“Updated NORSOK Standard D-010.

Webinars

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Introductions

How to access NORSOK standards

- Link to Standard Norway, NORSOK D-010:

https://www.standard.no/nettbutikk/sokeresultater/?search=D-010

Please note the corrigendum

- Posting a question or comment to D-010 use:

petroleum@standard.no

“Updated NORSOK Standard D-010

Webinars

Agenda:

1. Introduction to the Norwegian legislative hierarchy.
2. NORSOK governance.
3. The D-010 revision process.
4. NORSOK D-010 lay-out.
5. The two-barrier principle.
6. What is new.

The Norwegian Legislative Hierarchy

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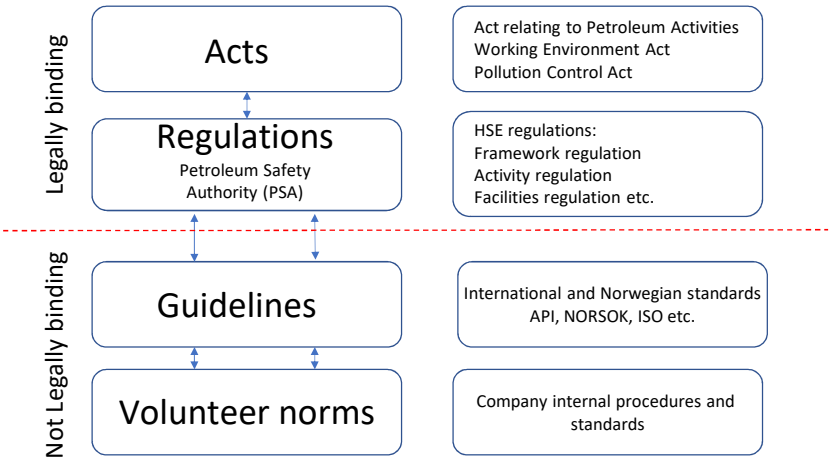

The Norwegian Legislative Hierarchy

HSE regulations vs. NORSOK:

- HSE regulations are functional
- NORSOK requirements shall be prescriptive
- QA/QC requirements are stipulated in the HSE regulations
- Maintenance system requirements are stipulated in the HSE regulations
- HSE regulations refers to NORSOK in Guidelines

The Norwegian Legislative Hierarchy

NORSOK D-010 vs. other NORSOK standards

Principle: State a requirement only once

D-010 will refer to other relevant NORSOK standards, e.g.:

- S series for HSE
- U series for sub-sea
- Other D standards for systems and equipment
  - D-001 for Drilling systems
  - D-002 for Workover systems
  - D-007 for Well Testing

The Norwegian Legislative Hierarchy

Shall – Should – May (as per PSA)

- **"Shall"** means the authorities' way of fulfilling the functional requirement. Alternative solutions with documented corresponding functionality and quality can be used providing a non-conformity handling documenting the alternative solution, approved by the PSA
- **"Should"** means the authorities' recommended way of fulfilling the functional requirement. Alternative solutions with documented corresponding functionality and quality can be used without having to present this to the authorities.
- **"Can"** means an alternative, equal way of fulfilling the regulatory requirements, e.g. where the guidelines recommend using maritime standards as an alternative to following a NORSOK standard.

The Norwegian Legislative Hierarchy

Shall – Should – May (NORSOK, according to ISO)

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

1. Requirements are expressed using the verbal forms specified in NS-EN ISO/IEC Directives, Part 2 subclause 7.2 Table 3.

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

1. Recommendations are expressed using the verbal forms specified in NS-EN ISO/IEC Directives, Part 2 subclause 7.3 Table 4.
2. 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.

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

1. Permissions are expressed using the verbal forms specified in NS-EN ISO/IEC Directives Part 2 subclause 7.4 Table 5.

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

1. Possibility and capability is expressed using the verbal forms specified in in NS-EN ISO/IEC Directives, Part 2 subclause 7.5 Table 6.

