



**SLOVENSKI STANDARD**  
**SIST EN 13480-2:2002/A2:2011**  
**01-junij-2011**

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**Kovinski industrijski cevovodi - 2. del: Materiali - Dopolnilo A2**

Metallic industrial piping - Part 2: Materials

Metallische industrielle Rohrleitungen - Teil 2: Werkstoffe

Tuyauteries industrielles métalliques - Partie 2: Matériaux

**Ta slovenski standard je istoveten z: EN 13480-2:2002/A2:2010**

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**ICS:**

77.140.75	Jeklene cevi in cevni profili za posebne namene	Steel pipes and tubes for specific use
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## Metallic industrial piping - Part 2: Materials

Tuyauteries industrielles métalliques - Partie 2: Matériaux

Metallische industrielle Rohrleitungen - Teil 2: Werkstoffe

This amendment A2 modifies the European Standard EN 13480-2:2002; it was approved by CEN on 16 April 2010.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for inclusion of this amendment into the relevant national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

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

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## Foreword

This document (EN 13480-2:2002/A2:2010) has been prepared by Technical Committee CEN/TC 267 "Metallic industrial piping", the secretariat of which is held by AFNOR.

This Amendment to the European Standard EN 13480-3:2002 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2011, and conflicting national standards shall be withdrawn at the latest by May 2011.

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

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

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

This document includes the text of the amendment itself. The corrected pages of EN 13480-2 will be delivered as issue 13 of the standard.

According to the CEN/CENELEC Internal Regulations, the national standards organizations 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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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**EN 13480-2:2002/A2:2010 (E)****Foreword**

*The text of the foreword shall include reference to EN 13480-8:*

Part 8: Additional requirements for aluminium and aluminium alloy piping

*Add the following references to clause 2:*

**2 Normative references**

EN 1092-1:2007, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 1: Steel flanges*

EN 10216-2:2002+A2:2007, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties*

EN 10216-3:2002/A1:2004, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 3: Alloy fine grain steel tubes*

EN 10216-4:2002/A1:2004, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 4: Non-alloy and alloy steel tubes with specified low temperature properties*

EN 10217-4:2002/A1:2005, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 4: Non-alloy and alloy steel tubes with specified low temperature properties*

EN 10217-6:2002/A1:2005, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 6: Submerged arc welded non-alloy steel tubes with specified low temperature properties*

EN 10217-3:2002/A1:2005, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 3: Alloy fine grain steel tubes*

EN 10222-4:1998/A1:2001, *Steel forgings for pressure purposes — Part 4: Weldable fine grain steels with high proof strength*

EN 10269:1999/A1:2006, *Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties*

EN 20898-2:1993, *Mechanical properties of fasteners — Part 2: Nuts with specified proof load values — Coarse thread (ISO 898-2:1992)*

EN ISO 898-1:2009, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread (ISO 898-1:2009)*

EN ISO 3506-1:2009, *Mechanical properties of corrosion-resistant stainless steel fasteners — Part 1: Bolts, screws and studs (ISO 3506-1:2009)*

EN ISO 3506-2:2009, *Mechanical properties of corrosion-resistant stainless steel fasteners — Part 2: Nuts (ISO 3506-2:2009)*

*Delete existing Annex B and replace it with the following text:*

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## Annex B (normative)

### Requirements for prevention of brittle fracture at low temperatures

#### B.1 General

This annex distinguishes between pressure equipment that has design temperature for normal operation higher or lower than 50 °C.

For pressure equipment with normal operation temperatures higher than 50 °C B.5 applies. If B.5 is not applicable, the following rules for lower normal operation temperatures shall be used.

For pressure equipment with design temperature equal to or less than 50 °C this annex specifies three alternative methods for establishing criteria for the prevention of low temperature brittle fracture<sup>1)</sup> of steels in the form of plate, strip, tubes, fittings, forgings, castings, flanges, fasteners and weldments used in pressure parts. In this case, the temperature for the design  $T_R$  shall be determined<sup>2)</sup>. The criteria are based on impact energy requirements at specified temperatures for the base material, heat affected zone (including the fusion line) and weld metals.

