

Petroleum and natural gas industries — Completion fluids and materials —

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

ICS 75.100

National foreword

This British Standard is the UK implementation of EN ISO 13503-2:2006+A1:2009. It is identical to ISO 13503-2:2006, incorporating amendment 1:2009. It supersedes BS EN ISO 13503-2:2006 which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to ISO text carry the number of the ISO amendment. For example, text altered by ISO amendment 1 is indicated by **A1** **A1**.

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A list of organizations represented on this subcommittee can be obtained on request to its secretary.

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Industries du pétrole et du gaz naturel - Fluides de complétion et matériaux - Partie 2: Mesurage des propriétés des matériaux de soutènement utilisés dans les opérations de fracturation hydraulique et de remplissage de gravier (ISO 13503-2:2006)

Erdöl- und Erdgasindustrie - Komplettierungsflüssigkeiten und -materialien - Teil 2: Messung der Eigenschaften von Stützmaterialien zum Einsatz bei hydraulischen Fraktionierungs- und in Kiespackungsvorgängen (ISO 13503-2:2006)

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Foreword

This document (EN ISO 13503-2:2006) 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of an identical text or by endorsement, at the latest by May 2007, and conflicting national standards shall be withdrawn at the latest by May 2007.

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Endorsement notice

The text of ISO 13503-2:2006 has been approved by CEN as EN ISO 13503-2:2006 without any modifications.

Foreword to amendment A1

This document (EN ISO 13503-2:2006/A1:2009) has been prepared by Technical Committee ISO/TC 67 "Materials, equipment and offshore structures for petroleum, petrochemical 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 Amendment to the European Standard EN ISO 13503:2006 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2010, and conflicting national standards shall be withdrawn at the latest by May 2010.

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Endorsement notice

The text of ISO 13503-2:2006/Amd 1:2009 has been approved by CEN as a EN ISO 13503-2:2006/A1:2009 without any modification.

INTERNATIONAL STANDARD

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Petroleum and natural gas industries — Completion fluids and materials —

Part 2:

Measurement of properties of proppants used in hydraulic fracturing and gravel-packing operations

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

*Partie 2: Mesurage des propriétés des matériaux de soutènement
utilisés dans les opérations de fracturation hydraulique et de
remplissage de gravier*



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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.

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ISO 13503-2 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 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 gravel-pack fluid leakoff under static conditions*
- *Part 5: Procedures for measuring the long-term conductivity of proppants*

Introduction

This part of ISO 13503 is a compilation and modification of API RP 56 ^[1], API RP 58 ^[2] and API RP 60 ^[3].

The procedures have been developed to improve the quality of proppants delivered to the well site. They are for use in evaluating certain physical properties used in hydraulic fracturing and gravel-packing operations. These tests should enable users to compare the physical characteristics of various proppants tested under the described conditions and to select materials useful for hydraulic fracturing and gravel-packing operations.

The procedures presented in this part of ISO 13503 are not intended to inhibit the development of new technology, material improvements or improved operational procedures. Qualified engineering analysis and judgment are required for their application to a specific situation.

In this part of ISO 13503, where practical, US Customary (USC) units are included in brackets for information.

Annex A of this part of ISO 13503 is for information only.

Petroleum and natural gas industries — Completion fluids and materials —

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

1 Scope

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

NOTE “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 a consistent methodology and specifications for testing performed on hydraulic fracturing and/or gravel-packing proppants. 

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.

