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Well intervention equipment

Brønnintervensjonsutstyr

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Foreword

NORSOK D-002:2020 was adopted as NORSOK Standard 2020-01-13.

NORSOK D-002:2020 supersedes NORSOK D-002 Rev. 2, June 2013.

NORSOK is an acronym for the competitive position of the Norwegian continental shelf and comprise petroleum industry standards in Norway. The collaboration initiative in 1993 between the authorities and the petroleum industry initiated the development of NORSOK standards.

Reducing the project execution time and developing and operating cost for petroleum installations on the Norwegian shelf was the target.

The intention for the Petroleum industry is to develop and use standards providing good technical and cost-effective solutions to ensure that the petroleum resources are exploited and managed in the best possible way by the industry and the authorities. The industry will actively contribute to the development and use of international standards in the global market.

The NORSOK standards shall:

- bridge the gap based on experiences from the Norwegian continental shelf where the international standards are unsatisfactory
- replace oil company internal specifications where possible
- be available as references for the authorities' regulations
- be cost-effective
- promote the Norwegian sector as an attractive area for investments and activities

Developing new NORSOK standards and regular maintenance of existing standards shall contribute to maintain the competitiveness both nationally and internationally for the Norwegian petroleum industry.

The NORSOK standards are developed by experts from the Norwegian petroleum industry and approved according to the consensus principles as laid down by the guidelines given in NORSOK A-001 N directive.

The NORSOK standards are owned by the Norwegian Oil and Gas Association, the Federation of Norwegian Industries and the Norwegian Shipowners' Association. They are managed and published by Standards Norway.

The following main changes are implemented in this revision:

- this document provides design requirements for well intervention surface equipment
- the work string definition is updated to include hose, rope and composite rod
- the requirement for design of the control cabins to be permanently manned, is removed
- requirements for wellhead pump have been added
- the quality check of coiled tubing work string validity has been changed from 6 to 12 months if stored under proper conditions
- the minimum bending radius of the coiled tubing has been changed from 48 to 40 times the OD
- requirements for grease injection capacity is updated both for grease injection head and BOP
- added new chapter, work string technologies

Introduction

This document is published as a supplement to other relevant current regulations and standards in order to state relevant governing requirements, recommendations and permissions relevant to equipment used in well intervention operations within Norwegian jurisdiction.

The target group of this document are all involved in well intervention operations under regulation by Petroleum Safety Authority Norway. The reader of this document will get an understanding of the requirements for well intervention equipment, however references to other standards and regulations are given to fulfil the complete understanding.

This document refers to relevant regulations, standards and other governing documents whenever possible and states supplemental definitions, requirements, recommendations and permissions whenever deemed necessary.

The bibliography lists standards, norms, laws, regulations and other literature that may be relevant to the use of this document.

Normative text contains the requirements of the standard. Informative text is only guidance to the reader. All text in foreword, introduction and notes is informative text. Note to entries in clause 3 and annexes to the document may be either normative or informative.

Well intervention equipment

1 Scope

This document provides design requirements for well intervention surface equipment common across all exploration and production companies and service companies operating on the Norwegian Continental Shelf.

The standard defines what is considered typical and ordinary well intervention equipment. New equipment, special operations and operations in certain environments may require additional requirements and specifications. These specific additions are excluded from the standard and should be addressed in the risk assessment of the specific job. The general requirements in clauses 5 and 6 of this standard also apply to well intervention equipment falling outside traditional snubbing, coiled tubing and wireline.

2 Normative references

The following referenced documents contain text which fully or in part is part of the requirements in the document. For dated references, only the edition cited applies. For undated references, the latest edition of the cited document applies (including amendments).

All informative references are listed in clause “Bibliography”.

NORSOK D-001, *Drilling facilities*

NORSOK D-010, *Well integrity in drilling and well operations*

NORSOK N-001, *Integrity of offshore structures*

NORSOK S-001, *Technical safety*

NORSOK S-002, *Working environment*

NORSOK R-002, *Lifting equipment*

NORSOK R-003, *Safe use of lifting equipment*

NORSOK Z-015, *Temporary equipment*

ISO 9001, *Quality management systems – Requirements*

ISO 10423, *Petroleum and natural gas industries – Drilling and production equipment – Wellhead and Christmas tree equipment (API Spec 6A)*

ISO 13533, *Petroleum and natural gas industries – Drilling and production equipment – Drill-through equipment (API Spec 16A)*

