INTERNATIONAL STANDARD

ISO 10432

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Petroleum and natural gas industries — Downhole equipment — Subsurface safety valve equipment

Industries du pétrole et du gaz naturel — Équipement de forage vertical — Vannes de protection de fond de puits

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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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 10432 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 4, *Drilling and production equipment*.

This third edition cancels and replaces the second edition (ISO 10432:1999), which has been technically revised.

Introduction

This International Standard has been developed by users/purchasers and suppliers/manufacturers of subsurface safety valves intended for use in the petroleum and natural gas industry worldwide. This International Standard is intended to give requirements and information to both parties in the selection, manufacture, testing and use of subsurface safety valves. Furthermore, this International Standard addresses the minimum requirements with which the supplier/manufacturer is to comply so as to claim conformity with this International Standard.

Users of this International Standard should be aware that requirements above those outlined in this International Standard may be needed for individual applications. This International Standard is not intended to inhibit a supplier/manufacturer from offering, or the user/purchaser from accepting, alternative equipment or engineering solutions. This may be particularly applicable where there is innovative or developing technology. Where an alternative is offered, the supplier/manufacturer should identify any variations from this International Standard and provide details.

The requirements for lock mandrels and landing nipples previously contained in this International Standard are now included in ISO 16070.

Petroleum and natural gas industries — Downhole equipment — Subsurface safety valve equipment

1 Scope

This International Standard provides the minimum acceptable requirements for subsurface safety valves (SSSVs). It covers subsurface safety valves including all components that establish tolerances and/or clearances which may affect performance or interchangeability of the SSSVs. It includes repair operations and the interface connections to the flow control or other equipment, but does not cover the connections to the well conduit.

NOTE Limits: The subsurface safety valve is an emergency safety device, and is not intended or designed for operational activities, such as production/injection reduction, production stop, or as a backflow valve.

Redress activities are beyond the scope of this International Standard, see Clause 8.

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.

ISO 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 527-1, *Plastics — Determination of tensile properties — Part 1: General principles*

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 3601-1, *Fluid power systems — O-rings — Part 1: Inside diameters, cross-sections, tolerances and size identification code*

ISO 3601-3, *Fluid systems — Sealing devices — O-rings — Part 3: Quality acceptance criteria*

ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method*

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T)*

ISO 6892, *Metallic materials — Tensile testing at ambient temperature*

ISO 9000:2000, *Quality management systems — Fundamentals and vocabulary*

ISO 9712, *Non-destructive testing — Qualification and certification of personnel*

ISO 10414-1, *Petroleum and natural gas industries — Field testing of drilling fluids — Par 1: Water-based fluids*

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

ISO 13628-3, *Petroleum and natural gas industries — Design and operation of subsea production systems — Part 3: Through flowline (TFL) systems*

ISO 13665, *Seamless and welded steel tubes for pressure purposes — Magnetic particle inspection of the tube body for the detection of surface imperfections*

ISO 15156 (all parts), *Petroleum and natural gas industries — Materials for use in H_2S-containing environments in oil and gas production*

ISO 16070, *Petroleum and natural gas industries — Downhole equipment — Lock mandrels and landing nipples*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

ANSI/NCSL Z540-1:1994, *General requirements for calibration laboratories and measuring and test equipment*[1)]

API Manual of Petroleum Measurement Standards, Chapter 10.4, *Determination of sediment and water in crude oil by the centrifuge method (field procedure)*[2)]

API Spec 5B, *Threading, gauging, and thread inspection of casing, tubing, and line pipe threads*

API Spec 14A, *Specification for subsurface safety valve equipment*

ASME Boiler and Pressure Vessel Code, Section II, *Materials specification*[3)]

ASME Boiler and Pressure Vessel Code, Section V, *Nondestructive examination*

ASME Boiler and Pressure Vessel Code, Section VIII:2001, *Pressure vessels*

ASME Boiler and Pressure Vessel Code, Section IX, *Welding and brazing qualifications*

ASTM A 388/A 388M, *Standard practice for ultrasonic examination of heavy steel forgings*[4)]

ASTM A 609/A 609M, *Standard practice for castings, carbon, low-alloy, and martensitic stainless steel, ultrasonic examination thereof*

ASTM D 395, *Standard test methods for rubber property — Compression set*

ASTM D 412, *Standard test methods for vulcanized rubber and thermoplastic elastomers — Tension*

ASTM D 1414, *Standard test methods for rubber O-rings*

ASTM D 2240, *Standard test methods for rubber propert — Durometer hardness*

ASTM E 94, *Standard guide for radiographic examination*

ASTM E 140, *Standard hardness conversion tables for metals. (Relationship among Brinell hardness, Vickers hardness, Rockwell hardness, superficial hardness, Knoop hardness, and scleroscope hardness)*

1) NCSL International, 2995 Wilderness Place, Suite 107, Boulder, Colorado 80301-5404, USA.

