First edition
2003-08-15

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

Part 3: Testing of deepwater well cement formulations

Industries du pétrole et du gaz naturel — Ciments et matériaux pour la cimentation des puits —

Partie 3: Essais de formulations de ciment pour puits en eau profonde

Reference number
ISO 10426-3:2003(E)

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Published in Switzerland

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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 10426-3 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 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

The test methods contained in this part of ISO 10426, though generally based on ISO 10426-2, take into account the specialized sampling/testing requirements and unique downhole temperature profiles found in deepwater wells. ISO 10426-2 contains no applicable well simulation schedules for deepwater cementing operations.

In a deepwater cementing environment, a number of factors impact the thermal history of the cement slurry. These factors include: water depth, mud-line temperature, geothermal gradient, the presence or absence of a drilling riser, drilling fluid temperature, ocean current velocity, presence of thermoclines (layers of ocean water separated by temperature), ambient sea-surface temperature, cement mix-water temperature, bulk cement temperature, cement mixing rate, cement heat of hydration, displacement rate, prior circulating and static event history, drill pipe size and mass, casing size and mass, and hole size.

Given the number of variables impacting the thermal history of a cement formulation during placement and curing, and the interdependence of many of those variables, the user is directed to employ numerical heat-transfer simulation or actual field measurement to determine the test temperature and the temperature/pressure schedule for the test methods contained in this part of ISO 10426. In this way, the testing of the cement formulation can reflect as closely as possible the actual temperature profile found during field cementing operations.

Numerical modelling may be used to determine the relative magnitude of the input variables so that “most likely” and “less likely” scenarios of temperature history can be assessed. The values of some input variables may not be known precisely and a range of possible values should be employed. Physical laboratory testing can then be conducted at “most likely” conditions, with some additional testing at “less likely” conditions to determine the sensitivity to well conditions. Sound engineering judgement can then be applied to assess the risks.

These procedures serve not only for the testing of well cements under deepwater well conditions, but may also be used in those circumstances where low seafloor temperatures are found at shallow water depths.

Well cements that can be used in deepwater well cementing can include those of ISO Classes A, C, G or H (as given in ISO 10426-1[1]), high-alumina cement, appropriate foamed cements, various types of ductile cement compositions, etc. In each deepwater well cementing operation, the cement chosen needs to be fit for purpose.

In this part of ISO 10426, where practical, United States customary (USC) units are included in parentheses for information.