

Plates and wide flats made of high yield strength structural steels in the quenched and tempered or precipitation hardened conditions

Part 2. Delivery conditions for quenched and tempered steels

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Committees responsible for this British Standard

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National foreword

This British Standard has been prepared by Technical Committee ISE/12 and is the English language version of EN 10137-2 : 1995 *Plates and wide flats made of high yield strength structural steels in the quenched and tempered or precipitation hardened conditions — Part 2. Delivery conditions for quenched and tempered steels*, published by the European Committee for Standardization (CEN).

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Cross-references

Publication referred to	Corresponding British Standard
EN 10137-1 : 1995	BS EN 10137 <i>Plates and wide flats made of high yield strength structural steels in the quenched and tempered or precipitation hardened conditions</i> Part 1 : 1996 <i>General delivery requirements</i>

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English version

Plates and wide flats made of high yield strength
structural steels in the quenched and tempered or
precipitation hardened conditions —
Part 2: Delivery conditions for quenched and tempered
steels

Tôles et larges plats en aciers de construction à
haute limite d'élasticité à l'état trempé et
revenu ou durci par précipitation —
Partie 2: Conditions de livraison des aciers à
l'état trempé et revenu

Blech und Breitflachstahl aus Baustählen mit
höherer Streckgrenze im vergüteten oder im
ausscheidungsgehärteten Zustand —
Teil 2: Lieferbedingungen für vergütete Stähle

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Ref. No. EN 10137-2 : 1995 E

Foreword

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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of an identical text or by endorsement, at the latest by March 1996, and conflicting national standards shall be withdrawn at the latest by March 1996.

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1 Scope

Part 2 of this European Standard, in addition to Part 1, specifies requirements for plates and wide flats of high yield strength alloy special steels.

The grades and qualities are given in tables 1 (chemical composition) and 2 and 3 (mechanical properties) and are supplied in the quenched and tempered condition as given in 7.2.

The steels specified in this European Standard are applicable to hot-rolled plates and wide flats with a nominal minimum thickness of 3 mm and a maximum nominal thickness ≤ 150 mm for grades S460, S500, S550, S620 and S690, a maximum nominal thickness ≤ 100 mm for grade S890 and a maximum nominal thickness ≤ 50 mm for grade S960, in steels which, after quenching and tempering, have a specified minimum yield strength of 460 N/mm² to 960 N/mm².

2 Normative references

The normative references as given in EN 10137-1 shall apply.

3 Definitions

The definitions given in EN 10137-1 shall apply.

4 Information to be supplied by the purchaser

4.1 General

The information to be supplied by the purchaser shall be in accordance with EN 10137-1.

4.2 Options

The options given in EN 10137-1 and clause 11 shall apply.

5 Dimensions, mass and tolerances

5.1 Dimensions and tolerances

The dimensions and tolerances shall be in accordance with EN 10137-1.

5.2 Mass of steel

The calculated mass of steel shall be determined in accordance with EN 10137-1.

6 Classification and designation

6.1 Classification

6.1.1 Classification

The steel grades of Part 2 of this European Standard are alloy special steels according to EN 10020.

6.1.2 Qualities

All the grades in Part 2 of this European Standard can be delivered in the following qualities as specified at the time of the enquiry and order:

- (no symbol) with specified minimum values of impact energy at temperatures not lower than -20 °C;
- L with specified minimum values of impact energy at temperatures not lower than -40 °C;
- L1 with specified minimum values of impact energy at temperatures not lower than -60 °C (with the exclusion of S960).

6.2 Designation

The designation shall comply with EN 10137-1.

NOTE. For a list of corresponding former national designations and the former designation from EURONORM 137 (1983) see Annex A, table A.1.

7 Technical requirements

7.1 Steel manufacturing process

The steel manufacturing process shall be in accordance with EN 10137-1.

See clause 11, option 1.

7.2 Delivery condition

Unless otherwise agreed at the time of the enquiry and order the products shall be supplied in the quenched and tempered condition (Q).

NOTE. Direct quenching after hot-rolling followed by tempering is considered equivalent to conventional quenching and tempering.

7.3 Chemical composition

7.3.1 The chemical composition determined by ladle analysis shall comply with the specified values of table 1.

7.3.2 The values for permissible deviations of the product analysis from the specified limits of the ladle analysis are as specified in table 1 of EN 10137-1. The manufacturer shall inform the purchaser at the time of the enquiry and order which of the alloying elements appropriate to the steel grade required will be deliberately added to the material to be delivered.

7.3.3 The product analysis shall be carried out when specified at the time of the enquiry and order.

See clause 11, option 2.

7.4 Mechanical properties

7.4.1 General

Under the inspection and testing conditions as specified in clause 8 and in the delivery condition as specified in 7.2 the mechanical properties shall comply with the values given in tables 2 and 3.