ISO 13628-7, *Petroleum and natural gas industries – Design and operation of subsea production systems – Part 7: Completion/workover riser systems*

ISO 15156-1, *Petroleum and natural gas industries – Materials for use in H₂S-containing environments in oil and gas production – Part 1: General principles for selection of cracking-resistant materials (NACE MR0175)*

API Spec 5ST, *Specification for Coiled Tubing*

API Spec 16D, *Specification for Control Systems for Drilling Well Control Equipment and Control Systems for Diverter Equipment Second Edition*

API RP 16ST, *Coiled Tubing Well Control Equipment Systems*

DNVGL-OS-E-101, *Drilling Plant*

Dropped Objects Safety, *Best Practice Dropped Object Prevention Manual*

The Norwegian Oil and Gas Association, *070 – Application of IEC 61508 and IEC 61511 in the Norwegian petroleum industry*

The Norwegian Oil and Gas Association, *081 – Norwegian oil and gas recommended guidelines for remote pipe handling operations*

3 Terms and definitions

For the purpose of this NORSOK standard, the following terms, definitions and abbreviations apply.

3.1**shall (requirement)**

expression in the content of a document conveying objectively verifiable criteria to be fulfilled and from which no deviation is permitted if compliance with the document is to be claimed

Note 1 to entry: Requirements are expressed using the verbal forms specified in ISO/IEC Directives, Part 2 clause 7.2 Table 3.

3.2**should (recommendation)**

expression in the content of a document conveying a suggested possible choice or course of action deemed to be particularly suitable without necessarily mentioning or excluding others

Note 1 to entry: Recommendations are expressed using the verbal forms specified in ISO/IEC Directives, Part 2 clause 7.3 Table 4.

Note 2 to entry: In the negative form, a recommendation is the expression that a suggested possible choice or course of action is not preferred but it is not prohibited.

3.3**may (permission)**

expression in the content of a document conveying consent or liberty (or opportunity) to do something

Note 1 to entry: Permissions are expressed using the verbal forms specified in ISO/IEC Directives Part 2 clause 7.4 Table 5.

3.4**can (possibility and capability)**

1: expression in the content of a document conveying expected or conceivable material, physical or causal outcome.

2: expression in the content of a document conveying the ability, fitness, or quality necessary to do or achieve a specified thing

Note 1 to entry: Possibility and capability is expressed using the verbal forms specified in ISO/IEC Directives, Part 2 clause 7.5 Table 6.

3.5**coiled tubing**

Intervention using continuous tubing

3.6**intervention**

well servicing operations conducted within a completed wellbore

3.7**maximum anticipated surface pressure**

the highest pressure predicted to be encountered at the surface of the well. This pressure prediction should be based upon formation pressure minus a wellbore filled with native formation fluid at current conditions. If formation fluid information is unknown, this pressure prediction should be based upon formation pressure minus a wellbore filled with dry gas from the surface to the completion interval

3.8**maximum anticipated operating pressure**

the highest calculated pressure that a given equipment component will be subjected to during the execution of the prescribed service and/or during a contingency operation. The maximum anticipated operating pressure may be equal or greater than the maximum anticipated surface pressure

3.9

rated working pressure

maximum internal pressure that the equipment is designed to contain and/or control

3.10

safety head

upper closure device of the secondary barrier

3.11

snubbing

intervention using jointed pipe and where the primary well control is at surface

3.12

wireline

intervention using a continuous wire or cable

3.13

work string

collective term for jointed pipe, coiled tubing, wireline, hose, rope or composite rod, BHA excluded

4 Symbols and abbreviations

For this document, the following symbols and abbreviations apply.

API	American Petroleum Institute
BHA	bottom hole assembly
BOP	blow out preventer
ESD	emergency shut down
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
PSA	Petroleum Safety Authority Norway

5 General requirements

5.1 Design principles

An overall principle for well intervention activities shall be that no single failure shall entail a life-threatening situation for the involved personnel or lead to significant material or environmental damage. This shall constitute the basis for definition, revision, reduction and acceptance of risk with regards to well intervention activities.

The fulfilment of this principle shall be assessed on a system level. An intervention system includes, but is not limited to, equipment falling under the scope of this standard, auxiliary equipment, equipment permanently installed on the location and operational procedures.

Well intervention equipment shall be designed to withstand all loads it may be exposed to. Limitations shall be known to the users of the equipment.

The design and layout of well intervention equipment shall ensure a safe and efficient workplace.

