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BSI Standards Publication

Petroleum and natural gas industries — Ceramic lined tubing

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 5, *Casing, tubing and drill pipe*.

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Introduction

Users of this document should be aware that further or differing requirements can be needed for individual applications. This document is not intended to inhibit a manufacturer from offering, or the purchaser from accepting, alternative equipment or engineering solutions for the individual application. This can be particularly applicable where there is innovative or developing technology. Where an alternative is offered, it is the responsibility of the manufacturer to identify and provide details of any variations from this document.

In this document, the following verbal forms are used:

— "shall" indicates a requirement;

— "should" indicates a recommendation;

— "can" indicates a possibility or a capability;

— "may" indicates a permission.

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Petroleum and natural gas industries — Ceramic lined tubing

1 Scope

This document specifies requirements for ceramic lined tubing (CLT) used in the petroleum and natural gas industries, including configuration and materials, manufacturing, inspection and testing, marking, packaging, transportation, and storage.

This document is applicable to CLT manufactured by centrifugal self-propagating high-temperature synthesis.

The applicable outside diameter of CLT ranges from 42,16 mm (1,66 inch) to 114,3 mm (4-1/2 inch). The steel grades include H40, J55, and N80 type 1.

NOTE Applicability of this document to other sizes and higher steel grades can be by agreement between the manufacturer and the purchaser.

CLT is suitable for extracting multiphase fluid, hydrocarbon gas, hydrocarbon liquid, and water under corrosive, abrasive, wax deposition, scaling, and high temperature environments.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2819, *Metallic coatings on metallic substrates — Electrodeposited and chemically deposited coatings — Review of methods available for testing adhesion*

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 8501-1, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings*

ISO 10405, *Petroleum and natural gas industries — Care and use of casing and tubing*

ISO 11960, *Petroleum and natural gas industries — Steel pipes for use as casing or tubing for wells*

ISO 14705, *Fine ceramics (advanced ceramics, advanced technical ceramics) — Test method for hardness of monolithic ceramics at room temperature*

ISO 15156-2, *Petroleum and natural gas industries — Materials for use in H2S-containing environments in oil and gas production — Part 2: Cracking-resistant carbon and low-alloy steels, and the use of cast irons*

ISO 21714, *Fine ceramics (advanced ceramics, advanced technical ceramics) — Test method for determining density of ceramic coatings*

ISO 23936-1, *Petroleum, petrochemical and natural gas industries — Non-metallic materials in contact with media related to oil and gas production — Part 1: Thermoplastics*

API Spec 5B, *Specification for Threading, Gauging, and Thread Inspection of Casing, Tubing, and Line Pipe Threads*

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ASTM A700, *Standard Guide for Packaging, Marking, and Loading Methods for Steel Products for Shipment*

ASTM D5420, *Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)*

ASTM G31, *Standard Guide for Laboratory Immersion Corrosion Testing of Metals*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1.1
backing pipe
tubing before being lined with ceramic liner

3.1.2
bonding strength
shear strength required to shear the ceramic liner along the axial direction of the backing pipe

3.1.3
centrifugal self-propagating high-temperature synthesis
centrifugal SHS
self-propagating high-temperature synthesis under the centrifugal force generated by high-speed rotation, which is helpful to promote reaction and phase separation of molten products

Note 1 to entry: The centrifugal self-propagating high-temperature synthesis technology comprises the following steps. Fill Fe_2O_3 (or Fe_3O_4) powder and aluminium powder with a given proportion into a steel tubing. Fix the tubing with the powder on a centrifuge and rotate it with a high speed. Then, start the reaction when the rotating speed reaches a given value. The reaction can be maintained due to a large amount of reaction heat released by the exothermic reaction. Under the action of centrifugal force, molten products are separated into layers from each other due to the difference in their specific gravity, and after cooling, ceramic lined tubing is formed.

3.1.4
ceramic liner
ceramic layer formed on the inner wall of the backing pipe by centrifugal self-propagating high-temperature synthesis method

Note 1 to entry: It is attached to the inner wall of the backing pipe and has the functions of corrosion prevention, scale prevention, and wear resistance.

3.1.5
ceramic lined tubing
CLT
tubing with a ceramic liner stuck on to its inner wall made by centrifugal self-propagating high-temperature synthesis

3.1.6
corrosion barrier ring
CB ring
polymeric ring inserted between adjacent lengths of liner in a tubing string to provide continuity of corrosion protection

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3.1.7
crushing strength
fracture strength of the ceramic liner when applying radial compression load on ceramic lined tubing

3.1.8
end cap
metal component used to seal the cut end of ceramic liner

3.1.9
flare of the end cap
edge formed by turning the outer edge of the end cap along the cross-section of the backing pipe

3.1.10
Label 1
dimensionless designation for the size or specified outside diameter that can be used when ordering the pipe

Note 1 to entry: See Table B.1.

3.1.11
Label 2
dimensionless designation for the mass per unit length that can be used when ordering the pipe

Note 1 to entry: See Table B.1.

3.1.12
self-propagating high-temperature synthesis
SHS
technique for synthesizing materials by using the heat released by the exothermic reaction to make the reaction proceed spontaneously

3.1.13
thermite
mixture of aluminium powder, metal oxides (such as Fe_2O_3 or Fe_3O_4) and related additives that generate a large amount of heat when ignited

3.2 Symbols and abbreviated terms

3.2.1 Symbols

d	inside diameter of ceramic lined tubing
t	wall thickness of backing pipe

3.2.2 Abbreviated terms

AQL	acceptance quality limit
CAL	connection assessment level
CB	corrosion barrier
CLT	ceramic lined tubing
EU	API Spec 5B external upset tubing connection
HIC	hydrogen induced cracking
NU	API Spec 5B non-upset tubing connection

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