BS EN
10250-3:2000

Open die steel forgings for general engineering purposes —

Part 3: Alloy special steels

The European Standard EN 10250-3:1999 has the status of a British Standard

National foreword

This British Standard is the official English language version of EN 10250-3:1999. This British Standard supersedes BS 4670:1971 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ISE/31, Wrought steels, 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 committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 12, an inside back cover and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

This British Standard, having been prepared under the direction of the Engineering Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 February 2000

Amendments issued since publication

Amd. No.	Date	Comments

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 10250-3

October 1999

ICS 77.140.20; 77.140.85

English version

Open die steel forgings for general engineering purposes - Part 3: Alloy special steels

Pièces forgées en acier pour usage général - Partie 3: Aciers spéciaux alliés

Freiformschmiedestücke aus Stahl für allgemeine Verwendung - Teil 3: Legierte Edelstähle

This European Standard was approved by CEN on 9 September 1999.

Contents

	Page
Foreword	3
1 Scope	4
2 Normative references	4
3 Chemical composition	4
4 Heat treatment	5
5 Mechanical properties	5
Annex A (informative) Heat treatment	12

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 April 2000, and conflicting national standards shall be withdrawn at the latest by April 2000.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association. This European Standard is considered to be a supporting standard to those application and product standards which in themselves support an essential safety requirement of a New Approach Directive and which make reference to this European Standard.

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

Part 1: General requirements

Part 2: Non-alloy quality and special steels

Part 4: 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 requirements for open die forgings, forged bars and products pre-forged and finished in ring rolling mills, manufactured from alloy special steel and supplied in the quenched and tempered condition.

> NOTE: The majority of steels listed in this part of EN 10250 are identical to steels specified in EN 10083-1 and more extensive information on hardenability and technological properties is given in that European Standard.

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

2 Normative references

This part of EN 10250 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 10083-1 Quenched and tempered steels – Part 1: Technical delivery conditions for special steels

EN 10250-1 Open die steel forgings for general engineering purposes – Part 1: General requirements

3 Chemical composition

3.1 Cast analysis

The chemical composition of the steel shall be determined by cast analysis and shall conform to the analysis given in Table 1 (see A.7 and A.8, of EN 10250-1).

Measures should be taken to prevent the addition from the scrap, or other material used in the manufacture of the steels, of such elements which affect the hardenability, mechanical properties and applicability of the steel.

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 10250-1).

4 Heat treatment

Heat treatment details are not given in Table A1 for guidance.

5 Mechanical properties

The mechanical properties determined on test pieces selected, prepared and tested in accordance with clauses 11 and 12 of EN 10250-1 shall conform to the property requirements given in Table 3.

Table 1: Steel grades and chemical composition[1)]

