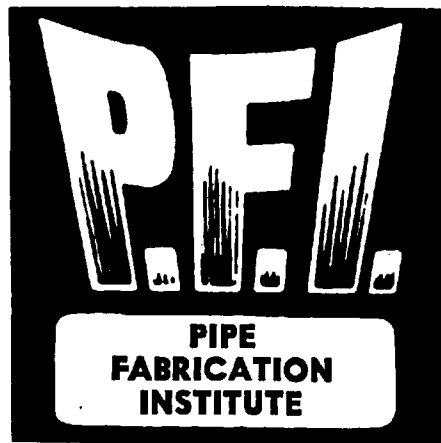


Internal Abrasive Blast Cleaning of Ferritic Piping

Prepared by
Pipe Fabrication Institute Engineering Committee



All PFI Standards are advisory only. There is no agreement to adhere to any PFI Standard and their use by anyone is entirely voluntary.

Issued by

PIPE FABRICATION INSTITUTE
*Dedicated to Technical Advancement and Standardization in
the Pipe Fabrication Industry*
Since — 1913

P. O. Box 173 ● Springdale, PA 15144

INTERNAL ABRASIVE BLAST CLEANING OF FERRITIC PIPING

1. Scope

- 1.1 This standard describes the materials and equipment used for abrasive blast cleaning the inside of ferritic piping and it defines the different levels of surface cleanliness which can be achieved.
- 1.2 Other mechanical cleaning methods such as brushing, grinding, chipping, sanding, etc., may be used as a supplement to abrasive blasting when necessary to achieve the required cleanliness level.
- 1.3 Maintenance of blast cleaned surfaces is not covered by this standard (i.e., use of corrosion inhibitors). If internal coatings are to be applied, refer to coating manufacturers recommendations.

2. Definitions

Contaminant — any undesirable foreign material on the surface to be cleaned

Grit — irregularly shaped particles with sharp edges, to promote high effectiveness in removal of contaminants.

Semi-Sharp Abrasives — irregularly shaped particles with some rounded and some sharp edges on one particle.

Shot — particles that are spherical or near spherical in shape.

3. Equipment for Abrasive Blasting

- 3.1 Dry direct pressure blast cleaning equipment and compressed air blast nozzles shall be used. Other equipment is permitted provided that the required acceptance criteria can be met.
- 3.2 Blast nozzle selection. See Table I.

TABLE I

Nozzle Type	Pipe Diameter
Deflection	8" and smaller
Spin blast (1)	10" thru 24"
Conventional or Straight	24" and larger

Note (1) — Spin blast units are mounted on standoff, or centering, devices with wheels which enable the operator to move the unit thru the pipe and maintain a relatively uniform blasting pattern.

4. Abrasives

- 4.1 Shot, grit, or semi-sharp abrasives may be used alone or in combination with each other. See Table II for a list of commonly used abrasives.

TABLE II

Metallic* Abrasives	Synthetic Abrasives	Siliceous Abrasives
Chilled Cast Iron	Silicon Carbide	Garnet
Cast Steel	Aluminum Oxide	Quartz
Malleable Iron	Refractory Slag	Silica
Crushed Steel		Decomposed Rock

Notes Re. Table II:

(1) The hardest material is listed at the top of each group and the others follow in order of decreasing hardness.

* (2) These should not be used on stainless steel.

- 4.2 Practically all of the grit and some of the shot become semi-sharp abrasives after they have been in use for a short time.
- 4.3 Shot blasting could result in fine mill scale and other impurities being driven into the surface of the material being blasted.

