Recommended Practice for Testing Well Cements

ANSI/API Recommended Practice 10B-2 (Formerly 10B)
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ISO 10426-2, Petroleum and natural gas industries—Cements and materials for well cementing—Part 2: Testing of well cements

AMENDMENT 1: Water-wetting capability testing

American Petroleum Institute

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API Foreword

This standard API RP 10B-2, *Recommended Practice for Testing Well Cements*, replaces API RP 10B 22nd edition of the same title. The designation change is to align with the ISO designation.

This standard shall become effective on the date printed on the cover but may be used voluntarily from the date of distribution.

Standards referenced herein may be replaced by other international or national standards that can be shown to meet or exceed the requirements of the referenced standard.

This American National Standard is under the jurisdiction of the API Subcommittee on Well Cements, SC10. This standard is considered identical to the English version of ISO 10426-2. ISO 10426-2 was prepared by Technical Committee ISO/TC 67 Materials, equipment and offshore structures for petroleum and natural gas industries, SC 3 Drilling and completion fluids, and well cements .

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Suggested revisions are invited and should be submitted to the Standards and Publications Department, API, 1220 L Street, NW, Washington, DC 20005, standards@api.org.

Petroleum and natural gas industries — Cements and materials for well cementing — Part 2: Testing of well cements

AMENDMENT 1: Water-wetting capability testing

Page 6, clause 3.1

Add the following term/definition:

3.1.52
water-wetting capability
capability of a fluid to alter the quality or state of being water-wetted

NOTE A fully water-wet state is considered most desirable to provide cement bonding.

Page 96, add the following new clause 16.8:

16.8 Water-wetting capability testing (WWCT)

16.8.1 Introduction

The water-wetting capability testing (WWCT) procedure is intended for use in determining the degree of compatibility of wellbore fluids in cementing operations. By the use of this procedure, the selection of proper preflushes and/or spacers, and/or surfactant components may be made when required. User discretion should be exercised in the selection of the portion(s) of the procedure needed.

The WWCT procedure is specific to evaluation of water-wetting capability of spacers and/or preflushes designed to water-wet the surfaces after these surfaces have been exposed to non-aqueous fluids, specifically oil- and synthetic-based drilling fluids. The apparent water-wetting capability of various mud/spacer interface volumes and the apparent wettability of spacer systems against oil-wetted surfaces may be evaluated using this method. This procedure does not address bulk displacement issues, nor does it directly address spacer/mud compatibility issues.

The procedure is applicable to aqueous spacer systems only. This procedure is not suitable for evaluating non-aqueous or non-conductive systems or mixtures of surfactants in base oils.

16.8.2 Method and apparatus

The apparatus provides a continuous measurement of the electrical conductivity between electrode surfaces. From the conductivity measurements, the emulsion state and apparent wettability of the fluid can be inferred if the titrating spacer fluid is conductive and the titrated drilling fluid is not. Normally, oil-external fluids are not electrically conductive. Water-based or water-external emulsion spacers are electrically conductive with the actual conductivity dependent on the solution chemistry.

16.8.3 Procedure

Observe all usual laboratory safety requirements pertaining to working with oil, synthetic, and solvent-based fluids. Note the flash points of all fluids before testing and ensure proper ventilation in the work area. All safe-handling procedures for the fluids being tested shall be observed.

16.8.4 Sample preparation

1) Prepare a mud sample according to instructions from the supplier. Laboratory-prepared mud samples may require additional preparation such as static aging or hot-rolling to more fully simulate field mud properties.

2) Mix the spacers and/or preflush fluids to be evaluated according to manufacturer's procedures. A 500-ml volume is normally sufficient to run a single test.

