

SURVESÜSTEEMIDES KASUTATAVATE
METALLKOMPENSAATORITE PAISUMISVUUGID

Metal bellows expansion joints for pressure
applications

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

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English Version

Metal bellows expansion joints for pressure applications

Compensateurs de dilatation à soufflets métalliques
pour appareils à pression

Kompensatoren mit metallischen Bälgen für
Druckanwendungen

This European Standard was approved by CEN on 21 June 2021.

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Contents	Page
European foreword.....	7
1 Scope.....	10
2 Normative references.....	10
3 Terms and definitions	14
4 Classification.....	17
4.1 Classification of expansion joints.....	17
4.1.1 General.....	17
4.1.2 Axial.....	17
4.1.3 Angular.....	17
4.1.4 Lateral	17
4.1.5 Universal	17
4.1.6 Pressure balanced designs (axial or universal).....	17
4.2 Classification of the parts of expansion joints.....	20
4.2.1 Main pressure-bearing parts (A).....	20
4.2.2 Pressure parts other than main pressure-bearing parts (B)	20
4.2.3 Attachments to main pressure-bearing parts and to pressure parts (C).....	20
4.2.4 Other parts (D)	20
5 Materials.....	22
5.1 General.....	22
5.1.1 Materials for pressure-bearing parts	22
5.1.2 Materials for parts attached to pressure-bearing parts.....	22
5.1.3 Materials for non-pressure parts	22
5.2 Pressure-bearing parts	22
5.2.1 Bellows.....	22
5.2.2 Other pressure-bearing parts.....	22
5.2.3 Ductility	23
5.2.4 Brittle fracture	23
5.3 Material documentation	27
6 Design.....	28
6.1 General.....	28
6.1.1 Symbols.....	28
6.1.2 Basic design criteria.....	34
6.1.3 Allowable stresses	34
6.1.4 Additional loadings.....	37
6.2 Bellows design.....	38
6.2.1 Purpose.....	38
6.2.2 Conditions of applicability.....	38
6.2.3 Design of U-shaped unreinforced bellows	56
6.2.4 Design of U-shaped reinforced bellows.....	72
6.2.5 Design of toroidal bellows	75
6.2.6 Fatigue.....	82
6.2.7 Bellows under the influence of movements	87
6.2.8 Equivalent axial displacement per corrugation.....	92
6.2.9 Forces and moments on pressurized expansion joints.....	97
6.2.10 Torsion acting on bellows (unreinforced or reinforced)	108
6.3 Internal sleeve.....	109
6.3.1 Scope.....	109
6.3.2 Additional symbols.....	109
6.3.3 Flow velocity.....	109
6.3.4 Design conditions.....	112
6.4 Hardware	113

6.4.1	General	113
6.4.2	Design parameters	113
6.4.3	Hardware parts	115
6.4.4	Permanent joints	116
7	Manufacturing.....	118
7.1	General	118
7.2	Materials.....	118
7.2.1	General	118
7.2.2	Material traceability.....	118
7.3	Permanent joints	119
7.3.1	General	119
7.3.2	Process and personal	119
7.3.3	Repair and rework during manufacturing.....	120
7.4	Forming of the bellows	120
7.4.1	Forming processes	120
7.4.2	Heat treatment.....	121
7.5	Tolerances.....	122
7.5.1	General	122
7.5.2	Bellows	122
7.5.3	Expansion joint.....	123
7.6	Production tests	123
8	Testing, inspection and documentation.....	124
8.1	General	124
8.2	Abbreviations.....	124
8.3	Documents	124
8.4	In-process inspection and testing.....	125
8.4.1	General	125
8.4.2	Materials.....	125
8.4.3	Permanent joints	125
8.4.4	Non-destructive testing of welds	127
8.5	NDT methods.....	134
8.5.1	Quality level.....	134
8.5.2	Acceptance levels and testing techniques	134
8.5.3	Non-destructive testing Personnel qualifications and approval.....	135
8.5.4	Non-destructive testing documentation.....	135
8.6	Final assessment and documentation.....	137
8.6.1	General	137
8.6.2	Final inspection.....	138
8.7	Documentation	140
8.7.1	Final documentation package.....	140
8.7.2	Declaration/certification.....	140
8.7.3	Operating instructions.....	141
9	Marking and labelling.....	141
10	Handling and installation	141
10.1	General instructions.....	141
10.2	Packaging and storage	142
10.3	Installation	142
10.4	Unrestrained expansion joints	142
10.5	Restrained expansions joints.....	142
Annex A	(informative) Categories of expansion joints.....	143
A.1	General	143
A.2	Determination of expansion joints categories.....	143
A.3	Fluid groups.....	143

