

**Petroleum and natural gas industries -
Pipeline transportation systems - Test
procedures for mechanical connectors**

Petroleum and natural gas industries - Pipeline
transportation systems - Test procedures for
mechanical connectors

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

<p>Käesolev Eesti standard EVS-EN ISO 21329:2004 sisaldab Euroopa standardi EN ISO 21329:2004 ingliskeelset teksti.</p> <p>Käesolev dokument on jõustatud 21.12.2004 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 21329:2004 consists of the English text of the European standard EN ISO 21329:2004.</p> <p>This document is endorsed on 21.12.2004 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:</p> <p>This International Standard specifies requirements and provides guidance for the testing of mechanical connectors for use in pipeline transportation systems for the petroleum and natural gas industries as defined in ISO 13623. The tests specified in this International Standard are intended to form part of the design verification process for connectors. They provide objective evidence that connectors conform to a defined performance envelope. This International Standard does not cover the use of design procedures as part of the qualification process for mechanical connectors, nor does it address fabrication and quality control. However, it can be used as input to a qualification procedure.</p>	<p>Scope:</p> <p>This International Standard specifies requirements and provides guidance for the testing of mechanical connectors for use in pipeline transportation systems for the petroleum and natural gas industries as defined in ISO 13623. The tests specified in this International Standard are intended to form part of the design verification process for connectors. They provide objective evidence that connectors conform to a defined performance envelope. This International Standard does not cover the use of design procedures as part of the qualification process for mechanical connectors, nor does it address fabrication and quality control. However, it can be used as input to a qualification procedure.</p>
---	---

ICS 75.200

Võtmesõnad:

EUROPEAN STANDARD

EN ISO 21329

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2004

ICS 75.200

English version

**Petroleum and natural gas industries - Pipeline transportation
systems - Test procedures for mechanical connectors
(ISO 21329:2004)**

Industries du pétrole et du gaz naturel - Systèmes de
transport par conduites - Modes opératoires d'essai des
connecteurs métalliques (ISO 21329:2004)

Erdöl- und Erdgasindustrie - Rohrleitungstransportsysteme
- Prüfverfahren für mechanische Verbindungen
(ISO 21329:2004)

This European Standard was approved by CEN on 23 September 2004.

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, 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

Contents

	Page
Foreword	4
Introduction	5
1 Scope	7
2 Normative references	7
3 Terms and definitions	8
4 Symbols and abbreviated terms	10
4.1 Symbols	10
4.2 Abbreviated terms	12
5 Test categories	12
5.1 General	12
5.2 Pressure, temperature and depth ratings	12
5.3 Application levels	13
5.4 Confidence levels	13
6 Test requirements	14
6.1 General	14
6.2 Purpose of tests	15
6.3 Basis for mechanical loads	15
6.4 Test-house selection	16
6.5 Selection of tests and number of test samples	16
6.6 Additional tests	17
6.7 Prior test results	17
7 Connector manufacturer requirements	19
7.1 General	19
7.2 Quality control	19
7.3 Connector geometry and performance data	19
7.4 Selection of diameter	19
7.5 Setting tolerances	19
7.6 Connector material requirements	21
7.7 Preparation of test samples	22
7.8 Ports	25
7.9 Replacement test samples	25
7.10 Test record retention	25
8 Test-house preparations	25
8.1 General	25
8.2 Calibration requirements	26
8.3 Pressurization media	27
9 Leak detection	27
9.1 Leak-detection methods	27
9.2 Leak-detection sensitivity	27
9.3 External pressure leak detection	27
10 Make-and-break testing	28
10.1 General requirements	28
10.2 Make-up method	29
10.3 Repeated make-up and breakout	31
10.4 Final make-up	31
10.5 Reverse-torque tests of non-rotational make-up connectors	31
10.6 Acceptance criteria	31

	Page
11 Service-load test	32
11.1 Set-up	32
11.2 Confirmation of seal integrity	34
11.3 Selection of test pressures and temperatures	34
11.4 Installation tests	36
11.5 Hydrostatic pressure tests	38
11.6 Operational unrestrained tests	39
11.7 Operational restrained tests	41
12 Limit-load tests	43
12.1 General	43
12.2 Tension-to-failure test	44
12.3 Compression-to-failure test	45
12.4 Pressure-to-failure test	46
12.5 Bending-to-failure test	46
13 Bending-fatigue test procedures	47
13.1 General	47
13.2 Setting stress ranges for the test	47
13.3 Bending-fatigue test set-up	48
13.4 Bending-fatigue test procedure	48
13.5 Interpretation of fatigue results	49
Annex A (normative) Application levels	50
Annex B (normative) Connector geometry and performance data	53
Annex C (normative) Calculation of connector service loads	56
Annex D (normative) Test data tables	60
Annex E (normative) Connector test reports — Content	68
Annex F (informative) Test sizes and data extrapolation considerations	71
Annex G (informative) Additional testing for special applications	73
Annex H (informative) Additional information on fatigue	81
Bibliography	86

Foreword

This document (EN ISO 21329:2004) has been prepared by Technical Committee ISO/TC 67 "Materials, equipment and offshore structures for petroleum and natural gas industries" in collaboration with 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 2005, and conflicting national standards shall be withdrawn at the latest by April 2005.