 ASTM E11-04, *Standard Specification for Wire Cloth and Sieves for Testing Purposes* 

3 Abbreviations

API	American Petroleum Institute
ASTM	American Society for Testing and Materials
ASG	apparent specific gravity
FTU	formazin turbidity unit
HCl	hydrochloric acid
HF	hydrofluoric acid
LOI	loss on ignition
NTU	nephelometric turbidity unit

4 Standard proppant sampling procedure

4.1 General

Before any sample is taken, consider what tests will be performed, as each test requires a different volume. It is very important that both the supplier and customer obtain the best representative sample possible. Unless the sample is truly representative of a total shipment or container, testing and correlation with specifications/standards is very difficult. It is unlikely that sampling/testing methods in the field duplicate the producer's system. The standard procedures included within this part of ISO 13503 are to assist in obtaining representative samples. However, there are inherent variations associated with sampling, testing equipment and the procedures that can lead to inconsistent results. A sample that is representative of a truckload [23 000 kg (50 700 lb)] or a railcar load [90 000 kg (198 000 lb)] can be an initial source of wide variation when making comparisons. All parties shall take care to insure uniform sampling. The customer and the supplier shall agree on sampling and testing methods/techniques.

For the best representation, continuous sampling is ideal. Although many proppant suppliers utilize automatic sampling, it is usually impractical at the job site. If sampling is conducted while unloading a container or at the site, consideration should be given to the number or frequency of samples.

If bulk containers are filled from a flowing stream of proppant material, sampling procedures in accordance with 4.5 shall be applied. If bulk containers are filled using sacked proppant material, sampling procedures in accordance with 4.6 shall be applied.

4.2 Particle segregation

It is important to have a basic understanding of segregation when sampling proppant. Depending on the size, shape, distribution and mechanisms involved, there is usually a certain amount of error or variability involved in sampling due to segregation. The sampling procedures described here are the result of much experience and are designed to minimize the effects of segregation of particles by size.

Particles, such as proppants, naturally find the path of least resistance when moved or when force is applied. During transfer or movement, particles of differing size and mass naturally separate or segregate. The degree of segregation depends on the mechanisms involved in the transfer or movement.

There are several forces, such as gravity, acting on a stream of particles as it flows. Within a moving stream, fine particles drop through the voids or gaps and coarser particles move to the outside. The fine particles migrate and usually rest close to the area where they land. The heavier, coarser particles bounce or roll much further, stratifying the material by size.

4.3 Equipment

The following equipment shall be used to compile representative proppant material samples.

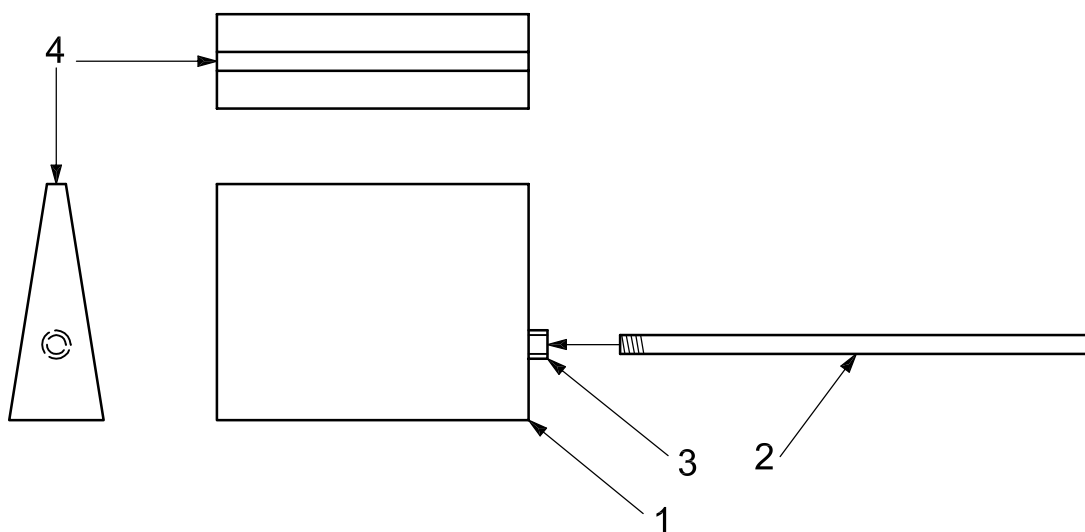
4.3.1 Box sampling device, with a 13 mm (0,50 in) slot opening.

