TECHNICAL SPECIFICATION

ISO/TS 16530-2

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Well integrity —

Part 2: Well integrity for the operational phase

Intégrité du puits —

Partie 2: Intégrité du puits pour la phase opérationnelle

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 4, *Drilling and production equipment.*

ISO/TS 16530 consists of the following parts, under the general title *Well integrity*:

— *Part 2: Well integrity for the operational phase*

The following parts are under preparation:

— *Part 1: Life cycle governance manual*

Introduction

This Technical Specification has been developed by producing operating companies for oil and gas, and is intended for use in the petroleum and natural gas industry worldwide. This Technical Specification is intended to give requirements and information to the Well Operator on managing well integrity for the operational phase. Furthermore, this Technical Specification addresses the minimum compliance requirements for the Well Operator, in order to claim conformity with this Technical Specification.

It is necessary that users of this Technical Specification are aware that requirements above those outlined in this Technical Specification can be needed for individual applications. This Technical Specification is not intended to inhibit or replace legal requirements; it is in addition to the legal requirements; where there is a conflict the legal requirement always takes precedence. This can be particularly applicable where there is innovative or developing technology, with changes in field or well design operating philosophy.

This Technical Specification addresses the process of managing well integrity by assuring compliance to the specified operating limits for identified well types, that are defined based on exposure of risk to people, environment, assets and reputation, supported by associated well maintenance/monitoring plans, technical reviews and management of change.

The following terminology is used in this Technical Specification.

a) The term “shall” or “must” denotes a minimum requirement in order to conform to this Technical Specification.

b) The term “should” denotes a recommendation or that which is advised but not required in order to conform to this Technical Specification.

c) The term “may” is used to indicate a course of action permissible within the limits of the document.

d) The term “consider” is used to indicate a suggestion or to advise.

e) The term “can” is used to express possibility or capability.

Well integrity —

Part 2:
Well integrity for the operational phase

IMPORTANT — The electronic file of this document contains colours which are considered to be useful for the correct understanding of the document. Users should therefore consider printing this document using a colour printer.

1 Scope

This Technical Specification provides requirements and methods to the oil and gas industry to manage well integrity during the well operational phase.

The operational phase is considered to extend from handover of the well after construction, to handover prior to abandonment. This represents only the period during the life cycle of the well when it is being operated and is illustrated in Figure 1.

The scope of the Technical Specification includes:

— A description of the processes required to assess and manage risk within a defined framework. The risk assessment process also applies when deviating from this Technical Specification.

— The process of managing well integrity by operating wells in compliance with operating limits for all well types that are defined based on exposure of risk to people, environment, assets and reputation. The management of well integrity is supported by associated maintenance/monitoring plans, technical reviews and the management of change.

— The assessment of existing assets (wells / fields) in order to start the process of Well Integrity Management in accordance with this technical specification.

— The handover process required when changing from one activity to another during the operational phase.

The scope of the Technical Specification applies to all wells that are utilized by the oil and gas industry, regardless of their age, type or location.

The scope of the Technical Specification does NOT apply to:

— The periods during well intervention or work-over activities but it DOES include the result of the intervention and any impact that this can have to the well envelope and the associated well barriers.

— The equipment that is required or used outside the well envelope for a well intervention such as wire-line or coiled tubing or a pumping package.

