BRITISH STANDARD

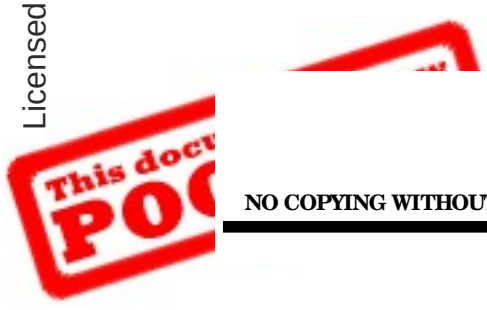
BS EN 10263-3:2001
Incorporating Corrigendum No. 1

Steel rod, bars and wire for cold heading and cold extrusion —

Part 3: Technical delivery conditions for case hardening steels

The European Standard EN 10263-3:2001 has the status of a British Standard

ICS 77.140.60; 77.140.65



National foreword

This British Standard is the official English language version of EN 10263-3:2001. Together with BS EN 10263-1:2001, BS EN 10263-2:2001 and BS EN 10263-4:2001 it supersedes BS 3111-1:1987, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ISE/71, Steel rods for wire drawing, 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.

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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 August 2001

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EUROPEAN STANDARD

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EN 10263-3

June 2001

ICS 77.140.60; 77.140.65

English version

Steel rod, bars and wire for cold heading and cold extrusion — Part 3: Technical delivery conditions for case hardening steels

Barres, fil machine et fil en acier pour transformation à froid et extrusion à froid — Partie 3: Conditions techniques de livraison des aciers de cémentation

Walzdraht, Stäbe und Draht aus Kaltstauch- und Kaltfließpreßstählen — Teil 3: Technische Lieferbedingungen für Einsatzstähle

This European Standard was approved by CEN on 19 April 2001.

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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 Management Centre has the same status as the official versions.

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Contents

Foreword

This European Standard has been prepared by Technical Committee ECISS/TC 15, Wire-rod — Qualities, dimensions, tolerances and specific tests, the Secretariat of which is held by UNI.

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 December 2001, and conflicting national standards shall be withdrawn at the latest by December 2001.

This European Standard EN 10263 is subdivided as follows:

— *Part 1: General technical delivery conditions;*

— *Part 2: Technical delivery conditions for steels not intended for heat treatment after cold working;*

— *Part 3: Technical delivery conditions for case hardening steels;*

— *Part 4: Technical delivery conditions for steels for quenching and tempering;*

— *Part 5: Technical delivery conditions for 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

1.1 This part of EN 10263 is applicable to round rod, round bars and wire with a diameter up to and including 100 mm, of non-alloy and alloy steel, intended for cold heading and cold extrusion and subsequent case hardening treatment.

1.2 This part of EN 10263 is complemented by EN 10263-1.

2 Normative References

This European Standard incorporates by date 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 date 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 (including amendments).

EN 10020, *Definitions and classification of grades of steel.*

EN 10263-1, *Steel rod, bars and wire for cold heading and cold extrusion— Part 1: General technical delivery conditions.*

3 Terms and definitions

For the purposes of this standard the definitions in EN 10263-1:2001 and the following apply.

3.1
case hardening steel
steel with a relatively low carbon content, which is intended for carburizing or carbonitriding and subsequent hardening. Such steels, after treatment, are characterized by a high hardness surface layer and a tough core

NOTE Other processes for case hardening include nitriding and nitrocarburizing

4 Classification and Designation

4.1 Classification

All steels covered by this part of EN 10263-1:2001 are special steels according to EN 10020.

Steel grades from C10E2C to C20E2C as quoted in Table 2 are non-alloy steels and all others are alloy steels according to EN 10020.

4.2 Designation

See EN 10263-1:2001.

5 Production process

5.1 Steelmaking process

See EN 10263-1:2001.

5.2 Deoxidation

All steels quoted in Table 2 shall be killed.

6 Requirements

6.1 Delivery conditions

The delivery conditions in which the products covered by this part of EN 10263 are normally supplied, the product forms and the applicable requirements are given in Table 1.

