Engineering Standard

SAES-N-140 30 November 2004

Installation Requirements
- Refractory Ceramic Fiber

Saudi Aramco DeskTop Standards

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1 Scope

1.1 This standard covers the minimum mandatory requirements for the installation, testing, and inspection of refractory ceramic fiber (RCF) systems for boilers and process heaters.

1.2 For equipment and refractory system not covered by this Standard, the Saudi Aramco Engineer is to be contacted for guidance in determining the extent to which this Standard is applicable.

1.3 This entire standard may be attached to and made a part of purchase orders.

1.4 This standard covers the installation of new RCF systems and the repair of existing RCF systems.

2 Conflicts and Deviations

2.1 Any conflicts between this standard and other applicable Saudi Aramco Engineering Standards (SAESs), Materials System Specifications (SAMSSs), Standard Drawings (SASDs), or industry standards, codes, and forms shall be resolved in writing by the Company or Buyer Representative through the Manager, Consulting Services Department of Saudi Aramco, Dhahran.

2.2 Direct all requests to deviate from this standard in writing to the Company or Buyer Representative, who shall follow internal company procedure SAEP-302 and forward such requests to the Manager, Consulting Services Department of Saudi Aramco, Dhahran.

3 References

The selection of material and equipment, and the design, construction, maintenance, and repair of equipment and facilities covered by this standard shall comply with the latest edition of the references listed below, unless otherwise noted.

3.1 Saudi Aramco References

Saudi Aramco Engineering Procedure

SAEP-302	*Instructions for Obtaining a Waiver of a Mandatory Saudi Aramco Engineering Requirement*

Saudi Aramco Engineering Standards

SAES-N-100	*Refractory Systems*
SAES-W-010	*Welding Requirements for Pressure Vessels*

Saudi Aramco Standard Drawings

AB-036395	*Installation Details of Refractory Ceramic Fiber Modules*
AB-036400	*Installation Details of Refractory Ceramic Fiber Layered Blanket and Blanket/Boards*

Commentary Note:

The Saudi Aramco Drawings listed above and referenced in this standard shall be used for the generation of detailed refractory system drawings, specific for each application.

Saudi Aramco Inspection Requirements

Form 175-328120	*Refractories: Ceramic Fiber System (RCF) for Boilers and Process Heaters*

3.2 Industry Codes and Standards

American Society of Mechanical Engineers

ASME SEC IX	*Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators*

Steel Structures Painting Council

SSPC SP 1	*Solvent Washing*
SSPC SP 3	*Power Tool Cleaned*
SSPC SP 7	*Brush Blasting*

4 Definitions

Anchors: The hardware that holds RCF modules and blankets in place.

Equipment Manufacturer: The company that is responsible for the fabrication of process heaters, boilers, and flare tips to which refractory is installed.

MSDS: Material Safety Data Sheets for refractory material, supplied by the RCF Manufacturer.

Parquet Installation: An installation method for RCF modules where the layers are oriented uni-directionally.

Refractory Installer: The company that is responsible for the installation of refractory systems.

Refractory Ceramic Fibers (RCF): Fibers made from melting alumina/silicate in an electric furnace.

Refractory Inspector: The person or company that is authorized by Saudi Aramco to inspect refractory installations to the requirements of this standard.

RCF Manufacturer: The company that manufactures RCF products from raw materials and designs RCF systems.

RCF Modules: Modules made from RCF material, including boards, blankets and straps.

Refractory System: A lining system that is designed to resist high temperatures, hot gases, and the action of erosive materials. Components include anchors, reinforcement, vapor barriers, and refractory materials needed for complete installation.

Saudi Aramco Engineer: The Supervisor of the Piping and Valves Unit, Consulting Services Department, Dhahran.

Soldier Installation: An installation method for RCF modules where the layers are oriented perpendicular to each module.

Vapor Barrier: A high-temperature coating that is applied to the shell of equipment to protect the steel from condensing corrosive gases. For RCF, the vapor barrier consists of a metal foil imbedded in RCF and high temperature coating on the shell.

