

NORSOK STANDARD

D-007

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Well testing system

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Foreword

The NORSOK standards are developed by the Norwegian petroleum industry to ensure adequate safety, value adding and cost effectiveness for petroleum industry developments and operations. Furthermore, NORSOK standards are, as far as possible, intended to replace oil company specifications and serve as references in the authorities' regulations.

The NORSOK standards are normally based on recognized international standards, adding the provisions deemed necessary to fill the broad needs of the Norwegian petroleum industry. Where relevant, NORSOK standards will be used to provide the Norwegian industry input to the international

standardization process. Subject to development and publication of international standards, the relevant NORSOK standard will be withdrawn.

The NORSOK standards are developed according to the consensus principle generally applicable for most standards work and according to established procedures defined in NORSOK A-001.

The NORSOK standards are prepared and published with support by the Norwegian Oil and Gas Association, the Federation of Norwegian Industries, the Norwegian Shipowners' Association and the Petroleum Safety Authority Norway.

NORSOK standards are administered and published by Standards Norway.

1 Scope

This standard describes functional, performance and operational requirements for temporary well testing, production clean-up and bleed-off equipment and systems used for hydrocarbon flow from exploration or production wells on both mobile units and fixed platforms.

2 Normative and informative references

2.1 Normative references

The standards referred to below include provisions and guidelines that constitute provisions and guidelines for this NORSOK standard. Latest issue of the references shall be used unless otherwise agreed. Other recognized standards may be used provided it can be shown that they meet the requirements of the referenced standards.

Table 1 – Normative references

Standard	Title	Comments vs. NORSOK D-007
NORSOK D-001	Drilling facilities	
NORSOK D-010	Well integrity in drilling and well operations	
NORSOK S-001	Technical safety	
NORSOK S-002	Working environment	
NORSOK Z-015	Temporary equipment	Covers lifting and electrical requirements
EU 2006/42/EC on machinery	Directive 2006/42/EC on machinery	
IEC 61508 (SIL)	Functional Safety of Electrical /Electronic/ Programmable Electronic Safety-related Systems	Handled via Norwegian Oil and Gas guideline 070 – Application of IEC 61508 and IEC 61511 in the Norwegian petroleum industry
IEC 61511 (SIL)	Functional safety - Safety instrumented systems for the process industry sector	Handled via Norwegian Oil and Gas guideline 070 – Application of IEC 61508 and IEC 61511 in the Norwegian petroleum industry
ISO 10407 (API RP 7G)	Petroleum and natural gas industries - Drilling and production equipment - Drill stem design and operating limits	
ISO 10418	Petroleum and natural gas industries - Offshore production Installations - Analysis, design, installation and testing of basic surface process safety systems	Equivalent to API RP 14C
ISO 10423 (API Spec. 6A)	Petroleum and natural gas industries - Drilling and production equipment. - Wellhead and Christmas tree equipment	
ISO 10432 (API Spec. 14A)	Petroleum and natural gas industries - Downhole equipment - Subsurface safety valve equipment	

Standard	Title	Comments vs. NORSOK D-007
ISO 13628-11 (API RP 17B)	Petroleum and natural gas industries - Design and operation of subsea production systems - Part 11: Flexible pipe systems for subsea and marine applications	
ISO 14310 (API Spec 11D1)	Petroleum and natural gas industries - Downhole equipment - Packers and bridge plugs	
ISO 15156 (ANSI/NACE MR0175)	Petroleum and Natural Gas Industries - Materials for use in H ₂ S containing environments in oil and gas production	ANSI/NACE MR0175 underwent a major revision in 2003, which cannot be bridged for older equipment. Equipment built before 2003 follows the old version of the standard, while equipment built after the major revision follows the latest edition of the standard.
ISO 23251 (API RP 521)	Petroleum and natural gas industries - Pressure-relieving and depressurizing systems	
API Spec, 5CT	Specifications for casing and tubing	
API RP 14C	Recommended practice for analysis, design, installation and testing of basic surface safety systems on offshore production platforms	Equivalent to ISO 10418
API RP 44	Recommended Practice for Sampling Petroleum Reservoir Fluids	
API RP 520	Recommended practice for sizing, selection and installation of pressure-relieving devices in refineries	
ASME Section VIII Div. 1 and 2	Boiler and Pressure Vessel Code – VIII, Pressure Vessels	
EN 13445	Unfired Pressure Vessels	This is based on BS 5500, updated and harmonized with the EU Machinery Directive.
PD 5500	Specification for unfired, fusion welded pressure vessels	This is the continuation of the former BS 5500.
ASME B31.3	Process piping	This is the old ANSI B31.3 - Chemical plant and petroleum refinery piping
EN 13480	Metallic industrial piping	European equivalent to ASME B31.3
ASME B16.5	Pipe flanges and flanged fittings NPS 1/2 through NPS 24 metric/ inch standard	

2.2 Informative references

Table 2 – Informative references

Standard	Title	Comments vs. NORSOK D-007
ISO 13703 (API RP 14E)	Petroleum and natural gas industries – Design and installation of piping systems on offshore production platforms	Refer also to NORSOK P-001 which modifies ISO 13703 with alternative velocity and sizing criteria.
IEC 61892 all parts	Mobile and fixed offshore units - Electrical installations	
API RP 505	Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, and Zone 2	
DNV-RP-A203	Qualification of New Technology	
NORSOK D-002	Well intervention equipment	

