DEP SPECIFICATION

SPECIFICATION AND QUALITY CONTROL FOR PRECAST OR SPECIALTY CAST REFRACTORY BAFFLE WALL TILE (SHAPES)

DEP 44.24.90.35-Gen.

February 2012

DESIGN AND ENGINEERING PRACTICE

© 2012 Shell Group of companies
All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, published or transmitted, in any form or by any means, without the prior written permission of the copyright owner or Shell Global Solutions International BV.

Documents
Document Sharing Hub

Full document details: SHELL 44.24.90.35 0

PREFACE

DEP (Design and Engineering Practice) publications reflect the views, at the time of publication, of Shell Global Solutions International B.V. (Shell GSI) and, in some cases, of other Shell Companies.

These views are based on the experience acquired during involvement with the design, construction, operation and maintenance of processing units and facilities. Where deemed appropriate DEPs are based on, or reference international, regional, national and industry standards.

The objective is to set the standard for good design and engineering practice to be applied by Shell companies in oil and gas production, oil refining, gas handling, gasification, chemical processing, or any other such facility, and thereby to help achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to Shell companies for their consideration and decision to implement. This is of particular importance where DEPs may not cover every requirement or diversity of condition at each locality. The system of DEPs is expected to be sufficiently flexible to allow individual Operating Units to adapt the information set forth in DEPs to their own environment and requirements.

When Contractors or Manufacturers/Suppliers use DEPs, they shall be solely responsible for such use, including the quality of their work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, the Principal will typically expect them to follow those design and engineering practices that will achieve at least the same level of integrity as reflected in the DEPs. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the Principal.

The right to obtain and to use DEPs is restricted, and is granted by Shell GSI (and in some cases by other Shell Companies) under a Service Agreement or a License Agreement. This right is granted primarily to Shell companies and other companies receiving technical advice and services from Shell GSI or another Shell Company. Consequently, three categories of users of DEPs can be distinguished:

1) Operating Units having a Service Agreement with Shell GSI or another Shell Company. The use of DEPs by these Operating Units is subject in all respects to the terms and conditions of the relevant Service Agreement.

2) Other parties who are authorised to use DEPs subject to appropriate contractual arrangements (whether as part of a Service Agreement or otherwise).

3) Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) or 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, Shell GSI disclaims any liability of whatsoever nature for any damage (including injury or death) suffered by any company or person whomsoever as a result of or in connection with the use, application or implementation of any DEP, combination of DEPs or any part thereof, even if it is wholly or partly caused by negligence on the part of Shell GSI or other Shell Company. The benefit of this disclaimer shall inure in all respects to Shell GSI and/or any Shell Company, or companies affiliated to these companies, that may issue DEPs or advise or require the use of DEPs.

Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, DEPs shall not, without the prior written consent of Shell GSI, be disclosed by users to any company or person whomsoever and the DEPs shall be used exclusively for the purpose for which they have been provided to the user. They shall be returned after use, including any copies which shall only be made by users with the express prior written consent of Shell GSI. The copyright of DEPs vests in Shell Group of companies. Users shall arrange for DEPs to be held in safe custody and Shell GSI may at any time require information satisfactory to them in order to ascertain how users implement this requirement.

All administrative queries should be directed to the DEP Administrator in Shell GSI.

Documents
Document Sharing Hub

Full document details: SHELL 44.24.90.35 0

TABLE OF CONTENTS

1. INTRODUCTION 4
1.1 SCOPE 4
1.2 ASSOCIATED DEPS 4
1.3 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS 4
1.4 DEFINITIONS 5
1.5 CROSS-REFERENCES 6
1.6 COMMENTS ON THIS DEP 6
1.7 DUAL UNITS 6

2. COMPLIANCE, SAMPLING AND TEST DOCUMENTATION 7
2.1 COMPLIANCE PROCEDURE 7
2.2 SAMPLING AND TESTING DOCUMENTATION 7

3. TESTING STANDARDS 8

4. SPECIFICATION OF BAFFLE WALL SHAPES 11
4.1 CLASSIFICATION OF BAFFLE WALL SHAPES 11
4.2 DIMENSIONAL REQUIREMENTS FOR BAFFLE WALL SHAPES 11

