

SSPC: The Society for Protective Coatings

ABRASIVE SPECIFICATION NO. 3

Newly Manufactured or Re-Manufactured Steel Abrasives

1. Scope

1.1 This specification covers the requirements for newly manufactured steel abrasive or re-manufactured steel abrasive for use in surface preparation by blast cleaning.

1.2 This specification does not cover recycled steel abrasive processed through field or shop abrasive blast cleaning units. Requirements for recycled steel abrasives are covered in SSPC-AB 2, Specification for Cleanliness of Recycled Ferrous Metallic Abrasives.

1.3 Steel abrasives covered by this specification are intended for the removal of rust, mill scale, paint or other surface coating system, or for general blast cleaning.

2. Description

2.1 Steel abrasives can have two basic particle shapes: spherical or round for shot and angular or irregular for grit, as defined in Sections 4.3.3.1 and 4.3.3.2.

2.2 The size designations and specifications for steel shot and grit are given in Tables 1 and 2 of this specification. Also see Note 7.4.

2.3 DEFINITIONS

New Steel Abrasives: Abrasive material not previously used for blast cleaning and produced from newly manufactured steel.

Recycled/Reclaimed Steel Abrasives: Used steel abrasives recovered from blasting operations and processed through field or shop abrasive cleaning units.

Re-Manufactured Steel Abrasives: Steel abrasives produced from reclaimed steel abrasives at a fixed manufacturing facility regularly engaged in this work.

3. Reference Standards

3.1 The standards referenced in this specification are listed in Sections 3.4 through 3.7 and 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 unless otherwise specified in the contract.

3.4 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARDS:

C 128	Test Method for Specific Gravity
C 136	Test Method for Sieve Analysis of Fine Sand and Coarse Aggregates
D 4940	Test Method for Conductometric Analysis of Water Soluble Ionic Contaminants of Blasting Abrasives
E 11	Specification for Wire-Cloth Sieves for Testing Purposes
E 29	Standard Practice for Using Digits in Test Data to Determine Conformance with Specifications
E 140	Hardness Conversion Tables for Metals
E 350	Standard Test Method for Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron and Wrought Iron
E 384	Test Methods for Microhardness of Materials

3.5 SSPC STANDARD:

AB 2	Specification for Cleanliness of Recycled Ferrous Metallic Abrasives
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3.6 INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO) STANDARD:

11124-3	High Carbon Cast Steel Shot and Grit
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3.7 SAE STANDARD:

J444	Cast Shot and Grit Size Specification for Cleaning
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4. Requirements

4.1 **ABRASIVE SELECTION:** The owner/specification writer shall define, based on the requirements listed below, abrasive shape, size and hardness to meet the job requirements.

TABLE 1
Steel Shot Size Specifications

Screen No. ASTM E 11	Screen Opening (inches)*	SHOT SIZE										
		780	660	550	460	390	330	280	230	170	110	70
7	0.111	all pass	—	—	—	—	—	—	—	—	—	—
8	0.0937	—	all pass	—	—	—	—	—	—	—	—	—
10	0.0787	85% min**	—	all pass	all pass	—	—	—	—	—	—	—
12	0.0661	97% min	85% min	—	5% max	all pass	—	—	—	—	—	—
14	0.0555	—	97% min	85% min	—	5% max	all pass	—	—	—	—	—
16	0.0469	—	—	97% min	85% min	—	5% max	all pass	—	—	—	—
18	0.0394	—	—	—	96% min	85% min	—	5% max	all pass	—	—	—
20	0.0331	—	—	—	—	96% min	85% min	—	10% max	all pass	—	—
25	0.028	—	—	—	—	—	96% min	85% min	—	10% max	—	—
30	0.0232	—	—	—	—	—	—	96% min	85% min	—	all pass	—
35	0.0197	—	—	—	—	—	—	—	97% min	—	10% max	—
40	0.0165	—	—	—	—	—	—	—	—	85% min	—	all pass
45	0.0138	—	—	—	—	—	—	—	—	97% min	—	10% max
50	0.0117	—	—	—	—	—	—	—	—	—	80% min	—
80	0.007	—	—	—	—	—	—	—	—	—	90% min	80% min
120	0.0049	—	—	—	—	—	—	—	—	—	—	90% min

* Screen opening sizes and screen numbers with maximum and minimum cumulative percentages allowed on corresponding screens.

NOTE: These sizes correspond to those in SAE J444 Cast Shot and Grit Size Specifications for Cleaning.