NORSOK Governance

NORSOK D-standards:

- Owned by the Sector Board Petroleum (3 – part cooperation).
- Issued by Standard Norway on behalf of the Sector Board.
- Day to day follow up by Expert Group Drilling:
  - Professionals from operators, contractors and vendors.
  - PSA contact person
- Revised every 5 years

NORSOK Governance

NORSOK standards revision process:

Governing document is NORSOK A-001:2016

1. Pre revision industry hearing;
2. Evaluate, process and implement comments;
3. Industry hearing of suggested revised document;
4. Evaluate, process and implement comments;
5. Sector Board approves revised document;
6. Issue of revised document;

The D-010 revision process

Revision period: 2017 – 2020
Industry hearing: 20.12.2019 – 17.03.2020

Participating companies			
AkerBP	Equinor	Lundin Norway	PSA (observer)
Aker Energy	Emerson	Maersk Drilling	Shell
BP	Husky Energy	Norwegian Oil and Gas	Schlumberger
ConocoPhillips	Hydrawell	OKEA	Technip FMC
DNO	Lotus Upstream	PTC	Wintershall DEA

The D-010 revision process

Professional fora:

- Well Integrity Forum
- Plug and Abandonment Forum
- Drilling Managers Forum

Provided comments and recommended practices

The D-010 revision process

Comments received in the pre revision hearing	:	+/- 1000
Comments received in the industry hearing	:	+/- 1000
Editorial vs. Technical comments in the pre-hearing	:	40:60
Editorial vs. Technical comments in the industry hearing	:	60:40

Short Q&A session

NORSOK D-010 Lay-out

- Based on ISO template
- Clauses 1 – 4:
  - Scope, normative references, definition and abbreviations.
- Clause 5:
  - General requirements.
- Clauses 6 – 15:
  - Activity related requirements, e.g., drilling, CT, WL, P&A.
- Annex A: Testing requirements.
- Annex B: Managed Pressure Drilling operational requirements.
- Annex C: Barrier Element Acceptance Criteria (EAC) tables
- Bibliography: relevant, but not normative reference standards etc.

NORSOK D-010 Lay-out

- Figures:
  - Successive numbering through the document
  - Well Barrier Schematics
    - example solutions
    - refers to relevant barrier element acceptance criteria
- Tables
  - Successive numbering through the document
  - Barrier element acceptance criteria tables in Annex C
    - Separate numbering

NORSOK D-010 Lay-out

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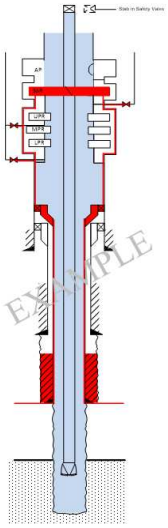
Well Barrier Schematic (WBS)



WBE	EAC table	Verification/monitoring
Primary well barrier		
Fluid column	1	
Secondary well barrier		
In-situ formation	51	
Annulus cement	22	
Casing	2	
Wellhead	5	
High pressure riser	26	
Drilling BOP	4	

Nomenclature

Overbalanced fluid column	
Underbalanced fluid column	
Cement as primary barrier element	
Gas lift gas	
Cement as secondary barrier element	
Cement as primary and secondary barrier element	

NORSOK D-010 Lay-out

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Barrier element acceptance criteria tables (EAC)

Features	Acceptance criteria	See
A. Description	This is a description of the WBE	
B. Function	This describes the main function of the WBE	
C. Design (capacity, rating, and function), construction and selection	For WBEs that are constructed in the field (e.g. drilling fluid, cement), this should describe a) design criteria, such as maximal load conditions that the WBE shall withstand and other functional requirements for the period that the WBE will be used, b) construction requirements for the WBE or its sub-components and will in most cases consist of references to normative standards. For WBEs that are pre-manufactured (production packer, DHSV), the focus should be on selection parameters for choosing the right equipment and proper field installation	Name of specific references
D. Initial test and verification	This describes the methodology for verifying that the WBE is ready for use and being accepted as part of a well barrier envelope	
E. Use	This describes proper use of the WBE to ensure that its function is maintained during execution of activities and operations	
F. Monitoring (regular surveillance, testing and verification)	This describes the methods for verifying that the WBE continues to be intact and fulfils the design criteria	
G. Common WBE	This describes additional criteria to the above when this element is a common WBE	

