INTERNATIONAL STANDARD

ISO 13679

First edition
2002-12-15

Petroleum and natural gas industries — Procedures for testing casing and tubing connections

Industries du pétrole et du gaz naturel — Procédures de test des connexions pour tubes de cuvelage et de production

Reference number
ISO 13679:2002(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

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 13679 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 5, *Casing, tubing and drill pipe*.

Introduction

This International Standard is part of a process to provide reliable tubing and casing connections for the oil and natural gas industry which are fit for purpose. It has been developed based on improvements to API Recommended Practice 5C5 and proprietary test procedures, with input from leading users, manufacturers and testing consultants from around the world. This International Standard represents the knowledge of many years of testing and qualification experiences.

The validation of connection test load envelope and failure limit loads is relevant to design of tubing and casing for the oil and natural gas industries. Tubing and casing are subject to loads which include internal pressure, external pressure, axial tension, axial compression, bending, torsion, transverse forces and temperature changes. The magnitude and combination of these loads result in various pipe body and connection failure modes. Although pipe body test and limit loads are well understood in general, the same cannot be stated for the connection. These failure modes and loads are generally different and often less than that of the pipe. Consequently experimental validation is required. Well design matches the test and limit loads of both the connection and pipe to the well conditions to provide load capacities with suitable reliability.

The validation of test and limit loads requires testing at the extremes of performance parameters to these defined loads. Testing at the extremes of the performance parameters assures that the production population, which falls within these limits, will meet or exceed the performance of the test population. Thread connection performance parameters include dimensional tolerances, mechanical properties, surface treatment, make-up torque and the type and amount of thread compound. For typical proprietary connections, worst-case tolerances are known and defined in this International Standard. For other connections design analysis is required to define worst-case tolerance combinations.

Users of this International Standard should be aware that further or differing requirements might be needed for individual applications. This International Standard is not intended to inhibit a vendor from offering, or a purchaser from accepting, alternate equipment or engineering solutions for the individual application. This may be particularly applicable when there is innovative or developing technology. Where an alternative is offered, the vendor should identify any variations from this International Standard and provide details.

This International Standard consists of the following major parts. Based on manufacturer's-supplied data specified in Annex A and/or calculations in Annex B, tests are conducted in accordance with Clauses 4 to 8 and reported on the data forms given in Annex C. Annex D lists all the information that is to be provided in the full report whereas Annex E lists the information that is to be provided in a summary test report. This summary test report lists the minimum information necessary to fully specify the connection tested and its preparation is intended for broader distribution. Annex F gives an example of a load frame calibration. Annex G gives considerations for possible connection product line qualification. Annex H provides guidelines for supplemental tests, which may be required for special applications. Annex I gives the design rationale for this International Standard. Annex J gives requirements for connections that contain both a metal-to-metal seal and a resilient seal which are tested separately.

Supplementary tests may be appropriate for specific applications that are not evaluated by the tests herein. The user and manufacturer should discuss well applications and limitations of the connection being considered.

Representatives of users and/or other third party personnel are encouraged to monitor the tests. ISO 13679 covers the testing of connections for the most commonly encountered well conditions. Not all possible service scenarios are included. For example, the presence of a corrosive fluid, which may influence the service performance of a connection, is not considered.

This International Standard includes provisions of various nature. These are identified by the use of certain verbal forms:

— SHALL is used to indicate that a provision is a REQUIREMENT, i.e. MANDATORY;

- SHOULD is used to indicate that a provision is a RECOMMENDATION to be used as good practice, but is not mandatory;
- MAY is used to indicate that a provision is OPTIONAL, i.e. indicates a course of action permissible within the limits of the document;
- CAN is used to indicate statements of POSSIBILITY and CAPABILITY.

Petroleum and natural gas industries — Procedures for testing casing and tubing connections

1 Scope

This International Standard establishes minimum design verification testing procedures and acceptance criteria for casing and tubing connections for the oil and natural gas industries. These physical tests are part of a design verification process and provide objective evidence that the connection conforms to the manufacturer's claimed test load envelope and limit loads.

It categorizes test severity into four test classes.

It describes a system of identification codes for connections.