A.3.1	General	143
A.3.2	Group 1	143
A.3.3	Group 2	144
A.4	Technical requirements	144
A.4.1	Expansion joints for vessels	144
A.4.2	Expansion joints for piping	144
A.4.3	Sound engineering practice (SEP)	145
A.5	Expansion joint category	145
Annex B (informative)	Specification for materials 1.4828, 1.4876, 2.4360 and 2.4858	147
Annex C (informative)	Incorporation of expansion joints into piping or pressure vessels	154
C.1	General	154
C.2	Specific symbols and definitions	155
C.3	Application criteria for expansion joints in piping	156
C.3.1	General	156
C.3.2	Use of axial expansion joints	156
C.3.3	Use of restraint expansion joints	162
C.3.4	Use of universal expansion joints	168
C.3.5	Indeterminate configurations of expansion joints	170
C.4	Application criteria for expansion joints in pressure vessels	173
C.4.1	General	173
C.4.2	Axial expansion joint installed in the shell	173
C.4.3	Axial expansion joint installed at the floating head	174
Annex D (informative)	Calculation methods for systems of pipes containing expansion joints	175
D.1	General	175
D.1.1	Preliminary remarks	175
D.1.2	Determining movement values	175
D.1.3	Thermal expansion	175
D.2	Approximate calculation of bellows movement	177
D.2.1	General	177
D.2.2	Hinged systems	178
D.2.3	Definitions	178
D.3	Exact calculation of bellows movement	182
D.3.1	Two hinges in a plane system (Z-system)	182
D.3.2	Two gimbals in a three-dimensional system (Z-system)	183
D.3.3	Three hinges in a plane system (U-system)	184
D.3.4	Three hinges in a plane system (L-system)	185
D.3.5	Three hinges in a three-dimensional system (Z-system)	187
D.4	Calculation of forces and moments	190
Annex E (informative)	Explanatory notes on the design of expansion bellows	191
E.1	General	191
E.2	Calculation design	191
E.3	Types of bellows	192
E.3.1	Corrugation shape	192
E.3.2	Number of plies	192
E.4	Fatigue life expectancy	192
E.5	Instability	193
E.5.1	General	193
E.5.2	Column instability	193
E.5.3	In-plane instability	193
E.5.4	Buckling	193
E.6	Bellows spring rate	194
Annex F (informative)	Procedure for setting-up a design fatigue curve	196
F.1	General	196

