SLOVENSKI STANDARD
SIST EN ISO 13503-3:2006

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Industrija za predelavo nafte in zemeljskega plina – Tekočine in materiali za zaključna dela – 3. del: Preskušanje težkih slanic (ISO 13503-3:2005)

Petroleum and natural gas industries - Completion fluids and materials - Part 3: Testing of heavy brines (ISO 13503-3:2005)

Erdöl- und Erdgasindustrie - Komplettierungsflüssigkeiten und -materialien - Teil 3: Prüfung von schweren Solen (ISO 13503-3:2005)

Industries du pétrole et du gaz naturel - Fluides et matériaux de complétion - Partie 3: Essais de saumures denses (ISO 13503-3:2005)

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ICS:

75.180.30	Oprema za merjenje prostornine in merjenje	Volumetric equipment and measurements

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Petroleum and natural gas industries - Completion fluids and materials - Part 3: Testing of heavy brines (ISO 13503-3:2005)

Industries du pétrole et du gaz naturel - Fluides et matériaux de complétion - Partie 3: Essais de saumures denses (ISO 13503-3:2005)

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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 13503-3:2005) 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of an identical text or by endorsement, at the latest by June 2006, and conflicting national standards shall be withdrawn at the latest by June 2006.

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Endorsement notice

The text of ISO 13503-3:2005 has been approved by CEN as EN ISO 13503-3:2005 without any modifications.

INTERNATIONAL STANDARD

ISO 13503-3

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Petroleum and natural gas industries — Completion fluids and materials —

Part 3: Testing of heavy brines

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

Partie 3: Essais de saumures denses

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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 13503-3 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 3: Testing of heavy brines*

The following parts are under preparation:

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

— *Part 4: Procedure for measuring stimulation and gravel-pack fluid leakoff under static conditions*

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

Introduction

This part of ISO 13503 covers heavy brines commonly used in petroleum and natural gas completion, workover and drill-in fluids. These brines can be purchased or rented from multiple sources, and are available worldwide. No single source or limited source of supply is included, either by inference or reference.

Annexes A to F are given for information.

Petroleum and natural gas industries — Completion fluids and materials —

Part 3: Testing of heavy brines

1 Scope

This part of ISO 13503 covers the physical properties, potential contaminants and test procedures for heavy brine fluids manufactured for use in oil and gas well drilling, completion and workover fluids.

This part of ISO 13503 provides methods for assessing the performance and physical characteristics of heavy brines for use in field operations. It includes procedures for evaluating the density or specific gravity, the clarity or amount of particulate matter carried in the brine, the crystallization point or the temperature (both ambient and under pressure) at which the brines make the transition between liquid and solid, the pH, and iron contamination.

It also contains a discussion of gas hydrate formation and mitigation, brine viscosity, corrosion testing, buffering capacity and a standardised reporting form.

This part of ISO 13503 is intended for the use of manufacturers, service companies and end-users of heavy brines.

2 Normative references

The following referenced documents are indispensable for the application 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 10414-1:2001, *Petroleum and natural gas industries — Field testing of drilling fluids — Part 1: Water-based fluids*

ASTM [1)] E77, *Standard Test Method for Inspection and Verification of Thermometers*

NIST [2)] SRM 185h, *Potassium Hydrogen Phthalate, pH Standard*

NIST SRM 186g, *Potassium Dihydrogen Phosphate, pH Standard*

NIST SRM 191C, *pH Standards*

NBS (NIST) Circular 555, *Testing of Hydrometers*, 22 Oct 1954

1) ASTM, American Society for Testing and Materials, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, USA. http://www.astm.org.

2) NIST, National Institute of Standards and Technology, 100 Bureau Drive, Stop 3460, Gaithersburg, MD 20899-3460, USA. http://www.nist.gov.

3 Terms, definitions and abbreviated terms

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

3.1 Terms and definitions

3.1.1
ACS reagent grade
grade of chemical that meets purity standards as specified by the American Chemical Society (ACS)

3.1.2
user
manufacturer, service company, end user or operator applying the testing of this part of ISO 13503

3.2 Symbols and abbreviated terms

ACS	American Chemical Society
API	American Petroleum Institute
ASTM	American Society for Testing and Materials
CAS	Chemical Abstracts Service
FCTA	first crystal to appear
LCTD	last crystal to dissolve
NIST	National Institute of Standards and Technology
NTU	nephelometric turbidity unit
psi	pounds per square inch
TCT	true crystallization temperature
TD	to deliver
USC	United States Customary
V	volts
ρ	density, in g/cm^3
ρ_1	density at lower temperature
ρ_2	density at upper temperature
ρ_{70}	density at 70 °F (21 °C), in lb/gal
ρ_{21}	density at 21 °C (70 °F), in g/cm^3
$\rho_{A\text{-}SI}$	average wellbore density, in g/cm^3
$\rho_{A\text{-}USC}$	average wellbore density, in lb/gal
ρ_m	measured density