Understanding the Two Barrier Principle

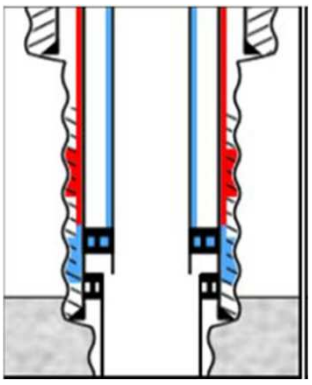
Barriers are defined as envelopes

Consisting of Barrier Elements (EACs)

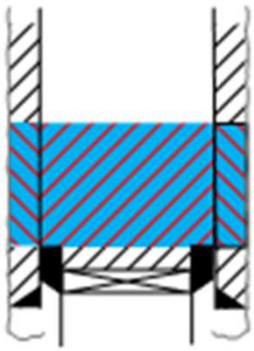
Two barriers are two independent barrier envelopes

Primary and secondary envelopes may have common elements

Understanding the Two Barrier Principle



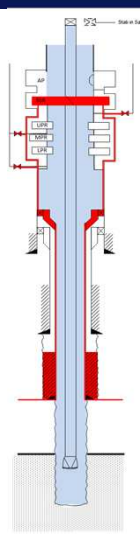
Cement as a barrier, not common element



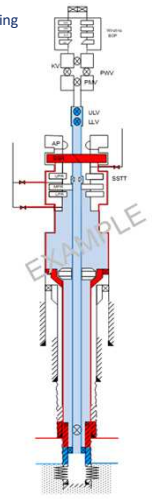
Cement as a barrier, common element

Understanding the Two Barrier Principle

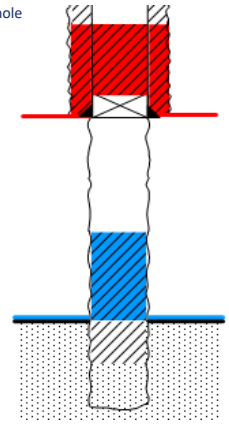
Drilling a well



WL, while testing



Abandonment open hole



Understanding the Two barrier Principle

Testing/verification of a barrier element:

- Described in the individual EAC, e.g.:
  - Pressure test in the direction of flow
  - Pressure test from above
  - In-flow test
  - Verification of top of cement/tagging
  - Logging

Q&A session

What is New?

Clause 5, Table 1, Minimum number of barriers

Pore-pressure	Source of inflow	Minimum number of well barrier envelopes: Drilling, Completion & P&A Phase	Minimum number of well barrier envelopes: Production[9] / Injection/Disposal Operations	Minimum number of well barrier envelopes: After Permanent P&A	Notes
Normal pressure (Note that local over-pressured shallow hazards may occur in this interval)	a) Interval with no hydrocarbon and no flow potential	One[1,2]	Not relevant[3]	Not relevant[4]	1. This interval may be drilled with seawater providing a risk evaluation finds this acceptable 2. A pilot hole is considered an acceptable method of de-risking potential shallow hazards, see 6.7.2.3 3. Surface casing should be cemented to surface during construction 4. An open hole to surface plug is required 5. A pilot hole with confirmed shallow gas should be cemented back to surface 6. One barrier may be acceptable based upon a specific risk evaluation considering well/template/installation stability 7. A specific risk evaluation of sustained casing pressure shall be performed, and mitigations incorporated in the well design or operating guidelines 8. For overburden formations with no or limited flow potential, a risk assessment (accounting for load scenarios, corrosion risks, fluid type, possibility to kill the formation, well operation limitations and challenges, etc) shall be performed to evaluate whether one less barrier is acceptable 9. Gas-lift gas require two barrier envelopes
	b) Interval with hydrocarbon and flow potential (included depleted reservoir)	Two[2]	Two	Two[5]	
	c) Shallow water flow potential	Two[2,6]	Two[6]	One	
Over pressure	d) Interval with no flow potential (with or without HC)	Two	One[7]	One[8]	
	e) Interval with limited flow potential (with or without HC)	Two	Two[8]	Two[8]	
	f) Interval with flow potential (including reservoir)	Two	Two	Two	

What is New?