The three methods are:

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- Method 1 Code of Practice: [SIST EN 13480-2:2002/A2:2011](https://standards.iteh.ai/catalog/standards/sist/34230file-72d5-4570-8c78-44c729384e1/sist-en-13480-2-2002-a2-2011)
- Technical requirements
- a) based on the assumption that  $T_R = T_{27J}$  as specified in harmonised European Material Standards and that it is possible to achieve these minimum properties after fabrication;
  - b) calculated from the principles of fracture mechanics used for Method 2 for C and CMn steels with yield strength < 460 N/mm<sup>2</sup> and
  - c) based on operating experience for Ni-alloyed steels with Ni > 1,5 % up to 9 %, for austenitic steels and for bolts and nuts.
- Method 2 Method developed from the principles of fracture mechanics and from operating experiences:
- A more flexible approach than Method 1 for derivation of technical requirements applicable to C, CMn and low alloy ferritic steels with a specified minimum yield strength ≤ 500 N/mm<sup>2</sup> and for austenitic-ferritic steels with a specified minimum yield strength ≤ 550 N/mm<sup>2</sup>. This method can be applied for these steels to a wider range of thicknesses and temperatures than Method 1 because  $T_R$  must not be equal to  $T_{27J}$  (see Figures B.2–1 to B.2–11). In addition for ferritic steels with max. 355 N/mm<sup>2</sup> in PWHT condition operation experience was considered for higher thicknesses.
- Method 3 The application of a fracture mechanics analysis:
- This general method is applicable to cases not covered by methods 1 or 2. This method may also be used to justify deviations from the requirements of Method 1 or 2. Only general

<sup>1)</sup> Including temperatures at pressure tests

<sup>2)</sup> See EN 13480-2:2002, 3.1.3.



guidance is given on the use of this method which shall only be used in agreement with the parties concerned.

Each of the three methods may be used independently. It is only necessary to satisfy the requirement of any one method.

All applicable combinations of the temperatures  $T_M$  (minimum metal temperature) and  $T_S$  (temperature adjustment term) shall be considered and the lowest possible  $T_R$ -value (design reference temperature) shall be used for the determination of the required material impact test temperature.

NOTE For definitions of temperature terms see 3.1.1 to 3.1.4.

## B.2 Material selection and impact energy requirements

The methods specified in B.2.1 (Method 1) or B.2.2 (Method 2) shall be used to determine the impact energy required to avoid brittle fracture. Alternatively, B.2.3 (Method 3) may be used to determine the required toughness. The method used shall be fully documented, in order to ensure that compliance can be verified.

Reference thickness for constructional details is defined in Table B.5-1.

### B.2.1 Method 1

#### B.2.1.1 General

Method 1 allows the selection of materials taken from harmonised European material standards with regard to prevention of brittle fracture. Table B.2-1 gives an overview to the following tables by steel type and product form.

The weld metal, the heat affected zone and other parts affected by manufacturing processes shall satisfy the same impact energy requirements as the guaranteed minimum properties for the base material at  $T_R$  given in the tables.

The tables list design reference temperatures for maximum thickness at given strength levels represented by steels from harmonised European material standards with guaranteed minimum strength and impact properties. Where it is not possible to achieve these minimum properties after fabrication a tougher material shall be selected.

Table B.2-1 — Guide to material selection

Table	Material or product form <sup>a)</sup>	Steel group	Clause
B.2-2	Plates and strips	Ferritic steels	B.2.1.2
B.2-3	Seamless and welded pipes		
B.2-4	Bars		
B.2-5	Forgings		
B.2-6	Ni alloyed steels ( $1,5 < Ni \leq 5 \%$ )	Ferritic steels	B.2.1.3
B.2-7	Ni-alloyed steel (9 % Ni)		
B.2-8	Bolts and nuts	Ferritic steels	B.2.1.4
B.2-9		Austenitic steels	
B.2-10			
B.2-11	Austenitic steel grades	Austenitic steels	B.2.1.5

<sup>a)</sup> For standardized fittings (Tees, Reducers, Elbows and Caps)  $T_R$  may be taken from Tables B.2-2 to B.2-6 as for the applied material or product form. The reference thickness  $e_B$  of the fitting shall be considered as equal to the reference thickness of the thicker of the mating pipes.

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NOTE Requirements for austenitic-ferritic steels are only given in B.2.2 (Method 2).

Where test pieces of at least 5 mm wide cannot be obtained, the material need not be subject to impact testing. For pipes with nominal thickness lower than 6,3 mm no impact testing is required.

