BRITISH STANDARD

BS EN
10277-2:1999

Bright steel products — Technical delivery conditions —

Part 2: Steels for general engineering purposes

The European Standard EN 10277-2:1999 has the status of a British Standard

ICS 77.140.20; 77.140.60

National foreword

This British Standard is the English language version of EN 10277-2:1999. This part of BS EN 10277 together with BS EN 10278 and BS EN 10277 parts 1, 3, 4 and 5 supersedes BS 970-3:1991 which is withdrawn.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.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 7 and a back cover.

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English version

Bright steel products — Technical delivery conditions — Part 2: Steels for general engineering purposes

Produits en acier transformés à froid — Conditions techniques de livraison — Partie 2: Aciers d'usage général

Blankstahlerzeugnisse — Technische Lieferbedingungen — Teil 2: Stähle für allgemeine technische Verwendung

This European Standard was approved by CEN on 11 June 1999.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Ref. No. EN 10277-2:1999 E

Foreword

This European Standard has been prepared by Technical Committee ECISS/TC 23, Steels for heat treatment, alloy steels and free-cutting steels — Qualities and dimensions, the Secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by January 2000, and conflicting national standards shall be withdrawn at the latest by January 2000.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 applications and product standards which in themselves support an essential safety requirement of a New Approach Directive and which make reference to this European Standard.

This European Standard EN 10277, Bright steel products — Technical delivery conditions, is subdivided as follows:

— *Part 1: General;*

— *Part 2: Steels for general engineering purposes;*

— *Part 3: Free-cutting steels;*

— *Part 4: Case-hardening steels;*

— *Part 5: Steels for quenching and tempering.*

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.

Contents

1 Scope

1.1 This part of EN 10277 applies to bright steel bars in the drawn, turned or ground condition, in straight lengths of general engineering steels.

1.2 This EN 10277-2 is complemented by EN 10277-1.

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 10025:1990+A1:1993, *Hot rolled products of non-alloy structural steels — Technical delivery conditions.*
(includes amendment A1:1993)

EN 10083-2:1991+A1:1996, *Quenched and tempered steels — Part 2: Technical delivery conditions for unalloyed quality steels.*
(includes amendment A1:1996)

EN 10277-1, *Bright steel products — Technical delivery conditions — Part 1: General.*

3 Definitions

See EN 10277-1.

4 Classification and designation

4.1 Classification

All steels specified in this European Standard are classified as non-alloy quality steels.

4.2 Designation

See EN 10277-1.

NOTE This standard does not comprise impact requirements.

5 Information to be supplied by the purchaser

See EN 10277-1.

6 Manufacturing process

See EN 10277-1.

7 Requirements

7.1 Chemical composition

7.1.1 *Cast analysis*

The chemical composition of the steel according to the cast analysis shall be as specified in Table 1.

7.1.2 *Product analysis*

The permissible deviations from the chemical composition as specified in Table 1 for cast analysis and the product analysis of the steel shall be as specified in Table 2.

7.2 Mechanical properties

The mechanical properties of the steels shall be as specified in Table 3.

7.3 Supplementary or special requirements

See annex B of EN 10277-1.

8 Inspection and testing

See EN 10277-1.

9 Marking

See EN 10277-1.

Table 1 — Chemical composition[1)]

Designation		Steel grade according to	Chemical composition, % by mass									
Steel name	Steel number		C	Si	Mn	P	S	N[2)3)]	Cr	Mo	Ni	Cr+Mo+Ni
S235JRG2	1.0122	EN 10025:1990+A1:1993	max. 0,17[4)]	—[5)]	max. 1,40	0,045	0,045	0,009	—	—	—	—
E295GC[6)]	1.0533[6)]	EN 10025:1990+A1:1993	—	—[7)]	—	0,045	0,045	0,009	—	—	—	—
E335GC	1.0543	EN 10025:1990+A1:1993	—	—[7)]	—	0,045	0,045	0,009	—	—	—	—
S355J2G3C	1.0569[6)]	EN 10025:1990+A1:1993	max. 0,20[8)]	0,55[9)]	max. 1,60	0,035	0,035	—	—	—	—	—
C10[10)]	1.0301[10)]	—	0,07 to 0,13	0,40	0,30 to 0,60	0,045	0,045	—	—	—	—	—
C15[10)]	1.0401[10)]	—	0,12 to 0,18	0,40	0,30 to 0,80	0,045	0,045	—	—	—	—	—
C16[10)]	1.0407[10)]	—	0,12 to 0,18	0,40	0,60 to 0,90	0,045	0,045	—	—	—	—	—
C35[10)]	1.0501[10)]	EN 10083-2:1991 + A1:1996	0,32 to 0,39	0 40	0,50 to 0,80	0,045	0,045	—	0,40	0,10	0,40	0,63
C40[10)]	1.0511[10)]	EN 10083-2:1991 + A1:1996	0,37 to 0,44	0,40	0,50 to 0,80	0,045	0,045	—	0,40	0,10	0,40	0,63
C45[10)]	1.0503[10)]	EN 10083-2:1991 + A1:1996	0,42 to 0,50	0,40	0,50 to 0,80	0,045	0,045	—	0,40	0,10	0,40	0,63
C50[10)]	1.0540[10)]	EN 10083-2:1991 + A1:1996	0,47 to 0,55	0,40	0,60 to 0,90	0,045	0,045	—	0,40	0,10	0,40	0,63
C60[10)]	1.0601[10)]	EN 10083-2:1991 + A1:1996	0,57 to 0,65	0,40	0,60 to 0,90	0,045	0,045	—	0,40	0,10	0,40	0,63