5. Blast Cleaning Procedure Selection

- 5.1 The actual blast cleaning procedure to be followed, including the selection of abrasives, depends on:
 - 5.1.1 Size and configuration of the assembly to be cleaned (determines accessibility).
 - 5.1.2 Local environmental conditions and proximity to other facilities.
 - 5.1.3 Contaminants to be removed.
 - 5.1.4 Available equipment.
 - 5.1.5 Cost of reclaiming abrasives.
- 5.2 If the piping assembly to be cleaned is so complex that accessibility is difficult or impossible, it may be necessary to pre-blast components or partial assemblies prior to completing the fabrication.
- 5.3 If abrasives are to be reclaimed and reused, suitable solvents should be used to remove visible grease and oil from the surface prior to blast cleaning.
- 5.4 After cleaning operations have been completed, all visible blasting residues shall be removed by blowing out the assembly with dry, clean, compressed air, or by any other suitable method capable of achieving the required cleanliness level.

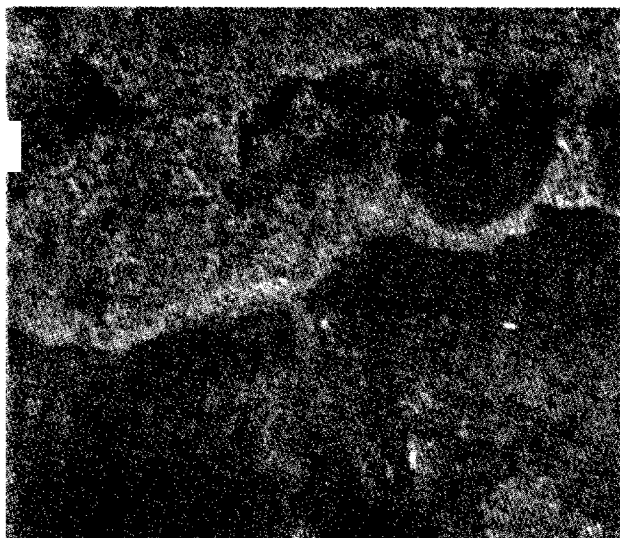


FIGURE A

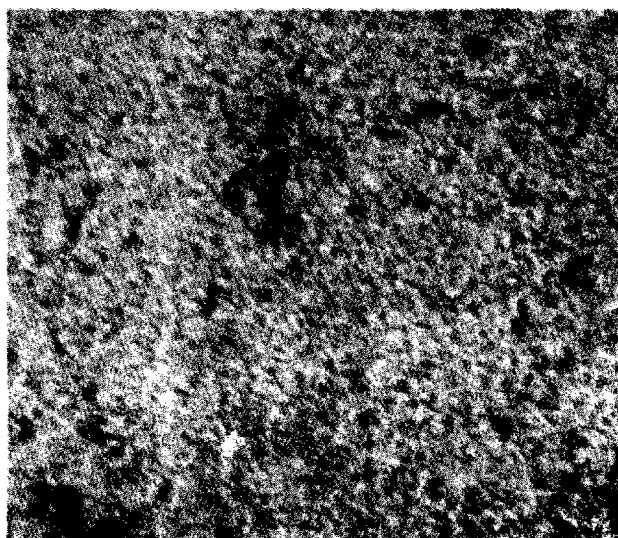


