DEP SPECIFICATION

REFRACTORY BRICKS AND SHAPES

DEP 44.24.90.31-Gen.

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DESIGN AND ENGINEERING PRACTICE

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1. INTRODUCTION

1.1 SCOPE

This DEP specifies general requirements and gives recommendations for the supply and installation of refractory bricks and special pre-cast shapes used in high temperature and acid-resistant process applications.

This DEP also provides general guidelines for the preservation and transportation of brick lined equipment as well as considerations and basic procedures for the normal inspection, maintenance and start-up of either new or existing fired equipment with brick linings.

This DEP covers various classifications of shaped materials with the general chemical classification of Alumina–Silica.

This DEP does not cover non-refractory chemical-resistant bricks and tiles.

Requirements for refractory unshaped materials may be found in DEP 64.24.32.30-Gen., which should be read in conjunction with this DEP where shaped pre-cast shapes from unshaped refractories and unshaped types of refractory are required.

This DEP is a revision of the DEP of the same number dated March 2001; see (1.6) regarding the changes

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 44.24.90.32-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 44.24.90.35-Gen.	Specification and quality control for precast or specialty cast refractory baffle wall tile (shapes)
DEP 64.24.32.31-Gen.	Construction details for refractory brick construction

1.3 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

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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.

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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
Applicator	The party that applies or installs the specified refractory linings.
Brick	A non-metallic shape that is comprised of specially formulated and sized raw materials formed into a green shape typically by pressing then fired or “burned” to achieve strength and other high temperature properties. Some bricks such as insulating bricks may also require after treatments such as “machining”. Raw material formulations for brick manufacture are typically exclusive to the manufacture of bricks.
Fireclay	An earthy or stony material aggregate of sufficient purity and refractoriness which has the essential constituent hydrous silicates of aluminium, with or without free silica. Fireclay is plastic when sufficiently pulverized and wetted and rigid when subsequently dried.
Flint Clay	A hard or flint-like fireclay with low natural plasticity. Flint clays are typically calcined to remove harmful oxides and make them volume stable as refractory aggregate base materials. There are a wide variety of calcined flint clays available to refractory Manufacturers. Calcined flint clays, beneficiated and mined outside the USA, are also referred to as fireclay Chamotte.
Mullite	A stable crystalline compound in the Alumina Silica system (under normal atmospheric pressure), crystallized most commonly in the form of long interlocking needle-like crystals. Naturally occurring Mullite is rare. The most common “mullite refractories” are manufactured with synthetic artificially produced mullite aggregates with the formula $3Al_2O_3.2Si0_2$.

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Term	Definition
Mullite Refractories	Alumina silica refractories produced with mullite (most often synthetic) aggregates and matrix particles manufactured by converting the Sillimanite group of minerals or by a melt or sinter process. The sinter process uses the rotary kiln and the fused process the electric arc furnace. Mullite refractories are often confused with other alumina-silica refractories and therefore have separate classification in ASTM to highlight the enhanced properties. ASTM C467 characterizes mullite refractories as having 56-79% Alumina, with <5% impurities (oxides other than aluminium and silicon) and <5% deformation under specified compressive load, at a specified temperature, for a specified time (ASTM C16).
Red Line Drawings	Approved construction detail drawings put back into the project documentation, on completion of the project, with any and all field changes clearly indicated with normal revision indicators
Refractory (Materials/Products/ Linings)	Dense, insulating, and/or special composite materials that are non-metallic and are chemically and physically stable at high temperatures.
Shape	Non-metallic shape manufactured from an unshaped refractory such as a castable, plastic or special blend of raw materials that can be cast or formed into moulds to create special sizes and shapes. Shapes typically “inherit” the physical properties of the unshaped material used in the manufacture. As in bricks, all special shapes shall be pre-fired preferably to temperatures greater than the intended application temperature.

1.4.3 Abbreviations

Term	Definition
ASTM	American Society for Testing and Materials
ISO	International Organization for Standardization
ITP	Inspection Test Plan
MOR	Modulus of Rupture
PCE	Pyrometric Cone Equivalent
PLC	Permanent Linear Change
SRU	Sulphur Recovery Units

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 SUMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated March 2001. This revision is a complete rewrite, so it is impractical to summarise the changes.

All appendices in the previous edition of this DEP have been removed and incorporated into a family of stand-alone DEPS listed in (1.2).

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