



# Standard Guide for Metallic Abrasive Blasting to Descale the Interior of Pipe<sup>1</sup>

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## 1. Scope

1.1 This guide covers metallic abrasive blasting to descale the interior of carbon steel pipe.

1.2 This guide is recommended for use in conjunction with an abrasive reclamation system.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *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.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

[D2200 Practice for Use of Pictorial Surface Preparation Standards and Guides for Painting Steel Surfaces](#)

[E18 Test Methods for Rockwell Hardness of Metallic Materials](#)

### 2.2 SAE Standards:<sup>3</sup>

[J444 Cast Shot and Grit Size Specifications for Peening Cleaning](#)

[J827 Cast Steel Shot](#)

### 2.3 Other Documents:

[SSPC SP10 Surface Preparation Specifications<sup>4</sup>](#)

[SFSA 20-66 Standard Specification for Cast Steel Abrasives<sup>5</sup>](#)

<sup>1</sup> This guide is under the jurisdiction of ASTM Committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.11 on Machinery and Piping Systems.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, <http://www.sae.org>.

<sup>4</sup> Available from Society for Protective Coatings (SSPC), 40 24th St., 6th Floor, Pittsburgh, PA 15222-4656, <http://www.sspc.org>.

<sup>5</sup> Available from Steel Founders' Society of America (SFSA), 780 McArdle Dr., Unit G, Crystal Lake, IL 60014, <http://www.sfsa.org>.

## 3. Significance and Use

3.1 The maximum length and minimum diameter of the pipe shall be determined by the capacity of the blast equipment used.

3.2 This guide is recommended for removing mill scale, rust scale, paints, zincs, and oxides.

## 4. General Requirements

4.1 Before blasting, pipe shall be dry and free of slag and weld spatter which would not be removed by abrasive blasting. Pipe shall also be free of loose dust and debris which might hamper the effectiveness of abrasive blasting.

4.2 Abrasive blasting shall be accomplished in a dry area with the ambient air condition such that condensation does not occur.

4.3 Shot and blasting equipment shall be stored at a temperature not less than  $-13^{\circ}\text{C}$  ( $10^{\circ}\text{F}$ ) above the dew point of the surrounding area.

4.3.1 Abrasive reclamation system shall include a filtration system capable of removing oxides, debris, dust, shot/grit fragments, and fines.

4.4 Compressed air system shall be equipped with moisture removal devices capable of reducing the dew point of the air at the nozzle to  $-18^{\circ}\text{C}$  (approximately  $0^{\circ}\text{F}$ ) or less.

4.5 Hoses shall have the maximum practical diameter and shall be as short as possible.

4.6 Nozzles shall have the maximum possible aperture as determined by the capacity of the blast equipment and as limited by the pipe diameter.

4.7 Internal pipe cleaning nozzle assemblies are commercially available and shall be used where required.

4.7.1 Internal pipe cleaning nozzle assemblies shall include a carriage which is capable of centering the nozzle concentrically in the pipe being blasted and a nozzle which is capable of producing a consistent  $360^{\circ}$  blast pattern.

