

**Petroleum and natural gas industries -
Procedures for testing casing and
tubing connections**

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

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

<p>Käesolev Eesti standard EVS-EN ISO 13679:2006 sisaldab Euroopa standardi EN ISO 13679:2006 ingliskeelset teksti.</p> <p>Käesolev dokument on jõustatud 24.11.2006 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes.</p> <p>Standard on kättesaadav Eesti standardiorganisatsioonist.</p>	<p>This Estonian standard EVS-EN ISO 13679:2006 consists of the English text of the European standard EN ISO 13679:2006.</p> <p>This document is endorsed on 24.11.2006 with the notification being published in the official publication of the Estonian national standardisation organisation.</p> <p>The standard is available from Estonian standardisation organisation.</p>
--	---

<p>Käsitlusala: 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.</p>	<p>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.</p>
--	--

ICS 75.180.10, 75.200

Võtmesõnad:

EUROPEAN STANDARD

EN ISO 13679

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2006

ICS 75.200; 75.180.10

English Version

Petroleum and natural gas industries - Procedures for testing casing and tubing connections (ISO 13679:2002)

Industries du pétrole et du gaz naturel - Procédures de test des connexions pour tubes de cuvelage et de production (ISO 13679:2002)

Erdöl- und Erdgasgewinnung - Prüfverfahren an Verbindungen für Futter- und Steigrohre

This European Standard was approved by CEN on 6 October 2006.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Foreword

The text of ISO 13679:2002 has been prepared by Technical Committee ISO/TC 67 "Materials, equipment and offshore structures for petroleum and natural gas industries" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 13679:2006 by Technical Committee CEN/TC 12 "Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2007, and conflicting national standards shall be withdrawn at the latest by April 2007.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Endorsement notice

The text of ISO 13679:2002 has been approved by CEN as EN ISO 13679:2006 without any modifications.

**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*



PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

© ISO 2002

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

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.....	vi
Introduction.....	vii
1 Scope	1
2 Normative references	1
3 Terms, definitions, symbols and abbreviated terms	2
3.1 Terms and definitions	2
3.2 Symbols and abbreviated terms	4
4 General requirements	8
4.1 Connection geometry, test load envelope and performance data sheet	8
4.2 Quality control	9
5 General test requirements	9
5.1 Test classes	9
5.2 Test matrix	10
5.3 Test programme	14
5.4 Calibration and accreditation requirements	15
5.5 Rehearsal tests	16
5.6 Material property tests	16
5.7 Make-up and break-out procedures	17
5.8 Internal pressure leak detection	18
5.9 Internal pressure leak trap device	18
5.10 External pressure leak detection	25
5.11 Data acquisition and test methods	28
5.12 Thermal cycling tests	30
6 Connection test specimen preparation	32
6.1 General connection test objectives	32
6.2 Connection test specimen identification and marking	33
6.3 Connection test specimen preparation	33
6.4 Connection test specimen machining	35
6.5 Machining tolerances	36
6.6 Tolerance limits on machining objectives	37
6.7 Grooved torque shoulder	37
7 Test procedures	38
7.1 Principle	38
7.2 Make-up/break-out tests	38
7.3 Test load envelope tests	40
7.4 Limit load tests	52
7.5 Limit load test path (see Figures 18 and 19)	55
8 Acceptance criteria	57
8.1 Make-up and break-out tests	57
8.2 Test load envelope tests	58
8.3 Limit load tests	58
9 Test reports	59
Annex A (normative) Connection geometry and performance data sheet	60
Annex B (informative) Connection test load envelope and limit loads	67
Annex C (normative) Data forms	85

Annex D (normative) Connection full test report	115
Annex E (normative) Connection testing summary report.....	118
Annex F (informative) Frame load range determination	121
Annex G (informative) Interpolation and extrapolation considerations	122
Annex H (informative) Special application testing	124
Annex I (informative) Rationale for design basis	130
Annex J (normative) Independent seal testing of connections with metal-to-metal and resilient seals.....	133
Bibliography.....	139
Table 1 — Test matrix — Test series and specimen identification numbers.....	11
Table 2 — Connection test specimen objectives for all CAL.....	32
Table 3 — Guidelines for selecting connection test specimens for testing a metal-to-metal sealing, tapered thread connection with a torque shoulder.....	33
Table 4 — Tolerance limits on machining objectives.....	36
Table 5 — Specimen description and summary of test series for a metal-to-metal sealing, tapered thread connection with a torque shoulder	38
Table 6 — Test Series A load steps (see Figures 13 or 14, as applicable) — Testing in quadrants I, II, III, IV (no bending) at ambient temperature	42
Table 7 — Test Series B load steps without bending for connection rated equal to pipe body (see Figure 15) — Testing in quadrants I and II without bending at ambient temperature	46
Table 8 — Test Series B load steps with bending for connection rated equal to pipe body (see Figure 16) — Testing in quadrants I and II with bending at ambient temperature	47
Table A.1 — Connection geometry and performance property data sheet.....	61
Table A.2 — Example Series A test load envelope for a connection rated equal to pipe body — 178 mm <i>D</i> × 10,16 mm wall thickness × grade P-110 (7 in 29 lb/ft P-110) strength (see Figure A.1).....	62
Table A.3 — Detailed load steps	63
Table B.1 — Areas and dimensions	70
Table B.2 — Required dimensions for critical cross-section computation	84
Table F.1 — Typical results from frame load range determination (200 kN to 2 000 kN).....	121
Figure 1 — Connection application level test programme.....	12
Figure 2 — Collared leak trap device for internal pressure leak detection	19
Figure 3 — Flexible boot leak trap device for internal pressure leak detection	20
Figure 4 — Ported box leak trap device for internal pressure leak detection.....	20
Figure 5 — Internal pressure leak detection by bubble method	22
Figure 6 — Example of a plot for determining leak detection sensitivity.....	23
Figure 7 — Leak detection by helium mass spectrometer method	24
Figure 8 — Example set-up for Test Series A	25

Figure 9 — Example of leak detection system for Test Series A.....	26
Figure 10 — Test Series C thermal/mechanical cycles for CAL II, III, and IV.....	30
Figure 11 — Connection test specimen nomenclature and unsupported length	34
Figure 12 — Torque shoulder pressure bypassing grooves.....	37
Figure 13 — Test Series A load path for connection rated greater than or equal to pipe body in compression.....	44
Figure 14 — Test Series A load path for connection rated less than pipe body in compression	45
Figure 15 — Test Series B load paths without bending for connection rated equal to pipe body.....	49
Figure 16 — Test Series B load paths with bending for connection rated equal to pipe body	50
Figure 17 — Test Series B load paths for connection rated less than pipe body in compression and with bending.....	51
Figure 18 — Limit load test paths for connections rated equal to or stronger than pipe body	53
Figure 19 — Limit load test paths for connections weaker than pipe body	54
Figure B.1 — Pipe body and connection test load envelopes at specified dimensions	68
Figure C.1 — Recommended layout of mother joints for test and material specimens.....	86
Figure G.1 — Example premium connection design space	123
Figure J.1 — Ported box leak trap device for internal pressure leak detection showing modifications for resilient seal	135
Figure J.2 — Connection acceptance levels with resilient seal ring.....	136
Figure J.3 — Alternative testing sequence for a connection with metal-to-metal (MTM) and resilient seal (RS) features	138

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.

This document is a preview generated by EVS

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