SLOVENSKI STANDARD
SIST EN ISO 13503-5:2007

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Industrija za predelavo nafte in zemeljskega plina - Tekočine in materiali za zaključna dela - 5. del: Postopki za merjenje dolgoročne prevodnosti podpornih materialov (ISO 13503-5:2006)

Petroleum and natural gas industries - Completion fluids and materials - Part 5: Procedures for measuring the long-term conductivity of proppants (ISO 13503-5:2006)

Erdöl- und Erdgasindustrie - Komplettierungsflüssigkeiten und Materialien - Teil 5: Verfahren zur Messung der Langzeitleitfähigkeit von Stützmaterialien (ISO 13503-5:2006)

Industries du pétrole et du gaz naturel - Fluides de complétion et matériaux - Partie 5: Modes opératoires pour mesurer la conductivité à long terme des agents de soutenement (ISO 13503-5:2006)

Ta slovenski standard je istoveten z: **EN ISO 13503-5:2006**

ICS:

75.100	Maziva	Lubricants, industrial oils and related products
75.180.30	Oprema za merjenje prostornine in merjenje	Volumetric equipment and measurements

SIST EN ISO 13503-5:2007 **en**

EUROPEAN STANDARD

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EN ISO 13503-5

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Petroleum and natural gas industries - Completion fluids and materials - Part 5: Procedures for measuring the long-term conductivity of proppants (ISO 13503-5:2006)

Industries du pétrole et du gaz naturel - Fluides de complétion et matériaux - Partie 5: Modes opératoires pour mesurer la conductivité à long terme des agents de soutènement (ISO 13503-5:2006)

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This European Standard was approved by CEN on 24 May 2006.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN ISO 13503-5:2006) has been prepared by Technical Committee ISO/TC 67 "Materials, equipment and offshore structures for petroleum and natural gas industries" in collaboration with Technical Committee CEN/TC 12 "Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2007, and conflicting national standards shall be withdrawn at the latest by January 2007.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Endorsement notice

The text of ISO 13503-5:2006 has been approved by CEN as EN ISO 13503-5:2006 without any modifications.

INTERNATIONAL STANDARD

ISO 13503-5

First edition
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Petroleum and natural gas industries — Completion fluids and materials —

Part 5: Procedures for measuring the long-term conductivity of proppants

Industries du pétrole et du gaz naturel — Fluides de complétion et matériaux —

Partie 5: Modes opératoires pour mesurer la conductivité à long terme des agents de soutènement

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 13503-5 was prepared by Technical Committee ISO/TC 67, *Materials. equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 3, *Drilling and completion fluids, and well cements*.

ISO 13503 consists of the following parts, under the general title *Petroleum and natural gas industries — Completion fluids and materials*:

— *Part 1: Measurement of viscous properties of completion fluids*

— *Part 2: Measurement of properties of proppants used in hydraulic fracturing and gravel-packing operations*

— *Part 3: Testing of heavy brines*

— *Part 4: Procedure for measuring stimulation and gravelpack fluid leakoff under static conditions*

— *Part 5: Procedures for measuring the long-term conductivity of proppants*

Introduction

This part of ISO 13503 is largely based on API RP 61[1]. Informative references are also included in the Biblography, References [2] to [15].

The tests and test apparatus herein have been developed to establish standard procedures and conditions for use in evaluating the long-term conductivity of various hydraulic fracture proppant materials under laboratory conditions. This procedure enables users to compare the conductivity characteristics under the specifically described test conditions. The test results can aid users in comparing proppant materials for use in hydraulic fracturing operations.

The procedures presented in this publication are not intended to inhibit the development of new technology, materials improvements, or improved operational procedures. Qualified engineering analysis and sound judgment is required for their application to fit a specific situation.

This part of ISO 13503 may be used by anyone desiring to do so. Every effort has been made by ISO and API to ensure the accuracy and reliability of the data contained in it. However, ISO and API make no representation, warranty, or guarantee in connection with this part of ISO 13503, and hereby expressly disclaim any liability or responsibility for loss or damage resulting from its use or for the violation of any federal, state, or municipal regulation with which this part of ISO may conflict.