3 Terms, definitions and abbreviations

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

3.1 Terms and definitions

3.1.1

shall

verbal form used to indicate requirements strictly to be followed in order to conform to this NORSOK standard and from which no deviation is permitted, unless accepted by all involved parties

3.1.2

should

verbal form used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required

3.1.3

may

verbal form used to indicate a course of action permissible within the limits of this NORSOK standard

3.1.4

can

verbal form used for statements of possibility and capability, whether material, physical or casual

3.1.5

bypass

the term "bypass" as used in this document is not the same as used in NORSOK P-001 section 7.1. For the purpose of this document "bypass" is used to describe a control process to isolate a process component

3.1.6

large bore subsea equipment

subsea equipment of 5" or larger size used for well intervention and well completion operations (large bore subsea equipment is not covered by NORSOK D-007)

3.1.7

main control room

the rig's main control room, where the ESD system control is located

3.1.8

PSD system

the electronic process shut-down system for the well test or production clean-up system. The system shuts the process down by stopping inflow from the well on surface. In addition the system has the ability to depressurize the well test or production clean-up system in case of a fire or gas situation. The PSD system is the responsibility of the well test or production clean-up service contractor

3.1.9

rig ESD

the rig ESD system, as defined in NORSOK S-001, is a rig owner responsibility, and is independent from the PSD system, except for the interfaces described in NORSOK D-007.

3.1.10

small bore subsea equipment

subsea equipment of 5" or smaller internal diameter used for well test operations

3.1.11**Zone 1 and Zone 2**

These are abbreviated terms for hazardous area classification:

Zone 0: An area in which an explosive gas atmosphere is present continuously or for long periods.

Zone 1: An area in which an explosive gas atmosphere is likely to occur in normal operation.

Zone 2: An area in which an explosive gas atmosphere is not likely to occur in normal operation and, if it occurs, will only exist for a short time.

For Norwegian operations it is recommended to use IEC 61892-7 – Mobile and fixed offshore units, electrical installations as the overall basis for area classification.

3.2 Abbreviations**Table 3 – Abbreviations**

Term	Explanation	Comments
ANSI	American National Standards Institute	
API	American Petroleum Institute	
ASME	American Society of Mechanical Engineers	
ATEX	ATmosphères EXplosives	French - explosive atmosphere
BOP	Blow-Out Preventer	
°C	Degree Celsius	
CO ₂	Carbon dioxide (gas)	
DODO	Drive-Off, Drift-Off	
DP	Dynamic Positioning	
EN	European standard (or Norm)	
ESD System	Emergency Shut-Down System	
ESP	Electrical, Submersible Pump	
HP	High Pressure	
HPHT	High Pressure High Temperature	
H ₂ S	Hydrogen sulfide (gas)	
ISO	International Organization for Standardization	
KO	Knock-Out	
LP	Low Pressure	
NACE	National Association of Corrosion Engineers	
NORSOK	NORSOK (The competitive standing of the Norwegian offshore sector) is the industry initiative to add value, reduce cost and lead time and remove unnecessary activities in offshore field developments and operations.	
PD	Published Document	British nomenclature for standards.
P&ID	Process and Instrumentation Diagram	
PSD System	Process Shut-Down System	This is the safety system for the

Term	Explanation	Comments
		surface well test equipment.
PSD 1	Process Shut-Down System - Level 1	Stops flow to the well test plant.
PSD 2	Process Shut-Down System - Level 2	Stops flow and depressurises the well test plant
RP	Recommended Practice	Used in conjunction with industry standards
SAC	Safety Analysis Checklist	Related to API RP 14C
SAFE	Safety Analysis Function Evaluation	Related to API RP 14C
SAT	Safety Analysis Table	Related to API RP 14C
SI	International System (of units)	
WHP	Well Head Pressure	
WOCS	Well Operations Control System	Control system for subsea and landing string equipment
WTDR	Well Test Design Report	

4 General principles

Any well test system design shall include barrier descriptions and schematics, in accordance with the requirements of NORSOK D-010, clause 4 and 6 with associated acceptance tables in clause 15.

In addition to the requirements mentioned specifically herein, the requirements in the following normative references shall apply for this NORSOK standard: NORSOK S-002, EU 2006/42/EC on machinery, ISO 10407 (API RP 7G), ISO 10418, ISO 10423 (API Spec. 6A), ISO 10432 (API Spec. 14A), ISO 13628-11 (API RP 17B), ISO 14310 (API Spec 11D1), ISO 15156 (ANSI/NACE MR0175), API RP 44, API RP 520, ASME Section VIII Div. 1 and 2, EN 13445, ASME B31.3, EN 13480, ASME B16.5. In addition to the informative references mentioned specifically herein, the following informative reference is given for informative purposes: API RP 505 and NORSOK D-002.

5 Functional requirements

5.1 General

SI units and Imperial units are used in this standard. SI units or imperial units may be used at the author's discretion, but the chosen unit shall be clearly identified and used consistently.

5.2 Products and services

The well testing equipment is grouped into five categories as detailed below. Equipment selection shall be suitable for the service conditions as provided for in the WTDR.

5.2.1 Downhole drill stem test tools

The downhole equipment shall control the production of reservoir fluids into the test tubing, or the injection of fluids from the tubing into the formation. It shall also provide a means of establishing communication between tubing and annulus for well control purposes.

5.2.2 Landing string equipment

The landing string equipment shall enable shutting in the well and allowing a controlled disconnect at BOP level, as required. It shall also provide means for lubricating working tools into the test string.

It also includes a shearable handling sub which provides a suitable place to do emergency cutting using the BOP shear ram.