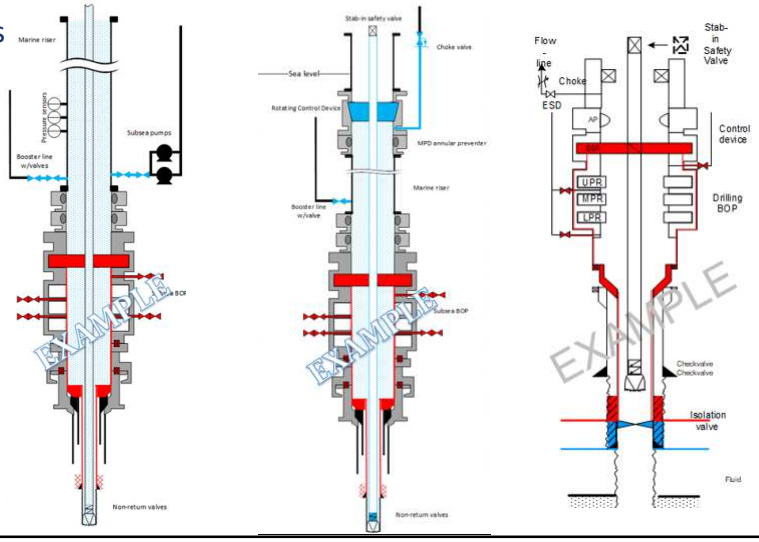
- Requirements for capping a well;
- Clause 14 – Manged Pressure Drilling and Underbalanced drilling activities;
- Annex A – BOP equipment Test pressure and Frequency:
  - Premises for the initial wellhead test after a previous stump test;
  - Conditions for extending the BOP test interval from 2 to 3 weeks;
- Annex B - Surface Back Pressure MPD and UBD Operational Considerations;
- Annex C – EAC tables (moved from clause 16);

What is New?

- MPD elements:
  - EAC 48; Rotating Control Device
  - EAC 49; Downhole Isolation Valve
  - EAC 50; MPD/UBD non-return valve
  - EAC 53; UBD/MPD choke system
  - EAC 54; Hydrostatically underbalanced fluid column
  - EAC 62; Marine drilling riser for SBP MPD applications

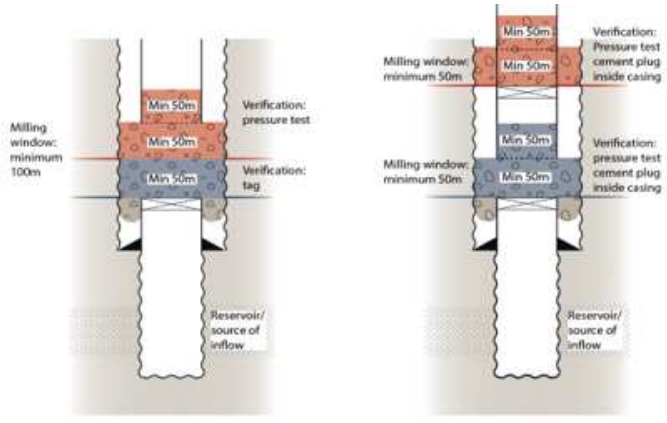
What is New?

- MPD techniques



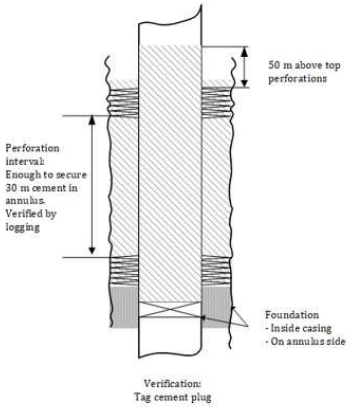
What is New?