1) Chemical composition is determined by cast analysis.

2) It is permissible to exceed the specified values provided that for each increase of 0,001 % N the P max. content will be reduced by 0,005 %; the N content of the ladle analysis, however, shall not be more than 0,012 %.

3) The max. value for nitrogen does not apply if the chemical composition shows a minimum total Al content of 0,020 % or if sufficient other N binding elements are present. The N binding elements shall be mentioned in the inspection document.

4) Max. 0,20 % C for nominal thicknesses >16 mm.

5) Method of deoxidation optional.

6) For applications where weldability is necessary, steel S355J2G3C (1.0569) should be used instead of E295GC (1.0533).

7) Rimming steel not permitted.

8) Max. 0,22 % C for nominal thicknesses >30 mm.

9) Fully killed steel containing nitrogen binding elements in amounts sufficient to bind the available nitrogen (for example min. 0,020 % Al). If other elements are used they shall be reported in the inspection document.

10) Steels with improved machinability and/or addition of lead (Pb) may be supplied on request (e.g. 0,15 % Pb to 0,35 % Pb).

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

Element	Specified maximum content in the cast analysis % by mass		Steel grades	Permissible deviations[1] % by mass
C	>0,17	≤0,17 ≤0,20	S235JRG2C	+0,04 +0,05
	>0,20	≤0,20 ≤0,22	S355J2G3C	+0,03 +0,04
	>0,55	≤0,55 ≤0,65	C10, C15, C16, C35, C45, C50, C60	±0,02 ±0,03
Si		≤0,40	C10 to C60	+0,03
		≤0,55	S355J2G3C	+0,05
Mn		≤1,40	S235JRC	+0,10
		≤1,60	S355J2G3C	+0,10
		≤0,90	C10 to C60	±0,04
P and S		≤0,035	S355J2G3C	+0,010
		≤0,045	S235JRC to E335GC	+0,010
			C10 to C60	+0,005
N			S235JRC to E335GC	+0,002
Cr		≤0,40	C35 to C60	+0,05
Mo		≤0,10		+0,03
Ni		≤0,40		+0,05

[1] ± means that in one cast, the deviation may occur over the upper value or under the lower value of the specified range in Table 1, but not both at the same time.

Table 3 — Mechanical properties[1)]

