

Cleaning of Fabricated Piping

Prepared by
Pipe Fabrication Institute Engineering Committee



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PFI Standard ES-5
(Revised 1993)

CLEANING OF FABRICATED PIPING

1.0 Scope

This standard describes cleaning methods normally used to clean fabricated pipe assemblies, the limitations of the methods and results to be expected. Acceptance Criteria for various levels of cleanliness shall be a matter of prior agreement between the fabricator and purchaser.

2.0 Selection of Cleaning Method

2.1 General

The need for and degree of cleanliness on fabricated piping assemblies are dictated by the system requirements, the degree to which the system can be cleaned after installation and the need for removal of contaminants picked up during fabrication.

2.2 Size and Configuration of Assembly

In selecting a method of cleaning, the size and configuration of the part or assembly must be considered to permit visual examination of the interior and to allow complete drainage or removal of the cleaning materials.

3.0 Standard Cleaning

Unless otherwise specified by the customer, cleaning will consist of removing all non-adhering material such as loose scale, sand, weld spatter particles, rust, cutting chips, etc., from the inside of the piping assembly by any suitable means.

4.0 Special Cleaning

4.1 General

When a greater degree of cleanliness is required, either the cleaning process or the acceptance criteria should be outlined in the purchaser's design specifications.

In all cases, the method of cleaning and the acceptance standard will be a matter of agreement between the purchaser and fabricator.

4.2 Special Methods—Ferritic Materials

4.2.1 Rotary Tools

Rotary type (turbining) tools will substantially remove most loosely adhering mill scale and a significant portion of very heavy rust. They will not remove tight mill scale, heat treatment scale, medium to fine rust or any pitting.

This type of cleaning is limited to internal surfaces only.

4.2.2 Wire Brushing

Steel wire brushing will remove medium to light rust, but will not remove tight mill or heat treatment scale. It is limited to readily accessible surfaces only.

4.2.3 Grinding

Grinding will remove rust, tight scale, pits, etc. from readily accessible surfaces only. Appropriate care must be taken to avoid grinding below the minimum allowable wall thickness.

4.2.4 Blasting

The most common method for removal of tight mill or heat treatment scale is blasting with sand, steel shot, or grit. This is most effective in producing a bare metal surface. Both internal and external surfaces may be cleaned by this method, but proper cleaning of piping internals is limited by accessibility to blasting equipment. Care should be taken in establishing configuration of fabricated piping assemblies which require internal blasting after fabrication so that all internal surfaces will be accessible to blasting equipment. See PFI Standard ES29 for a more thorough explanation of this cleaning method.

4.2.5 Pickling

For pipe sizes requiring internal cleanliness substantially equal to bare metal, pickling is an effective overall method of removing scale, rust, etc. However this method limits the configuration of fabricated piping assemblies to the tank size available and the ability to get acid flow to internal surfaces.

4.3 Special Methods—Austenitic Materials

4.3.1 Degreasing

Generally stainless steel materials which have not been subject to heat for forming or bending require only a degreasing operation. This may be accomplished by immersion in, or wiping with, a clean cloth saturated with a suitable solvent, or by steam degreasing as described in 4.3.4. below

4.3.2 Pickling and Passivating

For stainless steels which have been heated for forming or bending and subsequently given a solution heat treatment, or for solution heat treated materials which exhibit a rusted appearance due to some type of contact with ferritic materials, the most effective cleaning is a pickling and passivation. See ASTM A380 for recommended cleaning solutions. However this method limits the configuration of fabricated piping assemblies to the tank size available and the ability to get acid flow to internal surfaces.

4.3.3 Blasting

Scale or discoloration produced as a result of heating for bending or solution heat treatment may also be effectively removed by blasting with iron-free silica sand or new aluminum-oxide grit. (Reclaimed sand or grit usually contains scale particles which will result in a rusted surface on exposure to water and is therefore not recommended.)

If localized rusting appears after blasting, the assembly may be passivated by swabbing with a solution of nitric acid at room temperature until the free iron is removed. Follow with a water rinse.

4.3.4 Steam Degreasing and Rinse

Certain nuclear systems involving high level radioactive service may require not only scale removal, but removal of contaminants, particularly halogens and sulfur, both internally and externally.

An effective means of accomplishing this objective is a combination of steam-detergent wash followed by a rinse with demineralized water.

This is performed as follows:

All surfaces of all assemblies will be steam cleaned using spray nozzles and chemical additives such as tri-sodium phosphate with detergent. Nozzles will be passed along the pipe centerline throughout its entire length to the maximum extent practical.

Demineralized water used in preparing the chemical solution for steam cleaning as well as for rinsing shall have a conductivity of not more than 20.0 Micromhos/cm and a pH range between 6.0 and 8.0 or as agreed between the purchaser and fabricator.

Internal and external surfaces of pipe spools will then be spray rinsed with cold demineralized water without chemical additives. Rinsing will be done using a spray nozzle to thoroughly flush internal surfaces of the pipe until complete cleanliness to the specified acceptance standard is attained. After rinsing, spools will be tilted to insure complete drainage and left to "drip-dry."

5.0 Acceptance Criteria

5.1 Visual

In all cases assemblies will be visually inspected to assure that the required degree of cleanliness has been attained.

NOTE: Thin films of rust on stainless steels should not be a cause for rejection provided there is no visible evidence of corrosion pitting.

5.2 Testing of Water Rinse

For certain nuclear application the pipe assembly will be internally rinsed with water until the required acceptance level is attained.

Acceptance may be based on:

1. pH range of effluent.
2. Conductivity of effluent.
3. Particle number and size in filter cloths.

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