Veneering: The application of RCF materials over existing castable or brick linings.

5 Responsibilities

5.1 The Refractory Installer is responsible for installing refractory systems in accordance with requirements of this standard, and of the specific requirements of the RCF Manufacturer and the Equipment Manufacturer.

5.2 The Refractory Installer is also responsible for preparing a complete installation procedure in accordance with the requirements of the RCF Manufacturer, the Equipment Manufacturer, and this standard. The installation procedure is to be approved by the Saudi Aramco Engineer prior to installation.

5.3 The RCF Manufacturer is responsible for supplying all materials, installation drawings, and installation instructions for the complete installation of RCF modules.

5.4 The Equipment Manufacturer is responsible for preparing fully detailed engineering drawings of the refractory system. As a minimum, the drawings

shall include anchorage design including spacing and orientation, refractory thicknesses, all materials, surface preparation, and welding details.

6 Welding

6.1 General

6.1.1 Refractory anchor welding shall be in accordance with the requirements of ASME SEC IX, QW-190, for fillet welds or QW-192 for stud welding, as appropriate, and with the relevant welding standard for the application, if applicable.

6.1.2 Refractory anchors, stud supports, and vapor stops for the support of RCF modules shall be made only with the shielded metal arc (SMAW), or gas tungsten arc (GTAW) welding processes, and shall be welded all around. For anchors, stud welding is an acceptable alternative.

6.1.3 The Refractory Installer shall submit Welding Procedure Specifications and Performance Qualification Records to the Refractory Inspector for review and approval prior to welding.

6.1.4 The Refractory Installer shall prepare and have available the detailed anchor welding procedure(s) that is to be used. This procedure(s) shall include results of the procedure qualification tests.

6.1.5 For anchors welded by SMAW or GTAW, the procedure qualification test shall include tension tests to failure on three anchors that have been welded according to the procedure and on materials that will be used for production welds. One welded anchor shall be bent through 90° and shall show no evidence of failure in the weld.

6.2 Welding Details

6.2.1 Refractory anchorage, including anchors, studs, supports, edging bars, and similar items shall not be welded within 50 mm of circumferential and longitudinal seams of pressure vessels and piping.

6.2.2 If equipment is to be post weld heat treated, all anchors are to be welded prior to heat treatment.

6.2.3 Anchors shall be welded in accordance with AB-036395 and AB-036400.

7 Storage and Handling

7.1 Prior to placement, RCF modules shall be protected from water and moisture.

7.2 Materials shall be stored off the ground and shall be covered with tarps to protect against water or moisture damage.

7.3 Containers must be protected from mechanical damage, tears, rips, and other types of damage.

7.4 The RCF Manufacturer's precautions, as specified on the MSDS sheets, must be strictly followed.

8 Surface Preparation

8.1 All surfaces shall be clean, dry, and free from oil, grease, weld slag, and mill scale prior to installation of refractory.

8.2 Shells and casings of equipment to be lined shall be solvent cleaned in accordance with SSPC SP 1 and be rust free.

8.3 For shells and casings that were previously coated or that are rusty shall be brush-blasted in accordance with SSPC SP 7 or power-tool cleaned in accordance with SSPC SP 3.

9 Installation

9.1 General

9.1.1 Modular Construction

Modular construction shall comply with the following:

(1) Modules shall be installed using the uni-directional with batten strip (or "soldier") method.

(2) Batten strips shall be single folded for service temperatures up to 1090°C and shall be double folded for service temperatures above 1090°C.

(3) RCF Modules shall be installed in accordance with the RCF Manufacturer's installation drawings and AB-036395.

(4) RCF modules around doors shall be oriented such that the outside modules are perpendicular to the door frame.

(5) Joints between RCF modules and castable refractory shall be packed with a folded batten strip and shall be sealed with mortar.

9.1.2 Layered Blankets and Blanket Board Construction

Layered Blankets and Blanket Board shall comply with the following:

(1) The lap joint method shall be used for the installation of blankets.