F.2	Procedure for setting up a design fatigue curve for expansion bellows.....	196
F.2.1	General	196
F.2.2	Number of tests	196
F.2.3	Extrapolation range.....	196
F.2.4	Manufacturing methods.....	196
F.2.5	Bellows material.....	197
F.3	Tests	197
F.3.1	Movement.....	197
F.3.2	Test pressure.....	197
F.3.3	Other test conditions.....	197
F.3.4	Fatigue test equipment.....	198
F.4	Evaluation of the test results.....	199
F.5	Linear regression.....	204
Annex G	(informative) Polynomial approximations for coefficients C_p , C_f , C_d	205
G.1	Coefficient C_p	205
G.2	Coefficient C_f	206
G.3	Coefficient C_d	207
G.4	Linear interpolation	208
Annex H	(informative) Required design data and information	210
H.1	Required design conditions.....	210
H.2	Additional information.....	210
Annex I	(informative) Expansion joints risk analyses.....	211
Annex J	(informative) Additional material properties.....	212
Annex K	(normative) Hardware calculation.....	217
K.1	General	217
K.2	Additional symbols	217
K.3	Force due to pressure.....	220
K.4	Tie bar.....	221
K.4.1	General	221
K.4.2	Tie bar in tension.....	221
K.4.3	Tie bar in compression.....	222
K.5	Pin	222
K.6	Lug with bore	225
K.6.1	General	225
K.6.2	Forces due to pressure.....	225
K.6.3	Stresses due to reaction force.....	226
K.7	Gimbal, square and round	227
K.7.1	General	227
K.7.2	Stresses in bored section	227
K.7.3	Square type gimbal.....	228
K.7.4	Round type gimbal	231
K.8	Attachment plate.....	233
K.8.1	Attachment plate (closed/open) with 2 restraining parts	233
K.8.2	Circular attachment plate with 3 or more tie bars valid up to DN 800.....	241
K.9	Lug-plate connection (hinge/gimbal)	244
K.9.1	General	244
K.9.2	Lug-plate for form-lock connection	245
K.9.3	Lug-plate for welded buttonhole connection	248
K.10	Tie bar and lug attachment on flanges.....	249
K.10.1	Integral flange.....	249
K.10.2	Plate welded on flange.....	253
K.11	Gusset.....	256

K.12 Gusset with reinforcing rings.....	256
K.12.1 General.....	256
K.12.2 Basic definitions.....	258
K.12.3 Stresses in the gussets.....	259
K.12.4 Stresses in the ring and pipe.....	259
K.12.5 Stresses in welds a7, a8 and a9.....	260
Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2014/68/EU.....	262
Bibliography.....	264

European foreword

This document (EN 14917:2021) has been prepared by Technical Committee CEN/TC 342 “Metal hoses, hose assemblies, bellows and expansion joints”, the secretariat of which is held by SNV.

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 January 2022, and conflicting national standards shall be withdrawn at the latest by January 2022.

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

This document supersedes EN 14917:2009+A1:2012.

This document has been prepared under a Standardization Request given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s) / Regulation(s).

For relationship with EU Directive(s) / Regulation(s), see informative Annex ZA, which is an integral part of this document.

Modifications to EN 14917:2009+A1:2012:

- adaptation to Directive 2014/68/EU;
- general revision and correction;
- complete revision and restructuring of Clause 6, i.e.;
 - addition of design in the creep range;
 - modification of stress calculation for internal pressure capability;
 - reformulation of column instability calculation;
 - modification of in-plane instability calculation;
 - harmonisation of fatigue calculation for all bellows types and introduction of 4 fatigue curves for different material classes;
 - extension of material characteristics for calculating forces and moments on pressurised expansion joints;
- addition of Annex K for stress calculation of hardware;
- revision of Testing, inspection and documentation;
- revision of material properties in Annex B and Annex J;
- correction of Coefficient C_p .

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

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

Introduction

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

If an expansion joint is designed and manufactured covered by EU-Directive 2014/68/EU a risk assessment has to be done. The possible risks of an expansion joint and how they have been dealt in this document are described in Annex I.

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1 Scope

This document specifies the requirements for design, manufacture and installation of metal bellows expansion joints with circular cross section for pressure applications with 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 764-4:2014, *Pressure equipment — Part 4: Establishment of technical delivery conditions for metallic materials*

EN 764-5:2014, *Pressure equipment — Part 5: Inspection documentation of metallic materials and compliance with the material specification*

EN 1092-1:2018, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 1: Steel flanges*

EN 1591-1:2013, *Flanges and their joints — Design rules for gasketed circular flange connections — Part 1: Calculation*

EN 1759-1:2004, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, Class designated — Part 1: Steel flanges, NPS 1/2 to 24*

EN 10028-1:2017, *Flat products made of steels for pressure purposes — Part 1: General requirements*

EN 10028-2:2017, *Flat products made of steels for pressure purposes — Part 2: Non-alloy and alloy steels with specified elevated temperature properties*

EN 10028-3:2017, *Flat products made of steels for pressure purposes — Part 3: Weldable fine grain steels, normalized*

EN 10028-4:2017, *Flat products made of steels for pressure purposes — Part 4: Nickel alloy steels with specified low temperature properties*