5.2 External normative standards

Equipment under the scope of this standard will by default fall into at least one of the following categories and shall satisfy the requirements of the corresponding standards:

- topside pressure control equipment: ISO 10423 or ISO 13533
- subsea pressure control equipment: ISO 13628-7
- temporary equipment: NORSOK Z-015
- supporting structures: NORSOK N-001

Furthermore, the equipment shall fulfil the requirements of additional external standards through direct references throughout the text.

Equipment potentially exposed to H₂S shall be designed according to ISO 15156-1.

The intention of the above is not to provide an exhaustive list of all relevant standards and regulations. The majority of well intervention equipment will also fall within the scope of European directives (see clause “Bibliography”) and specific standards issued by API, ISO and IEC. It is the responsibility of the equipment manufacturers and those responsible for the use of the equipment to define the complete list of applicable standards and regulations for each individual product.

5.3 Applicability

A gap analysis on equipment relevant to this document shall be made available within half a year after publication of this document to identify any non-conformances with regards to this document.

All equipment under the scope of this document shall comply with this document no later than two years after publication of this document.

5.4 Quality management systems

All suppliers that design, manufacture or sell well intervention equipment shall have a quality management system based on ISO 9001 or equivalent.

5.5 Work string

Work strings shall have

- documented traceability
- historical use records
- periodic and systematic inspection

Work strings shall meet all relevant operational requirements with respect to expected pressures, temperatures, chemicals, hydraulics, tension, compression and torque.

5.6 Bottom hole assemblies

The following information shall be documented for all parts of a BHA:

- dimensions, including fishing neck details
- maximum loads
- service temperature range
- chemical compatibility
- special consideration necessary for safe use

5.7 Fluid pumps

Fluid pumps includes positive displacement pumps, used for well intervention activities such as; flush and test circulation systems, testing of well barriers, circulation through work string, well stimulation and other pumping application that requires high volume or pressure. Pumps may also be used as well kill pumps for well intervention activities.

Fluid pumps shall have a pressure relief valve and an adjustable pressure limiting device. These two functions shall be independent of each other.

The pressure relief valve shall be set slightly above the maximum anticipated operating pressure. It shall be connected to discharge ports that are directed away from work areas.

The adjustable pressure limiting device shall be used to prevent excessive pressurisation of the connected surface equipment or the well. Pump units shall have, or be connected to, a data acquisition system to display and record operational parameters. The sampling rate shall be sufficient to record relevant parameter variations.

The following parameters shall, as a minimum, be monitored, recorded and available to the pump operator:

- time and date
- pump pressure
- wellhead pressure (if connected to a well)
- annulus pressure of nearest annulus (if connected to a well)
- pump rate
- total volume of fluid pumped

5.8 Ignition source control

Equipment necessary to ensure and maintain well control is classified as safety critical equipment, group 3 according to NORSOK S-001 and should have emergency shutdown level C according to NORSOK Z-015. Such equipment is classified according to ATEX equipment-group II, category 3 (see clause “Bibliography”). The zone classification of the area where the equipment will be located might require category 2 or 1.

Equipment necessary to maintain the well intervention operation is classified as essential equipment, group 2 according to NORSOK S-001. This category includes snubbing units, coiled tubing units and wireline units. Pumps and other equipment are included in this group as far as they are necessary to maintain the current operation.

Other auxiliary non-essential equipment falling outside the scope of group 3 and group 2 of NORSOK S-001 shall be in accordance with the general requirements to ignition source control given by NORSOK Z-015.

5.9 Ambient conditions

The well intervention equipment shall be designed and selected to operate under those ambient conditions that the equipment will be exposed to. These conditions may vary across different areas of operation.

The following should be used as default conditions unless otherwise specified:

- ambient temperature for storage: -20° C to +40° C
- ambient temperature for operation: -10° C to +40° C
- maximum humidity: 95 %

It is the responsibility of the facility owner to define the ambient conditions at areas of operations deviating from these default conditions.

5.10 Working environment

The working environment for well intervention equipment shall be in accordance with NORSOK S-002.

External noise emissions from the equipment should be lower than 82 dB(A).

Control cabins shall satisfy the requirements for driller’s cabin in NORSOK S-002 while withstanding an external noise level impact of 90 dB(A).

There should be at least one extra seat available inside the cabin.

5.11 Lifting equipment

Lifting equipment shall be designed according to NORSOK R-002 and used according to NORSOK R-003.

5.12 Dropped objects

Well intervention equipment shall be designed according to Handbook – Best Practice – Dropped Object Management, part 2, to reduce the risk of dropped objects.