Values of the design reference temperature  $T_R$  shall be calculated from the metal temperature  $T_M$  using the values of the temperature adjustment  $T_S$  given in Table B.2–12.

### B.2.1.2 Ferritic steels

Tables B.2–2 to B.2–5 list ferritic steels taken from harmonised European material standards with specified impact properties below  $-10\text{ }^\circ\text{C}$ .

The tabulated value of  $T_R$  is based on the impact test temperature  $T_{KV}$  for  $KV = 27\text{ J}$ .

**Table B.2–2 — General requirements for prevention of brittle fracture with reference thickness for plates and strips**

Plates and Strips									
No. as per Table D.2-1	European Standard EN	Grade	Material No.	Max. reference thickness $e_B$		Design reference temperature $T_R$ ( $^\circ\text{C}$ )	Material group to CR ISO 15608:2000	Remarks	
				AW	PWHT				
1	10028-2:2003	P235GH	1.0345	35	90	-20	1.1		
2		P265GH	1.0425	35	75				
3		P295GH	1.0481	35	65		1.2		
4		P355GH	1.0473	35	55				
29	10028-3:2003	P275NH	1.0487	35	75	-20	1.1		
30		P275NL1	1.0488	35	75	-40			
31		P275NL2	1.1104	35	90	-50			
32		P355N	1.0562	35	55	-20	1.2		
33		P355NH	1.0565	35	55	-20			
34		P355NL1	1.0566	35	55	-40			
35		P355NL2	1.1106	35	55	-50			
39	10028-4:2003	11MnNi5-3	1.6212	35	50	-60	9.1		
40		13MnNi6-3	1.6217	35	50	-60			
41		15NiMn6	1.6228	35	50	-80			
50	10028-5:2003	P355M	1.8821	30	-	-20	1.2	a	
51		P355ML1	1.8832	35	-	-40			a
52		P355ML2	1.8833	35	-	-50			a
53		P420M	1.8824	35	-	-20	2.1	a	
54		P420ML1	1.8835	32	-	-40			a
55		P420ML2	1.8828	32	-	-50			a
59	10028-6:2003	P355Q	1.8866	35	60	-20	1.2		
60		P355QH	1.8867	35	60	-20			
61		P355QL1	1.8868	35	60	-40	3.1		
62		P355QL2	1.8869	35	60	-60			

<sup>a</sup> TMCP steels shall not be Post Weld Heat Treated.

**Table B.2-3 — General requirements for prevention of brittle fracture with reference thickness for seamless and welded tubes**

Seamless and welded tubes								
No. as per Table D.2-1	European Standard EN	Grade	Material No.	Max. reference thickness		Design reference temperature $T_R$ (°C)	Material group to CR ISO 15608:2000	Remarks
				$e_B$ AW	PWHT			
231	10216-3:2002/A1:2004	P275NL1	1.0488	35	75	- 40	1.1	
232		P275NL2	1.1104	35	75	- 50		
233		P355N	1.0562	35	55	- 20	1.2	
234		P355NH	1.0565	35	55	- 20		
235		P355NL1	1.0566	35	55	- 40		
236		P355NL2	1.1106	35	55	- 50		
248	10216-4:2002/A1:2004	P215NL	1.0451	10	10	- 40	1.1	a)
249		P255QL	1.0452	35	40	- 50		
250		P265NL	1.0453	25	25	- 40		
251		26CrMo4-2	1.7219	15	40	- 60	5.1	
252		11MnNi5-3	1.6212	35	40	- 60	9.1	
253		13MnNi6-3	1.6217	35	40	- 60	9.1	
306	10217-3:2002/A1:2005	P275NL1	1.0488	35	40	- 40	1.1	
307		P275NL2	1.1104	35	40	- 50		
308		P355N	1.0562	35	40	- 20	1.2	
309		P355NH	1.0565	35	40	- 20		
310		P355NL1	1.0566	35	40	- 40		
311		P355NL2	1.1106	35	40	- 50		
316	10217-4:2002/A1:2005	P215NL	1.0451	10	10	- 40	1.1	a
317		P265NL	1.0453	16	16	- 40	1.1	a
321	10217-6:2002/A1:2005	P215NL	1.0451	10	10	- 40	1.1	a
322		P265NL	1.0453	25	25	- 40	1.1	a

<sup>a</sup> Thickness limitation results from wall thickness limitation in the European material standard and in the European component standards respectively.