2) American Petroleum Institute, 1220 L Street NW, Washington, DC 20005-4070, USA.

3) American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990, USA.

4) American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA.

ASTM E 165, *Standard test method for liquid penetrant examination*

ASTM E 186, *Standard reference radiographs for heavy-walled [2 to 4 1/2-in. (51 to 114-mm)] steel castings*

ASTM E 280, *Standard reference radiographs for heavy-walled [4 1/2 to 12-in. (114 to 305-mm)] steel castings*

ASTM E 428, *Standard practice for fabrication and control of steel reference blocks used in ultrasonic inspection*

ASTM E 446, *Standard reference radiographs for steel castings up to 2 in. (51 mm) in thickness*

ASTM E 709, *Standard guide for magnetic particle examination*

BS 2M 54:1991, *Temperature control in the heat treatment of metals*[5)]

SAE-AMS-H-6875:1998, *Heat treatment of steel raw materials*[6)]

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9000:2000 and the following apply.

3.1
bean
orifice
designed restriction causing the pressure drop in velocity-type SSCSVs

3.2
design acceptance criteria
defined limits placed on characteristics of materials, products, or services established by the organization, customer, and/or applicable specifications to achieve conformity to the product design

[ISO/TS 29001:2003]

3.3
design validation
process of proving a design by testing to demonstrate conformity of the product to design requirements

[ISO/TS 29001:2003]

3.4
design verification
process of examining the result of a given design or development activity to determine conformity with specified requirements

[ISO/TS 29001:2003]

3.5
end connection
thread or other mechanism providing equipment-to-tubular interface

3.6
environment
set of conditions to which the product is exposed

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5) BSI, Customer Services, 389 Chiswick High Road, London W4 4AL, UK.

6) SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, USA.

3.7
failure
any equipment condition that prevents it from performing to the requirements of the functional specification

3.8
fit
geometric relationship between parts

NOTE This includes the tolerance criteria used during the design of a part and its mating parts, including seals.

3.9
form
essential shape of a product including all its component parts

3.10
function
operation of a product during service

3.11
functional test
test performed to confirm proper operation of equipment

3.12
heat treatment
heat treating
alternate steps of controlled heating and cooling of materials for the purpose of changing mechanical properties

3.13
interchangeable
conforming in every detail, within specified tolerances, to both fit and function of a safe design but not necessarily to the form

3.14
manufacturer
principal agent in the design, fabrication and furnishing of equipment, who chooses to comply with this International Standard

3.15
manufacturing
process and action performed by an equipment supplier/manufacturer that are necessary to provide finished component(s), assembly(ies) and related documentation, that fulfil the requests of the user/purchaser and meet the standards of the supplier/manufacturer

NOTE Manufacturing begins when the supplier/manufacturer receives the order and is completed at the moment the component(s), assembly(ies) and related documentation are surrendered to a transportation provider.

[ISO 16070]

3.16
mass loss corrosion
weight loss corrosion (deprecated term)
loss of metal in areas exposed to fluids which contain water or brine and carbon dioxide (CO_2), oxygen (O_2) or other corrosive agents

NOTE The term “weight” is commonly incorrectly used to mean mass, but this practice is deprecated.

3.17
model
SSSV equipment with unique components and operating characteristics which differentiate it from other SSSV equipment of the same type

NOTE The same model can have any of a variety of end connections.

3.18
operating manual
publication issued by the manufacturer which contains detailed data and instructions related to the design, installation, operation and maintenance of equipment

3.19
profile
feature that is designed for the reception of a locking mechanism

3.20
proof test
test specified by the manufacturer which is performed to verify that the SSSV meets those requirements of the technical specification which are relevant to the validation testing performance

3.21
qualified part
part manufactured under a recognized quality assurance programme and, in the case of replacement, produced to meet or exceed the performance of the original part produced by the original equipment manufacturer (OEM)

NOTE ISO 9001 is an example of a recognized quality assurance programme.