6.2 Chemical composition

6.2.1 Heat analysis

The chemical composition shall be in accordance with the values specified in Table 2 for the heat analysis.

6.2.2 Product analysis

In cases where a product analysis is requested, the admissible deviations from the values specified for the heat analysis are indicated in Table 3.

6.3 Mechanical properties

The mechanical properties of the products, to be determined by the tensile test or hardness test, shall be in accordance with the prescriptions given in Table 1, for that which concerns the delivery condition, and in Tables 4, 5 and 6.

6.4 Hardenability

6.4.1 In the case of products ordered with standard requirements regarding hardenability, that is, when the steel names or numbers as quoted in Table 2 are supplemented by the symbols "+H", the hardness values obtained in the end quench test (Jominy test) (see Table 1 of EN 10263-1:2001) shall be in compliance with the values given in Table 7.

6.4.2 In the case of products ordered with restricted requirements regarding the scatter bands of the hardness values obtained by the Jominy test, that is when the steel name or number as quoted in Table 2 is supplemented by the symbol "+HH" or "+HL", the above hardness values shall be in compliance with the values given in Table 8.

NOTE 1 The symbol "+HH" denotes that the upper limit of the scatter band coincides with the upper limit for the corresponding steel "+H".

NOTE 2 The symbol "+HL" denotes that the lower limit of the scatter band coincides with the lower limit for the corresponding steel "+H".

NOTE 3 See EN 10263-1:2001, 7.7.4.

6.4.3 The austenitizing temperatures for the Jominy test are given in Tables 7 and 8.

6.5 Surface quality

For any particular surface requirement to be agreed at the time of ordering see EN 10263-1:2001, 7.10.

6.6 Supplementary or special requirements

Other requirements that can be agreed at the time of enquiry and order are described in annex B of EN 10263-1:2001.

Table 1 — Delivery conditions, product forms and applicable requirements

Delivery condition		Symbols	Products form[a]			Applicable requirements in cases where the steel concerned has been ordered with reference to the steel names indicated in:					
			Rod	Bar	Wire	Table 2 and 4 or 5 or 6		Table 7 or 8			Table 2,4,5,6,7 or 8
Untreated	as hot rolled	+U or +U+PE	X	X	—	Chemical composition as specified in Tables 2 and 3	Mechanical properties as specified in Table 4 or 5 or 6	Chemical composition as specified in Tables 2 and 3	Mechanical properties as specified in Table 4 or 5 or 6	Values for hardenability according to Tables 7 or 8	Supplementary or special requirements as specified in annex B of EN 10263-1:2001[b]
	+cold drawn	+U+C	—	X	X						
	+cold drawn +spheroidized	+U+C+AC	—	X	X						
	+cold drawn +spheroidized +skin passed	+U+C+AC+LC	—	X	X						
Spheroidized	as treated	+AC	X	X	—						
	+peeled	+AC+PE	X	X	—						
	+cold drawn	+AC+C	—	X	X						
Ferrite-pearlite structure and hardness range	as treated	+FP	—	X	—						
other			Other delivery conditions can be agreed at the time of ordering								

a X = applicable
— = not applicable
b if agreed at the time of the ordering

Table 2 — Steel grades and chemical composition. Heat analysis % (by mass). [a b]