Steel designation		C	Si	Mn	P max	S max	Cr	Mo	Ni	V
Name	Number	%	%	%	%	%	%	%	%	%
38Cr2	1.7003	0,35 to 0,42	≤ 0,40	0,50 to 0,80	0,035	0,035	0,40 to 0,60	-	-	-
46Cr2	1.7006	0,42 to 0,50	≤ 0,40	0,50 to 0,80	0,035	0,035	0,40 to 0,60	-	-	-
34Cr4	1.7033	0,30 to 0,37	≤ 0,40	0,60 to 0,90	0,035	0,035	0,90 to 1,20	-	-	-
37Cr4	1.7034	0,34 to 0,41	≤ 0,40	0,60 to 0,90	0,035	0,035	0,90 to 1,20	-	-	-
41Cr4	1.7035	0,38 to 0,45	≤ 0,40	0,60 to 0,90	0,035	0,035	0,90 to 1,20	-	-	-
25CrMo4	1.7218	0,22 to 0,29	≤ 0,40	0,60 to 0,90	0,035	0,035	0,90 to 1,20	0,15 to 0,30	-	-
34CrMo4	1.7220	0,30 to 0,37	≤ 0,40	0,60 to 0,90	0,035	0,035	0,90 to 1,20	0,15 to 0,30	-	-
42CrMo4	1.7225	0,38 to 0,45	≤ 0,40	0,60 to 0,90	0,035	0,035	0,90 to 1,20	0,15 to 0,30	-	-
50CrMo4	1.7228	0,46 to 0,54	≤ 0,40	0,50 to 0,80	0,035	0,035	0,90 to 1,20	0,15 to 0,30	-	-
36CrNiMo4	1.6511	0,32 to 0,40	≤ 0,40	0,50 to 0,80	0,035	0,035	0,90 to 1,20	0,15 to 0,30	0,90 to 1,20	-
34CrNiMo6	1.6582	0,30 to 0,38	≤ 0,40	0,50 to 0,80	0,035	0,035	1,30 to 1,70	0,15 to 0,30	1,30 to 1,70	-
30CrNiMo8	1.6580	0,26 to 0,34	≤ 0,40	0,30 to 0,60	0,035	0,035	1,80 to 2,20	0,30 to 0,50	1,80 to 2,20	-
36NiCrMo16	1.6773	0,32 to 0,39	≤ 0,40	0,30 to 0,60	0,030	0,025	1,60 to 2,00	0,25 to 0,45	3,60 to 4,10	-

Table 1: Steel grades and chemical composition (concluded)

Steel designation		C	Si	Mn	P Max	S Max	Cr	Mo	Ni	V
Name	Number	%	%	%	%	%	%	%	%	%
51CrV4	1.8159	0,47 to 0,55	≤ 0,40	0,70 to 1,10	0,035	0,035	0,90 to 1,20	-	-	0,10 to 0,25
33NiCrMoV14-5	1.6956	0,28 to 0,38	≤ 0,40	0,15 to 0,40	0,035	0,035	1,00 to 1,70	0,30 to 0,60	2,90 to 3,80	0,08 to 0,25
40CrMoV13-9	1.8523	0,35 to 0,45	0,15 to 0,40	0,40 to 0,70	0,035	0,035	3,00 to 3,50	0,80 to 1,10	-	0,15 to 0,25
18CrMo4	1.7243	0,15 to 0,21	≤ 0,40	0,60 to 0,90	0,035	0,035	0,90 to 1,20	0,15 to 0,25	-	-
20MnMoNi4-5	1.6311	0,17 to 0,23	≤ 0,40	1,00 to 1,50	0,035	0,035	≤ 0,50	0,45 to 0,60	0,40 to 0,80[2)]	-
30CrMoV9	1.7707	0,26 to 0,34	≤ 0,40	0,40 to 0,70	0,035	0,035	2,30 to 2,70	0,15 to 0,25	≤ 0,60	0,10 to 0,20
32CrMo12	1.7361	0,28 to 0,35	≤ 0,40	0,40 to 0,70	0,035	0,035	2,80 to 3,30	0,30 to 0,50	≤ 0,60	-
28NiCrMoV8-5	1.6932	0,24 to 0,32	≤ 0,40	0,15 to 0,40	0,035	0,035	1,00 to 1,50	0,35 to 0,55	1,80 to 2,10	0,05 to 0,15

[1)] At the option of the manufacturer the elements aluminium, titanium, vanadium and niobium may be added singly or in combination for grain control purposes. Elements not quoted in Tables 1 and 2 shall not be added intentionally to the steel without the agreement of the purchaser, except for the purpose of finishing the heat.

[2)] For greater cross-sections up to 1,00 % Ni is admissible.

