SLOVENSKI STANDARD
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Kompenzatorji s kovinskimi mehovi v tlačnih cevovodih

Metal bellows expansion joints for pressure applications

Kompensatoren mit metallischen Bälgen für Druckanwendungen

Compensateurs de dilatation à soufflets métalliques pour appareils à pression

Ta slovenski standard je istoveten z: **EN 14917:2009+A1:2012**

ICS:

23.040.99	Drugi sestavni deli za cevovode	Other pipeline components

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 14917:2009+A1:2012) has been prepared by Technical Committee CEN/TC 342, "Metal hoses, hose assemblies, bellows and expansion joints", the secretariat of which is held by ▌A1⟩ SNV ⟨A1▐.

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of an identical text or by endorsement, at the latest by September 2012, and conflicting national standards shall be withdrawn at the latest by September 2012.

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For relationship with EU Directive 97/23/EC, see informative Annex ZA, which is an integral part of this document.

This document includes Amendment 1, approved by CEN on 2012-01-08.

This document supersedes EN 14917:2009.

The start and finish of text introduced or altered by amendment is indicated in the text by tags ▌A1⟩ ⟨A1▐.

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Introduction

Metal bellows expansion joints are used as components in piping or as parts of pressure vessels.

If an expansion joint is designed and manufactured according to this European Standard, the risk analysis is already undertaken, see Annex I.

1 Scope

This European Standard specifies the requirements for design, manufacture and installation of metal bellows expansion joints for pressure applications, i.e. maximum allowable pressure greater than 0,5 bar.

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.

EN 287-1, *Qualification test of welders — Fusion welding — Part 1: Steels*

EN 473, *Non destructive testing — Qualification and certification of NDT personnel — General principles*

EN 571-1, *Non destructive testing — Penetrant testing — Part 1: General principles*

EN 764-4, *Pressure equipment — Part 4: Establishment of technical delivery conditions for metallic materials*

EN 764-5:2002, *Pressure equipment — Part 5: Compliance and inspection documentation of materials*

EN 970, *Non-destructive examination of fusion welds — Visual examination*

EN 1092-1, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 1: Steel flanges*

EN 1289:1998, *Non-destructive examination of welds — Penetrant testing of welds — Acceptance levels*

EN 1290, *Non-destructive examination of welds — Magnetic particle examination of welds*

EN 1291:1998, *Non-destructive examination of welds — Magnetic particle testing of welds — Acceptance levels*

EN 1418, *Welding personnel — Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials*

EN 1435:1997, *Non-destructive examination of welds — Radiographic examination of welded joints*

EN 1593, *Non-destructive testing — Leak testing — Bubble emission techniques*

EN 1712:1997, *Non-destructive examination of welds — Ultrasonic examination of welded joints — Acceptance levels*

EN 1713, *Non-destructive examination of welds — Ultrasonic examination — Characterization of indications in welds*

EN 1714:1997, *Non-destructive examination of welds — Ultrasonic examination of welded joints*

EN 1779:1999, *Non-destructive testing — Leak testing — Criteria for method and technique selection*

EN 10002-1, *Metallic materials — Tensile testing — Part 1: Method of test at ambient temperature*

EN 10002-5, *Metallic materials — Tensile testing — Part 5: Method of testing at elevated temperature*

EN 10028-1, *Flat products made of steels for pressure purposes — Part 1: General requirements*

A1⟩ EN 10028-2:2009 ⟨A1, *Flat products made of steels for pressure purposes — Part 2: Non-alloy and alloy steels with specified elevated temperature properties*

[A1] EN 10028-3:2009 [A1], *Flat products made of steels for pressure purposes — Part 3: Weldable fine grain steels, normalized*

EN 10028-4, *Flat products made of steels for pressure purposes — Part 4: Nickel alloy steels with specified low temperature properties*

EN 10028-7:2007, *Flat products made of steels for pressure purposes — Part 7: Stainless steels*

EN 10045-1, *Metallic materials — Charpy impact test — Part 1: Test method*

EN 10204:2004, *Metallic products — Types of inspection documents*

EN 10216-1, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 1: Non-alloy steel tubes with specified room temperature properties*

EN 10216-2, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties*

EN 10216-3, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 3: Alloy fine grain steel tubes*

EN 10216-4, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 4: Non-alloy and alloy steel tubes with specified low temperature properties*