ρ_{cf}	density, in lb/ft^3
ρ_{SI}	density, in kg/m^3
ρ_{SI-21}	density at 21°C, in kg/m^3
ρ_{USC}	density, in lb/gal
ρ_W	density of water
θ	temperature, in °C (°F)
θ_1	temperature at lower reading, in °C (°F)
θ_2	temperature at upper reading, in °C (°F)
θ_m	measured temperature, in °C (°F)
∇_{cf}	mud gradient, in psi/foot calculated from density expressed in pounds per cubic foot
∇_{SI}	mud gradient, in kPa/m
∇_{USC}	mud gradient, in psi/foot calculated from density expressed in pounds per gallon
B_c	intercept of hydrometer-correction curve
C	density correction factor for temperature, in g/cm^3 per °C
C_θ	temperature correction factor, in lb/gal per 100 °F
C_p	pressure correction factor, in lb/gal per 1 000 psi
C_{SI}	density correction factor for temperature, in kg/m^3 per °C
C_{USC}	density correction factor for temperature, in lb/gal per °F
h	depth (height) of well, in feet
h_2	depth (height) of well at true vertical depth, in feet
R	hydrometer reading, specific gravity
R_1	hydrometer reading at lower temperature
R_2	hydrometer reading at higher temperature
V	volume, in cm^3
V_1	volume of the original sample, in cm^3
Z_c	slope of hydrometer-correction curve

4 Requirements

4.1 Quality control instructions

All quality control work shall be controlled by documented instructions which include appropriate methodology and quantitative acceptance criteria.

4.2 Records retention

All records specified in this part of ISO 13503 shall be maintained for a minimum of one year from the date of preparation.

5 Calibration of equipment

5.1 General requirements

5.1.1 Laboratory equipment and reagents shall be calibrated at periodic intervals, and by specified calibration procedures. For laboratory items not listed, the user shall develop procedures where deemed appropriate.

5.1.2 The user shall control, calibrate, verify and maintain the laboratory equipment and reagents used in this part of ISO 13503 for measuring product conformance.

5.1.3 The user shall maintain and use laboratory equipment and reagents in a manner such that measurement uncertainty is known and meets required measurement capability.

5.1.4 The user shall document and maintain calibration procedures, including details of laboratory equipment and reagent type, identification number, frequency of checks, acceptance criteria, and corrective action to be taken when results are unsatisfactory.

5.1.5 The user shall establish and document responsibility for administration of the calibration programme and responsibility for corrective action.

5.1.6 The user shall document and maintain calibration records for laboratory equipment and reagents; shall periodically review these records for trends, sudden shifts or other signals of approaching malfunction; and shall identify each item with a suitable indicator or approved identification record to show calibration status.

5.2 Reagents and materials for calibration

5.2.1 Chemicals and solutions

ACS reagent grade, or equivalent, is recommended. Shelf life shall not exceed the manufacturer's recommendation or six months after opening, if no recommendation is stated.

5.2.2 Distilled or de-ionized water

The user shall develop, document and implement a method to determine hardness of water, such as ASTM D1126 or equivalent. The water shall not be used if hardness is greater than 5 µg/cm^3 calcium ion concentration.

5.3 General requirements for calibration of particular apparatus

5.3.1 Volumetric glassware

Laboratory volumetric glassware used for testing, including flasks and pipettes, are usually calibrated by the supplier. Users of products in accordance with this part of ISO 13503 shall document evidence of glassware calibration prior to use. Supplier certification is acceptable. Calibration may be checked gravimetrically. Periodic recalibration is not required.

5.3.2 Laboratory temperature-measuring devices

The user shall calibrate all laboratory temperature-measuring devices used in measuring product conformance against a secondary reference temperature-measuring device. The secondary reference temperature-measuring device shall show evidence of calibration as performed against NIST certified master instruments in accordance with ASTM E77 and NBS (NIST) Circular 555.

5.3.3 Laboratory balances

The user shall calibrate laboratory balances periodically in the range of use with ASTM Class 1, 4 or 6 or better weights, depending on balance accuracy and in accordance with good laboratory practices, good management practices or ISO quality management standards, and shall service and adjust balances whenever calibration indicates a problem.

5.3.4 Hydrometers

The user shall check the calibration of each hydrometer with fluids of known density referenced to a standard.

5.3.5 Densitometer

The user shall calibrate each densitometer to a NIST standard according to the equipment manufacturer's recommendations.

5.4 Frequency of calibration verification

5.4.1 General

Any instrument subjected to movement that will affect its calibration shall be recalibrated prior to use.

5.4.2 Temperature-measuring devices

Calibrate each temperature-measuring device before it is put into service. After calibration, mark each temperature-measuring device with an identifying number that ties it to its corresponding correction chart. Check calibration as required and stated by manufacturer, against the secondary reference temperature-measuring device.

5.4.3 Laboratory balances

Calibrate each balance prior to being put into service. Check calibration at least annually, or more frequently as stated by manufacturer.

5.4.4 Hydrometers

Calibrate each hydrometer prior to being put into service. After calibration, note and record each hydrometer identifying number that ties it to its correction chart. Before each use, inspect for damage, and if needed recalibrate or discard.