[ISO 10417]

3.22
redress
any activity involving the replacement of qualified parts

cf. **repair** (3.23)

NOTE See Clause 8 for more information.

3.23
repair
any activity beyond the scope of redress that includes disassembly, re-assembly, and testing with or without the replacement of parts and may include machining, welding, heat treating or other manufacturing operations, that restores the equipment to its original performance

cf. **redress** (3.22)

[ISO 10417]

NOTE See Clause 8 for more information.

3.24
sealing device
device preventing contact of liquid and/or gas across the interface between the lock mandrel and the landing nipple

3.25
size
relevant dimensional characteristics of the equipment as defined by the manufacturer

3.26
sour service
exposure to oilfield environments that contain H_2S and can cause cracking of materials by the mechanisms addressed in ISO 15156

NOTE Adapted from ISO 15156-1:2001.

3.27
special feature
specific component or sub-assembly that provides a functional capability that is not validated during the validation test conducted in accordance with 6.5

3.28
subsurface safety valve
SSSV
device whose design function is to prevent uncontrolled well flow when closed

NOTE SSSVs can be installed and retrieved by wireline or pump-down methods (wireline-retrievable) or be an integral part of the tubing string (tubing-retrievable).

3.29
subsurface safety valve equipment
SSSV equipment
subsurface safety valve, and all components that establish tolerances and/or clearances which can affect its performance or interchangeability

3.30
stress corrosion cracking
SCC
cracking of metal involving anodic processes of localized corrosion and tensile stress (residual and/or applied) in the presence of water and H_2S

NOTE Chlorides and/or oxidants and elevated temperature can increase the susceptibility of metals to this mechanism of attack.

[ISO 15156-1]

3.31
stress cracking
stress corrosion cracking, or sulfide stress cracking, or both

NOTE Adapted from NACE MR0175: Jan 2003.

3.32
stress relief
controlled heating of material to a predetermined temperature for the purpose of reducing any residual stresses

3.33
sulfide stress cracking
SSC
cracking of metal involving corrosion and tensile stress (residual and/or applied) in the presence of water and H_2S

NOTE SSC is a form of hydrogen stress cracking (HSC) and involves embrittlement of the metal by atomic hydrogen that is produced by acid corrosion on the metal surface. Hydrogen uptake is promoted in the presence of sulfides. The atomic hydrogen can diffuse into the metal, reduce ductility and increase susceptibility to cracking. High strength metallic materials and hard weld zones are prone to SSC.

[ISO 15156-1]

3.34
test agency
organization which provides a test facility and administers a test program that meets the validation test requirements of this International Standard

NOTE See Annex A for test agency requirements.

3.35
test pressure
pressure at which the equipment is tested based upon all relevant design criteria

3.36
test section
test apparatus which contains the SSSV and provides for connection to a test facility's validation test apparatus

3.37
type
SSSV equipment with unique characteristics which differentiate it from other functionally similar SSSV equipment

EXAMPLES SCSSV, velocity-type SSCSV and low-tubing-pressure-type SSCSV are types of SSSV.

3.38
validation test
test performed to qualify a particular size, type and model of equipment for a specific class of service

NOTE See Annex B for details.

3.39
working pressure
SSSV internal pressure rating, including the differential rating with the valve closed

4 Abbreviated terms

AQL	acceptance quality limit
NDE	non-destructive examination
TFL	through flowline
SCSSV	surface-controlled subsurface safety valve
SSCSV	subsurface controlled subsurface safety valve
SSSV	subsurface safety valve
TRSV	tubing-retrievable safety valve
WRSV	wireline-retrievable safety valve

5 Functional specification

5.1 General

5.1.1 Functional requirements

The user/purchaser shall prepare a functional specification for ordering products which conform with this International Standard and specify the following requirements and operating conditions, as appropriate, and/or identify the supplier's/manufacturer's specific product. These requirements and operating conditions may be conveyed by means of a dimensional drawing, data sheet or other suitable documentation.

5.1.2 Classes of service

SSSV equipment manufactured in accordance with this International Standard shall conform to one or more of the following classes of service. The user/purchaser shall specify the class(s), as applicable.