In this part of ISO 13503, where practical, U.S. customary units are included in parentheses for information.

Petroleum and natural gas industries — Completion fluids and materials —

Part 5:
Procedures for measuring the long-term conductivity of proppants

CAUTION — The testing procedures in this part of ISO 13503 are not designed to provide absolute values of proppant conductivity under downhole reservoir conditions. Long-term test data have shown that time, elevated temperatures, fracturing fluid residues, cyclic stress loading, embedment, formation fines and other factors further reduce fracture proppant pack conductivity. Also, this reference test is designed to measure only the frictional energy losses corresponding to laminar flow within a pack. It is recognized that fluid velocity within an actual fracture can be significantly higher than in these laboratory tests, and can be dominated by inertial effects.

1 Scope

This part of ISO 13503 provides standard testing procedures for evaluating proppants used in hydraulic fracturing and gravel-packing operations.

NOTE The “proppants” mentioned henceforth in this part of ISO 13503 refer to sand, ceramic media, resin-coated proppants, gravel packing media, and other materials used for hydraulic fracturing and gravel-packing operations.

The objective of this part of ISO 13503 is to provide consistent methodology for testing performed on hydraulic-fracturing and/or gravel-packing proppants. It is not intended for use in obtaining absolute values of proppant pack conductivities under downhole reservoir conditions.

2 Normative reference

The following referenced document is indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced standard (including any amendments) applies.

ISO 3506-1, *Mechanical properties of corrosion-resistant stainless-steel fasteners — Part 1: Bolts, screws and studs*

3 Terms and definitions

3.1
conductivity
width of the fracture multiplied by the permeability of the proppant pack

3.2
laminar flow
type of streamlined flow for single-phase fluids in which the fluid moves in parallel layers, or laminae, such that the layers flow smoothly over each other with instabilities being dampened by the viscosity

3.3
Ohio sandstone
fine-grained sandstone found in the United States from the Scioto Formation in southern Ohio

3.4
permeability
a measure of the ability of media to transmit fluid through pore spaces

4 Abbreviations

API American Petroleum Institute

ASTM American Society for Testing and Materials

RTV Room temperature vulcanizing

ANSI American National Standards Institute

PID Proportional-integral device

5 Procedures for evaluating long-term proppant pack conductivity

5.1 Objective

The objective is to establish a standard test procedure, using a standard apparatus, under standard test conditions to evaluate the long-term conductivity of proppants under laboratory conditions. This procedure is used to evaluate the conductivity of proppants under laboratory conditions but is not intended for use in obtaining absolute values of proppant pack conductivities under downhole reservoir conditions. The effects of fines, formation hardness, resident fluids, time, and/or other factors are beyond the scope of this procedure.

5.2 Discussion

In this part of ISO 13503 procedure, a closure stress is applied across a test unit for 50 h ± 2 h to allow the proppant sample bed to reach a semi-steady state condition. As the fluid is forced through the proppant bed, the proppant pack width, differential pressure, temperature and flow rates are measured at each stress level. Proppant pack permeability and conductivity are calculated.

Multiple flow rates are used to verify the performance of the transducers, and to determine darcy flow regime at each stress; an average of the data at these flow rates is reported. A minimum pressure drop of 0,01 kPa (0,002 0 psi) is recommended; otherwise, flow rates shall be increased. At stipulated flow rates and temperature conditions, no appreciable non-darcy flow or inertial effects are encountered. After completing the rates at a closure stress level in all cells, the closure stress is increased to a new level; 50 h ± 2 h is allowed for the proppant bed to reach a semi-steady state condition, and multiple flow rates in all cells are introduced to gather data required to determine proppant pack conductivity at this stress level. The procedure is repeated until all desired closure stresses and flow rates have been evaluated. To achieve accurate conductivity measurements, it is essential that single-phase flow occurs.

Test condition parameters, such as test fluid, temperature, loading, sandstone and time, at each stress shall be reported along with long-term conductivity and permeability data. Other conditions can be used to evaluate different characteristics of proppants and, therefore, can be expected to produce differing results.