** All percentages refer to weight percent.

TABLE 2
Steel Grit Size Specifications

Screen No. ASTM E 11	Screen Opening (inches)*	GRIT SIZE								
		G12	G14	G16	G18	G25	G40	G50	G80	G120
8	0.0937	all pass	—	—	—	—	—	—	—	—
10	0.0787	—	all pass	—	—	—	—	—	—	—
12	0.0661	80%**	—	all pass	—	—	—	—	—	—
14	0.0555	90%	80%	—	all pass	—	—	—	—	—
16	0.0469	—	97%	75%	—	all pass	—	—	—	—
18	0.0394	—	—	85%	75%	—	all pass	—	—	—
25	0.0280	—	—	—	85%	70%	—	all pass	—	—
40	0.0165	—	—	—	—	80%	70%	—	all pass	—
50	0.0117	—	—	—	—	—	80%	65%	—	all pass
80	0.0070	—	—	—	—	—	—	75%	65%	—
120	0.0049	—	—	—	—	—	—	—	75%	60%
200	0.0029	—	—	—	—	—	—	—	—	70%

* Screen opening sizes and screen numbers with minimum cumulative percentages allowed on corresponding screens.

NOTE: These sizes correspond to those in SAE J444 Cast Shot and Grit Size Specifications for Cleaning.

** All percentages refer to weight percent.

4.2 GENERAL PHYSICAL AND CHEMICAL PROPERTIES: The abrasive shall meet the size requirements for each size specified as defined in Table 1 for steel shot or Table 2 for steel grit.

4.3 PHYSICAL PROPERTIES

4.3.1 Size Classification: The abrasive shall be tested in accordance with Section 5.2.1 and shall meet the size requirements for each size specified as defined in Table 1 for steel shot or Table 2 for steel grit.

4.3.2 Hardness: This specification defines two ranges of abrasive hardness: Rockwell C 50 and lower and Rockwell C 51 and higher. Steel abrasive hardness shall be tested in accordance with Section 5.2.4. Other hardness ranges between 35 and 65 on the Rockwell C scale are available and may be specified in the bid documents. (See Notes 7.2 and 7.6.)

4.3.3.1 Steel Shot: Using a 10X microscope or magnifying glass, steel shot shall be predominantly rounded particles with no more than 10% elongated particles. (An elongated particle is one with a length more than twice its diameter.)

4.3.3.2 Steel Grit: Using a 10X microscope or magnifying glass, steel grit shall be irregular and angular shaped, with no more than 10% round or half-round particles.

4.3.4 Specific Gravity: When tested in accordance with Section 5.2.2, the specific gravity of the steel abrasives shall be no less than 7.0.

4.3.5 Durability: When steel abrasives are tested for durability in accordance with Section 5.2.5, after 100 cycles in the durability test, no more than 20% by weight of the abrasive shall pass through the appropriate take-out screen as defined in Table 3 for grit or in Table 4 for shot.

4.4 CHEMICAL PROPERTIES

4.4.1 Chemistry: When tested in accordance with Section 5.2.3, the chemical composition of the steel abrasive shall conform with Table 5.

4.4.2 Conductivity: When tested in accordance with Section 5.2.7, the conductivity of the solution of water soluble contaminants shall not exceed 1000 µmho/cm.

4.4.3 Cleanliness: When tested in accordance with Section 5.2.6, the steel abrasive shall be free of dust, grease, corrosion, non-magnetic matter subject to the limitations in Sections 4.4.3.1 and 4.4.3.2, and other contaminants. The presence of rust in excess of a slight red or blue oxidation of the abrasive particle shall be cause for rejection.

**TABLE 3
 Steel Grit Take-Out Screens**

Steel Grit Size	Take-Out Screen Size
G12	40 mesh
G14	40 mesh
G16	40 mesh
G18	40 mesh
G25	50 mesh
G40	50 mesh
G50*	70 mesh
G80*	*
G120*	*

* Abrasive sizes G50, G80, and G120 cannot be accurately tested due to limitations of the test apparatus in retaining fine abrasives

**TABLE 4
 Steel Shot Take-Out Screens**

Steel Shot Size	Take-Out Screen Size
S780	40 mesh
S660	40 mesh
S550	40 mesh
S460	40 mesh
S390	40 mesh
S330	50 mesh
S280	50 mesh
S230	50 mesh
S170	50 mesh
S110*	70 mesh
S70*	*

* Shot sizes S110 and S70 cannot be accurately tested due to limitations of the test apparatus in retaining these sizes

**TABLE 5
 Steel Abrasive Chemistry**

Element	Percent by Weight
Iron	95.00% minimum
Carbon	1.50% maximum
Manganese	1.20% maximum
Phosphorous	0.05% maximum

4.4.3.1 Accept: If the sample has less than or equal to 0.2% by weight of non-magnetic matter and no oil film or slick on the surface of the water (clouding or discoloration of the water is not grounds for rejection).

4.4.3.2 Reject: If the sample has more than 0.2% by weight of non-magnetic matter or there is an oil film or slick on the surface of the water and sides of the container.

5. Quality Assurance Test Methods

5.1 RESPONSIBILITIES FOR TESTING: Unless otherwise specified, the supplier is responsible for performing and documenting the preliminary acceptance tests and inspections called for in this specification. The procurement documents should establish the specific responsibilities for conformance testing.