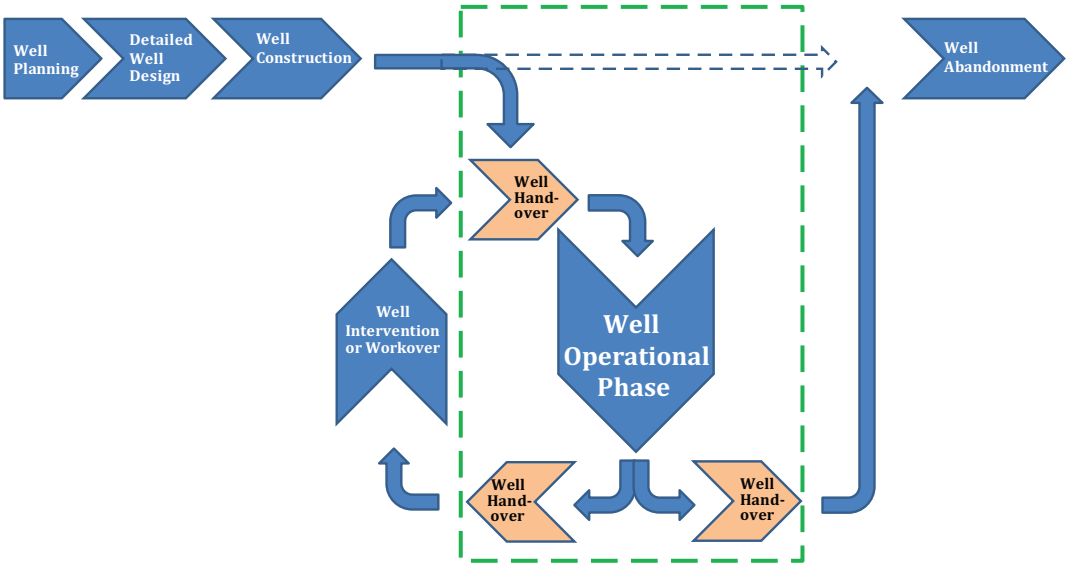

Figure 1 — Illustration of the scope of this Technical Specification

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 10417:2004, *Petroleum and natural gas industries — Subsurface safety valve systems — Design, installation, operation and redress*

API RP 14H, *Recommended Practice for Installation, Maintenance and Repair of Surface Safety Valves and Underwater Safety Valves Offshore, Fifth Edition*

3 Terms, definitions and abbreviated terms

For the purposes of this document, the following terms and definitions apply.

3.1
A-annulus
designation of annulus between the production tubing and production casing

[SOURCE: API RP 90, modified]

3.2
abandoned well
permanent subsurface isolation of the well

3.3
ambient pressure
pressure external to the wellhead

Note 1 to entry: In the case of a surface wellhead, the pressure is zero psig. In the case of a subsea wellhead, it is equal to the hydrostatic pressure of seawater at the depth of the subsea wellhead, in psig.

[SOURCE: API RP 90, modified]

3.4
anomaly
condition that differs from what is expected or typical, or which differs from that predicted by a theoretical model

3.5
B-annulus
designation of annulus between the production casing and the next outer casing

Note 1 to entry: The letter designation continues in sequence for each outer annular space encountered between casing strings, up to and including the surface casing and conductor casing strings.

[SOURCE: API RP 90, modified]

3.6
breaking of containment
breaking into the containment system of integrity or barrier envelope

3.7
competency
ability of an individual to perform a job properly through a combination of training, demonstrated skills and accumulated experience

3.8
component
mechanical part, including cement, used in the construction of a well

3.9
conductor casing
element that provides structural support for the well, wellhead and completion equipment, and often for hole stability for initial drilling operations

Note 1 to entry: This casing string is not designed for pressure containment, but upon completion of the well, it may have a casing head; therefore, it can be capable of containing low annular pressures. For subsea and hybrid wells, the low pressure subsea wellhead is normally installed on this casing string.

[SOURCE: API RP 90, modified]

3.10
consequence
expected effect of an event that occurs

3.11
deep-set
below or close to the production packer, or at the cap rock of a reservoir to isolate the production tubing or casing from the producing reservoir

3.12
deviation
departure from a standard

3.13
double-block and bleed principle
operation with two valves or seals, in series, or a valve and a blind cap in all relevant, utilized flow paths into and out of the well that are not connected to a closed system

3.14
failure
loss of intended function

3.15
failure mode
description of the method of failure

3.16
failure modes and effects analysis
FMEA
procedure used in design, development and operations management for the analysis of potential failure modes within a system for classification of the severity and likelihood of the failures

3.17
failure mode, effects, and criticality analysis
FMECA
extension of FMEA (3.16) that in addition includes an analysis of the criticalities to evaluate the seriousness of the consequences of a failure versus the probability of its occurrence

3.18
fault
abnormal, undesirable state of a system element (e.g. entire subsystem, assembly, component) induced by the presence of an improper command or absence of a proper one, or by a failure

Note 1 to entry: All failures cause faults, not all faults are caused by failure.

3.19
flow-wetted
any surface that is exposed to fluids coming from a pressure source for that fluid

3.20
handover
act or process of transferring responsibility for operating a well from one competent party to another, including both custody to operate (certificate) and the requisite data and documents which describe the well construction

3.21
hazard
source of potential harm or a situation with a potential to cause loss (any negative consequence)

[SOURCE: API RP 90, modified]

3.22
hybrid well
well drilled with a subsea wellhead and completed with a surface casing head, a surface tubing head, a surface tubing hanger, and a surface Christmas tree

Note 1 to entry: A hybrid well can have either one (single-bore production riser) casing string or two (dual-bore production riser) casing strings brought up from the subsea wellhead and tied back to the surface equipment. These wells are typically located on floating production platforms, such as spars or TLPs.