Table 1. Chemical composition of the ladle analysis for quenched and tempered steels¹⁾

Grade	Quality	C %	Mn %	Si %	P %	S %	N %	B %	Cr %	Cu %	Mo %	Nb %	Ni %	Ti %	V %	Zr %
		max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.
All grades	(no symbol)	0,20	1,70	0,80	0,025 0,020 0,020	0,015 0,010 0,010	0,015	0,0050	1,50	0,50	0,70	0,06	2,0	0,05	0,12	0,15
	L															
	L1															

¹⁾ Depending on the thickness of the product and the manufacturing conditions, the manufacturer may add to the steel one or several alloying elements up to the maximum values given in order to obtain the specified properties (see 7.3.2).

²⁾ There shall be at least 0,015 % of a grain-refining element present. Aluminium is also one of these elements. The minimum content of 0,015 % applies to soluble aluminium, this value is regarded as attained if the total aluminium content is at least 0,018 %; in case of dispute the soluble aluminium content shall be determined.

7.4.2 Impact energy

The verification of the impact energy values shall be carried out in accordance with EN 10137-1.

See clause 11, option 3.

See clause 11, option 4.

7.4.3 Improved deformation properties perpendicular to the surface

If agreed at the time of the enquiry and order the requirements of EN 10137-1 shall apply.

See clause 11, option 5.

7.5 Technological properties**7.5.1 Weldability**

Weldability shall be in accordance with EN 10137-1.

7.5.2 Formability

NOTE. Recommendations regarding hot and cold forming are laid down in ECSC IC 2.

7.5.2.1 Hot forming

The products shall comply with tables 2 and 3 if hot forming is carried out after delivery (see 7.4.1). Hot forming is only permitted up to the stress relief annealing temperature. For higher temperatures the manufacturer shall be consulted.

7.5.2.2 Cold forming

If specified at the time of the enquiry and order plates and wide flats ordered and supplied in the quenched and tempered condition with a nominal thickness ≤ 16 mm are suitable for flanging without cracking with the indicative values for the inside bend radii for cold forming as given in annex B.

See clause 11, option 6.

7.5.3 Other requirements

If specified at the time of enquiry and order the grade S460 shall be suitable for hot-dip zinc-coating and shall comply with the relevant product quality requirements.

See clause 11, option 7.

Table 2. Mechanical properties for quenched and tempered steels

Designation of steel grade		Minimum yield strength R_{eH}			Tensile strength R_m			Minimum percentage elongation at fracture %
		N/mm ² Nominal thickness mm			N/mm ² Nominal thickness mm			
Name	Material number	≥ 3 ≤ 50	> 50 ≤ 100	> 100 ≤ 150	≥ 3 ≤ 50	> 50 ≤ 100	> 100 ≤ 150	$L_0 = 5,65 \sqrt{S_0}$
S460Q	1,8908							
S460QL	1,8906	460	440	400	550-720		500-670	17
S460QL1	1,8916							
S500Q	1,8924							
S500QL	1,8909	500	480	440	590-770		540-720	17
S500QL1	1,8984							
S550Q	1,8904							
S550QL	1,8926	550	530	490	640-820		590-770	16
S550QL1	1,8986							
S620Q	1,8914							
S620QL	1,8927	620	580	560	700-890		650-830	15
S620QL1	1,8987							
S690Q	1,8931							
S690QL	1,8928	690	650	630	770-940	760-930	710-900	14
S690QL1	1,8988							
S890Q	1,8940							
S890QL	1,8983	890	830	—	940-1100	880-1100	—	11
S890QL1	1,8925							
S960Q	1,8941							
S960QL	1,8933	960	—	—	980-1150	—	—	10

Table 3. Minimum values of impact energy for impact tests on longitudinal v-notch test pieces

Designation of steel grade		Minimum values of impact energy in J at test temperatures, in °C			
Name	Material number	0	-20	-40	-60
S460Q	1,8908	40	30	—	—
S500Q	1,8924				
S550Q	1,8904				
S620Q	1,8914				
S690Q	1,8931				
S890Q	1,8940				
S960Q	1,8941				
S460QL	1,8906	50	40	30	—
S500QL	1,8909				
S550QL	1,8926				
S620QL	1,8927				
S690QL	1,8928				
S890QL	1,8983				
S960QL	1,8933				
S460QL1	1,8916	60	50	40	30
S500QL1	1,8984				
S550QL1	1,8986				
S620QL1	1,8987				
S690QL1	1,8988				
S890QL1	1,8925				

7.6 Surface finish

The surface finish shall be in accordance with EN 10137-1. Unless otherwise agreed previously with the purchaser repair by welding is not allowed. If agreed the welding shall be performed before final heat treatment and according to a qualified procedure.

See clause 11, option 14.

7.7 Internal soundness

The internal soundness shall be in accordance with EN 10137-1.

See clause 11, option 8.

8 Inspection and testing**8.1 General**

The products shall be supplied in accordance with 8.1 of EN 10137-1.