(2) The butt joint method shall be used for the installation of blanket boards.

(3) Blankets and blanket boards shall be installed in accordance with the RCF Manufacturer's installation drawings and AB-036400.

9.2 Anchor Materials

The materials for anchors shall be in accordance with AB-036395 and AB-036400.

9.3 Anchor Layout

The layout of anchors shall be in accordance with the RCF Manufacturer's detailed drawings.

9.4 Installation of Vapor Barrier

9.4.1 The Manufacturer's instructions must be followed for the application of the vapor barrier.

9.4.2 The vapor barrier shall be sprayed or brush applied to a dry film thickness of 0.063-0.125 in and shall be rated for a temperature of 175°C.

9.4.3 The refractory material shall be installed as soon as the vapor barrier is dry to the touch.

9.4.4 Additional metal vapor barrier (type 304 stainless steel) shall be provided when fuel sulfur content exceeds 500 ppm. The metal vapor barrier shall be located at a calculated temperature 56°C above the calculated acid dew point for all operating conditions.

9.4.5 Metal vapor barrier shall be overlapped, and edges and punctures shall be sealed.

9.5 Veneering with RCF

9.5.1 Only the parquet method of installation shall be used for veneering.

9.5.2 The installation of RCF veneering over brick or castable refractory shall be in accordance with the RCF Manufacturer's instructions and with AB-036395.

9.6 RCF System Limitations

9.6.1 RCF system shall not be used when velocities exceed limits in table 1 of SAES-N-100.

9.6.2 RCF system shall not be used in convection section where sootblowers, steam lances or water wash facilities are initially provided.

9.6.3 RCF system shall not be used when heavy metal fuel content exceeds 100 ppm.

10 Inspection and Repairs

10.1 General

10.1.1 All inspection shall be carried out in accordance with Form 175-328120 and the requirements of this standard.

10.1.2 Any refractory that is found to be defective due to construction damage shall be totally removed to the full thickness of the layer and shall be relined to comply with this standard and to meet the satisfaction of the Refractory Inspector.

10.1.3 The method of repair shall be in accordance with the original installation procedure.

10.1.4 Where needed, additional refractory anchors shall be installed.

10.2 Inspection of Anchors and Supports

10.2.1 A minimum of three trial anchors are to be welded on the same material composition and thickness that is used on the heater shell material.

10.2.2 These trial anchors shall be hit with a hammer, shall be bent a minimum of 15° from vertical, and shall be then straightened back to vertical. If there are no visual signs of cracking, the production welding can begin.

10.2.3 Production welding shall use the same welding parameters that were used during the trial. A maximum of 1% but not less than three welds of the production welds shall be inspected as specified in paragraph 10.2.2 at random locations.

10.3 Repairs

10.3.1 The method of repair shall be in accordance with the original installation procedure.

10.3.2 Where needed, additional anchors shall be installed.

10.4 Checklist for RCF Refractory Installation

The following is a checklist of activities that shall be used by the Refractory Installer for the installation of RCF refractory.

Revision Summary

30 November 2004	Revised the "Next Planned Update". Reaffirmed the contents of the document and reissued with no other changes.

Checklist for RCF Refractory Installation

Materials

( ) Verify the types of materials supplied, data sheets and mixing instructions.
( ) Verify availability of MSDS sheets.

Documents

( ) Verify approved detail assembly drawings.

Inspection

( ) Inspect surface preparation.
( ) Inspect anchor layout and welding.
( ) Review welding procedures.

Weather Protection

( ) Verify that materials are properly stored.
( ) Verify that equipment to be lined is prepared for inclement weather conditions.

Condition

( ) Ambient.
( ) Weather protection.

Surface Preparation and Anchorage.

( ) Surface preparation meets spec.
( ) Welding procedures.
( ) Anchor welds. Bend tests, cracks.
( ) Squaring of old refractory.
( ) Anchor layout.
( ) Hammer testing.
( ) Weld rod alloy.