected sample are likely to be affected by particle size, so it is imperative that every reasonable effort be made to select the sample in a way that will assure proper representation. Therefore, it is important to select the proper sampling location, and to use proper techniques to select the sample.

The following guidelines should be kept in mind when deciding on a sampling method:

**7.8.1** If possible, sample the material to be tested when it is in motion, in such places as a conveyor output point or a chute discharge.

**7.8.2** The whole of the material stream should be taken for many short periods of time in preference to part of the material stream being taken for the whole of the time.

\*Notes are not requirements of this specification.

## **Appendix A. Optional Test To Determine Rates of Surface Cleaning by Abrasives and of Abrasive Consumption\***

### **A.1 TEST PROCEDURE**

**A.1.1** For testing purposes hot rolled carbon steel plates or other flat structural steel with surface area of 20 to 80 sq. ft. (1.9 to 7.4 m<sup>2</sup>) shall be abrasive blast cleaned to a SSPC-SP 10 "Near White" condition. Surface profile shall range from 2.0 to 3.0 mils (51 to 76 micrometers) when measured by replica tape (ASTM D-4417, Method C). These panels shall be coated within 4 hours of abrasive blasting, or before surface rusting is visible —whichever occurs first.

**A.1.2** The panels prepared in A.1.1 shall be coated with three coats of epoxy-polyamide paint (total DFT 7-10 mils [178-254 micrometers]) conforming to MIL-DTL-24441 or other standard reference painting system agreed to by the contracting parties. The panels shall be cured for a minimum of seven days at a minimum temperature of 70°F (21° C). Following curing, the panels shall be marked in such a manner as to form a grid of squares, each being 1 sq. ft. (0.09 m<sup>2</sup>) in area. Each plate shall contain a minimum of 20 squares.

**A.1.3** Each abrasive type and size selected shall be tested using a 3/8 inch (9.6 mm) venturi nozzle operated at 95 ± 5 psig (655 ± 35 kilopascals) at the nozzle. A 600 lb pot shall be charges with 500 lbs (227 kg) of abrasive and the test panel blasted to SSPC-SP 10 near-white condition. Each trial shall cover approximately 20 sq. ft. (2 m<sup>2</sup>) of surface area. The blast pot shall be disconnected and weighed before and after each blast trial, and the following data recorded: start weight, finish weight, weight of abrasive used, square footage blasted, and time required to blast.

**A.2 ABRASIVE CONSUMPTION RATE:** The abrasive consumption rate shall be determined as the weight of abrasive used divided by the area cleaned, and reported in lbs of abrasive per square foot (kg per m<sup>2</sup>).

**A.3 SURFACE CLEANING RATE:** The surface cleaning rate shall be determined as the area cleaned divided by the time required to blast and reported in square feet (square meters) cleaned per hour.

\*The Appendix is not a requirement of this specification.