5. SAMPLING FOR QUALIFICATION TESTING OF BAFFLE WALL SHAPES 13

6. QUALIFICATION OF BAFFLE WALL TILES BASED ON PHYSICAL PROPERTIES AND MANUFACTURING DEFECTS 14
6.1 QUALIFICATION OF SHAPES BASED ON PHYSICAL PROPERTIES 14
6.2 QUALIFICATION OF BAFFLE WALL SHAPES BASED ON PHYSICAL CHARACTERISTICS OF MANUFACTURED DEFECTS 16
6.3 NON-CONFORMANCE CRITERIA FOR BAFFLE WALL SHAPES 19

7. SHIPPING 21

8. REFERENCES 22

APPENDICES

APPENDIX A MANUFACTURER/SUPPLIER PRODUCT COMPLIANCE DATA SHEET- BAFFLE WALL SHAPES 25

APPENDIX B MANUFACTURER MATERIAL TEST REPORT (MTR) – FOR BAFFLE WALL SHAPES 26

APPENDIX C INSTALLATION / SAMPLE / SPECIMEN RECORD 27

Documents
Document Sharing Hub

Full document details: SHELL 44.24.90.35 0

1. INTRODUCTION

1.1 SCOPE

This new DEP specifies requirements and gives recommendations for supply of baffle wall tiles. This DEP may be applied to other special shapes in non-standard sizes shapes outlined in DEP 44.24.90.33-Gen., DEP 44.24.90.34-Gen., or DEP 65.24.32.31-Gen. from conventional refractory "brick" manufacturing process.

This DEP covers various classifications of baffle wall tiles manufactured by "shop" practise of casting, ramming or pressing from unshaped materials and further processed by a complete cycle of curing, initial drying and firing and cooling as outlined herein.

This DEP does not cover any refractory mortar requirements for the assembly of baffle wall tiles. The Manufacturer/Supplier shall supply the Principal with full information about appropriate mortars to be used for assembly of refractory shapes as indicated in Figures 1 and 2.

For the purposes of this DEP and other related DEP's, all unshaped materials for the manufacture of baffle wall tiles shall have the general chemical classification of alumina–silica.

Requirements and recommendations for refractory unshaped materials are found in DEP 64.24.32.30-Gen., which should be read in conjunction with this DEP.

1.2 ASSOCIATED DEPS

This DEP may be used in conjunction with one or more of the following DEPs for refractory bricks and shapes.

DEP 44.24.90.31-Gen.	Refractory bricks and shapes
DEP 44.24.90.32-Gen.	Classification of refractory bricks and shapes
DEP 44.24.90.33-Gen.	Specification for sampling and testing of refractory bricks and shapes
DEP 44.24.90.34-Gen.	Classification specification and testing of ancillary materials for refractory brick construction
DEP 64.24.32.31-Gen.	Construction details for refractory brick construction

1.3 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorization to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to oil and gas production, gas handling, oil refining, chemical processing, gasification, distribution and supply/marketing. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall be implemented. This is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases, the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

Documents
Document Sharing Hub

Full document details: SHELL 44.24.90.35 0

1.4 DEFINITIONS

1.4.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Refractory Contractor** is the party that carries out all or part of the construction design, engineering, material procurement and installation of refractory materials. The Refractory Contractor has overall responsibly for the quality control of the products and services including those of any sub-contractors or Suppliers related to the installation.

The **Manufacturer/Supplier** is the party that manufactures or supplies materials, equipment and services to perform the duties specified by the Refractory Contractor. The Manufacturer may undertake all or part of the duties of the Refractory Contractor.

NOTE: For the purposes of this DEP, the Manufacturer/Supplier is the party that manufactures the refractory products and/or ancillaries for supply to the Refractory Contractor, Principal or another Supplier and has primary responsibility for material design properties, manufacturing quality control at the manufacturing site and specific procedures such as but not limited to those for product mixing, installation and start-up.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant, authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.4.2 Specific definitions