— **Class 1: standard service.** This class of SSSV equipment is intended for use in wells which are not expected to exhibit the detrimental effects defined by Classes 2, 3, or 4.

— **Class 2: sandy service.** This class of SSSV equipment is intended for use in wells where particulates such as sand could be expected to cause SSSV equipment failure.

— **Class 3: stress cracking service.** This class of SSSV equipment is intended for use in wells where water containing corrosive agents can cause stress cracking. Class 3 equipment shall meet the requirements for Class 1 or Class 2 service and be manufactured from metallic materials that are demonstrated as resistant to sulfide stress cracking and stress corrosion cracking.

The supplier/manufacturer shall ensure that the metallic materials used in Class 3 equipment meet the metallurgical requirements of ISO 15156 (all parts) for sour service and/or shall be suitable for service in non-sour-containing environments where stress corrosion cracking can occur.

The user/purchaser shall ensure that the specific metallic materials contained within Class 3 equipment are suitable for the intended application.

Within Class 3, there are two sub-classes, as follows:

1) 3S for sulfide stress cracking service and stress corrosion cracking service in which chlorides are present in a sour environment. Metallic materials suitable for a 3S environment shall be in accordance with ISO 15156 (all parts).

2) 3C for stress corrosion cracking service in a non-sour environment. Metallic materials suitable for Class 3C non-sour service are dependent on specific well conditions; no national or international standards exist for the application of metallic materials for this class of service.

NOTE For the purposes of these provisions, NACE MR0175/ISO 15156-1-2-3, is equivalent to ISO 15156 (all parts).

— **Class 4: mass loss corrosion service** (see 3.16). This class of SSSV equipment is intended for use in wells where corrosive agents could be expected to cause mass loss corrosion. Class 4 equipment shall meet the requirements for Class 1 or Class 2 and be manufactured from materials which are resistant to mass loss corrosion. Metallic materials suitable for Class 4 service are dependent on specific well conditions; no national or international standards exist for the application of metallic materials for this class of service.

5.2 SSSV functional characteristics

The SSSV functional characteristics should include but are not limited to the following:

a) type of SSSV control (surface-controlled, subsurface-controlled);

b) type of SSSV retrieval (tubing-retrievable, WL-retrievable, coil-tubing-retrievable, TFL-retrievable, etc.);

c) type of SSSV closing mechanism (ball, flapper, etc.);

d) requirement for internal self-equalizing capability;

e) requirement, if any, for holding the SCSSV open without the use of the primary operating source (temporary or permanent lock-open system);

f) requirement, if any, for providing control fluid communication from the SCSSV to any other subsurface device (e.g. a through-tubing retrievable secondary valve);

g) requirement, if any, for providing pump-through capability;

h) requirement, if any, for a redundant/independent back-up operating system;

i) requirements, if any, for minimal leakage (in accordance with 6.7.2) during functional testing.

5.3 Well parameters

The following characteristics shall be specified as applicable:

a) well location (land, platform, subsea);

b) size, mass, grade and material of the casing and tubing;

c) setting depth (maximum required for application) and control system parameters (control fluid type/properties, supply pressure, supply line(s) and connection rating(s), etc.);

d) casing and/or tubing architecture, trajectory, deviations, maximum dog leg severity;

e) restrictions through which the SSSV shall pass and restrictions/profiles through which the SSSV service tools/accessories shall pass;

f) requirement, if any, for passage of additional lines (electrical, hydraulic), between the valve OD and the casing ID, if applicable.

5.4 Operational parameters

5.4.1 SSSVs

The following operational parameters, as applicable, shall be specified for the SSSV:

a) rated working pressure;

b) rated temperature range;

c) if applicable, maximum allowable pressure drop at maximum flow rate through SSSV;

d) loading conditions, including combined loading (pressures, tension/compression, torque, bending) and the corresponding temperature extremes anticipated to be applied to the valve;

e) well stimulation operations, including its parameters, such as acidizing (give the composition of the acid), the pressure, the temperature, the acid flow rate and the exposure time, as well as any other chemicals used during the stimulation;

f) sand consolidation and fracturing operations, including sand/proppant description, fluid flow rate, proppant/fluid ratio or sand/fluid ratio, chemical composition, pressure and temperature;

g) well-servicing activities through the safety valve: size, type and configuration of other devices to be run through the valve, if applicable.