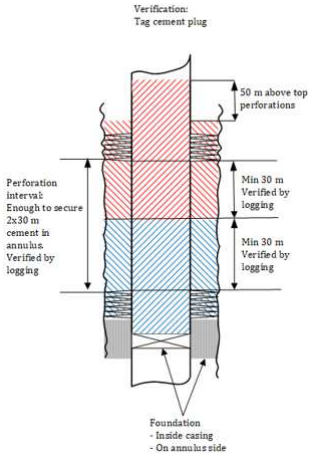
- EAC 60; Cement plug across a section milled interval.



What is New?

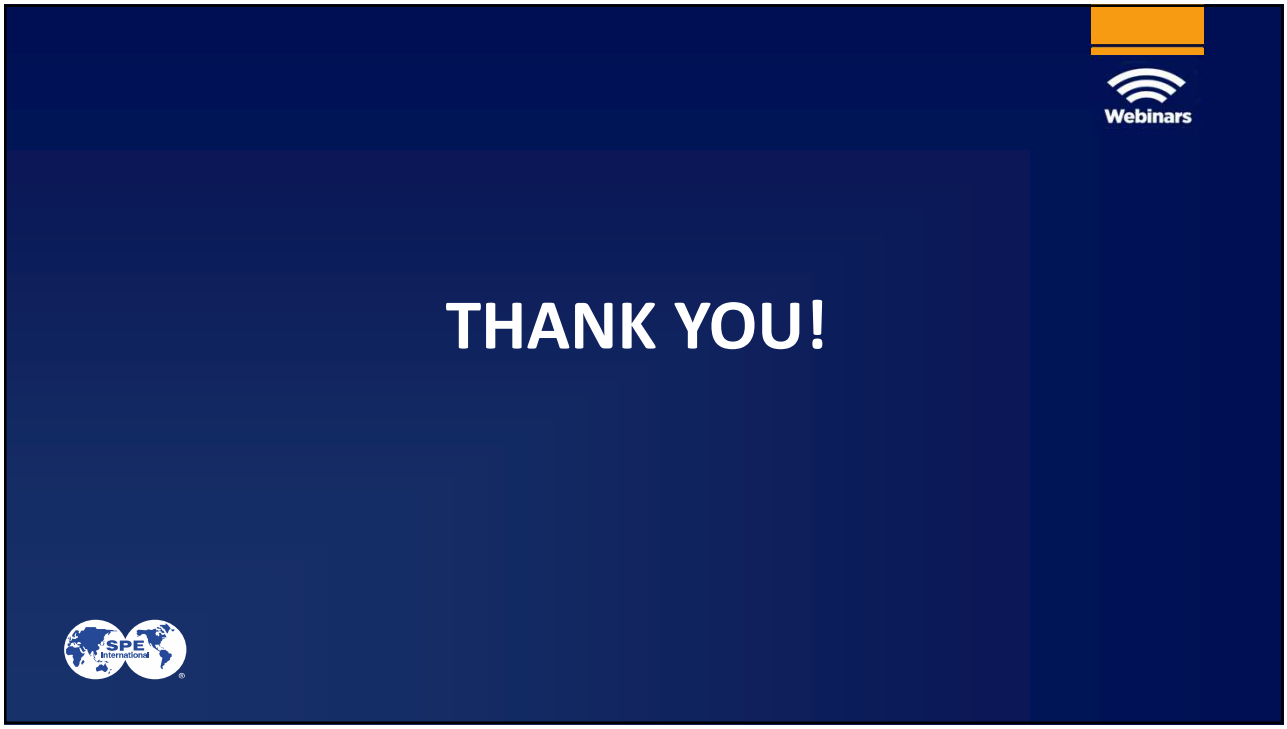
- EAC 61; Perforate/wash/cement (PWC) cement plug.





What is New?

- EAC 51; In-situ formation;
- EAC 52; Creeping formation;
- EAC 55; Alternative barrier material.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