4.7.2 Diagrams of some commercially available internal pipe cleaning assemblies are provided in [Figs. 1-4](#).

4.7.3 If a lance is required, it shall be at least as long as the pipe being blasted.

4.8 Blasting shall be accomplished using an abrasive mixture of cast steel shot and grit, or with iron shot or grit.

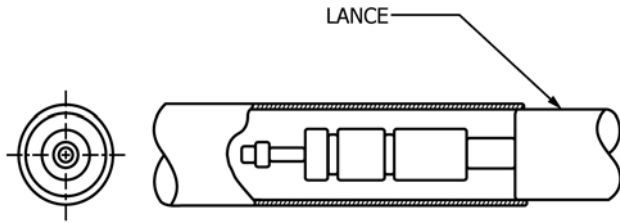


FIG. 1 For 20- to 50-mm (Approximately 3/4- to 2-in.) Inside Diameter Pipe

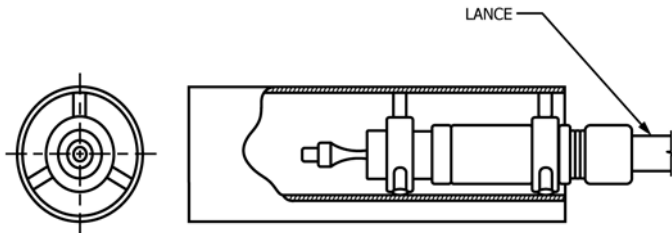


FIG. 2 For 50- to 125-mm (Approximately 2- to 5-in.) Inside Diameter Pipe

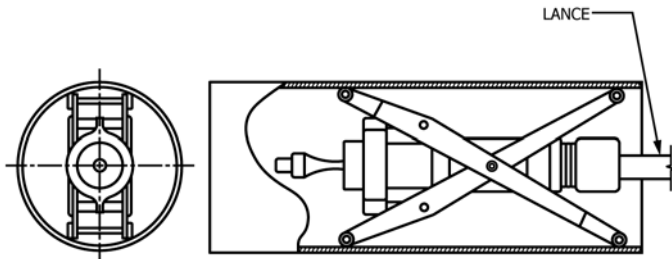


FIG. 3 For 125- to 305-mm (Approximately 5- to 12-in.) Inside Diameter Pipe

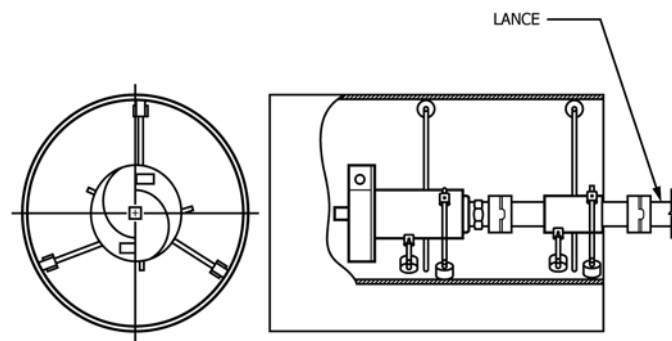


FIG. 4 For 305- to 915-mm (12- to 36-in.) Inside Diameter Pipe

4.8.1 Iron or grit may be used if desired.

4.8.2 Cast steel shot and grit mixtures shall be sized in accordance with SAE J444.

4.8.3 Reclaimed shot and grit shall be of the same quality as the original material.

4.9 Cast steel shot shall be manufactured in accordance with SAE J827 and tempered to a hardness of 40-50 Rockwell C in accordance with Test Methods E18 (see Table 1).

TABLE 1 Steel Shot and Grit Specifications<sup>A,B</sup>

Property	Shot	Grit
Size:		
New abrasive as manufactured	All material is screened to meet or exceed SAE J444 and SFSA 20-66.	
Chemistry:		
Carbon	0.85 to 1.20 %	
Manganese	0.60 to 1.00 %	
Silicon	0.50 to 1.00 %	
Sulfur	<0.05 %	
Phosphorus	<0.05 %	
Microstructure:		
Uniformly tempered martensite, with fine, well-distributed carbides, if any. Carbide networks, transformation products, decarburized surfaces, inclusions, and quench cracks are undesirable.		
Hardness:		
Commonly used structural steel <sup>C</sup>	40 to 50 RC	40 to 50 RC <sup>D</sup> 40 to 60 RC

<sup>A</sup>Courtesy of Steel Structures Painting Council.

<sup>B</sup>It is extremely important that contractual documents which specify abrasive to be used clearly designate the abrasive by size and by hardness.

<sup>C</sup>Both cast steel shot and grit of hardnesses in the range from 30 to 66 Rockwell C may be purchased. However, the abrasives of less than 40 RC and greater than 60 RC are generally used for applications other than surface preparation of structural steel.

<sup>D</sup>Abrasive manufacturers identify steel grit by designations which include two or more prefix letters, followed by the number size. Prefix letters are different for each of the abrasive suppliers for any given hardness range.

4.10 Cast steel grit shall be manufactured in accordance with SFSA 20-66 and tempered to a hardness of 55-65 Rockwell C in accordance with Test Methods E18 (see Table 2).

4.11 Shot and grit size shall be determined by the following criteria:

4.11.1 Smaller shot and grit produces more impacts per inch and is therefore more effective for removing paints and corrosion products.

4.11.2 Larger shot and grit produces more kinetic energy per impact and is therefore more efficient for removing heavier deposits such as mill scale.