5.2 TEST PARAMETERS: Unless otherwise specified in the contract or purchase order, the supplier shall be responsible for compliance with the requirements for size, durability, cleanliness, specific gravity, chemical composition, hardness, and conductivity.

5.2.1 Size: The abrasive sizing shall be tested in accordance with ASTM C 136.

5.2.2 Specific Gravity: Specific gravity shall be determined in accordance with ASTM C 128.

5.2.3 Chemical Composition: Chemical composition shall be determined in accordance with ASTM E 350.

5.2.4 Hardness: Hardness values shall be obtained in accordance with ASTM E 384 utilizing a microhardness tester with a 500 g load. Measurements taken in Knoop hardness numbers shall be converted to Rockwell C Scale.

5.2.4.1 Metallic abrasives sometimes contain internal shrinkage, voids, or inclusions which remain undetected beneath the surface in a mounted and polished sample. These characteristics can cause a non-uniform hardness reading and shall be ignored when testing for hardness.

5.2.5 Durability Testing

5.2.5.1 Procedure

1. Obtain a representative sample and weigh out 100 grams (± 0.1 g) of new abrasive.

2. Place 100 g sample in a calibrated standard durability test machine (see Section 5.2.5.2) and run for 100 passes.

3. Remove sample from test machine and screen sample on appropriate take-out screen (see Table 3 for grit, Table 4 for shot).

4. Hand screen sample on take-out screen and record weight.

5.2.5.2 Apparatus: Durability tests shall be performed using an Ervin Test Machine or equivalent shot/grit test machine, properly calibrated in accordance with the manufacturer's instructions.

5.2.6 Abrasive Cleanliness

1. Obtain a representative sample.

2. Weigh out 100 grams ± 1 gram.

3. Magnetically remove all magnetic material.

4. Weigh remaining non-magnetic material and record weight. Discard non-magnetic material.

5. Check magnetic material for rust in excess of slight red or blue oxidation.

6. Place magnetic material in a glass jar and cover with at least one inch of potable water.

7. Vigorously shake the jar containing water and magnetic material.

8. After shaking, observe water surface in jar as described in Sections 4.4.3.1 and 4.4.3.2.

5.2.7 Conductivity: Conductivity tests shall be run in accordance with ASTM D 4940.

6. Disclaimer

6.1 While every precaution is taken to ensure 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, paints, or methods specified therein, or of the specification itself.

7. Notes

Notes contain supplementary information and are not considered part of the specification.

7.1 ABRASIVE DISPOSAL: The disposal of spent abrasives should be in compliance with all applicable federal, state, and local regulations. It should be noted that the

spent abrasive may contain hazardous paint and other foreign matter.

7.2 ABRASIVE HARDNESS: Abrasive hardness may affect performance of steel abrasives as follows:

Rockwell C-51 and higher hardness

- Increasing hardness increases cutting rate compared to abrasives with hardnesses below C-51, particularly when removing live (i.e., soft, flexible) coating systems.
- Increased surface profile compared to abrasives with hardnesses below C-51.
- Lower durability, increased abrasive consumption compared to abrasives with hardnesses below C-51.

Rockwell C-50 and lower hardness

- Good cutting rate for new steel and most coating systems.
- Lower profile compared to abrasives with hardnesses of C-51 and higher.
- Higher durability but greater tendency to rounding compared to abrasives with hardnesses of C-51 and higher.

7.3 ABRASIVE SHAPE: Abrasive shape may affect performance and profile produced for subsequent new coating as follows:

- Steel shot generally produces a rounded profile and is effective in removing mill scale.

- Steel grit generally produces a deeper, angular profile and is more effective for the removal of existing coating systems and rust.

7.4 ABRASIVE PRODUCTIVITY: For greatest productivity, always use the finest size shot or grit that will effectively clean the surface and produce the proper profile. Abrasive recycling machines should be set to retain all usable shot or grit sizes in the working mix for maximum productivity and lowest abrasive consumption.

7.5 ABRASIVE DURABILITY: Abrasive durability is based on laboratory conditions using test equipment. Actual results under field conditions will vary.

7.6 ABRASIVE CHANGE WITH USE: This specification has been developed for newly manufactured or re-manufactured abrasives. With use, abrasive hardness, particle size, and particle shape will vary depending on initial hardness, blasting velocity, and blasting method. Abrasive hardness will increase with continued reuse. Abrasive shape will become more rounded with continued reuse. Abrasive size will decrease with continued reuse. Because of changes in hardness, shape, and size, it is important that new abrasives are added to the work mix on a regular basis to ensure quality and consistency of blast profile and cleanliness.

7.7 FOR MORE INFORMATION: Also see "Good Painting Practice," Volume 1 of the SSPC Painting Manual, for more information.