PIP RFTA1000
Refractory Anchor and Accessory Installation Qualification, Inspection, and Testing
PURPOSE AND USE OF PROCESS INDUSTRY PRACTICES

In an effort to minimize the cost of process industry facilities, this Practice has been prepared from the technical requirements in the existing standards of major industrial users, contractors, or standards organizations. By harmonizing these technical requirements into a single set of Practices, administrative, application, and engineering costs to both the purchaser and the manufacturer should be reduced. While this Practice is expected to incorporate the majority of requirements of most users, individual applications may involve requirements that will be appended to and take precedence over this Practice. Determinations concerning fitness for purpose and particular matters or application of the Practice to particular project or engineering situations should not be made solely on information contained in these materials. The use of trade names from time to time should not be viewed as an expression of preference but rather recognized as normal usage in the trade. Other brands having the same specifications are equally correct and may be substituted for those named. All Practices or guidelines are intended to be consistent with applicable laws and regulations including OSHA requirements. To the extent these Practices or guidelines should conflict with OSHA or other applicable laws or regulations, such laws or regulations must be followed. Consult an appropriate professional before applying or acting on any material contained in or suggested by the Practice.

This Practice is subject to revision at any time.

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PUBLISHING HISTORY
November 2009  Issued
January 2017  Reaffirmation w/Editorial Revision
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Data Form
RFTA 1000-F - Inspection Hold Point and Sign-Off Schedule
1. **Scope**

This Practice provides requirements for quality control and quality assurance for the installation of refractory anchors and accessories including the requirements for inspection and testing of anchors and accessory materials, in-progress installation inspection, surface preparation, welding qualification, weld repair, and final inspection.

2. **References**

Applicable parts of the following Practices and industry codes and standards shall be considered an integral part of this Practice. The edition in effect on the date of contract award shall be used, except as otherwise noted. Short titles will be used herein when appropriate.

2.1 **Process Industry Practices (PIP)**
- PIP CTSL1000 - Application of Internal Linings
- PIP RFIA1000 - Refractory Anchor and Accessory Installation Details
- PIP RFSA1000 - Refractory Anchor and Accessory Specification

2.2 **Industry Codes and Standards**
- American Petroleum Institute (API)
  - API Standard 936 - Refractory Installation Quality Control - Inspection and Testing Monolithic Refractory Linings and Materials
- American Society of Mechanical Engineers (ASME)
  - ASME Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators
- ASTM International (ASTM)
  - ASTM C 71 - Standard Terminology Relating to Refractories
- American Welding Society (AWS)
  - AWS D1.1 - Structural Welding Code – Steel
  - AWS D1.6 - Structural Welding Code – Stainless Steel

3. **Definitions**

With the exception of the terms listed in this section, terms used in this Practice are defined in accordance with API Standard 936 and ASTM C 71. If a definition as used in this Practice differs from the one listed in the referenced documents, the modified definition is included in the following listing:

- **installer**: Party responsible for installing the refractory anchors and accessories
- **installer’s inspector**: Installer’s authorized representative, responsible for the quality control of all materials, installations, and workmanship furnished by the installers, and any of the installer’s subcontractors or vendors
- **owner**: Party who owns the facility wherein the refractory lined equipment will be used
**purchaser:** Party who awards the contract to the installer. The purchaser may be the owner or the owner’s authorized agent.

**purchaser’s inspector:** Purchaser’s authorized representative with authority to act in the interest of, and on behalf of, the purchaser in all quality assurance matters

**welding qualification:** Incorporates welding procedure specifications (WPS), procedure qualification records (PQR), and welder performance qualifications (WPQ)

## 4. Requirements

### 4.1 General

#### 4.1.1 Conflicts, Exceptions, Deviations, and Substitutions

4.1.1.1 All conflicts between the referenced documents and this Practice shall be submitted in writing to purchaser for clarification and resolution before proceeding.

4.1.1.2 All exceptions, deviations, and substitutions to the requirements specified herein and in referenced documents shall be approved by the purchaser.

#### 4.1.2 Regulations and Safety Data Sheets (SDS)

4.1.2.1 Refractory anchors, accessories, welding materials, and welding shall be in accordance with all applicable federal, state, and local codes and regulations on storage, handling, safety, and environmental requirements.

4.1.2.2 The latest issue of the refractory anchor, accessory, and welding material manufacturer’s SDS shall be available at the installation site and complied with during the installation of refractory anchors.

#### 4.1.3 Documentation

4.1.3.1 Refractory anchor, accessory, and welding material manufacturer’s product data sheets and the approved installation procedure in accordance with PIP RFIA1000 shall be provided for each installation site and complied with during the installation of the refractory anchors.

4.1.3.2 Welding procedure specifications (WPS) and procedure qualification records (PQR) shall be reviewed and approved by purchaser before welding commences.

#### 4.1.4 Notification

Purchaser’s inspector(s) shall be given adequate notice (e.g., time and location) before the start of all work and prior to all hold points, so that the inspector(s) can witness the work.

### 4.2 Confirmation of Materials

4.2.1 Purchaser’s inspector shall confirm that refractory lining anchors and accessories are in accordance with the contract documents and PIP RFSA1000. Items to be confirmed shall include material, style, geometry and dimensions of anchors and
accessories, welding consumables, and auxiliary components (e.g., anchor tip caps/coating).