EN 10028-7:2016, *Flat products made of steels for pressure purposes — Part 7: Stainless steels*

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

EN 10216-1:2013, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 1: Non-alloy steel tubes with specified room temperature properties*

EN 10216-2:2013+A1:2019, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties*

EN 10216-3:2013, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 3: Alloy fine grain steel tubes*

EN 10216-4:2013, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 4: Non-alloy and alloy steel tubes with specified low temperature properties*

EN 10216-5:2013, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 5: Stainless steel tubes*

EN 10217-1:2019, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 1: Electric welded and submerged arc welded non-alloy steel tubes with specified room temperature properties*

EN 10217-2:2019, *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 10217-3:2019, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 3: Electric welded and submerged arc welded alloy fine grain steel tubes with specified room, elevated and low temperature properties*

EN 10217-4:2019, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 4: Electric welded non-alloy steel tubes with specified low temperature properties*

EN 10217-5:2019, *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 10217-6:2019, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 6: Submerged arc welded non-alloy steel tubes with specified low temperature properties*

EN 10217-7:2014, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 7: Stainless steel tubes*

EN 10222-2:2017, *Steel forgings for pressure purposes — Part 2: Ferritic and martensitic steels with specified elevated temperatures properties*

EN 10222-3:2017, *Steel forgings for pressure purposes — Part 3: Nickel steels with specified low temperature properties*

EN 10222-4:2017, *Steel forgings for pressure purposes — Part 4: Weldable fine grain steels with high proof strength*

EN 10222-5:2017, *Steel forgings for pressure purposes — Part 5: Martensitic, austenitic and austenitic-ferritic stainless steels*

EN 10253-2:2007, *Butt-welding pipe fittings — Part 2: Non alloy and ferritic alloy steels with specific inspection requirements*

EN 10253-3:2008, *Butt-welding pipe fittings — Part 3: Wrought austenitic and austenitic-ferritic (duplex) stainless steels without specific inspection requirements*

EN 10253-4:2008, *Butt-welding pipe fittings — Part 4: Wrought austenitic and austenitic-ferritic (duplex) stainless steels with specific inspection requirements*

EN 10269:2013, *Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties*

EN 10272:2016, *Stainless steel bars for pressure purposes*

EN 10273:2016, *Hot rolled weldable steel bars for pressure purposes with specified elevated temperature properties*

- EN 13184:2001, *Non-destructive testing — Leak testing — Pressure change method*
- EN 13445-2:2014, *Unfired pressure vessels — Part 2: Materials*
- EN 13445-3:2014, *Unfired pressure vessels — Part 3: Design*
- EN 13480-2:2017, *Metallic industrial piping — Part 2: Materials*
- EN 13480-2:2017/A1:2018, *Metallic industrial piping — Part 2: Materials*
- EN 13480-2:2017/A2:2018, *Metallic industrial piping — Part 2: Materials*
- EN 13480-2:2017/A3:2018, *Metallic industrial piping — Part 2: Materials*
- EN 13480-3:2017, *Metallic industrial piping — Part 3: Design and calculation*
- EN ISO 148-1:2016, *Metallic materials — Charpy pendulum impact test — Part 1: Test method (ISO 148-1:2016)*
- EN ISO 643:2020, *Steels — Micrographic determination of the apparent grain size (ISO 643:2019, Corrected version 2020-03)*
- EN ISO 3651-2:1998, *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 5817:2014, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections (ISO 5817:2014)*
- EN ISO 6506-1:2014, *Metallic materials — Brinell hardness test — Part 1: Test method (ISO 6506-1:2014)*
- EN ISO 6892-1:2019, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1:2019)*
- EN ISO 6892-2:2018, *Metallic materials — Tensile testing — Part 2: Method of test at elevated temperature (ISO 6892-2:2018)*
- EN ISO 9445-1:2010, *Continuously cold-rolled stainless steel — Tolerances on dimensions and form — Part 1: Narrow strip and cut lengths (ISO 9445-1:2009)*
- EN ISO 9445-2:2010, *Continuously cold-rolled stainless steel — Tolerances on dimensions and form — Part 2: Wide strip and plate/sheet (ISO 9445-2:2009)*
- EN ISO 9606-1:2017, *Qualification testing of welders — Fusion welding — Part 1: Steels (ISO 9606-1:2012 including Cor 1:2012 and Cor 2:2013)*
- EN ISO 9606-4:1999, *Approval testing of welders — Fusion welding — Part 4: Nickel and nickel alloys (ISO 9606-4:1999)*
- EN ISO 9712:2012, *Non-destructive testing — Qualification and Certification of NDT personnel (ISO 9712:2012)*
- EN ISO 14732:2013, *Welding personnel — Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials (ISO 14732:2013)*