Designation		Thickness[2)]	Mechanical properties[2)]				
			As rolled + turned (+SH)[3)]		Cold drawn (+C)		
Steel name	Steel number		Hardness[4)]	R_m	$R_{p0,2}$[5)]	R_m[5)]	A_5
		mm	HB	N/mm²	N/mm² min.	N/mm²	% min.
S235JRG2C	1.0122	≥5 ≤10			355	470 to 840	8
		>10 ≤16			300	420 to 710	9
		>16 ≤40	102 to 140	340 to 470	260	390 to 690	10
		>40 ≤63	102 to 140	340 to 470	235	380 to 630	11
		>63 ≤100	102 to 140	340 to 470	215	340 to 600	11
E295GC	1.0533	≥5 ≤10			510	650 to 950	6
		>10 ≤16			420	600 to 900	7
		>16 ≤40	140 to 181	470 to 610	320	550 to 850	8
		>40 ≤63	140 to 181	470 to 610	300	520 to 770	9
		>63 ≤100	140 to 181	470 to 610	255	470 to 740	9
E335GC	1.0543	≥5 ≤10			540	700 to 1 050	5
		>10 ≤16			480	680 to 970	6
		>16 ≤40	169 to 211	570 to 710	390	640 to 930	7
		>40 ≤63	169 to 211	570 to 710	340	620 to 870	8
		>63 ≤100	169 to 211	570 to 710	295	570 to 810	8
S355J2G3C	1.0569	≥5 ≤10			520	650 to 950	6
		>10 ≤16			450	600 to 880	7
		>16 ≤40	146 to 187	490 to 630	350	550 to 850	8
		>40 ≤63	146 to 187	490 to 630	335	520 to 770	9
		>63 ≤100	146 to 187	490 to 630	315	490 to 740	9
C10	1.0301	≥5 ≤10			350	460 to 760	8
		>10 ≤16			300	430 to 730	9
		>16 ≤40	92 to 163	310 to 550	250	400 to 700	10
		>40 ≤63	92 to 163	310 to 550	200	350 to 640	12
		>63 ≤100	92 to 163	310 to 550	180	320 to 580	12
C15	1.0401	≥5 ≤10			380	500 to 800	7
		>10 ≤16			340	480 to 780	8
		>16 ≤40	98 to 178	330 to 600	280	430 to 730	9
		>40 ≤63	98 to 178	330 to 600	240	380 to 670	11
		>63 ≤100	98 to 178	330 to 600	215	340 to 600	12
C16	1.0407	≥5 ≤10			400	520 to 820	7
		>10 ≤16			360	500 to 800	8
		>16 ≤40	105 to 184	350 to 620	300	450 to 750	9
		>40 ≤63	105 to 184	350 to 620	260	400 to 690	11
		>63 ≤100	105 to 184	350 to 620	235	360 to 620	12
C35	1.0501	≥5 ≤10			510	650 to 1 000	6
		>10 ≤16			420	600 to 950	7
		>16 ≤40	154 to 207	520 to 700	320	580 to 880	8
		>40 ≤63	154 to 207	520 to 700	300	550 to 840	9
		>63 ≤100	154 to 207	520 to 700	270	520 to 800	9

Table 3 — Mechanical properties[1)]

Designation		Thickness[2)]	Mechanical properties[2)]				
			As rolled + turned (+SH)[3)]		Cold drawn (+C)		
Steel name	Steel number		Hardness[4)]	R_m	$R_{p0,2}$[5)]	R_m[5)]	A_5
		mm	HB	N/mm²	N/mm² min.	N/mm²	% min.
C40	1.0511	≥5 ≤10			540	700 to 1 000	6
		>10 ≤16			460	650 to 980	7
		>16 ≤40	163 to 211	550 to 710	365	620 to 920	8
		>40 ≤63	163 to 211	550 to 710	330	590 to 840	9
		>63 ≤100	163 to 211	550 to 710	290	550 to 820	9
C45	1.0503	≥5 ≤10			565	750 to 1 050	5
		>10 ≤16			500	710 to 1 030	6
		>16 ≤40	172 to 242	580 to 820	410	650 to 1 000	7
		>40 ≤63	172 to 242	580 to 820	360	630 to 900	8
		>63 ≤100	172 to 242	580 to 820	310	580 to 850	8
C50	1.0540	≥5 ≤10			590	770 to 1 100	5
		>10 ≤16			520	730 to 1 080	6
		>16 ≤40	181 to 269	610 to 910	440	690 to 1 050	7
		>40 ≤63	181 to 269	610 to 910	390	650 to 1 030	8
		>63 ≤100	181 to 269	610 to 910	—	—	—
C60	1.0601	≥5 ≤10			630	800 to 1 150	5
		>10 ≤16			550	780 to 1 130	5
		>16 ≤40	198 to 278	670 to 940	480	730 to 1 100	6
		>40 ≤63	198 to 278	670 to 940	—	—	—
		>63 ≤100	198 to 278	670 to 940	—	—	—

1) This standard does not include impact requirements.

2) For thicknesses <5 mm, the mechanical properties may be agreed at the time of enquiry and order.

3) For this condition it is not necessary to choose the drawing qualities C. It is sufficient to use grades S235JRG2, E295, E335 and S355J2G3 instead.

4) For information only.

5) For flats the proof strength ($R_{p0,2}$) may deviate by −10 % and the tensile strength (R_m) by ±10 %.

BS EN 10277-2:1999

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