This International Standard does not provide the statistical basis for risk analysis.

This International Standard addresses only three of the five distinct types of primary loads to which casing and tubing strings are subjected in wells: fluid pressure (internal and/or external), axial force (tension or compression), bending (buckling and/or wellbore deviation), as well as make-up torsion. It does not address rotation torsion and non-axisymmetric (area, line or point contact) loads.

This International Standard specifies tests to be performed to determine the galling tendency, sealing performance and structural integrity of casing and tubing connections. The words casing and tubing apply to the service application and not to the diameter of the pipe.

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 3183-1, *Petroleum and natural gas industries — Steel pipe for pipelines — Technical delivery conditions — Part 1: Pipes of requirement class A*

ISO 3183-2, *Petroleum and natural gas industries — Steel pipe for pipelines — Technical delivery conditions — Part 2: Pipes of requirements class B*

ISO 3183-3, *Petroleum and natural gas industries — Steel pipe for pipelines — Technical delivery conditions — Part 3: Pipes of requirement class C*

ISO 10400:1993, *Petroleum and natural gas industries — Formulae and calculation for casing, tubing, drill pipe, and line pipe properties*

ISO 10422, *Petroleum and natural gas industries — Threading, gauging and thread inspection of casing, tubing and line pipe threads*

ISO 11960, *Petroleum and natural gas industries — Steel pipes for use as casing or tubing for wells*

ISO 13680, *Petroleum and natural gas industries — Corrosion-resistant alloy seamless tubes for use as casing, tubing and coupling stock — Technical delivery conditions*

API Bul 5C3, *Bulletin on formulas and calculations for casing, tubing, drill pipe and line pipe properties*

API Spec 5B, *Specification for threading, gauging, and thread inspection of casing, tubing, and line threads (U.S. Customary Units)*

API Spec 5L, *Specification for line pipe*

3 Terms, definitions, symbols and abbreviated terms

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

3.1 Terms and definitions

3.1.1
ambient temperature
actual room temperature in the test lab with no residual heat remaining in test specimens from previous thermal tests

3.1.2
axial-pressure load diagram
plot of pressure versus axial load showing pipe and/or connection test load envelope or limit load extremes

3.1.3
connection
assembly consisting of either two pins and a coupling or one pin and an integral box

3.1.4
failure load
load at which the pipe body or connection will fail catastrophically as in an axial separation, a rupture, large permanent deformation (e.g. buckling or collapse) or massive loss of sealing integrity

3.1.5
galling
cold welding of contacting material surfaces followed by tearing of the metal during further sliding/rotation

NOTE 1 Galling results from the sliding of metallic surfaces that are under high bearing forces. Galling can generally be attributed to insufficient lubrication between the mating surfaces. The purpose of the lubricating medium is to minimize metal-to-metal contact and allow efficient sliding of the surfaces. Other ways to prevent galling are to reduce the bearing forces or reduce the sliding distance.

NOTE 2 There are several degrees of galling used for repair and reporting purposes as defined in 3.1.5.1 to 3.1.5.3.

3.1.5.1
light galling
galling that can be repaired by the use of abrasive paper

3.1.5.2
moderate galling
galling that can be repaired by the use of fine files and abrasive paper

3.1.5.3
severe galling
galling that cannot be repaired by the use of fine files and abrasive paper

3.1.6
leak
any positive displacement of fluid in the measuring system during hold periods

3.1.7
limit load
load combination extreme (axial load and/or pressure) which defines the failure conditions for the connection or maximum load resulting in large permanent deformation (such as buckling) prior to catastrophic failure

3.1.8
lot
lengths of pipe with the same specified dimensions and grade from the same heat of steel which are heat-treated as part of a continuous operation (or batch)

3.1.9
metal-to-metal seal
seal or sealing system that relies on intimate and usually high contact stress of mating metal surfaces to achieve a seal

NOTE The thread compound can affect, both beneficially and detrimentally, the performance of a metal seal.