Steel grades		C	Si max. [c]	Mn	P max.	S	Cr	Mo	Ni	B	Cu max.
Steel name	Steel number										
C10E2C	1.1122	0.08/0,12	0,30	0,30/0,60	0,025	0,025 max.					0,25
C15E2C	1.1132	0,13/0,17	0,30	0,30/0,60	0,025	0,025 max.					0,25
C17E2C	1.1147	0,15/0,19	0,30	0,60/0,90	0,025	0,025 max.					0,25
C20E2C	1.1152	0,18/0,22	0,30	0,30/0,60	0,025	0,025 max.					0,25
15B2	1.5501	0,13/0,16	0,30	0,60/0,80	0,025	0,025 max.				0,0008/0,005	0,25
18B2	1.5503	0,16/0,20	0,30	0,60/0,80	0,025	0,025 max.				0,0008/0,005	0,25
18MnB4	1.5521	0,16/0,20	0,30	0,90/1,20	0,025	0,025 max.				0,0008/0,005	0,25
22MnB4	1.5522	0,20/0,24	0,30	0,90/1,20	0,025	0,025 max.				0,0008/0,005	0,25
17Cr3	1.7016	0,14/0,20	0,30	0,60/0,90	0,025	0,025 max.	0,70/1,00				0,25
17CrS3	1.7014	0,14/0,20	0,30	0,60/0,90	0,025	0,020/0,040	0,70/1,00				0,25
16MnCr5	1.7131	0,14/0,19	0,30	1,00/1,30	0,025	0,025max.	0,80/1,10				0,25
16MnCrS5	1.7139	0,14/0,19	0,30	1,00/1,30	0,025	0,020/0,040	0,80/1,10				0,25
16MnCrB5	1.7160	0,14/0,19	0,30	1,00/1,30	0,025	0,025 max.	0,80/1,10			0,0008/0,005	0,25
20MnCrS5	1.7149	0,17/0,22	0,30	1,10/1,40	0,025	0,020/0,040	1,00/1,30				0,25
12CrMo4	1.7201	0,10/0,15	0,30	0,60/0,90	0,025	0,025 max.	0,90/1,20	0,15/0,25			0,25
18CrMo4	1.7243	0,15/0,21	0,30	0,60/0,90	0,025	0,025 max.	0,90/1,20	0,15/0,25			0,25
18CrMoS4	1.7244	0,15/0,21	0,30	0,60/0,90	0,025	0,020/0,040	0,90/1,20	0,15/0,25			0,25
20MoCr4	1.7321	0,17/0,23	0,30	0,70/1,00	0,025	0,025 max.	0,30/0,60	0,40/0,50			0,25
20MoCrS4	1.7323	0,17/0,23	0,30	0,70/1,00	0,025	0,020/0,040	0,30/0,60	0,40/0,50			0,25
10NiCr5-4	1.5805	0,07/0,12	0,30	0,60/0,90	0,025	0,025 max.	0,90/1,20		1,20/1,50		0,25
12NiCr3-2	1.5701	0,09/0,15	0,30	0,30/0,60	0,025	0,025 max.	0,40/0,70		0,50/0,80		0,25
17CrNi6-6	1.5918	0,14/0,20	0,30	0,50/0,90	0,025	0,025 max.	1,40/1,70		1,40/1,70		0,25
20NiCrMo2-2	1.6523	0,17/0,23	0,30	0,65/0,95	0,025	0,025 max.	0,35/0,70	0,15/0,25	0,40/0,70		0,25
20NiCrMoS2-2	1.6526	0,17/0,23	0,30	0,65/0,95	0,025	0,020/0,040	0,35/0,70	0,15/0,25	0,40/0,70		0,25
20NiCrMoS6-4	1.6571	0,16/0,23	0,30	0,50/0,90	0,025	0,020/0,040	0,60/0,90	0,25/0,35	1,40/1,70		0,25

a Elements not quoted in this table should not be intentionally added to the steel without the agreement of the purchaser, except those intended for finishing the heat. All reasonable precautions shall be taken in order to prevent the addition of elements from scrap or other material used in the production process. However, residual elements may be present provided that the values for mechanical properties specified in Table 4 are satisfied and the final utilization of the product is not compromised.

b In the case of steels with Hardenability requirements (see Table 7 and 8) minor deviation from the specified limits are permitted (with the exception of sulphur and phosphorus), provided that they do not exceed 0,01 % for carbon and the values indicated in Table 3 for the other elements.

c A lower silicon content or a specific silicon range may be agreed at the time of ordering.