Table 2: Permissible deviations between the product analysis and the limiting values given in Table 1 for the cast analysis

Element	Permissible maximum content in the cast analysis %	Permissible deviation %
Carbon	≤ 0,55	± 0,02
Silicon[1)]	≤ 0,40	+ 0,03
Manganese	≤ 1,00	± 0,04
	> 1,00 ≤ 1,50	± 0,06
Phosphorus	≤ 0,035	+ 0,005
Sulphur	≤ 0,045	+ 0,005
Chromium	≤ 2,00	± 0,05
	> 2,00 ≤ 3,50	± 0,12
Molybdenum	≤ 0,30	± 0,03
	> 0,30 ≤ 1,10	± 0,06
Nickel	≤ 2,00	± 0,05
	> 2,00 ≤ 4,10	± 0,07
Vanadium	≤ 0,25	± 0,02

[1)] For steel 40 Cr Mo V13 9, the permissible deviation is ± 0,03 %

Table 3: Mechanical properties in the quenched and tempered condition

Thickness of ruling section t_R																	
Steel designation		≤ 70 mm t_R (longitudinal)				70 < t_R ≤ 160 mm						160 < t_R ≤ 330 mm					
Name	Number	R_e min N/mm^2	R_m min N/mm^2	A min %	KV min J	R_e min N/mm^2	R_m min N/mm^2	A min %		KV min J		R_e min N/mm^2	R_m min N/mm^2	A min %		KV min J	
								l[1)]	tr[1)]	l[1)]	tr[1)]			l[1)]	tr[1)]	l[1)]	tr[1)]
38Cr2	1.7003	350	600	17	35	-	-	-	-	-	-	-	-	-	-	-	-
46Cr2	1.7006	400	650	15	35	-	-	-	-	-	-	-	-	-	-	-	-
34Cr4	1.7033	460	700	15	40	-	-	-	-	-	-	-	-	-	-	-	-
37Cr4	1.7034	510	750	14	35	-	-	-	-	-	-	-	-	-	-	-	-
41Cr4	1.7035	560	800	14	35	-	-	-	-	-	-	-	-	-	-	-	-
25CrMo4	1.7218	450	700	15	50	400	650	17	13	45	27	380	600	18	14	38	22
34CrMo4	1.7220	550	800	14	45	450	700	15	10	40	22	410	650	16	12	33	17

[1)] l = longitudinal tr = transverse

Table 3: Mechanical properties in the quenched and tempered condition (continued)

Thickness of ruling section t_R																			
Steel designation		$t_R \leq 160$ mm						$160 < t_R \leq 330$ mm						$330 < t_R \leq 660$ mm[2]					
Name	Number	R_e min N/mm^2	R_m min N/mm^2	A min %		KV min J		R_e min N/mm^2	R_m min N/mm^2	A min %		KV min J		R_e min N/mm^2	R_m min N/mm^2	A min %		KV min J	
				l[1]	tr[1]	l[1]	tr[1]			l[1]	tr[1]	l[1]	tr[1]			l[1]	tr[1]	l[1]	tr[1]
42CrMo4	1.7225	500	750	14	10	30	16	460	700	15	11	27	14	390	600	16	12	22	12
50CrMo4	1.7228	550	800	13	9	25	14	540	750	14	10	20	12	490	700	15	11	15	10
36CrNiMo4	1.6511	550	750	14	10	45	22	500	700	15	11	45	22	450	650	16	12	40	20
34CrNiMo6	1.6582	600	800	13	9	45	22	540	750	14	10	45	22	490	700	15	11	40	20
30NiCrMo8	1.6580	700	900	12	8	45	22	630	850	12	8	45	22	590	800	12	8	40	20
36NiCrMo16	1.6773	800	1 000	11	8	45	22	800	1 000	11	8	45	22	800	1 000	11	8	45	22
51CrV4	1.8159	600	800	13	9	30	16	-	-	-	-	-	-	-	-	-	-	-	-

[1] l = longitudinal tr = transverse

[2] For steels 42 CrMo 4, 50 CrMo 4, 36 CrNiMo 4 these properties apply only to a $t_R \leq 500$ mm

Table 3: Mechanical properties in the quenched and tempered condition (concluded)