[SOURCE: API RP 90, modified]

3.23
impairment
state of diminished ability to perform a function, but not yet failed

3.24
inflow testing
use of the tubing or casing pressure to perform leak testing

3.25
intervention
operation to enter the well through the Christmas tree

3.26
leak
unintended and, therefore, undesired movement of fluids, either to or from, a container or a fluid containing system

3.27
casing/liner
casing string with its uppermost point inside and near the bottom end of a previous casing string using a liner hanger

3.28
major hazard
hazard (3.21) with a potential for causing major accidents, i.e. involving fatality due to fire or explosion, major pollution, multiple fatalities, or severe damage to the installation

3.29
maximum allowable annulus surface pressure
MAASP
***P*MAASP**
greatest pressure that an annulus can contain, as measured at the wellhead, without compromising the integrity of any element of that annulus, including any exposed open-hole formations

3.30
the operational phase
is considered to extend from handover of the well after construction, to handover prior to abandonment, indicating the life cycle of the well while being operated

3.31
Well Operator-imposed annulus pressure
casing pressure that is Well Operator-imposed for purposes such as gas lift, water injection, thermal insulation, etc

[SOURCE: API RP 90, modified]

3.32
performance standard
statement, which can be expressed in qualitative or quantitative terms as appropriate, of the performance required of a safety-critical element in order to ensure the safety and integrity of the installation

3.33
pressure test
application of a pressure from an external source (non-reservoir pressure) to ascertain the mechanical and sealing integrity of a component

3.34
primary well barrier
first well barrier envelope that the produced and/or injected fluids contact and that is in-place and functional during well operations

3.35
production casing
innermost string of casing in the well

Note 1 to entry: Production fluids enter the casing below the production packer and continue to the surface through the production string. At a minimum, the production casing is rated for the maximum anticipated pressure that can be encountered from the production zone.

[SOURCE: API RP 90, modified]

3.36
production riser
on fixed platforms, the casing strings rising from the seafloor to the wellhead or, on hybrid wells, the casing strings attached to the subsea wellhead rising from the seafloor to the surface wellhead

[SOURCE: API RP 90, modified]

3.37
production string
completion string
string consisting primarily of production tubing, but also including additional components such as the surface-controlled subsurface safety valve (SCSSV), gas lift mandrels, chemical injection and instrument ports, landing nipples, and packer or packer seal assemblies

Note 1 to entry: The production string is run inside the production casing and used to conduct production fluids to the surface.

[SOURCE: API RP 90, modified]

3.38
production tubing
tubing that is run inside the production casing and used to convey produced fluids from the hydrocarbon-bearing formation to the surface

Note 1 to entry: Tubing can also be used for injection. In some hybrid wells, for example, tubing is used as a conduit for gas for artificial lift below a mudline pack-off tubing hanger to isolate the gas-lift pressure from the production riser.

[SOURCE: API RP 90, modified]

3.39
reliability
probability that equipment can perform a specified function under stated conditions for a given period of time

3.40
risk
combination of the consequences of an event and the associated likelihood of its occurrence

3.41
risk assessment
systematic analysis of the risks from activities and a rational evaluation of their significance by comparison against predetermined standards, target risk levels or other risk criteria

Note 1 to entry: Risk assessment is used to determine risk management priorities.

3.42
safety critical element
part of the installation or plant that is essential to maintain the safety and integrity of the installation

Note 1 to entry: This includes any item that is intended to prevent or limit the effect of a major hazard or which, upon failure, can cause or contribute substantially to a major hazard affecting the safety or integrity of the installation.

Note 2 to entry: Safety-critical elements include measures for prevention, detection, control and mitigation (including personnel protection) of hazards.

Note 3 to entry: Within the context of this Technical Specification, an installation is considered as a well.

3.43
secondary well barrier
second set of barrier elements that prevent flow from a source

[SOURCE: API RP 90, modified]

3.44
shut-in well
well with one or more valve(s) closed in the direction of flow

3.45
subsea well
well completed with a subsea wellhead and a subsea tree

[SOURCE: API RP 90, modified]

3.46
subsea wellhead
wellhead that is installed at or near the seabed

3.47
surface casing
casing that is run inside the conductor casing to protect shallow water zones and weaker formations and may be cemented within the conductor string and is often cemented back to the mud-line or surface

Note 1 to entry: The surface wellhead is normally installed on this string for surface wells.

[SOURCE: API RP 90]

3.48
suspended well
well that has been isolated from the producing reservoir via a deep-set down-hole isolation device (mechanical or cement plug)

Note 1 to entry: Components above the isolation device are no longer considered flow wetted.

3.49
sustained annulus pressure (SAP)
pressure in an annulus that

a) rebuilds when bled down;

b) is not caused solely by temperature fluctuations; and

c) is not a pressure that has been imposed by the Well Operator

[SOURCE: API RP 90, modified]

3.50
thermally induced annulus pressure
pressure in an annulus generated by thermal expansion or contraction of trapped fluids

[SOURCE: API RP 90, modified]

3.51
verification
examination, testing, audit or review to confirm that an activity, product or service is in accordance with specified requirements

3.52
well barrier element
one or several dependent components that are combined to form a barrier envelope that, in combination, prevent uncontrolled flow of fluids within or from a well