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, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of ISO 21329:2004 has been approved by CEN as EN ISO 21329:2004 without any

Introduction

In some circumstances mechanical connectors provide a lower cost and/or enabling advantage to welded connectors usually used for pipelines. However, use of mechanical connectors has raised concerns about pipeline integrity due to the potential for leak paths and absence of a direct method of inspection. In the past, reassurance of the integrity of mechanical pipeline connectors has relied upon design information provided by the manufacturer, the results of finite element analysis and past experience.

This International Standard is primarily applicable to connectors to be used in a large number, and hence there is a significant burden in the number of connectors that need to be tested. However, it is recognized that the test burden can be reduced in project-specific cases, for example if there is no concern about fatigue, if the connector will not be subjected to fully restrained forces and/or if the connector design is less sensitive to accuracy of tolerance matching of components at assembly.

The tests specified in this International Standard provide a physical demonstration of the integrity of the pipeline connector. This International Standard has been developed from three main sources.

The first is the *Low cost pipeline connector systems joint industry project (JIP)*, (1995-1997)^[14], which defined the load envelopes for pipelines, identified the practical issues of installation, and conducted demonstration physical tests on three types of mechanical connectors.

The second source is ISO 13679, which has a parallel function for downhole connections.

The third is the *Connection testing specification JIP*, (1999-2000)^[15]. The JIP was sponsored by oil companies, connector suppliers, pipeline construction contractors and design consultants.

– Blank Page –

This document is a preview generated by EVS

1 Scope

This International Standard specifies requirements and provides guidance for the testing of mechanical connectors for use in pipeline transportation systems for the petroleum and natural gas industries as defined in ISO 13623.

The tests specified in this International Standard are intended to form part of the design verification process for connectors. They provide objective evidence that connectors conform to a defined performance envelope.

This International Standard does not cover the use of design procedures as part of the qualification process for mechanical connectors, nor does it address fabrication and quality control. However, it can be used as input to a qualification procedure.

Although its principles can be applied, this International Standard does not address

- a) connectors that are designed to rotate in use,
- b) manifolds,
- c) topsides pipework or piping,
- d) flanges,
- e) connectors used in pipelines installed by reeling or J-tube pulls,
- f) factory acceptance testing,
- g) statistical bases for risk analysis.

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 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

ISO 783:1999, *Metallic materials — Tensile testing at elevated temperature*

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 requirement 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 6892:1998, *Metallic materials — Tensile testing at ambient temperature*

ISO 9327, *Steel forgings and rolled or forged bars for pressure purposes — Technical delivery conditions*

ISO 13623, *Petroleum and natural gas industries — Pipeline transportation systems*

ISO 13679:2002, *Petroleum and natural gas industries — Procedures for testing casing and tubing connections*

EN 10213, *Technical delivery conditions for steel castings for pressure purposes*

EN 10222-1, *Steel forgings for pressure purposes – Part 1: General requirements for open die forgings*

ASTM A 370¹⁾, *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*

ASTM A 487/A 487M, *Standard Specification for Steel Castings Suitable for Pressure Service*

ASTM A 694/A 694M, *Standard Specification for Carbon and Alloy Steel Forgings for Pipe Flanges, Fittings, Valves, and Parts for High-Pressure Transmission Service*

3 Terms and definitions

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

3.1 actual yield strength
yield strength of material determined from specimens directly related to components used in construction of the test samples

3.2 application level
service loading envelope encompassing a group of pipeline and riser applications

3.3 batch
group of items manufactured or machined under controlled conditions to ensure consistent chemical composition, processing and heat treatment such that the group can be considered as a single population

3.4 by agreement
unless otherwise indicated, agreement between the manufacturer and purchaser at the time of enquiry and order

NOTE Adapted from ISO 3183-2:1996.

3.5 connector
mechanical device used to connect adjacent components in the pipeline

3.6 galling
localized damage to material surfaces resulting from contact conditions

NOTE Galling can be caused by cold welding of contacting material surfaces followed by tearing of the weld during further sliding or rotation.

3.7 heat, noun
batch of steel prepared in one steel-making operation

[ISO 15590-1:2001]

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