3.1.10
mother joint
length of pipe or coupling stock from which short lengths are cut for machining connection test specimens

3.1.11
multiple seals
sealing system, which consists of more than one independent barrier, and of which each barrier forms a seal itself

3.1.12
pipe string
pipe body and the connection

3.1.13
pup joint
short pipe length usually with threaded ends

3.1.14
resilient seal
seal or sealing system, which relies on entrapment of a seal ring within a section of the connection (e.g. in the thread-form, on a seal area, etc.) to achieve a seal

3.1.15
seal
barrier to prevent the passage of fluids

3.1.16
seal ovality
maximum seal diameter minus the minimum seal diameter divided by the average seal diameter multiplied by 100

NOTE Seal ovality is expressed as a percentage.

3.1.17
single seal
one barrier or multiple barriers that cannot be physically differentiated in their function

3.1.18
specimen
connection between two pieces of pipe

NOTE The specimen can be composed of one coupling and two pins for coupled connections, or one pin and one box for integral connections.

3.1.19
test load envelope
extremes of loads (axial load, pressure, bending) and temperature within which the connection will perform cyclically

NOTE The manufacturer has the primary responsibility for defining the test load envelope for their connection products (see 4.1).

3.1.20
thread lot
all products manufactured on a given machine during a continuous production cycle that is not interrupted by a catastrophic tool failure or injurious machine malfunction (excluding worn tools or minor tool breakage), tool holder change (except rough boring bar) or any other malfunction of either threading equipment or inspection gauges

3.1.21
thread seal
seal or sealing system, which relies on intimate fitting of the thread-form and usually entrapment of the thread compound within the thread-form to achieve a seal

3.2 Symbols and abbreviated terms

3.2.1 Symbols

A_i Area calculated based on the pipe inside diameter

A_o Area calculated based on the pipe outside diameter

A_p Cross-section area of pipe body

C Compressive axial force

D Specified pipe outside diameter

D_i Inside diameter

D_o Outside diameter

D_{leg} Effective dogleg severity expressed in degrees per thirty metres

E_r Error in load frame calibration

E_{rp} Error in load frame calibration expressed in percent

F Failure

F_a Axial force, tension or compression

F_b Bending equivalent axial force

F_c Published joint strength of the connection when the joint strength is the compressive rated load of the connection

F_f Actual load frame axial force, tension or compression

F_i Indicated load frame axial force, tension or compression

F_t Published joint strength of the connection when the joint strength is the tensile parting or failure load of the connection

F_y Published joint strength of the connection when the joint strength is the tensile yield load of the connection

I Moment of inertia

K_c Compression efficiency factor of the connection

K_{pi} Internal pressure efficiency factor of the connection

K_{pe} External pressure efficiency factor of the connection

K_t Tension efficiency factor of the connection

k_i, k_o Geometric variable

L_A Length of pin A end from coupling face (or connection) to end cap or grip length

L_B Length of pin B end from coupling face (or connection) to end cap or grip length

L_c Length of coupling or connection if integral

L_{pj} Minimum unsupported pup joint length

M Bending moment

M_o Super bending moment

p_c ISO 10400 collapse rating for specified wall thickness and actual specimen yield strength

p_i Internal pressure

p_{ib} Internal pressure with bending

p_{ih} High internal pressure

p_{in} Normalized internal test pressure

p_{il} Low internal pressure

p_{iyp} ISO 10400:1993, Section 3, internal yield pressure for the pipe body

p_o External pressure

p_{ob} External pressure with bending

p_{on} Normalized external test pressure

p_{tc} Thermal cycle pressure at elevated temperature

p_y Maximum pressure for an internal fibre stress S_{yt}

q_{ac} Actual leak rate to be reported

q_o Observed leak rate

R Radius of curvature of the pipe body at the axis of the pipe

S_t 100 % of minimum of the specimen mother joint tensile strength (measured at room temperature or at elevated temperature as given in Table 1) for a pipe member or coupling in a T&C specimen (pin or box member for an integral connection)

S_y 100 % of minimum of the specimen mother joint yield strength (measured at room temperature or at elevated temperature as given in Table 1) for a pipe member or coupling in a T&C specimen (pin or box member for an integral connection)