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Table B.2-4 — General requirements for prevention of brittle fracture with reference thickness for bars

Bars								
No. as per Table D.2-1	European Standard EN	Grade	Material No.	Max. reference thickness		Design reference temperature $T_R$ (°C)	Material group to CR ISO 15608:2000	Remarks
				$e_B$ AW	PWHT			
147	10273:2000	P275NH	1.0487	35	75	- 20	1.1	
148		P355NH	1.0565	35	55		1.2	
150		P355QH	1.8867	35	55		1.2	

Table B.2-5 — General requirements for prevention of brittle fracture with reference thickness for forgings

Forgings								
No. as per Table D.2-1	European Standard EN	Grade	Material No.	Max. reference thickness		Design reference temperature $T_R$ (°C)	Material group to CR ISO 15608:2000	Remarks
				$e_B$ AW	PWHT			
367	10222-3:1998	13MnNi6-3	1.6217	35	70	- 60	9.1	
369		15NiMn6	1.6228	35	50	- 80	9.1	
378	10222-4:1998/A1:2001	P285QH	1.0478	35	85	- 20	1.2	
380		P355QH1	1.0571	35	60	- 20	1.2	
382		P420QH	1.8936	35	50	20	3.1	

## B.2.1.3 Ni –alloyed steels (Ni &gt; 1.5 %)

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Table B.2-6 lists Ni alloyed steels up to and including 5 % Nickel taken from harmonised European material standards.

Table B.2-7 lists Ni alloyed steels with 9 % Nickel taken from harmonised European material standards.

The tabulated value of  $T_R$  is based on the impact test temperature  $T_{KV}$  for  $KV = 27$  J.

**Table B.2-6 — General requirements for prevention of brittle fracture with reference thickness for Ni-alloyed steels with 1,5 % < Ni ≤ 5 %**

Ni-alloyed steel, 1,5 % < Ni <sup>a</sup> ≤ 5 %									
No. as per Table D.2-1	European Standard EN	Grade	Material No.	Max. reference thickness $e_B$		Design reference temperature $T_R$ (°C)	Material group to CR ISO 15608:2000	Remarks	
				AW	PWHT				
<b>plates and strips</b>									
42	10028-4:2003	12Ni14	1.5637	35	80	- 100	9.2	b	
43		X12Ni5	1.5680	35	80	- 120			
<b>seamless tubes</b>									
254	10216-4:2002/A1:2004	12Ni14	1.5637	25		- 100	9.2	b	
255		12Ni14		35	40	- 90		b	
256		X12Ni5	1.5680	25		- 120			
257		X12Ni5		35	40	- 110			
<b>Forgings</b>									
370	10222-3:1998	12Ni14	1.5637	35		- 100	9.2	b	
371		12Ni14		35	50				b
372		12Ni14		35	70				b
373		X12Ni5	1.5680	35		- 120			
374		X12Ni5		35	50				

<sup>a</sup> Nickel content is nominal.

<sup>b</sup> If used at - 105 °C (e. g. ethylene application), then 27 J shall be guaranteed at this temperature.

NOTE Thickness limitation result from wall thickness limitation in European material standards.

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**Table B.2-7 — General requirements for prevention of brittle fracture with reference thickness for Ni-alloyed steels with 9 % Ni**

9 % - Ni <sup>a</sup> alloys								
No. as per Table D.2-1	European Standard EN	Grade	Material No.	Max. reference thickness $e_B$		Design reference temperature $T_R$ (°C)	Material group to CR ISO 15608:2000	Remarks
				AW	PWHT			
<b>plates and strips</b>								
44	10028-4:2003	X8Ni9	1.5662	— <sup>b</sup>		- 196	9.3	
48		X7Ni9	1.5663					
<b>seamless tubes</b>								
258	10216-4:2002/A1:2004	X10Ni9	1.5682	— <sup>b</sup>		- 196	9.3	
<b>Forgings</b>								
375	10222-3:1998	X8Ni9	1.5662	— <sup>b</sup>		- 196	9.3	

<sup>a</sup> Nickel content is nominal.

<sup>b</sup> Materials can be used to maximum thickness permitted in harmonised European material standards.