Table 3 — Permissible deviations between product analysis and the limiting values specified in Table 2 for the heat analysis

Elements	Limiting values of the cast (heat) analysis % by mass	Permissible deviation for the product analysis % by mass[a]
C	≤ 0,24	± 0,02
Si	≤ 0,30	± 0,03
Mn	≤ 1,00	± 0,04
	> 1,00 ≤ 1,40	± 0,06
P	≤ 0,025	+ 0,005
S	≤ 0,040	+ 0,005[b]
Cr	≤ 1,70	± 0,05
Mo	≤ 0,30	± 0,03
	> 0,30 ≤ 0,50	± 0,04
Ni	≤ 1,00	± 0,03
	> 1,00 ≤ 1,70	± 0,05
B	≤ 0,005 0	± 0,000 3
Cu	≤ 0,25	+ 0,03

a ± means that in one heat the deviation of the product analysis for a given element may occur over the upper value or under the lower value of the specified range in Table 2, but not both at the same time.

b for steels with a specified sulphur range (0,020 to 0,040 % according to cast analysis) the permissible deviation is ±0,005 %.

Table 4 — Mechanical properties for NON-ALLOY steel grades

Steel grade		Diameter		Delivery Condition											
				+U or +PE		+AC or +AC+PE		+U+C		+U+C+AC		+U+C+AC+LC		+AC+C	
Steel name	Steel number	above	up to	Mechanical properties											
		mm	mm	R_m max. MPa	Z [a] min. %	R_m max. MPa	Z min. %	R_m max. MPa	Z min. %	R_m max. MPa	Z min. %	R_m max. MPa	Z min. %	R_m max. MPa	Z min. %
C10E2C	1.1122	2	5	—	—	—	—	—	—	390	67	430	65	—	—
		5	10	450	58	400	65	540	56	380	67	420	65	490	62
		10	40	450	58	400	65	530	56	380	67	420	65	480	62
		40	100	450	58	400	65	—	—	—	—	—	—	—	—
C15E2C	1.1132	2	5	—	—	—	—	—	—	420	67	460	65	—	—
		5	10	480	58	430	65	570	56	410	67	450	65	520	62
		10	40	480	58	430	65	560	56	410	67	450	65	510	62
		40	100	480	58	430	65	—	—	—	—	—	—	—	—
C17E2C	1.1147	2	5	—	—	—	—	—	—	440	67	480	65	—	—
		5	10	530	58	450	65	630	56	430	67	470	65	550	62
		10	40	530	58	450	65	620	56	430	67	470	65	540	62
		40	100	530	57	450	65	—	—	—	—	—	—	—	—
C20E2C	1.1152	2	5	—	—	—	—	—	—	460	67	500	65	—	—
		5	10	530	58	470	65	640	56	450	67	490	65	580	62
		10	40	530	58	470	65	630	56	450	67	490	65	570	62
		40	100	530	58	470	65	—	—	—	—	—	—	—	—

a The values are given only for information

1 MPa = 1 N/mm^2

Table 5 — Mechanical properties for BORON alloyed steel grades

Steel grade		Diameter		Delivery Condition											
				+U		+AC or +AC+PE		+U+C		+U+C+AC		+U+C+AC+LC		+AC+C	
Steel name	Steel number	above mm	up to mm	Mechanical properties											
				R_m max. MPa	Z [a] min. %	R_m max. MPa	Z min. %	R_m max. MPa	Z min. %	R_m max. MPa	Z min. %	R_m max. MPa	Z min. %	R_m max. MPa	Z min. %
15B2	1.5501	2 5 10	5 10 40	— 500 500	— 58 58	— 450 450	— 65 65	— 590 580	— 56 56	440 430 430	67 67 67	480 470 470	65 65 65	— 540 530	— 62 62
18B2	1.5503	2 5 10	5 10 40	— 520 520	— 58 58	— 460 460	— 64 64	— 610 600	— 56 56	450 440 440	67 67 67	490 480 480	65 65 65	— 550 540	— 62 62
18MnB4	1.5521	2 5 10	5 10 40	— 580 580	— 55 55	— 500 500	— 64 64	— 680 670	— 53 53	500 480 480	64 64 64	540 520 520	62 62 62	— 600 590	— 59 59
22MnB4	1.5522	2 5 10	5 10 40	— 600 600	— 55 55	— 520 520	— 62 62	— 720 710	— 53 53	520 500 500	64 64 64	560 540 540	62 62 62	— 630 620	— 59 59