EN 10217-1, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 1: Non-alloy steel tubes with specified room temperature properties*

EN 10217-2, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 2: Electric welded non-alloy and alloy steel tubes with specified elevated temperature properties*

EN 10217-3, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 3: Alloy fine grain steel tubes*

EN 10217-4, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 4: Electric welded non-alloy steel tubes with specified low temperature properties*

EN 10217-5, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 5: Submerged arc welded non-alloy and alloy steel tubes with specified elevated temperature properties*

EN 10217-6, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 6: Submerged arc welded non-alloy steel tubes with specified low temperature properties*

EN 10222-2, *Steel forgings for pressure purposes — Part 2: Ferritic and martensitic steels with specified elevated temperature properties*

EN 10222-3, *Steel forgings for pressure purposes — Part 3: Nickel steels with specified low temperature properties*

EN 10222-4, *Steel forgings for pressure purposes — Part 4: Weldable fine grain steels with high proof strength*

EN 10253-2, *Butt-welding pipe fittings — Part 2: Non alloy and ferritic alloy steels with specific inspection requirements*

EN 10269, *Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties*

EN 10272, *Stainless steel bars for pressure purposes*

EN 10273, *Hot rolled weldable steel bars for pressure purposes with specified elevated temperature properties*

EN 12517-1:2006, *Non-destructive testing of welds — Part 1: Evaluation of welded joints in steel, nickel, titanium and their alloys by radiography — Acceptance levels*

EN 13184, *Non-destructive testing — Leak testing — Pressure change method*

EN 13185, *Non-destructive testing — Leak testing — Tracer gas method*

EN 13445-2:2002, *Unfired pressure vessels — Part 2: Materials*

EN 13445-3, *Unfired pressure vessels — Part 3: Design*

EN 13480-2:2002, *Metallic industrial piping — Part 2: Materials*

EN 13480-3, *Metallic industrial piping — Part 3: Design and calculation*

EN 13480-4, *Metallic industrial piping — Part 4: Fabrication and installation*

EN ISO 643, *Steels — Micrographic determination of the apparent grain size (ISO 643:2003)*

EN ISO 3651-2, *Determination of resistance to intergranular corrosion of stainless steels — Part 2: Ferritic, austenitic and ferritic-austenitic (duplex) stainless steels — Corrosion test in media containing sulfuric acid (ISO 3651-2:1998)*

EN ISO 5817, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections (ISO 5817:2003, corrected version: 2005, including Technical Corrigendum 1:2006)*

EN ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method (ISO 6506-1:2005)*

EN ISO 6520-1, *Welding and allied processes — Classification of geometric imperfections in metallic materials — Part 1: Fusion welding (ISO 6520-1:2007)*

EN ISO 9445:2006, *Continuously cold-rolled stainless steel narrow strip, wide strip, plate/sheet and cut lengths — Tolerances on dimensions and form (ISO 9445:2002)*

EN ISO 9606-4, *Approval testing of welders — Fusion welding — Part 4: Nickel and nickel alloys (ISO 9606-4:1999)*

EN ISO 15609-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding (ISO 15609-1:2004)*

EN ISO 15610, *Specification and qualification of welding procedures for metallic materials — Qualification based on tested welding consumables (ISO 15610:2003)*

EN ISO 15613, *Specification and qualification of welding procedures for metallic materials — Qualification based on pre-production welding test (ISO 15613:2004)*

EN ISO 15614-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1:2004)*

ISO 15348:2002, *Pipework — Metal bellows expansion joints — General*

EAM-0526-18 NiMo16Cr15W (2.4819) — Nickel-Molybdenum-chromium alloy — Flat products

EAM-0526-28 NiMo16Cr16Ti (2.4610) — Nickel-Chromium-Molybdenum alloy — Flat products

EAM-0526-40 NiCr22Mo9Nb-gr.1 (2.4856) — Nickel-Chromium-Molybdenum alloy — Flat products

EAM-0526-43-1 NiCr15Fe (2.4816) — Nickel-Chromium-Iron alloy — Hot and cold rolled flat products

EAM-0526-43-2 NiCr15Fe (2.4816) — Nickel-Chromium-Iron alloy — Bars and rods

3 Terms and definitions

For the purposes of this document, the basic terms and definitions given in ISO 15348:2002 and the following apply.