The length of the 13 mm (0,50 in) slot shall be longer than the thickness of the stream being sampled. The volume of the sampler shall be large enough so as to not overflow while cutting through the entire stream. A box sampling device meeting these criteria is shown in Figure 1.

4.3.2 Sample reducer, of appropriate size for handling sack-size samples and reducing the material to 1/16 of the original mass; see Figure 2.

4.3.3 Sample splitter, of appropriate size; see Figure 3.

Dimensions in centimetres (inches)

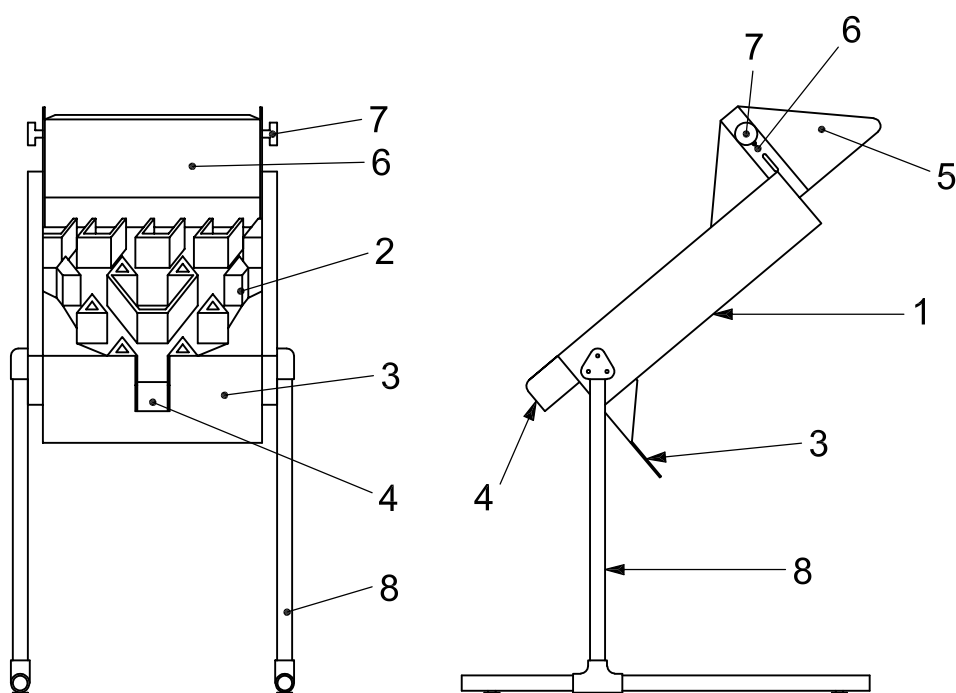


Key

- | | | | |
|---|--|---|-----------------------------|
| 1 | sampler body, 15,9 × 20,9 × 6,35 (6,25 × 8,25 × 2,5) | 3 | pipe coupling |
| 2 | handle | 4 | sample opening, 1,27 (0,50) |