Term	Definition
Castable/ Plastic Batch	A castable/plastic batch is the mixed blend of raw materials to produce a finished castable. Each batch shall be assigned a unique code identifier number to enable its tracking.
Host Product	Unshaped material used to manufacture a shape.
Lot Sample Average	The lot sample average is the average of multiple individual physical property test results where more than one test is required from a batch or batch lot from precision cast, pressed or rammed, and or vibration cast unshaped material for use in any special shape.
Precision Cast Batch	A precision cast batch is the mixed raw materials to formulate a batch for specialized manufacture, such as injection casting, extruding or other method of precision casting. Each batch shall be assigned a unique code identifier number to enable its tracking.
Precision Cast Lot	A precision cast lot is a group of cast (or extruded) shapes, all manufactured from the same batch of materials mixture, manufactured under the same procedures and fired under the same furnace settings.
Pressed (Rammed) Shape Batch	A pressed (rammed) shape batch is the mixed blend of raw materials to produce a lot of pressed shapes in a mechanical press. Each batch shall be assigned a unique code identifier number to enable its tracking.
Pressed (Rammed) Shape Lot	A pressed (rammed) shape lot is a group of pressed shapes from the same batch of materials mixture, manufactured under the same procedures and fired under the same furnace settings. Each batch shall be assigned a unique code identifier number to enable its tracking.

Documents
Document Sharing Hub
Full document details: SHELL 44.24.90.35 0

Term	Definition
Vibration Cast Lot	A vibration cast lot is the number of pieces cast from the same castable batch with the proper mixing and placing instructions, fired under the same furnace settings, all provided by the material Manufacturer/Supplier.

1.5 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets ( ). Other documents referenced by this DEP are listed in (8).

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be sent to the Administrator at standards@shell.com, using the DEP Feedback Form. The DEP Feedback Form can be found on the main page of "DEPs on the Web", available through the Global Technical Standards web portal http://sww.shell.com/standards and on the main page of the DEPs DVD-ROM.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

Documents
Document Sharing Hub

Full document details: SHELL 44.24.90.35 0

2. COMPLIANCE, SAMPLING AND TEST DOCUMENTATION

2.1 COMPLIANCE PROCEDURE

Prior to shipment of shapes, the Manufacturer/Supplier, shall guarantee, test, and report results for specified physical properties and provide for inspection testing and documentation verifying all shapes meet physical property and manufacturing workmanship requirements for shipment in accordance with the "compliance" procedure outlined in this DEP.

Where no practical opportunity exists for the following "compliance" procedure for material acceptance, the Manufacturer/Supplier's data from normal "in house" quality procedures may be used for shape qualification where each of the following criterion has been met:

a) The Manufacturer/Supplier manufacturing and test facility has successfully been audited by the Principal or designate.

b) The Manufacturer/Supplier quality documentation on product physical properties and manufacturing defects is suitable to evaluate a minimum of 1 year's performance of specified brand equalling a minimum of 4 times the anticipated quantity of project specific shape requirements.

c) The specific physical property or characteristic (cracks or flaws) tested falls within a 95% compliance level from normal statistical evaluation of 2-sigma limit.

d) The specific brand and shape definition has been used in similar applications with documented results or has been pre-approved by the Principal.

2.2 SAMPLING AND TESTING DOCUMENTATION

Sample and test documentation shall include:

a) Manufacturer/Supplier **product property data sheet (TDS)** (with bid documentation).

Normal as published technical data sheet for host unshaped material.

b) **Manufacturer/Supplier product compliance data sheet** (Appendix A) (with bid documentation).

This data sheet shall provide guaranteed values for "as specified" physical properties and compares guaranteed results to normally published data.

The data sheet shall include the Manufacturer/Supplier's regular technical data as illustrated on published regular technical data sheets (TDS) and the Manufacturer/Supplier's guarantee for selected physical properties and manufactured defects. The compliance data sheet shall also include appropriate identification and traceability information

c) **Manufacturer/Supplier material test report** (MTR) (Appendix B) (after receipt of order).