FIGURE A-3

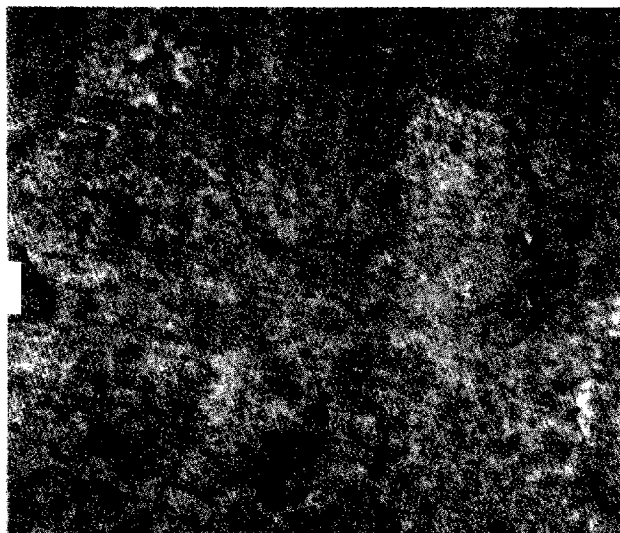


FIGURE B

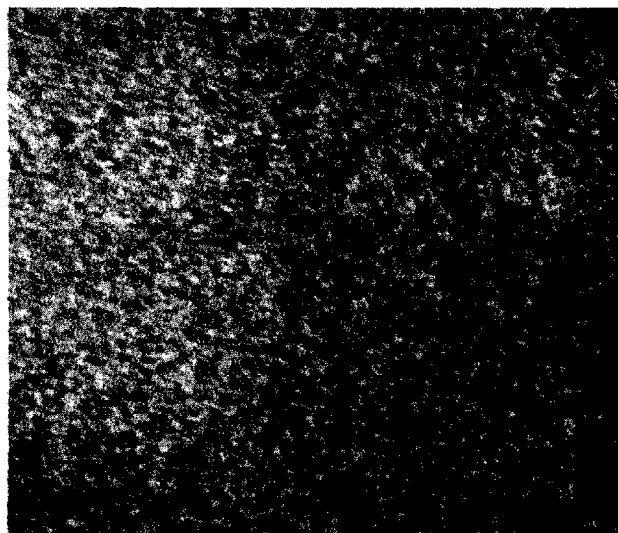


FIGURE B-3

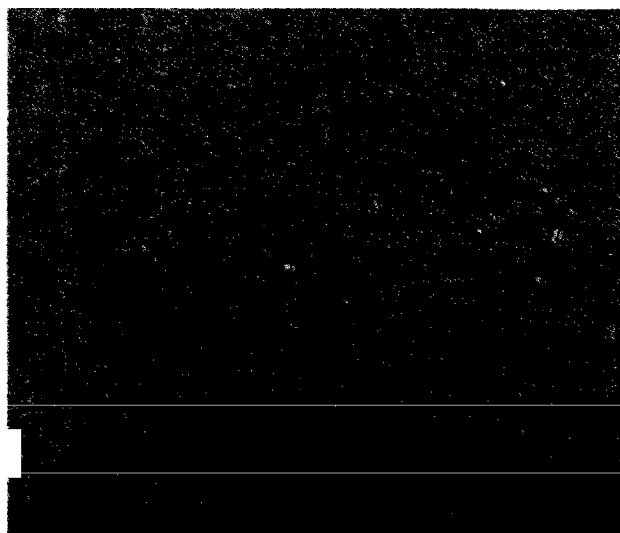


FIGURE C

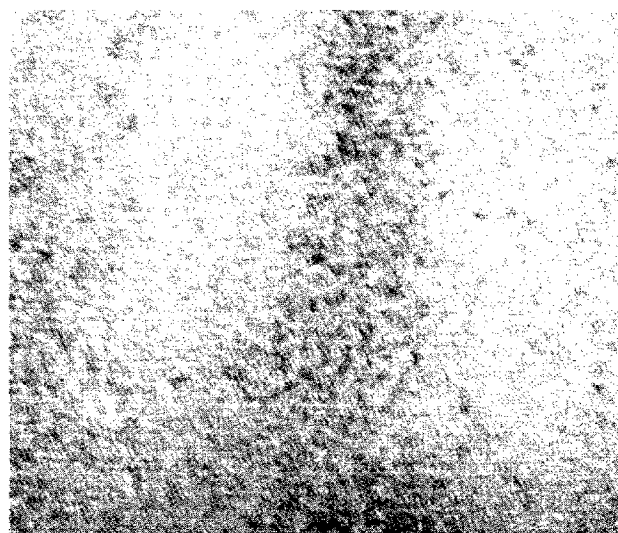


FIGURE C-3

6. Cleanliness Levels and Acceptance Criteria for Cleaned Fabricated Piping

6.1 General Comments

The cleanliness and appearance of the prepared surface will depend upon the operating procedure, the equipment and the abrasive used, and the starting condition of the surface to be cleaned. Color is not a criteria of cleanliness. For example, blast cleaned surfaces using sand may appear very white, while a blast cleaned surface using a dark abrasive such as crushed slag may have a dark appearance. The inspector must take all of the above factors into account when a "white" or "near-white" condition has been specified. For example, the attached photographs identified as:

- A, B and C, represent starting conditions of:
- A – a rough, heavy mill scaled, slightly weathered surface.
- B – a rough, heavy mill scaled, heavily weathered surface.
- C – a smooth, light mill scaled, medium weathered surface.