See clause 11, option 9.

8.2 Sampling

Sampling shall be in accordance with EN 10137-1.

8.3 Test units

The test unit shall be in accordance with EN 10137-1.

See clause 11, option 10.

See clause 11, option 11.

8.4 Verification of chemical composition

The verification of the chemical composition shall be in accordance with EN 10137-1.

See clause 11, option 2.

8.5 Preparation of samples and test pieces

The preparation of samples and test pieces shall be in accordance with EN 10137-1.

8.6 Test methods

The test methods shall be in accordance with EN 10137-1.

See clause 11, option 12.

8.7 Retests and resubmission for testing

The retests and resubmission for testing shall be in accordance with EN 10137-1.

8.8 Inspection documents

The inspection documents shall comply with EN 10137-1.

9 Marking

The marking shall comply with EN 10137-1.

See clause 11, option 13.

10 Disputes

In case of disputes EN 10137-1 applies.

11 Options

See options 1 to 13 of EN 10137-1.

14) Repair by welding is allowed (see 7.6).

Table 4. Minimum values of impact energy for impact tests on transverse v-notch test pieces, when the impact test on transverse test pieces is agreed at the time of the enquiry and order. See clause 11, option 4.					
Designation of steel grade		Minimum values of impact energy in J at test temperatures, in °C			
Name	Material number	0	-20	-40	-60
S460Q	1,8908	30	27	—	—
S500Q	1,8924				
S550Q	1,8904				
S620Q	1,8914				
S690Q	1,8931				
S890Q	1,8940				
S960Q	1,8941				
S460QL	1,8906	35	30	27	—
S500QL	1,8909				
S550QL	1,8926				
S620QL	1,8927				
S690QL	1,8928				
S890QL	1,8983				
S960QL	1,8933				
S460QL1	1,8916	40	35	30	27
S500QL1	1,8984				
S550QL1	1,8986				
S620QL1	1,8987				
S690QL1	1,8988				
S890QL1	1,8925				

Annex A (informative)

List of corresponding former designations

Table A.1 List of corresponding former designations					
Designation of steel grade		Equivalent former designations in			
Name	Material number	EU 137 (1983)	Germany	France	Sweden
S460Q	1,8908	FeE 460 V			
S460QL	1,8906	FeE 460 V KT	TStE 460 V	S 460 T	
S460QL1	1,8916				
S500Q	1,8924	FeE 500 V	StE 500 V		2614
S500QL	1,8909	FeE 500 V KT	TStE 500 V	S 500 T	2615
S500QL1	1,8984		ESTe 500 V		
S550Q	1,8904	FeE 550 V	StE 550 V		
S550QL	1,8926	FeE 550 V KT	TStE 550 V	S 550 T	
S550QL1	1,8986		ESTe 550 V		
S620Q	1,8914	FeE 620 V	StE 620 V		
S620QL	1,8927	FeE 620 V KT	TStE 620 V	S 620 T	
S620QL1	1,8987		ESTe 620 V		
S690Q	1,8931		StE 690 V		2624
S690QL	1,8928	FeE 690 V KT	TStE 690 V	S 690 T	2625
S690QL1	1,8988		ESTe 690 V		
S890Q	1,8940				
S890QL	1,8983		TStE 890 V		
S890QL1	1,8925		ESTe 890 V		
S960Q	1,8941				
S960QL	1,8933		TStE 960 V	S 960 T	

Annex B (informative)**Minimum inside bend radii for flanging**

B.1 Minimum inside bend radii for flanging			
Designation of steel grade		Minimum recommended inside bend radii for nominal thicknesses (t) $3 \leq t \leq 16$ mm¹⁾	
Name	Material number	Axis of bend in transverse direction	Axis of bend in longitudinal direction
S460Q	1,8908	3,0t	4,0t
S460QL	1,8906	3,0t	4,0t
S460QL1	1,8916	3,0t	4,0t
S500Q	1,8924	3,0t	4,0t
S500QL	1,8909	3,0t	4,0t
S500QL1	1,8984	3,0t	4,0t
S550Q	1,8904	3,0t	4,0t
S550QL	1,8926	3,0t	4,0t
S550QL1	1,8986	3,0t	4,0t
S620Q	1,8914	3,0t	4,0t
S620QL	1,8927	3,0t	4,0t
S620QL1	1,8987	3,0t	4,0t
S690Q	1,8931	3,0t	4,0t
S690QL	1,8928	3,0t	4,0t
S690QL1	1,8988	3,0t	4,0t
S890Q	1,8940	3,0t	4,0t
S890QL	1,8983	3,0t	4,0t
S890QL1	1,8925	3,0t	4,0t
S960Q	1,8941	4,0t	5,0t
S960QL	1,8933	4,0t	5,0t

1) The values are applicable for bend angles $\leq 90^\circ$

List of references

See national foreword.

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389 Chiswick High Road
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W4 4AL