3.1
bellows
flexible element consisting of one or more ⟨A1⟩ corrugations ⟨A1⟩ and the end tangents

3.2
corrugation (convolution)
flexible unit of a bellows

3.3
end tangents
straight un-corrugated portions at the ends of a bellows

3.4
reinforcing collar
reinforcing sleeve or ring attached to the end tangent for reinforcement

3.5
assisting collar
ring placed around the end tangents to facilitate welding

3.6
reinforcing and equalizing rings
devices fitting snugly in the roots of the corrugations in order to reinforce the bellows against internal pressure and/or to limit the ⟨A1⟩ equivalent axial compression ⟨A1⟩

3.7
classification
classifying expansion joints according to the type of movement they are capable of absorbing and their parts according to their pressure bearing capacity

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3.8
maximum allowable pressure, PS
maximum pressure for which the equipment is designed, as specified by the equipment manufacturer

3.9
maximum/minimum allowable temperature, TS
⟨A1⟩ maximum and minimum ⟨A1⟩ temperature for which the equipment is designed, as specified by the equipment manufacturer

3.10
nominal pressure PN
designation commonly used for reference purposes for piping components and stock parts, and which represents in this European Standard the maximum allowable pressure at 20 °C

NOTE Normally defined as a dimensionless alphanumeric number.

3.11
pressure thrust, F_p
axial force due to the effect of pressure

3.12
neutral position
bellows length in a “stress-free” state

3.13
squirm
column or in-plane instability of the bellows under the effect of internal pressure

3.14
category
classification of pressure equipment according to ascending level of hazard

NOTE See Annex A.

3.15
equipment manufacturer
person responsible for the values of the parameters PS and TS

NOTE This may be the manufacturer or planner of the piping or the pressure vessel for which the expansion joint is designed or the expansion joint manufacturer if free to set these values.

4 Classification

4.1 Classification of expansion joints

There are four types of expansion joints which are designed according to the type of movements absorbed; common examples are shown in Table 4.1:

4.1.1 Axial

Absorbs mainly axial [A1] displacement [A1]. When non-pressure balanced, it does not restrain pressure thrust. When pressure balanced, it restrains thrust. It can be internally or externally pressurized.

4.1.2 Angular

[A1] Absorbs angular rotation. When fitted with hinges, it allows rotation in a single plane. When fitted with gimbal rings, it allows multi-plane rotations. It restrains pressure thrust. [A1]

4.1.3 Lateral

[A1] Absorbs lateral deflection. An angular rotation is also permissible when the expansion joint is fitted with two spherical tie bars, the deflection being perpendicular to the plane containing the tie bars, or fitted with double hinges or fitted with double gimbals. It restrains pressure thrust. [A1]

4.1.4 Universal

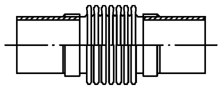
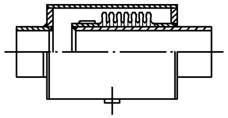
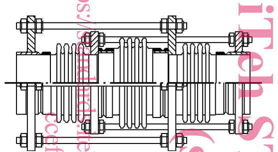
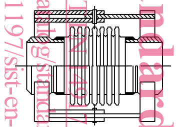
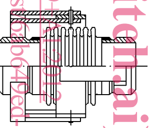
4.1.4.1 Non-pressure balanced

Absorbs several movements. It does not restrain pressure thrust.

4.1.4.2 Pressure balanced

A pressure balanced expansion joint accommodates axial and lateral movements and counteracts the bellows pressure thrust. An additional bellows is incorporated into the unit and is subject to the line pressure to generate a force equal and opposite to that on the main bellows. Tying these bellows together neutralises the pressure load on the unit. These joints are often installed at changes of direction in piping but in-line designs are also available.

Table 4.1 — Types of expansion joints

Type	Design		Pressure thrust restraint	Movement				
				Axial	Angular		Lateral	
					Single plane	Multi-plane	Single plane	Multi-plane
Axial	Non-pressure balanced internally pressurized		No	X	(X)	(X)	(X)	(X)
	Non-pressure balanced externally pressurized		No	X	(X)	(X)	(X)	(X)
	In-line pressure balanced		Yes	X				
Angu-lar	Hinge		Yes		X			
	Gimbal		Yes		X	X		