4.2.2 Purchaser’s inspector shall confirm that anchors and accessories are not damaged.

4.2.3 Purchaser’s inspector shall confirm that positive material identification has been performed and all items are appropriately marked.

4.3 Surface Preparation

4.3.1 Surface preparation for the installation of refractory anchors and accessories shall be in accordance with PIP RFIA1000.

4.3.2 Surface preparation for the application of coatings in conjunction with installation of anchors and accessories shall be in accordance with PIP CTSL1000.

4.4 Welding Qualification

4.4.1 Qualification of pressure welding shall be in accordance with ASME Section IX and the requirements of Section 4.4.3 of this Practice.

Comment: Pressure welds are those welds which attach anchors, supports, or tiebacks to pressure containing piping, equipment and internals.

4.4.2 Qualification of non-pressure welding shall be in accordance with AWS D1.1 and D1.6, and the requirements of Section 4.4.3 of this Practice.

Comment: Non-pressure welds are those welds which attach anchors, supports, or tiebacks to non-pressure containing equipment (e.g., heaters, stack and ducts).

4.4.3 Before installing anchors and/or accessories it shall be demonstrated that the welders are capable of meeting the specified quality standards. The demonstration shall be as follows:

a. Demonstration shall include anchors, accessories, equipment, welding procedure specifications (WPS), and welders to be utilized for the installation work.

b. The demonstration shall be performed by simulating the installation work (e.g., welding position and anchor spacing).

c. Inspecting, sampling, and testing of the welds shall be in accordance with this Practice.

d. The purchaser’s inspector shall witness the demonstration, sampling, and testing.

e. The acceptance/rejection criteria shall be in accordance with Sections 4.5.3 through 4.5.5 of this Practice except that at least one anchor shall be bend tested.

4.4.4 The installation of the anchors and accessories shall not be started until welder qualification tests have been completed and approved by the purchaser.

4.4.5 The scheduling of welders for qualification testing shall be done in a manner that shall not interfere with the project installation schedule.
4.5 Installation Inspection and Testing

4.5.1 General

4.5.1.1 Installation of anchors, supports, and tiebacks shall be performed in accordance with PIP RFIA1000.

4.5.1.2 In-progress inspection shall provide confirmation that anchors, accessories and weld consumable metallurgy, anchor style and layout, weld procedure, and welding details are in accordance with the contract documents.

Comment: “In-progress” refers to continuous monitoring at regular intervals throughout the duration of the work.

4.5.1.3 Confirm that anchor and accessory welding has been completed before post-weld heat treatment and coating applications where applicable.

4.5.2 Hold Points

4.5.2.1 Inspection hold points shall be in accordance with purchaser’s PIP RFIA1000-F Inspection Hold Point and Sign-Off Schedule.

4.5.2.2 Work shall not progress until all parties listed on purchaser’s PIP RFIA1000-F have signed off at each hold point in the order as shown on the form.

4.5.3 Visual Inspection

4.5.3.1 Inspect hexagonal mesh after roll forming and before welding to ensure that the separation between strips does not exceed 0.8 mm (1/32 inch) on the surface exposed to the process.

4.5.3.2 Welded anchors and accessories shall be 100% visually examined to confirm that the anchors and accessories have been welded in accordance with the specified layout, style, size, location, and extent of weld metal.

4.5.3.3 Confirm that weld defects (e.g., undercutting, cracks, lack of fusion) or anchor damage has not occurred during welding.

4.5.4 Hammer Testing

4.5.4.1 Except for continuous anchorage (e.g., hexmesh and flexmesh) and studs, 100% of welded anchors shall be hammer tested by striking with a small hammer and listening to the chime/sound produced. A consistent ring occurs if an anchor has been properly welded.

4.5.4.2 Hammer testing shall be performed in a manner that cannot damage the anchor system components.

4.5.4.3 Tined anchors which do not ring properly when hammer tested shall be checked by bend testing.

4.5.5 Bend Testing of Individually Welded Anchors

4.5.5.1 Tines shall be bent from the normal position to the shell surface and back to the normal position. The bend shall take place at the root of the tine.
4.5.5.2 Anchor studs shall be bent 30 degrees from the casing and then straightened back to the normal position. The bend shall take place at the weld.

4.5.5.3 Any cracking in the weld or pulling from the shell or anchor base shall constitute failure of a bend test.

4.5.5.4 Bend testing shall be conducted daily for all of the following circumstances:
   a. For each welder.
   b. For each weld procedure.
   c. Random 5% of all anchors installed shall be bend tested for each welder and each weld procedure.
   d. Failure of an anchor during bend testing shall require all anchors welded in the same area by the same welder on the same day to be bend tested.
   e. Anchors that do not ring properly when hammer tested shall not count as part of the random 5 percent bend tested.

4.6 **Weld Repairs**

4.6.1 Attachment welds of individual anchors that do not pass inspection shall be removed and replaced. Welds of continuous anchors may be repaired by grinding and re-welding.

4.6.2 The base metal surface shall be ground to remove residual weld metal. For welds to pressure boundaries, consider liquid penetrant or magnetic particle testing.

4.6.3 Surface preparation shall be in accordance with *PIP RFIA1000*.

4.6.4 Repairs shall be performed in accordance with *PIP RFIA1000* and re-inspected in accordance with this Practice.
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COMMENTS: 

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PURCHASER'S INSPECTOR SIGNATURE: (PRINTED)