3) Condition all spacer fluids at anticipated Bottom Hole Circulating Temperature (BHCT) to ensure that fluids are stable and all chemicals have been conditioned and are in solution. If desired, the fluids may be conditioned for an additional 30 min ± 0,5 min at BHCT. Condition fluids under pressure using high-temperature, high-pressure (HTHP) equipment if conditioning at temperatures above 90°C (194°F). Fluids should be cooled below 90° (194°F) before releasing pressure. Observe all safe-handling procedures for fluids being tested. This is a test conducted at atmospheric pressure. The test shall not be performed at temperatures exceeding 90°C (194°F).

16.8.5 Equipment set-up

1) Prepare equipment according to instructions from supplier.

2) Clean and dry test equipment before starting.

3) Add the mud sample to the container.

4) Heat the container to testing conditions to maintain the temperature of the test fluids. Use a stirring rate sufficient to quickly homogenise added fluids and prevent static areas. Avoid excessive shear, as it will cause air-entrainment that may affect readings and surfactant performance.

16.8.6 Test procedure and reporting

1) Evaluate the interaction of the spacer with the drilling fluid according to manufacturer's instructions. Observe safety precautions with respect to fluid temperatures and operator safety.

2) Record the starting volume of mud, volume of titrant (surfactant, flush, spacer), fluid conditioning procedure (time, temperature, etc.) and titration temperature. Slowly titrate into the mud while stirring the fluid in the test apparatus. Continue titrating until a stable conductivity measurement is reached. This indicates a water-continuous phase has been formed which is characteristic of a water-wetting state.

3) Report test results as the volume percentage of spacer in the mud-spacer mixture that exhibits conductivity measurements indicative of complete water wetting according to the formula:

$$V\% = V_s/(V_s+V_m) \times 100$$

where:

V_s is the volume of spacer required to change from oil to water continuous phase

V_m is the volume of mud initially in the test cell

For example, if 150 ml of spacer must be added to a starting mud volume of 200 ml in order to obtain a full-span reading, the result should be reported as 43 % (150 ml /350 ml).

Contents

Foreword

ISO (the International Organisation for Standardisation) 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 organisations, 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 standardisation.

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

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 10426-2 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 10426 consists of the following parts, under the general title *Petroleum and natural gas industries — Cements and materials for well cementing*:

— *Part 1: Specification*

— *Part 2: Testing of well cements*

— *Part 3: Testing of deepwater well cement formulations*

— *Part 4: Preparation and testing of foamed cement slurries at atmospheric pressure*

The following part is under preparation:

— *Part 5: Determination of shrinkage and expansion of well cement formulations at atmospheric pressure*

Introduction

This part of ISO 10426 is based on API RP 10B, 22nd edition, December 1997, addendum 1, October 1999.

Users of this part of ISO 10426 should be aware that further or differing requirements may be needed for individual applications. This part of ISO 10426 is not intended to inhibit a vendor from offering, or the purchaser from accepting, alternative equipment or engineering solutions for the individual application. This may be particularly applicable where there is innovative or developing technology. Where an alternative is offered, the vendor should identify any variations from this part of ISO 10426 and provide details.

In this part of ISO 10426, where practical, US Customary units are included in brackets for information.

Well cement classes and grades are defined in ISO 10426-1.

Petroleum and natural gas industries — Cements and materials for well cementing —

Part 2: **Testing of well cements**

1 Scope

This part of ISO 10426 specifies requirements and gives recommendations for the testing of cement slurries and related materials under simulated well conditions.

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, *Petroleum and natural gas industries — Field testing of drilling fluids — Part 1: Water-based fluids*

API RP 13J, *Testing of heavy brines (second edition), March 1996*

ASTM C 109, *Standard test method for compressive strength of hydraulic cement mortars (using 2 in. or [50 mm] cube specimens)*

ASTM C 188, *Standard test method for density of hydraulic cement*

3 Terms, definitions and symbols

3.1 Terms and definitions

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

3.1.1
absolute volume
reciprocal of absolute density

NOTE It is expressed as volume per unit mass.

3.1.2
additive
material added to a cement slurry to modify or enhance some desired property

NOTE Common properties that are modified include: setting time (by use of retarders or accelerators), fluid loss control, viscosity, etc.