

Steel forgings for pressure purposes —

Part 2: Ferritic and martensitic steels with specified elevated temperature properties

The European Standard EN 10222-2:1999 has the status of a
British Standard

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National foreword

This British Standard is the official English language version of EN 10222-2:1999. Together with BS EN 10222-1, -3, -4 and -5, it supersedes BS 1503:1989 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee ISE/73, Steel for pressure purposes, to Subcommittee ISE/73/3, Steel forgings for pressure purposes, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 20, an inside back cover and a back cover.

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Steel forgings for pressure purposes - Part 2: Ferritic and martensitic steels with specified elevated temperature properties

Pièces forgées pour appareils à pression - Partie 2: Aciers
ferritiques et martensitiques avec caractéristiques
spécifiées à température élevée

Schmiedestücke aus Stahl für Druckbehälter - Teil 2:
Ferritische und martensitische Stähle mit festgelegten
Eigenschaften bei erhöhten Temperaturen

This European Standard was approved by CEN on 5 September 1999.

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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.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This European Standard has been prepared by Technical Committee ECISS/TC 28, Steel forgings, the Secretariat of which is held by BSI.

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 June 2000, and conflicting national standards shall be withdrawn at the latest by June 2000.

This European Standard 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 the relationship with EU Directive(s), see informative annex ZB, which is an integral part of this standard.

Attention is drawn to annex ZA which is an A-deviation requested by Sweden.

Attention is drawn to non-conflicting national additions requested by France and Germany. These additions shall only appear as national annexes to the members' editions of this European Standard.

The titles of the other parts of this European Standard are:

Part 1: General requirements for open die forgings

Part 3: Nickel steels with specified low temperature properties

Part 4: Weldable fine grain steels with high proof strength

Part 5: Martensitic, austenitic and austenitic-ferritic stainless steels

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

1 Scope

This part of this European Standard specifies the technical delivery conditions for forgings for pressure purposes, made of ferritic and martensitic steels with specified elevated temperature properties. Chemical composition and mechanical properties are specified.

General information on technical delivery conditions is given in EN 10021.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 10021	General technical delivery requirements for iron and steel products.
EN 10222-1:1998	Steel forgings for pressure purposes - Part 1: General requirements for open die forgings.

3 Chemical composition

3.1 Cast analysis

The chemical composition (cast analysis), determined in accordance with EN 10222-1, shall conform to the requirements of table 1 (see 9.1 of EN 10222-1:1998).

3.2 Product analysis

The product analysis shall not deviate from the specified cast analysis (see table 1) by more than the values specified in table 2 (see 9.2 of EN 10222-1:1998).

4 Heat treatment and mechanical properties

When heat treated in accordance with table 1, the mechanical properties, determined in accordance with EN 10222-1, shall conform to the requirements of table 1.

Elevated temperature proof strength ($R_{p0,2}$) properties shall conform to the requirements of table 3.

The testing temperature for impact properties and elevated temperature properties shall be agreed at the time of enquiry and order.

Reference data for stress rupture properties and 1 % creep limit properties are given in annex A for information.

Table 1: Chemical composition, mechanical properties and heat treatment

Steel designation		Chemical composition (cast analysis) % ¹⁾									Mechanical properties at room temperature						Heat treatment				Carbon equivalent value max. %
Name	Number	C	Si max.	Mn	P max.	S max.	Cr	Mo	Others	Thickness of the ruling section t_R ²⁾ mm	Yield strength R_{eH} ³⁾ N/mm ² min	Tensile strength R_m N/mm ²	Elongation after fracture A ⁴⁾ min %	Notch impact KV ⁴⁾ min J	Symbol ⁵⁾	Austenitizing or solution annealing		Tempering			
																Temperature ° C	Cooling in ⁶⁾	Temperature ° C	Cooling in ⁶⁾		
P245GH	1.0352	0,08 to 0,20	0,40	0,50 to 1,30	0,025	0,015	—	—	—	$t_R \leq 35$ $35 < t_R \leq 160$	245 220	410 to 530 410 to 530	25 23	32 ⁷⁾ 32 ⁷⁾	A N NT or QT	890 to 930 890 to 930 890 to 930	f a a, o, w	— — 600 to 640	— — a, f		
P280GH	1.0426	0,08 to 0,20	0,40	0,90 to 1,50	0,025	0,015	—	—	—	$t_R \leq 35$ $35 < t_R \leq 160$	280 255	460 to 580 460 to 580	23 21	48 ⁷⁾ 27 ⁷⁾	N NT or QT	880 to 920 880 to 920 880 to 920	a a, o, w a, o, w	— 600 to 640 600 to 640	— a, f a, f		
P305GH	1.0436	0,15 to 0,20	0,40	0,90 to 1,60	0,025	0,015	—	—	—	$t_R \leq 35$ $35 < t_R \leq 160$ $t_R \leq 70$	305 280 285	490 to 610 490 to 610 510 to 630	22 20 22	48 ⁷⁾ 27 ⁷⁾ 48 ⁷⁾	N NT QT	880 to 920 880 to 920 880 to 920	a a, o, w o, w	— 620 to 660 620 to 660	— a, f a, f		
16Mo3	1.5415	0,12 to 0,20	0,35	0,40 to 0,90	0,025	0,015	—	0,25 to 0,35	—	$t_R \leq 35$ $35 < t_R \leq 70$ $70 < t_R \leq 100$	295 285 275	440 to 570 440 to 570	23 21	50 ⁷⁾ 34 ⁷⁾	N QT	890 to 950 890 to 960	a o, w	— 620 to 700	— a, f		
13CrMo4-5	1.7335	0,08 to 0,18	0,35	0,40 to 1,00	0,025	0,015	0,70 to 1,15 ⁸⁾	0,40 to 0,60	—	$t_R \leq 35$ $35 < t_R \leq 70$	295 285	440 to 590 440 to 590	20 18	44 ⁷⁾ 27 ⁷⁾	NT	890 to 950 890 to 950	a a, o, w	630 to 740 630 to 740	a, f a, f		

¹⁾ Elements not listed in this table shall not be intentionally added to the steel without the approval of the purchaser except for finishing the cast. All appropriate measures shall be taken to prevent the addition from scrap or other materials used in steelmaking of these elements which may adversely affect the mechanical properties and usability. The following elements shall not exceed the limits stated: chromium 0,30 % max., copper 0,30 % max., molybdenum 0,08 % max., nickel 0,30 % max., niobium 0,01 % max., vanadium 0,02 % max. The total of chromium + copper + molybdenum shall not exceed 0,50 %.

²⁾ The thickness ranges given in this column apply for the as heat treated thickness of forgings with the ruling section. This is characterized by rectangular shape, a width to thickness ratio of ≥ 2 and a length to thickness ratio of ≥ 4 . For forgings with other sections the equivalent thickness shall be determined according to EN 10222-1, annex B or be agreed at the time of enquiry and order.

³⁾ Until the yield point criteria are harmonized in the various national codes, determination of R_{eH} may be replaced by determination of $R_{p0.2}$. In this case, $R_{p0.2}$ values are 10 N/mm² lower for R_{eH} values up to 355 N/mm² and 15 N/mm² lower for R_{eH} values greater than 355 N/mm².

⁴⁾ l – longitudinal t – tangential tr – transverse
a – air f – furnace o – oil
annealed N – normalized QT – quenched and tempered NT – normalized and tempered
w – water

⁵⁾ If assistance to pressurized hydrogen is of importance, a min Cr of 0,80 % may be agreed at the time of enquiry and order.

⁶⁾ Optional at 0 °C. The minimum requirements of the standard shall be met.