The MTR shall document test results against compliance specification for each physical property tested and results from physical inspection for manufacturing defects.

d) Additional documentation (after receipt of order)

- **Material safety data sheets** (MSDSs) updated and in compliance with local regulations (host material and finished shape if different and where applicable);
- Initial firing temperatures;
- Test or sample procedures for different tests or procedures used in the Manufacturer/Supplier's laboratory not listed in this or project specification;

Documents
Document Sharing Hub

Full document details: SHELL 44.24.90.35 0

- If required, full information about appropriate mortars to be used with the refractory shapes.
- Detailed drawing showing all dimensions, material specification and tolerances (if different than outlined herein) for shapes other than Baffle wall tiles

For lots greater than 200 pieces, or where each piece must fit another with mating dimensions to fill an equally dimensioned shape or configuration, the Manufacturer/Supplier shall provide frequency distribution in both chart and graph form for all dimensions for fired shapes tested.

- As a minimum, this information shall include all identification information, all critical dimensions, allowable tolerance, for each dimension and mean and standard deviation calculations for each dimension.
- The graph shall show frequency against dimension for entire allowable specification range and frequency of each measurement within the specification.

Detail drawings illustrating all dimensional fit and warpage, tolerance, mortar specification (if required), assembly details, material specification, anchoring requirements (if any), firing specifications, fired weight and packaging details for approval by Principal.

3. TESTING STANDARDS

Unless otherwise specified, or agreed, physical properties for acceptance of baffle wall shapes shall be tested in accordance with ASTM standard test procedures listed in Table 1. Table 2 lists an acceptable cross reference for alternative acceptable test methods. Where individual project specification references the use of alternative methods, all conflicts between results of alternative methods shall be resolved prior to final approval of shapes and suitably documented in turnover or purchase documentation.

Firing temperatures for physical property testing of prepared specimens from “host” products, in accordance with standards organization procedures, shall be fired to temperatures noted in Table 3. In such situations, firing temperature shall be clearly stated in the specification and heating rate shall be in accordance with the applicable testing standard.

Table 1 ASTM standards for testing refractory shapes Reference Table testing methods

Standard	Title
A820	Standard Specification for Steel Fibers for Fiber-Reinforced Concrete
C16	Standard Test Method for Load Testing Refractory Shapes at High Temperatures
C20	Standard Test Methods for Apparent Porosity, Water Absorption, Apparent Specific Gravity, and Bulk Density of Burned Refractory Brick and Shapes by Boiling Water
C24	Standard Test Method for Pyrometric Cone Equivalent (PCE) of Fireclay and High Alumina Refractory Materials
C27	Standard Classification of Fireclay and High-Alumina Refractory Brick
C92	Standard Test Method for Sieve Analysis and water content of Refractory Materials
C113	Standard Test Method for Reheat Change of Refractory Brick
C133	Standard Test Methods for Cold Crushing Strength and Modulus of Rupture of Refractories
C134	Standard Test Methods for Size, Dimensional Measurements and Bulk Density of Refractory Brick and Insulating Firebrick

Documents
Document Sharing Hub

Full document details: SHELL 44.24.90.35 0

Standard	Title
C135	Standard Test Method for True Specific Gravity of Refractory Materials by Water Immersion
C155	Standard Classification of Insulating Firebrick
C179	Standard Test Method for Drying and Firing Linear Change of Refractory Plastic and Ramming Mix Specimens
C181	Standard Test Method for Workability Index of Fireclay and High-Alumina Plastic Refractories
C210	Standard Test Method for Reheat Change of Insulating Firebrick
C288	Standard Test Method for Disintegration of Refractories in an Atmosphere of Carbon Monoxide
C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
C401	Standard Classification of Alumina and Alumina-Silicate Castable Refractories
C467	Standard Classification of Mullite Refractories
C583	Standard Test Method for Modulus of Rupture of Refractory Materials at Elevated Temperatures
C673	Standard Classification of Fireclay and High-Alumina Plastic Refractories and Ramming Mixes
C832	Standard Test Method of Measuring the Thermal Expansion and Creep of Refractories Under Load
C860	Standard Practices for Determining and Measuring Consistency of Refractory Concretes
C862	Standards Practice for Preparing Refractory Concrete Specimens By Casting
C865	Standard Practice for Firing Refractory Concrete Specimens
C903	Standard Practice for Preparing Refractory Concrete Specimens by Cold Gunning
C1445	Standard Test method for Measuring Consistency of Castable Refractories using Flow Table
C1446	Standard Test Method for Measuring Consistency of Working time of Self Flow Castables

Documents
Document Sharing Hub

Full document details: SHELL 44.24.90.35 0