Thickness of ruling section t_R																			
Steel designation		$t_R \leq 160$ mm						$160 < t_R \leq 330$ mm						$330 < t_R \leq 660$ mm[2]					
Name	Number	R_e min N/mm^2	R_m min N/mm^2	A min %		KV min J		R_e min N/mm^2	R_m min N/mm^2	A min %		KV min J		R_e min N/mm^2	R_m min N/mm^2	A min %		KV min J	
				l[1]	tr[1]	l[1]	tr[1]			l[1]	tr[1]	l[1]	tr[1]			l[1]	tr[1]	l[1]	tr[1]
33NiCrMoV14-5	1.6956	980	1100	10	7	28	17	820	1000	12	8	48	27	780	950	12	8	48	27
40CrMoV13-9	1.8523	660	850	15	15	35	35	660	850	15	15	35	35	660	850	15	15	35	35
		720	900	15	15	32	32	720	900	15	15	32	32	720	900	15	15	32	32
		780	950	14	14	30	30	780	950	14	14	30	30	780	950	14	14	30	30
		840	1 000	12	12	25	25	840	1 000	12	12	25	25	-	-	-	-	-	-
		890	1 050	11	11	22	22	-	-	-	-	-	-	-	-	-	-	-	-
		940	1 100	11	11	20	20	-	-	-	-	-	-	-	-	-	-	-	-
18CrMo4	1.7243	275 (Rp 0.2)	485-660	20	20	50	50	-	-	-	-	-	-	-	-	-	-	-	-
20MnMoNi4-5	1.6311	420	580	17	14	39	24	390	550	17	14	39	24	-	-	-	-	-	-
30CrMoV9	1.7707	700	900	12	8	35	20	590	800	14	10	35	20	-	-	-	-	-	-
32CrMo12	1.7361	680	900	12	8	35	20	630	850	13	9	35	20	490	700	15	11	35	20
28NiCrMoV8-5	1.6932	630	800	14	10	45	25	590	750	15	11	40	21	590	750	15	11	40	21

[1] l = longitudinal tr = transverse

[2] For steels 42 CrMo 4, 50 CrMo 4, 36 CrNiMo 4 these properties apply only to a $t_R \leq 500$ mm

Annex A (informative)

Heat treatment

Heat treatment details are given in Table A.1

Table A.1: Heat treatment conditions

Steel designation		Quenching temperature[1)]	Tempering temperature
Name	Number	°C	°C
38Cr2	1.7003	830 to 870	540 to 680
34Cr4	1.7033	830 to 870	540 to 680
34CrMo4	1.7220	830 to 870	540 to 680
46Cr2	1.7006	820 to 860	540 to 680
37Cr4	1.7034	825 to 865	540 to 680
42CrMo4	1.7225	820 to 860	540 to 680
50CrMo4	1.7228	820 to 860	540 to 680
41Cr4	1.7035	820 to 860	540 to 680
25CrMo4	1.7218	840 to 880	540 to 680
36CrNiMo4	1.6511	820 to 850	540 to 680
34CrNiMo6	1.6582	830 to 860	540 to 680
30CrNiMo8	1.6580	830 to 860	540 to 680
36NiCrMo16	1.6773	865 to 885	550 to 650
51CrV4	1.8159	820 to 860	540 to 680
33NiCrMoV14-5	1.6956	820 to 890	550 to 650
40CrMoV13-9	1.8523	920 to 970	550 to 720
18CrMo4	1.7243	850 to 880	595 to 700
20MnMoNi4-5	1.6311	870 to 940	630 to 680
30CrMoV9	1.7707	840 to 870	540 to 680
32CrMo12	1.7361	890 to 940	550 to 740
28NiCrMoV8-5	1.6932	830 to 870	550 to 850

[1)] Quenching from hardening may be carried out in oil, water, or water based solutions. Caution should be observed in the use of water as a quenching medium to avoid the risk of cracking the forgings.

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

Copyright