S_{yt} 95 % S_y for Series A and B tests, and 80 %, 90 % and 95 % for Series C tests (see 5.12.4)

t Specified pipe wall thickness

t_{ac} Actual minimum wall thickness

T Tension axial force

η_{lds} Leak detection system efficiency

σ Stress

σ_a Axial stress without bending

σ_{ab} Axial stress with bending

σ_{ao} Axial stress with super critical bending

σ_b Axial stress due to bending

σ_{bo} Axial stress due to super critical bending

σ_c Axial compressive yield strength if available or otherwise axial tensile yield strength

σ_h Hoop (tangential) stress

σ_{ho} Hoop (tangential) stress at outside diameter

σ_r Radial (normal) stress

σ_{ro} Radial (normal) stress at outside diameter

σ_t Transverse tensile yield strength if available or otherwise axial tensile yield strength

σ_{tc} Defined transverse compressive yield strength if available or otherwise axial tensile yield strength

σ_v Von Mises equivalent stress

σ_y Axial tensile yield strength, normally the ISO/API axial tensile yield strength

3.2.2 Abbreviations

CAL	Connection application level for which the successfully tested pipe [size, mass (label: weight), grade] and connections are intended to be used
CCS	Critical cross-section
CCW	Counter-clockwise direction
CW	Clockwise direction
CEPL	Capped end pressure load (tension)
CEYP	Capped end yield pressure
CRA	Corrosion-resistant alloy
EUE	External upset end
FMU	Final make-up specimen condition
kips	1 000 lbf (pound-force)
ksi	1 000 lbf (pound-force) per square inch
lb	Pound mass
LL	Limit load
LP	Load point
LP1	Limit load test path 1
LP2	Limit load test path 2
LP3	Limit load test path 3
LP4	Limit load test path 4
LP5	Limit load test path 5
LP6	Limit load test path 6
LP7	Limit load test path 7
LP8	Limit load test path 8
M/B	Make-up/break-out
MBG	Make/break galling test specimen condition
MC	Mechanical cycle
MT	Material test coupon
MTC	Metal seal threaded and coupled connection
MTM	Metal-to-metal seal

Bestelformulier

Stuur naar:

NEN Standards Products & Services
t.a.v. afdeling Klantenservice
Antwoordnummer 10214
2600 WB Delft

NEN Standards Products & Services

Postbus 5059
2600 GB Delft

Vlinderweg 6
2623 AX Delft

T (015) 2 690 390
F (015) 2 690 271

www.nen.nl/normshop

Ja, ik bestel

__ ex. ISO 13679:2002 en Aardolie- en aardgasindustrie - Beproevingsprocedures voor verbindingen in mantel- en productiebuizen € 166.18

Wilt u deze norm in PDF-formaat? Deze bestelt u eenvoudig via www.nen.nl/normshop

Gratis e-mailnieuwsbrieven

Wilt u op de hoogte blijven van de laatste ontwikkelingen op het gebied van normen, normalisatie en regelgeving? Neem dan een gratis abonnement op een van onze e-mailnieuwsbrieven. www.nen.nl/nieuwsbrieven

Gegevens

Bedrijf / Instelling

T.a.v. O M O V

E-mail

Klantnummer NEN

Uw ordernummer BTW nummer

Postbus / Adres

Postcode Plaats

Telefoon Fax

Factuuradres (indien dit afwijkt van bovenstaand adres)

Postbus / Adres

Postcode Plaats

Datum Handtekening

Retourneren

Fax: 015 2 690 271
E-mail: klantenservice@nen.nl
Post: NEN Standards Products & Services,
t.a.v. afdeling Klantenservice
Antwoordnummer 10214,
2600 WB Delft
(geen postzegel nodig).

Voorwaarden

- De prijzen zijn geldig tot 31 december 2018, tenzij anders aangegeven.
- Alle prijzen zijn excl. btw, verzend- en handelingskosten en onder voorbehoud bij o.m. ISO- en IEC-normen.
- Bestelt u via de normshop een pdf, dan betaalt u geen handeling en verzendkosten.
- Meer informatie: telefoon 015 2 690 391, dagelijks van 8.30 tot 17.00 uur.
- Wijzigingen en typefouten in teksten en prijsinformatie voorbehouden.
- U kunt onze algemene voorwaarden terugvinden op: www.nen.nl/leveringsvoorwaarden.