a The values are given only for information

1 MPa = 1 N/mm^2

Table 6 — Mechanical properties for ALLOY steel grades

Steel grade		Diameter		Delivery condition									
				+AC		+FP		+U+C+AC		+U+C+AC+LC		+AC+C	
Steel name	Steel number	above mm	up to mm	Mechanical properties									
				R_m max. MPa	Z min. %	HB min.	HB max.	R_m max. MPa	Z min. %	R_m max. MPa	Z min. %	R_m max. MPa	Z min. %
17Cr3 17CrS3	1.7016 1.7014	2	5	—	—	—	—	520	62	560	60	—	—
		5	10	520	60	140	187	500	62	540	60	630	57
		10	40	520	60	140	187	500	62	540	60	620	57
16MnCr5	1.7131	2	5	—	—	—	—	550	64	590	62	—	—
16MnCrS5	1.7139	5	10	550	62	140	187	530	64	570	62	660	59
16MnCrB5	1.7160	10	40	550	62	140	187	530	64	570	62	650	59
20MnCrS5	1.7149	2	5	—	—	—	—	570	62	610	60	—	—
		5	10	570	60	152	201	550	62	590	60	680	57
		10	40	570	60	152	201	550	62	590	60	670	57
12CrMo4	1.7201	2	5	—	—	—	—	500	—	—	—	—	—
		5	10	500	62	135	185	480	64	520	62	—	—
		10	40	500	62	135	185	480	64	520	62		
18CrMo4 18CrMoS4	1.7243 1.7244	2	5	—	—	—	—	550	62	590	60	—	—
		5	10	550	60	140	187	530	62	570	60	660	57
		10	40	550	60	140	187	530	62	570	60	650	57
20MoCr4 20MoCrS4	1.7321 1.7323	2	5	—	—	—	—	560	62	600	60	—	—
		5	10	560	60	140	187	540	62	580	60	670	57
		10	40	560	60	140	187	540	62	580	60	660	57
10NiCr5-4	1.5805	2	5	—	—	—	—	520	64	560	62	—	—
		5	10	520	62	137	187	500	64	540	62	640	59
		10	40	520	62	137	187	500	64	540	62	630	59
12NiCr3-2	1.5701	2	5	—	—	—	—	500	64	540	62	—	—
		5	10	500	62	130	180	480	64	520	62	620	59
		10	40	500	62	130	180	480	64	520	62	610	59
1 Mpa = 1 N/mm^2													

Table 6 (*concluded*)

Steel grade		Diameter		Delivery condition									
				+AC		+FP		+U+C+AC		+U+C+AC+LC		+AC+C	
Steel name	Steel number	above mm	up to mm	Mechanical properties									
				R_m max. MPa	Z min. %	HB min	HB max	R_m max. Mpa	Z min. %	R_m max. MPa	Z min. %	R_m max. MPa	Z min. %
17CrNi6-6	1.5918	2	5	—	—	—	—	600	62	640	60	—	—
		5	10	600	60	156	207	580	62	620	60	720	57
		10	40	600	60	156	207	580	62	620	60	710	57
20NiCrMo2-2 20NiCrMoS2-2	1.6523 1.6526	2	5	—	—	—	—	590	62	630	60	—	—
		5	10	590	60	149	194	570	62	610	60	720	57
		10	40	590	60	149	194	570	62	610	60	710	57
20NiCrMoS6-4	1.6571	2	5	—	—	—	—	610	60	650	58	—	—
		5	10	610	58	149	201	590	60	630	58	730	55
		10	25	610	58	149	201	590	60	630	58	720	55
1 Mpa = 1 N/mm^2													

Table 7 — Hardness limits for steel grades with specified (normal) hardenability (+H grades — see 6.5.1)