The photos A3, B3 and C3 are typically representative of Level 3 surfaces that would be obtained from the illustrated starting conditions.

6.2 Surface Finish Levels

6.2.1 Level No. 1 – White Metal Surface Finish
This end condition constitutes the best possible surface that can be produced by blasting. The surface when viewed without magnification, on completion of blasting will be free of visible mill scale, rust, oxides, paints, or other foreign matter. The surface will appear as a uniform grayish, metallic white immediately after blasting, but may discolor after cleaning due to atmospheric conditions. When the inside of a piping assembly is being cleaned, this level of cleanliness cannot be expected to exist uniformly throughout the entire pipe inside surface unless the surface can be visually observed by the blasting operator while blasting.

6.2.2 Level 2 – Near-White Metal Surface Finish

Blast cleaning to this cleanliness level is recommended where a high degree of cleaning is required. It will remove practically all rust, mill scale, and other detrimental foreign material. The surface will not necessarily be completely uni-

form in color nor uniformly cleaned. Most of the surface area shall be free of all visible residues and the remainder limited to light discolorations.

6.2.3 Level 3 – Commercial Surface Finish

This includes the removal of all rust scale, paint, loose mill scale, and most of the tight mill scale. It does not necessarily include the removal of all tightly adherent mill scale, fine traces of rust, stains, or discoloration. The commercial blast finish may have a streaky appearance. See photos A3, B3 and C3.

6.2.4 Level 4 – Brush-Off Surface Finish

Brush-off blast finish permits tight mill scale, paint, and minor amounts of rust and other foreign material to remain on the surface. The surfaces should be free of loose mill scale and loose rust.

7. Inspection of Cleaned Surfaces

- 7.1 Inspection shall consist of direct visual examination of the surface, under normal lighting, without optical aids.
- 7.2 The inspection should be performed as soon as possible after the blast cleaning is completed.
- 7.3 Due to atmospheric conditions, freshly blast cleaned surfaces are subject to the formation of a powdery surface film of rust known as a "rust bloom." Such a condition is considered acceptable.

8. Safety Precautions and Disposal of Used Abrasives.

- 8.1 Normal safe shop operations and good house-keeping practices should be followed to reduce airbourne dust. Proper hand and eye protection precautions should be followed when handling and using abrasive materials:
 - 8.1.1 Control measures should be utilized that are effective in maintaining airbourne dust concentrations. Where this is not feasible, N.I.O.S.H. approved air supplied equipment should be worn by employees, especially when blast cleaning is being performed in an enclosed area and/or when the surface being cleaned could produce a potentially hazardous material.
 - 8.1.2 Abrasives should be supplied with O. S. H. A. "Material Safety Data Sheets" or facsimile.
- 8.2 Federal, State, and Local Regulations for disposal of spent abrasives should be followed.

A current index of the latest revised ES Standards and Technical Bulletins is available from the Pipe Fabrication Institute.

PFI Standards and Technical Bulletins are published to serve proven needs of the pipe fabricating industry at the design level and in actual shop operations. Hence, such needs are continually considered and reviewed by the Engineering Committee of the Pipe Fabrication Institute to provide recommended procedures which have been demonstrated by collective experiences to fulfill requirements in a manner for Code compliance. However, as the PFI Standards are for minimum requirements the designer or fabricator always has the option of specifying supplementary conditions in the form of requirements beyond the scope of the PFI publications.