Figure 1 — Box sampling device

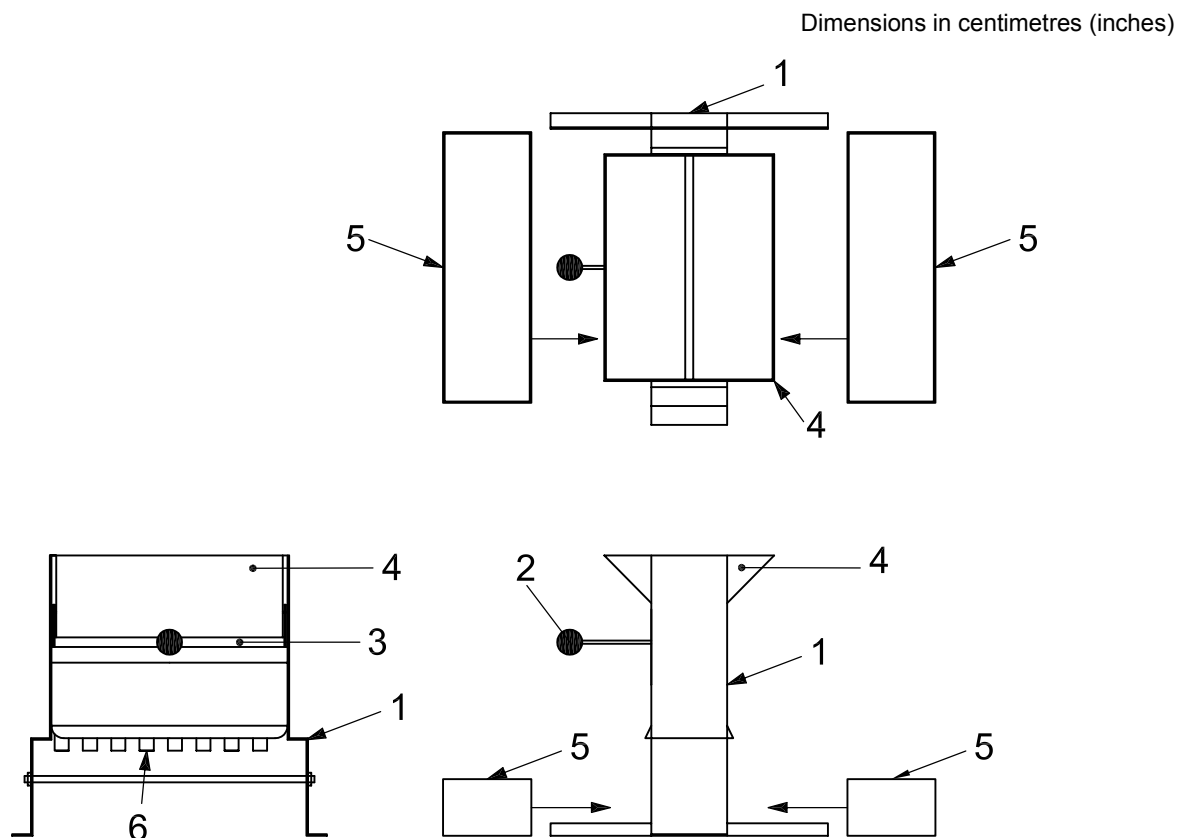
Dimensions in centimetres (inches)



Key

- | | | | |
|---|---|---|---|
| 1 | main body, 36,8 × 48,3 × 11,4 (14,5 × 19,0 × 4,5) | 5 | hopper, 36,8 × 24,1 × 15,2 (14,5 × 9,5 × 6,0) |
| 2 | splitter plate, 5,1 × 5,1 × 5,1 (2 × 2 × 2) | 6 | gate, 36,8 × 19,1 × 0,32 (14,5 × 7,5 × 0,125) |
| 3 | discharge plate, 36,8 × 30,5 × 0,32 (14,5 × 12 × 0,125) | 7 | hand knob, 3,8 (1,5) diameter |
| 4 | discharge chute, 5,7 × 5,7 × 7,6 (2,25 × 2,25 × 3,0) | 8 | support stand assembly, 71,1 × 38,1 × 68,6 (28 × 15 × 27) |

Figure 2 — Sample reducer



Key

- 1 main body, 29,2 × 27,9 × 16,5 (11,5 × 11,0 × 6,5)
- 2 handle
- 3 gate plate
- 4 hopper
- 5 pan
- 6 splitter vanes, 1,25 (0,5)

Figure 3 — Sample splitter

4.4 Number of required samples — Bulk

4.4.1 Proppants for hydraulic fracturing

A minimum of one sample per 9 000 kg (20 000 lb) or fraction thereof, shall be obtained. A maximum of 10 samples per bulk container shall be obtained, combined and tested.

4.4.2 Gravel-packing media

A minimum of one sample per 4 500 kg (10 000 lb) but no fewer than two samples per job shall be obtained, combined and tested.