- EN ISO 15609-1:2019, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding (ISO 15609-1:2019)*
- EN ISO 15609-2:2019, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 2: Gas welding (ISO 15609-2:2019)*
- EN ISO 15609-3:2004, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 3: Electron beam welding (ISO 15609-3:2004)*
- EN ISO 15609-4:2009, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 4: Laser beam welding (ISO 15609-4:2009)*
- EN ISO 15609-5:2011, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 5: Resistance welding (ISO 15609-5:2011, Corrected version 2011-12-01)*
- EN ISO 15609-6:2013, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 6: Laser-arc hybrid welding (ISO 15609-6:2013)*
- EN ISO 15610:2003, *Specification and qualification of welding procedures for metallic materials — Qualification based on tested welding consumables (ISO 15610:2003)*
- EN ISO 15613:2004, *Specification and qualification of welding procedures for metallic materials — Qualification based on pre-production welding test (ISO 15613:2004)*
- EN ISO 15614-1:2017,¹ *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 15614-1:2017, Corrected version 2017-10-01)*
- EN ISO 15614-2:2005, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 2: Arc welding of aluminium and its alloys (ISO 15614-2:2005)*
- EN ISO 15614-3:2008, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 3: Fusion welding of non-alloyed and low-alloyed cast irons (ISO 15614-3:2008)*
- EN ISO 15614-4:2005, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 4: Finishing welding of aluminium castings (ISO 15614-4:2005)*
- EN ISO 15614-5:2004, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 5: Arc welding of titanium, zirconium and their alloys (ISO 15614-5:2004)*
- EN ISO 15614-6:2006, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 6: Arc and gas welding of copper and its alloys (ISO 15614-6:2006)*
- EN ISO 15614-7:2019; *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 7: Overlay welding (ISO 15614-7:2016)*
- EN ISO 15614-8:2016, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 8: Welding of tubes to tube-plate joints (ISO 15614-8:2016)*

¹ As impacted by EN ISO 15614-1:2017/A1:2019.

EN ISO 15614-10:2005, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 10: Hyperbaric dry welding (ISO 15614-10:2005)*

EN ISO 15614-11:2002, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 11: Electron and laser beam welding (ISO 15614-11:2002)*

EN ISO 15614-12:2014, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 12: Spot, seam and projection welding (ISO 15614-12:2014)*

EN ISO 15614-13:2012, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 13: Upset (resistance butt) and flash welding (ISO 15614-13:2012)*

EN ISO 15614-14:2013, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 14: Laser-arc hybrid welding of steels, nickel and nickel alloys (ISO 15614-14:2013)*

EN ISO 17635:2016, *Non-destructive testing of welds — General rules for metallic materials (ISO 17635:2016)*

EN ISO 20485:2018, *Non-destructive testing — Leak testing — Tracer gas method (ISO 20485:2017)*

3 Terms and definitions

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

3.1 expansion joint

metal equipment consisting of one or more bellows used to absorb movements such as caused by thermal or mechanical effects in piping or pressure vessels

Note 1 to entry: See also Clause 4 Classification.

3.2 bellows

flexible element consisting of one or more corrugations and the end tangents

3.3 corrugation convolution

flexible unit of a bellows with a leakproof wall consisting of one or more plies

3.4 ply

element of the bellows' wall usually made from sheet or strip material

3.5 end tangent

straight un-corrugated portion at the ends of a bellows

3.6 reinforcing collar

reinforcing sleeve or ring attached to the end tangent for reinforcement