Steel grades		Symbol	Hardening temperature °C ± 5 °C	Limits of range	Hardness HRC at a distance from quenched end of test piece (in mm) of:												
Steel name	Steel number				1,5	3	5	7	9	11	13	15	20	25	30	35	40
18MnB4	1.5521	+H	890	max.	46	45	44	41	39	35	32	28	21	—	—	—	—
				min.	40	38	37	30	21	—	—	—	—	—	—	—	—
22MnB4	1.5522	+H	880	max.	49	48	47	45	42	39	35	32	24	20	—	—	—
				min.	43	41	40	32	23	—	—	—	—	—	—	—	
17Cr3	1.7016	+H	880	max.	47	44	40	33	29	27	25	24	23	21	—	—	—
17CrS3	1.7014	+H		min.	39	35	25	20	—	—	—	—	—	—	—	—	—
16MnCr5	1.7131	+H	870	max.	47	46	44	41	39	37	35	33	31	30	29	28	27
16MnCrS5	1.7139	+H		min.	39	36	31	28	24	21	—	—	—	—	—	—	—
16MnCrB5	1.7160	+H	870	max.	47	46	44	41	39	37	35	33	31	30	29	28	27
				min.	39	36	31	28	24	21	—	—	—	—	—	—	—
20MnCrS5	1.7149	+H	870	max.	49	49	48	46	43	42	41	39	37	35	34	33	32
				min.	41	39	36	33	30	28	26	25	23	21	—	—	—
12CrMo4	1.7201	+H	870	max.	44	43	41	38	34	30	28	27	23	21	—	—	—
				min.	36	34	30	26	22	—	—	—	—	—	—	—	—
18CrMo4	1.7243	+H	880	max.	47	46	45	42	39	37	35	34	31	29	28	27	26
18CrMoS4	1.7244	+H		min.	39	37	34	30	27	24	22	21	—	—	—	—	—
20MoCr4	1.7321	+H	910	max.	49	47	44	41	38	35	33	31	28	26	25	24	24
20MoCrS4	1.7323	+H		min.	41	37	31	27	24	22	—	—	—	—	—	—	—
10NiCr5	1.5805	+H	880	max.	41	39	37	34	32	30	—	—	—	—	—	—	—
				min.	32	27	24	22	—	—	—	—	—	—	—	—	—
12NiCr3-2	1.5701	+H	870	max.	43	40	35	26	21	—	—	—	—	—	—	—	—
				min.	37	32	25	—	—	—	—	—	—	—	—	—	—
17CrNi6-6	1.5918	+H	870	max.	47	47	46	45	43	42	41	39	37	35	34	34	33
				min.	39	38	36	35	32	30	28	26	24	22	21	20	20
20NiCrMo2-2	1.6523	+H	920	max.	49	48	45	42	36	33	31	30	27	25	24	24	23
20NiCrMoS2-2	1.6526	+H		min.	41	37	31	25	22	20	—	—	—	—	—	—	—
20NiCrMoS6-4	1.6571	+H	880	max.	49	49	48	48	47	47	46	44	41	39	38	37	36
				min.	41	40	39	36	33	30	28	26	23	21	—	—	—

Table 8 — Hardness limits for steel grades with restricted hardenability scatter bands (+HH and +HL grades — see 6.5.2)