TABLE 2 Types of Steel Abrasives Most Commonly Used for Various Structural Steel Blast Cleaning Operations<sup>A</sup>

	Abrasive Type		Size Range <sup>B</sup>	Hardness (RC)	
	Shot	Grit		40 to 50	50 to 60
New steel	X		S170 to S390	X	
Fabricated new steel	X		S170 to S390	X	
Heat-treated steel		X	G50 to G25	X	X
Heavy steel plate	X		S230 to S390	X	
Corroded steel		X	G50 to G25		X
Weld scale	X		S170 to S280	X	
Brush blast	X		S170 to S280	X	
Repair work		X	G50 to G40	X	
Maintenance		X	G80 to G18	X	X

<sup>A</sup>Courtesy of Steel Structures Painting Council.

<sup>B</sup>Size Range refers to working mix (operating mix) for recirculating abrasive blast systems. For additional information see Vol 1, Chapter 2 of the "Steel Structures Painting Manual."

4.12 If surface type and profile is specified, abrasive shall be selected using the following criteria:

4.12.1 Shot produces a wavy rounded surface profile which increases coating area coverage.

4.12.2 Grit produces a sharp angular profile which forms a better anchor pattern for most coatings.

4.12.3 **Table 3** lists some typical maximum profiles produced by some commercial abrasive media.<sup>4</sup>

4.13 Blasting shall be accomplished with a minimum of 620-kPa (90-psi) dry air pressure at the nozzle.

4.14 If an abrasive reclamation system is used, it shall be capable of filtering the used abrasive and returning the usable mixture.

**TABLE 3 Typical Maximum Profiles Produced by Some Commercial Abrasive Media<sup>A</sup>**

Abrasive—Steel Abrasives <sup>B</sup>	Maximum Particle Size NBS Screen No.	Typical Profile, max	Height (mils), avg, max
Shot S230	–No. 18 + No. 20	2.9 ± 0.2	2.2 ± 0.3
Shot S280	–No. 16 + No. 18	3.5 ± 0.3	2.5 ± 0.4
Shot S330	–No. 14 + No. 16	3.8 ± 0.4	2.8 ± 0.5
Shot S390	–No. 12 + No. 14	4.6 ± 0.5	3.5 ± 0.7
Grit G50	–No. 25 + No. 30	2.2 ± 0.3	1.6 ± 0.3
Grit G40	–No. 18 + No. 20	3.4 ± 0.4	2.4 ± 0.5
Grit G25	–No. 16 + No. 18	4.6 ± 0.5	3.1 ± 0.7
Grit G14	–No. 10	6.5 ± 0.8	5.1 ± 0.9

<sup>A</sup>Courtesy of Steel Structures Painting Council.

<sup>B</sup>Profile heights shown for steel abrasives were produced with conditioned abrasives of stabilized operating mixes in recirculating abrasive blast cleaning machine. Profile heights produced by new abrasives having screen analyses shown in SAE J444 will be appreciably higher.

Cast steel shot: Hardness 40 to 50 Rockwell C.

Cast steel grit: Hardness 55 to 60 Rockwell C.

## 5. Procedure

5.1 Pipe shall be located as close as possible to the blast equipment and blown clean of loose debris before blasting.

5.2 Pipe with an interior diameter of 100 mm (approximately 4 in.) or larger may be manually blasted from both ends if both ends are accessible and the pipe length configuration and equipment capabilities are such that the blasted surface is consistent throughout the pipe.

5.3 If pipe is inaccessible from one end, bent, or too long to be hand blasted, it will be necessary to use an internal pipe cleaning nozzle assembly.

5.3.1 Nozzle assembly shall be placed inside the pipe in a manner such that the nozzle is concentric with the pipe.

5.3.2 Nozzle assembly shall then be passed through the entire length of the pipe at a constant rate.

5.4 Extreme caution shall be used in all the blasting operations to avoid unnecessary removal of parent metal.

5.5 When blasting is completed, pipe shall be blown clean of residual debris and visually inspected in accordance with Standard **D2200** and reblasted as required.

5.6 Interior of pipe shall then be coated when specified. Coatings should be applied to freshly blasted surface before any rusting or contamination should occur.

## 6. Workmanship, Finish, and Appearance

6.1 Pipe shall be blasted to a near white finish in accordance with SSPC SP10, or as otherwise specified.

## 7. Keywords

7.1 abrasive blasting; carbon steel pipe; descaling; interior descaling; marine technology; metallic abrasive; pipe descaling; ships

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