Steel grades		Symbol	Hardening temperature °C ± 5 °C	Limits of range	Hardness HRC at a distance from quenched end of test piece (in mm) of												
Steel name	Steel number				1,5	3	5	7	9	11	13	15	20	25	30	35	40
17Cr 3 17CrS3	1.7016 1.7014	+HH +HH	880	max.	47	44	40	33	29	27	25	24	23	21	—	—	—
				min.	42	38	30	24	20	—	—	—	—	—	—	—	—
17Cr3 17CrS3	1.7016 1.7014	+HL +HL		max.	44	41	35	29	25	23	21	20	—	—	—	—	—
				min.	39	35	25	20									
16MnCr5 16MnCrS5	1.7131 1.7139	+HH +HH	870	max.	47	46	44	41	39	37	35	33	31	30	29	28	27
				min.	42	39	35	32	29	26	24	22	20	—	—	—	—
16MnCr5 16MnCrS5	1.7131 1.7139	+HL +HL		max.	44	43	40	37	34	32	30	28	26	25	24	23	22
				min.	39	36	31	28	24	21							
16MnCrB5	1.7160	+HH	870	max.	47	46	44	41	39	37	35	33	31	30	29	28	27
				min.	42	39	35	32	29	26	24	22	20	—	—	—	—
16MnCrB5	1.7160	+HL		max.	44	43	40	37	34	32	30	28	26	25	24	23	22
				min.	39	36	31	28	24	21	—	—	—	—	—	—	—
20MnCrS5	1.7149	+HH	870	max.	49	49	48	46	43	42	41	39	37	35	34	33	32
				min.	44	42	40	37	34	33	31	30	28	26	25	24	23
20MnCrS5	1.7149	+HL		max.	46	46	44	42	39	37	36	34	32	30	29	28	27
				min.	41	39	36	33	30	28	26	25	23	21	—	—	—
12CrMo4	1.7201	+HH	870	max.	44	43	41	38	34	30	28	27	23	21	—	—	—
				min.	39	37	34	30	26	21	—	—	—	—	—	—	—
12CrMo4	1.7201	+HL		max.	41	40	37	34	30	26	23	20	—	—	—	—	—
				min.	36	34	30	26	22	—	—	—	—	—	—	—	—
18CrMo4 18CrMoS4	1.7243 1.7244	+HH +HH	880	max.	47	46	45	42	39	37	35	34	31	29	28	27	26
				min.	42	40	38	34	31	28	26	25	22	20	—	—	—
18CrMo4 18CrMoS4	1.7243 1.7244	+HL +HL		max.	44	43	41	38	35	33	31	30	27	25	24	23	22
				min.	39	37	34	30	27	24	22	21	—	—	—	—	—
20MoCr4 20MoCrS4	1.7321 1.7323	+HH +HH	910	max.	49	47	44	41	38	35	33	31	28	26	25	24	24
				min.	44	40	35	32	29	26	24	22	—	—	—	—	—
20MoCr4 20MoCrS4	1.7321 1.7323	+HL +HL		max.	46	44	40	36	33	31	29	27	24	22	21	20	20
				min.	41	37	31	27	24	22	—	—	—	—	—	—	—
10NiCr5-4	1.5805	+HH	880	max.	41	39	37	34	32	30	—	—	—	—	—	—	—
				min.	33	29	26	24	21	20	—	—	—	—	—	—	—
10NiCr5-4	1.5805	+HL		max.	38	35	32	30	27	25	—	—	—	—	—	—	—
				min.	32	27	24	22	—	—	—	—	—	—	—	—	—

Table 8 (*concluded*)

Steel grades		Symbol	Hardening temperature °C ± 5 °C	Limits of range	Hardness HRC at a distance from quenched end of test piece (in mm) of:												
Steel name	Steel number				1,5	3	5	7	9	11	13	15	20	25	30	35	40
17CrNi6-6	1.5918	+HH	870	max.	47	47	46	45	43	42	41	39	37	35	34	34	33
				min.	42	41	39	38	36	34	32	30	28	26	25	25	24
		+HL		max.	44	44	43	42	39	38	37	35	33	31	30	29	29
				min.	39	38	36	35	32	30	28	26	24	22	21	20	20
20NiCrMo	1.6523	+HH	920	max.	49	48	45	42	36	33	31	30	27	25	24	24	23
20NiCrMo	1.6526	+HH		min.	44	41	36	31	27	24	22	21	—	—	—	—	—
20NiCrMo	1.6523	+HL		max.	46	44	40	36	31	29	27	26	23	21	20	20	—
20NiCrMo	1.6526	+HL		min.	41	37	31	25	22	20	—	—	—	—	—	—	—
20NiCrMo S6-4	1.6571	+HH	880	max.	49	49	48	48	47	47	46	44	41	39	38	37	36
				min.	44	43	42	40	38	36	34	32	29	27	26	25	24
		+HL		max.	46	46	45	44	42	41	40	38	35	33	32	31	30
				min.	41	40	39	36	33	30	28	26	23	21	—	—	—

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